MiCOM P541, P542, P543, P544, P545, P546

Operation Guide

Current Differential Protection Relays

Platform Hardware Version: J
Platform Software Version: 20 and 30
Publication Reference: P54x/EN O/I53

GRID

ALSTOM

Operational Guide
MiCOM P54x
Current Differential Protection

Volume 2

CURRENT DIFFERENTIAL RELAYS

MiCOM P541, P542, P543, P544, P545, P546

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ISSUE I			Amendments completed - 02.2005
Doc Ref.	Section	Page	Description
Throughout			Company name changed
IT	3.8.2	20/21	**Modbus communication** New cell added to end of section
CM	4.2.6	15	**Input opto-isolators** Paragraph deleted
CM	4.2.9	17	**Second rear communications port** New section added
CM	4.3.5	24	**IEEE C37.94 compatible multiplexers** New section added
CM	5.1	28	**Apply application-specific settings** Whole section replaced
CM	6.2	37	**Verify communications between relays** Last paragraph deleted and replaced
CM	9.3.1.2	44/45	**Replacing a PCB** Updated figures 5 - 9 for comms options
CM	9.3.1.2.6	52	**Replacement of the opto and separate relay boards (P542, P543, P544, P545 & P546**) Figure 16: Diagram updated
CM	10.	65	**Commissioning test record** Data added to end of section
CM	11.	69	**Setting record** Replaced text
CM	11.	71	**Setting record** Replaced text
CM	11.	75	**Setting record** 3 new lines added to table
CM	11.	77	**Setting record** New line added to bottom of table
CM	11.	79	**Setting record** 3 lines added to bottom of table
PR	7.4	8	**Current differential failures** Section deleted and text added to bottom of section
PR	8.	10	**Error Codes** Company name changed
GC	-	-	**Courier menu database** Amended to reflect latest relay software
VC	-	-	**Hardware/software version history and compatibility** Amended to reflect latest relay software
LG	-	1	**Distance P543/P544/P545/P546 Zone 1 Tripping Logic** Figure 1: Diagram amended
LG	-	1	**Distance P543/P544/P545/P546 Zone 2 Tripping Logic** Figure 2: Diagram amended

ISSUE I			Amendments completed - 02.2005
Doc Ref.	Section	Page	Description
LG	-	14	**CB failure for P541/P542 with Three Pole Tripping** Figure 25: Diagram amended
LG	-	8	**Autoreclose P543/P545 Single/Three Pole Tripping** Figure 17: Diagram amended
LG	-	9	**Autoreclose P543/P545 Inhibit Sequence Count** Figure 18: Diagram amended
LG	-	10	**Autoreclose P543/P545 Cycles** Figure 19: Diagram amended
LG	-	13	**Autoreclose P543/P545 Force 3 Pole Trip** Figure 22: Diagram amended
LG	-	14	**P543/P545 DDB Pole Discrepancy Trip** Figure24: Diagram amended
LG	-	16	**VTS Logic** Figure 29: Diagram amended
LG	-	24	**Autoreclose P543/P545 Repeat Closer** Figure 37: Diagram amended

HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling circuits can cause serious damage, which often may not be immediately apparent but the reliability of the circuit will have been reduced.

The electronic circuits of Alstom Grid are immune to the relevant levels of electrostatic discharge when housed in their cases. Do not expose them to the risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, the following precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure that you are a same electrostatic potential as the equipment by touching the case.
2. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit track or connectors.
3. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.
4. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
5. Store or transport the module in a conductive bag.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 60147-0F.

If you are making measurements on the internal electronic circuitry of an equipment in service, it is preferable that you are earthed to the case with a conductive wrist strap.

Wrist straps should have a resistance to ground between 500k – 10M ohms. If a wrist strap is not available you should maintain regular contact with the case to prevent the build up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

Alstom Grid strongly recommends that detailed investigations on the electronic circuitry, or modification work, should be carried out in a Special Handling Area such as described in BS5783 or IEC 60147-0F.

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1. SAFETY SECTION

This Safety Section should be read before commencing any work on the equipment.

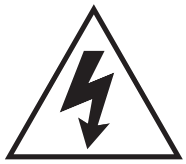
1.1 Health and safety

The information in the Safety Section of the product documentation is intended to ensure that products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety Section.

1.2 Explanation of symbols and labels

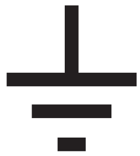
The meaning of symbols and labels may be used on the equipment or in the product documentation, is given below.

Caution: refer to product documentation



Caution: risk of electric shock

Protective/safety *earth terminal



Functional *earth terminal

Note: This symbol may also be used for a protective/safety earth terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

*NOTE: THE TERM EARTH USED THROUGHOUT THE PRODUCT DOCUMENTATION IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

2. INSTALLING, COMMISSIONING AND SERVICING

Equipment connections

Personnel undertaking installation, commissioning or servicing work on this equipment should be aware of the correct working procedures to ensure safety. The product documentation should be consulted before installing, commissioning or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electrical shock or energy hazards.

Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

Before energising the equipment it must be earthed using the protective earth terminal, or the appropriate termination of the supply plug in the case of plug connected equipment. Omitting or disconnecting the equipment earth may cause a safety hazard.

The recommended minimum earth wire size is 2.5mm^2, unless otherwise stated in the technical data section of the product documentation.

Before energising the equipment, the following should be checked:

– Voltage rating and polarity;

– CT circuit rating and integrity of connections;

– Protective fuse rating;

– Integrity of earth connection (where applicable)

– Remove front plate plastic film protection

– Remove insulating strip from battery compartment

3. EQUIPMENT OPERATING CONDITIONS

The equipment should be operated within the specified electrical and environmental limits.

3.1 Current transformer circuits

Do not open the secondary circuit of a live CT since the high level voltage produced may be lethal to personnel and could damage insulation.

3.2 External resistors

Where external resistors are fitted to relays, these may present a risk of electric shock or burns, if touched.

3.3 Battery replacement

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity, to avoid possible damage to the equipment.

3.4 Insulation and dielectric strength testing

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

3.5 Insertion of modules and pcb cards

These must not be inserted into or withdrawn from equipment whist it is energised since this may result in damage.

3.6 Fibre optic communication

Where fibre optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

4. OLDER PRODUCTS

Electrical adjustments

Equipments which require direct physical adjustments to their operating mechanism to change current or voltage settings, should have the electrical power removed before making the change, to avoid any risk of electrical shock.

Mechanical adjustments

The electrical power to the relay contacts should be removed before checking any mechanical settings, to avoid any risk of electric shock.

Draw out case relays

Removal of the cover on equipment incorporating electromechanical operating elements, may expose hazardous live parts such as relay contacts.

Insertion and withdrawal of extender cards

When using an extender card, this should not be inserted or withdrawn from the equipment whilst it is energised. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.

Insertion and withdrawal of heavy current test plugs

When using a heavy current test plug, CT shorting links must be in place before insertion or removal, to avoid potentially lethal voltages.

5. DECOMMISSIONING AND DISPOSAL

Decommissioning: The auxiliary supply circuit in the relay may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the relay (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to decommissioning.

Disposal: It is recommended that incineration and disposal to water courses is avoided. The product should be disposed of in a safe manner. Any products containing batteries should have them removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of lithium batteries.

6. TECHNICAL SPECIFICATIONS

Protective fuse rating

The recommended maximum rating of the external protective fuse for this equipment is 16A, Red Spot type or equivalent, unless otherwise stated in the technical data section of the product documentation.

Insulation class:	IEC 601010-1 : 1990/A2 : 2001 Class I EN 61010-1: 2001 Class I	This equipment requires a protective (safety) earth connection to ensure user safety.
Insulation Category (Overvoltage):	IEC 601010-1 : 1990/A2 : 1995 Category III EN 61010-1: 2001 Category III	Distribution level, fixed insulation. Equipment in this category is qualification tested at 5kV peak, 1.2/50µs, 500Ω, 0.5J, between all supply circuits and earth and also between independent circuits.
Environment:	IEC 601010-1 : 1990/A2 : 1995 Pollution degree 2 EN 61010-1: 2001 Pollution degree 2	Compliance is demonstrated by reference to generic safety standards.
Product Safety:	72/23/EEC	Compliance with the European Commission Low Voltage Directive.
CE	EN 61010-1: 2001 EN 60950-1: 2002	Compliance is demonstrated by reference to generic safety standards.

INTRODUCTION

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1. INTRODUCTION TO MiCOM

MiCOM is a comprehensive solution capable of meeting all electricity supply requirements. It comprises a range of components, systems and services from Alstom Grid.

Central to the MiCOM concept is flexibility.

MiCOM provides the ability to define an application solution and, through extensive communication capabilities, to integrate it with your power supply control system.

The components within MiCOM are:

- P range protection relays;
- C range control products;
- M range measurement products for accurate metering and monitoring;
- S range versatile PC support and substation control packages.

MiCOM products include extensive facilities for recording information on the state and behaviour of the power system using disturbance and fault records. They can also provide measurements of the system at regular intervals to a control centre enabling remote monitoring and control to take place.

For up-to-date information on any MiCOM product, visit our website:

www.alstom.com/grid/sas

2. INTRODUCTION TO MiCOM GUIDES

The guides provide a functional and technical description of the MiCOM protection relay and a comprehensive set of instructions for the relay's use and application.

Divided into two volumes, as follows:

Volume 1 – Technical Guide, includes information on the application of the relay and a technical description of its features. It is mainly intended for protection engineers concerned with the selection and application of the relay for the protection of the power system.

Volume 2 – Operation Guide, contains information on the installation and commissioning of the relay, and also a section on fault finding. This volume is intended for site engineers who are responsible for the installation, commissioning and maintenance of the relay.

The chapter content within each volume is summarised below:

Volume 1 Technical Guide

Handling of Electronic Equipment

Safety Section

P54x/EN IT Introduction

A guide to the different user interfaces of the protection relay describing how to start using the relay.

P54x/EN AP Application Notes

Comprehensive and detailed description of the features of the relay including both the protection elements and the relay's other functions such as event and disturbance recording, fault location and programmable scheme logic. This chapter includes a description of common power system applications of the relay, calculation of suitable settings, some typical worked examples, and how to apply the settings to the relay.

P54x/EN HW Relay Description

Overview of the operation of the relay's hardware and software. This chapter includes information on the self-checking features and diagnostics of the relay.

P54x/EN TD Technical Data

Technical data including setting ranges, accuracy limits, recommended operating conditions, ratings and performance data. Compliance with technical standards is quoted where appropriate.

P54x/EN CT Communications and Interface Guide

This chapter provides detailed information regarding the communication interfaces of the relay, including a detailed description of how to access the settings database stored within the relay. The chapter also gives information on each of the communication protocols that can be used with the relay, and is intended to allow the user to design a custom interface to a SCADA system.

P54x/EN UC UCA2.0 Communications

The chapter gives information on the UCA2.0 communication protocol that can be used with the relay.

P54x/EN GC Relay Menu Database: User Interface / Courier / Modbus / IEC 60870-5-103/ DNP 3.0

Listing of all of the settings contained within the relay together with a brief description of each.

P54x/EN CO External Connection Diagrams

All external wiring connections to the relay.

P54x/EN VC Hardware / Software Version History and Compatibility

P54x/EN HI Menu Table Contents

Volume 2 Operation Guide

Handling of Electronic Equipment

Safety Section

P54x/EN IT Introduction

A guide to the different user interfaces of the protection relay describing how to start using the relay.

P54x/EN IN Installation

Recommendations on unpacking, handling, inspection and storage of the relay. A guide to the mechanical and electrical installation of the relay is provided incorporating earthing recommendations.

P594/EN IN P594 Installation Notes

P54x/EN CM Commissioning and Maintenance

Instructions on how to commission the relay, comprising checks on the calibration and functionality of the relay. A general maintenance policy for the relay is outlined.

P54x/EN PR Problem Analysis

Advice on how to recognise failure modes and the recommended course of action.

P54x/EN GC Relay Menu Database: User Interface / Courier / Modbus / IEC 60870-5-103/ DNP 3.0 / UCA2.0

Listing of all of the settings contained within the relay together with a brief description of each.

P54x/EN CO External Connection Diagrams

All external wiring connections to the relay.

P54x/EN VC Hardware / Software Version History and Compatibility

P54x/EN HI Menu Table Contents

Repair Form

3. USER INTERFACES AND MENU STRUCTURE

The settings and functions of the MiCOM protection relay can be accessed both from the front panel keypad and LCD, and via the front and rear communication ports. Information on each of these methods is given in this section to describe how to get started using the relay.

3.1 Introduction to the relay

3.1.1 Front panel

The front panel of the relay is shown in Figure 1, with the hinged covers at the top and bottom of the relay shown open. Extra physical protection for the front panel can be provided by an optional transparent front cover. With the cover in place read only access to the user interface is possible. Removal of the cover does not compromise the environmental withstand capability of the product, but allows access to the relay settings. When full access to the relay keypad is required, for editing the settings, the transparent cover can be unclipped and removed when the top and bottom covers are open. If the lower cover is secured with a wire seal, this will need to be removed. Using the side flanges of the transparent cover, pull the bottom edge away from the relay front panel until it is clear of the seal tab. The cover can then be moved vertically down to release the two fixing lugs from their recesses in the front panel.

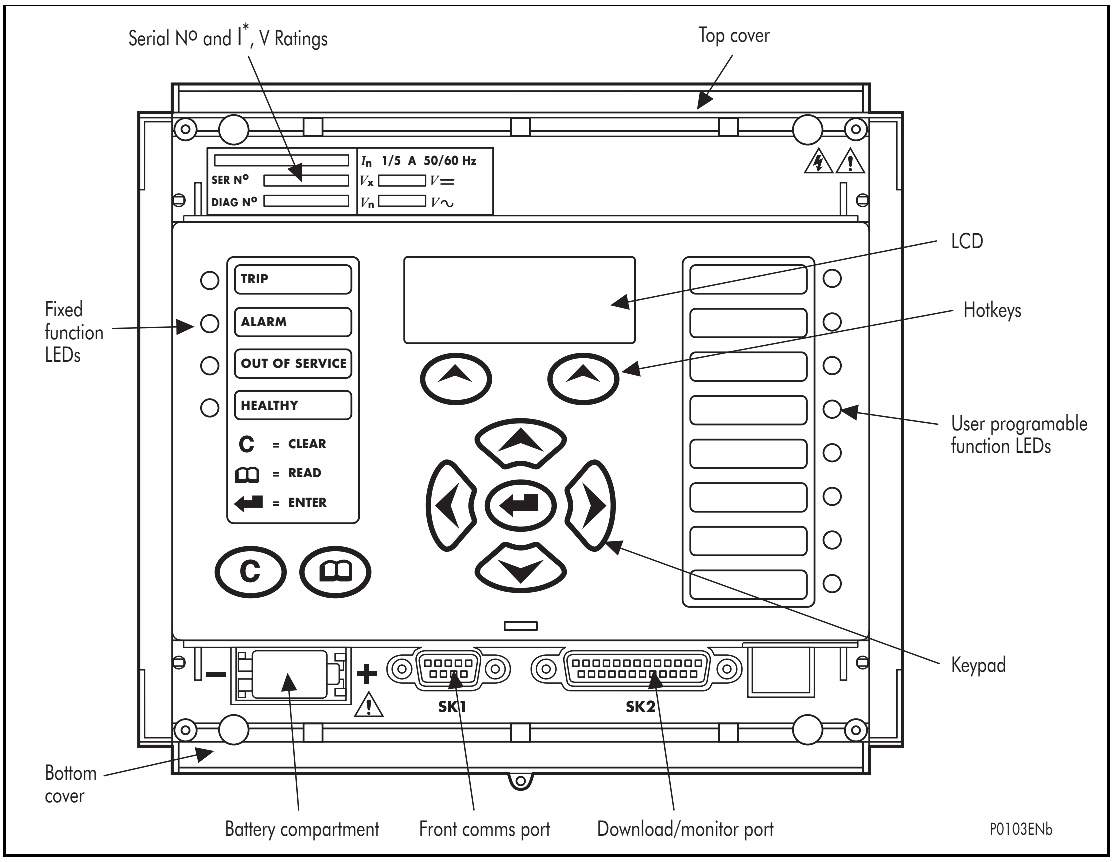

Figure 1: Relay front view

The front panel of the relay includes the following, as indicated in Figure 1:

- a 16-character by 3-line alphanumeric liquid crystal display (LCD).
- a 9 key keypad comprising 4 arrow keys (◁, ▷, △ and ▽), an enter key (↵), a clear key (C), a read key (📖) and 2 additional hotkeys (△).
- 12 LEDs; 4 fixed function LEDs on the left hand side of the front panel and 8 programmable function LEDs on the right hand side.

Hotkey functionality:

- SCROLL
  Starts scrolling through the various default displays
- STOP
  Stops scrolling the default display

Under the top hinged cover:

- the relay serial number, and the relay's current and voltage rating information*.

Under the bottom hinged cover:

- battery compartment to hold the $^{1}/_{2}$ AA size battery which is used for memory back-up for the real time clock, event, fault and disturbance records.
- a 9-pin female D-type front port for communication with a PC locally to the relay (up to 15m distance) via an EIA(RS)232 serial data connection.
- a 25-pin female D-type port providing internal signal monitoring and high speed local downloading of software and language text via a parallel data connection.

The fixed function LEDs on the left hand side of the front panel are used to indicate the following conditions:

Trip (Red) indicates that the relay has issued a trip signal. It is reset when the associated fault record is cleared from the front display. (Alternatively the trip LED can be configured to be self-resetting)*.

Alarm (Yellow) flashes to indicate that the relay has registered an alarm. This may be triggered by a fault, event or maintenance record. The LED will flash until the alarms have been accepted (read), after which the LED will change to constant illumination, and will extinguish when the alarms have been cleared.

Out of service (Yellow) indicates that the relay's protection is unavailable.

Healthy (Green) indicates that the relay is in correct working order, and should be on at all times. It will be extinguished if the relay's self-test facilities indicate that there is an error with the relay's hardware or software. The state of the healthy LED is reflected by the watchdog contact at the back of the relay.

To improve the visibility of the settings via the front panel, the LCD contrast can be adjusted using the "LCD Contrast" setting in the CONFIGURATION column.

3.1.2 Relay rear panel

The rear panel of the relay is shown in Figure 2. All current and voltage signals*, digital logic input signals and output contacts are connected at the rear of the relay. Also connected at the rear is the twisted pair wiring for the rear EIA(RS)485 communication port, the IRIG-B time synchronising input and the optical fibre rear communication port which are both optional.

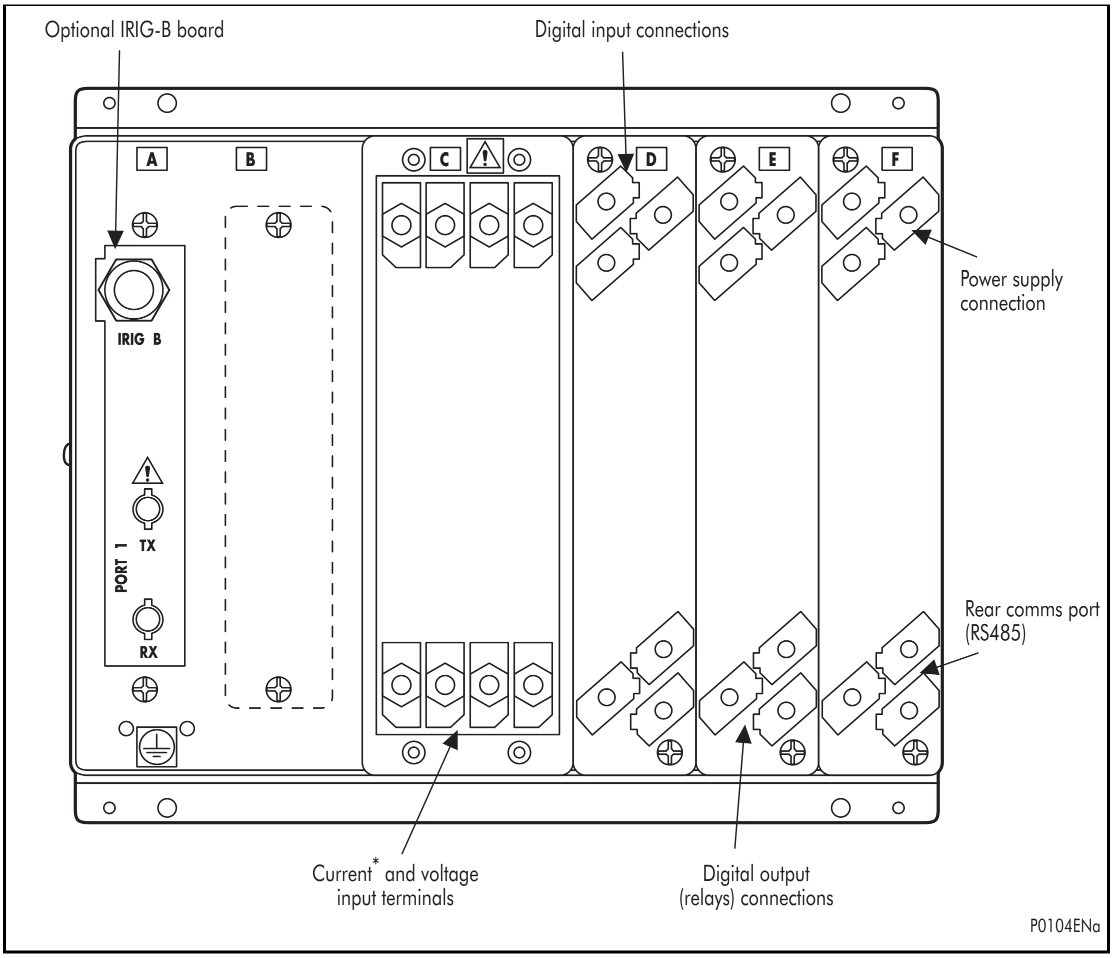

Figure 2: Relay rear view

Refer to the wiring diagram in the External Connection Diagrams chapter (P54x/EN CO) for complete connection details.

3.2 Introduction to the user interfaces and settings options

The relay has three user interfaces:

- the front panel user interface via the LCD and keypad.
- the front port which supports Courier communication.
- the rear port which supports one protocol of either Courier, Modbus, IEC 60870-5-103, DNP3.0 or UCA2.0. The protocol for the rear port must be specified when the relay is ordered.

The measurement information and relay settings which can be accessed from the five interfaces are summarised in Table 1.

	Keypad/ LCD	Courier	Modbus	IEC870 -5-103	DNP3.0	UCA2.0
Display & modification of all settings	•	•	•			•
Digital I/O signal status	•	•	•	•	•	•
Display/extraction of measurements	•	•	•	•	•	•
Display/extraction of fault records	•	•	•			
Extraction of disturbance records		•	•	•	•	•
Programmable scheme logic settings		•				
Reset of fault & alarm records	•	•	•	•	•	•
Clear event & fault records	•	•	•		•	•
Time synchronisation		•	•	•		•
Control commands	•	•	•	•	•	•

Table 1

3.3 Menu structure

The relay's menu is arranged in a tabular structure. Each setting in the menu is referred to as a cell, and each cell in the menu may be accessed by reference to a row and column address. The settings are arranged so that each column contains related settings, for example all of the disturbance recorder settings are contained within the same column. As shown in Figure 3, the top row of each column contains the heading which describes the settings contained within that column. Movement between the columns of the menu can only be made at the column heading level. A complete list of all of the menu settings is given the Relay Menu Database Chapter (P54x/EN GC) of the manual.

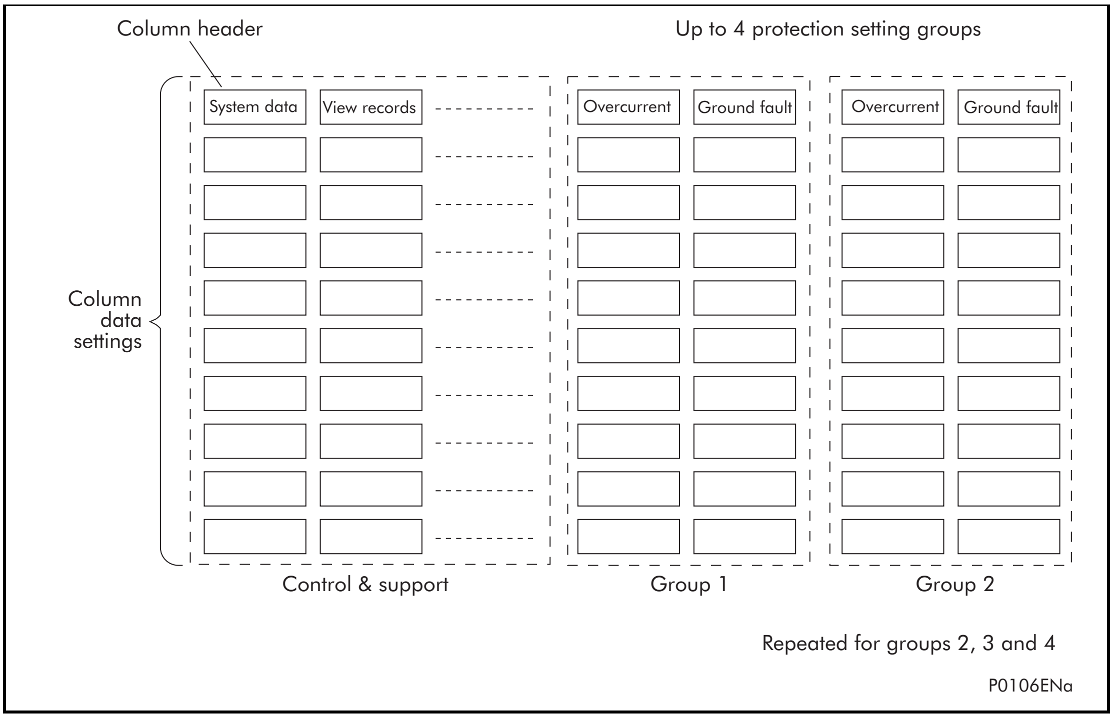

Figure 3: Menu structure

All of the settings in the menu fall into one of three categories: protection settings, disturbance recorder settings, or control and support (C&S) settings. One of two different methods is used to change a setting depending on which category the setting falls into. Control and support settings are stored and used by the relay immediately after they are entered. For either protection settings or disturbance recorder settings, the relay stores the new setting values in a temporary ‘scratchpad’. It activates all the new settings together, but only after it has been confirmed that the new settings are to be adopted. This technique is employed to provide extra security, and so that several setting changes that are made within a group of protection settings will all take effect at the same time.

3.3.1 Protection settings

The protection settings include the following items:

- protection element settings
- scheme logic settings
- auto-reclose and check synchronisation settings (where appropriate)*
- fault locator settings (where appropriate)*

There are four groups of protection settings, with each group containing the same setting cells. One group of protection settings is selected as the active group, and is used by the protection elements.

3.3.2 Disturbance recorder settings

The disturbance recorder settings include the record duration and trigger position, selection of analogue and digital signals to record, and the signal sources that trigger the recording.

3.3.3 Control and support settings

The control and support settings include:

- relay configuration settings
- open/close circuit breaker*
- CT & VT ratio settings*
- reset LEDs
- active protection setting group
- password & language settings
- circuit breaker control & monitoring settings*
- communications settings
- measurement settings
- event & fault record settings
- user interface settings
- commissioning settings

3.4 Password protection

The menu structure contains three levels of access. The level of access that is enabled determines which of the relay’s settings can be changed and is controlled by entry of two different passwords. The levels of access are summarised in Table 2.

Access level	Operations enabled
Level 0 No password required	Read access to all settings, alarms, event records and fault records
Level 1 Password 1 or 2	As level 0 plus: Control commands, e.g. circuit breaker open/close. Reset of fault and alarm conditions. Reset LEDs. Clearing of event and fault records.
Level 2 As level 1 plus:	Password 2 required All other settings

Table 2

Each of the two passwords are 4 characters of upper case text. The factory default for both passwords is AAAA. Each password is user-changeable once it has been correctly entered. Entry of the password is achieved either by a prompt when a setting change is attempted, or by moving to the 'Password' cell in the 'System data' column of the menu. The level of access is independently enabled for each interface, that is to say if level 2 access is enabled for the rear communication port, the front panel access will remain at level 0 unless the relevant password is entered at the front panel. The access level enabled by the password entry will time-out independently for each interface after a period of inactivity and revert to the default level. If the passwords are lost an emergency password can be supplied - contact Alstom Grid with the relay's serial number. The current level of access enabled for an interface can be determined by examining the 'Access level' cell in the 'System data' column, the access level for the front panel User Interface (UI), can also be found as one of the default display options. Additionally the current level of access for each interface is available for use in the PSL by mapping to the following DDB signals:

- HMI Access Lvl 1
- HMI Access Lvl 2
- FPort AccessLvl1
- FPort AccessLvl2
- RPrt1 AccessLvl1
- RPrt1 AccessLvl2
- RPrt2 AccessLvl1
- RPrt2 AccessLvl2

Each pair of DDB signals indicate the access level as follows:

- Lvl 1 off, Lvl 2 off = 0
- Lvl 1 on, Lvl 2 off = 1
- Lvl 1 off, Lvl 2 on = 2

The relay is supplied with a default access level of 2, such that no password is required to change any of the relay settings. It is also possible to set the default menu access level to either level 0 or level1, preventing write access to the relay settings without the correct password. The default menu access level is set in the 'Password control' cell which is found in the 'System data' column of the menu (note that this setting can only be changed when level 2 access is enabled).

3.5 Relay configuration

The relay is a multi-function device which supports numerous different protection, control and communication features. In order to simplify the setting of the relay, there is a configuration settings column which can be used to enable or disable many of the functions of the relay. The settings associated with any function that is disabled are made invisible, i.e. they are not shown in the menu. To disable a function change the relevant cell in the 'Configuration' column from 'Enabled' to 'Disabled'.

The configuration column controls which of the four protection settings groups is selected as active through the 'Active settings' cell. A protection setting group can also be disabled in the configuration column, provided it is not the present active group. Similarly, a disabled setting group cannot be set as the active group.

The column also allows all of the setting values in one group of protection settings to be copied to another group.

To do this firstly set the 'Copy from' cell to the protection setting group to be copied, then set the 'Copy to' cell to the protection group where the copy is to be placed. The copied settings are initially placed in the temporary scratchpad, and will only be used by the relay following confirmation.

To restore the default values to the settings in any protection settings group, set the 'Restore defaults' cell to the relevant group number. Alternatively it is possible to set the 'Restore defaults' cell to 'All settings' to restore the default values to all of the relay's settings, not just the protection groups' settings. The default settings will initially be placed in the scratchpad and will only be used by the relay after they have been confirmed. Note that restoring defaults to all settings includes the rear communication port settings, which may result in communication via the rear port being disrupted if the new (default) settings do not match those of the master station.

3.6 Front panel user interface (keypad and LCD)

When the keypad is exposed it provides full access to the menu options of the relay, with the information displayed on the LCD.

The , , and keys which are used for menu navigation and setting value changes include an auto-repeat function that comes into operation if any of these keys are held continually pressed. This can be used to speed up both setting value changes and menu navigation; the longer the key is held depressed, the faster the rate of change or movement becomes.

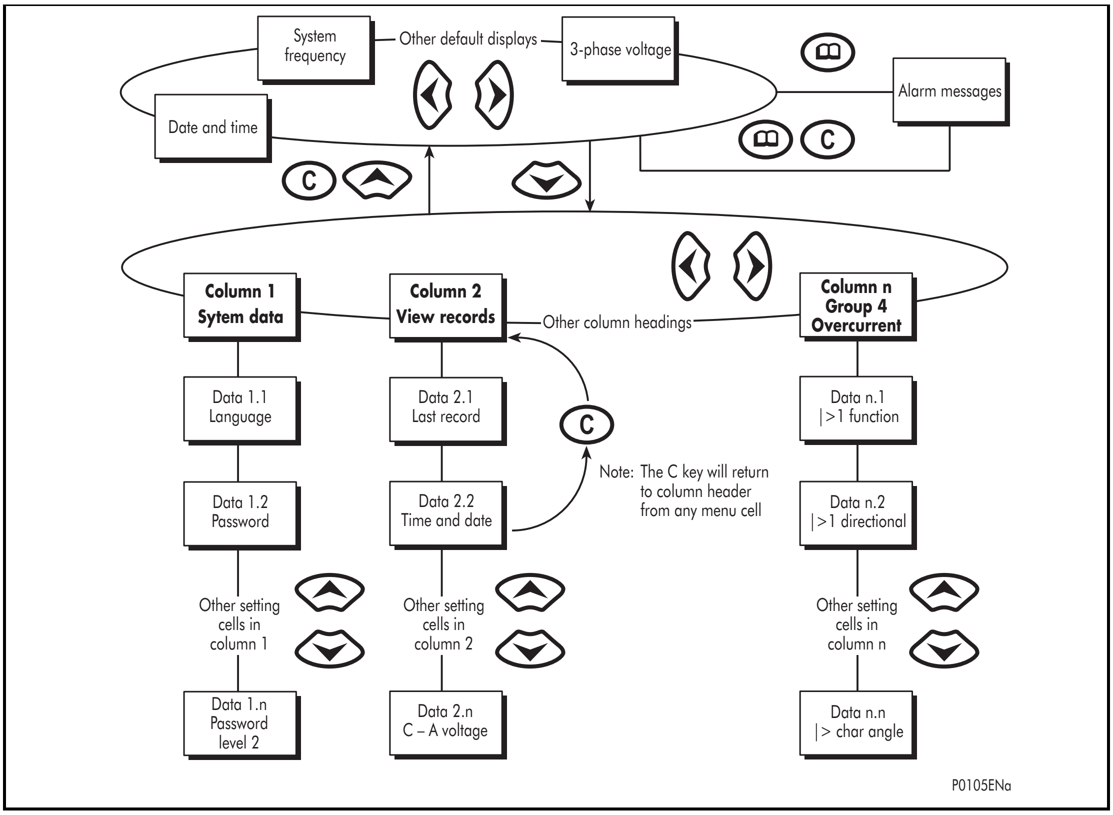

Figure 4: Front panel user interface

3.6.1 Default display and menu time-out

The front panel menu has a selectable default display. The relay will time-out and return to the default display and turn the LCD backlight off after 15 minutes of keypad inactivity. If this happens any setting changes which have not been confirmed will be lost and the original setting values maintained.

The contents of the default display can be selected from the following options: 3-phase and neutral current, 3-phase voltage, power, system frequency, date and time, relay description, or a user-defined plant reference*. The default display is selected with the 'Default display' cell of the 'Measure't setup' column. Also, from the default display the different default display options can be scrolled through using the ← and → keys. However the menu selected default display will be restored following the menu time-out elapsing. Whenever there is an uncleared alarm present in the relay (e.g. fault record, protection alarm, control alarm etc.) the default display will be replaced by:

```
Alarms/Faults
Present
```

Entry to the menu structure of the relay is made from the default display and is not affected if the display is showing the 'Alarms/Faults present' message.

3.6.2 Menu navigation and setting browsing

The menu can be browsed using the four arrow keys, following the structure shown in Figure 4. Thus, starting at the default display the ↑ key will display the first column heading. To select the required column heading use the ← and → keys. The setting data contained in the column can then be viewed by using the ↓ and ↑ keys. It is possible to return to the column header either by holding the [up arrow symbol] key down or by a single press of the clear key Ⓒ. It is only possible to move across columns at the column heading level. To return to the default display press the ↑ key or the clear key Ⓒ from any of the column headings. It is not possible to go straight to the default display from within one of the column cells using the auto-repeat facility of the ↑ key, as the auto-repeat will stop at the column heading. To move to the default display, the ↑ key must be released and pressed again.

3.6.3 Hotkey menu navigation

The hotkey menu can be browsed using the two keys directly below the LCD. These are known as direct access keys. The direct access keys perform the function that is displayed directly above them on the LCD. Thus, to access the hotkey menu from the default display the direct access key below the "HOTKEY" text must be pressed. Once in the hotkey menu the ← and → keys can be used to scroll between the available options and the direct access keys can be used to control the function currently displayed. If neither the ← or → keys are pressed with 20 seconds of entering a hotkey sub menu, the relay will revert to the default display. The clear key C will also act to return to the default menu from any page of the hotkey menu. The layout of a typical page of the hotkey menu is described below.

The top line shows the contents of the previous and next cells for easy menu navigation.

The centre line shows the function.

The bottom line shows the options assigned to the direct access keys.

The functions available in the hotkey menu are listed below.

3.6.3.1 Setting group selection

The user can either scroll using <<NXT GRP>> through the available setting groups or <<SELECT>> the setting group that is currently displayed.

When the SELECT button is pressed a screen confirming the current setting group is displayed for 2 seconds before the user is prompted with the <<NXT GRP>> or <<SELECT>> options again. The user can exit the sub menu by using the left and right arrow keys.

For more information on setting group selection refer to “Changing setting group” section in the application guide.

3.6.3.2 Control Inputs – user assignable functions

The number of control inputs (user assignable functions – USR ASS) represented in the hotkey menu is user configurable in the “CTRL I/P CONFIG” column. The chosen inputs can be SET/RESET using the hotkey menu.

For more information refer to the “Control Inputs” section in the application guide.

3.6.3.3 CB Control

The CB control functionality varies from one Px40 relay to another. For a detailed description of the CB control via the hotkey menu refer to the “Circuit breaker control” section of the application guide.

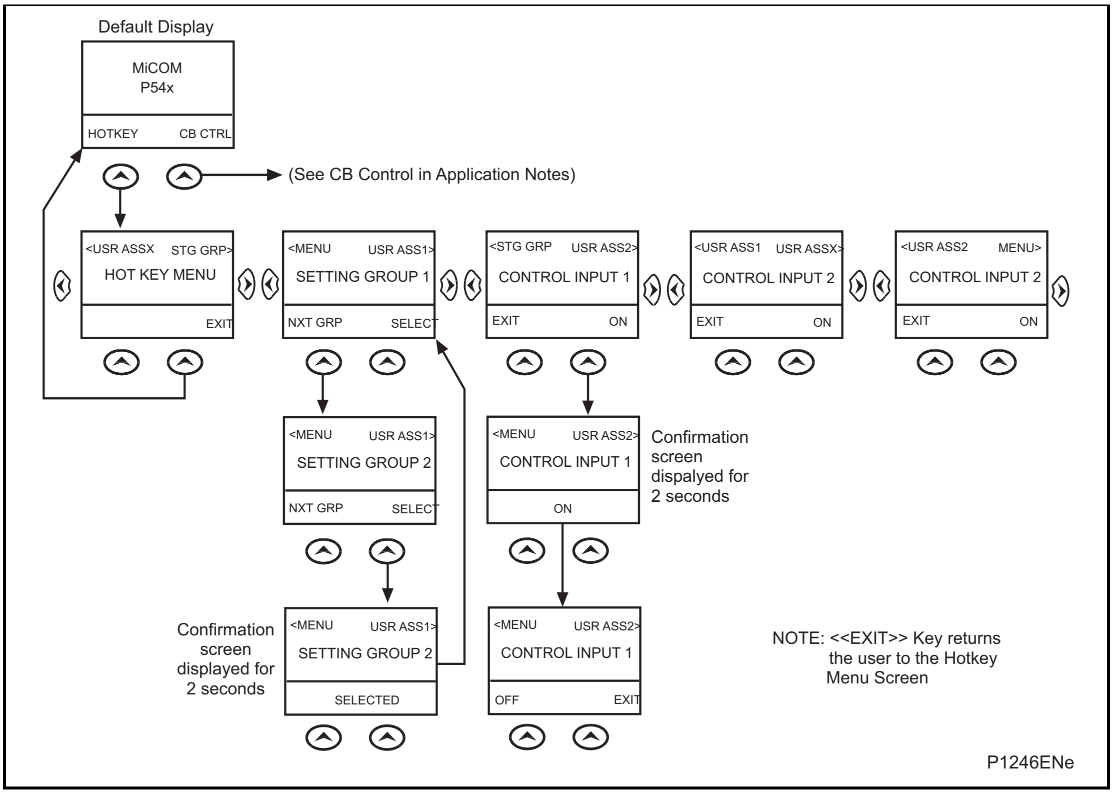

Figure 4: Hotkey menu navigation

3.6.4 Password entry

When entry of a password is required the following prompt will appear:

Enter password **** Level 1

Note: The password required to edit the setting is the prompt as shown above

A flashing cursor will indicate which character field of the password may be changed. Press the and keys to vary each character between A and Z. To move between the character fields of the password, use the and keys. The password is confirmed by pressing the enter key . The display will revert to ‘Enter Password’ if an incorrect password is entered. At this point a message will be displayed indicating whether a correct password has been entered and if so what level of access has been unlocked. If this level is sufficient to edit the selected setting then the display will return to the setting page to allow the edit to continue. If the correct level of password has not been entered then the password prompt page will be returned to. To escape from this prompt press the clear key ⓒ. Alternatively, the password can be entered using the 'Password' cell of the 'System data' column.

For the front panel user interface the password protected access will revert to the default access level after a keypad inactivity time-out of 15 minutes. It is possible to manually reset the password protection to the default level by moving to the 'Password' menu cell in the 'System data' column and pressing the clear key ⓒ instead of entering a password.

3.6.5 Reading and clearing of alarm messages and fault records

The presence of one or more alarm messages will be indicated by the default display and by the yellow alarm LED flashing. The alarm messages can either be self-resetting or latched, in which case they must be cleared manually. To view the alarm messages press the read key. When all alarms have been viewed, but not cleared, the alarm LED will change from flashing to constant illumination and the latest fault record will be displayed (if there is one). To scroll through the pages of this use the key. When all pages of the fault record have been viewed, the following prompt will appear:

Press clear to reset alarms

To clear all alarm messages press ⓒ; to return to the alarms/faults present display and leave the alarms uncleared, press. Depending on the password configuration settings, it may be necessary to enter a password before the alarm messages can be cleared (see section on password entry). When the alarms have been cleared the yellow alarm LED will extinguish, as will the red trip LED if it was illuminated following a trip.

Alternatively it is possible to accelerate the procedure, once the alarm viewer has been entered using the key, the ⓒ key can be pressed, this will move the display straight to the fault record. Pressing ⓒ again will move straight to the alarm reset prompt where pressing ⓒ once more will clear all alarms.

3.6.6 Setting changes

To change the value of a setting, first navigate the menu to display the relevant cell. To change the cell value press the enter key, which will bring up a flashing cursor on the LCD to indicate that the value can be changed. This will only happen if the appropriate password has been entered, otherwise the prompt to enter a password will appear. The setting value can then be changed by pressing the or keys. If the setting to be changed is a binary value or a text string, the required bit or character to be changed must first be selected using the and keys. When the desired new value has been reached it is confirmed as the new setting value by pressing. Alternatively, the new value will be discarded either if the clear button ⓒ is pressed or if the menu time-out occurs.

For protection group settings and disturbance recorder settings, the changes must be confirmed before they are used by the relay. To do this, when all required changes have been entered, return to the column heading level and press the key. Prior to returning to the default display the following prompt will be given:

Update settings? Enter or clear

Pressing will result in the new settings being adopted, pressing ⓒ will cause the relay to discard the newly entered values. It should be noted that, the setting values will also be discarded if the menu time out occurs before the setting changes have been confirmed. Control and support settings will be updated immediately after they are entered, without 'Update settings?' prompt.

3.7 Front communication port user interface

The front communication port is provided by a 9-pin female D-type connector located under the bottom hinged cover. It provides EIA(RS)232 serial data communication and is intended for use with a PC locally to the relay (up to 15m distance) as shown in Figure 5. This port supports the Courier communication protocol only. Courier is the communication language developed by Alstom Grid to allow communication with its range of protection relays. The front port is particularly designed for use with the relay settings program MiCOM S1 which is a Windows 98/NT based software package.

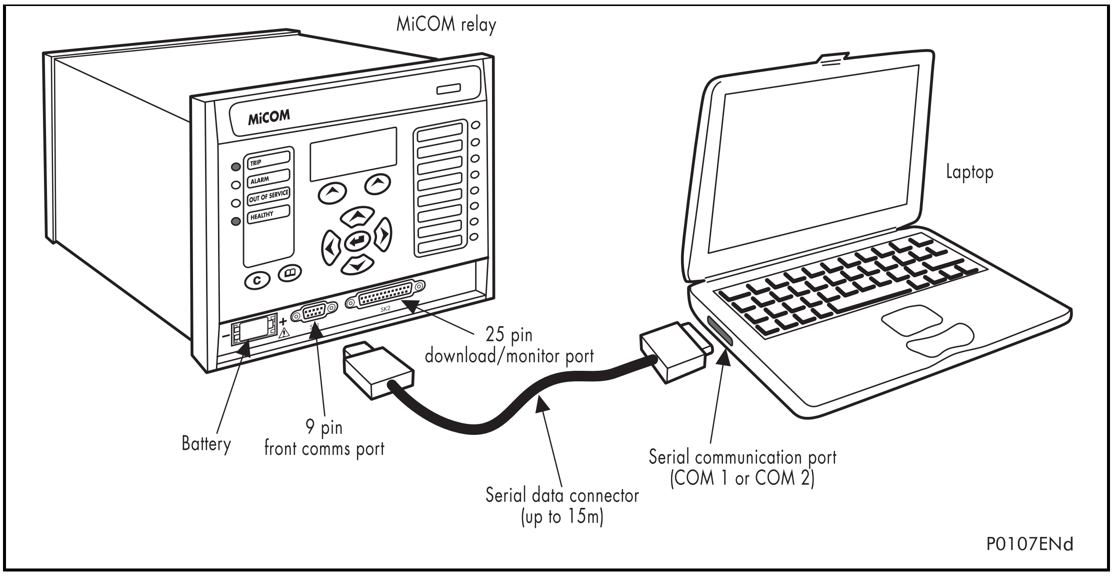

Figure 5: Front port connection

The relay is a Data Communication Equipment (DCE) device. Thus the pin connections of the relay's 9-pin front port are as follows:

Pin no. 2	Tx Transmit data
Pin no. 3	Rx Receive data
Pin no. 5	0V Zero volts common

None of the other pins are connected in the relay. The relay should be connected to the serial port of a PC, usually called COM1 or COM2. PCs are normally Data Terminal Equipment (DTE) devices which have a serial port pin connection as below (if in doubt check your PC manual):

25 Way	9 Way	
Pin no. 3	2	Rx Receive data
Pin no. 2	3	Tx Transmit data
Pin no. 7	5	0V Zero volts common

For successful data communication, the Tx pin on the relay must be connected to the Rx pin on the PC, and the Rx pin on the relay must be connected to the Tx pin on the PC, as shown in Figure 6. Therefore, providing that the PC is a DTE with pin connections as given above, a 'straight through' serial connector is required, i.e. one that connects pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5. Note that a common cause of difficulty with serial data communication is connecting Tx to Tx and Rx to Rx. This could happen if a 'cross-over' serial connector is used, i.e. one that connects pin 2 to pin 3, and pin 3 to pin 2, or if the PC has the same pin configuration as the relay.

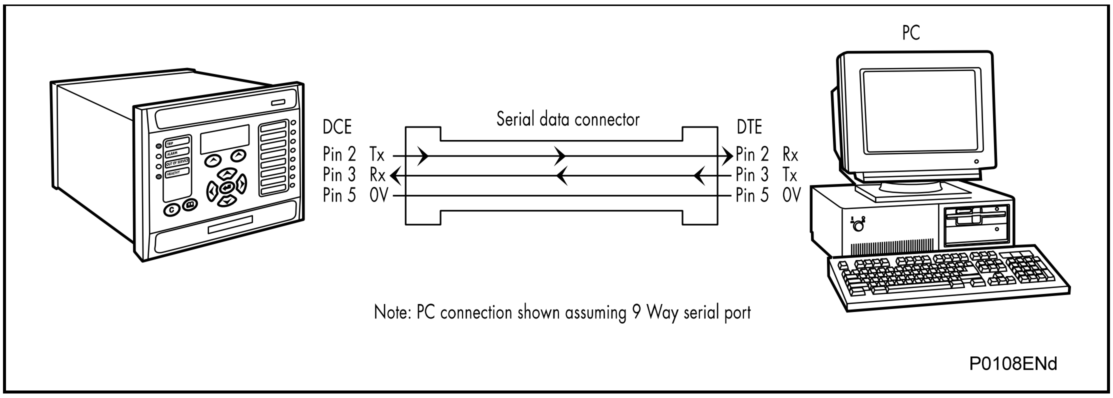

Figure 6: PC – relay signal connection

Having made the physical connection from the relay to the PC, the PC's communication settings must be configured to match those of the relay. The relay's communication settings for the front port are fixed as shown in the table below:

Protocol	Courier
Baud rate	19,200 bits/s
Courier address	1
Message format	11 bit - 1 start bit, 8 data bits, 1 parity bit (even parity), 1 stop bit

The inactivity timer for the front port is set at 15 minutes. This controls how long the relay will maintain its level of password access on the front port. If no messages are received on the front port for 15 minutes then any password access level that has been enabled will be revoked.

3.8 First rear communication port

Rear port 1 (RP1) support one of four communication protocols (Courier, Modbus, DNP3.0, IEC 60870-5-103), the choice of which must be made when the relay is ordered. The rear communication port is provided by a 3-terminal screw connector located on the back of the relay. See Appendix B for details of the connection terminals. The rear port provides K-Bus/EIA(RS)485 serial data communication and is intended for use with a permanently-wired connection to a remote control centre. Of the three connections, two are for the signal connection, and the other is for the earth shield of the cable. When the K-Bus option is selected for the rear port, the two signal connections are not polarity conscious, however for Modbus, IEC 60870-5-103 and DNP3.0 care must be taken to observe the correct polarity.

The protocol provided by the relay is indicated in the relay menu in the 'Communications' column. Using the keypad and LCD, firstly check that the 'Comms settings' cell in the 'Configuration' column is set to 'Visible', then move to the 'Communications' column. The first cell down the column shows the communication protocol being used by the rear port.

3.8.1 Courier communication

Courier is the communication language developed by Alstom Grid to allow remote interrogation of its range of protection relays. Courier works on a master/slave basis where the slave units contain information in the form of a database, and respond with information from the database when it is requested by a master unit.

The relay is a slave unit which is designed to be used with a Courier master unit such as MiCOM S1, MiCOM S10, PAS&T or a SCADA system. MiCOM S1 is a Windows NT4.0/98 compatible software package which is specifically designed for setting changes with the relay.

To use the rear port to communicate with a PC-based master station using Courier, a KITZ K-Bus to EIA(RS)232 protocol converter is required. This unit is available from Alstom Grid. A typical connection arrangement is shown in Figure 7. For more detailed information on other possible connection arrangements refer to the manual for the Courier master station software and the manual for the KITZ protocol converter. Each spur of the K-Bus twisted pair wiring can be up to 1000m in length and have up to 32 relays connected to it.

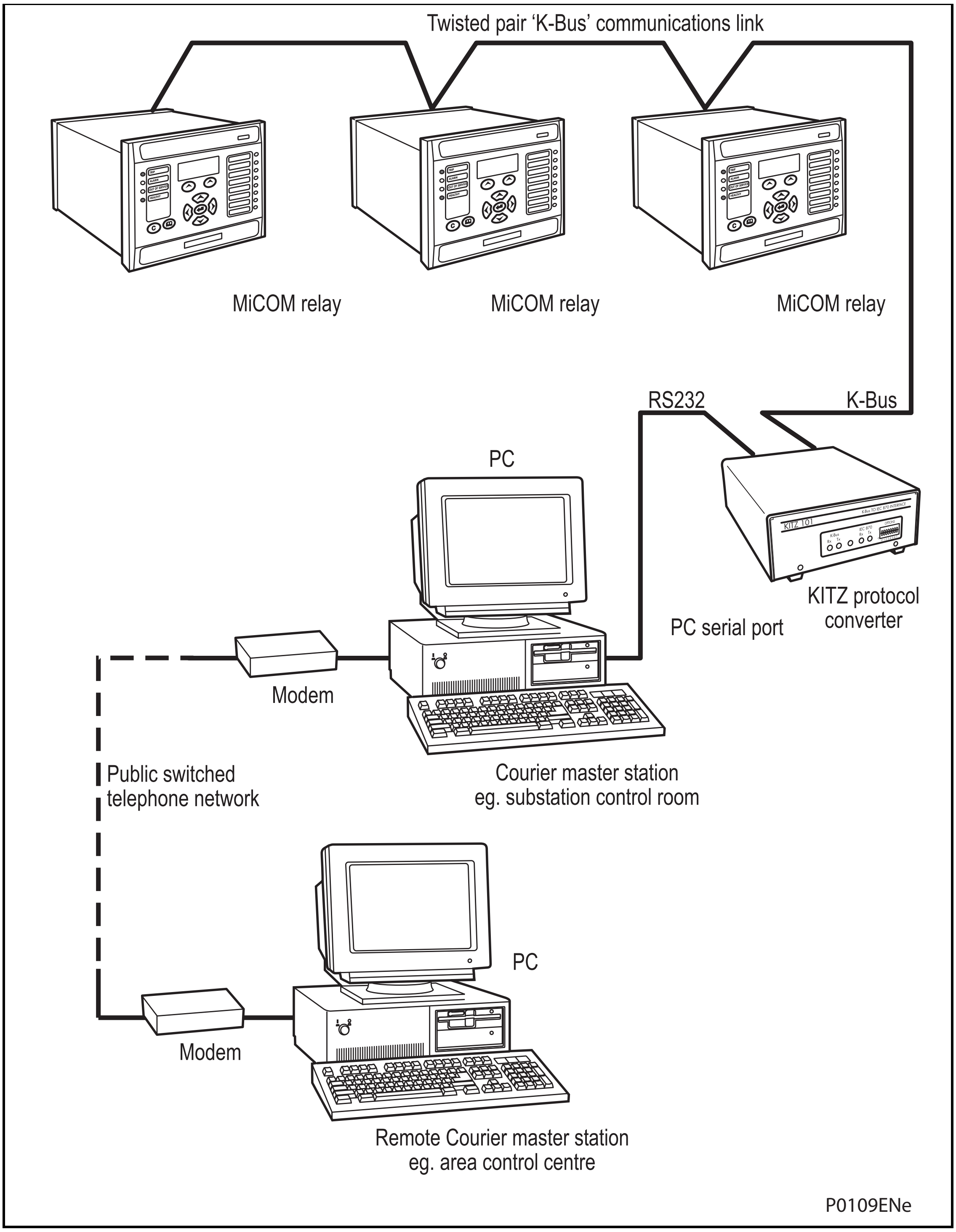

Figure 7: Remote communication connection arrangements

Having made the physical connection to the relay, the relay's communication settings must be configured. To do this use the keypad and LCD user interface. In the relay menu firstly check that the 'Comms settings' cell in the 'Configuration' column is set to 'Visible', then move to the 'Communications' column. Only two settings apply to the rear port using Courier, the relay's address and the inactivity timer. Synchronous communication is used at a fixed baud rate of 64kbits/s.

Move down the 'Communications' column from the column heading to the first cell down which indicates the communication protocol:

RP1 Protocol Courier

The next cell down the column controls the address of the relay:

RP1 Address 1

Since up to 32 relays can be connected to one K-bus spur, as indicated in Figure 7, it is necessary for each relay to have a unique address so that messages from the master control station are accepted by one relay only. Courier uses an integer number between 0 and 254 for the relay address which is set with this cell. It is important that no two relays have the same Courier address. The Courier address is then used by the master station to communicate with the relay.

The next cell down controls the inactivity timer:

RP1 Inactivity timer 10.00 mins

The inactivity timer controls how long the relay will wait without receiving any messages on the rear port before it reverts to its default state, including revoking any password access that was enabled. For the rear port this can be set between 1 and 30 minutes.

As an alternative to running courier over K-Bus, courier over EIA485 may be selected. The next cell down indicates the status of the hardware, e.g.

RP1 Card Status EIA232 OK

The next cell allows for selection of the port configuration

RP1 Port Config EIA232 (EIA(RS)232)

The port can be configured for EIA485 or K-Bus.

In the case of EIA485 the next cell selects the communication mode.

RP1 Comms Mode IEC60870 FT1.2

The choice is either IEC60870 FT1.2 for normal operation with 11-bit modems, or 10-bit no parity.

In the case of EIA485 the next cell down controls the baud rate. For K-Bus the baud rate is fixed at 64kbit/second between the relay and the KITZ interface at the end of the relay spur.

RP2 Baud Rate 19200

Courier communications is asynchronous. Three baud rates are supported by the relay, '9600 bits/s', '19200 bits/s' and '38400 bits/s',

Note that protection and disturbance recorder settings that are modified using an on-line editor such as PAS&T must be confirmed with a write to the 'Save changes' cell of the 'Configuration' column. Off-line editors such as MiCOM S1 do not require this action for the setting changes to take effect.

3.8.2 Modbus communication

Modbus is a master/slave communication protocol which can be used for network control. In a similar fashion to Courier, the system works by the master device initiating all actions and the slave devices, (the relays), responding to the master by supplying the requested data or by taking the requested action. Modbus communication is achieved via a twisted pair connection to the rear port and can be used over a distance of 1000m with up to 32 slave devices.

To use the rear port with Modbus communication, the relay's communication settings must be configured. To do this use the keypad and LCD user interface. In the relay menu firstly check that the 'Comms settings' cell in the 'Configuration' column is set to 'Visible', then move to the 'Communications' column. Four settings apply to the rear port using Modbus which are described below. Move down the 'Communications' column from the column heading to the first cell down which indicates the communication protocol:

RP1 Protocol Modbus

The next cell down controls the Modbus address of the relay:

RP1 Address 23

Up to 32 relays can be connected to one Modbus spur, and therefore it is necessary for each relay to have a unique address so that messages from the master control station are accepted by one relay only. Modbus uses an integer number between 1 and 247 for the relay address. It is important that no two relays have the same Modbus address. The Modbus address is then used by the master station to communicate with the relay.

The next cell down controls the inactivity timer:

RP1 InactivTimer 10.00 mins

The inactivity timer controls how long the relay will wait without receiving any messages on the rear port before it reverts to its default state, including revoking any password access that was enabled. For the rear port this can be set between 1 and 30 minutes.

The next cell down the column controls the baud rate to be used:

RP1 Baud rate 9600 bits/s

Modbus communication is asynchronous. Three baud rates are supported by the relay, '9600 bits/s', '19200 bits/s' and '38400 bits/s'. It is important that whatever baud rate is selected on the relay is the same as that set on the Modbus master station.

The next cell down controls the parity format used in the data frames:

RP1 Parity None

The parity can be set to be one of 'None', 'Odd' or 'Even'. It is important that whatever parity format is selected on the relay is the same as that set on the Modbus master station.

The next cell down controls the format of the Date/Time (software 30 or later)

Modbus IEC Time Standard

The format can be selected to either 'Standard' (as per IEC60870-5-4 'Binary Time 2a'), the default, or to 'Reverse' for compatibility with MICOM Px20 and Px30 product ranges. For further information see P54x/EN CT/XXX section 3.8.

3.8.3 IEC 60870-5 CS 103 communication

The IEC specification IEC 60870-5-103: Telecontrol Equipment and Systems, Part 5: Transmission Protocols Section 103 defines the use of standards IEC 60870-5-1 to IEC 60870-5-5 to perform communication with protection equipment. The standard configuration for the IEC 60870-5-103 protocol is to use a twisted pair connection over distances up to 1000m. As an option for IEC 60870-5-103, the rear port can be specified to use a fibre optic connection for direct connection to a master station. The relay operates as a slave in the system, responding to commands from a master station. The method of communication uses standardised messages which are based on the VDEW communication protocol.

To use the rear port with IEC 60870-5-103 communication, the relay's communication settings must be configured. To do this use the keypad and LCD user interface. In the relay menu firstly check that the 'Comms settings' cell in the 'Configuration' column is set to 'Visible', then move to the 'Communications' column. Four settings apply to the rear port using IEC 60870-5-103 which are described below. Move down the 'Communications' column from the column heading to the first cell which indicates the communication protocol:

RP1 Protocol IEC 60870-5-103

The next cell down controls the IEC 60870-5-103 address of the relay:

RP1 Address 162

Up to 32 relays can be connected to one IEC 60870-5-103 spur, and therefore it is necessary for each relay to have a unique address so that messages from the master control station are accepted by one relay only. IEC 60870-5-103 uses an integer number between 0 and 254 for the relay address. It is important that no two relays have the same IEC 60870-5-103 address. The IEC 60870-5-103 address is then used by the master station to communicate with the relay.

The next cell down the column controls the baud rate to be used:

RP1 Baud rate 9600 bits/s

IEC 60870-5-103 communication is asynchronous. Two baud rates are supported by the relay, '9600 bits/s' and '19200 bits/s'. It is important that whatever baud rate is selected on the relay is the same as that set on the IEC 60870-5-103 master station.

The next cell down controls the period between IEC 60870-5-103 measurements:

RP1 Meas period 30.00 s

The IEC 60870-5-103 protocol allows the relay to supply measurements at regular intervals. The interval between measurements is controlled by this cell, and can be set between 1 and 60 seconds.

The next cell down the column controls the physical media used for the communication:

RP1 Physical link EIA(RS)485

The default setting is to select the electrical EIA(RS)485 connection. If the optional fibre optic connectors are fitted to the relay, then this setting can be changed to 'Fibre optic'.

3.8.4 DNP 3.0 Communication

The DNP 3.0 protocol is defined and administered by the DNP User Group. Information about the user group, DNP 3.0 in general and protocol specifications can be found on their website: www.dnp.org

The relay operates as a DNP 3.0 slave and supports subset level 2 of the protocol plus some of the features from level 3. DNP 3.0 communication is achieved via a twisted pair connection to the rear port and can be used over a distance of 1000m with up to 32 slave devices.

To use the rear port with DNP 3.0 communication, the relay's communication settings must be configured. To do this use the keypad and LCD user interface. In the relay menu firstly check that the 'Comms setting' cell in the 'Configuration' column is set to 'Visible', then move to the 'Communications' column. Four settings apply to the rear port using DNP 3.0, which are described below. Move down the 'Communications' column from the column heading to the first cell which indicates the communications protocol:

RP1 Protocol DNP 3.0

The next cell controls the DNP 3.0 address of the relay:

RP1 Address 232

Upto 32 relays can be connected to one DNP 3.0 spur, and therefore it is necessary for each relay to have a unique address so that messages from the master control station are accepted by only one relay. DNP 3.0 uses a decimal number between 1 and 65519 for the relay address. It is important that no two relays have the same DNP 3.0 address. The DNP 3.0 address is then used by the master station to communicate with the relay.

The next cell down the column controls the baud rate to be used:

RP1 Baud rate 9600 bits/s

DNP 3.0 communication is asynchronous. Six baud rates are supported by the relay '1200bits/s', '2400bits/s', '4800bits/s', '9600bits/s', '19200bits/s' and '38400bits/s'. It is important that whatever baud rate is selected on the relay is the same as that set on the DNP 3.0 master station.

The next cell down the column controls the parity format used in the data frames:

RP1 Parity None

The parity can be set to be one of ‘None’, ‘Odd’ or ‘Even’. It is important that whatever parity format is selected on the relay is the same as that set on the DNP 3.0 master station.

The next cell down the column sets the time synchronisation request from the master by the relay:

RP1 Time Sync Enabled

The time synch can be set to either enabled or disabled. If enabled it allows the DNP 3.0 master to synchronise the time.

3.9 Second Rear Communication Port (option)

For relays with Courier, Modbus, IEC60870-5-103 or DNP3 protocol on the first rear communications port there is the hardware option of a second rear communications port, which will run the Courier language. This can be used over one of three physical links: twisted pair K-Bus (non polarity sensitive), twisted pair EIA485 (connection polarity sensitive) or EIA232.

The settings for this port are located immediately below the ones for the first port as described in previous sections of this chapter. Move down the settings until the following sub heading is displayed.

REAR PORT2 (RP2)

The next cell down indicates the language, which is fixed at Courier for RP2.

RP2 Protocol Courier

The next cell down indicates the status of the hardware, e.g.

RP2 Card Status EIA232 OK

The next cell allows for selection of the port configuration

RP2 Port Config EIA232 (EIA(RS)232)

The port can be configured for EIA232, EIA485 or K-Bus.

In the case of EIA232 and EIA485 the next cell selects the communication mode.

RP2 Comms Mode IEC60870 FT1.2

The choice is either IEC60870 FT1.2 for normal operation with 11-bit modems, or 10-bit no parity.

3.10 Ethernet Rear Port (option)

If UCA2.0 is chosen when the relay is ordered, the relay is fitted with an Ethernet interface card.
See P54x/EN UC section 4.4 for more detail of the Ethernet hardware.

INSTALLATION

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1. RECEIPT OF RELAYS

Protective relays, although generally of robust construction, require careful treatment prior to installation on site. Upon receipt, relays should be examined immediately to ensure no external damage has been sustained in transit. If damage has been sustained, a claim should be made to the transport contractor and Alstom Grid should be promptly notified.

Relays that are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags and delivery carton. Section 3 of this chapter gives more information about the storage of relays.

2. HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage which, although not always immediately apparent, will reduce the reliability of the circuit. This is particularly important to consider where the circuits use complementary metal oxide semiconductors (CMOS), as is the case with these relays.

The relay's electronic circuits are protected from electrostatic discharge when housed in the case. Do not expose them to risk by removing the front panel or printed circuit boards unnecessarily.

Each printed circuit board incorporates the highest practicable protection for it's semiconductor devices. However, if it becomes necessary to remove a printed circuit board, the following precautions should be taken to preserve the high reliability and long life for which the relay has been designed and manufactured.

Before removing a printed circuit board, ensure that you are at the same electrostatic potential as the equipment by touching the case.

Handle analogue input modules by the front panel, frame or edges of the circuit boards. Printed circuit boards should only be handled by their edges. Avoid touching the electronic components, printed circuit tracks or connectors.

Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.

Place the module on an anti-static surface, or on a conducting surface which is at the same potential as yourself.

If it is necessary to store or transport printed circuit boards removed from the case, place them individually in electrically conducting anti-static bags.

In the unlikely event that you are making measurements on the internal electronic circuitry of a relay in service, it is preferable that you are earthed to the case with a conductive wrist strap. Wrist straps should have a resistance to ground between 500kΩ to 10MΩ. If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of electrostatic potential. Instrumentation which may be used for making measurements should also be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS EN 100015: Part 1:1992. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the aforementioned British Standard document.

3. STORAGE

If relays are not to be installed immediately upon receipt, they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained. The action of the de-humidifier crystals will be impaired if the bag is exposed to ambient conditions and may be restored by gently heating the bag for about an hour prior to replacing it in the carton.

To prevent battery drain during transportation and storage a battery isolation strip is fitted during manufacture. With the lower access cover open, presence of the battery isolation strip can be checked by a red tab protruding from the positive side.

Care should be taken on subsequent unpacking that any dust which has collected on the carton does not fall inside. In locations of high humidity the carton and packing may become impregnated with moisture and the de-humidifier crystals will lose their efficiency.

Prior to installation, relays should be stored at a temperature of between –25˚C to +70˚C.

4. UNPACKING

Care must be taken when unpacking and installing the relays so that none of the parts are damaged and additional components are not accidentally left in the packing or lost.

Note: With the lower access cover open, the red tab of the battery isolation strip will be seen protruding from the positive side of the battery compartment. Do not remove this strip because it prevents battery drain during transportation and storage and will be removed as part of the commissioning tests.

Relays must only be handled by skilled persons.

The site should be well lit to facilitate inspection, clean, dry and reasonably free from dust and excessive vibration. This particularly applies to installations which are being carried out at the same time as construction work.

5. RELAY MOUNTING

MiCOM relays are dispatched either individually or as part of a panel/rack assembly.

Individual relays are normally supplied with an outline diagram showing the dimensions for panel cut-outs and hole centres. This information can also be found in the product publication.

Secondary front covers can also be supplied as an option item to prevent unauthorised changing of settings and alarm status. They are available in sizes 40TE (GN0037 001) and 60TE (GN0038 001). Note that the 60TE cover also fits the 80TE case size of the relay.

The design of the relay is such that the fixing holes in the mounting flanges are only accessible when the access covers are open and hidden from sight when the covers are closed.

If a P991 or MMLG test block is to be included, it is recommended that, when viewed from the front, it is positioned on the right-hand side of the relay (or relays) with which it is associated. This minimises the wiring between the relay and test block, and allows the correct test block to be easily identified during commissioning and maintenance tests.

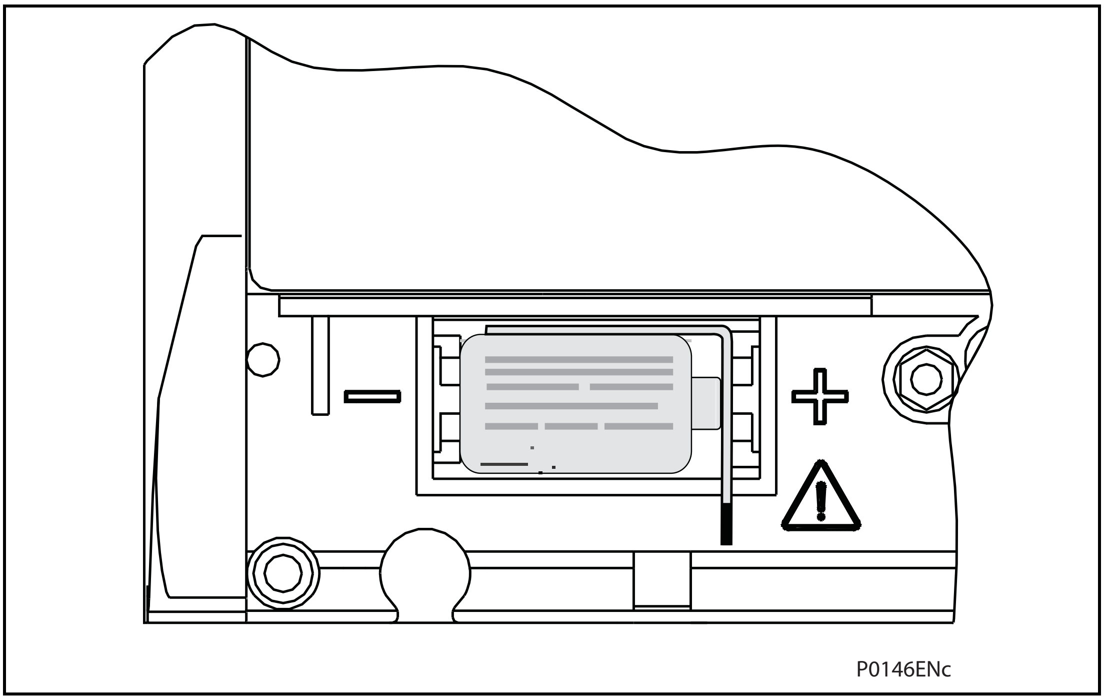

Figure 1: Location of battery isolation strip

If it is necessary to test correct relay operation during the installation, the battery isolation strip can be removed but should be replaced if commissioning of the scheme is not imminent. This will prevent unnecessary battery drain during transportation to site and installation. The red tab of the isolation strip can be seen protruding from the positive side of the battery compartment when the lower access cover is open. To remove the isolation strip, pull the red tab whilst lightly pressing the battery to prevent it falling out of the compartment. When replacing the battery isolation strip, ensure that the strip is refitted as shown in Figure 1, i.e. with the strip behind the battery with the red tab protruding.

5.1 Rack mounting

MiCOM relays may be rack mounted using single tier rack frames (our part number FX0021 001), as illustrated in Figure 2. These frames have been designed to have dimensions in accordance with IEC60297 and are supplied pre-assembled ready to use. On a standard 483mm (19”) rack system this enables combinations of widths of case up to a total equivalent of size 80TE to be mounted side by side.

P545 and P546 relays in 80TE cases are also available as direct 19” rack mounting ordering variants, having mounted flanges similar to those shown in Figure 2.

The two horizontal rails of the rack frame have holes drilled at approximately 26mm intervals and the relays are attached via their mounting flanges using M4 Taptite self-tapping screws with captive 3mm thick washers (also known as a SEMS unit). These fastenings are available in packs of 5 (our part number ZA0005 104).

Note: Conventional self-tapping screws, including those supplied for mounting MIDOS relays, have marginally larger heads which can damage the front cover moulding if used.

Once the tier is complete, the frames are fastened into the racks using mounting angles at each end of the tier.

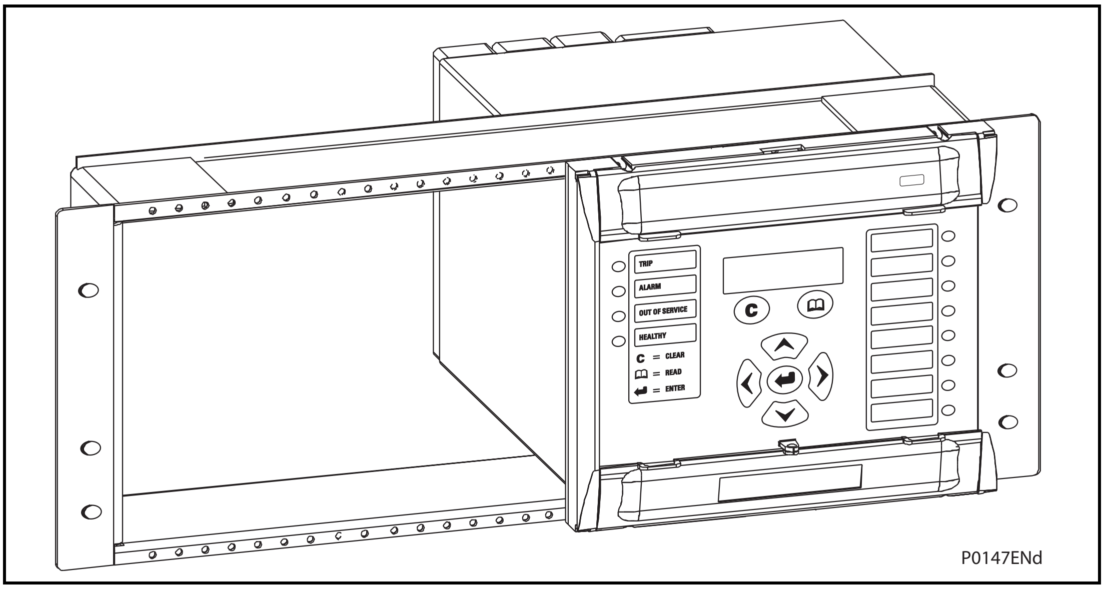

Figure 2: Rack mounting of relays

Relays can be mechanically grouped into single tier (4U) or multi-tier arrangements by means of the rack frame. This enables schemes using products from the MiCOM and MiDOS product ranges to be pre-wired together prior to mounting.

Where the case size summation is less than 80TE on any tier, or space is to be left for installation of future relays, blanking plates may be used. These plates can also be used to mount ancillary components. Table 1 shows the sizes that can be ordered.

Further details on mounting MiDOS relays can be found in publication R7012, “MiDOS Parts Catalogue and Assembly Instructions”.

Case size summation	Blanking plate part number
5TE	GJ2028 001
10TE	GJ2028 002
15TE	GJ2028 003
20TE	GJ2028 004
25TE	GJ2028 005
30TE	GJ2028 006
35TE	GJ2028 007
40TE	GJ2028 008

Table 1: Blanking plates

5.2 Panel mounting

The relays can be flush mounted into panels using M4 SEMS Taptite self-tapping screws with captive 3mm thick washers (also known as a SEMS unit). These fastenings are available in packs of 5 (our part number ZA0005 104).

Note: Conventional self-tapping screws, including those supplied for mounting MIDOS relays, have marginally larger heads which can damage the front cover moulding if used.

Alternatively tapped holes can be used if the panel has a minimum thickness of 2.5mm.

For applications where relays need to be semi-projection or projection mounted, a range of collars are available.

Where several relays are to mounted in a single cut-out in the panel, it is advised that they are mechanically grouped together horizontally and/or vertically to form rigid assemblies prior to mounting in the panel.

Note: It is not advised that MiCOM relays are fastened using pop rivets as this will not allow the relay to be easily removed from the panel in the future if repair is necessary.

If it is required to mount a relay assembly on a panel complying to BS EN60529 IP52, it will be necessary to fit a metallic sealing strip between adjoining relays (Part no GN2044 001) and a sealing ring selected from Table 2 around the complete assembly.

Width	Single tier	Double tier
10TE	GJ9018 002	GJ9018 018
15TE	GJ9018 003	GJ9018 019
20TE	GJ9018 004	GJ9018 020
25TE	GJ9018 005	GJ9018 021
30TE	GJ9018 006	GJ9018 022
35TE	GJ9018 007	GJ9018 023
40TE	GJ9018 008	GJ9018 024
45TE	GJ9018 009	GJ9018 025
50TE	GJ9018 010	GJ9018 026
55TE	GJ9018 011	GJ9018 027
60TE	GJ9018 012	GJ9018 028
65TE	GJ9018 013	GJ9018 029
70TE	GJ9018 014	GJ9018 030
75TE	GJ9018 015	GJ9018 031
80TE	GJ9018 016	GJ9018 032

Table 2: IP52 sealing rings

Further details on mounting MiDOS relays can be found in publication R7012, “MiDOS Parts Catalogue and Assembly Instructions”.

6. RELAY WIRING

This section serves as a guide to selecting the appropriate cable and connector type for each terminal on the MiCOM relay.

6.1 Medium and heavy duty terminal block connections

Loose relays are supplied with sufficient M4 screws for making connections to the rear mounted terminal blocks using ring terminals, with a recommended maximum of two ring terminals per relay terminal.

If required, Alstom Grid can supply M4 90° crimp ring terminals in three different sizes depending on wire size (see Table 3). Each type is available in bags of 100.

Part number	Wire size	Insulation colour
ZB9124 901	0.25 – 1.65mm^2 (22 – 16AWG)	Red
ZB9124 900	1.04 – 2.63mm^2 (16 – 14AWG)	Blue
ZB9124 904	2.53 – 6.64mm^2 (12 – 10AWG)	Uninsulated*

Table 3: M4 90° crimp ring terminals

* To maintain the terminal block insulation requirements for safety, an insulating sleeve should be fitted over the ring terminal after crimping.

The following minimum wire sizes are recommended:

- Current Transformers 2.5mm^2
- Auxiliary Supply, Vx 1.5mm^2
- EIA(RS)485 Port See separate section
- Other circuits 1.0mm^2

Due to the limitations of the ring terminal, the maximum wire size that can be used for any of the medium or heavy duty terminals is 6.0mm^2 using ring terminals that are not pre-insulated. Where it required to only use pre-insulated ring terminals, the maximum wire size that can be used is reduced to 2.63mm^2 per ring terminal. If a larger wire size is required, two wires should be used in parallel, each terminated in a separate ring terminal at the relay.

The wire used for all connections to the medium and heavy duty terminal blocks, except the EIA(RS)485 port, should have a minimum voltage rating of 300Vrms.

It is recommended that the auxiliary supply wiring should be protected by a 16A high rupture capacity (HRC) fuse of type NIT or TIA. For safety reasons, current transformer circuits must never be fused. Other circuits should be appropriately fused to protect the wire used.

6.2 EIA(RS)485 port

Connections to the EIA(RS)485 port are made using ring terminals. It is recommended that a 2 core screened cable is used with a maximum total length of 1000m or 200nF total cable capacitance. A typical cable specification would be:

Each core:	16/0.2mm copper conductors
	PVC insulated
Nominal conductor area:	0.5mm^2 per core
Screen:	Overall braid, PVC sheathed

6.3 IRIG-B connections (if applicable)

The IRIG-B input and BNC connector have a characteristic impedance of 50Ω. It is recommended that connections between the IRIG-B equipment and the relay are made using coaxial cable of type RG59LSF with a halogen free, fire retardant sheath.

6.4 EIA(RS)485 port

Short term connections to the EIA(RS)485 port, located behind the bottom access cover, can be made using a screened multi-core communication cable up to 15m long, or a total capacitance of 2500pF. The cable should be terminated at the relay end with a 9-way, metal shelled, D-type male plug. The Introduction (P54x/EN IT), Section 3.7 of this manual details the pin allocations.

6.5 Download/monitor port

Short term connections to the download/monitor port, located behind the bottom access cover, can be made using a screened 25-core communication cable up to 4m long. The cable should be terminated at the relay end with a 25-way, metal shelled, D-type male plug. The Introduction (P54x/EN IT), Section 3.7 of this manual details the pin allocations.

6.6 Earth connection

Every relay must be connected to the local earth bar using the M4 earth studs in the bottom left hand corner of the relay case. The minimum recommended wire size is 2.5mm^2 and should have a ring terminal at the relay end. Due to the limitations of the ring terminal, the maximum wire size that can be used for any of the medium or heavy duty terminals is 6.0mm^2 per wire. If a greater cross-sectional area is required, two parallel connected wires, each terminated in a separate ring terminal at the relay, or a metal earth bar could be used.

Note: To prevent any possibility of electrolytic action between brass or copper earth conductors and the rear panel of the relay, precautions should be taken to isolate them from one another. This could be achieved in a number of ways, including placing a nickel-plated or insulating washer between the conductor and the relay case, or using tinned ring terminals.

6.7 Protection Communication Channel Connections

A number of communications options are available as shown in the table together with the appropriate optical fibre. All terminations are BFOC 2.5 connectors (ST).

Communication option	Optical Fibre
850nm multi-mode	50/125μm or 62.5/125μm
1300nm multi-mode	50/125μm or 62.5/125μm
1300nm single-mode	9/125μm
1550nm single-mode	9/125μm

7. P590 SERIES INSTALLATION

MiCOM P59x series interface units are dispatched either individually or as part of a panel/rack assembly. Individual relays are normally supplied with an outline diagram showing the dimensions for panel cut-outs and hole centres. This information can also be found in the P59x publication.

The P59x series interface units should be mounted in close proximity to the telecommunications equipment with which it is intended for use. Ideally this will be in the same or an adjacent cubicle.

7.1 External connections

The external connections are shown on diagrams 10P59101, 10P59201, 10P59301 & 10P59401 and in the External Connection Diagram chapter (P54x/EN CO). The connections can be broken down into four groups.

7.1.1 Auxiliary supply connections

It is recommended that wire with a minimum cross section of 1.5mm^2 be used.

The recommended external protective fuse for the auxiliary DC supply of the P59x series interface units is:

2 Amp HRC (high rupture capacity) GE Red Spot type NIT or TIA;

or

if a UL recognised fuse is required, 2A time delay Gould type AJT2.

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety and Technical Data sections and the ratings on the equipment's rating label

7.1.2 Telecommunications equipment connections

7.1.2.1 P591 – G.703 connections

ITU-T G.703 electrical connections to the P591 interface unit are via the terminal blocks on the rear of the device. The G.703 signals are isolated by pulse transformers to 1kV. Since the G.703 signals are only ±1V magnitude, the cable connecting the P591 unit and the multiplexer must be properly screened against electromagnetic noise and interference. The interface cable should consist of pairs of 24AWG (19/0.12mm), twisted and shielded, and have a characteristic impedance of about 120 ohms.

The choice of grounding depends on the local codes and practices. It is recommended that the interface cable shield is connected to the multiplexer frame ground. The cable may be connected to the MiCOM P591 case earth if no earth loop current is expected.

7.1.2.2 P592 – V.35 connections

ITU-T V.35 electrical connections to the P592 interface unit are made via a standard female 34 pin ‘M’ block connector on the rear of the device. Since the V.35 signals are either of ±0.55V or ±12V magnitude, the cable connecting the P592 unit and the multiplexer must be properly screened against electromagnetic noise and interference. The interface cable should consist of pairs of 24AWG (19/0.12mm), twisted and shielded, and have a characteristic impedance of about 100 ohms. The choice of grounding depends on the local codes and practices.

It is recommended that the interface cable shield is connected to the multiplexer frame ground. The cable may be connected to the MiCOM P592 case earth if no earth loop current is expected.

7.1.2.3 P593 – X.21 connections

ITU-T X.21 electrical connections to the P593 interface unit are made via a standard male 15 way D-subminiature connector. The use of twisted pairs of 24 AWG (19/0.12mm) stranded cable, foil shielded, with drain wire is recommended. Due to the similarities between RS449 and X.21, the P593 may also be suitable for connection to RS449/RS422 equipment.

7.1.2.4 P594 - GPS Antenna

Please refer to the P594 Installation Guide (P594/EN IN) before you mount the GPS Antenna.

7.1.3 Protection Communication Channel Connections

The P59x unit is connected to the P540 relay using 850nm multi-mode optical fibre type 50/125µm or 62.5/125µm and fitted with BFOC 2.5 connectors (ST).

P594 INSTALLATION GUIDE

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1. SCOPE

This document gives installation guidelines for using the P594 GPS synchronising module, with the P545/P546 relays.

2. APPLICATION

The P545 and P546 relays may be deployed on communications links where the Multiplexer employs Synchronous Digital Hierarchy (SDH or SONET). In such applications the conventional propagation delay measurement may be unreliable, and GPS time measurements are required.

A P594 module must be deployed at each line terminal, to be connected by a coaxial cable to a GPS Antenna, and also by a single core 850nm fibre to the P545/P546 relay.

One P594 may supply up to four P545/P546 relays.

It is essential that installation of the GPS synchronism scheme is undertaken with care. Poor installation may lead to periodic unavailability of the line unit protection.

This installation guide recommends good installation practice to be followed.

3. GUIDELINES

The following guidelines should be observed when installing the GPS system to ensure sufficient GPS availability. GPS is available in all parts of the world, it is only poor installation practice that can cause the signal to drop out.

The P594 supplied by Alstom Grid includes all the parts required for its installation. The antenna cable can be 25m or 50m long and depending on the length required, the material list and mounting description is as follows:

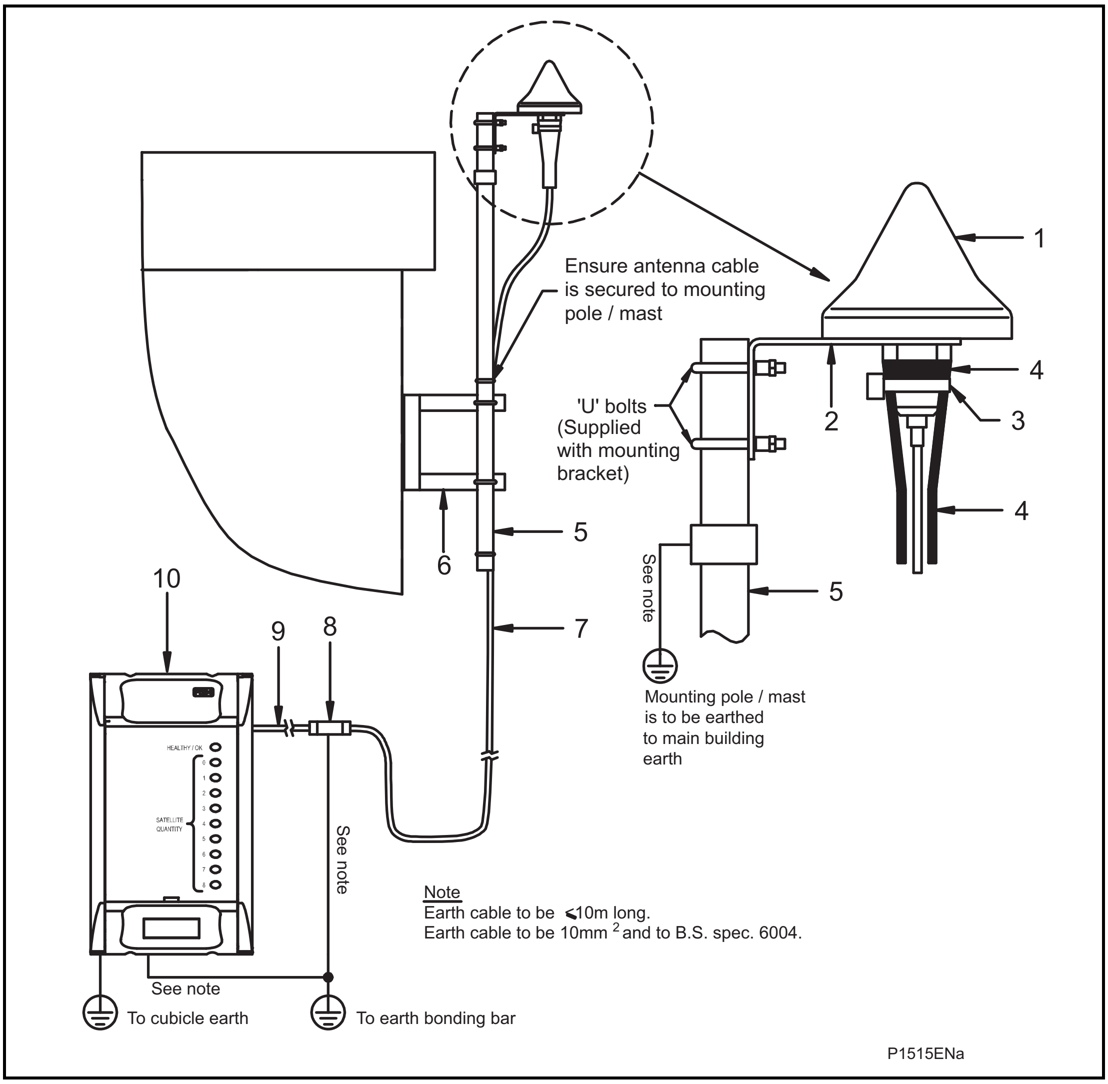

Figure 1: Mounting of the standard kit (25m)

Standard kit (25m antenna cable length)

1. One antenna
2. One antenna mounting bracket with 2 “U” bolts
3. One Cable tie
4. One PVC terminal shroud
5. One aluminium 25.4 mm diameter antenna pole
6. One pole/wall mounting bracket with fixings
7. One 17m ‘antenna to lightening arrestor’ cable – Ref. ZA0015 002
8. One lightening arrestor
9. One 8m ‘lightening arrestor to P594’ cable – Ref. ZA0015 001
10. One P594

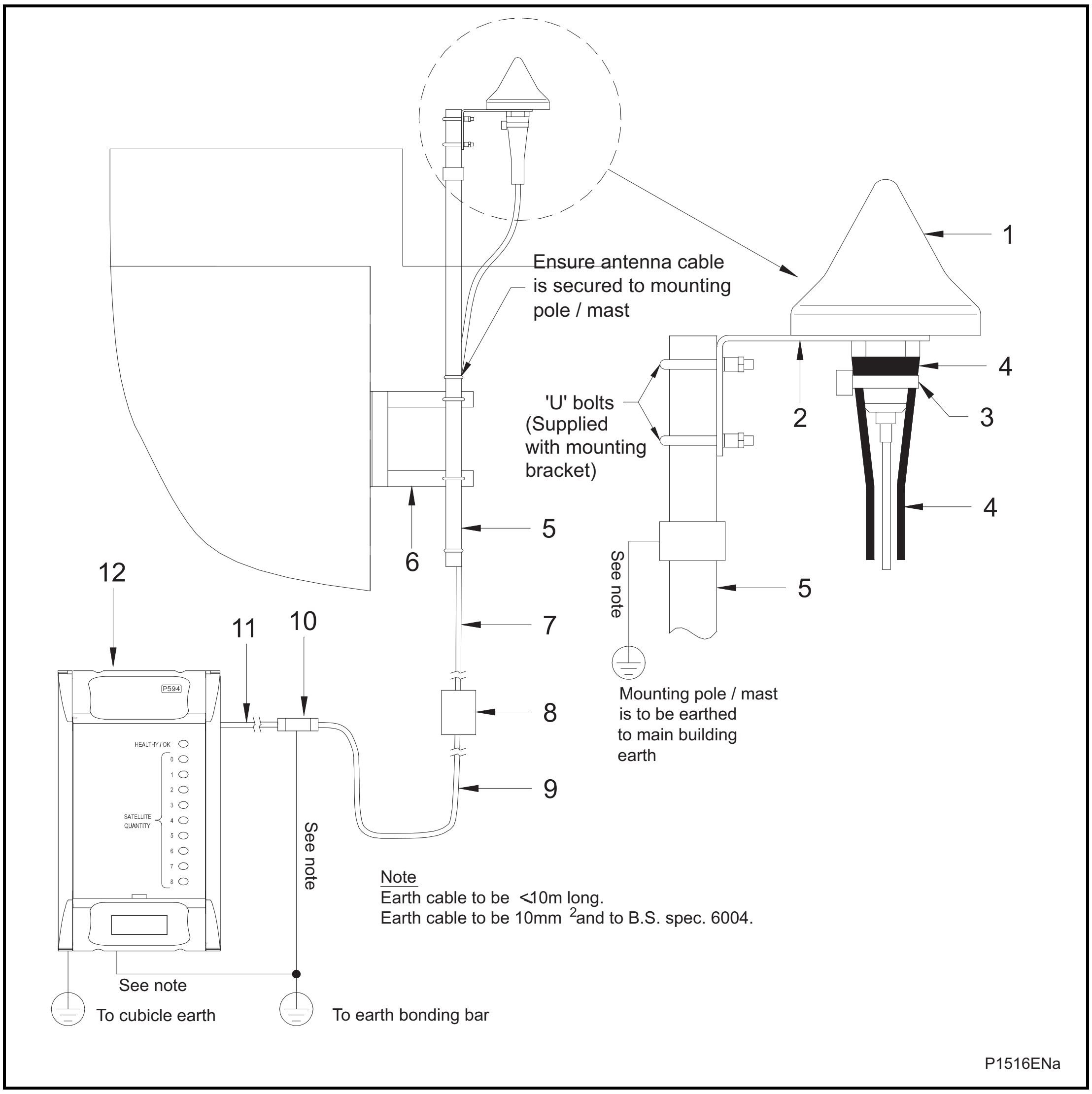

Figure 2: Mounting of the Optional kit (50m)

Optional kit (50m antenna cable length)

1. One antenna
2. One antenna mounting bracket with 2 “U” bolts
3. One Cable tie
4. One PVC terminal shroud
5. One aluminium 25.4 mm diameter antenna pole
6. One pole/wall mounting bracket with fixings
7. One 25m ‘antenna to amplifier’ cable – Ref. ZA0015 003
8. One amplifier
9. One 17m ‘amplifier to lightening arrestor’ cable – Ref. ZA0015 002
10. One lightening arrestor
11. One 8m ‘lightening arrestor to P594’ cable – Ref. ZA0015 001
12. One P594

4. THE ANTENNA

The antenna supplied by Alstom Grid is a MOTOROLA ONCORE™ TIMING2000. Description of this is available in the Antenna User's Guide, Chapter 4 "Antenna Description ", revision 5.0/08/30/02 available from the MOTOROLA website.

4.1 Site survey

The installer must choose a suitable site for the antenna observing the following:

- The antenna should be mounted so that it is just above the roofline of the building ensuring that there is a 360º horizontal and 150º vertical view of the sky (max. masking angle of 15º with respect to the horizon -see figure 3-). Ideally there should be no obstructions in view e.g. metal structures or buildings. **Under no circumstances must the Antenna be mounted below the roofline.** If the masking angle is greater than 15º with respect to the horizon (i.e. if is a large obstruction) the antenna must be re-sited or mounted on a longer antenna pole. Any obstructions to the antenna's line of sight may cause a reduction in the P594's ability to provide the time synchronizing signal required by the P545/P546 relay.

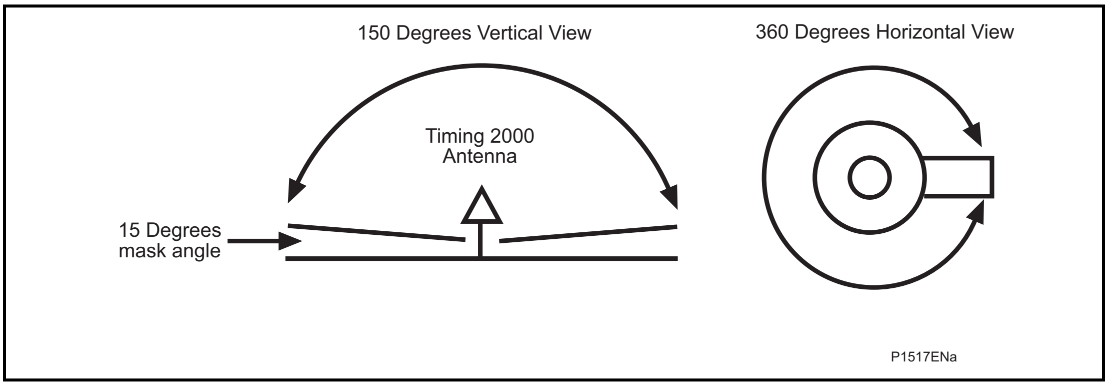

Figure 3: GPS antenna required line of sight

- Once the antenna is sited, a review should be made about how clean it will remain, during service. It is anticipated that a light build-up of dust, or discoloration will occur, as most installations will be outdoors.
  If the location is prone to salt, dirt, metallic dust, or sand, it must be ensured that a periodic cleaning regime is entered into the maintenance program for the site.
- Take care to mount the antenna securely, and not where standing water, ice, or snow coverage may be problematic.
  Ensure that the antenna is mounted away from bare live equipment. This is to ensure that should any maintenance attention be needed, it will not be necessary to encroach upon the recommended safe electrical clearance, which would require a work permit to be obtained.
  It should also be ensured that the structure to which the receiver is mounted is a permanent fixture, and is not planned for removal.
- If multiple antennas are to be installed it must be ensured there is a 1 metre gap between each antenna.

4.2 Mounting of the antenna

The Timing 2000 antenna must be mounted using its mounting bracket to an antenna pole. This pole should then be mounted to the side of the Communications/Radio Room via a wall bracket. Care must be taken that fixings for the wall bracket are into the brick and not into the mortar. This installation is shown in figure 1 and 2. The location of the antenna must observe the recommendations described above.

The antenna, mounting bracket, pole, and wall bracket must (via a pole earth strap) be grounded (earthed) to the earth of the substation (<10 ohms). The recommended ground cable specification is minimum of 10mm^2 diameter, 10m max. in length, stranded and complying with British Standard BS6004. Should a longer cable be required an earth cable with a bigger cross section should be used. The ground cable is not supplied by Alstom Grid.

Once the antenna has been installed and the P594 is in service, under no circumstances must the antenna be moved. If the antenna needs to be re-located the P594 must be de-energised. This is because the P594 uses a position fix mode and if the antenna is moved, the GPS receiver in the P594 needs to compute a new position.

The antenna must not be painted. If there is a risk of future painting, or inadvertent removal, a warning notice must be affixed alongside the antenna, to prevent such actions.

For safety reasons do not carry out the above activities during thunder-storms.

5. THE COAXIAL CABLE

The coaxial cable that connects the Timing 2000 GPS antenna to the P594 supplied by Alstom Grid is in total 25m or 50m long. This is the only cable that should be used to connect the GPS antenna to the P594. Once the coaxial cable has been connected to the Timing 2000 Antenna it should be ensured that the rubber boot fitted to the cable assembly is fitted over the bottom of the GPS antenna and secured into place with a suitable cable tie (See Figure 1).

5.1 Mounting and routing of the coaxial cable.

The coaxial cable must run to the P594 module via a safe and shielded route. In order to achieve that, the following recommendations should be taken into consideration:

During installation, always observe minimum bending radius

The ‘antenna to lightening arrestor’ cable, including the lightening arrestor (and the amplifier in the case of the optional 50m kit) must not be mounted into cable ducts. It must be wall mounted and 0.5m away from any flammable material. The ‘lightening arrestor to P594’ cable can be mounted into cable ducts.

5.1.1 Indoors

At ground level, coaxial cables must be routed to avoid mechanical damage. Kinking of the cable as well as sharp bending radii should be avoided. Inserting the cable into cable ducts should be done carefully to avoid stress to the cable. If this is the case it is advisable to use cable guides and lubricants in order to avoid any physical damage. Any looping of excess cable must be secured tidily, and safely. The sections where the cable is not laying should be fixed to the wall by using circular U cable clips with the appropriated diameter. Do not use cable-clamping tool, which can compromise the concentricity of the coaxial cable.

5.1.2 Outdoors

The cable should be secured to prevent wind damage or, worse, wind blowing onto bare live equipment. The cable must not be exposed to any mechanical damage. If the cable cannot be secured to a wall using U clips, the cable run should be protected by ducting so birds/wildlife cannot gain access. Any moisture that builds-up inside the ducts must be able to drain away. The cable should run clear of standing water. Do not run the cable next to a heating source.

5.2 Minimum bending radius.

The cable must be installed keeping smooth radii of curvature when traversing corners to avoid and sharp bend. The cable must not be bent beyond the minimum-bending radius. The diameter of the cable supplied 10.3mm and its minimum bending radius is 50mm. Any looping of excess cable must be done respecting the minimum-bending radius.

6. THE LIGHTNING ARRESTOR

The lightning arrestor must be mounted indoors against the wall of the building and not to any cubicle. It must not be inserted into a cable duct and must not be within 0.5m of any flammable material.

The lightning arrestor must be connected correctly ensuring that:

1. The end labelled “Unprotected side‘ is connected to the 17m ‘Lightning Arrestor to Antenna cable’(or for 50m kit to the 17m Lightning Arrestor to In Line Amplifier cable’).

2. The end labelled “Protected Side” is connected to the 8m ‘lightening arrestor to P594’ cable.

The lightening arrestor must be earthed to the building earth bonding bar and not to a cubicle earth. The recommended ground cable specification is minimum of $10mm^2$ diameter, 10m max. in length, stranded and complying with British Standard BS6004. The P594 module must additionally be earthed (using the same earth cable type and conditions as stated above for the lightning arrestor) to the same point of the bonding bar as well as being earthed to the cubicle earth.

Note : The Lightning Arrestor is not CE marked since:

- It is a component of the system
- It is EMC benign (89/336/EEC)
- The Low Voltage Directive (73/23/EEC) is not applicable since the device working voltage is below the minimum voltage requirement of this directive.

WARNING

It is recommended that a qualified person carry out the fitting/earthing of the Lightning Arrestor and pole. Alstom Grid accepts no responsibility for the results of improper or unsafe installation practices.

The lightning protection provided is designed to protect the P594 module and associated wiring. It will protect against an in-direct/secondary lightning strike but not a direct lightning strike.

For a complete lightning protection system that meets IEC61024-1 and IEC61312-1 please seek professional lightning protection advice.

The lightning arrestor uses a gas discharge capsule. It is recommended that the lightning arrestor is periodically checked for correct operation, and if the gas capsule is faulty, it is replaced. Please contact Huber & Suhner for replacement capsules.

Disconnect or switch off in-line equipment when installing, checking, disconnecting and connecting the lightning arrestor. This also includes replacing the gas discharge capsule.

For safety resons do not carry out the above activities during thunder-storms.

7. THE AMPLIFIER

The amplifier must not be earthed and must be connected correctly ensuring that:

- The end labelled “Antenna” is connected to the 25m ‘antenna to amplifier’ cable
- The end labelled “Receiver” is connected to the 17m ‘amplifier to lightening arrestor’ cable.

8. MOUNTING OF P594 MODULE

The P594 module must be mounted indoors, e.g. within the telecommunications or relay room. The same site environmental constraints apply as those for installation of a protection relay.

The P594 module must be earthed to the same point of the bonding bar as per the lightening arrestor, observing the same earthing cable recommendations. The P594 module will also be earthed by the cubicle where is installed as standard installation for protective relays.

8.1 Run the 850nm Fibre Connection to the P545/P546 Relay

A single fibre optic 50/125μm or 62.5/125μm multimode fibre run terminated with BFOC 2.5 (ST) connectors is required. The fibre runs from the P594 to the P54x current differential relay.

The fibre should run in ducting to be protected from mechanical damage, and to avoid sharp bending radii that might degrade the optical signal.

Ensure that the fibre is clearly marked at both ends with regard to the main protection relay that it serves.

The distance of the fibre optic cable between the relay and timing module P594 can be up to 1 km and the length at one end of the system must not differ by more than 0.5km to that at the other end, as this could introduce timing problems.

9. P594 ANTENNA INSTALLATION CHECKLIST

It is advised that the installation of the P594 and antenna is checked against the list below:

Circuit: ____________________

Cable Kit supplied: ____________________

	Tick box
1. Has the installation manual been read prior to carrying out the installation?	☐
2. Has the site survey for the antenna been carried out, please sketch rough position, including any obstructions of the antenna?	☐
3. Has the antenna a clear view of the sky (re-site the antenna if not)?	☐
4. Are there any large objects obstructing the view of the antenna (a taller antenna pole may be required to clear the object or the antenna may have to be re-sited)?	☐
5. Is the antenna above the roofline of the building (if not it must be re-sited)?	☐
6. If there are multiple antennas are they 1m (or greater) apart (if not re-site the antennas)?	☐
7. Are the pole mounting bracket fixings directly into the brick and not the mortar?	☐
8. Has the antenna pole been correctly earthed observing the minimum cable requirements?	☐
9. Has the rubber weatherproof boot been fitted over the connection point of the antenna cable to the antenna?	☐
10. Have the coaxial cables been correctly connected and mounted observing the guidelines in section 5 of the installation manual?	☐
11. Has the lightning arrestor been correctly installed as stated in section 2 of the manual?	☐
12. If supplied, has the line amplifier been correctly connected (the polarity)?	☐
13. Has the earth connection between the lightning arrestor and the P594 been correctly connected observing the minimum cable requirements?	☐
14. If the P594 has been installed, and is energized, after 10 minutes of connecting the antenna cable, does the P594 show any satellites (If not then check the antenna connection)?	☐

Installation Engineer: ____________________ Date: ____________

COMMISSIONING AND MAINTENANCE

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1. INTRODUCTION

The MiCOM P540 current differential protection relays are fully numerical in their design, implementing all protection and non-protection functions in software. The relays employ a high degree of self-checking and, in the unlikely event of a failure, will give an alarm. As a result of this, the commissioning tests do not need to be as extensive as with non-numeric electronic or electro-mechanical relays.

To commission numeric relays, it is only necessary to verify that the hardware is functioning correctly and the application-specific software settings have been applied to the relay. It is considered unnecessary to test every function of the relay if the settings have been verified by one of the following methods:

- Extracting the settings applied to the relay using appropriate setting software (preferred method)
- Via the operator interface.

Unless previously agreed to the contrary, the customer will be responsible for determining the application-specific settings to be applied to the relay and for testing of any scheme logic applied by external wiring and/or configuration of the relay's internal programmable scheme logic.

Blank commissioning test and setting records are provided at the end of this chapter for completion as required.

As the relay's menu language is user-selectable, it is acceptable for the Commissioning Engineer to change it to allow accurate testing as long as the menu is restored to the customer's preferred language on completion.

To simplify the specifying of menu cell locations in these Commissioning Instructions, they will be given in the form [courier reference: COLUMN HEADING, Cell Text]. For example, the cell for selecting the menu language (first cell under the column heading) is located in the System Data column (column 00) so it would be given as [0001: SYSTEM DATA, Language].

When P590 interface units are used to convert the optical signal from the P540 relay to an electrical signal for the multiplexer, the P590 units should be commissioned in conjunction with the relay.

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety and Technical Data sections and the ratings on the equipment's rating label.

2. SETTING FAMILIARISATION

When commissioning a MiCOM P540 relay for the first time, sufficient time should be allowed to become familiar with the method by which the settings are applied.

The Introduction (P54x/EN IT) contains a detailed description of the menu structure of P540 relays.

With the secondary front cover in place all keys except the ⏎ key are accessible. All menu cells can be read. LED's and alarms can be reset. However, no protection or configuration settings can be changed, or fault and event records cleared.

Removing the secondary front cover allows access to all keys so that settings can be changed, LED's and alarms reset, and fault and event records cleared. However, menu cells that have access levels higher than the default level will require the appropriate password to be entered before changes can be made.

Alternatively, if a portable PC is available together with suitable setting software (such as MiCOM S1), the menu can be viewed a page at a time to display a full column of data and text. This PC software also allows settings to be entered more easily, saved to a file on disk for future reference or printed to produce a setting record. Refer to the PC software user manual for details. If the software is being used for the first time, allow sufficient time to become familiar with its operation.

3. EQUIPMENT REQUIRED FOR COMMISSIONING

3.1 Minimum equipment required

Overcurrent test set with interval timer (multifunctional current and voltage test set for P543, P544, P545 & P546 relays if backup directionalised elements or distance zones are enabled).

Multimeter with suitable ac current range, and ac and dc voltage ranges of 0 – 440V and 0 – 250V respectively

Continuity tester (if not included in multimeter)

2 Lengths of 50/125µm fibre optic cable (approximately 1 metre long), terminated at each end with a ST connector

2 Lengths of 9/125µm fibre optic cable (approximately 1 metre long), terminated at each end with a ST connector if 1300 or 1550 fibre options fitted

Optical power meter with sensitivity 0 to –50dBm (to measure the optical signal level)

Phase angle meter (P543, P544, P545 & P546 relays only)

Phase rotation meter (P543, P544, P545 & P546relays only)

Note: Modern test equipment may contain many of the above features in one unit.

3.2 Optional equipment

Multi-finger test plug type P992 (if test block type P991 installed) or MMLB (if using MMLG blocks).

An electronic or brushless insulation tester with a dc output not exceeding 500V (for insulation resistance testing when required).

A portable PC, with appropriate software (this enables the rear communications port to be tested, if this is to be used, and will also save considerable time during commissioning).

KITZ K-Bus to EIA(RS)232 protocol convertor (if EIA(RS)485 K-Bus port is being tested and one is not already installed).

EIA(RS)485 to EIA(RS)232 convertor (if EIA(RS)485 Modbus port is being tested).

A printer (for printing a setting record from the portable PC).

4. PRODUCT CHECKS

These product checks cover all aspects of the relay which should be checked to ensure that it has not been physically damaged prior to commissioning, is functioning correctly and all input quantity measurements are within the stated tolerances.

If the application-specific settings have been applied to the relay prior to commissioning, it is advisable to make a copy of the settings so as to allow their restoration later. This could be done by:

Obtaining a setting file on a diskette from the customer (this requires a portable PC with appropriate setting software for transferring the settings from the PC to the relay)

Extracting the settings from the relay itself (this again requires a portable PC with appropriate setting software)

Manually creating a setting record. This could be done using a copy of the setting record located at the end of this chapter to record the settings as the relay's menu is sequentially stepped through via the front panel user interface.

If password protection is enabled and the customer has changed password 2 that prevents unauthorised changes to some of the settings, either the revised password 2 should be provided, or the customer should restore the original password prior to commencement of testing.

Note: In the event that the password has been lost, a recovery password can be obtained from Alstom Grid by quoting the serial number of the relay. The recovery password is unique to that relay and is unlikely to work on any other relay.

4.1 With the relay de-energised

The following group of tests should be carried out without the auxiliary supply being applied to the relay and with the trip circuit isolated.

The current and voltage transformer connections must be isolated from the relay for these checks. If a P991 test block is provided, the required isolation can easily be achieved by inserting test plug type P992 which effectively open-circuits all wiring routed through the test block.

Before inserting the test plug, reference should be made to the scheme (wiring) diagram to ensure that this will not potentially cause damage or a safety hazard. For example, the test block may be associated with protection current transformer circuits. It is essential that the sockets in the test plug which correspond to the current transformer secondary windings are linked before the test plug is inserted into the test block.

DANGER: Never open circuit the secondary circuit of a current transformer since the high voltage produced may be lethal and could damage insulation.

If a test block is not provided, the voltage transformer supply to the relay should be isolated by means of the panel links or connecting blocks. The line current transformers should be short-circuited and disconnected from the relay terminals. Where means of isolating the auxiliary supply and trip circuit (e.g. isolation links, fuses, MCB, etc.) are provided, these should be used. If this is not possible, the wiring to these circuits will have to be disconnected and the exposed ends suitably terminated to prevent them from being a safety hazard.

4.1.1 Visual inspection

Carefully examine the relay to see that no physical damage has occurred since installation.

The rating information given under the top access cover on the front of the relay should be checked to ensure it is correct for the particular installation.

Ensure that the case earthing connections, bottom left-hand corner at the rear of the relay case, are used to connect the relay to a local earth bar using an adequate conductor.

4.1.2 Current transformer shorting contacts

If required, the current transformer shorting contacts can be checked to ensure that they close when the heavy duty terminal block (block reference C in Figure 1) is disconnected from the current input PCB. In the case of P544 relays both block references C and E are heavy duty terminal blocks. For P545 and P546 relays both blocks D and F are heavy duty terminal blocks.

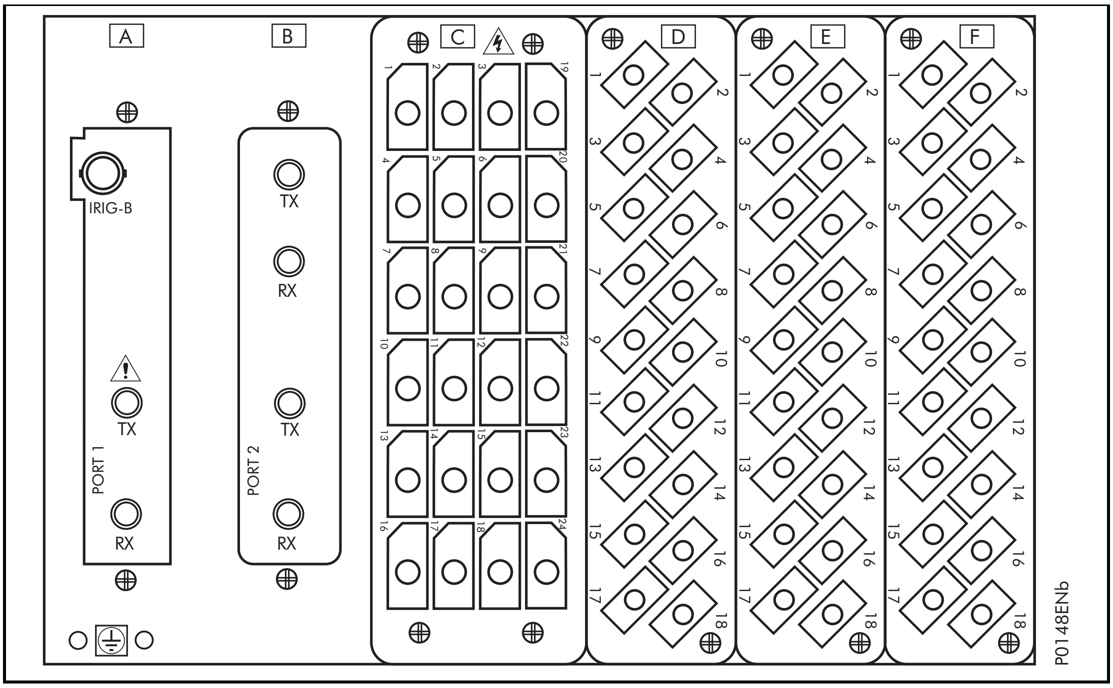


Figure 1: Rear terminal blocks on size 40TE case

The heavy duty terminal block is fastened to the rear panel using four crosshead screws. These are located top and bottom between the first and second, and third and fourth, columns of terminals (see Figure 2).

Note: The use of a magnetic bladed screwdriver is recommended to minimise the risk of the screws being left in the terminal block or lost.

Pull the terminal block away from the rear of the case and check with a continuity tester that all the shorting switches being used are closed. Table 1 shows the terminals between which shorting contacts are fitted.

Current input	Shorting contact between terminals			
	P541 – P543 1A – common 5A	P544 1A – common 5A	P545 1A – common 5A	P546 1A – common 5A
I_A	C3 – C2 – C1	C3 – C2 – C1	D3 – D2 – D1	D3 – D2 – D1
I_B	C6 – C5 – C4	C6 – C5 – C4	D6 – D5 – D4	D6 – D5 – D4
I_C	C9 – C8 – C7	C9 – C8 – C7	D9 – D8 – D7	D9 – D8 – D7
I_N	C15 – C14 – C13	C15 – C14 – C13	D15 – D14 – D13	D15 – D14 – D13
I_M	C12- C11 – C10	C12- C11 – C10	D12- D11 – D10	D12- D11 – D10
I_A(2)	-	E18 – E17 – E16	-	F18 – F17 – F16
I_B(2)	-	E15 – E14 – E13	-	F15 – F14 – F13
I_C(2)	-	E12 – E11 – E10	-	F12 – F11 – F10
I_N(2)	-	E9 – E8 – E7	-	F9 – F8 – F7

Table 1: Current transformer shorting contact locations.

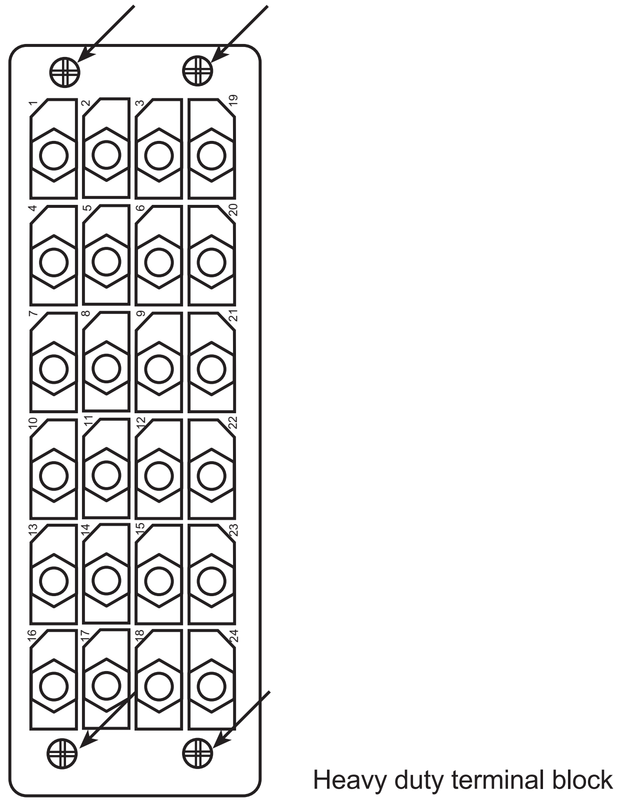


Figure 2: Location of securing screws for heavy duty terminal blocks

4.1.3 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they have not been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. Terminals of the same circuits should be temporarily connected together.

The main groups of relay terminals are:

a) Voltage transformer circuits.

b) Current transformer circuits

c) Auxiliary voltage supply.

d) Field voltage output and opto-isolated control inputs.

e) Relay contacts.

f) EIA(RS)485 communication port.

g) Case earth.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the relay.

4.1.4 External wiring

Check that the external wiring is correct to the relevant relay diagram or scheme diagram. The relay diagram number appears on the rating label under the top access cover on the front of the relay. The corresponding connection diagram will have been supplied with the Alstom Grid order acknowledgement for the relay.

If a P991 test block is provided, the connections should be checked against the scheme (wiring) diagram. It is recommended that the supply connections are to the live side of the test block [coloured orange with the odd numbered terminals (1, 3, 5, 7 etc.). The auxiliary supply is normally routed via terminals 13 (supply positive) and 15 (supply negative), with terminals 14 and 16 connected to the relay's positive and negative auxiliary supply terminals respectively. However, check the wiring against the schematic diagram for the installation to ensure compliance with the customer's normal practice.

4.1.5 Watchdog contacts

Using a continuity tester, check that the watchdog contacts are in the states given in Table 2 for a de-energised relay.

Terminals		Contact state	
		Relay de-energised	Relay energised
F11 – F12 J11 – J12	(P541) (P542, P543 & P544)	Closed	Open
M11 – M12	(P545 & P546)	Closed	Open
F13 – F14 J13 – J14	(P5141 & P142) (P542, P543 & P544)	Open	Closed
M13 – M14	(P545 & P546)	Open	Closed

Table 2: Watchdog contact status

4.1.6 Auxiliary supply

The P540 relay can be operated from either a dc only or an ac/dc auxiliary supply depending on the relay's nominal supply rating. The incoming voltage must be within the operating range specified in Table 3.

Without energising the relay measure the auxiliary supply to ensure it is within the operating range.

Nominal supply rating DC [AC rms]		DC operating range	AC operating range
24 – 48V	[–]	19 to 65V	-
48 – 110V	[30 – 100V]	37 to 150V	24 – 110V
110 – 250V	[100 – 240V]	87 to 300V	80 to 265V

Table 3: Operational range of auxiliary supply Vx.

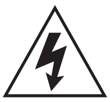
It should be noted that the P540 relay can withstand an ac ripple of up to 12% of the upper rated voltage on the dc auxiliary supply.

Do not energise the relay or interface unit using the battery charger with the battery disconnected as this can irreparably damage the relay's power supply circuitry.

Energise the relay only if the auxiliary supply is within the specified operating ranges. If a test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the relay.

4.2 With the relay energised

The following group of tests verify that the relay hardware and software is functioning correctly and should be carried out with the auxiliary supply applied to the relay and, if installed, the P590 interface units.



The current and voltage transformer connections must remain isolated from the relay for these checks. The trip circuit should also remain isolated to prevent accidental operation of the associated circuit breaker. The inter-relay communication channel should be disconnected to prevent the remote end relay being affected during the tests.

4.2.1 Watchdog contacts

Using a continuity tester, check the watchdog contacts are in the states given in Table 2 for an energised relay.

4.2.2 LCD front panel display

The liquid crystal display is designed to operate in a wide range of substation ambient temperatures. For this purpose, the Px40 relays have a “*LCD Contrast”* setting. This allows the user to adjust how light or dark the characters displayed will be. The contrast is factory pre-set to account for a standard room temperature, however it may be necessary to adjust the contrast to give the best in-service display. To change the contrast, cell [09FF: LCD Contrast] at the bottom of the CONFIGURATION column can be incremented (darker) or decremented (lighter), as required.

Care: **Before applying a contrast setting, ensure that it will not render the display too light or dark such that menu text becomes unreadable. Should such a mistake be made, it is possible to restore a visible display by downloading a MiCOM S1 setting file, with the LCD Contrast set within the typical range of 7 – 11.**

4.2.3 Date and time

Before setting the date and time, ensure that the factory-fitted battery isolation strip, that prevents battery drain during transportation and storage, has been removed. With the lower access cover open, presence of the battery isolation strip can be checked by a red tab protruding from the positive side of the battery compartment. Whilst lightly pressing the battery, to prevent it from falling out of the battery compartment, pull the red tab to remove the isolation strip.

The date and time should now be set to the correct values. The method of setting will depend on whether accuracy is being maintained via the optional Inter-Range Instrumentation Group standard B (IRIG-B) port on the rear of the relay.

4.2.3.1 With an IRIG-B signal

If a satellite time clock signal conforming to IRIG-B is provided and the relay has the optional IRIG-B port fitted, the satellite clock equipment should be energised.

To allow the relay’s time and date to be maintained from an external IRIG-B source cell [0804: DATE and TIME, IRIG-B Sync] must be set to ‘Enabled’.

Ensure the relay is receiving the IRIG-B signal by checking that cell [0805: DATE and TIME, IRIG-B Status] reads ‘Active’.

Once the IRIG-B signal is active, adjust the time offset of the universal co-ordinated time (satellite clock time) on the satellite clock equipment so that local time is displayed.

Check the time, date and month are correct in cell [0801: DATE and TIME, Date/Time]. The IRIG-B signal does not contain the current year so it will need to be set manually in this cell.

In the event of the auxiliary supply failing, with a battery fitted in the compartment behind the bottom access cover, the time and date will be maintained. Therefore, when the auxiliary supply is restored, the time and date will be correct and not need to be set again.

To test this, remove the IRIG-B signal, then remove the auxiliary supply from the relay. Leave the relay de-energised for approximately 30 seconds. On re-energisation, the time in cell [0801: DATE and TIME, Date/Time] should be correct.

Reconnect the IRIG-B signal.

4.2.3.2 Without an IRIG-B signal

If the time and date is not being maintained by an IRIG-B signal, ensure that cell [0804: DATE and TIME, IRIG-B Sync] is set to ‘Disabled’.

Set the date and time to the correct local time and date using cell [0801: DATE and TIME, Date/Time].

In the event of the auxiliary supply failing, with a battery fitted in the compartment behind the bottom access cover, the time and date will be maintained. Therefore when the auxiliary supply is restored the time and date will be correct and not need to be set again.

To test this, remove the auxiliary supply from the relay for approximately 30 seconds. On re-energisation, the time in cell [0801: DATE and TIME, Date/Time] should be correct.

4.2.4 Light Emitting Diodes (LED's)

On power up the green LED should have illuminated and stayed on indicating that the relay is healthy. The relay has non-volatile memory which remembers the state (on or off) of the alarm, trip and, if configured to latch, user-programmable LED indicators when the relay was last energised from an auxiliary supply. Therefore these indicators may also illuminate when the auxiliary supply is applied.

If any of these LED's are on then they should be reset before proceeding with further testing. If the LED's successfully reset (the LED goes out), there is no testing required for that LED because it is known to be operational.

Note: It is likely that alarms related to the communications channels will not reset at this stage.

Testing the alarm and out of service LED's

The alarm and out of service LED's can be tested using the COMMISSION TESTS menu column. Set cell [0F0D: COMMISSION TESTS, Test Mode] to 'Contacts Blocked'. Check that the out of service LED illuminates continuously and the alarm LED flashes.

It is not necessary to return cell [0F0D: COMMISSION TESTS, Test Mode] to 'Disabled' at this stage because the test mode will be required for later tests.

4.2.4.1 Testing the Trip LED

The trip LED can be tested by initiating a manual circuit breaker trip from the relay. However, the trip LED will operate during the setting checks performed later. Therefore no further testing of the trip LED is required at this stage.

4.2.4.2 Testing the user-programmable LEDS

To test the user-programmable LED's set cell [0F10: COMMISSION TESTS, Test LED's] to 'Apply Test'. Check that all 8 LED's on the right-hand side of the relay illuminate.

4.2.5 Field voltage supply

The relay generates a field voltage of nominally 48V that can be used to energise the opto-isolated inputs (alternatively the substation battery may be used).

Measure the field voltage across the terminals 7 and 9 on the terminal block given in Table 4. Check that the field voltage is within the range 40V to 60V when no load is connected and that the polarity is correct.

Repeat for terminals 8 and 10.

Supply rail	Terminals		
	P541	P542, P543, P544	P545 & P546
+ve	F7 & F8	J7 & J8	M7 & M8
–ve	F9 & F10	J9 & J10	M9 & M10

Table 4: Field voltage terminals

4.2.6 Input opto-isolators

This test checks that all the opto-isolated inputs on the relay are functioning correctly. The P541 relay has 8 opto-isolated inputs while the P542, P543 and P544 relays have 16 opto-isolated inputs. The P545 and P546 relays have 24 opto-isolated inputs.

The opto-isolated inputs should be energised one at a time, see external connection diagrams (Appendix B) for terminal numbers. Ensuring correct polarity, connect the field supply voltage to the appropriate terminals for the input being tested.

Note: The opto-isolated inputs may be energised from an external dc auxiliary supply (e.g. the station battery) in some installations. Check that this is not the case before connecting the field voltage otherwise damage to the relay may result.

The status of each opto-isolated input can be viewed using either cell [0020: SYSTEM DATA, Opto I/P Status] or [0F01: COMMISSION TESTS, Opto I/P Status], a '1' indicating an energised input and a '0' indicating a de-energised input. When each opto-isolated input is energised one of the characters on the bottom line of the display will change to indicate the new state of the inputs.

4.2.7 Output relays

This test checks that all the output relays are functioning correctly. The P541 relays have 7 output relays while P542, P543 and P544 relays have 14 output relays and the P545 and P546 have 32 output relays.

Ensure that the relay is still in test mode by viewing cell [0F0D: COMMISSION TESTS, Test Mode] to ensure that it is set to 'Blocked'.

The output relays should be energised one at a time. To select output relay 1 for testing, set cell [0F0E: COMMISSION TESTS, Test Pattern] as appropriate.

Connect a continuity tester across the terminals corresponding to output relay 1 as given in external connection diagram (Appendix B).

To operate the output relay set cell [0F0F: COMMISSION TESTS, Contact Test] to 'Apply Test'. Operation will be confirmed by the continuity tester operating for a normally open contact and ceasing to operate for a normally closed contact. Measure the resistance of the contacts in the closed state.

Reset the output relay by setting cell [0F0F: COMMISSION TESTS, Contact Test] to 'Remove Test'.

Note: It should be ensured that thermal ratings of anything connected to the output relays during the contact test procedure is not exceeded by the associated output relay being operated for too long. It is therefore advised that the time between application and removal of contact test is kept to the minimum.

Repeat the test for relays 2 to 7 for P541 relays, relays 2 to 14 for P542, P543 and P544 relays, or relays 2 to 32 for P545 and P546.

Return the relay to service by setting cell [0F0D: COMMISSION TESTS, Test Mode] to 'Disabled'.

4.2.8 Rear communications port

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communications standard being adopted.

It is not the intention of the test to verify the operation of the complete system from the relay to the remote location, just the relay's rear communications port and any protocol converter necessary.

4.2.8.1 Courier communications

If a K-Bus to EIA(RS)232 KITZ protocol convertor is installed, connect a portable PC running the appropriate software to the incoming (remote from relay) side of the protocol converter.

If a KITZ protocol convertor is not installed, it may not be possible to connect the PC to the type installed. In this case a KITZ protocol convertor and portable PC running appropriate software should be temporarily connected to the relay's K-Bus port. The terminal numbers for the relay's K-Bus port are given in Table 5. However, as the installed protocol convertor is not being used in the test, only the correct operation of the relay's K-Bus port will be confirmed

Connection		Terminal		
K-Bus	Modbus or VDEW	P541	P542, P543 & P544	P545 & P546
Screen	Screen	F16	J16	M16
1	+ve	F17	J17	M17
2	–ve	F18	J18	M18

Table 5: EIA(RS)485 terminals

Ensure that the communications baud rate and parity settings in the application software are set the same as those on the protocol convertor (usually a KITZ but could be a SCADA RTU). The relay's Courier address in cell [0E02: COMMUNICATIONS, Remote Access] must be set to a value between 1 and 254.

Check that communications can be established with this relay using the portable PC.

4.2.8.2 Modbus communications

Connect a portable PC running the appropriate Modbus Master Station software to the relay's EIA(RS)485 port via a EIA(RS)485 to EIA(RS)232 interface convertor. The terminal numbers for the relay's EIA(RS)485 port are given in Table 5.

Ensure that the relay address, baud rate and parity settings in the application software are set the same as those in cells [0E04: COMMUNICATIONS, Baud Rate] and [0E05: COMMUNICATIONS, Parity] of the relay.

Check that communications with this relay can be established.

4.2.8.3 IEC60870-5-103 (VDEW) communications

If the relay has the optional fibre optic communications port fitted, the port to be used should be selected by setting cell [0E07: COMMUNICATIONS, Physical Link] to 'Fibre Optic' or 'EIA(RS)485'.

IEC60870-5-103/VDEW communication systems are designed to have a local Master Station and this should be used to verify that the relay's fibre optic or EIA(RS)485 port, as appropriate, is working.

Ensure that the relay address and baud rate settings in the application software are set the same as those in cell [0E04: COMMUNICATIONS, Baud Rate] of the relay.

Check that, using the Master Station, communications with the relay can be established.

4.2.8.4 DNP 3.0 Interface

Connect a portable PC running the appropriate DNP 3.0 software to the relay's EIA(RS)485 port via a EIA(RS)232 interface convertor. The terminal numbers for the relay's EIA(RS)485 port are given in table 7. Ensure that the relay address, baud rate and parity are set the same as those in cells [0E04:COMMUNICATIONS, Baud Rate] and [0E05:COMMUNICATIONS, Parity] of the relay.

Check that communications with this relay can be established.

4.2.9 Second rear communications port

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communications standard being adopted.

It is not the intention of the test to verify the operation of the complete system from the relay to the remote location, just the relay's rear communications port and any protocol converter necessary.

4.2.9.1 K-Bus configuration

If a K-Bus to EIA(RS)232 KITZ protocol convertor is installed, connect a portable PC running the appropriate software (e.g. MiCOM S1 or PAS&T) to the incoming (remote from relay) side of the protocol converter.

If a KITZ protocol convertor is not installed, it may not be possible to connect the PC to the relay installed. In this case a KITZ protocol convertor and portable PC running appropriate software should be temporarily connected to the relay's second rear communications port configured for K-Bus. The terminal numbers for the relay's K-Bus port are given in Table 9. However, as the installed protocol convertor is not being used in the test, only the correct operation of the relay's K-Bus port will be confirmed.

Pin*	Connection
4	EIA485 – 1 (+ ve)
7	EIA485 – 2 (- ve)

Table 9: 2nd rear communications port K-Bus terminals

* - All other pins unconnected.

Ensure that the communications baud rate and parity settings in the application software are set the same as those on the protocol convertor (usually a KITZ but could be a SCADA RTU). The relay's Courier address in cell [0E90: COMMUNICATIONS, RP2 Address] must be set to a value between 1 and 254. The second rear communication's port configuration [0E88: COMMUNICATIONS RP2 Port Config] must be set to K-Bus.

Check that communications can be established with this relay using the portable PC.

4.2.9.2 EIA(RS)485 configuration

If an EIA(RS)485 to EIA(RS)232 convertor (e.g. Alstom Grid CK222) is installed, connect a portable PC running the appropriate software (e.g. MiCOM S1) to the EIA(RS)232 side of the converter and the second rear communications port of the relay to the EIA(RS)485 side of the converter.

The terminal numbers for the relay's EIA(RS)485 port are given in Table 9.

Ensure that the communications baud rate and parity settings in the application software are set the same as those in the relay. The relay's Courier address in cell [0E90: COMMUNICATIONS, RP2 Address] must be set to a value between 1 and 254. The second rear communication's port configuration [0E88: COMMUNICATIONS RP2 Port Config] must be set to EIA(RS)485.

Check that communications can be established with this relay using the portable PC.

4.2.9.3 EIA(RS)232 configuration

Connect a portable PC running the appropriate software (e.g. MiCOM S1) to the rear EIA(RS)232[1] port of the relay.

The second rear communications port connects via the 9-way female D-type connector (SK4). The connection is compliant to EIA(RS)574.

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[1] This port is actually compliant to EIA(RS)574; the 9-pin version of EIA(RS)232, see www.tiaonline.org.

Pin	Connection
1	No Connection
2	RxD
3	TxD
4	DTR[#]
5	Ground
6	No Connection
7	RTS[#]
8	CTS[#]
9	No Connection

Table 10: Second rear communications port EIA(RS)232 terminals

[#] - These pins are control lines for use with a modem.

Connections to the second rear port configured for EIA(RS)232 operation can be made using a screened multi-core communication cable up to 15m long, or a total capacitance of 2500pF. The cable should be terminated at the relay end with a 9-way, metal shelled, D-type male plug. The terminal numbers for the relay's EIA(RS)232 port are given in Table 10.

Ensure that the communications baud rate and parity settings in the application software are set the same as those in the relay. The relay's Courier address in cell [0E90: COMMUNICATIONS, RP2 Address] must be set to a value between 1 and 254. The second rear communication's port configuration [0E88: COMMUNICATIONS RP2 Port Config] must be set to EIA(RS)232.

Check that communications can be established with this relay using the portable PC.

4.3 Current differential communications

This test verifies that the relay's current differential fibre optic communications ports and, if installed, P590 interface units, used for communications between the P540 current differential relays at each end of the feeder being protected, are operating correctly.

A P590 unit will be situated near the multiplexer in applications where communications between P540 relays is via multiplexed communication channels and the PCM multiplexer is installed remote from the relay room. This unit provides bi-directional optical to electrical signal conversion between the cross-site optical fibre from the relay and the electrical interface of the multiplexer.

The method of testing is similar whether communications between relays is via dedicated optical fibres or using a P590 unit to interface the relay's fibre optic communications channel to a multiplexer. However, where P590 interface units are being used, there are a number of extra tests on the P590 units that need to be performed before testing of the communications can begin.

When connecting or disconnecting optical fibres care should be taken not to look directly into the transmit port or end of the optical fibre.

4.3.1 Direct fibre optic communications

Set cell [0F12 Test Loopback] to 'External'.

Using a length of fibre optic cable, refer to the Installation chapter (P54x/EN IN/XXX), section 6.7, terminated with a ST connector at each end, connect the Channel 1 transmit (Tx) and Channel 1 receive (Rx) ports on the rear of the relay together. If Channel 2 is being used (Three terminal or dual redundant application) connect the Channel 2 transmit and receive ports on the rear of the relay together. The relay will now respond as if it is connected to a remote relay with the current at the remote end equal to and in phase with the current injected at the local end. Reset any alarm indications and check that no further communications failure alarms are raised. As the loopback alarm is still active it will not reset. Check channel status, propagation delays and communication statistics in [MEASUREMENTS 4] column.

Alternatively use the internal loopback feature by setting cell [0F12 Test Loopback] to 'Internal'. In this mode it is not necessary to change the fibre.

4.3.2 Communications using P591 interface units

The P591 converts the optical output of the P540 relay to an electrical signal for a PCM multiplexer with G.703 interfaces. The unit is housed in a size 20TE case and should be located near to the multiplexer.

Before loopback testing can begin, some other checks must be completed.

4.3.2.1 Visual inspection

Carefully examine the unit to see that no physical damage has occurred since installation.

The rating information given under the top access cover on the front of the unit should be checked to ensure it is correct for the particular installation.

Ensure that the case earthing connection, top left-hand corner at the rear of the case, is used to connect the unit to a local earth bar using an adequate conductor.

4.3.2.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they haven't been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. The auxiliary dc supply terminals should be temporarily connected together.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the P591.

4.3.2.3 External wiring

Check that the external wiring is correct to the relevant connection diagram or scheme diagram. The connection diagram number appears on the rating label under the top access cover on the front of the P591. The corresponding connection diagram will have been supplied with the Alstom Grid order acknowledgement for the P591.

It is especially important that the dc supplies are wired with the correct polarity.

4.3.2.4 Auxiliary supply

P591 units operate from a dc only auxiliary supply within the operative range of 19V to 65V for a 24 – 48V version and 87.5V to 300V for a 110 – 250V version.

Without energising the P591 units measure the auxiliary supply to ensure it is within the operating range.

It should be noted that the P591 interface unit is designed to withstand an ac ripple component of up to 12% of the normal dc auxiliary supply. However, in all cases the peak value of the dc supply must not exceed the maximum specified operating limit.

Do not energise the P591 using the battery charger with the battery disconnected as this can irreparably damage the unit's power supply circuitry.

Energise the P591 only if the auxiliary supply is within the specified operating ranges. If a P991 test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the P591.

4.3.2.5 Light emitting diodes (LED's)

On power up the green 'SUPPLY HEALTHY' LED should have illuminated and stayed on, thus indicating that the P591 is healthy.

4.3.2.6 Loopback test

Remove any external wiring from terminals 3, 4, 7 and 8 at the rear of each P591 unit. Loopback the G.703 signals on each unit by connecting a wire link between terminals 3 and 7, and a second wire between terminals 4 and 8.

Measure and record the optical signal strength received by the P591 by disconnecting the optical fibre from the receive port on the rear of the unit and connecting it to an optical power meter. The mean level should be in the range –16.8dBm to –25.4dBm. If the mean level is outside of this range check the size and type of fibre being used.

Measure and record the optical output power of the transmit port of the P591 using the optical power meter and length of 50/125µm optical fibre. The mean value should be in the range –16.8dBm to –22.8dBm.

Ensure that the transmit (Tx) and receive (Rx) optical fibres between the P540 relay and P591 units are connected.

Return to the P540 relay and set cell [0F12 Test Loopback] to ‘External’. The relay will then respond as if it is connected to a remote relay with the current at the remote end equal to and in phase with the current injected at the local end.

Reset alarm indications. The loopback alarm is still active it will not reset. Channel status, propagation delays and communication statistics should be checked in [MEASUREMENTS 4] column.

4.3.3 Communications using P592 interface units

The P592 converts the optical output of the P540 relay to an electrical signal for a PCM multiplexer with V.35 interfaces. The unit is housed in a size 20TE case and should be located near to the multiplexer.

Before loopback testing can begin, some other checks must be completed.

4.3.3.1 Visual inspection

Carefully examine the unit to see that no physical damage has occurred since installation.

The rating information given under the top access cover on the front of the unit should be checked to ensure it is correct for the particular installation.

Ensure that the case earthing connection, top left-hand corner at the rear of the case, is used to connect the unit to a local earth bar using an adequate conductor.

4.3.3.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they haven’t been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. The auxiliary dc supply terminals should be temporarily connected together.

The V.35 circuits of the P592 are isolated from all other circuits but are electrically connected to the outer case. The circuits must not therefore be insulation or impulse tested to the case.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the P592.

4.3.3.3 External wiring

Check that the external wiring is correct to the relevant connection diagram or scheme diagram. The connection diagram number appears on the rating label under the top access cover on the front of the P592. The corresponding connection diagram will have been supplied with the Alstom Grid order acknowledgement for the P592.

It is especially important that the dc supplies are wired with the correct polarity.

4.3.3.4 Auxiliary supply

P592 units operate from a dc only auxiliary supply within the operative range of 19V to 300V.

Without energising the P592 units measure the auxiliary supply to ensure it is within the operating range.

It should be noted that the P592 interface unit is designed to withstand an ac ripple component of up to 12% of the normal dc auxiliary supply. However, in all cases the peak value of the dc supply must not exceed the maximum specified operating limit.

Do not energise the P592 using the battery charger with the battery disconnected as this can irreparably damage the unit's power supply circuitry.

Energise the P592 only if the auxiliary supply is within the specified operating ranges. If a P991 test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the P592.

4.3.3.5 Light emitting diodes (LED's)

On power up the green 'SUPPLY HEALTHY' LED should have illuminated and stayed on indicating that the P592 is healthy.

The four red LED's can be tested by appropriate setting of the DIL switches on the unit's front plate. Set the data rate switch according to the communication channel bandwidth available. Set all other switches to 0. To illuminate the 'DSR OFF' and 'CTS OFF' LED's, disconnect the V.35 connector from the rear of the P592 and set the 'DSR' and 'CTS' switches to '0'. The 'OPTO LOOPBACK' and 'V.35 LOOPBACK' LED's can be illuminated by setting their corresponding switches to '1'.

Once operation of the LED's has been established set all DIL switches, except for the 'OPTO LOOPBACK' switch, to '0' and reconnect the V.35 connector.

4.3.3.6 Loopback test

With the 'OPTO LOOPBACK' switch in the '1' position the receive and transmit optical ports are electrically connected together. This allows the optical fibre communications between the P540 relay and the P592 to be tested, but not the internal circuitry of the P592 itself.

Measure and record the optical signal strength received by the P592 by disconnecting the optical fibre from the receive port on the rear of the unit and connecting it to an optical power meter. The mean level should be in the range -16.8dBm to -25.4dBm. If the mean level is outside of this range check the size and type of fibre being used.

Measure and record the optical output power of the transmit port of the P592 using the optical power meter and length of 50/125μm optical fibre. The mean value should be in the range -16.8dBm to –22.8dBm.

Ensure that the transmit (Tx) and receive (Rx) optical fibres between the P540 relay and P592 units are connected.

Return to the P540 relay and set cell [0F12 Test Loopback] to 'External'. The relay will then respond as if it is connected to a remote with the current at the remote end equal to and in phase with the current injected at the local end.

Reset alarm indications. The loopback alarm is still active it will not reset. Channel status, propagation delays and communication statistics should be checked in [MEASUREMENTS 4] column.

4.3.4 Communications using P593 interface units

The P593 converts the optical output of the P540 relay to an electrical signal for a PCM multiplexer with X.21 interfaces. The unit is housed in a size 20TE case and should be located near to the multiplexer.

Before loopback testing can begin, some other checks must be completed.

4.3.4.1 Visual inspection

WARNING: Electrostatic Discharge (ESD) precautions must be applied while the secondary cover is removed from the unit.

If applicable replace the secondary front cover from the unit. Carefully examine the unit to see that no physical damage has occurred since installation.

The rating information given under the top access cover on the front of the unit should be checked to ensure it is correct for the particular installation.

Ensure that the case earthing connection, top left-hand corner at the rear of the case, is used to connect the unit to a local earth bar using an adequate conductor.

4.3.4.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they have not been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. The auxiliary dc supply terminals should be temporarily connected together.

The X.21 circuits of the P593 are isolated from all other circuits but are electrically connected to the outer case. The circuits must not therefore be insulation or impulse tested to the case.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the P593.

4.3.4.3 External wiring

Check that the external wiring is correct to the relevant connection diagram or scheme diagram. The connection diagram number appears on the rating label under the top access cover on the front of the P593. The corresponding connection diagram will have been supplied with the Alstom Grid order acknowledgement for the P593.

It is especially important that the dc supplies are wired with the correct polarity.

4.3.4.4 Auxiliary supply

P593 units operate from a dc only auxiliary supply within the operative range of 19.5V to 300V.

Without energising the P593 units measure the auxiliary supply to ensure it is within the operating range.

It should be noted that the P593 interface unit is designed to withstand an ac ripple component of up to 12% of the normal dc auxiliary supply. However, in all cases the peak value of the dc supply must not exceed the maximum specified operating limit.

Do not energise the P593 using the battery charger with the battery disconnected as this can irreparably damage the unit's power supply circuitry.

Energise the P593 only if the auxiliary supply is within the specified operating ranges. If a P991 test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the P593.

4.3.4.5 Light emitting diodes (LED's)

On power up the green 'SUPPLY' LED should have illuminated and stayed on indicating that the P593 is healthy.

Set the ‘X.21 LOOPBACK’ switch to ‘ON’. The green ‘CLOCK’ and red ‘X.21 LOOPBACK’ LED’s should illuminate. Reset the ‘X.21 LOOPBACK’ switch to the ‘OFF’ position.

Set the ‘OPTO LOOPBACK’ switch to ‘ON’. The red ‘OPTO LOOPBACK’ LED should illuminate. Do not reset the “OPTO LOOPBACK’ switch as it is required in this position for the next test.

4.3.4.6 Loopback test

With the ‘OPTO LOOPBACK’ switch in the ‘ON’ position the receive and transmit optical ports are electrically connected together. This allows the optical fibre communications between the P540 relay and the P593 to be tested, but not the internal circuitry of the P593 itself.

Measure and record the optical signal strength received by the P593 by disconnecting the optical fibre from the receive port on the rear of the unit and connecting it to an optical power meter. The mean level should in the range –16.8dBm to –25.4dBm. If the mean level is outside of this range check the size and type of fibre being used.

Measure and record the optical output power of the transmit port of the P593 using the optical power meter and length of 50/125μm optical fibre. The mean value should be in the range –16.8dBm to –22.8dBm

Ensure that the transmit (Tx) and receive (Rx) optical fibres between the P540 relay and P593 units are connected.

Set the ‘OPTO LOOPBACK’ switch to ‘OFF’ and ‘X.21 LOOPBACK’ switch to ‘ON’ respectively. With the ‘X.21 LOOPBACK’ switch in this position the ‘Receive Data’ and ‘Transmit Data’ lines of the X.21 communication interface are connected together. This allows the optical fibre communications between the P540 relay and the P593, and the internal circuitry of the P593 itself to be tested.

Return to the P540 relay and set cell [0F12 Test Loopback] to ‘External’. The relay will then respond as if it is connected to a remote relay with the current at the remote end equal to and in phase with the current injected at the local end.

Reset alarm indications. The loopback alarm is still active it will not reset. Channel status, propagation delays and communication statistics should be checked in [MEASUREMENTS 4] column.

4.3.5 IEEE C37.94 compatible multiplexers (Software 30 or later)

See section 4.3.1 for loopcback tests which are also appropriate for the IEEE C37.94 interface.

4.4 GPS synchronisation using the P594 interface units

The P594 provides one pulse per second for synchronising purposes. The unit is housed in a 20TE case and can be located upto 1 km away from the relay.

4.4.1 Visual inspection

Carefully examine the unit to see that no physical damage has occurred since installation.

The rating information, given under the top access cover on the front of the unit, should be checked to ensure that it is the correct model for the particular installation.

Ensure that the case earthing connection, top left hand corner at the rear of the case is used to connect the unit to a local earthing bar using an adequate conductor.

4.4.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they have not been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. The auxiliary dc supply terminals should be temporarily connected together.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure that all external wiring is correctly reconnected to the P594.

4.4.3 External Wiring

Check that the external wiring is correct to the relevant connection diagram or scheme diagram. The connection diagram number appears on the rating label under the top access cover on the front of the P594. The corresponding connection diagram will have been supplied with the Alstom Grid order acknowledgement for the P594.

It is especially important that the dc supplies are wired with the correct polarity.

4.4.4 Auxiliary Supply

P594 units operate from a dc auxiliary supply within the operative range of 19V to 150V for a 24 - 125V version and 33V to 300V for the 48 - 250V version. The 48 - 250V version also operates from a ac auxiliary supply within the operative range of 96V to 240V

Without energising the P594 units measure the auxiliary supply to ensure it is within the operating range.

It should be noted that the P594 interface unit is designed to withstand an ac ripple component of up to 12% of the normal dc auxiliary supply. However, in all cases the peak value of the dc supply must not exceed the maximum specified operating limit.

Do not energise the P594 using the battery charger with the battery disconnected as this can irreparably damage the unit's power supply circuitry.

Energise the P594 only if the auxiliary supply is within the specified operating ranges. If a P991 test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the P594.

4.4.5 Light Emitting Diodes

On power up the green 'Healthy' LED should have illuminated and stayed on indicating that the unit is healthy. If the LED is flashing check the antenna is connected. Initially the red '0' LED will be illuminated indicating the P594 has not initialised and is not outputting a signal to the P540. The remaining red LED '1-3' and green LED '4 – 8' indicate the number of satellites being seen by the P594. The P594 takes up to 3 hours to initialise before it starts to output a signal. This is indicated by the red '0' LED being extinguished and indicating four or more satellites. If the number of satellites drops below four the output again turns off again until the number of satellites exceeds four. Once the initialisation is complete the antenna can be disconnected (see next section) and reconnected without the power on initialisation time. However, if the power to the P594 is lost it will take up to 3 hours to re-initialise.

4.4.6 Synchronising signal

The normal optical output from the P594 is a 200ms light on with 800ms light off. Most optical power meters can not measure this signal. A commissioning feature has been added which is activated by disconnecting the antenna cable from the P594. This replaces the output signal by a 250kHz signal. This condition is indicated by the green 'healthy' LED flashing. The P540 is immune to this signal and treats it as a loss of GPS. Measure and record the optical power of each transmitter using an optical power meter and length of 50/125цm optical fibre. The mean value should be in the range –24.8dBm to –30.8dBm. Reconnect the antenna cable.

Note: If the antenna is removed for longer than 1 hour the GPS until will reset. It will require upto 3 hours to re-initialize following reconnection of the antenna.

4.4.7 Connection to P545 or P546 relay

Connect module to the P540 series relay. Enable GPS synchronisation in [2013:I DIFF CONFIG, GPS Connected] of the relay. Check that the relay is recognising the GPS synchronisation in [0503:MEASUREMENTS 4, Channel Status] of the relay. If this is satisfactory bit 4 should be 1 i.e. * * 1 * * * *.

Note: The P594 can take 2¾ hours following detection of at least 4 satellites before it outputs a signal to the P545/P546.

4.4.8 Final Checks

If the secondary front cover has been removed it should now be re-fitted to the P594.

4.5 Current and voltage inputs

All relays will leave the factory set for operation at a system frequency of 50Hz. If operation at 60Hz is required then this must be set in cell [0009: SYSTEM DATA, Frequency].

4.5.1 Current inputs

This test verifies that the accuracy of current measurement is within the acceptable tolerances.

Apply current equal to the line current transformer secondary winding rating to each current transformer input of the corresponding rating in turn, see table 1 or external connection diagram (Appendix B) for appropriate terminal numbers, checking its magnitude using a multimeter. The corresponding reading can then be checked in the relay's MEASUREMENTS 1 column and value displayed recorded.

The measured current values displayed on the relay LCD or a portable PC connected to the front communication port will either be in primary or secondary Amperes. If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Primary', the values displayed should be equal to the applied current multiplied by the corresponding current transformer ratio set in the 'CT and VT RATIOS' menu column (see Table 6). If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Secondary', the value displayed should be equal to the applied current.

Note: If a PC connected to the relay via the rear communications port is being used to display the measured current, the process will be similar. However, the setting of cell [0D03: MEASURE'T SETUP, Remote Values] will determine whether the displayed values are in primary or secondary Amperes.

The measurement accuracy of the relay is ±1%. However, an additional allowance must be made for the accuracy of the test equipment being used.

Cell in MEASUREMENTS 1 column (02)	Corresponding CT Ratio (in 'CT and VT RATIOS' column(0A) of menu)
[0201: IA Magnitude] [0203: IB Magnitude] [0205: IC Magnitude]	$\frac{\text{[0A07 : Phase CT Primary]}}{\text{[0A08 : Phase CT Secondary]}}$
[0207: IN Measured Mag]	$\frac{\text{[0A07 : E/F CT Primary]}}{\text{[0A0A : E/F CT Secondary]}}$
[0232: IM Magnitude]	$\frac{\text{[0A07 : MC amp CT Primary]}}{\text{[0A08 : MC amp CT Secondary]}}$

Table 6: CT ratio settings

4.5.2 Voltage inputs

This test only needs to be performed on models with voltage transformer inputs (i.e. P543, P544, P545 & P546) as it verifies that the accuracy of voltage measurement is within the acceptable tolerances.

Apply rated voltage to each voltage transformer input in turn, checking its magnitude using a multimeter. Refer to Table 7 for the corresponding reading in the relay's MEASUREMENTS 1 column and record the value displayed.

	Voltage applied to	
Cell in MEASUREMENTS 1 column (02)	P543 & P544	P545 & P546
[021A: VAN Magnitude]	C19 – C22	D19 – D22
[021C: VBN Magnitude]	C20 – C22	D20 – D22
[021E: VCN Magnitude]	C21 – C22	D21 – D22
[022E: C/S Voltage Mag] (P543 & P545 only)	C23 – C24	D23 – D24

Table 7: Voltage input terminals

The measured voltage values on the relay LCD or a portable PC connected to the front communication port will either be in primary or secondary volts. If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Primary', the values displayed should be equal to the applied voltage multiplied by the corresponding voltage transformer ratio set in the 'VT and CT RATIOS' menu column (see Table 8). If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Secondary', the value displayed should be equal to the applied voltage.

Note: If a PC connected to the relay via the rear communications port is being used to display the measured voltage, the process will be similar. However, the setting of cell [0D03: MEASURE'T SETUP, Remote Values] will determine whether the displayed values are in primary or secondary Volts.

The measurement accuracy of the relay is ±1%. However, an additional allowance must be made for the accuracy of the test equipment being used.

Cell in MEASUREMENTS 1 column (02)	Corresponding VT Ratio (in 'CT and VT RATIO' column (0A) of menu)
[021A: VAN Magnitude] [021C: VBN Magnitude] [021E: VCN Magnitude]	$\frac{\text{[0A01 : Main VT Primary]}}{\text{[0A02 : Main VT Secondary]}}$
[022E: C/S Voltage Mag]	$\frac{\text{[0A03 : C/S VT Primary]}}{\text{[0A04 : C/S VT Secondary]}}$

Table 8: VT ratio settings

5. SETTING CHECKS

The setting checks ensure that all of the application-specific relay settings (i.e. both the relay's function and programmable scheme logic settings), for the particular installation, have been correctly applied to the relay.

If the application-specific settings are not available, ignore sections 5.1 and 5.2.

Note: The trip circuit should remain isolated during these checks to prevent accidental operation of the associated circuit breaker.

5.1 Apply application-specific settings

The setting checks ensure that all of the application-specific relay settings for the particular installation have been correctly applied to the relay. The settings consist of:
Specific settings
Programmable Scheme Logic
DNP3 configuration (dnp3 versions only)
Goose files (UCA2 versions only)

Note: The trip circuit should remain isolated during these checks to prevent accidental operation of the associated circuit breaker.

5.2 Demonstrate Correct Relay Operation

Tests 4.2.9 and 4.2.10 have already demonstrated that the relay is within calibration, thus the purpose of these tests is as follows:

To determine that the primary protection function of the relay, current differential, can trip according to the correct application settings.

For P543, P544, P545 and P546 to check that where the distance elements are enabled, the relay can trip according to the correct application settings.

To verify correct setting of any backup phase overcurrent protection.

To verify correct assignment of the trip contacts, by monitoring the response to a selection of fault injections.

5.2.1 Current Differential Bias Characteristic

To avoid spurious operation of any distance, overcurrent, earth fault or breaker fail elements, these should be disabled for the duration of the differential element tests. This is done in the relay's CONFIGURATION column. Ensure that cells [090D: Distance], [0910: Overcurrent], [0913: Earth Fault] and [0920: CB Fail] are all set to "Disabled". Make a note of which elements need to be re-enabled after testing. The relay should also be set to loopback mode isolating it from the remote end. Refer to Section 4.3.1.

5.2.1.1 Connect the test circuit

The following tests require a variable transformer and two resistors connected as shown in Figure 3. Alternatively an injection test set can be used to supply Ia and Ib.

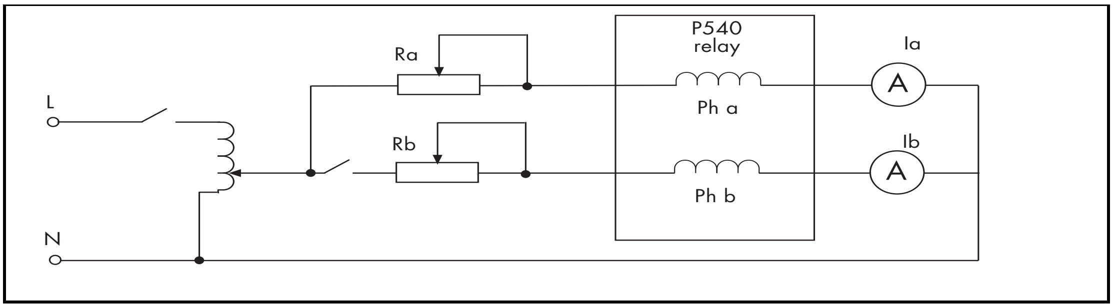

Figure 3: Connection for Bias Characteristic Testing

A current is injected into the A phase which is used as the bias current and another current is injected into the B phase which is used as differential current. Ia is always greater than Ib.

5.2.1.2 Lower slope

If three LEDs have been assigned to give phase segregated trip information, Trip A, Trip B and Trip C, these may be used to indicate correct per-phase operation. If not, monitor options will need to be used – see the next paragraph.

Go to the COMMISSION TESTS column in the menu, scroll down and change cells [0F05: Monitor Bit 1] to 352, [0F06: Monitor Bit 2] to 353 and [0F07: Monitor Bit 3] to 354. Doing so, cell [0F04: Test Port Status] will appropriately set or reset the bits that now represent Phase A Trip (DDB #352), Phase B Trip (DDB #353) and Phase C Trip (DDB #354) with the rightmost bit representing Phase A Trip. From now on you should monitor the indication of [0F04: Test Port Status]. Also make sure that the relay is in loopback mode by setting cell [0F12 Test Loopback] to ‘External’ and applying either a loop-back fibre on the relay or loopback is selected on the P590 as described in 4.2.8. Alternatively setting cell [0F12 Test Loopback] to ‘Internal’.

Adjust the variac and the resistor to give a bias current of 1pu in the A-phase. (NOTE: 1pu = 1A into terminals C3-C2 for 1A applications; or 1pu = 5A into terminals C1-C2 for 5A applications). The relay will trip and any contacts associated with the A-phase will operate, and bit 1 (rightmost) of [0F04: Test Port Status] will be set to 1. Some LEDs, including the yellow alarm LED, will go off, but ignore them for the moment.

When the current in A Phase is established, close the switch and slowly increase the current in the B phase from zero until Phase B trips (bit 2 of [0F04: Test Port Status] is set to 1). Record the phase B current magnitude and check that it corresponds to the information overleaf.

Switch OFF the ac supply, read and clear all alarms.

Bias Current		Differential current	Magnitude of differential current	
Phase	Magnitude	Phase		
A	1pu	B	2 Terminal & Dual Redundant	0.25pu +/-10%
			3 Terminal	0.216pu +/-10%

Assumption: I_{s1} = 0.2pu, k_1 = 30%, I_{s2} = 2.0pu

For other differential settings or current injected into A phase (I_a), the formula below can be used (enter slope in pu form, i.e. percentage/100):

2 Terminal & Dual Redundant:

B phase operate current is 0.5 x [I_{s1} + [I_a x k_1)] pu +/- 10% -

3 Terminal:

B phase operate current is 0.333 x [I_{s1} + (1.5 x I_a x k_1)] pu +/- 10% -

Ensure that $I_a < I_{S2}$

5.2.1.3 Upper slope

Repeat the test in 5.2.1.2 with the bias current set in the A-phase to be 3pu.

When the current in A Phase is established, close the switch and slowly increase the current in the B phase from zero until phase B trips (bit 2 of [0F04: Test Port Status] is set to 1). Record the phase B current magnitude and check that it corresponds to the information below.

Switch OFF the ac supply and reset the alarms.

Bias Current		Differential current	Magnitude of differential current		
Phase	Magnitude	Phase		k_2	
A	3pu	B	2 Terminal & Dual Redundant	150%	1.15pu +/- 10%
				100%	0.9pu +/- 10%
			3 Terminal	150%	1.51pu +/- 10%
				100%	1.1pu +/-10%

Assumption: I_{s1} = 0.2pu, k_1 = 30%, I_{s2} = 2.0pu, k_2 as above

For other differential settings or current injected into A phase (I_a), the formula below can be used (enter slopes in pu form, i.e. percentage/100):

2 Terminal & Dual Redundant:

Operate current is $0.5 \times [(I_a \times k_2) - \{(k_2 - k_1) \times I_{s2}\} + I_{s1}]$ pu +/- 20%

3 Terminal:

Operate current is $0.333 \times [(1.5 \times I_a \times k_2) - \{(k_2 - k_1) \times I_{s2}\} + I_{s1}]$ pu +/- 20%

Ensure that $I_a > I_{S2}$

Note that especially for 5A applications the duration of current injections should be short to avoid overheating of the variac or injection test set.

5.2.2 Current Differential Operation and Contact Assignment

5.2.2.1 Phase A

Retaining the same test circuit as before, prepare for an instantaneous injection of 3pu current in the A phase, with no current in the B phase (B phase switch open). Connect a timer to start when the fault injection is applied, and to stop when the trip occurs. To verify correct output contact mapping use the trip contacts that would be expected to trip the circuit breaker(s), as shown in the table. For two breaker applications, stop the timer once both CB1 and CB2 trip contacts have closed. This can be achieved by connecting the contacts in series to stop the timer.

	Single Breaker	Two Circuit Breakers
Three Pole Tripping	Any Trip	Any Trip (CB1) and Any Trip (CB2)
Single Pole Tripping	Trip A	Trip A (CB1) and Trip A (CB2)

5.2.2.2 Phase B

Reconfigure the test equipment to inject fault current into the B phase. Repeat the test in 5.2.2.1, this time ensuring that the breaker trip contacts relative to B phase operation close correctly. Record the phase B trip time. Switch OFF the ac supply and reset the alarms.

5.2.2.3 Phase C

Repeat 5.2.2.2 for the C phase.
The average of the recorded operating times for the three phases should be less than 40ms for 50Hz, and less than 35ms for 60Hz when set for instantaneous operation. Switch OFF the ac supply and reset the alarms.

Notes: For applications using magnetising inrush current restraint, use a test current higher than the [310E: Inrush High] setting to obtain fast operating times. At least twice setting is recommended.

Where an IDMT or definite time delay is set in the GROUP 1 PHASE DIFF menu column, the expected operating time is typically within +/- 5% of that for the curve equation plus the "instantaneous" delay quoted above.

Upon completion of the tests any distance, overcurrent, earth fault or breaker fail elements which were disabled for testing purposes must have their original settings restored in the CONFIGURATION column.

5.2.3 Distance Protection (P543, P544, P545 and P546 only)

If the distance protection function is being used, the reaches and time delays should be tested. If not, skip to section 5.2.5.

To avoid spurious operation of any current differential, overcurrent, earth fault or breaker fail elements, these should be disabled for the duration of the distance element tests. This is done in the relay's CONFIGURATION column. Ensure that cells [090B: Phase Diff], [0910: Overcurrent], [0913: Earth Fault] and [0920: CB Fail] are all set to "Disabled". Make a note of which elements need to be re-enabled after testing.

5.2.3.1 Connection and preliminaries

The relay should now be connected to equipment able to supply phase-phase and phase-neutral volts with current in the correct phase relation for a particular type of fault on the selected relay characteristic angle. The facility for altering the loop impedance (phase-to-ground fault or phase-phase) presented to the relay is essential.

It is recommended that a three phase digital/electronic injection test set is used for ease of commissioning. (For lower specification test equipment that cannot apply a full three phase set of healthy simulated pre-fault voltages, the VT supervision may need to be disabled to avoid spurious pickup. This is achieved in the CONFIGURATION column, by setting cell [0921: Supervision] to "Disabled").

Note: If any distance elements are set to be "Enabled on Channel Fail" it will be necessary to deliberately force a communications channel failure in order to test them. This can be achieved by removing the loopback test, and ensuring that the relay cannot communicate with the remote end relay.

Set cell [0F12: Test Loopback] to "Disabled"

Observe that the relay raises a Comms Fail alarm.

Connect the test equipment to the relay via the test block(s) taking care not to open-circuit any CT secondary. If MMLG type test blocks are used, the live side of the test plug must be provided with shorting links before it is inserted into the test block.

5.2.3.2 Zone 1 Reach Check

The zone 1 element is set to be directional forward.

Apply a dynamic A phase to neutral fault, slightly in excess of the expected reach. The duration of the injection should be in excess of the tZ1 timer setting, but less than tZ2 (settings found in the DISTANCE menu column). Observe that no trip should occur, and the red Trip LED remains extinguished.

Reduce the impedance and reapply this to the relay. This procedure should be repeated until a trip occurs. The display will show Alarms/Faults present and the Alarm and Trip LEDs will illuminate. To view the alarm message press the read key, repeat presses of this key should be used to verify that phase A was the “Start Element”. Keep pressing the key until the yellow alarm LED changes from flashing to being steadily on. At the prompt ‘Press clear to reset alarms’, press the ‘ⓒ’ key. This will clear the fault record from the display

Record the impedance at which the relay tripped. The measured impedance should be within +/- 10% of the expected reach.

Modern injection test sets usually calculate the expected fault loop impedance from the relay settings, for those that do not:

Connections for an A-N fault. The appropriate loop impedance is given by the vector sum: Z1 + Z1 residual = Z1 + (Z1 x kZN Res Comp∠kZN Angle) Ω.

5.2.3.3 Zone 2 Reach Check (If Enabled)

The zone 2 element is set to be directional forward.

Apply a dynamic B-C fault, slightly in excess of the expected reach. The duration of the injection should be in excess of the tZ2 timer setting, but less than tZ3. Repeat as in 5.2.3.2 to find the zone reach.

Record the impedance at which the relay tripped. The measured impedance should be within +/- 10% of the expected reach. Read and reset the alarms.

Modern injection test sets usually calculate the expected fault loop impedance from the relay settings, for those that do not:

Connections for a B-C fault. The reach for phase-phase should be checked and the operation of the appropriate contacts confirmed. The appropriate loop impedance is now given by:

2 x Z2 Ω

5.2.3.4 Zone 3 Reach Check (If Enabled)

The zone 3 element can be set to be forward or reverse directional. The current injected must be in the appropriate direction to match the setting in the “DISTANCE” menu column.

Apply a dynamic B-C fault, slightly in excess of the expected reach. The duration of the injection should be in excess of the tZ3 timer setting (typically tZ3 + 100ms). Repeat as in 5.2.3.3 to find the zone reach.

Record the impedance at which the relay tripped. The measured impedance should be within +/- 10% of the expected reach. Read and reset the alarms.

5.2.3.5 Resistive Reach

Only a visual check that the correct settings for phase and ground element resistive reaches have been applied is needed. The relevant settings are [3310: RPh] and [3311: RG].

5.2.4 Distance Protection Operation and Contact Assignment

5.2.4.1 Phase A

Prepare a dynamic A phase to neutral fault, at half the Zone 1 reach. Connect a timer to start when the fault injection is applied, and to stop when the trip occurs. To verify correct output contact mapping use the trip contacts that would be expected to trip the circuit breaker(s), as shown in the table. For two breaker applications, stop the timer once CB1 and CB2 trip contacts have both closed, monitored by connecting the contacts in series to stop the timer if necessary.

	Single Breaker	Two Circuit Breakers
Three Pole Tripping	Any Trip	Any Trip (CB1) and Any Trip (CB2)
Single Pole Tripping	Trip A	Trip A (CB1) and Trip A (CB2)

Apply the fault and record the phase A trip time. Switch OFF the ac supply and reset the alarms.

5.2.4.2 Phase B

Reconfigure to test a B phase fault. Repeat the test in 5.2.4.1, this time ensuring that the breaker trip contacts relative to B phase operation close correctly. Record the phase B trip time. Switch OFF the ac supply and reset the alarms.

5.2.4.3 Phase C

Repeat 5.2.4.2 for the C phase.

The average of the recorded operating times for the three phases should typically be less than 60ms for 50Hz, and less than 50ms for 60Hz when set for instantaneous operation. Switch OFF the ac supply and reset the alarms.

Where a non-zero tZ1 time delay is set in the DISTANCE menu column, the expected operating time is typically within +/- 5% of the tZ1 setting plus the "instantaneous" delay quoted above.

5.2.4.4 Time Delay Settings for Zones 2 and 3

Only a visual check that the correct time delay settings have been applied is needed. The relevant settings are [3307: tZ2] and [330B: tZ3].

Upon completion of the tests any current differential, overcurrent, earth fault, breaker fail or supervision elements which were disabled for testing purposes must have their original settings restored in the CONFIGURATION column.

5.2.5 Backup Phase Overcurrent Protection

If the overcurrent protection function is being used, the I>1 element should be tested. If not, skip to section 5.3.

To avoid spurious operation of any current differential, distance, overcurrent, earth fault or breaker fail elements, these should be disabled for the duration of the overcurrent tests. This is done in the relay's CONFIGURATION column. Make a note of which elements need to be re-enabled after testing.

> Note: If the I>1 element is set to be "Enabled on Channel Fail" it will be necessary to deliberately force a communications channel failure in order to test it. This can be achieved by removing the loopback test, and ensuring that the relay cannot communicate with the remote end relay.

Set cell [0F12: Test Loopback] to "Disabled"

Observe that the relay raises a Comms Fail alarm.

5.2.5.1 Connect the test circuit

Determine which output relay has been selected to operate when an I>1 trip occurs by viewing the relay's programmable scheme logic.

The programmable scheme logic can only be changed using the appropriate software. If this software has not been available then the default output relay allocations will still be applicable.

If the trip outputs are phase-segregated (i.e. a different output relay allocated for each phase), the relay assigned for tripping on 'A' phase faults should be used.

If stage 1 is not mapped directly to an output relay in the programmable scheme logic, output relay 3 should be used for the test as it operates for any trip condition.

The associated terminal numbers can be found either from the external connection diagram (Appendix 2) or Table 6.

Connect the output relay so that its operation will trip the test set and stop the timer.

Connect the current output of the test set to the ‘A’ phase current transformer input of the relay (terminals C3 and C2 where 1A current transformers are being used and terminals C1 and C2 for 5A current transformers).

If [3503: GROUP 1 OVERCURRENT, I>1 Directional] is set to ‘Directional Fwd’, the current should flow out of terminal C2 but into C2 if set to ‘Directional Rev’.

If cell [3503: GROUP 1 OVERCURRENT, I>1 Directional] has been set to ‘Directional Fwd’ or ‘Directional Rev’ then rated voltage should be applied to terminals C20 and C21.

Ensure that the timer will start when the current is applied to the relay.

Note: If the timer does not stop when the current is applied and stage 1 has been set for directional operation, the connections may be incorrect for the direction of operation set. Try again with the current connections reversed.

5.2.5.1.1 Perform the test

Ensure that the timer is reset.

Apply a current of twice the setting in cell [3504: GROUP 1 OVERCURRENT, I>1 Current Set] to the relay and note the time displayed when the timer stops.

Check that the red trip LED has illuminated.

5.2.5.1.2 Check the operating time

Check that the operating time recorded by the timer is within the range shown in Table 12.

Note: Except for the definite time characteristic, the operating times given in Table 9 are for a time multiplier or time dial setting of 1. Therefore, to obtain the operating time at other time multiplier or time dial settings, the time given in Table 12 must be multiplied by the setting of cell [3506: GROUP 1 OVERCURRENT, I>1 TMS] for IEC and UK characteristics or cell [3507: GROUP 1 OVERCURRENT, Time Dial] for IEEE and US characteristics.

In addition, for definite time and inverse characteristics there is an additional delay of up to 0.02 second and 0.08 second respectively that may need to be added to the relay’s acceptable range of operating times.

For all characteristics, allowance must be made for the accuracy of the test equipment being used.

Characteristic	Operating time at twice current setting and time multiplier/time dial setting of 1.0	
	Nominal (seconds)	Range (seconds)
DT	[3505: I>1 Time Delay] setting	Setting ±2%
IEC S Inverse	10.03	9.53 – 10.53
IEC V Inverse	13.50	12.83 – 14.18
IEC E Inverse	26.67	24.67 – 28.67
UK LT Inverse	120.00	114.00 – 126.00
IEEE M Inverse	3.8	3.61 – 4.0
IEEE V Inverse	7.03	6.68 – 7.38
IEEE E Inverse	9.50	9.02 – 9.97
US Inverse	2.16	2.05 – 2.27
US ST Inverse	12.12	11.51 – 12.73

Table 9: Characteristic operating times for I>1

Upon completion of the tests any current differential, distance, overcurrent, earth fault, breaker fail or supervision elements which were disabled for testing purposes must have their original settings restored in the CONFIGURATION column.

5.3 Check trip and auto-reclose cycle (P542, P543 and P545 only)

If the auto-reclose function is being used, the circuit breaker trip and auto-reclose cycle can be tested automatically at the application-specific settings.

To test the first three phase auto-reclose cycle, set cell [0F11: COMMISSION TESTS, Test Autoreclose] to ‘3 Pole Test’. The relay will perform a trip/reclose cycle. Repeat this operation to test the subsequent three phase auto-reclose cycles.

Check all output relays used for circuit breaker tripping and closing, blocking other devices, etc. operate at the correct times during the trip/close cycle.

Additionally on a P543 or P545 relay the auto-reclose cycles for single phase trip conditions can be checked one at a time by sequentially setting cell [0F12: COMMISSION TESTS, Test Autoreclose] to ‘Trip Pole A’, ‘Trip Pole B’ and ‘Trip Pole C’.

5.4 Check Application Settings

The settings applied should be carefully checked against the required application-specific settings to ensure that they are correct, and have not been mistakenly altered during the injection test.

There are two methods of checking the settings:

Extract the settings from the relay using a portable PC running the appropriate software via the front EIA(RS)232 port, located under the bottom access cover, or rear communications port (with a KITZ protocol convertor connected). Compare the settings transferred from the relay with the original written application-specific setting record. (For cases where the customer has only provided a printed copy of the required settings but a portable PC is available).

Step through the settings using the relay’s operator interface and compare them with the original application-specific setting record.

Unless previously agreed to the contrary, the application-specific programmable scheme logic will not be checked as part of the commissioning tests.

Due to the versatility and possible complexity of the programmable scheme logic, it is beyond the scope of these commissioning instructions to detail suitable test procedures. Therefore, when programmable scheme logic tests must be performed, written tests which will satisfactorily demonstrate the correct operation of the application-specific scheme logic should be devised by the Engineer who created it. These should be provided to the Commissioning Engineer together with the diskette containing the programmable scheme logic setting file.

6. END TO END TESTS

In section 4.3 a loopback test was initiated on the relay fibre optic communications channels, together with the P590 interface units, if installed, to verify correct operation of the communications channel local to the P540 relay whilst completing the remaining tests. In this section the loopback test is removed and, if possible, satisfactory communications between P540 relays in the same group will be confirmed.

Note: The trip circuit should remain isolated during these checks to prevent accidental operation of the associated circuit breaker.

6.1 Remove the loopback test

As well as removing the loopback test, this section checks that all wiring and optical fibres are reconnected. If P592 or P593 interface units are installed the application-specific settings will also be applied.

Check the alarm records to ensure that no communications failure alarms have occurred whilst the loopback test has been in progress.

Set cell [0F12 Test Loopback] to 'Disabled'.

Restore the communications channels as per the appropriate sub-section below.

6.1.1 Direct fibre optic communications

Remove the loopback test fibre and reconnect the fibre optic cables for communications between relays, ensuring correct placement.

When connecting or disconnecting optical fibres care should be taken not to look directly into the transmit port or end of the optical fibre.

6.1.2 Communications using P591 interface units

Return to the P591 units.

Ensure that all external wiring that has been removed to facilitate testing is replaced in accordance with the relevant connection diagram or scheme diagram.

If applicable, replace the secondary front cover on the P591 units.

6.1.3 Communications using P592 interface units

Return to the P592 units.

Ensure that all external wiring that has been removed to facilitate testing is replaced in accordance with the relevant connection diagram or scheme diagram.

Set the 'V.35 LOOPBACK' switch to the '0' position.

Set the 'CLOCK SWITCH', 'DSR', 'CTS' and 'DATA RATE' DIL switches on each unit to the positions required for the specific application and ensure the 'OPTO LOOPBACK' switch is in the '0' position.

If applicable, replace the secondary front cover on the P592 units.

Note: V.35 Loopback on the remote P592 can be selected to check the communications between the local relay, the local P592 and the communication link itself.

6.1.4 Communications using P593 interface units

Return to the P593 units.

Ensure that all external wiring that has been removed to facilitate testing is replaced in accordance with the relevant connection diagram or scheme diagram.

Set the 'X.21 LOOPBACK' switch to the 'OFF' position and ensure the 'OPTO LOOPBACK' switch is also in the 'OFF' position.

If applicable, replace the secondary front cover on the P593 units.

Note: X.21 Loopback on the remote P593 can be selected to check the communications between the local relay, the local P593 and the X.21 communication link itself. This setting on the local P593 can also be used to check the communications between the local relay and the local P593 if required.

6.2 Verify communications between relays

The following communication checks confirm that the optical power at the transmit and receive ports of the local relay are within the recommended operating limits. However, these checks can only be performed with the relays, and P590 interface units, if installed, at the other ends of the feeder known to be functional and energised.

Measure and record the optical signal strength received by the local P540 relay by disconnecting the optical fibre from the Channel 1 receive port and connecting it to an optical power meter. The mean level should be in the range –16.8dBm to -25.4dBm for an 850nm port and in the range –7dBm to -37dBm for either a 1300nm or 1550nm port. If the mean level is outside of this range check the size and type of fibre being used.

When connecting or disconnecting optical fibres care should be taken not to look directly into the transmit port or end of the optical fibre.

Repeat for Channel 2 receive port (if applicable).

Measure and record the optical power of the Channel 1 transmit port using the optical power meter and length of optical fibre. The mean value should be in the range –16.8dBm to 22.8dBm for an 850nm port and in the range -7dBm to -13dBm for either a 1300nm or 1550nm port.

Repeat for Channel 2 transmit port (if applicable).

Ensure that all transmit (Tx) and receive (Rx) optical fibres are reconnected to the P540, ensuring correct placement.

Reset any alarm indications and check that no further communications failure alarms are raised. Check channel status and propagation delays in [MEASUREMENTS 4] column. Clear the statistics and record the number of valid messages and the number of errored messages after a minimum period of 1 hour. Check that the ratio of errored/good messages is better than 10^{-4}.

6.2.1 Verification of communication between P594 Interface Unit and P545 or P546 Relay

Check that the relay is recognising the GPS synchronisation and communicating satisfactorily with the remote end in [0503:MEASUREMENTS 4, Channel Status] of the relay. If this is satisfactory bit 4, 5 and 6 should be 1 i.e. 111 * * * * for 3 terminal applications and bit 4 and 5 should be 1 i.e. 011 * * * * for 2 terminal applications.

Note: The P594 can take 2¾ hours following detection of at least 4 satellites before it outputs a signal to the P545/P546.

7. ON-LOAD CHECKS

The objectives of the on-load checks are to:

- confirm the external wiring to the current and voltage inputs is correct.
- measure the magnitude of capacitive current.
- ensure the on-load differential current is well below the relay setting.
- check the polarity of the line current transformers at each end is consistent.
- Directionality check for distance elements.

However, these checks can only be carried out if there are no restrictions preventing the energisation of the plant being protected and the other P540 relays in the group have been commissioned.

Remove all test leads, temporary shorting leads, etc. and replace any external wiring that has been removed to allow testing.

If it has been necessary to disconnect any of the external wiring from the relay in order to perform any of the foregoing tests, it should be ensured that all connections are replaced in accordance with the relevant external connection or scheme diagram.

7.1 Confirm current and voltage transformer wiring

7.1.1 Voltage connections (if applicable)

Using a multimeter measure the voltage transformer secondary voltages to ensure they are correctly rated. Check that the system phase rotation is correct using a phase rotation meter.

Compare the values of the secondary phase voltages with the relay's measured values, which can be found in the MEASUREMENTS 1 menu column.

Voltage	Cell in MEASUREMENTS 1 column (02)	Corresponding VT Ratio in 'VT and CT RATIO' column (0A) of menu)
VAB VBC VCA VAN VBN VCN	[0214: VAB Magnitude] [0216: VBC Magnitude] [0218: VCA Magnitude] [021A: VAN Magnitude] [021C: VBN Magnitude] [021E: VCN Magnitude]	[0A01 : Main VT Primary] [0A02 : Main VT Secondary]
VCHECKSYNC	[022E: C/S Voltage Mag]	[0A03 : C/S VT Primary] [0A04 : C/S VT Secondary]

Table 10: Measured voltages and VT ratio settings

If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Secondary', the values displayed on the relay LCD or a portable PC connected to the front EIA(RS)232 communication port should be equal to the applied secondary voltage. The values should be within 1% of the applied secondary voltages. However, an additional allowance must be made for the accuracy of the test equipment being used.

If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Primary', the values displayed should be equal to the applied secondary voltage multiplied the corresponding voltage transformer ratio set in the 'CT & VT RATIOS' menu column (see Table 10). Again the values should be within 1% of the expected value, plus an additional allowance for the accuracy of the test equipment being used.

7.1.2 Current connections

Measure the current transformer secondary values for each input using a multimeter connected in series with the corresponding relay current input.

Check that the current transformer polarities are correct by measuring the phase angle between the current and voltage, either against a phase meter already installed on site and known to be correct or by determining the direction of power flow by contacting the system control centre.

Ensure the current flowing in the neutral circuit of the current transformers is negligible.

Compare the values of the secondary phase currents and phase angle with the relay's measured values, which can be found in the MEASUREMENTS 1 menu column.

Note: Under normal load conditions the earth fault function will measure little, if any, current. It is therefore necessary to simulate a phase to neutral fault. This can be achieved by temporarily disconnecting one or two of the line current transformer connections to the relay and shorting the terminals of these current transformer secondary windings.

If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Secondary', the currents displayed on the LCD or a portable PC connected to the front EIA(RS)232 communication port of the relay should be equal to the applied secondary current. The values should be within 1% of the applied secondary currents. However, an additional allowance must be made for the accuracy of the test equipment being used.

If cell [0D02: MEASURE'T SETUP, Local Values] is set to 'Primary', the currents displayed on the relay should be equal to the applied secondary current multiplied by the corresponding current transformer ratio set in 'CT & VT RATIOS' menu column (see Table 9). Again the values should be within 1% of the expected value, plus an additional allowance for the accuracy of the test equipment being used.

Note: If a single dedicated current transformer is used for the earth fault function, it is not possible to check the relay's measured values.

7.2 Measure capacitive charging current

With the feeder energised from one end only, compare the local and remote measured currents in the MEASUREMENTS 3 menu column to confirm that the feeder capacitive charging current is similar to that expected on all three phases.

Check that the setting of cell [3105: GROUP 1 PHASE DIFF, Phase Is1] is higher than 2.5 times the capacitive charging current. If this is not the case, notify the Engineer who determined the original settings of the setting required to ensure stability under normal operating conditions.

7.3 Check differential current

With the feeder supplying load current check that the relay measurements in the MEASUREMENTS 3 menu column are as expected and that the differential current is similar to the value of capacitive charging current previously measured for all three phases.

7.4 Check consistency of current transformer polarity

The load current should be high enough to be certain beyond doubt that the main current transformers are connected with the same polarity to each relay in the group.

There is a possibility on cable circuits with high line capacitance that the load current could be masked by the capacitive charging current. If necessary reverse the connections to the main current transformers and check that the 'A' phase differential current in cell [0419: MEASUREMENTS 3, IA Differential] is significantly higher than for the normal connection. If the differential current falls with the connection reversed, the main current transformers may not be correct and should be thoroughly checked. Repeat the test for phases 'B' and 'C' using cells [0420: MEASUREMENTS 3, IB Differential] and [0419: MEASUREMENTS 3, IC Differential] respectively.

7.5 On load directional test (P543, P544, P545 and P546 relays)

This test is important to ensure that distance elements, directionalised overcurrent and fault locator functions have the correct forward/reverse response to fault and load conditions.

Firstly the actual direction of power flow on the system must be ascertained, using adjacent instrumentation or protection already in-service, or a knowledge of the prevailing network operation conditions.

For load current flowing in the Forward direction – i.e. power export to the remote line end, cell [0301: MEASUREMENTS 2, A Phase Watts] should show **positive** power signing.

For load current flowing in the Reverse direction – i.e. power import from the remote line end, cell [0301: MEASUREMENTS 2, A Phase Watts] should show **negative** power signing.

Note: The check above applies only for Measurement Modes 0 (default), and 2. This should be checked in [0D05: MEASURE'T SETUP, Measurement Mode = 0 or 2]. If measurement modes 1 or 3 are used, the expected power flow signing would be opposite to that shown in the bullets above.

In the event of any uncertainty, check the phase angle of the A phase current with respect to the A phase voltage.

8. FINAL CHECKS

The tests are now complete.

Remove all test or temporary shorting leads, etc. If it has been necessary to disconnect any of the external wiring from the relay in order to perform the wiring verification tests, it should be ensured that all connections are replaced in accordance with the relevant external connection or scheme diagram.

Ensure that the relay has been restored to service by checking that cell [0F0D: COMMISSION TESTS, Test Mode] is set to 'Disabled'.

If the relay is in a new installation or the circuit breaker has just been maintained, the circuit breaker maintenance and current counters should be zero. These counters can be reset using cell [0609: CB CONDITION, Reset All Values]. If the required access level is not active, the relay will prompt for a password to be entered so that the setting change can be made.

If the menu language has been changed to allow testing it should be restored to the customer's preferred language.

If a P991/MMLG test block is installed, remove the P992/MMLB test plug and replace the cover so that the protection is put into service.

Ensure that all event records, fault records, disturbance records, alarms and LED's have been reset before leaving the relay.

If applicable, replace the secondary front cover on the relay.

9. MAINTENANCE

9.1 Maintenance period

It is recommended that products supplied by Alstom Grid receive periodic monitoring after installation. As with all products some deterioration with time is inevitable. In view of the critical nature of protective relays and their infrequent operation, it is desirable to confirm that they are operating correctly at regular intervals.

Alstom Grid protective relays are designed for a life in excess of 20 years.

MiCOM P540 current differential relays are self-supervising and so require less maintenance than earlier designs of relay. Most problems will result in an alarm so that remedial action can be taken. However, some periodic tests should be done to ensure that the relay is functioning correctly and the external wiring is intact.

The operation of the P590 interface units, when installed, is continuously monitored by the P540 relay and a communication failure alarm will therefore be given if a P590 should cease to work properly.

> Note: A communication failure alarm could be caused by the failure of the equipment forming the communication link and can not in itself be conclusive evidence of a faulty P590 interface unit.

If a Preventative Maintenance Policy exists within the customer's organisation then the recommended product checks should be included in the regular programme. Maintenance periods will depend on many factors, such as:

- operating environment
- accessibility of the site
- amount of available manpower
- importance of the installation in the power system
- consequences of failure

9.2 Maintenance checks

Although some functionality checks can be performed from a remote location by utilising the communications ability of the relays, these are predominantly restricted to checking that the relay is measuring the applied currents and voltages accurately, and checking the circuit breaker maintenance counters. Therefore it is recommended that maintenance checks are performed locally (i.e. at the substation itself).

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety and Technical Data sections and the ratings on the equipment's rating label.

9.2.1 Alarms

The alarm status LED should first be checked to identify if any alarm conditions exist. If so, press the read key [] repeatedly to step through the alarms.

Clear the alarms to extinguish the LED.

9.2.2 Opto-isolators

The opto-isolated inputs can be checked to ensure that the relay responds to their energisation by repeating the commissioning test detailed in Section 4.2.6 of this chapter.

9.2.3 Output relays

The output relays can be checked to ensure that they operate by repeating the commissioning test detailed in Section 4.2.7 of this chapter.

9.2.4 Measurement accuracy

If the power system is energised, the values measured by the relay can be compared with known system values to check that they are in the approximate range that is expected. If they are then the analogue/digital conversion and calculations are being performed correctly by the relay. Suitable test methods can be found in Sections 7.1.1 and 7.1.2 of this chapter.

Alternatively, the values measured by the relay can be checked against known values injected into the relay via the test block, if fitted, or injected directly into the relay terminals. Suitable test methods can be found in Sections 4.5 and 4.5.2 of this chapter. These tests will prove the calibration accuracy is being maintained.

9.3 Method of repair

9.3.1 P540 relay

If the relay should develop a fault whilst in service, depending on the nature of the fault, the watchdog contacts will change state and an alarm condition will be flagged. Due to the extensive use of surface-mount components faulty PCBs should be replaced as it is not possible to perform repairs on damaged circuits. Thus either the complete relay or just the faulty PCB, identified by the in-built diagnostic software, can be replaced. Advice about identifying the faulty PCB can be found in the Problem Analysis chapter (P54x/EN PR).

The preferred method is to replace the complete relay as it ensures that the internal circuitry is protected against electrostatic discharge and physical damage at all times and overcomes the possibility of incompatibility between replacement PCBs. However, it may be difficult to remove an installed relay due to limited access in the back of the cubicle and rigidity of the scheme wiring.

Replacing PCBs can reduce transport costs but requires clean, dry conditions on site and higher skills from the person performing the repair. However, if the repair is not performed by an approved service centre, the warranty will be invalidated.

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety and Technical Data sections and the ratings on the equipment's rating label. This should ensure that no damage is caused by incorrect handling of the electronic components.

9.3.1.1 Replacing the complete relay

The case and rear terminal blocks have been designed to facilitate removal of the complete relay should replacement or repair become necessary without having to disconnect the scheme wiring.

Before working at the rear of the relay, isolate all voltage and current supplies to the relay.

Note: The MiCOM range of relays have integral current transformer shorting switches which will close when the heavy duty terminal block is removed.

Disconnect the relay earth, IRIG-B and fibre optic connections, as appropriate, from the rear of the relay.

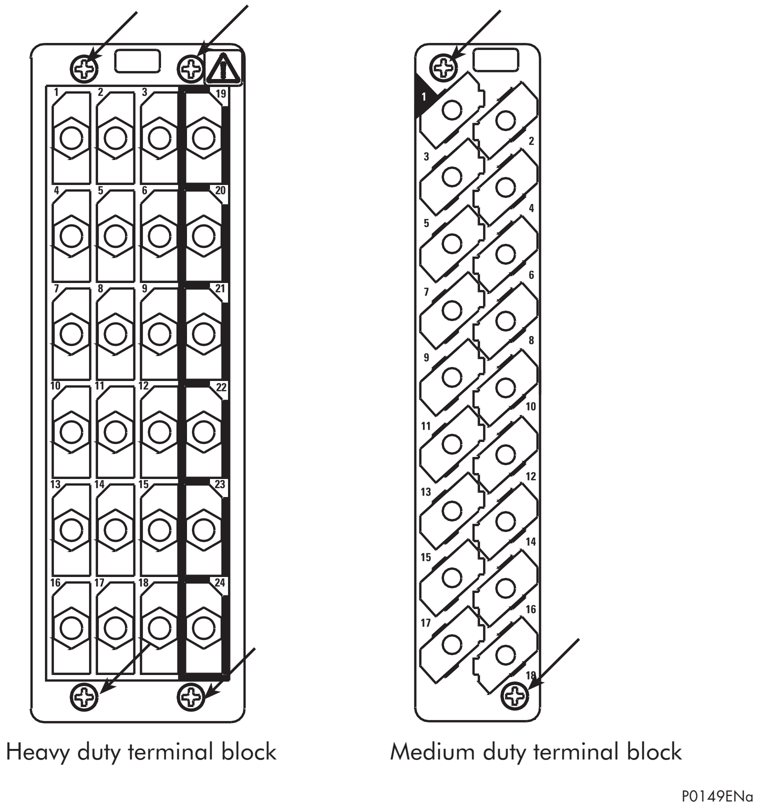

Figure 4: Location of securing screws for terminal blocks

There are two types of terminal block used on the relay, medium and heavy duty, which are fastened to the rear panel using crosshead screws, as in Figure 4.

Note: The use of a magnetic bladed screwdriver is recommended to minimise the risk of the screws being left in the terminal block or lost.

Without exerting excessive force or damaging the scheme wiring, pull the terminal blocks away from their internal connectors.

Remove the screws used to fasten the relay to the panel, rack, etc. These are the screws with the larger diameter heads that are accessible when the access covers are fitted and open.

If the top and bottom access covers have been removed, do not remove the screws with the smaller diameter heads which are accessible. These screws secure the front panel to the relay.

Withdraw the relay carefully from the panel, rack, etc. because it will be heavy due to the internal transformers, particularly in the case of a P544 or P546 relay.

To reinstall the repaired or replacement relay, follow the above instructions in reverse, ensuring that each terminal block is relocated in the correct position and the case earth, IRIG-B and fibre optic connections are replaced. To facilitate easy identification of each terminal block, they are labelled alphabetically with ‘A’ on the left hand side when viewed from the rear.

Once reinstallation is complete the relay should be recommissioned using the instructions in sections 1 to 8 inclusive of this chapter.

9.3.1.2 Replacing a PCB

If the relay fails to operate correctly refer to the Problem Analysis chapter (P54x/EN PR), to help determine which PCB has become faulty.

To replace any of the relay’s PCBs it is necessary to first remove the front panel.

Before removing the front panel to replace a PCB the auxiliary supply must be removed. It is also strongly recommended that the voltage and current transformer connections and trip circuit are isolated.

Open the top and bottom access covers. With size 60TE/80TE cases the access covers have two hinge-assistance T-pieces which clear the front panel moulding when the access covers are opened by more than 90°, thus allowing their removal.

If fitted, remove the transparent secondary front cover. A description of how to do this is given in the ‘Introduction’ (P54x/EN IT).

By applying outward pressure to the middle of the access covers, they can be bowed sufficiently so as to disengage the hinge lug allowing the access cover to be removed. The screws that fasten the front panel to the case are now accessible.

The size 40TE case has four crosshead screws fastening the front panel to the case, one in each corner, in recessed holes. The size 60TE/80TE case has an additional two screws, one midway along each of the top and bottom edges of the front plate. Undo and remove the screws.

Do not remove the screws with the larger diameter heads which are accessible when the access covers are fitted and open. These screws hold the relay in its mounting (panel or cubicle).

When the screws have been removed, the complete front panel can be pulled forward and separated from the metal case.

Caution should be observed at this stage because the front panel is connected to the rest of the relay circuitry by a 64-way ribbon cable.

Additionally, from here on, the internal circuitry of the relay is exposed and not protected against electrostatic discharges, dust ingress, etc. Therefore ESD precautions and clean working conditions should be maintained at all times.

The ribbon cable is fastened to the front panel using an IDC connector; a socket on the cable itself and a plug with locking latches on the front panel. Gently push the two locking latches outwards which will eject the connector socket slightly. Remove the socket from the plug to disconnect the front panel.

The PCBs within the relay are now accessible. Figures 5, 6 and 7 show the PCB locations for the current differential relays in a size 40TE case (P541), size 60TE/80TE cases with a single set of transformers (P542, P543 and P545) and size 60TE/80TE cases with two sets of transformers (P544 & P546) respectively.

Note: The numbers above the case outline identify the guide slot reference for each printed circuit board. Each printed circuit board has a label stating the corresponding guide slot number to ensure correct re-location after removal. To serve as a reminder of the slot numbering there is a label on the rear of the front panel metallic screen.

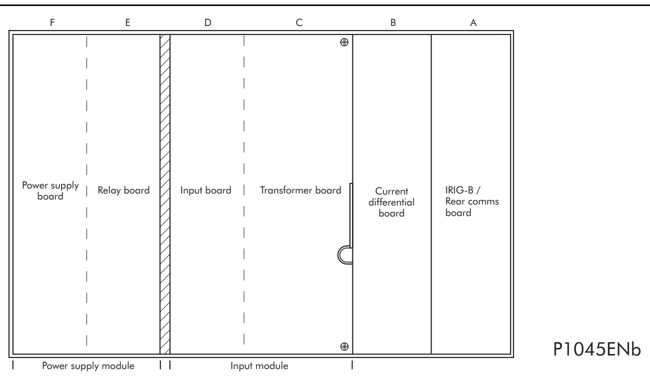

Figure 5: P541 PCB/module locations (viewed from front)

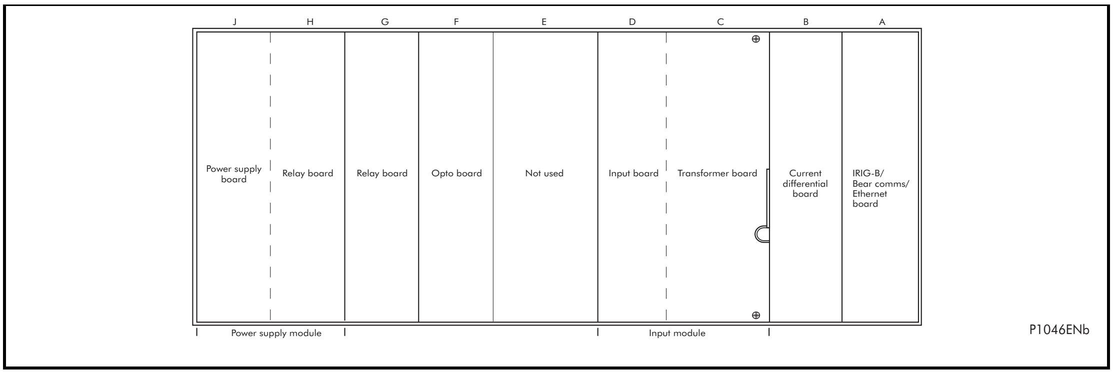

Figure 6: P542, & P543 PCB/module locations (viewed from front)

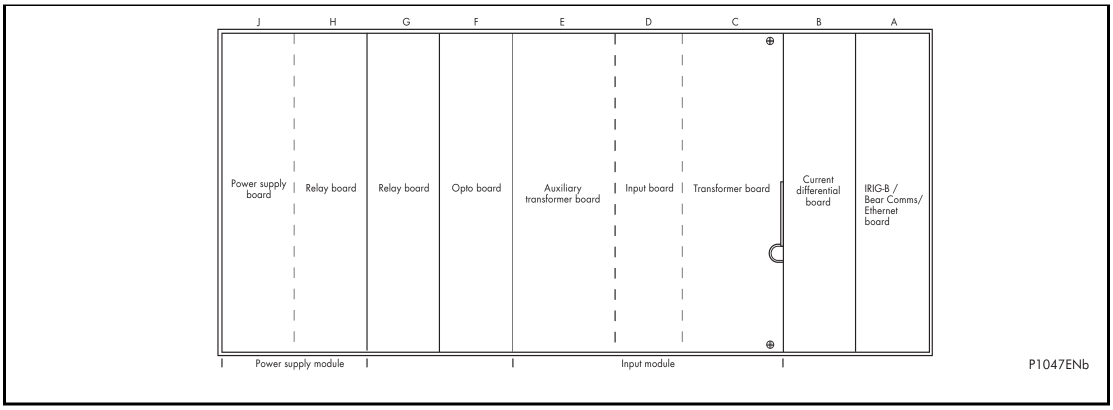

Figure 7: P544 PCB/module locations (viewed from front)

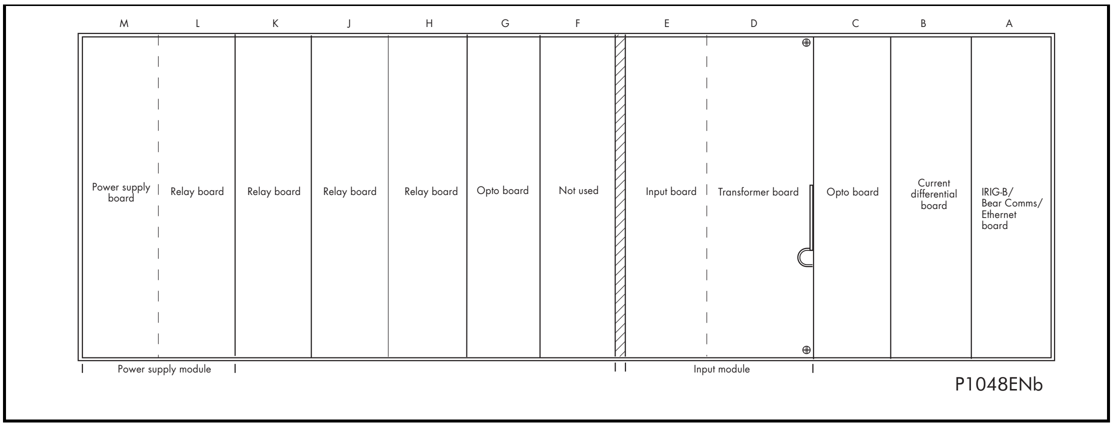

Figure 8: P545 PCB/module locations (viewed from front)

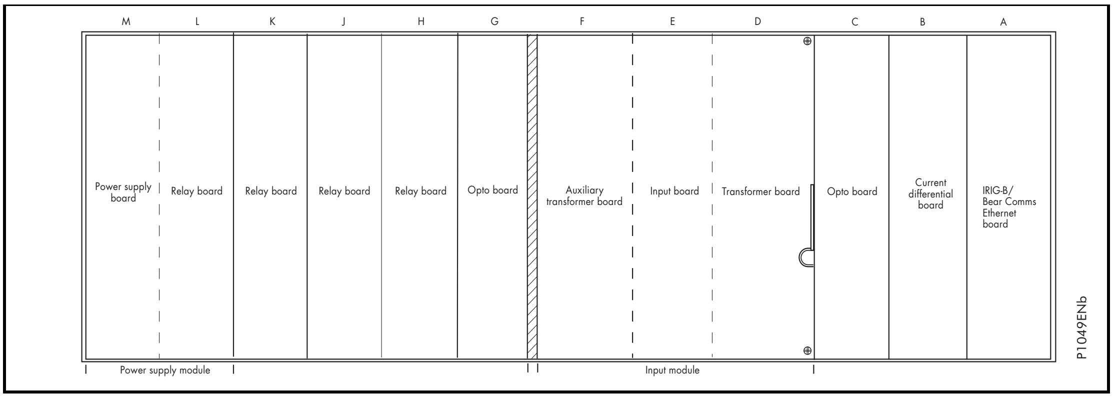

Figure 9: P546 PCB/module locations (viewed from front)

The 64-way ribbon cable to the front panel also provides the electrical connections between PCBs with the connections being via IDC connectors.

The slots inside the case to hold the PCBs securely in place each correspond to a rear terminal block. Looking from the front of the relay these terminal blocks are labelled from right to left.

Note: To ensure compatibility, always replace a faulty PCB with one of an identical part number.

9.3.1.2.1 Replacement of the main processor board

The main processor board is located in the front panel, not within the case as with all the other PCBs. Place the front panel with the user interface face-down and remove the six screws from the metallic screen, as shown in Figure 10. Remove the metal plate.

There are two further screws, one each side of the rear of the battery compartment recess, that hold the main processor PCB in position. Remove these screws.

The user interface keypad is connected to the main processor board via a flex-strip ribbon cable. Carefully disconnect the ribbon cable at the PCB-mounted connector as it could easily be damaged by excessive twisting.

The front panel can then be re-assembled with a replacement PCB using the reverse procedure. Ensure that the ribbon cable is reconnected to the main processor board and all eight screws are re-fitted.

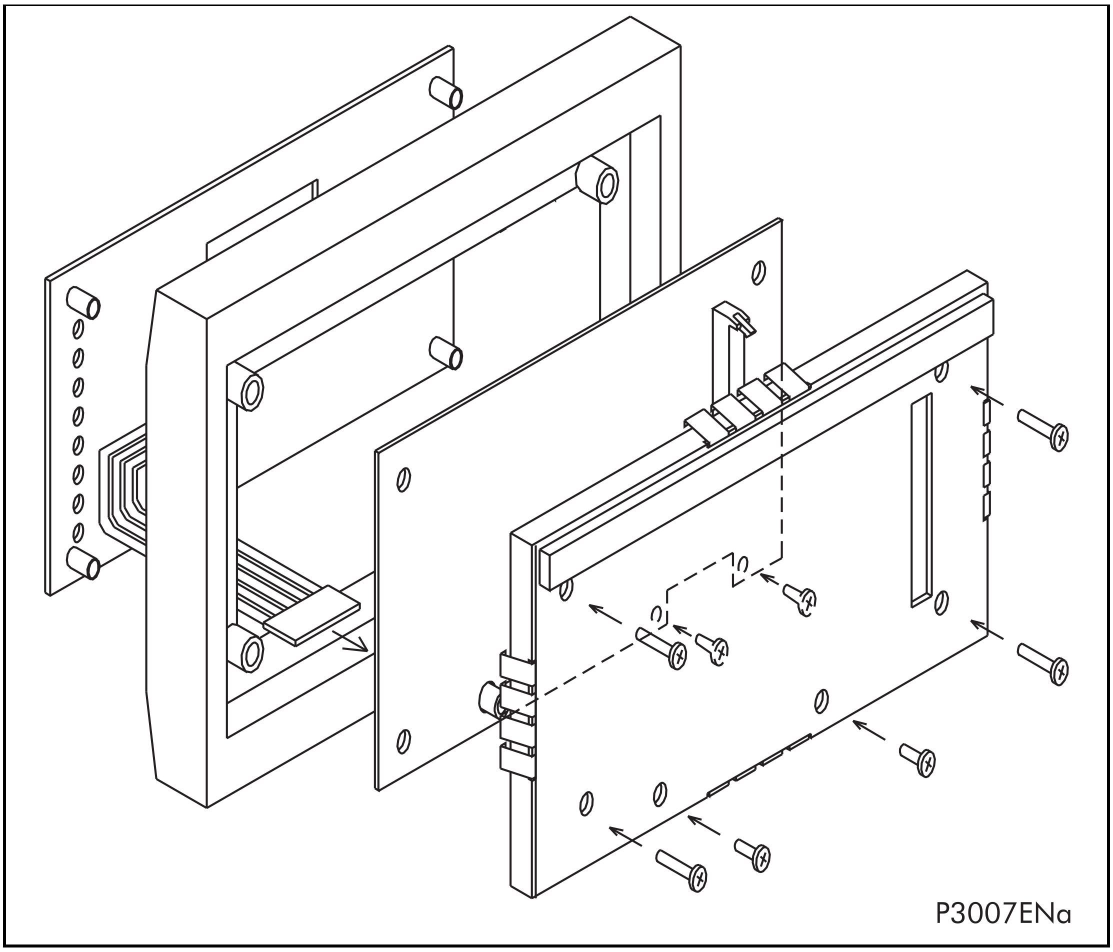

Figure 10: Front panel assembly

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

After replacement of the main processor board, all the settings required for the application will need to be re-entered. Therefore, it is useful if an electronic copy of the application-specific settings is available on disk. Although this is not essential, it can reduce the time taken to re-enter the settings and hence the time the protection is out of service.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

9.3.1.2.2 Replacement of the IRIG-B board

Depending on the model number of the relay, the IRIG-B board may have connections for IRIG-B signals, IEC60870-5-103 (VDEW) communications, both or not be present at all.

To replace a faulty board, disconnect all IRIG-B and/or IEC60870-5-103 connections at the rear of the relay.

The board is secured in the case by two screws accessible from the rear of the relay, one at the top and another at the bottom, as shown in Figure 11. Remove these screws carefully as they are not captive in the rear panel of the relay.

Gently pull the IRIG-B board forward and out of the case.

To help identify that the correct board has been removed, Figure 13 illustrates the layout of the IRIG-B board with both IRIG-B and IEC60870-5-103 options fitted (ZN0007 003). The other versions (ZN0007 001 and ZN0007 002) use the same PCB layout but have less components fitted.

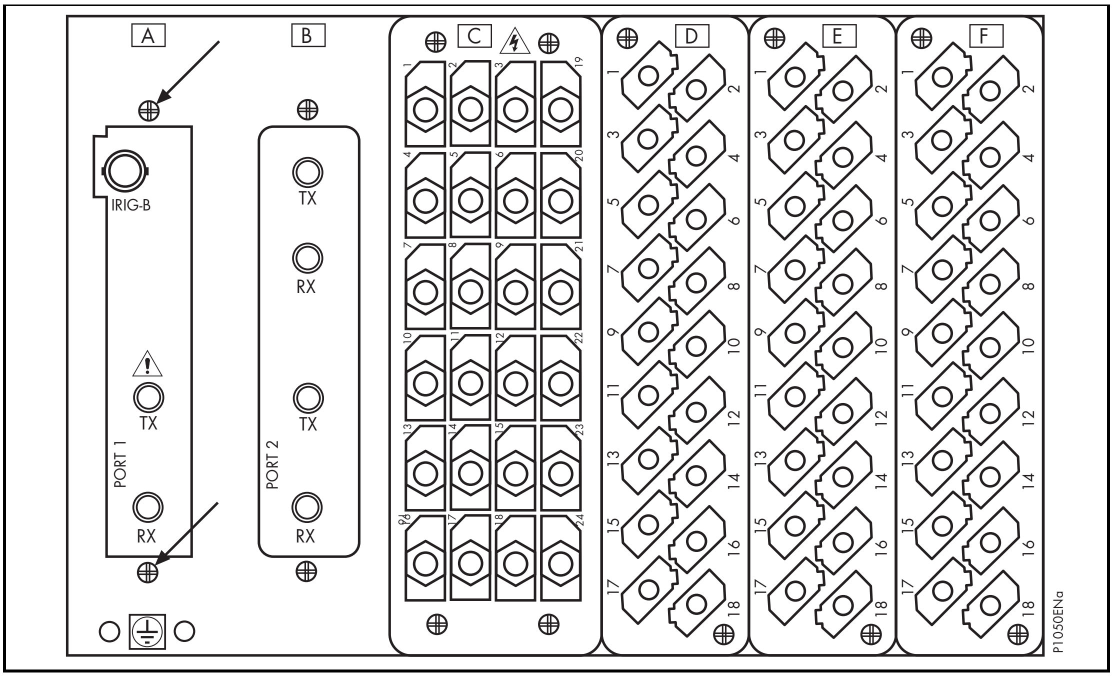

Figure 11: Location of securing screws for IRIG-B board

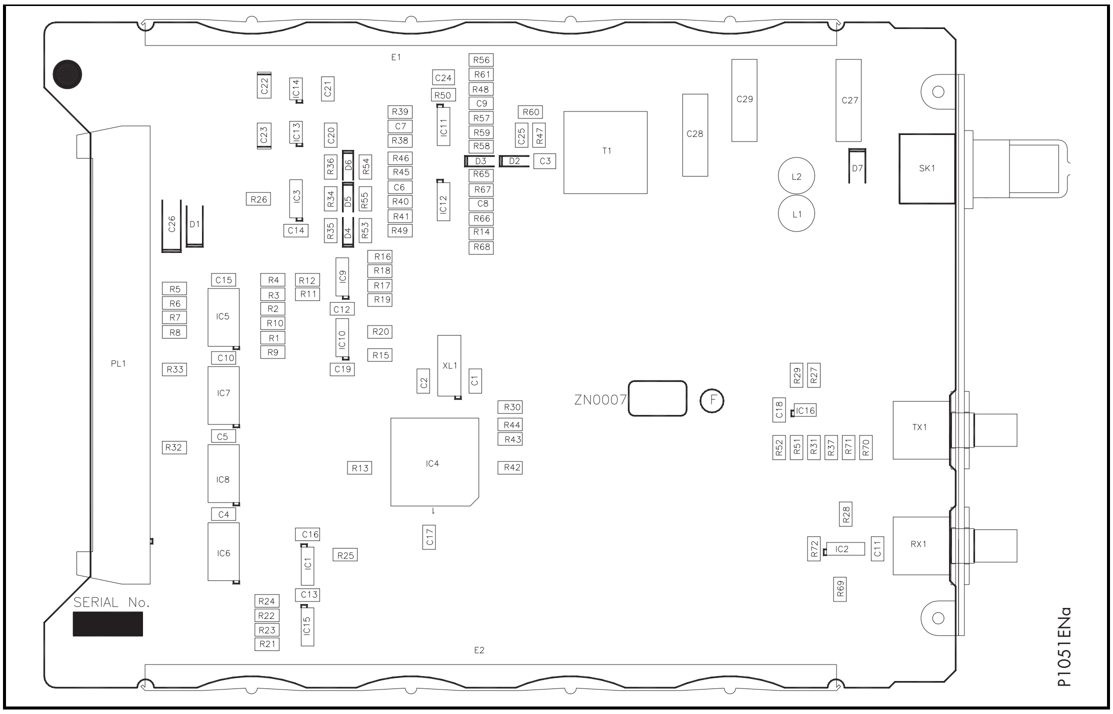

Figure 12: Typical IRIG-B board

Before fitting the replacement PCB check that the number on the round label adjacent to the front edge of the PCB matches the slot number into which it will be fitted. If the slot number is missing or incorrect write the correct slot number on the label.

The replacement PCB should be carefully slotted into the appropriate slot, ensuring that it is pushed fully back on to the rear terminal blocks and the securing screws are re-fitted.

Reconnect all IRIG-B and/or IEC60870-5-103 connections at the rear of the relay.

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

9.3.1.2.3 Replacement of the input module

The input module comprises of two boards fastened together, the transformer board and the input board.

The module is secured in the case by two screws on its right-hand side, accessible from the front of the relay, as shown in Figure 13. Remove these screws carefully as they are not captive in the front plate of the module.

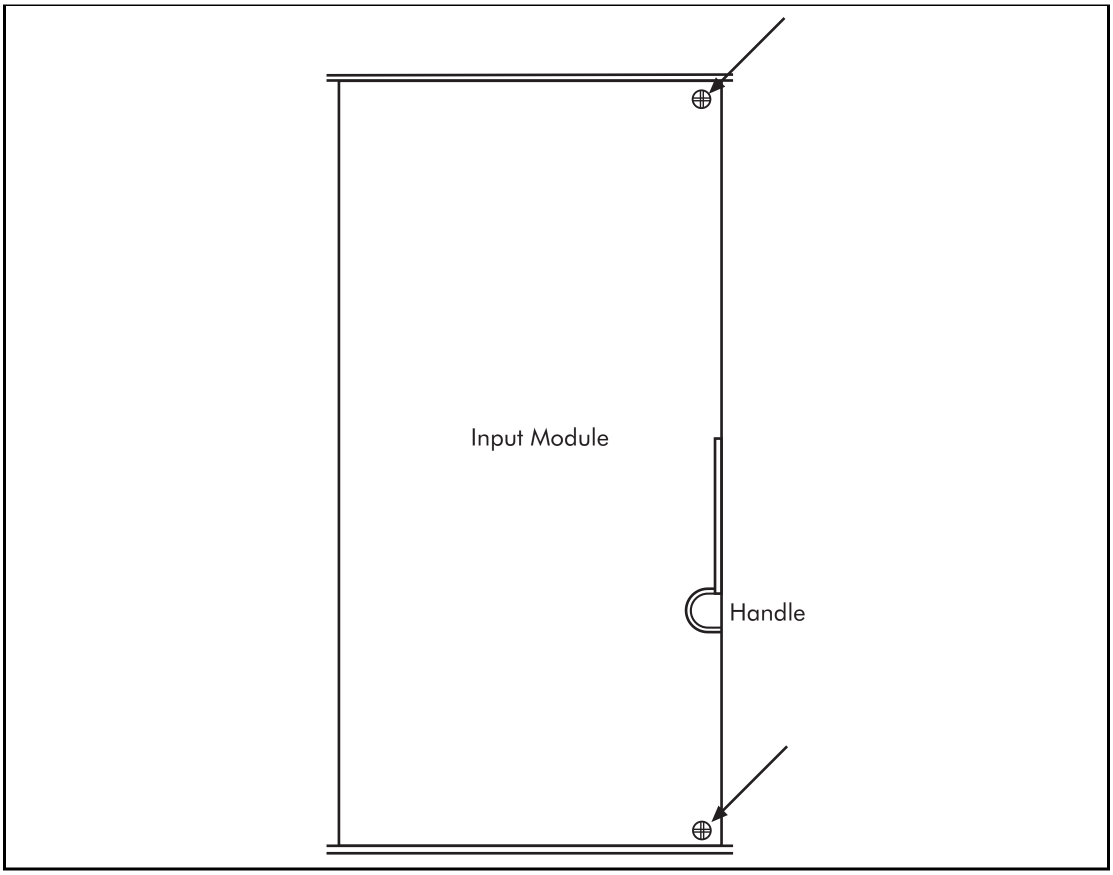

Figure 13: Location of securing screws for input module

On the right-hand side of the analogue input module there is a small metal tab which brings out a handle. Grasping this handle firmly, pull the module forward, away from the rear terminal blocks. A reasonable amount of force will be required to achieve this due to the friction between the contacts of two terminal blocks, one medium duty and one heavy duty.

Note: Care should be taken when withdrawing the input module as it will suddenly come loose once the friction of the terminal blocks has been overcome. This is particularly important with unmounted relays as the metal case will need to be held firmly whilst the module is withdrawn.

Remove the module from the case, taking care as it is heavy because it contains all the relay's input voltage and current transformers.

Before fitting the replacement module check that the number on the round label adjacent to the front edge of the PCB matches the slot number into which it will be fitted. If the slot number is missing or incorrect write the correct slot number on the label.

The replacement module can be slotted in using the reverse procedure, ensuring that it is pushed fully back on to the rear terminal blocks. To help confirm that the module has been inserted fully there is a V-shaped cut-out in the bottom plate of the case that should be fully visible. Re-fit the securing screws.

Note: The transformer and input boards within the module are calibrated together with the calibration data being stored on the input board. Therefore it is recommended that the complete module is replaced to avoid on-site recalibration having to be performed.

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

9.3.1.2.4 Replacement of the power supply board

The power supply board is fastened to a relay board to form the power supply module and is located on the extreme left-hand side of all MiCOM current differential relays.

Pull the power supply module forward, away from the rear terminal blocks and out of the case. A reasonable amount of force will be required to achieve this due to the friction between the contacts of the two medium duty terminal blocks.

The two boards are held together with push-fit nylon pillars and can be separated by pulling them apart. Care should be taken when separating the boards to avoid damaging the inter-board connectors located near the lower edge of the PCBs towards the front of the power supply module.

The power supply board is the one with two large electrolytic capacitors on it that protrude through the other board that forms the power supply module. To help identify that the correct board has been removed, Figure 14 illustrates the layout of the power supply board for all voltage ratings.

Before re-assembling the module with a replacement PCB check that the number on the round label adjacent to the front edge of the PCB matches the slot number into which it will be fitted. If the slot number is missing or incorrect write the correct slot number on the label.

Re-assemble the module with a replacement PCB ensuring the inter-board connectors are firmly pushed together and the four push-fit nylon pillars are securely located in their respective holes in each PCB.

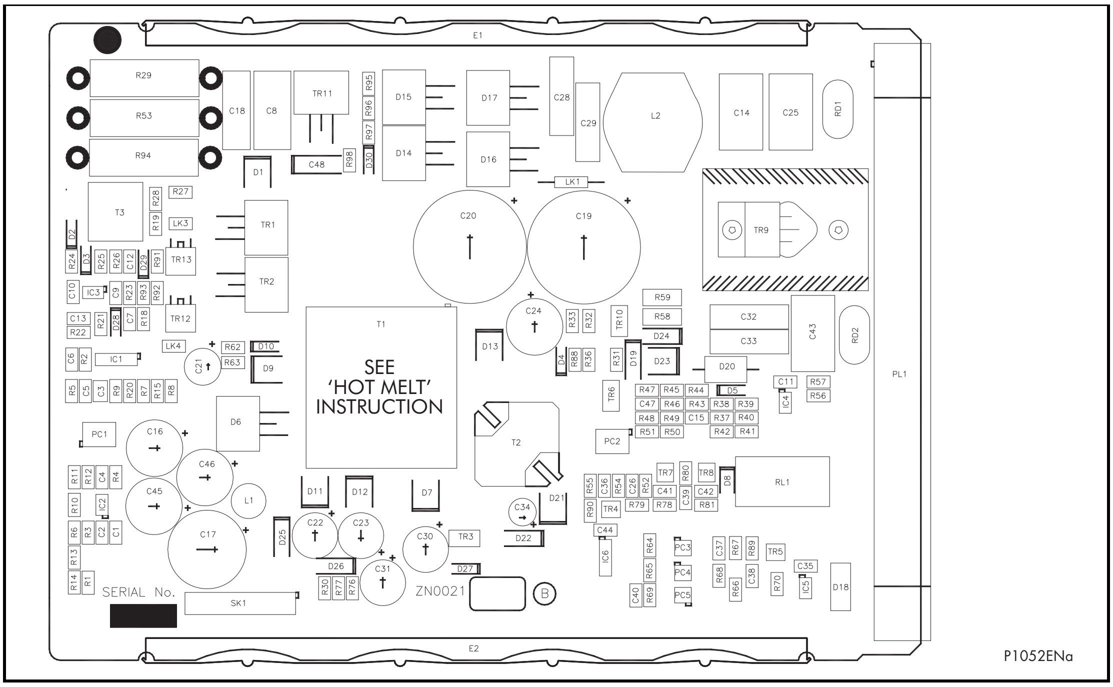

Figure 14: Typical power supply board

Slot the power supply module back into the relay case, ensuring that it is pushed fully back on to the rear terminal blocks.

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

9.3.1.2.5 Replacement of the relay board in the power supply module

Remove and replace the relay board in the power supply module as described in 9.3.1.2.4 above.

The relay board is the one with holes cut in it to allow the transformer and two large electrolytic capacitors of the power supply board to protrude through. To help identify that the correct board has been removed, Figure 15 illustrates the layout of the relay board.

Before re-assembling the module with a replacement relay board check that the number on the round label adjacent to the front edge of the PCB matches the slot number into which it will be fitted. If the slot number is missing or incorrect write the correct slot number on the label.

Ensure the setting of the link (located above IDC connector) on the replacement relay board is the same as the one being replaced before replacing the module in the relay case.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

Figure 15: Typical relay board

9.3.1.2.6 Replacement of the opto and separate relay boards (P542, P543, P544, P545 & P546)

The P542, P543, P544, P545 and P546 current differential relays have additional boards to the P541. These boards provide extra output relays and optically-isolated inputs to those in the power supply and input modules respectively.

To remove either, gently pull the faulty PCB forward and out of the case.

If the relay board is being replaced, ensure the setting of the link (located above IDC connector) on the replacement relay board is the same as the one being replaced. To help identify that the correct board has been removed, Figures 15 and 16 illustrate the layout of the relay and opto boards respectively.

Before fitting the replacement PCB check that the number on the round label adjacent to the front edge of the PCB matches the slot number into which it will be fitted. If the slot number is missing or incorrect write the correct slot number on the label.

The replacement PCB should be carefully slid into the appropriate slot, ensuring that it is pushed fully back on to the rear terminal blocks.

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

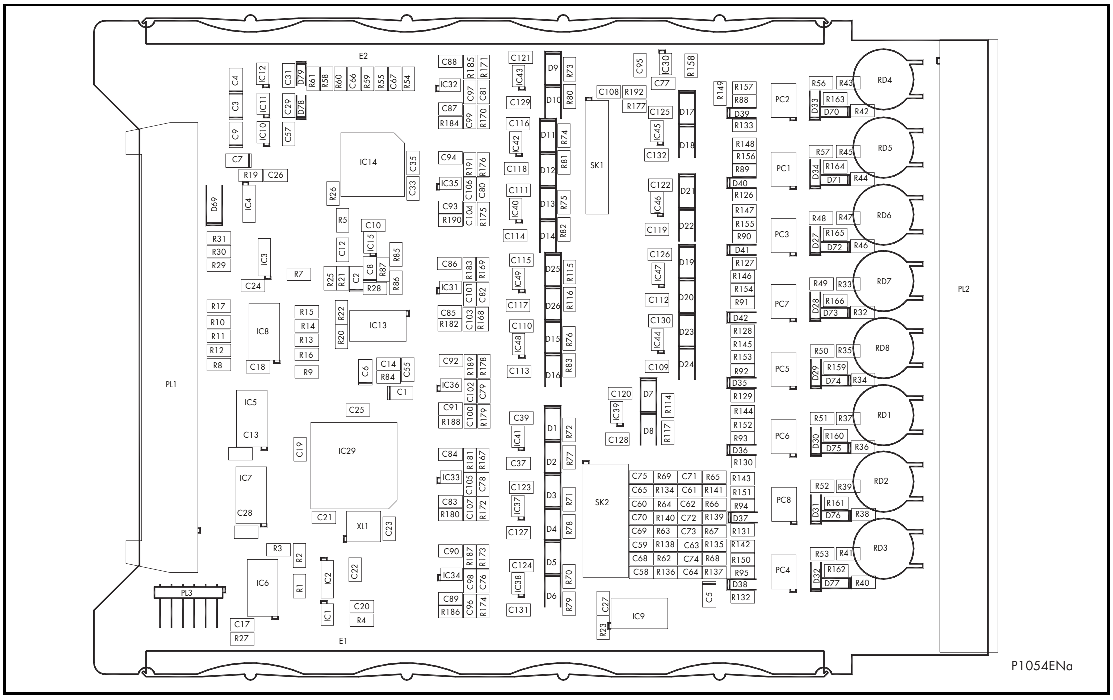

Figure 16: Typical opto board

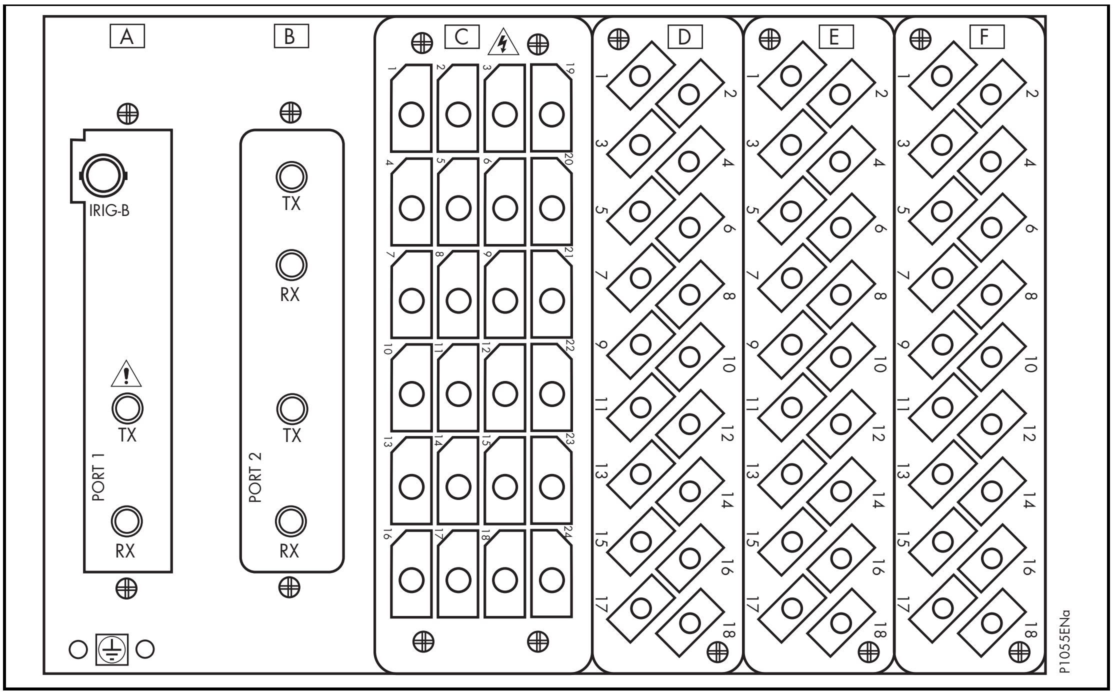

Figure 17: Location of securing screws for current differential board

9.3.1.2.7 Replacement of the current differential board

Before replacing a faulty current differential board, disconnect fibre optic cable connections at the rear of the relay.

The board is secured in the case by two screws accessible from the rear of the relay, one at the top and another at the bottom, as shown in Figure 13. Remove these screws carefully as they are not captive in the rear panel of the relay.

Using the small metal tab on the left hand side of the input module rotate handle used for extraction until it is in a horizontal orientation. This is necessary so that the two PCB connectors on the underside of the current differential PCB do not catch the handle as the PCB is extracted.

Gently pull the faulty current differential PCB forward and out of the case.

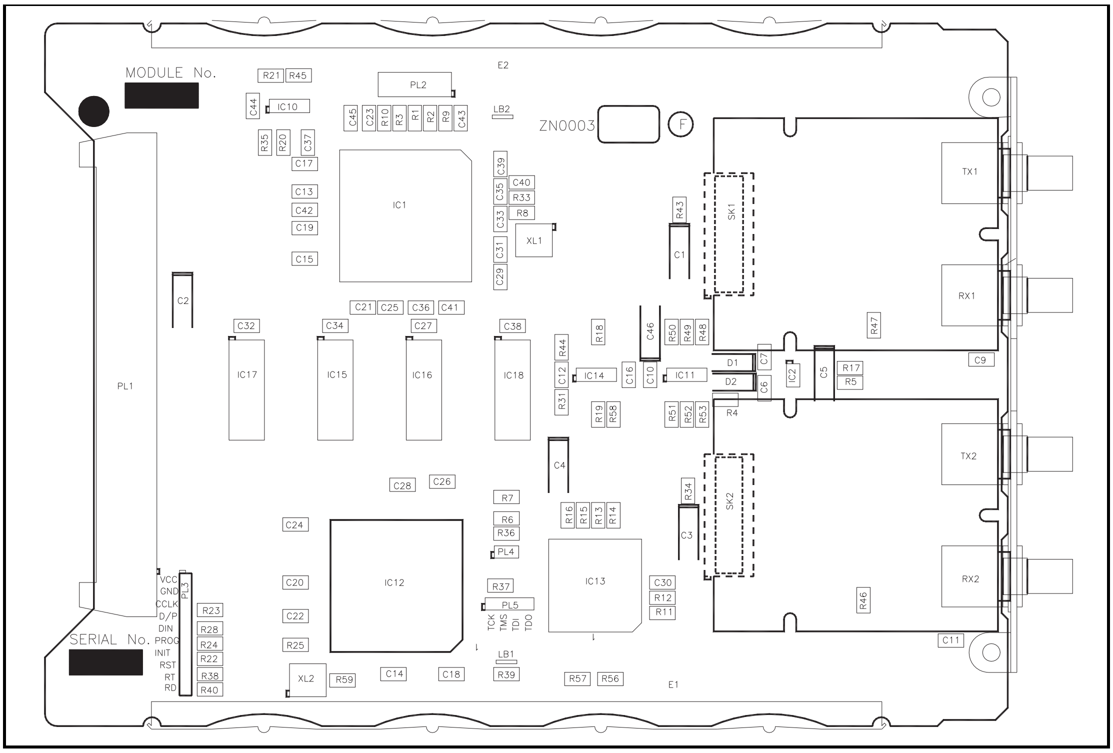

Figure 18: Typical current differential board

To help identify that the correct board has been removed, Figure 18 illustrates the layout of the current differential board with dual fibre optic communications channels fitted. The current differential boards with a single communications channel (used in relays for two ended feeders where dual redundant communications channels are not required) use the same PCB layout but have less components fitted.

The replacement PCB should be carefully slid into the appropriate slot, ensuring that it is pushed fully back and the board securing screws are re-fitted.

Refit the fibre optic cable connections, ensuring that they are in the correct locations.

Refit the front panel using the reverse procedure to that given in section 9.3.1.2. After refitting and closing the access covers on size 60TE/80TE cases, press at the location of the hinge-assistance T-pieces so that they click back into the front panel moulding.

Once the relay has been reassembled after repair, it should be recommissioned in accordance with the instructions in sections 1 to 8 inclusive of this chapter.

9.3.2 P590 interface units

Should a P590 interface unit be found to have developed a fault it is recommended that the complete P590 module, together with a suitable case for protection, is returned to Alstom Grid, or an approved service centre, for repair. If a compatible spare P590 is available this can be installed until the faulted unit has been repaired.

The main reasons for fault finding to sub-assembly or component level not being recommended are:

Fault finding on printed circuit boards requires a knowledge of the P590 circuitry and specialised equipment.

The components used in manufacture are subjected to strict quality control procedures and in all cases have been selected for particular characteristics.

Metal oxide semiconductors (MOS) are used which require very careful handling to prevent damage from electrostatic discharges.

Damage can be caused to printed circuit board tracks and surrounding components unless extreme care is used when replacing faulty components.

Replacement of certain components will require the relay to be recalibrated.

Once the P590 has been replaced, it should be recommissioned in accordance with the instructions in sections 4.3 and 6 of this chapter.

9.4 Recalibration

9.4.1 P540 relay

Recalibration is not required when a PCB is replaced unless it happens to be one of the boards in the input module, the replacement of either directly affects the calibration.

Although it is possible to carry out recalibration on site, this requires test equipment with suitable accuracy and a special calibration program to run on a PC. It is therefore recommended that the work is carried out by the manufacturer, or entrusted to an approved service centre.

9.5 Changing the relay battery

Each relay has a battery to maintain status data and the correct time when the auxiliary supply voltage fails. The data maintained includes event, fault and disturbance records and the thermal state at the time of failure.

This battery will periodically need changing, although an alarm will be given as part of the relay's continuous self-monitoring in the event of a low battery condition.

If the battery-backed facilities are not required to be maintained during an interruption of the auxiliary supply, the steps below can be followed to remove the battery, but do not replace with a new battery.

Before carrying out any work on the equipment, the user should be familiar with the contents of the safety and technical data sections and the ratings on the equipment's rating label.

9.5.1 Instructions for replacing the battery

Open the bottom access cover on the front of the relay.

Gently extract the battery from its socket. If necessary, use a small insulated screwdriver to prize the battery free.

Ensure that the metal terminals in the battery socket are free from corrosion, grease and dust.

The replacement battery should be removed from its packaging and placed into the battery holder, taking care to ensure that the polarity markings on the battery agree with those adjacent to the socket.

Note: Only use a type ½AA Lithium battery with a nominal voltage of 3.6V and safety approvals such as UL (Underwriters Laboratory), CSA (Canadian Standards Association) or VDE (Vereinigung Deutscher Elektrizitätswerke).

Ensure that the battery is securely held in its socket and that the battery terminals are making good contact with the metal terminals of the socket.

Close the bottom access cover.

9.5.2 Post modification tests

To ensure that the replacement battery will maintain the time and status data if the auxiliary supply fails, check cell [0806: DATE and TIME, Battery Status] reads 'Healthy'.

Additionally, if further confirmation that the replacement battery is installed correctly is required, the commissioning test described in section 4.2.3, 'Date and Time', can be performed.

9.5.3 Battery disposal

The battery that has been removed should be disposed of in accordance with the disposal procedure for Lithium batteries in the country in which the relay is installed.

9.6 Cleaning

Before cleaning the equipment ensure that all ac and dc supplies, current transformer and voltage transformer connections are isolated to prevent any chance of an electric shock whilst cleaning.

The equipment may be cleaned using a lint-free cloth dampened with clean water. The use of detergents, solvents or abrasive cleaners is not recommended as they may damage the relay's surface and leave a conductive residue.

10. COMMISSIONING TEST RECORD

Date:		Engineer:	
Station:		Circuit:	
		System Frequency:	

Front Plate Information

Current differential protection relay	**P54**_____
Model number	
Serial number	
Rated current In	
Rated voltage Vn	
Auxiliary voltage Vx	

Test Equipment Used

This section should be completed to allow future identification of protective devices that have been commissioned using equipment that is later found to be defective or incompatible but may not be detected during the commissioning procedure.

Overcurrent test set	Model: Serial No:	
Optical power meter	Model: Serial No:	
Phase angle meter	Model: Serial No:	
Phase rotation meter	Model: Serial No:	
Insulation tester	Model: Serial No:	
Setting software:	Type: Version:	

*Delete as appropriate

	Have all relevant safety instructions been followed?	Yes/No*

4 Product Checks

4.1 With the relay de-energised

4.1.1 Visual inspection

Relay damaged?	Yes/No*
Rating information correct for installation?	Yes/No*
Case earth installed?	Yes/No*

4.1.2	Current transformer shorting contacts close?	Yes/No/Not checked*
4.1.3	Insulation resistance >100MΩ at 500V dc	Yes/No/Not tested*

4.1.4 External Wiring

Wiring checked against diagram?	Yes/No*
Test block connections checked?	Yes/No/na*

4.1.5 Watchdog Contacts (auxiliary supply off)

Terminals 11 and 12	Contact closed?	Yes/No*
Contact resistance		______Ω/Not measured*
Terminals 13 and 14	Contact open?	Yes/No*

4.1.6	Measured auxiliary supply	______V ac/dc*

4.2 With the relay energised

4.2.1 Watchdog Contacts (auxiliary supply on)

Terminals 11 and 12	Contact open?	Yes/No*
Terminals 13 and 14	Contact closed?	Yes/No*
Contact resistance		______Ω/Not measured*

4.2.3 Date and time

Clock set to local time?	Yes/No*
Time maintained when auxiliary supply removed?	Yes/No*

4.2.4 Light emitting diodes

Alarm (yellow) LED working?	Yes/No*
Out of service (yellow) LED working?	Yes/No*

Trip (red) LED working?	Yes/No*
All 8 programmable LED's working?	Yes/No*

4.2.5 Field supply voltage

Value measured between terminals 7 and 9	_____V dc
Value measured between terminals 8 and 10	_____V dc

4.2.6 Input opto-isolators

Opto input 2 working?	Yes/No*
Opto input 3 working?	Yes/No*
Opto input 4 working?	Yes/No*
Opto input 5 working?	Yes/No*
Opto input 6 working?	Yes/No*
Opto input 7 working?	Yes/No*
Opto input 8 working?	Yes/No*
Opto input 9 working?	Yes/No/na*
Opto input 10 working?	Yes/No/na*
Opto input 11 working?	Yes/No/na*
Opto input 12 working?	Yes/No/na*
Opto input 13 working?	Yes/No/na*
Opto input 14 working?	Yes/No/na*
Opto input 15 working?	Yes/No/na*
Opto input 16 working?	Yes/No/na*
Opto input 17 working?	Yes/No/na*
Opto input 18 working?	Yes/No/na*
Opto input 19 working?	Yes/No/na*
Opto input 20 working?	Yes/No/na*
Opto input 21 working?	Yes/No/na*
Opto input 22 working?	Yes/No/na*
Opto input 23 working?	Yes/No/na*
Opto input 24 working?	Yes/No/na*

4.2.7 Output relays

Relay 1 Working?	Yes/No*
Contact resistance	_____Ω/Not measured*
Relay 2 Working?	Yes/No*
Contact resistance	_____Ω/Not measured*

Relay 3	Working?		Yes/No*
	Contact resistance		_____Ω/Not measured*
Relay 4	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 5	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 6	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 7	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 8	Working?		Yes/No/na*
	Contact resistance		_____Ω/Not measured*
Relay 9	Working?		Yes/No/na*
	Contact resistance		_____Ω/Not measured*
Relay 10	Working?		Yes/No/na*
	Contact resistance		_____Ω/Not measured*
Relay 11	Working?		Yes/No*
	Contac t resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 12	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 13	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 14	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 15	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 16	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 17	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*

		(N/O)	_____Ω/Not measured*
Relay 18	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 19	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 20	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 21	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 22	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 23	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 24	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 25	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 26	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 27	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 28	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 29	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*
Relay 30	Working?		Yes/No*
	Contact resistance	(N/C)	_____Ω/Not measured*
		(N/O)	_____Ω/Not measured*

	Relay 31	Working?		Yes/No*
		Contact resistance	(N/C)	_____Ω/Not measured*
			(N/O)	_____Ω/Not measured*
	Relay 32	Working?		Yes/No*
		Contact resistance	(N/C)	_____Ω/Not measured*
			(N/O)	_____Ω/Not measured*
4.2.8	Communication standard			K-Bus/Modbus/ IEC60870-5-103*/ DNP 3.0
	Communications established?			Yes/No*
	Protocol convertor tested?			Yes/No/na*
4.3	Current Differential Fibre Optic Communications			
	Type of communications:			
	Channel 1			Dedicated fibre/ via P590*
	Channel 2			Dedicated fibre/ via P590*
4.3.1	Direct Fibre Communication			
	Communication working			Yes/No/na*
	Type of P590 interface:			
	Channel 1 unit			P59_____/na*
	Channel 2 unit			P59_____/na*
4.3..x.1	Visual Inspection (P590 units only)			
	Unit damaged?			
	Channel 1 unit			Yes/No/na*
	Channel 2 unit			Yes/No/na*
	Rating information correct?			
	Channel 1 unit			Yes/No/na*
	Channel 2 unit			Yes/No/na*
	Case earth installed?			
	Channel 1 unit			Yes/No/na*
	Channel 2 unit			Yes/No/na*
4.3.x.2	Insulation resistance (P590 units only)			
	Channel 1 unit			Yes/No/Not tested/na*
	Channel 2 unit			Yes/No/Not tested/na*
4.3.x.3	External Wiring (P590 units only)			
	Wiring checked against diagram?			
	Channel 1 unit			Yes/No/na*
	Channel 2 unit			Yes/No/na*

4.3.x.4	Measured Auxiliary Supply (P590 units only)	
	Channel 1 unit	_____Vdc/ac/na*
	Channel 2 unit	_____Vdc/ac/na*
4.3.x.5	Light Emitting Diodes (P590 units only)	
	All LED's working?	
	Channel 1 unit	Yes/No/na*
	Channel 2 unit	Yes/No/na*
4.3.x.6	Loopback Test	
	Signal strength received by P590	
	Channel 1 unit	_____dBm/na*
	Channel 2 unit	_____dBm/na*
	Signal strength transmitted by P590	
	Channel 1 unit	_____dBm/na*
	Channel 2 unit	_____dBm/na*
	Signal Strength within tolerance	Yes/No/na*
	Loopback test applied?	
	Channel 1 unit	Yes/No*
	Channel 2 unit	Yes/No/na*
	Communications working	Yes/No/na*
4.4.1	Visual Inspection (P594 units only)	
	Unit damaged?	Yes/No/na*
	Rating information correct?	Yes/No/na*
	Case earth installed?	Yes/No/na*
4.4.2	Insulation resistance (P594 units only)	Yes/No/Not tested/na*
4.4.3	External Wiring (P594 units only)	
	Wiring checked against diagram?	Yes/No/na*
4.4.4	Measured Auxiliary Supply (P594 units only)	_____Vdc/ac/na*
4.4.5	Light Emitting Diodes (P594 units only)	
	All LED's working?	Yes/No/na*
4.4.6	Synchronising signal	
	Channel 1	_____dBm/na*
	Channel 2	_____dBm/na*
	Channel 3	_____dBm/na*

	Channel 4	_____dBm/na*
	Signal Strength within tolerance	Yes/No/na*

4.4.7	Connection to P595 or P596	
	Channel status correct?	Yes/No/na*

4.5.1	Current Inputs		
	Displayed Current		Primary/Secondary*
	Phase CT Ratio		_____ /na*
	Earth Fault CT Ratio		_____ /na*
	Mutual CT Ratio		_____ /na*
	Input CT	Applied value	Displayed value
	IA	_____A	_____A
	IB	_____A	_____A
	IC	_____A	_____A
	IN	_____A	_____A
	IM (P543, P544, P545 & P546 only)	_____A/na*	_____A/na*

4.5.2	Voltage Inputs		
	Displayed Voltage		Primary/Secondary*
	Main VT Ratio		_____ /na*
	C/S VT Ratio		_____ /na*
	Input VT	Applied value	Displayed value
	Va	_____V	_____V
	Vb	_____V	_____V
	Vc	_____V	_____V
	C/S Voltage	_____V/na*	_____V

5	Setting Checks	
5.1	Application-specific function settings applied?	Yes/No*
	Application-specific programmable scheme logic settings applied?	Yes/No/na*

5.2.1.2	Current Differential lower slope pickup	_____ A
5.2.1.3	Current Differential upper slope pickup	_____ A
5.2.2.1	Current Differential Phase A contact routing OK?	Yes/No
	Current Differential Phase A trip time	_____ s
5.2.2.2	Current Differential Phase B contact routing OK?	Yes/No
	Current Differential Phase B trip time	_____ s
5.2.2.3	Current Differential Phase C contact routing OK?	Yes/No

	Current Differential Phase C trip time	_____ s
	Average trip time, phases A, B and C	_____ s
5.2.3.2	Distance Protection Zone 1 Reach OK?	Yes/No
5.2.3.3	Distance Protection Zone 2 Reach OK?	Yes/No
5.2.3.4	Distance Protection Zone 3 Reach OK?	Yes/No
5.2.4.1	Distance Protection Phase A contact routing OK?	Yes/No
	Distance Protection Phase A trip time	_____ s
5.2.4.2	Distance Protection Phase B contact routing OK?	Yes/No
	Distance Protection Phase B trip time	_____ s
5.2.4.3	Distance Protection Phase C contact routing OK?	Yes/No
	Distance Protection Phase C trip time	_____ s
	Average trip time, phases A, B and C	_____ s
5.2.5	Protection function timing tested?	Yes/No*
	Overcurrent type (set in cell [I>1 Direction])	Directional /Non-directional*
	Applied voltage	_____ V/na*
	Applied current	_____ A
	Expected operating time	_____ s
	Measured operating time	_____ s
5.3	Trip and auto-reclose cycle checked	
	3 pole cycle tested? (P542, P543 & P545 only)	Yes/No/na*
	Pole A cycle tested? (P543 & P545 only)	Yes/No/na*
	Pole B cycle tested? (P543 & P545 only)	Yes/No/na*
	Pole C cycle tested? (P543 & P545 only)	Yes/No/na*
5.4	Application-specific function settings verified?	Yes/No/na*
	Application-specific programmable scheme logic tested?	Yes/No/na*
6	End to End Tests	
6.1	Remove the loopback test	
	Communications alarms?	
	Channel 1	No/Yes*
	Channel 2	No/Yes/na*
	Loopback test removed?	
	Channel 1	Yes/No*
	Channel 2	Yes/No/na*
	All connections restored?	

	Channel 1	Yes/No*
	Channel 2	Yes/No/na*
	Application-specific settings applied?	
	Channel 1	Yes/No*
	Channel 2 (P592 & P593 only)	Yes/No/na*
	Cover replaced? (P590 units only)	
	Channel 1	Yes/No*
	Channel 2	Yes/No/na*
6.2	Verify communications between relays	
	Optical port type	
	Channel 1	850nm/1300nm /1550nm*
	Channel 2	850nm/1300nm /1550nm/na*
	Signal strength received by P540	
	Channel 1	_____dBm/na*
	Channel 2	_____dBm/na*
	Signal strength transmitted by P540	
	Channel 1	_____dBm/na*
	Channel 2	_____dBm/na*
	Signal Strength within tolerance	Yes/No/na*
	Optical fibres reconnected?	
	Channel 1	Yes/No*
	Channel 2	Yes/No/na*
	Alarms reset?	Yes/No*
	Ch 1 Prop Delay	_____ms
	Ch 2 Prop Delay	_____ms/na*
	Ch1 1 No. Vald Mess	
	Ch1 No.Err Mess	
	Ch1 Errored / Valid	
	Ch1 Errored / Valid < 10^{-4}	Yes/No*
	Ch2 1 No.Vald Mess	
	Ch2 No.Err Mess	
	Ch2 Errored / Valid	

Ch2 Errored / Valid < 10^{-4}	Yes/No/na*

6.2.1 Verification of communications with P594

Communications working	Yes/No/na*

7 On-load Checks

Test wiring removed?	Yes/No/na*
Disturbed customer wiring re-checked?	Yes/No/na*
On-load test performed?	Yes/No*
Directionality test performed?	Yes/No/na*

7.1 Confirm current and voltage transformer wiring

7.1.1 Voltage Connections

Phase rotation correct?	Yes/No*
Displayed Voltage	Primary/Secondary*
Main VT Ratio	_____ /na*
C/S VT Ratio	_____ /na*

Voltages:	Applied value	Displayed value
Va	_____ V	_____ V
Vb	_____ V	_____ V
Vc	_____ V	_____ V
C/S Voltage	_____ V/na*	_____ V

7.1.2 Current connections

CT wiring checked?	Yes/No/na*
CT polarities correct?	Yes/No*
Displayed current	Primary/Secondary*
Phase CT ratio	_____ /na*
Earth fault CT ratio	_____ /na*
Mutual CT ratio	_____ /na*

Currents:	Applied value	Displayed value
IA	_____ A	_____ A
IB	_____ A	_____ A
IC	_____ A	_____ A

IN	_____ A/na*	_____ A/na*
IM (P543, P544, P545 & P546 only)	_____ A	_____ A

7.2 Capacitive Charging Current

Measured capacitive charging current

'A' phase	_____ A
'B' phase	_____ A
'C' phase	_____ A

[3105: GROUP 1 PHASE DIFF, Phase Is1]

Setting	_____ A

7.3	Differential current checked?	Yes/ No*

7.4 Consistency of Current Transformer Polarity

Polarity at each end consistent?

'A' phase	Yes/No*
'B' phase	Yes/No*
'C' phase	Yes/No*

8 Final Checks

Test wiring removed?	Yes/No/na*
Disturbed customer wiring re-checked?	Yes/No/na*
Test mode disabled?	Yes/No*
Circuit breaker operations counter reset?	Yes/No/na*
Current counters reset?	Yes/No/na*
Event records reset?	Yes/No*
Fault records reset?	Yes/No*
Disturbance records reset?	Yes/No*
Alarms reset?	Yes/No*
LED's reset?	Yes/No*
Secondary front cover replaced?	Yes/No/na*

Commissioning Engineer	Customer Witness
Date	Date

11. SETTING RECORD

Date: ______ Engineer: ______

Station: ______ Circuit: ______

System Frequency: ______

Front Plate Information

Current Differential Protection Relay	**P54__**
Model Number	
Serial Number	
Rated Current In	
Rated Voltage Vn	
Auxiliary Voltage Vx	

*Delete as appropriate

Setting Groups Used

Group 1	Yes/No*
Group 2	Yes/No*
Group 3	Yes/No*
Group 4	Yes/No*

0000 SYSTEM DATA

0001	Language	English/Francais/Deutsch/Espanol/PYCCКИЙ/*
0003	Sys Fn Links	
0004	Description	
0005	Plant Reference	
0006	Model Number	
0007	Firmware number	
0008	Serial Number	
0009	Frequency	
000A	Comms Level	
000B	Relay Address	
0011	Software Ref. 1	
00D1	Password Control	Level 0/Level 1/Level 2*
00D2	Password Level 1	
00D3	Password Level 2	

0600 CB CONDITION

0601	CB Operations	
0602	CB A Operations	
0603	CB B Operations	
0604	CB C Operations	
0605	Total IA Broken	
0606	Total IB Broken	
0607	Total IC Broken	
0608	CB Operate Time	

0700 CB CONTROL

0701	CB Control by	Disabled/Local/Remote/Local+Remote/Opto/ Opto+Local/Opto+Remote/Opto+Rem+Local*
0702	Close Pulse Time	
0703	Trip Pulse Time	
0705	Man Close Delay	
0706	CB Healthy Time	
0707	Check Sync Time	
0708	Lockout Reset	No/Yes*
0709	Reset Lockout by	User Interface/CB Close*
070A	Man Close RstDly	
070B	A/R Telecontrol	No Operation/Auto/Non-auto*
070C	Single Pole A/R	Disabled/Enabled*
070D	Double Pole A/R	Disabled/Enabled*
070E	A/R Status	Auto Mode/Non-auto Mode/Live Line*
070F	Total Reclosures	
0711	CB Status Input	

0800 DATE AND TIME

0804	IRIG-B Sync	Disabled/Enabled*
0805	IRIG-B Status	Inactive/Active*
0806	Battery Status	Dead/Healthy*
0807	Battery Alarm	Disabled/Enabled*

0900 CONFIGURATION

0902	Setting Group	Select via Menu/Select via Optos*
0903	Active Settings	Group 1/Group 2/Group 3/Group 4*
0907	Setting Group 1	Disabled/Enabled*
0908	Setting Group 2	Disabled/Enabled*
0909	Setting Group 3	Disabled/Enabled*
090A	Setting Group 4	Disabled/Enabled*
090B	Phase Diff	Disabled/Enabled*
090D	Distance	Disabled/Enabled*

090E	Tripping Mode	3 Pole/1 & 3 Pole*
090F	Opto Cntl	
0910	Overcurrent	Disabled/Enabled*
0912	Broken Conductor	Disabled/Enabled*
0913	Earth Fault	Disabled/Enabled*
0915	Sensitive E/F	Disabled/Enabled*
0917	Thermal Overload	Disabled/Enabled*
0920	CB Fail	Disabled/Enabled*
0921	Supervision	Disabled/Enabled*
0922	Fault Locator	Disabled/Enabled*
0923	System Checks	Disabled/Enabled*
0924	Auto-Reclose	Disabled/Enabled*
0925	Input Labels	Invisible/Visible*
0926	Output Labels	Invisible/Visible*
0928	CT & VT Ratios	Invisible/Visible*
0929	Recorder Control	Invisible/Visible*
092A	Disturb Recorder	Invisible/Visible*
092B	Measure't Setup	Invisible/Visible*
092C	Comms Settings	Invisible/Visible*
092D	Commission Tests	Invisible/Visible*
092E	Setting Values	Primary/Secondary*
0935	Ctrl I/P Config	Invisible/Visible*
0936	Ctrl I/P Labels	Invisible/Visible*
0939	Direct Access	Disabled/Enabled*
09FF	LCD Contrast	

0A00 CT AND VT RATIOS

0A01	Main VT Primary	
0A02	Main VT Sec'y	
0A03	C/S VT Primary	
0A04	C/S VT Secondary	
0A07	Phase CT Primary	
0A08	Phase CT Secondary	
0A09	E/F CT Primary	
0A0A	E/F CT Secondary	
0A0D	Mcomp CT Primary	
0A0E	Mcomp CT Secondary	
0A0F	C/S Input	A-N/B-N/C-N/A-B/B-C/C-A*
0A10	Main VT Location	Line/Bus*

0B00 RECORD CONTROL

0B04	Alarm Event	Disabled/Enabled*
0B05	Relay O/P Event	Disabled/Enabled*
0B06	Opto Input Event	Disabled/Enabled*
0B07	General Event	Disabled/Enabled*
0B08	Fault Rec Event	Disabled/Enabled*
0B0A	Maint Rec Event	Disabled/Enabled*
0B0B	Protection Event	Disabled/Enabled*
0B0C	DDB 31- 0	
0B0D	DDB 63 – 32	
0B0E	DDB 95 – 64	
0B0F	DDB 127 – 96	
0B10	DDB 159 – 128	
0B11	DDB 191 – 160	
0B12	DDB 223 – 192	
0B13	DDB 255 – 224	
0B14	DDB 287 – 256	
0B15	DDB 319 – 288	
0B16	DDB 351- 320	
0B17	DDB 383 – 352	
0B18	DDB 415 – 384	
0B19	DDB 447 – 416	
0B1A	DDB 479 – 448	
0B1B	DDB 511 – 480	
0B1C	DDB 543 – 512	
0B1D	DDB 575 – 544	
0B1E	DDB 607 – 576	
0B1F	DDB 639 – 608	
OB20	DDB 671 – 640	
OB21	DDB 703 – 672	
OB22	DDB 735- 704	
OB23	DDB 767 – 736	
OB24	DDB 799 – 768	
OB25	DDB 831 – 800	
OB26	DDB 863 – 832	
OB27	DDB 895 – 864	
OB28	DDB 927 – 896	
OB29	DDB 959 – 928	
OB2A	DDB 1022 - 929	

0C00 DISTURB RECORDER

0C01	Duration	
0C02	Trigger Position	
0C03	Trigger Mode	Single/Extended*
0C04	Analog Channel 1	
0C05	Analog Channel 2	
0C06	Analog Channel 3	
0C07	Analog Channel 4	
0C08	Analog Channel 5	
0C09	Analog Channel 6	
0C0A	Analog Channel 7	
0C0B	Analog Channel 8	
0C0C	Digital Input 1	
0C0D	Input 1 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C0E	Digital Input 2	
0C0F	Input 2 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C10	Digital Input 3	
0C11	Input 3 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C12	Digital Input 4	
0C13	Input 4 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C14	Digital Input 5	
0C15	Input 5 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C16	Digital Input 6	
0C17	Input 6 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C18	Digital Input 7	
0C19	Input 7 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C1A	Digital Input 8	
0C1B	Input 8 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C1C	Digital Input 9	
0C1D	Input 9 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C1E	Digital Input 10	
0C1F	Input 10 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C20	Digital Input 11	
0C21	Input 11 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C22	Digital Input 12	
0C23	Input 12 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C24	Digital Input 13	
0C25	Input 13 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C26	Digital Input 14	
0C27	Input 14 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C28	Digital Input 15	
0C29	Input 15 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C2A	Digital Input 16	
0C2B	Input 16 Trigger	No Trigger/Trigger L-H/Trigger H-L*

0C2C	Digital Input 17	
0C2D	Input 17 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C2E	Digital Input 18	
0C2F	Input 18 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C30	Digital Input 19	
0C31	Input 19 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C32	Digital Input 20	
0C33	Input 20 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C34	Digital Input 21	
0C35	Input 21 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C36	Digital Input 22	
0C37	Input 22 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C38	Digital Input 23	
0C39	Input 23 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C3A	Digital Input 24	
0C3B	Input 24 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C3C	Digital Input 25	
0C3D	Input 25 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C3E	Digital Input 26	
0C3F	Input 26 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C40	Digital Input 27	
0C41	Input 27 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C42	Digital Input 28	
0C43	Input 28 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C44	Digital Input 29	
0C45	Input 29 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C46	Digital Input 30	
0C47	Input 30 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C48	Digital Input 31	
0C49	Input 31 Trigger	No Trigger/Trigger L-H/Trigger H-L*
0C4A	Digital Input 32	
0C4B	Input 32 Trigger	No Trigger/Trigger L-H/Trigger H-L*

0D00 MEASURE'T SETUP

0D01	Default Display	3Ph+N Current/3Ph Voltage/Power/ Date and Time/Description/Plant Reference/ Frequency/ Access Level*
0D02	Local Values	Primary/Secondary*
0D03	Remote Values	Primary/Secondary*
0D04	Measurement Ref	VA/VB/VC/IA/IB/IC*
0D05	Measurement Mode	
0D06	Fix Dem Period	
0D07	Roll Sub Period	
0D08	Num Sub Periods	

0D09	Distance Unit	Kilometres/Miles*
0D0A	Fault Location	Distance/Ohms/% of Line*
0D0B	Remote 2 values	Primary/Secondary*

0E00 COMMUNICATIONS

0E01	RP1 Protocol	Courier/IEC870-5-103/Modbus/DNP3.0/UCA2*
0E02	RP1 Address	
0E03	RP1 InactivTimer	
0E04	RP1 Baud Rate	9600/19200/38400*
0E04	RP1 Baud Rate	
0E05	RP1 Parity	Odd/Even/None*
0E06	RP1 Meas Period*	
0E07	Physical Link	EIA(RS)485/Fibre Optic*
0E08	RP1 Time Sync	
0E09	Modbus IEC Time	Standard/Reverse/na*
0E0A	RP1 CS103 Blocking	Disabled/monitor blocking/Command blocking*
0E0C	RP1 Port Config	K Bus/ EIA485
0E0D	RP1 Comms Mode	IEC60860 FT1.2/10 bit no parity
0E0E	RP1 Baud Rate	9600/19200/38400 bits/s
0E20	IP Address	
0E21	Subnet Mask	
0E22	MAC Address	
0E23	GOOSE IED Name	
0E24	Number of routes	
0E25	Router Address 1	
0E26	Target Network 1	
0E27	Router Address 2	
0E28	Network 2	
0E29	Router Address 3	
0E2A	Network 3	
0E2B	Router Address 4	
0E2C	Network 4	
0E2D	NIC InactivTimer	
OE2E	Default Pass Lv1	
0E2F	GOOSE Min Cycle	
0E30	GOOSE Max Cycle	
0E31	GOOSE Increment	
0E32	GOOSE Startup	Broadcast/Promiscuous*
0E36	NSAP Address	
0E37	Transport Select	
0E38	Session Select	
0E39	Present Select	
0E3A	AP Title	
0E3B	AE Qual Used	

0E3C	AE Qualifier	
0E3D	Ethernet Media	Copper/Fibre*
0E50	IED View Select	
0E6B	Link Timeout	
0E88	RP2 Port Config	EIA232/EIA485/K Bus*
0E8A	RP2 Comms Mode	IEC60870 FT1.2/10 bit no parity*
0E90	RP2 Address	
0E92	RP2 InactivTimer	
0E94	RP2 Baud Rate	9600/19200/38400 bits/s*

0F00 COMMISSION TESTS

0F05	Monitor Bit 1	
0F06	Monitor Bit 2	
0F07	Monitor Bit 3	
0F08	Monitor Bit 4	
0F09	Monitor Bit 5	
0F0A	Monitor Bit 6	
0F0B	Monitor Bit 7	
0F0C	Monitor Bit 8	
0F0D	Test Mode	Disabled/Test Mode/Blocked*
0F0E	Test Pattern	
0F12	Test Loopback	Disabled/Internal/External*

1000 CB MONITOR SETUP

1001	Broken I^	
1002	I^ Maintenance	Alarm Disabled/Alarm Enabled*
1003	I^ Maintenance	
1004	I^ Lockout	Alarm Disabled/Alarm Enabled*
1005	I^ Lockout	
1006	No CB Ops Maint	Alarm Disabled/Alarm Enabled*
1007	No CB Ops Maint	
1008	No CB Ops Lock	Alarm Disabled/Alarm Enabled*
1009	No CB Ops Lock	
100A	CB Time Maint	Alarm Disabled/Alarm Enabled*
100B	CB Time Maint	
100C	CB Time Lockout	Alarm Disabled/Alarm Enabled*
100D	CB Time Lockout	
100E	Fault Freq Lock	Alarm Disabled/Alarm Enabled*
100F	Fault Freq Count	
1010	Fault Freq Time	

1100 OPTO CONFIG

1101	Global Nominal V	
1101	Opto Input 1	
1102	Opto Input 2	
1103	Opto Input 3	
1104	Opto Input 4	
1105	Opto Input 5	
1106	Opto Input 6	
1107	Opto Input 7	
1108	Opto Input 8	
1109	Opto Input 9	
110A	Opto Input 10	
110B	Opto Input 11	
110C	Opto Input 12	
110D	Opto Input 13	
110E	Opto Input 14	
110F	Opto Input 15	
1111	Opto Input 16	
1112	Opto Input 17	
1113	Opto Input 18	
1114	Opto Input 19	
1115	Opto Input 20	
1116	Opto Input 21	
1117	Opto Input 22	
1118	Opto Input 23	
1119	Opto Input 24	
1180	Characteristic	Standard 60%-80%/50%-70%*

1300 CTRL I/P CONFIG

1301	Hotkey Enabled	
1310	Control Input 1	Latched/Pulsed*
1311	Ctrl Command 1	
1314	Control Input 2	Latched/Pulsed*
1315	Ctrl Command 2	
1318	Control Input 3	Latched/Pulsed*
1319	Ctrl Command 3	
131C	Control Input 4	Latched/Pulsed*
131D	Ctrl Command 4	
1320	Control Input 5	Latched/Pulsed*
1321	Ctrl Command 5	
1324	Control Input 6	Latched/Pulsed*
1325	Ctrl Command 6	
1328	Control Input 7	Latched/Pulsed*

1329	Ctrl Command 7	
132C	Control Input 8	Latched/Pulsed*
132D	Ctrl Command 8	
1330	Control Input 9	Latched/Pulsed*
1331	Ctrl Command 9	
1334	Control Input 10	Latched/Pulsed*
1335	Ctrl Command 10	
1338	Control Input 11	Latched/Pulsed*
1339	Ctrl Command 11	
133C	Control Input 12	Latched/Pulsed*
133D	Ctrl Command 12	
1340	Control Input 13	Latched/Pulsed*
1341	Ctrl Command 13	
1344	Control Input 14	Latched/Pulsed*
1345	Ctrl Command 14	
1348	Control Input 15	Latched/Pulsed*
1349	Ctrl Command 15	
134C	Control Input 16	Latched/Pulsed*
134D	Ctrl Command 16	
1350	Control Input 17	Latched/Pulsed*
1351	Ctrl Command 17	
1354	Control Input 18	Latched/Pulsed*
1355	Ctrl Command 18	
1358	Control Input 19	Latched/Pulsed*
1359	Ctrl Command 19	
135C	Control Input 20	Latched/Pulsed*
135D	Ctrl Command 20	
1360	Control Input 21	Latched/Pulsed*
1361	Ctrl Command 21	
1364	Control Input 22	Latched/Pulsed*
1365	Ctrl Command 22	
1368	Control Input 23	Latched/Pulsed*
1369	Ctrl Command 23	
136C	Control Input 24	Latched/Pulsed*
136D	Ctrl Command 24	
1370	Control Input 25	Latched/Pulsed*
1371	Ctrl Command 25	
1374	Control Input 26	Latched/Pulsed*
1375	Ctrl Command 26	
1378	Control Input 27	Latched/Pulsed*
1379	Ctrl Command 27	
137C	Control Input 28	Latched/Pulsed*
137D	Ctrl Command 28	

1380	Control Input 29	Latched/Pulsed*
1381	Ctrl Command 29	
1384	Control Input 30	Latched/Pulsed*
1385	Ctrl Command 30	
1388	Control Input 31	Latched/Pulsed*
1389	Ctrl Command 31	
138C	Control Input 32	Latched/Pulsed*
138D	Ctrl Command 32	

2000 I DIFF CONFIG

2001	Scheme Setup	3 Terminal/2 Terminal/Dual Redundant*
2002/3	Address	
2004	Baud Rate	64kbits/s or 56kbits/s*
2005	Clock Source Ch1	Internal/External*
2006	Clock Source Ch2	Internal/External*
2007	Comm Delay Tol	
2008	Comm Fail Timer	
2009	Comm Fail Mode	Channel 1/Channel 2/Channel 1+2*
200A	Char Mod Time	
200B	I Cap Correction	Disabled/Enabled*
200C	Susceptance	
200D	Inrush Restraint	Disabled/Enabled*
200E	Vectorial Comp	Yy0 (0 deg)/Yd1 (-30 deg)/Yy2 (-60 deg)/ Yd3 (-90 deg)/ Yy4 (-120 deg)/Yd5 (-150 deg)/ Yy6 (180 deg)/ Yd7 (+150 deg)/ Yy8(+120 deg)/Yd9 (+90 deg)/Yy10 (+60 deg)/ Yd11 (+30 deg)/Ydy0 (0 deg)/Ydy6 (180 deg)*
200F	Ph CT Corr'tion	
2011	Re-Configuration	Three Ended/Two Ended (L&R1)/
2013	GPS Sync	Disabled/Enabled*
2014	Ch 2 Baud Rate	
2020	Comms Mode	Standard/IEEE C37.94*
2021	Ch1 N*64kbits/s	Auto/1/2/3/4/5/6/7/8/9/10/11/12*
2022	Ch2 N*64kbits/s	Auto/1/2/3/4/5/6/7/8/9/10/11/12*

2900 CTRL I/P LABELS

2901	Control Input 1	
2902	Control Input 2	
2903	Control Input 3	
2904	Control Input 4	
2905	Control Input 5	
2906	Control Input 6	
2907	Control Input 7	
2908	Control Input 8	
2909	Control Input 9	

290A	Control Input 10	
290B	Control Input 11	
290C	Control Input 12	
290D	Control Input 13	
290E	Control Input 14	
290F	Control Input 15	
2910	Control Input 16	
2911	Control Input 17	
2912	Control Input 18	
2913	Control Input 19	
2914	Control Input 20	
2915	Control Input 21	
2916	Control Input 22	
2917	Control Input 23	
2918	Control Input 24	
2919	Control Input 25	
291A	Control Input 26	
291B	Control Input 27	
291C	Control Input 28	
291D	Control Input 29	
291E	Control Input 30	
291F	Control Input 31	
2920	Control Input 32	

GROUP PROTECTION SETTINGS

3100 PHASE DIFF

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3101/5	Phase Is1				
3102/6	Phase Is2				
3103/7	Phase k1				
3104/8	Phase k2				
310A	Phase Time Delay				
310B	Phase TMS				
310C	Phase Time Dial				
310D	PIT Time				
310E	Inrush High				

3300 DISTANCE

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3301	Z1 Status				
3302	Z1				
3303	tZ1				
3304	Z1 Intertrip				
3305	Z2 Status				
3306	Z2				
3307	tZ2				
3308	Z2 Intertrip				
3309	Z3 Status				
330A	Z3				
330B	tZ3				
330C	Z3 Intertrip				
330D	Line Angle				
330E	kZN Res Comp				
330F	kZN Angle				
3310	RPh				
3311	RG				
3312	PSB Status				
3313	Delta R				
3314	Delta X				
3315	tZ6				
3316	Z3 Direction				
3317	Direction				

3500 OVERCURRENT

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3501	I>1 Status				
3502	I>1 Function				
3503	I>1 Directional				
3504	I>1 Current Set				
3505	I>1 Time Delay				
3506	I>1 TMS				
3507	I>1 Time Dial				
3508	I>1 Reset Char				
3509	I>1 tRESET				
350A	I>2 Status				
350B	I>2 Function				
350C	I>2 Directional				

350D	I>2 Current Set				
350E	I>2 Time Delay				
350F	I>2 TMS				
3510	I>2 Time Dial				
3511	I>2 Reset Char				
3512	I>2 tRESET				
3513	I>3 Status				
3514	I>3 Directional				
3515	I>3 Current Set				
3516	I>3 Time Delay				
3517	I>3 Intertrip				
3518	I>4 Status				
3519	I>4 Directional				
351A	I>4 Current Set				
351B	I>4 Time Delay				
351C	I> Char Angle				
351D	I> Blocking				

3700 BROKEN CONDUCTOR

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3701	Broken Conductor				
3702	I2/I1 Setting				
3703	I2/I1 Time Delay				

3800 EARTH FAULT

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3801	IN> Status				
3802	IN>1 Function				
3803	IN>1 Directional				
3804	IN>1 Current Set				
3805	IN>1 Time Delay				
3806	IN>1 TMS				
3807	IN>1 Time Dial				
3808	IN>1 Reset Char				
3809	IN>1 tRESET				
380A	IN>2 Status				
380B	IN>2 Function				
380C	IN>2 Directional				
380D	IN>2 Current Set				
380E	IN>2 Time Delay				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
380F	IN>2 TMS				
3810	IN>2 Time Dial				
3811	IN>2 Reset Char				
3812	IN>2 tRESET				
3813	IN>3 Status				
3814	IN>3 Directional				
3815	IN>3 Current Set				
3816	IN>3 Time Delay				
3817	IN>4 Status				
3818	IN>4 Directional				
3819	IN>4 Current Set				
381A	IN>4 Time Delay				
381B	IN> Blocking				
381C	IN> DIRECTIONAL				
381D	IN> Char Angle				
381E	IN> Polarisation				
3820	IN> VNpol Set				
3821	IN> V2pol Set				
3822	IN> I2pol Set				

3A00 SENSITIVE E/F

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3A01	Sens E/F Options				
3A02	ISEF>1 Function				
3A03	ISEF>1 Direction				
3A04	ISEF>1 Current				
3A05	ISEF>1 Delay				
3A06	ISEF>1 TMS				
3A07	ISEF>1 Time Dial				
3A08	ISEF>1 Reset Chr				
3A09	ISEF>1 tRESET				
3A0A	ISEF>2 Function				
3A0B	ISEF>2 Direction				
3A0C	ISEF>2 Current				
3A0D	ISEF>2 Delay				
3A0E	ISEF>2 TMS				
3A0F	ISEF>2 Time Dial				
3A10	ISEF>2 Reset Chr				
3A11	ISEF>2 tRESET				
3A12	ISEF>3 Status				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3A13	ISEF>3 Direction				
3A14	ISEF>3 Current				
3A15	ISEF>3 Delay				
3A16	ISEF>4 Status				
3A17	ISEF>4 Direction				
3A18	ISEF>4 Current				
3A19	ISEF>4 Delay				
3A1A	ISEF> Blocking				
3A1B	ISEF DIRECTIONAL				
3A1C	ISEF> Char Angle				
3A1E	ISEF> VNpol				
3A1F	Wattmetric SEF				
3A20	PN> Setting				

3C00 THERMAL OVERLOAD

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
3C01	Characteristic				
3C02	Thermal Trip				
3C03	Thermal Alarm				
3C04	Time Constant 1				
3C05	Time Constant 2				

4500 CB FAIL & I<

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4501	BREAKER FAIL				
4502	CB Fail 1 Status				
4503	CB Fail 1 Timer				
4504	CB Fail 2 Status				
4505	CB Fail 2 Timer				
4507	Ext Prot Reset				
4508	UNDER CURRENT				
4509	I< Current Set				
450B	ISEF< Current				
450C	BLOCKED O/C				
450D	Remove I> Start				
450E	Remove IN> Start				

4600 SUPERVISION

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4601	VT SUPERVISION				
4602	VTS Status				
4603	VTS Reset Mode				
4604	VTS Time Delay				
4605	VTS I> Inhibit				
4606	VTS I2> Inhibit				
4607	CT Supervision				
4608	CTS Status				
4609	CTS VN< Inhibit				
460A	CTS IN> Set				
460B	CT Time Delay				

4700 FAULT LOCATOR

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4701	Line Length				
4702	Line Length				
4703	Line Impedance				
4704	Line Angle				
4705	KZN Residual				
4706	KZN Res Angle				
4707	Mutual Comp				
4708	kZm Mutual Comp				
4709	kZm Angle				

4800 SYSTEM CHECKS

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4814	VOLTAGE MONITORS				
4815	Line Voltage				
4816	Dead Voltage				
4817	CHECK SYNCH				
4818	CS1 Status				
4819	CS1 Phase Angle				
481A	CS1 Slip Control				
481B	CS1 Slip Freq				
481C	CS1 Slip Timer				
481D	CS2 Status				
481E	CS2 Phase Angle				
481F	CS2 Slip Control				
4820	CS2 Slip Freq				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4821	CS2 Slip Timer				
4822	CS2 Status				
4823	CS Undervoltage				
4824	CD Overvoltage				
4825	CS Diff Voltage				
4826	SYSTEM SPLIT				
4827	SS Status				
4828	SS Phase Angle				
4829	SS Under V Block				
482A	SS Undervoltage				
482B	SS Timer				

4900 AUTORECLOSE

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4902	Number of Shots				
4905	Single Pole Shot				
4906	Three Pole Shot				
4907	1Pole Dead Time				
4908	Dead Time 1				
4909	Dead Time 2				
490A	Dead Time 3				
490B	Dead Time 4				
490C	490C Healthy Time				
490D	Start Dead t On				
490E	tReclaim Extend				
490F	Reclaim Time				
4910	4910 AR Inhibit Time				
4913	Eff Maint Lock				
4916	Trip 1 Main				
4917	Trip 2 Main				
4918	Trip 3 Main				
4919	Trip 4 Main				
491A	Trip 5 Main				
491B	Trip 1 SEF				
491C	Trip 2 SEF				
491D	Trip 3 SEF				
491E	Trip 4 SEF				
491F	Trip 5 SEF				
4922	Reset Lockout by				
4923	Man Close Blkdly				
4924	A/R on Man Close				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4925	Check Sync Time				
4927	SysChk on Shot1				
4928	Phase Diff AR				
492A	Z1 AR				
492B	Z2T AR				
492C	Z3T AR				
492D	I1> AR				
492E	I2> AR				
492F	I3> AR				
4930	I4> AR				
4931	IN1> AR				
4932	IN2> AR				
4933	IN3> AR				
4934	IN4> AR				
4935	ISEF1> AR				
4936	ISEF2> AR				
4937	ISEF3> AR				
4938	ISEF4> AR				
4939	Multi Phase AR				
4940	Dead Time Start				
4941	CheckSync1 Close				
4942	CheckSync2 Close				
4943	LiveLine/DeadBus				
4944	DeadLine/LiveBus				
4945	DeadLine/DeadBus				
4946	CS AR Immediate				

4A00 INPUT LABELS

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4A01	Opto Input 1				
4A02	Opto Input 2				
4A03	Opto Input 3				
4A04	Opto Input 4				
4A05	Opto Input 5				
4A06	Opto Input 6				
4A07	Opto Input 7				
4A08	Opto Input 8				
4A09	Opto Input 9				
4A0A	Opto Input 10				
4A0B	Opto Input 11				
4A0C	Opto Input 12				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4A0D	Opto Input 13				
4A0E	Opto Input 14				
4A0F	Opto Input 15				
4A10	Opto Input 16				
4A11	Opto Input 17				
4A12	Opto Input 18				
4A13	Opto Input 19				
4A14	Opto Input 20				
4A15	Opto Input 21				
4A16	Opto Input 22				
4A17	Opto Input 23				
4A18	Opto Input 24				

4B00 OUTPUT LABELS

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4B01	Relay 1				
4B02	Relay 2				
4B03	Relay 3				
4B04	Relay 4				
4B05	Relay 5				
4B06	Relay 6				
4B07	Relay 7				
4B08	Relay 8				
4B09	Relay 9				
4B0A	Relay 10				
4B0B	Relay 11				
4B0C	Relay 12				
4B0D	Relay 13				
4B0E	Relay 14				
4B0F	Relay 15				
4B10	Relay 16				
4B11	Relay 17				
4B12	Relay 18				
4B13	Relay 19				
4B14	Relay 20				
4B15	Relay 21				
4B16	Relay 22				
4B17	Relay 23				
4B19	Relay 24				
4B1A	Relay 25				
4B1B	Relay 26				

Group 1 Settings		Group 1 Settings	Group 2 Settings	Group 3 Settings	Group 4 Settings
4B1C	Relay 27				
4B1D	Relay 28				
4B1E	Relay 29				
4B1F	Relay 30				
4B21	Relay 31				
4B22	Relay 32				

Commissioning Engineer

Customer Witness

Date

Date

PROBLEM ANALYSIS

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1. INTRODUCTION

Before carrying out any work on the equipment, the user should be familiar with the contents of the safety and technical data sections and the ratings on the equipment's rating label.

The purpose of this chapter of the service manual is to allow an error condition on the relay to be identified so that appropriate corrective action can be taken.

Should the relay have developed a fault, it should be possible in most cases to identify which relay module requires attention. The 'Commissioning and Maintenance' chapter (P54x/EN CM), advises on the recommended method of repair where faulty modules need replacing. It is not possible to perform an on-site repair to a faulted module.

In cases where a faulty relay/module is being returned to the manufacturer or one of their approved service centres, completed copy of the Repair Form located at the end of this manual should be included.

2. INITIAL PROBLEM IDENTIFICATION

Consult the table below to find the description that best matches the problem experienced, then consult the section referenced to perform a more detailed analysis of the problem.

Symptom	Refer to
Relay fails to power up	Section 3
Relay powers up but indicates error and halts during power-up sequence	Section 4
Relay powers up but Out of Service LED is illuminated	Section 5
Relay reboots during normal operation	Section 6
Error during normal operation	Section 6
Misoperation of the relay during testing	Section 7

Table 1: Problem Identification

3. POWER UP ERRORS

If the relay does not appear to power up then the following procedure can be used to determine whether the fault is in the external wiring, auxiliary fuse, power supply module of the relay or the relay front panel.

Test	Check	Action
1	Measure auxiliary voltage on terminals 1 and 2, verify voltage level and polarity against the rating label on front panel, under the top cover. Terminal 1 is –dc, 2 is +dc	If auxiliary voltage is present and correct, then proceed to test 2. Otherwise the wiring/fuses in auxiliary supply should be checked.
2	Do LEDs/ and LCD backlight illuminate on power up, also check the N/O watchdog contact for closing.	If they illuminate or the contact closes and no error code is displayed then error is probably in the main processor board (front panel) If they do not illuminate and the contact does not close then proceed to test 3.
3	Check Field voltage output (nominally 48V DC)	If field voltage is not present then the fault is probably in the relay power supply module. Consult the Commissioning & Maintenance chapter (P54x/EN CM) for a description of how to remove this module. The part number of this module can be checked to verify that the rating of the module conforms to the auxiliary rating printed on the relay front panel.

Table 2: Failure of Relay to power up

4. ERROR MESSAGE/CODE ON POWER-UP

During the power-up sequence of the relay self-testing is performed as indicated by the messages displayed on the LCD. If an error is detected by the relay during these self-tests then an error message will be displayed and the power-up sequence will be halted. If the error occurs when the relay application software is executing then a maintenance record will be created and the relay will reboot.

Test	Check	Action
1	Is an error message or code permanently displayed during power up.	If relay locks up and displays an error code permanently then proceed to test 2. If the relay prompts for input by the user proceed to test 4. If the relay re- boots automatically then proceed to test 5.
2	Record displayed error, then remove and re-apply relay auxiliary supply.	Record whether the same error code is displayed when the relay is rebooted. If no error code is displayed then contact the local service centre stating the error code and relay information. If the same code is displayed proceed to test 3.
3	Error code Identification location. Following text messages (in English) will be displayed if a fundamental problem is detected preventing the system from booting:	Refer to the Commissioning & Maintenance chapter (P54x/EN CM) for module. These messages indicate that a problem has been detected on the main processor board of the relay (located in the front panel), or in the Current Differential processor board (located within the case).
	Bus Fail – address lines SRAM Fail - data lines FLASH Fail format error FLASH Fail checksum Code Verify Fail	
	Other error codes relate to errors detected in hardware or software:	Refer to section 8 for a list of error codes.
4	Relay displays message for corrupt settings and prompts for restoration of defaults to the affected settings.	The power up tests have detected corrupted relay settings. It is possible to restore defaults to allow the power- up to be completed. It will then be necessary to re-apply the application- specific settings.
5	Relay resets on completion of power up – record error code displayed.	Error 0x0E080000, programmable scheme logic error due to excessive execution time. Restore default settings by performing a power up with and keys depressed, confirm restoration of defaults at prompt using key. If relay powers up successfully, check programmable logic for feedback paths. Refer to section 8 for a list of error codes.

Table 3: Power-up self-test error

5. OUT OF SERVICE LED ILLUMINATED ON POWER UP

Test	Check	Action
1	Using the relay menu confirm whether the Commission Test/ Test Mode setting is Enabled.	If the setting is Enabled then disable the test mode and, verify that the Out of Service LED is extinguished. Otherwise proceed to test 2.
2	Select and view the last maintenance record from the menu (in the View Records).	Check for H/W Verify Fail (this indicates a discrepancy between the relay model number and the hardware). Examine the "Maint Data",(this indicates the causes of the failure using bit fields): Bit Meaning 0 The application type field in the model number does not match the software ID 1 The application field in the model number does not match the software ID 2 The variant 1 field in the model number does not match the software ID 3 The variant 2 field in the model number does not match the software ID 4 The protocol field in the model number does not match the software ID 5 The language field in the model number does not match the software ID 6 The VT type field in the model number is incorrect (110V VTs fitted) 7 The VT type field in the model number is incorrect (440V VTs fitted) 8 The VT type field in the model number is incorrect (no VTs fitted)

Table 4: Out-of-service condition

6. ERROR CODE DURING OPERATION

The relay performs continuous self-checking. If an error is detected, then an error message will be displayed, a maintenance record will be logged and the relay will reset (after a 1.6 second delay). A permanent problem (for example due to a hardware fault) will generally be detected on the power up sequence, following which the relay will display an error code and halt. If the problem was transient in nature then the relay should re-boot correctly and continue in operation. The nature of the detected fault can be determined by examination of the maintenance record logged.

There are also two cases where a maintenance record will be logged due to a detected error where the relay will not reset. These are detection of a failure of either the field voltage or the lithium battery. In these cases the failure is indicated by an alarm message. However, the relay will continue to operate.

If the field voltage is detected to have failed (the voltage level has dropped below threshold), then a scheme logic signal is also set. This allows the scheme logic to be adapted in the case of this failure (for example if a blocking scheme is being used).

In the case of a battery failure it is possible to prevent the relay from issuing an alarm using the setting under the Date and Time section of the menu. This setting "Battery Alarm" can be set to 'Disabled' to allow the relay to be used without a battery, without an alarm message being displayed.

7. MIS-OPERATION OF THE RELAY DURING TESTING

7.1 Failure of output contacts

An apparent failure of the relay output contacts may be caused by the relay configuration and the following tests should be performed to identify the real cause of the failure. Note that the relay self-tests verify that the coil of the contact has been energised. An error will be displayed if there is a fault in the output relay board.

Test	Check	Action
1	Is the Out of Service LED illuminated.	Illumination of this LED may indicate that the relay is in test mode or that the protection has been disabled due to a hardware verify error (see Table 4)
2	Examine the Contact status in the Commissioning section of the menu.	If the relevant bits of the contact status are operated then proceed to test 4. If not, proceed to test 3.
3	Verify by examination of the fault record, or by using the test port whether the protection element is operating correctly.	If the protection element does not operate, verify whether the test is being correctly applied. If the protection element does operate, then it will be necessary to check the programmable logic to ensure that the mapping of the protection element to the contacts is correct. If the mapping of the protection has been correctly configured, then the contact may be at fault. This can be verified – see test 4.
4	Using the Commissioning/Test mode function, apply a test pattern to the relevant relay output contacts and verify whether they operate (note the correct external connection diagram should be consulted). A continuity tester can be used at the rear of the relay for this purpose.	If the output relay does operate then the problem must be in the external wiring to the relay. If the output relay does not operate this could indicate a failure of the output relay contacts (note that the self-tests verify that the relay coil is being energised). Ensure that the closed resistance is not too high for the continuity tester to detect.

Table 5: Failure of output contacts

7.2 Failure of opto-isolated inputs

The opto-isolated inputs are mapped onto the relay internal signals using the programmable scheme logic. If an input does not appear to be recognised by the relay scheme logic the Commission Tests/Opto Status menu option can be used to verify whether the problem is in the opto-isolated input itself or the mapping of its signal to the scheme logic functions. If the opto-isolated input does appear to be read correctly then it will be necessary to examine its mapping within the programmable logic.

If the opto-isolated input state is not being correctly read by the relay the applied signal should be tested. Verify the connections to the opto-isolated input using the correct wiring diagram. Next, using a voltmeter verify that >80% of the programmed nominal battery voltage threshold is present on the terminals of the opto-isolated input in the energised state. If the signal is being correctly applied to the relay then the failure may be on the input card itself. Depending on which opto-isolated input has failed this may require replacement of either the complete analogue input module (the board within this module cannot be individually replaced without re-calibration of the relay) or a separate opto board.

7.3 Incorrect analogue signals

If it is suspected that the analogue quantities being measured by the relay are not correct then the measurement function of the relay can be used to verify the nature of the problem. The measured values displayed by the relay should be compared with the actual magnitudes at the relay terminals. Verify that the correct terminals are being used (in particular the dual rated CT inputs) and that the CT and VT ratios set on the relay are correct.

7.4 Current differential failures

The current differential board may cause the relay to report one or more of the following alarms:

Signalling Failure Alarm (on its own)

This indicates that there is a problem with one of the fibre optic signalling channels. This alarm can occur in dual redundant or three terminal schemes. The fibre may have been disconnected, the relay incorrectly configured at one of the ends, or there is a problem with the communications equipment if P59x relays are being used. The current differential protection is still in service. Further information about the status of the signalling channels can be found in MEASUREMENTS 4 column.

Signalling Failure and C Diff Failure Alarms together

This indicates that there is a problem with one or both fibre optic signalling channels. The fibre may have been disconnected, the relay incorrectly configured at one of the ends, or there is a problem with the communications equipment if P59x relays are being used. As a result the current differential protection is not available and backup protection will operate, if configured to do so. Further information about the status of the signalling channels can be found in MEASUREMENTS 4 column.

C Diff Failure Alarm (on its own)

This indicates there is a problem with the current differential board. As a result the current differential protection is not available and backup protection will operate, if configured to do so. Further information can be found in the maintenance records. See section 8 for details.

Incompatible Relay

This occurs if the relays trying to communicate with each other are of incompatible types. Relay types P541 and P542 can be freely mixed. Relay type P543, P544, P545 and P546 can be freely mixed. However, the two groups are mutually exclusive.

C Diff Comm Mode (Software 30 or later)

This indicates that the setting 2020 Comms Mode has been changed without a subsequent power off and on.

IEEE C37.94(Software 30 or later)

This indicates a Signal Lost, a Path Yellow or a mismatch in the number ofN*64 channels used on either channel 1 or channel 2. Further information can be found in the MEASURMENTS 4 column.

8. ERROR CODES

Error codes (as reported by the relay via the front panel or in the Maintenance Records) can offer a considerable amount of information about the source of the error.

The Hex Code is reported on the front user interface of the relay immediately prior to a reboot sequence. If this code could not be observed, use the Maintenance Records section of the View Records column to display the corresponding Decimal Code.

Hex Code	Decimal Code	Meaning
0x0C0D0000	202178560	An error has been detected in the acquisition driver. Check the input board and the opto boards
0x0C0E0000	202244096	An error has been detected in an output relay card. Check the relay boards.
0x0C140001	202637313	The serial driver failed to initialise properly. Check the serial port hardware on the power supply board and the main processor board.
0x0C140002	202637314	The LCD driver failed to initialise properly. Check the LCD on the main processor board.
0x0C140003	202637315	The Flash memory driver failed to initialise properly. Check the Flash memory on the main processor board.
0x0C140004	202637316	The date and time driver failed to initialise properly. Check the real-time clock and battery-backed SRAM on the main processor board.
0x0C140005	202637317	The data acquisition driver failed to initialise properly. Check the input board and the opto boards.
0x0C140006	202637318	The relay driver failed to initialise properly. Check the relay boards.
0x0C140007	202637319	The logs failed to initialise properly. Check the battery backed SRAM on the main processor board.
0x0C140008	202637320	The database failed to initialise properly. Check the EEPROM on the main processor board.
0x0C140009	202637321	The database took too long to commit a change. Check the EEPROM on the main processor board.
0x0C14000A	202637322	The IRIG-B driver failed to initialise properly. Check the IRIG-B interface hardware on the IRIG-B board.
0x0C160010	202768400	The continuous self-checks have found an error in the RAM bus. Check the RAM on the main processor board.
0x0C160011	202768401	The continuous self-checks have found an error in the RAM block. Check the RAM on the main processor board.
0x0C160012	202768402	The continuous self-checks have found an error in the Flash EPROM checksum. Check the Flash EPROM on the main processor board, and then try downloading a new program.
0x0C160013	202768403	The continuous self-checks have found an error in the code comparison. Check the Flash EPROM on the main processor board, and then try downloading a new program.
0x0C160014	202768404	The continuous self-checks have found an error in the battery backed SRAM. Check the battery, then the RAM on the main processor board.
0x0C160015	202768405	The continuous self-checks have found an error in the EEPROM. Check the EEPROM on the main processor board.
0x0C1600A0	202768544	The continuous self-checks have found an error on the acquisition board. Check the input board.
0x0C1600B0	202768560	The continuous self-checks have found an error on a relay board. Check the relay boards.

Hex Code	Decimal Code	Meaning
0x0C1600C0	202768576	The continuous self-checks have found an error on an opto board. Check the opto boards.
0x0C170016	202833942	Secondary initialisation tests detected a fast watchdog failure. Check the on the main processor board.
0x0C170017	202833943	Secondary initialisation tests detected a battery backed SRAM failure. Check the battery backed SRAM on the main processor board.
0x0C170018	202833944	Secondary initialisation tests detected a bus reset test failure. Check the main processor board.
0x0C170019	202833945	Secondary initialisation tests detected a slow watchdog failure.
0x0E020000	235012096	Excessive number of gates in PSL. Restore defaults and download new PSL.
0x0E080000	235405312	PSL excessive execution time. Restore defaults and download new PSL.
0x818xxxx	-2122252288 to -2122186753	The commissioning test module received an error code when writing to the relays. Check the relay boards.
0x8182xxxx	-2122186752 to -2122121217	The commissioning test module received an error code when writing to the LEDs. Check the processor card.
0x93830000	-1820131328	FPGA download failed, check current differential board and the model number
0x93840000	-1820065792	SRAM check failed, check current differential board
0x93850000	-1820000256	Program download failed, check current differential board
0x93860000	-1819934720	Program failed to start, check current differential board
0x93870000	-1819869184	Number of optical channels incorrect, check current differential board and model number.
0xAC810000	-1400832000	Current differential program stopped, check current differential board.

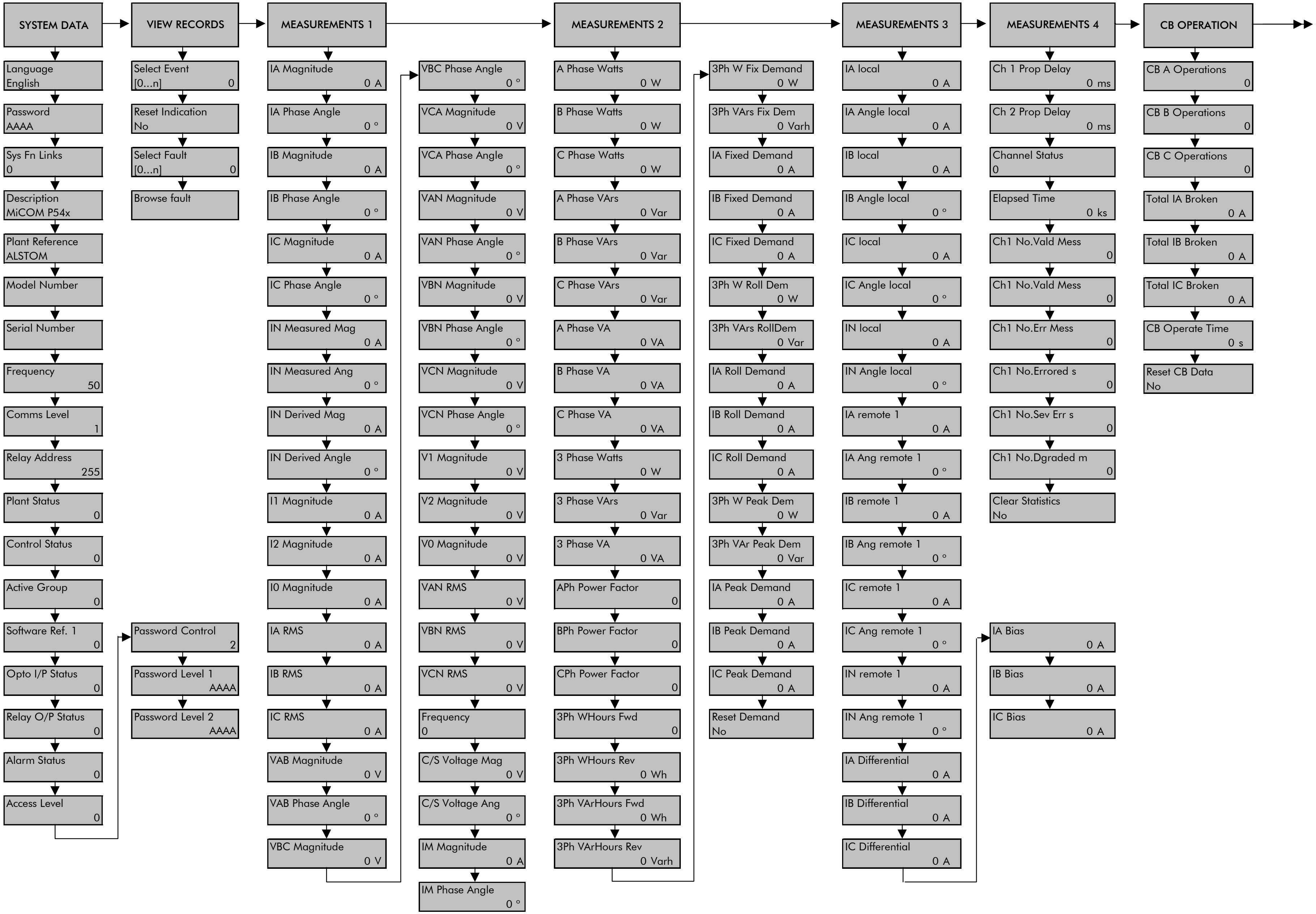
Table 6: Error Codes

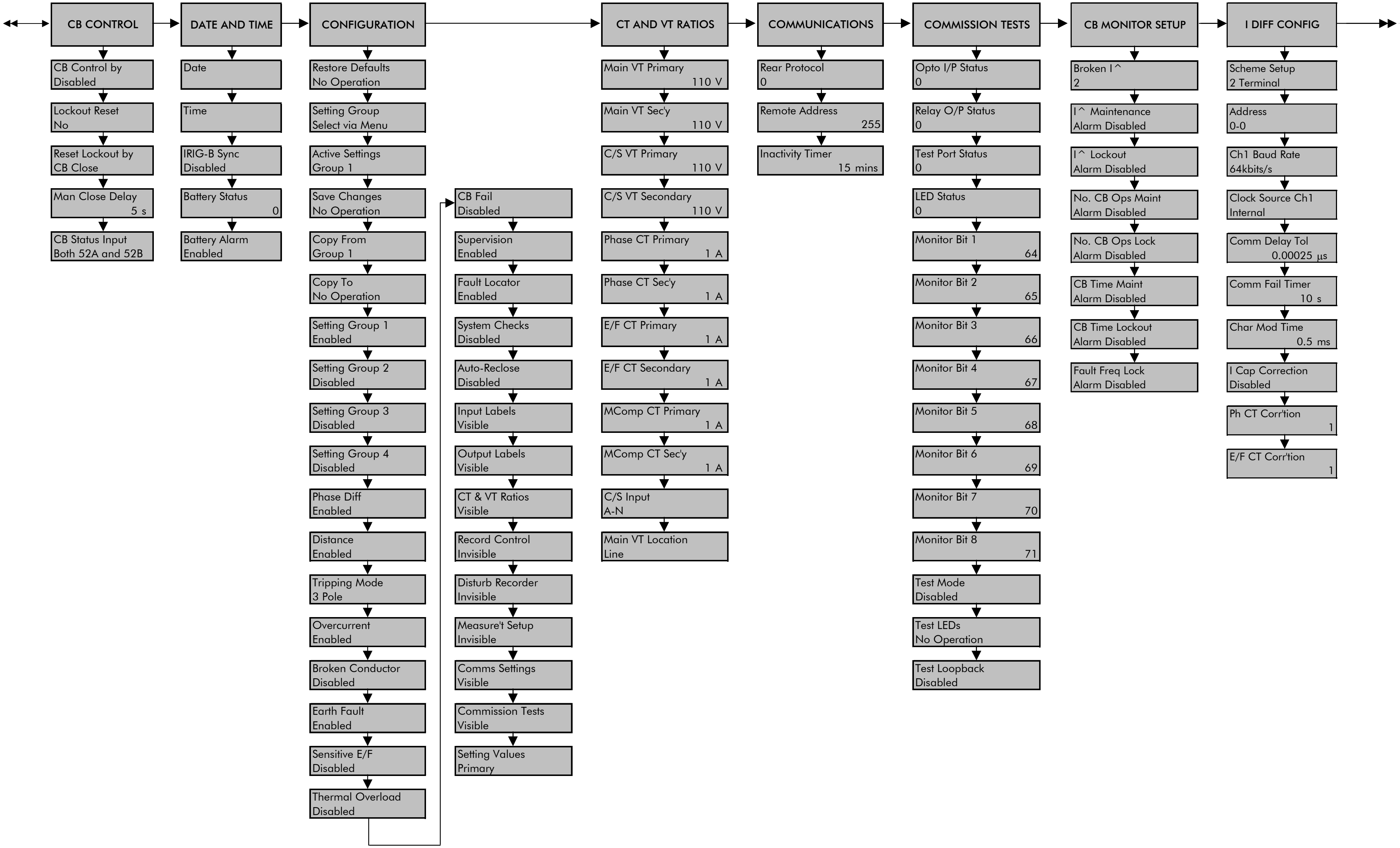
Other error codes relate to problems within the main processor board software. It will be necessary to contact Alstom Grid with details of the problem for a full analysis.

MENU CONTENT TABLES

Note 1: This specific menu map relates to the MiCOM P543, for other versions please make reference to the Courier Database (P54x/EN GC).

Note 2: * Group 1 is shown on the menu map, Groups 2, 3 and 4 are identical to Group 1 and therefore omitted.


SYSTEM DATA
Language English
Password AAAA
Sys Fn Links 0
Description MiCOM P54x
Plant Reference ALSTOM
Model Number
Serial Number
Frequency 50
Comms Level 1
Relay Address 255
Plant Status 0
Control Status 0
Active Group 0
Software Ref. 1 0
Opto I/P Status 0
Relay O/P Status 0
Alarm Status 0
Access Level 0
VIEW RECORDS
Select Event [0...n] 0
Reset Indication No
Select Fault [0...n] 0
Browse fault
Password Control 2
Password Level 1 AAAA
Password Level 2 AAAA
MEASUREMENTS 1
IA Magnitude 0 A
IA Phase Angle 0 °
IB Magnitude 0 A
IB Phase Angle 0 °
IC Magnitude 0 A
IC Phase Angle 0 °
IN Measured Mag 0 A
IN Measured Ang 0 °
IN Derived Mag 0 A
IN Derived Angle 0 °
I1 Magnitude 0 A
I2 Magnitude 0 A
I0 Magnitude 0 A
IA RMS 0 A
IB RMS 0 A
IC RMS 0 A
VAB Magnitude 0 V
VAB Phase Angle 0 °
VBC Magnitude 0 V
VBC Phase Angle 0 °
VCA Magnitude 0 V
VCA Phase Angle 0 °
VAN Magnitude 0 V
VAN Phase Angle 0 °
VBN Magnitude 0 V
VBN Phase Angle 0 °
VCN Magnitude 0 V
VCN Phase Angle 0 °
V1 Magnitude 0 V
V2 Magnitude 0 V
V0 Magnitude 0 V
VAN RMS 0 V
VBN RMS 0 V
VCN RMS 0 V
Frequency 0
C/S Voltage Mag 0 V
C/S Voltage Ang 0 °
IM Magnitude 0 A
IM Phase Angle 0 °
MEASUREMENTS 2
A Phase Watts 0 W
B Phase Watts 0 W
C Phase Watts 0 W
A Phase VArs 0 Var
B Phase VArs 0 Var
C Phase VArs 0 Var
A Phase VA 0 VA
B Phase VA 0 VA
C Phase VA 0 VA
3 Phase Watts 0 W
3 Phase VArs 0 Var
3 Phase VA 0 VA
APh Power Factor 0
BPh Power Factor 0
CPh Power Factor 0
3Ph WHours Fwd 0
3Ph WHours Rev 0 Wh
3Ph VArHours Fwd 0 Wh
3Ph VArHours Rev 0 Varh
3Ph W Fix Demand 0 W
3Ph VArs Fix Dem 0 Varh
IA Fixed Demand 0 A
IB Fixed Demand 0 A
IC Fixed Demand 0 A
3Ph W Roll Dem 0 W
3Ph VArs RollDem 0 Var
IA Roll Demand 0 A
IB Roll Demand 0 A
IC Roll Demand 0 A
3Ph W Peak Dem 0 W
3Ph VAr Peak Dem 0 Var
IA Peak Demand 0 A
IB Peak Demand 0 A
IC Peak Demand 0 A
Reset Demand No
MEASUREMENTS 3
IA local 0 A
IA Angle local 0 A
IB local 0 A
IB Angle local 0 °
IC local 0 A
IC Angle local 0 °
IN local 0 A
IN Angle local 0 °
IA remote 1 0 A
IA Ang remote 1 0 °
IB remote 1 0 A
IB Ang remote 1 0 °
IC remote 1 0 A
IC Ang remote 1 0 °
IN remote 1 0 A
IN Ang remote 1 0 °
IA Differential 0 A
IB Differential 0 A
IC Differential 0 A
MEASUREMENTS 4
Ch 1 Prop Delay 0 ms
Ch 2 Prop Delay 0 ms
Channel Status 0
Elapsed Time 0 ks
Ch1 No.Vald Mess 0
Ch1 No.Vald Mess 0
Ch1 No.Err Mess 0
Ch1 No.Errored s 0
Ch1 No.Sev Err s 0
Ch1 No.Dgraded m 0
Clear Statistics No
IA Bias 0 A
IB Bias 0 A
IC Bias 0 A
CB OPERATION
CB A Operations 0
CB B Operations 0
CB C Operations 0
Total IA Broken 0 A
Total IB Broken 0 A
Total IC Broken 0 A
CB Operate Time 0 s
Reset CB Data No


CB CONTROL
CB Control by Disabled
Lockout Reset No
Reset Lockout by CB Close
Man Close Delay 5 s
CB Status Input Both 52A and 52B
DATE AND TIME
Date
Time
IRIG-B Sync Disabled
Battery Status 0
Battery Alarm Enabled
CONFIGURATION
Restore Defaults No Operation
Setting Group Select via Menu
Active Settings Group 1
Save Changes No Operation
Copy From Group 1
Copy To No Operation
Setting Group 1 Enabled
Setting Group 2 Disabled
Setting Group 3 Disabled
Setting Group 4 Disabled
Phase Diff Enabled
Distance Enabled
Tripping Mode 3 Pole
Overcurrent Enabled
Broken Conductor Disabled
Earth Fault Enabled
Sensitive E/F Disabled
Thermal Overload Disabled
CB Fail Disabled
Supervision Enabled
Fault Locator Enabled
System Checks Disabled
Auto-Reclose Disabled
Input Labels Visible
Output Labels Visible
CT & VT Ratios Visible
Record Control Invisible
Disturb Recorder Invisible
Measure't Setup Invisible
Comms Settings Visible
Commission Tests Visible
Setting Values Primary
CT AND VT RATIOS
Main VT Primary 110 V
Main VT Sec'y 110 V
C/S VT Primary 110 V
C/S VT Secondary 110 V
Phase CT Primary 1 A
Phase CT Sec'y 1 A
E/F CT Primary 1 A
E/F CT Secondary 1 A
MComp CT Primary 1 A
MComp CT Sec'y 1 A
C/S Input A-N
Main VT Location Line
COMMUNICATIONS
Rear Protocol 0
Remote Address 255
Inactivity Timer 15 mins
COMMISSION TESTS
Opto I/P Status 0
Relay O/P Status 0
Test Port Status 0
LED Status 0
Monitor Bit 1 64
Monitor Bit 2 65
Monitor Bit 3 66
Monitor Bit 4 67
Monitor Bit 5 68
Monitor Bit 6 69
Monitor Bit 7 70
Monitor Bit 8 71
Test Mode Disabled
Test LEDs No Operation
Test Loopback Disabled
CB MONITOR SETUP
Broken I^ 2
I^ Maintenance Alarm Disabled
I^ Lockout Alarm Disabled
No. CB Ops Maint Alarm Disabled
No. CB Ops Lock Alarm Disabled
CB Time Maint Alarm Disabled
CB Time Lockout Alarm Disabled
Fault Freq Lock Alarm Disabled
I DIFF CONFIG
Scheme Setup 2 Terminal
Address 0-0
Ch1 Baud Rate 64kbits/s
Clock Source Ch1 Internal
Comm Delay Tol 0.00025 µs
Comm Fail Timer 10 s
Char Mod Time 0.5 ms
I Cap Correction Disabled
Ph CT Corr'tion 1
E/F CT Corr'tion 1

PHASE DIFF GROUP 1
- Phase Is1 — 0.2*I1 mA
- Phase Is2 — 2*I1 A
- Phase k1 — 30 %
- Phase k2 — 150 %
- Phase Char — DT
- Phase Time Delay — 0 s
- PIT Time — 0.2 ms

DISTANCE GROUP 1
- Z1 Status — Enabled
- Z1 — 0 Ω
- tZ1 — 0 s
- Z1 Intertrip — Disabled
- Z2 Status — Enabled
- Z2 — 5 Ω
- tZ2 — 0.5 ms
- Z2 Intertrip — Disabled
- Z3 Status — Enabled
- Z3 — 5 Ω
- tZ3 — 1 s
- Z3 Intertrip — Disabled
- Line Angle — 70 °
- kZN Res Comp — 1
- kZN Angle — 0 °
- RPh — 10 Ω
- RG — 10 Ω
- PSB Status — Disabled
- Z3 Direction — Reverse

OVERCURRENT GROUP 1
- I>1 Status — Enabled
- I>1 Function — IEC S Inverse
- I>1 Directional — Non-Directional
- I>1 Current Set — 1 A
- I>1 TMS — 1
- I>1 tRESET — 0 s
- I>2 Status — Disabled
- I>3 Status — Disabled
- I>4 Status — Disabled
- I> Char Angle — 30 °
- I> Blocking — 15

EARTH FAULT GROUP 1
- IN>1 Status — Enabled
- IN>1 Function — IEC S Inverse
- IN>1 Directional — Non-Directional
- IN>1 Current Set — 0.2 mA
- IN>1 TMS — 1
- IN>1 tRESET — 0 s
- IN>2 Status — Disabled
- IN>3 Status — Disabled
- IN>4 Status — Disabled
- IN> Blocking — 15
- IN>4 Directional
- IN> Char Angle — -60 °
- IN> Polarisation — Zero Sequence
- IN> VNpol Set — 5 V

CB FAIL & I< GROUP 1
- UNDER CURRENT
- I< Current Set — 0.1 mA
- ISEF< Current — 0.02 mA

SUPERVISION GROUP 1
- VT SUPERVISION
- VTS Status — Blocking
- VTS Reset Mode — Manual
- VTS Time Delay — 5 s
- VTS I> Inhibit — 10 A
- VTS I2> Inhibit — 0.05 mA

FAULT LOCATOR GROUP 1
- Line Length — 16000 mi
- Line Impedance — 6 Ω
- Line Angle — 70 °
- kZN Residual — 1
- kZN Res Angle — 1 °
- Mutual Comp — Disabled

INPUT LABELS GROUP 1
- Opto Input 1
- Opto Input 2
- Opto Input 3
- Opto Input 4
- Opto Input 5
- Opto Input 6
- Opto Input 7
- Opto Input 8
- Opto Input 9
- Opto Input 10
- Opto Input 11
- Opto Input 12
- Opto Input 13
- Opto Input 14
- Opto Input 15
- Opto Input 16

OUTPUT LABELS GROUP 1 *
- Relay 1
- Relay 2
- Relay 3
- Relay 4
- Relay 5
- Relay 6
- Relay 7
- Relay 8
- Relay 9
- Relay 10
- Relay 11
- Relay 12
- Relay 13
- Relay 14

RELAY MENU DATABASE

MiCOM P541, P542, P543, P544, P545, P546 Guides

Current Differential Relays

Relay Menu Database

This version of the Relay Menu Database is specific to the following models

Model number	Software number
P541------0300J	P541------0300-A
P542------0300J	P542------0300-A
P543------0300J	P543------0300-A
P544------0300J	P544------0300-A
P545------0300J	P545------0300-A
P546------0300J	P546------0300-A

Details for model number P54x------0200G, Software number P54x------0200-E can be found in P54x/EN GC/G42

For other models/software versions, please contact Alstom Grid.

This chapter is split into several sections, these are as follows:

- Menu Database for Courier, User Interface and Modbus
- Menu Datatype Definition
- IEC60870-5-103 Interoperability Guide
- Event Data for Courier, User Interface and Modbus
- Internal Digital Signals
- DNP 3.0 Device Profile
- Default Programmable Logic

Menu database

This database defines the structure of the relay menu for the courier interface, the front panel user interface and the Modbus interface. This includes all of the relay settings and measurements. Datatypes for Modbus and indexed strings for Courier and the user interface are cross-referenced to the Menu Datatype Definition section (using a G Number). For all settable cells the setting limits and default value are also defined within this database.

Note: The following labels are used within the database

Label	Description	Value
V1	Main VT Rating	1 (100/110V)
V2	Checksynch VT Rating	1 (100/110V)
V3	NVD VT Rating	1 (100/110V)
I1	Phase CT Rating	1 or 5 (Setting 0A08)
I2	Earth Fault CT Rating	1 or 5 (Setting 0A0A)
I3	Sensitive CT Rating	1 or 5 (Setting 0A0C)
I4	Mutual CT Rating	1 or 5 (Setting 0A0E)

Menu datatype definition

This table defines the datatypes used for Modbus (the datatypes for the Courier and user interface are defined within the Menu Database itself using the standard Courier Datatypes). This section also defines the indexed string setting options for all interfaces. The datatypes defined within this section are cross-referenced to from the menu Database using a G number.

IEC60870-5-103 Interoperability guide

This table fully defines the operation of the IEC60870-5-103 (VDEW) interface for the relay it should be read in conjunction with the relevant section of the SCADA Communications chapter of this manual (P54x/EN CT).

Event data

This section of the appendix specifies all the event information that can be produced by the relay. It details exactly how each event will be presented via the Courier, User and Modbus interfaces.

Internal digital signals

This table defines all of the relay internal digital signals (opto inputs, output contacts and protection inputs and outputs). A relay may have up to 512 internal signals each referenced by a numeric index as shown in this table. This numeric index is used to select a signal for the commissioning monitor port. It is also used to explicitly define protection events produced by the relay (see the Event Data section of this Appendix).

DNP 3.0 Device Profile

This table fully defines the operation of the DNP 3.0 interface for the relay it should be read in conjunction with the relevant section of the SCADA Communications Chapter of this Manual (P54x/EN CT).

UCA2.0

Protocol Implementation & Conformance Statement (PICS).

The table gives the PICS for models P543 to P546.

Default programmable logic

This section documents the default programmable logic for the various models of the relay. This default logic for each model of the relay is supplied with the MiCOM S1 Scheme Logic Editor PC support software.

References

P54x/EN IT - Introduction: User Interface operation and connections to the relay

P54x/EN CT - Communications: Overview of communication interfaces

Courier User Guide R6512

Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev E

IEC60870-5-103 Telecontrol Equipment and Systems – Transmission Protocols – Companion Standard for the informative interface of Protection Equipment.

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
SYSTEM DATA		00	00												*	*	*	*	*	*	
Language			01	Indexed String	G19			G19	English	Setting	0	3	1	2	*	*	*	*	*	*	Sets only for interface being used
Password			02	ASCII Password (4)	G20	40001	40002	G20	AAAA	Setting	65	90	1	0	*	*	*	*	*	*	Sets only for interface being used
Sys Fn Links			03	Binary Flag (1) Indexed String	G95	40003		G95	0	Setting	1	1	1	2	*	*	*	*	*	*	
Description			04	ASCII Text (16)		40004	40011	G3	MiCOM P54x	Setting	32	163	1	2	*	*	*	*	*	*	
Plant Reference			05	ASCII Text (16)		40012	40019	G3	ALSTOM	Setting	32	163	1	2	*	*	*	*	*	*	
Model Number			06	ASCII Text (32)		30020	30035	G3	Model Number	Data					*	*	*	*	*	*	
Firmware Number			07	ASCII Text (16)				G3	Firmware Number	Data											
Serial Number			08	ASCII Text (7)		30044	30051	G3	Serial Number	Data					*	*	*	*	*	*	
Frequency			09	Unsigned Integer (16 bits)		40020		G1	50	Setting	50	60	10	2	*	*	*	*	*	*	
Comms Level			0A	Unsigned Integer (16 bits)					1	Data					*	*	*	*	*	*	
Relay Address			0B	Unsigned Integer (16 bits)					255	Setting	0	255	1	1	*	*	*	*	*	*	Address of interface Rear Courier Address available via LCD
				Binary Flag (16)		30001		G26		Data					*	*	*	*	*	*	Modbus only (Relay status)
Plant Status			0C	Binary Flag (16)		30002	30003	G4		Data					*	*	*	*	*	*	
Control Status			0D	Binary Flag (16)		30004	30005	G5		Data					*	*	*	*	*	*	
Active Group			0E	Unsigned Integer (16 bits)		30006		G1		Data					*	*	*	*	*	*	
UNUSED			0F																		
CB Trip/Close			10	Indexed String	G55				No Operation	Command	0	2	1	1	*	*	*		*		Visible to LCD+Front Port
CB Trip/Close			10					G55	No Operation	Command	0	10	1	1				*		*	Visible to LCD + Front Port
CB Trip/Close	N/A		10	Indexed String	G55	40021		G55	No Operation	Command	0	2	1	1	*	*	*		*		Visible to Rear Port
CB Trip/Close			10	Indexed String	G55	40021		G55	No Operation	Command	0	10	1	1				*		*	Visible to Rear Port
Software Ref. 1			11	ASCII Text (16)		30052	30059	G3		Data					*	*	*	*	*	*	
Software Ref. 2			12	ASCII Text (16)		30060	30067	G3		Data											
Software Ref. 3			13	ASCII Text (16)		30068	30075	G3		Data											
Software Ref. 4			14	ASCII Text (16)		30076	30083	G3		Data											
UNUSED			15-1F																		
Opto I/P Status			20	Binary Flag (16) Indexed String		30007		G8		Data					*	*	*	*			
Opto I/P Status			20	Binary Flag (24) Indexed String		30725	30726	G27		Data					*	*	*	*	*	*	
Relay O/P Status			21	Binary Flag (32) Indexed String		30008	30009	G9		Data					*	*	*	*	*	*	
Alarm Status 1			22	Binary Flag (32) Indexed String		30011	30012	G96		Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
UNUSED			23																		
Alarm Status 1 (Copy of 0022)			50	Binary Flag (32) Indexed String						Data					*	*	*	*	*	*	
Alarm Status 2			51	Binary Flag (32) Indexed String		30013	30014	G128		Data					*	*	*	*	*	*	
Alarm Status 3			52	Binary Flag (32) Indexed String		30015	30016	G228		Data					*	*	*	*	*	*	
Access Level			D0	Unsigned Integer (16 bits)	G1	30010		G1		Data					*	*	*	*	*	*	
Password Control			D1	Unsigned Integer (16 bits)	G22	40022		G22	2	Setting	0	2	1	2	*	*	*	*	*	*	Sets only for interface being used
Password Level 1			D2	ASCII Password (4)	G20	40023	40024	G20	AAAA	Setting	65	90	1	1	*	*	*	*	*	*	Sets only for interface being used
Password Level 2			D3	ASCII Password (4)	G20	40025	40026	G20	AAAA	Setting	65	90	1	2	*	*	*	*	*	*	Sets only for interface being used
Reserved for levels > 2			D4-D8																		
VIEW RECORDS		01	00												*	*	*	*	*	*	
						30100 30101 30102		G1 G1 G1							* * *	* * *	* * *	* * *	* * *	* * *	No of event records stored Number of Fault records stored No of Maintenance Records stored
Select Event [0...n]			01	Unsigned Integer (16 bits)		40112			0	Setting	0	249	1	0	*	*	*	*	*	*	Max value is oldest record n is last event record.
Menu Cell Ref	N/A		02	Cell Reference		30107		G13	(From Record)	Data					*	*	*	*	*	*	Indicates type of event See Event sheet
Time & Date			03	IEC870 Time & Date		30103	30106	G12	(From Record)	Data					*	*	*	*	*	*	
Event Text			04	ASCII Text (32)						Data					*	*	*	*	*	*	See Event sheet
Event Value			05	Binary Flag (32)/UINT32		30108	30109	G27		Data					*	*	*	*	*	*	Note DTL depends on event type See Event sheet
Select Fault [0...n]			06	Unsigned Integer (16 bits)		40101		G1	0	Setting	0	4	1	0	*	*	*	*	*	*	Allows Fault Record to be selected n is last fault record
						30110		G1							*	*	*	*	*	*	Modbus address where change occurred Alarm 30011; Relay 30723, Opto 30725
						30111		G1							*	*	*	*	*	*	State of current 16 ddb elements
						30112		G1							*	*	*	*	*	*	Additional data present
Started Phase A B C N		N/A								Data					*	*	*	*	*	*	A/B/C/N Visible if Start A/B/C/N
Tripped Phase A B C N		N/A								Data					*	*	*	*	*	*	A/B/C/N Visible if Trip A/B/C/N
Current Diff Start		N/A								Data					*	*	*	*	*	*	
Current Diff Trip InterTrip / Stub Bus		N/A								Data					*	*	*	 *	*	 *	InterTrip & Stub Bus mutually exclusive Stub Bus only present in Model 4
Intertrips PIT DIT Dist I>3		N/A								Data					*	*	*	*	*	*	
Distance Start Z1 Z2 Z3		N/A								Data							*	*	*	*	Z1/Z2/Z3 if Start Z1/Z2/Z3
Distance Trip Z1 Z2 Z3		N/A								Data							*	*	*	*	Z1/Z2/Z3 if Trip Z1/Z2/Z3
Overcurrent Start I> 1234		N/A								Data					*	*	*	*	*	*	1/2/3/4 Visible if Start I>1/2/3/4
Overcurrent Trip I> 1234		N/A								Data					*	*	*	*	*	*	1/2/3/4 Visible if Trip I>1/2/3/4
Broken Conductor Trip		N/A								Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Earth Fault Start IN> 1234		N/A								Data					*	*	*	*	*	*	1/2/3/4 visible if Start IN>1/2/3/4
Earth Fault Trip IN> 1234		N/A								Data					*	*	*	*	*	*	1/2/3/4 visible if Trip IN>1/2/3/4
Sensitive E/F Start ISEF> 1234		N/A								Data							*	*	*	*	1/2/3/4 visible if Start ISEF>1/2/3/4
Sensitive E/F Trip ISEF> 1234		N/A								Data							*	*	*	*	1/2/3/4 visible if Trip ISEF>1/2/3/4
Thermal Overload Alarm Trip		N/A								Data					*	*	*	*	*	*	
Breaker Fail CB Fail		N/A								Data					*	*	*	*	*	*	1/2 visible if CB Fail 1/2
Supervision VTS PSB		N/A								Data							*	*	*	*	VTS/PSB visible if AlarmVTS/PSB
A/R State Trip 1 2 3 4 5		N/A								Data						*	*		*		1/2/3/4/5 visible if SC:Count 1/2/3/4/5
Faulted Phase	N/A		07	Binary Flag (8)	G16	30113		G16		Data					*	*	*	*	*	*	Started phases + tripped phases
Start Elements	N/A		08	Binary Flag (32) Indexed String	G84	30114	30115	G84		Data					*	*	*	*	*	*	Started Elements
Start Elements 2	N/A		09	Binary Flag (32) Indexed String	G84			G84		Data											Started Elements 2
Trip Elements(1)	N/A		0A	Binary Flag (32) Indexed String	G85	30116	30117	G85		Data					*	*	*	*	*	*	Tripped main elements
Trip Elements(2)	N/A		0B	Binary Flag (32) Indexed String	G86	30118	30119	G86		Data											Tripped secondary elements
Fault Alarms	N/A		0C	Binary Flag (32) Indexed String	G87	30120	30121	G87		Data					*	*	*	*	*	*	Faullt Alarms/Warnings
Fault Time			0D	IEC870 Time & Date		30122	30125	G12		Data					*	*	*	*	*	*	Fault Record Time Stamp
Active Group			0E	Unsigned Integer (16 bits)		30126		G1		Data					*	*	*	*	*	*	
System Frequency			0F	Courier Number (frequency)		30127		G30		Data					*	*	*	*	*	*	
Fault Duration			10	Courier Number (time)		30128	30129	G24		Data					*	*	*	*	*	*	
CB Operate Time			11	Courier Number (time)		30130		G25		Data					*	*	*	*	*	*	
Relay Trip Time			12	Courier Number (time)		30131	30132	G24		Data					*	*	*	*	*	*	
Fault Location			13	Courier Number (metres)		30133	30134	G125		Data							*	*	*	*	OD0A=0 AND 0D09=0, can be invalid
Fault Location			14	Courier Number (miles)		30135	30136	G125		Data							*	*	*	*	OD0A=0 AND 0D09=1, can be invalid
Fault Location			15	Courier Number (ohms)		30137	30138	G125		Data							*	*	*	*	Can be Invalid
Fault Location			16	Courier Number (percentage)		30139	30140	G125		Data							*	*	*	*	Can be Invalid
IA			17	Courier Number (current)		30141	30142	G24		Data					*	*	*	*	*	*	
IB			18	Courier Number (current)		30143	30144	G24		Data					*	*	*	*	*	*	
IC			19	Courier Number (current)		30145	30146	G24		Data					*	*	*	*	*	*	
VAB			1A	Courier Number (voltage)		30147	30148	G24		Data							*	*	*	*	
VBC			1B	Courier Number (voltage)		30149	30150	G24		Data							*	*	*	*	
VCA			1C	Courier Number (voltage)		30151	30152	G24		Data							*	*	*	*	
Add product specific fault record items from this row onwards, do not redefine any of the above Courier cells.																					
Additional product specific targetting information can be added for the front panel menu																					

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
IA local			1D	Courier Number (current)		30153	30154	G24		Data					*	*	*	*	*	*	
IB local			1E	Courier Number (current)		30155	30156	G24		Data					*	*	*	*	*	*	
IC local			1F	Courier Number (current)		30157	30158	G24		Data					*	*	*	*	*	*	
IA remote 1			20	Courier Number (current)		30159	30160	G24		Data					*	*	*	*	*	*	
IB remote 1			21	Courier Number (current)		30161	30162	G24		Data					*	*	*	*	*	*	
IC remote 1			22	Courier Number (current)		30163	30164	G24		Data					*	*	*	*	*	*	
IA remote 2			23	Courier Number (current)		30165	30166	G24		Data					*	*	*	*	*	*	
IB remote 2			24	Courier Number (current)		30167	30168	G24		Data					*	*	*	*	*	*	
IC remote 2			25	Courier Number (current)		30169	30170	G24		Data					*	*	*	*	*	*	
IA Differential			26	Courier Number (current)		30171	30172	G24		Data					*	*	*	*	*	*	
IB Differential			27	Courier Number (current)		30173	30174	G24		Data					*	*	*	*	*	*	
IC Differential			28	Courier Number (current)		30175	30176	G24		Data					*	*	*	*	*	*	
IN Differential			29	Courier Number (current)		30177	30178	G24		Data											
IA Bias			2A	Courier Number (current)		30179	30180	G24		Data					*	*	*	*	*	*	
IB Bias			2B	Courier Number (current)		30181	30182	G24		Data					*	*	*	*	*	*	
IC Bias			2C	Courier Number (current)		30183	30184	G24		Data					*	*	*	*	*	*	
Select Maint [0...n]			F0	Unsigned Integer (16 bits)		40102		G1	0	Setting	0	4	1	0	*	*	*	*	*	*	Allows Self Test Report to be selected n is last maintenance record.
Maint Text			F1	ASCII Text (32)						Data					*	*	*	*	*	*	
Maint Type			F2	UINT32		30036	30037	G27		Data					*	*	*	*	*	*	
Maint Data			F3	UINT32		30038	30039	G27		Data					*	*	*	*	*	*	
Reset Indication			FF	Indexed String	G11				No	Command	0	1	1	1	*	*	*	*	*	*	
MEASUREMENTS 1		02	00												*	*	*	*	*	*	
IA Magnitude			01	Courier Number (current)		30200	30201	G24		Data					*	*	*	*	*	*	
IA Phase Angle			02	Courier Number (angle)		30202		G30		Data					*	*	*	*	*	*	
IB Magnitude			03	Courier Number (current)		30203	30204	G24		Data					*	*	*	*	*	*	
IB Phase Angle			04	Courier Number (angle)		30205		G30		Data					*	*	*	*	*	*	
IC Magnitude			05	Courier Number (current)		30206	30207	G24		Data					*	*	*	*	*	*	
IC Phase Angle			06	Courier Number (angle)		30208		G30		Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
IN Measured Mag			07	Courier Number (current)		30209	30210	G24		Data					*	*	*	*	*	*	
IN Measured Ang			08	Courier Number (angle)		30211		G30		Data					*	*	*	*	*	*	
IN Derived Mag			09	Courier Number (current)		30212	30213	G24		Data					*	*	*	*	*	*	
IN Derived Angle			0A	Courier Number (angle)		30214		G30		Data					*	*	*	*	*	*	
ISEF Magnitude			0B	Courier Number (current)		30215	30216	G24		Data											
ISEF Angle			0C	Courier Number (angle)		30217		G30		Data											
I1 Magnitude			0D	Courier Number (current)		30218	30219	G24		Data					*	*	*	*	*	*	
I2 Magnitude			0E	Courier Number (current)		30220	30221	G24		Data					*	*	*	*	*	*	
I0 Magnitude			0F	Courier Number (current)		30222	30223	G24		Data					*	*	*	*	*	*	
IA RMS			10	Courier Number (current)		30224	30225	G24		Data					*	*	*	*	*	*	
IB RMS			11	Courier Number (current)		30226	30227	G24		Data					*	*	*	*	*	*	
IC RMS			12	Courier Number (current)		30228	30229	G24		Data					*	*	*	*	*	*	
IN RMS			13	Courier Number (current)				G24		Data											
VAB Magnitude			14	Courier Number (voltage)		30230	30231	G24		Data							*	*	*	*	
VAB Phase Angle			15	Courier Number (angle)		30232		G30		Data							*	*	*	*	
VBC Magnitude			16	Courier Number (voltage)		30233	30234	G24		Data							*	*	*	*	
VBC Phase Angle			17	Courier Number (angle)		30235		G30		Data							*	*	*	*	
VCA Magnitude			18	Courier Number (voltage)		30236	30237	G24		Data							*	*	*	*	
VCA Phase Angle			19	Courier Number (angle)		30238		G30		Data							*	*	*	*	
VAN Magnitude			1A	Courier Number (voltage)		30239	30240	G24		Data							*	*	*	*	
VAN Phase Angle			1B	Courier Number (angle)		30241		G30		Data							*	*	*	*	
VBN Magnitude			1C	Courier Number (voltage)		30242	30243	G24		Data							*	*	*	*	
VBN Phase Angle			1D	Courier Number (angle)		30244		G30		Data							*	*	*	*	
VCN Magnitude			1E	Courier Number (voltage)		30245	30246	G24		Data							*	*	*	*	
VCN Phase Angle			1F	Courier Number (angle)		30247		G30		Data							*	*	*	*	
VN Measured Mag			20	Courier Number (voltage)		30248	30249	G24		Data											
VN Measured Ang			21	Courier Number (angle)		30250		G30		Data											
VN Derived Mag			22	Courier Number (voltage)		30251	30252	G24		Data											
VN Derived Ang			23	Courier Number (angle)		30253		G30		Data											
V1 Magnitude			24	Courier Number (voltage)		30254	30255	G24		Data							*	*	*	*	
V2 Magnitude			25	Courier Number (voltage)		30256	30257	G24		Data							*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
V0 Magnitude			26	Courier Number (voltage)		30258	30259	G24		Data							*	*	*	*	
VAN RMS			27	Courier Number (voltage)		30260	30261	G24		Data							*	*	*	*	
VBN RMS			28	Courier Number (voltage)		30262	30263	G24		Data							*	*	*	*	
VCN RMS			29	Courier Number (voltage)		30264	30265	G24		Data							*	*	*	*	
VAB RMS			2A	Courier Number (voltage)		30266	30267	G24		Data											
VBC RMS			2B	Courier Number (voltage)		30268	30269	G24		Data											
VCA RMS			2C	Courier Number (voltage)		30270	30271	G24		Data											
Frequency			2D	Courier Number (frequency)		30272		G30		Data					*	*	*	*	*	*	
C/S Voltage Mag			2E	Courier Number (voltage)		30273	30274	G24		Data							*		*		Visible if System Checks enabled
C/S Voltage Ang			2F	Courier Number (angle)		30275		G30		Data							*		*		Visible if System Checks enabled
C/S Bus-Line Ang			30	Courier Number (angle)		30276		G30		Data							*		*		Visible if System Checks enabled
Slip Frequency			31	Courier Number (frequency)		30277		G30		Data							*		*		Visible if System Checks enabled
IM Magnitude			32	Courier Number (current)		30278	30279	G24		Data							*	*	*	*	
IM Phase Angle			33	Courier Number (angle)		30280		G30		Data							*	*	*	*	
MEASUREMENTS 2		03	00												*	*	*	*	*	*	
A Phase Watts			01	Courier Number (power)		30300	30302	G29		Data							*	*	*	*	
B Phase Watts			02	Courier Number (power)		30303	30305	G29		Data							*	*	*	*	
C Phase Watts			03	Courier Number (power)		30306	30308	G29		Data							*	*	*	*	
A Phase VArs			04	Courier Number (VAr)		30309	30311	G29		Data							*	*	*	*	
B Phase VArs			05	Courier Number (VAr)		30312	30314	G29		Data							*	*	*	*	
C Phase VArs			06	Courier Number (VAr)		30315	30317	G29		Data							*	*	*	*	
A Phase VA			07	Courier Number (VA)		30318	30320	G29		Data							*	*	*	*	
B Phase VA			08	Courier Number (VA)		30321	30323	G29		Data							*	*	*	*	
C Phase VA			09	Courier Number (VA)		30324	30326	G29		Data							*	*	*	*	
3 Phase Watts			0A	Courier Number (power)		30327	30329	G29		Data							*	*	*	*	
3 Phase VArs			0B	Courier Number (VAr)		30330	30332	G29		Data							*	*	*	*	
3 Phase VA			0C	Courier Number (VA)		30333	30335	G29		Data							*	*	*	*	
Zero Seq Power			0D	Courier Number (VA)				G29		Data											
3Ph Power Factor			0E	Courier Number (decimal)		30336		G30		Data							*	*	*	*	
APh Power Factor			0F	Courier Number (decimal)		30337		G30		Data							*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
BPh Power Factor			10	Courier Number (decimal)		30338		G30		Data							*	*	*	*	
CPh Power Factor			11	Courier Number (decimal)		30339		G30		Data							*	*	*	*	
3Ph WHours Fwd			12	Courier Number (Wh)		30340	30342	G29		Data							*	*	*	*	3 Phase Watt - Hours (Forward)
3Ph WHours Rev			13	Courier Number (Wh)		30343	30345	G29		Data							*	*	*	*	3 Phase Watts - Hours (Reverse)
3Ph VArHours Fwd			14	Courier Number (VArh)		30346	30348	G29		Data							*	*	*	*	3 Phase VAr - Hours (Forward)
3Ph VArHours Rev			15	Courier Number (VArh)		30349	30351	G29		Data							*	*	*	*	3 Phase VAr - Hours (Reverse)
3Ph W Fix Demand			16	Courier Number (power)		30352	30354	G29		Data							*	*	*	*	3 Phase Watts - Fixed Demand
3Ph VArs Fix Dem			17	Courier Number (VAr)		30355	30357	G29		Data							*	*	*	*	3 Phase VArs - Fixed Demand
IA Fixed Demand			18	Courier Number (current)		30358	30359	G24		Data					*	*	*	*	*	*	
IB Fixed Demand			19	Courier Number (current)		30360	30361	G24		Data					*	*	*	*	*	*	
IC Fixed Demand			1A	Courier Number (current)		30362	30363	G24		Data					*	*	*	*	*	*	
3Ph W Roll Dem			1B	Courier Number (power)		30364	30366	G29		Data							*	*	*	*	3 Phase Watts - Rolling Demand
3Ph VArs RollDem			1C	Courier Number (VAr)		30367	30369	G29		Data							*	*	*	*	3 Phase VArs - Rolling Demand
IA Roll Demand			1D	Courier Number (current)		30370	30371	G24		Data					*	*	*	*	*	*	
IB Roll Demand			1E	Courier Number (current)		30372	30373	G24		Data					*	*	*	*	*	*	
IC Roll Demand			1F	Courier Number (current)		30374	30375	G24		Data					*	*	*	*	*	*	
3Ph W Peak Dem			20	Courier Number (power)		30376	30378	G29		Data							*	*	*	*	3 Phase Watts - Peak Demand
3Ph VAr Peak Dem			21	Courier Number (VAr)		30379	30381	G29		Data							*	*	*	*	3 Phase VArs - Peak Demand
IA Peak Demand			22	Courier Number (current)		30382	30383	G24		Data					*	*	*	*	*	*	
IB Peak Demand			23	Courier Number (current)		30384	30385	G24		Data					*	*	*	*	*	*	
IC Peak Demand			24	Courier Number (current)		30386	30387	G24		Data					*	*	*	*	*	*	
Reset Demand			25	Indexed String	G11	40103		G11	No	Command	0	1	1	1	*	*	*	*	*	*	
	N/A					30388	30389	G125		Data							*	*	*	*	A Phase Watts (see [0301])
	N/A					30390	30391	G125		Data							*	*	*	*	B Phase Watts (see [0302])
	N/A					30392	30393	G125		Data							*	*	*	*	C Phase Watts (see [0303])
	N/A					30394	30395	G125		Data							*	*	*	*	A Phase VArs (see [0304])
	N/A					30396	30397	G125		Data							*	*	*	*	B Phase VArs (see [0305])
	N/A					30398	30399	G125		Data							*	*	*	*	C Phase VArs (see [0306])
	N/A					30400	30401	G125		Data							*	*	*	*	A Phase VA (see [0307])
	N/A					30402	30403	G125		Data							*	*	*	*	B Phase VA (see [0308])
	N/A					30404	30405	G125		Data							*	*	*	*	C Phase VA (see [0309])
	N/A					30406	30407	G125		Data							*	*	*	*	3 Phase Watts (see [030A])

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
	N/A					30408	30409	G125		Data							*	*	*	*	3 Phase VArs (see [030B])
	N/A					30410	30411	G125		Data							*	*	*	*	3 Phase VA (see [030C])
	N/A					30412	30413	G125		Data							*	*	*	*	3 Phase WHours Fwd (see [0312])
	N/A					30414	30415	G125		Data							*	*	*	*	3 Phase WHours Rev (see [0313])
	N/A					30416	30417	G125		Data							*	*	*	*	3 Phase VArHours Fwd (see [0314])
	N/A					30418	30419	G125		Data							*	*	*	*	3 Phase VArHours Rev (see [0315])
	N/A					30420	30421	G125		Data							*	*	*	*	3 Phase W Fix Demand (see [0316])
	N/A					30422	30423	G125		Data							*	*	*	*	3 Phase VArs Fix Demand (see [0317])
	N/A					30424	30425	G125		Data							*	*	*	*	3 Phase W Roll Demand (see [031B])
	N/A					30426	30427	G125		Data							*	*	*	*	3 Phase VArs Roll Demand (see [031C])
	N/A					30428	30429	G125		Data							*	*	*	*	3 Phase W Peak Demand (see [0320])
	N/A					30430	30431	G125		Data							*	*	*	*	3 Phase VArs Peak Demand (see [0321])
Do not add any more rows to this column																					
MEASUREMENTS 3		04	00												*	*	*	*	*	*	
IA local			01	Courier Number (current)		30440	30441	G24		Data					*	*	*	*	*	*	
IA Angle local			02	Courier Number (angle)		30442		G30		Data					*	*	*	*	*	*	
IB local			03	Courier Number (current)		30443	30444	G24		Data					*	*	*	*	*	*	
IB Angle local			04	Courier Number (angle)		30445		G30		Data					*	*	*	*	*	*	
IC local			05	Courier Number (current)		30446	30447	G24		Data					*	*	*	*	*	*	
IC Angle local			06	Courier Number (angle)		30448		G30		Data					*	*	*	*	*	*	
IN local			07	Courier Number (current)		30449	30450	G24		Data											
IN Angle local			08	Courier Number (angle)		30451		G30		Data											
IA remote 1			09	Courier Number (current)		30452	30453	G24		Data					*	*	*	*	*	*	
IA Ang remote 1			0A	Courier Number (angle)		30454		G30		Data					*	*	*	*	*	*	
IB remote 1			0B	Courier Number (current)		30455	30456	G24		Data					*	*	*	*	*	*	
IB Ang remote 1			0C	Courier Number (angle)		30457		G30		Data					*	*	*	*	*	*	
IC remote 1			0D	Courier Number (current)		30458	30459	G24		Data					*	*	*	*	*	*	
IC Ang remote 1			0E	Courier Number (angle)		30460		G30		Data					*	*	*	*	*	*	
IN remote 1			0F	Courier Number (current)		30461	30462	G24		Data											
IN Ang remote 1			10	Courier Number (angle)		30463		G30		Data											
IA remote 2			11	Courier Number (current)		30464	30465	G24		Data					*	*	*	*	*	*	
IA Ang remote 2			12	Courier Number (angle)		30466		G30		Data					*	*	*	*	*	*	
IB remote 2			13	Courier Number (current)		30467	30468	G24		Data					*	*	*	*	*	*	
IB Ang remote 2			14	Courier Number (angle)		30469		G30		Data					*	*	*	*	*	*	
IC remote 2			15	Courier Number (current)		30470	30471	G24		Data					*	*	*	*	*	*	
IC Ang remote 2			16	Courier Number (angle)		30472		G30		Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
IN remote 2			17	Courier Number (current)		30473	30474	G24		Data											
IN Ang remote 2			18	Courier Number (angle)		30475		G30		Data											
IA Differential			19	Courier Number (current)		30476	30477	G24		Data					*	*	*	*	*	*	
IB Differential			1A	Courier Number (current)		30478	30479	G24		Data					*	*	*	*	*	*	
IC Differential			1B	Courier Number (current)		30480	30481	G24		Data					*	*	*	*	*	*	
IN Differential			1C	Courier Number (current)		30482	30483	G24		Data											
IA Bias			1D	Courier Number (current)		30484	30485	G24		Data					*	*	*	*	*	*	
IB Bias			1E	Courier Number (current)		30486	30487	G24		Data					*	*	*	*	*	*	
IC Bias			1F	Courier Number (current)		30488	30489	G24		Data					*	*	*	*	*	*	
Thermal State			20	Courier Number (percentage)		30490		G30		Data					*	*	*	*	*	*	(0917 =1) && (3C01>=1)
Reset Thermal			21	Indexed String	G11	40104		G11	No	Command	0	1	1	1	*	*	*	*	*	*	(0917 =1) && (3C01>=1)
MEASUREMENTS 4		05	00												*	*	*	*	*	*	
Ch 1 Prop Delay			01	Courier Number (time)		30500		G25		Data					*	*	*	*	*	*	Propagation time delay Ch1
Ch 2 Prop Delay			02	Courier Number (time)		30501		G25		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 Propagation time delay Ch2
Channel Status			03	Binary Flag (10) & Indexed String	G113	30502		G113		Data					*	*	*	*			Channel status
Channel Status			03	Binary Flag (13) & Indexed String	G113	30502		G113		Data									*	*	Channel Status
Elapsed Time			04	Courier Number (time)		30503	30504	G24		Data					*	*	*	*	*	*	Seconds since power up or statistics reset
Ch1 No.Vald Mess			05	Unsigned Integer (32 bits)		30505		G1		Data					*	*	*	*	*	*	No. of valid messages Ch1
Ch1 No.Err Mess			06	Unsigned Integer (32 bits)		30506		G1		Data					*	*	*	*	*	*	No. of errored messages Ch1
Ch1 No.Errored s			07	Unsigned Integer (32 bits)		30507		G1		Data					*	*	*	*	*	*	No. of errored seconds Ch1
Ch1 No.Sev Err s			08	Unsigned Integer (32 bits)		30508		G1		Data					*	*	*	*	*	*	No. of severely errored seconds Ch1
Ch1 No.Dgraded m			09	Unsigned Integer (32 bits)		30509		G1		Data					*	*	*	*	*	*	No. of degraded minutes Ch1
Ch2 No.Vald Mess			0A	Unsigned Integer (32 bits)		30510		G1		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 No. of valid messages Ch2
Ch2 No.Err Mess			0B	Unsigned Integer (32 bits)		30511		G1		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 No. of errored messages Ch2
Ch2 No.Errored s			0C	Unsigned Integer (32 bits)		30512		G1		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 No. of errored seconds Ch2
Ch2 No.Sev Err s			0D	Unsigned Integer (32 bits)		30513		G1		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 No. of severely errored seconds Ch2
Ch2 No.Dgraded m			0E	Unsigned Integer (32 bits)		30514		G1		Data					*	*	*	*	*	*	2001 = 0 OR 2001 = 2 No. of degraded minutes Ch2
Clear Statistics			0F	Indexed String	G11	40105		G11	No	Command	0	1	1	1	*	*	*	*	*	*	Reset All Values
Ch1 Rx Prop Delay			11	Courier Number (time)		30515		G25		Data									*	*	Propagation Delay Ch1 Rx

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Ch1 Tx Prop Delay			12	Courier Number (time)		30516		G25		Data									*	*	Propagation Delay Ch1 Tx
Ch2 Rx Prop Delay			13	Courier Number (time)		30517		G25		Data									*	*	(2001 = 0 OR 2001 = 2)&2013=Enabled Propagation Delay Ch2 Rx
Ch2 Tx Prop Delay			14	Courier Number (time)		30518		G25		Data									*	*	(2001 = 0 OR 2001 = 2 &2013=Enabled Propagation Delay Ch2 Tx
	N/A					30519	30520	G27		Data					*	*	*	*	*	*	Ch1 No.Vald Mess (see [0505])
	N/A					30521	30522	G27		Data					*	*	*	*	*	*	Ch1 No.Err Mess (see [0506])
	N/A					30523	30524	G27		Data					*	*	*	*	*	*	Ch2 No.Vald Mess (see [050A])
	N/A					30525	30526	G27		Data					*	*	*	*	*	*	Ch2 No.Err Mess (see [050B])
CB OPERATION		06	00												*	*	*		*		CB CONDITION MONITORING
CB Operations			01	Unsigned Integer (16 bits)		30600		G1		Data					*	*					Number of Circuit Breaker Operations
CB A Operations			02	Unsigned Integer (16 bits)		30601		G1		Data							*		*		Number of Circuit Breaker Operations
CB B Operations			03	Unsigned Integer (16 bits)		30602		G1		Data							*		*		Number of Circuit Breaker Operations
CB C Operations			04	Unsigned Integer (16 bits)		30603		G1		Data							*		*		Number of Circuit Breaker Operations
Total IA Broken			05	Courier Number (current)		30604	30605	G24		Data							*		*		Broken Current A Phase
Total IB Broken			06	Courier Number (current)		30606	30607	G24		Data					*	*	*		*		Broken Current B Phase
Total IC Broken			07	Courier Number (current)		30608	30609	G24		Data					*	*	*		*		Broken Current C Phase
CB Operate Time			08	Courier Number (time)		30610		G25		Data					*	*	*		*		Circuit Breaker operating time
Reset CB Data			09	Indexed String	G11	40150		G11	No	Command					*	*	*		*		Reset All Values
CB CONTROL		07	00												*	*	*	*	*	*	
CB Control by			01	Indexed String	G99	40200		G99	Disabled	Setting	0	7	1	2	*	*	*	*	*	*	
Close Pulse Time			02	Courier Number (time)		40201		G2	0.5	Setting	0.1	10	0.01	2	*	*	*	*	*	*	
Trip Pulse Time			03	Courier Number (time)		40202		G2	0.5	Setting	0.1	5	0.01	2	*	*	*	*	*	*	
Man Close t max			04	Courier Number (time)				G35	1	Setting	0.01	9999	0.01	2							
Man Close Delay			05	Courier Number (time)		40203		G2	10	Setting	0.01	600	0.01	2	*	*	*	*	*	*	Manual Close Delay
CB Healthy Time			06	Courier Number (time)		40204	40205	G35	5	Setting	0.01	9999	0.01	2	*	*	*	*	*	*	CB Healthy Window
Check Sync Time			07	Courier Number (time)		40206	40207	G35	5	Setting	0.01	9999	0.01	2			*		*		System Checks OK Window
Lockout Reset			08	Indexed String	G11	40208		G11	No	Command	0	1	1	2		*	*		*		
Reset Lockout by			09	Indexed String	G81	40209		G81	CB Close	Setting	0	1	1	2	*	*	*		*		
Man Close RstDly			0A	Courier Number (time)		40210		G2	5	Setting	0.1	600	0.01	2	*	*	*		*		Manual Close Reset Delay
AR TeleControl			0B	Indexed String	G78	40211		G78	No Operation	Command	0	2	1	2		*					
Single Pole A/R			0C	Indexed String	G37	40212		G37	Disabled	Setting	0	1	1	2			*		*		Single Pole Autoreclose
Three Pole A/R			0D	Indexed String	G37	40213		G37	Enabled	Setting	0	1	1	2			*		*		Three Pole Autoclose

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
A/R Status			0E	Indexed String		30611		G83		Data						*					Auto mode / non auto mode
Total Reclosures			0F	Unsigned Integer (16 bits)				G1		Data						*	*		*		No of Autoreclosures
Reset Total A/R			10	Indexed String		40214		G11	No	Command	0	1	1	2		*	*		*		Reset No of Autoreclosures
CB Status Input			11	Indexed String	G118	40215		G118	Both 52A and 52B	Setting	0	3	1	2	*	*					52A and 52B Logic Input
CB Status Input			11	Indexed String	G118	405215		G118	52B 1 pole	Setting	0	6	1	2			*	*	*	*	52A and 52B Logic Input
DATE AND TIME		08	00												*	*	*	*	*	*	
Date/Time	N/A		01	IEC870 Time & Date		40300	40303	G12		Setting				0	*	*	*	*	*	*	
Date/Time	N/A		N/A	IEC870 Time & Date		42049	42052	G12		Setting				0	*	*	*	*	*	*	Modbus only
Date 12-Jan-98			N/A												*	*	*	*	*	*	Front Panel Menu only
Time 12:00			N/A												*	*	*	*	*	*	Front Panel Menu only
IRIG-B Sync			04	Indexed String	G37	40304		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
IRIG-B Status			05	Indexed String	G17	30090		G17		Data					*	*	*	*	*	*	
Battery Status			06	Indexed String	G59	30091		G59		Data					*	*	*	*	*	*	
Battery Alarm			07	Indexed String	G37	40305		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
CONFIGURATION		09	00												*	*	*	*	*	*	
Restore Defaults			01	Indexed String	G53	40402		G53	No Operation	Command	0	5	1	2	*	*	*	*	*	*	
Setting Group			02	Indexed String	G61	40403		G61	Select via Menu	Setting	0	1	1	2	*	*	*	*	*	*	
Active Settings			03	Indexed String	G90	40404		G90	Group 1	Setting	0	3	1	1	*	*	*	*	*	*	
Save Changes			04	Indexed String	G62	40405		G62	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Copy From			05	Indexed String	G90	40406		G90	Group 1	Setting	0	3	1	2	*	*	*	*	*	*	
Copy To			06	Indexed String	G98	40407		G98	No Operation	Command	0	3	1	2	*	*	*	*	*	*	
Setting Group 1			07	Indexed String	G37	40408		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Setting Group 2			08	Indexed String	G37	40409		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Setting Group 3			09	Indexed String	G37	40410		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Setting Group 4			0A	Indexed String	G37	40411		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Phase Diff			0B	Indexed String	G37	40412		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Neutral Diff			0C	Indexed String	G37	40413		G37	Disabled	Setting	0	1	1	2							
Distance			0D	Indexed String	G37	40414		G37	Enabled	Setting	0	1	1	2			*	*	*	*	
Tripping Mode			0E	Indexed String	G102	40415		G102	3 Pole	Setting	0	1	1	2			*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Opto Filter Cntl			0F	Binary Flag (8 Bit)	G8	40438	40439	G8	0xFF	Setting	0xFF	8	1	2	*						
Opto Filter Cntl			0F	Binary Flag (16 Bit)	G8	40438	40439	G8	0xFFFF	Setting	0xFFFF	16	1	2		*	*	*			
Opto Filter Cntl			0F	Binary Flag (32 Bit)	G8	40438	40439	G8	0xFFFFFF	Setting	0xFFFFFF	32	1	2					*	*	
Overcurrent			10	Indexed String	G37	40417		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Neg Sequence O/C			11	Indexed String	G37	40418		G37		Setting	0	1	1	2							
Broken Conductor			12	Indexed String	G37	40419		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Earth Fault			13	Indexed String	G37	40420		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Product Specific			14	Indexed String		40421				Setting	0	1	1	2							
Sensitive E/F			15	Indexed String	G37	40422		G37	Disabled	Setting	0	1	1	2			*	*	*	*	
Residual O/V NVD			16	Indexed String	G37	40423		G37		Setting	0	1	1	2							Residual Overvoltage
Thermal Overload			17	Indexed String	G37	40424		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Product Specific			18	Indexed String		40425								2							
Product Specific			19	Indexed String		40426								2							
Product Specific			1A	Indexed String		40427								2							
Product Specific			1B	Indexed String		40428								2							
Product Specific			1C	Indexed String		40429								2							
Volt Protection			1D	Indexed String	G37	40430		G37		Setting	0	1	1	2							
Freq Protection			1E	Indexed String	G37	40431		G37		Setting	0	1	1	2							
RTD Inputs			1F	Indexed String	G37	40432		G37		Setting	0	1	1	2							
CB Fail			20	Indexed String	G37	40433		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Supervision			21	Indexed String	G37	40434		G37	Enabled	Setting	0	1	1	2			*	*	*	*	
Fault Locator			22	Indexed String	G37	40435		G37	Enabled	Setting	0	1	1	2			*	*	*	*	
System Checks			23	Indexed String	G37	40436		G37	Disabled	Setting	0	1	1	2			*		*		
Auto-Reclose			24	Indexed String	G37	40437		G37	Disabled	Setting	0	1	1	2		*	*		*		
Input Labels			25	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Output Labels			26	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
RTD Labels			27	Indexed String	G80					Setting	0	1	1	1							
CT & VT Ratios			28	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Record Control			29	Indexed String	G80				Invisible	Setting	0	1	1	1	*	*	*	*	*	*	
Disturb Recorder			2A	Indexed String	G80				Invisible	Setting	0	1	1	1	*	*	*	*	*	*	Disturbance recorder
Measure't Setup			2B	Indexed String	G80				Invisible	Setting	0	1	1	1	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Comms Settings			2C	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Commission Tests			2D	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Setting Values			2E	Indexed String	G54				Primary	Setting	0	1	1	1	*	*	*	*	*	*	
Control Inputs			2F	Indexed String	G80				Visible	Setting	0	1	1	2	*	*	*	*	*	*	
Ctrl I/P Config			35	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Ctrl I/P Labels			36	Indexed String	G80				Visible	Setting	0	1	1	1	*	*	*	*	*	*	
Direct Access			39	Indexed String	G231				Enabled	Setting	0	1	1	1	*	*	*	*	*	*	
LCD Contrast			FF	Unsigned Integer (16 bits)					11	Setting	0	31	1	1	*	*	*	*	*	*	
						40400		G18							*	*	*	*	*	*	Record Selection command Register
						40401		G6							*	*	*	*	*	*	Record Control Command Register
																					Ratios used for display of primary
CT AND VT RATIOS		0A	00												*	*	*	*	*	*	values for multiplier see mult column
Main VT Primary			01	Courier Number (voltage)		40500	40501	G35	110	Setting	100	1000000	1	2			*	*	*	*	Label V1=Main VT Rating/110
Main VT Sec'y			02	Courier Number (voltage)		40502		G2	110	Setting	80*V1	140*V1	1*V1	2			*	*	*	*	Label M1=0A01/0A02
C/S VT Primary			03	Courier Number (voltage)		40503	40504	G35	110	Setting	100	1000000	1	2			*		*		Label V2=C/S VT Rating/110
C/S VT Secondary			04	Courier Number (voltage)		40505		G2	110	Setting	80*V2	140*V2	1*V2	2			*		*		Check Sync VT Secondary Label M2=0A03/0A04
NVD VT Primary			05	Courier Number (voltage)		40506	40507	G35		Setting	100	1000000	1	2							Neutral Displacement VT Primary Label V3=Neutral Disp VT Rating/110
NVD VT Secondary			06	Courier Number (voltage)		40508		G2		Setting	100	440	1	2							Neutral Displacement VT Secondary Label M3=0A05/0A06
Phase CT Primary			07	Courier Number (current)		40509		G2	1	Setting	1	30000	1	2	*	*	*	*	*	*	I1=Phase CT secondary rating
Phase CT Sec'y			08	Courier Number (current)		40510		G2	1	Setting	1	5	4	2	*	*	*	*	*	*	Label M4=0A07/0A08
E/F CT Primary			09	Courier Number (current)		40511		G2	1	Setting	1	30000	1	2	*	*	*	*	*	*	Label I2=E/F CT secondary rating
E/F CT Secondary			0A	Courier Number (current)		40512		G2	1	Setting	1	5	4	2	*	*	*	*	*	*	Label M5=0A09/0A0A
SEF CT Primary			0B	Courier Number (current)		40513		G2		Setting	1	30000	1	2							Label I3=SEF CT secondary rating
SEF CT Secondary			0C	Courier Number (current)		40514		G2		Setting	1	5	4	2							Label M6=0A0B/0A0C
MComp CT Primary			0D	Courier Number (current)		40515		G2	1	Setting	1	30000	1	2			*	*	*	*	Mutual Compensation CT Primary Label I4=Mutual Comp CT Rating
MComp CT Sec'y			0E	Courier Number (current)		40516		G2	1	Setting	1	5	4	2			*	*	*	*	Mutual Compensation CT Secondary Label M7=0A0D/0A0E
C/S Input			0F	Indexed String	G40	40517		G40	A-N	Setting	0	5	1	2			*		*		
Main VT Location			10	Indexed String	G89	40518		G89	Line	Setting	0	1	1	2			*		*		
RECORD CONTROL		0B	00												*	*	*	*	*	*	
Clear Events			01	Indexed String	G11				No	Command	0	1	1	1	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Clear Faults			02	Indexed String	G11				No	Command	0	1	1	1	*	*	*	*	*	*	
Clear Maint			03	Indexed String	G11				No	Command	0	1	1	1	*	*	*	*	*	*	
Alarm Event			04	Indexed String	G37	40520		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Relay O/P Event			05	Indexed String	G37	40521		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Opto Input Event			06	Indexed String	G37	40522		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
General Event			07	Indexed String	G37	40523		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Fault Rec Event			08	Indexed String	G37	40524		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Maint Rec Event			09	Indexed String	G37	40525		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
Protection Event			0A	Indexed String	G37	40526		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
DDB 31 - 0			0B	Binary Flag (32 Bit)	G27	40527	40528	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 63 - 32			0C	Binary Flag (32 Bit)	G27	40529	40530	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 95 - 64			0D	Binary Flag (32 Bit)	G27	40531	40532	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 127 - 96			0E	Binary Flag (32 Bit)	G27	40533	40534	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 159 - 128			0F	Binary Flag (32 Bit)	G27	40535	40536	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 191 - 160			10	Binary Flag (32 Bit)	G27	40537	40538	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 223 - 192			11	Binary Flag (32 Bit)	G27	40539	40540	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 255 - 224			12	Binary Flag (32 Bit)	G27	40541	40542	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 287 - 256			13	Binary Flag (32 Bit)	G27	40543	40544	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 319 - 288			14	Binary Flag (32 Bit)	G27	40545	40546	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 351 - 320			15	Binary Flag (32 Bit)	G27	40547	40548	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 383 - 352			16	Binary Flag (32 Bit)	G27	40549	40550	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 415 - 384			17	Binary Flag (32 Bit)	G27	40551	40552	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 447 - 416			18	Binary Flag (32 Bit)	G27	40553	40554	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 479 - 448			19	Binary Flag (32 Bit)	G27	40555	40556	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 511 - 480			1A	Binary Flag (32 Bit)	G27	40557	40558	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 543 - 512			1B	Binary Flag (32 Bit)	G27	40559	40560	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 575 - 544			1C	Binary Flag (32 Bit)	G27	40561	40562	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 607 - 576			1D	Binary Flag (32 Bit)	G27	40563	40564	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 639 - 608			1E	Binary Flag (32 Bit)	G27	40565	40566	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 671 - 640			1F	Binary Flag (32 Bit)	G27	40567	40568	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 703 - 672			20	Binary Flag (32 Bit)	G27	40569	40570	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
DDB 735 - 704			21	Binary Flag (32 Bit)	G27	40571	40572	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 767 - 736			22	Binary Flag (32 Bit)	G27	40573	40574	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 799 - 768			23	Binary Flag (32 Bit)	G27	40575	40576	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 831 - 800			24	Binary Flag (32 Bit)	G27	40577	40578	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 863 - 832			25	Binary Flag (32 Bit)	G27	40579	40580	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 895 - 864			26	Binary Flag (32 Bit)	G27	40581	40582	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 927 - 896			27	Binary Flag (32 Bit)	G27	40583	40584	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 959 - 928			28	Binary Flag (32 Bit)	G27	40585	40586	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 991 - 960			29	Binary Flag (32 Bit)	G27	40587	40588	G27	0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	
DDB 1022 - 992			2A	Binary Flag (32 Bit)	G27	40589	40590	G27	0xFFFFFFFF	Setting	0x7FFFFFFF	32	1	2	*	*	*	*	*	*	
Clear Dist Recs			30	Indexed String	G11				No	Command	0	1	1	1	*	*	*	*	*	*	
DISTURB RECORDER		0C	00												*	*	*	*	*	*	DISTURBANCE RECORDER
Duration			01	Courier Number (time)		40600		G2	1.5	Setting	0.1	10.5	0.01	2	*	*	*	*	*	*	
Trigger Position			02	Courier Number (percentage)		40601		G2	33.3	Setting	0	100	0.1	2	*	*	*	*	*	*	
Trigger Mode			03	Indexed String	G34	40602		G34	Single		0	1	1	2	*	*	*	*	*	*	
Analog Channel 1			04	Indexed String	G31	40603		G31	VA	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 2			05	Indexed String	G31	40604		G31	VB	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 3			06	Indexed String	G31	40605		G31	VC	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 4			07	Indexed String	G31	40606		G31	IA	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 5			08	Indexed String	G31	40607		G31	IB	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 6			09	Indexed String	G31	40608		G31	IC	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 7			0A	Indexed String	G31	40609		G31	IN	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Analog Channel 8			0B	Indexed String	G31	40610		G31	IN2	Setting	0	3/3/8/11	1	2	*	*	*	*	*	*	
Digital Input 1			0C	Indexed String	G32	40611		G32	Relay 1	Setting	0	DDB Size	1	2	*	*	*	*	*	*	Note: Number of Signals model dependant
Input 1 Trigger			0D	Indexed String	G66	40612		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 2			0E	Indexed String	G32	40613		G32	Relay 2	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 2 Trigger			0F	Indexed String	G66	40614		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 3			10	Indexed String	G32	40615		G32	Relay 3	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 3 Trigger			11	Indexed String	G66	40616		G66	Trigger L/H	Setting	0	2	1	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Digital Input 4			12	Indexed String	G32	40617		G32	Relay 4	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 4 Trigger			13	Indexed String	G66	40618		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 5			14	Indexed String	G32	40619		G32	Relay 5	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 5 Trigger			15	Indexed String	G66	40620		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 6			16	Indexed String	G32	40621		G32	Relay 6	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 6 Trigger			17	Indexed String	G66	40622		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 7			18	Indexed String	G32	40623		G32	Relay 7	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 7 Trigger			19	Indexed String	G66	40624		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 8			1A	Indexed String	G32	40625		G32	Relay 8 Opto Input 1	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 8 Trigger			1B	Indexed String	G66	40626		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 9			1C	Indexed String	G32	40627		G32	Relay 9 Opto Input 2	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 9 Trigger			1D	Indexed String	G66	40628		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 10			1E	Indexed String	G32	40629		G32	Relay 10 Opto Input 3	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 10 Trigger			1F	Indexed String	G66	40630		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 11			20	Indexed String	G32	40631		G32	Relay 11 Opto Input 4	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 11 Trigger			21	Indexed String	G66	40632		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 12			22	Indexed String	G32	40633		G32	Relay 12 Opto Input 5	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 12 Trigger			23	Indexed String	G66	40634		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 13			24	Indexed String	G32	40635		G32	Relay 13 Opto Input 6	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 13 Trigger			25	Indexed String	G66	40636		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 14			26	Indexed String	G32	40637		G32	Relay 14 Opto Input 7	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 14 Trigger			27	Indexed String	G66	40638		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 15			28	Indexed String	G32	40639		G32	Opto Input 1 Opto Input 8	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 15 Trigger			29	Indexed String	G66	40640		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 16			2A	Indexed String	G32	40641		G32	Opto Input 2 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 16 Trigger			2B	Indexed String	G66	40642		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 17			2C	Indexed String	G32	40643		G32	Opto Input 3 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 17 Trigger			2D	Indexed String	G66	40644		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 18			2E	Indexed String	G32	40645		G32	Opto Input 4 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 18 Trigger			2F	Indexed String	G66	40646		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 19			30	Indexed String	G32	40647		G32	Opto Input 5 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Input 19 Trigger			31	Indexed String	G66	40648		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 20			32	Indexed String	G32	40649		G32	Opto Input 6 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 20 Trigger			33	Indexed String	G66	40650		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 21			34	Indexed String	G32	40651		G32	Opto Input 7 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 21 Trigger			35	Indexed String	G66	40652		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 22			36	Indexed String	G32	40653		G32	Opto Input 8 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 22 Trigger			37	Indexed String	G66	40654		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 23			38	Indexed String	G32	40655		G32	Opto Input 9 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 23 Trigger			39	Indexed String	G66	40656		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 24			3A	Indexed String	G32	40657		G32	Opto Input 10 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 24 Trigger			3B	Indexed String	G66	40658		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 25			3C	Indexed String	G32	40659		G32	Opto Input 11 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 25 Trigger			3D	Indexed String	G66	40660		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 26			3E	Indexed String	G32	40661		G32	Opto Input 12 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 26 Trigger			3F	Indexed String	G66	40662		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 27			40	Indexed String	G32	40663		G32	Opto Input 13 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 27 Trigger			41	Indexed String	G66	40664		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 28			42	Indexed String	G32	40665		G32	Opto Input 14 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 28 Trigger			43	Indexed String	G66	40666		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 29			44	Indexed String	G32	40667		G32	Opto Input 15 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 29 Trigger			45	Indexed String	G66	40668		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 30			46	Indexed String	G32	40669		G32	Opto Input 16 Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 30 Trigger			47	Indexed String	G66	40670		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 31			48	Indexed String	G32	40671		G32	Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 31 Trigger			49	Indexed String	G66	40672		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
Digital Input 32			4A	Indexed String	G32	40673		G32	Not Used	Setting	0	DDB Size	1	2	*	*	*	*	*	*	
Input 32 Trigger			4B	Indexed String	G66	40674		G66	No Trigger	Setting	0	2	1	2	*	*	*	*	*	*	
MEASURE'T SETUP		0D	00												*	*	*	*	*	*	MEASUREMENT SETTINGS
Default Display			01	Indexed String	G52 G110	40700		G52	Description	Setting	0	7	1	2			*	*	*	*	
Default Display			01	Indexed String	G110	40700		G110	Description	Setting	0	5	1	2	*	*					

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Local Values			02	Indexed String	G54	40701		G54	Primary	Setting	0	1	1	1	*	*	*	*	*	*	Local Measurement Values
Remote Values			03	Indexed String	G54	40702		G54	Primary	Setting	0	1	1	1	*	*	*	*	*	*	Remote Measurement Values
Measurement Ref			04	Indexed String	G56	40703		G56	VA	Setting	0	5	1	1			*	*	*	*	Measurement Phase Reference
Measurement Ref			04	Indexed String	G56	40703		G56	IA	Setting	0	2	1	1	*	*					Measurement Phase Reference
Fix Dem Period			06	Courier Number (time-minutes)		40706		G2	30	Setting	1	99	1	2	*	*	*	*	*	*	Fixed Demand Interval
Roll Sub Period			07	Courier Number (time-minutes)		40707		G2	30	Setting	1	99	1	2	*	*	*	*	*	*	Rolling demand sub period
Num Sub Periods			08	Unsigned Integer (16 bits)		40708		G1	1	Setting	1	15	1	2	*	*	*	*	*	*	Number of rolling sub-periods
Distance Unit			09	Indexed String	G97	40709		G97	Miles	Setting	0	1	1	2			*	*	*	*	
Fault Location			0A	Indexed String	G51	40710		G51	Distance	Setting	0	2	1	2			*	*	*	*	
Remote 2 Values			0B	Indexed String	G54	40711		G54	Primary	Setting	0	1	1	1	*	*	*	*	*	*	Remote 2 Measurement Values
COMMUNICATIONS		0E	00												*	*	*	*	*	*	
RP1 Protocol			01	Indexed String	G71					Data					*	*	*	*	*	*	
RP1 Address			02	Unsigned Integer (16 bits)					255	Setting	0	255	1	1	*	*	*	*	*	*	Rear Port = Courier or IEC60870-5-103
RP1 Address			02	Unsigned Integer (16 bits)					1	Setting	1	247	1	2	*	*	*	*	*	*	Rear Port = Modbus
RP1 Address			02	Unsigned Integer (16 bits)					1	Setting	0	65519	1	1	*	*	*	*	*	*	Build = DNP 3.0
RP1 InactivTimer			03	Courier Number (time-minutes)					15	Setting	1	30	1	2	*	*	*	*	*	*	
RP1 Baud Rate			04	Indexed String	G38v				19200 bits/s	Setting	0	1	1	2	*	*	*	*	*	*	Rear Port = IEC60870-5-103
RP1 Baud Rate			04	Indexed String	G38m				19200 bits/s	Setting	0	2	1	2	*	*	*	*	*	*	Build = Modbus
RP1 Baud Rate			04	Indexed String	G38d				19200 bits/s	Setting	0	5	1	2	*	*	*	*	*	*	Build = DNP3
RP1 Meas Period			05	Indexed String	G39				None	Setting	0	2	1	2	*	*	*	*	*	*	Build = Modbus or DNP3
RP1 Meas Period			06	Courier Number (time)					10	Setting	1	60	1	2	*	*	*	*	*	*	Build = IEC60870-5-103
RP1 PhysicalLink			07	Indexed String	G21				Copper	Setting	0	1	1	1	*	*	*	*	*	*	Fibre Optic board fitted
RP1 Time Sync			08	Indexed String	G37				Disabled	Setting	0	1	1	2	*	*	*	*	*	*	Build=DNP 3.0
Modbus IEC Time			09	Indexed String	G238	40306		G1	Standard	Setting	0	1	1	2	*	*	*	*	*	*	Build = Modbus
RP1 CS103Blcking			0A	Indexed String	G210				Disabled	Setting	0	2	1	2	*	*	*	*	*	*	Build=IEC60870-5-103
RP1 Card Status			0B	Indexed String	G208			G1		Data					*	*	*	*	*	*	Build = K Bus
RP1 Port Config			0C	Indexed String	G207			G1	K Bus	Setting	0	1	1	2	*	*	*	*	*	*	When 0E0B ≠ 2 (RP1 Port status shows K-Bus OK or EIA485 OK)
RP1 Comms Mode			0D	Indexed String	G206			G1	IEC60870 FT1.2	Setting	0	1	1	2	*	*	*	*	*	*	When 0E0B ≠ 0 (RP1 Port status shows EIA485 OK or Fibre-Optic OK)
RP1 Baud Rate			0E	Indexed String	G38m			G1	19200 bits/s	Setting	0	1	1	2	*	*	*	*	*	*	When 0E0B ≠ 0 (RP1 Port status shows EIA485 OK or Fibre-Optic OK)
Ethernet Comms			1F	Indexed String						Data							*	*	*	*	Build=UCA2

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
IP Address			20	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Subnet Mask			21	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
MAC Address			22							Data							*	*	*	*	
GOOSE IED Name			23							Data							*	*	*	*	
Number of Routes			24	Unsigned Integer (16 bits)					0	Setting	0	4	1	2			*	*	*	*	Build=UCA2
Router Address 1			25	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Target Network 1			26	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Router Address 2			27	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Target Network 2			28	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Router Address 3			29	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Target Network 3			2A	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Router Address 4			2B	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
Target Network 4			2C	ASCII Text (16 chars)					000.000.000.000	Setting	48	57	1	2			*	*	*	*	Build=UCA2
NIC InactivTimer			2D	Unsigned Integer (16 bits)					15	Setting	1	30	1	2			*	*	*	*	Build=UCA2
Default Pass Lvl			2E	Unsigned Integer (16 bits)					2	Setting	0	2	1	2			*	*	*	*	Build=UCA2
GOOSE Min Cycle			2F	Unsigned Integer (16 bits)					10	Setting	1	50	1	2			*	*	*	*	Build=UCA2
GOOSE Max Cycle			30	Unsigned Integer (16 bits)					1	Setting	1	60	1	2			*	*	*	*	Build=UCA2
GOOSE Increment			31	Unsigned Integer (16 bits)					900	Setting	0	999	1	2			*	*	*	*	Build=UCA2
GOOSE Startup			32	Indexed String					Promiscuous	Setting	0	1	1	2			*	*	*	*	Build=UCA2
GOOSE VIP Status			34	Binary Flag (32 bits)					0x00000000h	Data							*	*	*	*	Build=UCA2
NSAP Address			36	ASCII Text					0x00000000h	Setting											Build=UCA2
Transport Select			37	ASCII Text					00.00.00.00	Setting											Build=UCA2
Session Select			38	ASCII Text					00.00	Setting											Build=UCA2
Present. Select			39	ASCII Text					00.00	Setting											Build=UCA2
AP Title			3A	ASCII Text					000.000.000.000	Setting											Build=UCA2
AE Qual. Used			3B	Indexed String					Not Used	Setting											Build=UCA2
AE Qualifier			3C	Unsigned Integer (16 bits)					0	Setting											Build=UCA2
Ethernet Media			3D	Indexed String	G220				Copper	Setting	0	1	1	2			*	*	*	*	Build=UCA2
GOOSE STATISTICS			3F	(Sub Heading)													*	*	*	*	Build=UCA2
Enrolled Flags			40	Binary Flag (32 bits)					0x00000000h	Data							*	*	*	*	Build=UCA2
Tx Msg Count			41	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Rx Msg Count			42	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
DDB Changes			43	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
Last Seq Tx			44	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
Last Msg Tx			45	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
Msg Reject Count			46	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED View Select			50	Unsigned Integer (16 bits)					0	Setting	0	32	1	0			*	*	*	*	Build=UCA2
IED Rx Msgs			51	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Last Seq Rx			52	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Last Msg Rx			53	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Missed Msgs			54	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Missed Chngs			55	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Timeouts			56	Unsigned Integer (16 bits)					0	Data							*	*	*	*	Build=UCA2
IED Stats Reset			5F	Indexed String					None	Setting	0	4	1	2			*	*	*	*	Build=UCA2
Loopback Mode			60	Indexed String					Loopback Off	Setting	0	2	1	2			*	*	*	*	Build=UCA2
Reload Mode			61	Indexed String					No Action	Setting	0	1	1	2			*	*	*	*	Build=UCA2
Report Link Test			6A	Indexed String	G226				Alarm	Data	0	2	1	2			*	*	*	*	Build=UCA2
Link Timeout			6B	Courier Number (time)					60	Setting	0.1	60	0.1	2			*	*	*	*	Build=UCA2
COMMUNICATIONS				extensions											*	*	*	*	*	*	
REAR PORT2 (RP2)			80	(Sub Heading)											*	*	*	*	*	*	RearCommsCardState != UNSUPPORTED
RP2 Protocol			81	Indexed String	G71			G1	Fixed at 'Courier'	Data					*	*	*	*	*	*	RearCommsCardState != UNSUPPORTED
RP2 Card Status			84	Indexed String	G204			G1		Data					*	*	*	*	*	*	RearCommsCardState != UNSUPPORTED
RP2 Port Config			88	Indexed String	G205			G1	RS232/60870-5-2	Setting	0	1	1	2	*	*	*	*	*	*	RearCommsCardState= OK
RP2 Comms Mode			8A	Indexed String	G206			G1	IEC60870 FT1.2	Setting	0	1	1	2	*	*	*	*	*	*	RearCommsCardState= OK AND OE18=0
RP2 Address			90	Unsigned Integer (16 bits)				G1	255	Setting	0	255	1	1	*	*	*	*	*	*	RearCommsCardState= OK
RP2 InactivTimer			92	Courier Number (time-minutes)				G2	15	Setting	1	30	1	2	*	*	*	*	*	*	RearCommsCardState= OK
RP2 Baud Rate			94	Indexed String	G38m			G1	19200 bits/s	Setting	0	1	1	2	*	*	*	*	*	*	RearCommsCardState= OK AND OE18=0
COMMISSION TESTS		0F	00												*	*	*	*	*	*	
Opto I/P Status			01	Binary Flag (24) Indexed String				G8		Data					*	*	*	*	*	*	
Relay O/P Status			02	Binary Flag (14) Indexed String				G9		Data					*	*	*	*	*	*	
Test Port Status			03	Binary Flag (8) Indexed String				0-7		Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
LED Status			04	Binary Flag (8)	0-7			0-7		Data					*	*	*	*	*	*	
Monitor Bit 1			05	Unsigned Integer (16 bits)		40850		G1	64	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 1
Monitor Bit 2			06	Unsigned Integer (16 bits)		40851		G1	65	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 2
Monitor Bit 3			07	Unsigned Integer (16 bits)		40852		G1	66	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 3
Monitor Bit 4			08	Unsigned Integer (16 bits)		40853		G1	67	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 4
Monitor Bit 5			09	Unsigned Integer (16 bits)		40854		G1	68	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 5
Monitor Bit 6			0A	Unsigned Integer (16 bits)		40855		G1	69	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 6
Monitor Bit 7			0B	Unsigned Integer (16 bits)		40856		G1	70	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 7
Monitor Bit 8			0C	Unsigned Integer (16 bits)		40857		G1	71	Setting	0	1022	1	1	*	*	*	*	*	*	Default LED 8
Test Mode			0D	Indexed String	G119	40858		G119	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
Test Pattern			0E	Binary Flag (21) Indexed String	G9	40859	40860	G9	0	Setting	127	7	1	2	*						
Test Pattern			0E	Binary Flag (21) Indexed String	G9	40859	40860	G9	0	Setting	16383	14	1	2		*	*	*			
Test Pattern			0E	Binary Flag (21) Indexed String	G9	40859	40860	G9	0	Setting	4294967295	32	1	2					*	*	
Contact Test			0F	Indexed String	G93	40861		G93	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Test LEDs			10	Indexed String	G94	40862		G94	No Operation	Command	0	1	1	2	*	*	*	*	*	*	
Test Autoreclose			11	Indexed String	G36	40863		G36	No Operation	Command	0	1	1	2		*			*		
Test Autoreclose			11	Indexed String	G36	40836		G36	No Operation	Command	0	4	1	2			*		*		
Test Loopback			12	Indexed String	G121	40864		G121	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
DDB 31 - 0	N/A		20	Binary Flag (32)		30723	30724	G27		Data					*	*	*	*	*	*	
DDB 63 - 32	N/A		21	Binary Flag (32)		30725	30726	G27		Data					*	*	*	*	*	*	
DDB 95 - 64	N/A		22	Binary Flag (32)		30727	30728	G27		Data					*	*	*	*	*	*	
DDB 127 - 96	N/A		23	Binary Flag (32)		30729	30730	G27		Data					*	*	*	*	*	*	
DDB 159 - 128	N/A		24	Binary Flag (32)		30731	30732	G27		Data					*	*	*	*	*	*	
DDB 191 - 160	N/A		25	Binary Flag (32)		30733	30734	G27		Data					*	*	*	*	*	*	
DDB 223 - 192	N/A		26	Binary Flag (32)		30735	30736	G27		Data					*	*	*	*	*	*	
DDB 255 - 224	N/A		27	Binary Flag (32)		30737	30738	G27		Data					*	*	*	*	*	*	
DDB 287 - 256	N/A		28	Binary Flag (32)		30739	30740	G27		Data					*	*	*	*	*	*	
DDB 319 - 288	N/A		29	Binary Flag (32)		30741	30742	G27		Data					*	*	*	*	*	*	
DDB 351 - 320	N/A		2A	Binary Flag (32)		30743	30744	G27		Data					*	*	*	*	*	*	
DDB 383 - 352	N/A		2B	Binary Flag (32)		30745	30746	G27		Data					*	*	*	*	*	*	
DDB 415 - 384	N/A		2C	Binary Flag (32)		30747	30748	G27		Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
DDB 447 - 416	N/A		2D	Binary Flag (32)		30749	30750	G27		Data					*	*	*	*	*	*	
DDB 479 - 448	N/A		2E	Binary Flag (32)		30751	30752	G27		Data					*	*	*	*	*	*	
DDB 511 - 480	N/A		2F	Binary Flag (32)		30753	30754	G27		Data					*	*	*	*	*	*	
DDB 543 - 512	N/A		30	Binary Flag (32)		30755	30756	G27		Data					*	*	*	*	*	*	
DDB 575 - 544	N/A		31	Binary Flag (32)		30757	30758	G27		Data					*	*	*	*	*	*	
DDB 607 - 576	N/A		32	Binary Flag (32)		30759	30760	G27		Data					*	*	*	*	*	*	
DDB 639 - 608	N/A		33	Binary Flag (32)		30761	30762	G27		Data					*	*	*	*	*	*	
DDB 671 - 640	N/A		34	Binary Flag (32)		30763	30764	G27		Data					*	*	*	*	*	*	
DDB 703 - 672	N/A		35	Binary Flag (32)		30765	30766	G27		Data					*	*	*	*	*	*	
DDB 735 - 704	N/A		36	Binary Flag (32)		30767	30768	G27		Data					*	*	*	*	*	*	
DDB 767 - 736	N/A		37	Binary Flag (32)		30769	30770	G27		Data					*	*	*	*	*	*	
DDB 799 - 768	N/A		38	Binary Flag (32)		30771	30772	G27		Data					*	*	*	*	*	*	
DDB 831 - 800	N/A		39	Binary Flag (32)		30773	30774	G27		Data					*	*	*	*	*	*	
DDB 863 - 832	N/A		3A	Binary Flag (32)		30775	30776	G27		Data					*	*	*	*	*	*	
DDB 895 - 864	N/A		3B	Binary Flag (32)		30777	30778	G27		Data					*	*	*	*	*	*	
DDB 927 - 896	N/A		3C	Binary Flag (32)		30779	30780	G27		Data					*	*	*	*	*	*	
DDB 959 - 928	N/A		3D	Binary Flag (32)		30781	30782	G27		Data					*	*	*	*	*	*	
DDB 991 - 960	N/A		3E	Binary Flag (32)		30783	30784	G27		Data					*	*	*	*	*	*	
DDB 1022 - 992	N/A		3F	Binary Flag (32)		30785	30786	G27		Data					*	*	*	*	*	*	
N.B. South Pars Extensions	N/A			Binary Flag (16)		30701		G1		Data					*	*	*	*	*	*	Relay status (repeat of Courier Status)
	N/A			Courier Number (current)		30702		G24		Data					*	*	*	*	*	*	IA Magnitude
	N/A			Courier Number (current)		30704		G24		Data					*	*	*	*	*	*	IB Magnitude
	N/A			Courier Number (current)		30706		G24		Data					*	*	*	*	*	*	IC Magnitude
	N/A			Courier Number (voltage)		30708		G24		Data							*	*	*	*	VAB Magnitude
	N/A			Courier Number (voltage)		30710		G24		Data							*	*	*	*	VBC Magnitude
	N/A			Courier Number (voltage)		30712		G24		Data							*	*	*	*	VCA Magnitude
	N/A			Courier Number (power)		30714		G29		Data							*	*	*	*	3 Phase Watts
	N/A			Courier Number (power)		30717		G29		Data							*	*	*	*	3 Phase VArs
	N/A			Courier Number (decimal)		30720		G30		Data							*	*	*	*	3 Phase Power Factor
	N/A			Courier Number (frequency)		30721		G30		Data					*	*	*	*	*	*	Frequency
	N/A			Binary Flag (8)		30722		G1		Data					*	*	*	*	*	*	Relay Test Port Status
CB MONITOR SETUP		10	00												*	*	*		*		
Broken I^			01	Courier Number (decimal)		40151		G2	2	Setting	1	2	0.1	2	*	*	*		*		Broken Current Index Note: NM1 = 0A08^1001
I^ Maintenance			02	Indexed String	G88	40152		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		Broken Current maintenance alarm
I^ Maintenance			03	Courier Number (current)		40153	40154	G35	1000	Setting	1	25000	1	2	*	*	*		*		IX Maintenance Alarm
I^ Lockout			04	Indexed String	G88	40155		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		Broken Current lockout alarm

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
I^ Lockout			05	Courier Number (current)		40156	40157	G35	2000	Setting	1	25000	1	2	*	*	*		*		Broken Current lockout threshold
No. CB Ops Maint			06	Indexed String	G88	40158		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		Circuit Breaker Trips maintenance alarm
No. CB Ops Maint			07	Unsigned Integer (16 bits)		40159		G1	10	Setting	1	10000	1	2	*	*	*		*		CB Trips maintenance threshold
No. CB Ops Lock			08	Indexed String	G88	40160		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		Circuit Breaker Trips lockout alarm
No. CB Ops Lock			09	Unsigned Integer (16 bits)		40161		G1	20	Setting	1	10000	1	2	*	*	*		*		CB Trips lockout threshold
CB Time Maint			0A	Indexed String	G88	40162		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		CB Operating Time maintenance alarm
CB Time Maint			0B	Courier Number (time)		40163	40164	G35	0.1	Setting	0.005	0.5	0.001	2	*	*	*		*		CB Operating Time maintenance threshold
CB Time Lockout			0C	Indexed String	G88	40165		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		CB Operating Time lockout alarm
CB Time Lockout			0D	Courier Number (time)		40166	40167	G35	0.2	Setting	0.005	0.5	0.001	2	*	*	*		*		CB Operating Time lockout threshold
Fault Freq Lock			0E	Indexed String	G88	40168		G88	Alarm Disabled	Setting	0	1	1	2	*	*	*		*		Excessive fault frequency alarm
Fault Freq Count			0F	Unsigned Integer (16 bits)		40169		G1	10	Setting	1	9999	1	2	*	*	*		*		Excessive Fault Frequency Counter
Fault Freq Time			10	Courier Number (time)		40170	40171	G35	3600	Setting	0	9999	1	2	*	*	*		*		Excessive Fault Frequency Time
OPTO CONFIG		11	00												*	*	*	*	*	*	Only visible if Universal Optos fitted
Global Nominal V			01	Indexed String	G200	40900		G200	24-27V	Setting	0	5	1	2	*	*	*	*	*	*	
Opto Input 1			02	Indexed String	G201	40901		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 2			03	Indexed String	G201	40902		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 3			04	Indexed String	G201	40903		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 4			05	Indexed String	G201	40904		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 5			06	Indexed String	G201	40905		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 6			07	Indexed String	G201	40906		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 7			08	Indexed String	G201	40907		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 8			09	Indexed String	G201	40908		G201	24-27V	Setting	0	4	1	2	*	*	*	*	*	*	
Opto Input 9			0A	Indexed String	G201	40909		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 10			0B	Indexed String	G201	40910		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 11			0C	Indexed String	G201	40911		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 12			0D	Indexed String	G201	40912		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 13			0E	Indexed String	G201	40913		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 14			0F	Indexed String	G201	40914		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 15			10	Indexed String	G201	40915		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Opto Input 16			11	Indexed String	G201	40916		G201	24-27V	Setting	0	4	1	2		*	*	*	*	*	
Opto Input 17			12	Indexed String	G201	40917		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 18			13	Indexed String	G201	40918		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 19			14	Indexed String	G201	40919		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 20			15	Indexed String	G201	40920		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 21			16	Indexed String	G201	40921		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 22			17	Indexed String	G201	40922		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 23			18	Indexed String	G201	40923		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 24			19	Indexed String	G201	40924		G201	24-27V	Setting	0	4	1	2					*	*	
Opto Input 25			1A	Indexed String	G201	40925		G201	24-27V	Setting	0	4	1	2							
Opto Input 26			1B	Indexed String	G201	40926		G201	24-27V	Setting	0	4	1	2							
Opto Input 27			1C	Indexed String	G201	40927		G201	24-27V	Setting	0	4	1	2							
Opto Input 28			1D	Indexed String	G201	40928		G201	24-27V	Setting	0	4	1	2							
Opto Input 29			1E	Indexed String	G201	40929		G201	24-27V	Setting	0	4	1	2							
Opto Input 30			1F	Indexed String	G201	40930		G201	24-27V	Setting	0	4	1	2							
Opto Input 31			20	Indexed String	G201	40931		G201	24-27V	Setting	0	4	1	2							
Opto Input 32			21	Indexed String	G201	40932		G201	24-27V	Setting	0	4	1	2							
Opto Input 32			21	Indexed String	G201	40932		G201	24-27V	Setting	0	4	1	2							
Characteristic			80	Indexed String	G237	40935		G1	Standard 60%-80%	Setting	0	1	1	2	*	*	*	*	*	*	
CONTROL INPUTS		12	00												*	*	*	*	*	*	
Ctrl I/P Status			01	Binary Flag (32 bits) Indexed String	G202	40800	40801	G202		Data				2	*	*	*	*	*	*	
Control Input 1			02	Indexed String	G203	40802		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 2			03	Indexed String	G203	40803		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 3			04	Indexed String	G203	40804		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 4			05	Indexed String	G203	40805		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 5			06	Indexed String	G203	40806		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 6			07	Indexed String	G203	40807		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 7			08	Indexed String	G203	40808		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 8			09	Indexed String	G203	40809		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 9			0A	Indexed String	G203	40810		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 10			0B	Indexed String	G203	40811		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	

	LCD	Courier Ref			Data Group	Modbus Address		Data Group						Password	Model						
Courier Text	ref	Col	Row	Data Type	Courier	Start	End	Modbus	Default Setting	Cell Type	Min	Max	Step	Level	1	2	3	4	5	6	Comment
Control Input 11			0C	Indexed String	G203	40812		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 12			0D	Indexed String	G203	40813		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 13			0E	Indexed String	G203	40814		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 14			0F	Indexed String	G203	40815		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 15			10	Indexed String	G203	40816		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 16			11	Indexed String	G203	40817		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 17			12	Indexed String	G203	40818		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 18			13	Indexed String	G203	40819		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 19			14	Indexed String	G203	40820		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 20			15	Indexed String	G203	40821		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 21			16	Indexed String	G203	40822		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 22			17	Indexed String	G203	40823		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 23			18	Indexed String	G203	40824		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 24			19	Indexed String	G203	40825		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 25			1A	Indexed String	G203	40826		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 26			1B	Indexed String	G203	40827		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 27			1C	Indexed String	G203	40828		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 28			1D	Indexed String	G203	40829		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 29			1E	Indexed String	G203	40830		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 30			1F	Indexed String	G203	40831		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 31			20	Indexed String	G203	40832		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
Control Input 32			21	Indexed String	G203	40833		G203	No Operation	Command	0	2	1	2	*	*	*	*	*	*	
CTRL I/P CONFIG		13	00												*	*	*	*	*	*	
Hotkey Enabled			01	Binary Flag (32 bits) Indexed String	G233				0xFFFFFFFF	Setting	0xFFFFFFFF	32	1	2	*	*	*	*	*	*	Hotkey Menu - Control Input availability
Control Input 1			10	Indexed String	G234	410,002		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 1			11	Indexed String	G234	410,003		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 2			14	Indexed String	G234	410,004		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 2			15	Indexed String	G232	410,005		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 3			18	Indexed String	G234	410,006		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 3			19	Indexed String	G232	410,007		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Control Input 4			1C	Indexed String	G234	410,008		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 4			1D	Indexed String	G232	410,009		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 5			20	Indexed String	G234	410,010		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 5			21	Indexed String	G232	410,011		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 6			24	Indexed String	G234	410,012		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 6			25	Indexed String	G232	410,013		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 7			28	Indexed String	G234	410,014		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 7			29	Indexed String	G232	410,015		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 8			2C	Indexed String	G234	410,016		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 8			2D	Indexed String	G232	410,017		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 9			30	Indexed String	G234	410,018		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 9			31	Indexed String	G232	410,019		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 10			34	Indexed String	G234	410,020		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 10			35	Indexed String	G232	410,021		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 11			38	Indexed String	G234	410,022		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 11			39	Indexed String	G232	410,023		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 12			3C	Indexed String	G234	410,024		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 12			3D	Indexed String	G232	410,025		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 13			40	Indexed String	G234	410,026		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 13			41	Indexed String	G232	410,027		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 14			44	Indexed String	G234	410,028		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 14			45	Indexed String	G232	410,029		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 15			48	Indexed String	G234	410,030		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 15			49	Indexed String	G232	410,031		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 16			4C	Indexed String	G234	410,032		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 16			4D	Indexed String	G232	410,033		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 17			50	Indexed String	G234	410,034		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 17			51	Indexed String	G232	410,035		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 18			54	Indexed String	G234	410,036		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 18			55	Indexed String	G232	410,037		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 19			58	Indexed String	G234	410,038		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Ctrl Command 19			59	Indexed String	G232	410,039		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 20			5C	Indexed String	G234	410,040		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 20			5D	Indexed String	G232	410,041		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 21			60	Indexed String	G234	410,042		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 21			61	Indexed String	G232	410,043		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 22			64	Indexed String	G234	410,044		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 22			65	Indexed String	G232	410,045		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 23			68	Indexed String	G234	410,046		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 23			69	Indexed String	G232	410,047		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 24			6C	Indexed String	G234	410,048		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 24			6D	Indexed String	G232	410,049		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 25			70	Indexed String	G234	410,050		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 25			71	Indexed String	G232	410,051		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 26			74	Indexed String	G234	410,052		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 26			75	Indexed String	G232	410,053		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 27			78	Indexed String	G234	410,054		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 27			79	Indexed String	G232	410,055		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 28			7C	Indexed String	G234	410,056		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 28			7D	Indexed String	G232	410,057		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 29			80	Indexed String	G234	410,058		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 29			81	Indexed String	G232	410,059		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 30			84	Indexed String	G234	410,060		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 30			85	Indexed String	G232	410,061		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 31			88	Indexed String	G234	410,062		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 31			89	Indexed String	G232	410,063		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
Control Input 32			8C	Indexed String	G234	410,064		G234	Latched	Setting	0	1	1	2	*	*	*	*	*	*	Individual Control Input Type
Ctrl Command 32			8D	Indexed String	G232	410,065		G232	SET/RESET	Setting	0	3	1	2	*	*	*	*	*	*	Individual Control Input Command Text
I DIFF CONFIG		20	00												*	*	*	*	*	*	
Scheme Setup			01	Indexed String	G101	40950		G101	2 Terminal	Setting	0	2	1	2	*	*	*	*	*	*	
Address			02	Indexed String	G103	40951		G103	0-0	Setting	0	60	1	2	*	*	*	*	*	*	Protection Signalling Address 3 Terminal

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Address			03	Indexed String	G103	40952		G103	0-0	Setting	0	40	1	2	*	*	*	*	*	*	Protection Signalling Address 2 Terminal + Dual Redundant
Baud Rate Ch1			04	Indexed String	G104	40953		G104	64kbits/s	Setting	0	1	1	2	*	*	*	*	*	*	
Clock Source Ch1			05	Indexed String	G105	40954		G105	Internal	Setting	0	1	1	2	*	*	*	*	*	*	
Clock Source Ch2			06	Indexed String	G105	40955		G105	Internal	Setting	0	1	1	2	*	*	*	*	*	*	2001 = 0 OR 2001 = 2 AND 2020 =0
Comm Delay Tol			07	Courier Number (time)		40956		G2	0.00025	Setting	0.00025	0.001	0.00005	2	*	*	*	*	*	*	Signalling Delay Tolerance
Comm Fail Timer			08	Courier Number (time)		40957		G2	10	Setting	0.1	10	0.1	2	*	*	*	*	*	*	Signalling Fail Alarm Timer
Comm Fail Mode			09	Indexed String	G106	40958		G106	Ch 1 and 2 Fail	Setting	0	2	1	2	*	*	*	*	*	*	Report Signalling Failure Mode
Char Mod Time			0A	Courier Number (time)		40959		G2	0.5	Setting	0	2	0.0001	2	*	*	*	*	*	*	Change in Td Modification Timer
I Cap Correction			0B	Indexed String	G37	40960		G37	Disabled	Setting	0	1	1	2			*	*	*	*	Capacitive Current Correction Status
Susceptance			0C	Courier Number (Inverse ohms)		40961	40962	G35	0.00000001*I1	Setting	0.00000001*I1	10*I1	.00000001*I	2			*	*	*	*	
Inrush Restraint			0D	Indexed String	G37	40963		G37	Disabled	Setting	0	1	1	2	*	*					
Vectorial Comp			0E	Indexed String	G108	40964		G108	Yy0 (0 deg)	Setting	0	13	1	2	*	*					
Ph CT Corr'tion			0F	Courier Number (decimal)		40965		G2	1	Setting	1	8	0.01	2	*	*	*	*	*	*	Phase CT Correction
E/F CT Corr'tion			10	Courier Number (decimal)		40966		G2	1	Setting	1	8	0.01	2							
Re-Configuration			11	Indexed String	G109	40967		G109	Three Ended	Command	0	3	1	2	*	*	*	*	*	*	
Kr (Temporary)			12	Courier Number (decimal)				G2	4	Setting	1	40	0.1	2	*	*					Tempory setting durring Development
GPS Sync			13	Indexed String	G37	40968		G37	Disabled	Setting	0	1	1	2					*	*	
Baud Rate Ch2			14	Indexed String	G104	40969		G104	64kbits/s	Setting	0	1	1	2	*	*	*	*	*	*	2001 = 0 OR 2001 = 2 AND 2020 =0
Prop Delay Equal			15	Indexed String	G11	40970		G126	No Operation	Command	0	1	1	1					*	*	Enable protection
Comms Mode			20	Indexed String	G130	40971		G1	Standard	Setting	0	1	1	2	*	*	*	*	*	*	
Ch1 N*64kbits/s			21	Indexed String	G131	40972		G1	1	Setting	0	12	1	2	*	*	*	*	*	*	
Ch2 N*64kbits/s			22	Indexed String	G131	40973		G1	1	Setting	0	12	1	2	*	*	*	*	*	*	2001 = 0 OR 2001 = 2 AND 2020 = 1
CTRL I/P LABELS		29	00																		
Control Input 1			01	ASCII Text (16 chars)		410,100	410,107	G3	Control Input 1	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 2			02	ASCII Text (16 chars)		410,108	410,115	G3	Control Input 2	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 3			03	ASCII Text (16 chars)		410,116	410,123	G3	Control Input 3	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 4			04	ASCII Text (16 chars)		410,124	410,131	G3	Control Input 4	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 5			05	ASCII Text (16 chars)		410,132	410,139	G3	Control Input 5	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 6			06	ASCII Text (16 chars)		410,140	410,147	G3	Control Input 6	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 7			07	ASCII Text (16 chars)		410,148	410,155	G3	Control Input 7	Setting	32	163	1	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Control Input 8			08	ASCII Text (16 chars)		410,156	410,163	G3	Control Input 8	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 9			09	ASCII Text (16 chars)		410,164	410,171	G3	Control Input 9	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 10			0A	ASCII Text (16 chars)		410,172	410,179	G3	Control Input 10	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 11			0B	ASCII Text (16 chars)		410,180	410,187	G3	Control Input 11	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 12			0C	ASCII Text (16 chars)		410,188	410,195	G3	Control Input 12	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 13			0D	ASCII Text (16 chars)		410,196	410,203	G3	Control Input 13	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 14			0E	ASCII Text (16 chars)		410,204	410,211	G3	Control Input 14	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 15			0F	ASCII Text (16 chars)		410,212	410,219	G3	Control Input 15	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 16			10	ASCII Text (16 chars)		410,220	410,227	G3	Control Input 16	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 17			11	ASCII Text (16 chars)		410,228	410,235	G3	Control Input 17	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 18			12	ASCII Text (16 chars)		410,236	410,243	G3	Control Input 18	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 19			13	ASCII Text (16 chars)		410,244	410,251	G3	Control Input 19	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 20			14	ASCII Text (16 chars)		410,252	410,259	G3	Control Input 20	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 21			15	ASCII Text (16 chars)		410,260	410,267	G3	Control Input 21	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 22			16	ASCII Text (16 chars)		410,268	410,275	G3	Control Input 22	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 23			17	ASCII Text (16 chars)		410,276	410,283	G3	Control Input 23	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 24			18	ASCII Text (16 chars)		410,284	410,291	G3	Control Input 24	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 25			19	ASCII Text (16 chars)		410,292	410,299	G3	Control Input 25	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 26			1A	ASCII Text (16 chars)		410,300	410,307	G3	Control Input 26	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 27			1B	ASCII Text (16 chars)		410,308	410,315	G3	Control Input 27	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 28			1C	ASCII Text (16 chars)		410,316	410,323	G3	Control Input 28	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 29			1D	ASCII Text (16 chars)		410,324	410,331	G3	Control Input 29	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 30			1E	ASCII Text (16 chars)		410,332	410,339	G3	Control Input 30	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 31			1F	ASCII Text (16 chars)		410,340	410,347	G3	Control Input 31	Setting	32	163	1	2	*	*	*	*	*	*	
Control Input 32			20	ASCII Text (16 chars)		410,348	410,355	G3	Control Input 32	Setting	32	163	1	2	*	*	*	*	*	*	
PRODUCT SPECIFIC		30	00			41000															
GROUP 1 PHASE DIFF		31	00												*	*	*	*	*	*	
Phase Is1			01	Courier Number (current)		41050		G2	0.2*I1	Setting	0.2*I1	2*I1	0.05*I1	2	*	*	*	*	*	*	3 Terminal
Phase Is2			02	Courier Number (current)		41051		G2	2*I1	Setting	1*I1	30*I1	0.05*I1	2	*	*	*	*	*	*	3 Terminal
Phase k1			03	Courier Number (percentage)		41052		G2	30	Setting	30	150	5	2	*	*	*	*	*	*	3 Terminal

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Phase k2			04	Courier Number (percentage)		41053		G2	100	Setting	30	150	5	2	*	*	*	*	*	*	3 Terminal
Phase Is1			05	Courier Number (current)		41054		G2	0.2*I1	Setting	0.2*I1	2*I1	0.05*I1	2	*	*	*	*	*	*	2 Terminal + Dual Redundant
Phase Is2			06	Courier Number (current)		41055		G2	2*I1	Setting	1*I1	30*I1	0.05*I1	2	*	*	*	*	*	*	2 Terminal + Dual Redundant
Phase k1			07	Courier Number (percentage)		41056		G2	30	Setting	30	150	5	2	*	*	*	*	*	*	2 Terminal + Dual Redundant
Phase k2			08	Courier Number (percentage)		41057		G2	150	Setting	30	150	5	2	*	*	*	*	*	*	2 Terminal + Dual Redundant
Phase Char			09	Indexed String	G112	41058		G112	DT	Setting	0	9	1	2	*	*	*	*	*	*	
Phase Time Delay			0A	Courier Number (time)		41059		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	
Phase TMS			0B	Courier Number (decimal)		41060		G2	1	Setting	0.025	1.2	0.025	2	*	*	*	*	*	*	4>=3109>=1
Phase Time Dial			0C	Courier Number (decimal)		41061		G2	1	Setting	0.01	100	0.01	2	*	*	*	*	*	*	
PIT Time			0D	Courier Number (time)		41062		G2	0.2	Setting	0	0.2	0.005	2	*	*	*	*	*	*	
Id High Set			0E	Courier Number (current)		41063		G2	4.0*I1	Setting	4*I1	32*I1	0.01*I1	2	*	*					
GROUP 1 DISTANCE		33	00														*	*	*	*	
Z1 Status			01	Indexed String	G100	41150		G100	Enabled	Setting	0	2	1	2			*	*	*	*	
Z1			02	Courier Number (impedance)		41151		G2	5	Setting	0.1/I1	250/I1	0.01/I1	2			*	*	*	*	pos seq
tZ1			03	Courier Number (time)		41152		G2	0	Setting	0	10	0.01	2			*	*	*	*	
Z1 Intertrip			04	Indexed String	G37	41153		G37	Disabled	Setting	0	1	1	2			*	*	*	*	
Z2 Status			05	Indexed String	G100	41154		G100	Enabled	Setting	0	2	1	2			*	*	*	*	
Z2			06	Courier Number (impedance)		41155		G2	5	Setting	0.1/I1	250/I1	0.01/I1	2			*	*	*	*	
tZ2			07	Courier Number (time)		41156		G2	0.5	Setting	0	10	0.01	2			*	*	*	*	
Z2 Intertrip			08	Indexed String	G37	41157		G37	Disabled	Setting	0	1	1	2			*	*	*	*	
Z3 Status			09	Indexed String	G100	41158		G100	Enabled	Setting	0	2	1	2			*	*	*	*	
Z3			0A	Courier Number (impedance)		41159		G2	5	Setting	0.1/I1	250/I1	0.01/I1	2			*	*	*	*	
tZ3			0B	Courier Number (time)		41160		G2	1	Setting	0	10	0.01	2			*	*	*	*	
Z3 Intertrip			0C	Indexed String	G37	41161		G37	Disabled	Setting	0	1	1	2			*	*	*	*	
Line Angle			0D	Courier Number (angle)		41162		G2	70	Setting	20	85	1	2			*	*	*	*	
kZN Res Comp			0E	Courier Number (decimal)		41163		G2	1	Setting	0	7	0.01	2			*	*	*	*	
kZN Angle			0F	Courier Number (angle)		41164		G2	0	Setting	-180	90	1	2			*	*	*	*	
RPh			10	Courier Number (impedance)		41165		G2	10	Setting	0.1/I1	400/I1	0.01/I1	2			*	*	*	*	Loop
RG			11	Courier Number (impedance)		41166		G2	10	Setting	0.1/I1	400/I1	0.01/I1	2			*	*	*	*	Loop
PSB Status			12	Indexed String	G37	41167		G37	Disabled	Setting	0	1	1	2			*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Delta R			13	Courier Number (impedance)		41168		G2	0.5	Setting	0	400/I1	0.01/I1	2			*	*	*	*	Loop
Delta X			14	Courier Number (impedance)		41169		G2	0.5	Setting	0	400/I1	0.01/I1	2			*	*	*	*	Loop
tZ6			15	Courier Number (time)		41170		G2	0.05	Setting	0	0.1	0.001	2			*	*	*	*	
Z3 Direction			16	Indexed String	G120	41171		G120	Reverse	Setting	0	1	1	2			*	*	*	*	
Direction			17	Indexed String	G120	41172		G120	Fordward	Setting	0	1	1	2			*	*	*	*	
GROUP 1 PRODUCT SPECIFIC		34	00			41200															
GROUP 1 OVERCURRENT		35	00												*	*	*	*	*	*	
I>1 Status			01	Indexed String	G100	41250		G100	Enabled	Setting	0	2	1	2	*	*	*	*	*	*	
I>1 Function			02	Indexed String	G112	41251		G112	IEC S Inverse	Setting	0	9	1	2	*	*	*	*	*	*	
I>1 Directional			03	Indexed String	G44	41252		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
I>1 Current Set			04	Courier Number (current)		41253		G2	1	Setting	0.08*I1	4.0*I1	0.01*I1	2	*	*	*	*	*	*	I>1 Current Setting
I>1 Time Delay			05	Courier Number (time)		41254		G2	1	Setting	0	100	0.01	2	*	*	*	*	*	*	I>1 Definite Time
I>1 TMS			06	Courier Number (decimal)		41255		G2	1	Setting	0.025	1.2	0.025	2	*	*	*	*	*	*	4>=3502>=1
I>1 Time Dial			07	Courier Number (decimal)		41256		G2	1	Setting	0.01	100	0.01	2	*	*	*	*	*	*	
I>1 Reset Char			08	Indexed String	G60	41257		G60	DT	Setting	0	1	1	2	*	*	*	*	*	*	
I>1 tRESET			09	Courier Number (time)		41258		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	4>=3502>=0 OR 3508=0
I>2 Status			0A	Indexed String	G100	41259		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
I>2 Function			0B	Indexed String	G112	41260		G112	IEC S Inverse	Setting	0	9	1	2	*	*	*	*	*	*	I>2 Overcurrent Status
I>2 Directional			0C	Indexed String	G44	41261		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
I>2 Current Set			0D	Courier Number (current)		41262		G2	1	Setting	0.08*I1	4.0*I1	0.01*I1	2	*	*	*	*	*	*	
I>2 Time Delay			0E	Courier Number (time)		41263		G2	1	Setting	0	100	0.01	2	*	*	*	*	*	*	
I>2 TMS			0F	Courier Number (decimal)		41264		G2	1	Setting	0.025	1.2	0.025	2	*	*	*	*	*	*	4>=350B>=1
I>2 Time Dial			10	Courier Number (decimal)		41265		G2	1	Setting	0.01	100	0.01	2	*	*	*	*	*	*	
I>2 Reset Char			11	Indexed String	G60	41266		G60	DT	Setting	0	1	1	2	*	*	*	*	*	*	
I>2 tRESET			12	Courier Number (time)		41267		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	4>=350B>=0 OR 3511=0
I>3 Status			13	Indexed String	G100	41268		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
I>3 Directional			14	Indexed String	G44	41269		G44	Directional Fwd	Setting	0	2	1	2			*	*	*	*	
I>3 Current Set			15	Courier Number (current)		41270		G2	10	Setting	0.08*I1	32*I1	0.01*I1	2	*	*	*	*	*	*	
I>3 Time Delay			16	Courier Number (time)		41271		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
I>3 Intertrip			17	Indexed String	G37	41272		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
I>4 Status			18	Indexed String	G100	41273		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
I>4 Directional			19	Indexed String	G44	41274		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
I>4 Current Set			1A	Courier Number (current)		41275		G2	10	Setting	0.08*I1	32*I1	0.01*I1	2	*	*	*	*	*	*	
I>4 Time Delay			1B	Courier Number (time)		41276		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	
I> Char Angle			1C	Courier Number (angle)		41277		G2	30	Setting	-95	95	1	2			*	*	*	*	I> Characteristic Angle
I> Blocking			1D	Binary Flag (6) Indexed String	G14	41278		G14	15	Setting	63	6	1	2		*	*	*	*	*	VTS Block/Autoreclose block per stage
reserved for voltage controlled overcurrent			1E	(Sub-heading)																	
reserved for voltage controlled overcurrent			1F																		
reserved for voltage controlled overcurrent			20																		
reserved for voltage controlled overcurrent			21																		
GROUP 1 NEG SEQ O/C		36	00											2							
GROUP 1 BROKEN CONDUCTOR		37	00												*	*	*	*	*	*	
Broken Conductor			01	Indexed String	G37	41350		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
I2/I1 Setting			02	Courier Number (decimal)		41351		G2	0.2	Setting	0.2	1	0.01	2	*	*	*	*	*	*	
I2/I1 Time Delay			03	Courier Number (time)		41352		G2	60	Setting	0	100	0.1	2	*	*	*	*	*	*	
GROUP 1 EARTH FAULT		38	00												*	*	*	*	*	*	
IN>1 Status			01	Indexed String	G100	41400		G100	Enabled	Setting	0	2	1	2	*	*	*	*	*	*	
IN>1 Function			02	Indexed String	G112	41401		G112	IEC S Inverse	Setting	0	9	1	2	*	*	*	*	*	*	
IN>1 Directional			03	Indexed String	G44	41402		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
IN>1 Current Set			04	Courier Number (current)		41403		G2	0.2	Setting	0.08*I1	4.0*I1	0.01*I1	2	*	*	*	*	*	*	I>1 Current Setting
IN>1 Time Delay			05	Courier Number (time)		41404		G2	1	Setting	0	200	0.01	2	*	*	*	*	*	*	I>1 Definite Time
IN>1 TMS			06	Courier Number (decimal)		41405		G2	1	Setting	0.025	1.2	0.025	2	*	*	*	*	*	*	4>=3802>=1
IN>1 Time Dial			07	Courier Number (decimal)		41406		G2	1	Setting	0.01	100	0.01	2	*	*	*	*	*	*	
IN>1 Reset Char			08	Indexed String	G60	41407		G60	DT	Setting	0	1	1	2	*	*	*	*	*	*	
IN>1 tRESET			09	Courier Number (time)		41408		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	4>=3802>=0 OR 3808=0
IN>2 Status			0A	Indexed String	G100	41409		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
IN>2 Function			0B	Indexed String	G112	41410		G112	IEC S Inverse	Setting	0	9	1	2	*	*	*	*	*	*	I>2 Overcurrent Status

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
IN>2 Directional			0C	Indexed String	G44	41411		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
IN>2 Current Set			0D	Courier Number (current)		41412		G2	0.2	Setting	0.08*I1	4.0*I1	0.01*I1	2	*	*	*	*	*	*	
IN>2 Time Delay			0E	Courier Number (time)		41413		G2	1	Setting	0	200	0.01	2	*	*	*	*	*	*	
IN>2 TMS			0F	Courier Number (decimal)		41414		G2	1	Setting	0.025	1.2	0.025	2	*	*	*	*	*	*	4>=380B>=1
IN>2 Time Dial			10	Courier Number (decimal)		41415		G2	1	Setting	0.01	100	0.1	2	*	*	*	*	*	*	
IN>2 Reset Char			11	Indexed String	G60	41416		G60	DT	Setting	0	1	1	2	*	*	*	*	*	*	
IN>2 tRESET			12	Courier Number (time)		41417		G2	0	Setting	0	100	0.01	2	*	*	*	*	*	*	4>=380B>=0 OR 3811=0
IN>3 Status			13	Indexed String	G100	41418		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
IN>3 Directional			14	Indexed String	G44	41419		G44	Directional Fwd	Setting	0	2	1	2			*	*	*	*	
IN>3 Current Set			15	Courier Number (current)		41420		G2	10	Setting	0.08*I1	32*I1	0.01*I1	2	*	*	*	*	*	*	
IN>3 Time Delay			16	Courier Number (time)		41421		G2	0	Setting	0	200	0.01	2	*	*	*	*	*	*	
IN>4 Status			17	Indexed String	G100	41422		G100	Disabled	Setting	0	2	1	2	*	*	*	*	*	*	
IN>4 Directional			18	Indexed String	G44	41423		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
IN>4 Current Set			19	Courier Number (current)		41424		G2	10	Setting	0.08*I1	32*I1	0.01*I1	2	*	*	*	*	*	*	
IN>4 Time Delay			1A	Courier Number (time)		41425		G2	0	Setting	0	200	0.01	2	*	*	*	*	*	*	
IN> Blocking			1B	Binary Flag (6) Indexed String	G63	41426		G63	15	Setting	63	6	1	2		*	*	*	*	*	
IN> DIRECTIONAL			1C	(Sub Heading)		41427								2			*	*	*	*	
IN> Char Angle			1D	Courier Number (angle)		41428		G2	-60	Setting	-95	95	1	2			*	*	*	*	
IN> Polarisation			1E	Indexed String	G46	41429		G46	Zero Sequence	Setting	0	1	1	2			*	*	*	*	
IN> Voltage Pol			1F	Indexed String	G49			G49	Derived	Setting	0	1	1	2							
IN> VNpol Set			20	Courier Number (voltage)		41430		G2	5	Setting	0.5*V1	80*V1	0.5*V1	2			*	*	*	*	IN> VN Polarising Setting
IN> V2pol Set			21	Courier Number (voltage)		41431		G2	5	Setting	0.5*V1	25*V1	0.5*V1	2			*	*	*	*	IN> V2 Polarising Setting
IN> I2pol Set			22	Courier Number (current)		41432		G2	0.08	Setting	0.08*I1	1.0*I1	0.01*I1	2			*	*	*	*	IN> I2 Polarising Setting
GROUP 1 PRODUCT SPECIFIC		39	00			41450															
GROUP 1 SENSITIVE E/F		3A	00														*	*	*	*	GROUP 1 - SENSITIVE EARTH FAULT
Sens E/F Options			01	Indexed String	G58	41500		G58	SEF Enabled	Setting	0	1	1	2			*	*	*	*	Sensitive Earth Fault Options
ISEF>1 Function			02	Indexed String	G43	41501		G43	DT	Setting	0	10	1	2			*	*	*	*	
ISEF>1 Direction			03	Indexed String	G44	41502		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	ISEF>1 Directionality
ISEF>1 Current			04	Courier Number (current)		41503		G2	0.05	Setting	0.005*I3	0.1*I3	0.00025*I3	2			*	*	*	*	ISEF>1 Current Setting

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
ISEF>1 Delay			05	Courier Number (time)		41504		G2	1	Setting	0	200	0.01	2			*	*	*	*	ISEF>1 Definite Time
ISEF>1 TMS			06	Courier Number (decimal)		41505		G2	1	Setting	0.025	1.2	0.025	2			*	*	*	*	5>=3A02>=2
ISEF>1 Time Dial			07	Courier Number (decimal)		41506		G2	1	Setting	0.01	100	0.01	2			*	*	*	*	ISEF>1 TMS
ISEF>1 Reset Chr			08	Indexed String	G60	41507		G60	DT	Setting	0	1	1	2			*	*	*	*	
ISEF>1 tRESET			09	Courier Number (time)		41508		G2	0	Setting	0	100	0.01	2			*	*	*	*	5>=3A02>=1 OR 3A08=0
ISEF>2 Function			0A	Indexed String	G43	41509		G43	Disabled	Setting	0	10	1	2			*	*	*	*	
ISEF>2 Direction			0B	Indexed String	G44	41510		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	
ISEF>2 Current			0C	Courier Number (current)		41511		G2	0.05	Setting	0.005*I3	0.1*I3	0.00025*I3	2			*	*	*	*	
ISEF>2 Delay			0D	Courier Number (time)		41512		G2	1	Setting	0	200	0.01	2			*	*	*	*	
ISEF>2 TMS			0E	Courier Number (decimal)		41513		G2	1	Setting	0.025	1.2	0.025	2			*	*	*	*	5>=3A0A>=2
ISEF>2 Time Dial			0F	Courier Number (decimal)		41514		G2	1	Setting	0.01	100	0.01	2			*	*	*	*	
ISEF>2 Reset Chr			10	Indexed String	G60	41515		G60	DT	Setting	0	1	1	2			*	*	*	*	
ISEF>2 tRESET			11	Courier Number (time)		41516		G2	0	Setting	0	100	0.01	2			*	*	*	*	5>=3A0A>=1 OR 3A10=0
ISEF>3 Status			12	Indexed String	G37	41517		G37	Disabled	Setting	0	1	1	2			*	*	*	*	ISEF>3 Sensitive Earth Fault Status
ISEF>3 Direction			13	Indexed String	G44	41518		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	ISEF>3 Directionality
ISEF>3 Current			14	Courier Number (current)		41519		G2	0.4	Setting	0.005*I3	0.8*I3	0.001*I3	2			*	*	*	*	ISEF>3 Current Setting
ISEF>3 Delay			15	Courier Number (time)		41520		G2	0.5	Setting	0	200	0.01	2			*	*	*	*	ISEF>3 Definite Time
ISEF>4 Status			16	Indexed String	G37	41521		G37	Disabled	Setting	0	1	1	2			*	*	*	*	ISEF>4 Sensitive Earth Fault Status
ISEF>4 Direction			17	Indexed String	G44	41522		G44	Non-Directional	Setting	0	2	1	2			*	*	*	*	ISEF>4 Directionality
ISEF>4 Current			18	Courier Number (current)		41523		G2	0.6	Setting	0.005*I3	0.8*I3	0.001*I3	2			*	*	*	*	ISEF>4 Current Setting
ISEF>4 Delay			19	Courier Number (time)		41524		G2	0.25	Setting	0	200	0.01	2			*	*	*	*	ISEF>4 Definite Time
ISEF> Blocking			1A	Binary Flag (6) Indexed String	G64	41525		G64	15	Setting	63	6	1	2			*	*	*	*	
ISEF DIRECTIONAL			1B	(Sub Heading)										2			*	*	*	*	ISEF Directional Element
ISEF> Char Angle			1C	Courier Number (angle)		41526		G2	90	Setting	-95	95	1	2			*	*	*	*	Characteristic Angle
ISEF> Vpol Input			1D	Indexed String	G49			G49	Derived	Setting	0	1	1	2							Polarising Neutral Voltage Input
ISEF> VN pol Set			1E	Courier Number (voltage)		41527		G2	5	Setting	0.5*V1	88*V1	0.5*V1	2			*	*	*	*	Polarisation voltage Vop>
Wattmetric SEF			1F	(Sub Heading)													*	*	*	*	Wattmetric Earth Fault
PN> Setting			20	Courier Number (power)		41528		G2	9	Setting	0.0*V1*I2	20*V1*I2	0.05*V1*I2	2			*	*	*	*	Po> Power Setting
Restricted E/F			21	(Sub Heading)																	Restricted Earth Fault
IREF> K1			22	Courier Number (percentage)				G2		Setting	0	20	1	2							REF K1
IREF> K2			23	Courier Number (percentage)				G2		Setting	0	150	1	2							REF K2

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
IREF> Is1			24	Courier Number (current)				G2		Setting	0.05*I3	1.0*I3	0.01*I3	2							REF Is1
IREF> Is2			25	Courier Number (current)				G2		Setting	0.1*I3	1.5*I3	0.01*I3	2							REF Is2
GROUP 1 RESIDUAL O/V NVD		3B	00																		
GROUP 1 THERMAL OVERLOAD		3C	00												*	*	*	*	*	*	
Characteristic			01	Indexed String	G67	41600		G67	Single	Setting	0	2	1	2	*	*	*	*	*	*	
Thermal Trip			02	Courier Number (current)		41601		G2	1	Setting	0.08*I1	4.0*I1	0.01*I1	2	*	*	*	*	*	*	
Thermal Alarm			03	Courier Number (percentage)		41602		G2	70	Setting	50	100	1	2	*	*	*	*	*	*	
Time Constant 1			04	Courier Number (time-minutes)		41603		G2	10	Setting	1	200	1	2	*	*	*	*	*	*	
Time Constant 2			05	Courier Number (time-minutes)		41604		G2	5	Setting	1	200	1	2	*	*	*	*	*	*	
GROUP 1 PRODUCT SPECIFIC		3D	00			41650															
GROUP 1 PRODUCT SPECIFIC		3E	00			41700															
GROUP 1 PRODUCT SPECIFIC		3F	00			41750															
GROUP 1 PRODUCT SPECIFIC		40	00			41800															
GROUP 1 PRODUCT SPECIFIC		41	00			41850															
GROUP 1 VOLT PROTECTION		42	00																		
GROUP 1 FREQ PROTECTION		43	00																		
GROUP 1 RTD PROTECTION		44	00																		
GROUP 1 CB FAIL & I<		45	00												*	*	*	*	*	*	
BREAKER FAIL			01	(Sub Heading)											*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
CB Fail 1 Status			02	Indexed String	G37	42100		G37	Enabled	Setting	0	1	1	2	*	*	*	*	*	*	
CB Fail 1 Timer			03	Courier Number (time)		42101		G2	0.2	Setting	0	10	0.01	2	*	*	*	*	*	*	
CB Fail 2 Status			04	Indexed String	G37	42102		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
CB Fail 2 Timer			05	Courier Number (time)		42103		G2	0.4	Setting	0	10	0.01	2	*	*	*	*	*	*	
Volt Prot Reset			06	Indexed String	G68	42104		G68		Setting	0	2	1	2							
Ext Prot Reset			07	Indexed String	G68	42105		G68	Prot Reset & I<	Setting	0	2	1	2	*	*	*	*	*	*	
UNDER CURRENT			08	(Sub Heading)											*	*	*	*	*	*	
I< Current Set			09	Courier Number (current)		42106		G2	0.1	Setting	0.02*I1	3.2*I1	0.01*I1	2	*	*	*	*	*	*	
IN< Current Set			0A	Courier Number (current)		42107		G2	0.1	Setting	0.02*I2	3.2*I2	0.01*I2	2							
ISEF< Current			0B	Courier Number (current)		42108		G2	0.02	Setting	0.001*I3	0.8*I3	0.0005*I3	2	*	*	*	*	*	*	
BLOCKED O/C			0C	(Sub Heading)											*	*	*	*	*	*	Blocked Overcurrent Schemes
Remove I> Start			0D	Indexed String	G37	42109		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
Remove IN> Start			0E	Indexed String	G37	42110		G37	Disabled	Setting	0	1	1	2	*	*	*	*	*	*	
GROUP 1 SUPERVISION		46	00														*	*	*	*	
VT SUPERVISION			01	(Sub Heading)													*	*	*	*	
VTS Status			02	Indexed String	G7	42150		G7	Blocking	Setting	0	1	1	2			*	*	*	*	
VTS Reset Mode			03	Indexed String	G69	42151		G69	Manual	Setting	0	1	1	2			*	*	*	*	
VTS Time Delay			04	Courier Number (time)		42152		G2	5	Setting	1	10	0.1	2			*	*	*	*	
VTS I> Inhibit			05	Courier Number (current)		42153		G2	10	Setting	0.08*I1	32*I1	0.01*I1	2			*	*	*	*	
VTS I2> Inhibit			06	Courier Number (current)		42154		G2	0.05	Setting	0.05*I1	0.5*I1	0.01*I1	2			*	*	*	*	
CT SUPERVISION			07	(Sub Heading)																	
CTS Status			08	Courier Number (voltage)	G37	42155		G37		Setting	0	1	1	2							
CTS VN< Inhibit			09	Courier Number (voltage)		42156		G2		Setting	0.5*V1	22*V1	0.5*V1	2							
CTS IN> Set			0A	Courier Number (current)		42157		G2		Setting	0.08*I1	4*I1	0.01*I1	2							
CTS Time Delay			0B	Courier Number (time)		42158		G2		Setting	0	10	1	2							
GROUP 1 FAULT LOCATOR		47	00														*	*	*	*	
Line Length			01	Courier Number (metres)		42200	42201	G35	16000	Setting	10	1E6	1	2			*	*	*	*	Length in km
Line Length			02	Courier Number (miles)		42202	42203	G35	10	Setting	0.005	621	0.005	2			*	*	*	*	Setting stored in km, displayed using miles
Line Impedance			03	Courier Number (impedance)		42204		G2	6	Setting	0.1*V1/I1	250*V1/I1	0.01*V1/I1	2			*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Line Angle			04	Courier Number (angle)		42205		G2	70	Setting	20	85	1	2			*	*	*	*	
kZN Residual			05	Courier Number (decimal)		42206		G2	1	Setting	0	7	0.01	2			*	*	*	*	Multiplier
kZN Res Angle			06	Courier Number (angle)		42207		G2	0	Setting	-180	90	1	2			*	*	*	*	
Mutual Comp			07	Indexed String	G37	42208		G37	Disabled	Setting	0	1	1	2			*	*	*	*	
kZm Mutual Comp			08	Courier Number (decimal)		42209		G2	1	Setting	0	7	0.01	2			*	*	*	*	
kZm Angle			09	Courier Number (angle)		42210		G2	0	Setting	-90	90	1	2			*	*	*	*	
GROUP 1 SYSTEM CHECKS		48	00														*		*		
C/S Phase Angle			01	Courier Number (angle)		42250		G2	20	Setting	5	90	1	2							
Voltage Blocking			02	Indexed String	G41	42251		G41	Undervoltage	Setting	0	3	1	2							
Undervoltage			03	Courier Number (voltage)		42252		G2	54	Setting	22*V1	132*V1	0.5*V1	2							(4802 = 1) OR (4802 = 3)
Diff Voltage			04	Courier Number (voltage)		42253		G2	6.5	Setting	0.5*V1	50*V1	0.5*V1	2							(4802 = 2) OR (4802 = 3)
Slip Control			05	Indexed String	G42	42254		G42	Frequency	Setting	0	3	1	2							
Slip Frequency			06	Courier Number (frequency)		42255		G2	0.05	Setting	0.02	1	0.01	2							(4805 = 2) OR (4805 = 3)
Slip Timer			07	Courier Number (time)		42256		G2	1	Setting	0	99	0.1	2							(4805 = 1) OR (4805 = 3)
Live Voltage			08	Courier Number (voltage)		42257		G2	32	Setting	5.5*V1	132*V1	0.5*V1	2							
Dead Voltage			09	Courier Number (voltage)		42258		G2	13	Setting	5.5*V1	132*V1	0.5*V1	2							
MAN CLOSE CHK			0A	(Sub Heading)																	
Check Synch			0B	Indexed String	G37	42259		G37	Enabled	Setting	0	1	1	2							
DeadLine/LiveBus			0C	Indexed String	G37	42260		G37	Enabled	Setting	0	1	1	2							Dead Line/Live Bus
LiveLine/DeadBus			0D	Indexed String	G37	42261		G37	Enabled	Setting	0	1	1	2							Live Line/Dead Bus
DeadLine/DeadBus			0E	Indexed String	G37	42262		G37	Disabled	Setting	0	1	1	2							Dead Line/Dead Bus
A/R CHECK			0F	(Sub Heading)																	
Check Synch			10	Indexed String	G37	42263		G37	Enabled	Setting	0	1	1	2							
DeadLine/LiveBus			11	Indexed String	G37	42264		G37	Enabled	Setting	0	1	1	2							Dead Line/Live Bus
LiveLine/DeadBus			12	Indexed String	G37	42265		G37	Enabled	Setting	0	1	1	2							Live Line/Dead Bus
DeadLine/DeadBus			13	Indexed String	G37	42266		G37	Disabled	Setting	0	1	1	2							Dead Line/Dead Bus
VOLTAGE MONITORS			14	(Sub Heading)													*		*		
Live Voltage			15	Courier Number (voltage)		42270		G2	32	Setting	1*V1	132*V1	0.5*V1	2			*		*		
Dead Voltage			16	Courier Number (voltage)		42271		G2	13	Setting	1*V1	132*V1	0.5*V1	2			*		*		
CHECK SYNCH			17	(Sub Heading)													*		*		

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
CS1 Status			18	Indexed String		42272		G1	Enabled	Setting	0	1	1	2			*		*		
CS1 Phase Angle			19	Courier Number (angle)		42273		G2	20	Setting	5	90	1	2			*		*		
CS1 Slip Control			1A	Indexed String		42274		G1	Frequency	Setting	0	3	1	2			*		*		
CS1 Slip Freq			1B	Courier Number (frequency)		42275		G2	0.05	Setting	0.01	1	0.01	2			*		*		4818=1 AND (481A=2 OR 481A=3)
CS1 Slip Timer			1C	Courier Number (time)		42276		G2	1	Setting	0	99	0.01	2			*		*		4818=1 AND (481A=1 OR 481A=3)
CS2 Status			1D	Indexed String		42277		G1	Enabled	Setting	0	1	1	2			*		*		
CS2 Phase Angle			1E	Courier Number (angle)		42278		G2	20	Setting	5	90	1	2			*		*		
CS2 Slip Control			1F	Indexed String		42279		G1	Frequency	Setting	0	3	1	2			*		*		
CS2 Slip Freq			20	Courier Number (frequency)		42280		G2	0.05	Setting	0.01	1	0.01	2			*		*		481D=1 AND (481F=2 OR 481F=3)
CS2 Slip Timer			21	Courier Number (time)		42281		G2	1	Setting	0	99	0.01	2			*		*		481D=1 AND (481F=1 OR 481F=3)
CS Undervoltage			22	Courier Number (voltage)		42282		G2	54	Setting	10*V1	132*V1	0.5*V1	2			*		*		4818=1 OR 481D=1
CS Overvoltage			23	Courier Number (voltage)		42283		G2	130	Setting	60*V1	185*V1	0.5*V1	2			*		*		4818=1 OR 481D=1
CS Diff Voltage			24	Courier Number (voltage)		42284		G2	6.5	Setting	1*V1	132*V1	0.5*V1	2			*		*		4818=1 OR 481D=1
CS Voltage Block			25	Indexed String		42285		G1	V<	Setting	0	7	1	2			*		*		4818=1 OR 481D=1
SYSTEM SPLIT			26	(Sub Heading)													*		*		
SS Status			27	Indexed String		42286		G1	Enabled	Setting	0	1	1	2			*		*		
SS Phase Angle			28	Courier Number (angle)		42287		G2	120	Setting	90	175	1	2			*		*		
SS Under V Block			29	Indexed String		42288		G1	Enabled	Setting	0	1	1	2			*		*		
SS Undervoltage			2A	Courier Number (voltage)		42289		G2	54	Setting	10*V1	132*V1	0.5*V1	2			*		*		
SS Timer			2B	Courier Number (time)		42290		G2	1	Setting	0	99	0.01	2			*		*		
GROUP 1 AUTORECLOSE		49	00													*	*		*		
A/R Mode Select			01	Indexed String	G70			G70		Setting	0	3	1	2							
Number of Shots			02	Unsigned Integer (16 bits)		42300		G1	1	Setting	1	4	1	2		*					
Number SEF Shots			03	Unsigned Integer (16 bits)				G1	0	Setting	0	4	1	2							
Sequence Co-ord			04	Indexed String	G37			G37	Disabled	Setting	0	1	1	2							
Single Pole Shot			05	Unsigned Integer (16 bits)		42301		G1	1	Setting	1	4	1	2			*		*		AR on 1 pole
Three Pole Shot			06	Unsigned Integer (16 bits)		42302		G1	1	Setting	1	4	1	2			*		*		AR on 3 pole
1 Pole Dead Time			07	Courier Number (time)		42303		G2	0.5	Setting	0.2	5	0.01	2			*		*		1PDTIME
Dead Time 1			08	Courier Number (time)		42304		G2	10	Setting	0.01	300	0.01	2		*					DTime1
Dead Time 1			08	Courier Number (time)		42304		G2	0.3	Setting	0.2	30	0.01	2			*		*		DTime1

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Dead Time 2			09	Courier Number (time)		42305		G2	60	Setting	0.01	300	0.01	2		*					DTime2
Dead Time 2			09	Courier Number (time)		42305		G2	60	Setting	1	1800	1	2			*		*		DTime2
Dead Time 3			0A	Courier Number (time)		42306	42307	G35	180	Setting	0.01 1	9999	0.01	2		*					DTime3
Dead Time 3			0A	Courier Number (time)		42306	42307	G35	180	Setting	0.01 1	9999 3600	0.01 1	2		*	*		*		DTime3
Dead Time 4			0B	Courier Number (time)		42308	42309	G35	180	Setting	0.01 1	9999	0.01	2		*					DTime4
Dead Time 4			0B	Courier Number (time)		42308	42309	G35	180	Setting	0.01 1	3600	1	2			*		*		DTime4
CB Healthy Time			0C	Courier Number (time)		42310	42311	G35	5	Setting	0.01	9999	0.01	2		*					
CB Healthy Time			0C	Courier Number (time)		42310	42311	G35	5	Setting	1	3600	1	2			*		*		
Start Dead t On			0D	Indexed String	G72			G72	Protection Resets	Setting	0	1	1	2							
tReclaim Extend			0E	Indexed String	G73	42312		G73	No operation	Setting	0	1	1	2		*					
Reclaim Time			0F	Courier Number (time)		42313		G2	180	Setting	1	600	0.01	2		*					Reclaim time
Reclaim Time			0F	Courier Number (time)		42313		G2	180	Setting	1	600	1	2			*		*		Reclaim time
AR Inhibit Time			10	Courier Number (time)		42314		G2	5	Setting	0.01	600	0.01	2		*	*		*		AR Inhibit Time Delay
Close pulse			11	Courier Number (time)		42315		G2	1	Setting	0.1	10	0.01	2							Successful Close pulse ARTime
A/R Lockout			12	Indexed String	G91			G91	Allow Tripping	Setting	0	1	1	2							Block Trips on Lockout
EFF Maint Lock			13	Indexed String	G91	42316		G91	Allow Tripping	Setting	0	1	1	2		*					Block Protection Trips when Maint/EFF Locked Out
A/R Deselected			14	Indexed String	G91			G91	Allow Tripping	Setting	0	1	1	2							Block Protection Trips if Auto Mode Deselected
Manual Close			15	Indexed String	G91			G91	Allow Tripping	Setting	0	1	1	2							Block Protection Trips after Control Close
Trip 1 Main			16	Indexed String	G82	42317		G82	No Block	Setting	0	1	1	2		*					Block Main Prot for 1st Trip
Trip 2 Main			17	Indexed String	G82	42318		G82	Block Inst Prot	Setting	0	1	1	2		*					Block Main Prot for 2nd Trip
Trip 3 Main			18	Indexed String	G82	42319		G82	Block Inst Prot	Setting	0	1	1	2		*					Block Main Prot for 3rd Trip
Trip 4 Main			19	Indexed String	G82	42320		G82	Block Inst Prot	Setting	0	1	1	2		*					Block Main Prot for 4th Trip
Trip 5 Main			1A	Indexed String	G82	42321		G82	Block Inst Prot	Setting	0	1	1	2		*					Block Main Prot for 5th Trip
Trip 1 SEF			1B	Indexed String	G82			G82	Block Inst Prot	Setting	0	1	1	2							Block SEF Protection Trips
Trip 2 SEF			1C	Indexed String	G82			G82	Block Inst Prot	Setting	0	1	1	2							Reinstate Protection Trips
Trip 3 SEF			1D	Indexed String	G82			G82	Block Inst Prot	Setting	0	1	1	2							Reinstate SEF Protection Trips
Trip 4 SEF			1E	Indexed String	G82			G82	Block Inst Prot	Setting	0	1	1	2							Reinstate Protection Trips
Trip 5 SEF			1F	Indexed String	G82			G82	Block Inst Prot	Setting	0	1	1	2							Reinstate SEF Protection Trips
Man Close on Flt			20	Indexed String	G92			G92	Lockout	Setting	0	1	1	2							Lockout for Control Close onto Fault
Trip in Non-auto			21	Indexed String	G92			G92	No Lockout	Setting	0	1	1	2							Lockout if Protection Operates in Non Auto or Liveline modes
Reset Lockout by			22	Indexed String	G74	42322		G74	User Interface	Setting	0	1	1	2							Reset Lockout

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Man Close BlkDly			23	Courier Number (time)				G2	5	Setting	0.01	300	0.01	2							Control Close Inhibit Time
A/R on Man Close			24	Indexed String	G75			G75	Disabled	Setting	0	1	1	2							Auto-Reclose after Control Close
Check Sync Time			25	Courier Number (time)		42323		G35	5	Setting	0.01	9999	0.01	2			*		*		Check Sync Window
C/S on 1st Shot			26	Indexed String	G37			G37	Enabled	Setting	0	1	1	2							System Check on First Shot
SysChk on Shot 1			27	Indexed String	G37	42325		G37	Disabled	Setting	0	1	1	2			*		*		SYNC AR3 Fast
Phase Diff AR			28	Indexed String	G114	42326		G114	Initiate AR	Setting	0	2	1	2		*	*		*		
Neutral Diff AR			29	Indexed String	G114	42327		G114	No Action	Setting	0	2	1	2							
Z1 AR			2A	Indexed String	G114	42328		G114	Initiate AR	Setting	0	2	1	2			*		*		(090D = 1) && (3301 <> 0)
Z2T AR			2B	Indexed String	G114	42329		G114	Block AR	Setting	0	2	1	2			*		*		(090D =1) && (3305 <> 0)
Z3T AR			2C	Indexed String	G114	42330		G114	Block AR	Setting	0	2	1	2			*		*		(090D = 1) && (3309 <>0)
I>1 AR			2D	Indexed String	G114	42331		G114	No Action	Setting	0	2	1	2		*	*		*		(0910 = 1) && (3501 <> 0)
I>2 AR			2E	Indexed String	G114	42332		G114	No Action	Setting	0	2	1	2		*	*		*		(0910 = 1) && (350A <> 0)
I>3 AR			2F	Indexed String	G114	42333		G114	No Action	Setting	0	2	1	2		*	*		*		(0910 = 1) && (3513 <> 0)
I>4 AR			30	Indexed String	G114	42334		G114	No Action	Setting	0	2	1	2		*	*		*		(0910 = 1) && (3518 <> 0)
IN>1 AR			31	Indexed String	G114	42335		G114	No Action	Setting	0	2	1	2		*	*		*		(0913 = 1) && (3801 <> 0)
IN>2 AR			32	Indexed String	G114	42336		G114	No Action	Setting	0	2	1	2		*	*		*		(0913 = 1) && (380A <> 0)
IN>3 AR			33	Indexed String	G114	42337		G114	No Action	Setting	0	2	1	2		*	*		*		(0913 = 1) && (3813 <> 0)
IN>4 AR			34	Indexed String	G114	42338		G114	No Action	Setting	0	2	1	2		*	*		*		(0913 = 1) && (3817 <> 0)
ISEF>1 AR			35	Indexed String	G114	42339		G114	No Action	Setting	0	2	1	2			*		*		(0915 = 1) && (3A02 <> 0)
ISEF>2 AR			36	Indexed String	G114	42340		G114	No Action	Setting	0	2	1	2			*		*		(0915 = 1) && (3A0A <> 0)
ISEF>3 AR			37	Indexed String	G114	42341		G114	No Action	Setting	0	2	1	2			*		*		(0915 = 1) && (3A12 <> 0)
ISEF>4 AR			38	Indexed String	G114	42342		G114	No Action	Setting	0	2	1	2			*		*		(0915 = 1) && (3A16 <> 0)
Mult Phase AR			39	Indexed String	G115	42343		G115	BAR 3 Phase	Setting	0	2	1	2			*		*		
Dead Time Start			3A		G127	42344		G127	Protection Op	Setting	0	1	1	2			*		*		
Discrim Time			3B	Courier Number (time)		42345		G2	0.1	Setting	0.1	5	0.01	2			*		*		
SYSTEM CHECKS			40	(Sub Heading)																	SYSTEM CHECKS
CheckSync1 Close			41	Indexed String	G37	42346		G37	Enabled	Setting	0	1	1	2			*		*		
CheckSync2 Close			42	Indexed String	G37	42347		G37	Disabled	Setting	0	1	1	2			*		*		
LiveLine/DeadBus			43	Indexed String	G37	42348		G37	Enabled	Setting	0	1	1	2			*		*		
DeadLine/LiveBus			44	Indexed String	G37	42349		G37	Enabled	Setting	0	1	1	2			*		*		
DeadLine/DeadBus			45	Indexed String	G37	42350		G37	Disabled	Setting	0	1	1	2			*		*		

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
CS AR Immediate			46	Indexed String	G37	42351		G37	Disabled	Setting	0	1	1	2			*		*		
GROUP 1 INPUT LABELS		4A	00												*	*	*	*	*	*	
Opto Input 1			01	ASCII Text (16)		42400	42407	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 2			02	ASCII Text (16)		42408	42415	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 3			03	ASCII Text (16)		42416	42423	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 4			04	ASCII Text (16)		42424	42431	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 5			05	ASCII Text (16)		42432	42439	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 6			06	ASCII Text (16)		42440	42447	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 7			07	ASCII Text (16)		42448	42455	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 8			08	ASCII Text (16)		42456	42463	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Opto Input 9			09	ASCII Text (16)		42464	42471	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 10			0A	ASCII Text (16)		42472	42479	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 11			0B	ASCII Text (16)		42480	42487	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 12			0C	ASCII Text (16)		42488	42495	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 13			0D	ASCII Text (16)		42496	42503	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 14			0E	ASCII Text (16)		42504	42511	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 15			0F	ASCII Text (16)		42512	42519	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 16			10	ASCII Text (16)		42520	42527	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Opto Input 17			11	ASCII Text (16 chars)		42870	42877	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 18			12	ASCII Text (16 chars)		42878	42885	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 19			13	ASCII Text (16 chars)		42886	42893	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 20			14	ASCII Text (16 chars)		42894	42901	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 21			15	ASCII Text (16 chars)		42902	42909	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 22			16	ASCII Text (16 chars)		42910	42917	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 23			17	ASCII Text (16 chars)		42918	42925	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Opto Input 24			18	ASCII Text (16 chars)		42926	42933	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
GROUP 1 OUTPUT LABELS		4B	00												*	*	*	*	*	*	
Relay 1			01	ASCII Text (16)		42550	42557	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 2			02	ASCII Text (16)		42558	42565	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref Col	Row	Data Type	Data Group Courier	Modbus Address Start	End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	2	3	4	5	6	Comment
Relay 3			03	ASCII Text (16)		42566	42573	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 4			04	ASCII Text (16)		42574	42581	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 5			05	ASCII Text (16)		42582	42589	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 6			06	ASCII Text (16)		42590	42597	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 7			07	ASCII Text (16)		42598	42605	G3	see 50315.3110.012	Setting	32	163	1	2	*	*	*	*	*	*	
Relay 8			08	ASCII Text (16)		42606	42613	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 9			09	ASCII Text (16)		42614	42621	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 10			0A	ASCII Text (16)		42622	42629	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 11			0B	ASCII Text (16)		42630	42637	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 12			0C	ASCII Text (16)		42638	42645	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 13			0D	ASCII Text (16)		42646	42653	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 14			0E	ASCII Text (16)		42654	42661	G3	see 50315.3110.012	Setting	32	163	1	2		*	*	*	*	*	
Relay 15			0F	ASCII Text (16)		42662	42669	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 16			10	ASCII Text (16)		42670	42677	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 17			11	ASCII Text (16)		42678	42685	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 18			12	ASCII Text (16)		42686	42693	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 19			13	ASCII Text (16)		42694	42701	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 20			14	ASCII Text (16)		42702	42709	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 21			15	ASCII Text (16)		42710	42717	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 22			16	ASCII Text (16)		42718	42725	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 23			17	ASCII Text (16)		42726	42733	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 24			18	ASCII Text (16)		42734	42741	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 25			19	ASCII Text (16)		42742	42749	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 26			1A	ASCII Text (16)		42750	42757	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 27			1B	ASCII Text (16)		42758	42765	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 28			1C	ASCII Text (16)		42766	42773	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 29			1D	ASCII Text (16)		42774	42781	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 30			1E	ASCII Text (16)		42782	42789	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 31			1F	ASCII Text (16)		42790	42797	G3	see 50315.3110.012	Setting	32	163	1	2					*	*	
Relay 32			20	ASCII Text (16)		42798	42805	G3	see 50315.3110.012										*	*	

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
GROUP 1 RTD LABELS		4C	00																		
GROUP 2 PROTECTION SETTINGS																					
Repeat of Group 1 columns/rows		50	00			*43000	44999								*	*	*	*	*	*	
GROUP 3 PROTECTION SETTINGS																					
Repeat of Group 1 columns/rows		70	00			*45000	46999								*	*	*	*	*	*	
GROUP 4 PROTECTION SETTINGS																					
Repeat of Group 1 columns/rows		90	00			*47000	48999								*	*	*	*	*	*	
This is an invisible column for auto extraction of event records, do not redefine any of its rows but keep it consistent with column [01]																					
(No Header)	N/A	B0	00	Auto extraction Event Record Column											*	*	*	*	*	*	
Select Record			01	Unsigned Integer(2)						Setting	0	65535	1		*	*	*	*	*	*	Unique cyclical fault number(from event)
Faulted Phases			04	Binary Flag (8) Indexed String						Data					*	*	*	*	*	*	Product Specific Bit Flags Targetting
Started Elements			05	Binary Flag (32)Indexed String	0..31			0..31	1 bit per elementLSB String..MSB String	Data					*	*	*	*	*	*	Product Specific Bit Flags Targetting
Started Elements 2			06	Binary Flag (32)Indexed String	0..31			0..31	1 bit per elementLSB String..MSB String	Data											Product Specific Bit Flags Targetting
Tripped Elements (1)			07	Binary Flag (32)Indexed String	0..31			0..31	1 bit per elementLSB String..MSB String	Data					*	*	*	*	*	*	Product Specific Bit Flags Targetting
Tripped Elements (2)			08	Binary Flag (32)Indexed String	0..31			0..31	1 bit per elementLSB String..MSB String	Data											Product Specific Bit Flags Targetting
Fault Alarms			09	Binary Flag (32)Indexed String	0..31			0..31	1 bit per elementLSB String..MSB String	Data					*	*	*	*	*	*	Product Specific Bit Flags Targetting
Fault Time			0A	IEC870 Time & Date						Data					*	*	*	*	*	*	
Active Setting Group			0B	Unsigned Integer						Data					*	*	*	*	*	*	
System Frequency			0C	Courier Number (frequency)						Data					*	*	*	*	*	*	
Fault Duration			0D	Courier Number (time)						Data					*	*	*	*	*	*	
CB Operate Time			0E	Courier Number (time)						Data					*	*	*	*	*	*	
Relay Trip Time			0F	Courier Number (time)						Data					*	*	*	*	*	*	
Fault Location			10	Courier Number (metres)						Data							*	*	*	*	
Fault Location			11	Courier Number (miles)						Data							*	*	*	*	
Fault Location			12	Courier Number (ohms)						Data							*	*	*	*	
Fault Location			13	Courier Number (percentage)						Data							*	*	*	*	
IA			14	Courier Number (current)						Data					*	*	*	*	*	*	
IB			15	Courier Number (current)						Data					*	*	*	*	*	*	
IC			16	Courier Number (current)						Data					*	*	*	*	*	*	
VAB			17	Courier Number (voltage)						Data							*	*	*	*	
VBC			18	Courier Number (voltage)						Data							*	*	*	*	
VCA			19	Courier Number (voltage)						Data							*	*	*	*	
IA local			1A	Courier Number (current)						Data					*	*	*	*	*	*	
IB local			1B	Courier Number (current)						Data					*	*	*	*	*	*	
IC local			1C	Courier Number (current)						Data					*	*	*	*	*	*	
IA remote 1			1D	Courier Number (current)						Data					*	*	*	*	*	*	
IB remote 1			1E	Courier Number (current)						Data					*	*	*	*	*	*	
IC remote 1			1F	Courier Number (current)						Data					*	*	*	*	*	*	
IA remote 2			20	Courier Number (current)						Data					*	*	*	*	*	*	
IB remote 2			21	Courier Number (current)						Data					*	*	*	*	*	*	
IC remote 2			22	Courier Number (current)						Data					*	*	*	*	*	*	
IA Diff			23	Courier Number (current)						Data					*	*	*	*	*	*	
IB Diff			24	Courier Number (current)						Data					*	*	*	*	*	*	
IC Diff			25	Courier Number (current)						Data					*	*	*	*	*	*	
IN Diff			26	Courier Number (current)						Data					*	*	*	*	*	*	
IA Bias			27	Courier Number (current)						Data					*	*	*	*	*	*	
IB Bias			28	Courier Number (current)						Data					*	*	*	*	*	*	
IC Bias			29	Courier Number (current)						Data					*	*	*	*	*	*	
Add product specific fault record items from this row onwards, do not redefine any of the above cells.																					

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
This is an invisible column for auto extraction of event records, do not redefine any of its rows but keep it consistent with column [01]																					
No Header	N/A	B1	00												*	*	*	*	*	*	
Select Record			01	UINT16						Setting	0	65535	1		*	*	*	*	*	*	
Time and Date			02	IEC Date and Time						Data					*	*	*	*	*	*	
Record Text			03	ASCII Text						Data					*	*	*	*	*	*	Text Description of Error
Type			04	UINT32						Data					*	*	*	*	*	*	Error Code
Data			05	UINT32						Data					*	*	*	*	*	*	Error Code
DATA TRANSFER (No Header)	N/A	B2	00												*	*	*	*	*	*	
Domain			04	Indexed String				G57	PSL Settings	Setting	0	1	1	2	*	*	*	*	*	*	
Sub-Domain			08	Indexed String				G90	Group 1	Setting	0	3	1	2	*	*	*	*	*	*	
Version			0C	Unsigned Integer (2 Bytes)					256	Setting	0	65535	1	2	*	*	*	*	*	*	
Start			10	Not Used											*	*	*	*	*	*	
Length			14	Not Used											*	*	*	*	*	*	
Reference			18	Not Used											*	*	*	*	*	*	
Transfer Mode			1C	Unsigned Integer Indexed String	G76			G76	6	Setting	0	7	1	2	*	*	*	*	*	*	
Data Transfer			20	Repeated groups of Unsigned Integers						Setting					*	*	*	*	*	*	Only settable if Domain = PSL Settings
RECORDER CONTROL (No Head	N/A	B3	00												*	*	*	*	*	*	
UNUSED			01																		
Recorder Source			02	Indexed String	0			0	Samples	Data					*	*	*	*	*	*	
Reserved for future use			03-1F																		
RECORDER EXTRACTION COLUMN (No Header)	N/A	B4	00												*	*	*	*	*	*	
Select Record			01	Unsigned Integer					0	Setting	-199	199	1	0	*	*	*	*	*	*	
Trigger Time			02	IEC870 Time & Date						Data					*	*	*	*	*	*	
Active Channels			03	Binary Flag						Data					*	*	*	*	*	*	CS103 only
Channel Types			04	Binary Flag						Data					*	*	*	*	*	*	CS103 only
Channels Offsets			05	Courier Number (decimal)						Data					*	*	*	*	*	*	CS103 only
Channel Scaling			06	Courier Number (decimal)						Data					*	*	*	*	*	*	CS103 only
Channel SkewVal			07	Integer						Data					*	*	*	*	*	*	CS103 only
Channel MinVal			08	Integer						Data					*	*	*	*	*	*	CS103 only
Channel MaxVal			09	Integer						Data					*	*	*	*	*	*	CS103 only
Format			0A	Unsigned Integer						Data					*	*	*	*	*	*	0 = incompressed, 1 = compressed
Upload			0B	Unsigned Integer						Data					*	*	*	*	*	*	
UNUSED			0C-0F																		
No. of Samples			10	Unsigned Integer						Data					*	*	*	*	*	*	CS103 only
Trig Position			11	Unsigned Integer						Data					*	*	*	*	*	*	CS103 only
Time Base			12	Courier Number (time)						Data					*	*	*	*	*	*	CS103 only
UNUSED			13																		
Sample Timer			14	Unsigned Integer						Data					*	*	*	*	*	*	CS103 only
UNUSED			15-1F																		
Dist Channel 1			20	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 2			21	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 3			22	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 3			23	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 4			24	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 5			25	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 6			26	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 7			27	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 8			28	Integer						Data					*	*	*	*	*	*	CS103 only

Courier Text	LCD ref	Courier Ref Col	Courier Ref Row	Data Type	Data Group Courier	Modbus Address Start	Modbus Address End	Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Comment
Dist Channel 9			29	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 10			2A	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 11			2B	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 12			2C	Integer						Data					*	*	*	*	*	*	CS103 only
Dist Channel 31			3D	Bginary Flag						Data					*	*	*	*	*	*	CS103 only
Dist Channel 32			3E	Binary Flag						Data					*	*	*	*	*	*	CS103 only
						30800		G1		Data											Number of Disturbance Records (0 to 200)
						30801		G1		Data											Oldest Stored Disturbance Record(1 to 65535)
						30802		G1		Data					*	*	*	*	*	*	Number of Registers in Current Page
						30803	30929	G1		Data					*	*	*	*	*	*	Disturbance Record Page (0 to 65535)
						40250		G1		Setting	1	65535	1	2	*	*	*	*	*	*	Select Disturbance Record
						30930	30933	G12		Data					*	*	*	*	*	*	Timestamp of selected record
						30934		G1		Data					*	*	*	*	*	*	
						40251		G1		Setting	1	65535	1	2	*	*	*	*	*	*	
Calibration Coefficients (Hidder	N/A	B5													*	*	*	*	*	*	
Cal Soft Version			01	ASCII Text (16)											*	*	*	*	*	*	
Cal Date and Time			02	IEC Date and time											*	*	*	*	*	*	
Channel Types			03	Repeated Group 16 * Binary Flag 8 bits											*	*	*	*	*	*	
Cal Coeffs			04	Block transfer Repeated Group of UINT32 (4 coeffs voltage channel, 8 coeffs current channel)											*	*	*	*	*	*	
Comms Diagnostics (Hidden)	N/A	B6	00	Note: No text in column text																	
Err Count F			01	UINT32											*	*	*	*	*	*	
Msg Count F			02	UINT32											*	*	*	*	*	*	
Prot Count F			03	UINT32											*	*	*	*	*	*	
Slave Count F			04	UINT32											*	*	*	*	*	*	
Reset Count F			05	(Reset Menu Cell cmd only)											*	*	*	*	*	*	
Err Count R			06	UINT32											*	*	*	*	*	*	
Prot Count R			07	UINT32											*	*	*	*	*	*	
Slave Count R			08	UINT32											*	*	*	*	*	*	
Busy Count R			09	UINT32											*	*	*	*	*	*	
Reset Count R			0A	(Reset Menu Cell cmd only)											*	*	*	*	*	*	
PSL DATA		B7	00												*	*	*	*	*	*	
Grp1 PSL Ref		B7	01	ASCII Text (32 chars)		31000	31015	G3	Default PSL "model number"	Data					*	*	*	*	*	*	
Date/Time		B7	02	IEC870 Date & Time		31016	31019	G12		Data					*	*	*	*	*	*	when downloaded
Grp1 PSL ID		B7	03	Unsigned Integer (32 bits)		31020	31021	G27	0	Data					*	*	*	*	*	*	
Grp2 PSL Ref		B7	11	ASCII Text (32 chars)		31022	31037	G3	Default PSL "model number"	Data					*	*	*	*	*	*	
Date/Time		B7	12	IEC870 Date & Time		31038	31041	G12		Data					*	*	*	*	*	*	when downloaded
Grp2 PSL ID		B7	13	Unsigned Integer (32 bits)		31042	31043	G27	0	Data					*	*	*	*	*	*	
Grp3 PSL Ref		B7	21	ASCII Text (32 chars)		31044	31059	G3	Default PSL "model number"	Data					*	*	*	*	*	*	
Date/Time		B7	22	IEC870 Date & Time		31060	31063	G12		Data					*	*	*	*	*	*	when downloaded
Grp3 PSL ID		B7	23	Unsigned Integer (32 bits)		31064	31065	G27	0	Data					*	*	*	*	*	*	

Courier Text	LCD ref	Courier Ref		Data Type	Data Group Courier	Modbus Address		Data Group Modbus	Default Setting	Cell Type	Min	Max	Step	Password Level	Model						Comment
		Col	Row			Start	End								1	2	3	4	5	6	
Grp4 PSL Ref		B7	31	ASCII Text (32 chars)		31066	31079	G3	Default PSL "model number"	Data					*	*	*	*	*	*	
Date/Time		B7	32	IEC870 Date & Time		31082	31085	G12		Data					*	*	*	*	*	*	when downloaded
Grp4 PSL ID		B7	33	Unsigned Integer (32 bits)		31086	31087	G27	0	Data					*	*	*	*	*	*	
COMMS SYS DATA	N/A	BF	00																		
Dist Record Cntrl Ref			01	Menu Cell(2)					B300	Data					*	*	*	*	*	*	Disturbance Record Control Reference
Dist Record Extract Ref			02	Menu Cell(2)					B400	Data					*	*	*	*	*	*	Disturbance Record Extraction Reference
Setting Transfer			03	Unsigned Integer						Setting					*	*	*	*	*	*	
Reset Demand			04	None (Reset Menu Cell)						Data (but supports Reset Menu)					*	*	*	*	*	*	Rest Measurements Demand Values
UNUSED			05																		
Block Xfer Ref			06	Menu Cell(2)					B200	Data					*	*	*	*	*	*	Block Transfer Reference

Data Types

Type	Value / Bit Mask	Description	Notes
G1		UNSIGNED INTEGER	eg. 5678 stored as 5678
G2		NUMERIC SETTING	See 50300.3110.004
G3		ASCII TEXT CHARACTERS	
	0x00FF	2nd character	
	0xFF00	1st character	
G4		PLANT STATUS (2 REGISTERS)	(0 = Off, 1 = On)
	(Second reg, First Reg)		
	0x0000,0x0001	Plant Status 1	
	0x0000,0x0002	Plant Status 2	
	0x0000,0x0004	Plant Status 3	
	0x0000,0x0008	Plant Status 4	
	0x0000,0x0010	Plant Status 5	
	0x0000,0x0020	Plant Status 6	
	0x0000,0x0040	Plant Status 7	
	0x0000,0x0080	Plant Status 8	
	0x0000,0x0100	Plant Status 9	
	0x0000,0x0200	Plant Status 10	
	0x0000,0x0400	Plant Status 11	
	0x0000,0x0800	Plant Status 12	
	0x0000,0x1000	Plant Status 13	
	0x0000,0x2000	Plant Status 14	
	0x0000,0x4000	Plant Status 15	
	0x0000,0x8000	Plant Status 16	
	0x0001,0x0000	Plant Status 17	
	0x0002,0x0000	Plant Status 18	
	0x0004,0x0000	Plant Status 19	
	0x0008,0x0000	Plant Status 20	
	0x0010,0x0000	Plant Status 21	
	0x0020,0x0000	Plant Status 22	
	0x0040,0x0000	Plant Status 23	
	0x0080,0x0000	Plant Status 24	
	0x0100,0x0000	Plant Status 25	
	0x0200,0x0000	Plant Status 26	
	0x0400,0x0000	Plant Status 27	
	0x0800,0x0000	Plant Status 28	
	0x1000,0x0000	Plant Status 29	
	0x2000,0x0000	Plant Status 30	
	0x4000,0x0000	Plant Status 31	
	0x8000,0x0000	Plant Status 32	
G5		CONTROL STATUS (2 REGISTERS)	(0 = Off, 1 = On)
	(Second reg, First Reg)		
	0x0000,0x0001	Control Status 1	
	0x0000,0x0002	Control Status 2	

Type	Value / Bit Mask	Description	Notes
	0x0000,0x0004	Control Status 3	
	0x0000,0x0008	Control Status 4	
	0x0000,0x0010	Control Status 5	
	0x0000,0x0020	Control Status 6	
	0x0000,0x0040	Control Status 7	
	0x0000,0x0080	Control Status 8	
	0x0000,0x0100	Control Status 9	
	0x0000,0x0200	Control Status 10	
	0x0000,0x0400	Control Status 11	
	0x0000,0x0800	Control Status 12	
	0x0000,0x1000	Control Status 13	
	0x0000,0x2000	Control Status 14	
	0x0000,0x4000	Control Status 15	
	0x0000,0x8000	Control Status 16	
	0x0001,0x0000	Control Status 17	
	0x0002,0x0000	Control Status 18	
	0x0004,0x0000	Control Status 19	
	0x0008,0x0000	Control Status 20	
	0x0010,0x0000	Control Status 21	
	0x0020,0x0000	Control Status 22	
	0x0040,0x0000	Control Status 23	
	0x0080,0x0000	Control Status 24	
	0x0100,0x0000	Control Status 25	
	0x0200,0x0000	Control Status 26	
	0x0400,0x0000	Control Status 27	
	0x0800,0x0000	Control Status 28	
	0x1000,0x0000	Control Status 29	
	0x2000,0x0000	Control Status 30	
	0x4000,0x0000	Control Status 31	
	0x8000,0x0000	Control Status 32	
G6		Record Control Command Register	
	0	No operation	
	1	Clear Event records	
	2	Clear Fault Record	
	3	Clear Maintenance Records	
	4	Reset Indications	
	5	Clear Disturbances	
G7		VTS Indicate/Block	
	0	Blocking	
	1	Indication	
G8	(Second reg, First Reg)	LOGIC INPUT STATUS	(0 = Off, 1 = Energised)
	0x0000,0x0001	Opto 1 Input State	
	0x0000,0x0002	Opto 2 Input State	
	0x0000,0x0004	Opto 3 Input State	
	0x0000,0x0008	Opto 4 Input State	
	0x0000,0x0010	Opto 5 Input State	
	0x0000,0x0020	Opto 6 Input State	
	0x0000,0x0040	Opto 7 Input State	

Type	Value / Bit Mask	Description	Notes
	0x0000,0x0080	Opto 8 Input State	
	0x0000,0x0100	Opto 9 Input State	
	0x0000,0x0200	Opto 10 Input State	
	0x0000,0x0400	Opto 11 Input State	
	0x0000,0x0800	Opto 12 Input State	
	0x0000,0x1000	Opto 13 Input State	
	0x0000,0x2000	Opto 14 Input State	
	0x0000,0x4000	Opto 15 Input State	
	0x0000,0x8000	Opto 16 Input State	
	0x0001,0x0000	Opto 17 Input State	
	0x0002,0x0000	Opto 18 Input State	
	0x0004,0x0000	Opto 19 Input State	
	0x0008,0x0000	Opto 20 Input State	
	0x0010,0x0000	Opto 21 Input State	
	0x0020,0x0000	Opto 22 Input State	
	0x0040,0x0000	Opto 23 Input State	
	0x0080,0x0000	Opto 24 Input State	
	0x0100,0x0000	Opto 25 Input State	
	0x0200,0x0000	Opto 26 Input State	
	0x0400,0x0000	Opto 27 Input State	
	0x0800,0x0000	Opto 28 Input State	
	0x1000,0x0000	Opto 29 Input State	
	0x2000,0x0000	Opto 30 Input State	
	0x4000,0x0000	Opto 31 Input State	
	0x8000,0x0000	Opto 32 Input State	
G9		RELAY OUTPUT STATUS	(0=Not Operated, 1=Operated)
	(Second reg, First Reg)		
	0x0000,0x0001	Relay 1	
	0x0000,0x0002	Relay 2	
	0x0000,0x0004	Relay 3	
	0x0000,0x0008	Relay 4	
	0x0000,0x0010	Relay 5	
	0x0000,0x0020	Relay 6	
	0x0000,0x0040	Relay 7	
	0x0000,0x0080	Relay 8	
	0x0000,0x0100	Relay 9	
	0x0000,0x0200	Relay 10	
	0x0000,0x0400	Relay 11	
	0x0000,0x0800	Relay 12	
	0x0000,0x1000	Relay 13	
	0x0000,0x2000	Relay 14	
	0x0000,0x4000	Relay 15	
	0x0000,0x8000	Relay 16	
	0x0001,0x0000	Relay 17	
	0x0002,0x0000	Relay 18	
	0x0004,0x0000	Relay 19	
	0x0008,0x0000	Relay 20	
	0x0010,0x0000	Relay 21	
	0x0020,0x0000	Relay 22	

Type	Value / Bit Mask	Description	Notes
	0x0040,0x0000	Relay 23	
	0x0080,0x0000	Relay 24	
	0x0100,0x0000	Relay 25	
	0x0200,0x0000	Relay 26	
	0x0400,0x0000	Relay 27	
	0x0800,0x0000	Relay 28	
	0x1000,0x0000	Relay 29	
	0x2000,0x0000	Relay 30	
	0x4000,0x0000	Relay 31	
	0x8000,0x0000	Relay 32	
G11		YES/NO	
	0	No	
	1	Yes	
G12		TIME AND DATE (4 REGISTERS)	This will take the IEC 870 format as shown in ref (J) section 5.1.16
	0xFFFF	1st register - Milli-seconds	
	0x9FBF	2nd register - Summertime & hours / Validity & minutes	
	0x0FFF	3rd Register - Month of year / Day of month / Day of week	
	0x007F	4th Register - Years	
G13		EVENT RECORD TYPE	
	0	Latched alarm active	
	1	Latched alarm inactive	
	2	Self reset alarm active	
	3	Self reset alarm inactive	
	4	Relay event	
	5	Opto event	
	6	Protection event	
	7	Platform event	
	8	Fault logged event	
	9	Maintenance record logged event	
G14		I> Blocking	
	Bit 0	VTS Blocks I>1	
	Bit 1	VTS Blocks I>2	
	Bit 2	VTS Blocks I>3	
	Bit 3	VTS Blocks I>4	
	Bit 4	A/R Blocks I>3	
	Bit 5	A/R Blocks I>4	
	Bit 6	Not Used	
	Bit 7	Not Used	
G15		DISTURBANCE RECORD INDEX STATUS	
	0	No Record	
	1	Unextracted	
	2	Extracted	
G16		FAULTED PHASE	
	0x0001	Start A	
	0x0002	Start B	
	0x0004	Start C	
	0x0008	Start N	
	0x0010	Trip A	

Type	Value / Bit Mask	Description	Notes
	0x0020	Trip B	
	0x0040	Trip C	
	0x0080	Trip N	
G17		IRIG-B Status	
	0	Card Not Fitted	
	1	Card Failed	
	2	Signal Healthy	
	3	No Signal	
G18		Record Selection Command Register	
	0x0000	No Operation	
	0x0001	Select next event	
	0x0002	Accept Event	
	0x0004	Select next Disurbance Record	
	0x0008	Accept disturbance record	
	0x0010	Select Next Disturbance record page	
G19		LANGUAGE	
	0	English	
	1	Francais	
	2	Deutsch	
	3	Espanol	
G20	(Second reg, First Reg)	PASSWORD (2 REGISTERS)	When registers of this type are read this slave will always indicate an "*" in each character poisition te preserve the password security.
	0x0000, 0x00FF	First password character	
	0x0000, 0xFF00	Second password character	
	0x00FF, 0x0000	Third password character	
	0xFF00, 0x0000	Fourth password character	
G21		IEC870 Interface	
	0	Copper	
	1	Fibre Optic	
G22		PASSWORD CONTROL ACCESS LEVEL	
	0	Level 0 - Passwords required for levels 1 & 2.	
	1	Level 1 - Password required for level 2.	
	2	Level 2 - No passwords required.	
G23		Voltage Curve selection	
	0	Disabled	
	1	DT	
	2	IDMT	
G24	2 REGISTERS	UNSIGNED LONG VALUE, 3 DECIMAL PLACES	
		High order word of long stored in 1st register	
		Low order word of long stored in 2nd register	
		Example 123456.789 stored as 123456789	
G25	1 REGISTER	UNSIGNED VALUE, 3 DECIMAL PLACES	
		Example 50.050 stored as 50050	
G26		RELAY STATUS	
	0x0001	In Service Status (1 = In service, 0 = out of service)	
	0x0002	Minor Self Test Failure (=1, 0 otherwise)	
	0x0004	New auto-extraction event available (=1, 0 otherwise)	
	0x0008	Time Synchronised (=1 after Modbus time synch. Resets to 0 after 5	
	0x0010	New auto-extraction disturbance record available (=1, 0 otherwise)	

Type	Value / Bit Mask	Description	Notes
	0x0020	Fault (not used always 0)	
	0x0040	Trip LED status (1 = LED on, 0 = LED off)	
	0x0080	Alarm status summary (logical OR of all alarm status bits)	
	0x0100	Unused	
	0x0200	Unused	
	0x0400	Unused	
	0x0800	Unused	
	0x1000	Unused	
	0x2000	Unused	
	0x4000	Unused	
	0x8000	Unused	
G27	2 REGISTERS	UNSIGNED LONG VALUE	Example 123456 stored as 123456
		High order word of long stored in 1st register	
		Low order word of long stored in 2nd register	
G28	1 REGISTER	SIGNED VALUE POWER & WATT-HOURS	
		Power = (Secondary power/CT secondary) *(100/VT secondary)	
G29	3 REGISTER	POWER MULTIPLER	
		All power measurments use a signed value of type G28 and a 2 unsigned long multiplier of type G27 Value = Real Value *110/(CTsecondary*VTsecondary).	
		For Primary Power Multipler = CTprimary *VTprimary/110	
		For Secondary Power Multipler = CTsecondary *VTsecondary/110	
G30	1 REGISTER	SIGNED VALUE, 2 DECIMAL PLACES	
G31		ANALOGUE CHANNEL ASSIGNMENT SELECTOR	(Models 1 & 2)
	0	IA	
	1	IB	
	2	IC	
	3	IN	
G31		ANALOGUE CHANNEL ASSIGNMENT SELECTOR	(Model 3 & 5)
	0	IA	
	1	IB	
	2	IC	
	3	IN	
	4	VA	
	5	VB	
	6	VC	
	7	IM	
	8	V Checksync	
G31		ANALOGUE CHANNEL ASSIGNMENT SELECTOR	(Model 4 & 6)
	0	IA	
	1	IB	
	2	IC	
	3	IN	
	4	VA	
	5	VB	
	6	VC	

Type	Value / Bit Mask	Description	Notes
	7	IM	
	8	IA2	
	9	IB2	
	10	IC2	
	11	IN2	
G32	***Please refer to table on page 71***		
G33		RECORDER TRIGGERING (2 REGISTERS, 32 BINARY FLAGS)	(0 = No Trigger, 1= Trigger)
	(Second reg, First Reg)		
	0x0000,0x0001	Digital Channel 1 Bit 0	
	0x0000,0x0002	Digital Channel 1 Bit 1	
	0x0000,0x0004	Digital Channel 1 Bit 2	
	0x0000,0x0008	Digital Channel 1 Bit 3	
	0x0000,0x0010	Digital Channel 1 Bit 4	
	0x0000,0x0020	Digital Channel 1 Bit 5	
	0x0000,0x0040	Digital Channel 1 Bit 6	
	0x0000,0x0080	Digital Channel 1 Bit 7	
	0x0000,0x0100	Digital Channel 1 Bit 8	
	0x0000,0x0200	Digital Channel 1 Bit 9	
	0x0000,0x0400	Digital Channel 1 Bit 10	
	0x0000,0x0800	Digital Channel 1 Bit 11	
	0x0000,0x1000	Digital Channel 1 Bit 12	
	0x0000,0x2000	Digital Channel 1 Bit 13	
	0x0000,0x4000	Digital Channel 1 Bit 14	
	0x0000,0x8000	Digital Channel 1 Bit 15	
	0x0001,0x0000	Digital Channel 2 Bit 0	
	0x0002,0x0000	Digital Channel 2 Bit 1	
	0x0004,0x0000	Digital Channel 2 Bit 2	
	0x0008,0x0000	Digital Channel 2 Bit 3	
	0x0010,0x0000	Digital Channel 2 Bit 4	
	0x0020,0x0000	Digital Channel 2 Bit 5	
	0x0040,0x0000	Digital Channel 2 Bit 6	
	0x0080,0x0000	Digital Channel 2 Bit 7	
	0x0100,0x0000	Digital Channel 2 Bit 8	
	0x0200,0x0000	Digital Channel 2 Bit 9	
	0x0400,0x0000	Digital Channel 2 Bit 10	
	0x0800,0x0000	Digital Channel 2 Bit 11	
	0x1000,0x0000	Digital Channel 2 Bit 12	
	0x2000,0x0000	Digital Channel 2 Bit 13	
	0x4000,0x0000	Digital Channel 2 Bit 14	
	0x8000,0x0000	Digital Channel 2 Bit 15	
G34		TRIGGER MODE	
	0	Single	
	1	Extended	
G35		Numeric Setting (as G2 but 2 registers)	Number of steps from minimum value expressed as 2 register 32 bit unsigned int
G36		TEST AUTORECLOSE	
	0	No Operation	
	1	Trip 3 Pole	

Type	Value / Bit Mask	Description	Notes
	2	Trip Pole A	
	3	Trip Pole B	
	4	Trip Pole C	
G37		ENABLED / DISABLED	
	0	Disabled	
	1	Enabled	
G38m		COMMUNICATION BAUD RATE (MODBUS)	
	0	9600 bits/s	
	1	19200 bits/s	
	2	38400 bits/s	
G38v		COMMUNICATION BAUD RATE (IEC 60870)	
	0	9600 bits/s	
	1	19200 bits/s	
G38d		COMMUNICATION BAUD RATE (DNP 3.0)	
	0	1200 bits/s	
	1	2400 bits/s	
	2	4800 bits/s	
	3	9600 bits/s	
	4	19200 bits/s	
	5	38400 bits/s	
G39		COMMUNICATIONS PARITY	
	0	Odd	
	1	Even	
	2	None	
G40		CHECK SYNC INPUT SELECTION	
	0	A-N	
	1	B-N	
	2	C-N	
	3	A-B	
	4	B-C	
	5	C-A	
G41		CHECK SYNC VOLTAGE BLOCKING	
	0	None	
	1	V<	
	2	V>	
	3	Vdiff>	
	4	V< and V>	
	5	V< and Vdiff>	
	6	V> and Vdiff>	
	7	V< V> and Vdiff>	
G42		CHECK SYNC SLIP CONTROL	
	0	None	
	1	Timer	
	2	Frequency	
	3	Both	
G43		IDMT CURVE TYPE	
	0	Disabled	
	1	DT	

Type	Value / Bit Mask	Description	Notes
	2	IEC S Inverse	
	3	IEC V Inverse	
	4	IEC E Inverse	
	5	UK LT Inverse	
	6	IEEE M Inverse	
	7	IEEE V Inverse	
	8	IEEE E Inverse	
	9	US Inverse	
	10	US ST Inverse	
G44		DIRECTION	
	0	Non-Directional	
	1	Directional Fwd	
	2	Directional Rev	
G45		VTS BLOCK	
	0	Block	
	1	Non-Directional	
G46		POLARISATION	
	0	Zero Sequence	
	1	Neg Sequence	
G47		MEASURING MODE	
	0	Phase-Phase	
	1	Phase-Neutral	
G48		OPERATION MODE	
	0	Any Phase	
	1	Three Phase	
G49		V0 INPUT	
	0	Measured	
	1	Derived	
G50		RTD SELECT	
	0x0001	RTD Input #1	
	0x0002	RTD Input #2	
	0x0004	RTD Input #3	
	0x0008	RTD Input #4	
	0x0010	RTD Input #5	
	0x0020	RTD Input #6	
	0x0040	RTD Input #7	
	0x0080	RTD Input #8	
	0x0100	RTD Input #9	
	0x0200	RTD Input #10	
G51		FAULT LOCATION	
	0	Distance	
	1	Ohms	
	2	% of Line	
G52		DEFAULT DISPLAY	
	0	3Ph + N Current	
	1	3Ph Voltage	
	2	Power	
	3	Date and Time	

Type	Value / Bit Mask	Description	Notes
	4	Description	
	5	Plant Reference	
	6	Frequency	
	7	Access Level	
G53		SELECT FACTORY DEFAULTS	
	0	No Operation	
	1	All Settings	
	2	Setting Group 1	
	3	Setting Group 2	
	4	Setting Group 3	
	5	Setting Group 4	
G54		SELECT PRIMARY SECONDARY MEASUREMENTS	
	0	Primary	
	1	Secondary	
G55		CIRCUIT BREAKER CONTROL	
	0	No Operation	
	1	Trip	
	2	Close	
	3	No Operation	
	4	No Operation	
	5	No Operation	
	6	No Operation	
	7	No Operation	
	8	No Operation	
	9	Trip CB2	
	10	Close CB2	
G56		PHASE MEASUREMENT REFERENCE	Models 3, 4, 5 & 6
	0	VA	
	1	VB	
	2	VC	
	3	IA	
	4	IB	
	5	IC	
G56		PHASE MEASUREMENT REFERENCE	Models 1 & 2
	0	IA	
	1	IB	
	2	IC	
G57		Data Transfer Domain	
	0	PSL Settings	
	1	PSL Configuration	
G58		SEF SELECTION	
	0	SEF Enabled	
	1	Wattmetric SEF	
	2	REF	
G59		BATTERY STATUS	
	0	Dead	
	1	Healthy	
G60		IDMT CURVE TYPE	

Type	Value / Bit Mask	Description	Notes
	0	DT	
	1	Inverse	
G61		ACTIVE GROUP CONTROL	
	0	Select via Menu	
	1	Select via Opto	
G62		SAVE AS	
	0	No Operation	
	1	Save	
	2	Abort	
G63		IN> Blocking	
	Bit 0	VTS Blocks IN>1	
	Bit 1	VTS Blocks IN>2	
	Bit 2	VTS Blocks IN>3	
	Bit 3	VTS Blocks IN>4	
	Bit 4	A/R Blocks IN>3	
	Bit 5	A/R Blocks IN>4	
	Bit 6	Not Used	
	Bit 7	Not Used	
G64		ISEF> Blocking	
	Bit 0	VTS Blks ISEF>1	
	Bit 1	VTS Blks ISEF>2	
	Bit 2	VTS Blks ISEF>3	
	Bit 3	VTS Blks ISEF>4	
	Bit 4	A/R Blks ISEF>3	
	Bit 5	A/R Blks ISEF>4	
	Bit 6	Not Used	
	Bit 7	Not Used	
G65		F< Function Link	
	Bit 0	F<1 U/V Block	
	Bit 1	F<2 U/V Block	
	Bit 2	F<3 U/V Block	
	Bit 3	F<4 U/V Block	
	Bit 4	Not Used	
	Bit 5	Not Used	
	Bit 6	Not Used	
	Bit 7	Not Used	
G66		MESSAGE FORMAT	
	0	No Trigger	
	1 2	Trigger L/H Trigger H/L	
G67		THERMAL OVERLOAD	
	0	Disabled	
	1	Single	
	2	Dual	
G68		CB Fail Reset Options	
	0	I< Only	
	1	CB Open & I<	

Type	Value / Bit Mask	Description	Notes
	2	Prot Reset & I<	
G69		VTS RESET MODE	
	0	Manual	
	1	Auto	
G70		AUTORECLOSE MODE	
	0	Opto Set	
	1	Auto	
	2	User Set	
	3	Pulse Set	
G71		PROTOCOL	
	0	Courier	
	1	IEC870-5-103	
	2	Modbus	
	3	DNP 3.0	
G72		START DEAD TIME	
	0	Protection Reset	
	1	CB Trips	
G73		RECLAIM TIME if PROTECTION START	
	0	On Prot Start	
	1	No operation	
G74		RESET LOCKOUT	
	0	User Interface	
	1	Select NonAuto	
G75		Auto-Reclose after Control Close	
	0	Enabled	
	1	Inhibited	
G76		TRANSFER MODE	
	0	Prepare Rx	
	1	Complete Rx	
	2	Prepare Tx	
	3	Complete Tx	
	4	Rx Prepared	
	5	Tx Prepared	
	6	OK	
	7	Error	
G77		Auto-Reclose	
	0	Out of Service	
	1	In Service	
G78		AR Telecontrol	
	0	No Operation	
	1	Auto	
	2	Non-auto	
G79		Custom Settings	
	0	Disabled	
	1	Basic	
	2	Complete	
G80		Visible/Invisible	
	0	Invisible	

Type	Value / Bit Mask	Description	Notes
	1	Visible	
G81		Reset Lockout by	
	0	User Interface	
	1	CB Close	
G82		A/R Protection blocking	
	0 1	No Block Block Inst Prot	
G83		A/R Status	
	0	Auto Mode	
	1	Non-auto Mode	
	2	Live Line	
G84	Modbus value+bit pos (Second reg, First Reg)	Started Elements(Product Specific)	
	0x0000,0x0001	General Start	
	0x0000,0x0002	Start I Diff	
	0x0000,0x0004	Start Z1	
	0x0000,0x0008	Start Z2	
	0x0000,0x0010	Start Z3	
	0x0000,0x0020	Start I>1	
	0x0000,0x0040	Start I>2	
	0x0000,0x0080	Start I>3	
	0x0000,0x0100	Start I>4	
	0x0000,0x0200	Start IN>1	
	0x0000,0x0400	Start IN>2	
	0x0000,0x0800	Start IN>3	
	0x0000,0x1000	Start IN>4	
	0x0000,0x2000	Start ISEF>1	
	0x0000,0x4000	Start ISEF>2	
	0x0000,0x8000	Start ISEF>3	
	0x0001,0x0000	Start ISEF>4	
	0x0002,0x0000	Start Thermal	
	0x0004,0x0000		
	0x0008,0x0000		
	0x0010,0x0000		
	0x0020,0x0000		
	0x0040,0x0000		
	0x0080,0x0000		
	0x0100,0x0000		
	0x0200,0x0000		
	0x0400,0x0000		
	0x0800,0x0000		
	0x1000,0x0000		
	0x2000,0x0000		
	0x4000,0x0000		
	0x8000,0x0000		
G85	Modbus value+bit pos (Second reg, First Reg)	Tripped Elements(1)(Product Specific)	
	0x0000,0x0001	Any Trip	
	0x0000,0x0002	Trip I Diff	

Type	Value / Bit Mask	Description	Notes
	0x0000,0x0004	InterTrip I Diff	
	0x0000,0x0008	PIT	
	0x0000,0x0010	DIT	
	0x0000,0x0020	Trip Z1	
	0x0000,0x0040	Trip Z2	
	0x0000,0x0080	Trip Z3	
	0x0000,0x0100	InterTrip Backup	
	0x0000,0x0200	Trip I>1	
	0x0000,0x0400	Trip I>2	
	0x0000,0x0800	Trip I>3	
	0x0000,0x1000	Trip I>4	
	0x0000,0x2000	Trip Broken line	
	0x0000,0x4000	Trip IN>1	
	0x0000,0x8000	Trip IN>2	
	0x0001,0x0000	Trip IN>3	
	0x0002,0x0000	Trip IN>4	
	0x0004,0x0000	Trip ISEF>1	
	0x0008,0x0000	Trip ISEF>2	
	0x0010,0x0000	Trip ISEF>3	
	0x0020,0x0000	Trip ISEF>4	
	0x0040,0x0000	Trip Thermal	
	0x0080,0x0000	Stub Bus Trip	
	0x0100,0x0000		
	0x0200,0x0000		
	0x0400,0x0000		
	0x0800,0x0000		
	0x1000,0x0000		
	0x2000,0x0000		
	0x4000,0x0000		
	0x8000,0x0000		
G86	Bit Description	Tripped Elements(2) (Product Specific)	
	(Second reg, First Reg)		
	(Courier and IEC870 Bit Position)		
	0x0000,0x0001	Trip V<1	
	0x0000,0x0002	Trip V<2	
	0x0000,0x0004	Trip V>1	
	0x0000,0x0008	Trip V>2	
	0x0000,0x0010	Trip F<1	
	0x0000,0x0020	Trip F<2	
	0x0000,0x0040	Trip F<3	
	0x0000,0x0080	Trip F<4	
	0x0000,0x0100	Trip F>1	
	0x0000,0x0200	Trip F>2	
	0x0000,0x0400		
	0x0000,0x0800		
	0x0000,0x1000		
	0x0000,0x2000		
	0x0000,0x4000		
	0x0000,0x8000		

Type	Value / Bit Mask	Description	Notes
	0x0001,0x0000	Trip RTD 1	
	0x0002,0x0000	Trip RTD 2	
	0x0004,0x0000	Trip RTD 3	
	0x0008,0x0000	Trip RTD 4	
	0x0010,0x0000	Trip RTD 5	
	0x0020,0x0000	Trip RTD 6	
	0x0040,0x0000	Trip RTD 7	
	0x0080,0x0000	Trip RTD 8	
	0x0100,0x0000	Trip RTD 9	
	0x0200,0x0000	Trip RTD 10	
	0x0400,0x0000		
	0x0800,0x0000		
	0x1000,0x0000		
	0x2000,0x0000		
	0x4000,0x0000		
	0x8000,0x0000		
G87	Bit Description	Fault Alarms (Product Specific)	
	(Second reg, First Reg)		
	(Courier and IEC870 Bit Position)		
	0x0000,0x0001	CB Fail 1	
	0x0000,0x0002	CB Fail 2	
	0x0000,0x0004	A/R Trip 1	
	0x0000,0x0008	A/R Trip 2	
	0x0000,0x0010	A/R Trip 3	
	0x0000,0x0020	A/R Trip 4	
	0x0000,0x0040	A/R Trip 5	
	0x0000,0x0080	VTS	
	0x0000,0x0100	PSB	
	0x0000,0x0200	CB2 Fail 1	
	0x0000,0x0400	CB2 Fail 2	
	0x0000,0x0800		
	0x0000,0x1000		
	0x0000,0x2000		
	0x0000,0x4000		
	0x0000,0x8000		
	0x0001,0x0000		
	0x0002,0x0000		
	0x0004,0x0000		
	0x0008,0x0000		
	0x0010,0x0000		
	0x0020,0x0000		
	0x0040,0x0000		
	0x0080,0x0000		
	0x0100,0x0000		
	0x0200,0x0000		
	0x0400,0x0000		
	0x0800,0x0000		
	0x1000,0x0000		
	0x2000,0x0000		

Type	Value / Bit Mask	Description	Notes
	0x4000,0x0000		
	0x8000,0x0000		
G88		Alarms	
	0	Alarm Disabled	
	1	Alarm Enabled	
G89		Main VT Location	
	0	Line	
	1	Bus	
G90		Group Selection	
	0	Group 1	
	1	Group 2	
	2	Group 3	
	3	Group 4	
G91		A/R Protection Blocking	
	0	Allow Tripping	
	1	Block Tripping	
G92		Lockout	
	0	No Lockout	
	1	Lockout	
G93		Commission Test	
	0	No Operation	
	1	Apply Test	
	2	Remove Test	
G94		Commission Test	
	0	No Operation	
	1	Apply Test	
G95		System Fn Links	
	Bit 0	Trip led self reset	(1 = enable self reset)
	Bit 1	Not Used	
	Bit 2	Not Used	
	Bit 3	Not used	
	Bit 4	Not Used	
	Bit 5	Not Used	
	Bit 6	Not Used	
	Bit 7	Not Used	
G96	Bit Position	Indexed Strings	
	0	Unused	
	1	Unused	
	2	SG-opto Invalid	
	3	Protection OFF	
	4	VT Fail Alarm	
	5	Power Swing	
	6	CB Fail	
	7	I^ Maint Alarm	
	8	I^ Maint Lockout	
	9	CB OPs Maint	
	10	CB OPs Lock	
	11	CB Time Maint	

Type	Value / Bit Mask	Description	Notes
	12	CB Time Lockout	
	13	Fault Freq Lock	
	14	CB Status Alarm	
	15	GPS Alarm	
	16	CB Trip Fail	
	17	CB Close Fail	
	18	Man CB Unhealthy	
	19	No C/S Man Close	
	20	A/R Lockout / CB2 Fail Alarm	
	21	A/R CB Unhealthy	
	22	A/R No Checksync	
	23	Incompatible Rly	
	24	Test Loopback	
	25	Signalling Fail	
	26	Change in TD	
	27	C Diff Failure	
	28	C Diff Inhibited	
	29	Config Error	
	30	Re-Config Error	
	31	F out of range	
G97		Distance Unit	
	0	Kilometres	
	1	Miles	
G98		Copy to	
	0	No Operation	
	1	Group 1	
	2	Group 2	
	3	Group 3	
	4	Group 4	
G99		CB Control	
	0	Disabled	
	1	Local	
	2	Remote	
	3	Local+Remote	
	4	Opto	
	5	Opto+local	
	6	Opto+Remote	
	7	Opto+Rem+local	
G100		ENABLE/DISABLE	
	0	Disabled	
	1	Enabled	
	2	Enabled Ch Fail	
G101		SET-UP	
	0	3 Terminal	
	1	2 Terminal	
	2	Dual Redundant	
G102		TRIPPING MODE	
	0	3 Pole	

Type	Value / Bit Mask	Description	Notes
	1	1 and 3 Pole	
G103		SIGNALLING ADDRESS	
	0	0-0	
	1	1-A	
	2	2-A	
	3	3-A	
	4	4-A	
	5	5-A	
	6	6-A	
	7	7-A	
	8	8-A	
	9	9-A	
	10	10-A	
	11	11-A	
	12	12-A	
	13	13-A	
	14	14-A	
	15	15-A	
	16	16-A	
	17	17-A	
	18	18-A	
	19	19-A	
	20	20-A	
	21	1-B	
	22	2-B	
	23	3-B	
	24	4-B	
	25	5-B	
	26	6-B	
	27	7-B	
	28	8-B	
	29	9-B	
	30	10-B	
	31	11-B	
	32	12-B	
	33	13-B	
	34	14-B	
	35	15-B	
	36	16-B	
	37	17-B	
	38	18-B	
	39	19-B	
	40	20-B	
	41	1-C	
	42	2-C	
	43	3-C	
	44	4-C	
	45	5-C	
	46	6-C	

Type	Value / Bit Mask	Description	Notes
	47	7-C	
	48	8-C	
	49	9-C	
	50	10-C	
	51	11-C	
	52	12-C	
	53	13-C	
	54	14-C	
	55	15-C	
	56	16-C	
	57	17-C	
	58	18-C	
	59	19-C	
	60	20-C	
G104		SIGNALLING BAUD RATE	
	0	64kbits/s	
	1	56kbits/s	
G105		SIGNALLING CLOCK SOURCE	
	0	Internal	
	1	External	
G106		REPORT CHANNEL FAILURE	
	0	Ch 1 Failure	
	1	Ch 2 Failure	
	2	Ch 1 and 2 Fail	
G107		NEUTRAL STATUS	
	0	Biased	
	1	Power	
G108		VECTORIAL COMPENSATION	
	0	Yy0 (0 deg)	
	1	Yd1 (-30 deg)	
	2	Yy2 (-60 deg)	
	3	Yd3 (-90 deg)	
	4	Yy4 (-120 deg)	
	5	Yd5 (-150 deg)	
	6	Yy6 (180 deg)	
	7	Yd7 (+150 deg)	
	8	Yy8 (+120 deg)	
	9	Yd9 (+90 deg)	
	10	Yy10 (+60 deg)	
	11	Yd11 (+30 deg)	
	12	Ydy0 (0 deg)	
	13	Ydy6 (180 deg)	
G109		RE-CONFIGURATION	
	0	Three Ended	
	1	Two Ended	(L&R1)
	2	Two Ended	(L&R2)
	3	Two Ended	(R1&R2)
G110		DEFAULT DISPLAY	(Models 1 & 2)

Type	Value / Bit Mask	Description	Notes
	0	3Ph + N Current	
	1	Date and Time	
	2	Description	
	3	Plant Reference	
	4	Frequency	
	5	Access Level	
G112		IDMT CURVE TYPE	
	0	DT	
	1	IEC S Inverse	
	2	IEC V Inverse	
	3	IEC E Inverse	
	4	UK LT Inverse	
	5	IEEE M Inverse	
	6	IEEE V Inverse	
	7	IEEE E Inverse	
	8	US Inverse	
	9	US ST Inverse	
G113		Channel Fn Links	(note logic 1 is healthy)
	Bit 0	Ch1 Rx	
	Bit 1	Ch1 Tx	
	Bit 2	Ch2 Rx	
	Bit 3	Ch2 Tx	
	Bit 4	Local GPS	
	Bit 5	Ch1 GPS	
	Bit 6	Ch2 GPS	
	Bit 7	Ch1 Signal Lost	
	Bit 8	Ch2 Signal Lost	
	Bit 9	Ch1 Path Yellow	
	Bit 10	Ch2 Path Yellow	
	Bit 11	Ch1 Mismatch RxN	
	Bit 12	Ch2 Mismatch RxN	
G114		AR STATUS	
	0	No Action	
	1	Initiate AR	
	2	Block AR	
G115		AR STATUS	
	0	Allow Autoclose	
	1	BAR 2 and 3 Phase	
	2	BAR 3 Phase	
G118		CB Control Logic Input Assignment	Models 1 & 2
	0	None	
	1	52A	
	2	52B	
	3	Both 52A and 52B	
G118		CB Control Logic Input Assignment	Models 3, 4, 5 & 6
	0	None	
	1	52A 3 pole	
	2	52B 3 pole	

Type	Value / Bit Mask	Description	Notes
	3	52A & 52B 3 pole	
	4	52A 1 pole	
	5	52B 1 pole	
	6	52A & 52B 1 pole	
G119		Test Mode	
	0	Disabled	
	1	Test Mode	
	2	Blocked contacts	
G120		Forward/Reverse	
		Forward	
		Reverse	
G121		Loopback Mode	
	0	Disabled	
	1	External	
	2	Internal	
G125	2 REGISTERS	IEEE FLOATING POINT FORMAT	
		Bit 31 = sign	
		Bits 30-23 = e7 - e0	
		Implicit 1.	
		Bits 22-0 = f22 - f0	
G126		Prop Relay Equal Command	
	0	No operation	
	1	Restore C Diff	
G127		Autoreclose Dead Time Start	
	0	Protection Op	
	1	Protection Reset	
G128	Bit Position	Indexed Strings	
	0	Rear Comms fail	
	1	Unused	
	2	Unused	
	3	Unused	
	4	Not Used	
	5	Not Used	
	6	Not Used	
	7	Not Used	
	8	Not Used	
	9	Not Used	
	10	Not Used	
	11	Not Used	
	12	Not Used	
	13	C Diff Comm Mode	
	14	IEEE C37.94	
	15	Not Used	
	16	SR User Alarm 1	
	17	SR User Alarm 2	
	18	SR User Alarm 3	
	19	SR User Alarm 4	
	20	SR User Alarm 5	

Type	Value / Bit Mask	Description	Notes
	21	SR User Alarm 6	
	22	SR User Alarm 7	
	23	SR User Alarm 8	
	24	MR User Alarm 9	
	25	MR User Alarm 10	
	26	MR User Alarm 11	
	27	MR User Alarm 12	
	28	MR User Alarm 13	
	29	MR User Alarm 14	
	30	MR User Alarm 15	
	31	MR User Alarm 16	
G130		Protection Comms Mode	
	0	Standard	
	1	IEEE C37.94	
G131		Protection Comms N*64kbits/s Slots	
	0	Auto	
	1	1	
	2	2	
	3	3	
	4	4	
	5	5	
	6	6	
	7	7	
	8	8	
	9	9	
	10	10	
	11	11	
	12	12	
G200		Threshold Voltages	
	0	24-27V	
	1	30-34V	
	2	48-54V	
	3	110-125V	
	4	220-250V	
	5	Custom	
G201		Universal Optos	
	0	24-27V	
	1	30-34V	
	2	48-54V	
	3	110-125V	
	4	220-250V	
G202	(2nd Reg, 1st Reg)	Controll Input Status (2 REGISTERS)	(0 = Reset, 1 = Set)
	0x0000,0x0001	Control Input 1	
	0x0000,0x0002	Control Input 2	
	0x0000,0x0004	Control Input 3	
	0x0000,0x0008	Control Input 4	
	0x0000,0x0010	Control Input 5	

Type	Value / Bit Mask	Description	Notes
	0x0000,0x0020	Control Input 6	
	0x0000,0x0040	Control Input 7	
	0x0000,0x0080	Control Input 8	
	0x0000,0x0100	Control Input 9	
	0x0000,0x0200	Control Input 10	
	0x0000,0x0400	Control Input 11	
	0x0000,0x0800	Control Input 12	
	0x0000,0x1000	Control Input 13	
	0x0000,0x2000	Control Input 14	
	0x0000,0x4000	Control Input 15	
	0x0000,0x8000	Control Input 16	
	0x0001,0x0000	Control Input 17	
	0x0002,0x0000	Control Input 18	
	0x0004,0x0000	Control Input 19	
	0x0008,0x0000	Control Input 20	
	0x0010,0x0000	Control Input 21	
	0x0020,0x0000	Control Input 22	
	0x0040,0x0000	Control Input 23	
	0x0080,0x0000	Control Input 24	
	0x0100,0x0000	Control Input 25	
	0x0200,0x0000	Control Input 26	
	0x0400,0x0000	Control Input 27	
	0x0800,0x0000	Control Input 28	
	0x1000,0x0000	Control Input 29	
	0x2000,0x0000	Control Input 30	
	0x4000,0x0000	Control Input 31	
	0x8000,0x0000	Control Input 32	
G203		Virtual Input	
	0	No Operation	
	1	Set	
	2	Reset	
G204		Second Rear Comms Card Status	
	0	Unsupported	
	1	Card Not Fitted	
	2	EAI232 OK	
	3	EAI485 OK	
	4	K Bus OK	
G205		Port Config (Second Rear Port)	
	0	EAI232 (RS232)	
	1	EAI485 (RS485)	
	2	K Bus	
G206		Comms Mode	
	0	IEC60870 FT1.2 Frame	
	1	10-bit no parity	
G207		Port Config	
	0	K Bus	
	1	EIA485 (RS485)	

Type	Value / Bit Mask	Description	Notes
G208		Port Status	
	0	K Bus OK	
	1	EIA485 OK	
	1	Fibre Optic OK	
G210		CS103 Blocking	
	0	Disabled	
	1	Monitor Blocking	
	2	Command Blocking	
G220		Ethernet Media	
	0	Copper	
	1	Fibre	
G221		GOOSE STARTUP MODE (Reserved)	
	0	Promiscuous	
	1	Broadcast	
G222		AE QUALIFIER SELECTOR (Reserved)	
	0	Not Used	
	1	Used	
G223		IED STATISTICS RESET (Reserved)	
	0	Our IED	
	1	Viewed IED	
	2	All Enrolled	
	3	All Enrolled + Ours	
G224		ETHERNET LOOPBACK MODE (Reserved)	
	0	Loopback Off	
	1	Internal Loop	
	2	External Loop	
G225		SOFTWARE RELOAD MODE (Reserved)	
	0	No Action	
	1	Reload Software	
G226		Link Status	
	0	Alarm	
	1	Event	
	2	None	
G100		ADD PRODUCT SPECIFIC DATA GROUPS HERE	
to			
G500			
G228		Alarm Status 3	
	0	Battery Fail	
	1	Field Volt Fail	
	2	Rear Comm 2 Fail	
	3	GOOSE IED Absent	
	4	NIC Not Fitted	
	5	NIC No Response	
	6	NIC Fatal Error	
	7	NIC Soft. Reload	
	8	Bad TCP/IP Cfg.	

Type	Value / Bit Mask	Description	Notes
	9	Bad OSI Config.	
	10	NIC Link Fail	
	11	NIC SW Mis-Match	
	12	IP Addr Conflict	
	13	Unused	
	14	Unused	
	15	Unused	
	16	Backup Setting	
	17	Unused	
	18	Unused	
	19	Unused	
	20	Unused	
	21	Unused	
	22	Unused	
	23	Unused	
	24	Unused	
	25	Unused	
	26	Unused	
	27	Unused	
	28	Unused	
	29	Unused	
	30	Unused	
	31	Unused	
G231		DIRECT ACCESS KEYS	
	0	Disabled	
	1	Enabled	
G232		CONTROL INPUT COMMAND TEXT	
	0	ON/OFF	
	1	SET/RESET	
	2	IN/OUT	
	3	ENABLED/DISABLED	
G233		HOTKEY ENABLED CONTROL INPUTS	
	0x00000001	Control Input 1	
	0x00000002	Control Input 2	
	0x00000004	Control Input 3	
	0x00000008	Control Input 4	
	0x00000010	Control Input 5	
	0x00000020	Control Input 6	
	0x00000040	Control Input 7	
	0x00000080	Control Input 8	
	0x00000100	Control Input 9	
	0x00000200	Control Input 10	
	0x00000400	Control Input 11	
	0x00000800	Control Input 12	
	0x00001000	Control Input 13	
	0x00002000	Control Input 14	
	0x00004000	Control Input 15	
	0x00008000	Control Input 16	
	0x00010000	Control Input 17	

Type	Value / Bit Mask	Description	Notes
	0x00020000	Control Input 18	
	0x00040000	Control Input 19	
	0x00080000	Control Input 20	
	0x00100000	Control Input 21	
	0x00200000	Control Input 22	
	0x00400000	Control Input 23	
	0x00800000	Control Input 24	
	0x01000000	Control Input 25	
	0x02000000	Control Input 26	
	0x04000000	Control Input 27	
	0x08000000	Control Input 28	
	0x10000000	Control Input 29	
	0x20000000	Control Input 30	
	0x40000000	Control Input 31	
	0x80000000	Control Input 32	
G234		CONTROL INPUT SIGNAL TYPE	
	0	Latched	
	1	Pulsed	
G235		ETHERNET PROTOCOL	
	0	UCA 2.0	
	1	UCA 2.0 GOOSE	
G237		Port Config	
	0	Standard 60%-80%	
	1	50% - 70%	
G238		Modbus IEC Time	
	0	Standard	
	1	Reverse	

Data Types

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	0	Unused	Unused	Unused	Unused	Unused	Unused
	1	Output R1	Output R1	Output R1	Output R1	Output R1	Output R1
	2	Output R2	Output R2	Output R2	Output R2	Output R2	Output R2
	3	Output R3	Output R3	Output R3	Output R3	Output R3	Output R3
	4	Output R4	Output R4	Output R4	Output R4	Output R4	Output R4
	5	Output R5	Output R5	Output R5	Output R5	Output R5	Output R5
	6	Output R6	Output R6	Output R6	Output R6	Output R6	Output R6
	7	Output R7	Output R7	Output R7	Output R7	Output R7	Output R7
	8	Input L1	Output R8	Output R8	Output R8	Output R8	Output R8
	9	Input L2	Output R9	Output R9	Output R9	Output R9	Output R9
	10	Input L3	Output R10	Output R10	Output R10	Output R10	Output R10
	11	Input L4	Output R11	Output R11	Output R11	Output R11	Output R11
	12	Input L5	Output R12	Output R12	Output R12	Output R12	Output R12
	13	Input L6	Output R13	Output R13	Output R13	Output R13	Output R13
	14	Input L7	Output R14	Output R14	Output R14	Output R14	Output R14
	15	Input L8	Input L1	Input L1	Input L1	Output R15	Output R15
	16	Programmable LED 1	Input L2	Input L2	Input L2	Output R16	Output R16
	17	Programmable LED 2	Input L3	Input L3	Input L3	Output R17	Output R17
	18	Programmable LED 3	Input L4	Input L4	Input L4	Output R18	Output R18
	19	Programmable LED 4	Input L5	Input L5	Input L5	Output R19	Output R19
	20	Programmable LED 5	Input L6	Input L6	Input L6	Output R20	Output R20
	21	Programmable LED 6	Input L7	Input L7	Input L7	Output R21	Output R21
	22	Programmable LED 7	Input L8	Input L8	Input L8	Output R22	Output R22
	23	Programmable LED 8	Input L9	Input L9	Input L9	Output R23	Output R23
	24	SG-opto Invalid	Input L10	Input L10	Input L10	Output R24	Output R24
	25	Prot'n Disabled	Input L11	Input L11	Input L11	Output R25	Output R25
	26	CB Fail Alarm	Input L12	Input L12	Input L12	Output R26	Output R26
	27	I^ Maint Alarm	Input L13	Input L13	Input L13	Output R27	Output R27
	28	I^ Lockout Alarm	Input L14	Input L14	Input L14	Output R28	Output R28
	29	CB OPs Maint	Input L15	Input L15	Input L15	Output R29	Output R29

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	30	CB OPs Lock	Input L16	Input L16	Input L16	Output R30	Output R30
	31	CB Time Maint	Programmable LED 1	Programmable LED 1	Programmable LED 1	Output R31	Output R31
	32	CB Time Lockout	Programmable LED 2	Programmable LED 2	Programmable LED 2	Output R32	Output R32
	33	Fault Freq Lock	Programmable LED 3	Programmable LED 3	Programmable LED 3	Input L1	Input L1
	34	CB Status Alarm	Programmable LED 4	Programmable LED 4	Programmable LED 4	Input L2	Input L2
	35	CB Trip Fail	Programmable LED 5	Programmable LED 5	Programmable LED 5	Input L3	Input L3
	36	CB Close Fail	Programmable LED 6	Programmable LED 6	Programmable LED 6	Input L4	Input L4
	37	Man CB Unhealthy	Programmable LED 7	Programmable LED 7	Programmable LED 7	Input L5	Input L5
	38	InCompatible Rly	Programmable LED 8	Programmable LED 8	Programmable LED 8	Input L6	Input L6
	39	Test Loopback	SG-opto Invalid	SG-opto Invalid	SG-opto Invalid	Input L7	Input L7
	40	Signalling Fail	Prot'n Disabled	Prot'n Disabled	Prot'n Disabled	Input L8	Input L8
	41	Comm Delay Alarm	CB Fail Alarm	VT Fail Alarm	VT Fail Alarm	Input L9	Input L9
	42	C Diff Failure	I^ Maint Alarm	Power Swing	Power Swing	Input L10	Input L10
	43	C Diff Inhibited	I^ Lockout Alarm	CB Fail Alarm	CB1 Fail Alarm	Input L11	Input L11
	44	Config Error	CB OPs Maint	I^ Maint Alarm	CB Status Alarm	Input L12	Input L12
	45	Re-Config Error	CB OPs Lock	I^ Lockout Alarm	CB Trip Fail	Input L13	Input L13
	46	F out of Range	CB Time Maint	CB OPs Maint	CB Close Fail	Input L14	Input L14
	47	Unused	CB Time Lockout	CB OPs Lock	Man CB Unhealthy	Input L15	Input L15
	48	Unused	Fault Freq Lock	CB Time Maint	CB2 Fail Alarm	Input L16	Input L16
	49	Unused	CB Status Alarm	CB Time Lockout	InCompatible Rly	Input L17	Input L17
	50	Unused	CB Trip Fail	Fault Freq Lock	Test Loopback	Input L18	Input L18
	51	Unused	CB Close Fail	CB Status Alarm	Signalling Fail	Input L19	Input L19
	52	Unused	Man CB Unhealthy	CB Trip Fail	Comm Delay Alarm	Input L20	Input L20
	53	Unused	A/R Lockout	CB Close Fail	C Diff Failure	Input L21	Input L21
	54	Unused	A/R CB Unhealthy	Man CB Unhealthy	C Diff Inhibited	Input L22	Input L22
	55	Unused	InCompatible Rly	No C/S Man Close	Config Error	Input L23	Input L23
	56	C Diff Comm Mode	Test Loopback	A/R Lockout	Re-Config Error	Input L24	Input L24
	57	IEEE C37.94	Signalling Fail	A/R CB Unhealthy	F out of Range	Programmable LED 1	Programmable LED 1
	58	Unused	Comm Delay Alarm	A/R No Checksync	Unused	Programmable LED 2	Programmable LED 2
	59	SR User Alarm 1	C Diff Failure	InCompatible Rly	Unused	Programmable LED 3	Programmable LED 3
	60	SR User Alarm 2	C Diff Inhibited	Test Loopback	Unused	Programmable LED 4	Programmable LED 4
	61	SR User Alarm 3	Config Error	Signalling Fail	Unused	Programmable LED 5	Programmable LED 5

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	62	SR User Alarm 4	Re-Config Error	Comm Delay Alarm	Unused	Programmable LED 6	Programmable LED 6
	63	SR User Alarm 5	F out of Range	C Diff Failure	Unused	Programmable LED 7	Programmable LED 7
	64	SR User Alarm 6	Unused	C Diff Inhibited	Unused	Programmable LED 8	Programmable LED 8
	65	SR User Alarm 7	Unused	Config Error	Unused	SG-opto Invalid	SG-opto Invalid
	66	SR User Alarm 8	Unused	Re-Config Error	Unused	Prot'n Disabled	Prot'n Disabled
	67	MR User Alarm 9	Unused	F out of Range	C Diff Comm Mode	VT Fail Alarm	VT Fail Alarm
	68	MR User Alarm 10	Unused	Unused	IEEE C37.94	Power Swing	Power Swing
	69	MR User Alarm 11	Unused	Unused	Unused	CB Fail Alarm	CB1 Fail Alarm
	70	MR User Alarm 12	Unused	Unused	SR User Alarm 1	I^ Maint Alarm	CB Status Alarm
	71	MR User Alarm 13	Unused	Unused	SR User Alarm 2	I^ Lockout Alarm	GPS Alarm
	72	MR User Alarm 14	Unused	Unused	SR User Alarm 3	CB OPs Maint	CB Trip Fail
	73	MR User Alarm 15	C Diff Comm Mode	Unused	SR User Alarm 4	CB OPs Lock	CB Close Fail
	74	MR User Alarm 16	IEEE C37.94	Unused	SR User Alarm 5	CB Time Maint	Man CB Unhealthy
	75	Control Input 1	Unused	Unused	SR User Alarm 6	CB Time Lockout	CB2 Fail Alarm
	76	Control Input 2	SR User Alarm 1	Unused	SR User Alarm 7	Fault Freq Lock	InCompatible Rly
	77	Control Input 3	SR User Alarm 2	C Diff Comm Mode	SR User Alarm 8	CB Status Alarm	Test Loopback
	78	Control Input 4	SR User Alarm 3	IEEE C37.94	MR User Alarm 9	GPS Alarm	Signalling Fail
	79	Control Input 5	SR User Alarm 4	System Split alarm	MR User Alarm 10	CB Trip Fail	Comm Delay Alarm
	80	Control Input 6	SR User Alarm 5	SR User Alarm 1	MR User Alarm 11	CB Close Fail	C Diff Failure
	81	Control Input 7	SR User Alarm 6	SR User Alarm 2	MR User Alarm 12	Man CB Unhealthy	C Diff Inhibited
	82	Control Input 8	SR User Alarm 7	SR User Alarm 3	MR User Alarm 13	No C/S Man Close	Config Error
	83	Control Input 9	SR User Alarm 8	SR User Alarm 4	MR User Alarm 14	A/R Lockout	Re-Config Error
	84	Control Input 10	MR User Alarm 9	SR User Alarm 5	MR User Alarm 15	A/R CB Unhealthy	F out of Range
	85	Control Input 11	MR User Alarm 10	SR User Alarm 6	MR User Alarm 16	A/R No Checksync	Unused
	86	Control Input 12	MR User Alarm 11	SR User Alarm 7	Control Input 1	InCompatible Rly	Unused
	87	Control Input 13	MR User Alarm 12	SR User Alarm 8	Control Input 2	Test Loopback	Unused
	88	Control Input 14	MR User Alarm 13	MR User Alarm 9	Control Input 3	Signalling Fail	Unused
	89	Control Input 15	MR User Alarm 14	MR User Alarm 10	Control Input 4	Comm Delay Alarm	Unused
	90	Control Input 16	MR User Alarm 15	MR User Alarm 11	Control Input 5	C Diff Failure	Unused
	91	Control Input 17	MR User Alarm 16	MR User Alarm 12	Control Input 6	C Diff Inhibited	Unused
	92	Control Input 18	Control Input 1	MR User Alarm 13	Control Input 7	Config Error	Unused
	93	Control Input 19	Control Input 2	MR User Alarm 14	Control Input 8	Re-Config Error	Unused

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	94	Control Input 20	Control Input 3	MR User Alarm 15	Control Input 9	F out of Range	C Diff Comm Mode
	95	Control Input 21	Control Input 4	MR User Alarm 16	Control Input 10	Unused	IEEE C37.94
	96	Control Input 22	Control Input 5	Control Input 1	Control Input 11	Unused	Unused
	97	Control Input 23	Control Input 6	Control Input 2	Control Input 12	Unused	SR User Alarm 1
	98	Control Input 24	Control Input 7	Control Input 3	Control Input 13	Unused	SR User Alarm 2
	99	Control Input 25	Control Input 8	Control Input 4	Control Input 14	Unused	SR User Alarm 3
	100	Control Input 26	Control Input 9	Control Input 5	Control Input 15	Unused	SR User Alarm 4
	101	Control Input 27	Control Input 10	Control Input 6	Control Input 16	Unused	SR User Alarm 5
	102	Control Input 28	Control Input 11	Control Input 7	Control Input 17	Unused	SR User Alarm 6
	103	Control Input 29	Control Input 12	Control Input 8	Control Input 18	Unused	SR User Alarm 7
	104	Control Input 30	Control Input 13	Control Input 9	Control Input 19	C Diff Comm Mode	SR User Alarm 8
	105	Control Input 31	Control Input 14	Control Input 10	Control Input 20	IEEE C37.94	MR User Alarm 9
	106	Control Input 32	Control Input 15	Control Input 11	Control Input 21	System Split alarm	MR User Alarm 10
	107	Any Trip	Control Input 16	Control Input 12	Control Input 22	SR User Alarm 1	MR User Alarm 11
	108	Diff Trip	Control Input 17	Control Input 13	Control Input 23	SR User Alarm 2	MR User Alarm 12
	109	Diff Trip A	Control Input 18	Control Input 14	Control Input 24	SR User Alarm 3	MR User Alarm 13
	110	Diff Trip B	Control Input 19	Control Input 15	Control Input 25	SR User Alarm 4	MR User Alarm 14
	111	Diff Trip C	Control Input 20	Control Input 16	Control Input 26	SR User Alarm 5	MR User Alarm 15
	112	Diff InterTrip	Control Input 21	Control Input 17	Control Input 27	SR User Alarm 6	MR User Alarm 16
	113	Diff InterTrip A	Control Input 22	Control Input 18	Control Input 28	SR User Alarm 7	Control Input 1
	114	Diff InterTrip B	Control Input 23	Control Input 19	Control Input 29	SR User Alarm 8	Control Input 2
	115	Diff InterTrip C	Control Input 24	Control Input 20	Control Input 30	MR User Alarm 9	Control Input 3
	116	Perm InterTrip	Control Input 25	Control Input 21	Control Input 31	MR User Alarm 10	Control Input 4
	117	BU Intertrip	Control Input 26	Control Input 22	Control Input 32	MR User Alarm 11	Control Input 5
	118	BU InterTrip A	Control Input 27	Control Input 23	Any Trip	MR User Alarm 12	Control Input 6
	119	BU InterTrip B	Control Input 28	Control Input 24	Diff Trip	MR User Alarm 13	Control Input 7
	120	BU InterTrip C	Control Input 29	Control Input 25	Diff Trip A	MR User Alarm 14	Control Input 8
	121	I>1 Trip	Control Input 30	Control Input 26	Diff Trip B	MR User Alarm 15	Control Input 9
	122	I>1 Trip A	Control Input 31	Control Input 27	Diff Trip C	MR User Alarm 16	Control Input 10
	123	I>1 Trip B	Control Input 32	Control Input 28	Diff InterTrip	Control Input 1	Control Input 11
	124	I>1 Trip C	Any Trip	Control Input 29	Diff InterTrip A	Control Input 2	Control Input 12
	125	I>2 Trip	Diff Trip	Control Input 30	Diff InterTrip B	Control Input 3	Control Input 13

Type	**Value / Bit Mask**						
G32		P541	P542	P543	P544	P545	P546
	126	I>2 Trip A	Diff Trip A	Control Input 31	Diff InterTrip C	Control Input 4	Control Input 14
	127	I>2 Trip B	Diff Trip B	Control Input 32	Perm InterTrip	Control Input 5	Control Input 15
	128	I>2 Trip C	Diff Trip C	Any Trip	Zone 1 Trip	Control Input 6	Control Input 16
	129	I>3 Trip	Diff InterTrip	Diff Trip	Zone 1 A Trip	Control Input 7	Control Input 17
	130	I>3 Trip A	Diff InterTrip A	Diff Trip A	Zone 1 B Trip	Control Input 8	Control Input 18
	131	I>3 Trip B	Diff InterTrip B	Diff Trip B	Zone 1 C Trip	Control Input 9	Control Input 19
	132	I>3 Trip C	Diff InterTrip C	Diff Trip C	Zone 1 N Trip	Control Input 10	Control Input 20
	133	I>4 Trip	Perm InterTrip	Diff InterTrip	Zone 2 Trip	Control Input 11	Control Input 21
	134	I>4 Trip A	BU Intertrip	Diff InterTrip A	Zone 2 A Trip	Control Input 12	Control Input 22
	135	I>4 Trip B	BU InterTrip A	Diff InterTrip B	Zone 2 B Trip	Control Input 13	Control Input 23
	136	I>4 Trip C	BU InterTrip B	Diff InterTrip C	Zone 2 C Trip	Control Input 14	Control Input 24
	137	IN>1 Trip	BU InterTrip C	Perm InterTrip	Zone 2 N Trip	Control Input 15	Control Input 25
	138	IN>2 Trip	I>1 Trip	Zone 1 Trip	Zone 3 Trip	Control Input 16	Control Input 26
	139	IN>3 Trip	I>1 Trip A	Zone 1 A Trip	Zone 3 A Trip	Control Input 17	Control Input 27
	140	IN>4 Trip	I>1 Trip B	Zone 1 B Trip	Zone 3 B Trip	Control Input 18	Control Input 28
	141	Broken Wire Trip	I>1 Trip C	Zone 1 C Trip	Zone 3 C Trip	Control Input 19	Control Input 29
	142	Thermal Trip	I>2 Trip	Zone 1 N Trip	Zone 3 N Trip	Control Input 20	Control Input 30
	143	Diff Start	I>2 Trip A	Zone 2 Trip	BU Intertrip	Control Input 21	Control Input 31
	144	Any Start	I>2 Trip B	Zone 2 A Trip	BU InterTrip A	Control Input 22	Control Input 32
	145	Diff Start A	I>2 Trip C	Zone 2 B Trip	BU InterTrip B	Control Input 23	Any Trip
	146	Diff Start B	I>3 Trip	Zone 2 C Trip	BU InterTrip C	Control Input 24	Diff Trip
	147	Diff Start C	I>3 Trip A	Zone 2 N Trip	Force 3pole BU	Control Input 25	Diff Trip A
	148	I>1 Start	I>3 Trip B	Zone 3 Trip	I>1 Trip	Control Input 26	Diff Trip B
	149	I>1 Start A	I>3 Trip C	Zone 3 A Trip	I>1 Trip A	Control Input 27	Diff Trip C
	150	I>1 Start B	I>4 Trip	Zone 3 B Trip	I>1 Trip B	Control Input 28	Diff InterTrip
	151	I>1 Start C	I>4 Trip A	Zone 3 C Trip	I>1 Trip C	Control Input 29	Diff InterTrip A
	152	I>2 Start	I>4 Trip B	Zone 3 N Trip	I>2 Trip	Control Input 30	Diff InterTrip B
	153	I>2 Start A	I>4 Trip C	Pole Discrepancy	I>2 Trip A	Control Input 31	Diff InterTrip C
	154	I>2 Start B	IN>1 Trip	BU Intertrip	I>2 Trip B	Control Input 32	Perm InterTrip
	155	I>2 Start C	IN>2 Trip	BU InterTrip A	I>2 Trip C	Any Trip	Zone 1 Trip
	156	I>3 Start	IN>3 Trip	BU InterTrip B	I>3 Trip	Diff Trip	Zone 1 A Trip
	157	I>3 Start A	IN>4 Trip	BU InterTrip C	I>3 Trip A	Diff Trip A	Zone 1 B Trip

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	158	I>3 Start B	Broken Wire Trip	Force 3pole BU	I>3 Trip B	Diff Trip B	Zone 1 C Trip
	159	I>3 Start C	Thermal Trip	I>1 Trip	I>3 Trip C	Diff Trip C	Zone 1 N Trip
	160	I>4 Start	AR Trip Test	I>1 Trip A	I>4 Trip	Diff InterTrip	Zone 2 Trip
	161	I>4 Start A	Diff Start	I>1 Trip B	I>4 Trip A	Diff InterTrip A	Zone 2 A Trip
	162	I>4 Start B	Any Start	I>1 Trip C	I>4 Trip B	Diff InterTrip B	Zone 2 B Trip
	163	I>4 Start C	Diff Start A	I>2 Trip	I>4 Trip C	Diff InterTrip C	Zone 2 C Trip
	164	IN>1 Start	Diff Start B	I>2 Trip A	IN>1 Trip	Perm InterTrip	Zone 2 N Trip
	165	IN>2 Start	Diff Start C	I>2 Trip B	IN>2 Trip	Zone 1 Trip	Zone 3 Trip
	166	IN>3 Start	I>1 Start	I>2 Trip C	IN>3 Trip	Zone 1 A Trip	Zone 3 A Trip
	167	IN>4 Start	I>1 Start A	I>3 Trip	IN>4 Trip	Zone 1 B Trip	Zone 3 B Trip
	168	Thermal Alarm	I>1 Start B	I>3 Trip A	ISEF>1 Trip	Zone 1 C Trip	Zone 3 C Trip
	169	I> BlockStart	I>1 Start C	I>3 Trip B	ISEF>2 Trip	Zone 1 N Trip	Zone 3 N Trip
	170	IN/SEF>Blk Start	I>2 Start	I>3 Trip C	ISEF>3 Trip	Zone 2 Trip	BU Intertrip
	171	Platform Alarm 0	I>2 Start A	I>4 Trip	ISEF>4 Trip	Zone 2 A Trip	BU InterTrip A
	172	Platform Alarm 2	I>2 Start B	I>4 Trip A	Broken Wire Trip	Zone 2 B Trip	BU InterTrip B
	173	Platform Alarm 3	I>2 Start C	I>4 Trip B	Thermal Trip	Zone 2 C Trip	BU InterTrip C
	174	Platform Alarm 4	I>3 Start	I>4 Trip C	Stub Bus Trip	Zone 2 N Trip	Force 3pole BU
	175	Platform Alarm 5	I>3 Start A	IN>1 Trip	Zone 1 Start	Zone 3 Trip	I>1 Trip
	176	Platform Alarm 6	I>3 Start B	IN>2 Trip	Zone 2 Start	Zone 3 A Trip	I>1 Trip A
	177	Platform Alarm 7	I>3 Start C	IN>3 Trip	Zone 3 Start	Zone 3 B Trip	I>1 Trip B
	178	Platform Alarm 8	I>4 Start	IN>4 Trip	Diff Start	Zone 3 C Trip	I>1 Trip C
	179	Platform Alarm 9	I>4 Start A	ISEF>1 Trip	Any Start	Zone 3 N Trip	I>2 Trip
	180	Platform Alarm 10	I>4 Start B	ISEF>2 Trip	Diff Start A	Pole Discrepancy	I>2 Trip A
	181	Platform Alarm 11	I>4 Start C	ISEF>3 Trip	Diff Start B	BU Intertrip	I>2 Trip B
	182	Platform Alarm 12	IN>1 Start	ISEF>4 Trip	Diff Start C	BU InterTrip A	I>2 Trip C
	183	Platform Alarm 13	IN>2 Start	Broken Wire Trip	Zone 1 A Start	BU InterTrip B	I>3 Trip
	184	Platform Alarm 14	IN>3 Start	Thermal Trip	Zone 1 B Start	BU InterTrip C	I>3 Trip A
	185	Platform Alarm 15	IN>4 Start	AR Trip Test	Zone 1 C Start	Force 3pole BU	I>3 Trip B
	186	Platform Alarm 16	Thermal Alarm	AR Trip Test A	Zone 1 N Start	I>1 Trip	I>3 Trip C
	187	Platform Alarm 17	I> BlockStart	AR Trip Test B	Zone 2 A Start	I>1 Trip A	I>4 Trip
	188	Platform Alarm 18	IN/SEF>Blk Start	AR Trip Test C	Zone 2 B Start	I>1 Trip B	I>4 Trip A
	189	Platform Alarm 19	Platform Alarm 0	Zone 1 Start	Zone 2 C Start	I>1 Trip C	I>4 Trip B

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	190	Platform Alarm 20	Platform Alarm 2	Zone 2 Start	Zone 2 N Start	I>2 Trip	I>4 Trip C
	191	Platform Alarm 21	Platform Alarm 3	Zone 3 Start	Zone 3 A Start	I>2 Trip A	IN>1 Trip
	192	Platform Alarm 22	Platform Alarm 4	Diff Start	Zone 3 B Start	I>2 Trip B	IN>2 Trip
	193	Platform Alarm 23	Platform Alarm 5	Any Start	Zone 3 C Start	I>2 Trip C	IN>3 Trip
	194	Platform Alarm 24	Platform Alarm 6	Diff Start A	Zone 3 N Start	I>3 Trip	IN>4 Trip
	195	Platform Alarm 25	Platform Alarm 7	Diff Start B	Zone 6 Start	I>3 Trip A	ISEF>1 Trip
	196	Platform Alarm 26	Platform Alarm 8	Diff Start C	I>1 Start	I>3 Trip B	ISEF>2 Trip
	197	Platform Alarm 27	Platform Alarm 9	Zone 1 A Start	I>1 Start A	I>3 Trip C	ISEF>3 Trip
	198	Platform Alarm 28	Platform Alarm 10	Zone 1 B Start	I>1 Start B	I>4 Trip	ISEF>4 Trip
	199	Platform Alarm 29	Platform Alarm 11	Zone 1 C Start	I>1 Start C	I>4 Trip A	Broken Wire Trip
	200	Platform Alarm 30	Platform Alarm 12	Zone 1 N Start	I>2 Start	I>4 Trip B	Thermal Trip
	201	Platform Alarm 31	Platform Alarm 13	Zone 2 A Start	I>2 Start A	I>4 Trip C	Stub Bus Trip
	202	Bfail1 Trip 3ph	Platform Alarm 14	Zone 2 B Start	I>2 Start B	IN>1 Trip	Zone 1 Start
	203	Bfail2 Trip 3ph	Platform Alarm 15	Zone 2 C Start	I>2 Start C	IN>2 Trip	Zone 2 Start
	204	Control Trip	Platform Alarm 16	Zone 2 N Start	I>3 Start	IN>3 Trip	Zone 3 Start
	205	Control Close	Platform Alarm 17	Zone 3 A Start	I>3 Start A	IN>4 Trip	Diff Start
	206	Close in Prog	Platform Alarm 18	Zone 3 B Start	I>3 Start B	ISEF>1 Trip	Any Start
	207	Lockout Alarm	Platform Alarm 19	Zone 3 C Start	I>3 Start C	ISEF>2 Trip	Diff Start A
	208	Field Volt Fail	Platform Alarm 20	Zone 3 N Start	I>4 Start	ISEF>3 Trip	Diff Start B
	209	IA< Start	Platform Alarm 21	Zone 6 Start	I>4 Start A	ISEF>4 Trip	Diff Start C
	210	IB< Start	Platform Alarm 22	I>1 Start	I>4 Start B	Broken Wire Trip	Zone 1 A Start
	211	IC< Start	Platform Alarm 23	I>1 Start A	I>4 Start C	Thermal Trip	Zone 1 B Start
	212	ISEF< Start	Platform Alarm 24	I>1 Start B	IN>1 Start	AR Trip Test	Zone 1 C Start
	213	All Poles Dead	Platform Alarm 25	I>1 Start C	IN>2 Start	AR Trip Test A	Zone 1 N Start
	214	Any Pole Dead	Platform Alarm 26	I>2 Start	IN>3 Start	AR Trip Test B	Zone 2 A Start
	215	CB Open 3 ph	Platform Alarm 27	I>2 Start A	IN>4 Start	AR Trip Test C	Zone 2 B Start
	216	CB Closed 3 ph	Platform Alarm 28	I>2 Start B	ISEF>1 Start	Zone 1 Start	Zone 2 C Start
	217	SignalFail Ch1Rx	Platform Alarm 29	I>2 Start C	ISEF>2 Start	Zone 2 Start	Zone 2 N Start
	218	SignalFail Ch1Tx	Platform Alarm 30	I>3 Start	ISEF>3 Start	Zone 3 Start	Zone 3 A Start
	219	SignalFail Ch2Rx	Platform Alarm 31	I>3 Start A	ISEF>4 Start	Diff Start	Zone 3 B Start
	220	SignalFail Ch2Tx	Bfail1 Trip 3ph	I>3 Start B	Thermal Alarm	Any Start	Zone 3 C Start
	221	CB Status Alarm	Bfail2 Trip 3ph	I>3 Start C	I> BlockStart	Diff Start A	Zone 3 N Start

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	222	Ch1 Intertrip 1	Control Trip	I>4 Start	IN/SEF>Blk Start	Diff Start B	Zone 6 Start
	223	Ch1 Intertrip 2	Control Close	I>4 Start A	Platform Alarm 0	Diff Start C	I>1 Start
	224	Ch1 Intertrip 3	Close in Prog	I>4 Start B	Platform Alarm 2	Zone 1 A Start	I>1 Start A
	225	Ch1 Intertrip 4	Block Main Prot	I>4 Start C	Platform Alarm 3	Zone 1 B Start	I>1 Start B
	226	Ch1 Intertrip 5	AR 3pole in prog	IN>1 Start	Platform Alarm 4	Zone 1 C Start	I>1 Start C
	227	Ch1 Intertrip 6	Seq Counter = 0	IN>2 Start	Platform Alarm 5	Zone 1 N Start	I>2 Start
	228	Ch1 Intertrip 7	Seq Counter = 1	IN>3 Start	Platform Alarm 6	Zone 2 A Start	I>2 Start A
	229	Ch1 Intertrip 8	Seq Counter = 2	IN>4 Start	Platform Alarm 7	Zone 2 B Start	I>2 Start B
	230	Ch2 Intertrip 1	Seq Counter = 3	ISEF>1 Start	Platform Alarm 8	Zone 2 C Start	I>2 Start C
	231	Ch2 Intertrip 2	Seq Counter = 4	ISEF>2 Start	Platform Alarm 9	Zone 2 N Start	I>3 Start
	232	Ch2 Intertrip 3	Successful Close	ISEF>3 Start	Platform Alarm 10	Zone 3 A Start	I>3 Start A
	233	Ch2 Intertrip 4	Dead T in Prog	ISEF>4 Start	Platform Alarm 11	Zone 3 B Start	I>3 Start B
	234	Ch2 Intertrip 5	Auto Close	Thermal Alarm	Platform Alarm 12	Zone 3 C Start	I>3 Start C
	235	Ch2 Intertrip 6	A/R Status	I> BlockStart	Platform Alarm 13	Zone 3 N Start	I>4 Start
	236	Ch2 Intertrip 7	Lockout Alarm	IN/SEF>Blk Start	Platform Alarm 14	Zone 6 Start	I>4 Start A
	237	Ch2 Intertrip 8	Field Volt Fail	Platform Alarm 0	Platform Alarm 15	I>1 Start	I>4 Start B
	238	HMI Access Lvl 1	IA< Start	Platform Alarm 2	Platform Alarm 16	I>1 Start A	I>4 Start C
	239	HMI Access Lvl 2	IB< Start	Platform Alarm 3	Platform Alarm 17	I>1 Start B	IN>1 Start
	240	FPort AccessLvl1	IC< Start	Platform Alarm 4	Platform Alarm 18	I>1 Start C	IN>2 Start
	241	FPort AccessLvl2	ISEF< Start	Platform Alarm 5	Platform Alarm 19	I>2 Start	IN>3 Start
	242	RPrt1 AccessLvl1	All Poles Dead	Platform Alarm 6	Platform Alarm 20	I>2 Start A	IN>4 Start
	243	RPrt1 AccessLvl2	Any Pole Dead	Platform Alarm 7	Platform Alarm 21	I>2 Start B	ISEF>1 Start
	244	RPrt2 AccessLvl1	CB Open 3 ph	Platform Alarm 8	Platform Alarm 22	I>2 Start C	ISEF>2 Start
	245	RPrt2 AccessLvl2	CB Closed 3 ph	Platform Alarm 9	Platform Alarm 23	I>3 Start	ISEF>3 Start
	246	Ch1 Signal Lost	SignalFail Ch1Rx	Platform Alarm 10	Platform Alarm 24	I>3 Start A	ISEF>4 Start
	247	Ch1 Path Yellow	SignalFail Ch1Tx	Platform Alarm 11	Platform Alarm 25	I>3 Start B	Thermal Alarm
	248	Ch1 Mismatch RxN	SignalFail Ch2Rx	Platform Alarm 12	Platform Alarm 26	I>3 Start C	I> BlockStart
	249	Ch2 Signal Lost	SignalFail Ch2Tx	Platform Alarm 13	Platform Alarm 27	I>4 Start	IN/SEF>Blk Start
	250	Ch2 Path Yellow	CB Status Alarm	Platform Alarm 14	Platform Alarm 28	I>4 Start A	Platform Alarm 0
	251	Ch2 Mismatch RxN	Ch1 Intertrip 1	Platform Alarm 15	Platform Alarm 29	I>4 Start B	Platform Alarm 2
	252	Virtual Input 1	Ch1 Intertrip 2	Platform Alarm 16	Platform Alarm 30	I>4 Start C	Platform Alarm 3
	253	Virtual Input 2	Ch1 Intertrip 3	Platform Alarm 17	Platform Alarm 31	IN>1 Start	Platform Alarm 4

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	254	Virtual Input 3	Ch1 Intertrip 4	Platform Alarm 18	VTS Fast Block	IN>2 Start	Platform Alarm 5
	255	Virtual Input 4	Ch1 Intertrip 5	Platform Alarm 19	VTS Slow Block	IN>3 Start	Platform Alarm 6
	256	Virtual Input 5	Ch1 Intertrip 6	Platform Alarm 20	CB1 Fail1 Trip	IN>4 Start	Platform Alarm 7
	257	Virtual Input 6	Ch1 Intertrip 7	Platform Alarm 21	CB1 Fail2 Trip	ISEF>1 Start	Platform Alarm 8
	258	Virtual Input 7	Ch1 Intertrip 8	Platform Alarm 22	CB2 Fail1 Trip	ISEF>2 Start	Platform Alarm 9
	259	Virtual Input 8	Ch2 Intertrip 1	Platform Alarm 23	CB2 Fail2 Trip	ISEF>3 Start	Platform Alarm 10
	260	Virtual Input 9	Ch2 Intertrip 2	Platform Alarm 24	Control Trip 1	ISEF>4 Start	Platform Alarm 11
	261	Virtual Input 10	Ch2 Intertrip 3	Platform Alarm 25	Control Close 1	Thermal Alarm	Platform Alarm 12
	262	Virtual Input 11	Ch2 Intertrip 4	Platform Alarm 26	Control Trip 2	I> BlockStart	Platform Alarm 13
	263	Virtual Input 12	Ch2 Intertrip 5	Platform Alarm 27	Control Close 2	IN/SEF>Blk Start	Platform Alarm 14
	264	Virtual Input 13	Ch2 Intertrip 6	Platform Alarm 28	Close in Prog	Platform Alarm 0	Platform Alarm 15
	265	Virtual Input 14	Ch2 Intertrip 7	Platform Alarm 29	Field Volt Fail	Platform Alarm 2	Platform Alarm 16
	266	Virtual Input 15	Ch2 Intertrip 8	Platform Alarm 30	IA< Start	Platform Alarm 3	Platform Alarm 17
	267	Virtual Input 16	HMI Access Lvl 1	Platform Alarm 31	IB< Start	Platform Alarm 4	Platform Alarm 18
	268	Virtual Input 17	HMI Access Lvl 2	VTS Fast Block	IC< Start	Platform Alarm 5	Platform Alarm 19
	269	Virtual Input 18	FPort AccessLvl1	VTS Slow Block	ISEF< Start	Platform Alarm 6	Platform Alarm 20
	270	Virtual Input 19	FPort AccessLvl2	Bfail1 Trip 3ph	CB1 IA< Start	Platform Alarm 7	Platform Alarm 21
	271	Virtual Input 20	RPrt1 AccessLvl1	Bfail2 Trip 3ph	CB1 IB< Start	Platform Alarm 8	Platform Alarm 22
	272	Virtual Input 21	RPrt1 AccessLvl2	Control Trip	CB1 IC< Start	Platform Alarm 9	Platform Alarm 23
	273	Virtual Input 22	RPrt2 AccessLvl1	Control Close	CB1 ISEF< Start	Platform Alarm 10	Platform Alarm 24
	274	Virtual Input 23	RPrt2 AccessLvl2	Close in Prog	CB2 IA< Start	Platform Alarm 11	Platform Alarm 25
	275	Virtual Input 24	Ch1 Signal Lost	AR 3pole in prog	CB2 IB< Start	Platform Alarm 12	Platform Alarm 26
	276	Virtual Input 25	Ch1 Path Yellow	AR 1pole in prog	CB2 IC< Start	Platform Alarm 13	Platform Alarm 27
	277	Virtual Input 26	Ch1 Mismatch RxN	Seq Counter = 0	CB2 ISEF< Start	Platform Alarm 14	Platform Alarm 28
	278	Virtual Input 27	Ch2 Signal Lost	Seq Counter = 1	All Poles Dead	Platform Alarm 15	Platform Alarm 29
	279	Virtual Input 28	Ch2 Path Yellow	Seq Counter = 2	Any Pole Dead	Platform Alarm 16	Platform Alarm 30
	280	Virtual Input 29	Ch2 Mismatch RxN	Seq Counter = 3	Pole Dead A	Platform Alarm 17	Platform Alarm 31
	281	Virtual Input 30	Virtual Input 1	Seq Counter = 4	Pole Dead B	Platform Alarm 18	VTS Fast Block
	282	Virtual Input 31	Virtual Input 2	Seq Counter = 5	Pole Dead C	Platform Alarm 19	VTS Slow Block
	283	Virtual Input 32	Virtual Input 3	Successful Close	CB1 Open 3 ph	Platform Alarm 20	CB1 Fail1 Trip
	284	Virtual Output 1	Virtual Input 4	Auto Close	CB1 Open A ph	Platform Alarm 21	CB1 Fail2 Trip
	285	Virtual Output 2	Virtual Input 5	A/R Status 3P	CB1 Open B ph	Platform Alarm 22	CB2 Fail1 Trip

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	286	Virtual Output 3	Virtual Input 6	A/R Status 1P	CB1 Open C ph	Platform Alarm 23	CB2 Fail2 Trip
	287	Virtual Output 4	Virtual Input 7	Force 3 pole AR	CB1 Closed 3 ph	Platform Alarm 24	Control Trip 1
	288	Virtual Output 5	Virtual Input 8	Lockout Alarm	CB1 Closed A ph	Platform Alarm 25	Control Close 1
	289	Virtual Output 6	Virtual Input 9	Field Volt Fail	CB1 Closed B ph	Platform Alarm 26	Control Trip 2
	290	Virtual Output 7	Virtual Input 10	IA< Start	CB1 Closed C ph	Platform Alarm 27	Control Close 2
	291	Virtual Output 8	Virtual Input 11	IB< Start	CB2 Open 3 ph	Platform Alarm 28	Close in Prog
	292	Virtual Output 9	Virtual Input 12	IC< Start	CB2 Open A ph	Platform Alarm 29	Field Volt Fail
	293	Virtual Output10	Virtual Input 13	ISEF< Start	CB2 Open B ph	Platform Alarm 30	IA< Start
	294	Virtual Output11	Virtual Input 14	All Poles Dead	CB2 Open C ph	Platform Alarm 31	IB< Start
	295	Virtual Output12	Virtual Input 15	Any Pole Dead	CB2 Closed 3 ph	VTS Fast Block	IC< Start
	296	Virtual Output13	Virtual Input 16	Pole Dead A	CB2 Closed A ph	VTS Slow Block	ISEF< Start
	297	Virtual Output14	Virtual Input 17	Pole Dead B	CB2 Closed B ph	Bfail1 Trip 3ph	CB1 IA< Start
	298	Virtual Output15	Virtual Input 18	Pole Dead C	CB2 Closed C ph	Bfail2 Trip 3ph	CB1 IB< Start
	299	Virtual Output16	Virtual Input 19	Ctl Check Sync	SignalFail Ch1Rx	Control Trip	CB1 IC< Start
	300	Virtual Output17	Virtual Input 20	A/R Check Synch	SignalFail Ch1Tx	Control Close	CB1 ISEF< Start
	301	Virtual Output18	Virtual Input 21	CB Open 3 ph	SignalFail Ch2Rx	Close in Prog	CB2 IA< Start
	302	Virtual Output19	Virtual Input 22	CB Open A ph	SignalFail Ch2Tx	AR 3pole in prog	CB2 IB< Start
	303	Virtual Output20	Virtual Input 23	CB Open B ph	1 Pole Trip En	AR 1pole in prog	CB2 IC< Start
	304	Virtual Output21	Virtual Input 24	CB Open C ph	CB1 Status Alarm	Seq Counter = 0	CB2 ISEF< Start
	305	Virtual Output22	Virtual Input 25	CB Closed 3 ph	CB2 Status Alarm	Seq Counter = 1	All Poles Dead
	306	Virtual Output23	Virtual Input 26	CB Closed A ph	Ch1 Intertrip 1	Seq Counter = 2	Any Pole Dead
	307	Virtual Output24	Virtual Input 27	CB Closed B ph	Ch1 Intertrip 2	Seq Counter = 3	Pole Dead A
	308	Virtual Output25	Virtual Input 28	CB Closed C ph	Ch1 Intertrip 3	Seq Counter = 4	Pole Dead B
	309	Virtual Output26	Virtual Input 29	SignalFail Ch1Rx	Ch1 Intertrip 4	Seq Counter = 5	Pole Dead C
	310	Virtual Output27	Virtual Input 30	SignalFail Ch1Tx	Ch1 Intertrip 5	Successful Close	CB1 Open 3 ph
	311	Virtual Output28	Virtual Input 31	SignalFail Ch2Rx	Ch1 Intertrip 6	Auto Close	CB1 Open A ph
	312	Virtual Output29	Virtual Input 32	SignalFail Ch2Tx	Ch1 Intertrip 7	A/R Status 3P	CB1 Open B ph
	313	Virtual Output30	Virtual Output 1	1 Pole Trip En	Ch1 Intertrip 8	A/R Status 1P	CB1 Open C ph
	314	Virtual Output31	Virtual Output 2	CB Status Alarm	Ch2 Intertrip 1	Force 3 pole AR	CB1 Closed 3 ph
	315	Virtual Output32	Virtual Output 3	Ch1 Intertrip 1	Ch2 Intertrip 2	Lockout Alarm	CB1 Closed A ph
	316		Virtual Output 4	Ch1 Intertrip 2	Ch2 Intertrip 3	Field Volt Fail	CB1 Closed B ph
	317		Virtual Output 5	Ch1 Intertrip 3	Ch2 Intertrip 4	IA< Start	CB1 Closed C ph

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	318		Virtual Output 6	Ch1 Intertrip 4	Ch2 Intertrip 5	IB< Start	CB2 Open 3 ph
	319		Virtual Output 7	Ch1 Intertrip 5	Ch2 Intertrip 6	IC< Start	CB2 Open A ph
	320		Virtual Output 8	Ch1 Intertrip 6	Ch2 Intertrip 7	ISEF< Start	CB2 Open B ph
	321		Virtual Output 9	Ch1 Intertrip 7	Ch2 Intertrip 8	All Poles Dead	CB2 Open C ph
	322		Virtual Output10	Ch1 Intertrip 8	I2>	Any Pole Dead	CB2 Closed 3 ph
	323		Virtual Output11	Ch2 Intertrip 1	HMI Access Lvl 1	Pole Dead A	CB2 Closed A ph
	324		Virtual Output12	Ch2 Intertrip 2	HMI Access Lvl 2	Pole Dead B	CB2 Closed B ph
	325		Virtual Output13	Ch2 Intertrip 3	FPort AccessLvl1	Pole Dead C	CB2 Closed C ph
	326		Virtual Output14	Ch2 Intertrip 4	FPort AccessLvl2	Ctl Check Sync	SignalFail Ch1Rx
	327		Virtual Output15	Ch2 Intertrip 5	RPrt1 AccessLvl1	A/R Check Synch	SignalFail Ch1Tx
	328		Virtual Output16	Ch2 Intertrip 6	RPrt1 AccessLvl2	CB Open 3 ph	SignalFail Ch2Rx
	329		Virtual Output17	Ch2 Intertrip 7	RPrt2 AccessLvl1	CB Open A ph	SignalFail Ch2Tx
	330		Virtual Output18	Ch2 Intertrip 8	RPrt2 AccessLvl2	CB Open B ph	Ch 1 GPS Fail
	331		Virtual Output19	I2>	Ch1 Signal Lost	CB Open C ph	Ch 2 GPS Fail
	332		Virtual Output20	HMI Access Lvl 1	Ch1 Path Yellow	CB Closed 3 ph	1 Pole Trip En
	333		Virtual Output21	HMI Access Lvl 2	Ch1 Mismatch RxN	CB Closed A ph	CB1 Status Alarm
	334		Virtual Output22	FPort AccessLvl1	Ch2 Signal Lost	CB Closed B ph	CB2 Status Alarm
	335		Virtual Output23	FPort AccessLvl2	Ch2 Path Yellow	CB Closed C ph	Ch1 Intertrip 1
	336		Virtual Output24	RPrt1 AccessLvl1	Ch2 Mismatch RxN	SignalFail Ch1Rx	Ch1 Intertrip 2
	337		Virtual Output25	RPrt1 AccessLvl2	Virtual Input 1	SignalFail Ch1Tx	Ch1 Intertrip 3
	338		Virtual Output26	RPrt2 AccessLvl1	Virtual Input 2	SignalFail Ch2Rx	Ch1 Intertrip 4
	339		Virtual Output27	RPrt2 AccessLvl2	Virtual Input 3	SignalFail Ch2Tx	Ch1 Intertrip 5
	340		Virtual Output28	Live Line	Virtual Input 4	Ch 1 GPS Fail	Ch1 Intertrip 6
	341		Virtual Output29	Dead Line	Virtual Input 5	Ch 2 GPS Fail	Ch1 Intertrip 7
	342		Virtual Output30	Live Bus	Virtual Input 6	1 Pole Trip En	Ch1 Intertrip 8
	343		Virtual Output31	Dead Bus	Virtual Input 7	CB Status Alarm	Ch2 Intertrip 1
	344		Virtual Output32	Check Sync 1 OK	Virtual Input 8	Ch1 Intertrip 1	Ch2 Intertrip 2
	345			Check Sync 2 OK	Virtual Input 9	Ch1 Intertrip 2	Ch2 Intertrip 3
	346			SysChks Inactive	Virtual Input 10	Ch1 Intertrip 3	Ch2 Intertrip 4
	347			Ch1 Signal Lost	Virtual Input 11	Ch1 Intertrip 4	Ch2 Intertrip 5
	348			Ch1 Path Yellow	Virtual Input 12	Ch1 Intertrip 5	Ch2 Intertrip 6
	349			Ch1 Mismatch RxN	Virtual Input 13	Ch1 Intertrip 6	Ch2 Intertrip 7

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	350			Ch2 Signal Lost	Virtual Input 14	Ch1 Intertrip 7	Ch2 Intertrip 8
	351			Ch2 Path Yellow	Virtual Input 15	Ch1 Intertrip 8	I2>
	352			Ch2 Mismatch RxN	Virtual Input 16	Ch2 Intertrip 1	HMI Access Lvl 1
	353			Virtual Input 1	Virtual Input 17	Ch2 Intertrip 2	HMI Access Lvl 2
	354			Virtual Input 2	Virtual Input 18	Ch2 Intertrip 3	FPort AccessLvl1
	355			Virtual Input 3	Virtual Input 19	Ch2 Intertrip 4	FPort AccessLvl2
	356			Virtual Input 4	Virtual Input 20	Ch2 Intertrip 5	RPrt1 AccessLvl1
	357			Virtual Input 5	Virtual Input 21	Ch2 Intertrip 6	RPrt1 AccessLvl2
	358			Virtual Input 6	Virtual Input 22	Ch2 Intertrip 7	RPrt2 AccessLvl1
	359			Virtual Input 7	Virtual Input 23	Ch2 Intertrip 8	RPrt2 AccessLvl2
	360			Virtual Input 8	Virtual Input 24	I2>	Ch1 Signal Lost
	361			Virtual Input 9	Virtual Input 25	HMI Access Lvl 1	Ch1 Path Yellow
	362			Virtual Input 10	Virtual Input 26	HMI Access Lvl 2	Ch1 Mismatch RxN
	363			Virtual Input 11	Virtual Input 27	FPort AccessLvl1	Ch2 Signal Lost
	364			Virtual Input 12	Virtual Input 28	FPort AccessLvl2	Ch2 Path Yellow
	365			Virtual Input 13	Virtual Input 29	RPrt1 AccessLvl1	Ch2 Mismatch RxN
	366			Virtual Input 14	Virtual Input 30	RPrt1 AccessLvl2	Virtual Input 1
	367			Virtual Input 15	Virtual Input 31	RPrt2 AccessLvl1	Virtual Input 2
	368			Virtual Input 16	Virtual Input 32	RPrt2 AccessLvl2	Virtual Input 3
	369			Virtual Input 17	Virtual Output 1	Live Line	Virtual Input 4
	370			Virtual Input 18	Virtual Output 2	Dead Line	Virtual Input 5
	371			Virtual Input 19	Virtual Output 3	Live Bus	Virtual Input 6
	372			Virtual Input 20	Virtual Output 4	Dead Bus	Virtual Input 7
	373			Virtual Input 21	Virtual Output 5	Check Sync 1 OK	Virtual Input 8
	374			Virtual Input 22	Virtual Output 6	Check Sync 2 OK	Virtual Input 9
	375			Virtual Input 23	Virtual Output 7	SysChks Inactive	Virtual Input 10
	376			Virtual Input 24	Virtual Output 8	Ch1 Signal Lost	Virtual Input 11
	377			Virtual Input 25	Virtual Output 9	Ch1 Path Yellow	Virtual Input 12
	378			Virtual Input 26	Virtual Output10	Ch1 Mismatch RxN	Virtual Input 13
	379			Virtual Input 27	Virtual Output11	Ch2 Signal Lost	Virtual Input 14
	380			Virtual Input 28	Virtual Output12	Ch2 Path Yellow	Virtual Input 15
	381			Virtual Input 29	Virtual Output13	Ch2 Mismatch RxN	Virtual Input 16

Type	Value / Bit Mask						
G32		P541	P542	P543	P544	P545	P546
	382			Virtual Input 30	Virtual Output14	Virtual Input 1	Virtual Input 17
	383			Virtual Input 31	Virtual Output15	Virtual Input 2	Virtual Input 18
	384			Virtual Input 32	Virtual Output16	Virtual Input 3	Virtual Input 19
	385			Virtual Output 1	Virtual Output17	Virtual Input 4	Virtual Input 20
	386			Virtual Output 2	Virtual Output18	Virtual Input 5	Virtual Input 21
	387			Virtual Output 3	Virtual Output19	Virtual Input 6	Virtual Input 22
	388			Virtual Output 4	Virtual Output20	Virtual Input 7	Virtual Input 23
	389			Virtual Output 5	Virtual Output21	Virtual Input 8	Virtual Input 24
	390			Virtual Output 6	Virtual Output22	Virtual Input 9	Virtual Input 25
	391			Virtual Output 7	Virtual Output23	Virtual Input 10	Virtual Input 26
	392			Virtual Output 8	Virtual Output24	Virtual Input 11	Virtual Input 27
	393			Virtual Output 9	Virtual Output25	Virtual Input 12	Virtual Input 28
	394			Virtual Output10	Virtual Output26	Virtual Input 13	Virtual Input 29
	395			Virtual Output11	Virtual Output27	Virtual Input 14	Virtual Input 30
	396			Virtual Output12	Virtual Output28	Virtual Input 15	Virtual Input 31
	397			Virtual Output13	Virtual Output29	Virtual Input 16	Virtual Input 32
	398			Virtual Output14	Virtual Output30	Virtual Input 17	Virtual Output 1
	399			Virtual Output15	Virtual Output31	Virtual Input 18	Virtual Output 2
	400			Virtual Output16	Virtual Output32	Virtual Input 19	Virtual Output 3
	401			Virtual Output17		Virtual Input 20	Virtual Output 4
	402			Virtual Output18		Virtual Input 21	Virtual Output 5
	403			Virtual Output19		Virtual Input 22	Virtual Output 6
	404			Virtual Output20		Virtual Input 23	Virtual Output 7
	405			Virtual Output21		Virtual Input 24	Virtual Output 8
	406			Virtual Output22		Virtual Input 25	Virtual Output 9
	407			Virtual Output23		Virtual Input 26	Virtual Output10
	408			Virtual Output24		Virtual Input 27	Virtual Output11
	409			Virtual Output25		Virtual Input 28	Virtual Output12
	410			Virtual Output26		Virtual Input 29	Virtual Output13
	411			Virtual Output27		Virtual Input 30	Virtual Output14
	412			Virtual Output28		Virtual Input 31	Virtual Output15
	413			Virtual Output29		Virtual Input 32	Virtual Output16

Type	**Value / Bit Mask**						
G32		P541	P542	P543	P544	P545	P546
	414			Virtual Output30		Virtual Output 1	Virtual Output17
	415			Virtual Output31		Virtual Output 2	Virtual Output18
	416			Virtual Output32		Virtual Output 3	Virtual Output19
	417					Virtual Output 4	Virtual Output20
	418					Virtual Output 5	Virtual Output21
	419					Virtual Output 6	Virtual Output22
	420					Virtual Output 7	Virtual Output23
	421					Virtual Output 8	Virtual Output24
	422					Virtual Output 9	Virtual Output25
	423					Virtual Output10	Virtual Output26
	424					Virtual Output11	Virtual Output27
	425					Virtual Output12	Virtual Output28
	426					Virtual Output13	Virtual Output29
	427					Virtual Output14	Virtual Output30
	428					Virtual Output15	Virtual Output31
	429					Virtual Output16	Virtual Output32
	430					Virtual Output17	
	431					Virtual Output18	
	432					Virtual Output19	
	433					Virtual Output20	
	434					Virtual Output21	
	435					Virtual Output22	
	436					Virtual Output23	
	437					Virtual Output24	
	438					Virtual Output25	
	439					Virtual Output26	
	440					Virtual Output27	
	441					Virtual Output28	
	442					Virtual Output29	
	443					Virtual Output30	
	444					Virtual Output31	
	445					Virtual Output32	

IEC870-5-103: Compatibility Level					**Compatability Level 2**							
Physical Layer												
Electrical Interface EIA RS-485												
Number of loads 1 for one protection equipment												
Optical Interface (Order option)												
Plastic fibre BFOC/2.5 type connector												
Transmission speed												
User Setting : 9600 or 19200												
Application Layer												
One COMMON ADDRESS OF ASDU = LINK ADDRESS												
Standard Information numbers in monitor direction												
ASDU TYPE	**COT**	**FUN**	**Inf No.**	**Description**	**GI**	**Model Number**						**Interpretation**
						1	**2**	**3**	**4**	**5**	**6**	
System Functions(Monitor)												
8	10	255	0	End of General Interrogration		*	*	*	*	*	*	
6	8	255	0	Time Synchronisation		*	*	*	*	*	*	
5	3	192	2	Reset FCB		*	*	*	*	*	*	
5	4	192	3	Reset CU		*	*	*	*	*	*	
5	5	192	4	Start/Restart		*	*	*	*	*	*	
5	6	192	5	Power On		*	*	*	*	*	*	
Note: Indentification message in ASDU 5: "Alstom Grid"+ 16bit model + 8bit major version +1character minor version e.g. "Alstom Grid" + 543 + 21 + 'A												
Status Indications												
1	1,7,9,11,12,20,21	192	16	A/R Status	*		*					Autoreclose in Service
1	1,7,9,11,12,20,21	192	16	A/R Status 3P	*			*		*		Autoreclose in Service 1 pole
1	1,7,9,11,12,20,21	192	17	Tele-protection active								
1	1,7,9,11,12,20,21	192	18	Protection active								
1	1,7,9,11,12,20,21	192	19	LED Reset		*	*	*	*	*	*	RESET_INDICATIONS
1	9,11	192	20	Monitor direction blocked	*	*	*	*	*	*	*	
1	9,11	192	21	Test mode	*	*	*	*	*	*	*	Prot'n Disabled
1	9,11	192	22	Local parameter setting								
1	1,7,9,11,12,20,21	192	23	Characteristic 1	*	*	*	*	*	*	*	PG1 Changed
1	1,7,9,11,12,20,21	192	24	Characteristic 2	*	*	*	*	*	*	*	PG2 Changed

ASDU TYPE	COT	FUN	Inf No.	Description	GI	Model Number						Interpretation
						1	2	3	4	5	6	
1	1,7,9,11,12,20,21	192	25	Characteristic 3	*	*	*	*	*	*	*	PG3 Changed
1	1,7,9,11,12,20,21	192	26	Characteristic 4	*	*	*	*	*	*	*	PG4 Changed
1	1,7,9,11	192	27	Opto 1	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_1
1	1,7,9,11	192	28	Opto 2	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_2
1	1,7,9,11	192	29	Opto 3	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_3
1	1,7,9,11	192	30	Opto 4	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_4
Supervision Indications												
1	1,7,9	192	32	Measurand supervision I								
1	1,7,9	192	33	Measurand supervision V								
1	1,7,9	192	35	Phase sequence supervision								
1	1,7,9	192	36	Trip circuit supervision								
1	1,7,9	192	37	I>> back-up supervision								
1	1,7,9	192	38	VT fuse failure	*			*	*	*	*	VT Supervision Indication
1	1,7,9	192	39	Teleprotection disturbed								
1	1,7,9	192	46	Group warning								
1	1,7,9	192	47	Group alarm								
Earth Fault Indications												
1	1,7,9	192	48	Earth Fault L1								
1	1,7,9	192	49	Earth Fault L2								
1	1,7,9	192	50	Earth Fault L3								
1	1,7,9	192	51	Earth Fault Fwd								
1	1,7,9	192	52	Earth Fault Rev								
Fault Indications												
2	1,7,9	192	64	Start /pickup L1	*	*	*	*	*	*	*	Differential Start A
2	1,7,9	192	65	Start /pickup L2	*	*	*	*	*	*	*	Differential Start B
2	1,7,9	192	66	Start /pickup L3	*	*	*	*	*	*	*	Differential Start C
2	1,7,9	192	67	Start /pickup N								
2	1,7	192	68	General Trip		*	*	*	*	*	*	Any Trip
2	1,7	192	69	Trip L1		*	*	*	*	*	*	Differential Trip A
2	1,7	192	70	Trip L2		*	*	*	*	*	*	Differential Trip B
2	1,7	192	71	Trip L3		*	*	*	*	*	*	Differential Trip C
2	1,7	192	72	Trip I>>								

ASDU TYPE	COT	FUN	Inf No.	Description	GI	Model Number						Interpretation
						1	2	3	4	5	6	
4	1,7	192	73	Fault Location in ohms				*	*	*	*	
2	1,7	192	74	Fault forward								
2	1,7	192	75	Fault reverse								
2	1,7	192	76	Teleprotection signal sent								
2	1,7	192	77	Teleprotection signal received								
2	1,7	192	78	Zone 1				*	*	*	*	Zone 1 Trip
2	1,7	192	79	Zone 2				*	*	*	*	Zone 2 Trip
2	1,7	192	80	Zone 3				*	*	*	*	Zone 3 Trip
2	1,7	192	81	Zone 4								
2	1,7	192	82	Zone 5								
2	1,7	192	83	Zone 6								
2	1,7,9	192	84	General Start	*	*	*	*	*	*	*	Any Start
2	1,7	192	85	Breaker Failure		*	*	*	*	*	*	CB Fail Alarm
2	1,7	192	86	Trip measuring system L1								
2	1,7	192	87	Trip measuring system L2								
2	1,7	192	88	Trip measuring system L3								
2	1,7	192	89	Trip measuring system E								
2	1,7	192	90	Trip I>		*	*	*	*	*	*	I>1 Trip
2	1,7	192	91	Trip I>>		*	*	*	*	*	*	I>3 Trip
2	1,7	192	92	Trip IN>		*	*	*	*	*	*	IN1>1 Trip
2	1,7	192	93	Trip IN>>		*	*	*	*	*	*	IN1>3 Trip
Auto-Reclose Indications (Monitor)												
1	1,7	192	128	CB 'on' by A/R			*	*		*		Autoreclose Close Signal
1	1,7	192	129	CB 'on' by long time A/R								
1	1,7,9	192	130	AR blocked	*		*	*		*		Autoreclose Lockout
Measurands (Monitor)												
3.1	2,7	192	144	Measurand I								
3.2	2,7	192	145	Measurands I,V								
3.3	2,7	192	146	Measurands I,V,P,Q								
3.4	2,7	192	147	Measurands IN,VEN								
9	2,7	192	148	Measurands IL1,2,3,VL1,2,3,P,Q,f		*	*	*	*	*	*	Note unavailable measurands sent as invalid
Generic Functions(Monitor)												

ASDU TYPE	COT	FUN	Inf No.	Description	GI	Model Number						Interpretation
						1	2	3	4	5	6	
10	42,43	192	240	Read Headings								
10	42,43	192	241	Read attributes of all entries of a group								
10	42,43	192	243	Read directory of entry								
10	1,2,7,9,11,12,42,43	192	244	Real attribute of entry								
10	10	192	245	End of GGI								
10	41,44	192	249	Write entry with confirm								
10	40,41	192	250	Write entry with execute								
10	40	192	251	Write entry aborted								
Standard information numbers in control direction												
System Functions (Control)												
7	9	192	0	Init General Interrogation		*	*	*	*	*	*	
6	8			Time Synchronisation		*	*	*	*	*	*	
General Commands												
20	20	192	16	Auto-recloser on/off			*					Autoreclose in Service
20	20	192	16	Auto-recloser on/off				*		*		Autoreclose in Service 3 pole
20	20	192	17	Teleprotection on/off								
20	20	192	18	Protection on/off								
20	20	192	19	LED Reset		*	*	*	*	*	*	Reset Indications and Latches
20	20	192	23	Activate characteristic 1		*	*	*	*	*	*	Group 1 Active
20	20	192	24	Activate characteristic 2		*	*	*	*	*	*	Group 2 Active
20	20	192	25	Activate characteristic 3		*	*	*	*	*	*	Group 3 Active
20	20	192	26	Activate characteristic 4		*	*	*	*	*	*	Group 4 Active
Generic Functions												
21	42	192	240	Read headings of all defined groups								
21	42	192	241	Read single attribute of all entries of a group								
21	42	192	243	Read directory of single entry								
21	42	192	244	Read attribute of sngle entry								
21	9	192	245	Generic General Interrogation (GGI)								

ASDU TYPE	COT	FUN	Inf No.	Description	GI	Model Number 1	2	3	4	5	6	Interpretation
10	40	192	248	Write entry								
10	40	192	249	Write with confirm								
10	40	192	250	Write with execute								
10	40	192	251	Write entry abort								
Basic Application Functions												
Test Mode						*	*	*	*	*	*	
Blocking of monitor direction						*	*	*	*	*	*	
Disturbance data						*	*	*	*	*	*	
Generic services												
Private data						*	*	*	*	*	*	
Miscellaneous												
					Max.MVAL = times rated value							
Measurands							1.2			2.4		
Current L1										*		
Current L2										*		
Current L3										*		
Voltage L1-E										*		
Voltage L2-E										*		
Voltage L3-E										*		
Active Power P										*		
Reactive Power Q										*		
Frequency f										*		
Voltage L1-L2												

Non Standard Information numbers in monitor direction

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7,9	194	0	Contact 1	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_1	0
1	1,7,9	194	1	Contact 2	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_2	1
1	1,7,9	194	2	Contact 3	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_3	2
1	1,7,9	194	3	Contact 4	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_4	3
1	1,7,9	194	4	Contact 5	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_5	4
1	1,7,9	194	5	Contact 6	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_6	5
1	1,7,9	194	6	Contact 7	*	*	*	*	*	*	*	DDB_OUTPUT_RELAY_7	6
1	1,7,9	194	7	Contact 8	*		*	*	*	*	*	DDB_OUTPUT_RELAY_8	7
1	1,7,9	194	8	Contact 9	*		*	*	*	*	*	DDB_OUTPUT_RELAY_9	8
1	1,7,9	194	9	Contact 10	*		*	*	*	*	*	DDB_OUTPUT_RELAY_10	9
1	1,7,9	194	10	Contact 11	*		*	*	*	*	*	DDB_OUTPUT_RELAY_11	10
1	1,7,9	194	11	Contact 12	*		*	*	*	*	*	DDB_OUTPUT_RELAY_12	11
1	1,7,9	194	12	Contact 13	*		*	*	*	*	*	DDB_OUTPUT_RELAY_13	12
1	1,7,9	194	13	Contact 14	*		*	*	*	*	*	DDB_OUTPUT_RELAY_14	13
1	1,7,9	194	14	Contact 15	*					*	*	DDB_OUTPUT_RELAY_15	14
1	1,7,9	194	15	Contact 16	*					*	*	DDB_OUTPUT_RELAY_16	15
1	1,7,9	194	16	Contact 17	*					*	*	DDB_OUTPUT_RELAY_17	16
1	1,7,9	194	17	Contact 18	*					*	*	DDB_OUTPUT_RELAY_18	17
1	1,7,9	194	18	Contact 19	*					*	*	DDB_OUTPUT_RELAY_19	18
1	1,7,9	194	19	Contact 20	*					*	*	DDB_OUTPUT_RELAY_20	19
1	1,7,9	194	20	Contact 21	*					*	*	DDB_OUTPUT_RELAY_21	20
1	1,7,9	194	21	Contact 22	*					*	*	DDB_OUTPUT_RELAY_22	21
1	1,7,9	194	22	Contact 23	*					*	*	DDB_OUTPUT_RELAY_23	22
1	1,7,9	194	23	Contact 24	*					*	*	DDB_OUTPUT_RELAY_24	23
1	1,7,9	194	24	Contact 25	*					*	*	DDB_OUTPUT_RELAY_25	24
1	1,7,9	194	25	Contact 26	*					*	*	DDB_OUTPUT_RELAY_26	25
1	1,7,9	194	26	Contact 27	*					*	*	DDB_OUTPUT_RELAY_27	26
1	1,7,9	194	27	Contact 28	*					*	*	DDB_OUTPUT_RELAY_28	27
1	1,7,9	194	28	Contact 29	*					*	*	DDB_OUTPUT_RELAY_29	28
1	1,7,9	194	29	Contact 30	*					*	*	DDB_OUTPUT_RELAY_30	29
1	1,7,9	194	30	Contact 31	*					*	*	DDB_OUTPUT_RELAY_31	30
1	1,7,9	194	31	Contact 32	*					*	*	DDB_OUTPUT_RELAY_32	31
1	1,7,9,11	192	27	Opto 1	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_1	32
1	1,7,9,11	192	28	Opto 2	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_2	33
1	1,7,9,11	192	29	Opto 3	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_3	34
1	1,7,9,11	192	30	Opto 4	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_4	35

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7,9,11	194	36	Opto 5	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_5	36
1	1,7,9,11	194	37	Opto 6	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_6	37
1	1,7,9,11	194	38	Opto 7	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_7	38
1	1,7,9,11	194	39	Opto 8	*	*	*	*	*	*	*	DDB_OPTO_ISOLATOR_8	39
1	1,7,9,11	194	40	Opto 9	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_9	40
1	1,7,9,11	194	41	Opto 10	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_10	41
1	1,7,9,11	194	42	Opto 11	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_11	42
1	1,7,9,11	194	43	Opto 12	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_12	43
1	1,7,9,11	194	44	Opto 13	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_13	44
1	1,7,9,11	194	45	Opto 14	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_14	45
1	1,7,9,11	194	46	Opto 15	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_15	46
1	1,7,9,11	194	47	Opto 16	*		*	*	*	*	*	DDB_OPTO_ISOLATOR_16	47
1	1,7,9,11	194	48	Opto 17	*					*	*	DDB_OPTO_ISOLATOR_17	48
1	1,7,9,11	194	49	Opto 18	*					*	*	DDB_OPTO_ISOLATOR_18	49
1	1,7,9,11	194	50	Opto 19	*					*	*	DDB_OPTO_ISOLATOR_19	50
1	1,7,9,11	194	51	Opto 20	*					*	*	DDB_OPTO_ISOLATOR_20	51
1	1,7,9,11	194	52	Opto 21	*					*	*	DDB_OPTO_ISOLATOR_21	52
1	1,7,9,11	194	53	Opto 22	*					*	*	DDB_OPTO_ISOLATOR_22	53
1	1,7,9,11	194	54	Opto 23	*					*	*	DDB_OPTO_ISOLATOR_23	54
1	1,7,9,11	194	55	Opto 24	*					*	*	DDB_OPTO_ISOLATOR_24	55
		194	56									DDB_UNUSED_56	56
		194	57									DDB_UNUSED_57	57
		194	58									DDB_UNUSED_58	58
		194	59									DDB_UNUSED_59	59
		194	60									DDB_UNUSED_60	60
		194	61									DDB_UNUSED_61	61
		194	62									DDB_UNUSED_62	62
		194	63									DDB_UNUSED_63	63
		194	64	LED 1								DDB_OUTPUT_LED_1	64
		194	65	LED 2								DDB_OUTPUT_LED_2	65
		194	66	LED 3								DDB_OUTPUT_LED_3	66
		194	67	LED 4								DDB_OUTPUT_LED_4	67
		194	68	LED 5								DDB_OUTPUT_LED_5	68
		194	69	LED 6								DDB_OUTPUT_LED_6	69
		194	70	LED 7								DDB_OUTPUT_LED_7	70
		194	71	LED 8								DDB_OUTPUT_LED_8	71
		194	72	Relay Cond 1								DDB_OUTPUT_CON_1	72

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		194	73	Relay Cond 2								DDB_OUTPUT_CON_2	73
		194	74	Relay Cond 3								DDB_OUTPUT_CON_3	74
		194	75	Relay Cond 4								DDB_OUTPUT_CON_4	75
		194	76	Relay Cond 5								DDB_OUTPUT_CON_5	76
		194	77	Relay Cond 6								DDB_OUTPUT_CON_6	77
		194	78	Relay Cond 7								DDB_OUTPUT_CON_7	78
		194	79	Relay Cond 8								DDB_OUTPUT_CON_8	79
		194	80	Relay Cond 9								DDB_OUTPUT_CON_9	80
		194	81	Relay Cond 10								DDB_OUTPUT_CON_10	81
		194	82	Relay Cond 11								DDB_OUTPUT_CON_11	82
		194	83	Relay Cond 12								DDB_OUTPUT_CON_12	83
		194	84	Relay Cond 13								DDB_OUTPUT_CON_13	84
		194	85	Relay Cond 14								DDB_OUTPUT_CON_14	85
		194	86	Relay Cond 15								DDB_OUTPUT_CON_15	86
		194	87	Relay Cond 16								DDB_OUTPUT_CON_16	87
		194	88	Relay Cond 17								DDB_OUTPUT_CON_17	88
		194	89	Relay Cond 18								DDB_OUTPUT_CON_18	89
		194	90	Relay Cond 19								DDB_OUTPUT_CON_19	90
		194	91	Relay Cond 20								DDB_OUTPUT_CON_20	91
		194	92	Relay Cond 21								DDB_OUTPUT_CON_21	92
		194	93	Relay Cond 22								DDB_OUTPUT_CON_22	93
		194	94	Relay Cond 23								DDB_OUTPUT_CON_23	94
		194	95	Relay Cond 24								DDB_OUTPUT_CON_24	95
		194	96	Relay Cond 25								DDB_OUTPUT_CON_25	96
		194	97	Relay Cond 26								DDB_OUTPUT_CON_26	97
		194	98	Relay Cond 27								DDB_OUTPUT_CON_27	98
		194	99	Relay Cond 28								DDB_OUTPUT_CON_28	99
		194	100	Relay Cond 29								DDB_OUTPUT_CON_29	100
		194	101	Relay Cond 30								DDB_OUTPUT_CON_30	101
		194	102	Relay Cond 31								DDB_OUTPUT_CON_31	102
		194	103	Relay Cond 32								DDB_OUTPUT_CON_32	103
		194	104	LED Cond IN 1								DDB_LED_CON_1	104
		194	105	LED Cond IN 2								DDB_LED_CON_2	105
		194	106	LED Cond IN 3								DDB_LED_CON_3	106
		194	107	LED Cond IN 4								DDB_LED_CON_4	107
		194	108	LED Cond IN 5								DDB_LED_CON_5	108
		194	109	LED Cond IN 6								DDB_LED_CON_6	109

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		194	110	LED Cond IN 7								DDB_LED_CON_7	110
		194	111	LED Cond IN 8								DDB_LED_CON_8	111
		194	112	Timer in 1								DDB_TIMERIN_1	112
		194	113	Timer in 2								DDB_TIMERIN_2	113
		194	114	Timer in 3								DDB_TIMERIN_3	114
		194	115	Timer in 4								DDB_TIMERIN_4	115
		194	116	Timer in 5								DDB_TIMERIN_5	116
		194	117	Timer in 6								DDB_TIMERIN_6	117
		194	118	Timer in 7								DDB_TIMERIN_7	118
		194	119	Timer in 8								DDB_TIMERIN_8	119
		194	120	Timer in 9								DDB_TIMERIN_9	120
		194	121	Timer in 10								DDB_TIMERIN_10	121
		194	122	Timer in 11								DDB_TIMERIN_11	122
		194	123	Timer in 12								DDB_TIMERIN_12	123
		194	124	Timer in 13								DDB_TIMERIN_13	124
		194	125	Timer in 14								DDB_TIMERIN_14	125
		194	126	Timer in 15								DDB_TIMERIN_15	126
		194	127	Timer in 16								DDB_TIMERIN_16	127
		194	128	Timer out 1								DDB_TIMEROUT_1	128
		194	129	Timer out 2								DDB_TIMEROUT_2	129
		194	130	Timer out 3								DDB_TIMEROUT_3	130
		194	131	Timer out 4								DDB_TIMEROUT_4	131
		194	132	Timer out 5								DDB_TIMEROUT_5	132
		194	133	Timer out 6								DDB_TIMEROUT_6	133
		194	134	Timer out 7								DDB_TIMEROUT_7	134
		194	135	Timer out 8								DDB_TIMEROUT_8	135
		194	136	Timer out 9								DDB_TIMEROUT_9	136
		194	137	Timer out 10								DDB_TIMEROUT_10	137
		194	138	Timer out 11								DDB_TIMEROUT_11	138
		194	139	Timer out 12								DDB_TIMEROUT_12	139
		194	140	Timer out 13								DDB_TIMEROUT_13	140
		194	141	Timer out 14								DDB_TIMEROUT_14	141
		194	142	Timer out 15								DDB_TIMEROUT_15	142
		194	143	Timer out 16								DDB_TIMEROUT_16	143
		194	144	Fault REC TRIG								DDB_FAULT_RECORDER_START	144
1	1,7,9	194	145	SG-opto Invalid	*	*	*	*	*	*	*	DDB_ILLEGAL_OPTO_SETTINGS_GROUP	145
1	9,11	192	21	Prot'n Disabled	*	*	*	*	*	*	*	DDB_OOS_ALARM	146

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1	1,7,9	192	38	VT Fail Alarm	*			*	*	*	*	DDB_VTS_INDICATION	147
1	1,7,9	194	148	Power Swing	*			*	*	*	*	DDB_PSB_ALARM	148
2	1,7	192	85	CB Fail Alarm		*	*	*	*	*	*	DDB_BREAKER_FAIL_ALARM	149
1	1,7,9	194	150	I^ Maint Alarm	*	*	*	*		*		DDB_BROKEN_CURRENT_ALARM	150
1	1,7,9	194	151	I^ Lockout Alarm	*	*	*	*		*		DDB_BROKEN_CURRENT_LOCKOUT	151
1	1,7,9	194	152	CB OPs Maint	*	*	*	*		*		DDB_MAINTENANCE_ALARM	152
1	1,7,9	194	153	CB OPs Lock	*	*	*	*		*		DDB_MAINTENANCE_LOCKOUT	153
1	1,7,9	194	154	CB Time Maint	*	*	*	*		*		DDB_EXCESSIVE_OP_TIME_ALARM	154
1	1,7,9	194	155	CB Time Lockout	*	*	*	*		*		DDB_EXCESSIVE_OP_TIME_LOCKOUT	155
1	1,7,9	194	156	Fault Freq Lock	*	*	*	*		*		DDB_EFF_LOCKOUT	156
1	1,7,9	194	157	CB Status Alarm	*	*	*	*	*	*	*	DDB_COMBINED_CB_STATUS_ALARM	157
1	1,7,9	194	158	GPS Alarm	*					*	*	DDB_LOCAL_GPS_FAIL	158
1	1,7,9	194	159	CB Trip Fail	*	*	*	*	*	*	*	DDB_CB_FAILED_TO_TRIP	159
1	1,7,9	194	160	CB Close Fail	*	*	*	*	*	*	*	DDB_CB_FAILED_TO_CLOSE	160
1	1,7,9	194	161	Man CB Unhealthy	*	*	*	*	*	*	*	DDB_CONTROL_CB_UNHEALTHY	161
1	1,7,9	194	162	No C/S Man Close	*			*		*		DDB_CONTROL_NO_CHECK_SYNC	162
1	1,7,9	192	130	A/R Lockout	*		*	*		*		DDB_AR_LOCKOUT	163
2	1,7	194	163	CB2 Fail Alarm					*		*	DDB_BREAKER_FAIL_ALARM_2	163
1	1,7,9	194	164	A/R CB Unhealthy	*		*	*		*		DDB_AR_CB_UNHEALTHY	164
1	1,7,9	194	165	A/R No Checksync	*			*		*		DDB_AR_NO_CHECK_SYNC	165
1	1,7,9	194	166	Incompatible Rly	*	*	*	*	*	*	*	DDB_IN_COMPATABLE_RELAYS	166
1	1,7,9	194	167	Test Loopback	*	*	*	*	*	*	*	DDB_LOOPBACK_TEST	167
1	1,7,9	194	168	Signalling Fail	*	*	*	*	*	*	*	DDB_SIGNALLING_FAILURE	168
1	1,7,9	194	169	Comm Delay Alarm	*	*	*	*	*	*	*	DDB_PROPAGATION_DELAY_FAILURE	169
1	1,7,9	194	170	C Diff Failure	*	*	*	*	*	*	*	DDB_PROTECTION_FAILURE	170
1	1,7,9	194	171	C Diff Inhibited	*	*	*	*	*	*	*	DDB_INHIBIT_CD_PROTECTION	171
1	1,7,9	194	172	Config Error	*	*	*	*	*	*	*	DDB_CONFIGURATION_ERROR	172
1	1,7,9	194	173	Re-Config Error	*	*	*	*	*	*	*	DDB_RE_CONFIGURATION_ERROR	173
1	1,7,9	194	174	F out of range	*	*	*	*	*	*	*	DDB_FREQ_ALARM	174
		194	175	Future Product Alarms								DDB_ALARM_36	175
		194	176	Future Product Alarms								DDB_ALARM_37	176
		194	177	Future Product Alarms								DDB_ALARM_38	177
		194	178	Future Product Alarms								DDB_ALARM_39	178
		194	179	Future Product Alarms								DDB_ALARM_40	179
		194	180	Future Product Alarms								DDB_ALARM_41	180
		194	181	Future Product Alarms								DDB_ALARM_42	181
		194	182	Future Product Alarms								DDB_ALARM_43	182

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		194	183	Future Product Alarms								DDB_ALARM_44	183
		194	184	Future Product Alarms								DDB_ALARM_45	184
		194	185	Future Product Alarms								DDB_ALARM_46	185
1	1,7,9	194	184	C Diff Comm Mode	*	*	*	*	*	*	*	DDB_CD_PROT_COMMS_MODE	184
1	1,7,9	194	185	IEEE C37.94	*	*	*	*	*	*	*	DDB_CD_IEEE_37_94	185
1	1,7,9	194	186	System Split	*		*		*			DDB_SYSTEM_SPLIT_ALARM	186
1	1,7,9	194	187	SR User Alarm 1	*	*	*	*	*	*	*	DDB_ALARM_48	187
1	1,7,9	194	188	SR User Alarm 2	*	*	*	*	*	*	*	DDB_ALARM_49	188
1	1,7,9	194	189	SR User Alarm 3	*	*	*	*	*	*	*	DDB_ALARM_50	189
1	1,7,9	194	190	SR User Alarm 4	*	*	*	*	*	*	*	DDB_ALARM_51	190
1	1,7,9	194	191	SR User Alarm 5	*	*	*	*	*	*	*	DDB_ALARM_52	191
1	1,7,9	194	192	SR User Alarm 6	*	*	*	*	*	*	*	DDB_ALARM_53	192
1	1,7,9	194	193	SR User Alarm 7	*	*	*	*	*	*	*	DDB_ALARM_54	193
1	1,7,9	194	194	SR User Alarm 8	*	*	*	*	*	*	*	DDB_ALARM_55	194
1	1,7,9	194	195	MR User Alarm 9	*	*	*	*	*	*	*	DDB_ALARM_56	195
1	1,7,9	194	196	MR User Alarm 10	*	*	*	*	*	*	*	DDB_ALARM_57	196
1	1,7,9	194	197	MR User Alarm 11	*	*	*	*	*	*	*	DDB_ALARM_58	197
1	1,7,9	194	198	MR User Alarm 12	*	*	*	*	*	*	*	DDB_ALARM_59	198
1	1,7,9	194	199	MR User Alarm 13	*	*	*	*	*	*	*	DDB_ALARM_60	199
1	1,7,9	194	200	MR User Alarm 14	*	*	*	*	*	*	*	DDB_ALARM_61	200
1	1,7,9	194	201	MR User Alarm 15	*	*	*	*	*	*	*	DDB_ALARM_62	201
1	1,7,9	194	202	MR User Alarm 16	*	*	*	*	*	*	*	DDB_ALARM_63	202
		194	203	Unused								DDB_UNUSED_203	203
		194	204	Unused								DDB_UNUSED_204	204
		194	205	Unused								DDB_UNUSED_205	205
		194	206	Unused								DDB_UNUSED_206	206
		194	207									DDB_UNUSED_207	207
		194	208									DDB_UNUSED_208	208
		194	209									DDB_UNUSED_209	209
		194	210									DDB_UNUSED_210	210
		194	211									DDB_UNUSED_211	211
		194	212									DDB_UNUSED_212	212
		194	213									DDB_UNUSED_213	213
		194	214									DDB_UNUSED_214	214
		194	215									DDB_UNUSED_215	215
		194	216									DDB_DIRECT_1	216
		194	217									DDB_DIRECT_2	217

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		194	218									DDB_DIRECT_3	218
		194	219									DDB_DIRECT_4	219
		194	220									DDB_DIRECT_5	220
		194	221									DDB_DIRECT_6	221
		194	222									DDB_DIRECT_7	222
		194	223									DDB_DIRECT_8	223
1	9,11,12,20,21	194	224	Control Input 1	*	*	*	*	*	*	*	DDB_CONTROL_1	224
1	9,11,12,20,21	194	225	Control Input 2	*	*	*	*	*	*	*	DDB_CONTROL_2	225
1	9,11,12,20,21	194	226	Control Input 3	*	*	*	*	*	*	*	DDB_CONTROL_3	226
1	9,11,12,20,21	194	227	Control Input 4	*	*	*	*	*	*	*	DDB_CONTROL_4	227
1	9,11,12,20,21	194	228	Control Input 5	*	*	*	*	*	*	*	DDB_CONTROL_5	228
1	9,11,12,20,21	194	229	Control Input 6	*	*	*	*	*	*	*	DDB_CONTROL_6	229
1	9,11,12,20,21	194	230	Control Input 7	*	*	*	*	*	*	*	DDB_CONTROL_7	230
1	9,11,12,20,21	194	231	Control Input 8	*	*	*	*	*	*	*	DDB_CONTROL_8	231
1	9,11,12,20,21	194	232	Control Input 9	*	*	*	*	*	*	*	DDB_CONTROL_9	232
1	9,11,12,20,21	194	233	Control Input 10	*	*	*	*	*	*	*	DDB_CONTROL_10	233
1	9,11,12,20,21	194	234	Control Input 11	*	*	*	*	*	*	*	DDB_CONTROL_11	234
1	9,11,12,20,21	194	235	Control Input 12	*	*	*	*	*	*	*	DDB_CONTROL_12	235
1	9,11,12,20,21	194	236	Control Input 13	*	*	*	*	*	*	*	DDB_CONTROL_13	236
1	9,11,12,20,21	194	237	Control Input 14	*	*	*	*	*	*	*	DDB_CONTROL_14	237
1	9,11,12,20,21	194	238	Control Input 15	*	*	*	*	*	*	*	DDB_CONTROL_15	238
1	9,11,12,20,21	194	239	Control Input 16	*	*	*	*	*	*	*	DDB_CONTROL_16	239
1	9,11,12,20,21	194	240	Control Input 17	*	*	*	*	*	*	*	DDB_CONTROL_17	240
1	9,11,12,20,21	194	241	Control Input 18	*	*	*	*	*	*	*	DDB_CONTROL_18	241
1	9,11,12,20,21	194	242	Control Input 19	*	*	*	*	*	*	*	DDB_CONTROL_19	242
1	9,11,12,20,21	194	243	Control Input 20	*	*	*	*	*	*	*	DDB_CONTROL_20	243
1	9,11,12,20,21	194	244	Control Input 21	*	*	*	*	*	*	*	DDB_CONTROL_21	244
1	9,11,12,20,21	194	245	Control Input 22	*	*	*	*	*	*	*	DDB_CONTROL_22	245
1	9,11,12,20,21	194	246	Control Input 23	*	*	*	*	*	*	*	DDB_CONTROL_23	246
1	9,11,12,20,21	194	247	Control Input 24	*	*	*	*	*	*	*	DDB_CONTROL_24	247
1	9,11,12,20,21	194	248	Control Input 25	*	*	*	*	*	*	*	DDB_CONTROL_25	248
1	9,11,12,20,21	194	249	Control Input 26	*	*	*	*	*	*	*	DDB_CONTROL_26	249
1	9,11,12,20,21	194	250	Control Input 27	*	*	*	*	*	*	*	DDB_CONTROL_27	250
1	9,11,12,20,21	194	251	Control Input 28	*	*	*	*	*	*	*	DDB_CONTROL_28	251
1	9,11,12,20,21	194	252	Control Input 29	*	*	*	*	*	*	*	DDB_CONTROL_29	252
1	9,11,12,20,21	194	253	Control Input 30	*	*	*	*	*	*	*	DDB_CONTROL_30	253
1	9,11,12,20,21	194	254	Control Input 31	*	*	*	*	*	*	*	DDB_CONTROL_31	254

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1	9,11,12,20,21	194	255	Control Input 32	*	*	*	*	*	*	*	DDB_CONTROL_32	255
		195	0	Perm Intertrip								DDB_PERMISSIVE_INTERTRIP_OPTO	256
		195	1	Stub Bus Enabled								DDB_STUB_BUS_ENABLED	257
		195	2	Inhibit C Diff								DDB_INHIBIT_CURRENT_DIFF_OPTO	258
		195	3	Recon Interlock								DDB_RECONFIGURATION_INTERLOCK	259
		195	4	I>1 Timer Block								DDB_POC_1_TIMER_BLOCK	260
		195	5	I>2 Timer Block								DDB_POC_2_TIMER_BLOCK	261
		195	6	I>3 Timer Block								DDB_POC_3_TIMER_BLOCK	262
		195	7	I>4 Timer Block								DDB_POC_4_TIMER_BLOCK	263
		195	8	IN>1 Timer Block								DDB_EF1_1_TIMER_BLOCK	264
		195	9	IN>2 Timer Block								DDB_EF1_2_TIMER_BLOCK	265
		195	10	IN>3 Timer Block								DDB_EF1_3_TIMER_BLOCK	266
		195	11	IN>4 Timer Block								DDB_EF1_4_TIMER_BLOCK	267
		195	12	ISEF>1 Timer Blk								DDB_SEF_1_TIMER_BLOCK	268
		195	13	ISEF>2 Timer Blk								DDB_SEF_2_TIMER_BLOCK	269
		195	14	ISEF>3 Timer Blk								DDB_SEF_3_TIMER_BLOCK	270
		195	15	ISEF>4 Timer Blk								DDB_SEF_4_TIMER_BLOCK	271
		195	16	External Trip3ph								DDB_EXTERNAL_TRIP_3PH	272
		195	17	External Trip A								DDB_EXTERNAL_TRIP_A	273
		195	18	External Trip B								DDB_EXTERNAL_TRIP_B	274
		195	19	External Trip C								DDB_EXTERNAL_TRIP_C	275
		195	20	CB2 Ext Trip3ph								DDB_CB2_EXTERNAL_TRIP_3PH	276
		195	21	CB2 Ext Trip A								DDB_CB2_EXTERNAL_TRIP_A	277
		195	22	CB2 Ext Trip B								DDB_CB2_EXTERNAL_TRIP_B	278
		195	23	CB2 Ext Trip C								DDB_CB2_EXTERNAL_TRIP_C	279
		195	24	CB Aux 3ph(52-A)								DDB_CB_THREE_PHASE_52A	280
		195	25	CB Aux A(52-A)								DDB_CB_PHASE_A_52A	281
		195	26	CB Aux B(52-A)								DDB_CB_PHASE_B_52A	282
		195	27	CB Aux C(52-A)								DDB_CB_PHASE_C_52A	283
		195	28	CB Aux 3ph(52-B)								DDB_CB_THREE_PHASE_52B	284
		195	29	CB Aux A(52-B)								DDB_CB_PHASE_A_52B	285
		195	30	CB Aux B(52-B)								DDB_CB_PHASE_B_52B	286
		195	31	CB Aux C(52-B)								DDB_CB_PHASE_C_52B	287
		195	32	CB2Aux 3ph(52-A)								DDB_CB2_THREE_PHASE_52A	288
		195	33	CB2Aux A(52-A)								DDB_CB2_PHASE_A_52A	289
		195	34	CB2Aux B(52-A)								DDB_CB2_PHASE_B_52A	290
		195	35	CB2Aux C(52-A)								DDB_CB2_PHASE_C_52A	291

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		195	36	CB2Aux 3ph(52-B)								DDB_CB2_THREE_PHASE_52B	292
		195	37	CB2Aux A(52-B)								DDB_CB2_PHASE_A_52B	293
		195	38	CB2Aux B(52-B)								DDB_CB2_PHASE_B_52B	294
		195	39	CB2Aux C(52-B)								DDB_CB2_PHASE_C_52B	295
		195	40	CB Healthy								DDB_CB_HEALTHY	296
		195	41	CB2 Healthy								DDB_CB2_HEALTHY	297
		195	42	MCB/VTS								DDB_VTS_MCB_OPTO	298
		195	43	Trip CB								DDB_LOGIC_INPUT_TRIP	299
		195	44	Close CB								DDB_LOGIC_INPUT_CLOSE	300
		195	45	Trip CB2								DDB_LOGIC_INPUT_TRIP_2	301
		195	46	Close CB2								DDB_LOGIC_INPUT_CLOSE_2	302
		195	47	Reset Close Dly								DDB_RESET_CB_CLOSE_DELAY	303
		195	48	Reset Relays/LED								DDB_RESET_RELAYS_LEDS	304
		195	49	Reset Thermal								DDB_RESET_THERMAL	305
		195	50	Reset Lockout								DDB_RESET_LOCKOUT	306
		195	51	Reset CB Data								DDB_RESET_ALL_VALUES	307
		195	52	BAR								DDB_BLOCK_AR	308
		195	53	En 1pole reclose								DDB_INP_SPAR	309
		195	54	En 3pole reclose								DDB_INP_TPAR	310
		195	55	Pole Discrepancy								DDB_INP_TR2P	311
		195	56									DDB_UNUSED_312	312
		195	57	Inhibit PSB								DDB_INHIBIT_PSB	313
		195	58	Any 3 Pole Trip								DDB_TR_3_PHASE	314
		195	59	Any Trip A								DDB_TR_A_PHASE	315
		195	60	Any Trip B								DDB_TR_B_PHASE	316
		195	61	Any Trip C								DDB_TR_C_PHASE	317
		195	62	Test Mode								DDB_TEST_MODE	318
		195	63	Prop Delay Eq								DDB_OVERRIDE_INHIBIT	319
		195	64	Ch 1 Intertrip 1								DDB_USER_DEF_INTERTRIP_CH1_1_IN	320
		195	65	Ch 1 Intertrip 2								DDB_USER_DEF_INTERTRIP_CH1_2_IN	321
		195	66	Ch 1 Intertrip 3								DDB_USER_DEF_INTERTRIP_CH1_3_IN	322
		195	67	Ch 1 Intertrip 4								DDB_USER_DEF_INTERTRIP_CH1_4_IN	323
		195	68	Ch 1 Intertrip 5								DDB_USER_DEF_INTERTRIP_CH1_5_IN	324
		195	69	Ch 1 Intertrip 6								DDB_USER_DEF_INTERTRIP_CH1_6_IN	325
		195	70	Ch 1 Intertrip 7								DDB_USER_DEF_INTERTRIP_CH1_7_IN	326
		195	71	Ch 1 Intertrip 8								DDB_USER_DEF_INTERTRIP_CH1_8_IN	327
		195	72	Ch 2 Intertrip 1								DDB_USER_DEF_INTERTRIP_CH2_1_IN	328

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		195	73	Ch 2 Intertrip 2								DDB_USER_DEF_INTERTRIP_CH2_2_IN	329
		195	74	Ch 2 Intertrip 3								DDB_USER_DEF_INTERTRIP_CH2_3_IN	330
		195	75	Ch 2 Intertrip 4								DDB_USER_DEF_INTERTRIP_CH2_4_IN	331
		195	76	Ch 2 Intertrip 5								DDB_USER_DEF_INTERTRIP_CH2_5_IN	332
		195	77	Ch 2 Intertrip 6								DDB_USER_DEF_INTERTRIP_CH2_6_IN	333
		195	78	Ch 2 Intertrip 7								DDB_USER_DEF_INTERTRIP_CH2_7_IN	334
		195	79	Ch 2 Intertrip 8								DDB_USER_DEF_INTERTRIP_CH2_8_IN	335
		195	80	Loopback Mode								DDB_INTERNAL_LOOPBACK	336
		195	81	Z1 Block								DDB_BLOCK_Z1	337
		195	82	Z2 Block								DDB_BLOCK_Z2	338
		195	83	Z3 Block								DDB_BLOCK_Z3	339
1	9,11	195	84	Command Blocking	*	*	*	*	*	*	*	DDB_COMMAND_BLOCKING	340
1	9,11	192	20	Monitor direction blocked	*	*	*	*	*	*	*	DDB_MONITOR_BLOCKING	341
		195	86									DDB_PSB_UNBLOCK	342
		195	87									DDB_CHECKSYNC_1_ENABLED	343
		195	88									DDB_CHECKSYNC_2_ENABLED	344
		195	89									DDB_SYSTEM_SPLIT_ENABLED	345
		195	90									DDB_SYNC_AR_CS_CHECK_OK	346
		195	91									DDB_TIME_SYNCH	347
		195	92									DDB_UNUSED_348	348
		195	93									DDB_UNUSED_349	349
2	1,7	192	68	Any Trip		*	*	*	*	*	*	DDB_ANY_TRIP	350
2	1,7	195	95	Diff Trip		*	*	*	*	*	*	DDB_DIFFERENTIAL_TRIP	351
2	1,7	192	69	Diff Trip A		*	*	*	*	*	*	DDB_DIFFERENTIAL_TRIP_A	352
2	1,7	192	70	Diff Trip B		*	*	*	*	*	*	DDB_DIFFERENTIAL_TRIP_B	353
2	1,7	192	71	Diff Trip C		*	*	*	*	*	*	DDB_DIFFERENTIAL_TRIP_C	354
2	1,7	195	99	Diff Intertrip		*	*	*	*	*	*	DDB_DIFFERENTIAL_INTERTRIP	355
2	1,7	195	100	Diff Intertrip A		*	*	*	*	*	*	DDB_DIFFERENTIAL_INTERTRIP_A	356
2	1,7	195	101	Diff Intertrip B		*	*	*	*	*	*	DDB_DIFFERENTIAL_INTERTRIP_B	357
2	1,7	195	102	Diff Intertrip C		*	*	*	*	*	*	DDB_DIFFERENTIAL_INTERTRIP_C	358
2	1,7	195	103	Direct Intertrip								DDB_DIRECT_INTERTRIP	359
2	1,7	195	104	Perm Intertrip		*	*	*	*	*	*	DDB_PERMISSIVE_INTERTRIP	360
2	1,7	192	78	Zone 1 Trip				*	*	*	*	DDB_ZONE_1_TRIP	361
2	1,7	195	106	Zone 1 A Trip				*	*	*	*	DDB_ZONE_1_TRIP_A	362
2	1,7	195	107	Zone 1 B Trip				*	*	*	*	DDB_ZONE_1_TRIP_B	363
2	1,7	195	108	Zone 1 C Trip				*	*	*	*	DDB_ZONE_1_TRIP_C	364
2	1,7	195	109	Zone 1 N Trip				*	*	*	*	DDB_ZONE_1_TRIP_N	365

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
2	1,7	192	79	Zone 2 Trip				*	*	*	*	DDB_ZONE_2_TRIP	366
2	1,7	195	111	Zone 2 A Trip				*	*	*	*	DDB_ZONE_2_TRIP_A	367
2	1,7	195	112	Zone 2 B Trip				*	*	*	*	DDB_ZONE_2_TRIP_B	368
2	1,7	195	113	Zone 2 C Trip				*	*	*	*	DDB_ZONE_2_TRIP_C	369
2	1,7	195	114	Zone 2 N Trip				*	*	*	*	DDB_ZONE_2_TRIP_N	370
2	1,7	192	80	Zone 3 Trip				*	*	*	*	DDB_ZONE_3_TRIP	371
2	1,7	195	116	Zone 3 A Trip				*	*	*	*	DDB_ZONE_3_TRIP_A	372
2	1,7	195	117	Zone 3 B Trip				*	*	*	*	DDB_ZONE_3_TRIP_B	373
2	1,7	195	118	Zone 3 C Trip				*	*	*	*	DDB_ZONE_3_TRIP_C	374
2	1,7	195	119	Zone 3 N Trip				*	*	*	*	DDB_ZONE_3_TRIP_N	375
2	1,7	195	120	Pole Discrepancy				*		*		DDB_POLE_DISCREPENCE_TRIP	376
2	1,7	195	121	BU Intertrip		*	*	*	*	*	*	DDB_BACKUP_INTERTRIP	377
2	1,7	195	122	BU Intertrip A		*	*	*	*	*	*	DDB_BACKUP_INTERTRIP_A	378
2	1,7	195	123	BU Intertrip B		*	*	*	*	*	*	DDB_BACKUP_INTERTRIP_B	379
2	1,7	195	124	BU Intertrip C		*	*	*	*	*	*	DDB_BACKUP_INTERTRIP_C	380
2	1,7	195	125	Force 3pole BU				*	*	*	*	DDB_FORCE_3POLE_INTERTRIP	381
2	1,7	192	90	I>1 Trip		*	*	*	*	*	*	DDB_POC_1_3PH_TRIP	382
2	1,7	195	127	I>1 Trip A		*	*	*	*	*	*	DDB_POC_1_PH_A_TRIP	383
2	1,7	195	128	I>1 Trip B		*	*	*	*	*	*	DDB_POC_1_PH_B_TRIP	384
2	1,7	195	129	I>1 Trip C		*	*	*	*	*	*	DDB_POC_1_PH_C_TRIP	385
2	1,7	192	91	I>2 Trip		*	*	*	*	*	*	DDB_POC_2_3PH_TRIP	386
2	1,7	195	131	I>2 Trip A		*	*	*	*	*	*	DDB_POC_2_PH_A_TRIP	387
2	1,7	195	132	I>2 Trip B		*	*	*	*	*	*	DDB_POC_2_PH_B_TRIP	388
2	1,7	195	133	I>2 Trip C		*	*	*	*	*	*	DDB_POC_2_PH_C_TRIP	389
2	1,7	195	134	I>3 Trip		*	*	*	*	*	*	DDB_POC_3_3PH_TRIP	390
2	1,7	195	135	I>3 Trip A		*	*	*	*	*	*	DDB_POC_3_PH_A_TRIP	391
2	1,7	195	136	I>3 Trip B		*	*	*	*	*	*	DDB_POC_3_PH_B_TRIP	392
2	1,7	195	137	I>3 Trip C		*	*	*	*	*	*	DDB_POC_3_PH_C_TRIP	393
2	1,7	195	138	I>4 Trip		*	*	*	*	*	*	DDB_POC_4_3PH_TRIP	394
2	1,7	195	139	I>4 Trip A		*	*	*	*	*	*	DDB_POC_4_PH_A_TRIP	395
2	1,7	195	140	I>4 Trip B		*	*	*	*	*	*	DDB_POC_4_PH_B_TRIP	396
2	1,7	195	141	I>4 Trip C		*	*	*	*	*	*	DDB_POC_4_PH_C_TRIP	397
2	1,7	192	92	IN>1 Trip		*	*	*	*	*	*	DDB_EF1_1_TRIP	398
2	1,7	192	93	IN>2 Trip		*	*	*	*	*	*	DDB_EF1_2_TRIP	399
2	1,7	195	144	IN>3 Trip		*	*	*	*	*	*	DDB_EF1_3_TRIP	400
2	1,7	195	145	IN>4 Trip		*	*	*	*	*	*	DDB_EF1_4_TRIP	401
2	1,7	195	146	ISEF>1 Trip				*	*	*	*	DDB_SEF_1_TRIP	402

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
2	1,7	195	147	ISEF>2 Trip				*	*	*	*	DDB_SEF_2_TRIP	403
2	1,7	195	148	ISEF>3 Trip				*	*	*	*	DDB_SEF_3_TRIP	404
2	1,7	195	149	ISEF>4 Trip				*	*	*	*	DDB_SEF_4_TRIP	405
2	1,7	195	150	Broken Wire Trip		*	*	*	*	*	*	DDB_BROKEN_CONDUCTOR_TRIP	406
2	1,7	195	151	Thermal Trip		*	*	*	*	*	*	DDB_THERMAL_TRIP	407
2	1,7	195	152	Stub Bus Trip					*		*	DDB_STUB_BUS_TRIP	408
2	1,7	195	153	AR Trip Test			*	*		*		DDB_AR_TRIP_TEST	409
2	1,7	195	154	AR Trip Test A				*		*		DDB_AR_TRIP_TEST_A	410
2	1,7	195	155	AR Trip Test B				*		*		DDB_AR_TRIP_TEST_B	411
2	1,7	195	156	AR Trip Test C				*		*		DDB_AR_TRIP_TEST_C	412
		195	157									DDB_UNUSED_413	413
		195	158									DDB_UNUSED_414	414
		195	159									DDB_UNUSED_415	415
		195	160									DDB_UNUSED_416	416
		195	161									DDB_UNUSED_417	417
		195	162									DDB_UNUSED_418	418
		195	163									DDB_UNUSED_419	419
		195	164									DDB_UNUSED_420	420
		195	165									DDB_UNUSED_421	421
		195	166									DDB_UNUSED_422	422
		195	167									DDB_UNUSED_423	423
		195	168									DDB_UNUSED_424	424
		195	169									DDB_UNUSED_425	425
		195	170									DDB_UNUSED_426	426
		195	171									DDB_UNUSED_427	427
		195	172									DDB_UNUSED_428	428
		195	173									DDB_UNUSED_429	429
2	1,7,9	195	174	Zone 1 Start	*			*	*	*	*	DDB_ZONE_1_START	430
2	1,7,9	195	175	Zone 2 Start	*			*	*	*	*	DDB_ZONE_2_START	431
2	1,7,9	195	176	Zone 3 Start	*			*	*	*	*	DDB_ZONE_3_START	432
2	1,7,9	195	177	Diff Start	*	*	*	*	*	*	*	DDB_DIFFERENTIAL_START	433
2	1,7,9	192	84	Any Start	*	*	*	*	*	*	*	DDB_ANY_START	434
2	1,7,9	192	64	Diff Start A	*	*	*	*	*	*	*	DDB_DIFFERENTIAL_START_A	435
2	1,7,9	192	65	Diff Start B	*	*	*	*	*	*	*	DDB_DIFFERENTIAL_START_B	436
2	1,7,9	192	66	Diff Start C	*	*	*	*	*	*	*	DDB_DIFFERENTIAL_START_C	437
2	1,7,9	195	182	Zone 1 A Start	*			*	*	*	*	DDB_ZONE_1_START_A	438
2	1,7,9	195	183	Zone 1 B Start	*			*	*	*	*	DDB_ZONE_1_START_B	439

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
2	1,7,9	195	184	Zone 1 C Start	*			*	*	*	*	DDB_ZONE_1_START_C	440
2	1,7,9	195	185	Zone 1 N Start	*			*	*	*	*	DDB_ZONE_1_START_N	441
2	1,7,9	195	186	Zone 2 A Start	*			*	*	*	*	DDB_ZONE_2_START_A	442
2	1,7,9	195	187	Zone 2 B Start	*			*	*	*	*	DDB_ZONE_2_START_B	443
2	1,7,9	195	188	Zone 2 C Start	*			*	*	*	*	DDB_ZONE_2_START_C	444
2	1,7,9	195	189	Zone 2 N Start	*			*	*	*	*	DDB_ZONE_2_START_N	445
2	1,7,9	195	190	Zone 3 A Start	*			*	*	*	*	DDB_ZONE_3_START_A	446
2	1,7,9	195	191	Zone 3 B Start	*			*	*	*	*	DDB_ZONE_3_START_B	447
2	1,7,9	195	192	Zone 3 C Start	*			*	*	*	*	DDB_ZONE_3_START_C	448
2	1,7,9	195	193	Zone 3 N Start	*			*	*	*	*	DDB_ZONE_3_START_N	449
2	1,7,9	195	194	Zone 6 Start	*			*	*	*	*	DDB_ZONE_6_START	450
2	1,7,9	195	195	I>1 Start	*	*	*	*	*	*	*	DDB_POC_1_3PH_START	451
2	1,7,9	195	196	I>1 Start A	*	*	*	*	*	*	*	DDB_POC_1_PH_A_START	452
2	1,7,9	195	197	I>1 Start B	*	*	*	*	*	*	*	DDB_POC_1_PH_B_START	453
2	1,7,9	195	198	I>1 Start C	*	*	*	*	*	*	*	DDB_POC_1_PH_C_START	454
2	1,7,9	195	199	I>2 Start	*	*	*	*	*	*	*	DDB_POC_2_3PH_START	455
2	1,7,9	195	200	I>2 Start A	*	*	*	*	*	*	*	DDB_POC_2_PH_A_START	456
2	1,7,9	195	201	I>2 Start B	*	*	*	*	*	*	*	DDB_POC_2_PH_B_START	457
2	1,7,9	195	202	I>2 Start C	*	*	*	*	*	*	*	DDB_POC_2_PH_C_START	458
2	1,7,9	195	203	I>3 Start	*	*	*	*	*	*	*	DDB_POC_3_3PH_START	459
2	1,7,9	195	204	I>3 Start A	*	*	*	*	*	*	*	DDB_POC_3_PH_A_START	460
2	1,7,9	195	205	I>3 Start B	*	*	*	*	*	*	*	DDB_POC_3_PH_B_START	461
2	1,7,9	195	206	I>3 Start C	*	*	*	*	*	*	*	DDB_POC_3_PH_C_START	462
2	1,7,9	195	207	I>4 Start	*	*	*	*	*	*	*	DDB_POC_4_3PH_START	463
2	1,7,9	195	208	I>4 Start A	*	*	*	*	*	*	*	DDB_POC_4_PH_A_START	464
2	1,7,9	195	209	I>4 Start B	*	*	*	*	*	*	*	DDB_POC_4_PH_B_START	465
2	1,7,9	195	210	I>4 Start C	*	*	*	*	*	*	*	DDB_POC_4_PH_C_START	466
2	1,7,9	195	211	IN>1 Start	*	*	*	*	*	*	*	DDB_EF1_1_START	467
2	1,7,9	195	212	IN>2 Start	*	*	*	*	*	*	*	DDB_EF1_2_START	468
2	1,7,9	195	213	IN>3 Start	*	*	*	*	*	*	*	DDB_EF1_3_START	469
2	1,7,9	195	214	IN>4 Start	*	*	*	*	*	*	*	DDB_EF1_4_START	470
2	1,7,9	195	215	ISEF>1 Start	*			*	*	*	*	DDB_SEF_1_START	471
2	1,7,9	195	216	ISEF>2 Start	*			*	*	*	*	DDB_SEF_2_START	472
2	1,7,9	195	217	ISEF>3 Start	*			*	*	*	*	DDB_SEF_3_START	473
2	1,7,9	195	218	ISEF>4 Start	*			*	*	*	*	DDB_SEF_4_START	474
2	1,7,9	195	219	Thermal Alarm	*	*	*	*	*	*	*	DDB_THERMAL_ALARM	475
2	1,7,9	195	220	I> BlockStart	*	*	*	*	*	*	*	DDB_PH_BLOCKED_OC_START	476

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
2	1,7,9	195	221	IN/SEF>Blk Start	*	*	*	*	*	*	*	DDB_N_BLOCKED_OC_START	477
		195	222									DDB_UNUSED_478	478
		195	223									DDB_UNUSED_479	479
		195	224									DDB_UNUSED_480	480
		195	225									DDB_UNUSED_481	481
		195	226									DDB_UNUSED_482	482
		195	227									DDB_UNUSED_483	483
		195	228									DDB_UNUSED_484	484
		195	229									DDB_UNUSED_485	485
		195	230									DDB_UNUSED_486	486
		195	231									DDB_BATTERY_FAIL_ALARM	487
		195	232									DDB_UNUSED_488	488
		195	233									DDB_GOOSE_MISSING_IED_ALARM	489
		195	234									DDB_ECARD_NOT_FITTED_ALARM	490
		195	235									DDB_NIC_NOT_RESPONDING_ALARM	491
		195	236									DDB_NIC_FATAL_ERROR_ALARM	492
		195	237									DDB_NIC_SOFTWARE_RELOAD_ALARM	493
		195	238									DDB_INVALID_TCP_IP_CONFIG_ALARM	494
		195	239									DDB_INVALID_OSI_CONFIG_ALARM	495
		195	240									DDB_NIC_LINK_FAIL_ALARM	496
		195	241									DDB_SW_MISMATCH_ALARM	497
		195	242									DDB_IP_ADDRESS_CONFLICT_ALARM	498
		195	243									DDB_UNUSED_499	499
		195	244									DDB_UNUSED_500	500
		195	245									DDB_UNUSED_501	501
		195	246									DDB_UNUSED_502	502
		195	247									DDB_BACKUP_DATA_IN_USE	503
		195	248									DDB_UNUSED_504	504
		195	249									DDB_UNUSED_505	505
		195	250									DDB_UNUSED_506	506
		195	251									DDB_UNUSED_507	507
		195	252									DDB_UNUSED_508	508
		195	253									DDB_UNUSED_509	509
		195	254									DDB_UNUSED_510	510
		195	255									DDB_UNUSED_511	511
		196	0									DDB_UNUSED_512	512
		196	1									DDB_UNUSED_513	513

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		196	2									DDB_UNUSED_514	514
		196	3									DDB_UNUSED_515	515
		196	4									DDB_UNUSED_516	516
		196	5									DDB_UNUSED_517	517
1	1,7	196	6	VTS Fast Block				*	*	*	*	DDB_VTS_FAST_BLOCK	518
1	1,7	196	7	VTS Slow Block				*	*	*	*	DDB_VTS_SLOW_BLOCK	519
1	1,7	196	8	Bfail1 Trip 3ph		*	*	*	*	*	*	DDB_CBF1_TRIP_3PH	520
1	1,7	196	9	Bfail2 Trip 3ph		*	*	*	*	*	*	DDB_CBF2_TRIP_3PH	521
1	1,7	196	10	CB2 Fail1 Trip					*		*	DDB_CB2F1_TRIP_3PH	522
1	1,7	196	11	CB2 Fail2 Trip					*		*	DDB_CB2F2_TRIP_3PH	523
1	1,7	196	12	Control Trip		*	*	*	*	*	*	DDB_CONTROL_TRIP	524
1	1,7	196	13	Control Close		*	*	*	*	*	*	DDB_CONTROL_CLOSE	525
1	1,7	196	14	Control Trip 2					*		*	DDB_CONTROL_TRIP_2	526
1	1,7	196	15	Control Close 2					*		*	DDB_CONTROL_CLOSE_2	527
1	1,7	196	16	Close in Prog		*	*	*	*	*	*	DDB_CONTROL_CLOSE_IN_PROGRESS	528
1	1,7	196	17	Block Main Prot			*					DDB_AR_BLOCK_MAIN_PROTECTION	529
1	1,7	196	18	Block SEF Prot			*					DDB_AR_BLOCK_SEF_PROTECTION	530
1	1,7	196	19	AR 3pole in prog			*	*		*		DDB_AR_3_POLE_IN_PROGRESS	531
1	1,7	196	20	AR 1pole in prog				*		*		DDB_AR_1_POLE_IN_PROGRESS	532
1	1,7	196	21	Seq Counter = 0			*	*		*		DDB_SEQ_COUNT_0	533
1	1,7	196	22	Seq Counter = 1			*	*		*		DDB_SEQ_COUNT_1	534
1	1,7	196	23	Seq Counter = 2			*	*		*		DDB_SEQ_COUNT_2	535
1	1,7	196	24	Seq Counter = 3			*	*		*		DDB_SEQ_COUNT_3	536
1	1,7	196	25	Seq Counter = 4			*	*		*		DDB_SEQ_COUNT_4	537
1	1,7	196	26	Seq Counter = 5				*		*		DDB_SEQ_COUNT_5	538
1	1,7,9	196	27	Successful Close	*		*	*		*		DDB_AR_SUCCESSFUL_RECLOSE	539
1	1,7	196	28	Dead T in Prog			*					DDB_DEAD_TIME_IN_PROGRESS	540
1	1,7	192	128	Auto Close			*	*		*		DDB_AUTO_CLOSE	541
1	1,7,9,11,12,20,21	192	16	A/R Status	*		*					DDB_AR_IN_SERVICE	542
1	1,7,9,11,12,20,21	192	16	A/R Status 3P	*			*		*		DDB_AR_IN_SERVICE_3P	543
1	1,7,9,11,12,20,21	196	32	AR Status 1P	*			*		*		DDB_AR_IN_SERVICE_1P	544
1	1,7	196	33	Force 3 pole				*		*		DDB_AR_FORCE_3_POLE_TRIPS	545
1	9	196	34	Lockout Alarm	*	*	*	*		*		DDB_CB_LOCKOUT_ALARM	546
1	1,7,9	196	35	Field Volts Fail	*	*	*	*	*	*	*	DDB_FIELD_VOLTS_FAIL	547
1	1,7	196	36	IA< Start		*	*	*	*	*	*	DDB_PHASE_A_UNDERCURRENT	548
1	1,7	196	37	IB< Start		*	*	*	*	*	*	DDB_PHASE_B_UNDERCURRENT	549
1	1,7	196	38	IC< Start		*	*	*	*	*	*	DDB_PHASE_C_UNDERCURRENT	550

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7	196	39	ISEF< Start		*	*	*	*	*	*	DDB_SEF_UNDERCURRENT	551
1	1,7	196	40	CB1 IA< Start					*		*	DDB_PHASE_A_UNDERCURRENT_CB1	552
1	1,7	196	41	CB1 IB< Start					*		*	DDB_PHASE_B_UNDERCURRENT_CB1	553
1	1,7	196	42	CB1 IC< Start					*		*	DDB_PHASE_C_UNDERCURRENT_CB1	554
1	1,7	196	43	CB1 ISEF< Start					*		*	DDB_SEF_UNDERCURRENT_CB1	555
1	1,7	196	44	CB2 IA< Start					*		*	DDB_PHASE_A_UNDERCURRENT_CB2	556
1	1,7	196	45	CB2 IB< Start					*		*	DDB_PHASE_B_UNDERCURRENT_CB2	557
1	1,7	196	46	CB2 IC< Start					*		*	DDB_PHASE_C_UNDERCURRENT_CB2	558
1	1,7	196	47	CB2 ISEF< Start					*		*	DDB_SEF_UNDERCURRENT_CB2	559
1	1,7	196	48	All Poles Dead		*	*	*	*	*	*	DDB_ALL_POLEDEAD	560
1	1,7	196	49	Any Pole Dead		*	*	*	*	*	*	DDB_ANY_POLEDEAD	561
1	1,7	196	50	Pole Dead A				*	*	*	*	DDB_PHASE_A_POLEDEAD	562
1	1,7	196	51	Pole Dead B				*	*	*	*	DDB_PHASE_B_POLEDEAD	563
1	1,7	196	52	Pole Dead C				*	*	*	*	DDB_PHASE_C_POLEDEAD	564
1	1,7	196	53	VTS Acc Ind				*	*	*	*	DDB_VTS_ACCELERATE_INPUT	565
1	1,7	196	54	VTS Volt Dep				*	*	*	*	DDB_VTS_ANY_VOLTAGE_DEP_FN	566
1	1,7	196	55	VTS Ia>				*	*	*	*	DDB_VTS_IA_OPERATED	567
1	1,7	196	56	VTS Ib>				*	*	*	*	DDB_VTS_IB_OPERATED	568
1	1,7	196	57	VTS Ic>				*	*	*	*	DDB_VTS_IC_OPERATED	569
1	1,7	196	58	VTS Va>				*	*	*	*	DDB_VTS_VA_OPERATED	570
1	1,7	196	59	VTS Vb>				*	*	*	*	DDB_VTS_VB_OPERATED	571
1	1,7	196	60	VTS Vc>				*	*	*	*	DDB_VTS_VC_OPERATED	572
1	1,7	196	61	VTS I2>				*	*	*	*	DDB_VTS_I2_OPERATED	573
1	1,7	196	62	VTS V2>				*	*	*	*	DDB_VTS_V2_OPERATED	574
1	1,7	196	63	VTS Ia delta>				*	*	*	*	DDB_VTS_DELTA_IA_OPERATED	575
1	1,7	196	64	VTS Ib delta>				*	*	*	*	DDB_VTS_DELTA_IB_OPERATED	576
1	1,7	196	65	VTS Ic delta >				*	*	*	*	DDB_VTS_DELTA_IC_OPERATED	577
1	1,7	196	66	B Fail SEF Trip				*	*	*	*	DDB_CURRENT_PROT_SEF_TRIP	578
1	1,7	196	67	Ctl Check Synch				*		*		DDB_SYNC_CTRL_SYS_CHECK_OK	579
1	1,7	196	68	AR Check Synch				*		*		DDB_SYNC_AR_SYS_CHECK_OK	580
1	1,7	196	69	Pre-Lockout			*					DDB_CB_PRE_LOCKOUT	581
1	1,7,9	196	70	CB Open 3 ph	*	*	*	*	*	*	*	DDB_CB_OPEN	582
1	1,7,9	196	71	CB Open A ph	*			*	*	*	*	DDB_CB_PHASE_A_OPEN	583
1	1,7,9	196	72	CB Open B ph	*			*	*	*	*	DDB_CB_PHASE_B_OPEN	584
1	1,7,9	196	73	CB Open C ph	*			*	*	*	*	DDB_CB_PHASE_C_OPEN	585
1	1,7,9	196	74	CB Closed 3 ph	*	*	*	*	*	*	*	DDB_CB_CLOSED	586
1	1,7,9	196	75	CB Closed A ph	*			*	*	*	*	DDB_CB_PHASE_A_CLOSED	587

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7,9	196	76	CB Closed B ph	*			*	*	*	*	DDB_CB_PHASE_B_CLOSED	588
1	1,7,9	196	77	CB Closed C ph	*			*	*	*	*	DDB_CB_PHASE_C_CLOSED	589
1	1,7,9	196	78	CB2 Open 3 ph	*				*		*	DDB_CB2_OPEN	590
1	1,7,9	196	79	CB2 Open A ph	*				*		*	DDB_CB2_PHASE_A_OPEN	591
1	1,7,9	196	80	CB2 Open B ph	*				*		*	DDB_CB2_PHASE_B_OPEN	592
1	1,7,9	196	81	CB2 Open C ph	*				*		*	DDB_CB2_PHASE_C_OPEN	593
1	1,7,9	196	82	CB2 Closed 3 ph	*				*		*	DDB_CB2_CLOSED	594
1	1,7,9	196	83	CB2 Closed A ph	*				*		*	DDB_CB2_PHASE_A_CLOSED	595
1	1,7,9	196	84	CB2 Closed B ph	*				*		*	DDB_CB2_PHASE_B_CLOSED	596
1	1,7,9	196	85	CB2 Closed C ph	*				*		*	DDB_CB2_PHASE_C_CLOSED	597
1	1,7	196	86	Freq High		*	*	*	*	*	*	DDB_FREQ_ABOVE_RANGE_LIMIT	598
1	1,7	196	87	Freq Low		*	*	*	*	*	*	DDB_FREQ_BELOW_RANGE_LIMIT	599
1	1,7	196	88	Freq Not found		*	*	*	*	*	*	DDB_FREQ_NOT_FOUND	600
1	1,7	196	89	Stop Freq Track		*	*	*	*	*	*	DDB_FREQ_STOP_TRACK	601
1	1,7,9	196	90	SignalFail Ch1Rx	*	*	*	*	*	*	*	DDB_SIGNALLING_FAIL_CH1_RX	602
1	1,7,9	196	91	SignalFail Ch1Tx	*	*	*	*	*	*	*	DDB_SIGNALLING_FAIL_CH1_TX	603
1	1,7,9	196	92	SignalFail Ch2Rx	*	*	*	*	*	*	*	DDB_SIGNALLING_FAIL_CH2_RX	604
1	1,7,9	196	93	SignalFail Ch2Tx	*	*	*	*	*	*	*	DDB_SIGNALLING_FAIL_CH2_TX	605
1	1,7,9	196	94	Ch 1 GPS Fail	*					*	*	DDB_REMOTE_1_GPS_FAIL	606
1	1,7,9	196	95	Ch 2 GPS Fail	*					*	*	DDB_REMOTE_2_GPS_FAIL	607
1	1,7	196	96	Config Same		*	*	*	*	*	*	DDB_CONFIGURED	608
1	1,7	196	97	Reconfig Pass		*	*	*	*	*	*	DDB_RECONFIGURE_OK	609
1	1,7	196	98	Reconfig Fail		*	*	*	*	*	*	DDB_RECONFIGURE_FAIL	610
1	1,7	196	99	Restore Pass		*	*	*	*	*	*	DDB_RESTORE_OK	611
1	1,7	196	100	Restore Fail		*	*	*	*	*	*	DDB_RESTORE_FAIL	612
1	1,7	196	101	Inhibit C Diff		*	*	*	*	*	*	DDB_INHIBIT_CURRENT_DIFF	613
1	1,7	196	102	I>3 Intertrip		*	*	*	*	*	*	DDB_OVER_CURRENT_INTERTRIP_EN	614
1	1,7	196	103	Z1 Intertrip				*	*	*	*	DDB_ZONE_1_INTERTRIP_EN	615
1	1,7	196	104	Z2 Intertrip				*	*	*	*	DDB_ZONE_2_INTERTRIP_EN	616
1	1,7	196	105	Z3 Intertrip				*	*	*	*	DDB_ZONE_3_INTERTRIP_EN	617
1	1,7	196	106	1 Pole Trip En				*	*	*	*	DDB_SINGLE_POLE_TRIP_EN	618
1	1,7,9	196	107	CB Status Alarm	*	*	*	*	*	*	*	DDB_CB_STATUS_ALARM	619
1	1,7,9	196	108	CB2 Status Alarm	*				*		*	DDB_CB2_STATUS_ALARM	620
1	1,7	196	109	Ch 1 Intertrip 1		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_1_OUT	621
1	1,7	196	110	Ch 1 Intertrip 2		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_2_OUT	622
1	1,7	196	111	Ch 1 Intertrip 3		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_3_OUT	623
1	1,7	196	112	Ch 1 Intertrip 4		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_4_OUT	624

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7	196	113	Ch 1 Intertrip 5		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_5_OUT	625
1	1,7	196	114	Ch 1 Intertrip 6		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_6_OUT	626
1	1,7	196	115	Ch 1 Intertrip 7		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_7_OUT	627
1	1,7	196	116	Ch 1 Intertrip 8		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH1_8_OUT	628
1	1,7	196	117	Ch 2 Intertrip 1		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_1_OUT	629
1	1,7	196	118	Ch 2 Intertrip 2		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_2_OUT	630
1	1,7	196	119	Ch 2 Intertrip 3		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_3_OUT	631
1	1,7	196	120	Ch 2 Intertrip 4		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_4_OUT	632
1	1,7	196	121	Ch 2 Intertrip 5		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_5_OUT	633
1	1,7	196	122	Ch 2 Intertrip 6		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_6_OUT	634
1	1,7	196	123	Ch 2 Intertrip 7		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_7_OUT	635
1	1,7	196	124	Ch 2 Intertrip 8		*	*	*	*	*	*	DDB_USER_DEF_INTERTRIP_CH2_8_OUT	636
1	1,7	196	125	I2>				*	*	*	*	DDB_NEG_SEQ	637
		196	126									DDB_UIPASSWORD_ONE	638
		196	127									DDB_UIPASSWORD_TWO	639
		196	128									DDB_FCURPASSWORD_ONE	640
		196	129									DDB_FCURPASSWORD_TWO	641
		196	130									DDB_REMOTEPASSWORD_ONE	642
		196	131									DDB_REMOTEPASSWORD_TWO	643
		196	132									DDB_REMOTE2PASSWORD_ONE	644
		196	133									DDB_REMOTE2PASSWORD_TWO	645
		196	134									DDB_RESET_Z1_EXT	646
		196	135									DDB_SYSCHECKS_LINE_LIVE	647
		196	136									DDB_SYSCHECKS_LINE_DEAD	648
		196	137									DDB_SYSCHECKS_BUS_LIVE	649
		196	138									DDB_SYSCHECKS_BUS_DEAD	650
		196	139									DDB_CHECKSYNC_1_OK	651
		196	140									DDB_CHECKSYNC_2_OK	652
		196	141									DDB_SYSCHECKS_INACTIVE	653
1	1,7,9	196	142		*	*	*	*	*	*	*	DDB_IEEE37_94_CH1_LOSS_OF_SIG	654
1	1,7,9	196	143		*	*	*	*	*	*	*	DDB_IEEE37_94_CH1_PATH_YELLOW	655
1	1,7,9	196	144		*	*	*	*	*	*	*	DDB_IEEE37_94_CH1_BAD_RX_N	656
1	1,7,9	196	145		*	*	*	*	*	*	*	DDB_IEEE37_94_CH2_LOSS_OF_SIG	657
1	1,7,9	196	146		*	*	*	*	*	*	*	DDB_IEEE37_94_CH2_PATH_YELLOW	658
1	1,7,9	196	147		*	*	*	*	*	*	*	DDB_IEEE37_94_CH2_BAD_RX_N	659
		196	148									DDB_UNUSED_660	660
		196	149									DDB_UNUSED_661	661

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		196	150									DDB_UNUSED_662	662
		196	151									DDB_UNUSED_663	663
		196	152									DDB_UNUSED_664	664
		196	153									DDB_UNUSED_665	665
		196	154									DDB_UNUSED_666	666
		196	155									DDB_UNUSED_667	667
		196	156									DDB_UNUSED_668	668
		196	157									DDB_UNUSED_669	669
		196	158									DDB_UNUSED_670	670
		196	159									DDB_UNUSED_671	671
1	1,7,9	196	160		*	*	*	*	*	*	*	DDB_GOOSEIN_1	672
1	1,7,9	196	161		*	*	*	*	*	*	*	DDB_GOOSEIN_2	673
1	1,7,9	196	162		*	*	*	*	*	*	*	DDB_GOOSEIN_3	674
1	1,7,9	196	163		*	*	*	*	*	*	*	DDB_GOOSEIN_4	675
1	1,7,9	196	164		*	*	*	*	*	*	*	DDB_GOOSEIN_5	676
1	1,7,9	196	165		*	*	*	*	*	*	*	DDB_GOOSEIN_6	677
1	1,7,9	196	166		*	*	*	*	*	*	*	DDB_GOOSEIN_7	678
1	1,7,9	196	167		*	*	*	*	*	*	*	DDB_GOOSEIN_8	679
1	1,7,9	196	168		*	*	*	*	*	*	*	DDB_GOOSEIN_9	680
1	1,7,9	196	169		*	*	*	*	*	*	*	DDB_GOOSEIN_10	681
1	1,7,9	196	170		*	*	*	*	*	*	*	DDB_GOOSEIN_11	682
1	1,7,9	196	171		*	*	*	*	*	*	*	DDB_GOOSEIN_12	683
1	1,7,9	196	172		*	*	*	*	*	*	*	DDB_GOOSEIN_13	684
1	1,7,9	196	173		*	*	*	*	*	*	*	DDB_GOOSEIN_14	685
1	1,7,9	196	174		*	*	*	*	*	*	*	DDB_GOOSEIN_15	686
1	1,7,9	196	175		*	*	*	*	*	*	*	DDB_GOOSEIN_16	687
1	1,7,9	196	176		*	*	*	*	*	*	*	DDB_GOOSEIN_17	688
1	1,7,9	196	177		*	*	*	*	*	*	*	DDB_GOOSEIN_18	689
1	1,7,9	196	178		*	*	*	*	*	*	*	DDB_GOOSEIN_19	690
1	1,7,9	196	179		*	*	*	*	*	*	*	DDB_GOOSEIN_20	691
1	1,7,9	196	180		*	*	*	*	*	*	*	DDB_GOOSEIN_21	692
1	1,7,9	196	181		*	*	*	*	*	*	*	DDB_GOOSEIN_22	693
1	1,7,9	196	182		*	*	*	*	*	*	*	DDB_GOOSEIN_23	694
1	1,7,9	196	183		*	*	*	*	*	*	*	DDB_GOOSEIN_24	695
1	1,7,9	196	184		*	*	*	*	*	*	*	DDB_GOOSEIN_25	696
1	1,7,9	196	185		*	*	*	*	*	*	*	DDB_GOOSEIN_26	697
1	1,7,9	196	186		*	*	*	*	*	*	*	DDB_GOOSEIN_27	698

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7,9	196	187		*	*	*	*	*	*	*	DDB_GOOSEIN_28	699
1	1,7,9	196	188		*	*	*	*	*	*	*	DDB_GOOSEIN_29	700
1	1,7,9	196	189		*	*	*	*	*	*	*	DDB_GOOSEIN_30	701
1	1,7,9	196	190		*	*	*	*	*	*	*	DDB_GOOSEIN_31	702
1	1,7,9	196	191		*	*	*	*	*	*	*	DDB_GOOSEIN_32	703
1	1,7,9	196	192		*	*	*	*	*	*	*	DDB_GOOSEOUT_1	704
1	1,7,9	196	193		*	*	*	*	*	*	*	DDB_GOOSEOUT_2	705
1	1,7,9	196	194		*	*	*	*	*	*	*	DDB_GOOSEOUT_3	706
1	1,7,9	196	195		*	*	*	*	*	*	*	DDB_GOOSEOUT_4	707
1	1,7,9	196	196		*	*	*	*	*	*	*	DDB_GOOSEOUT_5	708
1	1,7,9	196	197		*	*	*	*	*	*	*	DDB_GOOSEOUT_6	709
1	1,7,9	196	198		*	*	*	*	*	*	*	DDB_GOOSEOUT_7	710
1	1,7,9	196	199		*	*	*	*	*	*	*	DDB_GOOSEOUT_8	711
1	1,7,9	196	200		*	*	*	*	*	*	*	DDB_GOOSEOUT_9	712
1	1,7,9	196	201		*	*	*	*	*	*	*	DDB_GOOSEOUT_10	713
1	1,7,9	196	202		*	*	*	*	*	*	*	DDB_GOOSEOUT_11	714
1	1,7,9	196	203		*	*	*	*	*	*	*	DDB_GOOSEOUT_12	715
1	1,7,9	196	204		*	*	*	*	*	*	*	DDB_GOOSEOUT_13	716
1	1,7,9	196	205		*	*	*	*	*	*	*	DDB_GOOSEOUT_14	717
1	1,7,9	196	206		*	*	*	*	*	*	*	DDB_GOOSEOUT_15	718
1	1,7,9	196	207		*	*	*	*	*	*	*	DDB_GOOSEOUT_16	719
1	1,7,9	196	208		*	*	*	*	*	*	*	DDB_GOOSEOUT_17	720
1	1,7,9	196	209		*	*	*	*	*	*	*	DDB_GOOSEOUT_18	721
1	1,7,9	196	210		*	*	*	*	*	*	*	DDB_GOOSEOUT_19	722
1	1,7,9	196	211		*	*	*	*	*	*	*	DDB_GOOSEOUT_20	723
1	1,7,9	196	212		*	*	*	*	*	*	*	DDB_GOOSEOUT_21	724
1	1,7,9	196	213		*	*	*	*	*	*	*	DDB_GOOSEOUT_22	725
1	1,7,9	196	214		*	*	*	*	*	*	*	DDB_GOOSEOUT_23	726
1	1,7,9	196	215		*	*	*	*	*	*	*	DDB_GOOSEOUT_24	727
1	1,7,9	196	216		*	*	*	*	*	*	*	DDB_GOOSEOUT_25	728
1	1,7,9	196	217		*	*	*	*	*	*	*	DDB_GOOSEOUT_26	729
1	1,7,9	196	218		*	*	*	*	*	*	*	DDB_GOOSEOUT_27	730
1	1,7,9	196	219		*	*	*	*	*	*	*	DDB_GOOSEOUT_28	731
1	1,7,9	196	220		*	*	*	*	*	*	*	DDB_GOOSEOUT_29	732
1	1,7,9	196	221		*	*	*	*	*	*	*	DDB_GOOSEOUT_30	733
1	1,7,9	196	222		*	*	*	*	*	*	*	DDB_GOOSEOUT_31	734
1	1,7,9	196	223		*	*	*	*	*	*	*	DDB_GOOSEOUT_32	735

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		196	224									DDB_UNUSED_736	736
		196	225									DDB_UNUSED_737	737
		196	226									DDB_UNUSED_738	738
		196	227									DDB_UNUSED_739	739
		196	228									DDB_UNUSED_740	740
		196	229									DDB_UNUSED_741	741
		196	230									DDB_UNUSED_742	742
		196	231									DDB_UNUSED_743	743
		196	232									DDB_UNUSED_744	744
		196	233									DDB_UNUSED_745	745
		196	234									DDB_UNUSED_746	746
		196	235									DDB_UNUSED_747	747
		196	236									DDB_UNUSED_748	748
		196	237									DDB_UNUSED_749	749
		196	238									DDB_FL_OC_SEND_A	750
		196	239									DDB_FL_OC_SEND_B	751
		196	240									DDB_FL_OC_SEND_C	752
		196	241									DDB_FL_Z1_INTERTRIP_SEND_A	753
		196	242									DDB_FL_Z1_INTERTRIP_SEND_B	754
		196	243									DDB_FL_Z1_INTERTRIP_SEND_C	755
		196	244									DDB_FL_Z2_INTERTRIP_SEND_A	756
		196	245									DDB_FL_Z2_INTERTRIP_SEND_B	757
		196	246									DDB_FL_Z2_INTERTRIP_SEND_C	758
		196	247									DDB_FL_Z3_INTERTRIP_SEND_A	759
		196	248									DDB_FL_Z3_INTERTRIP_SEND_B	760
		196	249									DDB_FL_Z3_INTERTRIP_SEND_C	761
		196	250									DDB_FL_CURRENT_PROT_SEF_TRIP	762
		196	251									DDB_BACKUP_INTERTRIP_SEND_A	763
		196	252									DDB_BACKUP_INTERTRIP_SEND_B	764
		196	253									DDB_BACKUP_INTERTRIP_SEND_C	765
		196	254									DDB_BACKUP_IN	766
		196	255									DDB_UNUSED_767	767
		197	0									DDB_UNUSED_768	768
		197	1									DDB_UNUSED_769	769
		197	2									DDB_UNUSED_770	770
		197	3									DDB_UNUSED_771	771
		197	4									DDB_UNUSED_772	772

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	5									DDB_UNUSED_773	773
		197	6									DDB_UNUSED_774	774
		197	7									DDB_UNUSED_775	775
		197	8									DDB_UNUSED_776	776
		197	9									DDB_UNUSED_777	777
		197	10									DDB_UNUSED_778	778
		197	11									DDB_UNUSED_779	779
		197	12									DDB_UNUSED_780	780
		197	13									DDB_UNUSED_781	781
		197	14									DDB_UNUSED_782	782
		197	15									DDB_UNUSED_783	783
		197	16									DDB_UNUSED_784	784
		197	17									DDB_UNUSED_785	785
		197	18									DDB_UNUSED_786	786
		197	19									DDB_UNUSED_787	787
		197	20									DDB_UNUSED_788	788
		197	21									DDB_UNUSED_789	789
		197	22									DDB_UNUSED_790	790
		197	23									DDB_UNUSED_791	791
		197	24									DDB_UNUSED_792	792
		197	25									DDB_UNUSED_793	793
		197	26									DDB_UNUSED_794	794
		197	27									DDB_UNUSED_795	795
		197	28									DDB_UNUSED_796	796
		197	29									DDB_UNUSED_797	797
		197	30									DDB_UNUSED_798	798
		197	31									DDB_UNUSED_799	799
		197	32									DDB_UNUSED_800	800
		197	33									DDB_UNUSED_801	801
		197	34									DDB_UNUSED_802	802
		197	35									DDB_UNUSED_803	803
		197	36									DDB_UNUSED_804	804
		197	37									DDB_UNUSED_805	805
		197	38									DDB_UNUSED_806	806
		197	39									DDB_UNUSED_807	807
		197	40									DDB_UNUSED_808	808
		197	41									DDB_UNUSED_809	809

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	42									DDB_UNUSED_810	810
		197	43									DDB_UNUSED_811	811
		197	44									DDB_UNUSED_812	812
		197	45									DDB_UNUSED_813	813
		197	46									DDB_UNUSED_814	814
		197	47									DDB_UNUSED_815	815
		197	48									DDB_UNUSED_816	816
		197	49									DDB_UNUSED_817	817
		197	50									DDB_UNUSED_818	818
		197	51									DDB_UNUSED_819	819
		197	52									DDB_UNUSED_820	820
		197	53									DDB_UNUSED_821	821
		197	54									DDB_UNUSED_822	822
		197	55									DDB_UNUSED_823	823
		197	56									DDB_PSLINT_1	824
		197	57									DDB_PSLINT_2	825
		197	58									DDB_PSLINT_3	826
		197	59									DDB_PSLINT_4	827
		197	60									DDB_PSLINT_5	828
		197	61									DDB_PSLINT_6	829
		197	62									DDB_PSLINT_7	830
		197	63									DDB_PSLINT_8	831
		197	64									DDB_PSLINT_9	832
		197	65									DDB_PSLINT_10	833
		197	66									DDB_PSLINT_11	834
		197	67									DDB_PSLINT_12	835
		197	68									DDB_PSLINT_13	836
		197	69									DDB_PSLINT_14	837
		197	70									DDB_PSLINT_15	838
		197	71									DDB_PSLINT_16	839
		197	72									DDB_PSLINT_17	840
		197	73									DDB_PSLINT_18	841
		197	74									DDB_PSLINT_19	842
		197	75									DDB_PSLINT_20	843
		197	76									DDB_PSLINT_21	844
		197	77									DDB_PSLINT_22	845
		197	78									DDB_PSLINT_23	846

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	79									DDB_PSLINT_24	847
		197	80									DDB_PSLINT_25	848
		197	81									DDB_PSLINT_26	849
		197	82									DDB_PSLINT_27	850
		197	83									DDB_PSLINT_28	851
		197	84									DDB_PSLINT_29	852
		197	85									DDB_PSLINT_30	853
		197	86									DDB_PSLINT_31	854
		197	87									DDB_PSLINT_32	855
		197	88									DDB_PSLINT_33	856
		197	89									DDB_PSLINT_34	857
		197	90									DDB_PSLINT_35	858
		197	91									DDB_PSLINT_36	859
		197	92									DDB_PSLINT_37	860
		197	93									DDB_PSLINT_38	861
		197	94									DDB_PSLINT_39	862
		197	95									DDB_PSLINT_40	863
		197	96									DDB_PSLINT_41	864
		197	97									DDB_PSLINT_42	865
		197	98									DDB_PSLINT_43	866
		197	99									DDB_PSLINT_44	867
		197	100									DDB_PSLINT_45	868
		197	101									DDB_PSLINT_46	869
		197	102									DDB_PSLINT_47	870
		197	103									DDB_PSLINT_48	871
		197	104									DDB_PSLINT_49	872
		197	105									DDB_PSLINT_50	873
		197	106									DDB_PSLINT_51	874
		197	107									DDB_PSLINT_52	875
		197	108									DDB_PSLINT_53	876
		197	109									DDB_PSLINT_54	877
		197	110									DDB_PSLINT_55	878
		197	111									DDB_PSLINT_56	879
		197	112									DDB_PSLINT_57	880
		197	113									DDB_PSLINT_58	881
		197	114									DDB_PSLINT_59	882
		197	115									DDB_PSLINT_60	883

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	116									DDB_PSLINT_61	884
		197	117									DDB_PSLINT_62	885
		197	118									DDB_PSLINT_63	886
		197	119									DDB_PSLINT_64	887
		197	120									DDB_PSLINT_65	888
		197	121									DDB_PSLINT_66	889
		197	122									DDB_PSLINT_67	890
		197	123									DDB_PSLINT_68	891
		197	124									DDB_PSLINT_69	892
		197	125									DDB_PSLINT_70	893
		197	126									DDB_PSLINT_71	894
		197	127									DDB_PSLINT_72	895
		197	128									DDB_PSLINT_73	896
		197	129									DDB_PSLINT_74	897
		197	130									DDB_PSLINT_75	898
		197	131									DDB_PSLINT_76	899
		197	132									DDB_PSLINT_77	900
		197	133									DDB_PSLINT_78	901
		197	134									DDB_PSLINT_79	902
		197	135									DDB_PSLINT_80	903
		197	136									DDB_PSLINT_81	904
		197	137									DDB_PSLINT_82	905
		197	138									DDB_PSLINT_83	906
		197	139									DDB_PSLINT_84	907
		197	140									DDB_PSLINT_85	908
		197	141									DDB_PSLINT_86	909
		197	142									DDB_PSLINT_87	910
		197	143									DDB_PSLINT_88	911
		197	144									DDB_PSLINT_89	912
		197	145									DDB_PSLINT_90	913
		197	146									DDB_PSLINT_91	914
		197	147									DDB_PSLINT_92	915
		197	148									DDB_PSLINT_93	916
		197	149									DDB_PSLINT_94	917
		197	150									DDB_PSLINT_95	918
		197	151									DDB_PSLINT_96	919
		197	152									DDB_PSLINT_97	920

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	153									DDB_PSLINT_98	921
		197	154									DDB_PSLINT_99	922
		197	155									DDB_PSLINT_100	923
		197	156									DDB_PSLINT_101	924
		197	157									DDB_PSLINT_102	925
		197	158									DDB_PSLINT_103	926
		197	159									DDB_PSLINT_104	927
		197	160									DDB_PSLINT_105	928
		197	161									DDB_PSLINT_106	929
		197	162									DDB_PSLINT_107	930
		197	163									DDB_PSLINT_108	931
		197	164									DDB_PSLINT_109	932
		197	165									DDB_PSLINT_110	933
		197	166									DDB_PSLINT_111	934
		197	167									DDB_PSLINT_112	935
		197	168									DDB_PSLINT_113	936
		197	169									DDB_PSLINT_114	937
		197	170									DDB_PSLINT_115	938
		197	171									DDB_PSLINT_116	939
		197	172									DDB_PSLINT_117	940
		197	173									DDB_PSLINT_118	941
		197	174									DDB_PSLINT_119	942
		197	175									DDB_PSLINT_120	943
		197	176									DDB_PSLINT_121	944
		197	177									DDB_PSLINT_122	945
		197	178									DDB_PSLINT_123	946
		197	179									DDB_PSLINT_124	947
		197	180									DDB_PSLINT_125	948
		197	181									DDB_PSLINT_126	949
		197	182									DDB_PSLINT_127	950
		197	183									DDB_PSLINT_128	951
		197	184									DDB_PSLINT_129	952
		197	185									DDB_PSLINT_130	953
		197	186									DDB_PSLINT_131	954
		197	187									DDB_PSLINT_132	955
		197	188									DDB_PSLINT_133	956
		197	189									DDB_PSLINT_134	957

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	190									DDB_PSLINT_135	958
		197	191									DDB_PSLINT_136	959
		197	192									DDB_PSLINT_137	960
		197	193									DDB_PSLINT_138	961
		197	194									DDB_PSLINT_139	962
		197	195									DDB_PSLINT_140	963
		197	196									DDB_PSLINT_141	964
		197	197									DDB_PSLINT_142	965
		197	198									DDB_PSLINT_143	966
		197	199									DDB_PSLINT_144	967
		197	200									DDB_PSLINT_145	968
		197	201									DDB_PSLINT_146	969
		197	202									DDB_PSLINT_147	970
		197	203									DDB_PSLINT_148	971
		197	204									DDB_PSLINT_149	972
		197	205									DDB_PSLINT_150	973
		197	206									DDB_UNUSED_974	974
		197	207									DDB_UNUSED_975	975
		197	208									DDB_UNUSED_976	976
		197	209									DDB_UNUSED_977	977
		197	210									DDB_UNUSED_978	978
		197	211									DDB_UNUSED_979	979
		197	212									DDB_UNUSED_980	980
		197	213									DDB_UNUSED_981	981
		197	214									DDB_UNUSED_982	982
		197	215									DDB_UNUSED_983	983
		197	216									DDB_UNUSED_984	984
		197	217									DDB_UNUSED_985	985
		197	218									DDB_UNUSED_986	986
		197	219									DDB_UNUSED_987	987
		197	220									DDB_UNUSED_988	988
		197	221									DDB_UNUSED_989	989
		197	222									DDB_UNUSED_990	990
		197	223									DDB_UNUSED_991	991
		197	224									DDB_UNUSED_992	992
		197	225									DDB_UNUSED_993	993
		197	226									DDB_UNUSED_994	994

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
		197	227									DDB_UNUSED_995	995
		197	228									DDB_UNUSED_996	996
		197	229									DDB_UNUSED_997	997
		197	230									DDB_UNUSED_998	998
		197	231									DDB_UNUSED_999	999
		197	232									DDB_UNUSED_1000	1000
		197	233									DDB_UNUSED_1001	1001
		197	234									DDB_UNUSED_1002	1002
		197	235									DDB_UNUSED_1003	1003
		197	236									DDB_UNUSED_1004	1004
		197	237									DDB_UNUSED_1005	1005
		197	238									DDB_UNUSED_1006	1006
		197	239									DDB_UNUSED_1007	1007
		197	240									DDB_UNUSED_1008	1008
		197	241									DDB_UNUSED_1009	1009
		197	242									DDB_UNUSED_1010	1010
		197	243									DDB_UNUSED_1011	1011
		197	244									DDB_UNUSED_1012	1012
		197	245									DDB_UNUSED_1013	1013
		197	246									DDB_UNUSED_1014	1014
		197	247									DDB_UNUSED_1015	1015
		197	248									DDB_UNUSED_1016	1016
		197	249									DDB_UNUSED_1017	1017
		197	250									DDB_UNUSED_1018	1018
		197	251									DDB_UNUSED_1019	1019
		197	252									DDB_UNUSED_1020	1020
		197	253									DDB_UNUSED_1021	1021
		197	254									DDB_UNUSED_1022	1022
1	1,7	197	255	Battery Fail		*	*	*	*	*	*		
1	1,7	198	0	Rear Comm 2 Fail		*	*	*	*	*	*		
1	1,7	198	1	GOOSE IED Absent									
1	1,7	198	2	NIC Not Fitted									
1	1,7	198	3	NIC No Response									
1	1,7	198	4	NIC Fatal Error									
1	1,7	198	5	NIC Soft. Reload									
1	1,7	198	6	Bad TCP/IP Cfg.									
1	1,7	198	7	Bad OSI Config.									

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
1	1,7	198	8	NIC Link Fail									
1	1,7	198	9	NIC SW Mis-Match									
1	1,7	198	10	IP Addr Conflict									
		198	11	Unused									
		198	12	Unused									
		198	13	Unused									
1	1,7	198	14	Backup Setting	*	*	*	*	*	*	*		
		198	15	Unused									
		198	16	Unused									
		198	17	Unused									
		198	18	Unused									
		198	19	Unused									
		198	20	Unused									
		198	21	Unused									
		198	22	Unused									
		198	23	Unused									
		198	24	Unused									
		198	25	Unused									
		198	26	Unused									
		198	27	Unused									
		198	28	Unused									
		198	29	Unused									

Non Standard Information numbers in control direction

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
20	20	196	32	Auto-recloser on/off				*		*		Autoreclose in Service 1 pole	
20	20	194	224	Control Input 1		*	*	*	*	*	*		
20	20	194	225	Control Input 2		*	*	*	*	*	*		
20	20	194	226	Control Input 3		*	*	*	*	*	*		
20	20	194	227	Control Input 4		*	*	*	*	*	*		
20	20	194	228	Control Input 5		*	*	*	*	*	*		
20	20	194	229	Control Input 6		*	*	*	*	*	*		
20	20	194	230	Control Input 7		*	*	*	*	*	*		
20	20	194	231	Control Input 8		*	*	*	*	*	*		
20	20	194	232	Control Input 9		*	*	*	*	*	*		
20	20	194	233	Control Input 10		*	*	*	*	*	*		
20	20	194	234	Control Input 11		*	*	*	*	*	*		
20	20	194	235	Control Input 12		*	*	*	*	*	*		

ASDU TYPE	COT	FUN	INF	English Text	GI	1	2	3	4	5	6	DDB Element Name	Ordinal
20	20	194	236	Control Input 13		*	*	*	*	*	*		
20	20	194	237	Control Input 14		*	*	*	*	*	*		
20	20	194	238	Control Input 15		*	*	*	*	*	*		
20	20	194	239	Control Input 16		*	*	*	*	*	*		
20	20	194	240	Control Input 17		*	*	*	*	*	*		
20	20	194	241	Control Input 18		*	*	*	*	*	*		
20	20	194	242	Control Input 19		*	*	*	*	*	*		
20	20	194	243	Control Input 20		*	*	*	*	*	*		
20	20	194	244	Control Input 21		*	*	*	*	*	*		
20	20	194	245	Control Input 22		*	*	*	*	*	*		
20	20	194	246	Control Input 23		*	*	*	*	*	*		
20	20	194	247	Control Input 24		*	*	*	*	*	*		
20	20	194	248	Control Input 25		*	*	*	*	*	*		
20	20	194	249	Control Input 26		*	*	*	*	*	*		
20	20	194	250	Control Input 27		*	*	*	*	*	*		
20	20	194	251	Control Input 28		*	*	*	*	*	*		
20	20	194	252	Control Input 29		*	*	*	*	*	*		
20	20	194	253	Control Input 30		*	*	*	*	*	*		
20	20	194	254	Control Input 31		*	*	*	*	*	*		
20	20	194	255	Control Input 32		*	*	*	*	*	*		

Disturbance Data Actual Channel Identifiers

ACC	Standard	Interpretation
0	Global	Null Channel
1	IL1	IA
2	IL2	IB
3	IL3	IC
4	IN	IN
5	VL1E	VAN
6	VL2E	VBN
7	VL3E	VCN
8	VEN	VN
100	-	IA-2
101	-	IB-2
102	-	IC-2
103	-	IN-2
104	-	VChkSyn
105	-	IM

Event record data format

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value	P541	P542	P543	P544	P545	P546
Logic Inputs		**Change in Opto Input**	5	0020	Binary Flag (8 bits)	*					
					Binary Flag (16 bits)		*	*	*		
				0F21	Binary Flag (24 bits)					*	*
					Value contains new opto input status						
Output Contacts		**Change in output contact status**	4	0021	Binary Flag (7 bits)	*					
					Binary Flag (14 bits)		*	*	*		
				0F20	Binary Flag (32 bits)					*	*
					Value contains new output contact status						
		Alarm Events:									
					Binary Flag (32 bits) Bit Number						
Battery Fail	ON/OFF	Battery Fail	2/3	0022	0	*	*	*	*	*	*
Field Volt Fail	ON/OFF	Field Voltage Fail	2/3	0022	1	*	*	*	*	*	*
SG-opto Invalid	ON/OFF	Setting group via opto invalid (Self Reset)	2/3	0022	2	*	*	*	*	*	*
Prot'n Disabled	ON/OFF	Protection Disabled (Self Reset)	2/3	0022	3	*	*	*	*	*	*
VT Fail Alarm	ON/OFF	VT Fail Alarm (Self Reset)	2/3	0022	4			*	*	*	*
Power Swing	ON/OFF	Power Swingl Alarm (Latched)	0/1	0022	5			*	*	*	*
CB Fail Alarm	ON/OFF	CB Fail Alarm (Latched)	0/1	0022	6	*	*	*	*	*	*
I^ Maint Alarm	ON/OFF	Broken current Maintenance Alarm (Self Reset)	2/3	0022	7	*	*	*		*	
I^ Lockout Alarm	ON/OFF	Broken current Lockout Alarm (Self Reset)	2/3	0022	8	*	*	*		*	
CB Ops Maint	ON/OFF	No of CB Ops Maintenance Alarm (Self Reset)	2/3	0022	9	*	*	*		*	
CB Ops Lock	ON/OFF	No of CB Ops Lockout Alarm (Self Reset)	2/3	0022	10	*	*	*		*	
CB Time Maint	ON/OFF	CB Op Time Maintenance Alarm (Self Reset)	2/3	0022	11	*	*	*		*	
CB Time Lockout	ON/OFF	CB Op Time Lockout Alarm (Self Reset)	2/3	0022	12	*	*	*		*	
Fault Freq Lock	ON/OFF	Excessive Fault Frequency Lockout (Self Reset)	2/3	0022	13	*	*	*		*	
CB Status Alarm	ON/OFF	CB Status Alarm (Latched)	0/1	0022	14	*	*	*	*	*	*
GPS Alarm	ON/OFF	GPS Alarm (Latched)	0/1	0022	15					*	*
CB Trip Fail	ON/OFF	CB Fail Trip Control (Latched)	0/1	0022	16	*	*	*	*	*	*
CB Close Fail	ON/OFF	CB Fail Close Control (Latched)	0/1	0022	17	*	*	*	*	*	*
Man CB Unhealthy	ON/OFF	No Healthy Control Close (Latched)	0/1	0022	18	*	*	*	*	*	*
No C/S Man Close	ON/OFF	No C/S control close (Latched)	0/1	0022	19			*		*	
AR Lockout	ON/OFF	A/R Lockout (Self Reset)	2/3	0022	20		*	*		*	

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value	P541	P542	P543	P544	P545	P546
CB2 Fail Alarm	ON/OFF	CB2 Fail Alarm (Latched)	0/1	0022	20				*		*
AR CB Unhealthy	ON/OFF	A/R CB Not healthy (Latched)	0/1	0022	21		*	*		*	
A/R No Check Sync	ON/OFF	A/R No Checksync (Latched)	0/1	0022	22			*		*	
InCompatible Rly	ON/OFF	Incompatible Relay Alarm (Self Reset)	2/3	0022	23	*	*	*	*	*	*
Test Loopback	ON/OFF	Test Loopback Alarm (Self Reset)	2/3	0022	24	*	*	*	*	*	*
Signalling Fail	ON/OFF	Signalling Fail Alarm (Latched)	0/1	0022	25	*	*	*	*	*	*
Comm Delay Alarm	ON/OFF	Communications Delay Alarm (Latched)	0/1	0022	26	*	*	*	*	*	*
C Diff Failure	ON/OFF	Current Differential Failure Alarm (Latched)	0/1	0022	27	*	*	*	*	*	*
C Diff Inhibited	ON/OFF	Current Diff Protection Inhibited (Self Reset)	2/3	0022	28	*	*	*	*	*	*
Config Error	ON/OFF	Configuration Error Alarm (Latched)	0/1	0022	29	*	*	*	*	*	*
Re-Config Error	ON/OFF	Re-Configuration Alarm (Latched)	0/1	0022	30	*	*	*	*	*	*
F out of Range	ON/OFF	Frequency out of Range Alarm (Self Reset)	2/3	0022	31	*	*	*	*	*	*
C Diff Comm Mode	ON/OFF	C Diff Protection Comms Mode (Self Reset)	2/3	0051	13	*	*	*	*	*	*
IEEE C37.94	ON/OFF	IEEE C37.94 Communications Alarms (Self Reset)	2/3	0051	14	*	*	*	*	*	*
System Split	ON/OFF	System Split Latched)	2/3	0051	15	.	.	*	.	*	.
SR User Alarm 1	ON/OFF	User Alarm 1 (Self Reset)	2/3	0051	16	*	*	*	*	*	*
SR User Alarm 2	ON/OFF	User Alarm 2 (Self Reset)	2/3	0051	17	*	*	*	*	*	*
SR User Alarm 3	ON/OFF	User Alarm 3 (Self Reset)	2/3	0051	18	*	*	*	*	*	*
SR User Alarm 4	ON/OFF	User Alarm 4 (Self Reset)	2/3	0051	19	*	*	*	*	*	*
SR User Alarm 5	ON/OFF	User Alarm 5 (Self Reset)	2/3	0051	20	*	*	*	*	*	*
SR User Alarm 6	ON/OFF	User Alarm 6 (Self Reset)	2/3	0051	21	*	*	*	*	*	*
SR User Alarm 7	ON/OFF	User Alarm 7 (Self Reset)	2/3	0051	22	*	*	*	*	*	*
SR User Alarm 8	ON/OFF	User Alarm 8 (Self Reset)	2/3	0051	23	*	*	*	*	*	*
MR User Alarm 9	ON/OFF	User Alarm 9 (Latched)	0/1	0051	24	*	*	*	*	*	*
MR User Alarm 10	ON/OFF	User Alarm 10 (Latched)	0/1	0051	25	*	*	*	*	*	*
MR User Alarm 11	ON/OFF	User Alarm 11 (Latched)	0/1	0051	26	*	*	*	*	*	*
MR User Alarm 12	ON/OFF	User Alarm 12 (Latched)	0/1	0051	27	*	*	*	*	*	*
MR User Alarm 13	ON/OFF	User Alarm 13 (Latched)	0/1	0051	28	*	*	*	*	*	*
MR User Alarm 14	ON/OFF	User Alarm 14 (Latched)	0/1	0051	29	*	*	*	*	*	*
MR User Alarm 15	ON/OFF	User Alarm 15 (Latched)	0/1	0051	30	*	*	*	*	*	*
MR User Alarm 16	ON/OFF	User Alarm 16 (Latched)	0/1	0051	31	*	*	*	*	*	*
Battery Fail	ON/OFF	Battery Fail	2/3	0052	0	*	*	*	*	*	*
Field Volt Fail	ON/OFF	Field Voltage Fail	2/3	0052	1	*	*	*	*	*	*
Rear Comm 2 Fail	ON/OFF	Rear Comm 2 Fail		0052	2	*	*	*	*	*	*
GOOSE IED Absent	ON/OFF			0052	3	*	*	*	*	*	*
NIC Not Fitted	ON/OFF			0052	4	*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value	P541	P542	P543	P544	P545	P546
NIC No Response	ON/OFF			0052	5	*	*	*	*	*	*
NIC Fatal Error	ON/OFF			0052	6	*	*	*	*	*	*
NIC Soft. Reload	ON/OFF			0052	7	*	*	*	*	*	*
Bad TCP/IP Cfg.	ON/OFF			0052	8	*	*	*	*	*	*
Bad OSI Config.	ON/OFF			0052	9	*	*	*	*	*	*
NIC Link Fail	ON/OFF			0052	10	*	*	*	*	*	*
NIC SW Mis-Match	ON/OFF			0052	11	*	*	*	*	*	*
IP Addr Conflict	ON/OFF			0052	12	*	*	*	*	*	*
unused	ON/OFF			0052	13	*	*	*	*	*	*
unused	ON/OFF			0052	14	*	*	*	*	*	*
unused	ON/OFF			0052	15	*	*	*	*	*	*
unused	ON/OFF			0052	16	*	*	*	*	*	*
Backup Setting	ON/OFF			0052	17	*	*	*	*	*	*
		Protection Events:			Binary Flag (32 bits) Bit Number						
Control Input 1	ON/OFF		6	0F27	0	*	*	*	*	*	*
Control Input 2	ON/OFF		6	0F27	1	*	*	*	*	*	*
Control Input 3	ON/OFF		6	0F27	2	*	*	*	*	*	*
Control Input 4	ON/OFF		6	0F27	3	*	*	*	*	*	*
Control Input 5	ON/OFF		6	0F27	4	*	*	*	*	*	*
Control Input 6	ON/OFF		6	0F27	5	*	*	*	*	*	*
Control Input 7	ON/OFF		6	0F27	6	*	*	*	*	*	*
Control Input 8	ON/OFF		6	0F27	7	*	*	*	*	*	*
Control Input 9	ON/OFF		6	0F27	8	*	*	*	*	*	*
Control Input 10	ON/OFF		6	0F27	9	*	*	*	*	*	*
Control Input 11	ON/OFF		6	0F27	10	*	*	*	*	*	*
Control Input 12	ON/OFF		6	0F27	11	*	*	*	*	*	*
Control Input 13	ON/OFF		6	0F27	12	*	*	*	*	*	*
Control Input 14	ON/OFF		6	0F27	13	*	*	*	*	*	*
Control Input 15	ON/OFF		6	0F27	14	*	*	*	*	*	*
Control Input 16	ON/OFF		6	0F27	15	*	*	*	*	*	*
Control Input 17	ON/OFF		6	0F27	16	*	*	*	*	*	*
Control Input 18	ON/OFF		6	0F27	17	*	*	*	*	*	*
Control Input 19	ON/OFF		6	0F27	18	*	*	*	*	*	*
Control Input 20	ON/OFF		6	0F27	19	*	*	*	*	*	*
Control Input 21	ON/OFF		6	0F27	20	*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
Control Input 22	ON/OFF		6	0F27	21		*	*	*	*	*	*
Control Input 23	ON/OFF		6	0F27	22		*	*	*	*	*	*
Control Input 24	ON/OFF		6	0F27	23		*	*	*	*	*	*
Control Input 25	ON/OFF		6	0F27	24		*	*	*	*	*	*
Control Input 26	ON/OFF		6	0F27	25		*	*	*	*	*	*
Control Input 27	ON/OFF		6	0F27	26		*	*	*	*	*	*
Control Input 28	ON/OFF		6	0F27	27		*	*	*	*	*	*
Control Input 29	ON/OFF		6	0F27	28		*	*	*	*	*	*
Control Input 30	ON/OFF		6	0F27	29		*	*	*	*	*	*
Control Input 31	ON/OFF		6	0F27	30		*	*	*	*	*	*
Control Input 32	ON/OFF		6	0F27	31		*	*	*	*	*	*
Reset Relays/LED	ON/OFF	Reset Latched Relays & LED’s	6	0F29	16		*	*	*	*	*	*
Any Trip	ON/OFF	Any Trip	6	0F2A	30		*	*	*	*	*	*
Diff Trip	ON/OFF	Differential Trip	6	0F2A	31		*	*	*	*	*	*
Diff Trip A	ON/OFF	Differential Trip A	6	0F2B	0		*	*	*	*	*	*
Diff Trip B	ON/OFF	Differential Trip B	6	0F2B	1		*	*	*	*	*	*
Diff Trip C	ON/OFF	Differential Trip C	6	0F2B	2		*	*	*	*	*	*
Diff Intertrip	ON/OFF	Differential Intertrip	6	0F2B	3		*	*	*	*	*	*
Diff Intertrip A	ON/OFF	Differential Intertrip A	6	0F2B	4		*	*	*	*	*	*
Diff Intertrip B	ON/OFF	Differential Intertrip B	6	0F2B	5		*	*	*	*	*	*
Diff Intertrip C	ON/OFF	Differential Intertrip C	6	0F2B	6		*	*	*	*	*	*
Direct Intertrip	ON/OFF	Direct Intertrip	6	0F2B	7							
Perm Intertrip	ON/OFF	Permissive Intertrip	6	0F2B	8		*	*	*	*	*	*
Zone 1 Trip	ON/OFF	Any Zone 1 Trip	6	0F2B	9				*	*	*	*
Zone 1 A Trip	ON/OFF	Zone 1 A Phase Trip	6	0F2B	10				*	*	*	*
Zone 1 B Trip	ON/OFF	Zone 1 B Phase Trip	6	0F2B	11				*	*	*	*
Zone 1 C Trip	ON/OFF	Zone 1 C Phase Trip	6	0F2B	12				*	*	*	*
Zone 1 N Trip	ON/OFF	Zone 1 N Trip	6	0F2B	13				*	*	*	*
Zone 2 Trip	ON/OFF	Any Zone 2 Trip	6	0F2B	14				*	*	*	*
Zone 2 A Trip	ON/OFF	Zone 2 A Phase Trip	6	0F2B	15				*	*	*	*
Zone 2 B Trip	ON/OFF	Zone 2 B Phase Trip	6	0F2B	16				*	*	*	*
Zone 2 C Trip	ON/OFF	Zone 2 C Phase Trip	6	0F2B	17				*	*	*	*
Zone 2 N Trip	ON/OFF	Zone 2 N Trip	6	0F2B	18				*	*	*	*
Zone 3 Trip	ON/OFF	Any Zone 3 Trip	6	0F2B	19				*	*	*	*
Zone 3 A Trip	ON/OFF	Zone 3 A Phase Trip	6	0F2B	20				*	*	*	*
Zone 3 B Trip	ON/OFF	Zone 3 B Phase Trip	6	0F2B	21				*	*	*	*
Zone 3 C Trip	ON/OFF	Zone 3 C Phase Trip	6	0F2B	22				*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
Zone 3 N Trip	ON/OFF	Zone 3 N Trip	6	0F2B	23				*	*	*	*
Pole Discrepancy	ON/OFF	Pole Discrepancy	6	0F2B	24				*		*	
BU Intertrip	ON/OFF	Pole Discrepancy	6	0F2B	25		*	*	*	*	*	*
BU Intertrip A	ON/OFF	Differential Intertrip A	6	0F2B	26		*	*	*	*	*	*
BU Intertrip B	ON/OFF	Differential Intertrip B	6	0F2B	27		*	*	*	*	*	*
BU Intertrip C	ON/OFF	Differential Intertrip C	6	0F2B	28		*	*	*	*	*	*
Force 3pole BU	ON/OFF	Force 3 pole backup Intertrip	6	0F2B	29				*	*	*	*
I>1 Trip	ON/OFF	1st Stage O/C Trip 3ph	6	0F2B	30		*	*	*	*	*	*
I>1 Trip A	ON/OFF	1st Stage O/C Trip A	6	0F2B	31		*	*	*	*	*	*
I>1 Trip B	ON/OFF	1st Stage O/C Trip B	6	0F2C	0		*	*	*	*	*	*
I>1 Trip C	ON/OFF	1st Stage O/C Trip C	6	0F2C	1		*	*	*	*	*	*
I>2 Trip	ON/OFF	2nd Stage O/C Trip 3ph	6	0F2C	2		*	*	*	*	*	*
I>2 Trip A	ON/OFF	2nd Stage O/C Trip A	6	0F2C	3		*	*	*	*	*	*
I>2 Trip B	ON/OFF	2nd Stage O/C Trip B	6	0F2C	4		*	*	*	*	*	*
I>2 Trip C	ON/OFF	2nd Stage O/C Trip C	6	0F2C	5		*	*	*	*	*	*
I>3 Trip	ON/OFF	3rd Stage O/C Trip 3ph	6	0F2C	6		*	*	*	*	*	*
I>3 Trip A	ON/OFF	3rd Stage O/C Trip A	6	0F2C	7		*	*	*	*	*	*
I>3 Trip B	ON/OFF	3rd Stage O/C Trip B	6	0F2C	8		*	*	*	*	*	*
I>3 Trip C	ON/OFF	3rd Stage O/C Trip C	6	0F2C	9		*	*	*	*	*	*
I>4 Trip	ON/OFF	4th Stage O/C Trip 3ph	6	0F2C	10		*	*	*	*	*	*
I>4 Trip A	ON/OFF	4th Stage O/C Trip A	6	0F2C	11		*	*	*	*	*	*
I>4 Trip B	ON/OFF	4th Stage O/C Trip B	6	0F2C	12		*	*	*	*	*	*
I>4 Trip C	ON/OFF	4th Stage O/C Trip C	6	0F2C	13		*	*	*	*	*	*
IN>1 Trip	ON/OFF	1st Stage SBEF Trip	6	0F2C	14		*	*	*	*	*	*
IN>2 Trip	ON/OFF	2nd Stage SBEF Trip	6	0F2C	15		*	*	*	*	*	*
IN>3 Trip	ON/OFF	3rd Stage SBEF Trip	6	0F2C	16		*	*	*	*	*	*
IN>4 Trip	ON/OFF	4th Stage SBEF Trip	6	0F2C	17		*	*	*	*	*	*
ISEF>1 Trip	ON/OFF	1st Stage SEF Trip	6	0F2C	18				*	*	*	*
ISEF>2 Trip	ON/OFF	2nd Stage SEF Trip	6	0F2C	19				*	*	*	*
ISEF>3 Trip	ON/OFF	3rd Stage SEF Trip	6	0F2C	20				*	*	*	*
ISEF>4 Trip	ON/OFF	4th Stage SEF Trip	6	0F2C	21				*	*	*	*
Broken Wire Trip	ON/OFF	Broken Conductor Trip	6	0F2C	22		*	*	*	*	*	*
Thermal Trip	ON/OFF	Thermal Overload Trip	6	0F2C	23		*	*	*	*	*	*
Stub Bus Trip	ON/OFF	Stub Bus Trip	6	0F2C	24					*		*
AR Trip Test	ON/OFF	Autoreclose trip test	6	0F2C	25			*	*		*	
AR Trip Test A	ON/OFF	Autoreclose trip test A phase	6	0F2C	26				*		*	
AR Trip Test B	ON/OFF	Autoreclose trip test B phase	6	0F2C	27				*		*	

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
AR Trip Test C	ON/OFF	Autoreclose trip test C Phase	6	0F2C	28				*		*	
Zone 1 Start	ON/OFF	Zone 1 Start	6	0F2D	14				*	*	*	*
Zone 2 Start	ON/OFF	Zone 2 Start	6	0F2D	15				*	*	*	*
Zone 3 Start	ON/OFF	Zone 3 Start	6	0F2D	16				*	*	*	*
Diff Start	ON/OFF	Differential Start	6	0F2D	17		*	*	*	*	*	*
Any Start	ON/OFF	Any Start	6	0F2D	18		*	*	*	*	*	*
Diff Start A	ON/OFF	Differential Start A	6	0F2D	19		*	*	*	*	*	*
Diff Start B	ON/OFF	Differential Start B	6	0F2D	20		*	*	*	*	*	*
Diff Start C	ON/OFF	Differential Start C	6	0F2D	21		*	*	*	*	*	*
Zone 1 A Start	ON/OFF	Zone 1 A Phase Start	6	0F2D	22				*	*	*	*
Zone 1 B Start	ON/OFF	Zone 1 B Phase Start	6	0F2D	23				*	*	*	*
Zone 1 C Start	ON/OFF	Zone 1 C Phase Start	6	0F2D	24				*	*	*	*
Zone 1 N Start	ON/OFF	Zone 1 N Start	6	0F2D	25				*	*	*	*
Zone 2 A Start	ON/OFF	Zone 2 A Phase Start	6	0F2D	26				*	*	*	*
Zone 2 B Start	ON/OFF	Zone 2 B Phase Start	6	0F2D	27				*	*	*	*
Zone 2 C Start	ON/OFF	Zone 2 C Phase Start	6	0F2D	28				*	*	*	*
Zone 2 N Start	ON/OFF	Zone 2 N Start	6	0F2D	29				*	*	*	*
Zone 3 A Start	ON/OFF	Zone 3 A Phase Start	6	0F2D	30				*	*	*	*
Zone 3 B Start	ON/OFF	Zone 3 B Phase Start	6	0F2D	31				*	*	*	*
Zone 3 C Start	ON/OFF	Zone 3 C Phase Start	6	0F2E	0				*	*	*	*
Zone 3 N Start	ON/OFF	Zone 3 N Start	6	0F2E	1				*	*	*	*
Zone 6 Start	ON/OFF	Zone 6 Start (PSB Start)	6	0F2E	2				*	*	*	*
I>1 Start	ON/OFF	1st Stage O/C Start 3ph	6	0F2E	3		*	*	*	*	*	*
I>1 Start A	ON/OFF	1st Stage O/C Start A	6	0F2E	4		*	*	*	*	*	*
I>1 Start B	ON/OFF	1st Stage O/C Start B	6	0F2E	5		*	*	*	*	*	*
I>1 Start C	ON/OFF	1st Stage O/C Start C	6	0F2E	6		*	*	*	*	*	*
I>2 Start	ON/OFF	2nd Stage O/C Start 3ph	6	0F2E	7		*	*	*	*	*	*
I>2 Start A	ON/OFF	2nd Stage O/C Start A	6	0F2E	8		*	*	*	*	*	*
I>2 Start B	ON/OFF	2nd Stage O/C Start B	6	0F2E	9		*	*	*	*	*	*
I>2 Start C	ON/OFF	2nd Stage O/C Start C	6	0F2E	10		*	*	*	*	*	*
I>3 Start	ON/OFF	3rd Stage O/C Start 3ph	6	0F2E	11		*	*	*	*	*	*
I>3 Start A	ON/OFF	3rd Stage O/C Start A	6	0F2E	12		*	*	*	*	*	*
I>3 Start B	ON/OFF	3rd Stage O/C Start B	6	0F2E	13		*	*	*	*	*	*
I>3 Start C	ON/OFF	3rd Stage O/C Start C	6	0F2E	14		*	*	*	*	*	*
I>4 Start	ON/OFF	4th Stage O/C Start 3ph	6	0F2E	15		*	*	*	*	*	*
I>4 Start A	ON/OFF	4th Stage O/C Start A	6	0F2E	16		*	*	*	*	*	*
I>4 Start B	ON/OFF	4th Stage O/C Start B	6	0F2E	17		*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
I>4 Start C	ON/OFF	4th Stage O/C Start C	6	0F2E	18		*	*	*	*	*	*
IN>1 Start	ON/OFF	1st Stage SBEF Start	6	0F2E	19		*	*	*	*	*	*
IN>2 Start	ON/OFF	2nd Stage SBEF Start	6	0F2E	20		*	*	*	*	*	*
IN>3 Start	ON/OFF	3rd Stage SBEF Start	6	0F2E	21		*	*	*	*	*	*
IN>4 Start	ON/OFF	4th Stage SBEF Start	6	0F2E	22		*	*	*	*	*	*
ISEF>1 Start	ON/OFF	1st Stage SEF Start	6	0F2E	23				*	*	*	*
ISEF>2 Start	ON/OFF	2nd Stage SEF Start	6	0F2E	24				*	*	*	*
ISEF>3 Start	ON/OFF	3rd Stage SEF Start	6	0F2E	25				*	*	*	*
ISEF>4 Start	ON/OFF	4th Stage SEF Start	6	0F2E	26				*	*	*	*
Thermal Alarm	ON/OFF	Thermal Overload Alarm	6	0F2E	27		*	*	*	*	*	*
I> BlockStart	ON/OFF	I> Blocked O/C Start	6	0F2E	28		*	*	*	*	*	*
IN/SEF>Blk Start	ON/OFF	IN/ISEF> Blocked O/C Start	6	0F2E	29		*	*	*	*	*	*
Bfail1 Trip 3ph	ON/OFF	tBF1 Trip 3Ph	6	0F30	8		*	*	*	*	*	*
Bfail2 Trip 3ph	ON/OFF	tBF2 Trip 3Ph	6	0F30	9		*	*	*	*	*	*
CB2 Fail1 Trip	ON/OFF	Autoreclose Block Main Protection	6	0F30	10					*		*
CB2 Fail2 Trip	ON/OFF	Autoreclose Block SEF Protection	6	0F30	11					*		*
Control Trip	ON/OFF	Control Trip	6	0F30	12		*	*	*	*	*	*
Control Close	ON/OFF	Control Close	6	0F30	13		*	*	*	*	*	*
Control Trip 2	ON/OFF	Control Trip 2	6	0F30	14					*		*
Control Close 2	ON/OFF	Control Close 2	6	0F30	15					*		*
Close in Prog	ON/OFF	Control Close in Progress	6	0F30	16		*	*	*	*	*	*
Block Main Prot	ON/OFF	AR Block Main Protection	6	0F30	17			*				
AR 3pole in prog	ON/OFF	Auto Reclose/(AR 3 pole) in Progress	6	0F30	19			*	*		*	
AR 1pole in prog	ON/OFF	AR 1pole in progress	6	0F30	20				*		*	
Seq Counter = 1	ON/OFF	Seq Counter = 1	6	0F30	22			*	*		*	
Seq Counter = 2	ON/OFF	Seq Counter = 2	6	0F30	23			*	*		*	
Seq Counter = 3	ON/OFF	Seq Counter = 3	6	0F30	24			*	*		*	
Seq Counter = 4	ON/OFF	Seq Counter = 4	6	0F30	25			*	*		*	
Successful Close	ON/OFF	Successful Reclosure	6	0F30	27			*	*		*	
Dead T in Prog	ON/OFF	Dead Time in Progress	6	0F30	28			*				
Auto Close	ON/OFF	Auto Close/ AR Close	6	0F30	29			*	*		*	
A/R Status	ON/OFF	Autoreclose In/Out of service	6	0F30	30			*				
A/R Status 3P	ON/OFF	Autoreclose In/Out of service	6	0F30	31				*		*	
AR Status 1P	ON/OFF	Autoreclose In/Out of service	6	0F31	0				*		*	
Force 3 pole	ON/OFF	AR Force 3 pole trips	6	0F31	1				*		*	
CB Open 3 ph	ON/OFF	3 ph CB Open	6	0F32	6		*	*	*	*	*	*
CB Open A ph	ON/OFF	Ph A CB Open	6	0F32	7				*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
CB Open B ph	ON/OFF	Ph B CB Open	6	0F32	8				*	*	*	*
CB Open C ph	ON/OFF	Ph C CB Open	6	0F32	9				*	*	*	*
CB Closed 3 ph	ON/OFF	3 ph CB Closed	6	0F32	10		*	*	*	*	*	*
CB Closed A ph	ON/OFF	Ph A CB Closed	6	0F32	11				*	*	*	*
CB Closed B ph	ON/OFF	Ph B CB Closed	6	0F32	12				*	*	*	*
CB Closed C ph	ON/OFF	Ph C CB Closed	6	0F32	13				*	*	*	*
CB2 Open 3 ph	ON/OFF	3 ph CB2 Open	6	0F32	14					*		*
CB2 Open A ph	ON/OFF	Ph A CB2 Open	6	0F32	15					*		*
CB2 Open B ph	ON/OFF	Ph B CB2 Open	6	0F32	16					*		*
CB2 Open C ph	ON/OFF	Ph C CB2 Open	6	0F32	17					*		*
CB2 Closed 3 ph	ON/OFF	3 ph CB2 Closed	6	0F32	18					*		*
CB2 Closed A ph	ON/OFF	Ph A CB2 Closed	6	0F32	19					*		*
CB2 Closed B ph	ON/OFF	Ph B CB2 Closed	6	0F32	20					*		*
CB2 Closed C ph	ON/OFF	Ph C CB2 Closed	6	0F32	21					*		*
SignalFail Ch1Rx	ON/OFF	Protection Signaling Failure Alarm - Ch1 Rx	6	0F32	26		*	*	*	*	*	*
SignalFail Ch1Tx	ON/OFF	Protection Signaling Failure Alarm - Ch1 Tx	6	0F32	27		*	*	*	*	*	*
SignalFail Ch2Rx	ON/OFF	Protection Signaling Failure Alarm - Ch2 Rx	6	0F32	28		*	*	*	*	*	*
SignalFail Ch2Tx	ON/OFF	Protection Signaling Failure Alarm - Ch2 Tx	6	0F32	29		*	*	*	*	*	*
Ch 1 GPS Fail	ON/OFF	Remote 1 GPS Fail	6	0F32	30						*	*
Ch 2 GPS Fail	ON/OFF	Remote 2 GPS Fail	6	0F32	31						*	*
Config Same	ON/OFF	relay is already configured	6	0F33	0		*	*	*	*	*	*
Reconfig Pass	ON/OFF	reconfigure was successful	6	0F33	1		*	*	*	*	*	*
Reconfig Fail	ON/OFF	reconfigure was unsuccessful	6	0F33	2		*	*	*	*	*	*
Restore Pass	ON/OFF	restore was successful	6	0F33	3		*	*	*	*	*	*
Restore Fail	ON/OFF	restore was unsuccessful	6	0F33	4		*	*	*	*	*	*
CB Status Alarm	ON/OFF	CB Status Alarm	6	0F33	11		*	*	*	*	*	*
CB2 Status Alarm	ON/OFF	CB Status Alarm 2	6	0F33	12					*		*
Ch 1 Intertrip 1	ON/OFF	User Defined Intertrip	6	0F33	13		*	*	*	*	*	*
Ch 1 Intertrip 2	ON/OFF	User Defined Intertrip	6	0F33	14		*	*	*	*	*	*
Ch 1 Intertrip 3	ON/OFF	User Defined Intertrip	6	0F33	15		*	*	*	*	*	*
Ch 1 Intertrip 4	ON/OFF	User Defined Intertrip	6	0F33	16		*	*	*	*	*	*
Ch 1 Intertrip 5	ON/OFF	User Defined Intertrip	6	0F33	17		*	*	*	*	*	*
Ch 1 Intertrip 6	ON/OFF	User Defined Intertrip	6	0F33	18		*	*	*	*	*	*
Ch 1 Intertrip 7	ON/OFF	User Defined Intertrip	6	0F33	19		*	*	*	*	*	*
Ch 1 Intertrip 8	ON/OFF	User Defined Intertrip	6	0F33	20		*	*	*	*	*	*
Ch 2 Intertrip 1	ON/OFF	User Defined Intertrip	6	0F33	21		*	*	*	*	*	*
Ch 2 Intertrip 2	ON/OFF	User Defined Intertrip	6	0F33	22		*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
Ch 2 Intertrip 3	ON/OFF	User Defined Intertrip	6	0F33	23		*	*	*	*	*	*
Ch 2 Intertrip 4	ON/OFF	User Defined Intertrip	6	0F33	24		*	*	*	*	*	*
Ch 2 Intertrip 5	ON/OFF	User Defined Intertrip	6	0F33	25		*	*	*	*	*	*
Ch 2 Intertrip 6	ON/OFF	User Defined Intertrip	6	0F33	26		*	*	*	*	*	*
Ch 2 Intertrip 7	ON/OFF	User Defined Intertrip	6	0F33	27		*	*	*	*	*	*
Ch 2 Intertrip 8	ON/OFF	User Defined Intertrip	6	0F33	28		*	*	*	*	*	*
Ch1 Signal Lost	ON/OFF	Ch1 Loss Of Signal	6	0F34	14		*	*	*	*	*	*
Ch1 Path Yellow	ON/OFF	Ch1 Path "Yellow"	6	0F34	15		*	*	*	*	*	*
Ch1 Mismatch RxN	ON/OFF	Ch1 Mismatch Received N	6	0F34	16		*	*	*	*	*	*
Ch2 Signal Lost	ON/OFF	Ch2 Loss Of Signal	6	0F34	17		*	*	*	*	*	*
Ch2 Path Yellow	ON/OFF	Ch2 Path "Yellow"	6	0F34	18		*	*	*	*	*	*
Ch2 Mismatch RxN	ON/OFF	Ch2 Mismatch Received N	6	0F34	19		*	*	*	*	*	*
GOOSE VIP 1	ON/OFF	GOOSE Input 1	6	0F35	0		*	*	*	*	*	*
GOOSE VIP 2	ON/OFF	GOOSE Input 2	6	0F35	1		*	*	*	*	*	*
GOOSE VIP 3	ON/OFF	GOOSE Input 3	6	0F35	2		*	*	*	*	*	*
GOOSE VIP 4	ON/OFF	GOOSE Input 4	6	0F35	3		*	*	*	*	*	*
GOOSE VIP 5	ON/OFF	GOOSE Input 5	6	0F35	4		*	*	*	*	*	*
GOOSE VIP 6	ON/OFF	GOOSE Input 6	6	0F35	5		*	*	*	*	*	*
GOOSE VIP 7	ON/OFF	GOOSE Input 7	6	0F35	6		*	*	*	*	*	*
GOOSE VIP 8	ON/OFF	GOOSE Input 8	6	0F35	7		*	*	*	*	*	*
GOOSE VIP 9	ON/OFF	GOOSE Input 9	6	0F35	8		*	*	*	*	*	*
GOOSE VIP 10	ON/OFF	GOOSE Input 10	6	0F35	9		*	*	*	*	*	*
GOOSE VIP 11	ON/OFF	GOOSE Input 11	6	0F35	10		*	*	*	*	*	*
GOOSE VIP 12	ON/OFF	GOOSE Input 12	6	0F35	11		*	*	*	*	*	*
GOOSE VIP 13	ON/OFF	GOOSE Input 13	6	0F35	12		*	*	*	*	*	*
GOOSE VIP 14	ON/OFF	GOOSE Input 14	6	0F35	13		*	*	*	*	*	*
GOOSE VIP 15	ON/OFF	GOOSE Input 15	6	0F35	14		*	*	*	*	*	*
GOOSE VIP 16	ON/OFF	GOOSE Input 16	6	0F35	15		*	*	*	*	*	*
GOOSE VIP 17	ON/OFF	GOOSE Input 17	6	0F35	16		*	*	*	*	*	*
GOOSE VIP 18	ON/OFF	GOOSE Input 18	6	0F35	17		*	*	*	*	*	*
GOOSE VIP 19	ON/OFF	GOOSE Input 19	6	0F35	18		*	*	*	*	*	*
GOOSE VIP 20	ON/OFF	GOOSE Input 20	6	0F35	19		*	*	*	*	*	*
GOOSE VIP 21	ON/OFF	GOOSE Input 21	6	0F35	20		*	*	*	*	*	*
GOOSE VIP 22	ON/OFF	GOOSE Input 22	6	0F35	21		*	*	*	*	*	*
GOOSE VIP 23	ON/OFF	GOOSE Input 23	6	0F35	22		*	*	*	*	*	*
GOOSE VIP 24	ON/OFF	GOOSE Input 24	6	0F35	23		*	*	*	*	*	*
GOOSE VIP 25	ON/OFF	GOOSE Input 25	6	0F35	24		*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value		P541	P542	P543	P544	P545	P546
GOOSE VIP 26	ON/OFF	GOOSE Input 26	6	0F35	25		*	*	*	*	*	*
GOOSE VIP 27	ON/OFF	GOOSE Input 27	6	0F35	26		*	*	*	*	*	*
GOOSE VIP 28	ON/OFF	GOOSE Input 28	6	0F35	27		*	*	*	*	*	*
GOOSE VIP 29	ON/OFF	GOOSE Input 29	6	0F35	28		*	*	*	*	*	*
GOOSE VIP 30	ON/OFF	GOOSE Input 30	6	0F35	29		*	*	*	*	*	*
GOOSE VIP 31	ON/OFF	GOOSE Input 31	6	0F35	30		*	*	*	*	*	*
GOOSE VIP 32	ON/OFF	GOOSE Input 32	6	0F35	31		*	*	*	*	*	*
GOOSE Out 1	ON/OFF	GOOSE Output 1	6	0F36	0		*	*	*	*	*	*
GOOSE Out 1	ON/OFF	GOOSE Output 2	6	0F36	1		*	*	*	*	*	*
GOOSE Out 2	ON/OFF	GOOSE Output 3	6	0F36	2		*	*	*	*	*	*
GOOSE Out 3	ON/OFF	GOOSE Output 4	6	0F36	3		*	*	*	*	*	*
GOOSE Out 4	ON/OFF	GOOSE Output 5	6	0F36	4		*	*	*	*	*	*
GOOSE Out 5	ON/OFF	GOOSE Output 6	6	0F36	5		*	*	*	*	*	*
GOOSE Out 6	ON/OFF	GOOSE Output 7	6	0F36	6		*	*	*	*	*	*
GOOSE Out 7	ON/OFF	GOOSE Output 8	6	0F36	7		*	*	*	*	*	*
GOOSE Out 8	ON/OFF	GOOSE Output 9	6	0F36	8		*	*	*	*	*	*
GOOSE Out 9	ON/OFF	GOOSE Output 10	6	0F36	9		*	*	*	*	*	*
GOOSE Out 10	ON/OFF	GOOSE Output 11	6	0F36	10		*	*	*	*	*	*
GOOSE Out 11	ON/OFF	GOOSE Output 12	6	0F36	11		*	*	*	*	*	*
GOOSE Out 12	ON/OFF	GOOSE Output 13	6	0F36	12		*	*	*	*	*	*
GOOSE Out 13	ON/OFF	GOOSE Output 14	6	0F36	13		*	*	*	*	*	*
GOOSE Out 14	ON/OFF	GOOSE Output 15	6	0F36	14		*	*	*	*	*	*
GOOSE Out 15	ON/OFF	GOOSE Output 16	6	0F36	15		*	*	*	*	*	*
GOOSE Out 16	ON/OFF	GOOSE Output 17	6	0F36	16		*	*	*	*	*	*
GOOSE Out 17	ON/OFF	GOOSE Output 18	6	0F36	17		*	*	*	*	*	*
GOOSE Out 18	ON/OFF	GOOSE Output 19	6	0F36	18		*	*	*	*	*	*
GOOSE Out 19	ON/OFF	GOOSE Output 20	6	0F36	19		*	*	*	*	*	*
GOOSE Out 20	ON/OFF	GOOSE Output 21	6	0F36	20		*	*	*	*	*	*
GOOSE Out 21	ON/OFF	GOOSE Output 22	6	0F36	21		*	*	*	*	*	*
GOOSE Out 22	ON/OFF	GOOSE Output 23	6	0F36	22		*	*	*	*	*	*
GOOSE Out 23	ON/OFF	GOOSE Output 24	6	0F36	23		*	*	*	*	*	*
GOOSE Out 24	ON/OFF	GOOSE Output 25	6	0F36	24		*	*	*	*	*	*
GOOSE Out 25	ON/OFF	GOOSE Output 26	6	0F36	25		*	*	*	*	*	*
GOOSE Out 26	ON/OFF	GOOSE Output 27	6	0F36	26		*	*	*	*	*	*
GOOSE Out 27	ON/OFF	GOOSE Output 28	6	0F36	27		*	*	*	*	*	*
GOOSE Out 28	ON/OFF	GOOSE Output 29	6	0F36	28		*	*	*	*	*	*
GOOSE Out 29	ON/OFF	GOOSE Output 30	6	0F36	29		*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value	P541	P542	P543	P544	P545	P546
GOOSE Out 30	ON/OFF	GOOSE Output 31	6	0F36	30	*	*	*	*	*	*
GOOSE Out 31	ON/OFF	GOOSE Output 32	6	0F36	31	*	*	*	*	*	*
		General Events			Unsigned Integer (32 bits)						
Alarms Cleared		Relay Alarms Cleared	7	FFFF	0	*	*	*	*	*	*
Events Cleared		Relay Event Records Cleared	7	0B01	1	*	*	*	*	*	*
Faults Cleared		Relay Fault Records Cleared	7	0B02	2	*	*	*	*	*	*
Maint Cleared		Relay Maintenance Records Cleared	7	0B03	3	*	*	*	*	*	*
PW Unlocked UI		Password Unlocked via User Interface	7	0002	4	*	*	*	*	*	*
PW Invalid UI		Invalid Password entered on User Interface	7	0002	5	*	*	*	*	*	*
PW1 Modified UI		Password Level 1 Modified on User Interface	7	0002	6	*	*	*	*	*	*
PW2 Modified UI		Password Level 2 Modified on User Interface	7	0002	7	*	*	*	*	*	*
PW Expired UI		Password unlock expired User Interface	7	0002	8	*	*	*	*	*	*
PW Unlocked F		Password Unlocked via Front Port	7	0002	9	*	*	*	*	*	*
PW Invalid F		Invalid Password entered on Front Port	7	0002	10	*	*	*	*	*	*
PW1 Modified F		Password Level 1 Modified on Front Port	7	0002	11	*	*	*	*	*	*
PW2 Modified F		Password Level 2 Modified on Front Port	7	0002	12	*	*	*	*	*	*
PW Expired F		Password unlock expired Front Port	7	0002	13	*	*	*	*	*	*
PW Unlocked R		Password Unlocked via Rear Port	7	0002	14	*	*	*	*	*	*
PW Invalid R		Invalid Password entered on Rear Port	7	0002	15	*	*	*	*	*	*
PW1 Modified R		Password Level 1 Modified on Rear Port	7	0002	16	*	*	*	*	*	*
PW2 Modified R		Password Level 2 Modified on Rear Port	7	0002	17	*	*	*	*	*	*
PW Expired R		Password unlock expired Rear Port	7	0002	18	*	*	*	*	*	*
IRIG-B Active		IRIG-B Timesync Active (Valid Signal)	7	0805	19	*	*	*	*	*	*
IRIG-B Inactive		IRIG-B Timesync Inactive (No Signal)	7	0805	20	*	*	*	*	*	*
Time Synch		Relay Clock Adjusted	7	0801	21	*	*	*	*	*	*
C&S Changed		Disturbance Recorder Settings Changed	7	FFFF	22	*	*	*	*	*	*
Dist Changed		Control and Support Settings Changed	7	0904	23	*	*	*	*	*	*
Group 1 Changed		Change to Protection Setting Group 1	7	0904	24	*	*	*	*	*	*
Group 2 Changed		Change to Protection Setting Group 2	7	0904	25	*	*	*	*	*	*
Group 3 Changed		Change to Protection Setting Group 3	7	0904	26	*	*	*	*	*	*
Group 4 Changed		Change to Protection Setting Group 4	7	0904	27	*	*	*	*	*	*
Act Grp Changed		Active Group Selection Changed	7	0903	28	*	*	*	*	*	*
Indication Reset		Relay Indications Reset	7	01FF	29	*	*	*	*	*	*
Power On		Relay Powered Up	7	FFFF	30	*	*	*	*	*	*
Bad GOOSE Logic		Invalid GOOSE Scheme Logic	7	FFFF	31	*	*	*	*	*	*
Bad Masks		Invalid Ethernet Card Masks	7	FFFF	32	*	*	*	*	*	*

Event Text 16 Chars	Additional Text	Event Description	Modbus Event Type G13	Courier Cell Ref	Value	P541	P542	P543	P544	P545	P546
Bad Deadbands		Invalid Ethernet Card Deadbands	7	FFFF	33	*	*	*	*	*	*
Bad DI Object		Invalid Ethernet Card DI Object	7	FFFF	34	*	*	*	*	*	*
Rear Comm 2 Fail		Rear Port 2 Communications Failure	7	FFFF	35	*	*	*	*	*	*
PW Unlocked R2		Password Unlocked via Rear Port 2	7	0002	36	*	*	*	*	*	*
PW Invalid R2		Invalid Password entered on Rear Port 2	7	0002	37	*	*	*	*	*	*
PW1 Modified R2		Password Level 1 Modified on Rear Port 2	7	0002	38	*	*	*	*	*	*
PW2 Modified R2		Password Level 2 Modified on Rear Port 2	7	0002	39	*	*	*	*	*	*
PW Expired R2		Password unlock expired Rear Port 2	7	0002	40	*	*	*	*	*	*
No Fibre Card		CS103 Optic Fibre Port Not Fitted	7	FFFF	41	*	*	*	*	*	*
NIC Link Fail		Ethernet Card Link Failure	7	FFFF	42	*	*	*	*	*	*
Fault Recorded		Fault Records:	8	Cell Ref 0100	Value Extraction Column 0 B000	Record Number 16bit UINT					
Text		Self Monitoring:		Cell Ref	Value Extraction Column	Record Number					
Maint Recorded		Maintenance Records	9	FFFF	0 B100	16bit UINT					
Maintenance Record Text:		**Description**			Continuous						
Fast W'Dog Error		Fast Watchdog Error				*	*	*	*	*	*
Battery Failure		Battery Failure			*	*	*	*	*	*	*
BBRAM Failure		Battery Back RAM Failure			*	*	*	*	*	*	*
Field Volt Fail		Field Voltage Failure			*	*	*	*	*	*	*
Bus Reset Error		Bus Error				*	*	*	*	*	*
Slow W'Dog Error		Slow Watchdog Error				*	*	*	*	*	*
SRAM Failure Bus		SRAM Bus Failure			*	*	*	*	*	*	*
SRAM Failure Blk		SRAM Block Failure			*	*	*	*	*	*	*
FLASH Failure		Flash checksum Error			*	*	*	*	*	*	*
Code Verify Fail		Software Code Verification Failure			*	*	*	*	*	*	*
EEPROM Failure		EEPROM Failure			*	*	*	*	*	*	*
Software Failure		Software Error			*	*	*	*	*	*	*
Hard Verify Fail		Hardware Verification Error				*	*	*	*	*	*
Non Standard		General Error			*	*	*	*	*	*	*
Ana. Sample fail		Ana. Sample fail			*	*	*	*	*	*	*
Set Commit Error		Setting commit failure			*	*	*	*	*	*	*

Digital Data Bus

DDB No	Source	Description	English Text	1	2	3	4	5	6
0	Output Condition	Output Relay 1	Output Label 1(Setting)	*	*	*	*	*	*
1	Output Condition	Output Relay 2	Output Label 2(Setting)	*	*	*	*	*	*
2	Output Condition	Output Relay 3	Output Label 3(Setting)	*	*	*	*	*	*
3	Output Condition	Output Relay 4	Output Label 4(Setting)	*	*	*	*	*	*
4	Output Condition	Output Relay 5	Output Label 5(Setting)	*	*	*	*	*	*
5	Output Condition	Output Relay 6	Output Label 6(Setting)	*	*	*	*	*	*
6	Output Condition	Output Relay 7	Output Label 7(Setting)	*	*	*	*	*	*
7	Output Condition	Output Relay 8	Output Label 8(Setting)		*	*	*	*	*
8	Output Condition	Output Relay 9	Output Label 9(Setting)		*	*	*	*	*
9	Output Condition	Output Relay 10	Output Label 10(Setting)		*	*	*	*	*
10	Output Condition	Output Relay 11	Output Label 11(Setting)		*	*	*	*	*
11	Output Condition	Output Relay 12	Output Label 12(Setting)		*	*	*	*	*
12	Output Condition	Output Relay 13	Output Label 13(Setting)		*	*	*	*	*
13	Output Condition	Output Relay 14	Output Label 14(Setting)		*	*	*	*	*
14	Output Condition	Output Relay 15	Output Label 15(Setting)					*	*
15	Output Condition	Output Relay 16	Output Label 16(Setting)					*	*
16	Output Condition	Output Relay 17	Output Label 17(Setting)					*	*
17	Output Condition	Output Relay 18	Output Label 18(Setting)					*	*
18	Output Condition	Output Relay 19	Output Label 19(Setting)					*	*
19	Output Condition	Output Relay 20	Output Label 20(Setting)					*	*
20	Output Condition	Output Relay 21	Output Label 21(Setting)					*	*
21	Output Condition	Output Relay 22	Output Label 22(Setting)					*	*
22	Output Condition	Output Relay 23	Output Label 23(Setting)					*	*
23	Output Condition	Output Relay 24	Output Label 24(Setting)					*	*
24	Output Condition	Output Relay 25	Output Label 25(Setting)					*	*
25	Output Condition	Output Relay 26	Output Label 26(Setting)					*	*
26	Output Condition	Output Relay 27	Output Label 27(Setting)					*	*
27	Output Condition	Output Relay 28	Output Label 28(Setting)					*	*
28	Output Condition	Output Relay 29	Output Label 29(Setting)					*	*
29	Output Condition	Output Relay 30	Output Label 30(Setting)					*	*
30	Output Condition	Output Relay 31	Output Label 31(Setting)					*	*
31	Output Condition	Output Relay 32	Output Label 32(Setting)					*	*
32	Opto	Opto Input 1	Opto Label 1(Setting)	*	*	*	*	*	*
33	Opto	Opto Input 2	Opto Label 2(Setting)	*	*	*	*	*	*
34	Opto	Opto Input 3	Opto Label 3(Setting)	*	*	*	*	*	*
35	Opto	Opto Input 4	Opto Label 4(Setting)	*	*	*	*	*	*
36	Opto	Opto Input 5	Opto Label 5(Setting)	*	*	*	*	*	*
37	Opto	Opto Input 6	Opto Label 6(Setting)	*	*	*	*	*	*
38	Opto	Opto Input 7	Opto Label 7(Setting)	*	*	*	*	*	*
39	Opto	Opto Input 8	Opto Label 8(Setting)	*	*	*	*	*	*
40	Opto	Opto Input 9	Opto Label 9(Setting)		*	*	*	*	*
41	Opto	Opto Input 10	Opto Label 10(Setting)		*	*	*	*	*
42	Opto	Opto Input 11	Opto Label 11(Setting)		*	*	*	*	*
43	Opto	Opto Input 12	Opto Label 12(Setting)		*	*	*	*	*
44	Opto	Opto Input 13	Opto Label 13(Setting)		*	*	*	*	*
45	Opto	Opto Input 14	Opto Label 14(Setting)		*	*	*	*	*
46	Opto	Opto Input 15	Opto Label 15(Setting)		*	*	*	*	*
47	Opto	Opto Input 16	Opto Label 16(Setting)		*	*	*	*	*
48	Opto	Opto Input 17	Opto Label 17(Setting)					*	*
49	Opto	Opto Input 18	Opto Label 18(Setting)					*	*
50	Opto	Opto Input 19	Opto Label 19(Setting)					*	*
51	Opto	Opto Input 20	Opto Label 20(Setting)					*	*
52	Opto	Opto Input 21	Opto Label 21(Setting)					*	*
53	Opto	Opto Input 22	Opto Label 22(Setting)					*	*
54	Opto	Opto Input 23	Opto Label 23(Setting)					*	*
55	Opto	Opto Input 24	Opto Label 24(Setting)					*	*
56		Unused							
57		Unused							
58		Unused							
59		Unused							
60		Unused							
61		Unused							
62		Unused							
63		Unused							
64	Output Condition	Programmable LED 1	LED 1	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
65	Output Condition	Programmable LED 2	LED 2	*	*	*	*	*	*
66	Output Condition	Programmable LED 3	LED 3	*	*	*	*	*	*
67	Output Condition	Programmable LED 4	LED 4	*	*	*	*	*	*
68	Output Condition	Programmable LED 5	LED 5	*	*	*	*	*	*
69	Output Condition	Programmable LED 6	LED 6	*	*	*	*	*	*
70	Output Condition	Programmable LED 7	LED 7	*	*	*	*	*	*
71	Output Condition	Programmable LED 8	LED 8	*	*	*	*	*	*
72	PSL	Input to Relay Output Condition	Relay Cond 1	*	*	*	*	*	*
73	PSL	Input to Relay Output Condition	Relay Cond 2	*	*	*	*	*	*
74	PSL	Input to Relay Output Condition	Relay Cond 3	*	*	*	*	*	*
75	PSL	Input to Relay Output Condition	Relay Cond 4	*	*	*	*	*	*
76	PSL	Input to Relay Output Condition	Relay Cond 5	*	*	*	*	*	*
77	PSL	Input to Relay Output Condition	Relay Cond 6	*	*	*	*	*	*
78	PSL	Input to Relay Output Condition	Relay Cond 7	*	*	*	*	*	*
79	PSL	Input to Relay Output Condition	Relay Cond 8		*	*	*	*	*
80	PSL	Input to Relay Output Condition	Relay Cond 9		*	*	*	*	*
81	PSL	Input to Relay Output Condition	Relay Cond 10		*	*	*	*	*
82	PSL	Input to Relay Output Condition	Relay Cond 11		*	*	*	*	*
83	PSL	Input to Relay Output Condition	Relay Cond 12		*	*	*	*	*
84	PSL	Input to Relay Output Condition	Relay Cond 13		*	*	*	*	*
85	PSL	Input to Relay Output Condition	Relay Cond 14		*	*	*	*	*
86	PSL	Input to Relay Output Condition	Relay Cond 15					*	*
87	PSL	Input to Relay Output Condition	Relay Cond 16					*	*
88	PSL	Input to Relay Output Condition	Relay Cond 17					*	*
89	PSL	Input to Relay Output Condition	Relay Cond 18					*	*
90	PSL	Input to Relay Output Condition	Relay Cond 19					*	*
91	PSL	Input to Relay Output Condition	Relay Cond 20					*	*
92	PSL	Input to Relay Output Condition	Relay Cond 21					*	*
93	PSL	Input to Relay Output Condition	Relay Cond 22					*	*
94	PSL	Input to Relay Output Condition	Relay Cond 23					*	*
95	PSL	Input to Relay Output Condition	Relay Cond 24					*	*
96	PSL	Input to Relay Output Condition	Relay Cond 25					*	*
97	PSL	Input to Relay Output Condition	Relay Cond 26					*	*
98	PSL	Input to Relay Output Condition	Relay Cond 27					*	*
99	PSL	Input to Relay Output Condition	Relay Cond 28					*	*
100	PSL	Input to Relay Output Condition	Relay Cond 29					*	*
101	PSL	Input to Relay Output Condition	Relay Cond 30					*	*
102	PSL	Input to Relay Output Condition	Relay Cond 31					*	*
103	PSL	Input to Relay Output Condition	Relay Cond 32					*	*
104	PSL	Input to LED Output Condition	LED Cond IN 1	*	*	*	*	*	*
105	PSL	Input to LED Output Condition	LED Cond IN 2	*	*	*	*	*	*
106	PSL	Input to LED Output Condition	LED Cond IN 3	*	*	*	*	*	*
107	PSL	Input to LED Output Condition	LED Cond IN 4	*	*	*	*	*	*
108	PSL	Input to LED Output Condition	LED Cond IN 5	*	*	*	*	*	*
109	PSL	Input to LED Output Condition	LED Cond IN 6	*	*	*	*	*	*
110	PSL	Input to LED Output Condition	LED Cond IN 7	*	*	*	*	*	*
111	PSL	Input to LED Output Condition	LED Cond IN 8	*	*	*	*	*	*
112	PSL	Input to Auxiliary Timer 1	Timer in 1	*	*	*	*	*	*
113	PSL	Input to Auxiliary Timer 2	Timer in 2	*	*	*	*	*	*
114	PSL	Input to Auxiliary Timer 3	Timer in 3	*	*	*	*	*	*
115	PSL	Input to Auxiliary Timer 4	Timer in 4	*	*	*	*	*	*
116	PSL	Input to Auxiliary Timer 5	Timer in 5	*	*	*	*	*	*
117	PSL	Input to Auxiliary Timer 6	Timer in 6	*	*	*	*	*	*
118	PSL	Input to Auxiliary Timer 7	Timer in 7	*	*	*	*	*	*
119	PSL	Input to Auxiliary Timer 8	Timer in 8	*	*	*	*	*	*
120	PSL	Input to Auxiliary Timer 9	Timer in 9	*	*	*	*	*	*
121	PSL	Input to Auxiliary Timer 10	Timer in 10	*	*	*	*	*	*
122	PSL	Input to Auxiliary Timer 11	Timer in 11	*	*	*	*	*	*
123	PSL	Input to Auxiliary Timer 12	Timer in 12	*	*	*	*	*	*
124	PSL	Input to Auxiliary Timer 13	Timer in 13	*	*	*	*	*	*
125	PSL	Input to Auxiliary Timer 14	Timer in 14	*	*	*	*	*	*
126	PSL	Input to Auxiliary Timer 15	Timer in 15	*	*	*	*	*	*
127	PSL	Input to Auxiliary Timer 16	Timer in 16	*	*	*	*	*	*
128	Auxiliary Timer	Output from Auxiliary Timer 1	Timer out 1	*	*	*	*	*	*
129	Auxiliary Timer	Output from Auxiliary Timer 2	Timer out 2	*	*	*	*	*	*
130	Auxiliary Timer	Output from Auxiliary Timer 3	Timer out 3	*	*	*	*	*	*
131	Auxiliary Timer	Output from Auxiliary Timer 4	Timer out 4	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
132	Auxiliary Timer	Output from Auxiliary Timer 5	Timer out 5	*	*	*	*	*	*
133	Auxiliary Timer	Output from Auxiliary Timer 6	Timer out 6	*	*	*	*	*	*
134	Auxiliary Timer	Output from Auxiliary Timer 7	Timer out 7	*	*	*	*	*	*
135	Auxiliary Timer	Output from Auxiliary Timer 8	Timer out 8	*	*	*	*	*	*
136	Auxiliary Timer	Output from Auxiliary Timer 9	Timer out 9	*	*	*	*	*	*
137	Auxiliary Timer	Output from Auxiliary Timer 10	Timer out 10	*	*	*	*	*	*
138	Auxiliary Timer	Output from Auxiliary Timer 11	Timer out 11	*	*	*	*	*	*
139	Auxiliary Timer	Output from Auxiliary Timer 12	Timer out 12	*	*	*	*	*	*
140	Auxiliary Timer	Output from Auxiliary Timer 13	Timer out 13	*	*	*	*	*	*
141	Auxiliary Timer	Output from Auxiliary Timer 14	Timer out 14	*	*	*	*	*	*
142	Auxiliary Timer	Output from Auxiliary Timer 15	Timer out 15	*	*	*	*	*	*
143	Auxiliary Timer	Output from Auxiliary Timer 16	Timer out 16	*	*	*	*	*	*
144	PSL	Trigger for Fault Recorder	Fault REC TRIG	*	*	*	*	*	*
145	Group Selection	Setting Group via opto invalid	SG-opto Invalid	*	*	*	*	*	*
146	Commission Test	Test Mode Enabled	Prot'n Disabled	*	*	*	*	*	*
147	VT Supervision	VTS Indication	VT Fail Alarm			*	*	*	*
148	Distance	Power Swing	Power Swing			*	*	*	*
149	Breaker Fail	BF Block AR	CB Fail Alarm	*	*	*	*	*	*
150	CB Monitoring	Broken Current Alarm	I^ Maint Alarm	*	*	*		*	
151	CB Monitoring	Broken Current lookout	I^ Lockout Alarm	*	*	*		*	
152	CB Monitoring	Maintenance Alarm	CB OPs Maint	*	*	*		*	
153	CB Monitoring	Maintenance Lockout	CB OPs Lock	*	*	*		*	
154	CB Monitoring	Excessive Op Time Alarm	CB Time Maint	*	*	*		*	
155	CB Monitoring	Excessive Op Time Lookout	CB Time Lockout	*	*	*		*	
156	CB Monitoring	EFF Lockout	Fault Freq Lock	*	*	*		*	
157	CB Status	CB Status Alarm	CB Status Alarm	*	*	*	*	*	*
158	Current Differential	GPS Alarm	GPS Alarm					*	*
159	CB Control	CB Failed to Trip	CB Trip Fail	*	*	*	*	*	*
160	CB Control	CB Failed to Close	CB Close Fail	*	*	*	*	*	*
161	CB Control	Control CB Unhealthy	Man CB Unhealthy	*	*	*	*	*	*
162	CB Control	Control No Checksync	No C/S Man Close			*		*	
163	Autoreclose	Autoclose Lockout/RLY BAR	A/R Lockout		*	*		*	
163	Breaker Fail	Autoclose Lockout/RLY BAR	CB2 Fail Alarm				*		*
164	Autoreclose	No Healthy (AR)	A/R CB Unhealthy		*	*		*	
165	Autoreclose	No Check Sync / AR Fail	A/R No Checksync			*		*	
166	Current Differential	Incompatible relays	Incompatible Rly	*	*	*	*	*	*
167	Commission Test	Loop Back Test Enabled	Test Loopback	*	*	*	*	*	*
168	Current Differential	Signaling failure alarm	Signalling Fail	*	*	*	*	*	*
169	Current Differential	Signaling Propagation Delay Alarm	Comm Delay Alarm	*	*	*	*	*	*
170	Current Differential	Differential protection failure alarm	C Diff Failure	*	*	*	*	*	*
171	Current Differential	Diff Protection inhibited	C Diff Inhibited	*	*	*	*	*	*
172	Current Differential	Configuration Error	Config Error	*	*	*	*	*	*
173	Current Differential	Re-Configuration Error	Re-Config Error	*	*	*	*	*	*
174	Frequency Tracking	Frequency out of range	F out of range	*	*	*	*	*	*
175		Unused	Alarm 36	*	*	*	*	*	*
176		Unused	Alarm 37	*	*	*	*	*	*
177		Unused	Alarm 38	*	*	*	*	*	*
178		Unused	Alarm 39	*	*	*	*	*	*
179		Unused	Alarm 40	*	*	*	*	*	*
180		Unused	Alarm 41	*	*	*	*	*	*
181		Unused	Alarm 42	*	*	*	*	*	*
182		Unused	Alarm 43	*	*	*	*	*	*
183		Unused	Alarm 44	*	*	*	*	*	*
184		C Diff Protection Comms Mode	Alarm 45	*	*	*	*	*	*
185		IEEE C37.94 Communications Alarms	Alarm 46	*	*	*	*	*	*
186		System Split alarm	Alarm 47	*	*	*	*	*	*
187	PSL	SR User Alarm 1	Alarm 48	*	*	*	*	*	*
188	PSL	SR User Alarm 2	Alarm 49	*	*	*	*	*	*
189	PSL	SR User Alarm 3	Alarm 50	*	*	*	*	*	*
190	PSL	SR User Alarm 4	Alarm 51	*	*	*	*	*	*
191	PSL	SR User Alarm 5	Alarm 52	*	*	*	*	*	*
192	PSL	SR User Alarm 6	Alarm 53	*	*	*	*	*	*
193	PSL	SR User Alarm 7	Alarm 54	*	*	*	*	*	*
194	PSL	SR User Alarm 8	Alarm 55	*	*	*	*	*	*
195	PSL	MR User Alarm 9	Alarm 56	*	*	*	*	*	*
196	PSL	MR User Alarm 10	Alarm 57	*	*	*	*	*	*
197	PSL	MR User Alarm 11	Alarm 58	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
198	PSL	MR User Alarm 12	Alarm 59	*	*	*	*	*	*
199	PSL	MR User Alarm 13	Alarm 60	*	*	*	*	*	*
200	PSL	MR User Alarm 14	Alarm 61	*	*	*	*	*	*
201	PSL	MR User Alarm 15	Alarm 62	*	*	*	*	*	*
202	PSL	MR User Alarm 16	Alarm 63	*	*	*	*	*	*
203		Reserved							
204		Reserved							
205		Reserved							
206		Reserved							
207		Unused							
208		Unused							
209		Unused							
210		Unused							
211		Unused							
212		Unused							
213		Unused							
214		Unused							
215		Unused							
216		Unused							
217		Unused							
218		Unused							
219		Unused							
220		Unused							
221		Unused							
222		Unused							
223		Unused							
224	Menu		Control Input 1	*	*	*	*	*	*
225	Menu		Control Input 2	*	*	*	*	*	*
226	Menu		Control Input 3	*	*	*	*	*	*
227	Menu		Control Input 4	*	*	*	*	*	*
228	Menu		Control Input 5	*	*	*	*	*	*
229	Menu		Control Input 6	*	*	*	*	*	*
230	Menu		Control Input 7	*	*	*	*	*	*
231	Menu		Control Input 8	*	*	*	*	*	*
232	Menu		Control Input 9	*	*	*	*	*	*
233	Menu		Control Input 10	*	*	*	*	*	*
234	Menu		Control Input 11	*	*	*	*	*	*
235	Menu		Control Input 12	*	*	*	*	*	*
236	Menu		Control Input 13	*	*	*	*	*	*
237	Menu		Control Input 14	*	*	*	*	*	*
238	Menu		Control Input 15	*	*	*	*	*	*
239	Menu		Control Input 16	*	*	*	*	*	*
240	Menu		Control Input 17	*	*	*	*	*	*
241	Menu		Control Input 18	*	*	*	*	*	*
242	Menu		Control Input 19	*	*	*	*	*	*
243	Menu		Control Input 20	*	*	*	*	*	*
244	Menu		Control Input 21	*	*	*	*	*	*
245	Menu		Control Input 22	*	*	*	*	*	*
246	Menu		Control Input 23	*	*	*	*	*	*
247	Menu		Control Input 24	*	*	*	*	*	*
248	Menu		Control Input 25	*	*	*	*	*	*
249	Menu		Control Input 26	*	*	*	*	*	*
250	Menu		Control Input 27	*	*	*	*	*	*
251	Menu		Control Input 28	*	*	*	*	*	*
252	Menu		Control Input 29	*	*	*	*	*	*
253	Menu		Control Input 30	*	*	*	*	*	*
254	Menu		Control Input 31	*	*	*	*	*	*
255	Menu		Control Input 32	*	*	*	*	*	*
256	PSL	Permissive Intertrip	Perm Intertrip	*	*	*	*	*	*
257	PSL	Stub Bus Enabled	Stub Bus Enabled				*		*
258	PSL	Inhibit Current Differential	Inhibit C Diff	*	*	*	*	*	*
259	PSL	Reconfiguration Interlock	Recon Interlock	*	*	*	*	*	*
260	PSL	Block Phase Overcurrent Stage 1 time delay	I>1 Timer Block	*	*	*	*	*	*
261	PSL	Block Phase Overcurrent Stage 2 time delay	I>2 Timer Block	*	*	*	*	*	*
262	PSL	Block Phase Overcurrent Stage 3 time delay	I>3 Timer Block	*	*	*	*	*	*
263	PSL	Block Phase Overcurrent Stage 4 time delay	I>4 Timer Block	*	*	*	*	*	*
264	PSL	Block Standby Earth Fault Stage 1 time delay	IN>1 Timer Block	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
265	PSL	Block Standby Earth Fault Stage 2 time delay	IN>2 Timer Block	*	*	*	*	*	*
266	PSL	Block Standby Earth Fault Stage 3 time delay	IN>3 Timer Block	*	*	*	*	*	*
267	PSL	Block Standby Earth Fault Stage 4 time delay	IN>4 Timer Block	*	*	*	*	*	*
268	PSL	Block SEF Stage 1 time delay	ISEF>1 Timer Blk			*	*	*	*
269	PSL	Block SEF Stage 2 time delay	ISEF>2 Timer Blk			*	*	*	*
270	PSL	Block SEF Stage 3 time delay	ISEF>3 Timer Blk			*	*	*	*
271	PSL	Block SEF Stage 4 time delay	ISEF>4 Timer Blk			*	*	*	*
272	PSL	External Trip 3ph	External Trip3ph	*	*	*	*	*	*
273	PSL	External Trip A	External Trip A			*	*	*	*
274	PSL	External Trip B	External Trip B			*	*	*	*
275	PSL	External Trip C	External Trip C			*	*	*	*
276	PSL	CB2 External Trip 3Ph	CB2 Ext Trip3ph				*		*
277	PSL	CB2 External Trip Aph	CB2 Ext Trip A				*		*
278	PSL	CB2 External Trip Bph	CB2 Ext Trip B				*		*
279	PSL	CB2 External Trip Cph	CB2 Ext Trip C				*		*
280	PSL	52-A CB Contact Input	CB Aux 3ph(52-A)	*	*	*	*	*	*
281	PSL	52-A CB Contact Input A Phase	CB Aux A(52-A)			*	*	*	*
282	PSL	52-A CB Contact Input B Phase	CB Aux B(52-A)			*	*	*	*
283	PSL	52-A CB Contact Input C Phase	CB Aux C(52-A)			*	*	*	*
284	PSL	52-B CB Contact Input	CB Aux 3ph(52-B)	*	*	*	*	*	*
285	PSL	52-B CB Contact Input A Phase	CB Aux A(52-B)			*	*	*	*
286	PSL	52-B CB Contact Input B Phase	CB Aux B(52-B)			*	*	*	*
287	PSL	52-B CB Contact Input C Phase	CB Aux C(52-B)			*	*	*	*
288	PSL	52-A CB 2 Contact Input	CB2Aux 3ph(52-A)				*		*
289	PSL	52-A CB Contact Input A Phase	CB2Aux A(52-A)				*		*
290	PSL	52-A CB Contact Input B Phase	CB2Aux B(52-A)				*		*
291	PSL	52-A CB Contact Input C Phase	CB2Aux C(52-A)				*		*
292	PSL	52-B CB Contact Input	CB2Aux 3ph(52-B)				*		*
293	PSL	52-B CB Contact Input A Phase	CB2Aux A(52-B)				*		*
294	PSL	52-B CB Contact Input B Phase	CB2Aux B(52-B)				*		*
295	PSL	52-B CB Contact Input C Phase	CB2Aux C(52-B)				*		*
296	PSL	CB Healthy	CB Healthy	*	*	*	*	*	*
297	PSL	CB Healthy 2	CB2 Healthy				*		*
298	PSL	MCB/VTS opto	MCB/VTS			*	*	*	*
299	PSL	Logic Input Trip	Trip CB	*	*	*	*	*	*
300	PSL	Logic Input Close	Close CB	*	*	*	*	*	*
301	PSL	Logic Input Trip 2	Trip CB2				*		*
302	PSL	Logic Input Close 2	Close CB2				*		*
303	PSL	Reset Manual CB Close Timer Delay	Reset Close Dly	*	*	*	*	*	*
304	PSL	Reset Latched Relays & LED's	Reset Relays/LED	*	*	*	*	*	*
305	PSL	Reset Thermal State	Reset Thermal	*	*	*	*	*	*
306	PSL	Reset Lockout Opto Input	Reset Lockout		*	*		*	
307	PSL	Reset CB Maintance values	Reset CB Data	*	*	*		*	
308	PSL	Block Autoreclose / BAR	BAR		*	*		*	
309	PSL	Enable 1 pole reclose	En 1pole reclose			*		*	
310	PSL	Enable 3 pole reclose	En 3pole reclose			*		*	
311	PSL	Pole Discrepancy	Pole Discrepancy			*		*	
312		Unused							
313	PSL	Inhibit Power Swing Blocking	Inhibit PSB			*	*	*	*
314	PSL	Trip 3 Phase - Input to Trip Latching Logic	Any 3 Pole Trip			*	*	*	*
315	PSL	A Phase Trip- Input to Trip Latching Logic	Any Trip A			*	*	*	*
316	PSL	B Phase Trip- Input to Trip Latching Logic	Any Trip B			*	*	*	*
317	PSL	C Phase Trip- Input to Trip Latching Logic	Any Trip C			*	*	*	*
318	PSL	Commissioning Tests	Test Mode	*	*	*	*	*	*
319	PSL	Propagagtion Delay Equal	Prop Delay Equal	*	*	*	*	*	*
320	PSL	User Defined Intertrip	Ch 1 Intertrip 1	*	*	*	*	*	*
321	PSL	User Defined Intertrip	Ch 1 Intertrip 2	*	*	*	*	*	*
322	PSL	User Defined Intertrip	Ch 1 Intertrip 3	*	*	*	*	*	*
323	PSL	User Defined Intertrip	Ch 1 Intertrip 4	*	*	*	*	*	*
324	PSL	User Defined Intertrip	Ch 1 Intertrip 5	*	*	*	*	*	*
325	PSL	User Defined Intertrip	Ch 1 Intertrip 6	*	*	*	*	*	*
326	PSL	User Defined Intertrip	Ch 1 Intertrip 7	*	*	*	*	*	*
327	PSL	User Defined Intertrip	Ch 1 Intertrip 8	*	*	*	*	*	*
328	PSL	User Defined Intertrip	Ch 2 Intertrip 1	*	*	*	*	*	*
329	PSL	User Defined Intertrip	Ch 2 Intertrip 2	*	*	*	*	*	*
330	PSL	User Defined Intertrip	Ch 2 Intertrip 3	*	*	*	*	*	*
331	PSL	User Defined Intertrip	Ch 2 Intertrip 4	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
332	PSL	User Defined Intertrip	Ch 2 Intertrip 5	*	*	*	*	*	*
333	PSL	User Defined Intertrip	Ch 2 Intertrip 6	*	*	*	*	*	*
334	PSL	User Defined Intertrip	Ch 2 Intertrip 7	*	*	*	*	*	*
335	PSL	User Defined Intertrip	Ch 2 Intertrip 8	*	*	*	*	*	*
336	PSL	Loopback	Loopback Mode	*	*	*	*	*	*
337	PSL	Block Distance Zone 1	Z1 Block			*	*	*	*
338	PSL	Block Distance Zone 2	Z2 Block			*	*	*	*
339	PSL	Block Distance Zone 3	Z3 Block			*	*	*	*
340	PSL	Command Blocking	Command Blocking	*	*	*	*	*	*
341	PSL	Monitor Blocking	Monitor Blocking	*	*	*	*	*	*
342	PSL	PSB Unblock	PSB Unblock			*	*	*	*
343	PSL	CS1 Enabled	CS1 Enabled			*		*	
344	PSL	CS2 Enabled	CS2 Enabled			*		*	
345	PSL	SysSplit Enabled	SysSplit Enabled			*		*	
346	PSL		AR Check Sync OK			*		*	
347	PSL	Time Synch	Time Synch	*	*	*	*	*	*
348		Unused							
349		Unused							
350	All Protection	Any Trip	Any Trip	*	*	*	*	*	*
351	Current Differential	Differential Trip	Diff Trip	*	*	*	*	*	*
352	Current Differential	Differential Trip A	Diff Trip A	*	*	*	*	*	*
353	Current Differential	Differential Trip B	Diff Trip B	*	*	*	*	*	*
354	Current Differential	Differential Trip C	Diff Trip C	*	*	*	*	*	*
355	Current Differential	Differential Intertrip	Diff Intertrip	*	*	*	*	*	*
356	Current Differential	Differential Intertrip A	Diff Intertrip A	*	*	*	*	*	*
357	Current Differential	Differential Intertrip B	Diff Intertrip B	*	*	*	*	*	*
358	Current Differential	Differential Intertrip C	Diff Intertrip C	*	*	*	*	*	*
359	Current Differential	Direct Intertrip	Direct Intertrip						
360	Current Differential	Permissive Intertrip	Perm Intertrip	*	*	*	*	*	*
361	Distance	Any Zone 1 Trip	Zone 1 Trip			*	*	*	*
362	Distance	Zone 1 A Phase Trip	Zone 1 A Trip			*	*	*	*
363	Distance	Zone 1 B Phase Trip	Zone 1 B Trip			*	*	*	*
364	Distance	Zone 1 C Phase Trip	Zone 1 C Trip			*	*	*	*
365	Distance	Zone 1 N Trip	Zone 1 N Trip			*	*	*	*
366	Distance	Any Zone 2 Trip	Zone 2 Trip			*	*	*	*
367	Distance	Zone 2 A Phase Trip	Zone 2 A Trip			*	*	*	*
368	Distance	Zone 2 B Phase Trip	Zone 2 B Trip			*	*	*	*
369	Distance	Zone 2 C Phase Trip	Zone 2 C Trip			*	*	*	*
370	Distance	Zone 2 N Trip	Zone 2 N Trip			*	*	*	*
371	Distance	Any Zone 3 Trip	Zone 3 Trip			*	*	*	*
372	Distance	Zone 3 A Phase Trip	Zone 3 A Trip			*	*	*	*
373	Distance	Zone 3 B Phase Trip	Zone 3 B Trip			*	*	*	*
374	Distance	Zone 3 C Phase Trip	Zone 3 C Trip			*	*	*	*
375	Distance	Zone 3 N Trip	Zone 3 N Trip			*	*	*	*
376	Autoreclose	Pole Discrepancy	Pole Discrepancy			*		*	
377	Current Differential	BU Intertrip	BU Intertrip	*	*	*	*	*	*
378	Current Differential	BU Intertrip A	BU Intertrip A	*	*	*	*	*	*
379	Current Differential	BU Intertrip B	BU Intertrip B	*	*	*	*	*	*
380	Current Differential	BU Intertrip C	BU Intertrip C	*	*	*	*	*	*
381	Current Differential	Force 3 pole backup Intertrip	Force 3pole BU			*	*	*	*
382	Phase Overcurrent	1st Stage O/C Trip 3ph	I>1 Trip	*	*	*	*	*	*
383	Phase Overcurrent	1st Stage O/C Trip A	I>1 Trip A	*	*	*	*	*	*
384	Phase Overcurrent	1st Stage O/C Trip B	I>1 Trip B	*	*	*	*	*	*
385	Phase Overcurrent	1st Stage O/C Trip C	I>1 Trip C	*	*	*	*	*	*
386	Phase Overcurrent	2nd Stage O/C Trip 3ph	I>2 Trip	*	*	*	*	*	*
387	Phase Overcurrent	2nd Stage O/C Trip A	I>2 Trip A	*	*	*	*	*	*
388	Phase Overcurrent	2nd Stage O/C Trip B	I>2 Trip B	*	*	*	*	*	*
389	Phase Overcurrent	2nd Stage O/C Trip C	I>2 Trip C	*	*	*	*	*	*
390	Phase Overcurrent	3rd Stage O/C Trip 3ph	I>3 Trip	*	*	*	*	*	*
391	Phase Overcurrent	3rd Stage O/C Trip A	I>3 Trip A	*	*	*	*	*	*
392	Phase Overcurrent	3rd Stage O/C Trip B	I>3 Trip B	*	*	*	*	*	*
393	Phase Overcurrent	3rd Stage O/C Trip C	I>3 Trip C	*	*	*	*	*	*
394	Phase Overcurrent	4th Stage O/C Trip 3ph	I>4 Trip	*	*	*	*	*	*
395	Phase Overcurrent	4th Stage O/C Trip A	I>4 Trip A	*	*	*	*	*	*
396	Phase Overcurrent	4th Stage O/C Trip B	I>4 Trip B	*	*	*	*	*	*
397	Phase Overcurrent	4th Stage O/C Trip C	I>4 Trip C	*	*	*	*	*	*
398	Earth Fault	1st Stage SBEF Trip	IN>1 Trip	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
399	Earth Fault	2nd Stage SBEF Trip	IN>2 Trip	*	*	*	*	*	*
400	Earth Fault	3rd Stage SBEF Trip	IN>3 Trip	*	*	*	*	*	*
401	Earth Fault	4th Stage SBEF Trip	IN>4 Trip	*	*	*	*	*	*
402	Sensitive Earth Fault	1st Stage SEF Trip	ISEF>1 Trip			*	*	*	*
403	Sensitive Earth Fault	2nd Stage SEF Trip	ISEF>2 Trip			*	*	*	*
404	Sensitive Earth Fault	3rd Stage SEF Trip	ISEF>3 Trip			*	*	*	*
405	Sensitive Earth Fault	4th Stage SEF Trip	ISEF>4 Trip			*	*	*	*
406	Broken Conductor	Broken Conductor Trip	Broken Wire Trip	*	*	*	*	*	*
407	Thermal Overload	Thermal Overload Trip	Thermal Trip	*	*	*	*	*	*
408	Current Differential	Stub Bus Trip	Stub Bus Trip				*		*
409	Autoreclose	Autoreclose trip test	Trip 3 Pole		*	*		*	
410	Autoreclose	Autoreclose trip test A phase	Trip Pole A			*		*	
411	Autoreclose	Autoreclose trip test B phase	Trip Pole B			*		*	
412	Autoreclose	Autoreclose trip test C Phase	Trip Pole C			*		*	
413		Unused							
414		Unused							
415		Unused							
416		Unused							
417		Unused							
418		Unused							
419		Unused							
420		Unused							
421		Unused							
422		Unused							
423		Unused							
424		Unused							
425		Unused							
426		Unused							
427		Unused							
428		Unused							
429		Unused							
430		Zone 1 Start	Zone 1 Start			*	*	*	*
431		Zone 2 Start	Zone 2 Start			*	*	*	*
432		Zone 3 Start	Zone 3 Start			*	*	*	*
433		Differential Start	Diff Start	*	*	*	*	*	*
434	All Protection	Any Start	Any Start	*	*	*	*	*	*
435	Current Differential	Differential Start A	Diff Start A	*	*	*	*	*	*
436	Current Differential	Differential Start B	Diff Start B	*	*	*	*	*	*
437	Current Differential	Differential Start C	Diff Start C	*	*	*	*	*	*
438	Distance	Zone 1 A Phase Start	Zone 1 A Start			*	*	*	*
439	Distance	Zone 1 B Phase Start	Zone 1 B Start			*	*	*	*
440	Distance	Zone 1 C Phase Start	Zone 1 C Start			*	*	*	*
441	Distance	Zone 1 N Start	Zone 1 N Start			*	*	*	*
442	Distance	Zone 2 A Phase Start	Zone 2 A Start			*	*	*	*
443	Distance	Zone 2 B Phase Start	Zone 2 B Start			*	*	*	*
444	Distance	Zone 2 C Phase Start	Zone 2 C Start			*	*	*	*
445	Distance	Zone 2 N Start	Zone 2 N Start			*	*	*	*
446	Distance	Zone 3 A Phase Start	Zone 3 A Start			*	*	*	*
447	Distance	Zone 3 B Phase Start	Zone 3 B Start			*	*	*	*
448	Distance	Zone 3 C Phase Start	Zone 3 C Start			*	*	*	*
449	Distance	Zone 3 N Start	Zone 3 N Start			*	*	*	*
450	Distance	Zone 6 Start (PSB Start)	Zone 6 Start			*	*	*	*
451	Overcurrent	1st Stage O/C Start 3ph	I>1 Start	*	*	*	*	*	*
452	Overcurrent	1st Stage O/C Start A	I>1 Start A	*	*	*	*	*	*
453	Overcurrent	1st Stage O/C Start B	I>1 Start B	*	*	*	*	*	*
454	Overcurrent	1st Stage O/C Start C	I>1 Start C	*	*	*	*	*	*
455	Overcurrent	2nd Stage O/C Start 3ph	I>2 Start	*	*	*	*	*	*
456	Overcurrent	2nd Stage O/C Start A	I>2 Start A	*	*	*	*	*	*
457	Overcurrent	2nd Stage O/C Start B	I>2 Start B	*	*	*	*	*	*
458	Overcurrent	2nd Stage O/C Start C	I>2 Start C	*	*	*	*	*	*
459	Overcurrent	3rd Stage O/C Start 3ph	I>3 Start	*	*	*	*	*	*
460	Overcurrent	3rd Stage O/C Start A	I>3 Start A	*	*	*	*	*	*
461	Overcurrent	3rd Stage O/C Start B	I>3 Start B	*	*	*	*	*	*
462	Overcurrent	3rd Stage O/C Start C	I>3 Start C	*	*	*	*	*	*
463	Overcurrent	4th Stage O/C Start 3ph	I>4 Start	*	*	*	*	*	*
464	Overcurrent	4th Stage O/C Start A	I>4 Start A	*	*	*	*	*	*
465	Overcurrent	4th Stage O/C Start B	I>4 Start B	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
466	Overcurrent	4th Stage O/C Start C	I>4 Start C	*	*	*	*	*	*
467	Earth Fault	1st Stage SBEF Start	IN>1 Start	*	*	*	*	*	*
468	Earth Fault	2nd Stage SBEF Start	IN>2 Start	*	*	*	*	*	*
469	Earth Fault	3rd Stage SBEF Start	IN>3 Start	*	*	*	*	*	*
470	Earth Fault	4th Stage SBEF Start	IN>4 Start	*	*	*	*	*	*
471	Sensitive Earth Fault	1st Stage SEF Start	ISEF>1 Start			*	*	*	*
472	Sensitive Earth Fault	2nd Stage SEF Start	ISEF>2 Start			*	*	*	*
473	Sensitive Earth Fault	3rd Stage SEF Start	ISEF>3 Start			*	*	*	*
474	Sensitive Earth Fault	4th Stage SEF Start	ISEF>4 Start			*	*	*	*
475	Thermal Overload	Thermal Overload Alarm	Thermal Alarm	*	*	*	*	*	*
476	Overcurrent	I> Blocked O/C Start	I> BlockStart	*	*	*	*	*	*
477	Overcurrent	IN/ISEF> Blocked O/C Start	IN/SEF>Blk Start	*	*	*	*	*	*
478		Unused							
479		Unused							
480		Unused							
481		Unused							
482		Unused							
483		Unused							
484		Unused							
485		Unused							
486		Unused							
487	Battery Fail Monitor	Platform Alarm 0	Battery Fail	*	*	*	*	*	*
488		Platform Alarm 2		*	*	*	*	*	*
489	Ehernet Card	Platform Alarm 3	GOOSE IED Absent	*	*	*	*	*	*
490	Ehernet Card	Platform Alarm 4	NIC Not Fitted	*	*	*	*	*	*
491	Ehernet Card	Platform Alarm 5	NIC No Response	*	*	*	*	*	*
492	Ehernet Card	Platform Alarm 6	NIC Fatal Error	*	*	*	*	*	*
493	Ehernet Card	Platform Alarm 7	NIC Soft. Reload	*	*	*	*	*	*
494	Ehernet Card	Platform Alarm 8	Bad TCP/IP Cfg.	*	*	*	*	*	*
495	Ehernet Card	Platform Alarm 9	Bad OSI Config.	*	*	*	*	*	*
496	Ehernet Card	Platform Alarm 10	NIC Link Fail	*	*	*	*	*	*
497	Ehernet Card	Platform Alarm 11	NIC SW Mis-Match	*	*	*	*	*	*
498	Ehernet Card	Platform Alarm 12	IP Addr Conflict	*	*	*	*	*	*
499		Platform Alarm 13		*	*	*	*	*	*
500		Platform Alarm 14		*	*	*	*	*	*
501		Platform Alarm 15		*	*	*	*	*	*
502		Platform Alarm 16		*	*	*	*	*	*
503		Platform Alarm 17	Backup Setting	*	*	*	*	*	*
504		Platform Alarm 18		*	*	*	*	*	*
505		Platform Alarm 19		*	*	*	*	*	*
506		Platform Alarm 20		*	*	*	*	*	*
507		Platform Alarm 21		*	*	*	*	*	*
508		Platform Alarm 22		*	*	*	*	*	*
509		Platform Alarm 23		*	*	*	*	*	*
510		Platform Alarm 24		*	*	*	*	*	*
511		Platform Alarm 25		*	*	*	*	*	*
512		Platform Alarm 26		*	*	*	*	*	*
513		Platform Alarm 27		*	*	*	*	*	*
514		Platform Alarm 28		*	*	*	*	*	*
515		Platform Alarm 29		*	*	*	*	*	*
516		Platform Alarm 30		*	*	*	*	*	*
517		Platform Alarm 31		*	*	*	*	*	*
518	VT Supervision	VTS Fast Block	VTS Fast Block			*	*	*	*
519	VT Supervision	VTS Slow Block	VTS Slow Block			*	*	*	*
520	Breaker Fail	tBF1 Trip 3Ph	Bfail1 Trip 3ph	*	*	*	*	*	*
521	Breaker Fail	tBF2 Trip 3Ph	Bfail2 Trip 3ph	*	*	*	*	*	*
522	Breaker Fail	Autoreclose Block Main Protection	CB2 Fail1 Trip				*		*
523	Breaker Fail	Autoreclose Block SEF Protection	CB2 Fail2 Trip				*		*
524	CB Control	Control Trip	Control Trip	*	*	*	*	*	*
525	CB Control	Control Close	Control Close	*	*	*	*	*	*
526	CB Control	Control Trip 2	Control Trip 2				*		*
527	CB Control	Control Close 2	Control Close 2				*		*
528	CB Control	Control Close in Progress	Close in Prog	*	*	*	*	*	*
529	Autoreclose	AR Block Main Protection	Block Main Prot		*				
530	Autoreclose	AR Block SEF Protection	Block SEF Prot		*				
531	Autoreclose	Auto Reclose/(AR 3 pole) in Progress	AR 3pole in prog		*	*		*	
532	Autoreclose	AR 1pole in progress	AR 1pole in prog			*		*	

DDB No	Source	Description	English Text	1	2	3	4	5	6
533	Autoreclose	Seq Counter = 0	Seq Counter = 0		*	*		*	
534	Autoreclose	Seq Counter = 1	Seq Counter = 1		*	*		*	
535	Autoreclose	Seq Counter = 2	Seq Counter = 2		*	*		*	
536	Autoreclose	Seq Counter = 3	Seq Counter = 3		*	*		*	
537	Autoreclose	Seq Counter = 4	Seq Counter = 4		*	*		*	
538	Autoreclose	Seq Counter = 5	Seq Counter = 5			*		*	
539	Autoreclose	Successful Reclosure	Successful Close		*	*		*	
540	Autoreclose	Dead Time in Progress	Dead T in Prog		*				
541	Autoreclose	Auto Close/ AR Close	Auto Close		*	*		*	
542	Autoreclose	Autoreclose In/Out of service	A/R Status		*				
543	Autoreclose	Autoreclose In/Out of service	A/R Status 3P			*		*	
544	Autoreclose	Autoreclose In/Out of service	AR Status 1P			*		*	
545	Autoreclose	AR Force 3 pole trips	Force 3 pole			*		*	
546	CB Control	Composite Lockout Alarm	Lockout Alarm	*	*	*		*	
547	Field Voltage Monitor	Field Voltage Failure	Field Volts Fail	*	*	*	*	*	*
548	Undercurrent	IA< operate	IA< Start	*	*	*	*	*	*
549	Undercurrent	IB< operate	IB< Start	*	*	*	*	*	*
550	Undercurrent	IC< operate	IC< Start	*	*	*	*	*	*
551	Undercurrent	ISEF< operate	ISEF< Start	*	*	*	*	*	*
552	Undercurrent	PSL Internal Node 5	CB1 IA< Start				*		*
553	PSL	PSL Internal Node 6	CB1 IB< Start				*		*
554	Undercurrent	PSL Internal Node 7	CB1 IC< Start				*		*
555	Undercurrent	PSL Internal Node 8	CB1 ISEF< Start				*		*
556	Undercurrent	PSL Internal Node 9	CB2 IA< Start				*		*
557	Undercurrent	PSL Internal Node 10	CB2 IB< Start				*		*
558	Undercurrent	PSL Internal Node 11	CB2 IC< Start				*		*
559	Undercurrent	PSL Internal Node 12	CB2 ISEF< Start				*		*
560	Poledead	All Poles Dead	All Poles Dead	*	*	*	*	*	*
561	Poledead	Any Pole Dead	Any Pole Dead	*	*	*	*	*	*
562	Poledead	Phase A Pole Dead	Pole Dead A			*	*	*	*
563	Poledead	Phase B Pole Dead	Pole Dead B			*	*	*	*
564	Poledead	Phase C Pole Dead	Pole Dead C			*	*	*	*
565	All Protection	Accelerate Ind	VTS Acc Ind			*	*	*	*
566	All Protection	Any Voltage Dependent	VTS Volt Dep			*	*	*	*
567	VT Supervision	Ia over threshold	VTS Ia>			*	*	*	*
568	VT Supervision	Ib over threshold	VTS Ib>			*	*	*	*
569	VT Supervision	Ic over threshold	VTS Ic>			*	*	*	*
570	VT Supervision	Va over threshold	VTS Va>			*	*	*	*
571	VT Supervision	Vb over threshold	VTS Vb>			*	*	*	*
572	VT Supervision	Vc over threshold	VTS Vc>			*	*	*	*
573	VT Supervision	I2 over threshold	VTS I2>			*	*	*	*
574	VT Supervision	V2 over threshold	VTS V2>			*	*	*	*
575	VT Supervision	Superimposed Ia over threshold	VTS Ia delta>			*	*	*	*
576	VT Supervision	Superimposed Ib over threshold	VTS Ib delta>			*	*	*	*
577	VT Supervision	Superimposed Ic over threshold	VTS Ic delta >			*	*	*	*
578	All SEF Stages	Current Prot SEF Trip	B Fail SEF Trip			*	*	*	*
579	Autoreclose	Control System Check OK	Ctl Check Synch			*		*	
580	Autoreclose	AR System Check OK/SYNC	AR Sys Check OK			*		*	
581	Autoreclose	Pre-Lockout	Pre-Lockout		*				
582	CB Status Monitor	3 ph CB Open	CB Open 3 ph	*	*	*	*	*	*
583	CB Status Monitor	Ph A CB Open	CB Open A ph			*	*	*	*
584	CB Status Monitor	Ph B CB Open	CB Open B ph			*	*	*	*
585	CB Status Monitor	Ph C CB Open	CB Open C ph			*	*	*	*
586	CB Status Monitor	3 ph CB Closed	CB Closed 3 ph	*	*	*	*	*	*
587	CB Status Monitor	Ph A CB Closed	CB Closed A ph			*	*	*	*
588	CB Status Monitor	Ph B CB Closed	CB Closed B ph			*	*	*	*
589	CB Status Monitor	Ph C CB Closed	CB Closed C ph			*	*	*	*
590	CB Status Monitor	3 ph CB2 Open	CB2 Open 3 ph				*		*
591	CB Status Monitor	Ph A CB2 Open	CB2 Open A ph				*		*
592	CB Status Monitor	Ph B CB2 Open	CB2 Open B ph				*		*
593	CB Status Monitor	Ph C CB2 Open	CB2 Open C ph				*		*
594	CB Status Monitor	3 ph CB2 Closed	CB2 Closed 3 ph				*		*
595	CB Status Monitor	Ph A CB2 Closed	CB2 Closed A ph				*		*
596	CB Status Monitor	Ph B CB2 Closed	CB2 Closed B ph				*		*
597	CB Status Monitor	Ph C CB2 Closed	CB2 Closed C ph				*		*
598	Frequency Tracking	Freq High	Freq High	*	*	*	*	*	*
599	Frequency Tracking	Freq Low	Freq Low	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
600	Frequency Tracking	Freq Not found	Freq Not found	*	*	*	*	*	*
601	Frequency Tracking	Stop Freq Track	Stop Freq Track	*	*	*	*	*	*
602	Current Differential	Protection Signaling Failure Alarm - Ch1 Rx	SignalFail Ch1Rx	*	*	*	*	*	*
603	Current Differential	Protection Signaling Failure Alarm - Ch1 Tx	SignalFail Ch1Tx	*	*	*	*	*	*
604	Current Differential	Protection Signaling Failure Alarm - Ch2 Rx	SignalFail Ch2Rx	*	*	*	*	*	*
605	Current Differential	Protection Signaling Failure Alarm - Ch2 Tx	SignalFail Ch2Tx	*	*	*	*	*	*
606	PSL	Remote 1 GPS Fail	Ch 1 GPS Fail					*	*
607	PSL	Remote 2 GPS Fail	Ch 2 GPS Fail					*	*
608	Current Differential	relay is already configured	Config Same	*	*	*	*	*	*
609	Current Differential	reconfigure was successful	Reconfig Pass	*	*	*	*	*	*
610	Current Differential	reconfigure was unsuccessful	Reconfig Fail	*	*	*	*	*	*
611	Current Differential	restore was successful	Restore Pass	*	*	*	*	*	*
612	Current Differential	restore was unsuccessful	Restore Fail	*	*	*	*	*	*
613	Current Differential	Inhibit Current Differential	Inhibit C Diff	*	*	*	*	*	*
614	Overcurrent	Overcurrent Intertrip Enabled	I>3 Intertrip	*	*	*	*	*	*
615	Distance	Zone 1 Intertrip Enabled	Z1 Intertrip			*	*	*	*
616	Distance	Zone 2 Intertrip Enabled	Z2 Intertrip			*	*	*	*
617	Distance	Zone 3 Intertrip Enabled	Z3 Intertrip			*	*	*	*
618	Menu	Single Pole Trip Enable	1 Pole Trip En			*	*	*	*
619	CB Status	CB Status Alarm	CB Status Alarm	*	*	*	*	*	*
620	CB Status	CB Status Alarm 2	CB2 Status Alarm				*		*
621	PSL	User Defined Intertrip	Ch 1 Intertrip 1	*	*	*	*	*	*
622	PSL	User Defined Intertrip	Ch 1 Intertrip 2	*	*	*	*	*	*
623	PSL	User Defined Intertrip	Ch 1 Intertrip 3	*	*	*	*	*	*
624	PSL	User Defined Intertrip	Ch 1 Intertrip 4	*	*	*	*	*	*
625	PSL	User Defined Intertrip	Ch 1 Intertrip 5	*	*	*	*	*	*
626	PSL	User Defined Intertrip	Ch 1 Intertrip 6	*	*	*	*	*	*
627	PSL	User Defined Intertrip	Ch 1 Intertrip 7	*	*	*	*	*	*
628	PSL	User Defined Intertrip	Ch 1 Intertrip 8	*	*	*	*	*	*
629	PSL	User Defined Intertrip	Ch 2 Intertrip 1	*	*	*	*	*	*
630	PSL	User Defined Intertrip	Ch 2 Intertrip 2	*	*	*	*	*	*
631	PSL	User Defined Intertrip	Ch 2 Intertrip 3	*	*	*	*	*	*
632	PSL	User Defined Intertrip	Ch 2 Intertrip 4	*	*	*	*	*	*
633	PSL	User Defined Intertrip	Ch 2 Intertrip 5	*	*	*	*	*	*
634	PSL	User Defined Intertrip	Ch 2 Intertrip 6	*	*	*	*	*	*
635	PSL	User Defined Intertrip	Ch 2 Intertrip 7	*	*	*	*	*	*
636	PSL	User Defined Intertrip	Ch 2 Intertrip 8	*	*	*	*	*	*
637	PFSO	I2> detector	I2>			*	*	*	*
638	UI	HMI Access Lvl 1	HMI Access Lvl 1	*	*	*	*	*	*
639	UI	HMI Access Lvl 2	HMI Access Lvl 2	*	*	*	*	*	*
640	UI	FPort AccessLvl1	FPort AccessLvl1	*	*	*	*	*	*
641	UI	FPort AccessLvl2	FPort AccessLvl2	*	*	*	*	*	*
642	UI	RPrt1 AccessLvl1	RPrt1 AccessLvl1	*	*	*	*	*	*
643	UI	RPrt1 AccessLvl2	RPrt1 AccessLvl2	*	*	*	*	*	*
644	UI	RPrt2 AccessLvl1	RPrt2 AccessLvl1	*	*	*	*	*	*
645	UI	RPrt2 AccessLvl2	RPrt2 AccessLvl2	*	*	*	*	*	*
646	AR	Unused							
647		Live Line	Live Line			*		*	
648		Dead Line	Dead Line			*		*	
649		Live Bus	Live Bus			*		*	
650		Dead Bus	Dead Bus			*		*	
651		Check Sync 1 OK	Check Sync 1 OK			*		*	
652		Check Sync 2 OK	Check Sync 2 OK			*		*	
653		SysChks Inactive	SysChks Inactive			*		*	
654		Unused							
655		Unused							
656		Unused							
657		Ch1 Loss Of Signal	Ch1 Signal Lost	*	*	*	*	*	*
658		Ch1 Path "Yellow"	Ch1 Path Yellow	*	*	*	*	*	*
659		Ch1 Mismatch Received N	Ch1 Mismatch RxN	*	*	*	*	*	*
660		Ch2 Loss Of Signal	Ch2 Signal Lost	*	*	*	*	*	*
661		Ch2 Path "Yellow"	Ch2 Path Yellow	*	*	*	*	*	*
662		Ch2 Mismatch Received N	Ch2 Mismatch RxN	*	*	*	*	*	*
663		Unused							
664		Unused							
665		Unused							
666		Unused							

DDB No	Source	Description	English Text	1	2	3	4	5	6
667		Unused							
668		Unused							
669		Unused							
670		Unused							
671		Unused							
672		GOOSE VIP 1	Virtual Input 1	*	*	*	*	*	*
673		GOOSE VIP 2	Virtual Input 2	*	*	*	*	*	*
674		GOOSE VIP 3	Virtual Input 3	*	*	*	*	*	*
675		GOOSE VIP 4	Virtual Input 4	*	*	*	*	*	*
676		GOOSE VIP 5	Virtual Input 5	*	*	*	*	*	*
677		GOOSE VIP 6	Virtual Input 6	*	*	*	*	*	*
678		GOOSE VIP 7	Virtual Input 7	*	*	*	*	*	*
679		GOOSE VIP 8	Virtual Input 8	*	*	*	*	*	*
680		GOOSE VIP 9	Virtual Input 9	*	*	*	*	*	*
681		GOOSE VIP 10	Virtual Input 10	*	*	*	*	*	*
682		GOOSE VIP 11	Virtual Input 11	*	*	*	*	*	*
683		GOOSE VIP 12	Virtual Input 12	*	*	*	*	*	*
684		GOOSE VIP 13	Virtual Input 13	*	*	*	*	*	*
685		GOOSE VIP 14	Virtual Input 14	*	*	*	*	*	*
686		GOOSE VIP 15	Virtual Input 15	*	*	*	*	*	*
687		GOOSE VIP 16	Virtual Input 16	*	*	*	*	*	*
688		GOOSE VIP 17	Virtual Input 17	*	*	*	*	*	*
689		GOOSE VIP 18	Virtual Input 18	*	*	*	*	*	*
690		GOOSE VIP 19	Virtual Input 19	*	*	*	*	*	*
691		GOOSE VIP 20	Virtual Input 20	*	*	*	*	*	*
692		GOOSE VIP 21	Virtual Input 21	*	*	*	*	*	*
693		GOOSE VIP 22	Virtual Input 22	*	*	*	*	*	*
694		GOOSE VIP 23	Virtual Input 23	*	*	*	*	*	*
695		GOOSE VIP 24	Virtual Input 24	*	*	*	*	*	*
696		GOOSE VIP 25	Virtual Input 25	*	*	*	*	*	*
697		GOOSE VIP 26	Virtual Input 26	*	*	*	*	*	*
698		GOOSE VIP 27	Virtual Input 27	*	*	*	*	*	*
699		GOOSE VIP 28	Virtual Input 28	*	*	*	*	*	*
700		GOOSE VIP 29	Virtual Input 29	*	*	*	*	*	*
701		GOOSE VIP 30	Virtual Input 30	*	*	*	*	*	*
702		GOOSE VIP 31	Virtual Input 31	*	*	*	*	*	*
703		GOOSE VIP 32	Virtual Input 32	*	*	*	*	*	*
704		GOOSE Out 1	Virtual Output 1	*	*	*	*	*	*
705		GOOSE Out 2	Virtual Output 2	*	*	*	*	*	*
706		GOOSE Out 3	Virtual Output 3	*	*	*	*	*	*
707		GOOSE Out 4	Virtual Output 4	*	*	*	*	*	*
708		GOOSE Out 5	Virtual Output 5	*	*	*	*	*	*
709		GOOSE Out 6	Virtual Output 6	*	*	*	*	*	*
710		GOOSE Out 7	Virtual Output 7	*	*	*	*	*	*
711		GOOSE Out 8	Virtual Output 8	*	*	*	*	*	*
712		GOOSE Out 9	Virtual Output 9	*	*	*	*	*	*
713		GOOSE Out 10	Virtual Output10	*	*	*	*	*	*
714		GOOSE Out 11	Virtual Output11	*	*	*	*	*	*
715		GOOSE Out 12	Virtual Output12	*	*	*	*	*	*
716		GOOSE Out 13	Virtual Output13	*	*	*	*	*	*
717		GOOSE Out 14	Virtual Output14	*	*	*	*	*	*
718		GOOSE Out 15	Virtual Output15	*	*	*	*	*	*
719		GOOSE Out 16	Virtual Output16	*	*	*	*	*	*
720		GOOSE Out 17	Virtual Output17	*	*	*	*	*	*
721		GOOSE Out 18	Virtual Output18	*	*	*	*	*	*
722		GOOSE Out 19	Virtual Output19	*	*	*	*	*	*
723		GOOSE Out 20	Virtual Output20	*	*	*	*	*	*
724		GOOSE Out 21	Virtual Output21	*	*	*	*	*	*
725		GOOSE Out 22	Virtual Output22	*	*	*	*	*	*
726		GOOSE Out 23	Virtual Output23	*	*	*	*	*	*
727		GOOSE Out 24	Virtual Output24	*	*	*	*	*	*
728		GOOSE Out 25	Virtual Output25	*	*	*	*	*	*
729		GOOSE Out 26	Virtual Output26	*	*	*	*	*	*
730		GOOSE Out 27	Virtual Output27	*	*	*	*	*	*
731		GOOSE Out 28	Virtual Output28	*	*	*	*	*	*
732		GOOSE Out 29	Virtual Output29	*	*	*	*	*	*
733		GOOSE Out 30	Virtual Output30	*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
734		GOOSE Out 31	Virtual Output31	*	*	*	*	*	*
735		GOOSE Out 32	Virtual Output32	*	*	*	*	*	*
736		Unused							
737		Unused							
738		Unused							
739		Unused							
740		Unused							
741		Unused							
742		Unused							
743		Unused							
744		Unused							
745		Unused							
746		Unused							
747		Unused							
748		Unused							
749		Unused							
750	FL	Fixed Logic Internal Node				*	*	*	*
751	FL	Fixed Logic Internal Node				*	*	*	*
752	FL	Fixed Logic Internal Node				*	*	*	*
753	FL	Fixed Logic Internal Node				*	*	*	*
754	FL	Fixed Logic Internal Node				*	*	*	*
755	FL	Fixed Logic Internal Node				*	*	*	*
756	FL	Fixed Logic Internal Node				*	*	*	*
757	FL	Fixed Logic Internal Node				*	*	*	*
758	FL	Fixed Logic Internal Node				*	*	*	*
759	FL	Fixed Logic Internal Node				*	*	*	*
760	FL	Fixed Logic Internal Node				*	*	*	*
761	FL	Fixed Logic Internal Node				*	*	*	*
762	FL	Fixed Logic Internal Node				*	*	*	*
763	FL	Fixed Logic Internal Node	BU Trip Send A	*	*	*	*	*	*
764	FL	Fixed Logic Internal Node	BU Trip Send B	*	*	*	*	*	*
765	FL	Fixed Logic Internal Node	BU Trip Send C	*	*	*	*	*	*
766	FL	Fixed Logic Internal Node	Backup Enabled	*	*	*	*	*	*
767		Unused							
768		Unused							
769		Unused							
770		Unused							
771		Unused							
772		Unused							
773		Unused							
774		Unused							
775		Unused							
776		Unused							
777		Unused							
778		Unused							
779		Unused							
780		Unused							
781		Unused							
782		Unused							
783		Unused							
784		Unused							
785		Unused							
786		Unused							
787		Unused							
788		Unused							
789		Unused							
790		Unused							
791		Unused							
792		Unused							
793		Unused							
794		Unused							
795		Unused							
796		Unused							
797		Unused							
798		Unused							
799		Unused							
800		Unused							

DDB No	Source	Description	English Text	1	2	3	4	5	6
801		Unused							
802		Unused							
803		Unused							
804		Unused							
805		Unused							
806		Unused							
807		Unused							
808		Unused							
809		Unused							
810		Unused							
811		Unused							
812		Unused							
813		Unused							
814		Unused							
815		Unused							
816		Unused							
817		Unused							
818		Unused							
819		Unused							
820		Unused							
821		Unused							
822		Unused							
823		Unused							
824	PSL	PSL Internal Node		*	*	*	*	*	*
825	PSL	PSL Internal Node		*	*	*	*	*	*
826	PSL	PSL Internal Node		*	*	*	*	*	*
827	PSL	PSL Internal Node		*	*	*	*	*	*
828	PSL	PSL Internal Node		*	*	*	*	*	*
829	PSL	PSL Internal Node		*	*	*	*	*	*
830	PSL	PSL Internal Node		*	*	*	*	*	*
831	PSL	PSL Internal Node		*	*	*	*	*	*
832	PSL	PSL Internal Node		*	*	*	*	*	*
833	PSL	PSL Internal Node		*	*	*	*	*	*
834	PSL	PSL Internal Node		*	*	*	*	*	*
835	PSL	PSL Internal Node		*	*	*	*	*	*
836	PSL	PSL Internal Node		*	*	*	*	*	*
837	PSL	PSL Internal Node		*	*	*	*	*	*
838	PSL	PSL Internal Node		*	*	*	*	*	*
839	PSL	PSL Internal Node		*	*	*	*	*	*
840	PSL	PSL Internal Node		*	*	*	*	*	*
841	PSL	PSL Internal Node		*	*	*	*	*	*
842	PSL	PSL Internal Node		*	*	*	*	*	*
843	PSL	PSL Internal Node		*	*	*	*	*	*
844	PSL	PSL Internal Node		*	*	*	*	*	*
845	PSL	PSL Internal Node		*	*	*	*	*	*
846	PSL	PSL Internal Node		*	*	*	*	*	*
847	PSL	PSL Internal Node		*	*	*	*	*	*
848	PSL	PSL Internal Node		*	*	*	*	*	*
849	PSL	PSL Internal Node		*	*	*	*	*	*
850	PSL	PSL Internal Node		*	*	*	*	*	*
851	PSL	PSL Internal Node		*	*	*	*	*	*
852	PSL	PSL Internal Node		*	*	*	*	*	*
853	PSL	PSL Internal Node		*	*	*	*	*	*
854	PSL	PSL Internal Node		*	*	*	*	*	*
855	PSL	PSL Internal Node		*	*	*	*	*	*
856	PSL	PSL Internal Node		*	*	*	*	*	*
857	PSL	PSL Internal Node		*	*	*	*	*	*
858	PSL	PSL Internal Node		*	*	*	*	*	*
859	PSL	PSL Internal Node		*	*	*	*	*	*
860	PSL	PSL Internal Node		*	*	*	*	*	*
861	PSL	PSL Internal Node		*	*	*	*	*	*
862	PSL	PSL Internal Node		*	*	*	*	*	*
863	PSL	PSL Internal Node		*	*	*	*	*	*
864	PSL	PSL Internal Node		*	*	*	*	*	*
865	PSL	PSL Internal Node		*	*	*	*	*	*
866	PSL	PSL Internal Node		*	*	*	*	*	*
867	PSL	PSL Internal Node		*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
868	PSL	PSL Internal Node		*	*	*	*	*	*
869	PSL	PSL Internal Node		*	*	*	*	*	*
870	PSL	PSL Internal Node		*	*	*	*	*	*
871	PSL	PSL Internal Node		*	*	*	*	*	*
872	PSL	PSL Internal Node		*	*	*	*	*	*
873	PSL	PSL Internal Node		*	*	*	*	*	*
874	PSL	PSL Internal Node		*	*	*	*	*	*
875	PSL	PSL Internal Node		*	*	*	*	*	*
876	PSL	PSL Internal Node		*	*	*	*	*	*
877	PSL	PSL Internal Node		*	*	*	*	*	*
878	PSL	PSL Internal Node		*	*	*	*	*	*
879	PSL	PSL Internal Node		*	*	*	*	*	*
880	PSL	PSL Internal Node		*	*	*	*	*	*
881	PSL	PSL Internal Node		*	*	*	*	*	*
882	PSL	PSL Internal Node		*	*	*	*	*	*
883	PSL	PSL Internal Node		*	*	*	*	*	*
884	PSL	PSL Internal Node		*	*	*	*	*	*
885	PSL	PSL Internal Node		*	*	*	*	*	*
886	PSL	PSL Internal Node		*	*	*	*	*	*
887	PSL	PSL Internal Node		*	*	*	*	*	*
888	PSL	PSL Internal Node		*	*	*	*	*	*
889	PSL	PSL Internal Node		*	*	*	*	*	*
890	PSL	PSL Internal Node		*	*	*	*	*	*
891	PSL	PSL Internal Node		*	*	*	*	*	*
892	PSL	PSL Internal Node		*	*	*	*	*	*
893	PSL	PSL Internal Node		*	*	*	*	*	*
894	PSL	PSL Internal Node		*	*	*	*	*	*
895	PSL	PSL Internal Node		*	*	*	*	*	*
896	PSL	PSL Internal Node		*	*	*	*	*	*
897	PSL	PSL Internal Node		*	*	*	*	*	*
898	PSL	PSL Internal Node		*	*	*	*	*	*
899	PSL	PSL Internal Node		*	*	*	*	*	*
900	PSL	PSL Internal Node		*	*	*	*	*	*
901	PSL	PSL Internal Node		*	*	*	*	*	*
902	PSL	PSL Internal Node		*	*	*	*	*	*
903	PSL	PSL Internal Node		*	*	*	*	*	*
904	PSL	PSL Internal Node		*	*	*	*	*	*
905	PSL	PSL Internal Node		*	*	*	*	*	*
906	PSL	PSL Internal Node		*	*	*	*	*	*
907	PSL	PSL Internal Node		*	*	*	*	*	*
908	PSL	PSL Internal Node		*	*	*	*	*	*
909	PSL	PSL Internal Node		*	*	*	*	*	*
910	PSL	PSL Internal Node		*	*	*	*	*	*
911	PSL	PSL Internal Node		*	*	*	*	*	*
912	PSL	PSL Internal Node		*	*	*	*	*	*
913	PSL	PSL Internal Node		*	*	*	*	*	*
914	PSL	PSL Internal Node		*	*	*	*	*	*
915	PSL	PSL Internal Node		*	*	*	*	*	*
916	PSL	PSL Internal Node		*	*	*	*	*	*
917	PSL	PSL Internal Node		*	*	*	*	*	*
918	PSL	PSL Internal Node		*	*	*	*	*	*
919	PSL	PSL Internal Node		*	*	*	*	*	*
920	PSL	PSL Internal Node		*	*	*	*	*	*
921	PSL	PSL Internal Node		*	*	*	*	*	*
922	PSL	PSL Internal Node		*	*	*	*	*	*
923	PSL	PSL Internal Node		*	*	*	*	*	*
924	PSL	PSL Internal Node		*	*	*	*	*	*
925	PSL	PSL Internal Node		*	*	*	*	*	*
926	PSL	PSL Internal Node		*	*	*	*	*	*
927	PSL	PSL Internal Node		*	*	*	*	*	*
928	PSL	PSL Internal Node		*	*	*	*	*	*
929	PSL	PSL Internal Node		*	*	*	*	*	*
930	PSL	PSL Internal Node		*	*	*	*	*	*
931	PSL	PSL Internal Node		*	*	*	*	*	*
932	PSL	PSL Internal Node		*	*	*	*	*	*
933	PSL	PSL Internal Node		*	*	*	*	*	*
934	PSL	PSL Internal Node		*	*	*	*	*	*

DDB No	Source	Description	English Text	1	2	3	4	5	6
935	PSL	PSL Internal Node		*	*	*	*	*	*
936	PSL	PSL Internal Node		*	*	*	*	*	*
937	PSL	PSL Internal Node		*	*	*	*	*	*
938	PSL	PSL Internal Node		*	*	*	*	*	*
939	PSL	PSL Internal Node		*	*	*	*	*	*
940	PSL	PSL Internal Node		*	*	*	*	*	*
941	PSL	PSL Internal Node		*	*	*	*	*	*
942	PSL	PSL Internal Node		*	*	*	*	*	*
943	PSL	PSL Internal Node		*	*	*	*	*	*
944	PSL	PSL Internal Node		*	*	*	*	*	*
945	PSL	PSL Internal Node		*	*	*	*	*	*
946	PSL	PSL Internal Node		*	*	*	*	*	*
947	PSL	PSL Internal Node		*	*	*	*	*	*
948	PSL	PSL Internal Node		*	*	*	*	*	*
949	PSL	PSL Internal Node		*	*	*	*	*	*
950	PSL	PSL Internal Node		*	*	*	*	*	*
951	PSL	PSL Internal Node		*	*	*	*	*	*
952	PSL	PSL Internal Node		*	*	*	*	*	*
953	PSL	PSL Internal Node		*	*	*	*	*	*
954	PSL	PSL Internal Node		*	*	*	*	*	*
955	PSL	PSL Internal Node		*	*	*	*	*	*
956	PSL	PSL Internal Node		*	*	*	*	*	*
957	PSL	PSL Internal Node		*	*	*	*	*	*
958	PSL	PSL Internal Node		*	*	*	*	*	*
959	PSL	PSL Internal Node		*	*	*	*	*	*
960	PSL	PSL Internal Node		*	*	*	*	*	*
961	PSL	PSL Internal Node		*	*	*	*	*	*
962	PSL	PSL Internal Node		*	*	*	*	*	*
963	PSL	PSL Internal Node		*	*	*	*	*	*
964	PSL	PSL Internal Node		*	*	*	*	*	*
965	PSL	PSL Internal Node		*	*	*	*	*	*
966	PSL	PSL Internal Node		*	*	*	*	*	*
967	PSL	PSL Internal Node		*	*	*	*	*	*
968	PSL	PSL Internal Node		*	*	*	*	*	*
969	PSL	PSL Internal Node		*	*	*	*	*	*
970	PSL	PSL Internal Node		*	*	*	*	*	*
971	PSL	PSL Internal Node		*	*	*	*	*	*
972	PSL	PSL Internal Node		*	*	*	*	*	*
973	PSL	PSL Internal Node		*	*	*	*	*	*
974		Unused							
975		Unused							
976		Unused							
977		Unused							
978		Unused							
979		Unused							
980		Unused							
981		Unused							
982		Unused							
983		Unused							
984		Unused							
985		Unused							
986		Unused							
987		Unused							
988		Unused							
989		Unused							
990		Unused							
991		Unused							
992		Unused							
993		Unused							
994		Unused							
995		Unused							
996		Unused							
997		Unused							
998		Unused							
999		Unused							
1000		Unused							
1001		Unused							

DDB No	Source	Description	English Text	1	2	3	4	5	6
1002		Unused							
1003		Unused							
1004		Unused							
1005		Unused							
1006		Unused							
1007		Unused							
1008		Unused							
1009		Unused							
1010		Unused							
1011		Unused							
1012		Unused							
1013		Unused							
1014		Unused							
1015		Unused							
1016		Unused							
1017		Unused							
1018		Unused							
1019		Unused							
1020		Unused							
1021		Unused							
1022		Unused							
		Event FIFO Overflow	Event FIFO full	*	*	*	*	*	*
		Fault FIFO Overflow	Fault FIFO full	*	*	*	*	*	*
		Fault Rec Overflow	Fault Rec full	*	*	*	*	*	*

The following table defines the visibility & Validity of each cell in the fault record

Cell	Text	Comment
0100	VIEW RECORDS	
0101	Last Record -	
0102	Menu Cell Ref	
0103	Time & Date	
0104	Record Text	
0105	Record Value	
0106	Select Fault	
N/A	Started Phase A B C N	Visible if (DDB_ANY_START = 1) x if (DDB_DIFFERENTIAL_START_x | DDB_ZONE_1_START_x | DDB_ZONE_2_START_x | DDB_ZONE_3_START_x | DDB_POC_1_PH_x_START | DDB_POC_2_PH_x_START | DDB_POC_3_PH_x_START | DDB_POC_4_PH_x_START=1) where x = A, B or C N if (DDB_ZONE_1_START_N | DDB_ZONE_2_START_N | DDB_ZONE_3_START_N | DDB_EF1_1_START | DDB_EF1_2_START | DDB_EF1_3_START | DDB_EF1_4_START | DDB_SEF_1_START | DDB_SEF_2_START | DDB_SEF_3_START | DDB_SEF_4_START =1)
N/A	Tripped Phase A B C N	Visible if (DDB_DIFFERENTIAL_TRIP | DDB_DIFFERENTIAL_INTERTRIP | DDB_ZONE_x_TRIP | DDB_BACKUP_INTERTRIP | DDB_POC_x_3PH_START | | DDB_EF1_x_TRIP | DDB_SEF_x_TRIP) x if(DDB_DIFFERENTIAL_TRIP_x | DDB_DIFFERENTIAL_INTERTRIP_x | DDB_ZONE_1_TRIP_x | DDB_ZONE_2_TRIP_x | DDB_ZONE_3_TRIP_x | DDB_BACKUP_INTERTRIP_x | DDB_POC_1_PH_x_TRIP | DDB_POC_2_PH_x_TRIP | DDB_POC_3_PH_x_TRIP | DDB_POC_4_PH_x_TRIP | DDB_AR_TRIP_TEST_x | = 1) where x = A, B or C N if (DDB_ZONE_1_TRIP_N | DDB_ZONE_2_TRIP_N | DDB_ZONE_3_TRIP_N | DDB_EF1_1_TRIP | DDB_EF1_2_TRIP | DDB_EF1_3_TRIP | DDB_EF1_4_TRIP | DDB_SEF_1_TRIP | DDB_SEF_2_TRIP | DDB_SEF_3_TRIP | DDB_SEF_4_TRIP = 1)
N/A	Current Diff Start	Visible if (DDB_DIFFERENTIAL_START_A | DDB_DIFFERENTIAL_START_B | DDB_DIFFERENTIAL_START_C = 1) Start
N/A	Current Diff Trip InterTrip Stub Bus	 Visible if (DDB_DIFFERENTIAL_TRIP | DDB_DIFFERENTIAL_INTERTRIP = 1) Trip if (DDB_DIFFERENTIAL_TRIP = 1) InterTrip if (DDB_DIFFERENTIAL_INTERTRIP =1) Stub Bus if (DDB_STUB_BUS_TRIP =1)
	PIT DIT Dist/I>3	PIT if (DDB_PERMISSIVE_INTERTRIP = 1) DIT if (DDB_DIRECT_INTERTRIP = 1) dIST/I>3 if (DDB_BACKUP_INTERTRIP = 1)
N/A	Distance Start Z1 Z2 Z3	 Visible if (DDB_ZONE_1_START_A | DDB_ZONE_1_START_B | DDB_ZONE_1_START_C | DDB_ZONE_2_START_A | DDB_ZONE_2_START_B | DDB_ZONE_2_START_C | DDB_ZONE_3_START_A | DDB_ZONE_3_START_B | DDB_ZONE_3_START_C =1) Start Z1 if (DDB_ZONE_1_START_A | DDB_ZONE_1_START_B | DDB_ZONE_1_START_C = 1)
		Start Z2 if (DDB_ZONE_2_START_A | DDB_ZONE_2_START_B | DDB_ZONE_2_START_C = 1) Start Z3 if (DDB_ZONE_3_START_A | DDB_ZONE_3_START_B | DDB_ZONE_3_START_C = 1)
N/A	Distance Trip Z1 Z2 Z3	 Visible if (DDB_ZONE_1_TRIP | DDB_ZONE_2_TRIP | DDB_ZONE_3_TRIP = 1) Trip Z1 if (DDB_ZONE_1_TRIP = 1) Trip Z2 if (DDB_ZONE_2_TRIP = 1) Trip Z3 if (DDB_ZONE_3_TRIP = 1)
N/A	Overcurrent Start I> 1234	Visible if (DDB_POC_1_3PH_START | DDB_POC_2_3PH_START | DDB_POC_3_3PH_START | DDB_POC_4_3PH_START = 1) Start I >1 if (DDB_POC_1_3PH_START = 1) Start I >2 if (DDB_POC_2_3PH_START = 1) Start I >3 if (DDB_POC_3_3PH_START = 1) Start I >4 if (DDB_POC_4_3PH_START = 1)

Note :
Differential InterTrip & Stub Bus are mutually exclusive

Cell	Text	Comment	
N/A	Overcurrent Trip I> 1234	Visible if (DDB_POC_1_3PH_TRIP | DDB_POC_2_3PH_TRIP | DDB_POC_3_3PH_TRIP | DDB_POC_4_3PH_TRIP = 1) Trip I>1 if (DDB_POC_1_3PH_TRIP = 1) Trip I>2 if (DDB_POC_2_3PH_TRIP = 1) Trip I>3 if (DDB_POC_3_3PH_TRIP = 1) Trip I>4 if (DDB_POC_4_3PH_TRIP = 1)	
N/A	Broken Conductor Trip	Visible if (DDB_BROKEN_CONDUCTOR_TRIP = 1) Trip	
N/A	Earth Fault Start IN> 1234	Visible if (DDB_EF1_1_START | DDB_EF1_2_START | DDB_EF1_3_START | DDB_EF1_4_START =1) Start IN>1 if (DDB_EF1_1_START =1) Start IN>2 if (DDB_EF1_2_START =1) Start IN>3 if (DDB_EF1_3_START =1) Start IN>4 if (DDB_EF1_4_START =1)	
N/A	Earth Fault Trip IN> 1234	Visible if (DDB_EF1_1_TRIP | DDB_EF1_2_TRIP | DDB_EF1_3_TRIP | DDB_EF1_4_TRIP =1) Trip IN>1 if (DDB_EF1_1_TRIP =1) Trip IN>2 if (DDB_EF1_2_TRIP =1) Trip IN>3 if (DDB_EF1_3_TRIP =1) Trip IN>4 if (DDB_EF1_4_TRIP =1)	
N/A	Sensitive E/F Start ISEF> 1234	Visible if (DDB_SEF_1_START | DDB_SEF_2_START | DDB_SEF_3_START | DDB_SEF_4_START =1) Start ISEF>1 if (DDB_SEF_1_START =1) Start ISEF>2 if (DDB_SEF_2_START =1) Start ISEF>3 if (DDB_SEF_3_START =1) Start ISEF>4 if (DDB_SEF_4_START =1)	
N/A	Sensitive E/F Trip ISEF> 1234	Visible if (DDB_SEF_1_TRIP | DDB_SEF_2_TRIP | DDB_SEF_3_TRIP | DDB_SEF_4_TRIP =1) Trip ISEF>1 if (DDB_SEF_1_TRIP =1) Trip ISEF>2 if (DDB_SEF_2_TRIP =1) Trip ISEF>3 if (DDB_SEF_3_TRIP =1) Trip ISEF>4 if (DDB_SEF_4_TRIP =1)	
N/A	Thermal Overload Alarm Trip	Visible if (DDB_THERMAL_ALARM | DDB_THERMAL_TRIP = 1) Alarm if (DDB_THERMAL_ALARM =1) Trip if (DDB_THERMAL_TRIP =1)	
N/A	Breaker Fail CB Fail 1 2	Visible if (DDB_BREAKER_FAIL_ALARM =1) 1 if (DDB_CBF1_TRIP_3PH = 1) 2 if (DDB_CBF2_TRIP_3PH = 1)	Model 1,2,3
N/A	Breaker Fail CB1 1 2 CB2 1 2	Visible if (DDB_BREAKER_FAIL_ALARM|DDB_BREAKER_FAIL_ALARM2 =1) 1 if (DDB_CBF1_TRIP_3PH = 1) 2 if (DDB_CBF2_TRIP_3PH = 1) 1 if (DDB_CB2F1_TRIP_3PH = 1) 2 if (DDB_CB2F2_TRIP_3PH = 1)	Model 4
N/A	Supervision VTS PSB	Visible if (DDB_VTS_INDICATION | DDB_PSB_ALARM = 1) VTS if (DDB_VTS_INDICATION = 1) PSB if (DDB_PSB_ALARM = 1)	
N/A	A/R State Shot 1 2 3 4 5	Visible if AR enabled	
0107	Faulted Phase	Bit 0,1,2 = (DDB_DIFFERENTIAL_START_x | DDB_ZONE_1_START_x | DDB_ZONE_2_START_x | DDB_ZONE_3_START_x | DDB_POC_1_PH_x_START | DDB_POC_2_PH_x_START | DDB_POC_3_PH_x_START | DDB_POC_4_PH_x_START) where x = A, B or C Bit 3 = (DDB_ZONE_1_START_N | DDB_ZONE_2_START_N | DDB_ZONE_3_START_N | DDB_EF1_1_START | DDB_EF1_2_START | DDB_EF1_3_START | DDB_EF1_4_START | DDB_SEF_1_START | DDB_SEF_2_START | DDB_SEF_3_START | DDB_SEF_4_START) Bit 4,5,6 = (DDB_DIFFERENTIAL_TRIP_x | DDB_DIFFERENTIAL_INTERTRIP_x | DDB_ZONE_1_TRIP_x | DDB_ZONE_2_TRIP_x | DDB_ZONE_3_TRIP_x | DDB_BACKUP_INTERTRIP_x | DDB_POC_1_PH_x_TRIP | DDB_POC_2_PH_x_TRIP | DDB_POC_3_PH_x_TRIP | DDB_POC_4_PH_x_TRIP | DDB_AR_TRIP_TEST_x) where x = A, B or C Bit 7 = (DDB_ZONE_1_TRIP_N | DDB_ZONE_2_TRIP_N | DDB_ZONE_3_TRIP_N | DDB_EF1_1_TRIP | DDB_EF1_2_TRIP | DDB_EF1_3_TRIP | DDB_EF1_4_TRIP | DDB_SEF_1_TRIP | DDB_SEF_2_TRIP | DDB_SEF_3_TRIP | DDB_SEF_4_TRIP)	

Cell	Text	Comment
0108	Start Elements	Bit 0 = DDB_ANY_START) Bit 1 = (DDB_DIFFERENTIAL_START_A | DDB_DIFFERENTIAL_START_B | DDB_DIFFERENTIAL_START_C) Bit 2 = (DDB_ZONE_1_START_A | DDB_ZONE_1_START_B | DDB_ZONE_1_START_C) Bit 3 = (DDB_ZONE_2_START_A | DDB_ZONE_2_START_B | DDB_ZONE_2_START_C) Bit 4 = (DDB_ZONE_3_START_A | DDB_ZONE_3_START_B | DDB_ZONE_3_START_C) Bit 5 = (DDB_POC_1_3PH_START) Bit 6 = (DDB_POC_2_3PH_START) Bit 7 = (DDB_POC_3_3PH_START) Bit 8 = (DDB_POC_4_3PH_START) Bit 9 = (DDB_EF1_1_START) Bit 10 = (DDB_EF1_2_START) Bit 11 = (DDB_EF1_3_START) Bit 12 = (DDB_EF1_4_START) Bit 13 = (DDB_SEF_1_START) Bit 14 = (DDB_SEF_2_START) Bit 15 = (DDB_SEF_3_START) Bit 16 = (DDB_SEF_4_START) Bit 17 = (DDB_THERMAL_ALARM)
010A	Trip Elements(1)	Bit 0 = (DDB_ANY_TRIP) Bit 1 = (DDB_DIFFERENTIAL_TRIP) Bit 2 = (DDB_DIFFERENTIAL_INTERTRIP) Bit 3 = (DDB_PERMISSIVE_INTERTRIP) Bit 4 = (DDB_DIRECT_INTERTRIP) Bit 5 = (DDB_ZONE_1_TRIP) Bit 6 = (DDB_ZONE_2_TRIP) Bit 7 = (DDB_ZONE_3_TRIP) Bit 8 = (DDB_BACKUP_INTERTRIP) Bit 9 = (DDB_POC_1_3PH_TRIP) Bit 10 = (DDB_POC_2_3PH_TRIP) Bit 11 = (DDB_POC_3_3PH_TRIP) Bit 12 = (DDB_POC_4_3PH_TRIP) Bit 13 = (DDB_BROKEN_CONDUCTOR_TRIP) Bit 14 = (DDB_EF1_1_TRIP) Bit 15 = (DDB_EF1_2_TRIP) Bit 16 = (DDB_EF1_3_TRIP) Bit 17 = (DDB_EF1_4_TRIP) Bit 18 = (DDB_SEF_1_TRIP) Bit 19 = (DDB_SEF_2_TRIP) Bit 20 = (DDB_SEF_3_TRIP) Bit 21 = (DDB_SEF_4_TRIP) Bit 22 = (DDB_THERMAL_TRIP) Bit 23 = (DDB_STUB_BUS_TRIP)
010C	Fault Alarms	Bit 0 = (DDB_CBF1_TRIP_3PH =1) Bit 1 = (DDB_CBF2_TRIP_3PH =1) Bit 2 = (DDB_SEQ_COUNT_1) Bit 3 = (DDB_SEQ_COUNT_2) Bit 4 = (DDB_SEQ_COUNT_3) Bit 5 = (DDB_SEQ_COUNT_4) Bit 6 = (DDB_SEQ_COUNT_5) Bit 7 = (DDB_VTS_INDICATION) Bit 8 = (DDB_PSB_ALARM) Bit 9 = (DDB_CB2F1_TRIP_3PH) Bit 10 = (DDB_CB2F2_TRIP_3PH)
010D	Fault Time	
010E	Active Group	
010F	System Frequency	Valid if ("Enabled flag" = 1)
0110	Fault Duration	Valid if "FaultDurTimeValid flag" = 1
0111	CB Operate Time	Valid if "CBOperateTimeValid flag" = 1
0112	Relay Trip Time	Valid if "ProtOperateTimeValid flag" = 1

Cell	Text	Comment
0113	Fault Location	Visible if (0D0A = 0 & 0D09 = 0 & "Fault Locator en flag" = 0) Valid if "FaultLocValid Flag" = 1
0114	Fault Location	Visible if (0D0A = 0 & 0D09 = 1 & "Fault Locator en flag" = 0) Valid if "FaultLocValid Flag" = 1
0115	Fault Location	Visible if (0D0A = 1 & "Fault Locator en flag" = 0) Valid if "FaultLocValid Flag" = 1
0116	Fault Location	Visible if (0D0A = 2 & "Fault Locator en flag" = 0) Valid if "FaultLocValid Flag" = 1
0117	IA	
0118	IB	
0119	IC	
011A	VAB	
011B	VBC	
011C	VCA	
011D	IA local	Valid if "Current Diff flag 1" = 1
011E	IB local	Valid if "Current Diff flag 1" = 1
011F	IC local	Valid if "Current Diff flag 1" = 1
0120	IA remote 1	Valid if "Current Diff flag 2" = 1
0121	IB remote 1	Valid if "Current Diff flag 2" = 1
0122	IC remote 1	Valid if "Current Diff flag 2" = 1
0123	IA remote 2	Visible if (1001 = 0) Valid if "Current Diff flag 3" = 1
0124	IB remote 2	Visible if (1001 = 0) Valid if "Current Diff flag 3" = 1
0125	IC remote 2	Visible if (1001 = 0) Valid if "Current Diff flag 3" = 1
0126	IA Diff	Valid if "Current Diff flag 4" = 1
0127	IB Diff	Valid if "Current Diff flag 4" = 1
0128	IC Diff	Valid if "Current Diff flag 4" = 1
012A	IA Bias	Valid if "Current Diff flag 4" = 1
012B	IB Bias	Valid if "Current Diff flag 4" = 1
012C	IC Bias	Valid if "Current Diff flag 4" = 1

1. INTRODUCTION

The purpose of this document is to describe the specific implementation of the Distributed Network Protocol (DNP) version 3.0 within P54x MiCOM relays.

The MiCOM P54x uses the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library version 2.31.

This document, in conjunction with the DNP 3.0 Basic 4 Document Set, and the DNP Subset Definitions Document, provides complete information on how to communicate with P54x relays with the DNP 3.0 protocol.

This implementation of DNP 3.0 is fully compliant with DNP 3.0 Subset Definition Level 2. It also contains many Subset Level 3 and above features.

2. DNP V3.0 DEVICE PROFILE

The following table provides a "Device Profile Document" in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a "Document", it is only a component of a total interoperability guide. This table, in combination with the following should provide a complete interoperability/configuration guide for the P54x range of MiCOM relays:

The Implementation Table provided in Section §3

The Point List Tables provided in Section §4

DNP 3.0

Device Profile Document

Vendor Name:	**Alstom Grid – Automation and Information Systems**
Device Name:	**MiCOM P54x Current Differential**
Models Covered:	**P541, P542, P543, P544, P545, P546**

Highest DNP Level Supported: For Requests: **Level 2** For Responses: **Level 2**	Device Function: ☐ Master ☑ **Slave**

Notable objects, functions, and/or qualifiers supported in addition to the highest DNP levels supported (the complete list is described in the DNP 3.0 Implementation Table):

- For static (non-change-event) object requests, request qualifier codes 00 and 01 (start-stop), 07 and 08 (limited quantity), and 17 and 28 (index) are supported in addition to request qualifier code 06 (no range).
- Static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01.
- Static object requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28.
- For change-event object requests, qualifiers 17 or 28 are always responded.
- 16-bit and 32-bit Analog Change Events with Time may be requested.
- The read function code for Object 50 (Time and Date), variation 1, is supported.

Maximum Data Link Frame Size (octets): Transmitted: **292** Received: **292**	Maximum Application Fragment Size (octets) Transmitted: **2048** Received: **249**
Maximum Data Link Retries: ☐ None ☑ **Fixed at 2** ☐ Configurable	Maximum Application Layer Retries: ☑ **None** ☐ Configurable
Requires Data Link Layer Confirmation: ☑ **Never** ☐ Always ☐ Sometimes ☐ Configurable	Requires Application Layer Confirmation: ☐ Never ☐ Always ☑ **When reporting event data** ☑ **When sending multi-fragment responses** ☐ Sometimes ☐ Configurable

Timeouts while waiting for:

Data Link Confirm:	☐ None	☑ **Fixed at 100ms**	☐ Variable	☐ Configurable
Complete Appl. Fragment:	☑ **None**	☐ Fixed at ___	☐ Variable	☐ Configurable
Application Confirm:	☐ None	☑ **Fixed at 1s**	☐ Variable	☐ Configurable
Complete Appl. Response:	☑ None	☐ Fixed at ___	☐ Variable	☐ Configurable

Others:				
Inter-character Delay:	**4 character times at selected baud rate**			
Select/Operate Arm Timeout:	**Default 10s**			
Need Time Interval:	**Configurable, 0 or 30min**			
Sends/Executes Control Operations:				
WRITE Binary Outputs:	☑ **Never**	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☑ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☑ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE–NO ACK	☐ Never	☑ **Always**	☐ Sometimes	☐ Configurable
Count > 1	☑ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☐ Always	☑ **Sometimes**	☐ Configurable
Pulse Off	☑ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ Never	☐ Always	☑ **Sometimes**	☐ Configurable
Latch Off	☐ Never	☐ Always	☑ **Sometimes**	☐ Configurable
Queue	☑ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☑ **Never**	☐ Always	☐ Sometimes	☐ Configurable

Reports Binary Input Change Events when no specific variation requested: ☑ Never ☑ **Only time-tagged variation 2** ☐ Only non-time-tagged ☐ Configurable	Reports time-tagged Binary Input Change Events when no specific variation requested: ☐ Never ☑ **Binary input change with time** ☐ Binary input change with relative time ☐ Configurable
Sends Unsolicited Responses: ☑ **Never** ☐ Configurable ☐ Certain objects only ☐ Sometimes ☐ ENABLE/DISABLE UNSOLICITED function codes supported	Sends Static Data in Unsolicited Responses: ☑ **Never** ☐ When device restarts ☐ When status flags changes No other options are permitted.
Default Counter Object/Variation: ☐ No counters reported ☐ Configurable ☑ **Default object: 20** ☑ **Default variation: 5** ☑ **Point-by-point list attached**	Counters Roll Over at: ☐ No counters reported ☐ Configurable ☐ 16 bits ☑ **32 bits** ☐ Other value: _____ ☑ **Point-by-point list attached**
Sends multi-fragment responses: ☑ **Yes** ☐ No	

3. IMPLEMENTATION TABLE

The following table identifies the variations, function codes, and qualifiers supported by the P54x in both request and response messages.

For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Static object requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

Object			Request		Response	
Object Number	**Variation Number**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
1	0	Binary Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)		
1	1 (default – see note 1)	Binary Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
1	2	Binary Input with Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
2	2 (default – see note 1)	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
10	0	Binary Output Status (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)		
10	2 (default – see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, no ack)	00, 01 (start-stop) 06 (limited qty) 07, 08 (index) 17, 28	129 (response)	echo of request
20	0	Binary Counter (Variation 0 is used to request default variation)	1 (read) 7 (freeze) 8 (freeze no ack) 9 (freeze clear) 10 (frz. cl. no ack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)		
20	1	32-Bit Binary Counter with Flag	1 (read) 7 (freeze) 8 (freeze no ack) 9 (freeze clear) 10 (frz. cl. no ack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

Object			Request		Response	
Object Number	**Variation Number**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
20	2	16-Bit Binary Counter with Flag	1 (read) 7 (freeze) 8 (freeze no ack) 9 (freeze clear) 10 (frz. cl. no ack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	5 (default – see note 1)	32-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze no ack) 9 (freeze clear) 10 (frz. cl. no ack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	6	16-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze no ack) 9 (freeze clear) 10 (frz. cl. no ack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	0	Frozen Counter (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)		
21	1	32-Bit Frozen Counter with Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	2	16-Bit Frozen Counter with Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	9 (default – see note 1)	32-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	10	16-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	0	Analog Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)		
30	1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	2 (default – see note 1)	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	3	32-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

Object			Request				Response			
Object Number	Variation Number	Description	Function Codes (dec)		Qualifier Codes (hex)		Function Codes (dec)		Qualifier Codes (hex)	
30	4	16-Bit Analog Input without Flag	1	(read)	00, 01 06 07, 08 17, 28	(start-stop) (no range, or all) limited qty) (index)	129	(response)	00, 01 17, 28	(start-stop) (index – see note 2)
32	0	Analog Change Event (Variation 0 is used to request default variation)	1	(read)	06 07, 08	(no range, or all) (limited qty)				
32	1	32-Bit Analog Change Event without Time	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
32	2 (default – see note 1)	16-Bit Analog Change Event without Time	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
32	3	32-Bit Analog Change Event with Time	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
32	4	16-Bit Analog Change Event with Time	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
50	0	Time and Date	1	(read)	00, 01 06 07, 08 17, 28	(start-stop) (no range, or all) limited qty) (index)	129	(response)	00, 01 17, 28	(start-stop) (index – see note 2)
50	1 (default – see note 1)	Time and Date	1 2	(read) (write)	00, 01 06 07 08 17, 28	(start-stop) (no range, or all) (limited qty = 1) (limited qty) (index)	129	(response)	00, 01 17, 28	(start-stop) (index – see note 2)
52	2	Time Delay Fine					129	(response)	07	(limited qty) (qty = 1)
60	0	Class 0, 1, 2, and 3 Data	1	(read)	06	(no range, or all)				
60	1	Class 0 Data	1	(read)	06	(no range, or all)	129	(response)	17, 28	(index)
60	2	Class 1 Data	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
60	3	Class 2 Data	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
60	4	Class 3 Data	1	(read)	06 07, 08	(no range, or all) (limited qty)	129	(response)	17, 28	(index)
80	1	Internal Indications	1	(write)	00	(start–stop) (index must = 7)				
		No Object (function code only)	13	(cold restart)						
		No Object (function code only)	1	(warm restart)						
		No Object (function code only)	1	(delay meas.)						

Notes:

1. A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans.

2. For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

4. POINT LIST

The tables in the following sections identify all the individual data points provided by this implementation of DNP 3.0.

4.1 Binary input points

The Binary Input objects (1 & 2) provide read-only access to a sub-set of the P54x's digital data bus (DDB).

By default, all the static object (object 1) points belong to the Class 0 data set. The default allocation of the points in the change-event object (object 2) to a change-event class (1, 2, 3) is indicated in the point-list table below. The MiCOM S1 setting support software may be used to alter both of these assignments. However, deselecting a point from class 0 also has the effect of removing the point from the point-list of objects 1 & 2 and renumbering the remaining points to ensure the point indices are contiguous.

The validity of each point is reported through the "online" bit in the "flag", which is supplied for each point with the "with flag" object variations. Points reported as being offline, will typically be points that are invalid for the relay's current configuration, which is a product of its model number and current settings.

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
						Output Relay Status			
0	0	0	0	0	0	Output Relay 1	0	2	FALSE
1	1	1	1	1	1	Output Relay 2	1	2	FALSE
2	2	2	2	2	2	Output Relay 3	2	2	FALSE
3	3	3	3	3	3	Output Relay 4	3	2	FALSE
4	4	4	4	4	4	Output Relay 5	4	2	FALSE
5	5	5	5	5	5	Output Relay 6	5	2	FALSE
6	6	6	6	6	6	Output Relay 7	6	2	FALSE
	7	7	7	7	7	Output Relay 8	7	2	FALSE
	8	8	8	8	8	Output Relay 9	8	2	FALSE
	9	9	9	9	9	Output Relay 10	9	2	FALSE
	10	10	10	10	10	Output Relay 11	10	2	FALSE
	11	11	11	11	11	Output Relay 12	11	2	FALSE
	12	12	12	12	12	Output Relay 13	12	2	FALSE
	13	13	13	13	13	Output Relay 14	13	2	FALSE
				14	14	Output Relay 15	14	2	FALSE
				15	15	Output Relay 16	15	2	FALSE
				16	16	Output Relay 17	16	2	FALSE
				17	17	Output Relay 18	17	2	FALSE
				18	18	Output Relay 19	18	2	FALSE
				19	19	Output Relay 20	19	2	FALSE
				20	20	Output Relay 21	20	2	FALSE
				21	21	Output Relay 22	21	2	FALSE
				22	22	Output Relay 23	22	2	FALSE
				23	23	Output Relay 24	23	2	FALSE
				24	24	Output Relay 25	24	2	FALSE
				25	25	Output Relay 26	25	2	FALSE
				26	26	Output Relay 27	26	2	FALSE
				27	27	Output Relay 28	27	2	FALSE
				28	28	Output Relay 29	28	2	FALSE
				29	29	Output Relay 30	29	2	FALSE
				30	30	Output Relay 31	30	2	FALSE
				31	31	Output Relay 32	31	2	FALSE
						Opto Isolator Status			
7	14	14	14	32	32	Opto Isolator Input 1	32	2	FALSE
8	15	15	15	33	33	Opto Isolator Input 2	33	2	FALSE
9	16	16	16	34	34	Opto Isolator Input 3	34	2	FALSE
10	17	17	17	35	35	Opto Isolator Input 4	35	2	FALSE
11	18	18	18	36	36	Opto Isolator Input 5	36	2	FALSE
12	19	19	19	37	37	Opto Isolator Input 6	37	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
13	20	20	20	38	38	Opto Isolator Input 7	38	2	FALSE
14	21	21	21	39	39	Opto Isolator Input 8	39	2	FALSE
	22	22	22	40	40	Opto Isolator Input 9	40	2	FALSE
	23	23	23	41	41	Opto Isolator Input 10	41	2	FALSE
	24	24	24	42	42	Opto Isolator Input 11	42	2	FALSE
	25	25	25	43	43	Opto Isolator Input 12	43	2	FALSE
	26	26	26	44	44	Opto Isolator Input 13	44	2	FALSE
	27	27	27	45	45	Opto Isolator Input 14	45	2	FALSE
	28	28	28	46	46	Opto Isolator Input 15	46	2	FALSE
	29	29	29	47	47	Opto Isolator Input 16	47	2	FALSE
				48	48	Opto Isolator Input 17	48	2	FALSE
				49	49	Opto Isolator Input 18	49	2	FALSE
				50	50	Opto Isolator Input 19	50	2	FALSE
				51	51	Opto Isolator Input 20	51	2	FALSE
				52	52	Opto Isolator Input 21	52	2	FALSE
				53	53	Opto Isolator Input 22	53	2	FALSE
				54	54	Opto Isolator Input 23	54	2	FALSE
				55	55	Opto Isolator Input 24	55	2	FALSE
						Alarm Indications			
15	30	30	30	56	56	Field Voltage Fail	547	2	FALSE
16	31	31	31	57	57	Setting Group Via Opto Invalid	145	2	FALSE
17	32	32	32	58	58	Test Mode Enabled	146	2	FALSE
		33	33	59	59	VTS Indication	147	2	FALSE
		34	34	60	60	Power Swing	148	2	FALSE
18	33	35	35	61	61	BF Block	149	2	FALSE
19	34	36		62		Broken Current Alarm	150	2	FALSE
20	35	37		63		Broken Current lookout	151	2	FALSE
21	36	38		64		Maintenance Alarm	152	2	FALSE
22	37	39		65		Maintenance Lockout	153	2	FALSE
23	38	40		66		Excessive Op Time Alarm	154	2	FALSE
24	39	41		67		Excessive Op Time Lockout	155	2	FALSE
25	40	42		68		EFF Lockout	156	2	FALSE
26	41	43	36	69	62	CB Alarm Status	619	2	FALSE
			37		63	CB Alarm Status 2	620	2	FALSE
27	42	44	38	70	64	CB Failed to Trip	159	2	FALSE
28	43	45	39	71	65	CB Failed to Close	160	2	FALSE
29	44	46	40	72	66	Control CB Unhealthy	161	2	FALSE
		47		73		Control No Checksync	162	2	FALSE
	45	48		74		Autoclose Locout/RLY BAR	163	2	FALSE
			41		67	CB2 Fail Alarm	163	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
	46	49		75		No Healthy (AR)	164	2	FALSE
		50		76		No Check Sync /AR Fail	165	2	FALSE
30	47	51	42	77	68	Incompatible relays	166	2	FALSE
31	48	52	43	78	69	Loop Back Test Enabled	167	2	FALSE
32	49	53	44	79	70	Signalling failure alarm	168	2	FALSE
33	50	54	45	80	71	Signalling Propagation Delay Alarm	169	2	FALSE
34	51	55	46	81	72	Differential protection failure alarm	170	2	FALSE
35	52	56	47	82	73	Diff Protection inhibited	171	2	FALSE
36	53	57	48	83	74	Configuration Error	172	2	FALSE
37	54	58	59	84	75	Re-Configuration Error	173	2	FALSE
38	55	59	60	85	76	Frequency out of range	174	2	FALSE
				86	77	GPS Alarm	158	2	FALSE
				87	78	Ch1 GPS Fail	606	2	FALSE
				88	79	Ch 2 GPS Fail	607	2	FALSE
						Miscellaneous Indications			
39	56	60	51	89	80	Battery Status	N/A	2	FALSE
40	57	61	52	90	81	IRIG-B Status	N/A	2	FALSE
						Protection Events (Digital Databus Signals)			
41	58	62	53	91	82	Any Trip	350	2	FALSE
42	59	63	54	92	83	Differential Trip	351	2	FALSE
43	60	64	55	93	84	Differential Trip A	352	2	FALSE
44	61	65	56	94	85	Differential Trip B	353	2	FALSE
45	62	66	57	95	86	Differential Trip C	354	2	FALSE
		67		96		Pole Discrepancy	376	2	FALSE
46	63	68	58	97	87	Differential Intertrip	355	2	FALSE
47	64	69	59	98	88	Differential Intertrip A	356	2	FALSE
48	65	70	60	99	89	Differential Intertrip B	357	2	FALSE
49	66	71	61	100	90	Differential Intertrip C	358	2	FALSE
50	67	72	62	101	91	Direct Intertrip	359	2	FALSE
51	68	73	63	102	92	Permissive Intertrip	360	2	FALSE
		74	64	103	93	Zone 1 Trip	361	2	FALSE
		75	65	104	94	Zone 1 A Trip	362	2	FALSE
		76	66	105	95	Zone 1 B Trip	363	2	FALSE
		77	67	106	96	Zone 1 C Trip	364	2	FALSE
		78	68	107	97	Zone 1 N Trip	365	2	FALSE
		79	69	108	98	Zone 2 Trip	366	2	FALSE
		80	70	109	99	Zone 2 A Trip	367	2	FALSE
		81	71	110	100	Zone 2 B Trip	368	2	FALSE
		82	72	111	101	Zone 2 C Trip	369	2	FALSE
		83	73	112	102	Zone 2 N Trip	370	2	FALSE
		84	74	113	103	Zone 3 Trip	371	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
		85	75	114	104	Zone 3 A Trip	372	2	FALSE
		86	76	115	105	Zone 3 B Trip	373	2	FALSE
		87	77	116	106	Zone 3 C Trip	374	2	FALSE
		88	78	117	107	Zone 3 N Trip	375	2	FALSE
52	69	89	79	118	108	BU Intertrip	377	2	FALSE
53	70	90	80	119	109	BU Intertrip A	378	2	FALSE
54	71	91	81	120	110	BU Intertrip B	379	2	FALSE
55	72	92	82	121	111	BU Intertrip C	380	2	FALSE
		93	83	122	112	Force 3pole BU	381	2	FALSE
56	73	94	84	123	113	1st Stage O/C Trip 3ph	382	2	FALSE
57	74	95	85	124	114	1st Stage O/C Trip A	383	2	FALSE
58	75	95	86	125	115	1st Stage O/C Trip B	384	2	FALSE
59	76	97	87	126	116	1st Stage O/C Trip C	385	2	FALSE
60	77	98	88	127	117	2nd Stage O/C Trip 3ph	386	2	FALSE
61	78	99	89	128	118	2nd Stage O/C Trip A	387	2	FALSE
62	79	100	90	129	119	2nd Stage O/C Trip B	388	2	FALSE
63	80	101	91	130	120	2nd Stage O/C Trip C	389	2	FALSE
64	81	102	92	131	121	3rd Stage O/C Trip 3ph	390	2	FALSE
65	82	103	93	132	122	3rd Stage O/C Trip A	391	2	FALSE
66	83	104	94	133	123	3rd Stage O/C Trip B	392	2	FALSE
67	84	105	95	134	124	3rd Stage O/C Trip C	393	2	FALSE
68	85	106	96	135	125	4th Stage O/C Trip 3ph	394	2	FALSE
69	86	107	97	136	126	4th Stage O/C Trip A	395	2	FALSE
70	87	108	98	137	127	4th Stage O/C Trip B	396	2	FALSE
71	88	109	99	138	128	4th Stage O/C Trip C	397	2	FALSE
72	89	110	100	139	129	1st Stage SBEF Trip	398	2	FALSE
73	90	111	101	140	130	2nd Stage SBEF Trip	399	2	FALSE
74	91	112	102	141	131	3rd Stage SBEF Trip	400	2	FALSE
75	92	113	103	142	132	4th Stage SBEF Trip	401	2	FALSE
		114	104	143	133	1st Stage SEF Trip	402	2	FALSE
		115	105	144	134	2nd Stage SEF Trip	403	2	FALSE
		116	106	145	135	3rd Stage SEF Trip	404	2	FALSE
		117	107	146	136	4th Stage SEF Trip	405	2	FALSE
76	93	118	108	147	137	Broken Conductor Trip	406	2	FALSE
77	94	119	109	148	138	Thermal Overload Trip	407	2	FALSE
			110		139	Stub Bus Trip	408	2	FALSE
78	95	120	111	149	140	Any Start	434	2	FALSE
79	96	121	112	150	141	Differential Start A	435	2	FALSE
80	97	122	113	151	142	Differential Start B	436	2	FALSE
81	98	123	114	152	143	Differential Start C	437	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
		124	115	153	144	Zone 1 A Start	438	2	FALSE
		125	116	154	145	Zone 1 B Start	439	2	FALSE
		126	117	155	146	Zone 1 C Start	440	2	FALSE
		127	118	156	147	Zone 1 N Start	441	2	FALSE
		128	119	157	148	Zone 2 A Start	442	2	FALSE
		129	120	158	149	Zone 2 B Start	443	2	FALSE
		130	121	159	150	Zone 2 C Start	444	2	FALSE
		131	122	160	151	Zone 2 N Start	445	2	FALSE
		132	123	161	152	Zone 3 A Start	446	2	FALSE
		133	124	162	153	Zone 3 B Start	447	2	FALSE
		134	125	163	154	Zone 3 C Start	448	2	FALSE
		135	126	164	155	Zone 3 N Start	449	2	FALSE
		136	127	165	156	Zone 6 Start	450	2	FALSE
82	99	137	128	166	157	1st Stage O/C Start 3ph	451	2	FALSE
83	100	138	129	167	158	1st Stage O/C Start A	452	2	FALSE
84	101	139	130	168	159	1st Stage O/C Start B	453	2	FALSE
85	102	140	131	169	160	1st Stage O/C Stage C	454	2	FALSE
86	103	141	132	170	161	2nd Stage O/C Start 3ph	455	2	FALSE
87	104	142	133	171	162	2nd Stage O/C Start A	456	2	FALSE
88	105	143	134	172	163	2nd Stage O/C Start B	457	2	FALSE
89	106	144	135	173	164	2nd Stage O/C Start C	458	2	FALSE
90	107	145	136	174	165	3rd Stage O/C Start 3ph	459	2	FALSE
91	108	146	137	175	166	3rd Stage O/C Start A	460	2	FALSE
92	109	147	138	176	167	3rd Stage O/C Start B	461	2	FALSE
93	110	148	139	177	168	3rd Stage O/C Start C	462	2	FALSE
94	111	149	140	178	169	4th Stage O/C Start 3ph	463	2	FALSE
95	112	150	141	179	170	4th Stage O/C Start A	464	2	FALSE
96	113	151	142	480	171	4th Stage O/C Start B	465	2	FALSE
97	114	152	143	181	172	4th Stage O/C Start C	466	2	FALSE
98	115	153	144	182	173	1st Stage SBEF Start	467	2	FALSE
99	116	154	145	183	174	2nd Stage SBEF Start	468	2	FALSE
100	117	155	146	184	175	3rd Stage SBEF Start	469	2	FALSE
101	118	156	147	185	176	4th Stage SBEF Start	470	2	FALSE
		157	148	186	177	1st Stage SEF Start	471	2	FALSE
		158	149	187	178	2nd Stage SEF Start	472	2	FALSE
		159	150	188	179	3rd Stage SEF Start	473	2	FALSE
		160	151	189	180	4th Stage SEF Start	474	2	FALSE
102	119	161	152	190	181	Thermal Overload Alarm	475	2	FALSE
103	120	162	153	191	182	tBF1 Trip 3ph	520	2	FALSE
104	121	163	154	192	183	tBF2 Trip 3ph	521	2	FALSE
105	122	164	155	193	184	Control Trip	524	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
106	123	165	156	194	185	Control Close	525	2	FALSE
			157		183	Control Trip 2	526	2	FALSE
			158		187	Control Close 2	527	2	FALSE
107	124	166	159	195	188	Control Close in Progress	528	2	FALSE
	125					AR Block Main Protection	529	2	FALSE
			160		189	CB2 Fail1 Trip	522	2	FALSE
	126					AR Block Main Protection	530	2	FALSE
			161		190	CB2 Fail2 Trip	523	2	FALSE
	127	167		196		Auto Reclose/(AR 3 pole) in Progress	531	2	FALSE
		168		197		AR 1pole in progress	532	2	FALSE
	128	169		198		Seq Counter = 1	534	2	FALSE
	129	170		199		Seq Counter = 2	535	2	FALSE
	130	171		200		Seq Counter = 3	536	2	FALSE
	131	172		201		Seq Counter = 4	537	2	FALSE
	132	173		202		Successful Reclosure	539	2	FALSE
	133					Dead Time in progress	540	2	FALSE
	134	174		203		Auto Close/AR Close	541	2	FALSE
	135	175		204		Autoreclose trip test	409	2	FALSE
		176		205		Autoreclose trip test A phase	410	2	FALSE
		177		206		Autoreclose trip test B phase	411	2	FALSE
		178		207		Autoreclose trip test C phase	412	2	FALSE
		179		208		Autoreclose In/Out of service	544	2	FALSE
108	136	180	163	209	191	Protection Signaling Failure Alarm – Ch1 Rx	602	2	FALSE
109	137	181	164	210	192	Protection Signaling Failure Alarm – Ch1 Tx	603	2	FALSE
110	138	182	165	211	193	Protection Signaling Failure Alarm – Ch2 Rx	604	2	FALSE
111	139	183	166	212	194	Protection Signaling Failure Alarm – Ch2 Tx	605	2	FALSE
112	140	184	166	213	195	Relay is already configured	608	2	FALSE
113	141	185	167	214	196	Reconfigure was successful	609	2	FALSE
114	142	186	168	215	197	Reconfigure was unsuccessful	610	2	FALSE
115	143	187	169	216	198	Restore was successful	611	2	FALSE
116	144	188	170	217	199	Restore was unsuccessful	612	2	FALSE
117	145	189	171	218	200	Inhibit C Diff	613	2	FALSE
118	146	190	172	219	201	Backup Enabled	766	2	FALSE
119	147	191	173	220	202	I>3 Intertrip	614	2	FALSE
		192	174	221	203	Z1 Intertrip	615	2	FALSE
		193	175	222	204	Z2 Intertrip	616	2	FALSE
		194	176	223	205	Z3 Intertrip	617	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
		195	177	224	206	1 Pole Trip En	618	2	FALSE
120	148	196		225		Composite Lockout Alarm	546	2	FALSE
	149					Autoreclose In/Out of service	542	2	FALSE
		197		226		Autoreclose In/Out of service	543	2	FALSE
		198		227		Seq Counter = 5	538	2	FALSE
			178		207	2B1 IA< Start	552	2	FALSE
			179		208	CB1 IB< Start	553	2	FALSE
			180		209	CB1 IC< Start	554	2	FALSE
			181		210	CB1 ISEF< Start	555	2	FALSE
			182		211	CB2 IA<Start	556	2	FALSE
			183		212	CB2 IB< Start	557	2	FALSE
			184		213	CB2 IC< Start	558	2	FALSE
			185		214	CB2 ISEF< Start	559	2	FALSE
						CB Status			
121	150	199	186	228	215	3 ph CB Open	582	2	FALSE
		200	187	229	216	Ph A CB Open	583	2	FALSE
		201	188	230	217	Ph B CB Open	584	2	FALSE
		202	189	231	218	Ph C CB Open	585	2	FALSE
122	151	203	190	232	219	3 ph CB Closed	586	2	FALSE
		204	191	233	220	Ph A CB Closed	587	2	FALSE
		205	192	234	221	Ph B CB Closed	588	2	FALSE
		206	193	235	222	Ph C CB Closed	589	2	FALSE
			194		223	3 ph CB 2 Open	590	2	FALSE
			195		224	Ph A CB2 Open	591	2	FALSE
			196		225	Ph B CB 2 Open	592	2	FALSE
			197		226	Ph C CB 2 Open	593	2	FALSE
			198		227	3 ph CB2 Closed	594	2	FALSE
			199		228	Ph A CB2 Closed	595	2	FALSE
			200		229	Ph B CB2 Closed	596	2	FALSE
			201		230	Ph C CB2 Closed	597	2	FALSE
123	152	207	202	236	231	IA< operate	548	2	FALSE
124	153	208	203	237	232	IB< operate	549	2	FALSE
125	154	209	204	238	233	IC< operate	550	2	FALSE
126	155	210	205	239	234	ISEF< operate	551	2	FALSE
127	156	211	206	240	235	All Poles Dead	560	2	FALSE
128	157	212	207	241	236	Any Pole Dead	561	2	FALSE
		213	208	242	237	Phase A Pole Dead	562	2	FALSE
		214	209	243	238	Phase B Pole Dead	563	2	FALSE
		215	210	244	239	Phase C Pole Dead	564	2	FALSE
129	158	216	211	245	240	Unused	203	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
130	159	217	212	246	241	Unused	204	2	FALSE
131	160	218	213	247	242	Unused	205	2	FALSE
132	161	219	214	248	243	Unused	206	2	FALSE
133	162	220	215	249	244	Not Used	175	2	FALSE
134	163	221	216	250	245	Not Used	176	2	FALSE
135	164	222	217	251	246	Not Used	177	2	FALSE
136	165	223	218	252	247	Not Used	178	2	FALSE
137	166	224	219	253	248	Not Used	179	2	FALSE
138	167	225	220	254	249	Not Used	180	2	FALSE
139	168	226	221	255	250	Not Used	181	2	FALSE
140	169	227	222	256	251	Not Used	182	2	FALSE
141	170	228	223	257	252	Not Used	183	2	FALSE
142	171	229	224	258	253	C Diff Protection Comms Mode	184	2	FALSE
143	172	230	225	259	254	IEEE 37.94 Communications Alarms	185	2	FALSE
144	173	231	226	260	255	System Split / Not Used	186	2	FALSE
145	174	232	227	261	256	SR User Alarm 1	187	2	FALSE
146	175	233	228	262	257	SR User Alarm 2	188	2	FALSE
147	176	234	229	263	258	SR User Alarm 3	189	2	FALSE
148	177	235	230	264	259	SR User Alarm 4	190	2	FALSE
149	178	236	231	265	260	SR User Alarm 5	191	2	FALSE
150	179	237	232	266	261	SR User Alarm 6	192	2	FALSE
151	180	238	233	267	262	SR User Alarm 7	193	2	FALSE
152	181	239	234	268	263	SR User Alarm 8	194	2	FALSE
153	182	240	235	269	264	MR User Alarm 9	195	2	FALSE
154	183	241	236	270	265	MR User Alarm 10	196	2	FALSE
155	184	242	237	271	266	MR User Alarm 11	197	2	FALSE
156	185	243	238	272	267	MR User Alarm 12	198	2	FALSE
157	186	244	239	273	268	MR User Alarm 13	199	2	FALSE
158	187	245	240	274	269	MR User Alarm 14	200	2	FALSE
159	188	246	241	275	270	MR User Alarm 15	201	2	FALSE
160	189	247	242	276	271	MR User Alarm 16	202	2	FALSE
		248	243	277	272	Zone 1 Start	430	2	FALSE
		249	244	278	273	Zone 2 Start	431	2	FALSE
		250	245	279	274	Zone 3 Start	432	2	FALSE
161	190	251	246	280	275	Differential Start	433	2	FALSE
162	191	252	247	281	276	Virtual Input 1	672	2	FALSE
163	192	253	248	282	277	Virtual Input 2	673	2	FALSE
164	193	254	249	283	278	Virtual Input 3	674	2	FALSE
165	194	255	250	284	279	Virtual Input 4	675	2	FALSE
166	195	256	251	285	280	Virtual Input 5	676	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
167	196	257	252	286	281	Virtual Input 6	677	2	FALSE
168	197	258	253	287	282	Virtual Input 7	678	2	FALSE
169	198	259	254	288	283	Virtual Input 8	679	2	FALSE
170	199	260	255	289	284	Virtual Input 9	680	2	FALSE
171	200	261	256	290	285	Virtual Input 10	681	2	FALSE
172	201	262	257	291	286	Virtual Input 11	682	2	FALSE
173	202	263	258	292	287	Virtual Input 12	683	2	FALSE
174	203	264	259	293	288	Virtual Input 13	684	2	FALSE
175	204	265	260	294	289	Virtual Input 14	685	2	FALSE
176	205	266	261	295	290	Virtual Input 15	686	2	FALSE
177	206	267	262	296	291	Virtual Input 16	687	2	FALSE
178	207	268	263	297	292	Virtual Input 17	688	2	FALSE
179	208	269	264	298	293	Virtual Input 18	689	2	FALSE
180	209	270	265	299	294	Virtual Input 19	690	2	FALSE
181	210	271	266	300	295	Virtual Input 20	691	2	FALSE
182	211	272	267	301	296	Virtual Input 21	692	2	FALSE
183	212	273	268	302	297	Virtual Input 22	693	2	FALSE
184	213	274	269	303	298	Virtual Input 23	694	2	FALSE
185	214	275	270	304	299	Virtual Input 24	695	2	FALSE
186	215	276	271	305	300	Virtual Input 25	696	2	FALSE
187	216	277	272	306	301	Virtual Input 26	697	2	FALSE
188	217	278	273	307	302	Virtual Input 27	698	2	FALSE
189	218	279	274	308	303	Virtual Input 28	699	2	FALSE
190	219	280	275	309	304	Virtual Input 29	700	2	FALSE
191	220	281	276	310	305	Virtual Input 30	701	2	FALSE
192	221	282	277	311	306	Virtual Input 31	702	2	FALSE
193	222	283	278	312	307	Virtual Input 32	703	2	FALSE
194	223	284	279	313	308	Virtual Output 1	704	2	FALSE
195	224	285	280	314	309	Virtual Output 2	705	2	FALSE
196	225	286	281	315	310	Virtual Output 3	706	2	FALSE
197	226	287	282	316	311	Virtual Output 4	707	2	FALSE
198	227	288	283	317	312	Virtual Output 5	708	2	FALSE
199	228	289	284	318	313	Virtual Output 6	709	2	FALSE
200	229	290	285	319	314	Virtual Output 7	710	2	FALSE
201	230	291	286	320	315	Virtual Output 8	711	2	FALSE
202	231	292	287	321	316	Virtual Output 9	712	2	FALSE
203	232	293	288	322	317	Virtual Output10	713	2	FALSE
204	233	294	289	323	318	Virtual Output11	714	2	FALSE
205	234	295	290	324	319	Virtual Output12	715	2	FALSE
206	235	296	291	325	320	Virtual Output13	716	2	FALSE
207	236	297	292	326	321	Virtual Output14	717	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
208	237	298	293	327	322	Virtual Output15	718	2	FALSE
209	238	299	294	328	323	Virtual Output16	719	2	FALSE
210	239	300	295	329	324	Virtual Output17	720	2	FALSE
211	240	301	296	330	325	Virtual Output18	721	2	FALSE
212	241	302	297	331	326	Virtual Output19	722	2	FALSE
213	242	303	298	332	327	Virtual Output20	723	2	FALSE
214	243	304	299	333	328	Virtual Output21	724	2	FALSE
215	244	305	300	334	329	Virtual Output22	725	2	FALSE
216	245	306	301	335	330	Virtual Output23	726	2	FALSE
217	246	307	302	336	331	Virtual Output24	727	2	FALSE
218	247	308	303	337	332	Virtual Output25	728	2	FALSE
219	248	309	304	338	333	Virtual Output26	729	2	FALSE
220	249	310	305	339	334	Virtual Output27	730	2	FALSE
221	250	311	306	340	335	Virtual Output28	731	2	FALSE
222	251	312	307	341	336	Virtual Output29	732	2	FALSE
223	252	313	308	342	337	Virtual Output30	733	2	FALSE
224	253	314	309	343	338	Virtual Output31	734	2	FALSE
225	254	315	310	344	339	Virtual Output32	735	2	FALSE
226	255	316	311	345	340	Battery Fail	487	2	FALSE
227	256	317	312	346	341	Not Used	488	2	FALSE
228	257	318	313	347	342	GOOSE IED Absent	489	2	FALSE
229	258	319	314	348	343	NIC Not Fitted	490	2	FALSE
230	259	320	315	349	344	NIC No Response	491	2	FALSE
231	260	321	316	350	345	NIC Fatal Error	492	2	FALSE
232	261	322	317	351	346	NIC Soft. Reload	493	2	FALSE
233	262	323	318	352	347	Bad TCP/IP Cfg.	494	2	FALSE
234	263	324	319	353	348	Bad OSI Config.	495	2	FALSE
235	264	325	320	354	349	NIC Link Fail	496	2	FALSE
236	265	326	321	355	350	NIC SW Mis-Match	497	2	FALSE
237	266	327	322	356	351	IP Addr Conflict	498	2	FALSE
238	267	328	323	357	352	Not Used	499	2	FALSE
239	268	329	324	358	353	Not Used	500	2	FALSE
240	269	330	325	359	354	Not Used	501	2	FALSE
241	270	331	326	360	355	Not Used	502	2	FALSE
242	271	332	327	361	356	Backup Setting	503	2	FALSE
243	272	333	328	362	357	Not Used	504	2	FALSE
244	273	334	329	363	358	Not Used	505	2	FALSE
245	274	335	330	364	359	Not Used	506	2	FALSE
246	275	336	331	365	360	Not Used	507	2	FALSE
247	276	337	332	366	361	Not Used	508	2	FALSE
248	277	338	333	367	362	Not Used	509	2	FALSE

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description		Change Event Assigned Class (1, 2, 3)	Initial Va,ue
249	278	339	334	368	363	Not Used	510	2	FALSE
250	279	340	335	369	364	Not Used	511	2	FALSE
251	280	341	336	370	365	Not Used	512	2	FALSE
252	281	342	337	371	366	Not Used	513	2	FALSE
253	282	343	338	372	367	Not Used	514	2	FALSE
254	283	344	339	373	368	Not Used	515	2	FALSE
255	284	345	340	374	369	Not Used	516	2	FALSE
256	285	346	341	375	370	Not Used	517	2	FALSE
257	286	347	342	376	371	Ch1 loss of Signal	654	2	FALSE
258	287	348	343	377	372	Ch1 Path “Yellow”	655	2	FALSE
259	288	349	344	378	373	Ch1 Mismatch Received N	656	2	FALSE
260	289	350	345	379	374	Ch2 Loss of Signal	657	2	FALSE
261	290	351	346	380	375	Ch2 Path “Yellow”	658	2	FALSE
262	291	352	347	381	376	Ch2 Mismatch Received N	659	2	FALSE

4.2 Binary output status points and control relay output block

The following table lists both the Binary Output Status Points (Object 10) and the Control Relay Output Block (Object 12).

Binary Output Status points are included in Class 0 data set. (Since there is not a change-event object for the binary outputs, the binary output points are not part of the class 1, 2, or 3 data sets). It is not possible to configure the class 0 membership of this object with MiCOM S1.

The validity of each point is reported through the “online” bit in the “flag”, which is supplied for each point with the “with flag” object variations. Points reported as being offline, will typically be points that are invalid for the relay’s current configuration, which is a product of its model number and current settings.

The Control Relay Output Block (CROB) implementation is compliant with the DNP technical bulletin TB2000-006, which rescinds CROB behaviours specified in the original four document set and addendum sub-set documents.

The following text is a brief summary of DNP technical bulletin TB2000-006:

Each control point in the CROB may be either a "complimentary control function" or a "single function".

Examples of complimentary control functions are:

- Trip and close
- On and Off

Examples of single-function controls are:

- Trip
- Activate

A point index cannot support both complimentary and single-function methods of operation.

Complimentary control function points require the use of a complementary control-code pair. The CROB provides two sets of control pairs:

- Code 03_{16} "Latch On" and code 04_{16} "Latch Off"
- Code 41_{16} "Pulse On/Close" and code 81_{16} "Pulse On/Trip"

In DNP there is no significance to these codes; they do the same thing. A complimentary-control point may "permit" either or both of these pairs. If a point permits both pairs of codes then:

- Latch On and Pulse Close must perform the same function
- Latch Off and Pulse Trip must perform the same function

Single-function control points may permit one or more of the following control codes:

- Code 01_{16} "Pulse On"
- Code 03_{16} "Latch On"
- Code 04_{16} "Latch Off"
- Code 41_{16} "Pulse On/Close
- Code 81_{16} "Pulse On/Trip"

There is no significance to these codes; they do the same thing. Each of the permitted single-function codes must perform the same function on a given single-function point index.

The original DNP 3.0 specification for the CROB "exposes the details of the device hardware to the protocol stack. This is unnecessary and creates interoperability issues". Moreover, "some IED vendors have implemented points that do different things based on the control code that is sent. " E.g. a point latches for the latch codes and pulses for the pulse codes. "This perverts the original intent of the CROB and makes it impossible for masters that statically configure control codes to be interoperable with such [IEDs]. This type of implementation is also not transportable across legacy protocol boundaries."

In the following table, point indices that are marked as “unpaired” will accept the correspondingly marked control codes and treat them identically as a “trigger” for the command action associated with the point. Unpaired points do not have a state value that can be read and a read request, whilst completing successfully, will always return a value of zero.

Points that are marked as “paired” behave as complimentary-controls and have a state value that can be read. The Latch On and Pulse On/Close control-codes set the specified output status point whilst the Latch Off and Pulse On/Trip codes reset it.

The Count field is not supported and must be either zero or one. The On-time, and Off-time fields are ignored. The Queue and Clear bits in the Control-Code field are not supported and must be zero. The “Pulse Off” control-code code is not supported.

Binary Output Status Points
Object Number: **10**
Request Function Code supported: **1 (read)**
Default Variation reported when variation 0 requested: **2 (Binary Output Status)**
Control Relay Output Blocks (CROB)
Object Number: **12**
Request Function Code supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, no ack)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Supported Control Relay Output Block Fields
						Activate Setting Groups	
0	0	0	0	0	0	Activate Setting Group 1	Note 1
1	1	1	1	1	1	Activate Setting Group 2	Note 1
2	2	2	2	2	2	Activate Setting Group 3	Note 1
3	3	3	3	3	3	Activate Setting Group 4	Note 1
						Controls	
4	4	4	4	4	4	CB Trip	Note 1
5	5	5	5	5	5	CB Close	Note 1
6	6	6	6	6	6	Reset Indication	Note 1
7	7	7	7	7	7	Reset Demand	Note 1
8	8	8	8	8	8	Reset Thermal	Note 1
9	9	9	9	9	9	Clear Events	Note 1
10	10	10	10	10	10	Clear Faults	Note 1
11	11	11	11	11	11	Clear Maint	Note 1
12	12	12	12	12	12	Test LEDs	Note 1
	13	13		13		Test Autoreclose – 3 phase	Note 1
		14		14		Test Autoreclose – Phase A	Note 1
		15		15		Test Autoreclose – Phase B	Note 1
		16		16		Test Autoreclose – Phase C	Note 1
	14	17		17		LockoutReset	Note 1
	15	18		18		Reset Total A/R	Note 1
13	16	19		19		Reset CB Data	Note 1
	17					AR Telecontrol Auto	Note 1
	18					AR Telecontrol Non-Auto	Note 1
14	19	20	13	20	13	Clear Statistics	Note 1
			14		14	CB Trip 2	Note 1
			15		15	CB Close 2	Note 1
15	20	21	16	21	16	Control Input 1	Note 2
16	21	22	17	22	17	Control Input 2	Note 2
17	22	23	18	23	18	Control Input 3	Note 2
18	23	24	19	24	19	Control Input 4	Note 2
19	24	25	20	25	20	Control Input 5	Note 2
20	25	26	21	26	21	Control Input 6	Note 2
21	26	27	22	27	22	Control Input 7	Note 2
22	27	28	23	28	23	Control Input 8	Note 2
23	28	29	24	29	24	Control Input 9	Note 2
24	29	30	25	30	25	Control Input 10	Note 2
25	30	31	26	31	26	Control Input 11	Note 2
26	31	32	27	32	27	Control Input 12	Note 2
27	32	33	28	33	28	Control Input 13	Note 2

Binary Output Status Points
Object Number: **10**
Request Function Code supported: **1 (read)**
Default Variation reported when variation 0 requested: **2 (Binary Output Status)**
Control Relay Output Blocks (CROB)
Object Number: **12**
Request Function Code supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, no ack)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Supported Control Relay Output Block Fields
28	33	33	29	34	29	Control Input 14	Note 2
29	34	34	30	35	30	Control Input 15	Note 2
30	35	35	31	36	31	Control Input 16	Note 2
31	36	36	32	37	32	Control Input 17	Note 2
32	37	37	33	38	33	Control Input 18	Note 2
33	38	38	34	39	34	Control Input 19	Note 2
34	39	39	35	40	35	Control Input 20	Note 2
35	40	40	36	41	36	Control Input 21	Note 2
36	41	41	37	42	37	Control Input 22	Note 2
37	42	42	38	43	38	Control Input 23	Note 2
38	43	43	39	44	39	Control Input 24	Note 2
39	44	44	40	45	40	Control Input 25	Note 2
40	45	45	41	46	41	Control Input 26	Note 2
41	46	46	42	47	42	Control Input 27	Note 2
42	47	47	43	48	43	Control Input 28	Note 2
43	48	48	44	49	44	Control Input 29	Note 2
44	49	49	45	50	45	Control Input 30	Note 2
45	50	50	46	51	46	Control Input 31	Note 2
46	51	52	47	52	47	Control Input 32	Note 2
47	52	53	48	53	48	Clear Disturbance Records	Note 1

Note 1: LATCH_ON and PULSE_ON operations are supported, although both have the same effect for these data points; the operation is carried out once.

Note 2: LATCH_ON and LATCH_OFF operations are supported. PULSE_ON is not supported. The queue, clear trip/close, on time and off time fields are ignored. A read of these points through object 10 will always return zero.

4.3 Counters

The following table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point.

By default the Binary Counters (object 20) and Frozen Counters (object 21) are included in class 0 polls. The MiCOM S1 setting support software may be used to alter both of these assignments. (Since there is not a change-event object for the Binary Counters or Frozen Counters, the counter points are not part of the class 1, 2, or 3 data sets). However, deselecting a point from class 0 also has the effect of removing the point from the point-list of the associated object (20 or 21) and renumbering the remaining points to ensure the point indices are contiguous. Moreover, if a point is deselected from the running counter object (20) then it is also deselected from the frozen counter object (21).

The validity of each point is reported through the “online” bit in the “flag”, which is supplied for each point with the “with flag” object variations. Points reported as being offline, will typically be points that are invalid for the relay’s current configuration, which is a product of its model number and current settings.

Binary Counter Points
Static (Steady-State) Object Number: **20**
Request Function Code supported: **1 (read), 7 (freeze), 8 (freeze no ack), 9 (freeze no ack), 10 (freeze and clear, no ack)**
Static Variation reported when variation 0 requested: **5 (32-Bit Binary Counter without Flag)**
Change Event Variation reported when variation 0 requested: **none – not supported**
Frozen Counter Points
Static (Steady State) Object Number: **21**
Request Function Code supported: **1 (read)**
Static Variation reported when variation 0 requested: **9 (32-Bit Binary Counter without Flag)**
Change Event Variation reported when variation 0 requested: **none – not supported**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Data Type
						Activate Setting Groups	
		0	0	0	0	3Ph Whours Fwd	D10
		1	1	1	1	3Ph Whours Rev	D10
		2	2	2	2	3Ph VarHours Fwd	D10
		3	3	3	3	3Ph VarHours Rev	D10
0	0					CB Operations	
		4		4		CB A Operations	
		5		5		CB B Operations	
		6		6		CB C Operations	
	1	7		7		Total Reclosures	
1	2	8	4	8	4	Elapsed Time	
2	3	9	5	9	5	Ch1 No.Vald Mess	
3	4	10	6	10	6	Ch1 No.Err Mess	
4	5	11	7	11	7	Ch1 No.Errored s	
5	6	12	8	12	8	Ch1 No.Sev Err s	
6	7	13	9	13	9	Ch1 No.Dgraded m	
7	8	14	10	14	10	Ch2 No.Vald Mess	
8	9	15	11	15	11	Ch2 No.Err Mess	
9	10	16	12	16	12	Ch2 No.Errored s	
10	11	17	13	17	13	Ch2 No.Sev Err s	
11	12	18	14	18	14	Ch2 No Dgraded m	

4.4 Analog inputs

The following table lists the Analog Inputs (Object 30).

For each point, the “Data Type” code refers to the points scaling information in section §4.5; analog values are provided in a fixed-point integer format derived from the relay’s internal per-unit quantities. The scaling information associated with each data-type code, in section §4.5, will result in an equivalent secondary (i.e. relay input) value. Additional scaling will be required to produce the primary (i.e. power system) values.

By default, all the static object (object 30) points belong to the Class 0 data set. The “Default Deadband”, and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before an analog change event will be generated. The default allocation of the points in the change-event object (object 32) to a change-event class (1, 2, 3) is also indicated. The class 0, deadband, and event class values may be changed with the MiCOM S1 setting support software. However, deselecting a point from class 0 also has the effect of removing the point from the point-list of objects 30 & 32 and renumbering the remaining points to ensure the point indices are contiguous.

The validity of each point is reported through the “online” bit in the “flag”, which is supplied for each point with the “with flag” object variations. Points reported as being offline, will typically be points that are invalid for the relay’s current configuration, which is a product of its model number and current settings.

Analog Inputs	
Static (Steady State) Object Number:	**30**
Change Event Object Number:	**32**
Request Function Codes supported:	**1 (read)**
Static Variation reported when variation 0 requested:	**2 (16-Bit Analog Input)**
Change Event Variation reported when variation 0 requested:	**2 (16-Bit Analog Change Event without Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Data Type	Valid Range	Default Deadband	Default Change Event Class (1, 2, 3, or none)
						Active Group				
0	0	0	0	0	0	Active Group	D9	1 … 4	1	3
						Measurements 1				
1	1	1	1	1	1	IA Magnitude	D1	0.000…65.534	0.1	3
2	2	2	2	2	2	IA Phase Angle	D4	-180.00…+180.00	1	3
3	3	3	3	3	3	IB Magnitude	D1	0.000…65.534	0.1	3
4	4	4	4	4	4	IB Phase Angle	D4	-180.00…+180.00	1	3
5	5	5	5	5	5	IC Magnitude	D1	0.000…65.534	0.1	3
6	6	6	6	6	6	IC Phase Angle	D4	-180.00…+180.00	1	3
7	7	7	7	7	7	IN Measured Magnitude	D2	0.0000…2.0000	0.01	3
8	8	8	8	8	8	IN Measured Angle	D4	-180.00…+180.00	1	3
9	9	9	9	9	9	IN Derived Magnitude	D1	0.000…65.534	0.1	3
10	10	10	10	10	10	IN Derived Angle	D4	-180.00…+180.00	1	3
11	11	11	11	11	11	I1 Magnitude	D1	0.000…65.534	0.1	3
12	12	12	12	12	12	I2 Magnitude	D1	0.000…65.534	0.1	3
13	13	13	13	13	13	I0 Magnitude	D1	0.000…65.534	0.1	3
14	14	14	14	14	14	IA RMS	D1	0.000…65.534	0.1	3
15	15	15	15	15	15	IB RMS	D1	0.000…65.534	0.1	3
16	16	16	16	16	16	IC RMS	D1	0.000…65.534	0.1	3
		17	17	17	17	VAB Magnitude	D3	0.00…220.00	5	3
		18	18	18	18	VAB Phase Angle	D4	-180.00..+180.00	1	3

Analog Inputs
Static (Steady State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **2 (16-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **2 (16-Bit Analog Change Event without Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Data Type	Valid Range	Default Deadband	Default Change Event Class (1, 2, 3, or none)
		19	19	19	19	VBC Magnitude	D3	0.00…220.00	5	3
		20	20	20	20	VBC Phase Angle	D4	-180.00…+180.00	1	3
		21	21	21	21	VCA Magnitude	D3	0.00…220.00	5	3
		22	22	22	22	VBA Phase Angle	D4	-180.00…+180.00	1	3
		23	23	23	23	VAN Magnitude	D3	0.00…220.00	5	3
		24	24	24	24	VAN Phase Angle	D4	-180.00…+180.00	1	3
		25	25	25	25	VBN Magnitude	D3	0.00…220.00	5	3
		26	26	26	26	VBN Phase Angle	D4	-180.00…+180.00	1	3
		27	27	27	27	VCN Magnitude	D3	0.00…220.00	5	3
		28	28	28	28	VCN Phase Angle	D4	-180.00…+180.00	1	3
		29	29	29	29	V1 Magnitude	D3	0.00…220.00	5	3
		30	30	30	30	V2 Magnitude	D3	0.00…220.00	5	3
		31	31	31	31	V0 Magnitude	D3	0.00…220.00	5	3
		32	32	32	32	VAN RMS	D3	0.00…220.00	5	3
		33	33	33	33	VBN RMS	D3	0.00…220.00	5	3
		34	34	34	34	VCN RMS	D3	0.00…220.00	5	3
17	17	35	35	35	35	Frequency	D5	5.00…70.00	5	3
		36		36		C/S Voltage Mag	D3	0.00…220.00	5	3
		37		37		C/S Voltage Ang	D4	-180.00…+180.00	1	3
		38		38		C/S Bus-Line Ang	D3	-180.00…+180.00	1	3
		39		39		Sin Frequency	D5	5.00…70.00	0.5	3
		40	36	40	36	IM Magnitude	D1	0.000…65.534	0.1	3
		41	37	41	37	IM Phase Angle	D4	-180.00…+180.00	1	3
						Measurements 2				
		42	38	42	38	A Phase Watts	D6	-3150.0…+3150.0	1	3
		43	39	43	39	B Phase Watts	D6	-3150.0…+3150.0	1	3
		44	40	44	40	C Phase Watts	D6	-3150.0…+3150.0	1	3
		45	41	45	41	A Phase VArs	D6	-3150.0…+3150.0	1	3
		46	42	46	42	B Phase VArs	D6	-3150.0…+3150.0	1	3
		47	43	47	43	C Phase VArs	D6	-3150.0…+3150.0	1	3
		48	44	48	43	A Phase VA	D6	-3150.0…+3150.0	1	3
		49	45	49	45	B Phase VA	D6	-3150.0…+3150.0	1	3
		50	46	50	46	C Phase VA	D6	-3150.0…+3150.0	1	3
		51	47	51	47	3 Phase Watts	D6	-31,500…+31,500	1	3
		52	48	52	48	3 Phase VArs	D6	-31,500…+31,500	1	3
		53	49	53	49	3 Phase VA	D6	-31,500…+31,500	1	3
		54	50	54	50	3Ph Power Factor	D8	0.000…1.000	0.1	3
		55	51	55	51	APh Power Factor	D8	0.000…1.000	0.1	3
		56	52	56	52	BPh Power Factor	D8	0.000…1.000	0.1	3
		57	53	57	53	CPh Power Factor	D8	0.000…1.000	0.1	3

Analog Inputs
Static (Steady State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **2 (16-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **2 (16-Bit Analog Change Event without Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Data Type	Valid Range	Default Deadband	Default Change Event Class (1, 2, 3, or none)
		58	54	58	54	3Ph W Fix Demand	D6	-31,500…+31,500	1	3
		59	55	59	55	3Ph VArs Fix Demand	D6	-31,500…+31,500	1	3
18	18	60	56	60	56	IA Fixed Demand	D1	0.000…65.534	0.1	3
19	19	61	57	61	57	IB Fixed Demand	D1	0.000…65.534	0.1	3
20	20	62	58	62	58	IC Fixed Demand	D1	0.000…65.534	0.1	3
		63	59	63	59	3 Ph W Roll Demand	D6	-31,500…+31,500	1	3
		64	60	64	60	3 Ph VArs Roll Demand	D6	-31,500…+31,500	1	3
21	21	65	61	65	61	IA Roll Demand	D1	0.000…65.534	1	3
22	22	66	62	66	62	IB Roll Demand	D1	0.000…65.534	1	3
23	23	67	63	67	63	IC Roll Demand	D1	0.000…65.534	1	3
		68	64	68	64	3Ph W Peak Demand	D6	-31,500…+31,500	1	3
		69	65	69	65	3Ph VAr Peak Demand	D6	-31,500…+31,500	1	3
24	24	70	66	70	66	IA Peak Demand	D1	0.000…65.534	0.1	3
25	25	71	67	71	67	IB Peak Demand	D1	0.000…65.534	0.1	3
26	26	72	68	72	68	IC Peak Demand	D1	0.000…65.534	0.1	3
						Measurements 3				
27	27	73	69	73	69	IA Local	D1	0.000…65.534	0.1	3
28	28	74	70	74	70	IA Angle Local	D4	-180.00…+180.00	1	3
29	29	75	71	75	71	IB Local	D1	0.000…65.534	0.1	3
30	30	76	72	76	72	IB Angle Local	D4	-180.00…+180.00	1	3
31	31	77	73	77	73	IC Local	D1	0.000…65.534	0.1	3
32	32	78	74	78	74	IC Angle Local	D4	-180.00…+180.00	1	3
33	33	79	75	79	75	IA remote 1	D1	0.000…65.534	0.1	3
34	34	80	76	80	76	IA Ang remote 1	D4	-180.00…+180.00	1	3
35	35	81	77	81	77	IB remote 1	D1	0.000…65.534	0.1	3
36	36	82	78	82	78	IB Ang remote 1	D4	-180.00…+180.00	1	3
37	37	83	79	83	79	IC remote 1	D1	0.000…65.534	0.1	3
38	38	84	80	84	80	IC Ang remote 1	D4	-180.00…+180.00	1	3
39	39	85	81	85	81	IA remote 2	D1	0.000…65.534	0.1	3
40	40	86	82	86	82	IA Ang remote 2	D4	-180.00…+180.00	1	3
41	41	87	83	87	83	IB remote 2	D1	0.000…65.534	0.1	3
42	42	88	84	88	84	IB ANG remote 2	D4	-180.00…+180.00	1	3
43	43	89	85	89	85	IC remote 2	D1	0.000…65.534	0.1	3
44	44	90	86	90	86	IC Ang remote 2	D4	-180.00…+180.00	1	3
45	45	91	87	91	87	IA Differential	D1	0.000…65.534	0.1	3
46	46	92	88	92	88	IB Differential	D1	0.000…65.534	0.1	3
47	47	93	89	93	89	IC Differential	D1	0.000…65.534	0.1	3
48	48	94	90	94	90	IA Bias	D1	0.000…65.534	0.1	3

Analog Inputs
Static (Steady State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **2 (16-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **2 (16-Bit Analog Change Event without Time)**

P541 Point Index	P542 Point Index	P543 Point Index	P544 Point Index	P545 Point Index	P546 Point Index	Name/Description	Data Type	Valid Range	Default Deadband	Default Change Event Class (1, 2, 3, or none)
49	49	95	91	95	91	IB Bias	D1	0.000…65.534	0.1	3
50	50	96	92	96	92	IC Bias	D1	0.000…65.534	0.1	3
51	51	97	93	97	93	Thermal State	D7	0.00…327.67	10	3
						Measurements 4				
52	52	98	94	98	94	Ch 1 Prop Delay	D15	0.00000…0.32767	0.001	3
53	53	99	95	99	95	Ch 2 Prop Delay	D15	0.00000…0.32767	0.001	3
				100	96	Ch1 Rx Prop data	D15	0.00000…0.32767	0.001	3
				101	97	Ch1 Tx Prop data	D15	0.00000…0.32767	0.001	3
				102	98	Ch 2 Rx Prop data	D15	0.00000…0.32767	0.001	3
				103	99	Ch 2 Tx Prop data	D15	0.00000…0.32767	0.001	3

4.5 Data type codes

Data Type	Name/Description	Scaling	Default Change Event Deadband	Change Event Deadband MIN	Change Event Deadband MAX	Change Event Deadband STEP	Standard Numeric Range
D1	Standard Phase, RMS, & sequence current	x In / 500	0.1	0.05 In	64 In	0.01 In	0.000…65.534
D2	Sensitive currents	x In / 10,000	0.01	0.01 In	2 In	0.001 In	0.0000…2.0000
D3	Voltage	x Vn /(110 x 100)	5	0.1 Vn / 110	220 Vn / 110	0.1 Vn / 110	0.00…220.00
D4	Angle	x 0.01	1	0.1	180	0.1	-180.00…+180.00
D5	Frequency	x 0.01	0.5	0.1	70	0.1	5.00…70.00
D6	Power	x 0.1In .Vn / 110	1	0.1In .Vn / 110	3200 In .Vn / 110	0.1In .Vn / 110	-3150.0…+3150.0
D7	Percentage	x 0.01	10	0.1	320	0.1	0.00…327.67
D8	Power Factor	X 0.001	0.1	0.01	1	0.01	0.000…1.000
D9	Setting Group	x 1	1	1	4	1	1…4
D10	Energy	x In .Vn / 110		In .Vn / 110	32000 In .Vn / 110	In .Vn / 110	0…(2^31)-1
D11	Admittance (Standard current)	x (In / 1000).(110 / Vn)	0.1	(0.01 In).(110 / Vn)	32 In .(110 / Vn)	(0.01 In).(110 / Vn)	-7.040...+7.040
D12	Admittance (Sensitive current)	x (In / 10000).(110 / Vn)	0.01	(0.001 In).(110 / Vn)	2 In .(110 / Vn)	(0.001 In).(110 / Vn)	-0.0220…+0.0220
D13	Time (minutes)	x 0.01	5	1	30	0.5	0.00…327.67
D14	Temperature	x 0.1	1	0.1	300	0.1	-40.0…300.0
D15	Time (seconds)	x 0.00001	0.001	0.0001	0.03	0	0.0000…0.32767
D16	CLIO Input value	x 0.1	10	0.1	9999	0.1	-9999.9…+9999.9

Notes:

1. Type D6 can represent Watts, VArs or VA; the exact unit applied depends on the description of the item.
2. The default change event deadband is used unless specified otherwise in the point list.
3. The scaling value represents the multiplier required at the master station.
4. In and Vn represent the rated current and rated voltage respectively.

UCA 2.0

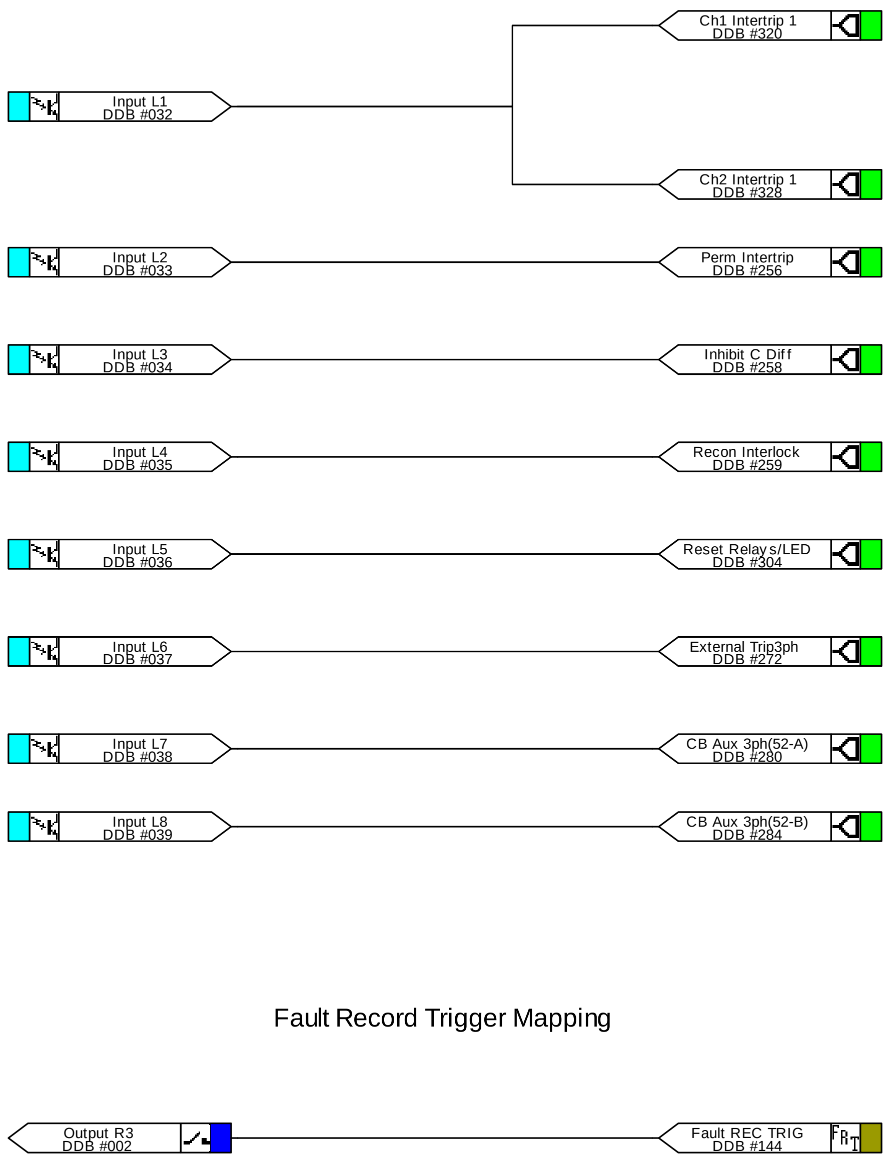
PROTOCOL IMPLEMENTATION & CONFORMANCE STATEMENT (PICS)

Vendor Name: **Alstom Grid – Automation & Information**
Device Name: **P540 DIFFERENTIAL PROTECTION Relay**, Model numbers:
P541, P542, P543, P544, P545 & P546

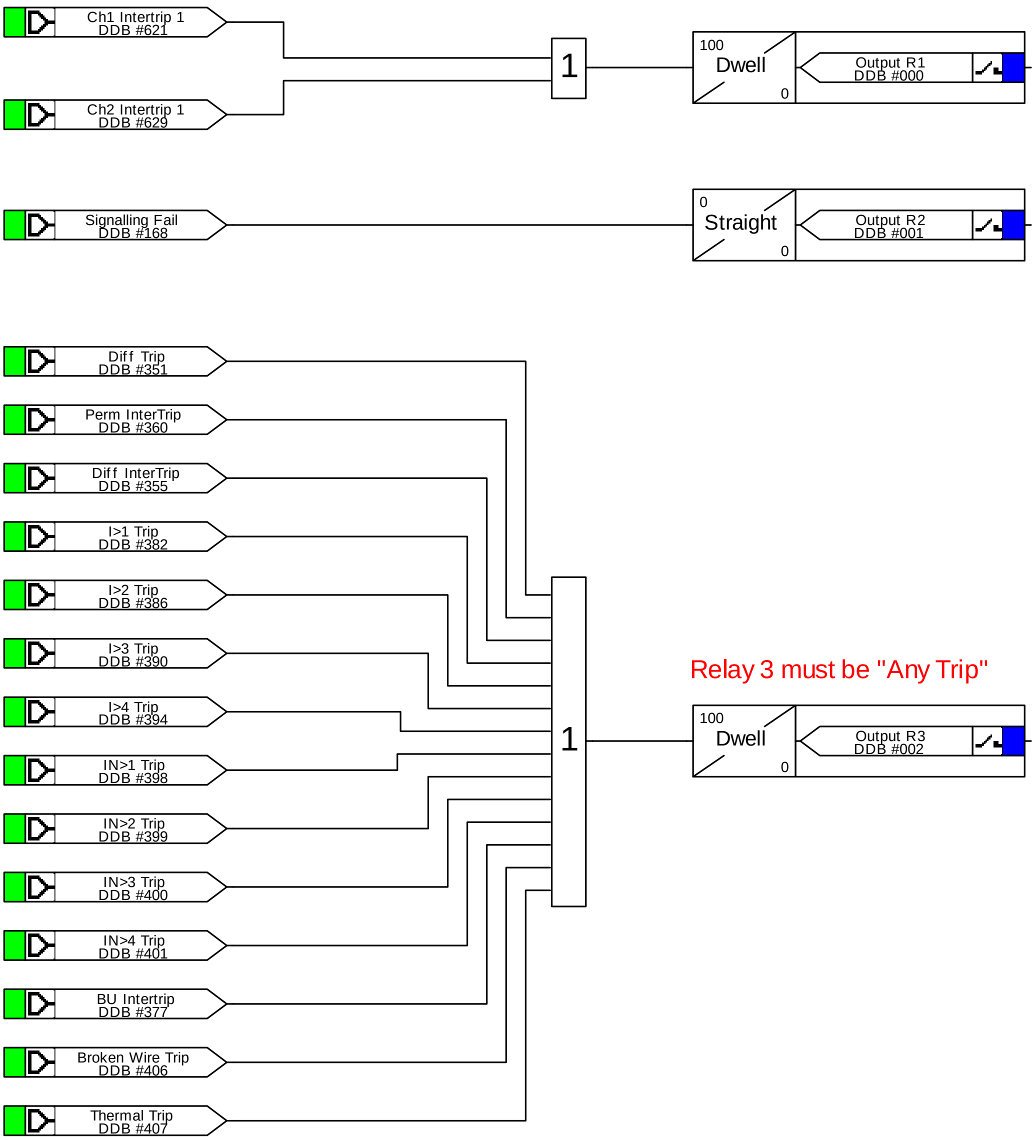
Ethernet Medium Supported: Copper: **S10baseT S100baseTx** ≤1000baseT Fibre: **S10baseFL S100baseFX** ≤1000baseSX	Device Function: ≤ Client **Σ Server**
TCP/IP Support: IP Address ≤ Fixed **Σ Configurable, IP1.IP2.IP3.IP4** IP NetMask ≤ Fixed **Σ Configurable, IP1.IP2.IP3.IP4** IP Gateways ≤ Fixed **Σ Configurable, up to 4** **- Target Network IP** **- Gateway IP**	OSI Support: Address PSEL **Σ Fixed** **00 00 00 00** ≤ Configurable SSEL S Fixed **00 00** ≤ Configurable TSEL **Σ Fixed** **00 00** ≤ Configurable NSAP ≤ Fixed **Σ Configurable, via IP Address** **05 49 IP1 IP2 IP3 IP4**
Connection Management Services: **Σ Initiate** **Σ Conclude** **Σ Abort** **Σ Reject** ≤ Cancel Maximum Simultaneous Connections: **4**	GOOSE: Supported: ≤ Yes **Σ No** IED Name: **Σ Not Applicable** **≤ Fixed** ≤ Configurable, using GOOSE Editor Timeout Logic: **Σ Not Applicable** ≤ Supported ≤ Not Supported
VMD Support Services: **Σ Status** ≤ Extended Status **Σ Identify** **Σ GetNameList** ≤ GetCapability	Variable Access Services: **Σ Read** **Σ Write** **Σ Information Report** **Σ GetVariableAccessAttributes** **Σ GetVariableListAttributes**
Reporting Services: ≤ Create Report Control Block ≤ Delete Report Control Block **Σ Get Report Control Block** **Σ Get Report Control Block names** **Σ Set Report Control Block**	Domain Management Services: **Σ Get Domain attributes** ≤ InitiateDownloadSequenceRequest ≤ DeleteDomainRequest
Maximum MMS Pdu Size (bytes): Transmitted: **8000** Received: **8000**	Minimum MMS Pdu Size (bytes): Transmitted: **64** Received: **64**
Sends Unsolicited Responses: ≤ Never **Σ Configurable**	Multi-Fragment Responses: Supported: **Σ Yes** ≤ No
Σ Only certain Objects ≤ Sometimes	Time Syncronisation: Supported: **Σ Yes** ≤ No

MiCOM P541 PROGRAMMABLE LOGIC

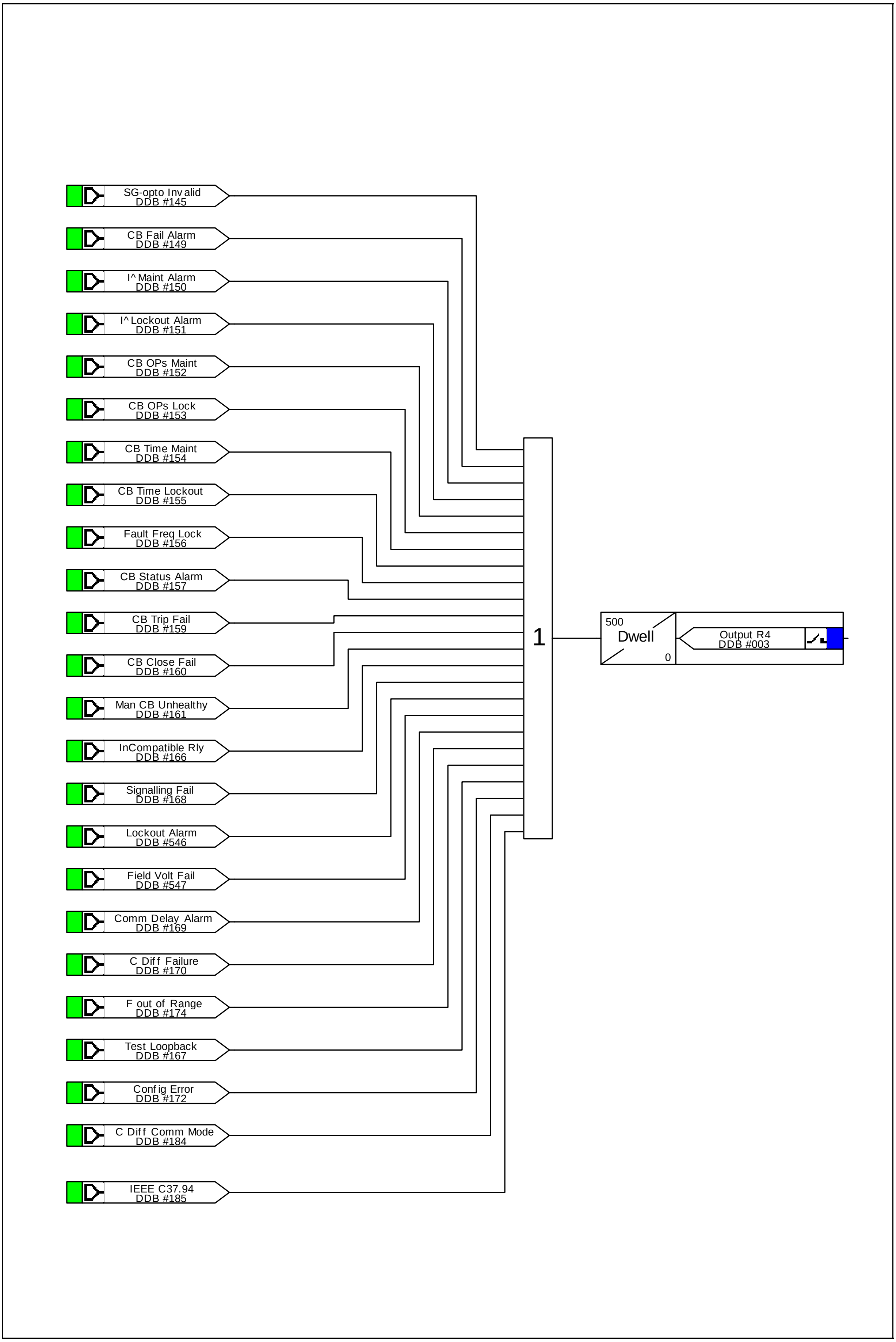
Opto Input Mappings



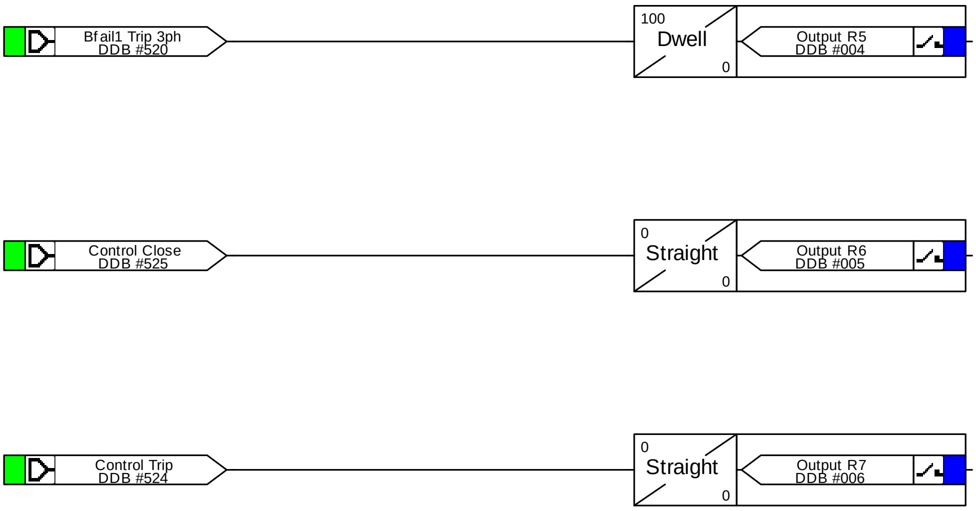
Output Relay Mapping



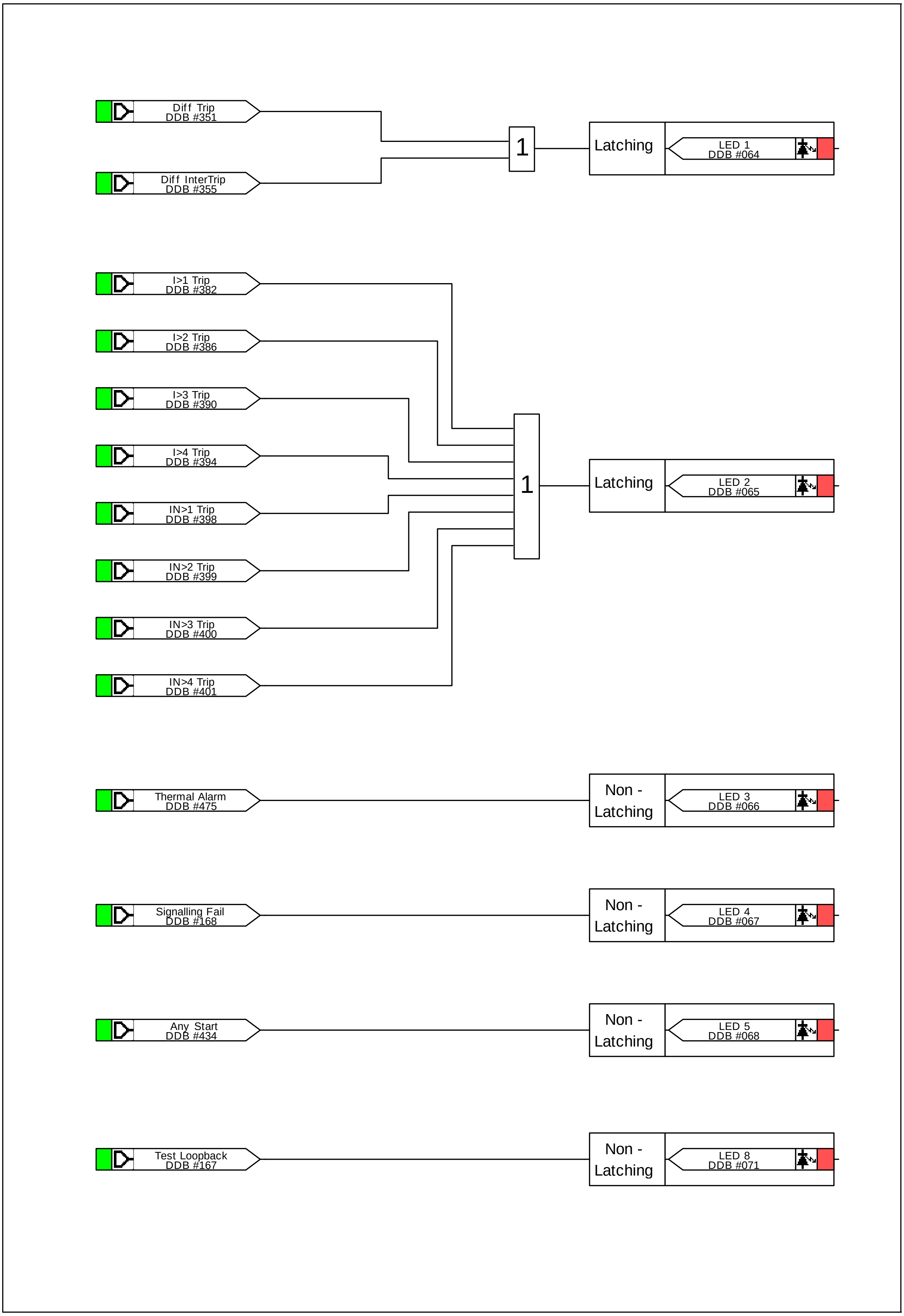
Output Relay Mapping



Output Relay Mapping



LED Mapping



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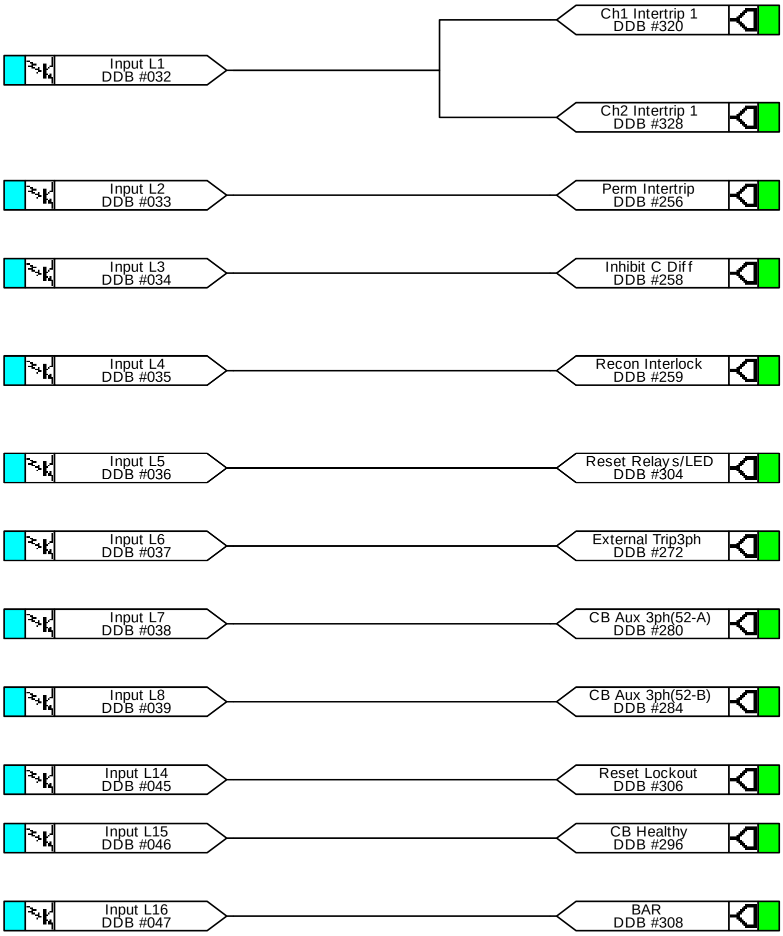
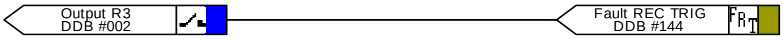
MiCOM P542 PROGRAMMABLE LOGIC

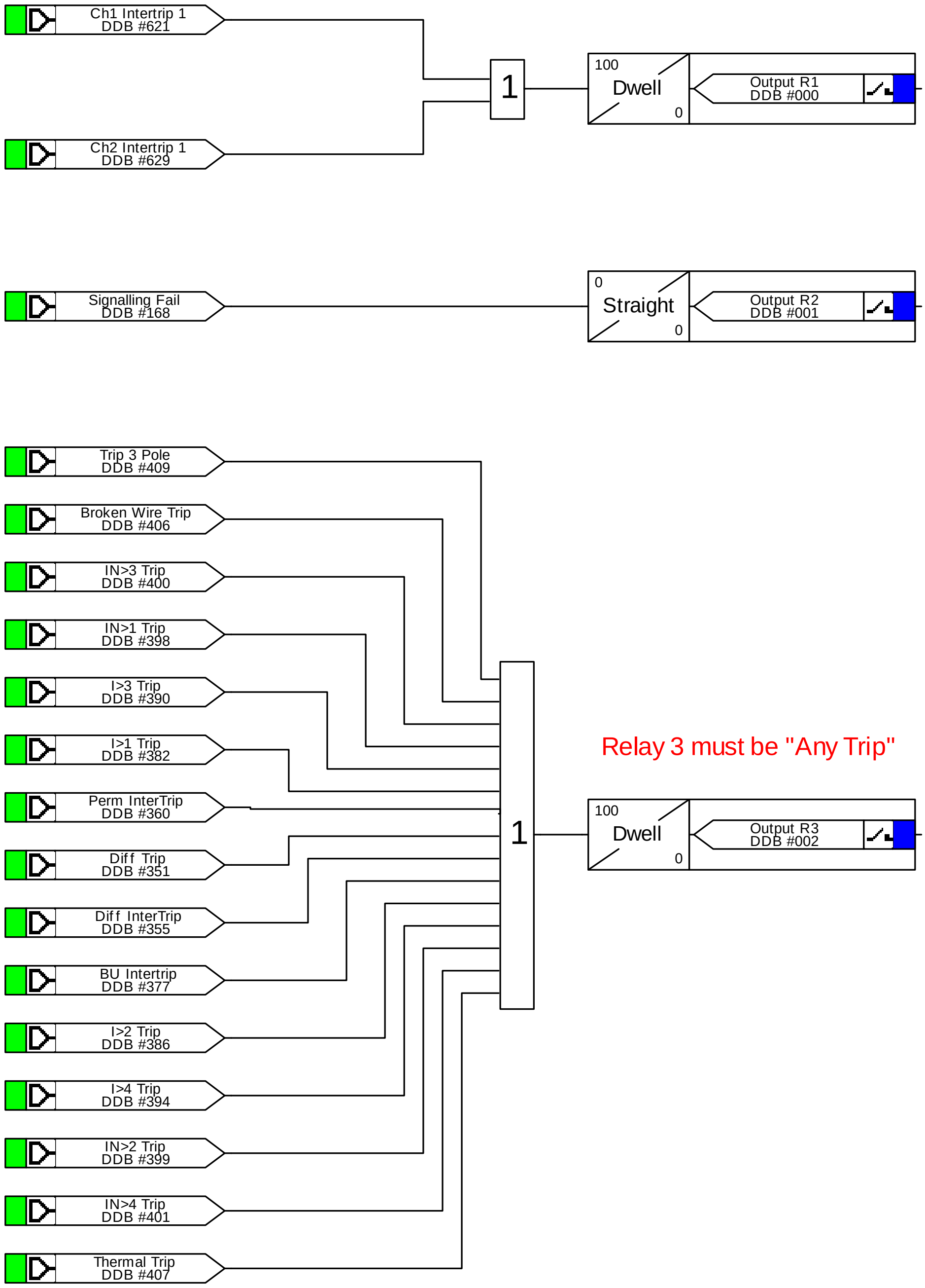
Opto Input Mappings



Fault Record Trigger Mapping



Output Relay Mapping



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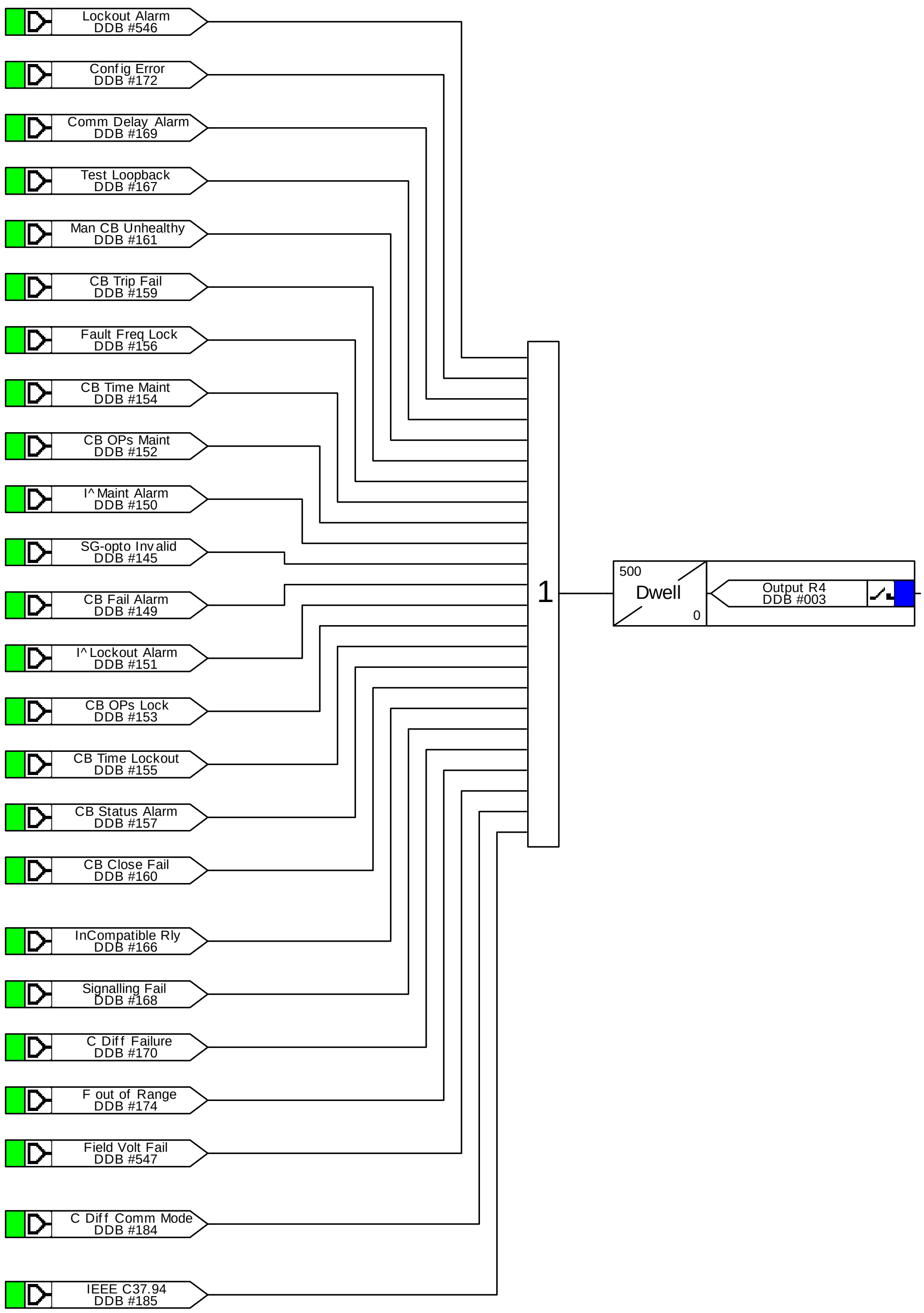
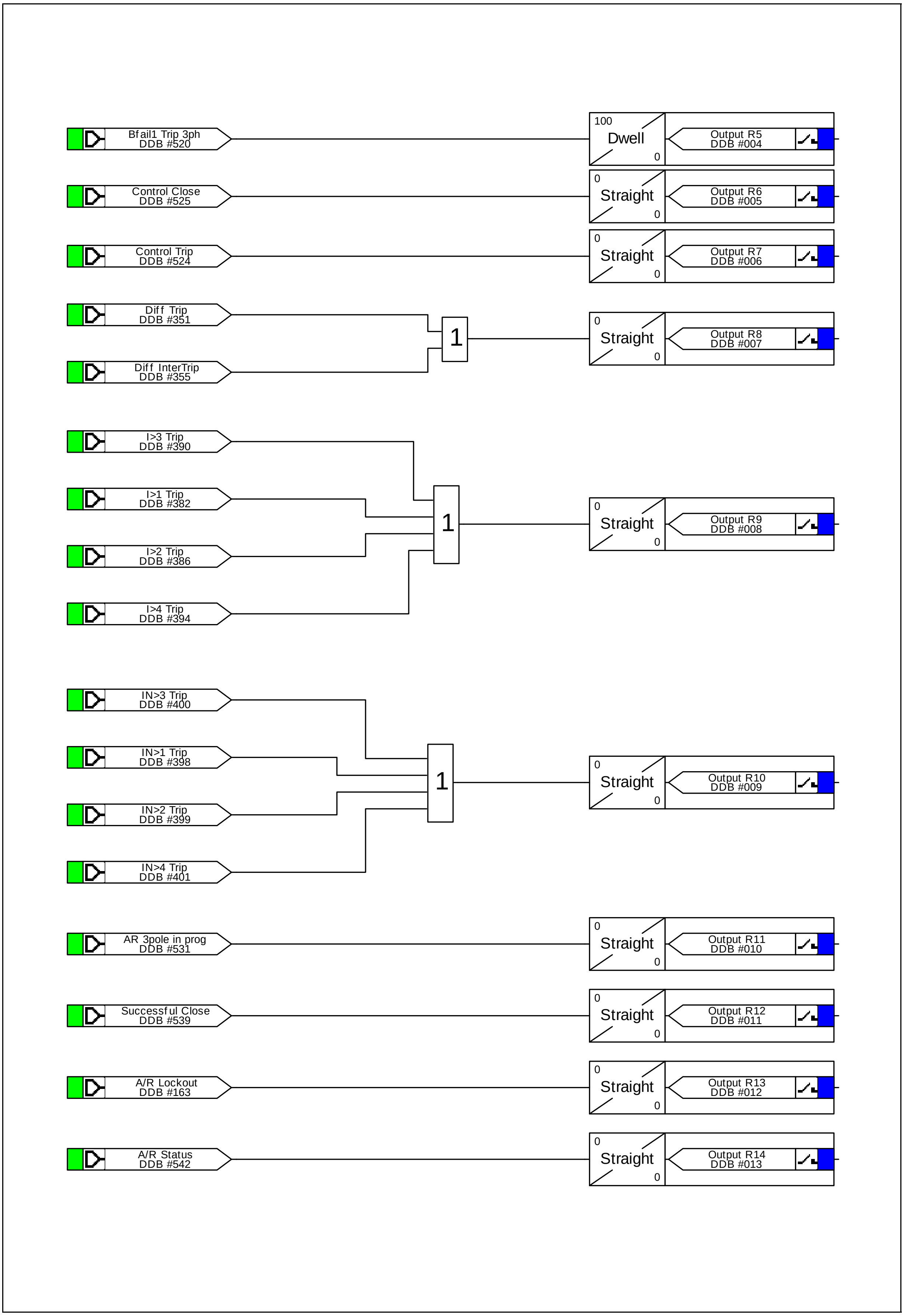
Output Relay Mapping

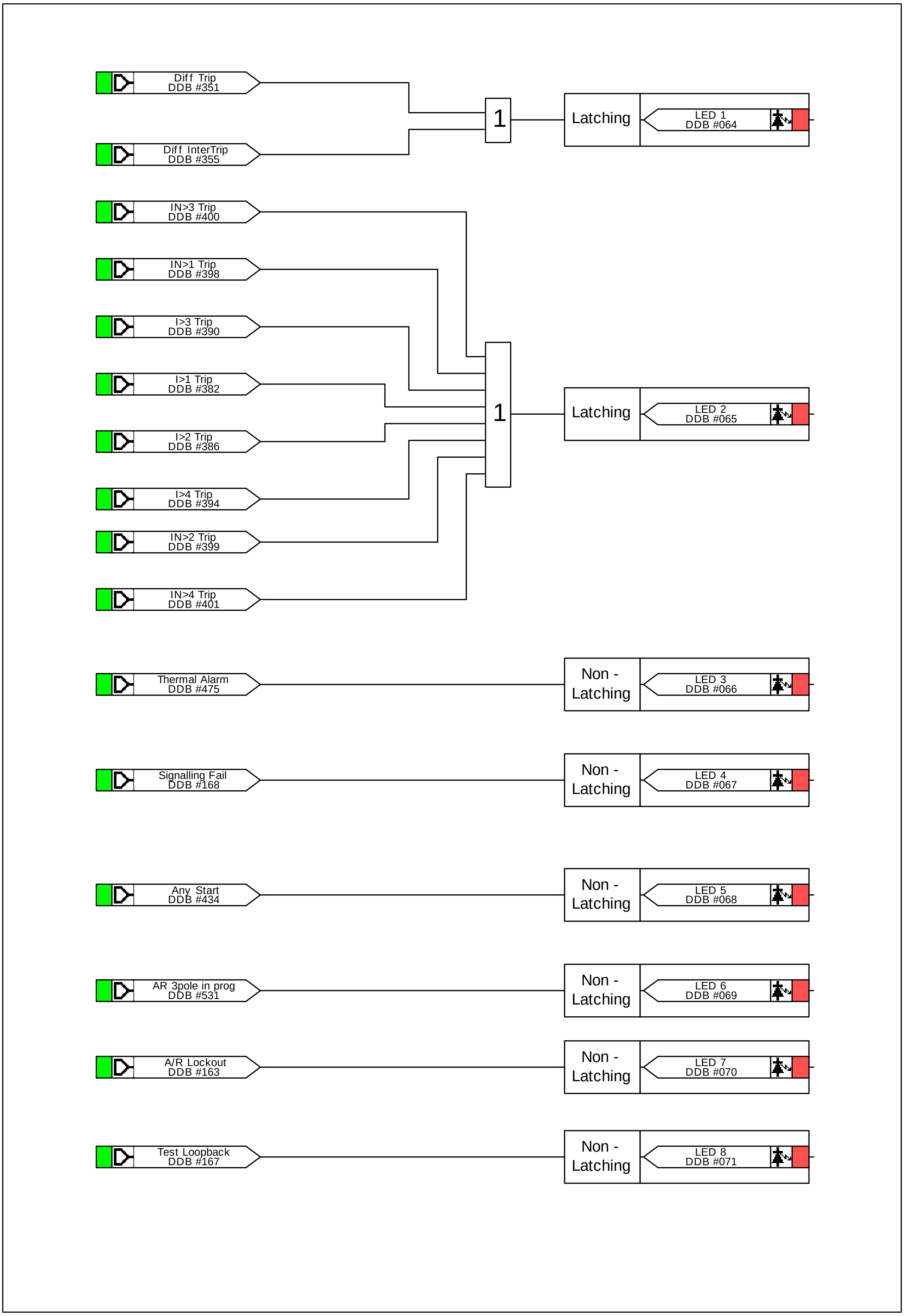


Output Relay Mapping



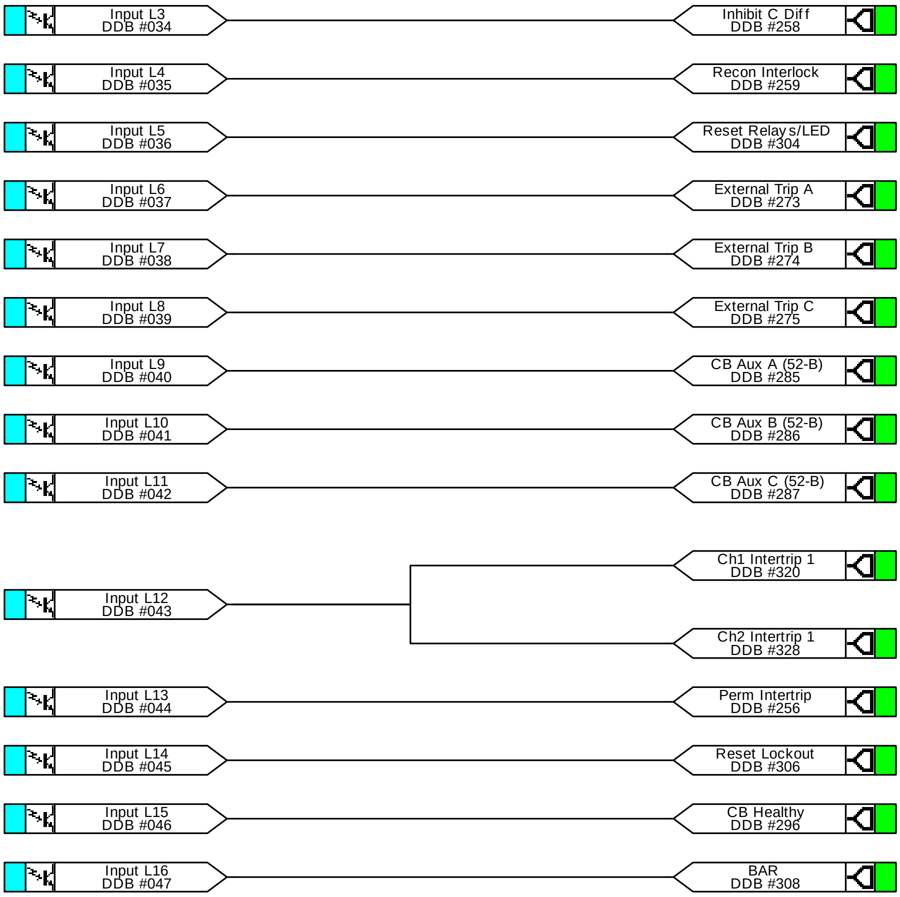
MiCOM P542, Page 4

LED Mapping

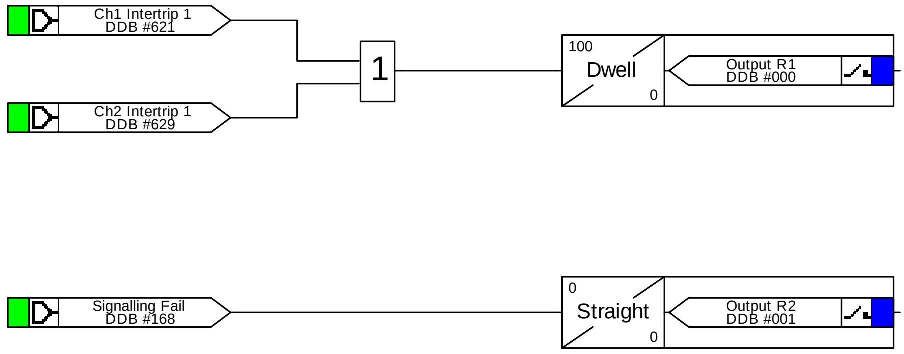

Diff Trip
DDB #351
Diff InterTrip
DDB #355
IN>3 Trip
DDB #400
IN>1 Trip
DDB #398
I>3 Trip
DDB #390
I>1 Trip
DDB #382
I>2 Trip
DDB #386
I>4 Trip
DDB #394
IN>2 Trip
DDB #399
IN>4 Trip
DDB #401
Thermal Alarm
DDB #475
Signalling Fail
DDB #168
Any Start
DDB #434
AR 3pole in prog
DDB #531
A/R Lockout
DDB #163
Test Loopback
DDB #167
1
1
Latching
Latching
Non - Latching
Non - Latching
Non - Latching
Non - Latching
Non - Latching
Non - Latching
LED 1
DDB #064
LED 2
DDB #065
LED 3
DDB #066
LED 4
DDB #067
LED 5
DDB #068
LED 6
DDB #069
LED 7
DDB #070
LED 8
DDB #071

MICOM P543 PROGRAMMABLE LOGIC

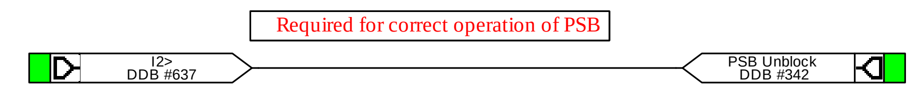
Opto Input Mappings



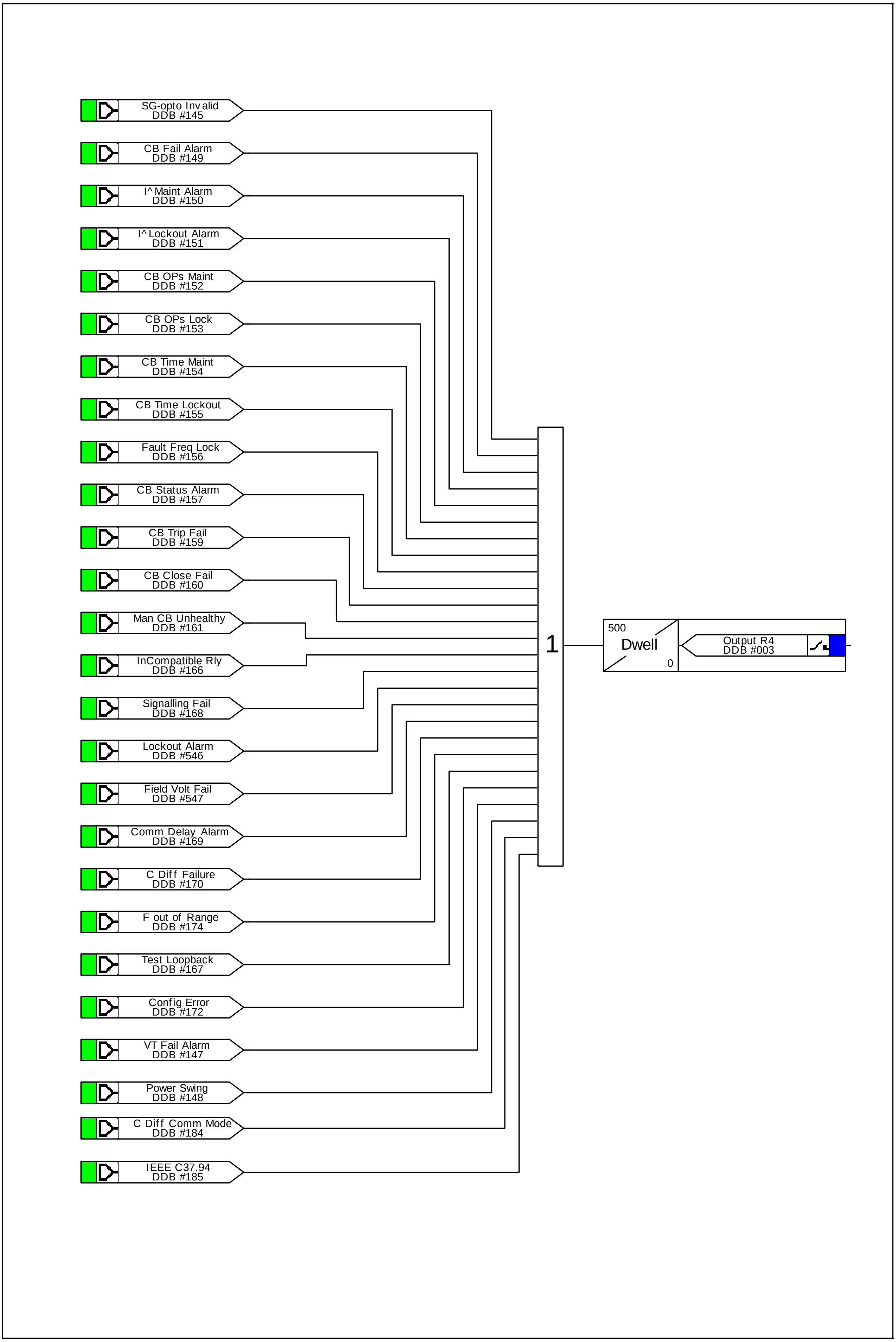
Output Relay Mapping



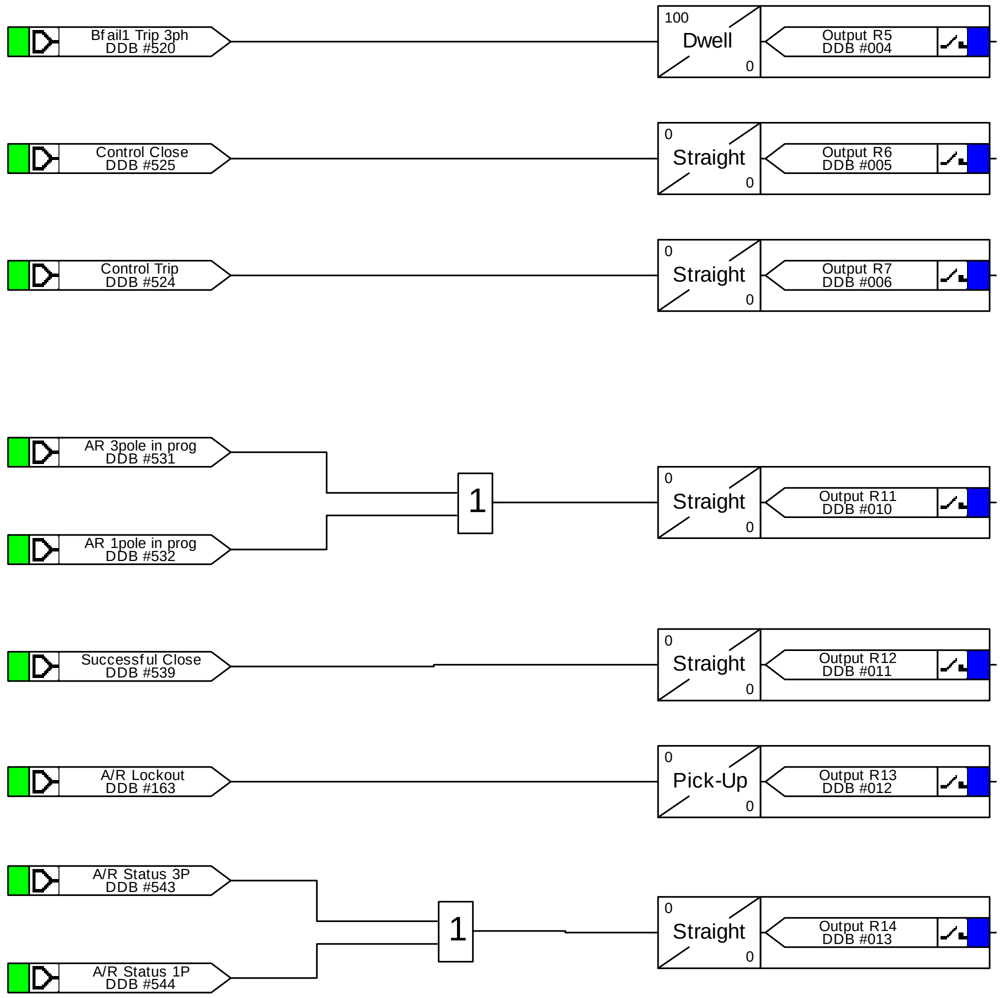
Fault Record Trigger Mapping



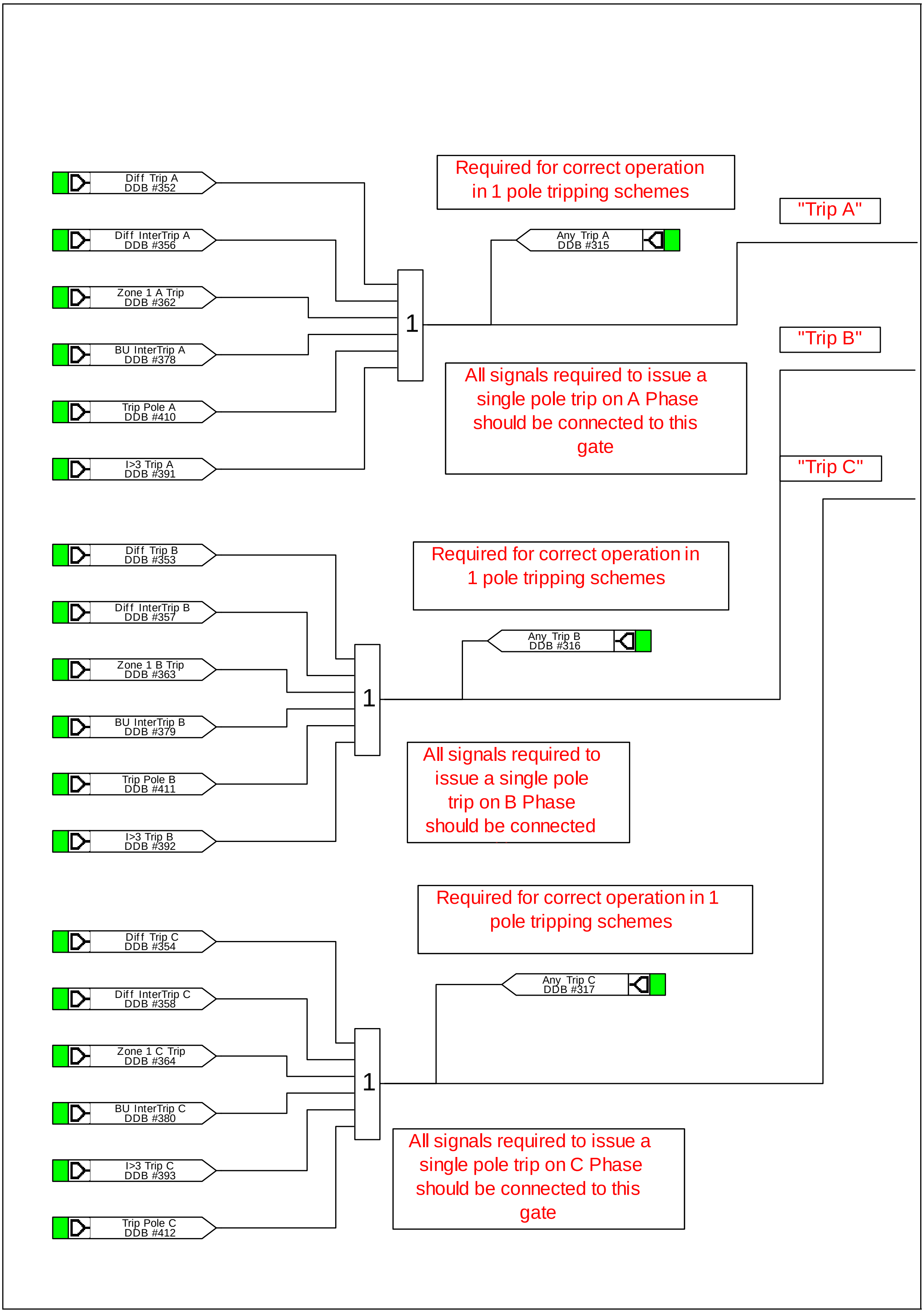
Output Relay Mapping



Output Relay Mapping

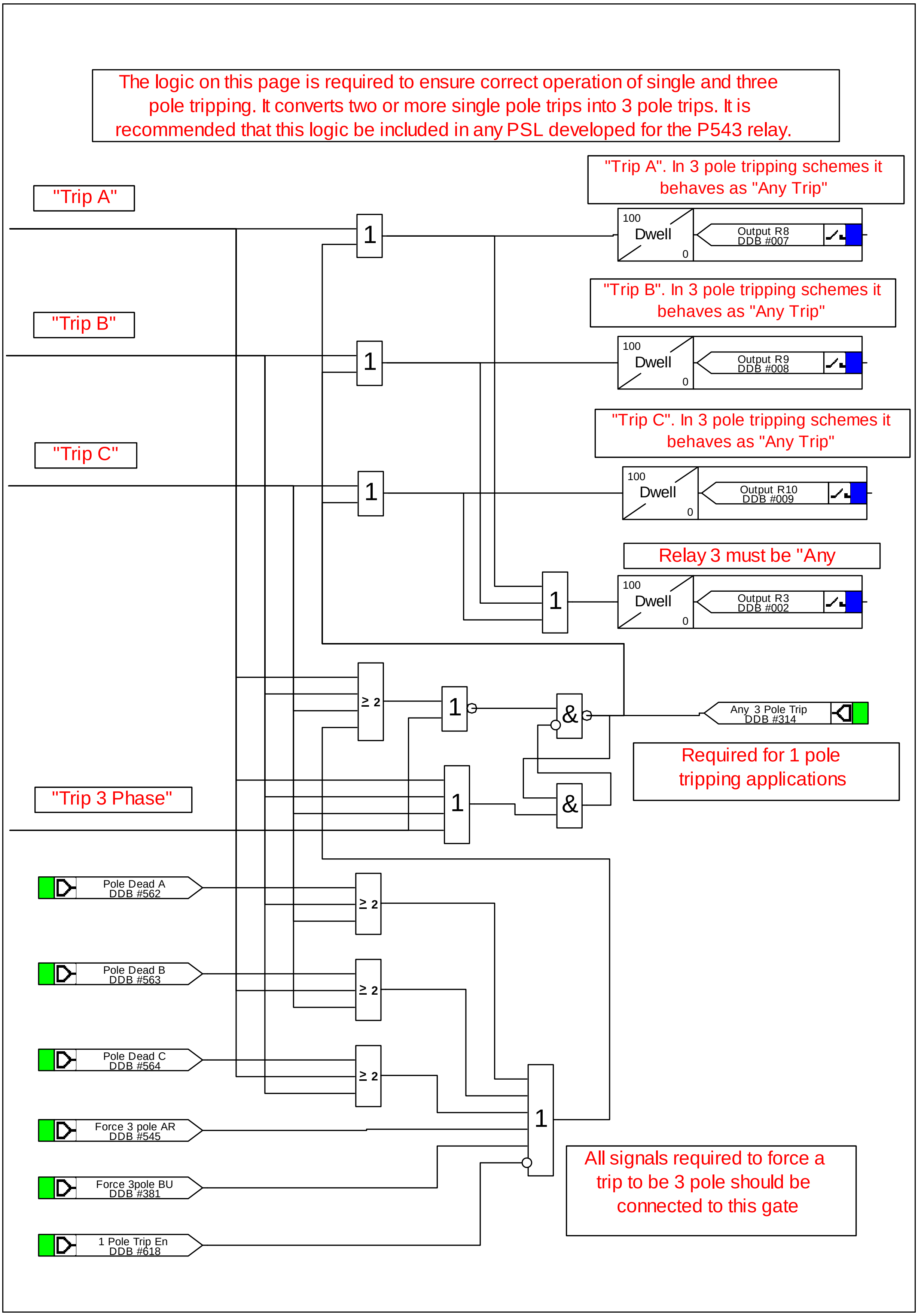


Trip Logic Mapping

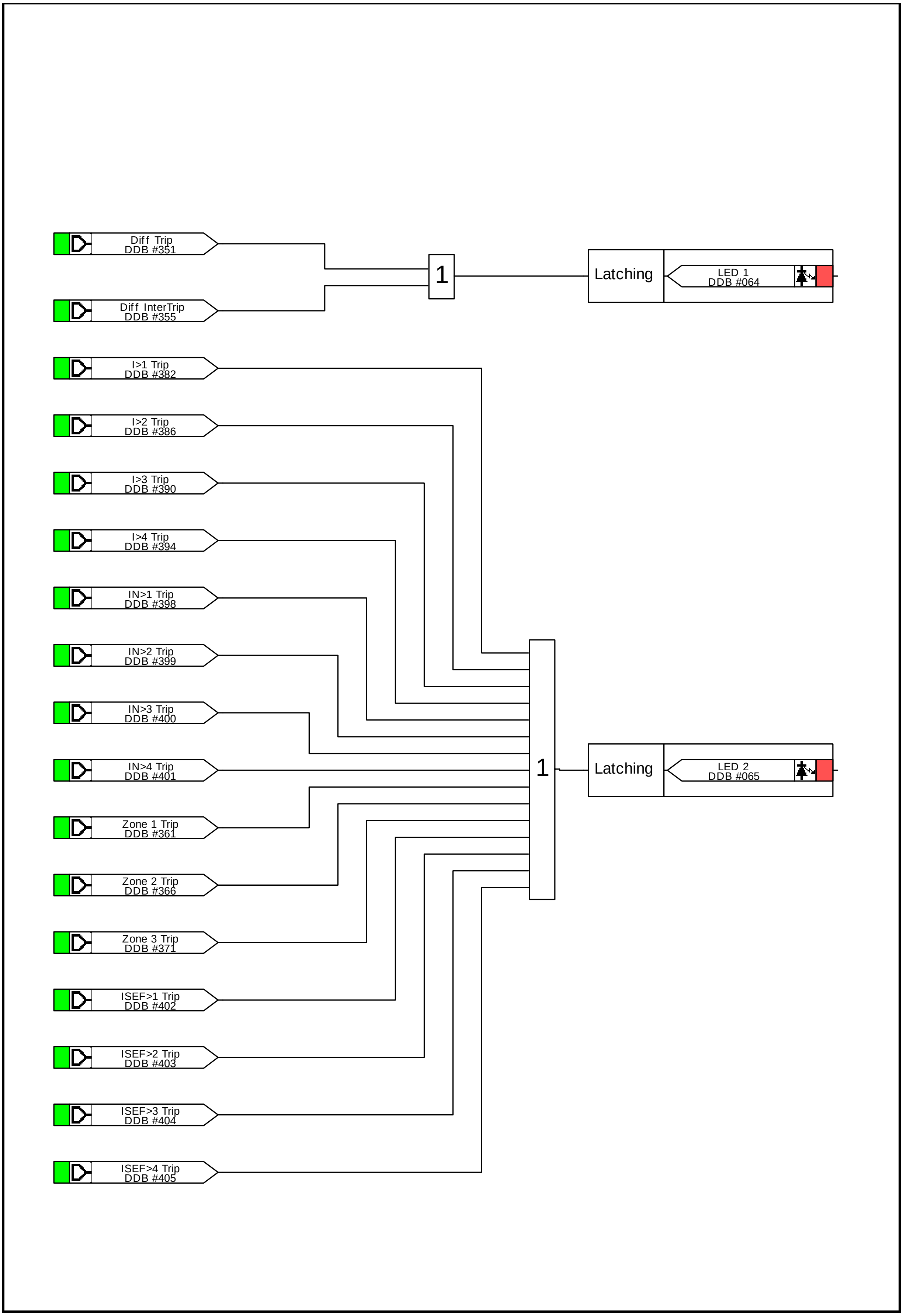


MiCOM P543, Page 5

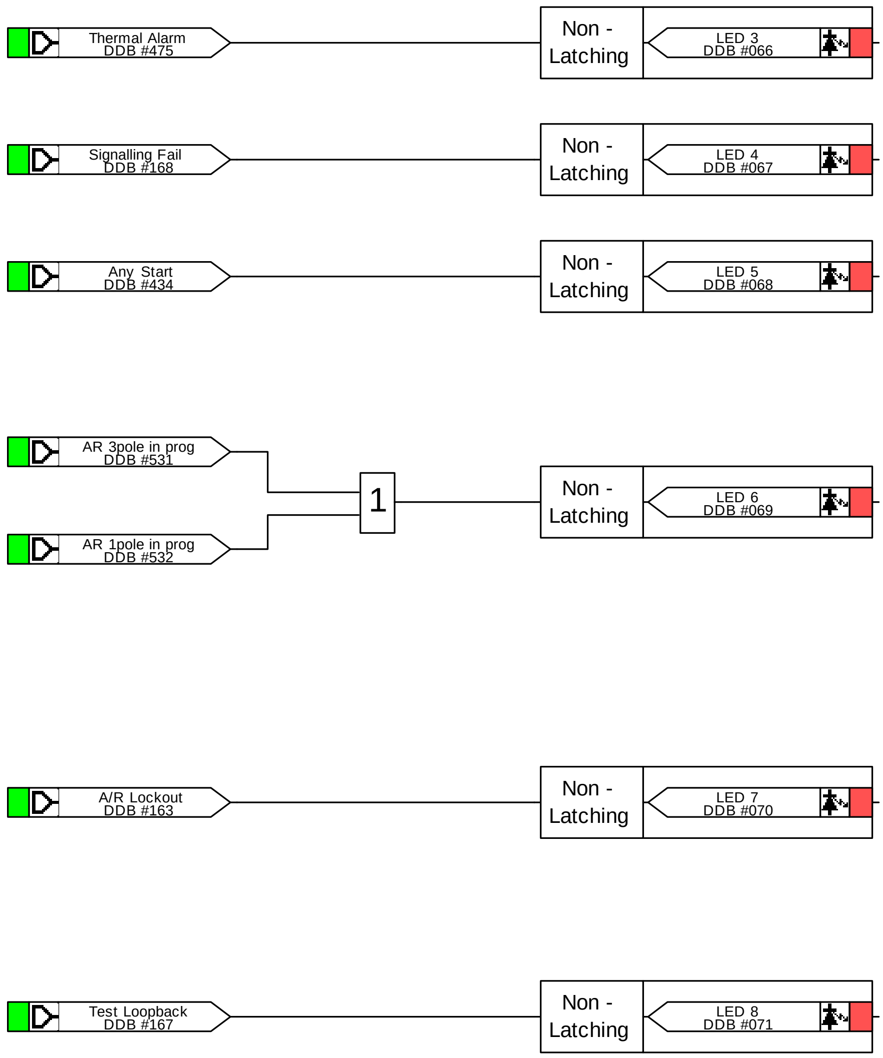
Trip Conversion Logic and Mapping



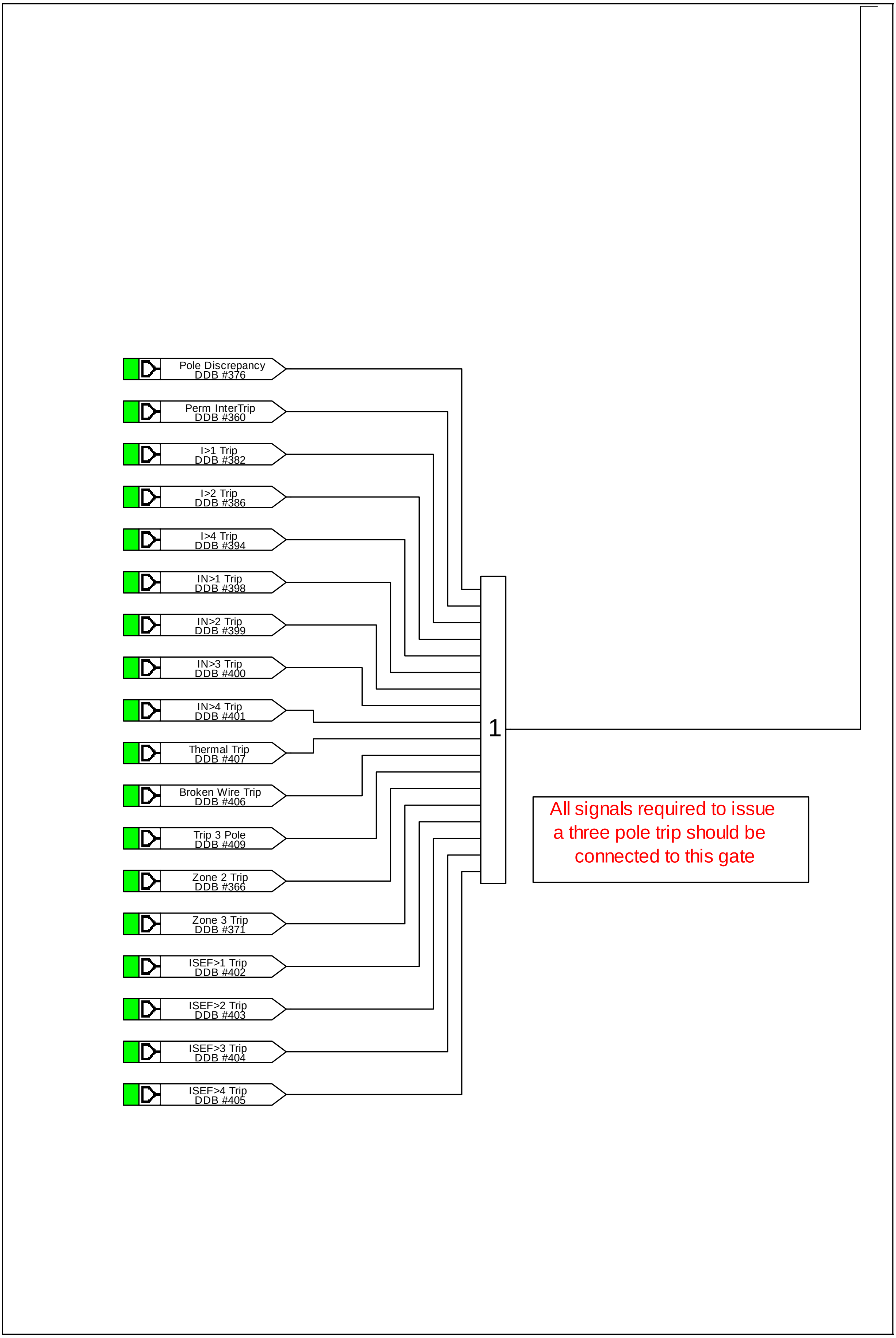
LED Mapping


Diff Trip
DDB #351
Diff InterTrip
DDB #355
1
Latching
LED 1
DDB #064
I>1 Trip
DDB #382
I>2 Trip
DDB #386
I>3 Trip
DDB #390
I>4 Trip
DDB #394
IN>1 Trip
DDB #398
IN>2 Trip
DDB #399
IN>3 Trip
DDB #400
IN>4 Trip
DDB #401
Zone 1 Trip
DDB #361
Zone 2 Trip
DDB #366
Zone 3 Trip
DDB #371
ISEF>1 Trip
DDB #402
ISEF>2 Trip
DDB #403
ISEF>3 Trip
DDB #404
ISEF>4 Trip
DDB #405
1
Latching
LED 2
DDB #065

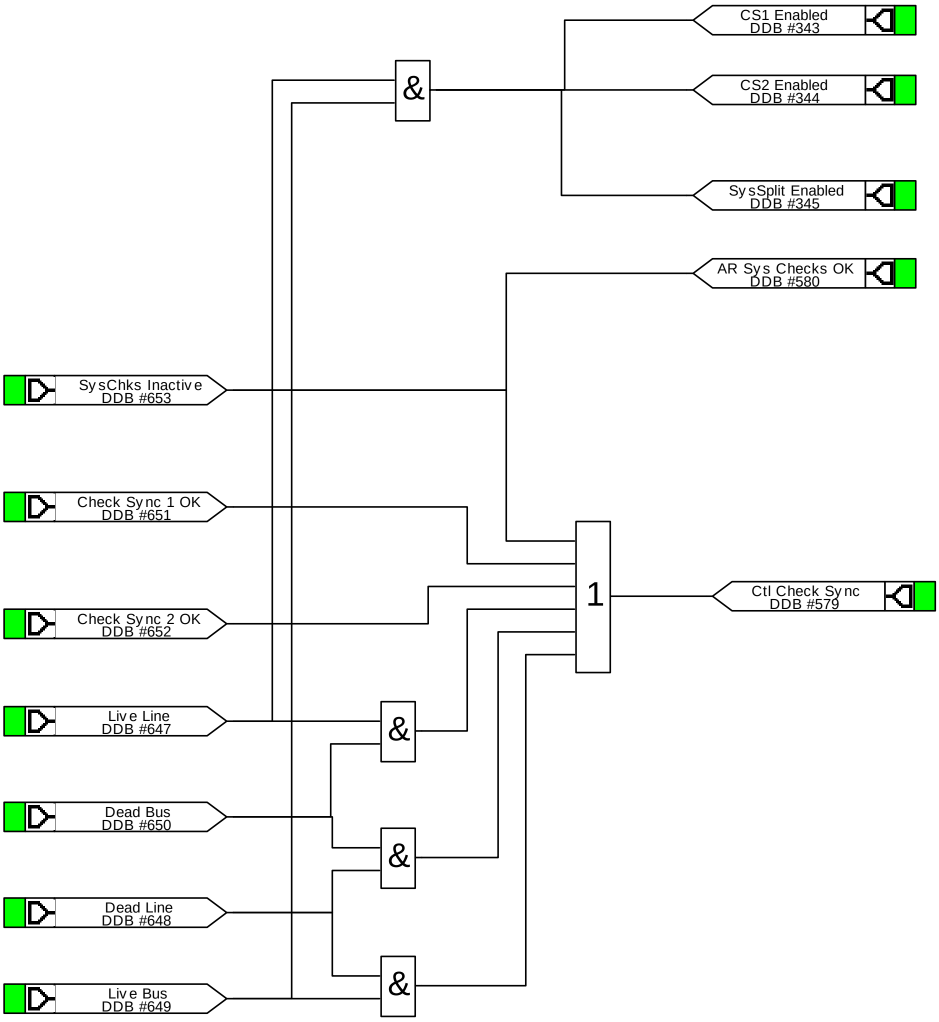
LED Mapping


Thermal Alarm
DDB #475
Non - Latching
LED 3
DDB #066
Signalling Fail
DDB #168
Non - Latching
LED 4
DDB #067
Any Start
DDB #434
Non - Latching
LED 5
DDB #068
AR 3pole in prog
DDB #531
AR 1pole in prog
DDB #532
1
Non - Latching
LED 6
DDB #069
A/R Lockout
DDB #163
Non - Latching
LED 7
DDB #070
Test Loopback
DDB #167
Non - Latching
LED 8
DDB #071

Trip Logic Mapping

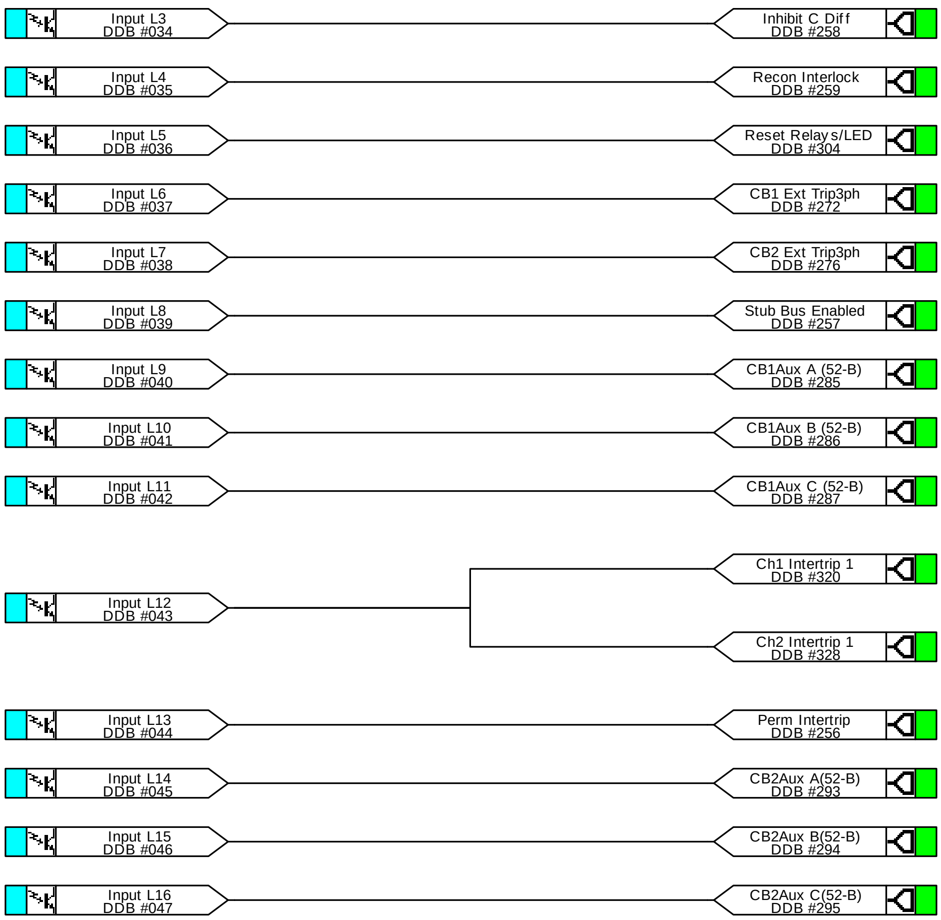


Check Synch. and Voltage Monitor Mapping

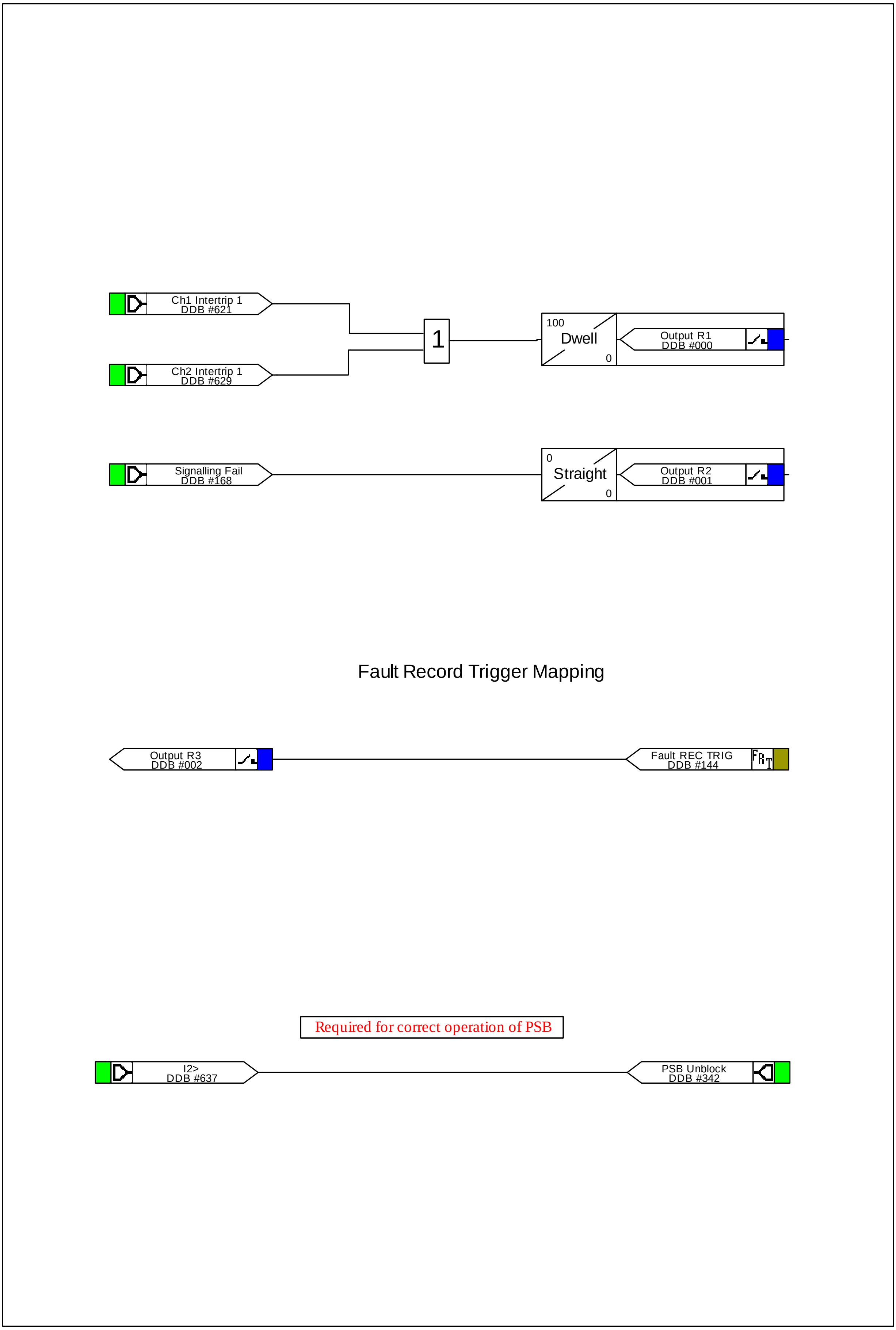


MiCOM P544 PROGRAMMABLE LOGIC

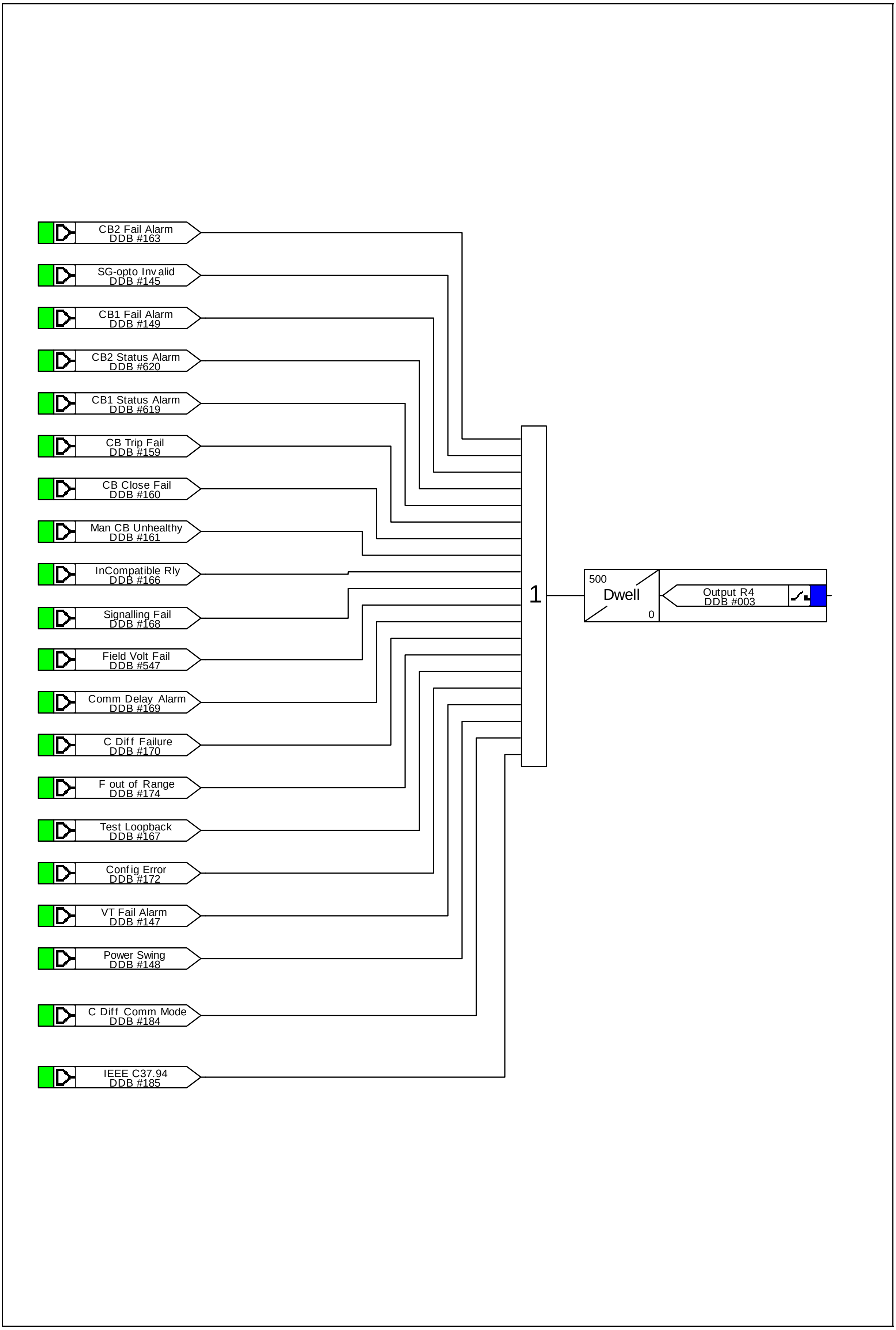
Opto Input Mappings



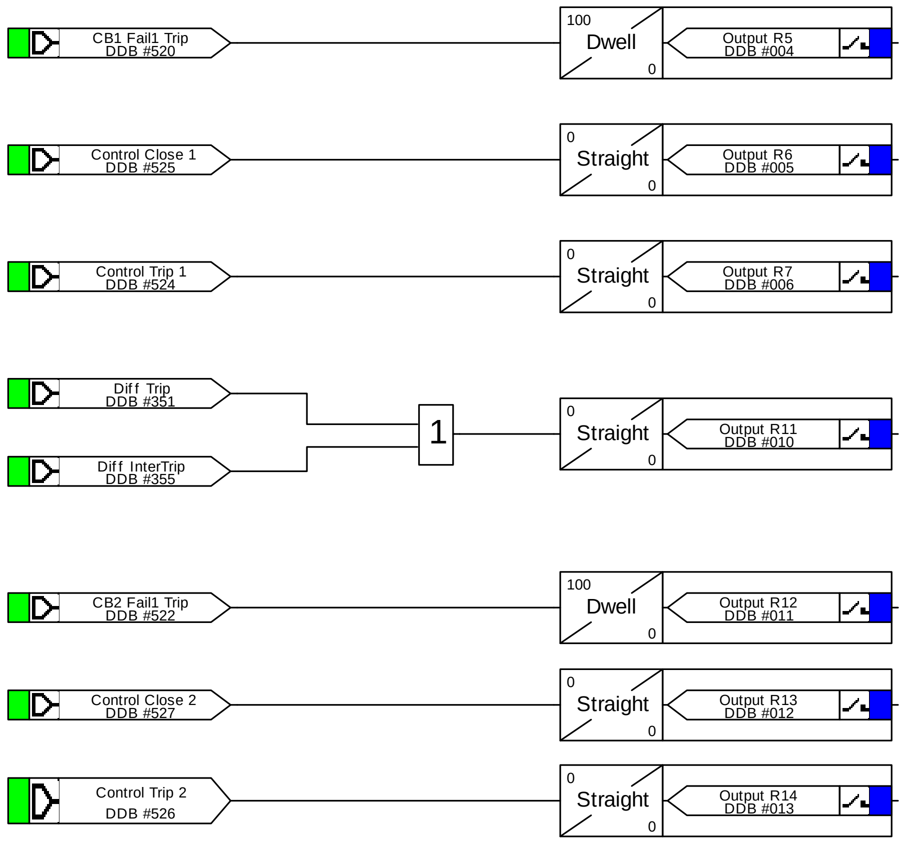
Output Relay Mapping



Output Relay Mapping



Output Relay Mapping



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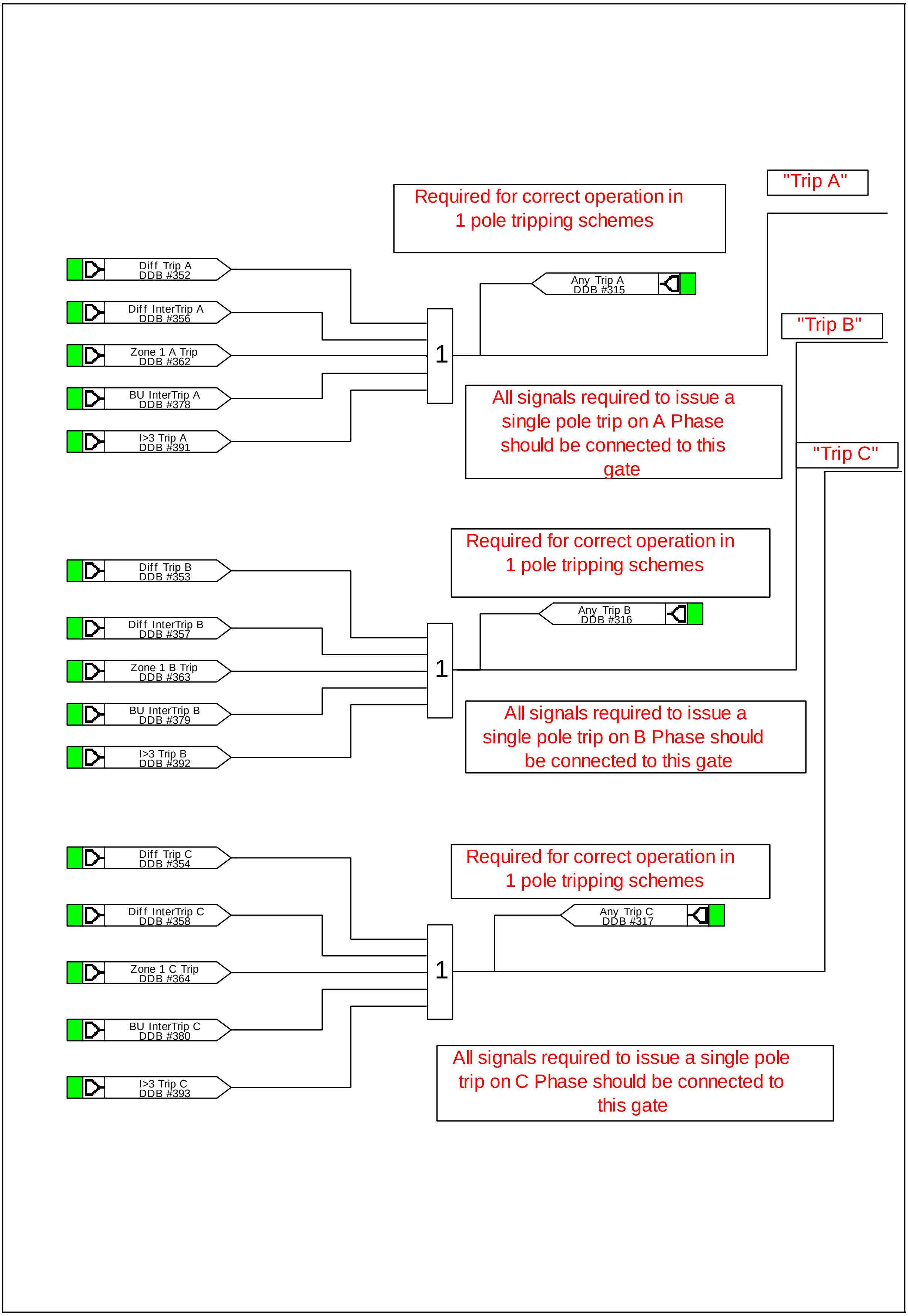
Trip Logic Mapping



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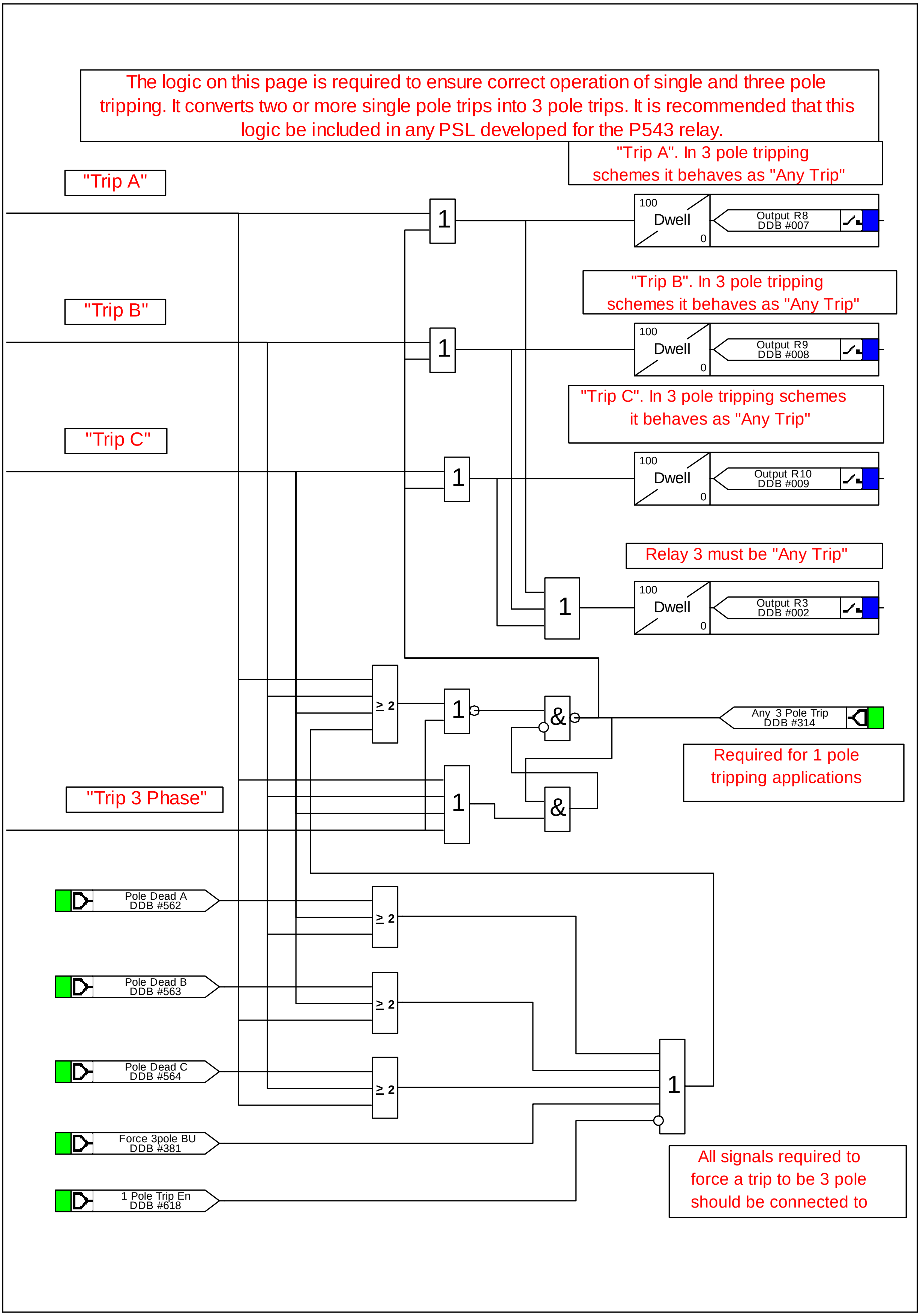
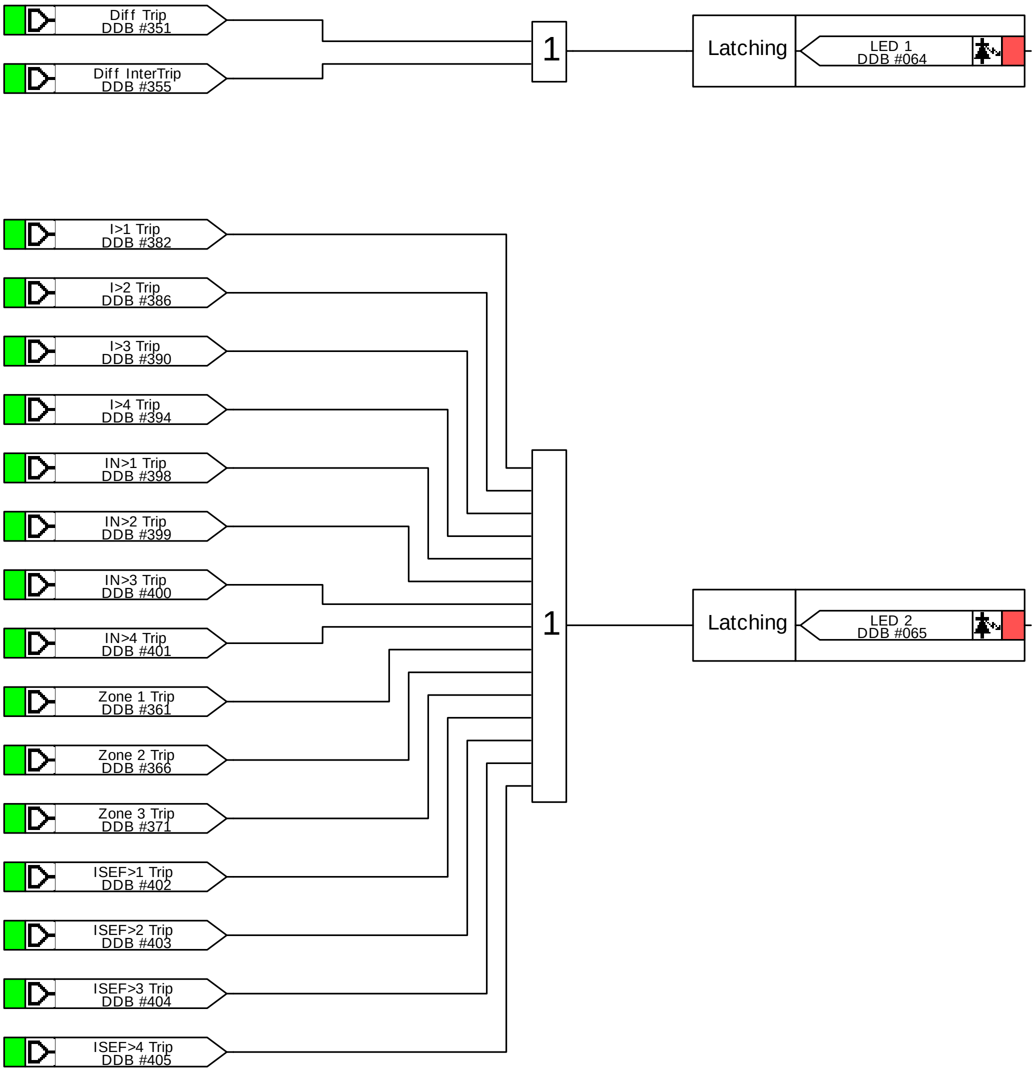
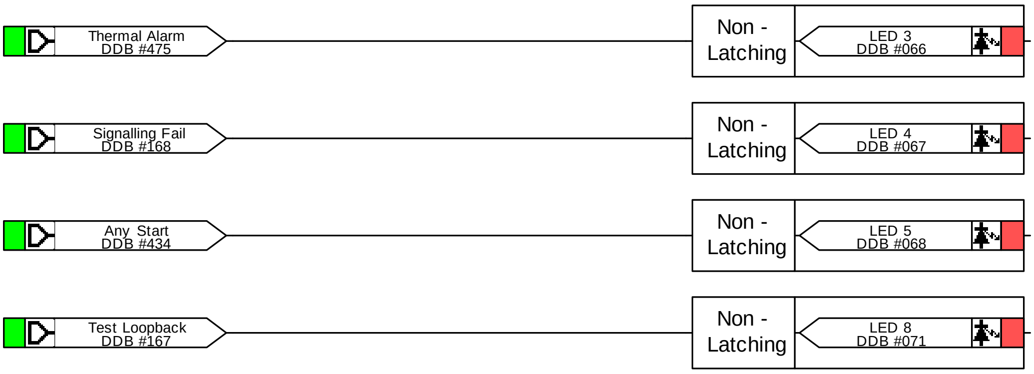
Trip Conversion Logic and Mapping



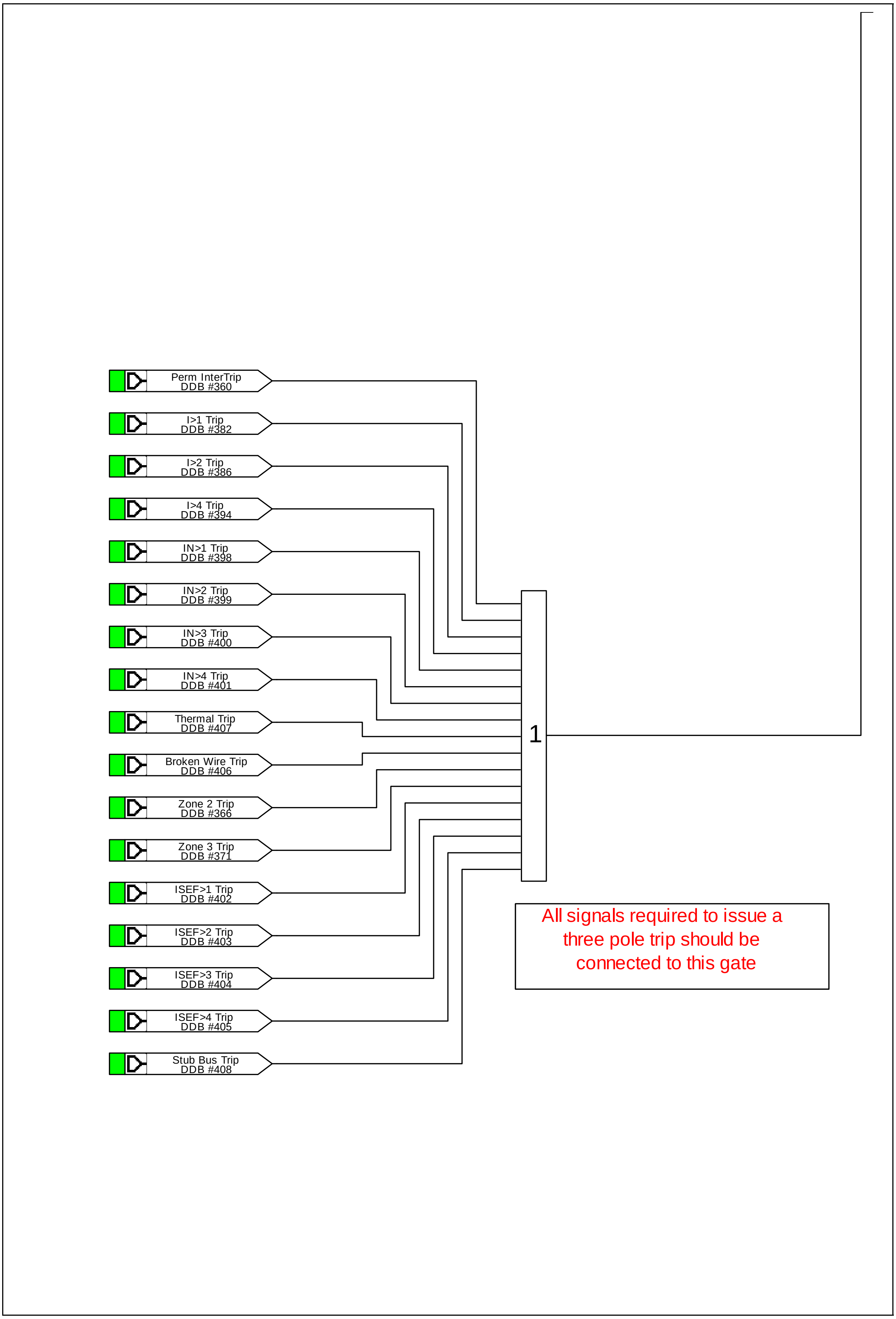
LED Mapping


Diff Trip
DDB #351
Diff InterTrip
DDB #355
1
Latching
LED 1
DDB #064
I>1 Trip
DDB #382
I>2 Trip
DDB #386
I>3 Trip
DDB #390
I>4 Trip
DDB #394
IN>1 Trip
DDB #398
IN>2 Trip
DDB #399
IN>3 Trip
DDB #400
IN>4 Trip
DDB #401
Zone 1 Trip
DDB #361
Zone 2 Trip
DDB #366
Zone 3 Trip
DDB #371
ISEF>1 Trip
DDB #402
ISEF>2 Trip
DDB #403
ISEF>3 Trip
DDB #404
ISEF>4 Trip
DDB #405
1
Latching
LED 2
DDB #065

LED Mapping

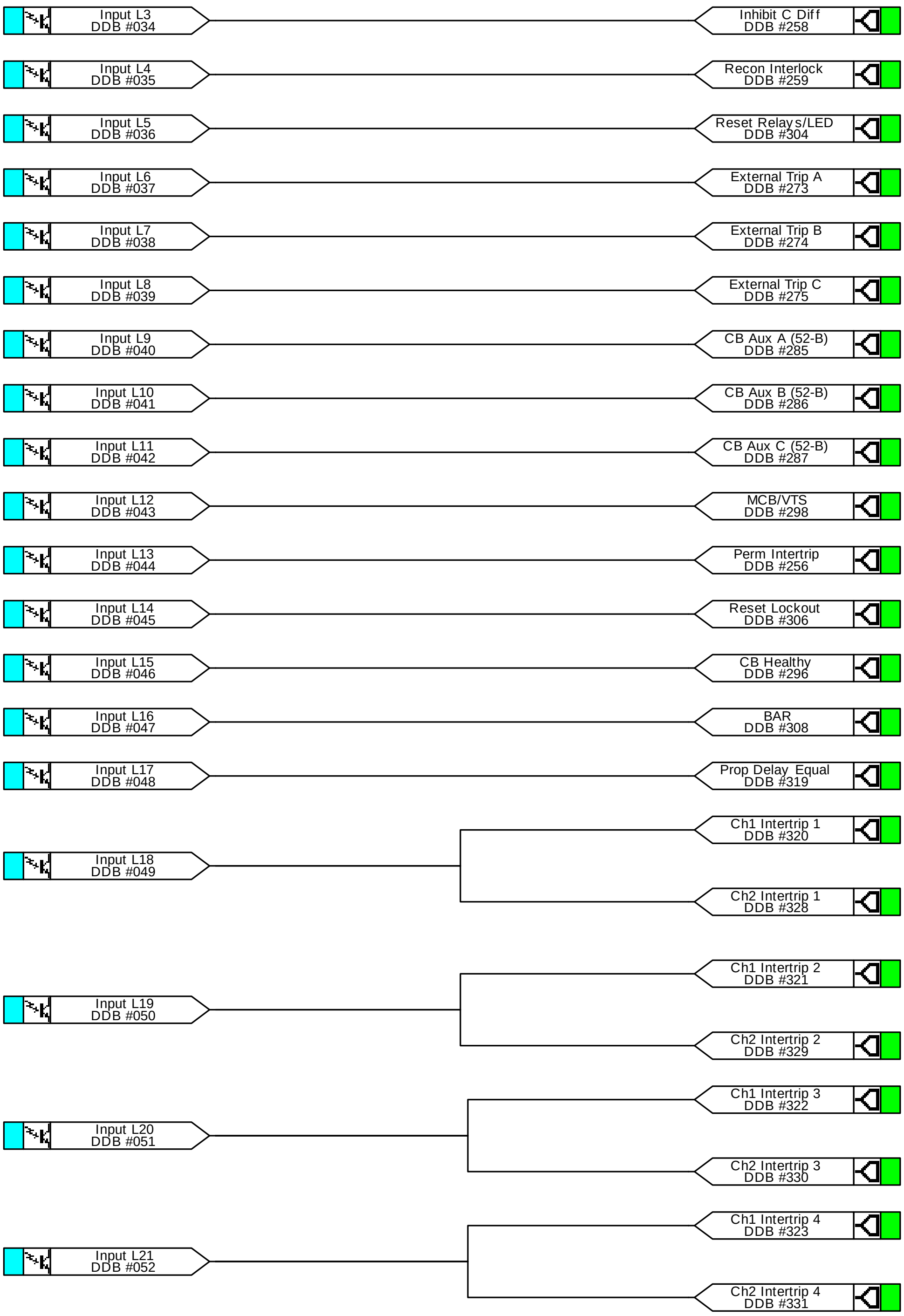

Thermal Alarm
DDB #475
Signalling Fail
DDB #168
Any Start
DDB #434
Test Loopback
DDB #167
Non - Latching
LED 3
DDB #066
Non - Latching
LED 4
DDB #067
Non - Latching
LED 5
DDB #068
Non - Latching
LED 8
DDB #071

Trip Logic Mapping

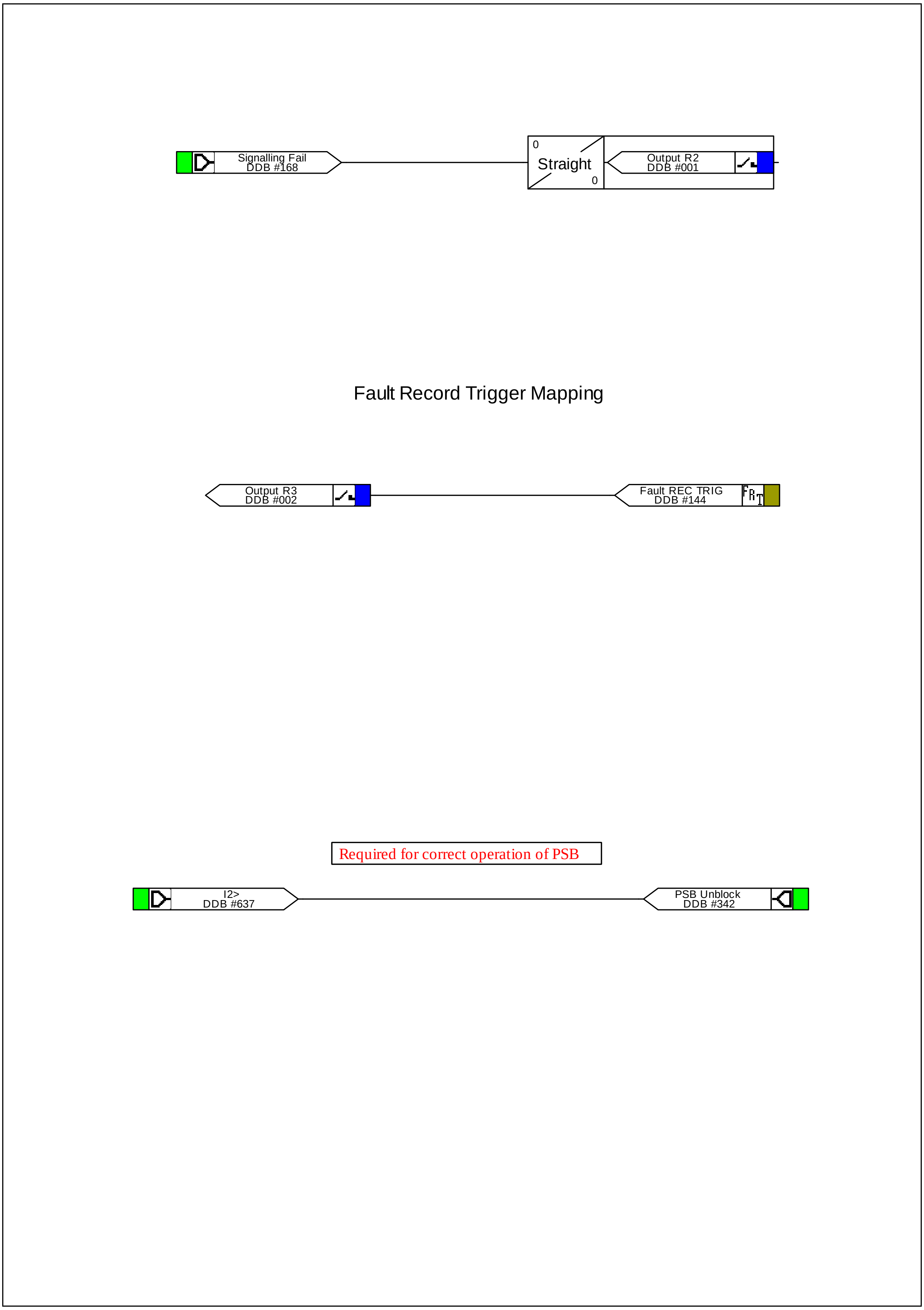


MiCOM P545 PROGRAMMABLE LOGIC

Opto Input Mappings



Output Relay Mapping



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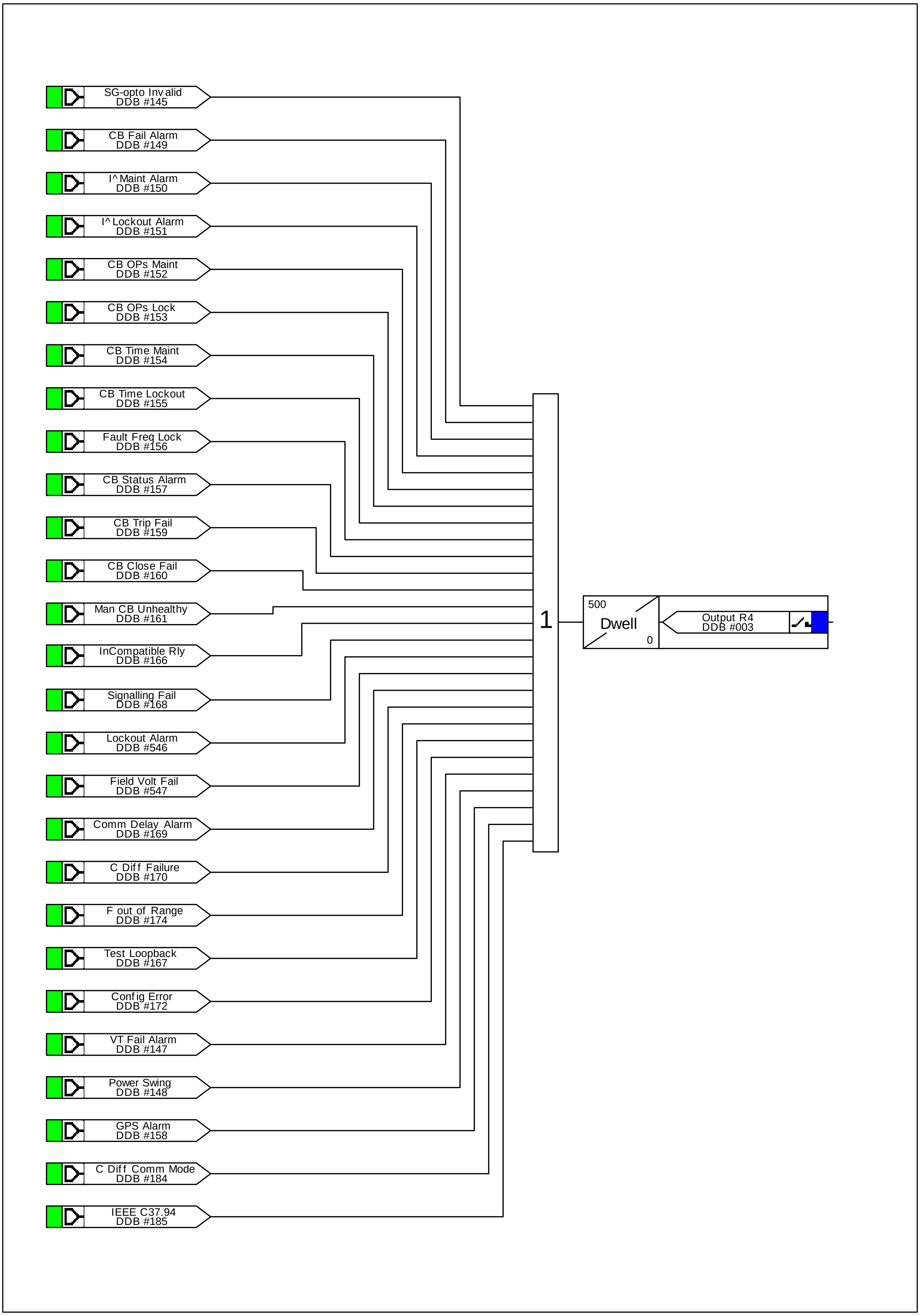
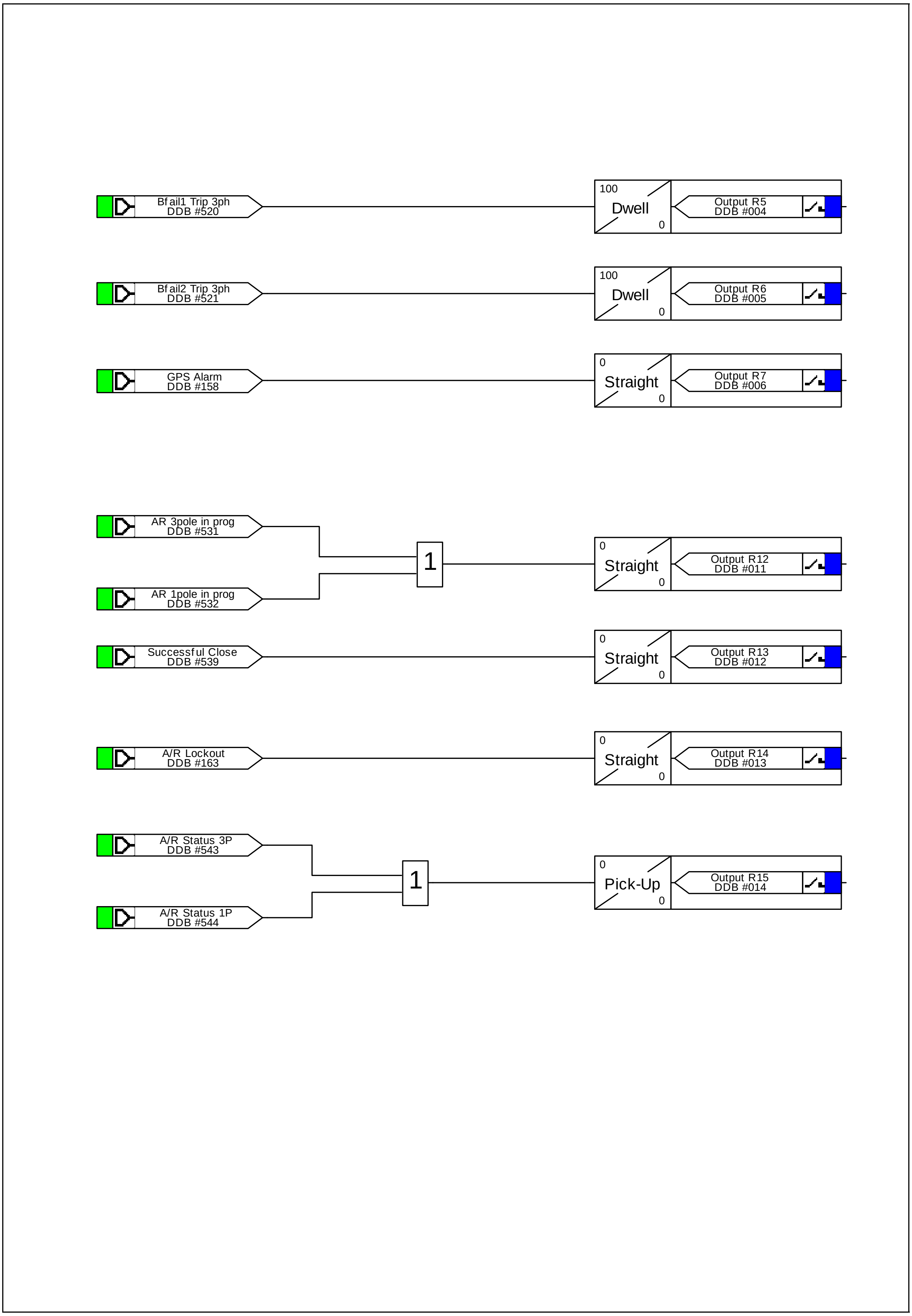
Output Relay Mapping



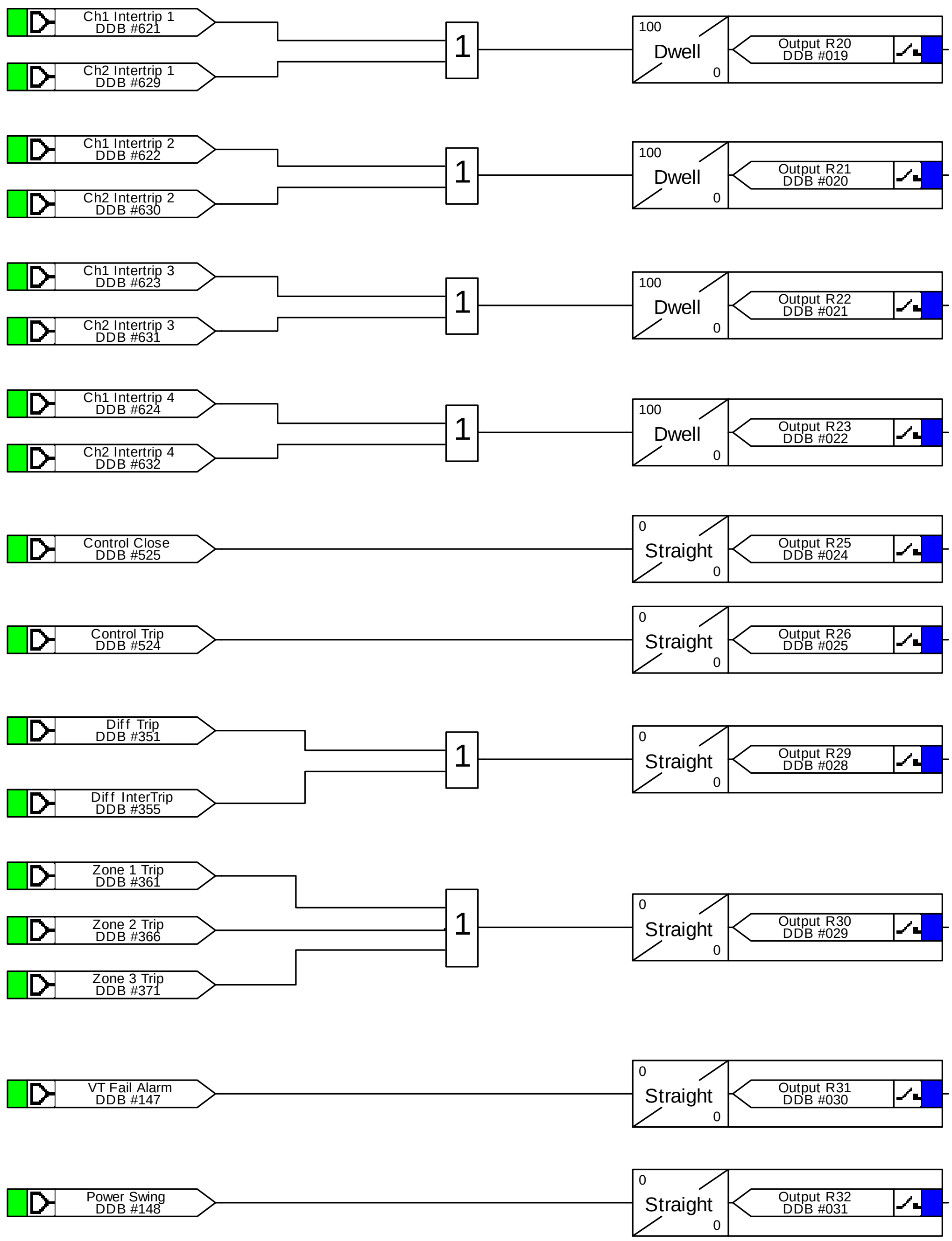
MiCOM P545, Page 3

Output Relay Mapping



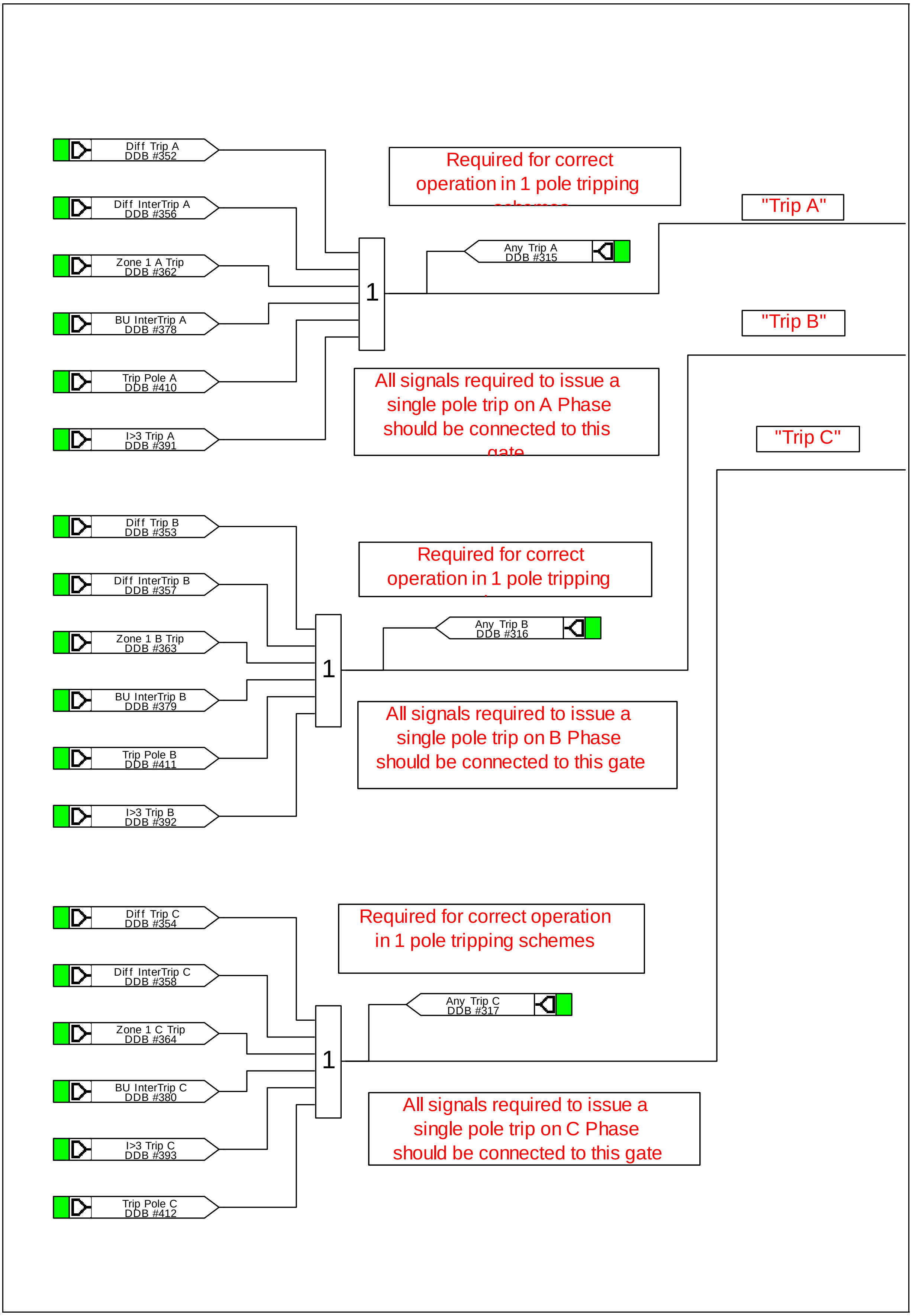
MiCOM P545, Page 4

Output Relay Mapping



MiCOM P545, Page 5

Trip Logic Mapping



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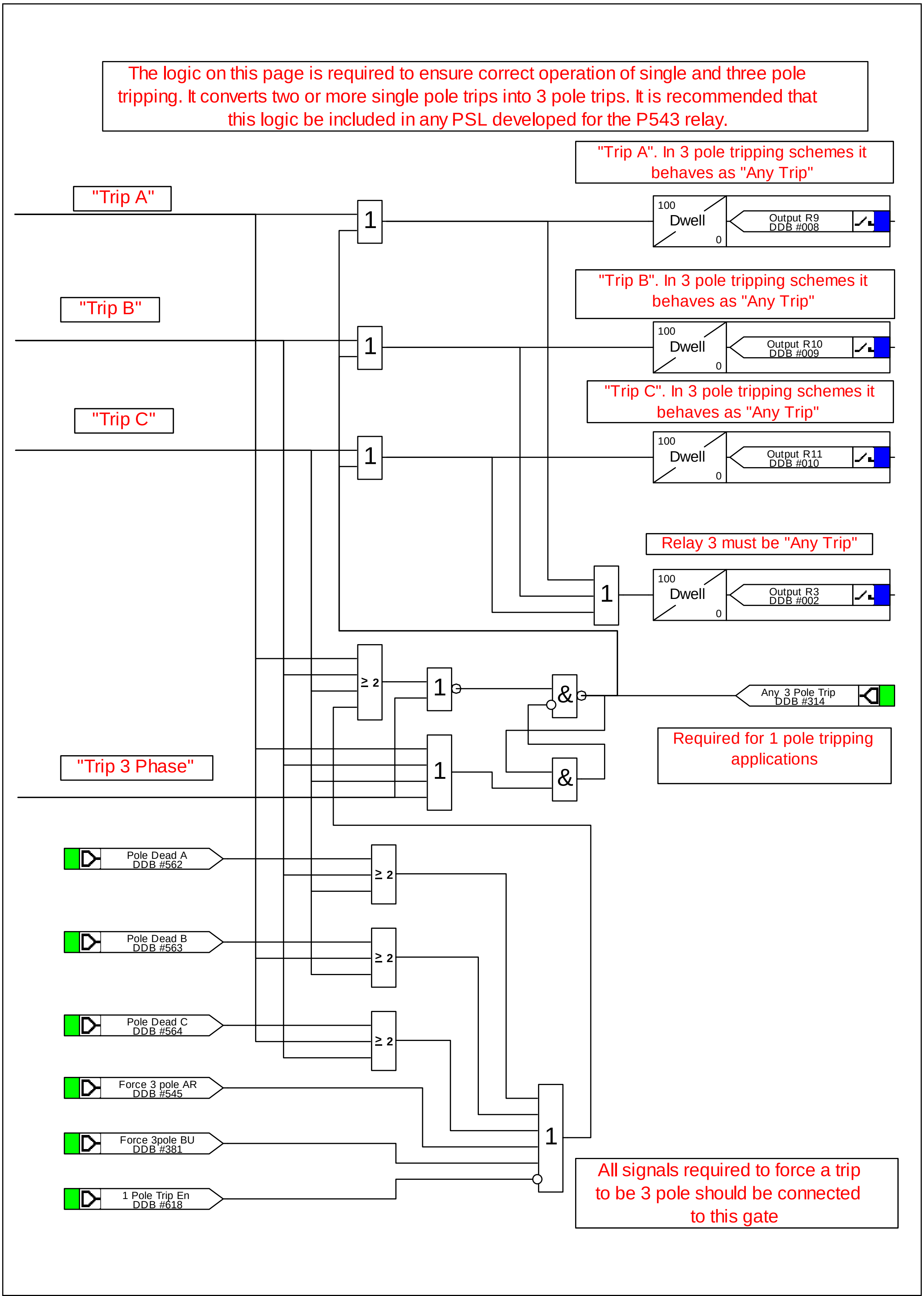
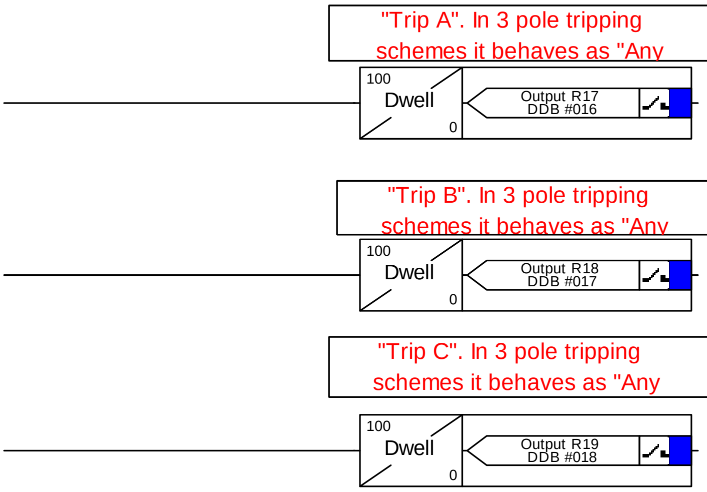
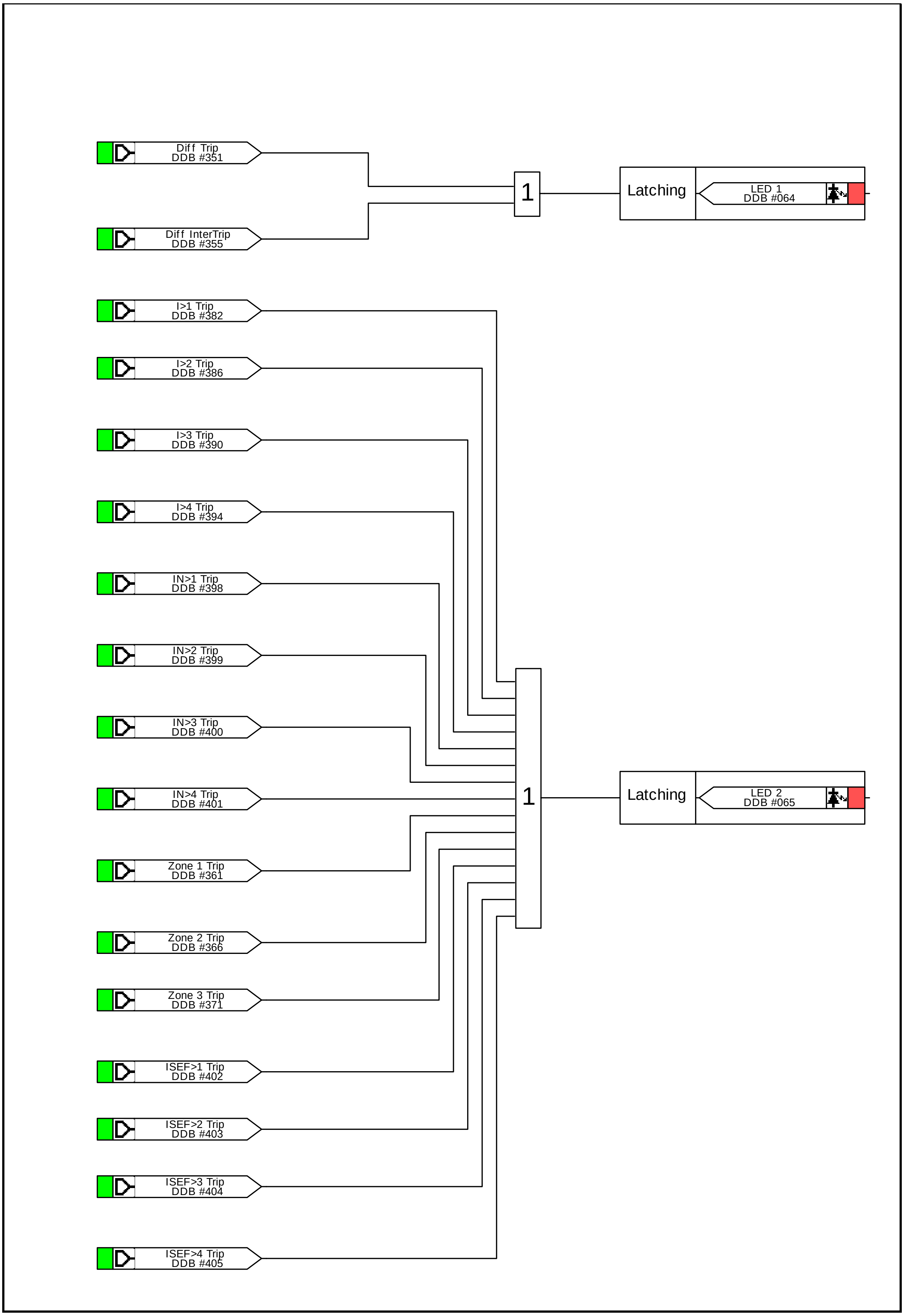
Trip Conversion and Logic Mapping



Output Relay Mapping



LED Mapping



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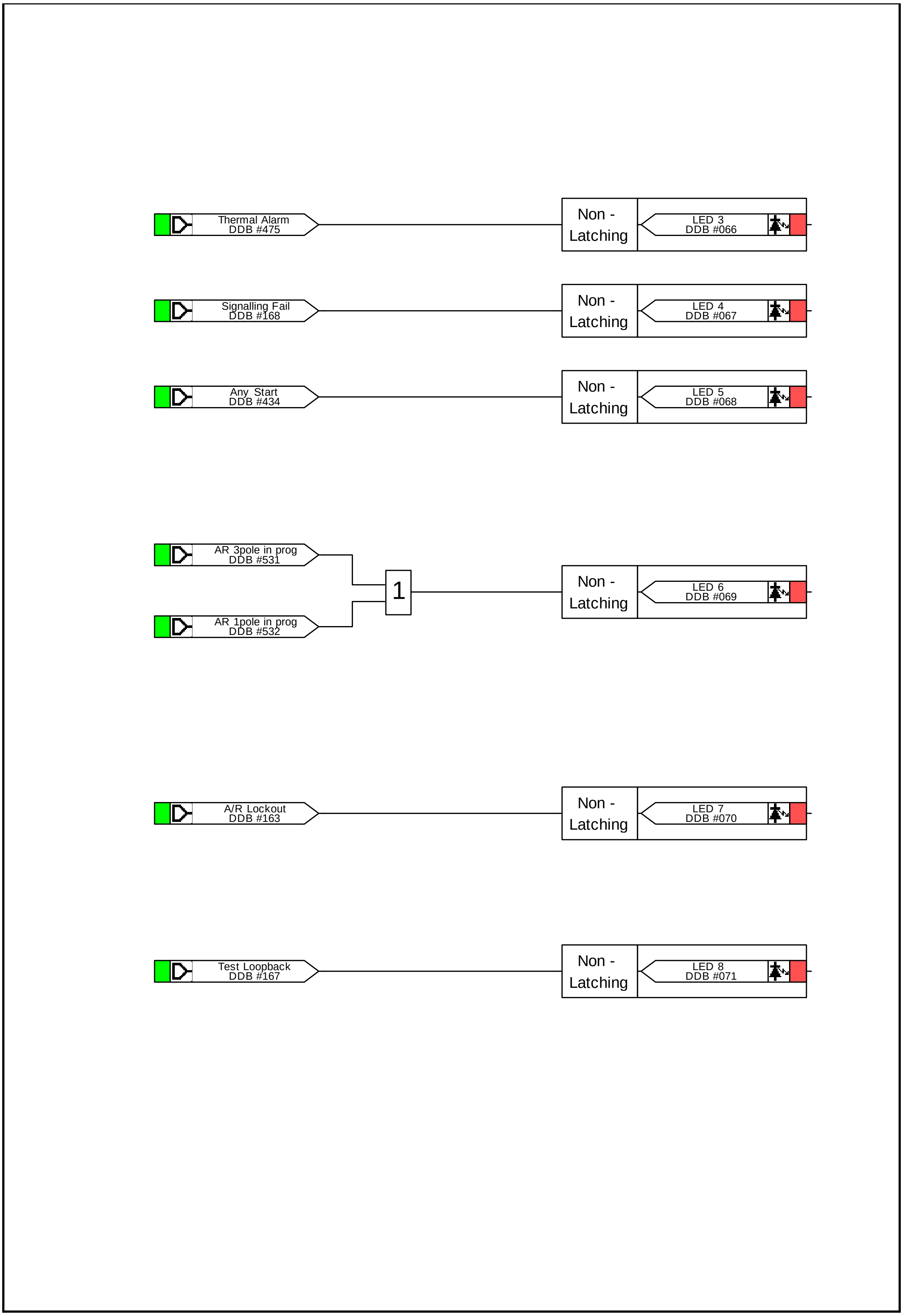
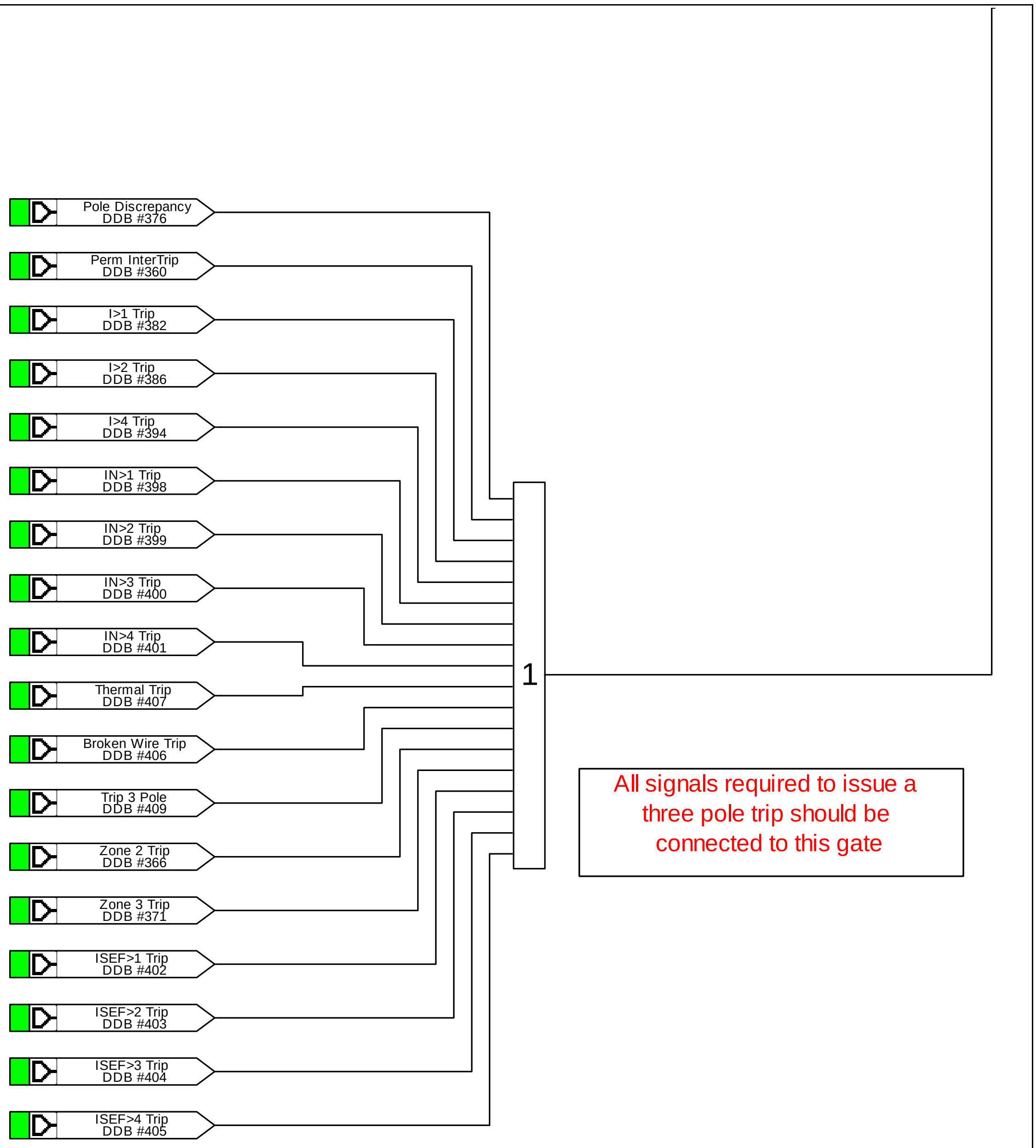
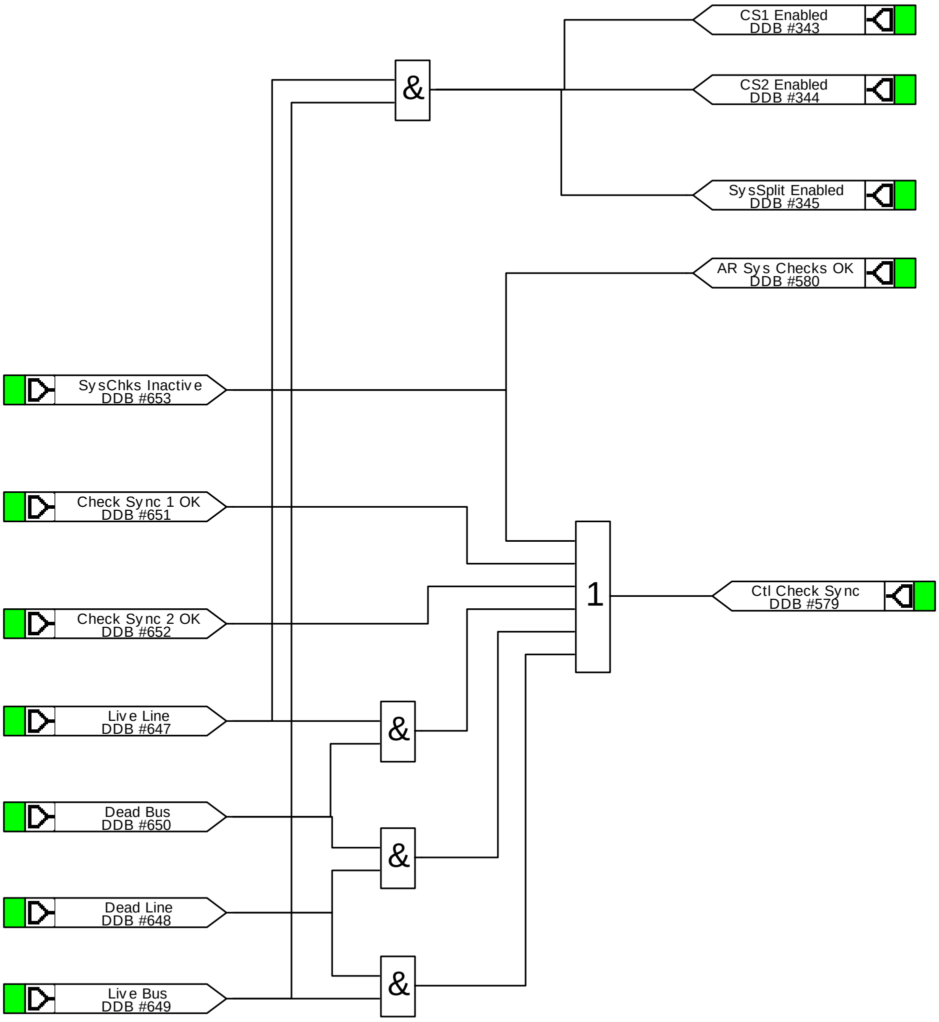
LED Mapping


Thermal Alarm
DDB #475
Non - Latching
LED 3
DDB #066
Signalling Fail
DDB #168
Non - Latching
LED 4
DDB #067
Any Start
DDB #434
Non - Latching
LED 5
DDB #068
AR 3pole in prog
DDB #531
AR 1pole in prog
DDB #532
1
Non - Latching
LED 6
DDB #069
A/R Lockout
DDB #163
Non - Latching
LED 7
DDB #070
Test Loopback
DDB #167
Non - Latching
LED 8
DDB #071

Trip Logic Mapping

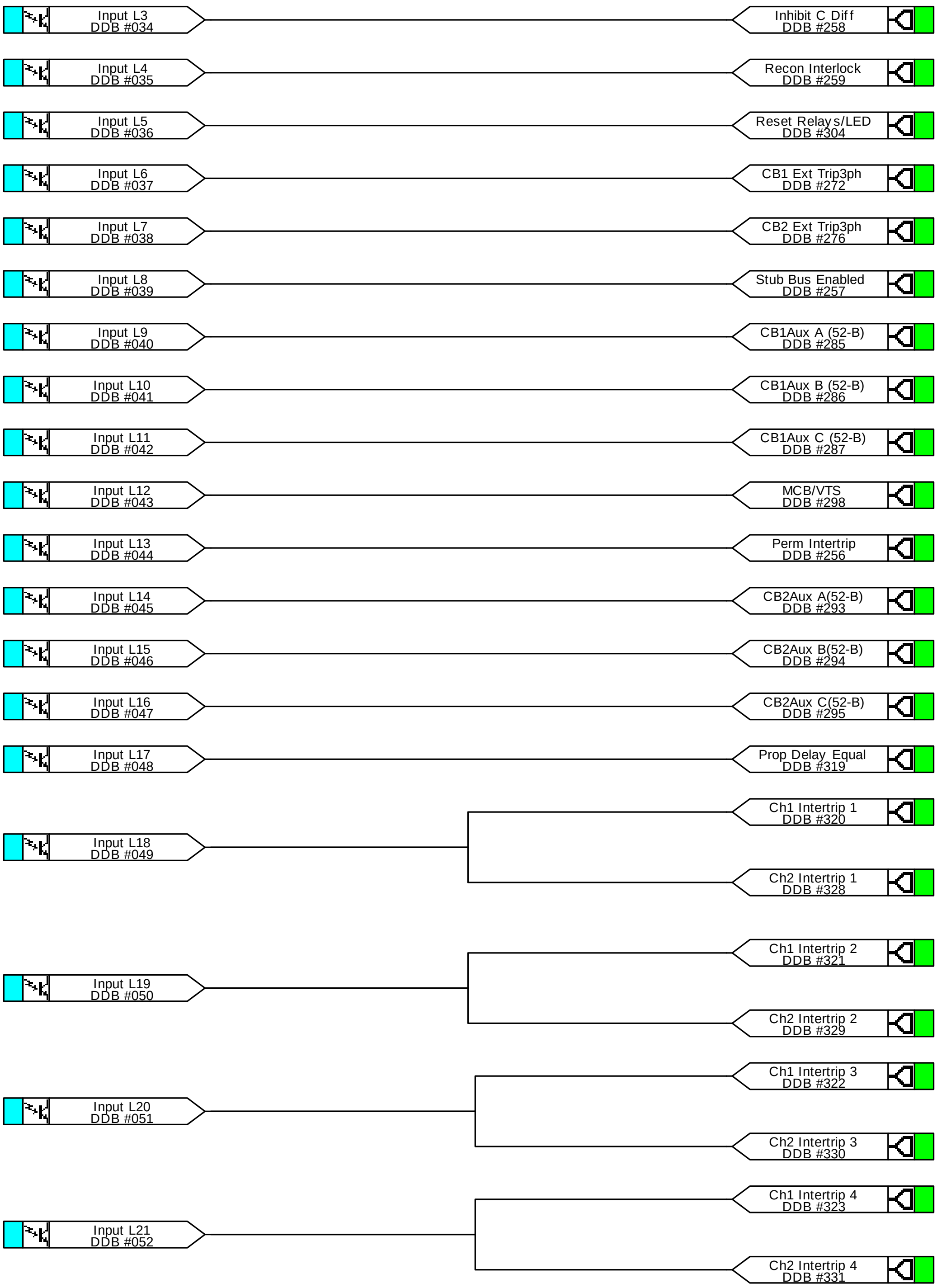


Check Synch. and Voltage Monitor Mapping

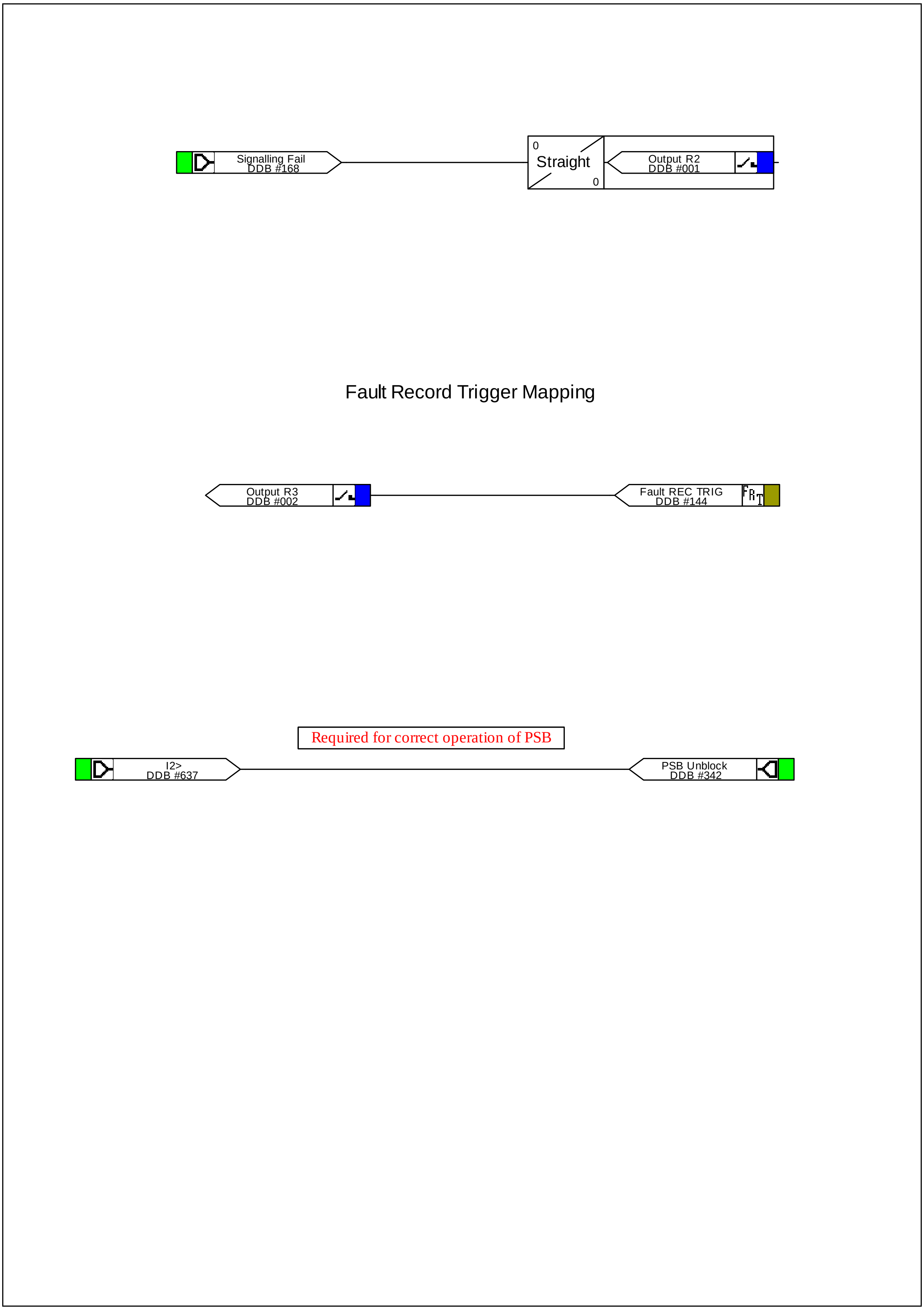


MiCOM P546 PROGRAMMABLE LOGIC

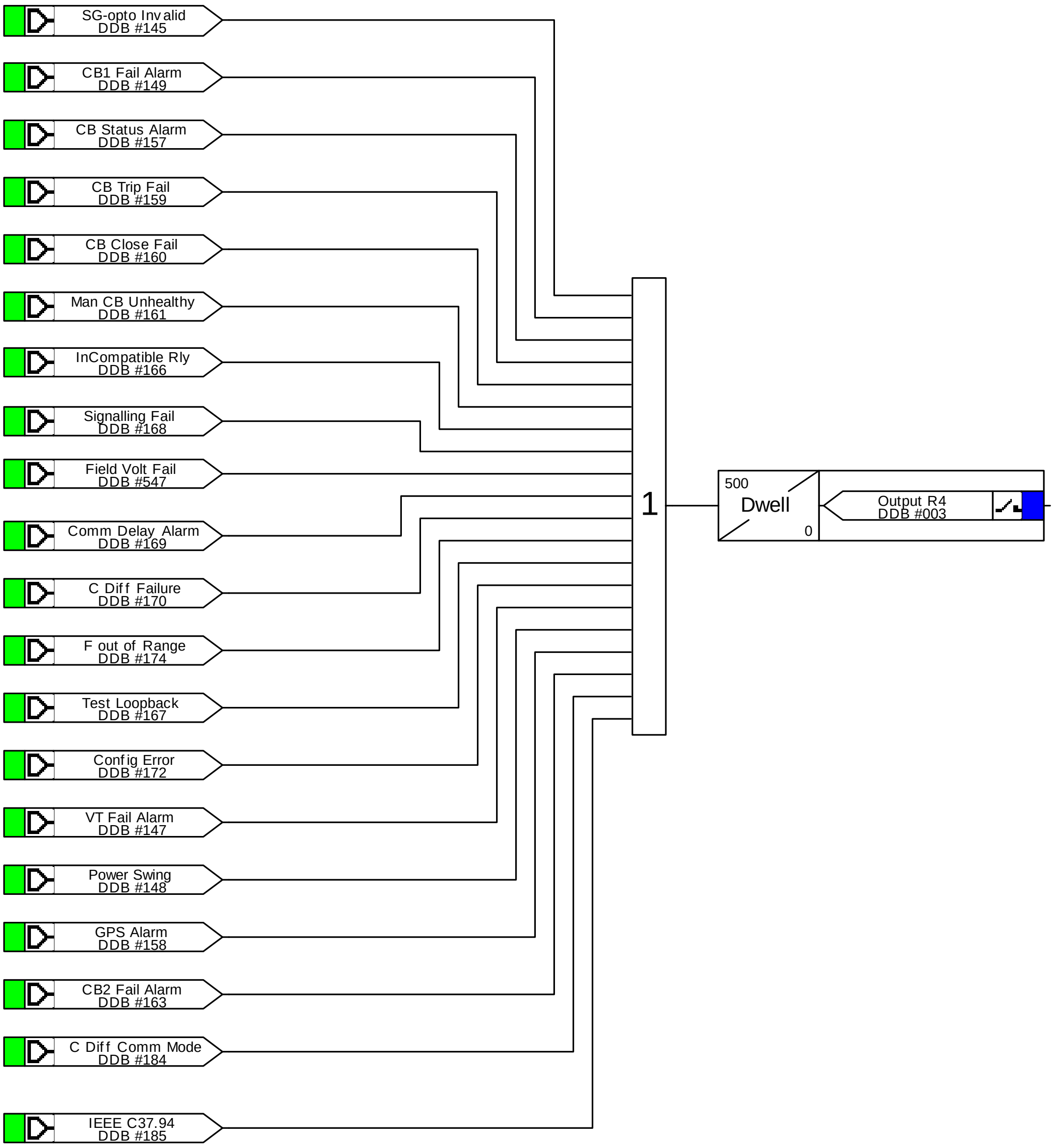
Opto Input Mappings



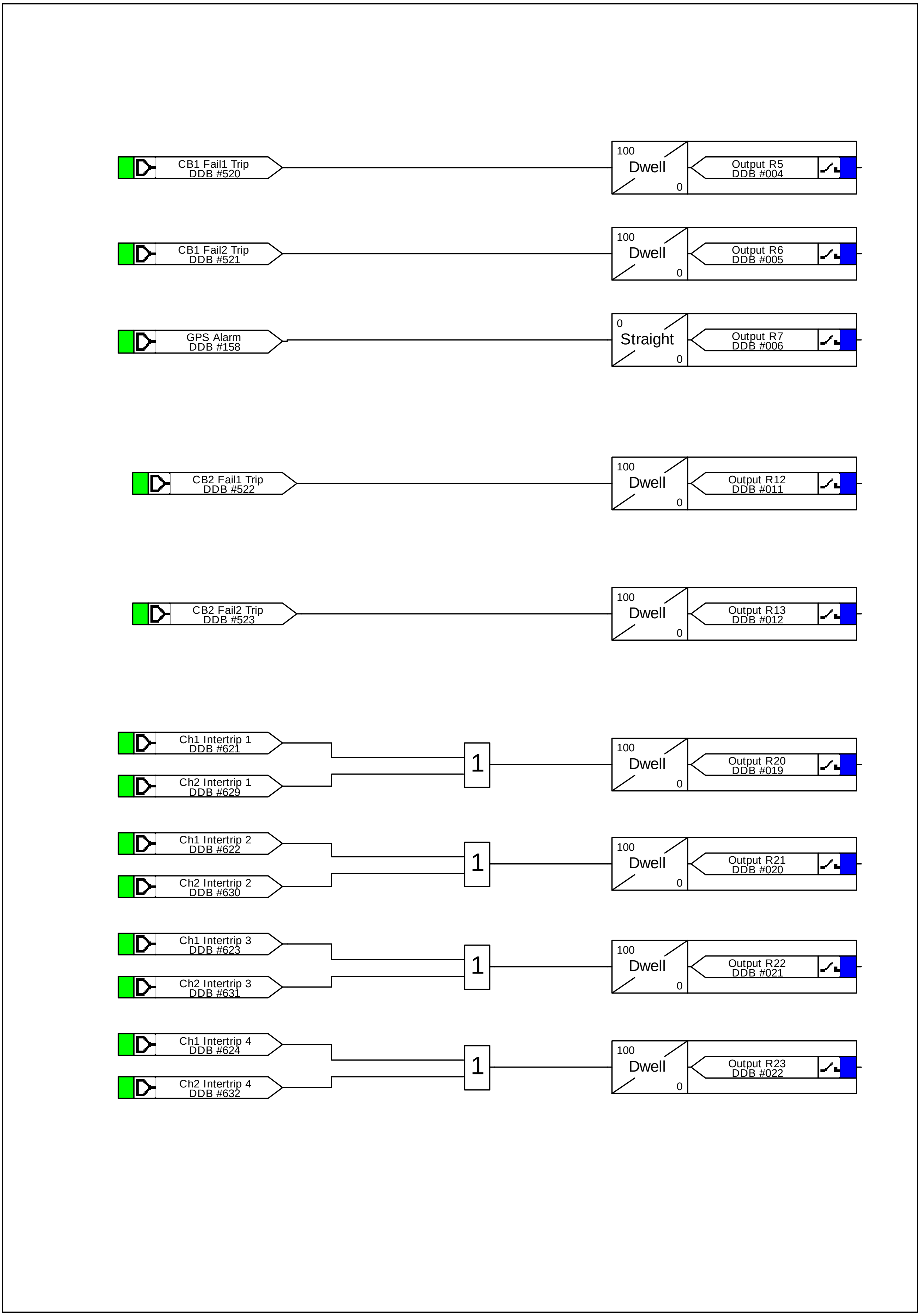
Output Relay Mapping



Output Relay Mapping

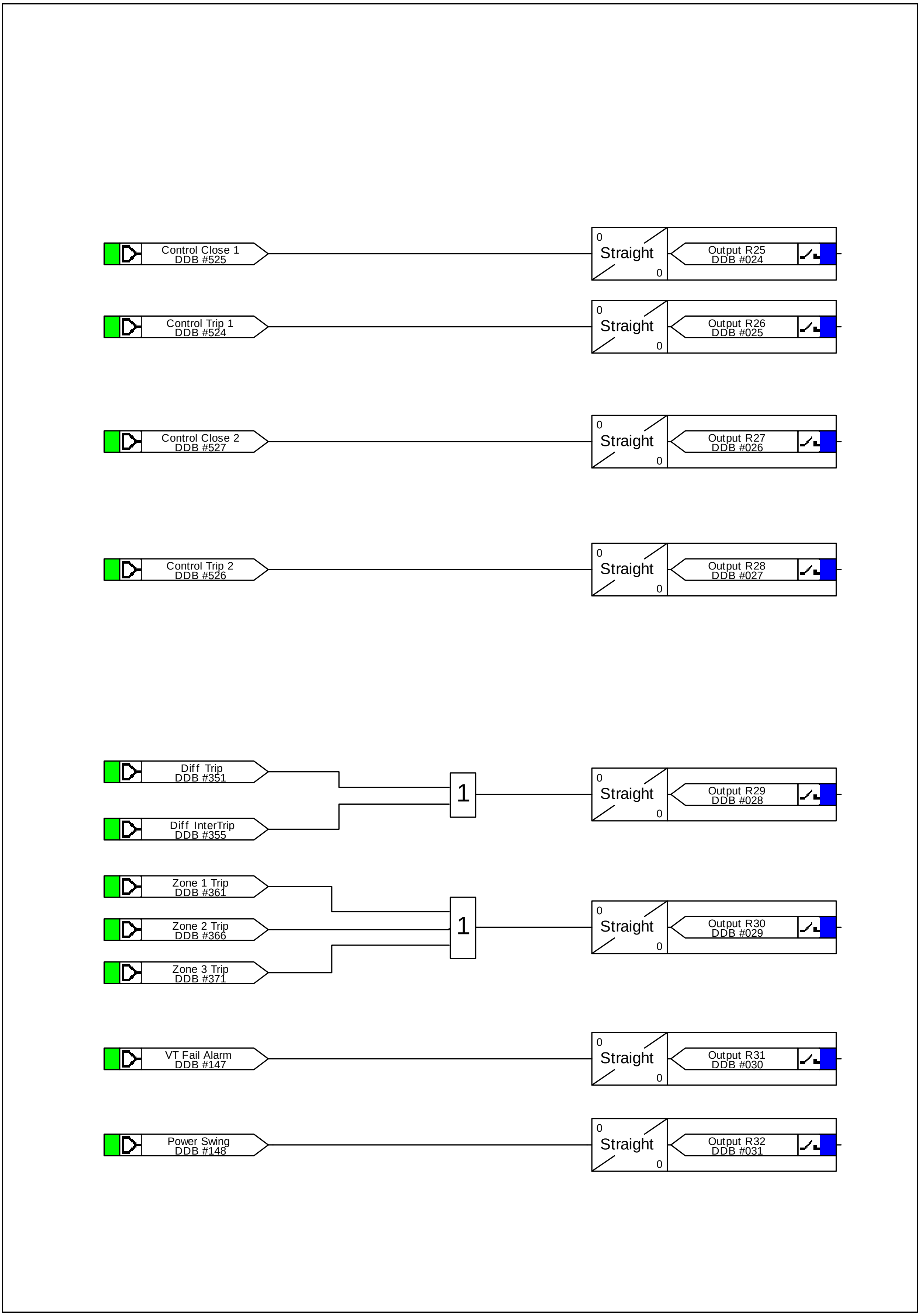


Output Relay Mapping



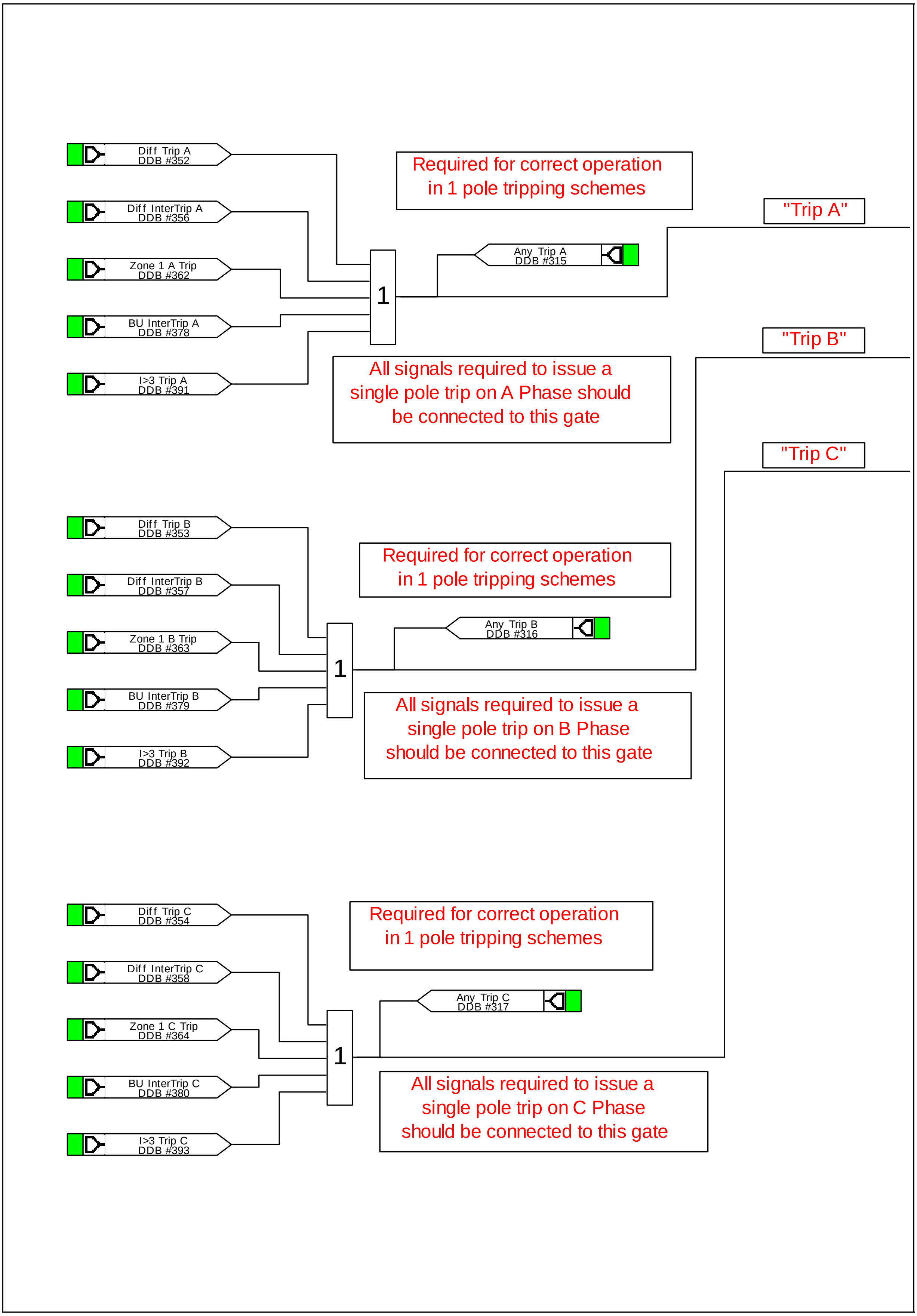
MiCOM P546, Page 4

Output Relay Mapping

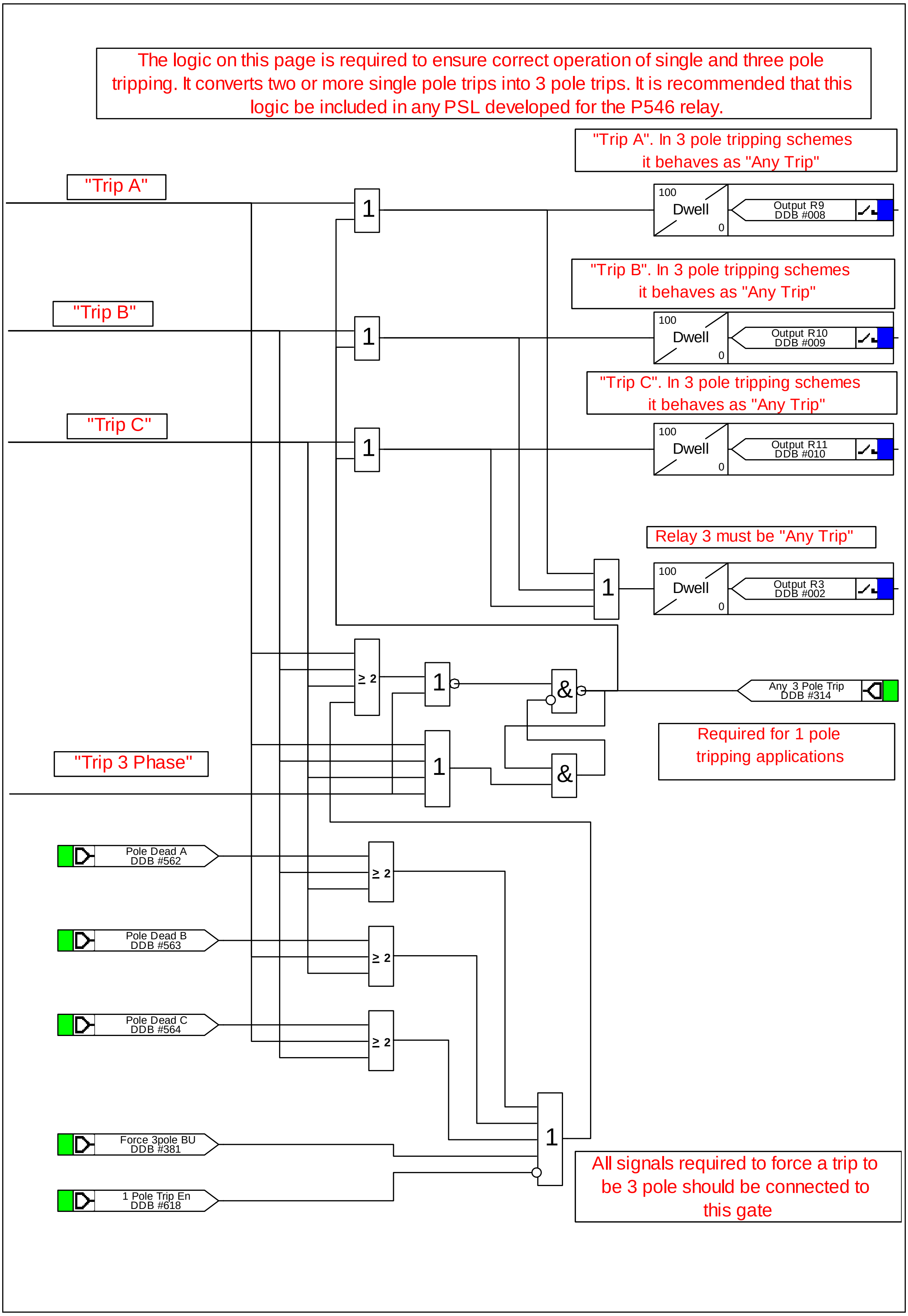


MiCOM P546, Page 5

Trip Logic Mapping



Trip Conversion and Logic Mapping



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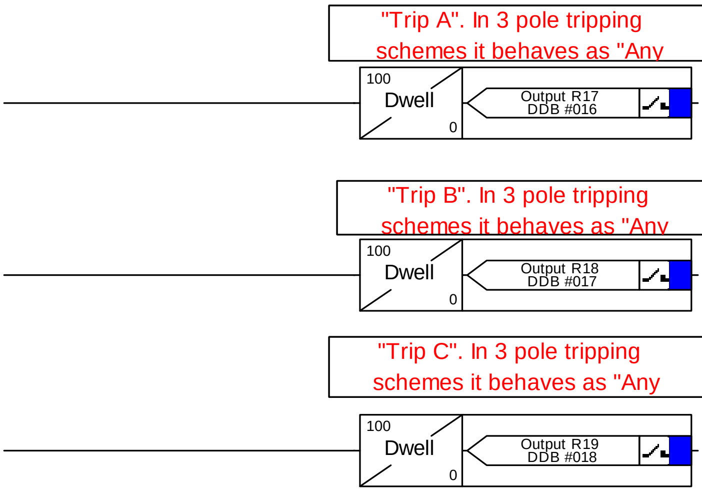
Output Relay Mapping



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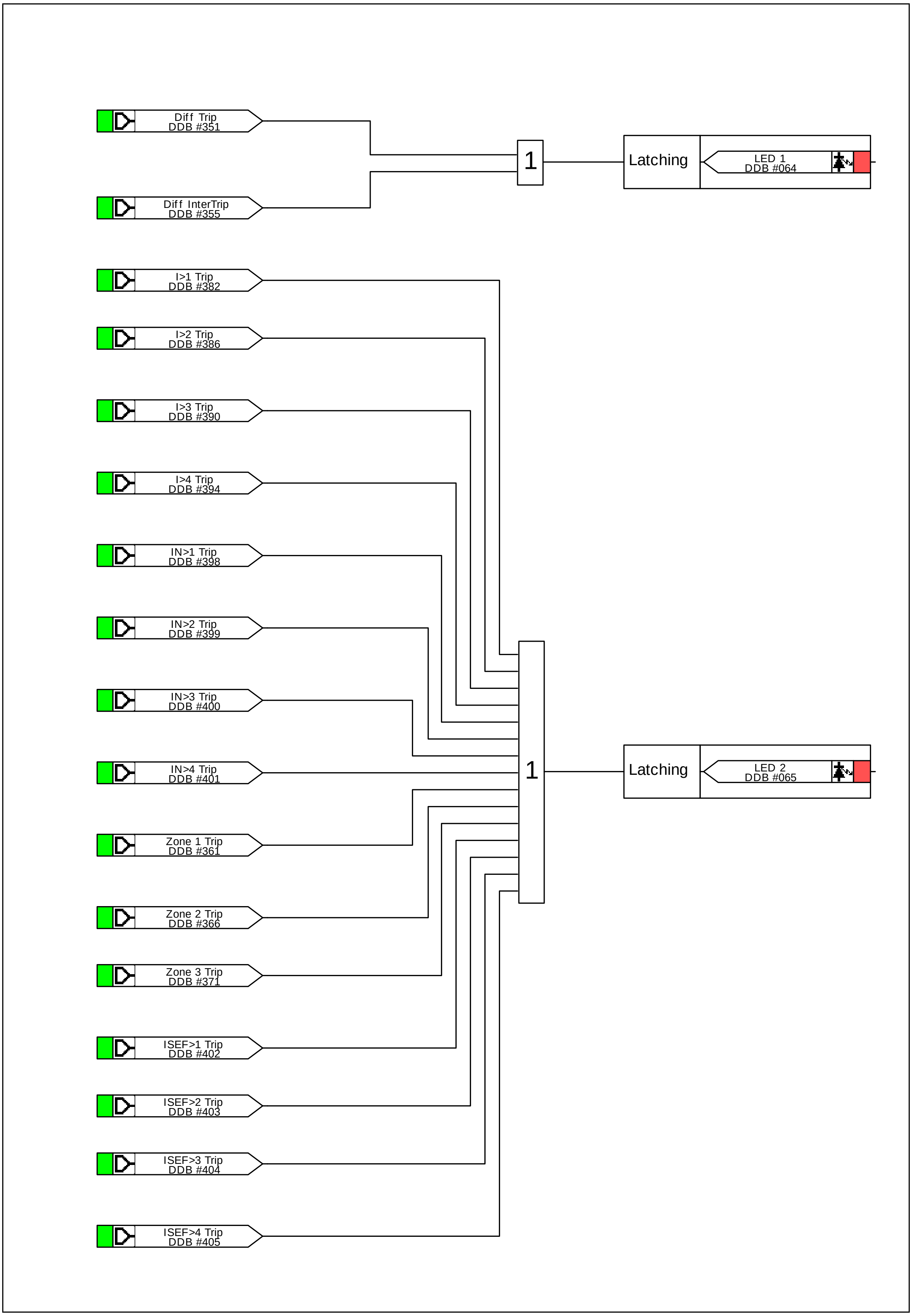
Trip Logic Mapping

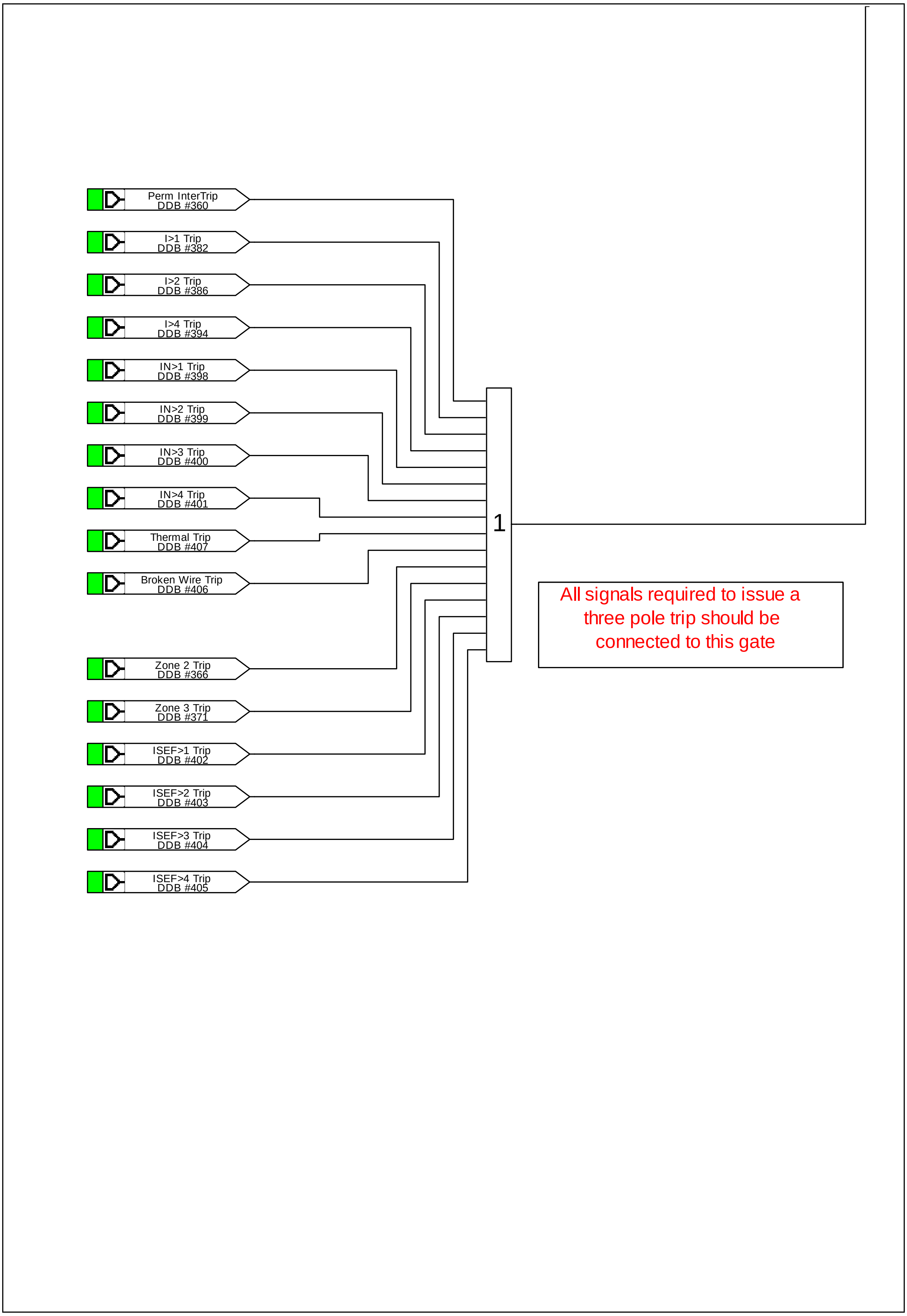


MiCOM P546, Page 9

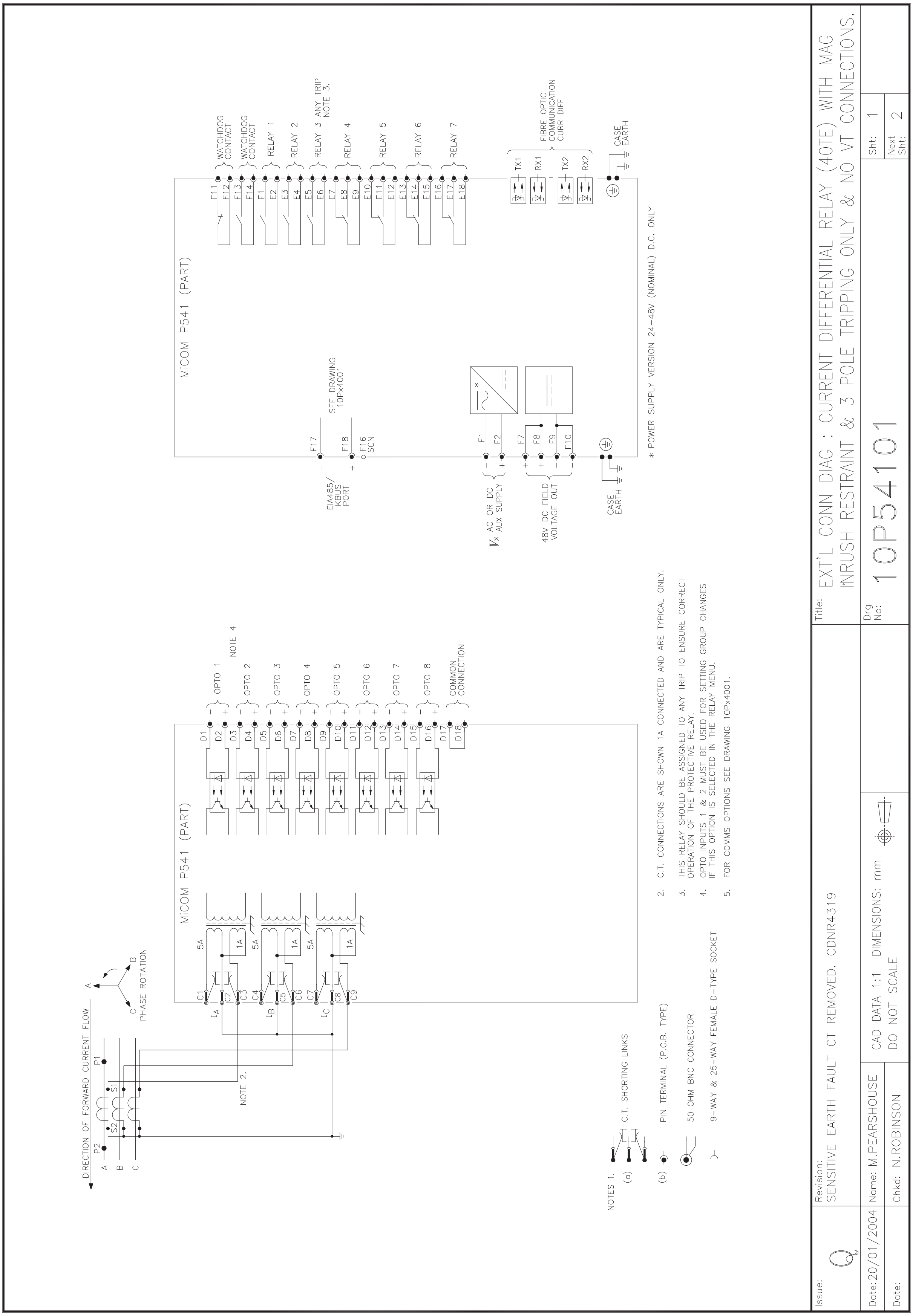
LED Mapping

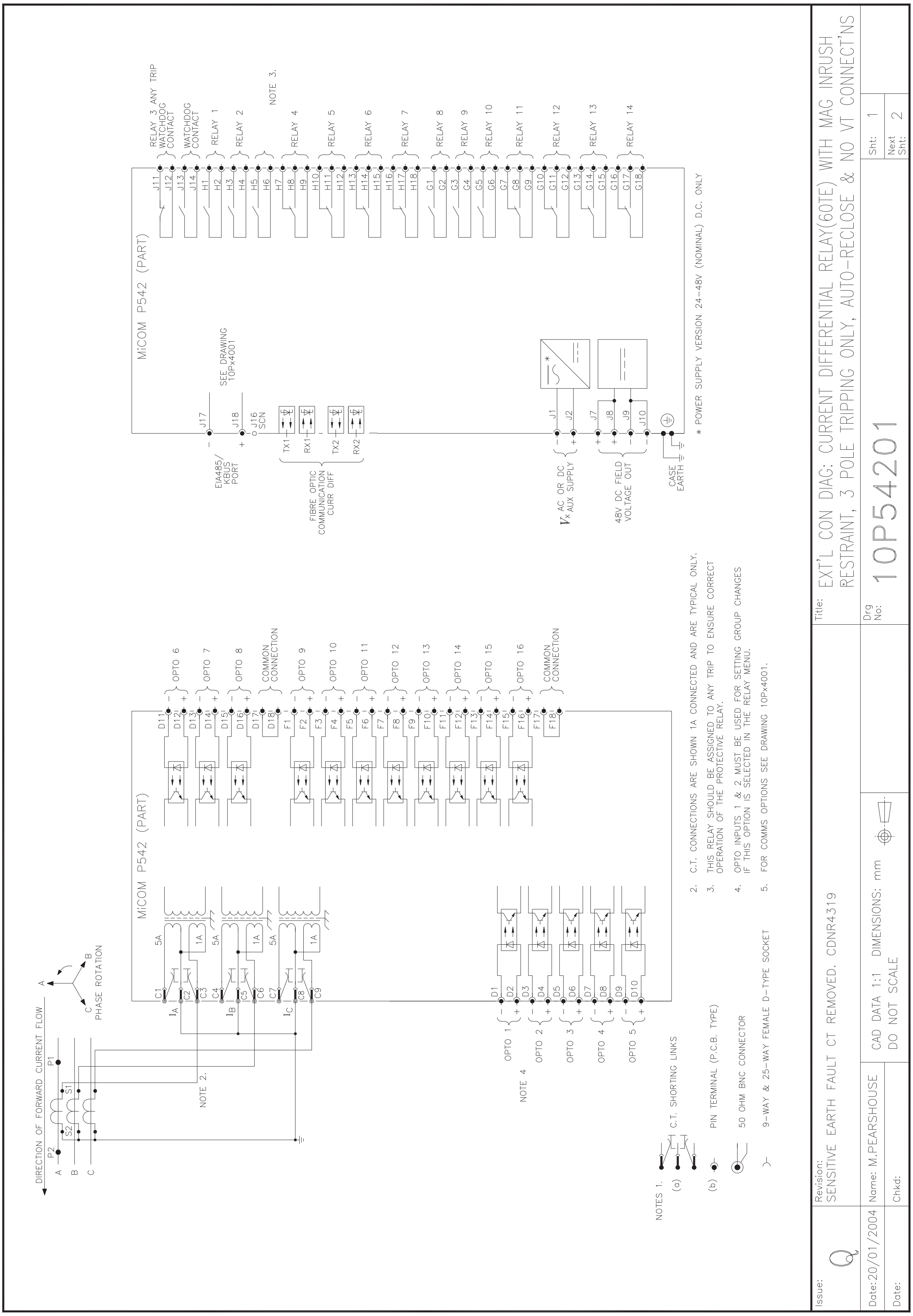

Thermal Alarm
DDB #475
Non -
Latching
LED 3
DDB #066
Signalling Fail
DDB #168
Non -
Latching
LED 4
DDB #067
Any Start
DDB #434
Non -
Latching
LED 5
DDB #068
Test Loopback
DDB #167
Non -
Latching
LED 8
DDB #071

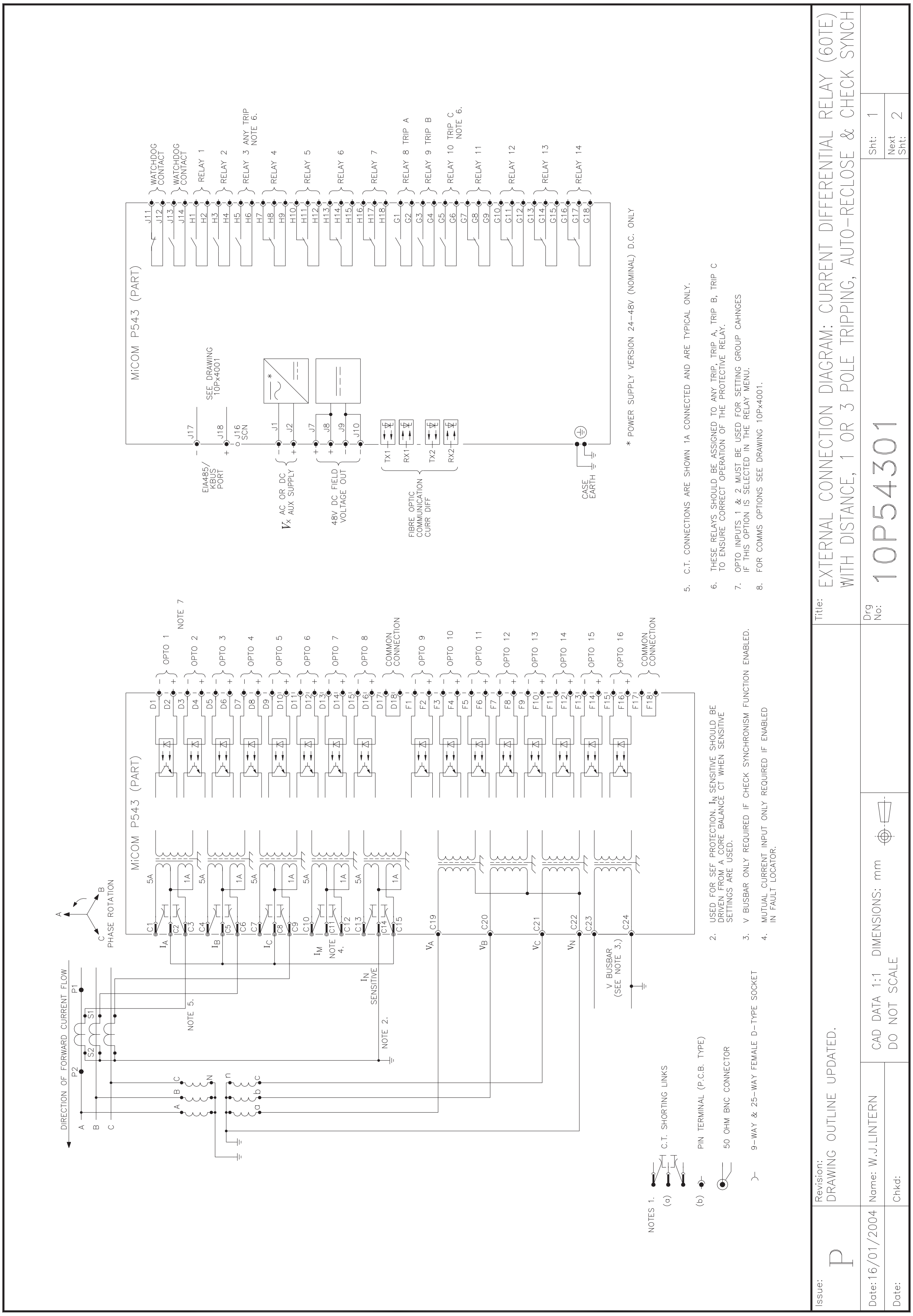
Trip Logic Mapping



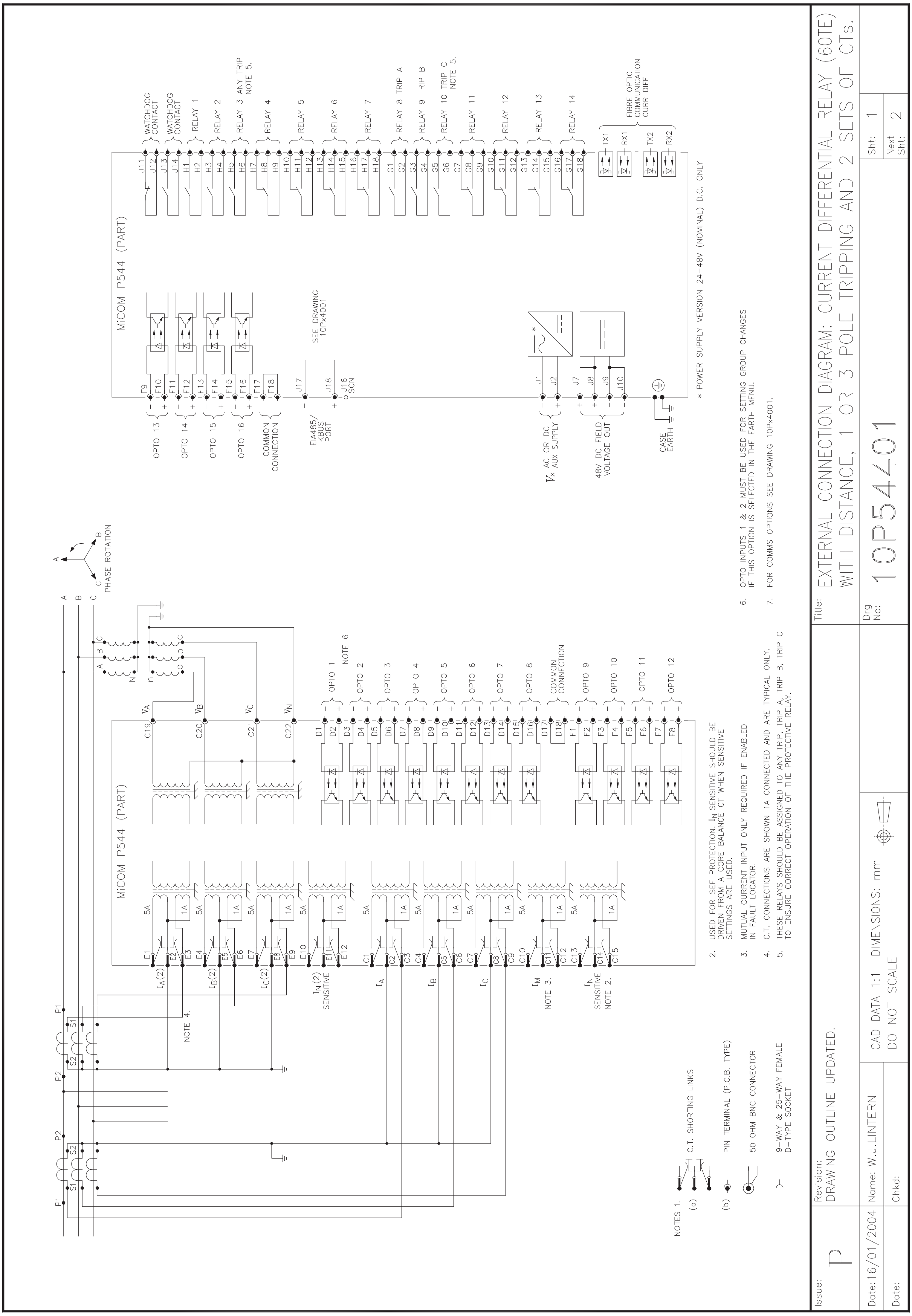
EXTERNAL CONNECTION DIAGRAMS

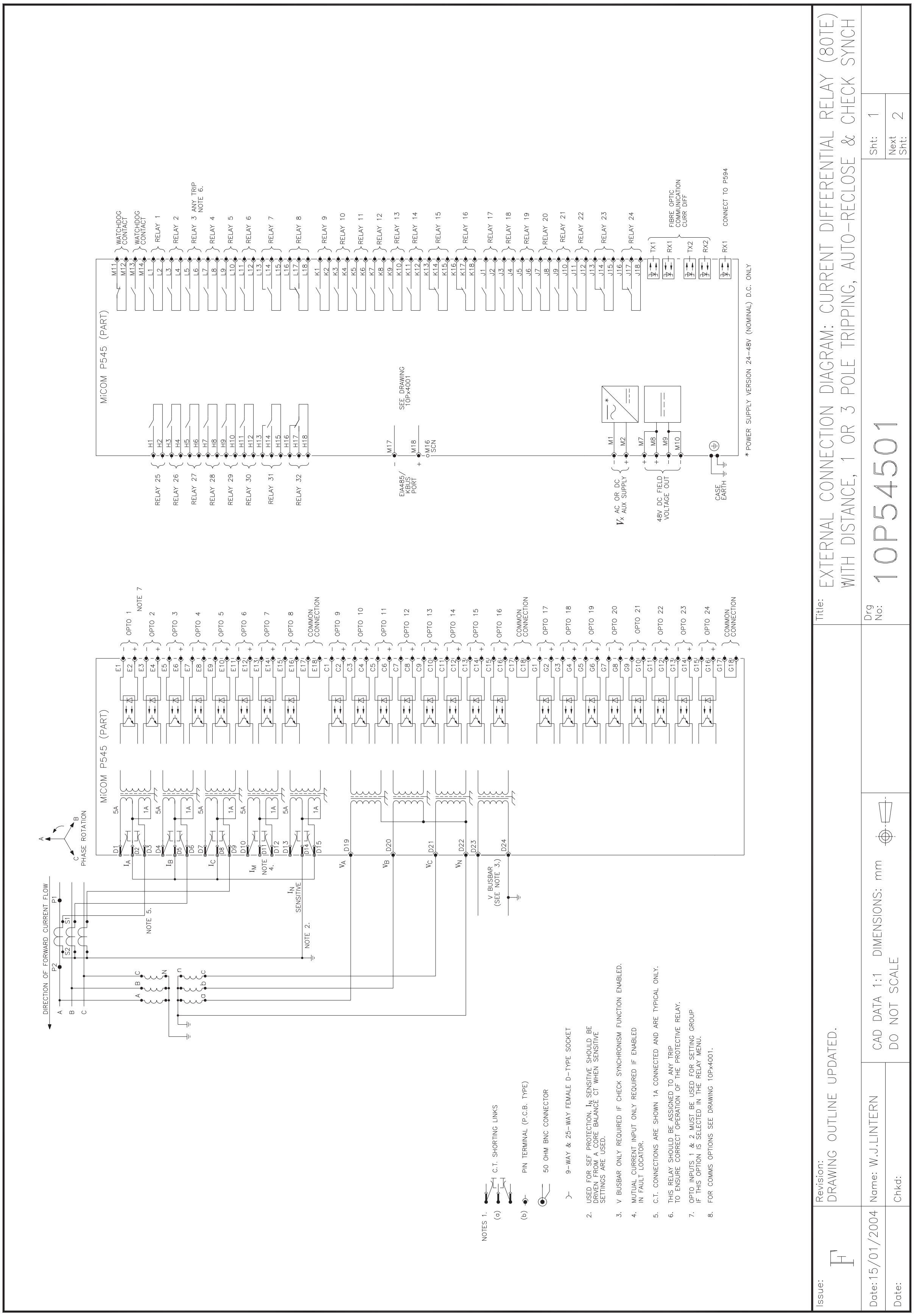

MiCOM P541 (PART)
WATCHDOG CONTACT
RELAY 1
RELAY 2
RELAY 3 ANY TRIP NOTE 3.
RELAY 4
RELAY 5
RELAY 6
RELAY 7
FIBRE OPTIC COMMUNICATION CURR DIFF
CASE EARTH
SEE DRAWING 10Px4001
EIA485/ KBUS PORT
AC OR DC AUX SUPPLY
48V DC FIELD VOLTAGE OUT
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY
OPTO 1
OPTO 2
OPTO 3
OPTO 4
OPTO 5
OPTO 6
OPTO 7
OPTO 8
COMMON CONNECTION
NOTE 4
PHASE ROTATION
DIRECTION OF FORWARD CURRENT FLOW
NOTE 2.
NOTES 1. (a) C.T. SHORTING LINKS
(b) PIN TERMINAL (P.C.B. TYPE)
50 OHM BNC CONNECTOR
9-WAY & 25-WAY FEMALE D-TYPE SOCKET
2. C.T. CONNECTIONS ARE SHOWN 1A CONNECTED AND ARE TYPICAL ONLY.
3. THIS RELAY SHOULD BE ASSIGNED TO ANY TRIP TO ENSURE CORRECT OPERATION OF THE PROTECTIVE RELAY.
4. OPTO INPUTS 1 & 2 MUST BE USED FOR SETTING GROUP CHANGES IF THIS OPTION IS SELECTED IN THE RELAY MENU.
5. FOR COMMS OPTIONS SEE DRAWING 10Px4001.
Title: EXT'L CONN DIAG : CURRENT DIFFERENTIAL RELAY (40TE) WITH MAG INRUSH RESTRAINT & 3 POLE TRIPPING ONLY & NO VT CONNECTIONS.
Drg No: 10P54101
Sht: 1
Next Sht: 2
Issue: Q
Revision: SENSITIVE EARTH FAULT CT REMOVED. CDNR4319
Date: 20/01/2004
Name: M.PEARSHOUSE
Chkd: N.ROBINSON
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE

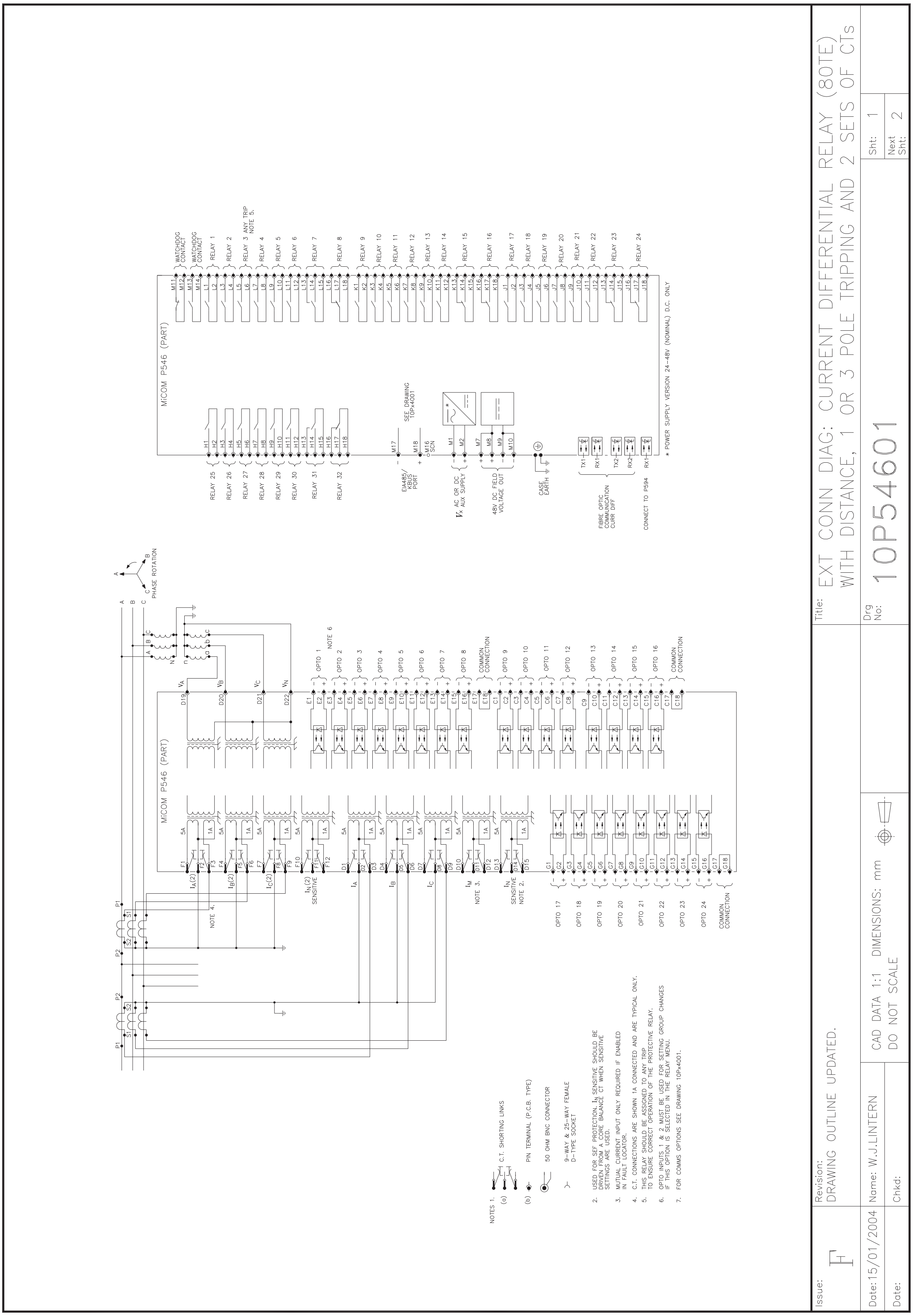

MiCOM P542 (PART)
EXT'L CON DIAG: CURRENT DIFFERENTIAL RELAY(60TE) WITH MAG INRUSH
RESTRAINT, 3 POLE TRIPPING ONLY, AUTO-RECLOSE & NO VT CONNECT'NS
10P54201
Sht: 1
Next Sht: 2
Revision: SENSITIVE EARTH FAULT CT REMOVED. CDNR4319
Name: M.PEARSHOUSE
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Date: 20/01/2004
Issue: Q
NOTES 1. (a) C.T. SHORTING LINKS
(b) PIN TERMINAL (P.C.B. TYPE)
50 OHM BNC CONNECTOR
9-WAY & 25-WAY FEMALE D-TYPE SOCKET
2. C.T. CONNECTIONS ARE SHOWN 1A CONNECTED AND ARE TYPICAL ONLY.
3. THIS RELAY SHOULD BE ASSIGNED TO ANY TRIP TO ENSURE CORRECT OPERATION OF THE PROTECTIVE RELAY.
4. OPTO INPUTS 1 & 2 MUST BE USED FOR SETTING GROUP CHANGES IF THIS OPTION IS SELECTED IN THE RELAY MENU.
5. FOR COMMS OPTIONS SEE DRAWING 10Px4001.
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY
DIRECTION OF FORWARD CURRENT FLOW
PHASE ROTATION
EIA485/ KBUS PORT
SEE DRAWING 10Px4001
FIBRE OPTIC COMMUNICATION CURR DIFF
AC OR DC AUX SUPPLY
48V DC FIELD VOLTAGE OUT
CASE EARTH
WATCHDOG CONTACT
COMMON CONNECTION

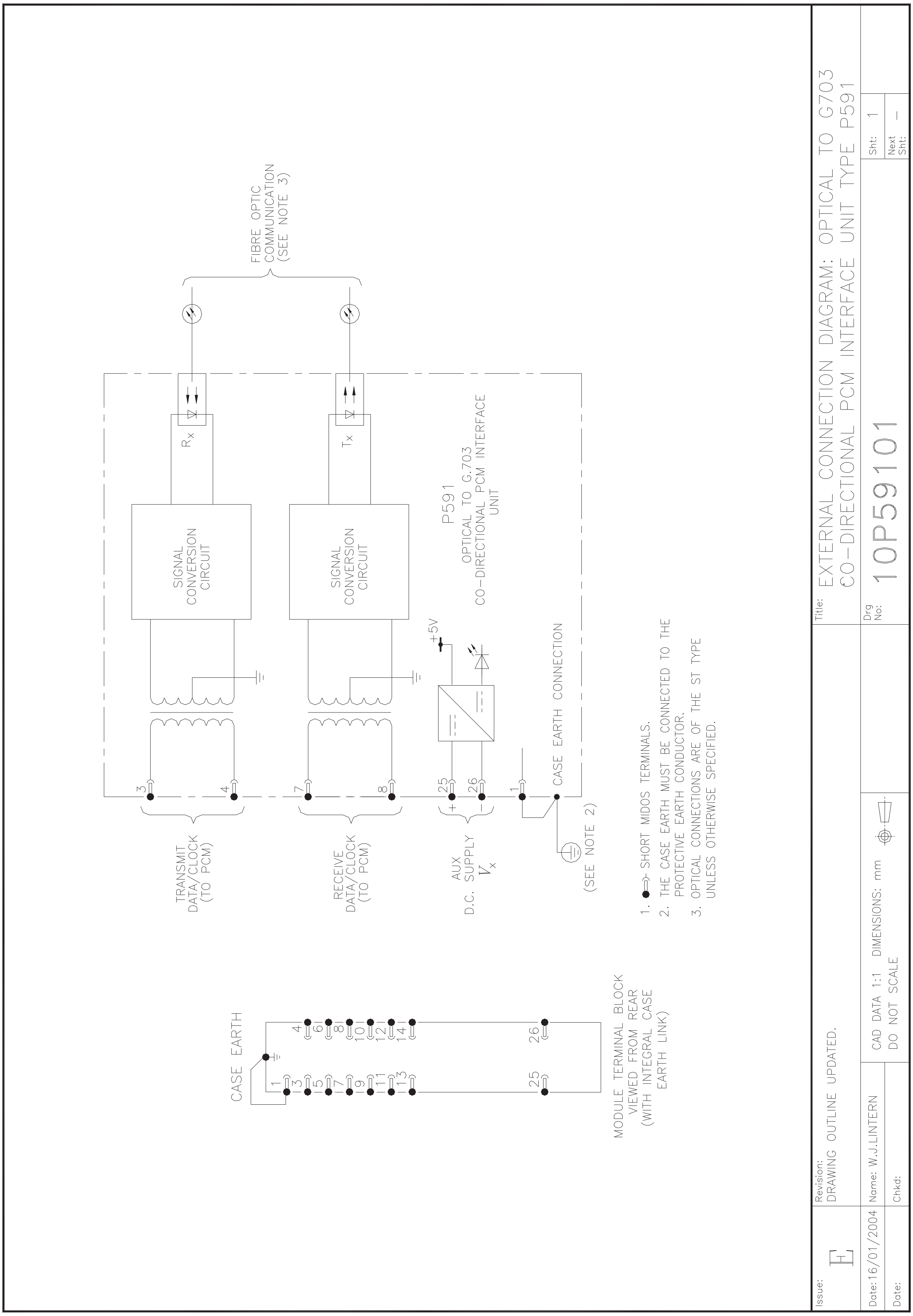


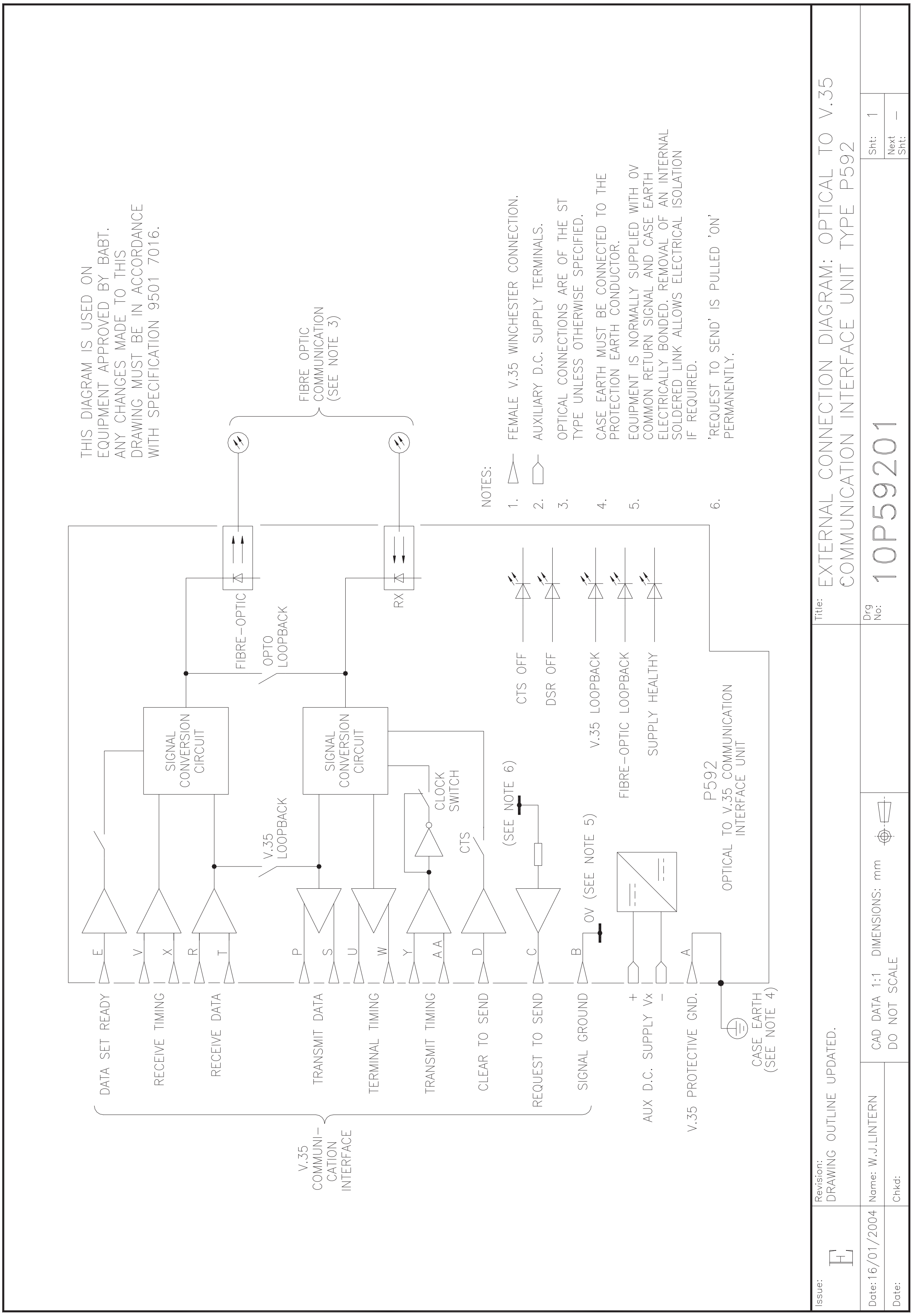
MiCOM P543 (PART)
DIRECTION OF FORWARD CURRENT FLOW
PHASE ROTATION
NOTE 5.
NOTE 2.
NOTE 4.
NOTE 7
I_N SENSITIVE
V BUSBAR (SEE NOTE 3.)
COMMON CONNECTION
EIA485/ KBUS PORT
SEE DRAWING 10Px4001
AC OR DC AUX SUPPLY
48V DC FIELD VOLTAGE OUT
FIBRE OPTIC COMMUNICATION CURR DIFF
CASE EARTH
WATCHDOG CONTACT
RELAY 3 ANY TRIP NOTE 6.
RELAY 8 TRIP A
RELAY 9 TRIP B
RELAY 10 TRIP C NOTE 6.
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY
NOTES 1. (a) C.T. SHORTING LINKS
(b) PIN TERMINAL (P.C.B. TYPE)
50 OHM BNC CONNECTOR
9-WAY & 25-WAY FEMALE D-TYPE SOCKET
2. USED FOR SEF PROTECTION. I_N SENSITIVE SHOULD BE DRIVEN FROM A CORE BALANCE CT WHEN SENSITIVE SETTINGS ARE USED.
3. V BUSBAR ONLY REQUIRED IF CHECK SYNCHRONISM FUNCTION ENABLED.
4. MUTUAL CURRENT INPUT ONLY REQUIRED IF ENABLED IN FAULT LOCATOR.
5. C.T. CONNECTIONS ARE SHOWN 1A CONNECTED AND ARE TYPICAL ONLY.
6. THESE RELAYS SHOULD BE ASSIGNED TO ANY TRIP, TRIP A, TRIP B, TRIP C TO ENSURE CORRECT OPERATION OF THE PROTECTIVE RELAY.
7. OPTO INPUTS 1 & 2 MUST BE USED FOR SETTING GROUP CAHNGES IF THIS OPTION IS SELECTED IN THE RELAY MENU.
8. FOR COMMS OPTIONS SEE DRAWING 10Px4001.
Issue: P
Revision: DRAWING OUTLINE UPDATED.
Date: 16/01/2004 Name: W.J.LINTERN
Date: Chkd:
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Title: EXTERNAL CONNECTION DIAGRAM: CURRENT DIFFERENTIAL RELAY (60TE) WITH DISTANCE, 1 OR 3 POLE TRIPPING, AUTO-RECLOSE & CHECK SYNCH
Drg No: 10P54301
Sht: 1
Next Sht: 2

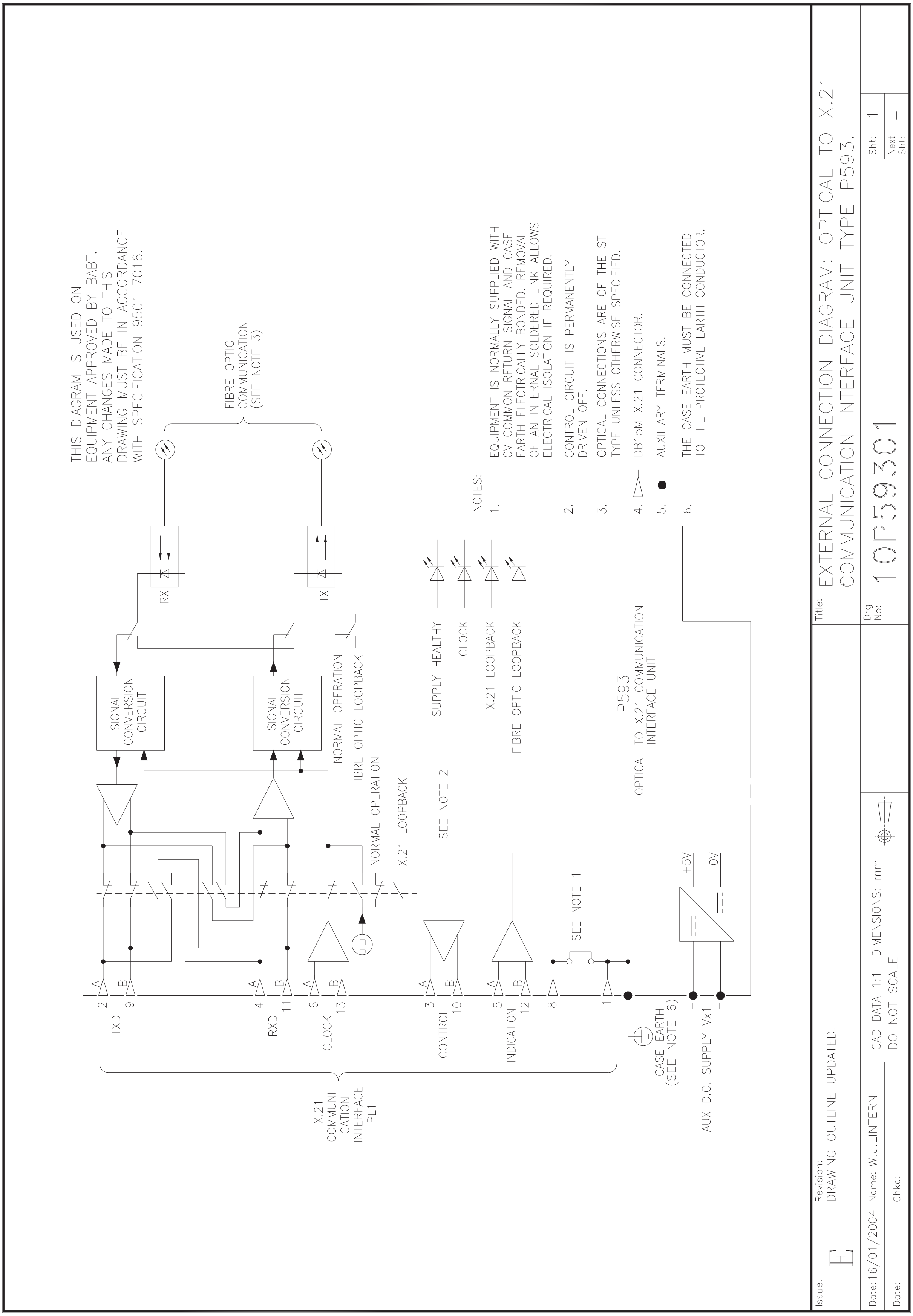

EXTERNAL CONNECTION DIAGRAM: CURRENT DIFFERENTIAL RELAY (60TE)
WITH DISTANCE, 1 OR 3 POLE TRIPPING AND 2 SETS OF CTs.
10P54401
MiCOM P544 (PART)
Revision: DRAWING OUTLINE UPDATED.
Issue: P
Date: 16/01/2004
Name: W.J.LINTERN
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Sht: 1
Next Sht: 2
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY

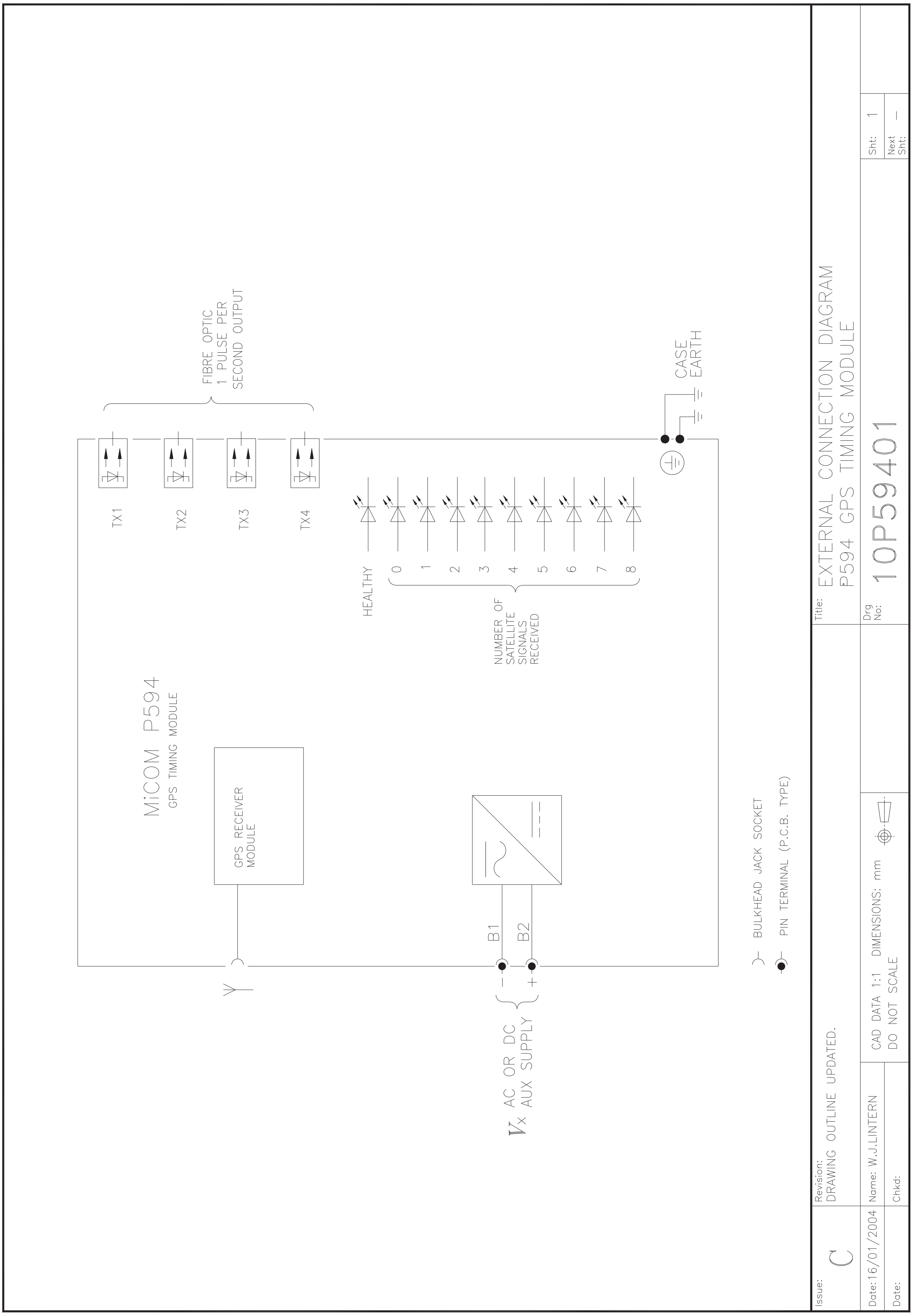

Title: EXTERNAL CONNECTION DIAGRAM: CURRENT DIFFERENTIAL RELAY (80TE)
WITH DISTANCE, 1 OR 3 POLE TRIPPING, AUTO-RECLOSE & CHECK SYNCH
Drg No: 10P54501
Sht: 1
Next Sht: 2
Issue: F
Revision: DRAWING OUTLINE UPDATED.
Date: 15/01/2004
Name: W.J.LINTERN
Chkd:
Date:
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
MiCOM P545 (PART)
NOTES 1. (a) C.T. SHORTING LINKS
(b) PIN TERMINAL (P.C.B. TYPE)
50 OHM BNC CONNECTOR
9-WAY & 25-WAY FEMALE D-TYPE SOCKET
2. USED FOR SEF PROTECTION. IN SENSITIVE SHOULD BE DRIVEN FROM A CORE BALANCE CT WHEN SENSITIVE SETTINGS ARE USED.
3. V BUSBAR ONLY REQUIRED IF CHECK SYNCHRONISM FUNCTION ENABLED.
4. MUTUAL CURRENT INPUT ONLY REQUIRED IF ENABLED IN FAULT LOCATOR.
5. C.T. CONNECTIONS ARE SHOWN 1A CONNECTED AND ARE TYPICAL ONLY.
6. THIS RELAY SHOULD BE ASSIGNED TO ANY TRIP TO ENSURE CORRECT OPERATION OF THE PROTECTIVE RELAY.
7. OPTO INPUTS 1 & 2 MUST BE USED FOR SETTING GROUP IF THIS OPTION IS SELECTED IN THE RELAY MENU.
8. FOR COMMS OPTIONS SEE DRAWING 10Px4001.
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY


Title: EXT CONN DIAG: CURRENT DIFFERENTIAL RELAY (80TE)
WITH DISTANCE, 1 OR 3 POLE TRIPPING AND 2 SETS OF CTs
Drg No: 10P54601
Sht: 1
Next Sht: 2
Issue: F
Revision: DRAWING OUTLINE UPDATED.
Date: 15/01/2004
Name: W.J.LINTERN
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
MiCOM P546 (PART)
PHASE ROTATION
NOTES 1. (a) C.T. SHORTING LINKS
(b) PIN TERMINAL (P.C.B. TYPE)
50 OHM BNC CONNECTOR
9-WAY & 25-WAY FEMALE D-TYPE SOCKET
2. USED FOR SEF PROTECTION. IN SENSITIVE SHOULD BE DRIVEN FROM A CORE BALANCE CT WHEN SENSITIVE SETTINGS ARE USED.
3. MUTUAL CURRENT INPUT ONLY REQUIRED IF ENABLED IN FAULT LOCATOR.
4. C.T. CONNECTIONS ARE SHOWN 1A CONNECTED AND ARE TYPICAL ONLY.
5. THIS RELAY SHOULD BE ASSIGNED TO ANY TRIP TO ENSURE CORRECT OPERATION OF THE PROTECTIVE RELAY.
6. OPTO INPUTS 1 & 2 MUST BE USED FOR SETTING GROUP CHANGES IF THIS OPTION IS SELECTED IN THE RELAY MENU.
7. FOR COMMS OPTIONS SEE DRAWING 10Px4001.
* POWER SUPPLY VERSION 24-48V (NOMINAL) D.C. ONLY


FIBRE OPTIC
COMMUNICATION
(SEE NOTE 3)
Rx
Tx
SIGNAL
CONVERSION
CIRCUIT
SIGNAL
CONVERSION
CIRCUIT
P591
OPTICAL TO G.703
CO-DIRECTIONAL PCM INTERFACE
UNIT
+5V
CASE EARTH CONNECTION
3
4
7
8
25
26
1
+
-
TRANSMIT
DATA/CLOCK
(TO PCM)
RECEIVE
DATA/CLOCK
(TO PCM)
AUX
D.C. SUPPLY
V_x
(SEE NOTE 2)
1. SHORT MIDOS TERMINALS.
2. THE CASE EARTH MUST BE CONNECTED TO THE PROTECTIVE EARTH CONDUCTOR.
3. OPTICAL CONNECTIONS ARE OF THE ST TYPE UNLESS OTHERWISE SPECIFIED.
CASE EARTH
MODULE TERMINAL BLOCK
VIEWED FROM REAR
(WITH INTEGRAL CASE
EARTH LINK)
Title: EXTERNAL CONNECTION DIAGRAM: OPTICAL TO G703
CO-DIRECTIONAL PCM INTERFACE UNIT TYPE P591
Sht: 1
Next Sht: -
Drg No: 10P59101
Issue: E
Revision: DRAWING OUTLINE UPDATED.
Date: 16/01/2004
Name: W.J.LINTERN
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Chkd:
Date:


THIS DIAGRAM IS USED ON EQUIPMENT APPROVED BY BABT. ANY CHANGES MADE TO THIS DRAWING MUST BE IN ACCORDANCE WITH SPECIFICATION 9501 7016.
FIBRE OPTIC COMMUNICATION (SEE NOTE 3)
NOTES:
1. FEMALE V.35 WINCHESTER CONNECTION.
2. AUXILIARY D.C. SUPPLY TERMINALS.
3. OPTICAL CONNECTIONS ARE OF THE ST TYPE UNLESS OTHERWISE SPECIFIED.
4. CASE EARTH MUST BE CONNECTED TO THE PROTECTION EARTH CONDUCTOR.
5. EQUIPMENT IS NORMALLY SUPPLIED WITH 0V COMMON RETURN SIGNAL AND CASE EARTH ELECTRICALLY BONDED. REMOVAL OF AN INTERNAL SOLDERED LINK ALLOWS ELECTRICAL ISOLATION IF REQUIRED.
6. 'REQUEST TO SEND' IS PULLED 'ON' PERMANENTLY.
FIBRE-OPTIC
RX
OPTO LOOPBACK
SIGNAL CONVERSION CIRCUIT
SIGNAL CONVERSION CIRCUIT
CLOCK SWITCH
V.35 LOOPBACK
CTS
(SEE NOTE 6)
0V (SEE NOTE 5)
CTS OFF
DSR OFF
V.35 LOOPBACK
FIBRE-OPTIC LOOPBACK
SUPPLY HEALTHY
P592
OPTICAL TO V.35 COMMUNICATION INTERFACE UNIT
E V X R T P S U W Y AA D C B A
DATA SET READY
RECEIVE TIMING
RECEIVE DATA
TRANSMIT DATA
TERMINAL TIMING
TRANSMIT TIMING
CLEAR TO SEND
REQUEST TO SEND
SIGNAL GROUND
AUX D.C. SUPPLY Vx + −
V.35 PROTECTIVE GND.
CASE EARTH (SEE NOTE 4)
V.35 COMMUNI-CATION INTERFACE
Title: EXTERNAL CONNECTION DIAGRAM: OPTICAL TO V.35 COMMUNICATION INTERFACE UNIT TYPE P592
Sht: 1
Next Sht: –
Drg No: 10P59201
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Revision: DRAWING OUTLINE UPDATED.
Name: W.J.LINTERN
Chkd:
Issue: E
Date: 16/01/2004
Date:


THIS DIAGRAM IS USED ON EQUIPMENT APPROVED BY BABT. ANY CHANGES MADE TO THIS DRAWING MUST BE IN ACCORDANCE WITH SPECIFICATION 9501 7016.
FIBRE OPTIC COMMUNICATION (SEE NOTE 3)
RX
TX
SIGNAL CONVERSION CIRCUIT
SIGNAL CONVERSION CIRCUIT
NORMAL OPERATION
FIBRE OPTIC LOOPBACK
NORMAL OPERATION
X.21 LOOPBACK
SUPPLY HEALTHY
CLOCK
X.21 LOOPBACK
FIBRE OPTIC LOOPBACK
P593
OPTICAL TO X.21 COMMUNICATION INTERFACE UNIT
SEE NOTE 2
SEE NOTE 1
+5V
0V
TXD
RXD
CLOCK
CONTROL
INDICATION
X.21 COMMUNI-CATION INTERFACE PL1
CASE EARTH (SEE NOTE 6)
AUX D.C. SUPPLY Vx1
NOTES:
1. EQUIPMENT IS NORMALLY SUPPLIED WITH 0V COMMON RETURN SIGNAL AND CASE EARTH ELECTRICALLY BONDED. REMOVAL OF AN INTERNAL SOLDERED LINK ALLOWS ELECTRICAL ISOLATION IF REQUIRED.
2. CONTROL CIRCUIT IS PERMANENTLY DRIVEN OFF.
3. OPTICAL CONNECTIONS ARE OF THE ST TYPE UNLESS OTHERWISE SPECIFIED.
4. DB15M X.21 CONNECTOR.
5. AUXILIARY TERMINALS.
6. THE CASE EARTH MUST BE CONNECTED TO THE PROTECTIVE EARTH CONDUCTOR.
Title: EXTERNAL CONNECTION DIAGRAM: OPTICAL TO X.21 COMMUNICATION INTERFACE UNIT TYPE P593.
Sht: 1
Next Sht: -
Drg No: 10P59301
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE
Revision: DRAWING OUTLINE UPDATED.
Name: W.J.LINTERN
Chkd:
Issue: E
Date: 16/01/2004
Date:


FIBRE OPTIC
1 PULSE PER
SECOND OUTPUT
TX1
TX2
TX3
TX4
CASE
EARTH
HEALTHY
0
1
2
3
4
5
6
7
8
NUMBER OF
SATELLITE
SIGNALS
RECEIVED
MiCOM P594
GPS TIMING MODULE
GPS RECEIVER
MODULE
B1
B2
–
+
Vx AC OR DC
AUX SUPPLY
BULKHEAD JACK SOCKET
PIN TERMINAL (P.C.B. TYPE)
Title: EXTERNAL CONNECTION DIAGRAM
P594 GPS TIMING MODULE
Drg No: 10P59401
Sht: 1
Next Sht: –
Issue: C
Revision: DRAWING OUTLINE UPDATED.
Date: 16/01/2004
Name: W.J.LINTERN
Chkd:
Date:
CAD DATA 1:1 DIMENSIONS: mm
DO NOT SCALE

HARDWARE/SOFTWARE VERSION HISTORY AND COMPATIBILITY

(Note: Includes versions released and supplied to customers only)

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
01	A	A	Feb 2000	First release to production.	V1.07 or later	TG8613A
02	A	A	Mar 2000	✓ PSB. Three settings added to set Zone 6 to increase flexibility ✓ Protection Address. Universal Address added ✓ SEF & EF. Polarising voltage setting range increased ✓ Thermal. Setting range increased ✓ Trip Conversion Logic. 3 DDB signals added to simplify logic for users ✓ Distance. Min polarising voltage increased to prevent tripping for close up three phase faults ✓ Check Sync. Angle measurement improved ✓ PSB. Text for Power Swing indication improved ✓ Include pole discrepancy logic to P543 ✓ Remove DDB elements for Neutral Diff. ✓ Modify IEC870 Test Mode operation ✓ Susceptance setting corrected	V1.08 or later	TG8613B
03	A	A	May 2000	✓ German text changed ✓ Spanish text changed ✓ Changes to DDB names & properties ✓ Improvements in autoreclose and reset from lockout code ✓ Changes to pole dead & Trip Conversion Logic ✓ Changes to P544 circuit breaker fail logic ✓ Added DDB for CS103 Test Mode × Recommend upgrading to 03B software or later	V1.09 or later	TG8613B

Relay type: P54x …

Software Version – Major	Software Version – Minor	Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
03	B	A	Feb 2002	All builds released for maintenance upgrades. ✓ Resolved possible reboot caused by Disturbance Recorder ✓ Resolved possible reboot caused by invalid modbus requests ✓ Resolved a loss of measurements (column 3 & 4) problem that can occur in 3 terminal applications ✓ Problem whereby MiCOM S1 could only set group 1 line length corrected ✓ Fixed capactive charging current compensation in P544 ✓ Corrected P544 display of Phase C current phase angle ✓ IDMT curve improvements ✓ Removed rounding error in tp calculation ✓ Menu dependence using ripple bit corrected ✓ Directional / non direction Earth Fault changes ✓ Battery Fail Alarm improvement ✓ Power measurements read over modbus corrected ✓ Improving read key functionality in the presence of alarms ✓ Prevented software errors from clearing event log	V1.09 or later	TG8613B
04	A	A	Aug 2000	✓ Trip conversion logic moved from internal fixed logic to PSL	V1.10 or later	TG8613B
04	B	A	Mar 2001	Only P543 CS103 builds released. ✓ Improvements to the CS103 time synchronisation	V1.10 or later	TG8613B
04	C	A	Jun 2001	Only P543 CS103 builds released. Based on 04B. ✓ Resolved a loss of measurements (columns 3 & 4) problem that can occur in 3 terminal applications	V1.10 or later	TG8613B
04	D	A	Jun 2001	Only P543 CS103 build released. Based on 04C. ✓ Prevents a reboot on power-up when battery is removed	V1.10 or later	TG8613B

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
05	B	A	Oct 2000	✓ Includes DNP3.0 ✓ Courier Bay Module compatibility modification ✓ Modbus Bay Module compatibility modification ✓ Distance – Z3 selectable forward / reverse ✓ Spanish text corrected ✓ Menu dependencies improved ✓ Modbus reading of fault location corrected ✓ RDF file modified ✓ Directional / non direction Earth Fault directionality improvements ✓ Some modbus address changed ✓ Requirement to use relays 8, 9 & 10 for Trip A, B & C removed ✓ Modbus communication when used with140 harmonised ✓ Battery Fail Alarm improvement ✓ Blocking negative sign for fault location for close-up faults ✓ Power measurements read over modbus corrected ✓ Modbus status register reports disturbance records incorrectly following power up cycle ✓ Recommend upgrading to 05G software or later, or 05H+ for modbus	V2.0 or later	TG8613B
05	E	A	Jun 2001	✓ Improvements to measurements 3 and 4 columns for three terminal applications × Recommend upgrading to 05G software or later, or 05K or later	V2.0 or later	TG8613B

Relay type: P54x …							
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
05	F	A	Sep 2001	All builds released to production. Based on 05E software. ✓ Problem whereby MiCOM S1 could only set group 1 line length correct ✓ Fixed capacitive charging current compensation in P544 ✓ Corrected P544 display of Phase C current phase angle ✓ IDMT curve improvements ✓ Removed rounding error in tp calculation ✓ Fixed problems caused by changes to DNP3 address ✓ Recommend upgrading to 05K or later	V2.0 or later	TG8613B
05	G	A	Jan 2002	✓ Resolved possible reboot caused by Disturbance Recorder × Problem in modbus build which could cause a reboot. Recommend upgrading to 05K or later	V2.0 or later	TG8613B
05	H	A	Jan 2002	✓ Resolved possible reboot caused by invalid modbus requests × Recommend upgrading to 05K or later	V2.0 or later	TG8613B
05	I	A	Oct 2002	✓ Correct the format used to display frequency over the modbus interface × Recommended upgrading to 05K or later	V2.0 or later	TG8613B
05	J	A	Nov 2002	✓ Resolved incorrect operation of C Diff Failure Alarm in 3 terminal schemes ✓ Correct operation of Capacitive Charging Current Compensation in 3 terminal schemes ✓ Resolved problem with resample timer on microprocessor × Recommended upgrading to 05K or later	V2.0 or later	TG8613B
05	K	A	Feb 2003	✓ Resolved problem with IEC60870-5-103 time synchronisation	V2.0 or later	TG8613B

Relay type: P54x …						
Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
05	L	A	Jan 2004	Maintenance Release based on 05K (not formally released) ✓ Prevents compressed disturbance recorder stalling. ✓ Prevent a maintenance record when reading from an inaccessible modbus register	V2.0 or Later	TG8613B
05	M	A	Jun 2004	Maintenance Release based on 05L ✓ Improved Self-checking of Analogue data acquisition ✓ Improved self checking of SRAM ✓ Reception of modbus frame improved ✓ Rejection of spurious messages injected onto RS485 network improved ✓ Permissive Intertrip in dual redundant schemes corrected	V2.0 or Later	TG8613B
11	A	B	Sep 2001	✓ GPS synchronisation for P545 & P546 ✓ Flexible intertripping ✓ Event Optimisation & Filtering ✓ Watt Hour Measurement Change ✓ Addition of digital opto filtering control ✓ Increase in protection signalling address to 20 ✓ DDB increased in size to 1022 ✓ Support for universal optos (Model number suffix B) ✓ Internal loopback added ✓ Restore defaults now restores DNP3 cells correctly ✓ Prevent non DNP3 builds generating fatal error when S1 request DNP3 upload ✓ Modbus enabling/disabling of IRIG-B improved	V2.03 or later	P54x/EN x/D11

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
11 Cont	A	B	Sep 2001	✓ Courier/modbus event bit functionality corrected ✓ Rear port address setting improvement ✓ Improving read key functionality in the presence of alarm ✓ Prevented software errors from clearing event log ✓ Unextracted Disturbance records now set the courier status flag on power up ✓ Added support for modbus function code 7 ✓ Corrected the modbus status bit 0 ✓ Changes to OTEV bit in the Status of Fault in IEC60870-5-103 ✓ PSL version history reference identifier added ✓ Reset LEDs DDB name change ✓ Change to line length of fault locator ✓ Control inputs added ✓ Changes to capacitive charging current compensation in P544 & P546 ✓ Minor changes to IDMT characteristics ✓ Added a 1s drop off timer to C Diff inhibit ✓ Changed max value of Char mod timer to 2s ✓ Increased number of PSL timers to 16 (all models) ✓ Added a setting to P543/5 AR to select which edge of trip initiates AR ✓ Added 3 DDB signals to block distance ✓ Removed force 3 pole trip DDB ✓ DNP & modbus address are compatible but there are several new ones	V2.03 or later	P54x/EN x/D11

Relay type: P54x …

Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
11 Cont	A	B	Sep 2001	✓ Software is not compatible with previous software (signalling message) ✓ Distance. Directional line now inclined at –30 degrees and +150 degrees on polar plot (previously perpendicular to line impedance angle) ✓ Power swing blocking. Unblocking for faults during power swing now selectable in PSL (default uses I2 unblocking to match phase 1) ✓ Power swing blocking logic improved ✓ Enhancements to IEC60870-5-103 builds to add disturbance recorder, private codes and monitor blocking ✗ Recommend upgrading to software 11G or later	V2.03 or later	P54x/EN x/D11
11	B	B	Oct 2001	✓ Modified the co-processor start-up routine to work with alternative types of SRAM ✓ Improved response to a CS103 poll class 1 when monitor blocked was active ✓ Resolved a time alignment problem which resulted in C Diff failure Alarms being raised ✓ Corrected some modbus address for P545 & P546 ✓ Fixed a problem with the relays response to modbus commands read coils and read inputs ✓ Fixed an incorrect response to a DNP3.0 command ✗ Recommended upgrading to 11G or later	V2.03 or Later	P54x/EN x/D11
11	C	B	Dec 2001	✓ Voltage and power measurements in CS103 build now marked as invalid ✓ Fixed a problem in P544 & P546 where the SEF current measurement was incorrect when set to 1A & 60Hz	V2.03 or later	P54x/EN x/D11

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
11 Cont	C	B	Dec 2001	× Recommend upgrading to software 11G or later	V2.03 or later	P54x/EN x/D11
11	D	B	Jan 2002	✓ Resolved possible reboot caused by Disturbance Recorder ✓ Resolved possible reboot caused by invalid modbus requests ✓ Resolved problem when internal loopback was selected with external clocks ✓ Resolved a problem which caused the loss of IEC60870-5-103 class 1 messages × Recommend upgrading to 11G or later	V2.03 or later	P54x/EN X/D11
11	E	B	Oct 2002	✓ Resolved incorrect operation of C Diff Failure Alarm in 3 terminal schemes ✓ Correct operation of Capacitive Charging Current Compensation on 3 terminal schemes ✓ Resolved problem which caused short duration GPS Failure Alarms ✓ Recommended upgrading to 11G or later	V2.03 or later	P54x/En x/D11
11	F	B	Feb 2003	✓ Resolved several problems related to the IEC 60870-5-103 protocol ✓ Resolved problem with resample timer on microprocessor ✓ Corrected the format used to display frequency over the modbus interface × Recommend upgrading to 11G or later.	V2.03 or later	P54x/EN x/D11
11	G	B	May 2003	✓ Changes to clock recovery circuits to improve operation with mutliplexers ✓ PSL logic for user defined intertrips corrected P545 & P546 ✓ Permissive intertrip in dual redundant schemes corrected	V2.03 or later	P54x/EN x/D11

Relay type: P54x …						
Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
11 **Cont**	G	B	May 2003	✓ Prevented unwanted Comms Delay Alarms	V2.03 or later	P54x/EN x/D11
11	H	B	Sept 2003	✓ Prevents compressed disturbance recorder stalling. ✓ Prevents CS103 reporting more non-compressed disturbance records than actually present.	V2.03 or later	P54x/EN x/D11
11	I	B	Oct 2004	All builds released to production. Based on 11G software. ✓ Improved Self-checking of Analogue data acquisition ✓ Differential Intertrip in IEC60870-5-103 reported with correct FAN ✓ SRAM self checking added to co-processor board ✓ Reception of modbus frame improved ✓ Rejection of spurious messages injected onto RS485 network improved ✓ Improved self checking of SRAM ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol ✓ Prevented incorrect behaviour of P545/P546 when one relay is energised when there is noise on the signalling channel ✓ Status of local GPS reported incorrectly in dual redundant schemes ✓ Setting “Char Mod Time” was missing on P541- P544 ✓ Prevent a maintenance record when reading from an inaccessible modbus register ✓ Prevents relay crashing when phase 2 software used with phase 1 optos ✓ Cell 0709 now replies OK Change	V2.03 or Later	P54x/EN x/D11

Relay type: P54x …						
Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
12	B	B	Mar 2002	✓ 2nd Rear Communications supported ✓ Alarms increased to 64 with user programmable alarms ✓ Enhancements and corrections to CS103 ✓ Suppression of certain events in power up ✓ French language text improvements ✓ Prevent a maintenance record when reading from an inaccessible modbus register ✓ Setting "Char Mod Time" was missing on P541-P544 ✓ Cell 0709 corrected × Maximum pre-trigger time for Disturbance recorder in IEC870-103-5 builds reduced, to allow extraction via rear port ✓ Resolved incorrect operation of C Diff Failure Alarm in 3 terminal schemes ✓ Correct operation of Capactive Charging Current Compensation in 3 terminal schemes Resolved problem which caused short duration GPS Failure Alarms ✓ Resolved problem selecting setting via optos ✓ Resolved a Circuit Breaker Lockout problem ✓ Corrected the thermal measurement displayed when thermal protection is disabled ✓ Failure Alarms ✓ Resolved problem selecting setting via optos ✓ Resolved a Circuit Breaker Lockout problem ✓ Corrected the thermal measurement displayed when thermal protection is disabled ✓ Spanish text for user defined alarms contained an extra letter	V2.05 or later	P54x/EN x/E21

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
12 Cont	B	B	Mar 2002	✓ Blocked overcurrent elements now generate events ✓ Correct DNP3 operation of object 10 ✓ Resolved problem with P541 & P542 IEC60870-5-103 builds not running ✓ Resolved a problem with IEC60870-5-103 class 1 polling ✓ Resolved a problem with IEC60870-5-103 ASDU2 events which occurred prior to a start event ✓ Correct the format used to display frequency over the modbus interface ✓ Resolved problem related to incorrect CB trip/close commands via Modbus being accepted when not selected ✓ Resolved a problem which prevented protection setting being saved after control and support setting had been saved ✓ Corrected the saving of Fault Locator settings in groups 2, 3, 7, 4 when made via user interface ✓ Added object 10 to DNP3 class 0 poll ✓ Corrected the way DNP3 handled the season bit in the time & date × Recommended upgrading to 12D or later	V2.05 or later	P54x/EN x/E21
12	C	B	Mar 2003	✓ Resolved several problems related to the IEC 60870-5-103 protocol ✓ Resolved problem with resample timer on microprocessor ✓ Improved self diagnostics relating to input module clock ✓ Modified courier block transfer mechanism so it can handle more than 255 blocks ✓ Intermittent loss of data from 2nd rear comms port corrected	V2.05 or later	P54x/EN x/E21

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
12 Cont	C	B	Mar 2003	✓ PSL logic for user defined intertrips corrected P545 & P546 ✓ Permissive Intertrip in dual redundant schemes corrected × Recommended upgrading to 12D or later	V2.05 or later	P54x/EN x/E21
12	D	B	Jun 2003	✓ Changes to clock recovery circuits to improve operation with multiplexers ✓ Prevented unwanted Comms Delay Alarms	V2.05 or later	P54x/EN x/E21
12	E	B	Sept 2003	✓ Prevents compressed disturbance recorder stalling. ✓ Correction to operation of Reset Relays / LEDs opto. ✓ Prevents CS103 reporting more non-compressed disturbance records than actually present.	V2.05 or later	P54x/EN x/E21
12	F	B	Jun 2004	Not released to production. Supplied to one customer. Based on 12E software. ✓ Improved Self-checking of Analogue data acquisition ✓ Differential Intertrip in IEC60870-5-103 reported with correct FAN	V2.05 or Later	P54x/EN x/E21
12	G	B	Oct 2004	All builds released to production. Based on 12E software. ✓ Improved Self-checking of Analogue data acquisition ✓ Differential Intertrip in IEC60870-5-103 reported with correct FAN ✓ SRAM self checking added to co-processor board ✓ Reception of modbus frame improved ✓ Rejection of spurious messages injected onto RS485 network improved ✓ Improved self checking of SRAM ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol	V2.05 or Later	P54x/EN x/E21

Relay type: P54x …

Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
12 Cont	G	B	Oct 2004	✓ Prevented incorrect behaviour of P545/P546 when one relay is energised when there is noise on the signalling channel ✓ Status of local GPS reported incorrectly in dual redundant schemes	V2.05 or Later	P54x/EN x/E21
13	A	B	April 2004	All builds released to production. Based on 12E software. ✓ Control inputs enhancements including non-volatile, latched, pulsed and support for DNP3 pulsed. ✓ Enhanced DNP3 ✓ Distance Residual compensation angle range extended ✓ Display of number of good messages via modbus is corrected ✓ Prevented DNP3 time sync causes relay to reboot when IRIG-B is active ✓ Improved self-checking of analogue data acquisition ✓ Improved self-checking of SRAM ✓ Added TRIP & ALARM to modbus status word ✓ Addition of MODBUS only setting to allow transmission of IEC time format in reverse IEC byte order ✓ Reception of modbus frame improved ✓ Rejection of spurious messages injected onto RS485 network improved ✓ Handling of FAN in IEC60870-5-103 improved ✓ Differential Intertrip in IEC60870-5-103 reported with correct FAN	V2.10 or later	P54x/EN x/E21

Relay type: P54x …

Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
13	B	B	Aug 2004	All builds released to production. Based on 13A software. ✓ SRAM self checking added to co-processor board ✓ Fault location & cumulative broken current measurements reported over dnp3 ✓ Accuracy of modbus time sync improved ✓ Invalid modbus register 4x00966 removed ✓ Reception of modbus frame improved	V2.10 or Later DNP3 files different to 13A	P54x/EN x/E21
13	C	B	Oct 2004	All builds released to production. Based on 13B software. ✓ Resolved a problem relating to co-processor SRAM checking ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol ✓ Prevented incorrect behaviour of P545/P546 when one relay is energised when there is noise on the signalling channel ✓ Status of local GPS reported incorrectly in dual redundant schemes	V2.10 or Later DNP3 files different to 13A	P54x/EN x/E21
20	E	G	Oct 2002	All builds released to production – runs on phase 2 processor board. Based on 12B. ✓ UCA2 option added ✓ Added Fault Location ✓ Added TRIP and ALARM to modbus status word ✓ Distance direction setting added ✓ Distance residual compensation angle range extended ✓ Password status indicated on DDBs ✓ Improvements to Autoreclose ✓ Alarms increased to 96 ✓ Russian text added	V2.09 or later	P54x/EN x/F32

Relay type: P54x …

Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
Major	Minor					
20 Cont	E	G	Oct 2002	✓ Disturbance recorder sampling rate increased to 24 samples per cycle and changed to non compressed design ✓ IDMT IEEE curves corrected ✓ Corrected the response to courier SEND EVENT ✓ Improved self diagnostics relating to input module clock ✓ Removed the setting for IEC60870-5-103 over fibre when hardware not present ✓ Resolved problem related to CB trip/close commands via Modbus being accepted when not selected ✓ Corrected the saving of Fault locator settings in groups 2, 3, 7, 4 when made via user interface ✓ Added object 10 to DNP3 class 0 poll ✓ Corrected the way DNP3 handled the season bit in the time & date ✓ Enhanced Check Synchronisation feature ✓ Control inputs enhancements including non-volatile, latched, pulsed and support for DNP3 pulsed ✓ Resolved several problems related to the IEC60870-5-103 protocol ✓ Resolved problem with resample timer on microprocessor ✓ Improved self diagnostics relating to input module clock ✓ PSL logic for user defined intertrips corrected P545 & P546 ✓ Operation of manual reset alarms corrected ✓ CB Control via hot keys ✓ Changes to clock recovery circuits to improve operation with multiplexers ✓ Prevented unwanted Comms Delay Alarms ✓ Alarms handled better in CS103 GI	V2.09 or later	P54x/EN x/F32

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
20 Cont	E	G	Oct 2002	✓ Time synchronisation via opto added ✓ Platform Alarms copied to DDB ✓ Correction to operation of Reset Relays / LEDs opto ✓ Backup protection run if co-processor fails to start up on power on ✓ Correction to cell OB25	V2.09 or later	P54x/EN x/F32
20	F	G	Feb 2004	Release to production ✓ UCA2: Increase Max. pending requests & Max. Connected clients ✓ Enhanced DNP3 ✓ Prevented DNP3 time sync causes relay to reboot when IRIG-B is active ✓ Corrected cause of transmission which may be returned for “fault location” ✓ Prevents relay rebooting during EMC ANSI Fast transient and IEC high frequency ✓ A number of bug fixes relating to CPU2	V2.09 or later	P54x/EN x/F32
20	G	G	Jun 2004	Release to production ✓ Prevented repeated downloads of GSL files without Ethernet card restart rebooting Ethernet card ✓ Correction to uploading of Disturbance Records over UCA2. ✓ Corrected operation of ethernet card link LED for 10 Base-FL ✓ Closed UCA2 association after ‘dirty’ client disconnection ✓ Made UAC2 Disturbance Record directory service compatible with PACiS ✓ Improved Self-checking of Analogue data acquisition ✓ Handling of FAN in IEC60870-5-103 improved ✓ Differential intertrip in IEC60870-5-103 reported with correct FAN	V2.09 or later	P54x/EN x/G42

Relay type: P54x …

Software Version Major	Software Version Minor	Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	Technical Documentation
20 Cont	G	G	Jun 2004	✓ Prevented C Diff Fail alarm occurs before Signaling Fail alarm for loss of communications ✓ Improved self checking of SRAM	V2.09 or later	P54x/EN x/G42
20	H	G	Oct 2005	Release to Production. Based on 20G software. ✓ SRAM self checking added to co-processor board ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol ✓ Prevented incorrect behaviour of P545/P546 when one relay is energised when there is noise on the signalling channel ✓ Status of local GPS reported incorrectly in dual redundant schemes ✓ Accuracy of modbus time sync improved ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol ✓ Prevented Ethernet card restarting after approximately 20 hours when no connection made ✓ Improvements to time sync for Courier, CS103 and DNP3 ✓ Invalid modbus register 4x00966 removed	V2.09 or later	P54x/EN x/G42
20	I	G	Nov 2004	Release to Production. Based on 20G software. ✓ Display of No. Valid messages on LCD corrected ✓ Operation of CB Maintenance alarm corrected ✓ Corrections to allow Extended Courier characters to be used in string setting cells for Courier and Modbus ✓ Corrected default display of neutral current for 5A CTs ✓ Prevented a reboot for modbus versions during event extraction when messages where close together ✓ Correction to prevent the 2nd rear comms locking up	V2.09 or later	P54x/EN x/G42

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
30	C	J	Nov 2004	Released to production, Based on 20G ✓ Interface to Optical Multiplexer (IEEE standard C37.94) ✓ SRAM checking in Co-processor ✓ Dual range optos ✓ Livery & software changes ✓ Extended Residual angle in fault locator to match Distance ✓ Rename GOOSE signals in line with P443 ✓ Add virtual signals, control inputs & user alarms to DR in line with P443 ✓ Relay settings shall be stored in FLASH EEPROM instead of EEPROM memory. ✓ Extend Range of Time Dial to line up with P140 ✓ Accuracy of modbus time sync improved ✓ Invalid modbus register 4x00966 removed ✓ Improvements to time sync for Courier, CS103 and DNP3 ✓ Addition of MODBUS only time and Date format setting to common Courier settings for access from the other interfaces. ✓ Vector group compensations for YY2 and YY10 corrected ✓ Prevented Ethernet card restarting after approximately 20 hours when no connection made ✓ Prevented incorrect behaviour of P545/P546 when one relay is energised when there is noise on the signalling channel ✓ Courier, Modbus & DNP3 communications over Fibre added ✓ Display of No. Valid messages on LCD corrected ✓ Operation of CB Maintenance alarm corrected ✓ Some text in autoreclose column made consistent with that in overcurrent column ✓ Improvements to VTS and Autoreclose in single pole tripping	V2.11 or Later	P54x/EN x/H53

Relay type: P54x …						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
30 Cont	C	J	Nov 2004	applications ✓ Corrections to allow Extended Courier characters to be used in string setting cells for Courier and Modbus ✓ Fixed an incorrect response of the summertime time bit in IEC60870-5-103 protocol ✓ Corrected reporting of local GPS fail in dual redundant schemes ✓ Corrected default display of neutral current for 5A CTs ✓ Prevented a reboot for dnp3 versions when control & support settings are changed rapidly. ✓ Prevented a reboot for modbus versions during event extraction when messages where close together ✓ Correction to prevent the 2nd rear comms locking up ✓ Changes to co-processor start-up to eliminate a timing problem	V2.11 or Later	P54x/EN x/H53
30	D	J	Dec 2004	Released to Production, Based on 30C ✓ Improvements to operation when subjected to multiple communication switches when operating in non-GPS mode.	V2.11 or Later	P54x/EN x/H53

Setting File Compatibility

Setting File Software Version	Relay Software Version 01	02	03	04	05	07	11	12	13	14	15	20	30
01	✓	×	×	×	×	×	×	×	×	×	×	×	×
02	×	✓	×	×	×	×	×	×	×	×	×	×	×
03	×	×	✓	1	×	×	×	×	×	×	×	×	×
04	×	×	×	✓	2	2	×	×	×	×	×	×	×
05	×	×	×	×	✓	✓	×	×	×	×	×	×	×
07	×	×	×	×	✓	✓	×	×	×	×	×	2	×
11	×	×	×	×	×	×	✓	✓	2	2	×	2	×
12	×	×	×	×	×	×	✓	✓	2	2	×	2	×
13	×	×	×	×	×	×	✓	✓	✓	2	×	2	×
14	×	×	×	×	×	×	×	×	×	✓	×	×	×
15	×	×	×	×	×	×	×	×	×	×	✓	×	×
20	×	×	×	×	×	×	×	×	×	×	×	✓	3
30	×	×	×	×	×	×	×	×	×	×	×	×	✓

1 Compatible except for Disturbance recorder digital channel selection.
2 Additional functionality added such that’s setting files from earlier software versions will need additional settings to be made.
3 Compatible except for Disturbance recorder digital channel selection & settings for additional functionality will be missing.

PSL File Compatibility

PSL File Software Version	Relay Software Version												
	01	02	03	04	05	07	11	12	13	14	15	20	30
01	✓	×	×	×	×	×	×	×	×	×	×	×	×
02	×	✓	×	×	×	×	×	×	×	×	×	×	×
03	×	×	✓	×	×	×	×	×	×	×	×	×	×
04	×	×	×	✓	×	×	×	×	×	×	×	×	×
05	×	×	×	×	✓	1	×	×	×	×	×	×	×
07	×	×	×	×	×	✓	×	×	×	×	×	×	×
11	×	×	×	×	×	×	✓	✓	✓	×	×	1	1
12	×	×	×	×	×	×	×	✓	✓	×	×	1	1
13	×	×	×	×	×	×	×	×	✓	×	×	1	1
14	×	×	×	×	×	×	×	×	×	✓	×	×	×
15	×	×	×	×	×	×	×	×	×	×	✓	×	×
20	×	×	×	×	×	×	×	×	×	×	×	✓	1
30	×	×	×	×	×	×	×	×	×	×	×	×	✓

1 Additional DDBs were added such that PSL files from earlier software versions will not be able to access them.

Menu Text File Compatibility

Menu Text File Software Version	Relay Software Version: 01	02	03	04	05	07	11	12	13	14	15	20	30
01	✓	×	×	×	×	×	×	×	×	×	×	×	×
02	×	✓	×	×	×	×	×	×	×	×	×	×	×
03	×	×	✓	×	×	×	×	×	×	×	×	×	×
04	×	×	×	✓	×	×	×	×	×	×	×	×	×
05	×	×	×	×	✓	✓	×	×	×	×	×	×	×
07	×	×	×	×	✓	✓	×	×	×	×	×	×	×
11	×	×	×	×	×	×	✓	×	×	×	×	×	×
12	×	×	×	×	×	×	×	✓	×	×	×	×	×
13	×	×	×	×	×	×	×	×	✓	×	×	×	×
14	×	×	×	×	×	×	×	×	×	✓	×	×	×
15	×	×	×	×	×	×	×	×	×	×	✓	×	×
20	×	×	×	×	×	×	×	×	×	×	×	✓	×
30	×	×	×	×	×	×	×	×	×	×	×	×	✓

Menu text remains compatible within each software version but is NOT compatible across different versions.

MiCOM CURRENT DIFFERENTIAL NOMENCLATURE Design Suffix A

Software Number	P	5	4	*	_	_	_	_	*	_	0	0	5	0	_	H
Character Type (A=Alpha, N=Numeric, X = Alpha-numeric)	A	N	N	N	A	X	X	X	A	X	X	N	N	X	A	
Character Numbering (Maximum = 15)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Model Number/Cortec Number	P	5	4	*	*	1	*	*	*	A	0	0	5	0	A	

Current Differential - standard version	1
Current Differential - with 3 pole autoreclose	2
C Diff with Distance, 1/3 pole autoreclose	3
C Diff with Distance,for 2 breaker configurations	4

Vx Aux Rating	
24/48 Vdc	1
48/125 Vdc	2
110/250 Vdc	3

Hardware options	
Nothing	1
IRIG-B only	2
Fibre Optic Converter only	3
IRIG-B & Fibre Optic Converter	4

Product Specific	
850nm dual channel	A
1300nm SM single channel	B
1300nm SM dual channel	C
1300nm MM single channel	D
1300nm MM dual channel	E
1550nm SM single channel	F
1550nm SM dual channel	G
RWE Special (one version of P543 only)	Y

Protocol Options	
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4

Software Number	05

Setting Files	
Default	0
Customer	1

Hardware Design Suffix	
Original	A

Software Letter of Issue	H

MiCOM CURRENT DIFFERENTIAL NOMENCLATURE Design Suffix B

Software Number	P	5	4	*	_	_	_	_	*	_	0	1	3	0	_	C
Character Type (A=Alpha, N=Numeric, X = Alpha-numeric)	A	N	N	N	A	X	X	X	A	X	X	N	N	X	A	
Character Numbering (Maximum = 15)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Model Number/Cortec Number	P	5	4	*	*	1	*	*	*	A	0	1	3	0	B	

Current Differential - standard version	1
Current Differential - with 3 pole autoreclose	2
C Diff with Distance, 1/3 pole autoreclose	3
C Diff with Distance,for 2 breaker configurations	4
P543 with extra I/O plus GPS	5
P544 with extra I/O plus GPS	6

Vx Aux Rating	
24/48 Vdc	1
48/125 Vdc	2
110/250 Vdc	3

Hardware options	
Nothing	1
IRIG-B only	2
Fibre Optic Converter only	3
IRIG-B & Fibre Optic Converter	4
Rear Comms Board	7
IRIG-B plus Rear Comms Board	8

Product Specific	
850nm dual channel	A
1300nm SM single channel	B
1300nm SM dual channel	C
1300nm MM single channel	D
1300nm MM dual channel	E
1550nm SM single channel	F
1550nm SM dual channel	G

Protocol Options	
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4

Software Number	13

Setting Files	
Default	0
Customer	1

Hardware Design Suffix	
Phase 2 post April 2001	B

Software Letter of Issue	C

Note Design Suffix
A = Original
B = Universal Optos, New Relays, New Co-Processor Board, New PSU

MiCOM CURRENT DIFFERENTIAL NOMENCLATURE Design Suffix G

Software Number	P	5	4	*	_	_	_	_	*	_	_	2	0	0	_	I
Character Type (A=Alpha, N=Numeric, X = Alpha-numeric)	A	N	N	N	A	X	X	X	A	X	X	N	N	X	A
Character Numbering (Maximum = 15)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Model Number/Cortec Number	P	5	4	*	*	1	*	*	*	*	*	2	0	0	G

Current Differential - standard version	1
Current Differential - with 3 pole autoreclose	2
C Diff with Distance, 1/3 pole autoreclose	3
C Diff with Distance,for 2 breaker configurations	4
P543 with extra I/O plus GPS	5
P544 with extra I/O plus GPS	6

Vx Aux Rating	
24/48 Vdc	1
48/125 Vdc	2
110/250 Vdc	3

Hardware options	
Nothing	1
IRIG-B only	2
Fibre Optic Converter only	3
IRIG-B & Fibre Optic Converter	4
Ethernet (10MHz)	5
Ethernet (100MHz)	6
Rear Comms Board	7
IRIG-B plus Rear Comms Board	8

Product Specific *	
850nm dual channel	A
1300nm SM single channel	B
1300nm SM dual channel	C
1300nm MM single channel	D
1300nm MM dual channel	E
1550nm SM single channel	F
1550nm SM dual channel	G
850nm MM + 1300mn SM	H
850nm MM + 1300mn MM	J
850nm MM + 1550mn SM	K
1300mn SM + 850nm MM	L
1300mn MM + 850nm MM	M
1550mn SM + 850nm MM	R
Reserved for future single channel	N
Reserved for future single channel	P
Reserved - was used for RWE special	Y

Protocol Options	
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4
UCA2	5

Mounting	
Flush Panel	A
Rack (P545 P546 only)	B

Language Options	
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Russian	5

Software Number	20

Setting Files	
Default	0
Customer	1

Hardware Design Suffix	
	G

Software Letter of Issue	I

Note Design Suffix
A = Original
B = Universal Optos, New Relays, New Co-Processor Board, New PSU
G = CPU2

Note on Hardware Options
Any other letter = two channel

MiCOM CURRENT DIFFERENTIAL NOMENCLATURE Design Suffix J

Software Number	P	5	4	*	_	_	_	_	*	_	_	3	0	0	_	D
Character Type (A=Alpha, N=Numeric, X = Alpha-numeric)	A	N	N	N	A	X	X	X	A	X	X	N	N	X	A	
Character Numbering (Maximum = 15)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Model Number/Cortec Number	P	5	4	*	*	1	*	*	*	*	*	3	0	0	J	

Current Differential - standard version	1
Current Differential - with 3 pole autoreclose	2
C Diff with Distance, 1/3 pole autoreclose	3
C Diff with Distance,for 2 breaker configuration	4
P543 with extra I/O plus GPS	5
P544 with extra I/O plus GPS	6

Vx Aux Rating	
24/48 Vdc	1
48/125 Vdc	2
110/250 Vdc	3

Hardware options	
Nothing	1
IRIG-B only	2
Fibre Optic Converter only	3
IRIG-B & Fibre Optic Converter	4
Ethernet (10MHz)	5
Ethernet (100MHz)	6
Rear Comms Board	7
IRIG-B plus Rear Comms Board	8

Product Specific *	
850nm dual channel	A
1300nm SM single channel	B
1300nm SM dual channel	C
1300nm MM single channel	D
1300nm MM dual channel	E
1550nm SM single channel	F
1550nm SM dual channel	G
850nm MM + 1300mn SM	H
850nm MM + 1300mn MM	J
850nm MM + 1550mn SM	K
1300mn SM + 850nm MM	L
1300mn MM + 850nm MM	M
1550mn SM + 850nm MM	R
Reserved for future single channel	N
Reserved for future single channel	P
Reserved - was used for RWE special	Y

Protocol Options	
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4
UCA2	5

Mounting	
Flush Panel	M
Rack (P545 P546 only)	N

Language Options	
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Spanish	0
English, French, German, Russian	5

Software Number	30

Setting Files	
Default	0
Customer	1

Hardware Design Suffix	
	J

Software Letter of Issue	D

Note Design Suffix
A = Original
B = Universal Optos, New Relays, New Co-Processor Board, New PSU
G = CPU2
J = Dual rated optos

Note on Hardware Options
Any other letter = two channel

P594 HARDWARE/SOFTWARE VERSION HISTORY AND COMPATIBILITY

Interface type: P594 ...							
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
N/A	N/A	A	July 2001	First release to production.	N/A	P54x/EN x/E21
N/A	N/A	B	April 2003	Resolved problems after startup and GPS module problems with on board SRAM causing module to fail to start up.	N/A	P54x/EN x/E21
N/A	N/A	C	May 2004	Hardware and software design enhancements to improve performance. New antenna and cable employed New GPS receiver	N/A	P54x/EN x/G42

P594 LINE DIFFERENTIAL PROTECTION : GPS TIMING MODULE KIT Design Suffix C

Software Number	P	5	9	4	_	0	_	_	_	_	C
Character Type (A=Alpha, N=Numeric, X = Alpha-numeric)	A	N	N	N	A	A	A	A	A	A	X
Character Numbering (Maximum = 15)	1	2	3	4	5	6	7	8	9	10	11
Model Number/Cortec Number	P	5	9	4	*	0	*	*	*	*	C

P594 - GPS Timing Module Kit

Vx Aux Rating (character 5)	
Select one of:	
48 - 250 Vdc / 96 - 240 Vac	8
24 - 125 Vdc	7

Timing module casing

Hardware options (characters 7–9)	
Select one of:	
Timing module ONLY	000
Kit 1 : Timing module + kit + 25 metres (overall length) antenna cables	025
Kit 2 : Timing module + kit + 50 metres (overall length) antenna cables + amplifier	050

Language Options (character 10)	
Select one of:	
English	1
French	2
German	3
Spanish	4

Design Suffix (Factory determined) (character 11)	C

SCHEME LOGIC DIAGRAMS

Current Differential Relays

Scheme Logic Diagrams

Note 1: The diagrams in this chapter are fixed, and are an accurate indication of the relay's performance.

Note 2: The diagrams in this chapter correspond to the latest version of the relay at time of manual issue.

KEY:

SET	Setting
DDB	Digital Data Bus
INTSIG	Internal Signal
LD	Level Detector
CTRL SET	Control Setting (from front panel display or remote communications)
COMMAND	Command (from front panel display or communications)
RD	Reset Dominant
SD	Set Dominant
	Raising Edge / Falling Edge

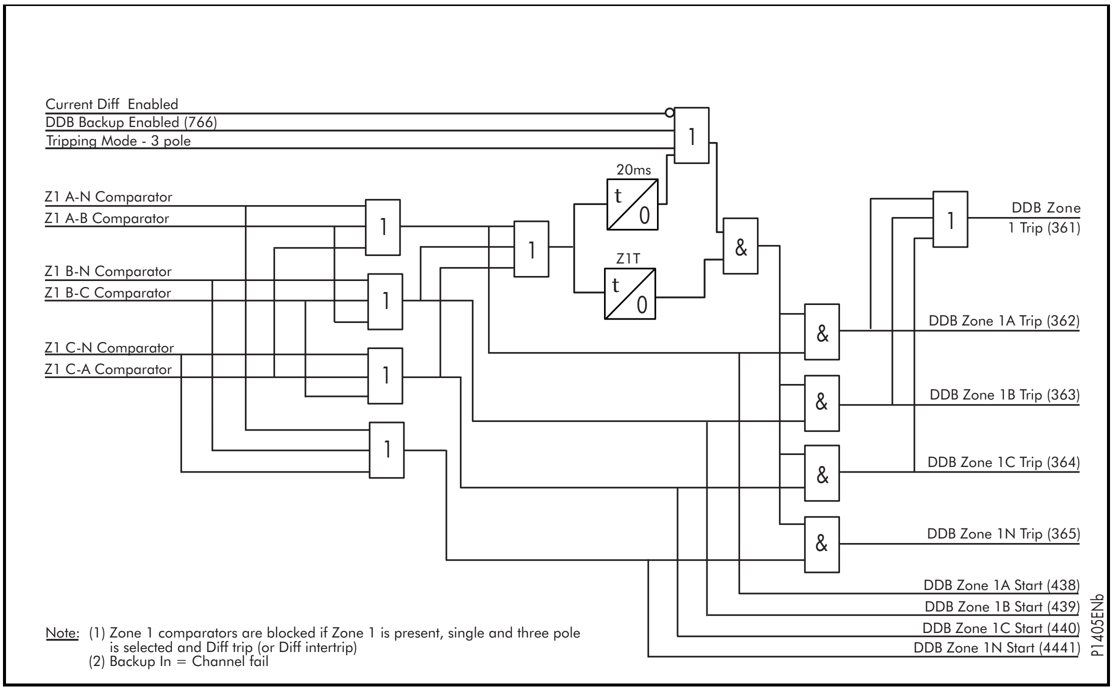


Figure 1: Distance P543/P544/P545/P546 Zone 1 Tripping Logic

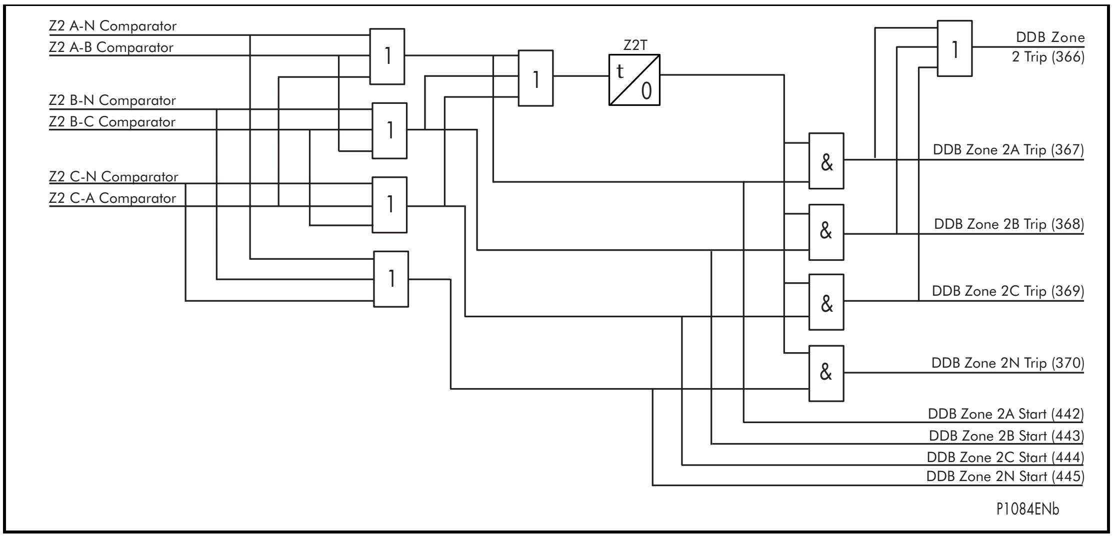


Figure 2: Distance P543/P544/P545/P546 Zone 2 Tripping Logic

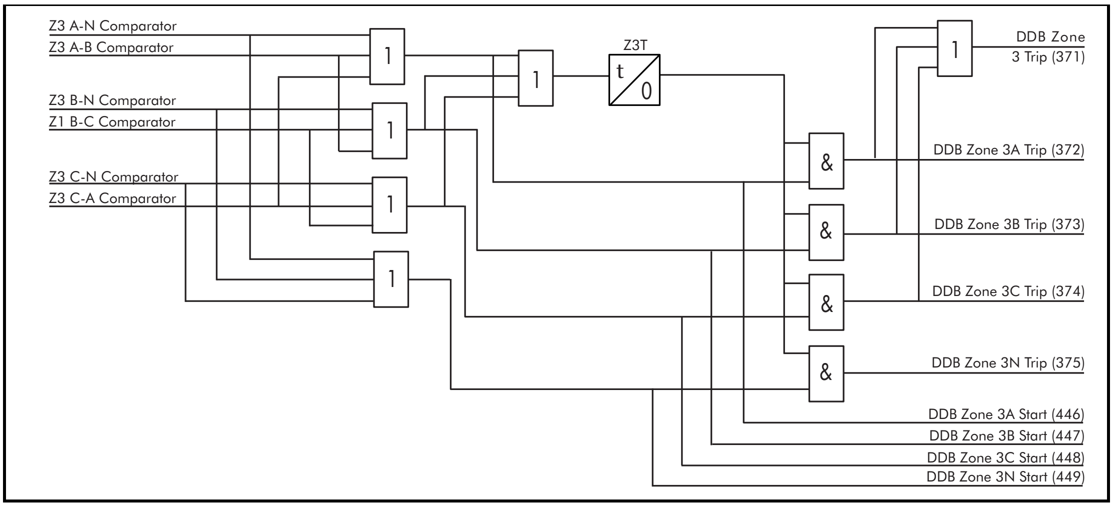


Figure 3: Distance P543/P544/P545/P546 Zone 3 Tripping Logic

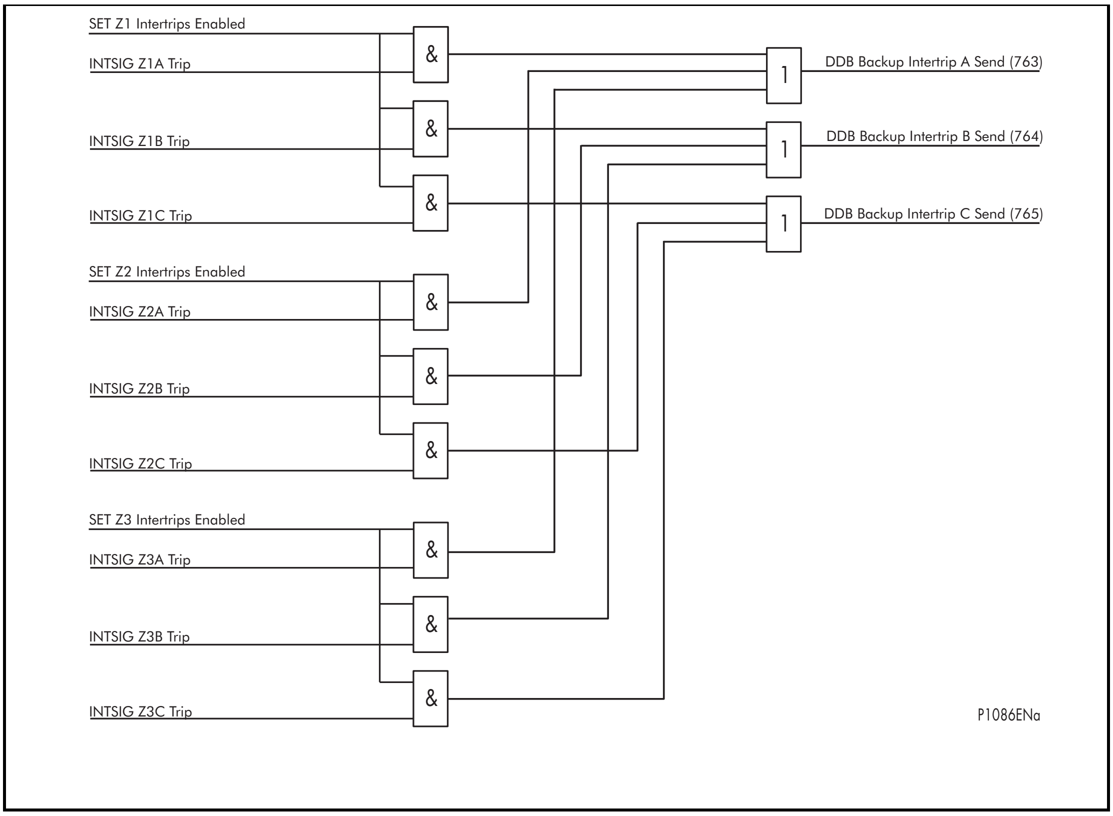


Figure 4: Distance P543/P544/P545/P546 Intertrip Logic

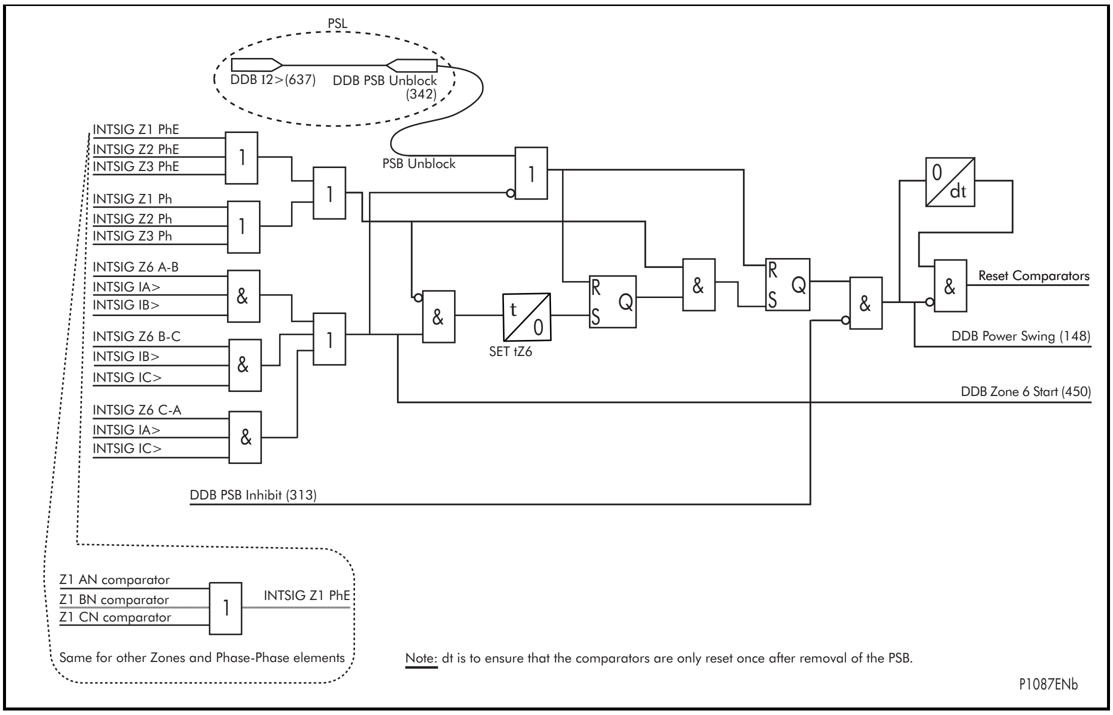


Figure 5: Distance P543/P544/P545/P546 Power Swing Logic (Phase 2)

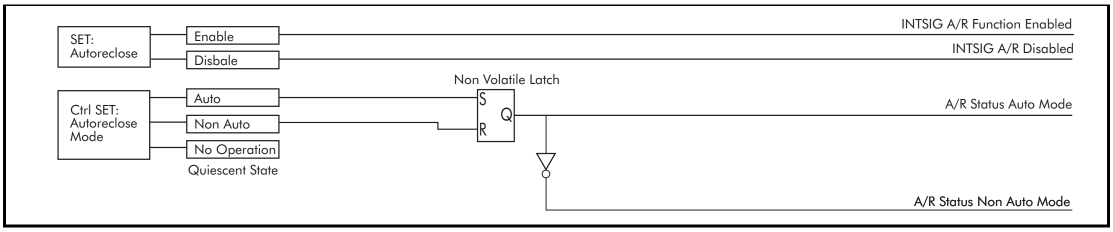


Figure 6: Autoreclose P542 In/Out of Service Selection

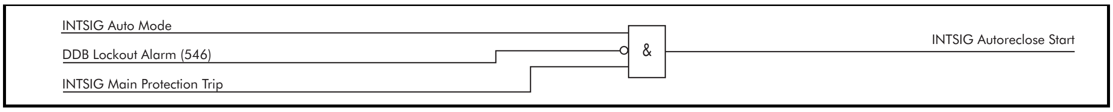


Figure 7: Autoreclose P542 Protection Monitor

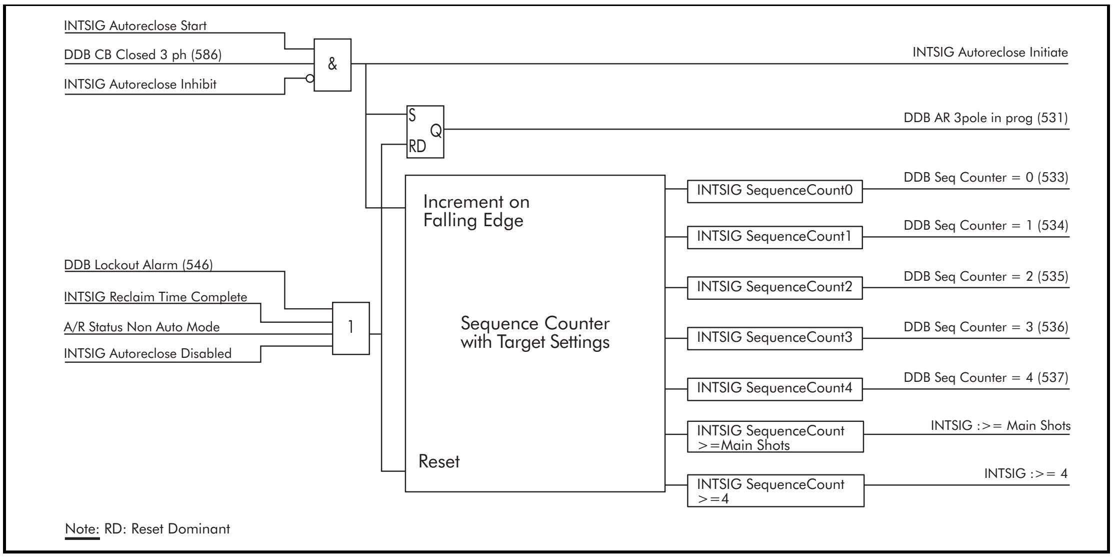


Figure 8: Autoreclose P542 Initiate Sequence

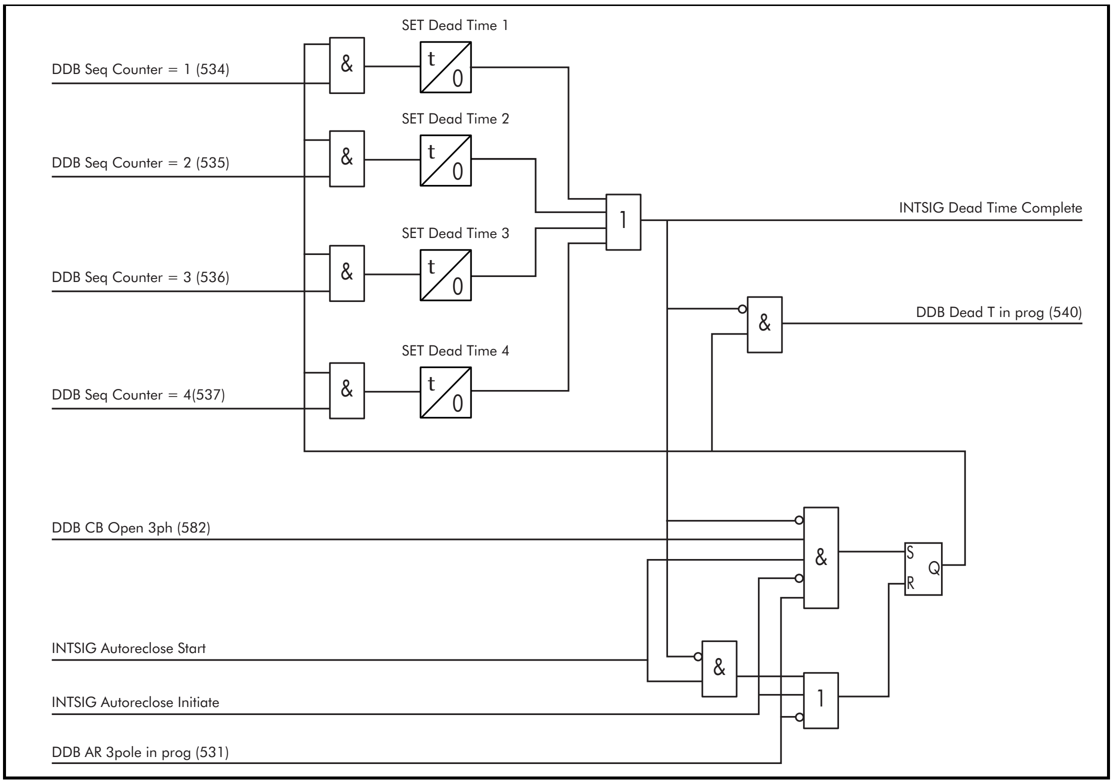


Figure 9: Autoreclose P542 Dead Times

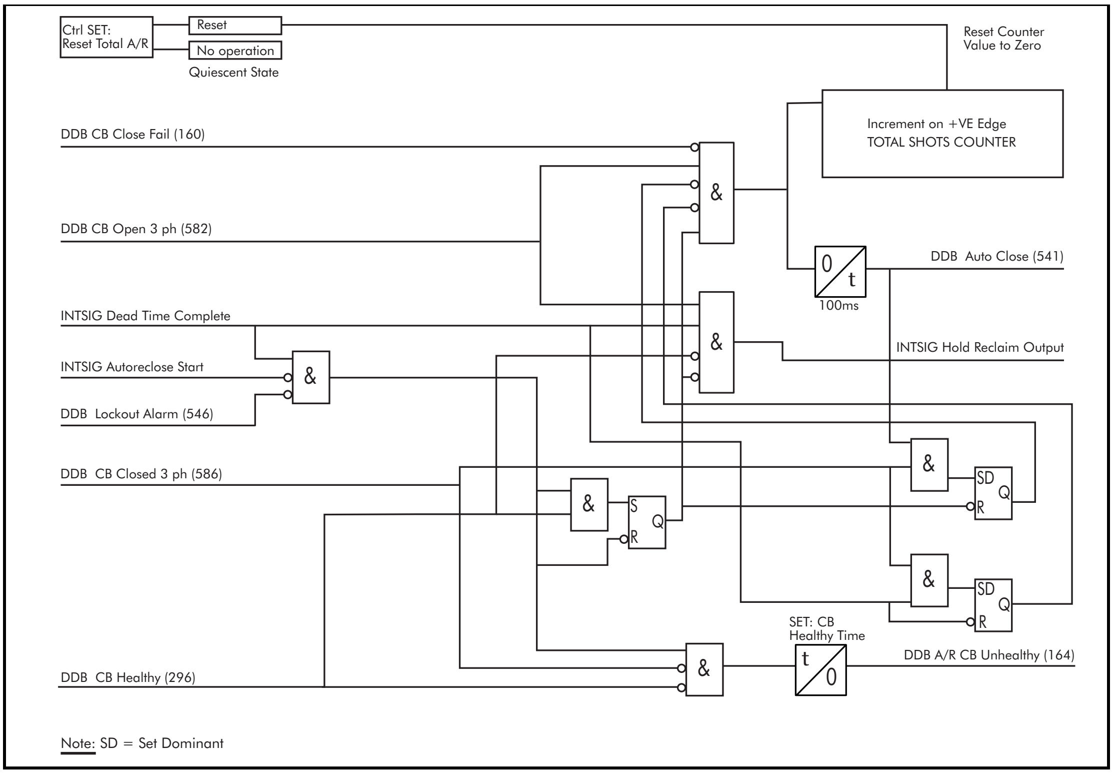


Figure 10: Autoreclose P542 Close Circuit Breaker

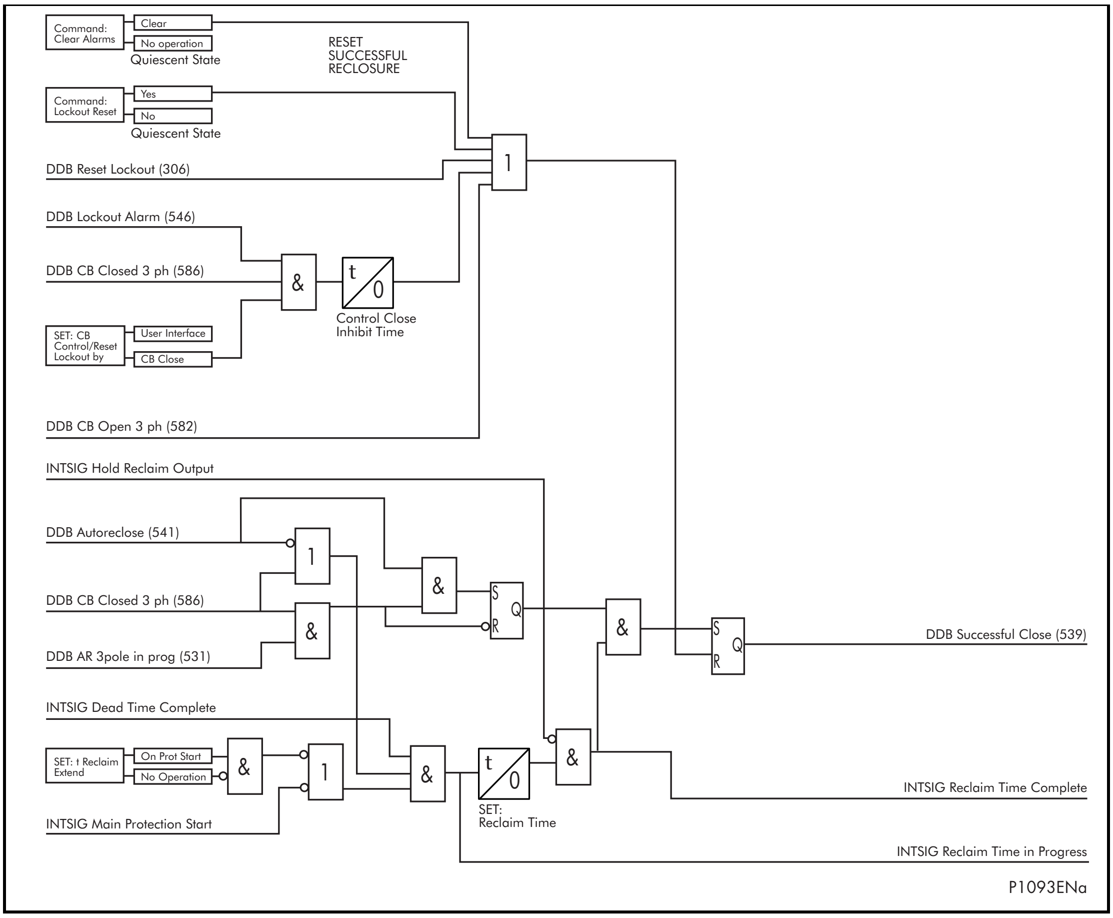


Figure 11: Autoreclose P542 Reclaim Time

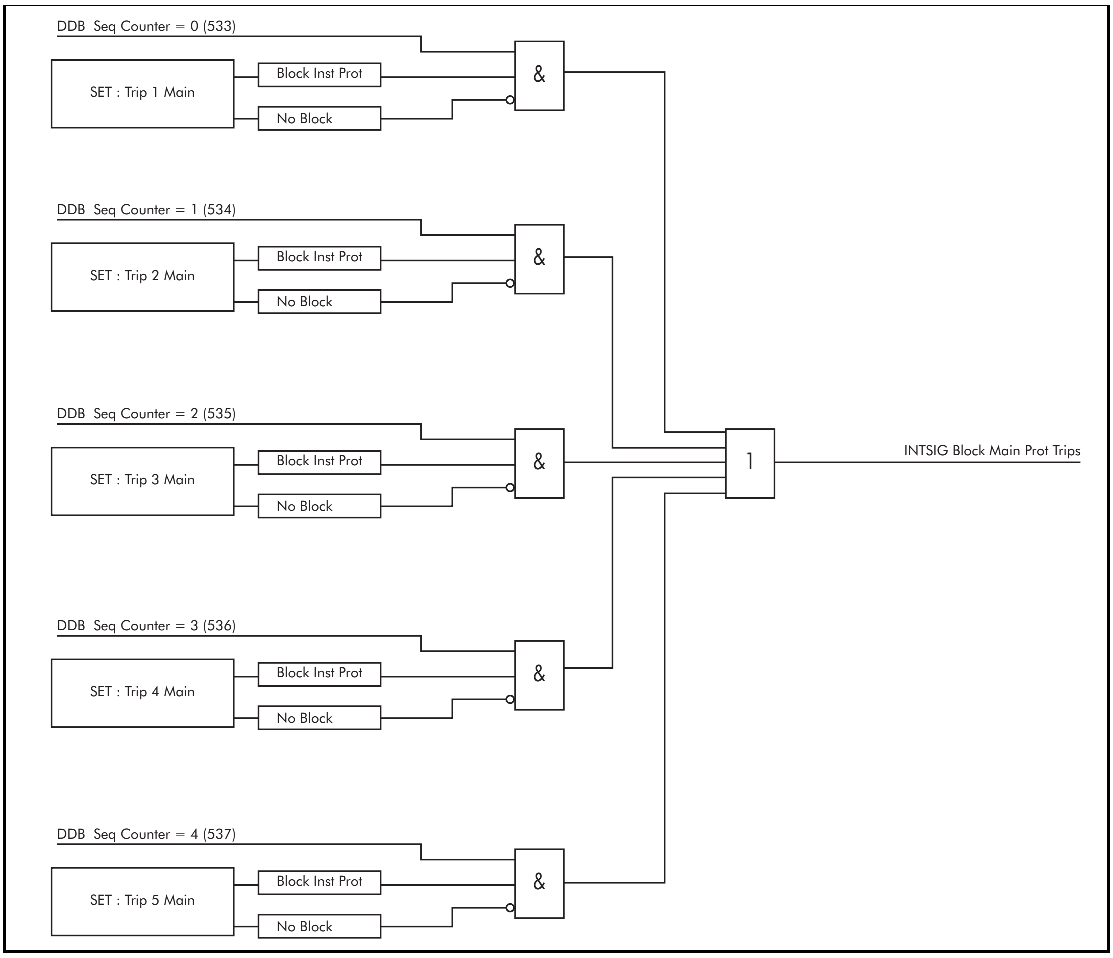


Figure 12: Autoreclose P542: Block Protection (1)

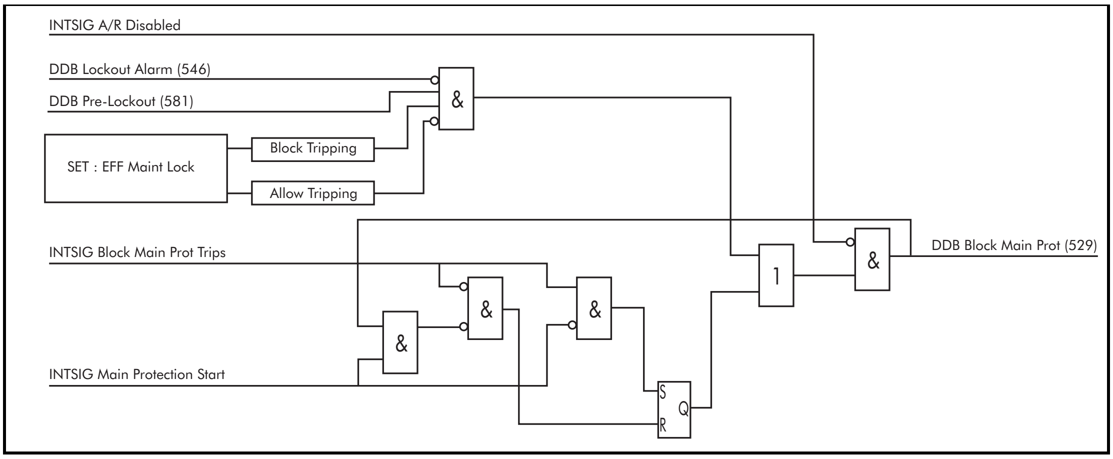


Figure 13: Autoreclose P542 Block Protection (2)

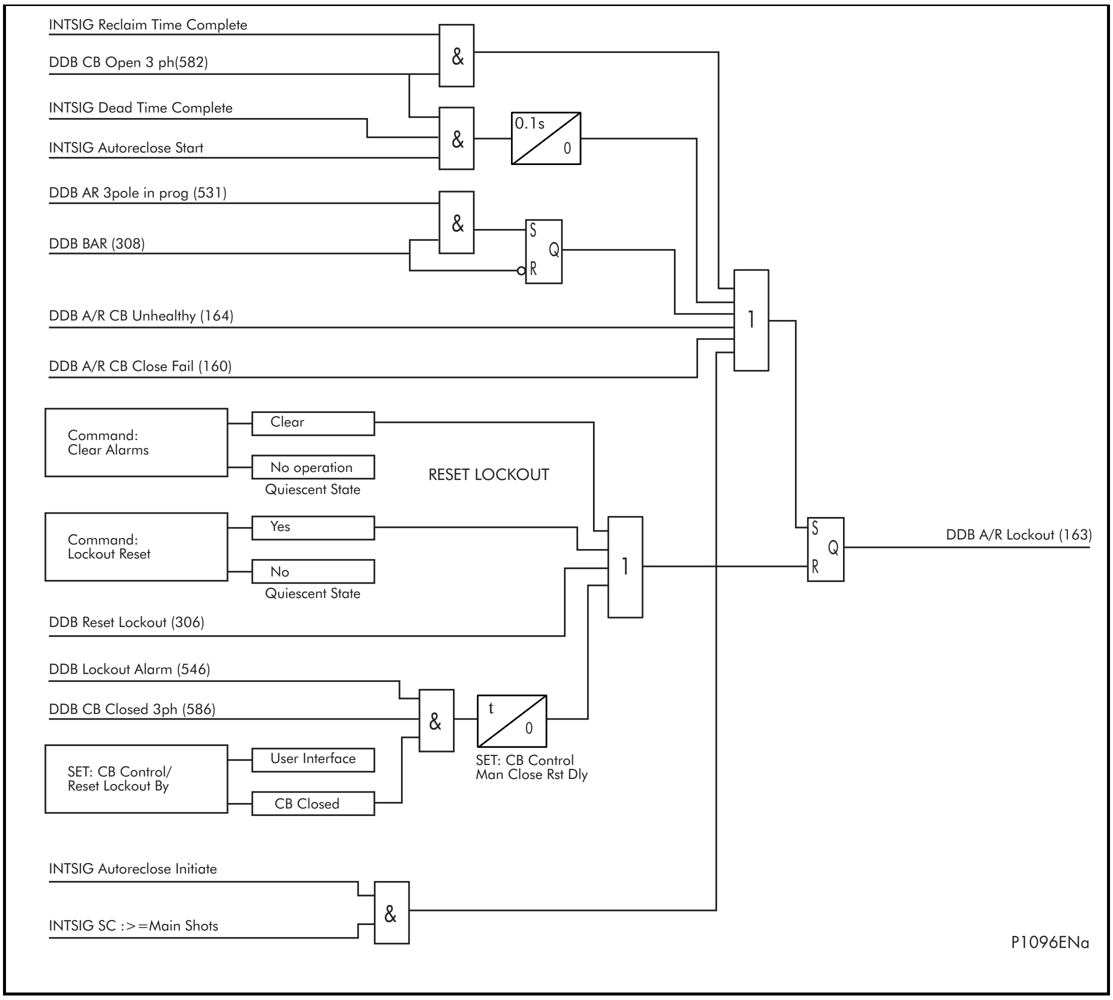


Figure 14: Autoreclose P542 Lockout

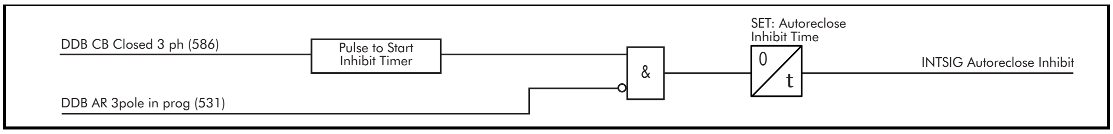


Figure 15: Autoreclose P542 Inhibit

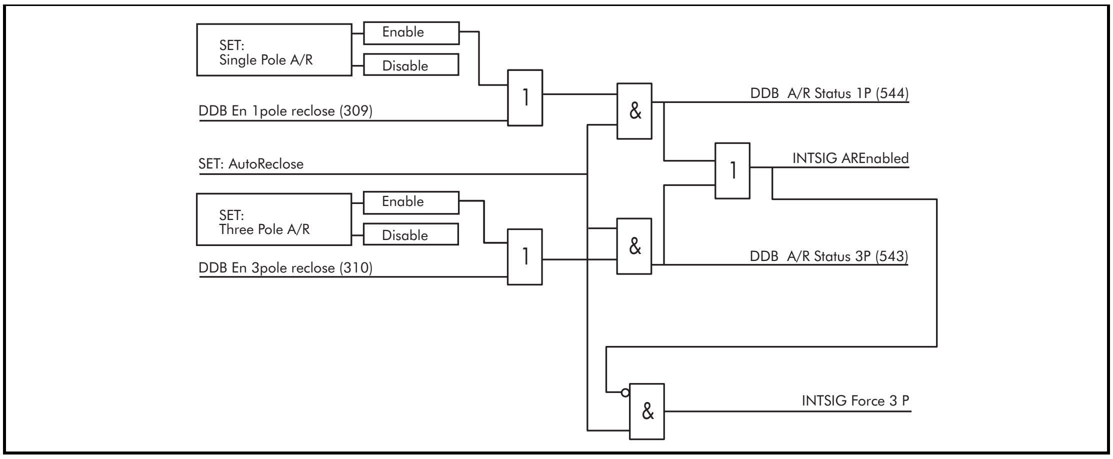


Figure 16: Autoreclose P543/P545 Enable Logic

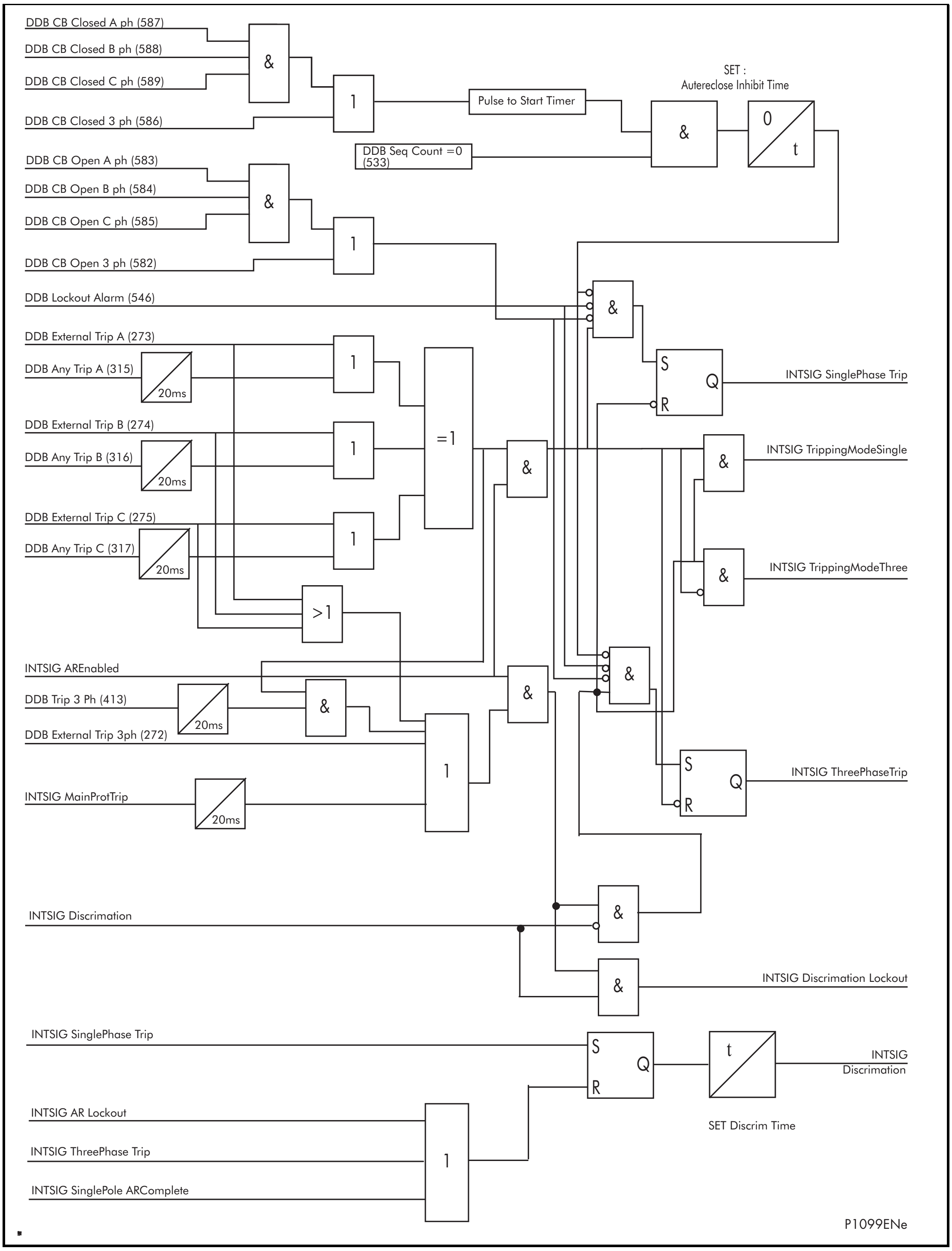


Figure 17: Autoreclose P543/P545 Single/Three Pole Tripping

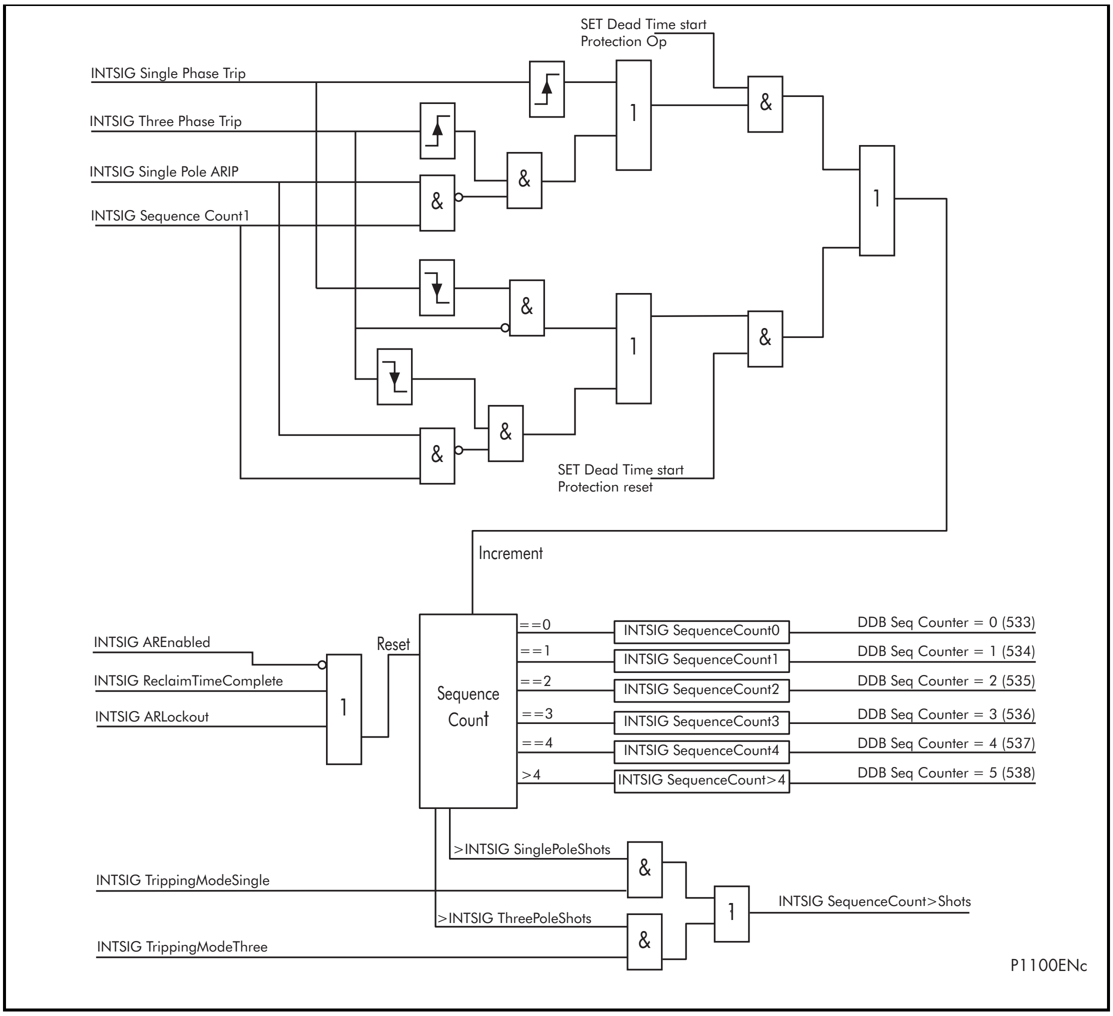


Figure 18: Autoreclose P543/P545 Inhibit Sequence Count

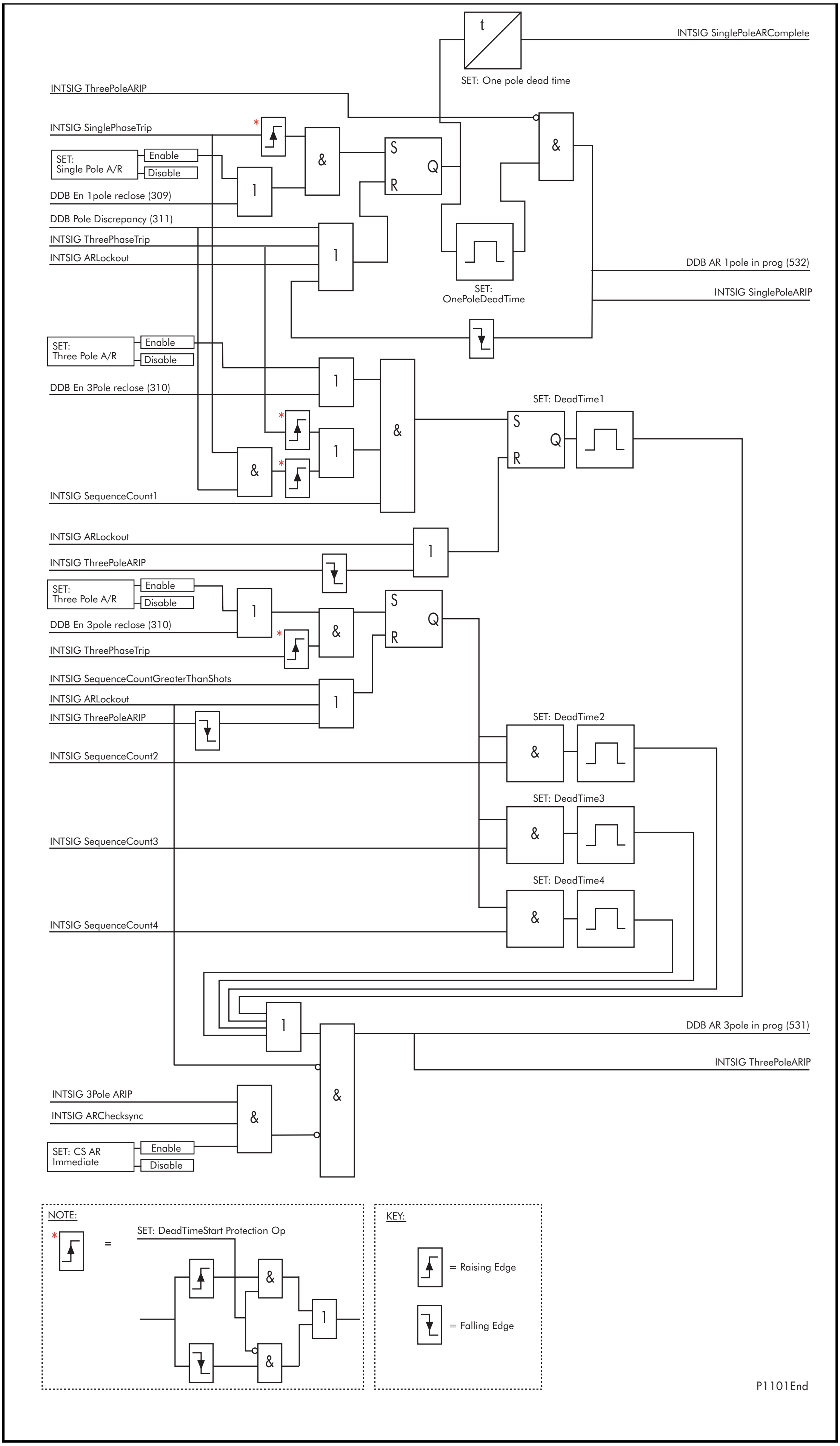


Figure 19: Autoreclose P543/P545 Cycles

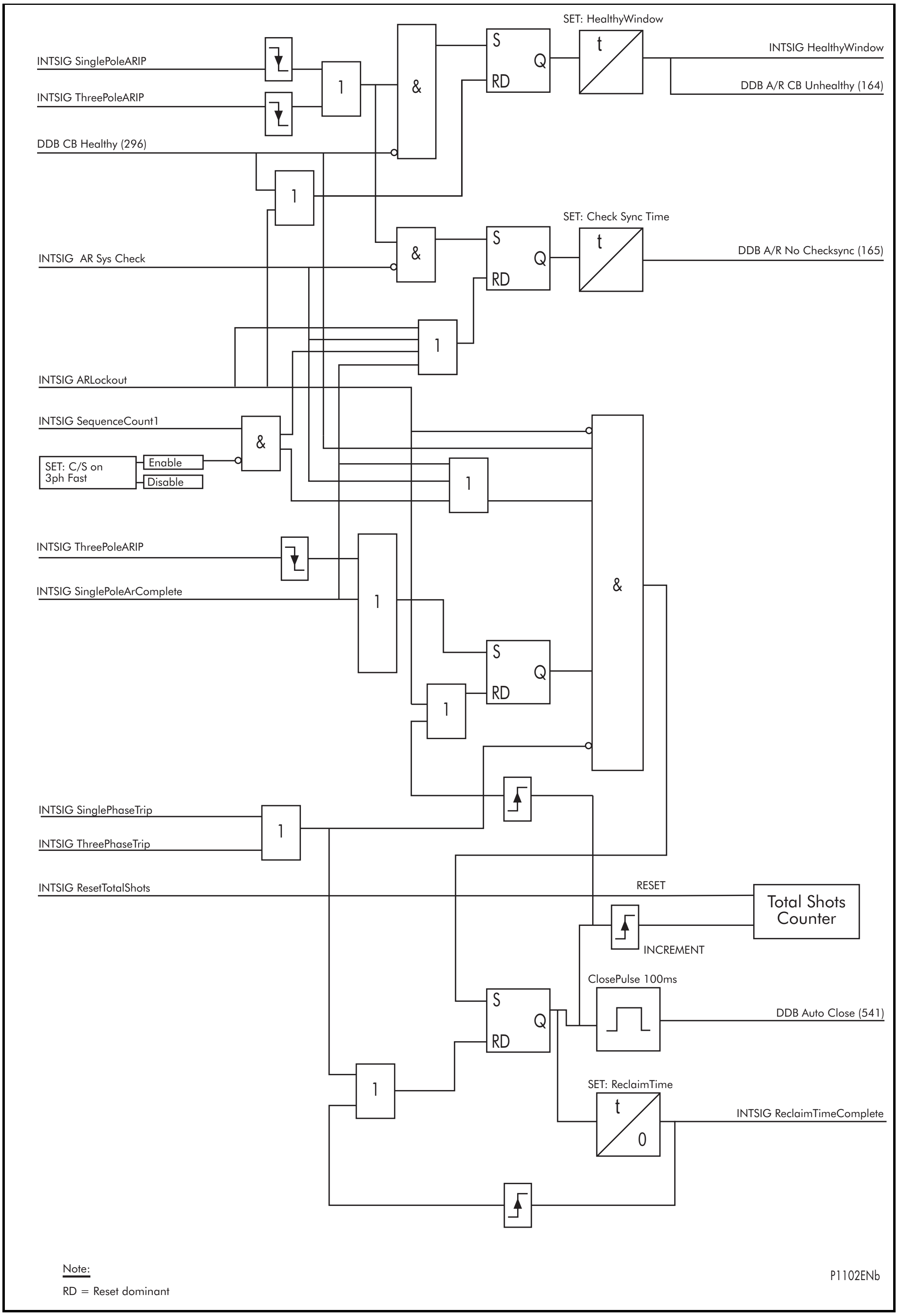


Figure 20: Autoreclose P543/P545 Close

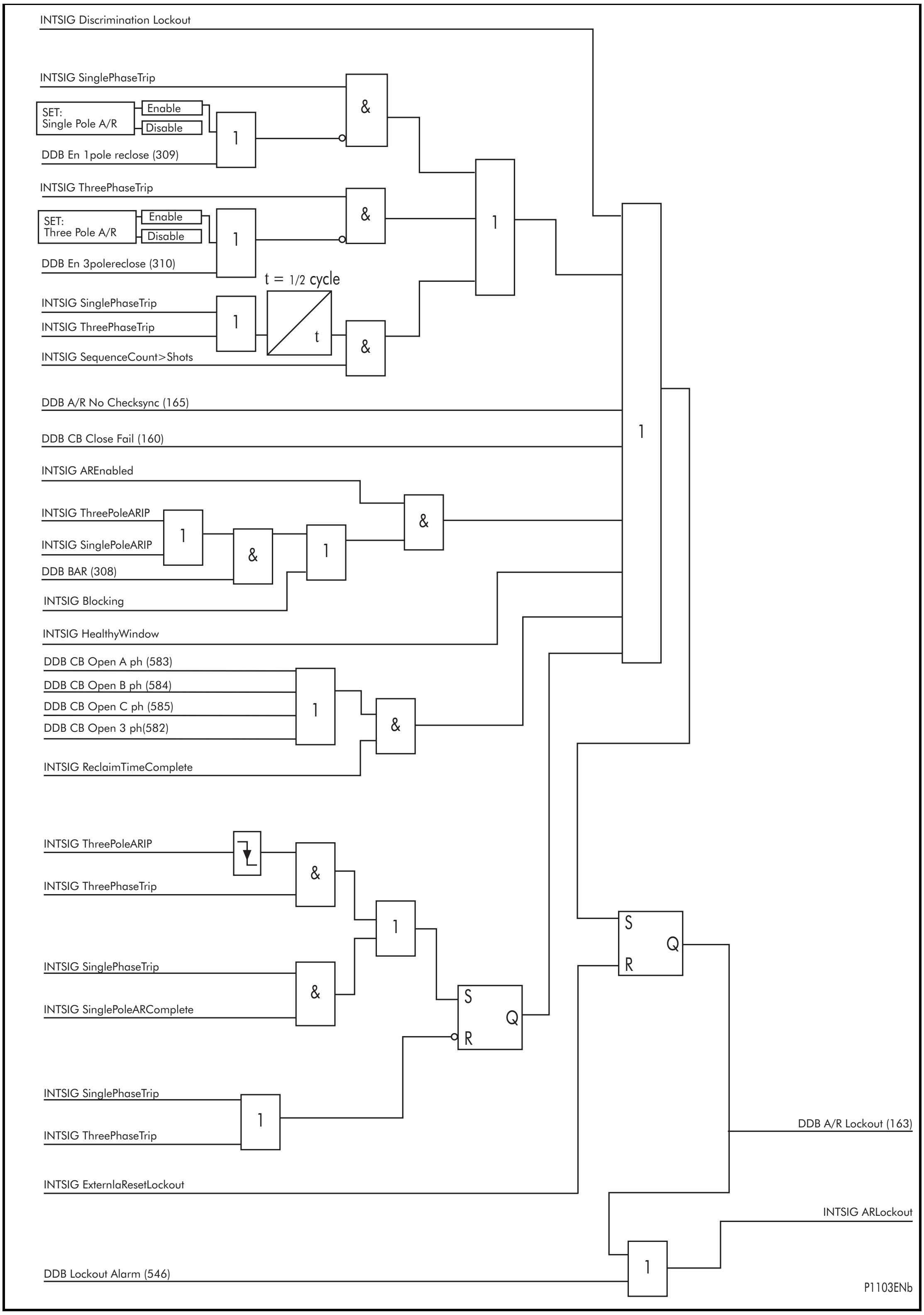


Figure 21: Autoreclose P543/P545 Lockout Logic

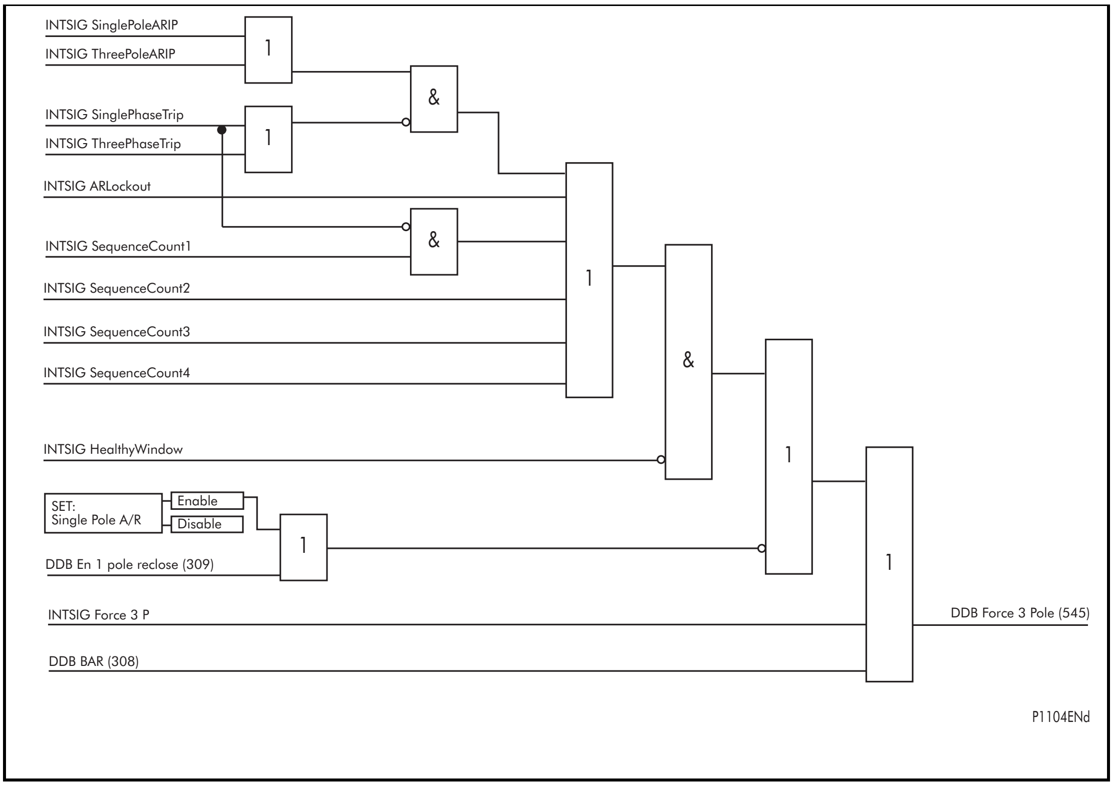


Figure 22: Autoreclose P543/P545 Force 3 Pole Trip

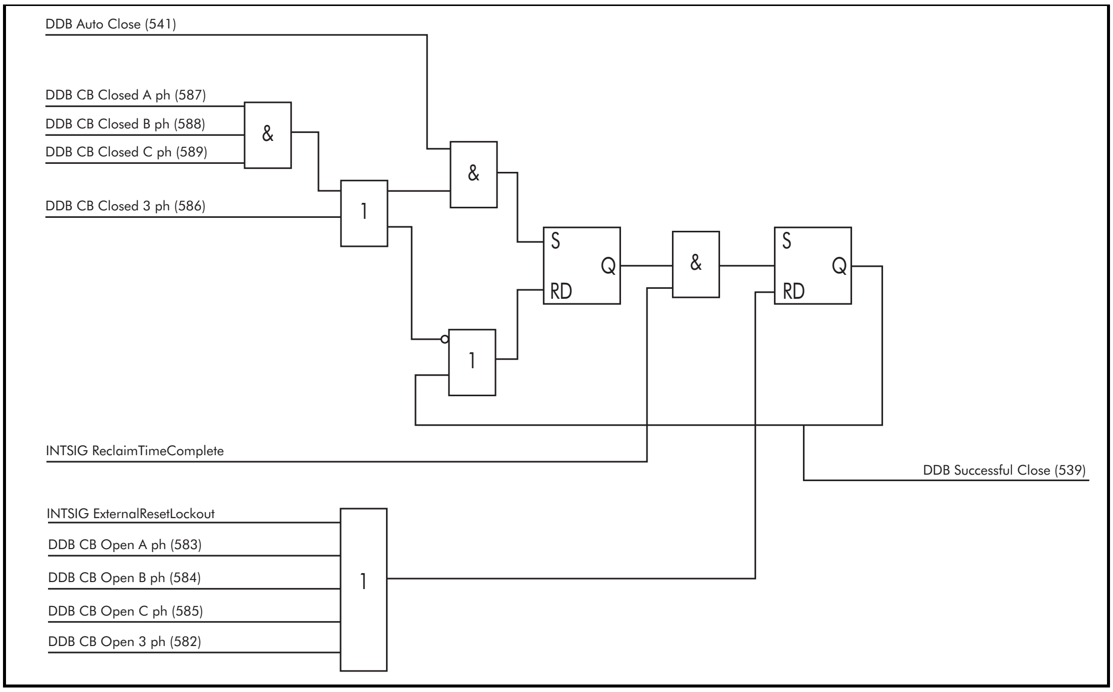


Figure 23: Autoreclose P543/P545 Close Notify

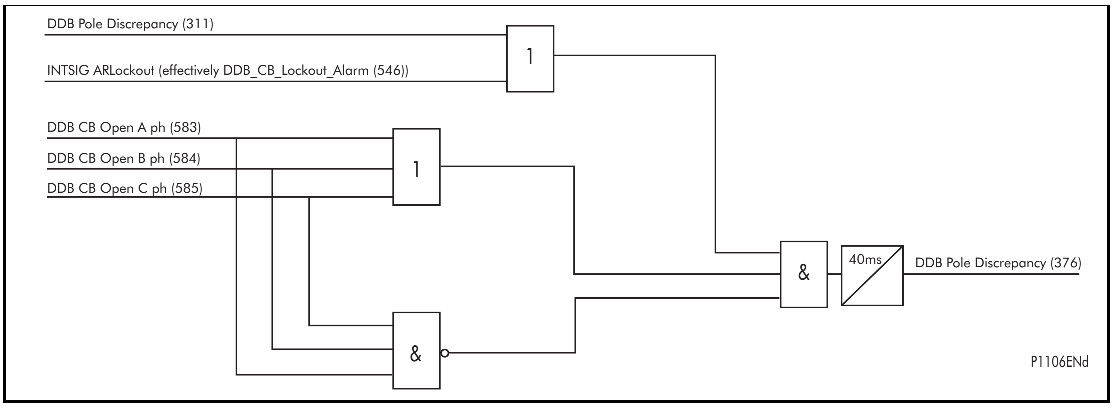


Figure 24: P543/P545 DDB Pole Discrepancy Trip

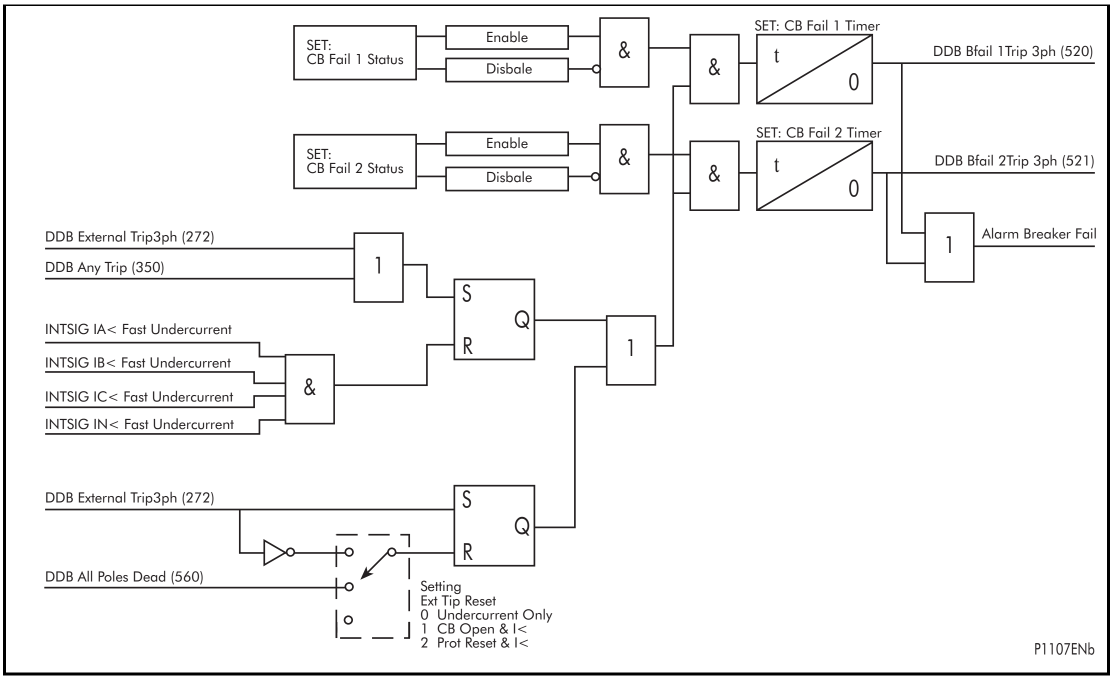


Figure 25: CB failure for P541/P542 with Three Pole Tripping

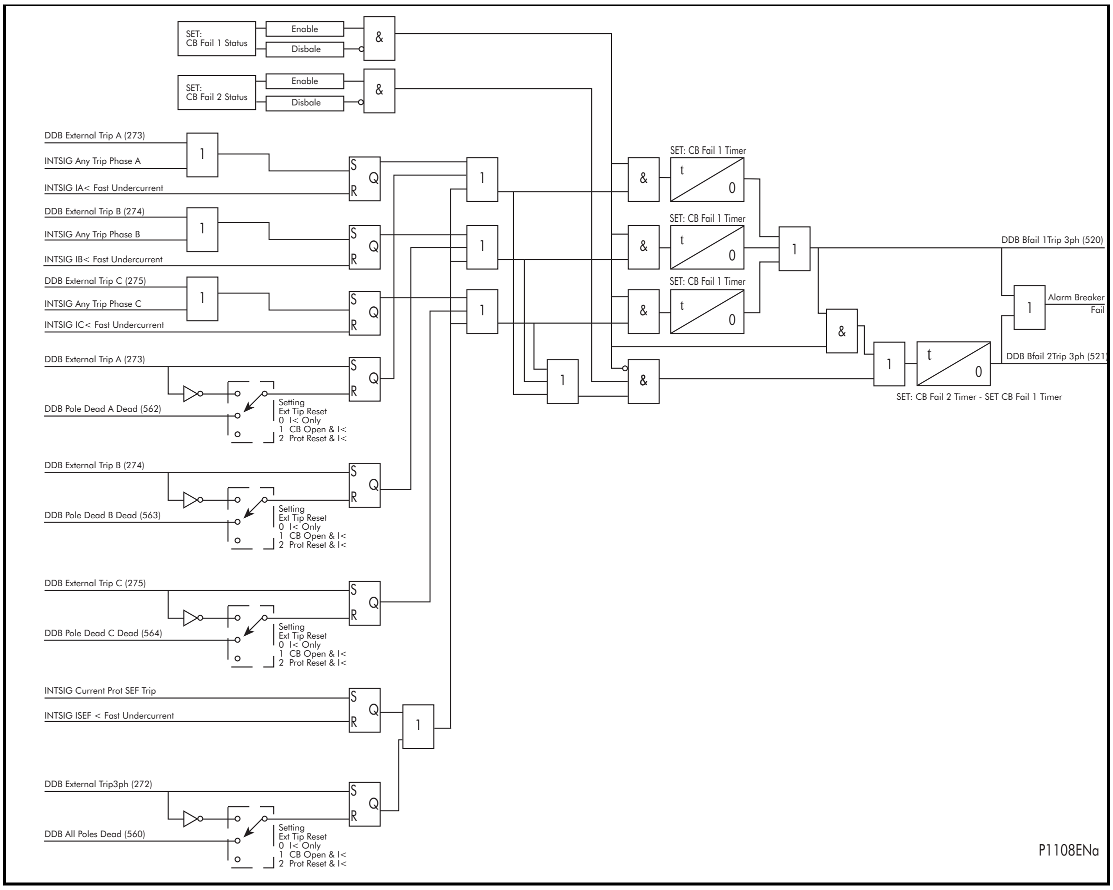


Figure 26: CB Failure for P543/P545 with Single/Three Pole Tripping

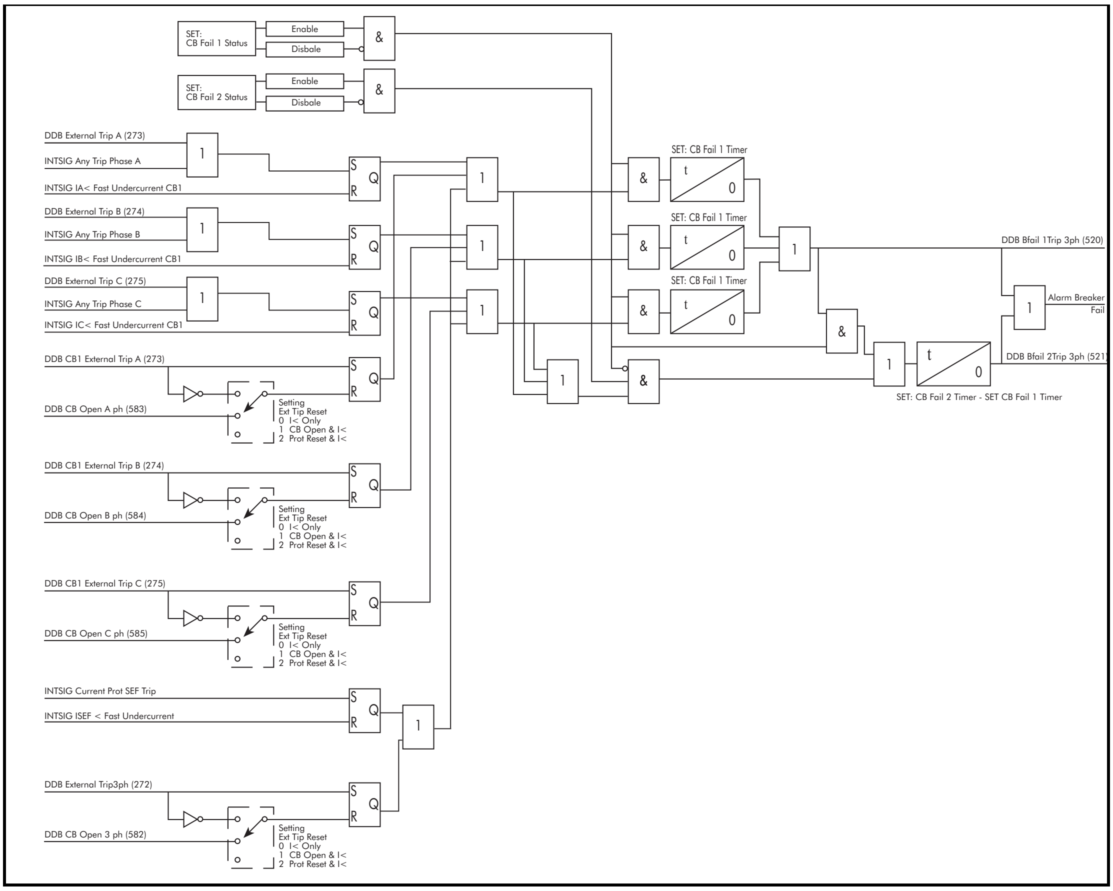


Figure 27: CB failure for P544/P546 (repeated for each CB)

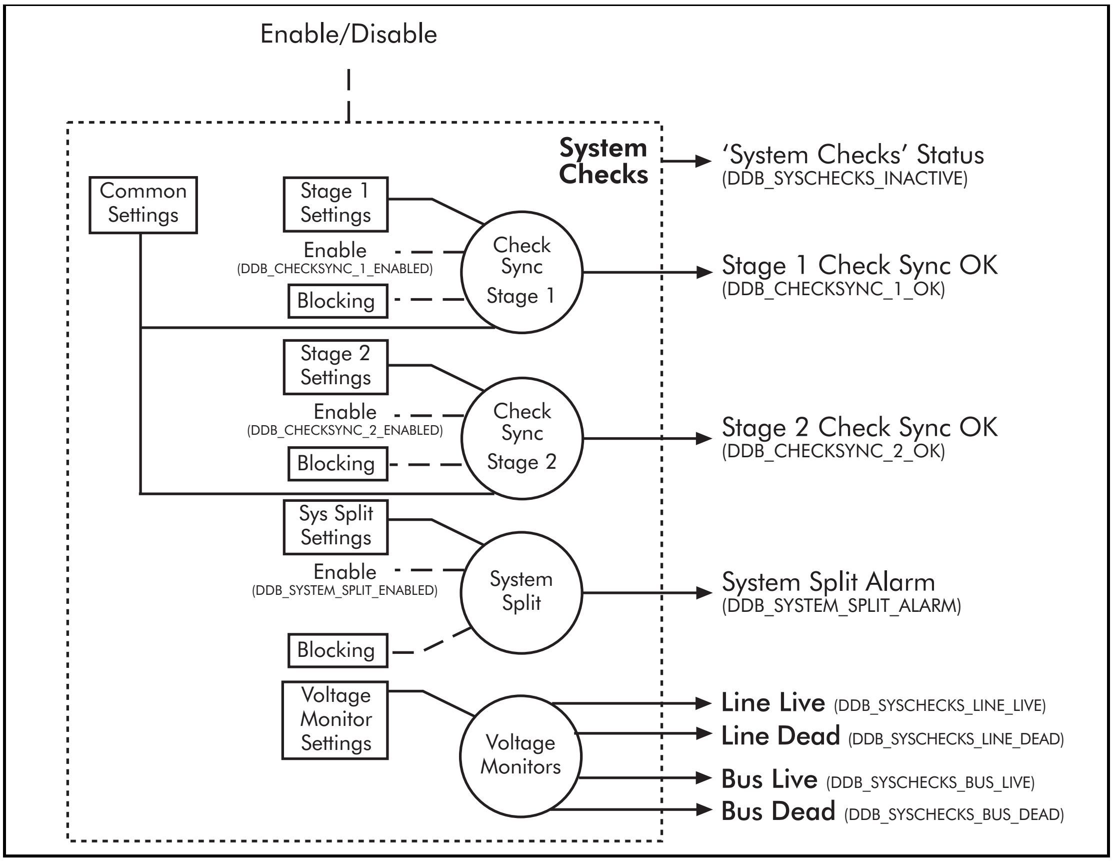


Figure 28: Check Synch

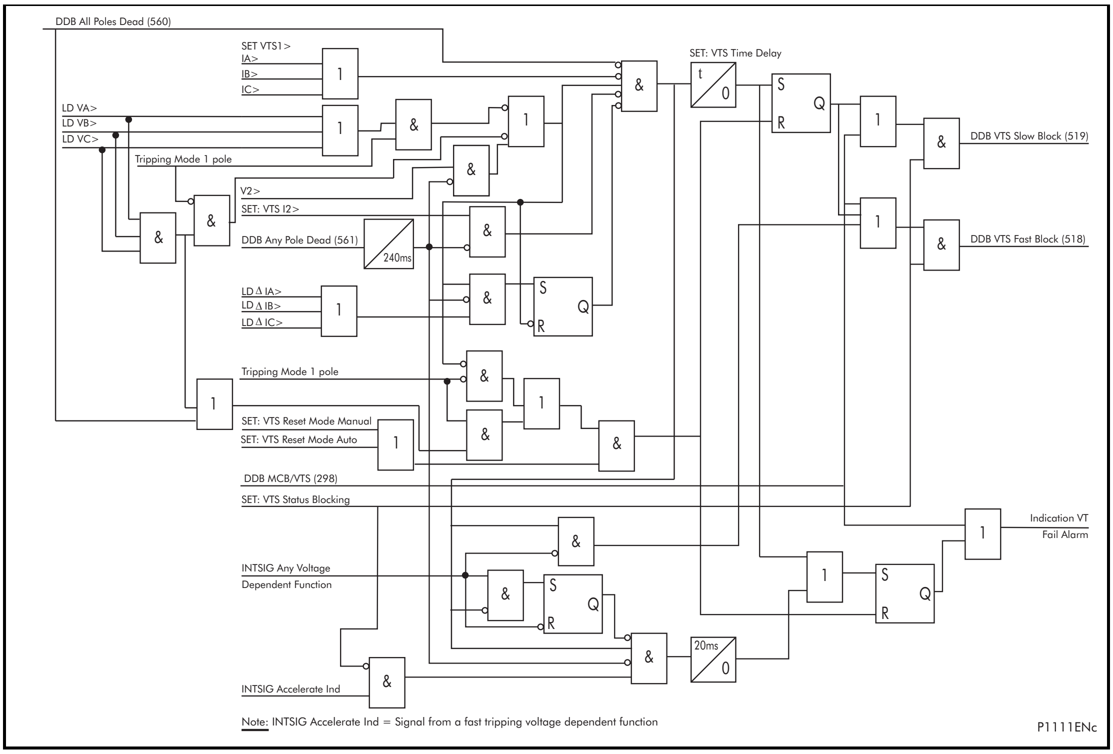


Figure 29: VTS Logic

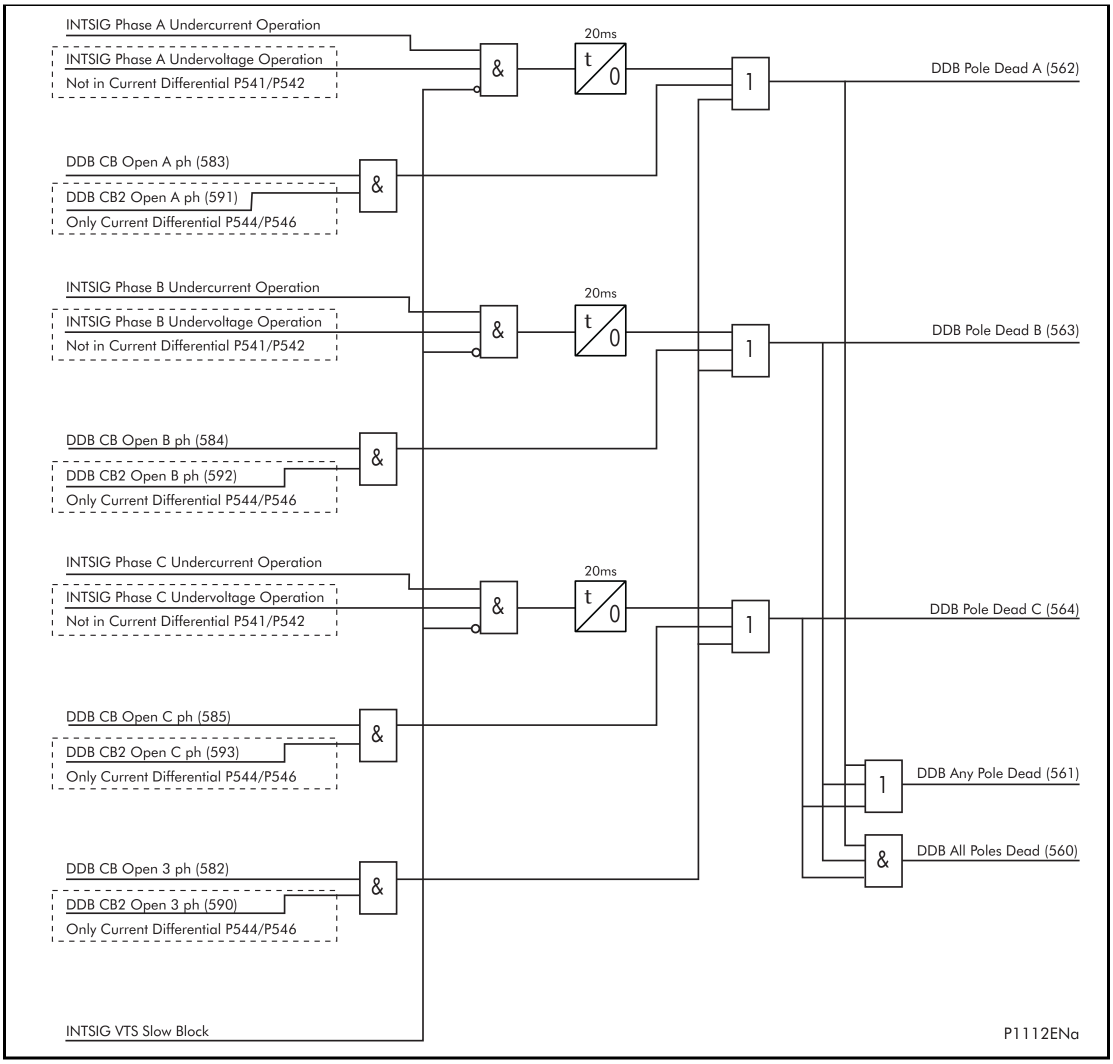


Figure 30: Pole Dead Logic

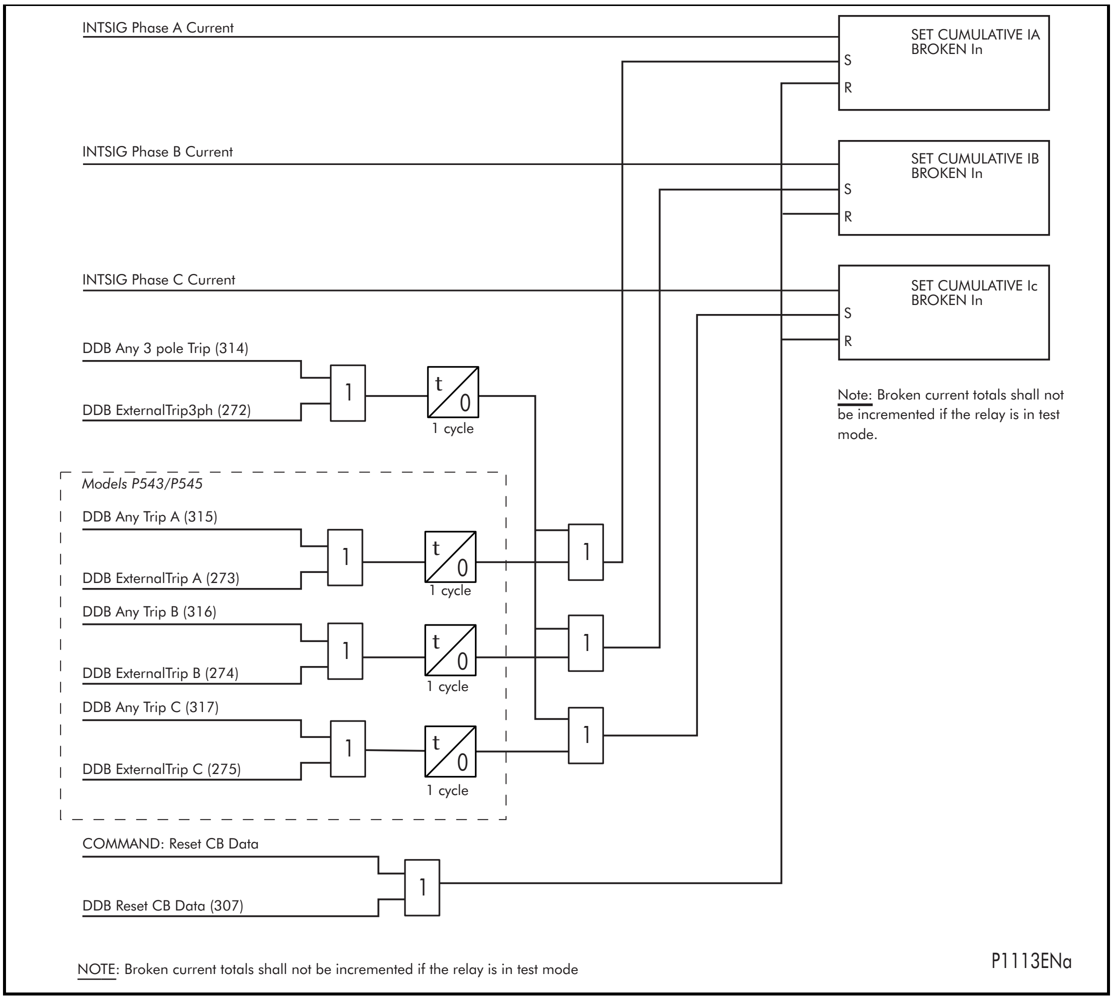


Figure 31: Circuit Breaker Condition Monitoring Broken Current P541/P542/P543

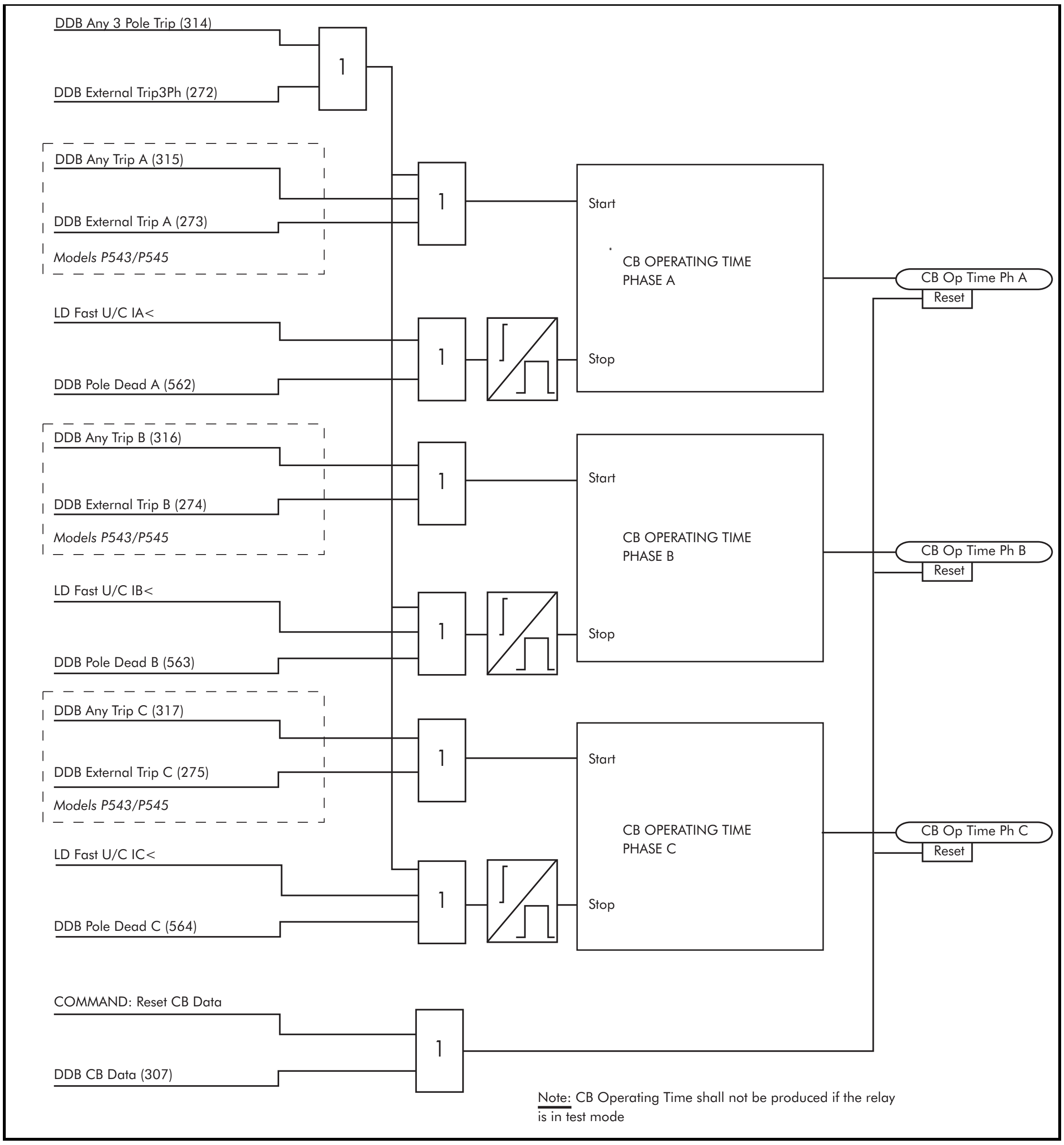


Figure 32: Circuit Breaker Condition Monitoring - Operation Time P541/P542/P543/P545

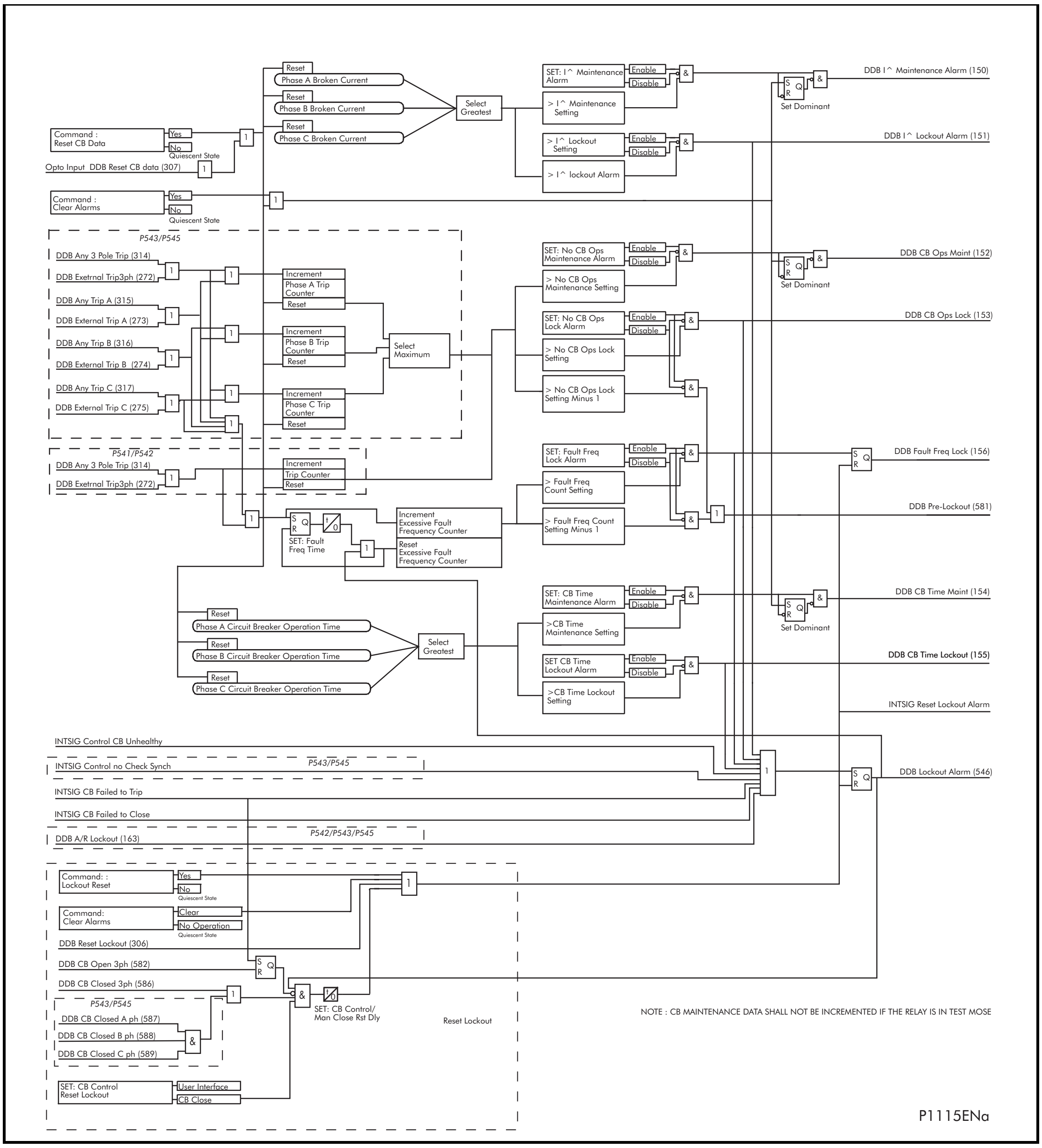


Figure 33: CB Monitoring P541/P542/P543/P545

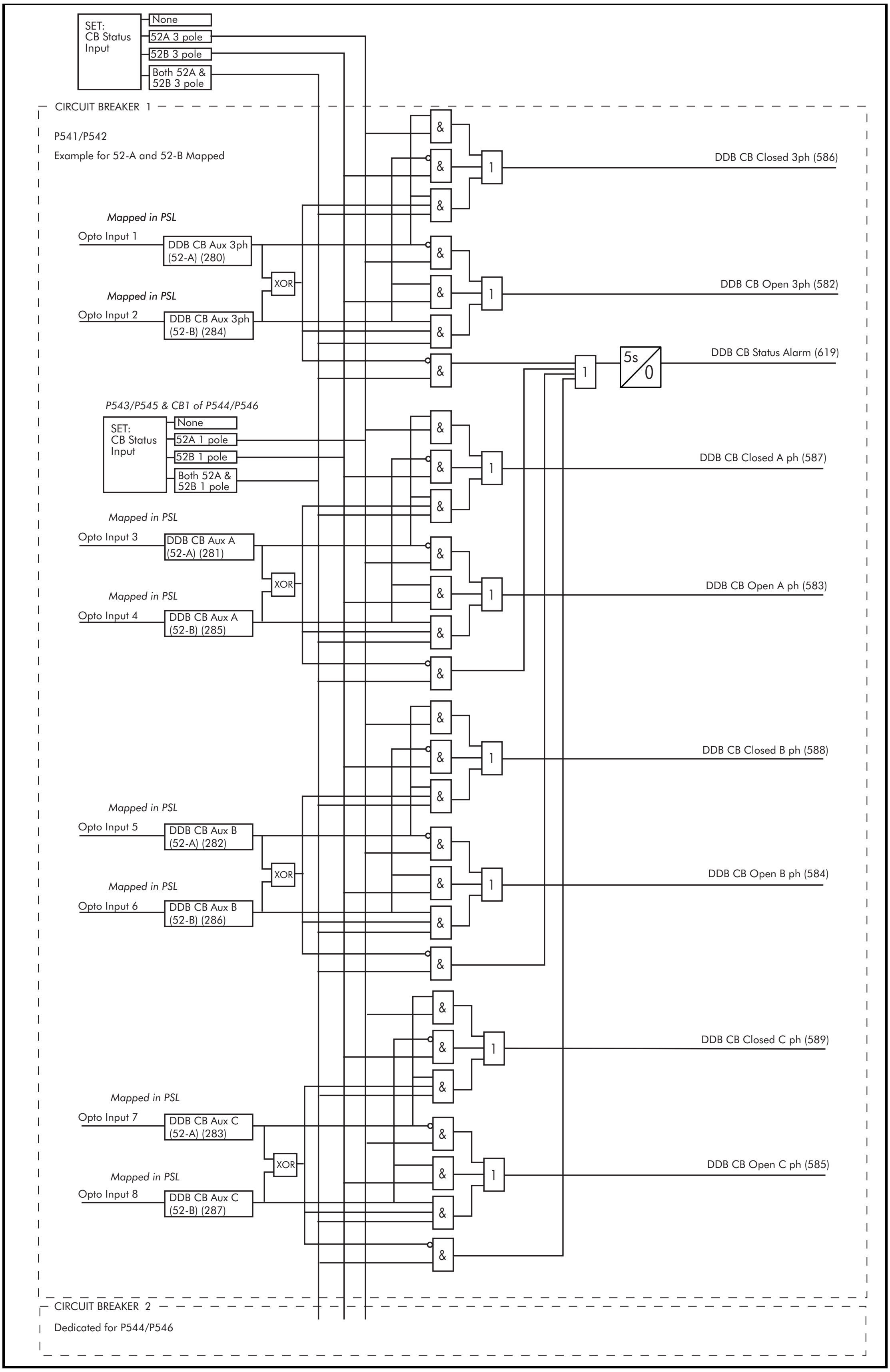


Figure 34: Circuit Breaker State Monitor P541/P542/P543/P544/P545/P546

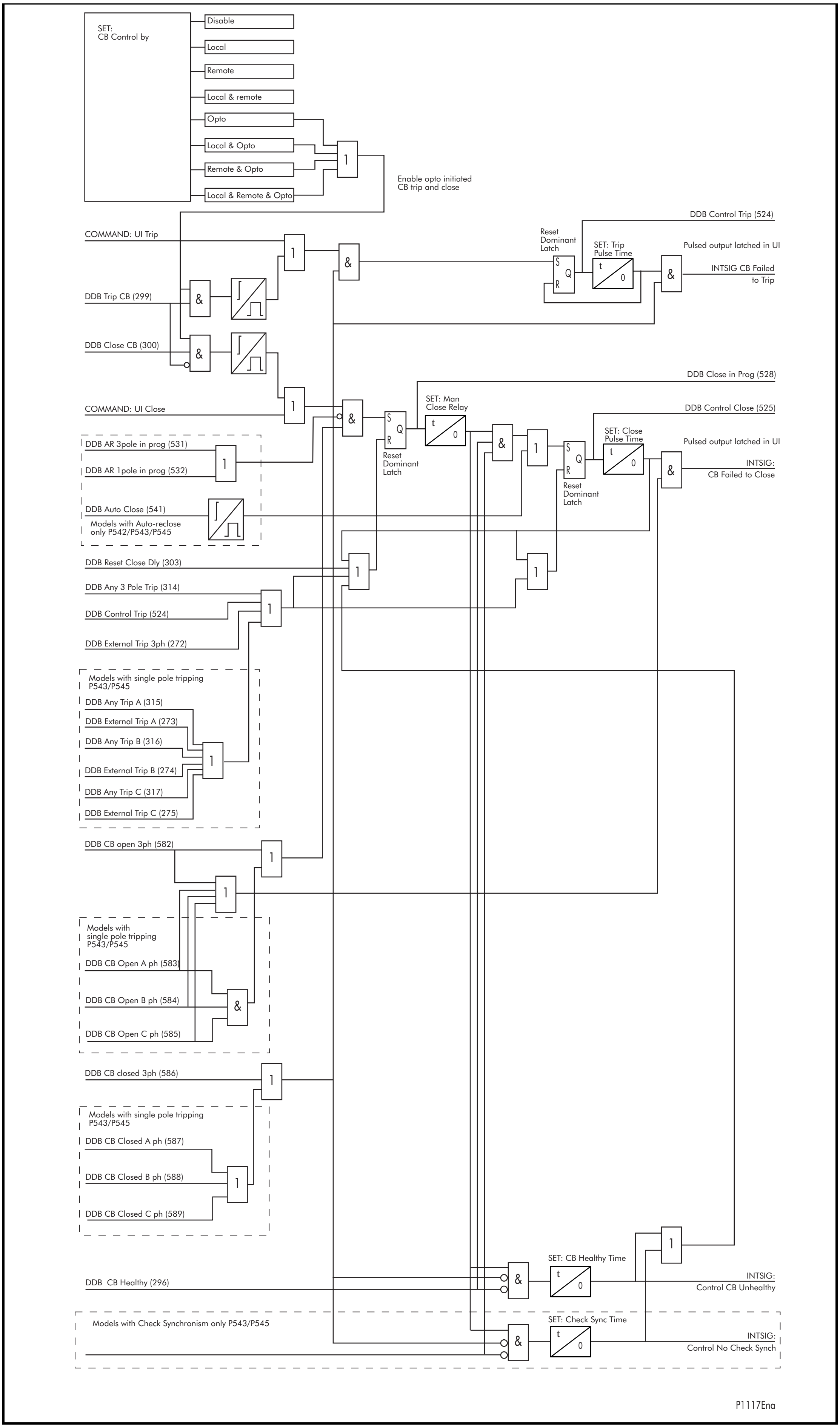


Figure 35: Circuit Breaker Control for P541/P542/P543/P545

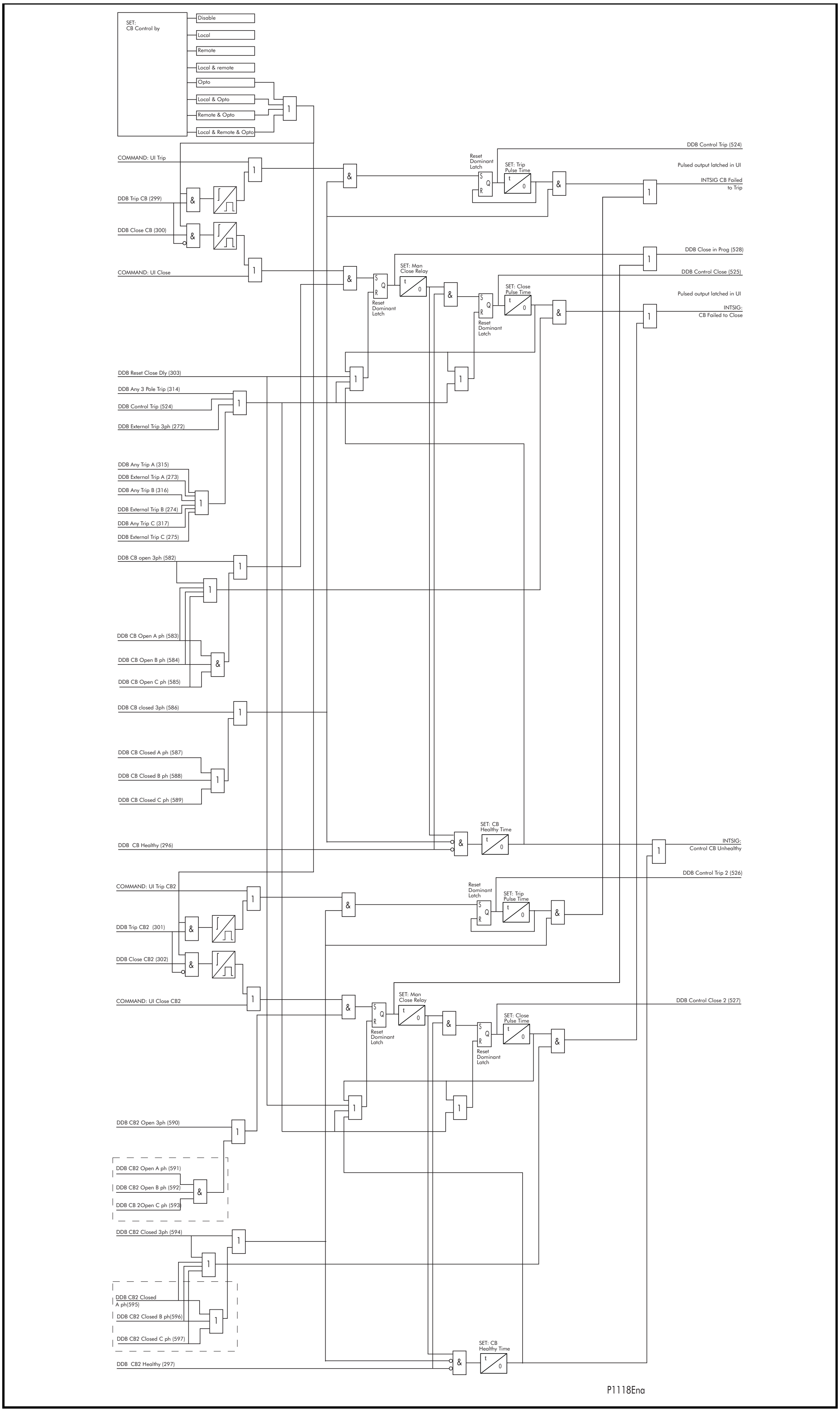


Figure 36: Circuit Breaker Control P544/P546

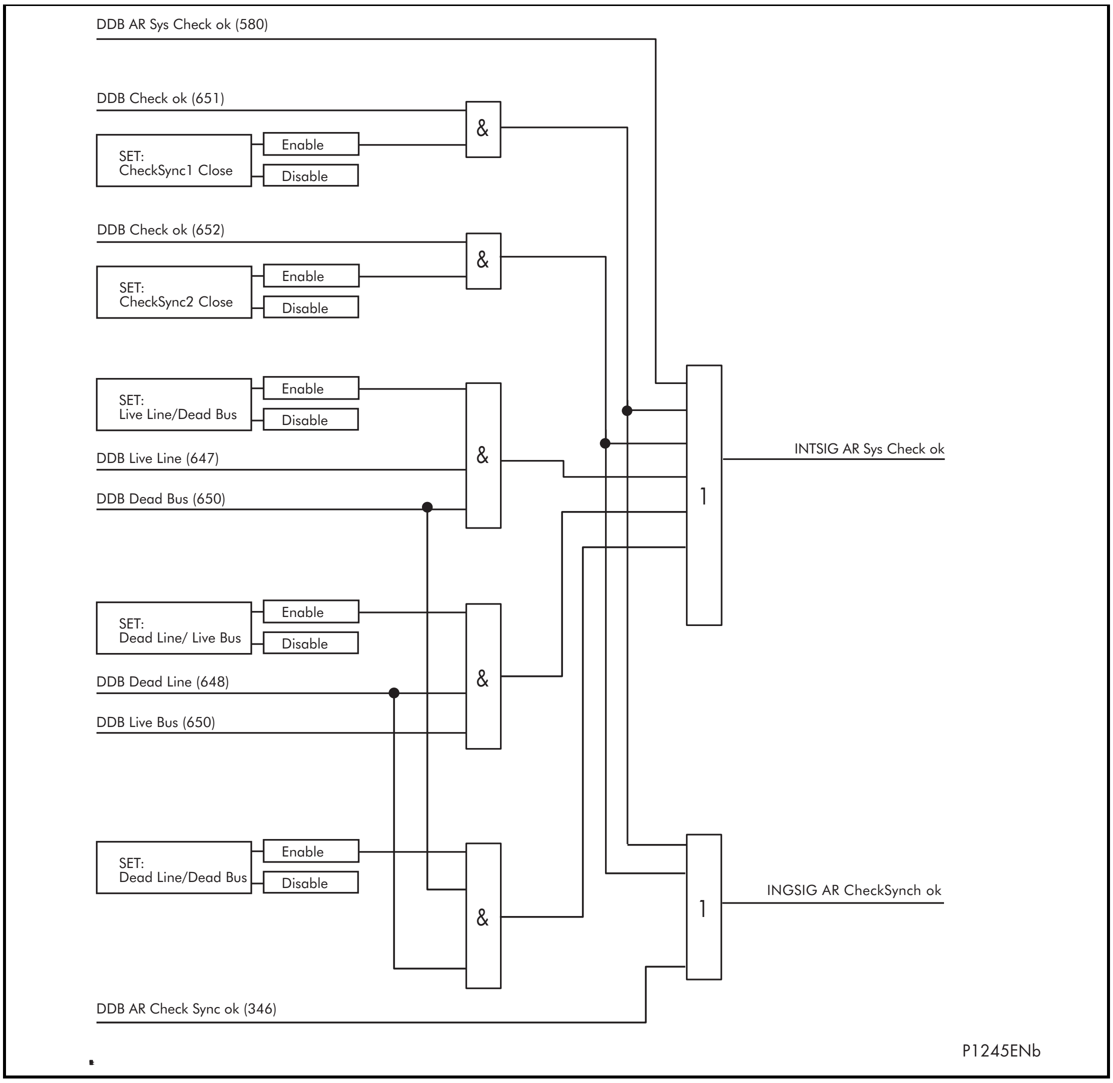


Figure 37: Autoreclose P543/P545 Repeat Closer

Alstom Grid Worldwide Contact Centre

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