



# 100 Series Drawout Relays

*the new competitive range of withdrawable protection relays*

Developed from many years experience of intelligent protection and control applications within the high specification offshore / onshore Oil and Gas and Petrochemical sectors.

P&B Engineering's new highly sophisticated relay range has been designed to offer cost effective, versatile and competitive protection relays for medium voltage switchgear.

Integral to the design is the flexible twin board relay hardware platform and robust construction. This allows for consistency in relay manufacture and functional flexibility within firmware.

The rationalised hardware and pin arrangement provides the following:

- 4x Output Relays with Changeover Contacts
- 2x Digital Inputs
- 4x Push Buttons for Navigable Menu Driven LCD Screen
- 2x Tri Colour LEDs for Indication and Status
- 1x Front Mounted RS232 Port
- 1x Rear Mounted RS485 Port for Modbus RTU or P&B Protocol
- 4x 1A or 5A CT Inputs or
- 4x VT Inputs (or combination of, function dependant)
- Wide Ranging Auxiliary AC/DC Power Supply

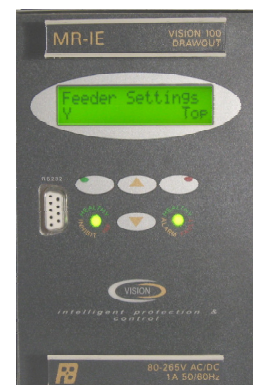
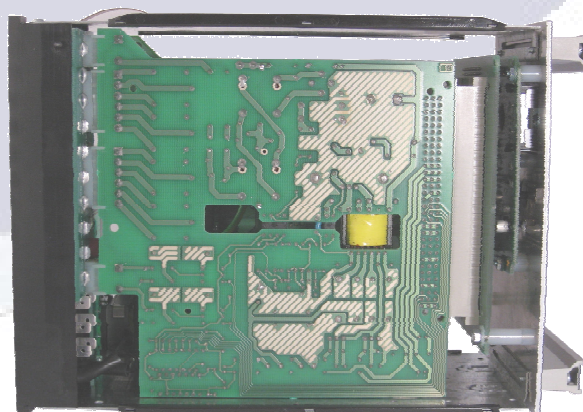


The MR-IE protection relay shown slightly withdrawn from the relay case & with the hinged perspex front cover removed

The 100 Series Drawout Relay range briefly comprises:

- **MR - IE:**                    **3- Phase Multi Stage Overcurrent and Earth Fault Protection**
- **MR - I:**                    **3- Phase Multi Stage Overcurrent Protection**
- **MR - EF:**                 **Single Phase Multi Stage Earth Fault Protection**
- **MR - REF:**               **Restricted Earth Fault Protection**
- **MR - EX:**                 **Sensitive Earth Fault Protection**
- **MR - CS:**                **3- Phase Voltage Check Synchronism**
- **MR - VT:**                **3- Phase Multi Stage Over and Under Voltage Protection**
- **MPR3E5:**                 **3- Phase Motor Overload & Earth Fault Protection**

- Time & Date Stamping to 1ms
- 32 Event Trip and Alarm Histories
- Last Fault with Trip Data
- Stats Information
- Fully Programmable Settings
- Programmable Digital Inputs
- Programmable Relay Outputs





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## LCD Display

The navigable LCD menu is driven by the four push buttons, this allows access to measured and recorded data as well as providing a programming interface for the relay settings.

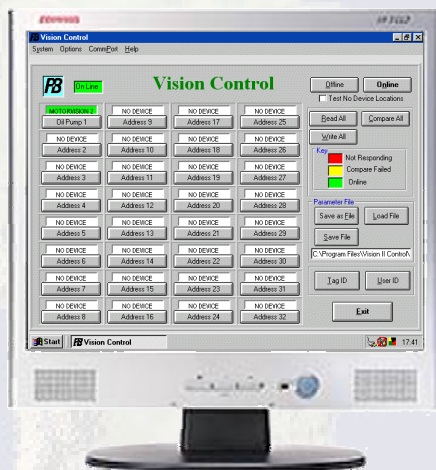
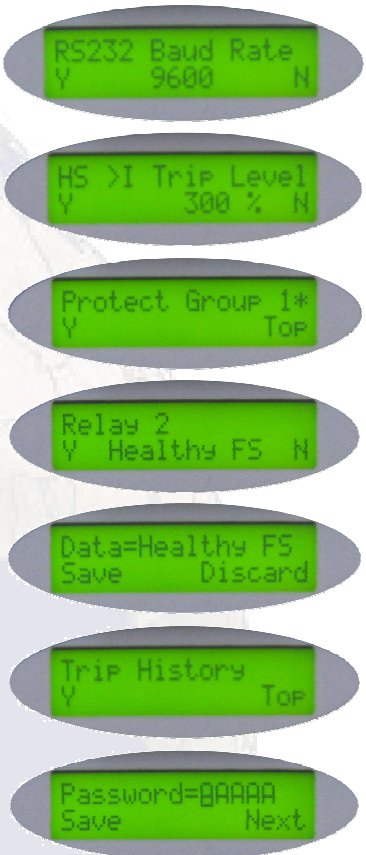
The menu is structured in an intuitive way to allow easy of use and understanding of the presented information. Where possible acronyms are not used, instead full text descriptions are displayed.

The front RS232 port can be used for local programming or data extraction as well as firmware updates.

The rear port is normally used for connection to a daisy-chained, twisted pair data highway which in turn is connected to SCADA or DCS systems or to a local electrical work station (EWS). This provides a route for direct remote circuit monitoring, telemetry or metering and consumption analysis.

In addition the Xcell Data Concentrator can be used as a protocol or host interface hub and allows many multiples of relays to be connected together. The Xcell is a fault tolerant and fully dual redundant system for relay communication.

Examples of the LCD screen layout



A Smart Card facility can be included within the relay to further aid programming or be used to collect statistical and recorded data. Settings are stored to a card and those settings can then be downloaded to relays of the same type and function. The top handle of the relay is replaced by a credit card sized slot to allow smart card access.

Vision Control, P&Bs pc based programming tool can be used to program and configure multiple relays through either communication port. Settings can then be saved, stored & printed.

## Disturbance Recording

Each relay can be equipped with its own onboard disturbance recording facility. This provides up to 8 seconds of waveform capture and can be multi triggered and weighted pre and post fault. Each phase is individually recorded and can be extracted from the relay using the front RS232 port in a 'comtrade' format for analysis by any compatible software.

## Environmental / Technical Data

### Rated Inputs:

CT In = 1A or 5A  
VT Vn= 110 - 415Vac 50-60Hz  
Aux. Supply 80-265Vac, 90 -300Vdc

### Burden / Consumption:

CTs <0.01VA  
VTs <0.01VA  
Aux. Supply Approx. 10W

### Electrical:

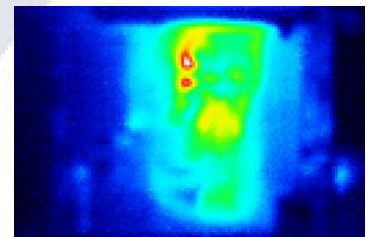
IEC61000-4  
IEC60255-21  
IEC60255-22

### Withstand:

CT Cont 4x  
10s 30x  
1s 100x  
Half Wave 250x

VT 1Kv  
Relays 10A @ 240Vac  
Temp Up to 60degree C cont.

Min Op Time: 30ms  
Trip Time Acc: +/- 20ms  
Display Acc: +/- 3%  
Measurement: True RMS  
Weight (app): 1Kg



For over 60 years, we have invested significantly in product design in order to produce equipment capable of operating in demanding and high ambient conditions. This thermal image shows the PSU / Relay pcb performing under high ambient endurance testing during IEC and UL type testing.



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## Protection Functionality

### MR - IE:

ANSI	Function
50/51	>I
50/51	>I2
50	HS>
50/51n	E/F
50n	E/F HS
48	Brk Fail

### 3- Phase Multi Stage Overcurrent and Earth Fault Protection Blockable protective functions and 2x setting groups

Desc.	Characteristic	Trip Level	INV Time Mult.	Trip Time
Overcurrent	DEFT, NINV, VINV, EINV	20-400%	0.05 - 10 x	0.05 -120s
Overcurrent 2	DEFT, NINV, VINV, EINV	20-400%	0.05 - 10 x	0.05 -120s
High Set Overcurrent	DEFT	50-2500%		0.05 -10s
Earth Fault	DEFT, NINV, VINV, EINV	4-40%	0.05 - 10 x	0.05 -120s
High Set Earth Fault	DEFT	4-200%		0.05 -10s
Breaker Fail				0.1 - 2s

### MR - I:

ANSI	Function
50/51	>I
50/51	>I2
50	HS>
48	Brk Fail

### 3- Phase Multi Stage Overcurrent Protection Blockable protective functions and 2x setting groups

Desc.	Characteristic	Trip Level	INV Time Mult.	Trip Time
Overcurrent	DEFT, NINV, VINV, EINV	20-400%	0.05 - 10 x	0.05 -120s
Overcurrent 2	DEFT, NINV, VINV, EINV	20-400%	0.05 - 10 x	0.05 -120s
High Set Overcurrent	DEFT	50-2500%		0.05 -10s
Breaker Fail				0.1 - 2s

### MR - EF:

ANSI	Function
50/51n	E/F
50n	E/F HS

### Single Phase Multi Stage Earth Fault Protection Blockable protective functions and 2x setting groups

Desc.	Characteristic	Trip Level	INV Time Mult.	Trip Time
Earth Fault	DEFT, NINV, VINV, EINV	4-40%	0.05 - 10 x	0.05 -120s
High Set Earth Fault	DEFT	4-200%		0.05 -10s

### MR - REF:

ANSI	Function
64	REF

### Restricted Earth Fault Protection Blockable protective function

Desc.	Characteristic	Trip Level	INV Time Mult.	Trip Time
Restricted Earth Fault	DEFT	1 - 200%		0.05 - 0.5s

### MR - EX:

ANSI	Function
50/51n	SEF

### Sensitive Earth Fault Protection Blockable protective function

Desc.	Characteristic	Trip Level	INV Time Mult.	Trip Time
Sensitive Earth Fault	DEFT	0.1 - 20%		0.05 - 0.5s

### MR - CS:

ANSI	Function
25	Sync. Chk

### 3- Phase Voltage Check Synchronism Blockable protective function

Desc.	Angle	Volt diff.	In Sync	Dwell	Dead Volts	Sync On bus/line
Synchronism Check	2-30 degree	1 - 20%	0.3 - 5s	0.1 - 5s	5 - 50%	

### MR - VT:

ANSI	Function
27	< Voltage
27	HS U/V
59	> Voltage
59	HS O/V

### 3- Phase Multi Stage Over and Under Voltage Protection Blockable protective functions

Desc.	Trip Level	Trip Time
Under Voltage	5 - 200%	0.05 - 60s
Under Under Voltage	5 - 200%	0.05 - 2s
Over Voltage	105 - 150%	0.05 - 60s
Over Over Voltage	5 - 200%	0.05 - 2s

### MPR3E5:

ANSI	Function
49	Start Time Thermal
66	Too Many Starts
37	< Current
51	> Current
46	> Inps
50n	Earth Flt
51	Load Inc
46SP	Sgl Phase
46	Unbal.
50	Short Circ
48	Cont Fault
47	Phase Rot

### 3- Phase Motor Overload & Earth Fault Protection Blockable protective functions

Desc.	Trip Level	Trip Time
Maximum Start Time		1 - 250s
Thermal Overload	t6x:	1 - 120s
	Hot/Cold:	20-80%
	Cool Time Factor:	25-2000%
Too Many Starts	Starts per hour:	1 - 30
	Inhibit Time:	1 - 120mins
Under Current	30 - 95%	1 - 60s
	Reset Delay:	0 - 1200s
Overcurrent	150 - 750 %	0.3 - 10s
Negative Phase Sequence	4 - 200%	0.1 - 10s
Earth Fault	4 - 40%	0.05 - 5s
Load Increase	105 - 150%	1 - 60s
Single Phasing		INST.
Unbalance	10 - 40%	1 - 60s
Short Circuit	Inhibit level 8 - 12x	INST.
Contact Fault		0.1 - 2s
Phase Rotation	ABC / ACB	INST.

## Terminations & Mechanical

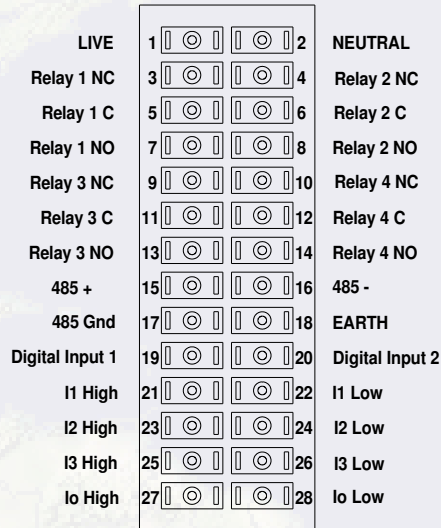


Diagram left shows the rationalised rear layout of the relay terminations.

A single midos type connector is utilised and the rear connections of each terminal comprise both a 4mm screw outlet and two blade type connectors.

The switchgear control wiring cable should then be terminated using:

1x 4mm (M4) L-shaped ring crimp  
and/or

2x 4.8mm push-on blade crimps to BS 5057

Output relay terminations for the MR-REF & MR-EF differ from the rest of the range as both relays are fitted with a 1A and a 5A CT input.

The specific manual should always be consulted prior to installation or commissioning.

Pins 21 through 28 provide self shorting CT connections (upon relay withdrawal).

Otherwise they are replaced with non shorting contacts for the VT input connections of the MR-CS and MR-VT relays.

The front perspex cover offers protection to IP52.

The relay range has been designed for flush mounting in standard height 4U cases to IEC 60297, the mechanical details are indicated below.

