



# 150 Series Drawout Relays

*Intelligent Motor & Feeder Integrated Protection & Control Relays*



Feedervision Drawout, FVD shown without front perspex bezel

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 intelligent drawout relays have been designed to offer cost effective, versatile, protection and control relaying for medium voltage switchgear.

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

- 4x Output Relays with Changeover Contacts
- 12x Programmable Digital Inputs
- 16K Pixel Graphical LCD
- 4x Push Buttons for Menu Driven LCD
- 2x Tri Colour LEDs for Indication and Status
- 1x Front Mounted RS232 Port
- 1x Rear Mounted RS485 Port
- 4x 1A or 5A CT Inputs
- 4x VT Inputs
- Wide Ranging Auxiliary AC/DC Power Supply
- Optional Dual channel TCS with 2x C/O Output Relays

## Motorvision Drawout [MVD]

Specifically designed to provide complete and comprehensive protection and control for medium voltage (MV) 3-phase motors which are either circuit breaker or contactor controlled. Multiple starter options provide full control and transfer timing for most DOL, dual wound, reversing, or reduced starting voltage drives. Combined with programmable automatic re-acceleration of the drive on restoration of the auxiliary supply or bus bar voltages. The 3 phase voltage transformer inputs provide voltage protection, phase metering functionality and the 4th input can provide neutral voltage displacement protection from an open delta voltage transformer.

During starting the graphical display will trend the machine energising current and display this for comparison to a previously recorded starting curve.

## Feedervision Drawout [FVD]

Provides co-ordinated protection and control of distribution voltage, fused contactors and incoming or outgoing transformer feeders. Selectable 4-stage inverse curve and definite time overcurrent protection with 3 phase VT inputs for voltage based protection, metering of phase kW's, kVARs and power factor values by phase. The optional TCS (trip circuit supervision) and check synchronisation functions give the FVD the flexibility to suit practically any MV or LV protection and control requirement.

Both the MVD and FVD are equipped with fully programmable digital inputs and relay outputs which cater for configurable interlocking and permissive starter / breaker control. Which can be issued from multiple locations; serially from remote communicating systems, electrically from field wired inputs or via local control at the switchgear panel.

**Time & Date Stamping to 1ms**

**32 Event Trip and Alarm Histories**

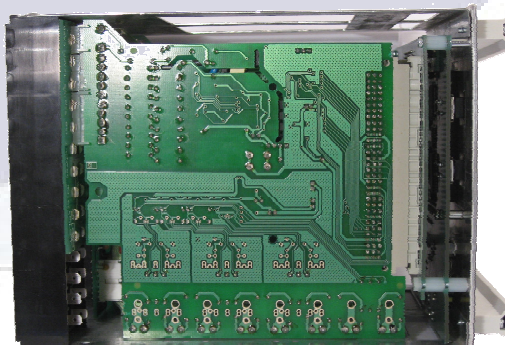
**Last 5 Faults with Trip Data**

**Stats / Historical Information**

**Fully Programmable Settings**

**Programmable Digital Inputs**

**Programmable Relay Outputs**





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## LCD Display

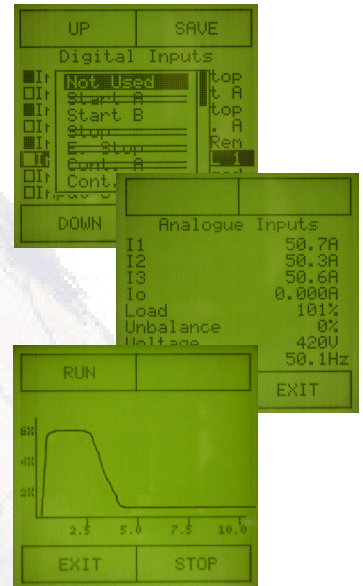
The navigable LCD menu is driven by the four push buttons, this allows access to measured and recorded data as well as providing a programming interface for the relay settings.

The large display allow the menu to be structured in an intuitive way to allow ease of use and understanding of the presented information.

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.



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.

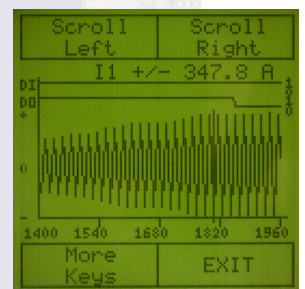
The top handle of the relay is replaced by a credit card sized slot to allow smart card access whilst the relay remains functional within the panel.

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.

Uniquely, due to the powerful graphical display, waveform traces can also be viewed directly at the relay with zoom and scroll functions without the need for any external equipment.



## 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:

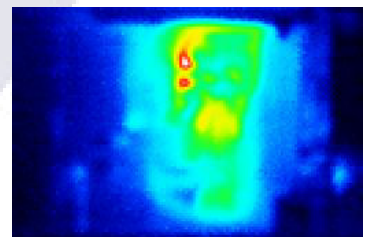
IEC61000-4
IEC60255-21
IEC60255-22

### 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):	1.5Kg



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. The red high-lighted area shows the location of the heatsink.



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## Protection Functionality

- Selectable Option
- Not Selectable
- ◆ Available only for FVD

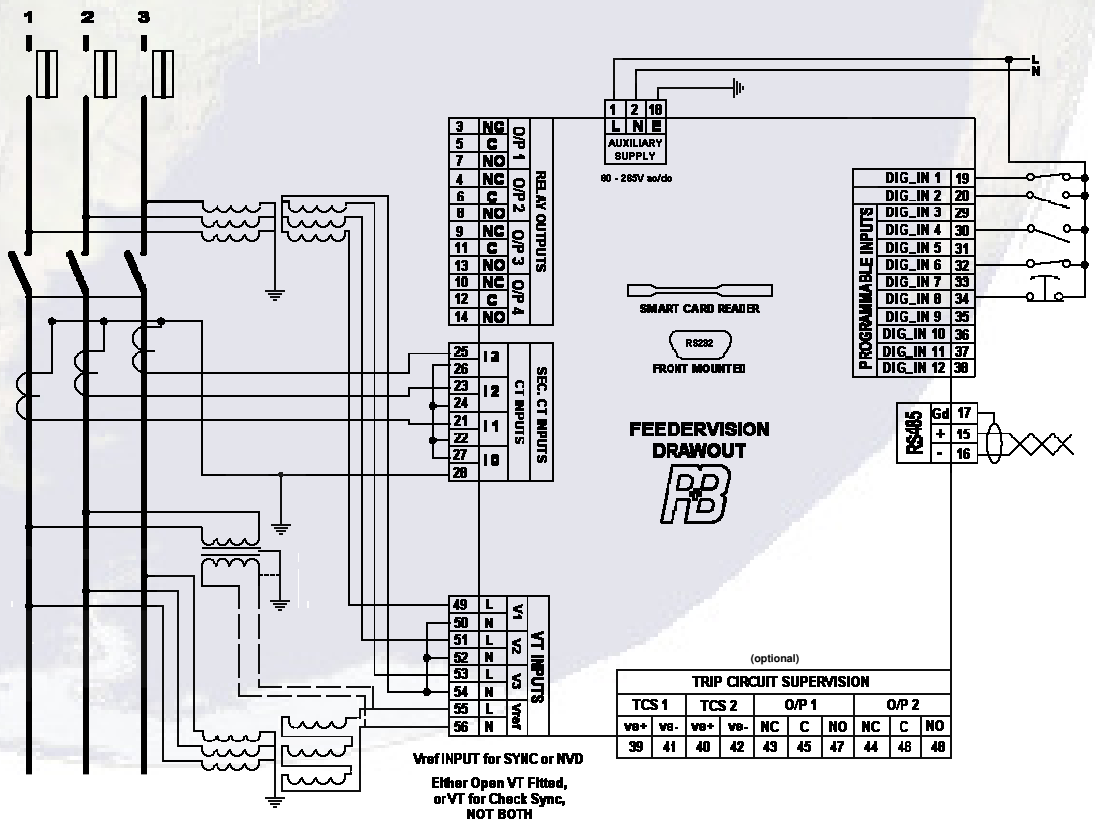
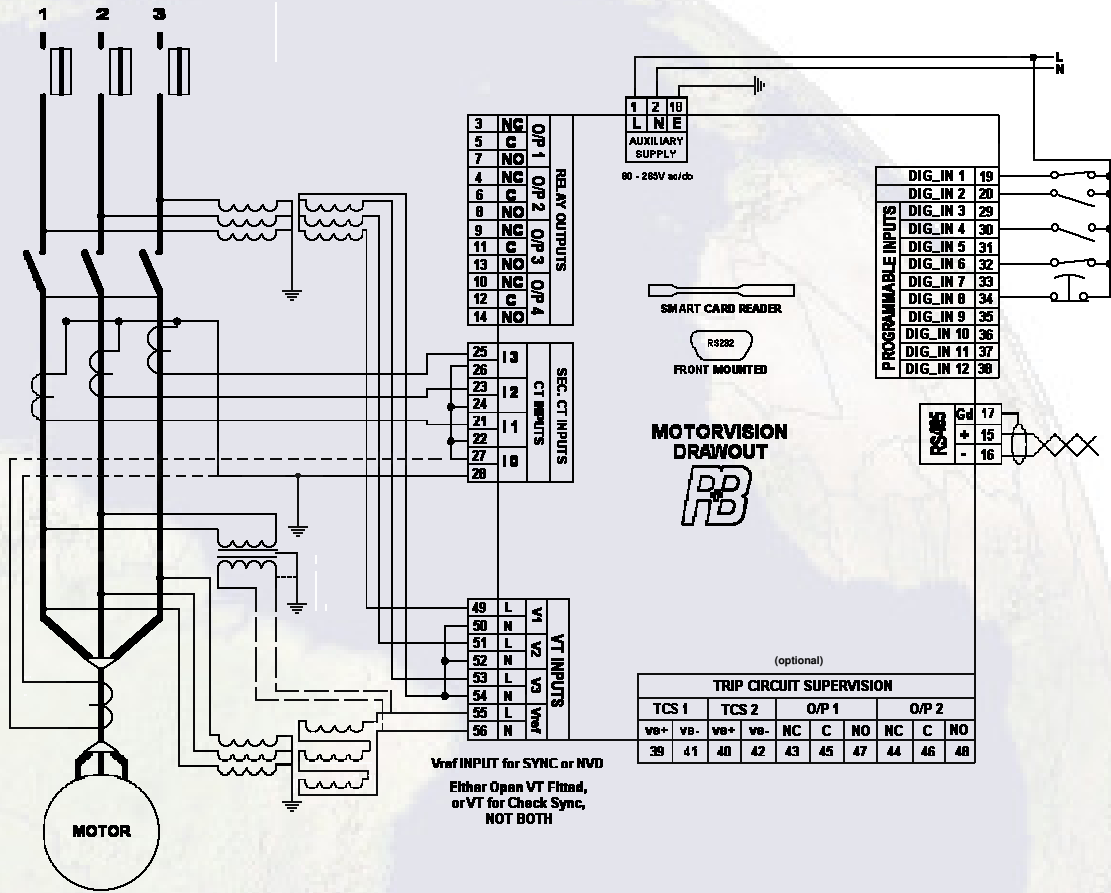
MVD	FVD	ANSI No.	Protective Function	Trip	Alarm	Inhibit	Stop	Block	Test Option	Auto	Panel	Serial	Remote	Indicators 1-5	Change Name	Variable	Range	Step
				Available Action			Available Reset											
●		48/14	Maximum Start Time	●	●					●	●	●	●	●		Trip Time:	1-250s	1s
●		26/49	Thermal Model	■	●					●	●	●	●	●		Hot/Cold Ratio: Cool Time Factor: t6x:	20-80% 25-2000% 0.1-120s	1% 5% 0.1s
●		37	Undercurrent	●	●					●	●	●	●	●		Trip Level: Trip Time: U/C Reset Delay:	50-95% 1-60s 0-1200s	5% 1s 10s
●	●	51	Load Increase	●	●	◆		◆	◆	●	●	●	●	●		Trip Level: Trip Time:	105-150% 1-60s	5% 1s
●		50/51	Overcurrent	●	●					●	●	●	●	●		Trip Level: Trip Time:	150-750% 0.1-10.0s	5% 0.1s
●		50/51	Overcurrent 1 & 2	●	●	●		●	●	●	●	●	●	●		Characteristic Trip Level: Time Multiplier:	DT, NI, VI, EI 10-400% 0.01-10.0	10% 0.01
●		50/51	LS Overcurrent	●	●	●		●	●	●	●	●	●	●		Trip Level: Trip Time:	10-1000% 0.1-20.0s	5% 0.1s
●		50/51	HS Overcurrent	●	●	●		●	●	●	●	●	●	●		Trip Level: Trip Time:	10-2500% 0.1-20.0s	5% 0.1s
●		32	Overpower	●	●	●		●	●	●	●	●	●	●		Trip Level: Trip Time:	2-8MW 1-120s	0.1MW 1s
●	●	81H	Overfrequency	●	●	◆		◆	◆	●	●	●	●	●		Trip Level: Trip Time:	40-70Hz 1-60s	1Hz 1s
●	●	81L	Underfrequency	●	●	◆		◆	◆	●	●	●	●	●		Trip Level: Trip Time:	40-70Hz 1-60s	1Hz 1s
●		46SP	Single Phase	■	●					●	●	●	●	●		Trip Time: [fixed]	<100ms	
●		47	Phase Rotation	●	●					●	●	●	●	●		Direction:	ABC/ACB	
●		46	Unbalance / Negative Phase Sequence	●	●					●	●	●	●	●		Trip Level: Trip Time:	10-40% 1-60s	5% 1s
●	●	27	Undervoltage	●	●					●	●	●	●	●		Trip Level: Trip Time:	50-95% 0.1-60s	5% 0.1s
●		27/86	U/V Lockout		●	■				●	●	●	●	●		Lockout Level:	50-95%	5%
●		50n/51n	Earth Fault	●	●					●	●	●	●	●		Trip Level: Trip Time:	1-40% 0.1-5.0s	0.1% 0.1s
●		50n/51n	Earth Fault 1 & 2	●	●	●		●	●	●	●	●	●	●		Characteristic Trip Level: Time Multiplier:	DT, NI, VI, EI 5-200% 0.01-10.0	5% 0.01
●		50n/51n	Earth Fault 1 HS & 2 HS	●	●	●		●	●	●	●	●	●	●		Trip Level: Trip Time:	10-2500% 0.1-20.0s	5.0% 0.01s
●		67n	Additional Settings when Directional Earth Fault is active	●	●	●		●	●	●	●	●	●	●		Ve Pick Up: le Direction le Sector	2-150% 0-360° 0-360°	1.0% 1 1
●		66	Too Many Starts			■				■				●		Starts Per Period Start Inhibit Time: Start Period: Start Inhibit Type	1-60 1m-120m 1m-60m IT / RSP / RSP+IT	1 1m 1m
●	●	59	Overvoltage	●	●	◆		◆	◆	●	●	●	●	●		Trip Level: Trip Time:	105-120% 1-60s	5% 1s
●		86	Backspin			■								■		Backspin Time:	1-300s	1s
●	●	36	Breaker Fail	●	●	●		●	●	●	●	●	●	●		Backspin Time:	1-300s	1s
●		55	Power Factor	●	●					●	●	●	●	●		Trip Level: Trip Time:	0.20-0.95 1-60s	0.05 1s
●	●	25	Synchronisation	●	●	■		●	●	●	●	●	●	●		Angle: Voltage Difference: Time In Sync:	2-30° 1-20% 0.3 - 5s	1 1% 0.1s
●	●	36	External Faults	●	●	◆		◆	◆	●	●	●	●	●	●	Fault Polarity: Trip Time:	ON / OFF 0.4-60s	0.1s
●		50	Short Circuit	■						●	●	●	●	●		Trip Level [fixed]: Trip Time: [fixed]	10x In <100ms	
●		48	Contactors Fault	●	●					●	●	●	●	●		Trip Time:	1-200s	1s
●		86	Emergency Stop	■	●						●	●	●	●		Trip Time [fixed]:	<100ms	
●	●		Serial Timeout	●	●					●	●	●	●	●		Timeout In:	1-120s	1s
●	●		Internal Error	●	●					●	●	●	●	●				
●	●	74	Serial Inhibit			●	●					■						
●	●	74TC	Trip Circuit Supervision*							■								

All functions can be selected to be active or inactive except the Thermal Model protection which is always active.

\* TCS is a fixed protection arrangement providing two dedicated change-over contacts.

Due to the programmable nature of our equipment the following ansi no's are also applicable 3/9/19/34/62/69/68/74/86 and 94.

## Typical Schematics



## Terminations & Mechanical

LIVE	1		2	NEUTRAL	Digital Input 3	29		30	Digital Input 4
Relay 1 NC	3		4	Relay 2 NC	Digital Input 5	31		32	Digital Input 6
Relay 1 C	5		6	Relay 2 C	Digital Input 7	33		34	Digital Input 8
Relay 1 NO	7		8	Relay 2 NO	Digital Input 9	35		36	Digital Input 10
Relay 3 NC	9		10	Relay 4 NC	Digital Input 11	37		38	Digital Input 12
Relay 3 C	11		12	Relay 4 C	TCS 1 +	39		40	TCS 2+
Relay 3 NO	13		14	Relay 4 NO	TCS 1-	41		42	TCS 2-
485 +	15		16	485 -	TCS O/P 1 NC	43		44	TCS O/P 2 NC
485 Gnd	17		18	EARTH	TCS O/P 1 C	45		46	TCS O/P 2 C
Digital Input 1	19		20	Digital Input 2	TCS O/P 1 NO	47		48	TSC O/P 2 NO
I1 High	21		22	I1 Low	V1	49		50	V1 Low
I2 High	23		24	I2 Low	V2	51		52	V2 Low
I3 High	25		26	I3 Low	V3	53		54	V3 Low
Io High	27		28	Io Low	Vref	55		56	Vref Low

Each of the rear connection terminals comprise both a 4mm screw outlet and two blade-type connectors. The switchgear control wiring cable can then be terminated using 1x 4mm (M4) L-shaped ring crimp and/or 2x 4.8mm push-on blade crimps to BS 5057.

Pins 21 through 28 provide self shorting pairs for CT connections upon relay withdrawal.

The front perspex cover offers protection to IP52.

The relay is designed for flush mounting in a standard height 4U case to IEC 60297, the mechanical details are indicated below, the required panel cutout is also shown.

