MREF
(RESTRICTED EARTH FAULT)

Technical Manual

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1. GENERAL DESCRIPTION

P+B Engineering, design and manufacture a range of Drawout Protection Relays and Intelligent Protection and Control Systems. These Microprocessor based range of relays are mounted in 50, 100, 150 and 200mm wide Drawout cases. In general terms, Auxiliary and Tripping relays are supplied in 50mm cases. The majority of MREF, Feeder, Transformer, Generator and Motor protection relays are fitted into 100mm wide cases and the more complex Multifunction relays command wider 150 and 200mm cases.

The **Vision** range of Protection Relays and Controllers, are sub-divided into two categories:

1.   **MR** Range – Cost effective General Protection Drawout Relays with a 2 line LCD display.

2.   **Vision Drawout** – Multifunction Protection and Control devices with a large, fully graphical LCD display.

MREF   This manual describes the MREF – 1 or 3 single or triple pole Drawout cased
Microprocessor based Restricted Earth Fault Relay

1.1 Protection Functions

- Restricted Earth Fault
- Programmable External Faults
- Serial Timeout protection
- Internal Error Protection

1.2 Displayable Data

- Restricted Earth Fault Current
- Trip Status
- Alarm Status
- Digital I/O Status
- Active Fault Status

1.3 Displayable MREF Status

- Healthy / Trip / Alarm
- Alarm Description
- Trip Description

1.4 Control Output Relays

- 1 Relay Output Fixed for trip Pulse
- 3 Programmable Output Trip Relays

1.5 Control Inputs.

- 2 Programmable Inputs

2. SPECIFIC DESCRIPTION/APPLICATION

Application of type MREF Circulating Current Differential relay

The P&B **MREF** high impedance differential relay can be used over a wide range of applications.

The most common application of the **MREF** is in the protection of transformer restricted earth fault and is detailed in this note. However, the principle may be extended over a much wider range to encompass machine / busbar differential protection.

Principle of operation
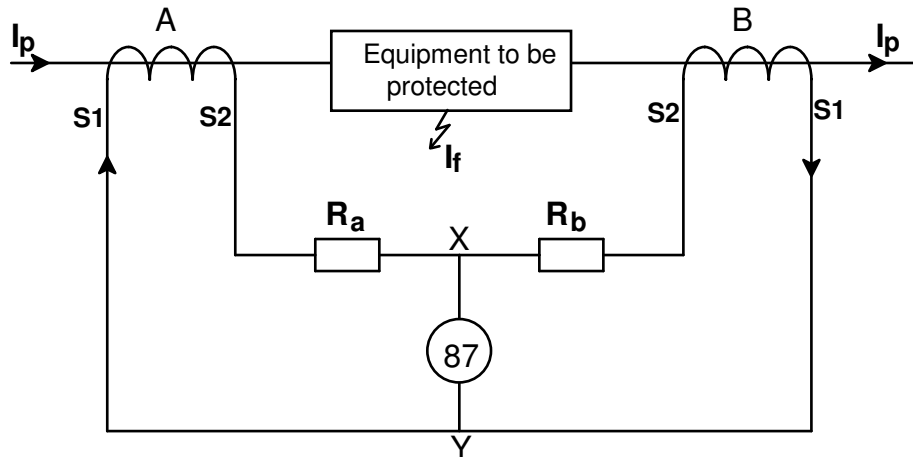
In the simple case above, for a current I_p flowing through both CT's will produce an equal secondary current. This will flow around the loop and the voltage X-Y will remain zero and the MREF relay would not operate.

In the event of an internal [in zone] fault I_f, only CT [A] would "see" this fault. The other CT [B] would appear as an open circuit. Thus any Secondary current in CT [A] would flow between X & Y operating the MREF.

In practice, should I_p become extremely large, one CT may saturate, in effect representing a shorted secondary. In this case, the circulating current would produce a voltage across X/Y. Calculations must be made to ensure stability under these circumstances, these are described in P&B application Note MR901.

2.1 Typical Application Diagrams.

1]   <u>Unbiased Differential</u>
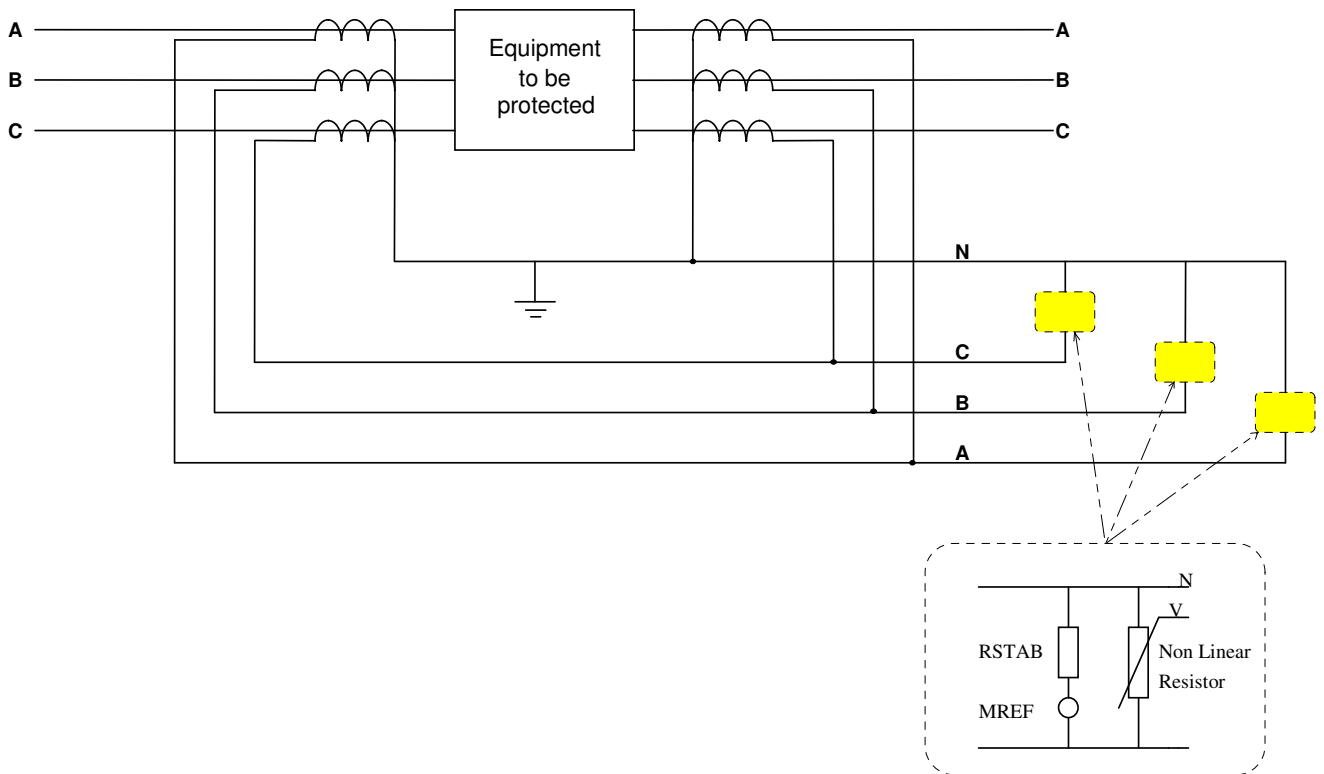
Three **MREF-1** relays are required to achieve full protection. Each with a stabilising resistor and possibly a voltage dependent non-linear resistor.

Alternatively, a single **MREF-3** relay may be used, although this will not indicate in which phase a fault has occurred.

2.2 Restricted Earth Fault Protection for Transformers.
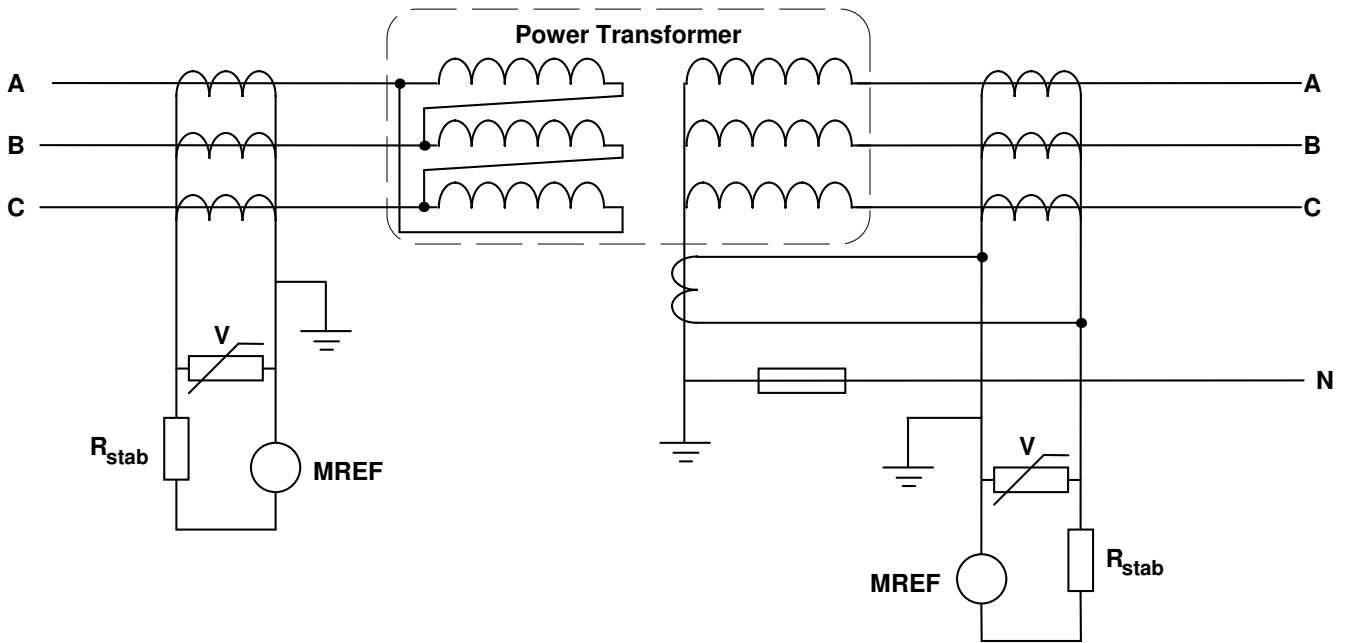
Power Transformer

Balanced Earth Fault

Application for 3 & 4 wire systems [System Earth at Switchboard].
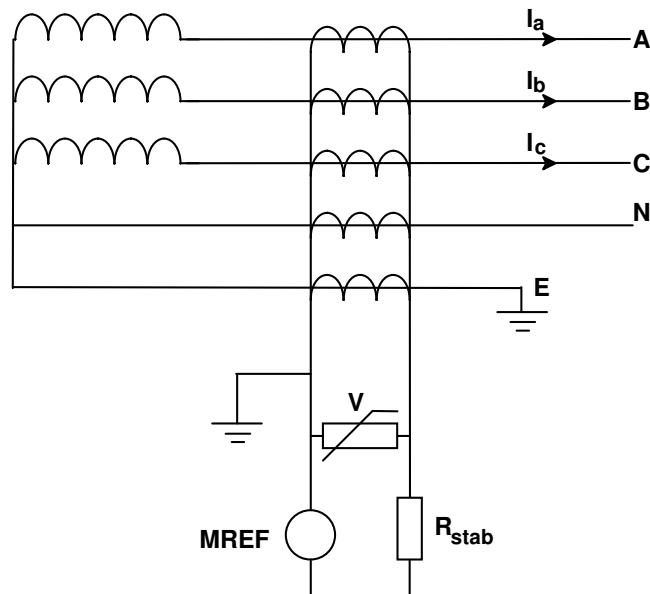
Application for "5" wire systems [Earth & Neutral connections both available at the transformer].

3. Technical Specification

Power Supply

Auxiliary Power Supply & Low Voltage Power Supply	
AC Nominal	Range 80 – 265V AC / DC Range 24V AC / 24-48V Dc (Low Voltage Power Supply Optional Extra)
Frequency	50 **OR** 60 Hz
Maximum Power Consumption	10VA, 15VA Nominal

Measurement

Restricted Earth Phase Current Measurement	
Method	True RMS, Sample time <1ms
Range	1.0 - 200% E/F CT Primary Amps
Display Accuracy	± 3% of Reading Over Range
Pick Up accuracy	± 3% of setting
CT Burden	0.05 VA

Protection Functions

Restricted Earth Fault Time Delay	
Earth Fault Trip	Ψ 50mS Adjustable from 50-500mS
Time Delays	
Accuracy	± 0.04 seconds
Exceptions	
Earth Fault Trip	+40mS,-0.0@ 1.1 x setting
	+30mS,-0.0@ 2 x setting
	+20mS,-0.0@ 5 x setting

Relay Contacts Ratings

Output Relays	
Rated Load	12A @ 120 AC 12A @ 28V DC
Maximum Operating Voltage	330V AC
Max Making Current	1.2A
Max Breaking Current	100-200mA

4. Environmental Tests.

P+B Protection Relays and Controllers are all type tested over a range of climatic, mechanical, electrical and electromagnetic compatibility IEC tests.   Please refer to Type Test information to be found on
www.pbeng.co.uk

5. MREF Terminations.

External connections are made using crimp or screw terminals to the MIDOS connection block.. This then allows pre-wiring to be carried out prior to fitting into the switchgear. These are suitable for accepting 2.5 sq. mm wire.
See **SECTION 14.2** for terminal assignment.

6. MREF Analogue Inputs.

6.1. Power Supply Live

The MREF requires an AC or DC Voltage to supply the unit. The digital inputs are connected to this supply too.

The MREF can also be fitted with a Low Voltage Power Supply (PSU) and / or Low Voltage digital inputs.

6.2 Conventional Current Transformers

Normally, the MREF has provision to allow connection of standard 1 amp or 5 amp secondary current transformer.

7. MREF Serial Port

7.1. RS485

The Serial Port supplied with MREF as standard utilises a half duplex RS485 protocol allowing up to 32 units to be daisy-chained together, or to be multi-drop connected with a single shielded twisted pair cable.

The MREF in addition to its very comprehensive protection and control features has been equipped with a very powerful data communications system. It provides high-speed data acquisition to supervisory computers to form a complete protection monitoring.

Each MREF can be connected to an isolated data highway using RS485 communications. Up to 32 units can be connected to each data highway. The host system can interrogate the unit to monitor status, historical data and fault data as well as control functions such as reset fault / alarm conditions.

The MREF is available with P&B network gold (P&B protocol) installed for use with the Xcell Data Concentrator for fully Integrated Protection, Control & Monitoring Systems with full dual redundancy or with a Slave implementation of Modbus RTU protocol for small systems and direct Modbus access to devices where data concentration is not required.

7.2. Profibus - Optional

Please contact P&B Engineering for further details of this optional protocol.

7.3. RS232

This RS232 port allows access to historical and dynamic data without disturbing the rear RS485 network.

Full details of the protocols, device mapping, gsd files and other support documents are available on request.

Information on the Xcell Data Concentrator is contained in the P&B Integrated Protection & Control System Integrators Manual, available on request.

8.0 Protection Functions.

8.1 MREF Settings

8.2 REF CT Primary

This setting allows the user to program the primary current rating of the protection class current transformers on the supply phases. It is assumed that all phase current transformers are of the same rating.

8.3. Protection Settings.

The Restricted Earth Fault protection function is configurable independently of the others settings.

8.3.1 Restricted Earth Fault

The MREF may be configured to trip, alarm and/or indicate as a result of a Restricted Earth Fault condition. Definite Time Character

The MREF provides the following settings to choose from:

# Selectable Option		Trip	Alarm	Alarm & Trip	Auto	Panel	Serial	Remote	Blockable				
ANSI No.	**Protective Function**	Available Action				Available Reset					**Variable**	**Range**	**Step**
64	Restricted Earth Fault	#	#	#	#	#	#	#	#	#	Trip Level	1% - 200%	1%
											Trip Time (DEFT ONLY)	50mS - 500mS	0.01s
94	Serial Timeout	#	#	#	#	#	#	#	#	#	Timeout In	1-120s	1s
94	Profibus DP Fault ■	#	#	#	#	#	#	#	#	#	Trip Time	1-60s	1s
94	Internal Error	#	#	#	#	#	#	#	#	#			

■ Only available on PROFIBUS model only

8.3.2 Serial Timeout.

For a set period of inactivity on the rear or front communication port the unit can be configured to take some action in the event.
It is worth noting that the MREF device is slave to any host system, the unit will not send information via the serial port unless it has been requested by a master device.

8.3.3 Internal Error

The MREF incorporates an internal software and hardware watchdog feature to monitor the integrity of both on board hardware and software systems. This feature may be configured to indicate as a result of any registered problems. If a problem with the hardware or software is located during the error check routines the MREF will generate an error code which will be reported at the very bottom of the Analogue Values, Measured Values screen.

8.3.4 Alarm.

An Alarm is considered as a high level function. If the function activates it cause the MREF to enter an alarm state; the fault will be displayed on the screen and the right hand LED will turn ORANGE.
If an output relay is set as Alarm it will change state with the fault.

8.3.5 Trip.

A Trip is considered as a high level function. If the function activates it will cause the MREF to enter a trip state; the fault will be on the screen and the right hand LED will turn RED.

8.3.6 Reset.

The configuration of the reset allows that particular function to be cleared or reset to a healthy condition providing the condition that caused the fault, alarm or inhibit has been removed.

8.3.7 Auto Reset.

This option, when enabled, automatically resets the Fault when the situation that caused the trip has been removed.

8.3.8 Panel-Reset.

This option, when Enabled, allows a reset of a fault to be carried out from the front panel of the relay. A reset button will be displayed on the screen just above the top right button. This will only occur if the fault has been removed and the MREF is enabled for a panel reset.

8.3.9 Blocking Input.

A digital input configured as a "Blocking input" will provide the facility to block any MREF protection function configured to be "Blockable". Most of the MREF protection features may have blocking logic assigned. In the event this digital input changes to a blocking status then all those protection features configured as "Blockable" will be disabled for the duration of time the blocking input is energised. This feature may be beneficial in blocking the likes of Undervoltage protection during the starting of large machines connected to the feeder/transformer being protected.

8.3.10 Remote Reset

Allows remote reset of a protection Trip/alarm on energising of Digital Input. Needs to be configured in protection settings. Reset = Remote 'R'

9. System Settings.

9.1 Password.

If the password is set to enabled the default password (6363) may be used to change setting and reset statistical data. If the password has been changed to something else the new password must be used.

Engineer Password – This is generally only used during commissioning/setup of the relay. The option allows a global password to be used to access the relay's data and settings menus. When 'Engineer Password' is enabled the following passwords will work for all menus:-

ABAAA,   PBACS, xxxxx (User Set Password, Factory Default at P&B is 6363)

When 'engineer Password' is disabled only the User Set Password will work. Please note if this user set password is lost, no other password will override it. The only way to retrieve a lost password is to read back through the comms or default the relay at power up, back to the factory defaults.

9.2 Change Password.

The MREF default password is '6363'. It is recommended for security purposes this password can be changed. The password may be up to 6 characters long and alphanumeric if desired.
If the User Password is lost the only options are to either Read the information via the serial Link or execute a Configuration Reset on the relay to restore all of the factory defaults.

9.3 LCD Contrast and LCD Backlight.

These functions allow the user to change the display contrast and backlight.

```
Contrast
Y        30     N
```
```
Data = 000030
Save          Next
```

Selecting 'Y' displays the input screen

	Light	**Dark**
For Contrast	0 ───────▶	128
	Maximum	**Minimum**
For Backlight	0 ───────▶	156
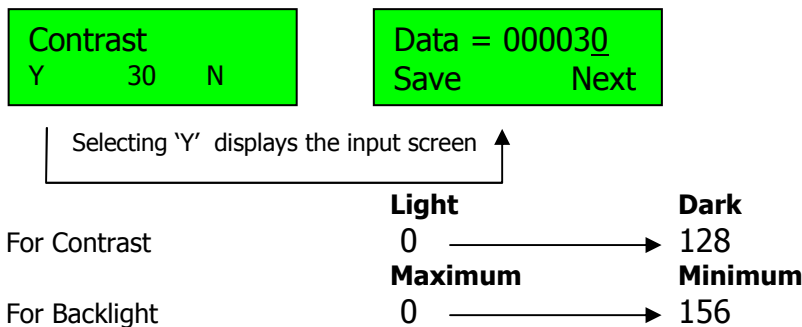
9.4 Set Default Page / Default Return Time.

Any of the display scroll data pages can be nominated as the default page and returned to after a set period of key press inactivity.
To set the page; select the required one using the display scroll button, then enter the system settings and select 'set default page'.

9.5 Default Return Time.

If the MREF is not being accessed using the buttons on the front of the relay after a predetermined time the relay will default to the Pre-set Page. In this setting you can control that feature. You are able to switch off the return feature or specify a time for the delay before the return to the Pre-set Page.

9.6 Time Sync Delay. (Only for use with Chronovision)

Chronovision is a GPS based device which connects on the RS485 network and synchronises the time and date of each connected unit. This delay prevents immediate updating of the RTC.

9.7 Software Version.

Displays the operating firmware loaded on to the unit. This should be noted along with the serial number when corresponding about this equipment

9.8 Unit ID. / Unit Type.

Displays the Serial number and device type.

9.9 Software Activation Keys

In order for some functions to operate a unique activation code is required to access hidden menu screens.

9.10 Time and Date.

These functions allow the user to set the date and the time on the relay.

9.11 Chronovision

When enabled allows the real time clock to be updated via the broadcast GPS sync signal from Chronovision.

9.12 Screen Saver

To help extend the life of the LCD we can power the display down if the application suits. The screen will power down after the set time from the last key press. The MREF will still operate and can be remotely controlled via digital inputs or the serial interface. On any key press or active fault the display will re-activate.

9.13 Screen Saver Time

Sets period of inactivity before activating screen saver function.

10. Serial Settings.

10.1 Serial Enabled / Disabled.

This setting allows the user to enable the MREF serial communications port. This setting must be set to 'Enable' if communication with the relay through any serial link is required.

10.2 Feeder Number.

This setting range 1 to 32 (125 Profibus), with a default setting of 1, identifies the MREF unit to the Xcell unit (or any Master device connected to the Data highway) to which the RS485 or Profibus port is connected. When updating firmware the auto program mode requires the feeder number to be 1.

10.3 RS485 Baud Rate.

This setting allows the user to configure the appropriate communications baud rate such that the MREF can communicate correctly on the Data Highway to which it is connected.

10.4 RS232 Baud Rate.

This setting allows the user to configure the baud rate for the front mounted RS232 port.

10.5 Serial Delay.

The MREF may be configured to respond to a request for information from the serial port instantly or after a designated delay.

A communications delay may be beneficial to ensure the Master device on the Data Highway receives all information sent back by the MREF without enduring data collisions on the network.

10.7 Fast Scan 1 to 3.

Each FastScan number can be programmed to export important data when requested. This number references an internal address in MREF and allows configurable data mapping between units. Typical data could be Average Phase Current, Voltage and so on. A table of the FastScan reference numbers can be found in **SECTION 15**.

10.8 Max Scan Time.

This setting need only be used in order to limit the amount of data traffic on a RS485 network. Dynamic data can change rapidly, this setting allows the MREF to limit the number of updates it makes to its Fast Scan values.

10.9 Protocol. (RS232 & RS485)

The RS232/RS485 serial communications ports, may be configured to operate using a slave implementation of Modbus RTU® or P&B Engineering's own protocol "P&B Standard" designed to remove some of the speed issues associated with a function based protocol like Modbus.

10.10 Parity. (RS232 & RS485)

This setting allows the user to set the parity to match that of the host system on the serial link. The options are "Odd", "Even" and "None". Not required if Profibus.

10.11 Serial Timeout Protection.

DETAILED IN SECTION 8.3

11. MREF Faceplate Functions

The MREF Faceplate has been designed to provide display and access to all the required information an operator may require.

This is achieved by using 2 tri-colour LED's, a LCD display and 4 software driven function keys.

This eliminates the need for additional indication devices on the front of the feeder panel such as Lamps, Ammeter, Voltmeter, Hours Run Indicator, Operations Counter, etc. which helps reduce the cost of the switchgear panel and gives improved reliability by the reduction of separate components.
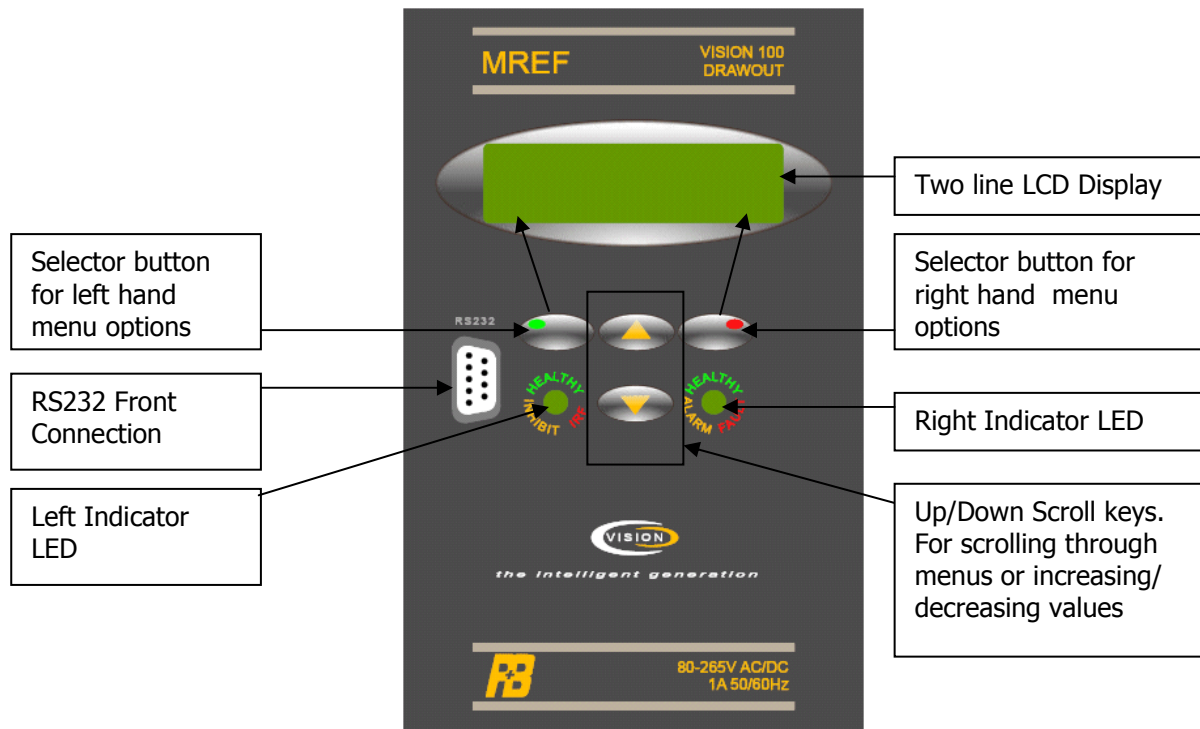
The following section details the function of the Front plate devices.

11.1. LED Status.

The LED's on the front of the MREF operates as follows:

LED Colour	Left LED [MREF Status]	Right LED [Fault Status]
Green	Healthy	Healthy
Yellow	Inhibit	Alarm
Red	Internal Fault	Fault

12. Menu Tree Structure.

INITIAL MENU

DISPLAY SCROLL
Section 13.2

Restricted Earth Current, Alarm Status, Trip Status, Digital I/P1 Status, Digital I/P2 Status, Profibus Status (if option fitted)
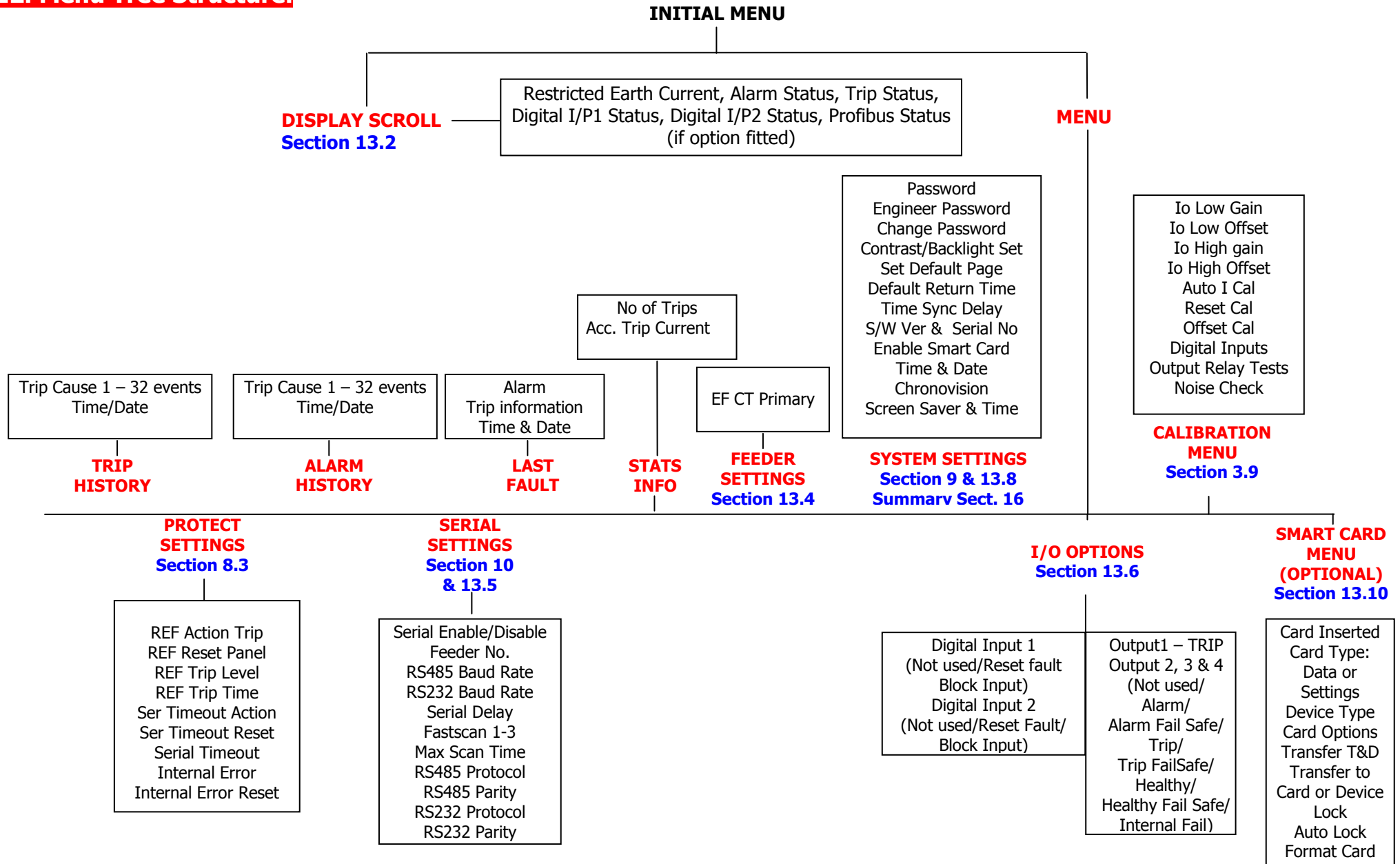
MENU

Password
Engineer Password
Change Password
Contrast/Backlight Set
Set Default Page
Default Return Time
Time Sync Delay
S/W Ver & Serial No
Enable Smart Card
Time & Date
Chronovision
Screen Saver & Time

Io Low Gain
Io Low Offset
Io High gain
Io High Offset
Auto I Cal
Reset Cal
Offset Cal
Digital Inputs
Output Relay Tests
Noise Check

CALIBRATION MENU
Section 3.9

No of Trips
Acc. Trip Current

Trip Cause 1 – 32 events
Time/Date

Trip Cause 1 – 32 events
Time/Date

Alarm
Trip information
Time & Date

EF CT Primary

TRIP HISTORY

ALARM HISTORY

LAST FAULT

STATS INFO

FEEDER SETTINGS
Section 13.4

SYSTEM SETTINGS
Section 9 & 13.8
Summary Sect. 16

PROTECT SETTINGS
Section 8.3

SERIAL SETTINGS
Section 10 & 13.5

I/O OPTIONS
Section 13.6

SMART CARD MENU (OPTIONAL)
Section 13.10

REF Action Trip
REF Reset Panel
REF Trip Level
REF Trip Time
Ser Timeout Action
Ser Timeout Reset
Serial Timeout
Internal Error
Internal Error Reset

Serial Enable/Disable
Feeder No.
RS485 Baud Rate
RS232 Baud Rate
Serial Delay
Fastscan 1-3
Max Scan Time
RS485 Protocol
RS485 Parity
RS232 Protocol
RS232 Parity

Digital Input 1
(Not used/Reset fault Block Input)
Digital Input 2
(Not used/Reset Fault/ Block Input)

Output1 – TRIP
Output 2, 3 & 4
(Not used/
Alarm/
Alarm Fail Safe/
Trip/
Trip FailSafe/
Healthy/
Healthy Fail Safe/
Internal Fail)

Card Inserted
Card Type:
Data or
Settings
Device Type
Card Options
Transfer T&D
Transfer to
Card or Device
Lock
Auto Lock
Format Card

13. Graphical Display.

The LCD screen provides access to limited dynamic and historical data, protection parameter set points and control set-up.

13.1. Menu Screens.

```
SV100-MREF
    SW Version 0.002
```

On power up the introduction screen appears for a few seconds. The screen shows the software version and the unit type, which should be noted in all correspondence with P&B regarding the relay.

After the Introduction screen disappears then the Initial screen appears.

The bottom line shows the Key prompt for the *left hand button*

```
Iref  0A        Hlth
MENU
```
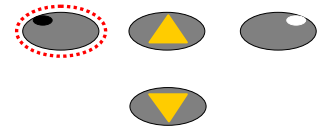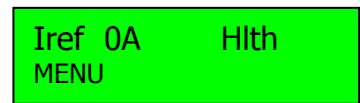
The *right hand button* prompt appears only when the right hand button is assigned a function. Otherwise this will display any active messages.
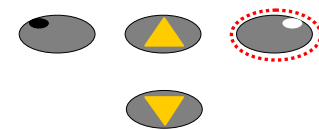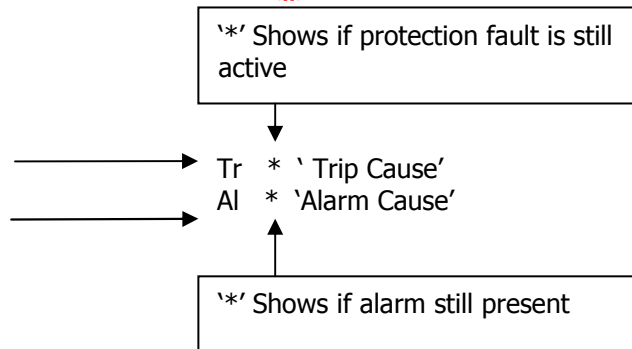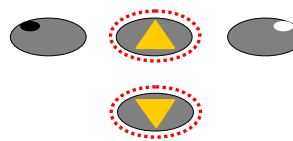
The *up and down* arrow keys scroll in a loop displaying various measured values and MREF status data shown on the top line. Any one of these pages can be selected as the 'default' page, so that if the unit is left whilst in a sub menu, the screen can return to a pre-selected page after a set time-out period (See 'System Settings')
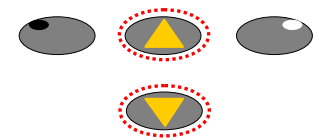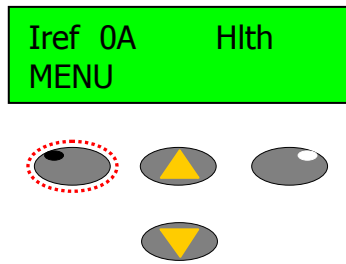
Using the scroll keys to view
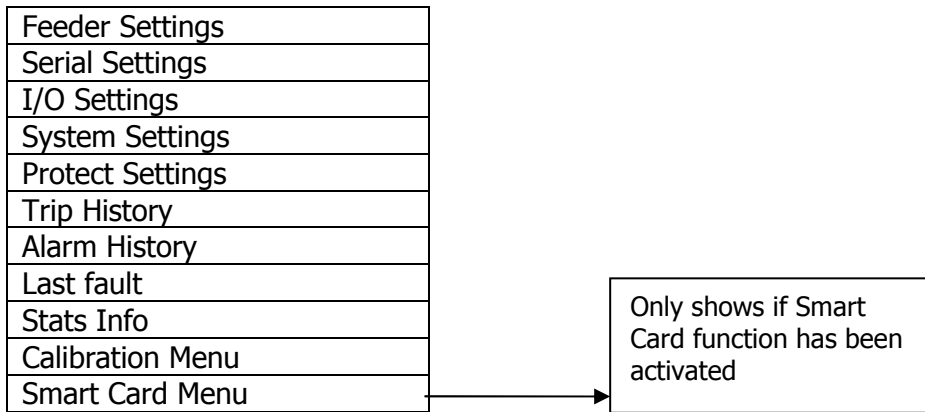The following status of the
MREF

```
I ref  0A      Hlth
DI  1        OFF
DI  2        OFF
Tr    Normal
Al    No alarm
```

'*' Shows if protection fault is still active

Tr * ' Trip Cause'
Al * 'Alarm Cause'

'*' Shows if alarm still present

13.2. Display Scroll.

```
Iref  0A        Hlth
MENU
```

Examples of the Display Scroll screens

| Feeder Settings |
| Serial Settings |
| I/O Settings |
| System Settings |
| Protect Settings |
| Trip History |
| Alarm History |
| Last fault |
| Stats Info |
| Calibration Menu |
| Smart Card Menu |

Only shows if Smart Card function has been activated

13.3. Menu.

Pressing the MENU button allows access in to the sub menu and settings structure. The UP and DOWN buttons scroll through each sub menu heading.

The left button selects entry to each level. The right button restores the screen to the display scroll and menu prompt.
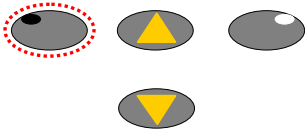
```
Iref  0A        Hlth
MENU
```

```
Feeder Settings
Y                Top
```

```
Serial Settings
Y                Top
```
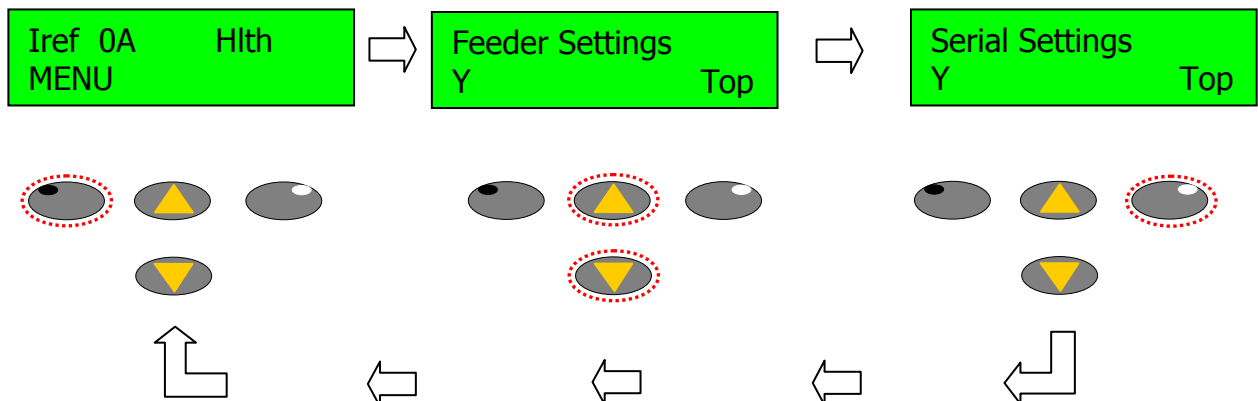
The following details each menu sub level in turn:-

13.4. MREF Settings.

Feeder Settings	
Y	Top

| EFCT Primary	
Y 1500 A	N

This screen allows access to the MREF Settings of the relay. In this case the EFCT Primary.

A value can be selected to have its value changed by pressing the Y button when the value is highlighted. This then brings up the VALUE CHANGE SCREEN

The Value Change pop-up allows you to alter settings in specified steps within the minimum and maximum values of the particular setting range. The UP and DOWN arrow buttons are used to alter the value. The Next function is used to skip along to the next character. Save is pressed to store the new value and exit.

| EFCT Primary		Data = 001500	
Y 1500 A	N	Save	Next
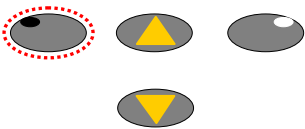
If an undesired value is inserted incorrectly use the Next button to skip past the last character to the left. The Save option button now operates as a Discard to dump the new value without saving – reverting back to the original value on initial selection.

13.5. Serial Settings.

Serial Settings	
Y	Top

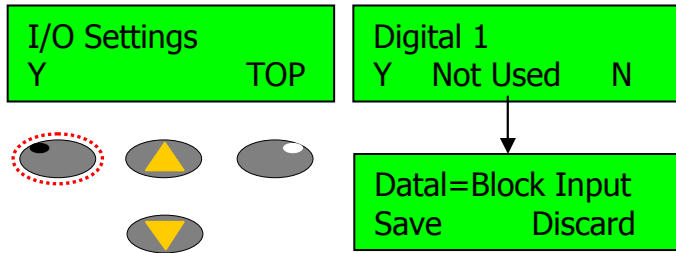| Serial	
Y Enabled	N

This screen allows the configuration of the communication ports details each function.
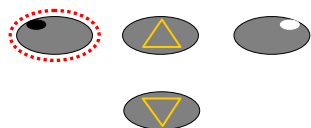
Using the UP and DOWN arrows will switch between 'Enabled' and 'Disabled' selection.

See SECTION 10, for further details

13.6. I / O Settings.

```
I/O Settings
Y              TOP
```

```
Digital 1
Y    Not Used    N
```

```
Data1=Block Input
Save       Discard
```
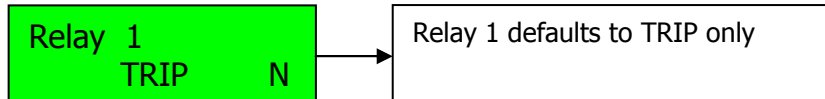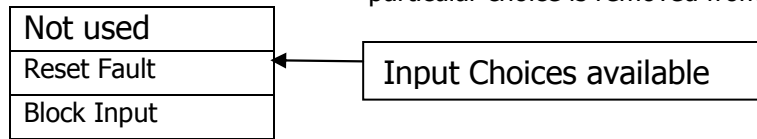
The I / O settings are where the 2 digital inputs are programmable, 1 out of the 4 relay outputs is assigned to TRIP, the other 3 are programmable.
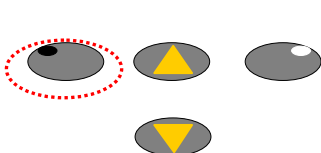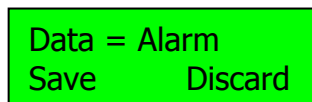
Relay outputs can be assigned to the same function where as the digital inputs cannot.

Select 'Y' to make selection from the list, using the scroll function, choose the option required and 'Save'.

If a digital input has previously been assigned, that particular choice is removed from the list for the other.

Not used
Reset Fault
Block Input

Input Choices available

```
Relay  1
       TRIP       N
```

Relay 1 defaults to TRIP only

Relay 2 – 4 are programmable. By selecting 'Y' , the Scroll Buttons can be used to select
 the appropriate relay setting.

```
Relay  2
Y     TRIP       N
```

```
Data = Alarm
Save        Discard
```

Not Used
Alarm
Alarm Fail Safe
Trip
Trip Fail Safe
Healthy
Healthy Fail Safe
Internal Fail
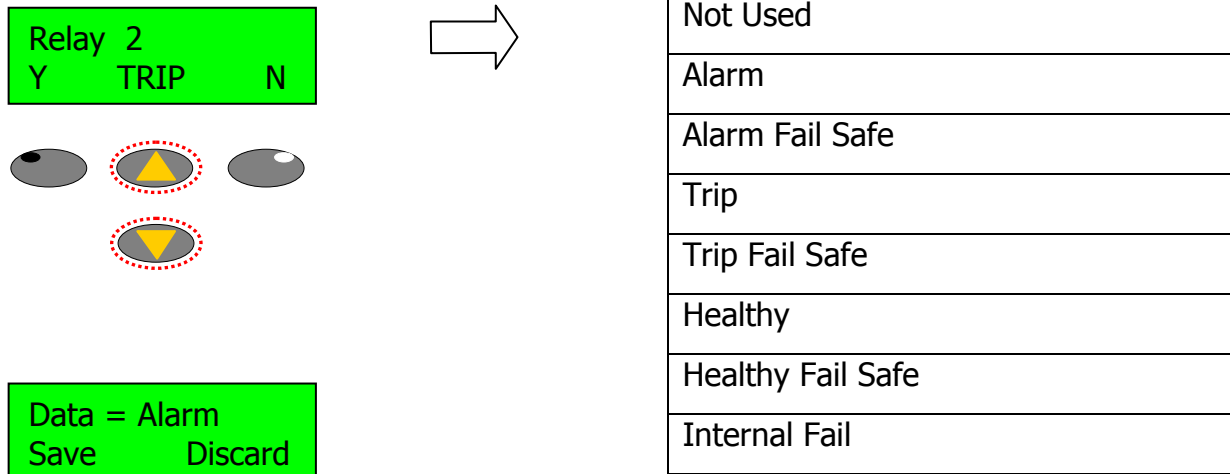
Selecting 'Save' will confirm setting.

13.7.1. Programmable Output.

The MREF has 4 outputs - Relay O/P1 is fixed to TRIP, this provides a fixed pulse output of 500mS, upon the protection function, if enabled, activating.
Relay 2 – 4 can be programmed as follows

13.7.2 Not Used.

This option switches off the use of that particular output relay.

13.7.2 Alarm.

If an output relay is assigned as "Alarm" then this relay will change state from de- energised to energised when triggered by any protection function or external device connected to the relay that is configured to alarm.

The alarm operates after the expiry of the programmed time delay assigned to the protection feature.

13.7.3 Alarm Fail-Safe.

If an output relay is assigned as "Alarm FS" then this relay will change state from energised to de-energised when triggered by any protection function or external device connected to the relay that is configured to alarm. The alarm operates after the expiry of the programmed time delay assigned to the protection feature.

13.7.4 Trip.

If an output relay is assigned as 'Trip' then this relay will change state from the de-energised to the energised relay contact when triggered by any protection function or external device connected to the MREF.

13.7.5 Trip Fail Safe.

If an output relay is assigned as 'Trip FS' (Trip Failsafe) then this relay will change state from energised to the de-energised relay contact when triggered by any protection function or external device connected to the MREF.

13.7.6 Healthy

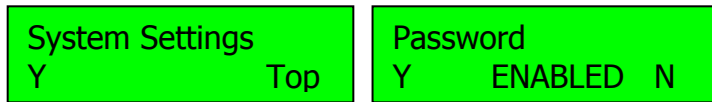Will energise if no alarm, Trip or Internal Error is present, i.e. System 'Healthy'.

13.7.7 Healthy Fail Safe
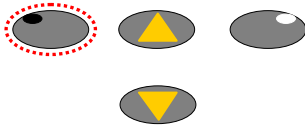
As above (Healthy), but Fail Safe will de-energise

13.7.8 Internal Fail

Relay O/P will energise upon internal relay hardware or software failure.

13.8. System Settings.

```
System Settings
Y              Top
```

```
Password
Y     ENABLED   N
```

This screen allows access to relay specific settings. Such as, password functionality, screen contrast settings etc.

These settings and their functions are explained in SECTION 9.

13.9. Calibration Menu.

The calibration menu should not be entered unless it is necessary to do so. Any inadvertent settings made here may compromise the accuracy of the unit and its ability to trip. It should be noted that the Calibration should be left alone as it could result in the invalidation of the factory calibrations test certificate.

```
Calibration Menu
Y              Top
```

```
Password =  AAAAA
Save           Next
```

If the Password is set to enabled **(SECTION 9.1 & 9.2)** it will be requested here to allow access.
The gain and offset values for each of the analogue channels can be adjusted. Auto calibration routines can also be performed.
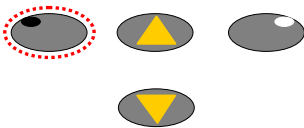
13.10. Smart Card Settings. (OPTIONAL)

```
Smart Card Menu
Y              Top
```

```
Card Type
Y      Setting     N
```
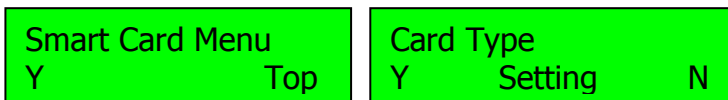
The Smart Card is a removable eeprom memory card which can be supplied with MREF on request.

An activation code is required to access this menu system in order to allow full manipulation of the card.
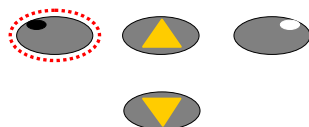
The activation code is programmed in the System Settings, Enable Smart Card option.

The Smart Card can be used for parameter storage and for cloning the MREF settings or it can be formatted as an extended data card which will log and store events.

The Smart Card is explained in more detail – PLEASE CONTACT P & B ENGINEERING FOR MORE INFORMATION.

14.1 VISION INSTALLATION DIAGRAM

The MREF is supplied in a Drawout case suitable for flush mounting as detailed below.
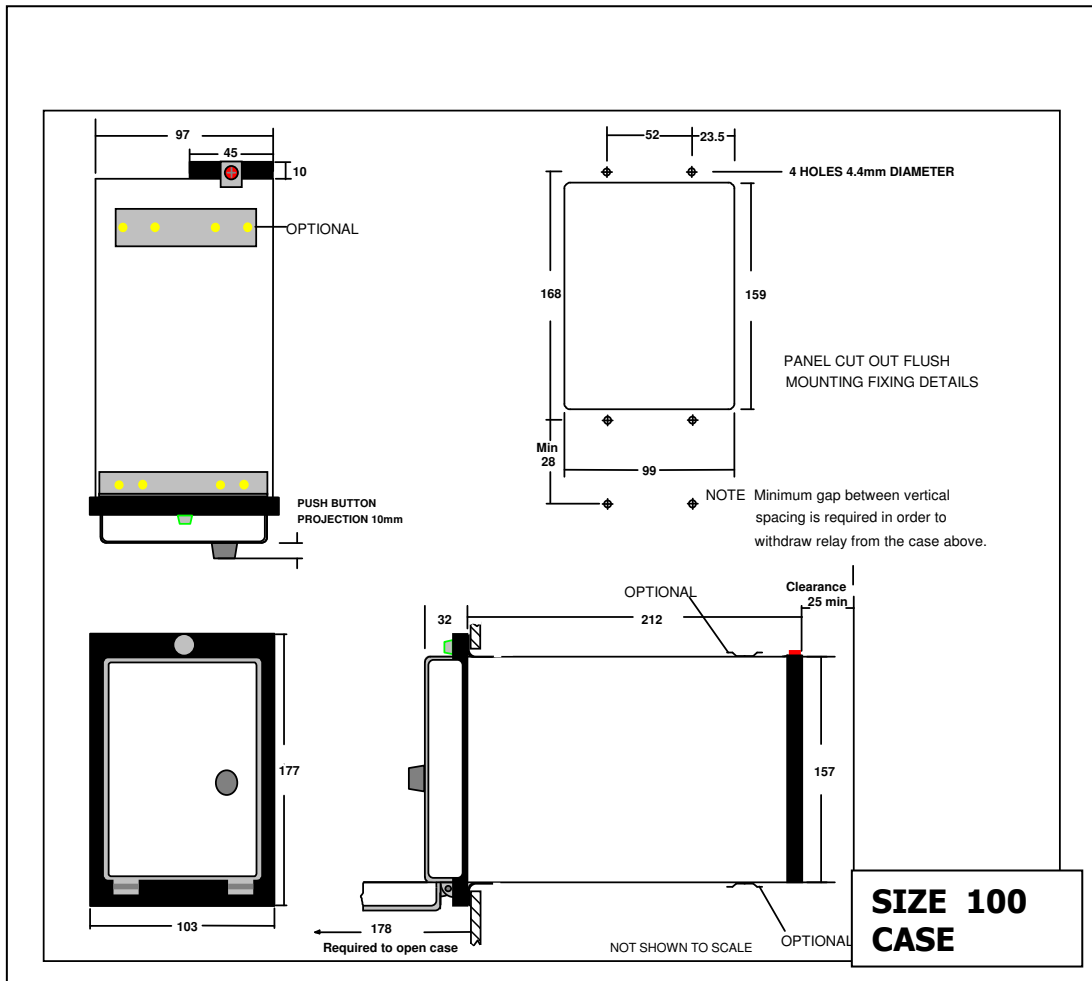
The case can be supplied with an optional sash lockable dustproof cover.

14.2. TERMINATION DETAILS SUMMARY

|			
1	Aux Supply Live or +	15	RS485 Communication +
2	Aux Supply Neutral or -	16	RS485 Communication -
3	Relay 1 N/O	17	RS485 Shield
4	Relay 1 Common	18	Chassis Earth
5	Relay 1 N/C	19	Digital 1I/P 1
6	Relay 2 N/O	20	Digital 1I/P 2
7	Relay 2 Common	21	NC
8	Relay 2 N/C	22	NC
9	Relay 3 N/O	23	NC
10	Relay 3 Common	24	NC
11	Relay 3 N/C	25	NC
12	Relay 4 N/O	26	NC
13	Relay 4 Common	27	Ie Current +
14	Relay 4 N/C	28	Ie Current -
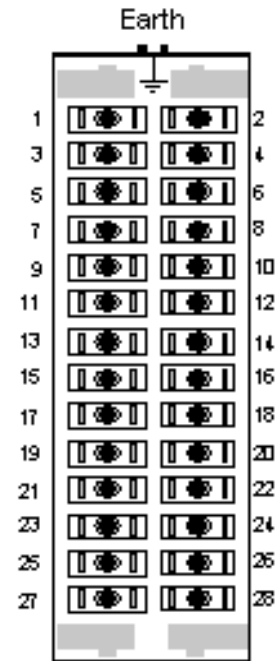
Earth

Rear terminal block connections
Each terminal: 1 Screw & 2 Spade

15. Fast Scan Numbers

Fastscan Parameter	Fastscan Address
Restricted Earth Fault Current (Iref)	0
Iref Current Scale	2
Pre Trip Iref	4
Trip Fault Number	6
Pre Alarm Iref	8
Trip Alarm Number	10
Trip Time (part 1)	12
Trip Time (part 2)	14
Trip Date (part 1)	16
Trip Date (part 2)	18
Number of Trips	20
Accumulated Trip Current	22
Digital 1 (Trip Status Bits)	24
Digital Inputs 1 - 2	26
Output Relays 1 - 4	28
Logic Status (FS0)	30

16. Setting Pages Summary

	Range	Steps	Default
Serial settings:			
Serial	Enabled/Disabled		Enabled
Drive Number	1-32 (125 Profibus)	1	1
RS485 Baud Rate	9600/19200/38400		9600
RS232 Baud Rate	4800/9600		9600
Serial Delay	1ms-20ms	1ms	1ms
Fastscan Analogue 1	0-128	2	0
Fastscan Analogue 2	0-128	2	0
Fastscan Analogue 3	0-128	2	0
Max Fast Scan	1-30s	1s	2s
Serial Protocol RS232/RS485	Modbus / P&B Standard		P&B Standard
Parity RS232/RS485	Even / Odd / None		Even
MREF Setting:			
E/F 1 CT Primary	1-4000A	1A	100A
I/O Settings:			
Output Relays 2-4	Not Used, Alarm, Alarm FS, Trip, Trip FS, Healthy/Healthy FS/Internal Error		
Digital Inputs 2 (Programmable)	Not Used, Blocking, Reset Fault		
System Settings:			
Password	Enabled/Disabled		Disabled
Engineer Password	Enabled/Disabled		Enabled
Change Password	5 Characters		6363
Time	HH:MM:SS		
Date	DD:MM:YY		
Time Sync Delay	0-2000ms	1ms	0ms
Smart Card Key	6 digits		
Scrn Saver	Enabled/Disabled		Disabled
Scrn Saver Time	60-3600s	1s	3600s
Chronovision	Enabled/Disabled		Disabled
Contrast	0 - 128	1	30
LCD Backlight	0 - 156	1	156
Default Return Time	No Return/1/2/3/4/5 Mins.		No Return

17. Order Form

Restricted Earth Fault Relay   (MREF)

MREF	

Rated Current, 1A	1
5A	5

Housing: 100 Series Drawout Case
                                                          Flush Mounting

Frequency:	50Hz
	60Hz

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