MiCOM ALSTOM P342, P343, P344, P345 & P391

Generator Protection Relay

Software Version: 35

Hardware Version: J (P342), K (P343/4/5), A (P391)

Update Documentation

P34x/EN AD/J86

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Note: The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Alstom Grid technical sales office and request the necessary information.

Any agreements, commitments, and legal relationships and any obligations on the part of Alstom Grid including settlements of warranties, result solely from the applicable purchase contract, which is not affected by the contents of the technical manual.

This device MUST NOT be modified. If any modification is made without the express permission of Alstom Grid, it will invalidate the warranty, and may render the product unsafe.

P34x UPDATE DOCUMENTATION

In the firmware version 33K of P34x, several changes on existing features have been added. These are described with reference to the documentation listed below:

Release	Version	Documentation
07.07.2008	P34x/EN M/J76	Technical Manual

Document ref.	Section	Page no.	Description
P34x/EN IT/J76	3.2	1-11-16	**Ordering options** P342/3/4 & 5 Cortec updated with the latest software details
P34x/EN TD/J76	-	2-1	**Enclosure protection** Redundant Ethernet added Extended temperature claim added
P34x/EN OP/J76	2.14	5-93	**Read only mode** New section
P34x/EN FD/J76	2.8	9-12-13	**Ethernet board** Section updated to include Redundant Ethernet Board New figure 6 added
P34x/EN SC/J76	7.3.1	13-69	**Capability** IEC 61850 capability updated
	7.8	13-72	**Redundant Ethernet communication ports** New section
P34x/EN IN/J76	10	15-26	**External connection diagram** Figure 9 updated to show Redundant Ethernet
P34x/EN VH/I76	-	-	**FIRMWARE AND SERVICE MANUAL VERSION HISTORY** Updated with the latest software details

INTRODUCTION (P34x/EN IT/J76)

3.2 Ordering options

Information required with order

Varients	Order Number
P342 MiCOM (Generator Protection Relay)	P342 ☐ ☐ ☐ ☐ M 0 ** 0 J

Vx Aux Rating	
24-48 Vdc	1
48 - 100 Vdc, 30 - 100 Vac	2
110 - 250 Vdc, 100 - 240 Vac	3

In / Vn Rating	
In= 1A / 5A, Vn= 100 / 120 V	1
In= 1A / 5A, Vn= 380 / 480 V	2

Hardware options	
Nothing	1
IRIG-B only (modulated)	2
Fibre Optic Converter only	3
IRIG-B (modulated) + Fiber Optic Converter	4
Ethernet (100 Mbits/s)**	6
2nd Rear Comms port*	7
IRIG-B (modulated) + 2nd Rear Comms port*	8
Ethernet (100 Mbit/s) + IRIG-B (modulated)**	A
Ethernet (100 Mbit/s) + IRIG-B (un-modulated)**	B
IRIG-B (un-modulated)**	C
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (modulated)**	G
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (un-modulated)**	H
Redundant Ethernet RSTP, 2 multi-mode fibre ports + IRIG-B (modulated)**	J
Redundant Ethernet RSTP, 2 multi-mode fibre ports + IRIG-B (un-modulated)**	K
Redundant Ethernet Dual Homing Star, 2 multi-mode fiber ports + IRIG-B (modulated)**	L
Redundant Ethernet Dual-Homing Star, 2 multi-mode fiber ports + IRIG-B (un-modulated)**	M

Product Specific	
40TE Case, 8 Opto Inputs + 7 Relay Outputs	A
40TE Case, 8 Opto Inputs + 7 Relay Outputs + RTD	B
40TE Case, 8 Opto Inputs + 7 Relay Outputs + CLIO*	C
40TE Case, 16 Opto Inputs + 7 Relay Outputs*	D
40TE Case, 8 Opto Inputs + 15 Relay Outputs*	E
40TE Case, 12 Opto Inputs + 11 Relay Outputs*	F
60TE Case, 16 Opto Inputs + 16 Relay Outputs*	G
60TE Case, 16 Opto Inputs + 16 Relay Outputs + RTD*	H
60TE Case, 16 Opto Inputs + 16 Relay Outputs + CLIO*	J
60TE Case, 24 Opto Inputs + 16 Relay Outputs*	K
60TE Case, 16 Opto Inputs + 24 Relay Outputs*	L
60TE Case, 16 Opto Inputs + 16 Relay Outputs + RTD + CLIO*	M
60TE Case, 24 Opto Inputs + 16 Relay Outputs + RTD*	N
60TE Case, 16 Opto Inputs + 24 Relay Outputs + RTD*	P
40TE Case, 8 Opto Inputs + 11 Relay Outputs (4 High Break)**	Q
60TE Case, 16 Opto Inputs + 20 Relay Outputs (4 High Break)**	R
60TE Case, 16 Opto Inputs + 12 Relay Outputs (4 High Break) + RTD**	S
60TE Case, 16 Opto Inputs + 12 Relay Outputs (4 High Break) + CLIO**	T
60TE Case, 16 Opto Inputs + 12 Relay Outputs (4 High Break) + RTD + CLIO**	U

Protocal Options	
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4
IEC61850 + Courier (via rear RS485 port)**	6

Mounting	
Panel Mounting	M
Order FX0021001 rack mounting frame if rack mounting is required	

Multilingual Language Option	
English, French, German, Spanish	0
English, French, German, Russian**	5

Software	
Latest software	35

Settings Files	
Default	0
Customer	A

Design Suffix	
Original hardware (48 V opto inputs only, lower contact rating, no I/O expansion available)	A
Universal Optos, new relays, new power supply	C
Phase 2 CPU and front panel with 2 hotkeys and dual characteristic optos	J

* Not available in Design suffix A relays	
** Not available in Design suffix A & C relays	

Varients	Order Number
P343 MiCOM (Generator Protection Relay with Differential)	P343 [ ][ ][ ][ ] M 0 ** 0 J

Vx Aux Rating

24-48 Vdc	1
48 - 100 Vdc, 30 – 100 Vac	2
110 – 250 Vdc, 100 – 240 Vac	3

In / Vn Rating

In= 1A / 5A, Vn= 100 / 120 V	1
In= 1A / 5A, Vn= 380 / 480 V	2

Hardware options

Nothing	1
IRIG-B only (modulated)	2
Fibre Optic Converter only	3
IRIG-B (modulated) + Fiber Optic Converter	4
Ethernet (100 Mbits/s)**	6
2nd Rear Comms port*	7
IRIG-B (modulated) + 2nd Rear Comms port*	8
Ethernet (100 Mbit/s) + IRIG-B (modulated)**	A
Ethernet (100 Mbit/s) + IRIG-B (un-modulated)**	B
IRIG-B (un-modulated)**	C
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (modulated)**	G
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (un-modulated)**	H
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (modulated)**	J
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (un-modulated)**	K
Redundant Ethernet Dual Homing Star, 2 multi-mode fiber ports + IRIG-B (modulated)**	L
Redundant Ethernet Dual-Homing Star, 2 multi-mode fiber ports + IRIG-B (un-modulated)**	M

Product Specific

Size 60TE Case, No Option (16 Opto Inputs + 14 Relays)	A
Size 60TE Case, 16 Opto Inputs + 14 Relays + RTD	B
Size 60TE Case, 16 Opto Inputs + 14 Relays + CLIO*	C
Size 60TE Case, 24 Opto Inputs + 14 Relays*	D
Size 60TE Case, 16 Opto Inputs + 22 Relays*	E
Size 80TE Case, 24 OptoI Inputs + 24 Relays*	F
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD*	G
Size 80TE Case, 24 Opto Inputs + 24 Relays + CLIO*	H
Size 80TE Case, 32 Opto Inputs + 24 Relays	J
Size 80TE Case, 24 Opto Inputs + 32 Relays	K
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD + CLIO	L
Size 80TE Case, 32 Opto Inputs + 24 Relays + RTD	M
Size 80TE Case, 24 Opto Inputs + 32 Relays + RTD	N
Size 80TE Case, 32 Opto Inputs + 16 Relays + RTD + CLIO	P
Size 80TE Case, 16 Opto Inputs + 32 Relays + RTD + CLIO	Q
Size 60TE Case, 16 Opto Inputs + 18 Relays (4 High Break)**	R
Size 60TE Case, 16 Opto Inputs + 11 Relays (4 High Break)**	S
Size 60TE Case, 16 Opto Inputs + 11 Relays (4 High Break) + CLIO**	T
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break)**	U
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD**	V
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + CLIO**	W
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD + CLIO**	X

Protocal Options

K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4
IEC61850 + Courier (via rear RS485 port)**	6

Mounting

Panel Mounting	M
Rack Panel Mounting, (Size 80TE Case Only)	N
Order FX0021001 rack mounting frame if rack mounting is required for 60TE case	

Multilingual Language Option

English, French, German, Spanish	0
English, French, German, Russian**	5

Software

Latest software	35

Settings Files

Default	0
Customer	A

Design Suffix

Original hardware (48 V opto inputs only, lower contact rating, no I/O expansion available)	A
Universal Optos, new relays, new power supply	C
Phase 2 CPU and front panel with 2 hotkeys and dual characteristic optos	J

* Not available in Design suffix A relays
** Not available in Design suffix A & C relays

Varients	Order Number
P344 MiCOM (Generator Protection Relay with Differential)	P344 _ _ _ _ M 0 ** 0 J

Vx Aux Rating
24 – 48 Vdc	1
48 – 100 Vdc, 30 – 100 Vac	2
110 – 250 Vdc, 100 – 240 Vac	3

In / Vn Rating
In= 1A / 5A, Vn= 100 / 120 V	1
In= 1A / 5A, Vn= 380 / 480 V	2

Hardware Options
Nothing	1
IRIG-B only (modulated)	2
Fiber Optic Converter only	3
IRIG-B (modulated) + Fiber Optic Converter	4
Ethernet (100 Mbits/s)	6
2nd Rear Comms port	7
IRIG-B (modulated) + 2nd Rear Comms port	8
Ethernet (100 Mbit/s) + IRIG-B (modulated)	A
Ethernet (100 Mbit/s) + IRIG-B (un-modulated)	B
IRIG-B (un-modulated)	C
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (modulated)	G
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (un-modulated)	H
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (modulated)	J
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (un-modulated)	K
Redundant Ethernet Dual Homing Star, 2 multi-mode fiber ports + IRIG-B (modulated)	L
Redundant Ethernet Dual-Homing Star, 2 multi-mode fiber ports + IRIG-B (un-modulated)	M

Product Specific
Size 80TE Case, No Option (24 Opto Inputs + 24 Relays)	A
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD	B
Size 80TE Case, 24 Opto Inputs + 24 Relays + CLIO	C
Size 80TE Case, 32 Opto Inputs + 24 Relays	D
Size 80TE Case, 24 Opto Inputs + 32 Relays	E
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD + CLIO	F
Size 80TE Case, 32 Opto Inputs + 24 Relays + RTD	G
Size 80TE Case, 24 Opto Inputs + 32 Relays + RTD	H
Size 80TE Case, 32 Opto Inputs + 16 Relays + RTD + CLIO	J
Size 80TE Case, 16 Opto Inputs + 32 Relays + RTD + CLIO	K
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break)	L
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + RTD	M
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + CLIO	N
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + RTD + CLIO	P
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break)	Q
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD	R
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + CLIO	S
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD + CLIO	T

Protocol Options
K-Bus	1
Modbus	2
IEC870	3
DNP3.0	4
IEC61850 + Courier (via rear RS485 port)	6

Mounting
Panel Mounting	M
Rack Panel Mounting (80TE case only)	N

Multilingual Language Option
English, French, German, Spanish	0
English, French, German, Russian	5

Software
Latest software	35

Settings Files
Default	0
Customer	M

Design Suffix
Phase 2 CPU and front panel with 2 hotkeys and dual characteristic optos	J

Varients		Order Number									
P345	MiCOM (Generator Protection Relay with Differential)	P345				M	0	**	0	K	

Vx Aux Rating										
24 - 48 Vdc	1									
48 - 100 Vdc, 30 - 100 Vac	2									
110 - 250 Vdc, 100 - 240 Vac	3									

In / Vn Rating										
In= 1A / 5A, Vn= 100 / 120 V	1									
In= 1A / 5A, Vn= 380 / 480 V	2									

Hardware options										
Nothing	1									
IRIG-B only (modulated)	2									
Fiber Optic Converter only	3									
IRIG-B (modulated) + Fiber Optic Converter	4									
Ethernet (100 Mbits/s)	6									
2nd Rear Comms port	7									
IRIG-B (modulated) + 2nd Rear Comms port	8									
Ethernet (100Mbit/s) + IRIG-B (modulated)	A									
Ethernet (100Mbit/s) + IRIG-B (un-modulated)	B									
IRIG-B (un-modulated)	C									
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (modulated)	G									
Redundant Ethernet Self-Healing Ring, 2 multi-mode fiber ports + IRIG-B (un-modulated)	H									
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (modulated)	J									
Redundant Ethernet RSTP, 2 multi-mode fiber ports + IRIG-B (un-modulated)	K									
Redundant Ethernet Dual Homing Star, 2 multi-mode fiber ports + IRIG-B (modulated)	L									
Redundant Ethernet Dual-Homing Star, 2 multi-mode fiber ports + IRIG-B (un-modulated)	M									

Product Specific										
Size 80TE Case, No Option (24 Opto Inputs + 24 Relays)	A									
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD	B									
Size 80TE Case, 24 Opto Inputs + 24 Relays + CLIO	C									
Size 80TE Case, 32 Opto Inputs + 24 Relays	D									
Size 80TE Case, 24 Opto Inputs + 32 Relays	E									
Size 80TE Case, 24 Opto Inputs + 24 Relays + RTD + CLIO	F									
Size 80TE Case, 32 Opto Inputs + 24 Relays + RTD	G									
Size 80TE Case, 24 Opto Inputs + 32 Relays + RTD	H									
Size 80TE Case, 32 Opto Inputs + 16 Relays + RTD + CLIO	J									
Size 80TE Case, 16 Opto Inputs + 32 Relays + RTD + CLIO	K									
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break)	L									
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + RTD	M									
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + CLIO	N									
Size 80TE Case, 24 Opto Inputs + 20 Relays (4 High Break) + RTD + CLIO	P									
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break)	Q									
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD	R									
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + CLIO	S									
Size 80TE Case, 16 Opto Inputs + 24 Relays (8 High Break) + RTD + CLIO	T									

Protocol Options										
K-Bus	1									
Modbus	2									
IEC870	3									
DNP3.0	4									
IEC61850 + Courier (via rear RS485 port)	6									

Mounting										
Panel Mounting	M									
Rack Mounting	N									

Multilingual Language Option										
English, French, German, Spanish	0									
English, French, German, Russian	5									

Software										
Latest software	35									

Settings Files										
Default	0									
Customer	A									

Design Suffix
Extended Phase 2 CPU and front panel with 10 function keys and tri-colour LEDs and dual characteristic optos — K
Separately ordered P345 accessories for low frequency injection 100% stator earth fault protection
1. 20 Hz generator (Surface/Flush/Rail Mounted)
2. Bandpass filter (Surface/Flush/Rail Mounted)
3. 400/5 A tripping CT

		Character positions														
Character Type (A=Alpha, N=Numeric, X=Alpha-numeric) Character Numbering (Maximum = 15)		A	N	N	N	A	X	X	X	A	X	X	N	N	X	A
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		P	3	9	1	9	0	1	A	0	M	0	0	0	0	A

Vx Aux Rating
60-250 Vdc, 100-230 V ac   9

In/Vn Rating
N/A   0

Hardware Options
None   1

Product Specific
None   A

Protocol Options
N/A   0

Mounting
Panel Mounting   P
Rack Mounting   R
Wall Mounting   W

Software   33

Setting Files
N/A   0

Design Suffix
Original hardware   A

TECHNICAL DATA (P34x/EN TDJ76)

Technical Data

Mechanical specifications

Design

Modular MiCOM Px40 platform relay, P342 in 40TE or 60TE case, P343 in 60TE or 80TE case, P344/5 in 80TE case.
Mounting is front of panel flush mounting, or 19" rack mounted (ordering options).

Enclosure protection

Per IEC 60529: 1992:
IP 52 Protection (front panel) against dust and dripping water,
IP 50 Protection for rear and sides of the case, against dust,
IP 10 Protection Product safety protection for the rear due to live connections on the terminal block.

Weight

P342	(40TE):	7.9kg
P342	(60TE):	9.2kg
P343	(60TE):	11.5kg
P343/4/5	(80TE):	14kg

Terminals

AC current and voltage measuring inputs

Located on heavy duty (black) terminal block:
Threaded M4 terminals, for ring lug connection.
CT inputs have integral safety shorting, upon removal of the terminal block.

General input/output terminals

For power supply, opto inputs, output contacts and RP1 rear communications.
Located on general purpose (grey) blocks:
Threaded M4 terminals, for ring lug connection.

Case protective earth connection

Two rear stud connections, threaded M4.
Must be earthed (grounded) for safety, minimum earth wire size 2.5 mm2.

Front port serial PC interface

EIA(RS)232 DCE, 9 pin D-type female connector Socket SK1.
Courier protocol for interface to MiCOM S1 Studio software.
Isolation to ELV (extra low voltage) level.
Maximum cable length 15 m.

Front download/monitor port

EIA(RS)232, 25 pin D-type female connector Socket SK2.
For firmware and menu text downloads.
Isolation to ELV level.

Rear communications port (RP1)

EIA(RS)485 signal levels, two wire connections located on general purpose block, M4 screw.
For screened twisted pair cable, multidrop, 1000 m max.
For K-Bus, IEC-60870-5-103, MODBUS or DNP3.0 protocol (ordering options).
Isolation to SELV (Safety Extra Low Voltage) level.

Optional rear fiber connection for SCADA/DCS

BFOC 2.5 -(ST®)-interface for glass fiber, as per IEC 874-10.
850 nm short-haul fibers, one Tx and one Rx.
For Courier, IEC-60870-5-103, MODBUS or DNP3.0 (Ordering options).

Optional second rear communications Port (RP2)

EIA(RS)232, 9 pin D-type female connector, socket SK4.
Courier protocol: K-Bus, EIA(RS)232, or EIA(RS)485 connection.
Isolation to SELV level.

Optional rear IRIG-B interface modulated or de-modulated

BNC plug
Isolation to SELV level.
50 ohm coaxial cable.
Optional Rear Ethernet Connection for IEC 61850

10BaseT/100BaseTX communications

Interface in accordance with IEEE802.3 and IEC 61850
Isolation: 1.5 kV
Connector type: RJ45
Cable type: Screened Twisted Pair (STP)
Max. cable length: 100 m

100 base FX interface

Interface in accordance with IEEE802.3 and IEC 61850
Wavelength: 1300 nm
Fiber: multi-mode 50/125 µm or 62.5/125 µm
Connector type: BFOC 2.5 -(ST®)

Optional rear redundant Ethernet connection for IEC 61850

100 base FX interface

Interface in accordance with IEEE802.3 and IEC 61850
Wavelength: 1300 nm
Fiber: multi-mode 50/125 µm or 62.5/125 µm
Connector style: BFOC 2.5 -(ST®)

Transmitter optical characteristics 100 base FX interface

Parameter	Sym	Min	Typ	Max	Unit
Output Optical Power BOL 62.5/125 µm, NA = 0.275 Fiber EOL	PO	-19 -20	-16.8	-14	dBm avg.
Output Optical Power BOL 50/125 µm, NA = 0.20 Fiber EOL	PO	-22.5 -23.5	-20.3	-14	dBm avg.
Optical Extinction Ratio				10 -10	% dB
Output Optical Power at Logic "0" State	PO ("0")			-45	dBm avg.

BOL - Beginning of life
EOL - End of life

Receiver optical characteristics 100 base FX interface

Parameter	Sym	Min	Typ	Max	Unit
Input Optical Power Minimum at Window Edge	PIN Min. (W)		-33.5	-31	dBm avg.
Input Optical Power Minimum at Eye Center	PIN Min. (C)		-34.5	-31.8	Bm avg.
Input Optical Power Maximum	PIN Max.	-14	-11.8		dBm avg.

Fiber defect connector (watchdog relay) – redundant Ethernet board

Connector (3 terminals): 2 NC contacts
Rated voltage: 250 V
Continuous current: 5A
Short-duration current: 30 A for 3 s
Breaking capacity:
  DC: 50 W resistive
  DC: 25 W inductive (L/R = 40 ms)
  AC: 1500 VA resistive (cos ϕ = unity)
  AC: 1500 VA inductive (cos ϕ = 0.5)
Subject to maxima of 5 A and 250 V

Ratings

AC measuring inputs

Nominal frequency: 50 and 60 Hz (settable)
Operating range: 5 to 70 Hz

AC current

Nominal current (In): 1 and 5 A dual rated.
(1A and 5A inputs use different transformer tap connections, check correct terminals are wired).
Nominal burden
  <0.04 VA at In, <40 mΩ(0-30 In)In = 1 A
  <0.01 VA at In, <8 mΩ(0-30 In) In = 5 A
Thermal withstand:
  continuous 4 In
  for 10 s: 30 In
  for 1 s; 100 In
Standard: linear to 16 In (non-offset AC current).
Sensitive: linear to 2 In (non-offset AC current).

AC voltage

Nominal voltage (Vn): 100 to 120 V or 380 to 480 V phase-phase
Nominal burden per phase: < 0.02 VA at 110/√3 V or 440/√3 V
Thermal withstand:
  continuous 2 Vn
  for 10 s: 2.6 Vn
Linear to 200 V (100 V/120 V), 800 V (380/480 V).

Power supply

Auxiliary voltage (Vx)

Three ordering options:
(i)   Vx: 24 to 48 Vdc
(ii) Vx: 48 to 110 Vdc, and 40 to 100 Vac (rms)
(iii) Vx: 110 to 250 Vdc, and 100 to 240 Vac (rms)

Operating range

(i)   19 to 65 V (dc only for this variant)
(ii)   37 to 150 V (dc), 32 to 110 V (ac)
(iii)   87 to 300 V (dc), 80 to 265 V (ac).
With a tolerable ac ripple of up to 12% for a dc supply, per IEC 60255-11: 1979.

Nominal burden

Quiescent burden: 11 W or 24 VA. (Extra 1.25 W when fitted with second rear communications board).
Additions for energized binary inputs/outputs:

Per opto input:
  0.09 W (24 to 54 V)
  0.12 W (110/125 V)
  0.19 W (220/250 V)
Per energized output relay: 0.13 W

Power-up time
Time to power up < 11 s.

Power supply interruption
Per IEC 60255-11: 1979:
  The relay will withstand a 20 ms interruption
  in the DC auxiliary supply, without
  de-energizing.
Per IEC 61000-4-11: 1994:
  The relay will withstand a 20 ms interruption
  in an AC auxiliary supply, without
  de-energizing.

Battery backup
Front panel mounted
Type ½ AA, 3.6 V Lithium Thionyl Chloride
Battery (SAFT advanced battery reference
  LS14250)
Battery life (assuming relay energized for 90%
  time) >10 years

Field voltage output
Regulated 48 Vdc
Current limited at 112 mA maximum output
Operating range 40 to 60 V

Digital ("Opto") inputs
Universal opto inputs with programmable
voltage thresholds (24/27, 30/34, 48/54,
110/125, 220/250 V). May be energized from
the 48 V field voltage, or the external battery
supply.
Rated nominal voltage: 24 to 250 Vdc
Operating range: 19 to 265 Vdc
Withstand: 300 Vdc, 300 Vrms.
Peak current of opto input when energized is
  3.5 mA (0-300 V)
Nominal pick-up and reset thresholds:
Nominal battery 24/27: 60 - 80% DO/PU
  (logic 0) <16.2 (logic 1) >19.2
Nominal battery 24/27: 50 - 70% DO/PU
  (logic 0) <12.0 (logic 1) >16.8
Nominal battery 30/34: 60 - 80% DO/PU
  (logic 0) <20.4 (logic 1) >24.0
Nominal battery 30/34: 50 - 70% DO/PU
  (logic 0) <15.0 (logic 1) >21.0
Nominal battery 48/54: 60 - 80% DO/PU
  (logic 0) <32.4 (logic 1) >38.4
Nominal battery 48/54: 50 - 70% DO/PU
  (logic 0) <24.0 (logic 1) >33.6
Nominal battery 110/125: 60 - 80% DO/PU
  (logic 0) <75.0 (logic 1) >88.0
Nominal battery 110/125: 50 - 70% DO/PU

  (logic 0) <55.0 (logic 1) >77.0
Nominal battery 220/250: 60 - 80% DO/PU
  (logic 0) <150.0 (logic 1) >176.0
Nominal battery 220/250:50 - 70% DO/PU
  (logic 0) <110 (logic 1) >154
Recognition time:
  <2 ms with long filter removed,
  <12 ms with half cycle ac immunity filter on

Output contacts

Standard contacts
General purpose relay outputs for signaling,
tripping and alarming:
Continuous Carry Ratings (Not Switched):
Maximum continuous current: 10 A (UL: 8 A)
Short duration withstand carry: 30 A for 3 s
                                 250 A for 30 ms
Rated voltage: 300 V

Make & Break Capacity:
  DC: 50 W resistive
  DC: 62.5 W inductive (L/R = 50 ms)
  AC: 2500 VA resistive (cos ϕ = unity)
  AC: 2500 VA inductive (cos ϕ = 0.7)

Make, Carry:
  30 A for 3 secs, dc resistive, 10,000
  operations (subject to the above limits of
  make / break capacity and rated voltage)

Make, Carry & Break:
  30 A for 200 ms, ac resistive, 2,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)
  4 A for 1.5 secs, dc resistive, 10,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)

  0.5 A for 1 sec, dc inductive, 10,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)

  10 A for 1.5 secs, ac resistive / inductive,
  10,000 operations (subject to the above
  limits of make / break capacity & rated
  voltage)

Durability:
  Loaded contact: 10 000 operations
                        minimum,
  Unloaded contact: 100 000 operations
                        minimum.

Operate Time
  Less than 5 ms
Reset Time
  Less than 5 ms

High break contacts

Continuous Carry Ratings (Not Switched):
Maximum continuous current: 10 A
Short duration withstand carry: 30 A for 3 s
                                 250 A for 30 ms
Rated voltage: 300 V

Make & Break Capacity:
  DC: 7500 W resistive
  DC: 2500 W inductive (L/R = 50 ms)

Make, Carry:
  30 A for 3 secs, dc resistive, 10,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)

Make, Carry & Break:
  30 A for 3 secs, dc resistive, 5,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)

  30 A for 200 ms, dc resistive, 10,000
  operations (subject to the above limits of
  make / break capacity & rated voltage)
  10 A (*), dc inductive, 10,000 operations
  (subject to the above limits of make / break
  capacity & rated voltage)

  *Typical for repetitive shots – 2 minutes idle
  for thermal dissipation

Voltage	Current	L/R	No of shots in 1 sec
65 V	10 A	40 ms	5
150 V	10 A	40 ms	4
250 V	10 A	40 ms	2
250 V	10 A	20 ms	4

MOV protection: Max Voltage 330 V dc

Durability:
  Loaded contact: 10 000 operations
                      minimum,
  Unloaded contact: 100 000 operations
                      minimum.
Operate Time:
  Less than 0.2 ms
Reset Time:
  Less than 8 ms

Watchdog contacts

Non-programmable contacts for relay
healthy/relay fail indication:
Breaking capacity:
  DC: 30 W resistive
  DC: 15 W inductive (L/R = 40 ms)
  AC: 375 VA inductive (cos ϕ = 0.7)

IRIG-B 12X interface (modulated)

External clock synchronization per IRIG
standard 200-98, format B12x
Input impedance 6 kΩ at 1000 Hz
Modulation ratio: 3:1 to 6:1
Input signal, peak-peak: 200 mV to 20 V

IRIG-B 00X interface (un-modulated)

External clock synchronization per IRIG
standard 200-98, format B00X.
Input signal TTL level
Input impedance at dc 10 kΩ

Environmental conditions

Ambient temperature range

Per IEC 60255-6: 1988:
Operating temperature range:
  -25°C to +55°C (or -13°F to +131°F)
Storage and transit:
  -25°C to +70°C (or -13°F to +158°F)

Tested as per
IEC 60068-2-1: 2007
-25°C storage (96 hours)
-40°C operation (96 hours)
IEC 60068-2-2: 2007
+85°C storage (96 hours)
+85°C operation (96 hours)

Ambient humidity range

Per IEC 60068-2-3: 1969:
  56 days at 93% relative humidity and +40 °C
Per IEC 60068-2-30: 1980
  Damp heat cyclic, six (12 + 12) hour cycles,
  93% RH, +25 to +55 °C

Corrosive environments

Per IEC 60068-2-60: 1995, Part 2, Test Ke,
Method (class) 3
  Industrial corrosive environment/poor
environmental control, mixed gas flow test.
  21 days at 75% relative humidity and +30°C
  exposure to elevated concentrations of H_2S,
NO_2, Cl_2 and SO_2

Type tests

Insulation

Per IEC 60255-27: 2005
Insulation resistance > 100 MΩ at 500 Vdc
  (Using only electronic/brushless insulation
  tester).

Creepage distances and clearances

IEC 60255-27: 2005
Pollution degree 3,
Overvoltage category III,
Impulse test voltage 5 kV.

High voltage (Dielectric) withstand
 (i) Per IEC 60255-27: 2005, 2 kV rms
    AC, 1 minute:
Between all independent circuits.
Between independent circuits and protective
(earth) conductor terminal.
  1 kV rms AC for 1 minute, across open
  watchdog contacts.
  1 kV rms AC for 1 minute, across open
  contacts of changeover output relays.
  1 kV rms AC for 1 minute for all D-type
  EIA(RS)232/EIA(RS)485 ports between the
  communications port terminals and protective
  (earth) conductor terminal.
(ii) Per ANSI/IEEE C37.90-1989 (reaffirmed
    1994):
  1.5 kV rms AC for 1 minute, across open
  contacts of normally open output relays.
  1 kV rms AC for 1 minute, across open
  watchdog contacts.
  1 kV rms AC for 1 minute, across open
  contacts of changeover output relays.

Impulse voltage withstand test
Per IEC 60255-27: 2005
Front time: 1.2 μs, Time to half-value: 50 μs,
Peak value: 5 kV, 0.5J
Between all independent circuits.
Between all independent circuits and
protective (earth) conductor terminal.
Between the terminals of independent circuits.
EIA(RS)232 & EIA(RS)485 ports and normally
open contacts of output relays excepted.

Electromagnetic compatibility (EMC)

**1 MHz burst high frequency disturbance
test**
Per IEC 60255-22-1: 1988, Class III,
Common-mode test voltage: 2.5 kV,
Differential test voltage: 1.0 kV,
Test duration: 2 s, Source impedance: 200 Ω
(EIA(RS)232 ports excepted).

100 kHz damped oscillatory test
Per EN61000-4-18: 2007: Level 3
Common mode test voltage: 2.5 kV
Differential mode test voltage: 1 kV

Immunity to electrostatic discharge
Per IEC 60255-22-2: 1996, Class 4,
  15 kV discharge in air to user interface,
  display, communication port and exposed
  metalwork.
8 kV point contact discharge to any part of the
front of the product.

**Electrical fast transient or burst
requirements**
Per IEC 60255-22-4: 2002 and
EN61000-4-4:2004. Test severity Class III and
IV:
Amplitude: 2 kV, burst frequency 5 kHz
(Class III),
Amplitude: 4 kV, burst frequency 2.5 kHz
(Class IV).
  Applied directly to auxiliary supply, and
  applied to all other inputs. (EIA(RS)232
  ports excepted).
Amplitude: 4 kV, burst frequency 5 kHz
(Class IV) applied directly to auxiliary.

Surge withstand capability
Per IEEE/ANSI C37.90.1: 2002:
  4 kV fast transient and 2.5 kV oscillatory
  applied directly across each output contact,
  optically isolated input, and power supply
  circuit.
4 kV fast transient and 2.5 kV oscillatory
  applied common mode to communications,
  IRIG-B.

Surge immunity test
(EIA(RS)232 ports excepted).
Per IEC 61000-4-5: 2005 Level 4,
Time to half-value: 1.2 / 50 μs,
  Amplitude: 4 kV between all groups and
  protective (earth) conductor terminal,
  Amplitude: 2 kV between terminals of each
  group.

Conducted/radiated immunity
For RTDs used for tripping applications the
conducted and radiated immunity performance
is guaranteed only when using totally shielded
RTD cables (twisted leads).

**Immunity to radiated electromagnetic
energy**
Per IEC 60255-22-3: 2000, Class III:
Test field strength, frequency band 80 to 1000
MHz:
  10 V/m,
  Test using AM: 1 kHz / 80%,
  Spot tests at 80, 160, 450, 900 MHz
Per IEEE/ANSI C37.90.2: 2004:
80 MHz to 1000 MHz, 1 kHz 80% am and am
pulsed modulated.
Field strength of 35 V/m.

**Radiated immunity from digital
communications**
Per EN61000-4-3: 2002, Level 4:
Test field strength, frequency band 800 to 960
MHz, and 1.4 to 2.0 GHz:
  30 V/m,
  Test using AM: 1 kHz/80%.

Radiated immunity from digital radio telephones
Per IEC61000-4-3: 2002:
10 V/m, 900 MHz and 1.89 GHz.

Immunity to conducted disturbances induced by radio frequency fields
Per IEC 61000-4-6: 1996, Level 3,
Disturbing test voltage: 10 V.

Power frequency magnetic field immunity
Per IEC 61000-4-8: 1994, Level 5,
  100 A/m applied continuously,
  1000 A/m applied for 3 s.
Per IEC 61000-4-9: 1993, Level 5,
  1000 A/m applied in all planes.
Per IEC 61000-4-10: 1993, Level 5,
  100 A/m applied in all planes at
100 kHz/1 MHz with a burst duration of 2 s.

Conducted emissions
Per EN 55022: 1998 Class A:
  0.15 - 0.5 MHz, 79 dBμV (quasi peak)
  66 dBμV (average)
  0.5 – 30 MHz, 73dBμV (quasi peak) 60 dBμV
  (average).

Radiated emissions
Per EN 55022: 1998 Class A:
  30 - 230 MHz, 40 dBμV/m at 10 m
  measurement distance
  230 - 1 GHz, 47 dBμV/m at 10 m
  measurement distance.

EU directives

EMC compliance
Per 2004/108/EC:
Compliance to the European Commission Directive on EMC is demonstrated using a Technical File. Product Specific Standards were used to establish conformity:
EN 50263: 2000

Product safety
Per 2006/95/EC:
Compliance to the European Commission Low Voltage Directive. (LVD) is demonstrated using a Technical File.
A product specific standard was used to establish conformity.
  EN 60255-27: 2005

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R&TTE compliance
Radio and Telecommunications Terminal Equipment (R & TTE) directive 99/5/EC.
Compliance demonstrated by compliance to both the EMC directive and the Low voltage directive, down to zero volts.
Applicable to rear communications ports.

ATEX compliance
ATEX Potentially Explosive Atmospheres directive 94/9/EC, for equipment.
The equipment is compliant with Article 1(2) of European directive 94/9/EC.

It is approved for operation outside an ATEX hazardous area. It is however approved for connection to Increased Safety, "Ex e", motors with rated ATEX protection, Equipment Category 2, to ensure their safe operation in gas Zones 1 and 2 hazardous areas.

CAUTION - Equipment with this marking is not itself suitable for operation within a potentially explosive atmosphere.

Compliance demonstrated by Notified Body certificates of compliance.

⟨Ex⟩ **II (2) G**
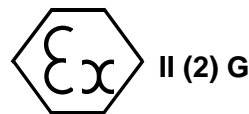
Mechanical robustness

Vibration test
Per IEC 60255-21-1: 1996:
  Response Class 2
  Endurance Class 2

Shock and bump
Per IEC 60255-21-2: 1996:
  Shock response Class 2
  Shock withstand Class 1
  Bump Class 1

Seismic test
Per IEC 60255-21-3: 1995:
  Class 2

P34x Third party compliances

Underwriters laboratory (UL)

c(UL)us

File Number: E202519
Original Issue Date: 05-10-2002
(Complies with Canadian and US requirements).

Energy Networks Association (ENA)

Certificate Number: 104 Issue 2
Assessment Date: 16-04-2004

Settings, measurements and records list

Settings list

Global settings (system data)
Language: English/French/German/Spanish
Frequency: 50/60Hz

Circuit breaker control (CB control):
Reset Lockout by: User Interface/CB Close
Man Close RstDly: 0.10…600.00s
CB Status Input:
  None
  52A
  52B
  Both 52A & 52B

Date and time
IRIG-B Sync: Disabled/Enabled
Battery Alarm: Disabled/Enabled
LocalTime Enable: Disabled/Fixed/Flexible
LocalTime Offset: -720 min…720min
DST Enable: Disabled/Enabled
DST Offset: 30min…60min
DST Start: First/Second/Third/Fourth/
                    Last
DST Start Day: Sun/Mon/Tues/Wed/
                    Thurs/Fri/Sat
DST Start Month: Jan/Feb/Mar/Apr/May/Jun/
                    Jul/Aug/Sept/Oct/Nov/Dec
DST Start Mins: 0 min…1425 min
DST End: First/Second/Third/Fourth/
                    Last
DST End Day: Sun/Mon/Tues/Wed/
                    Thurs/Fri/Sat
DST End Month: Jan/Feb/Mar/Apr/May/Jun/
                    Jul/Aug/Sept/Oct/Nov/Dec
DST End Mins: 0 min…1425 min
RP1 Time Zone: UTC/Local
RP2 Time Zone: UTC/Local
Tunnel Time Zone: UTC/Local

Configuration
Setting Group:
  Select via Menu
  Select via Opto
Active Settings: Group 1/2/3/4
Setting Group 1:   Disabled/Enabled

Setting Group 2:   Disabled/Enabled
Setting Group 3:   Disabled/Enabled
Setting Group 4:   Disabled/Enabled

System Config: Invisible/Visible

Power: Disabled/Enabled
Field Failure: Disabled/Enabled
NPS Thermal: Disabled/Enabled
System Back-up: Disabled/Enabled
Overcurrent: Disabled/Enabled
Thermal Overload: Disabled/Enabled
Gen Differential: Disabled/Enabled
Earth Fault: Disabled/Enabled
Rotor EF   Disabled/Enabled
SEF/REF/Spower: Disabled or SEF/REF
                        or Sensitive Power
Residual O/V NVD: Disabled/Enabled
100% Stator EF: Disabled/Enabled
V/Hz: Disabled/Enabled
Dead Machine: Disabled/Enabled
Volt Protection: Disabled/Enabled
Freq Protection: Disabled/Enabled
RTD Inputs: Disabled/Enabled
CB Fail: Disabled/Enabled
Supervision: Disabled/Enabled
Pole Slipping: Disabled/Enabled
Input Labels: Invisible/Visible
Output Labels: Invisible/Visible
RTD Labels: Invisible/Visible

CT & VT Ratios: Invisible/Visible
Event Recorder: Invisible/Visible
Disturb Recorder: Invisible/Visible
Measure't Setup: Invisible/Visible
Comms Settings: Invisible/Visible
Commission Tests: Invisible/Visible
Setting Values: Primary/Secondary
Control Inputs: Invisible/Visible
CLIO Inputs: Disabled/Enabled
CLIO Outputs: Disabled/Enabled
Ctrl I/P Config: Invisible/Visible
Ctrl I/P Labels: Invisible/Visible
Direct Access: Disabled/Enabled
Function Keys: Invisible/Visible
IEC GOOSE   Invisible/Visible
RP1 Read Only   Disabled/Enabled
RP2 Read Only   Disabled/Enabled
NIC Read Only   Disabled/Enabled
LCD Contrast: 0…31

CT and VT ratios
Main VT Primary: 100...1000000 V
Main VT Sec'y: 80...140 V(100/120 V)
  320…560V (380/480 V)
VN1 Primary: 100…1000000 V
VN1 VT Sec'y: 80…140 V(100/120 V)
  320…560 V (380/480 V)
VN2 Primary (P344/5): 100…1000000 V
VN2 VT Sec'y (P344/5):80…140 V(100/120 V)
  320…560 V (380/480 V)
Phase CT Primary: 1 A…30 kA
Phase CT Sec'y: 1 A/5 A
E/F CT Primary: 1 A…30 KA
E/F CT Sec'y: 1 A/5 A
ISen CT Primary: 1 A…30 KA

ISen CT Sec'y: 1 A/5 A

Sequence of event recorder (record control)

Alarm Event:	Disabled/Enabled
Relay O/P Event:	Disabled/Enabled
Opto Input Event:	Disabled/Enabled
General Event:	Disabled/Enabled
Fault Rec Event:	Disabled/Enabled
Maint Rec Event:	Disabled/Enabled
Protection Event:	Disabled/Enabled
DDB 31 - 0:	(up to):
DDB 1022 - 992:	

Binary function link strings, selecting which DDB signals will be stored as events, and which will be filtered out.

Oscillography (disturbance recorder)

Duration:	0.10…10.50 s
Trigger Position:	0.0…100.0%
Trigger Mode:	Single/Extended
Analog Channel 1:	(up to):

Analog Channel 15 (depending on model):
   Disturbance channels selected from:
   IA-1/IB-1/IC-1/IA-2/IB-2/IC-2/IN/VA/VB/VC/
   VN1/VN2/ISensitive/ I64S/ V64S/ Frequency/
64R CL Input Raw/ 64R R Fault Raw/ 64R R
Fault (depending on model)

Digital Input 1: (up to):
Digital Input 32:
Selected binary channel assignment from any DDB status point within the relay (opto input, output contact, alarms, starts, trips, controls, logic…).
Input 1 Trigger: No Trigger/Trigger/LH (Low to High)/Trigger H/L (High to Low)
   (up to):
Input 32 Trigger: No Trigger/Trigger
L/H/Trigger H/L

Measured operating data (Measure't setup)

Default Display:
   Access Level
   3Ph + N Current
   3Ph Voltage
   Power
   Date and Time
   Description
   Plant Reference
   Frequency

Local Values:	Primary/Secondary
Remote Values:	Primary/Secondary
Measurement Ref:	VA/VB/VC/IA/IB/IC
Measurement Mode:	0/1/2/3
Fix Dem Period:	1…99 mins
Roll Sub Period:	1…99 mins
Num Sub Periods:	1…15
Remote2 Values:	Primary/Secondary

Communications

RP1 Address:	(Courier or IEC870-5-103):
0…255	
RP1 Address:	(DNP3.0):
0…65534	
RP1 Address:	(MODBUS):
1…247	
RP1 InactivTimer:	1…30 mins
RP1 Baud Rate:	(IEC870-5-103):
9600/19200 bits/s	
RP1 Baud Rate:	(MODBUS, Courier):
9600/19200/38400 bits/s	
RP1 Baud Rate:	(DNP3.0):
1200/2400/4800/9600/19200/ 38400 bits/s	
RP1 Parity:	Odd/Even/None
	(MODBUS, DNP3.0)
RP1 Meas Period:	1…60s
	(IEC870-5-103)
RP1 PhysicalLink:	Copper (EIA(RS)485/K bus) or Fiber Optic
RP1 Time Sync:	Disabled/Enabled
MODBUS IEC Timer:	Standard/Reverse

RP1 CS103Blocking:
   Disabled
   Monitor Blocking
   Command Blocking
RP1 Port Config: (Courier):
   K Bus
   EIA485 (RS485)

RP1 Comms Mode: (Courier):
   IEC60870 FT1.2
   IEC60870 10-Bit No parity
Note: If RP1 Port Config is K Bus the baud rate is fixed at 64 kbits/s

Optional Ethernet port

NIC Tunl Timeout: 1...30 mins
NIC Link Report: Alarm, Event, None
NIC Link Timeout: 0.1...60 s

Optional additional second rear communicationm(Rear port2 (RP2))

RP2 Port Config:
   EIA(RS)232
   EIA(RS)485
   K-Bus
RP2 Comms Mode:
   IEC60870 FT1.2
   IEC60870 10-Bit No parity

RP2 Address:	0…255
RP2 InactivTimer:	1…30 mins

RP2 Baud Rate:
   9600/19200/38400 bits/s
Note: If RP2 Port Config is K Bus the baud rate is fixed at 64 kbits/s

Commission tests

Monitor Bit 1:
   (up to):
Monitor Bit 8:

Binary function link strings, selecting which DDB signals have their status visible in the Commissioning menu, for test purposes

Test Mode:
  Disabled
  Test Mode
  Blocked Contacts

Test Pattern:
  Configuration of which output contacts are to be energized when the contact test is applied

Circuit Breaker Condition Monitoring (CB Monitor Setup)

Broken I^:   1.0…2.0
I^ Maintenance: Alarm Disabled/Enabled
I^ Maintenance: 1…25000
I^ Lockout: Alarm Disabled/Enabled
I^ Lockout: 1…25000
No. CB Ops Maint: Alarm
Disabled/Enabled
No. CB Ops Maint: 1…10000
No. CB Ops Lock: Alarm
Disabled/Enabled
No. CB Ops Lock: 1…10000
CB Time Maint: Alarm Disabled/Enabled
CB Time Maint: 0.005…0.500 s
CB Time Lockout: Alarm
Disabled/Enabled
CB Time Lockout: 0.005…0.500 s
Fault Freq Lock: Alarm
Disabled/Enabled
Fault Freq Count: 1…9999
Fault Freq Time: 0…9999 s

Opto coupled binary inputs (Opto config)

Global Nominal V:
  24 - 27 V
  30 - 34 V
  48 - 54 V
  110 - 125 V
  220 - 250 V
Custom
Opto Input 1:
  (up to):
Opto Input #. (# = max. opto no. fitted):
  Custom options allow independent thresholds to be set per opto, from the same range as above.
Opto Filter Control:
  Binary function link string, selecting which optos will have an extra 1/2 cycle noise filter, and which will not.
Characteristics:
  Standard 60% - 80%
  50% - 70%

Control inputs into PSL (Ctrl. I/P config.)

Hotkey Enabled:
  Binary function link string, selecting which of the control inputs will be driven from Hotkeys.
Control Input 1: Latched/Pulsed
  (up to):
Control Input 32:   Latched/Pulsed
Ctrl Command 1:
  (up to):
Ctrl Command 32:
  ON/OFF
  SET/RESET
  IN/OUT
  ENABLED/DISABLED

Function keys

Fn. Key Status 1:
  (up to):
Fn. Key Status 10
  Disable
  Lock
  Unlock/Enable
Fn. Key 1 Mode: Toggled/Normal
  (up to):
Fn. Key 10 Mode: Toggled/Normal
Fn. Key 1 Label:
  (up to):
Fn. Key 10 Label:
User defined text string to describe the function of the particular function key

IED configurator

Switch Conf. Bank: No Action/Switch Banks
Restore MCL: No Action, Restore MCL

IEC 61850 GOOSE

GoEna: Disabled/Enabled
Test Mode: Disabled/Pass Through/Forced
VOP Test Pattern: 0x00000000...
0xFFFFFFFF
Ignore Test Flag: No/Yes

Control input user labels (Ctrl. I/P labels)

Control Input 1:
  (up to):
Control Input 32:
  User defined text string to describe the function of the particular control input

Settings in multiple groups

Note: *All settings here onwards apply for setting groups # = 1 to 4.*

Protection Functions

System config
Phase Sequence: Standard ABC/Reverse ACB
VT Reversal: No Swap/A-B Swapped/B-C Swapped/C-A Swapped
CT1 Reversal: No Swap/A-B Swapped/B-C Swapped/C-A Swapped
CT2 Reversal: No Swap/A-B Swapped/B-C Swapped/C-A Swapped

Generator differential protection
GenDiff Function:
  Disabled/Percentage Bias
  High Impedance
  Interturn
Gen Diff Is1: 0.05…0.50 In
Gen Diff k1: 0…20%
Gen Diff Is2: 1…5.0In
Gen Diff k2: 20…150.00%
Interturn Is_A: 0.05…2.0 In
Interturn Is_B: 0.05…2.0 In
Interturn Is_C: 0.05…2.0 In
Interturn Delay: 0.00…100.0 s

Reverse/low forward/over power (3 phase)
Operating mode:
  Generating
  Motoring
Power 1 Function:
  Reverse
  Low forward
  Over
-P>1 Setting (reverse power/P<1
Setting (Low forward power)/ P>1
Setting (Overpower):
  1…300.0 W   (1A, 100 V/120 V)
  4…1200.0 W   (1A, 380 V/480 V)
  5…1500.0 W   (5A, 100 V/120 V)
  20…6000.0 W   (5A, 380V/480 V)
Equivalent Range in %Pn 0.5%…157%
Power 1 Time Delay: 0.00…100.0 s
Power 1 DO Timer: 0.00…100.0 s
P1 Poledead Inh: Disabled/Enabled
Power 2 as Power 1

Sensitive/reverse/low forward/over power (1 phase)
Operating mode:
  Generating
  Motoring
Sen Power1 Func:
  Reverse
  Low forward
  Over
Sen -P>1 Setting (Reverse Power)/Sen <P Setting (Low Forward Power)/Sen >P Setting (Over Power):

  0.3…100.0 W (1A, 100/120 V)
  1.20…400.0 W (1A, 380/480 V)
  1.50…500.0 W (5A, 100/120 V)
  6.0…2000.0 W (5A, 380/480 V)
Equivalent range in %Pn 0.5%…157%
Sen Power 1 Delay: 0.00…100.0 s
Power 1 DO Timer: 0.00…100.0 s
P1 Poledead Inh: Disabled/Enabled
Comp angle θC: -5°…+5.0°
Sen Power2 as Sen Power 1

NPS overpower
S2>1 Status: Disabled/Enabled
S2>1 Setting: 0.10…30.00 In VA (100/120 V)
  0.40…120.00 In VA (380/480 V)
S2> 1 Time Delay: 0.00…100.00 s

Field failure
FFail Alm Status: Disabled/Enabled
FFail Alm Angle: 15°…75°
FFail Alm Delay: 0.00…100.0 s
FFail 1 Status: Disabled/Enabled
FFail 1 -Xa1:
  0.0…40.0 Ω (1A, 100/120 V)
  0.0…8.0 Ω (5A, 100/120 V)
  0…160 Ω (1A, 380/480 V)
  0.0…32.0 Ω (5A, 380/480 V)
FFail 1 Xb1:
  25…325.0 Ω (1A, 100/120 V)
  5…65.0 Ω (5A, 100/120 V)
  100…1300 Ω (1A, 380/480 V)
  20…260.0 Ω (5A, 380/480 V)
FFail 1 Time Delay: 0…100 s
FFail 1 DO Timer: 0…100 s
FFail 2 as FFail1

NPS thermal
I2therm>1 Alarm: Disabled/Enabled
I2therm>1 Set: 0.03…0.5 In
I2therm>1 Delay: 0…100 s
I2therm>2 Trip: Disabled/Enabled
I2therm>2 Set: 0.05…0.5 In
I2therm>2 k: 2…40.0 s
I2therm>2 kRESET: 2…40.0
I2therm>2 tMAX: 500…2000.00 s
I2therm>2 tMIN: 0.25…40 s
The P34x negative phase sequence element offers a true thermal characteristic according to the following formula:

$$t = - \frac{(\text{I2>2 k Setting})}{\left(\text{I2>2 Current set}\right)^2} \; 2 \, \text{Log}_e \left(1 - \left(\frac{(\text{I2>2 Current set})}{\text{I}_2} \right)^2 \right)$$

Note: All current terms are in per-unit, based on the relay rated current, In.
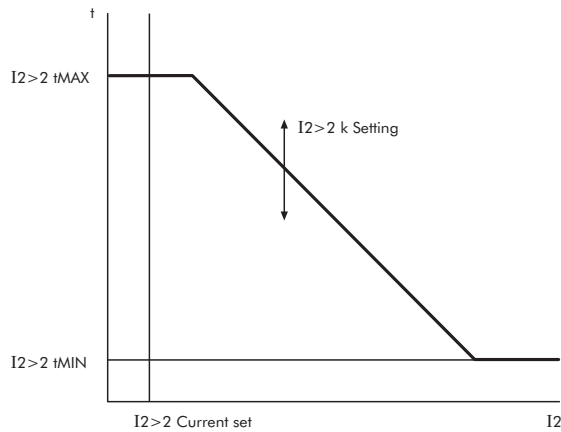
P2247ENa

Negative phase sequence thermal characteristic

System backup

Voltage dependent overcurrent and underimpedance

Backup Function:
  Disabled
  Voltage Controlled
  Voltage Restrained
  Under Impedance
Vector Rotation: None/Delta-Star
V Dep OC Char:
  DT
  IEC S Inverse
  IEC V Inverse
  IEC E Inverse
  UK LT Inverse
  UK Rectifier
  RI
  IEEE M Inverse
  IEEE V Inverse
  IEEE E Inverse
  US Inverse
  US ST Inverse
V Dep OC I > Set: 0.8…4 In
V Dep OC T Dial: 0.01…100
V Dep OC Reset: DT or Inverse
V Dep OC Delay: 0…100 s
V Dep OC TMS: 0.025…1.2
V Dep OC K(RI): 0.1…10
V Dep OC tRESET: 0…100 s
V Dep OC V<1/2 Set: 5…120 V (100/120 V)
V Dep OC V<1/2 Set: 20…480 V (380/480 V)
V Dep OC k Set: 0.1…1
Z<1 Setting:
  2…120.0 Ω   (100/120 V, 1A)
  0.4…24.0 Ω   (100/120 V, 5A)
  8…480 Ω   (380/440 V, 1A)
  1.60…96.0 Ω (380/440 V, 5A)
Z<1 Time Delay: 0.00…100.0 s
Z<1 tRESET: 0…100 s
Z<2 as Z<1

Inverse time (IDMT) characteristic
IDMT characteristics are selectable from a choice of four IEC/UK and five IEEE/US curves as shown in the table below.
The IEC/UK IDMT curves conform to the following formula:

$$ t = T \times \left(\frac{K}{(I/I_S)^{\alpha} - 1} + L \right) $$

The IEEE/US IDMT curves conform to the following formula:

$$ t = TD \times \left(\frac{K}{(I/I_S)^{\alpha} - 1} + L \right) $$

Where:

t	=	Operation time
K	=	Constant
I	=	Measured current
IS	=	Current threshold setting
α	=	Constant
L	=	ANSI/IEEE constant (zero for IEC/UK curves)
T	=	Time multiplier setting for IEC/UK curves
TD	=	Time dial setting for IEEE/US curves

IDMT characteristics

IDMT curve	Stand.	K	α	L
Standard inverse	IEC	0.14	0.02	0
Very inverse	IEC	13.5	1	0
Extremely inverse	IEC	80	2	0
Long time inverse	UK	120	1	0
Rectifier	UK	45900	5.6	0
Moderately inverse	IEEE	0.0515	0.02	0.114
Very inverse	IEEE	19.61	2	0.491
Extremely inverse	IEEE	28.2	2	0.1217
Inverse	US-C08	5.95	2	0.18
Short time inverse	US-C02	0.16758	0.02	0.11858

The IEC extremely inverse curve becomes definite time at currents greater than 20 x setting. The IEC standard, very and long time inverse curves become definite time at currents greater than 30 x setting.

The definite time part of the IEC inverse time characteristics at currents greater than 20x and 30x setting are only relevant for currents in the operating range of the relay.

The operating range of the P342/3/4/5 current inputs is 0 − 16 In for the standard current inputs and is 0 − 2 In for the sensitive current input.

For all IEC/UK curves, the reset characteristic is definite time only.

For all IEEE/US curves, the reset characteristic can be selected as either inverse curve or definite time.

The inverse reset characteristics are dependent upon the selected IEEE/US IDMT curve as shown in the table below.

All inverse reset curves conform to the following formula:

$$tRESET = \frac{TD \times S}{(1 - M^2)} \text{ in seconds}$$

Where:

TD = Time dial setting for IEEE curves
S = Constant
M = I/Is

Curve description	Standard	S
Moderately inverse	IEEE	4.85
Very inverse	IEEE	21.6
Extremely inverse	IEEE	29.1
Inverse	US	5.95
Short time inverse	US	2.261

The RI curve (electromechanical) has been included in the first stage characteristic setting options for Phase Overcurrent and Earth Fault protections. The curve is represented by the following equation:

$$t = K \times \left(\frac{1}{0.339 - \left(0.236 / M \right)} \right) \text{ in seconds}$$

With K adjustable from 0.1 to 10 in steps of 0.05
M = I/Is

IEC Curves
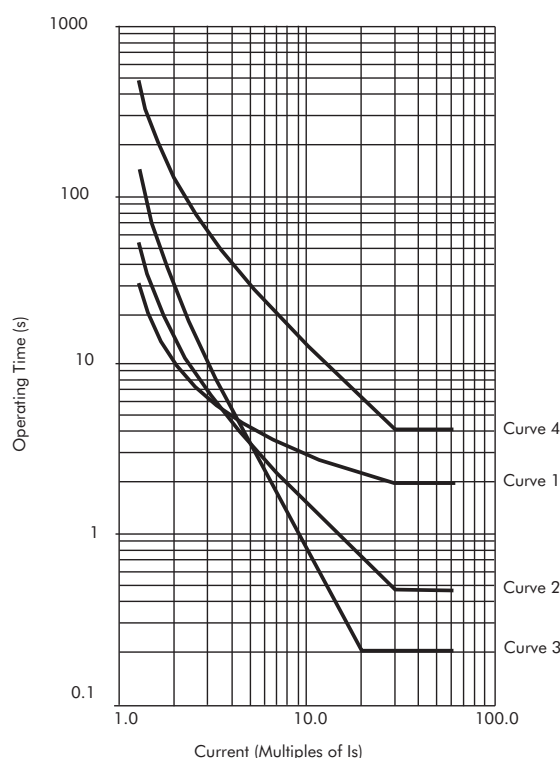
Curve 1   Standard inverse
Curve 2   Very inverse
Curve 3   Extremely inverse
Curve 4   UK long time inverse

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Amercian Curves
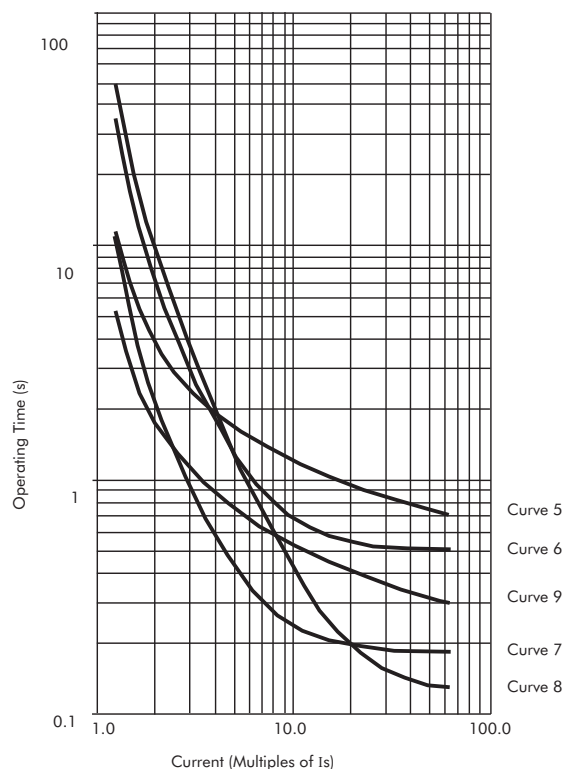
Curve 5   IEEE moderately inverse
Curve 6   IEEE very inverse
Curve 7   IEEE extremely inverse
Curve 8   US inverse
Curve 9   US short time inverse

P2137ENa

Phase overcurrent (overcurrent)

Phase O/C: Sub Heading
I>1 Function:
　Disabled
　DT
　IEC S Inverse
　IEC V Inverse
　IEC E Inverse
　UK LT Inverse
　UK Rectifier
　RI
　IEEE M Inverse
　IEEE V Inverse
　IEEE E Inverse
　US Inverse
　US ST Inverse
I>1 Direction:
　Non-Directional
　Directional Fwd
　Directional Rev
I>1 Current Set: 0.08…4.00 In
I>1 Time Delay: 0.00…100.00 s
I>1 TMS: 0.025…1.200
I>1 Time Dial: 0.01…100.00
I>1 K (RI): 0.10…10.00
I>1 Reset Char: DT/Inverse
I>1 tRESET: 0.00…100.00 s
I>2 as I>1
I>3 Status: Disabled/Enabled
I>3 Direction:
　Non-Directional
　Directional Fwd
　Directional Rev
I>3 Current Set: 0.08…10.00 In
I>3 Time Delay: 0.00…100.00 s
I>4 as I>3
I> Char Angle: -95…+95°
I >Function Link:
　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, 5, 6 & 7 are not used
　Binary function link string, selecting which overcurrent elements (stages 1 to 4) will be blocked if VTS detection of fuse failure occurs.

NPS overcurrent

I2>1 Status: Disabled/Enabled
I2>1 Direction:
　Non-Directional
　Directional Fwd
　Directional Rev
I2> Current Set: 0.08…4.00 In
I2> Time Delay: 0.00…100.00 s
I2>2/3/4 as for I2>1
I2> VTS Block:
　Bit 0 = VTS Blocks I2>1
　Bit 1 = VTS Blocks I2>2
　Bit 2 = VTS Blocks I2>3
　Bit 3 = VTS Blocks I2>4

　Bits 4, 5, 6 & 7 are not used
　Binary function link string, selecting which NPS overcurrent elements (stages 1 to 4) will be blocked if VTS detection of fuse failure occurs.
I2> V2pol Set: 0.5…25.0 (100V 120V)
　2…100V(380/480V)
I2> Char Angle: -95°…+95°

Thermal overload

Thermal: Disabled/Enabled
Thermal I>: 0.50…2.50 In
Thermal Alarm: 20..100%
T-heating: 1…200 minutes
T-cooling: 1…200 minutes
M Factor: 0…10
The thermal time characteristic is given by:

$$t = \tau \log_e \ (I_{eq}^2 - I_P^2)/(I_{eq}^2 - (\text{Thermal } I>)^2)$$

$$t = \tau . \log_e (K^2 - A^2/(K^2 - 1))$$

Where:

K　　　　= I_{eq}/Thermal I>
A　　　　= I_P /Thermal I>
t　　　　=Time to trip, following application of the overload current, I
τ　　　=Heating time constant of the protected plant
I_{eq}　　　　= Equivalent current
Thermal I>　= Relay setting current
I_P　　　　= Steady state pre-load current before application of the overload
I_{eq}　　　=　　$\sqrt{(I_1^2 + MI_2^2)}$
I1　　=　　Positive sequence current
I2　　=　　Negative sequence current
M　　=　　A user settable constant proportional to the thermal capacity of the machine

2-Stage non-directional earth fault

IN>1 Function:
　Disabled
　DT
　IEC S Inverse
　IEC V Inverse
　IEC E Inverse
　UK LT Inverse
　RI
　IEEE M Inverse
　IEEE V Inverse
　IEEE E Inverse
　US Inverse
　US ST Inverse
　IDG
IN>1 Current: 0.02…4 In
IN>1 IDG Is: 1…4 In
IN>1 Time Delay: 0.00…200.0 s
IN>1 TMS: 0.025…1.200
IN>1 Time Dial: 0.01…100.00

IN>1 K(RI): 0.1…10.00
IN>1 IDG Time: 1…2.00
IN>1 Reset Char: DT, Inverse
IN>1 tRESET: 0.00…100.00 s
IN>2 Function: Disabled, DT
IN>2 Current Set: 0.02…10.00In
IN>2 Time Delay: 0.00…200.00 s

The IDG curve is commonly used for time delayed earth fault protection in the Swedish market. This curve is available in stage 1 of the Earth Fault protection.

The IDG curve is represented by the following equation:

$$t = 5.8 - 1.35 \log_e \left(\frac{I}{IN > Setting} \right) \text{ in seconds}$$

Where:

I = Measured current

IN>Setting = An adjustable setting which defines the start point of the characteristic

Although the start point of the characteristic is defined by the "IN>" setting, the actual relay current threshold is a different setting called "IDG Is". The "IDG Is" setting is set as a multiple of "IN>".

An additional setting "IDG Time" is also used to set the minimum operating time at high levels of fault current.
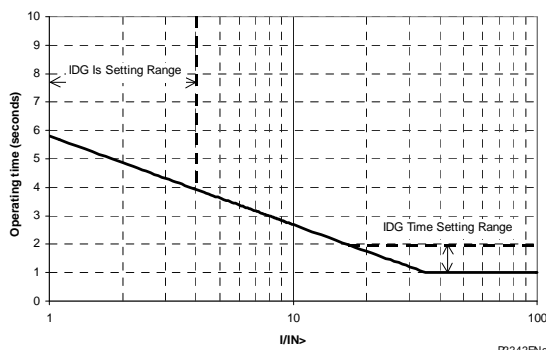
IDG Characteristic

Rotor EF

Injection Freq: 0.25/0.5/1 Hz
CL I/P Select:
  Current Loop CL1/2/3/4
64R< 1 Alarm: Disabled/Enabled
64R<1 Alm Set: 1000…80000 Ω
64R<1 Alm Dly: 0.0…600.0 s
64R<2 Trip: Disabled/Enabled
64R<2 Trip Set: 1000…80000 Ω
64R<2 Trip Dly: 0.0…600.0s
R Compensation: -1000…1000 Ω

SEF/REF Prot'n

SEF/REF Options:
  SEF
  SEF Cos (PHI)
  SEF Sin (PHI)
  Wattmetric

  Hi Z REF
  Lo Z REF
  Lo Z REF + SEF
  Lo Z REF + Watt
ISEF>1 Function:
  Disabled
  DT
ISEF>1 Directional:
  Non-Directional
  Directional Fwd
  Directional Rev
ISEF>1 Current: 0.0050…0.1000 In A
ISEF>1 Delay: 0.00…200.00 s
ISEF> Func Link: Bit 0 - Block
  ISEF> from VTS
ISEF > Char Angle: -95°…95°
ISEF > VNpol Input: Measured/Derived
ISEF > Vnpol Set: 0.5…80.0 V (100/120 V)
  2…320.0 V (380/480 V)
WATTMETRIC SEF:
PN> Setting: 0.00…20.00 In W (100/120 V)
  0.00…80.00 In W (380/480 V)

Residual O/V NVD

VN>1 Status: Disabled/Enabled
VN>1 Input: Derived
VN> 1 Function:
  Disabled
  DT
  IDMT
VN> 1 Voltage Set:
  1…80 V   (100/120 V)
  4…320 V   (380/480 V)
VN> 1 Time Delay: 0.00…100.00 s
VN>1 TMS: 0.5…100.0
VN> 1 tRESET: 0.00…100.00
VN>2 as VN>1
VN>3/4 as VN>1 except
VN>3/4 Input: VN1
VN>5/6 as VN>1 except
VN>5/6 Input: VN2 (P344/5)

100% stator earth fault (3rd harmonic)

100% St EF Status: Disabled, VN3H< Enabled, VN3H> Enabled
100% St EF VN3H<: 0.3…20.0 V
VN3H< Delay: 0.00…100.00 s
V < Inhibit Set:
  30…120 V   (100/120 V)
  120…480 V   (380/440 V)
P < Inhibit: Disabled/Enabled
P < Inhibit Set:
  4…200.0 In W (100/120 V)
  16…800.In W (380/480 V)
Q < Inhibit: Disabled/Enabled
Q < Inhibit: Set:
  4…200.0 In W (100/120 V)
  16…800 In W (380/480 V)
S < Inhibit: Disabled/Enabled
S < Inhibit Set:
  4…200.0 In W (100/120 V)

100% St EF VN3H>:
  0.3…20.0 V   (100/120 V)
  1.20…80.0 V (380/480 V)
VN3H> Delay: 0.00…100.00 s

100% stator earth fault (low frequency injection)

64S LF Injection: Disabled/Enabled
64S R Factor: 0.01…200
64S R<1 Alarm: Disabled/Enabled
64S R<1 Alm Set: 10…700 Ω
64S R<1 Alm Delay: 0.00…100.0 s
64S R<2 Trip: Disabled/Enabled
64S R<2 Trip Set: 10…700 Ω
64S R<2 Trip Dly: 0.00…100.0 s
64S Angle Comp: -60°…60°
64S Series R: 0…700 Ω
64S Series X: 0…700 Ω
64S Parallel G: 0.00…0.1 s
64S Overcurrent: Disabled/Enabled
64S I>1 TripSet: 0.02…1.5A
64S I>1 TripDly: 0.00…100.0 s
64S Supervision: Disabled/Enabled
64S V<1 Set: 0.3…25 V
64S I<1 Set: 0.005…0.04A
64S Supern'n Dly: 0.00…100.0 s

Volts/Hz

V/Hz Alarm Status: Disabled/Enabled
V/Hz Alarm Set:
  1.50…3.500 V/Hz (100/120 V)
  6…14.00 V/Hz (380/480 V)
V/Hz Alarm Delay: 0.00…100.0 s
V/Hz>1 Status: Disabled/Enabled
V/Hz Trip Func:
  DT
  IDMT
V/Hz> 1 Trip Set:
  1.500…3.500 V/Hz   (100/120 V)
  6…14.00 V/Hz   (380/480 V)
V/Hz> 1Trip TMS: 0.01…12.00
V/Hz> 1 Trip Delay: .0.00…600.0 s
V/Hz>2 Status: Disabled/Enabled
V/Hz>2 Trip Set:
  1.500…3.500 V/Hz   (100/120 V)
  6…14.00 V/Hz   (380/480 V)
V/Hz>2 Trip Delay: .0.00…600.0 s
V/Hz>3/4 as V/Hz>2
The inverse time characteristic has the following formula:

$$t = \frac{TMS}{(M - 1)^2}$$

Where:

$$M = \frac{V/f}{(V/f\ Trip\ Setting)}$$

V   =   Measured voltage
F   =   Measured frequency

Note: The IDMT characteristic has been changed in the 31 version software. The new characteristic is compatible with the old one and allows the option of future expansion of the number of characteristics with different exponents of (M-1).

Inverse time characteristic in software version 30 and lower is as shown below:

$$t = 0.8 + \frac{0.18 * TMS}{(M - 1)^2}$$

Dead machine

Dead Mach Status: Disabled/Enabled
Dead Mach I>: 0.08…4.00 In A
Dead Mach V <:
  10…120 V (100/120 V)
  40…480 V (380/480 V)
Dead Mach tPU: 0.0…10.0 s
Dead Mach tDO: 0.0…10.0 s

Voltage protection

Undervoltage

V< Measur't Mode:
  Phase-Phase
  Phase-Neutral
V< Operate Mode:
  Any Phase
  Three Phase
V< 1 Function:
  Disabled
  DT
  IDMT
V<1 Voltage Set:
  10…120V (100/120 V)
  40…480V (380/480 V)
V<1 Time Delay: 0.00…100.00 s
V<1 TMS: 0.05…100.0
V<1 Poledead Inh: Disabled/Enabled
V<2 Function:
  Disabled
  DT
V<2 Status: Disabled/Enabled
V<2 Voltage Set:
  10…120 V (100/120 V)
  40…480 V (380/480 V)
V<2 Time Delay: 0.00…100.00 s
V<2 Poledead Inh: Disabled/Enabled
The inverse characteristic is given by the following formula:

$$t = \frac{K}{(1 - M)}$$

Where:
K   = Time multiplier setting
t   = Operating time in seconds
M   =Applied input voltage/relay setting voltage

Overvoltage
V> Measur't Mode:
  Phase-Phase
  Phase-Neutral
V> Operate Mode:
  Any Phase
  Three Phase

V> 1 Function:
  Disabled
  DT
  IDMT
V>1 Voltage Set:
  60…185 V   (100/120 V)
  240…740 V   (380/480 V)
V>1 Time Delay: 0.00…100.00 s
V>1 TMS: 0.05…100.0
V>2 Status: Disabled/Enabled
V>2 Voltage Set:
  60…185 V   (100/120 V)
  240…740 V   (380/480 V)
V>2 Time Delay: 0.00…100.00 s
The inverse characteristic is given by the following formula:

$$t = \frac{K}{(M - 1)}$$

Where:
K   = Time multiplier setting
t   = Operating time in seconds
M   = Applied input voltage/relay setting voltage

NPS overvoltage
V2>1 status: Enabled/Disabled
V2>1 Voltage Set:
  1…150 V (100/120 V)
  4…600 V (380/480 V)
V2>1 Time Delay: 0.00…100.00 s

Frequency protection

Underfrequency
F<1 Status: Disabled/Enabled
F<1 Setting: 45.00…65.00 Hz
F<1 Time Delay: 0.1…100.0 s
F<2/3/4 as F<1
F< Function Link:
  Bit 0 - Enable Block F<1 during poledead
  Bit 1 - Enable Block F<2 during poledead
  Bit 2 - Enable Block F<3 during poledead
  Bit 3 - Enable Block F<4 during poledead

Overfrequency
F>1 Status: Disabled/Enabled
F>1 Setting: 45.00…68.00 Hz
F>1 Time Delay: 0.1…100.0 s
F>2 as F>1

Generator turbine abnormal frequency
Turbine F Status: Disabled/Enabled
Band 1 Status: Disabled/Enabled
Band 1 Freq Low: 20.00…70.00 Hz
Band 1 Freq High: 20.00…70.00 Hz
Band 1 Duration: 0.00…3600000.00 s
Band 1 Dead Time: 0.00…200.00 s
Band 2/3/4/5/6 as Band 1

RTD protection
Select RTD:
  Bit 0 - Select RTD 1
  Bit 1 - Select RTD 2
  Bit 2 - Select RTD 3
  Bit 3 - Select RTD 4
  Bit 4 - Select RTD 5
  Bit 5 - Select RTD 6
  Bit 6 - Select RTD 7
  Bit 7 - Select RTD 8
  Bit 8 - Select RTD 9
  Bit 9 - Select RTD 10
Binary function link string, selecting which RTDs (1 - 10) are enabled.
RTD 1 Alarm Set: 0°C…200°C
RTD 1 Alarm Dly: 0s…100s
RTD 1 Trip Set: 0°C…200°C
RTD 1 Trip Dly: 0s…100s
RTD2/3/4/5/6/7/8/9/10 as RTD1

CB fail
CB Fail 1 Status: Disabled/Enabled
CB Fail 1 Timer: 0.00…10.00 s
CB Fail 2 Status: Disabled/Enabled
CB Fail 2 Timer: 0.00…10.00 s
CBF Non I Reset: I< Only, CB Open & I<, Prot Reset & I<
CBF Ext Reset: I< Only, CB Open & I <, Prot Reset & I<
I< Current Set: 0.02…3.200 In
IN< Current Set: 0.02…3.200 In
ISEF< Current: 0.0010…0.8000 In
Remove I> Start: Disabled/Enabled
Remove IN< Start: Disabled/Enabled
I< CT Source: IA-1, IB-1, IC-1/IA-2, IB-2, IC-2

Pole slipping
PSlip Function: Disabled/Enabled
Pole Slip Mode:
  Motoring
  Generating
  Both
PSlip Za Forward:
  0.5…350.0/InΩ (100/120 V)
  2.0…1400.0/InΩ (380/480 V)
PSlip Zb Reverse:
  0.5…350.0/InΩ (100/120 V)
  2.0…1400/InΩ (380/480 V)
Lens Angle: 90°…150°
PSlip Timer T1: 0.00…1.00 s
PSlip Timer T2: 0.00…1.00 s

Blinder Angle: 20°…90°
PSlip Zc:
   0.5…350.0/InΩ (100/120 V)
   2.0…1400.0/InΩ (380/480 V)
Zone 1 Slip Count: 1…20
Zone 2 Slip Count: 1…20
PSlip Reset Time: 0.00…100.0 s

Supervisory functions

Voltage transformer supervison
VTS Status: Blocking/Indication
VTS Reset Mode: Manual/Auto
VTS Time Delay: 1.0…10.0 s
VTS I> Inhibit: 0.08 In…32.0 In
VTS I2> Inhibit: 0.05 In…0.50 In
Negative phase sequence voltage (V2):
   10V (100/120V)
   40V (380/480V)
Phase overvoltage:
   Pick-up   30 V,
   Drop-off   10 V   (100/120 V)
   Pick-up   120 V,
   Drop-off   40 V   (380/480 V)
Superimposed Current: 0.1 In

Current transformer supervision
CTS 1 Status: Disabled/Enabled
CTS 1 VN Input: Measured/Derived
CTS 1 VN< Inhibit:
   0.5…22 V (100/120 V)
   2…88 V (380/480 V)
CTS 1 IN> Set: 0.08…4 In
CTS 2 as CTS1

Plant supervision

CB state monitoring control and condition monitoring
Broken I^: 1…2.0
I^ Maintenance:
   Alarm disabled
   Alarm enabled
I^ Maintenance: 1 In^…25000 In^
I^ Lockout:
   Alarm disabled
   Alarm enabled
I^ Lockout: 1…25000
No CB Ops. Maint:
   Alarm disabled
   Alarm enabled
No CB Ops: Maint: 1…10000
No CB Ops Lock:
   Alarm disabled
   Alarm enabled
No CB Ops Lock: 1…10000
CB Time Maint:
   Alarm disabled
   Alarm enabled
CB Time Maint: 0.005…0.500 s

CB Time Lockout:
   Alarm disabled
   Alarm enabled
CB Time Lockout: 0.005…0.500 s
Fault Freq Lock:
   Alarm disabled
   Alarm enabled
Fault Freq Count: 1…9999
Fault Freq Time: 0…9999 s

Input labels
Opto Input 1…32: Input L1…Input L32
User defined text string to describe the function of the particular opto input.

Output labels
Relay 1…32: Output R1…Output R32
User defined text string to describe the function of the particular relay output contact.

RTD labels
RTD 1-10: RTD1…RTD10
User defined text string to describe the function of the particular RTD.

Current loop input
CLIO1 Input 1: Disabled/Enabled
CLI1 Input Type:
   0 - 1 mA
   0 - 10 mA
   0 - 20 mA
   4 - 20 mA
CLI1 Input Label: 16 characters (CLIO input 1)
CLI1 Minimum: -9999…+9999
CLI1 Maximum: -9999…+9999
CLI1 Alarm: Disabled/Enabled
CLI1 Alarm Fn: Over/Under
CLI1 Alarm Set: CLI1 min…CLI1 max
CLI1 Alarm Delay: 0.0…100.0s
CLI1 Trip: Disabled/Enabled
CLI1 Trip Fn: Over/Under
CLI1 Trip Set: CLI1 min…CLI1 max
CLI1 Trip Delay: 0.0…100.0 s
CLI1 I< Alarm (4…20 mA input only): Disabled/Enabled
CLI1 I< Alm Set (4…20 mA input only):
   0.0…4.0 mA
CLI2/3/4 as CLI1

Current loop output
CLO1 Output 1: Disabled/Enabled
CLO1 Output Type:
   0 - 1 mA
   0 - 10 mA
   0 - 20 mA
   4 - 20 mA
CLO1 Set Values: Primary/Secondary
CLO1 Parameter: As shown below*
CLO1 Min: Range, step size and unit corresponds to the selected parameter

CLO1 Max: Same as CLO1 Min
CLO2/3/4 as CLO1
Current Loop Output Parameters
Current Magnitude:
  IA Magnitude
  IB Magnitude
  IC Magnitude
  IN Measured Mag   (P342)
  IN-1 Measured Mag   (P343/4/5)
  IN-2 Measured Mag   (P343/4/5)
  0.00…16.0 A…
I Sen Mag: 0.00… 2.0 A
Phase Sequence Components:
  I1 Magnitude
  I2 Magnitude
  I0 Magnitude:
  0.00…16.0A
Phase Currents:
  IA RMS*
  IB RMS*
  IC RMS*
  0.00…16.0A
P-P Voltage Magnitude:
  VAB Magnitude
  VBC Magnitude
  VCA Magnitude
  0.0…200.0 V
P-N Voltage Magnitude:
  VAN Magnitude
  VBN Magnitude
  VCN Magnitude
  0.0…200.0 V
Neutral Voltage Magnitude:
  VN1 Measured Mag
  VN Derived Mag
  VN2 Measured Mag   (P344/5)
  0.0…200.0V
VN 3rd Harmonic: 0.0…200.0 V (P343/4/5)
Phase Sequence Voltage Components:
  V1 Magnitude
  V2 Magnitude
  V0 Magnitude
  0.0…200.0 V
RMS Phase Voltages:
  VAN RMS*
  VBN RMS*
  VCN RMS*
  0.0…200.0 V
Frequency: 0.00…70.0 Hz
3 Phase Watts*: -6000 W…6000 W
3 Phase Vars*: -6000 Var…6000 Var
3 Phase VA*: 0…6000 VA
3Ph Power Factor*: -1…1
Single Phase Active Power:
  A Phase Watts*:
  B Phase Watts*:
  C Phase Watts*:
  -2000W…2000 W
Single Phase Reactive Power:
  A Phase Vars*:
  B Phase Vars*:
  C Phase Vars*
  -2000Var…2000 Var
Single Phase Apparent Power:

  A Phase VA*:
  B Phase VA*:
  C Phase VA*
  0…2000 VA
Single Phase Power Factor:
  Aph Power Factor*
  BPh Power Factor*
  CPh Power Factor*
  -1…1
3 Phase Current Demands:
  IA Fixed/Roll/Peak Demand*
  IB Fixed/Roll/Peak Demand*
  IC Fixed/Roll/Peak Demand*
  0.00…16.0A
3ph Active Power Demands:
  3Ph W Fix/Roll/Peak Demand*
  -6000W…6000 W
3ph Reactive Power Demands:
  3Ph Vars Fix/Roll/Peak Dem*
  -6000 Var…6000 Var
NPS Thermal: 0.00…200.0%
Thermal Overload: 0.00…200.0%
RTD 1-10*: -40°C…300.0°C
CL Input 1-4: -9999…9999.0
Volts/Hz: 0…20 V/Hz

Note 1: Measurements marked with an asterisk, the internal refresh rate is nominally 1s, others are 0.5 power system cycles or less.

Note 2: The polarity of Watts, Var and power factor is affected by the measurements Mode setting.

Note 3: These settings are for nominal 1A and 100/120 V versions only. For other versions they need to be multiplied accordingly.

Measurements list

Measurements 1
Iφ Magnitude
Iφ Phase Angle
  Per phase (φ = A/A-1, B/B-1, C/C-1) current measurements
IN Measured Mag
IN Measured Angle
IN Derived Mag
IN Derived Angle
ISen Mag
ISen Angle
I1 Magnitude
I2 Magnitude
I0 Magnitude
Iφ RMS
  Per phase (φ = A, B, C) RMS current measurements
IN -2 Derived
Vφ-φ Magnitude
Vφ-φ Phase Angle
Vφ Magnitude

Vφ Phase Angle
  All phase-phase and phase-neutral voltages
  (φ = A, B, C).
VN/VN1 Measured Mag
VN/VN1 Measured Ang
VN Derived Mag
V1 Magnitude
V2 Magnitude
V0 Magnitude
Vφ RMS
  All phase-neutral voltages (φ = A, B, C).
Frequency
I1 Magnitude
I1 Angle
I2 Magnitude
I2 Angle
I0 Magnitude
I0 Angle
V1 Magnitude
V1 Angle
V2 Magnitude
V2 Angle
V0 Magnitude
V0 Angle
VN2 Measured Mag
VN2 Measured Ang

Measurements 2

φ Phase Watts
φ Phase VArs
φ Phase VA
All phase segregated power measurements,
real, reactive and apparent (φ = A, B, C).
3 Phase Watts
3 Phase VArs
3 Phase VA
NPS Power S2
3Ph Power Factor
φPh Power Factor
  Independent power factor measurements for
  all three phases (φ = A, B, C).
3Ph WHours Fwd
3Ph WHours Rev
3Ph VArHours Fwd
3Ph VArHours Rev
3Ph W Fix Demand
3Ph VArs Fix Dem
Iφ Fixed Demand
  Maximum demand currents measured on a
  per phase basis (φ = A, B, C).
3Ph W Roll Dem
3Ph VArs Roll Dem
Iφ Roll Demand
  Maximum demand currents measured on a
  per phase basis (φ = A, B, C).
3Ph W Peak Dem
3Ph VAr Peak Dem
Iφ Peak Demand

  Maximum demand currents measured on a
  per phase basis (φ = A, B, C).
Reset Demand: No/Yes

Measurements 3

Iφ Magnitude
Iφ Phase Angle
  Per phase (φ = A-2, B-2, C-2) current
  measurements
IA Differential
IB Differential
IC Differential
IA Bias
IB Bias
IC Bias
IREF Diff
IREF Bias
VN 3rd harmonic
NPS Thermal
Reset NPS Thermal: No/Yes
RTD1-10
RTD Open Cct
RTD Short Cct
RTD Data Error
Reset RTD1-10: No/Yes
A Ph Sen Watts
A Ph Sen VArs
A Phase Power Angle
Thermal Overload
Reset Thermal O/L: No/Yes
CLIO Input 1/2/3/4
F Band1-6 Time(s)
Reset Freq Band1-6: No/Yes
Reset Freq Bands: No/Yes
Volts/Hz
64S Magnitude
64S I Magnitude
64S I Angle
64S R secondary
64S R primary
64R CL Input
64R R Fault

Circuit breaker monitoring statistics

CB Operations
Total Iφ Broken
  Cumulative breaker interruption duty on a
  per phase basis (φ = A, B, C).
CB Operate Time
Reset CB Data: No/Yes

OPERATION (P34x/EN OP/J76)

2.14 Read only mode

With IEC 61850 and Ethernet/Internet communication capabilities, security has become a pressing issue. The Px40 relay provides a facility to allow the user to enable or disable the change in configuration remotely. This feature is available only in relays with Courier, Courier with IEC 60870-5-103, Courier with IEC 61850 and IEC 61850 protocol options. It has to be noted that in IEC 60870-5-103 protocol, Read Only Mode function is different from the existing Command block feature.

Read only mode can be enabled/disabled for the following rear ports:

• Rear Port 1 - IEC 60870-5-103 and Courier protocols

• Rear Port 2 (if fitted) - Courier protocol

• Ethernet Port (if fitted) - Courier protocol ("tunneled")

FIRMWARE DESIGN (P34x/EN FD/J76)

2.8 Ethernet board

For IEC 61850 over Ethernet two boards are available, the single Ethernet board (ZN0049) and the redundant Ethernet board (ZN0071). Both are required for communications but the dual redundant Ethernet board allows an alternative path to be always available, providing bumpless redundancy.

The optional Ethernet board (ZN0049) has three variants which support the IEC 61850 implementation:

• 100 Mbits/s Fiber Optic + 10/100 Mbits/s Copper

• 100 Mbits/s Fiber Optic + 10/100 Mbits/s Copper + modulated IRIG-B

• 100 Mbits/s Fiber Optic + 10/100 Mbits/s Copper + un-modulated IRIG-B

The single Ethernet port card is fitted into Slot A of the relay, which is the optional communications slot. Each Ethernet card has a unique MAC address used for Ethernet communications. This is printed on the rear of the card, alongside the Ethernet sockets.

The 100 Mbits/s Fiber Optic ports use ST® type connectors and are suitable for 1300 nm multi-mode fiber type.

The single Ethernet port board has copper ports using RJ45 type connectors. When using copper Ethernet, it is important to use Shielded Twisted Pair (STP) or Foil Twisted Pair (FTP) cables, to shield the IEC 61850 communications against electromagnetic interference. The RJ45 connector at each end of the cable must be shielded, and the cable shield must be connected to this RJ45 connector shield, so that the shield is grounded to the relay case. Both the cable and the RJ45 connector at each end of the cable must be Category 5 minimum, as specified by the IEC 61850 standard. It is recommended that each copper Ethernet cable is limited to a maximum length of three meters and confined within one bay/cubicle.

When using IEC 61850 communications through the Ethernet card, the rear EIA(RS)485 and front EIA(RS)232 ports are also available for simultaneous use, both using the Courier protocol.

The physical layout of the single port Ethernet board is shown in figure 5.

Industrial network failure can be disastrous. Redundancy provides increased security and reliability, but also devices can be added to or removed from the network without network downtime.

The following list shows Alstom Grid's implementation of Ethernet redundancy, which has six variants with embedded IEC 61850 over Ethernet, plus SHP, RSTP and DHP redundancy protocols.

- Self Healing Protocol (SHP) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and modulated IRIG-B input.
- Self Healing Protocol (SHP) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and unmodulated IRIG-B input.

> **Note:**   Both of these boards offer compatibility with C264-SWR202 and MiCOM H35x multi-mode switches. Self healing Protocol is an Alstom Grid proprietary solution providing extremely fast recovery time.

- Rapid Spanning Tree Protocol (RSTP IEEE 802.1D 2004) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and modulated IRIG-B input.
- Rapid Spanning Tree Protocol (RSTP IEEE 802.1D 2004) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and unmodulated IRIG-B input.

> **Note:** Both of these boards offer the RSTP protocol.

- Dual Homing Protocol (DHP) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and modulated IRIG-B input.
- Dual Homing Protocol (DHP) with 1300 nm multi mode 100BaseFx fiber optic Ethernet ports (ST® connector) and unmodulated IRIG-B input.

> **Note:**   Both of these boards offer compatibility with C264-SWD202 and H36x multi-mode switches. Dual Homing Protocol is an Alstom Grid proprietary solution providing bumpless redundancy to the IED.

The redundant Ethernet board is fitted into Slot A of the IED, which is the optional communications slot. Each Ethernet board has two MAC addresses, one for the managed embedded switch and one for the IED. The MAC address of the IED is printed on the rear panel of the IED. See the Redundant Ethernet Board User Guide, *Px4x/EN REB* for more information on redundant Ethernet communications.
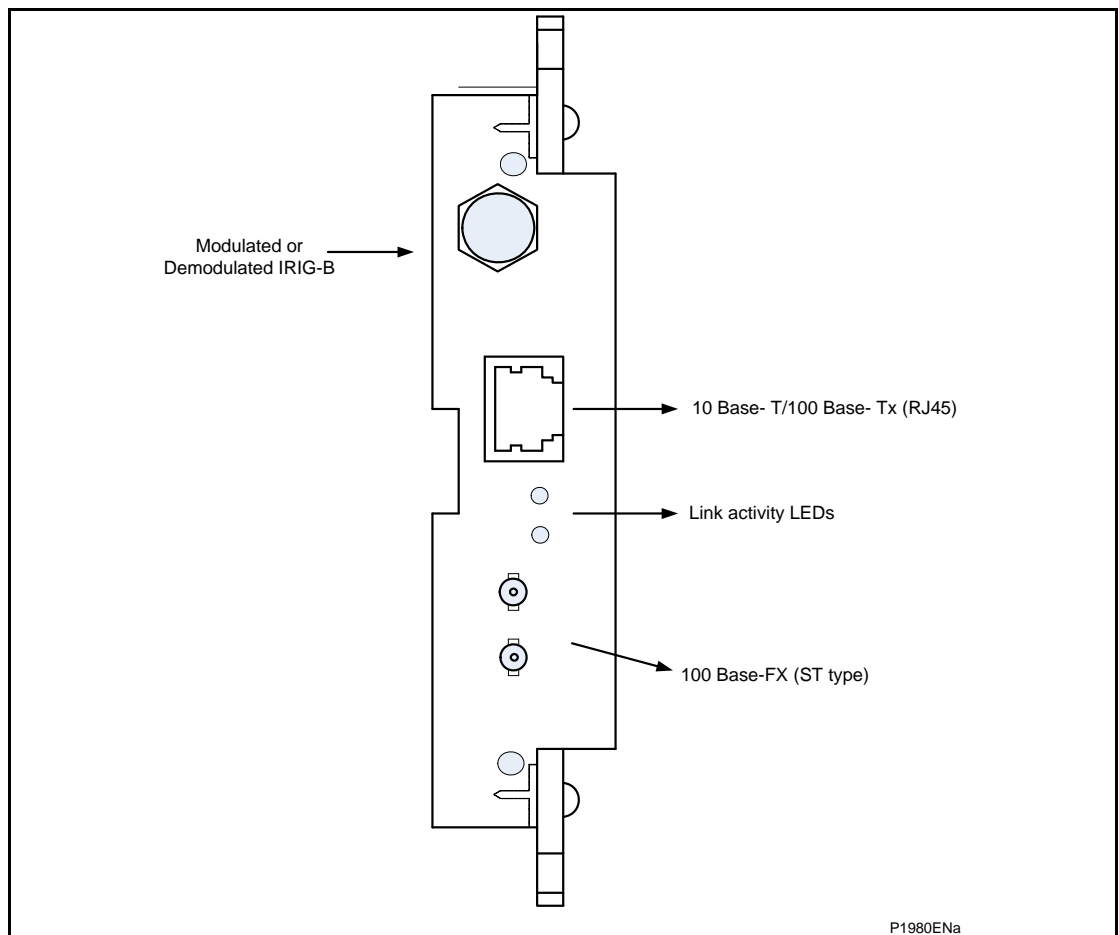

Modulated or Demodulated IRIG-B

10 Base- T/100 Base- Tx (RJ45)

Link activity LEDs

100 Base-FX (ST type)

P1980ENa
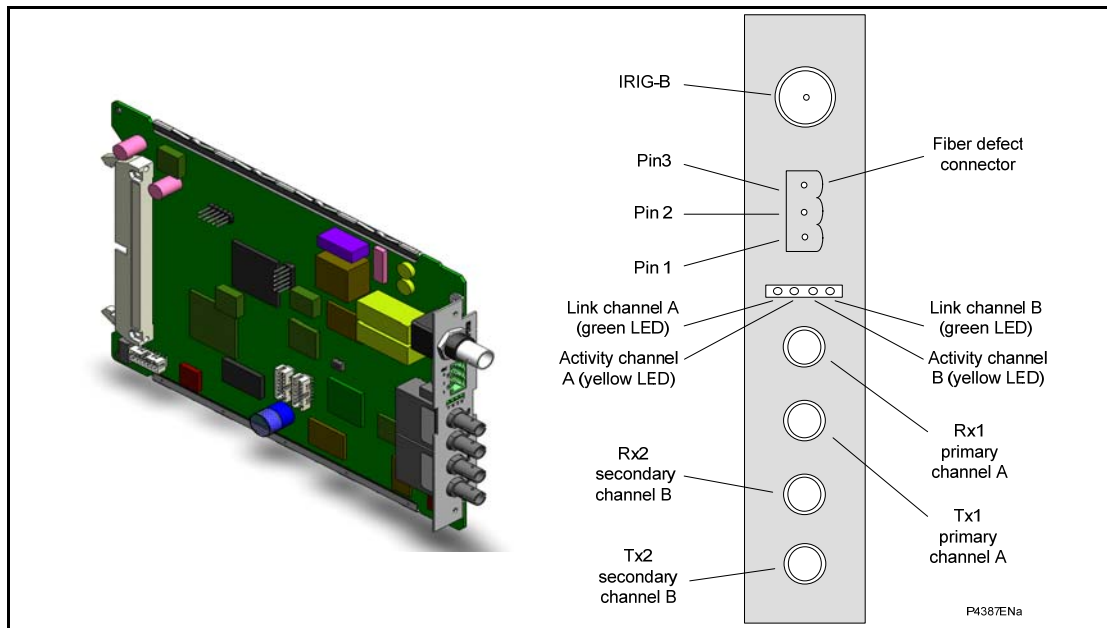
Figure 5: Ethernet board (optional)

Figure 6: Redundant Ethernet board connectors

SCADA COMMUNICATIONS (P34x/EN SC/J76)

7.3.1   Capability

The IEC 61850 interface provides the following capabilities:

- Read access to measurements

All measurands are presented using the measurement Logical Nodes, in the 'Measurements' Logical Device. Reported measurement values are refreshed by the relay once per second, in line with the relay user interface.

- Generation of unbuffered reports on change of status/measurement

Unbuffered reports, when enabled, report any change of state in statuses and/or measurements (according to deadband settings).

- Support for time synchronization over an Ethernet link

Time synchronization is supported using SNTP (Simple Network Time Protocol); this protocol is used to synchronize the internal real time clock of the relays.

- GOOSE peer-to-peer communication

GOOSE communications of statuses are included as part of the IEC 61850 implementation. Please see section 7.6 for more details.

- Disturbance record extraction

Extraction of disturbance records, by file transfer, is supported by the MiCOM relays. The record is extracted as an ASCII format COMTRADE file.

- Controls

The following control services are available:

- Direct Control
- Direct Control with enhanced security
- Select Before Operate (SBO) with enhanced security

Controls shall be applied to open and close circuit breakers via XCBR.Pos and DDB signals 'Control Trip' and 'Control Close'.

System/LLN0. LLN0.LEDRs shall be used to reset any trip LED indications.

- Reports

Reports only include data objects that have changed and not the complete dataset. The exceptions to this are a General Interrogation request and integrity reports.

- Buffered Reports

Eight Buffered Report Control Blocks, (BRCB), are provided in SYSTEM/LLN0 in Logical Device 'System'

Buffered reports are configurable to use any configurable dataset located in the same Logical device as the BRCB (i.e. SYSTEM/LLN0)

- Unbuffered Reports

Sixteen Unbuffered Report Control Blocks, (URCB) are provided in SYSTEM/LLN0 in Logical Device 'System'

Unbuffered reports are configurable to use any configurable dataset located in the same Logical device as the URCB (i.e. SYSTEM/LLN0)

- Configurable Data Sets

It is possible to create and configure datasets in any Logical Node using the IED Configurator. The maximum number of datasets will be specified in an IEDs ICD file. An IED is capable of handling 100 datasets.

- Published GOOSE message

Eight GOCBs are provided in SYSTEM/LLN0.

- Uniqueness of control

Uniqueness of control mechanism is implemented in the P34x to have consistency with the PACiS mechanism. This requires the relay to subscribe to the OrdRun signal from all devices in the system and be able to publish such a signal in a GOOSE message.

- Select Active Setting Group

Functional protection groups can be enabled/disabled via private mod/beh attributes in Protection/LLN0.OcpMod object. Setting groups are selectable using the Setting Group Control Block class, (SGCB). The Active Setting Group can be selected using the System/LLN0.SP.SGCB.ActSG data attribute in Logical Device 'System'.

- Quality for GOOSE

It is possible to process the quality attributes of any Data Object in an incoming GOOSE message. Devices that do not support IEC 61850 Quality flags shall send quality attributes as all zeros.

- Address List

An Address List document (to be titled ADL) is produced for each IED which shows the mapping between the IEC 61850 data model and the internal data model of the IED. It includes a mapping in the reverse direction, which may be more useful. This document is separate from the PICS/MICS document.

- Originator of Control

Originator of control mechanism is implemented for operate response message and in the data model on the ST of the related control object, consistent with the PACiS mechanism.

Setting changes (e.g. of protection settings) are not supported in the current IEC 61850 implementation. In order to keep this process as simple as possible, such setting changes are done using MiCOM S1 Studio Settings & Records program. This can be done as previously using the front port serial connection of the relay, or now optionally over the Ethernet link if preferred (this is known as "tunneling").

7.8 Redundant Ethernet communication ports

For information regarding the Redundant Ethernet communication ports and the three redundancy protocols available, RSTP (Rapid Spanning Tree Protocol), SHP (Self Healing Protocol) and DHP (Dual Homing Protocol), refer to the User Guide, *Px4x/EN REB*.

INSTALLATION (P34x/EN IN/J76)

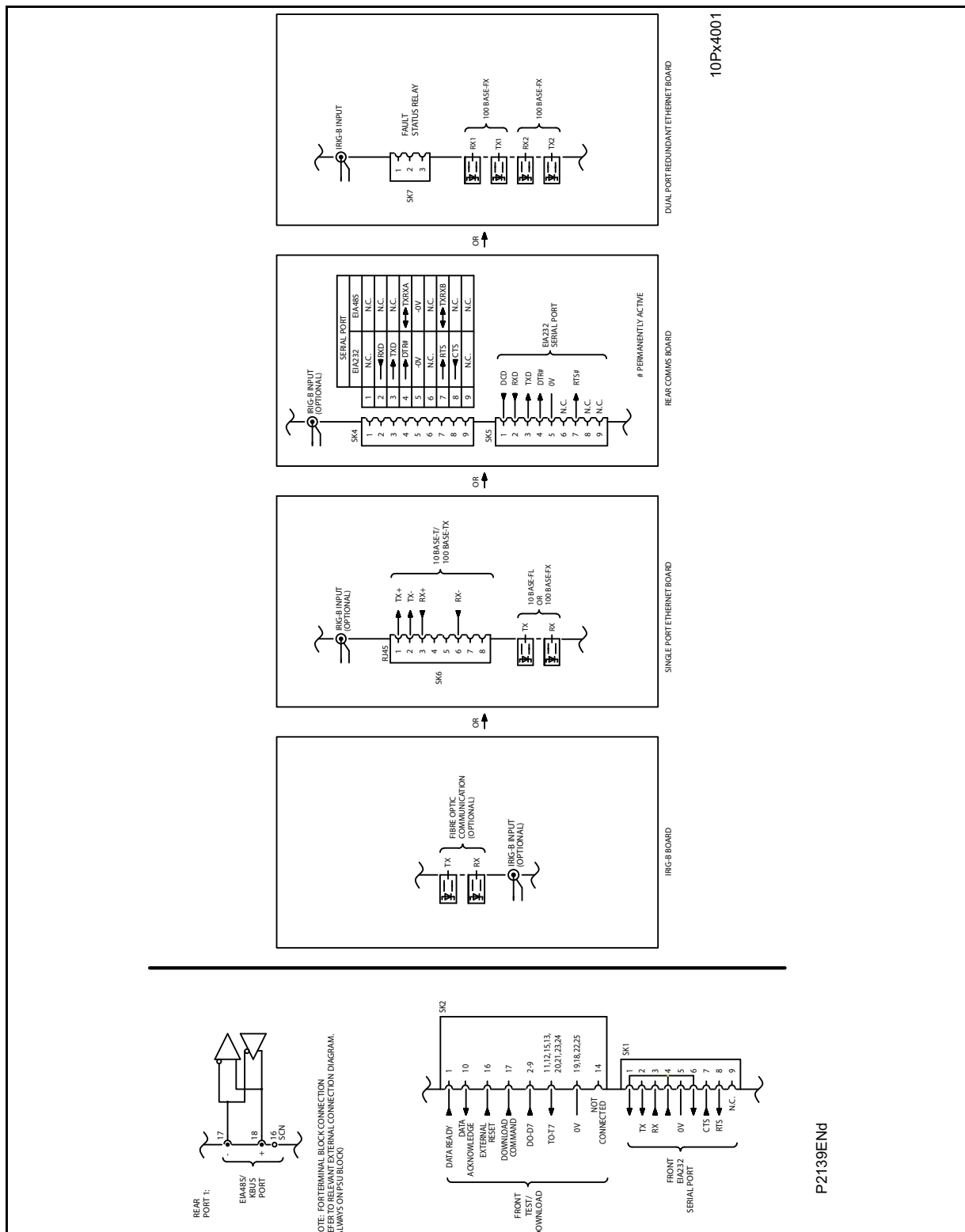### 10 P34x External connection diagram

Figure 9: Comms. options MiCOM Px40 platform

FIRMWARE AND SERVICE MANUAL VERSION HISTORY (P34x/EN VH/J76)

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
01	A	A	Oct 1999	Original Issue	V1.09 or Later	TG8614A
	B	A	Dec 1999	✓ Corrected 90 degree phase angle displacement in measurement of Ia, Ib, Ic ✓ Corrected RTD temperature and invalid system frequency measurements in MODBUS fault records ✓ Corrected VT scaling factors for Va, Vb, Vc in fault records ✓ Minor bug fixes	V1.09 or Later	TG8614A
	C	A	Mar 2000	✓ Trip LED status saved during power cycling ✓ Corrections to omission of fault duration and CB operating time in fault record ✓ Corrected -90 degree phase angle displacement in measurement of VN and VN derived ✓ Reset of alarms and indications event added to event record ✓ Minor bug fixes	V1.09 or Later	TG8614A
02	A	A	Oct 2000	✓ DNP 3.0 protocol added ✓ Courier and MODBUS enhancements to improve compatibility with other protection (mainly PX20 products) ✓ Modifications to IEC 60870-5-103 Test Mode ✓ Poledead logic DDB signals made visible in PSL ✓ Foreign Language text updated ✓ Active and reactive power added to MODBUS fault record ✓ Minor bug fixes	V1.10 or Later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
03	A	A	Jan 2001	✓ Event filtering added ✓ Correction to energy measurement inaccuracy ✓ Minor bug fixes	V2.00 or Later	TG8614B
	B	A	May 2001	✓ Correction to NPS Alarm operation ✓ Minor bug fixes	V2.00 or Later	TG8614B
	C	A	Jan 2002	✓ Resolved possible reboot caused by Disturbance Recorder ✓ Minor bug fixes	V2.00 or Later	TG8614B
	D	A	Feb 2002	✓ Resolved possible reboot caused by invalid MODBUS requests ✓ Minor bug fixes	V2.00 or Later	TG8614B
	E	A	Dec 2002	✓ DNP 3.0 Object 12 "CROB" implementation is now compliant for simple function points ✓ DNP 3.0 Object 10 included in Class 0 poll ✓ DNP 3.0 support for season in time information ✓ Correction to MODBUS CB Trip and Close via "0" command ✓ Change to neutral voltage displacement protection and directional SEF protection so that they are not blocked by the VT supervision logic when the VN Input and ISEF>VNPol are selected as Measured ✓ Correction to undervoltage stage 2 (V<2) setting range. The setting range has been increased from 10-70 V to 10-120 V (Vn=110/120 V) so that it is the same as V<1 ✓ Correction to VT ratio scaling problem in the disturbance recorder ✓ Improvement to the RTD start-up calibration routine ✓ Minor bug fixes	V2.00 or Later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
03 Cont	F	A	Mar 2004	✓ Improvement to the differential protection performance at low frequencies ✓ Correction to the fault recorder window for current based trips so that it can terminate properly once the FAULT_REC_TRIG signal (DDB 288) is reset. Previously it needed to wait for Relay 3 to reset also before termination ✓ Power measurement limits added to prevent non zero values with no current and voltage. Also power factor measurements limited to +/-1 ✓ Resolved possible reboot caused by failure to time sync. from DNP 3.0 when IRIG-B is active which is also providing the time sync. Now, any failure of the DNP 3.0 to time sync. will only produce a maintenance record ✓ Correction to French, German and Spanish language menu text for generator differential IS2 setting [3004] which incorrectly refers to the setting as IS1. ✓ Resolved possible problem with disturbance recorder triggering which could cause loss of disturbance record data, temporary freezing of the user interface or loss of rear port communications ✓ Resolved unreliable MODBUS framing ✓ Resolved creation of spurious password expired event when menu cell or MODBUS register is accessed ✓ Resolved error code 0x 8D840000 ✓ Minor bug fixes	V2.00 or Later	TG8614B
	G	A	Jun 2004	✓ For Courier/DNP 3.0/IEC 60870-5-103 builds only ✓ Correction to parity setting for MODBUS and DNP 3.0 when the relay is powered up ✓ Improvement to the self checking of the analog channels and SRAM ✓ Minor bug fixes	V2.00 or later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
03 Cont	H	A	Jul 2004	✓ For MODBUS builds only ✓ Changes as for G ✓ Improvement to the MODBUS driver to cope better with spurious data transmissions and failures of the relay to respond to commands where the server response time is fast ✓ Minor bug fixes	V2.00 or later	TG8614B
	J	A	Jun 2005	✓ Correction to the alarm and trip indication of the faulted phase(s) for the second stage of the undervoltage and overvoltage protection in the fault record information on the relay LCD ✓ Correction to false frequency protection start at power-up ✓ MODBUS driver modified to prevent relay reboot with error code 0x8C810000 in hardware A/B/C relays for 60 Hz applications where fast polling and high baud rates are used ✓ Modification to prevent reboot when large number of control and settings are sent to relay in quick succession over DNP 3.0 ✓ Minor bug fixes	V2.00 or later	TG8614B
04	A	A	Jun 2001	✓ **Not released to production** ✓ Pole slipping and sensitive reverse power added ✓ 100% stator earth fault protection enhancements. W/VAr/VA inhibit elements added to 3rd harmonic undervoltage protection and 3rd harmonic overvoltage protection added ✓ Neutral voltage displacement threshold, VN>1/2, increased from 50 to 80 V (Vn=100/120 V), 200 to 320 V (Vn=380/480 V) ✓ Earth fault polarizing voltage threshold, Vnpol, increased from 22 to 88 V (Vn=100/120 V) and 88 to 352 V (Vn=380/480 V) ✓ Cos phi and sin phi features added to SEF protection ✓ Minor bug fixes	V2.01 or later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
04 Cont.	B	A	Jul 2001	✓ **Not released to production** ✓ Minor bug fix to background self-check diagnostics introduced in 04A	V2.01 or later	TG8614B
	C	A	Dec 2001	✓ Correction to Courier NPS thermal reset command ✓ Minor bug fixes	V2.01 or later	TG8614B
	D	A	Jan 2002	✓ Resolved possible reboot caused by Disturbance Recorder ✓ Minor bug fixes	V2.01 or later	TG8614B
	E	A	Feb 2002	✓ Resolved possible reboot caused by invalid MODBUS requests ✓ Minor bug fixes	V2.01 or later	TG8614B
	F	A	Dec 2002	✓ Enhanced DNP 3.0 Object 10 support for Pulse On/Close control points ✓ DNP 3.0 Object 10 included in Class 0 poll ✓ DNP 3.0 support for season in time information ✓ Correction to MODBUS CB Trip and Close via "0" command ✓ Change to neutral voltage displacement protection and directional SEF protection so that they are not blocked by the VT supervision logic when the VN Input and ISEF>VNPol are selected as Measured ✓ Correction to undervoltage stage 2 (V<2) setting range. The setting range has been increased from 10-70 V to 10-120 V (Vn=110/120 V) so that it is the same as V<1 ✓ Correction to VT ratio scaling problem in the disturbance recorder ✓ Improvement to the RTD start-up calibration routine ✓ Minor bug fixes	V2.01 or later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
04 Cont.	G	A	Mar 2004	✔ Improvement to the differential protection performance at low frequencies ✔ Correction to the fault recorder window for current based trips so that it can terminate properly once the FAULT_REC_TRIG signal (DDB 288) is reset. Previously it needed to wait for Relay 3 to reset also before termination ✔ Power measurement limits added to prevent non zero values with no current and voltage. Also power factor measurements limited to +/-1	V2.01 or later	TG8614B
	G	A	Mar 2004	✔ Resolved possible reboot caused by failure to time sync. from DNP 3.0 when IRIG-B is active which is also providing the time sync. Now, any failure of the DNP 3.0 to time sync. will only produce a maintenance record ✔ Correction to French, German and Spanish language menu text for generator differential IS2 setting [3004] which incorrectly refers to the setting as IS1 ✔ Resolved possible problem with disturbance recorder triggering which could cause loss of disturbance record data, temporary freezing of the user interface or loss of rear port communications ✔ Resolved unreliable MODBUS framing ✔ Resolved creation of spurious password expired event when menu cell or MODBUS register is accessed ✔ Resolved error code 0x 8D840000 ✔ Minor bug fixes	V2.01 or later	TG8614B
	(1)G	A	Mar 2004	✔ Changes are the same as 04G ✔ Special for Powerformer stuck pole breaker fail application where the neutral voltage displacement setting range has been increased from 80 to 200 V (Vn-100/120 V) ✔ MODBUS build only	V2.01 or later	TG8614B

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
04 Cont.	H	A	Jun 2004	✓ For Courier/DNP 3.0/IEC 60870-5-103 builds only ✓ Correction to parity setting for MODBUS and DNP 3.0 when the relay is powered up ✓ Improvement to the self checking of the analog channels and SRAM	V2.01 or later	TG8614B
	J	A	Jul 2004	✓ For MODBUS builds only ✓ Changes as for H ✓ Improvement to the MODBUS driver to cope better with spurious data transmissions and failures of the relay to respond to commands where the server response time is fast ✓ Minor bug fixes	V2.01 or later	TG8614B
	K	A	Jun 2005	✓ Changes are the same as 03J	V2.01 or later	TG8614B

Relay type: P342/3/4/5 ...						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05	A	A/B	Sep 2001	✔ Not released to production ✔ Thermal overload protection added ✔ Additional stage of under-impedance protection ✔ Control inputs added ✔ PSL DDB list of signals increased from 512 to 1023 signals ✔ PSL Data menu added with PSL Reference information for version history ✔ Optional additional opto inputs and output contacts with a larger case size option available ✔ New 'Universal' wide ranging opto inputs (Model number hardware suffix changed to B) ✔ New output contacts with better break and continuous carry ratings (Model number hardware suffix changed to B) ✔ Minor bug fixes ✔ Courier and MODBUS builds only	V2.05 or Later	P34x/EN T/C11

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	B	A/B	Oct 2001	✓ Not released to production ✓ Correction to VT ratio scaling problem in the disturbance recorder ✓ Minor bug fixes ✓ Courier and MODBUS builds only	V2.05 or Later	P34x/EN T/C11
	1(C)	A/B	Aug 2000	✓ IEC 60870-5-103 build with special private code mapping for ALSTOM Power project in Iceland. Includes private codes and uncompressed disturbance recorder ✓ Resolved possible reboot caused by Disturbance Recorder ✓ Minor bug fixes ✓ IEC60870-5-103 build only	V2.05 or Later	P34x/EN T/C11
	D	A/B	Feb 2002	✓ Resolved possible reboot caused by Disturbance Recorder ✓ Resolved possible reboot caused by invalid MODBUS requests ✓ Enhancements to IEC 60870-5-103 build to include private codes, monitor blocking and disturbance record extraction. New uncompressed disturbance recorder for IEC 60870-5-103 build only ✓ Correction to Courier NPS thermal reset command ✓ Correction to IEC 60870-5-103 voltage measurements for Vn=380/480 V relays ✓ Minor bug fixes	V2.05 or Later	P34x/EN T/C11
	E	A/B	Mar 2002	✓ Correction to foreign language text for System Backup protection not included in previous 05 software builds ✓ Minor bug fixes	V2.05 or Later	P34x/EN T/C11

Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	F	A/B	Oct 2002	✓ DNP 3.0 Object 12 "CROB" implementation is now compliant for simple function points ✓ Correction to MODBUS CB Trip and Close via "0" command ✓ Change to neutral voltage displacement protection and directional SEF protection so that they are not blocked by the VT supervision logic when the VN Input and ISEF>VNPol are selected as Measured ✓ Correction to undervoltage stage 2 (V<2) setting range. The setting range has been increased from 10-70 V to 10-120 V (Vn=110/120 V) so that it is the same as V<1 ✓ Improvement to the RTD start-up calibration routine ✓ Minor bug fixes	V2.05 or later	P34x/EN T/C11
	1(F)	A/B	Oct 2002	✓ IEC 60870-5-103 build with special private code mapping for ALSTOM Power project in Iceland. Includes private codes and uncompressed disturbance recorder ✓ Correction to IEC 60870-5-103 voltage measurements for Vn=380/480 V relays ✓ Correction to foreign language text for System Backup protection not included in previous 05 software builds ✓ Change to neutral voltage displacement protection and directional SEF protection so that they are not blocked by the VT supervision logic when the VN Input and ISEF>VNPol are selected as Measured	V2.05 or later	P34x/EN T/C11
	1(F)	A/B	Oct 2002	✓ Improvement to the RTD start-up calibration routine ✓ Minor bug fixes ✓ IEC 60870-5-103 build only	V2.05 or later	P34x/EN T/C11

Relay type: P342/3/4/5 …

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	G	A/B	Mar 2004	✓ Control input states added to non-volatile memory ✓ German language text updated ✓ Power measurement limits added to prevent non zero values with no current and voltage. Also power factor measurements limited to +/-1 ✓ In the Commissioning Test menu the DDB status has been made visible on the front panel display ✓ Support for Trip LED Status and Alarm Status added to G26 data type for MODBUS register 30001 ✓ Correction to the CB trip/Close functionality via MODBUS so that local/remote setting in the CB Control menu is not ignored ✓ Correction to MODBUS auto event extraction which does not work correctly ✓ DNP 3.0 Object 12 "CROB" implementation is now compliant for simple function points ✓ DNP 3.0 object 10 added to class 0 poll ✓ Correction to DNP 3.0 time sync. operation so that it does not modify the season bit in the time stamp ✓ Improvement to the differential protection performance at low frequencies	V2.05 or Later	P34x/EN T/C11

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	G	A/B	Mar 2004	✓ Correction to the manual reset user alarms so that the event record shows the alarm turning off only when a reset command has been issued. Previously the "alarm off" event is produced once the initiating signal is removed ✓ Correction to the fault recorder window for current based trips so that it can terminate properly once the FAULT_REC_TRIG signal (DDB 288) is reset. Previously it needed to wait for Relay 3 to reset also before termination ✓ DDB 649 for pole slip reactance line start removed from the event list ✓ Resolved possible reboot caused by failure to time sync. from DNP 3.0 when IRIG-B is active which is also providing the time sync. Now, any failure of the DNP 3.0 to time sync. will only produce a maintenance record ✓ Correction to French, German and Spanish language menu text for generator differential IS2 setting [3004] which incorrectly refers to the setting as IS1 ✓ Correction to the alarm and trip indication of the faulted phase(s) for the second stage of the undervoltage and overvoltage protection in the fault record information on the relay LCD ✓ Correction to the C32CS error when extracting and saving an uncompressed disturbance record from the P34x through the front port using MiCOM S1 Studio. This only applies to P34x IEC 60870-5-103 protocol builds since this is the only communication option that supports uncompressed disturbance records. The error is caused by unavailable opto inputs or relay contacts being assigned to digital inputs in the Disturbance Recorder menu	V2.05 or Later	P34x/EN T/C11
	G	A/B	Mar 2004	✓ Resolved possible problem with disturbance recorder triggering which could cause loss of disturbance record data, temporary freezing of the user interface or loss of rear port communications ✓ Resolved unreliable MODBUS framing ✓ Resolved creation of spurious password expired event when menu cell or MODBUS register is accessed ✓ Resolved error code 0x 8D840000 ✓ Minor bug fixes	V2.05 or Later	P34x/EN T/C11

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	H	A/B	Jun 2004	✓ For Courier/DNP 3.0/IEC 60870-5-103 builds only ✓ Correction to parity setting for MODBUS and DNP 3.0 when the relay is powered up ✓ Improvement to the self checking of the analog channels and SRAM ✓ Minor bug fixes	V2.05 or later	P34x/EN T/C11
	J	A/B	Jun 2004	✓ For MODBUS builds only ✓ Changes as for H ✓ Improvement to the MODBUS driver to cope better with spurious data transmissions and failures of the relay to respond to commands where the server response time is fast ✓ Minor bug fixes	V2.05 or later	P34x/EN T/C11
	K	A/B	Jun 2005	✓ MODBUS Time Transmission Format selectable via MODBUS only setting as Standard or Reverse for transmission of byte order	V2.05 or later	P34x/EN T/C11

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
05 Cont.	K	A/B	Jun 2005	✓ V/Hz Protection drop-off/pick-up (DO/PU) ratio changed from 95% to 98% ✓ DO/PU ratio changed from 95% to 98% for Over/Under Voltage protection. Trip threshold changed from 1.05, 0.95 Vs to 1 Vs for Over and Under Voltage and NVD protection. TMS setting of Under/Over Voltage protection reduced from 0.5 to 0.05. ✓ Correction to false frequency protection start at power-up ✓ MODBUS driver modified to prevent relay reboot with error code 0x8C810000 in hardware A/B/C relays for 60 Hz applications where fast polling and high baud rates are used ✓ Modification to prevent reboot when large number of control and settings are sent to relay in quick succession over DNP 3.0 ✓ IEC 60870-5-103. Status of summer bit now works correctly in time sync. command ✓ Correction to DNP 3.0 software where settings download from MiCOM S1 Studio can fail for relays that have model dependent I/O configurations ✓ Minor bug fixes	V2.05 or later	P34x/EN T/C11
	L	A/B	July 2007	✓ Correction to menu cell addressing for 05K. Version 05K software was built from 31 software to incorporate latest bug fixes. In doing this build of the 05K software the menu cell addressing changes that are in 06 software were included. These mainly affect the cell addresses of functions which have IDMT characteristics. The result is the default S1 files for 05 software are not compatible with a relay with 05K software. The 05L software fixes this problem so now the default S1 files for 05 software are compatible with a relay with 05L software. ✓ Minor bug fixes	V2.05 or later	P34x/EN T/C11

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
	A	A/C	Aug 2000	✓ **Not released to production** ✓ Additional IDMT characteristics for overcurrent and voltage dependent overcurrent protection (rectifier and RI curve), earth fault protection (RI and IDG curve) and sensitive earth fault protection (IDG curve)	V2.06 or Later	P34x/EN T/D22
06	A	A/C	Aug 2000	✓ Change to time dial setting range of IEEE and US curves. Previously curves were based on TD/7 where TD = 0.5-15. Now, curves are based on TD where TD = 0.01-100. Also, includes change to US ST Inverse (C02) curve. K constant and L constant multiplied x 7 because of change to TD, now K=0.16758 and L=0.11858 ✓ Angle measurements for sequence quantities in Measurements 1 menu added ✓ Interturn protection added ✓ Optional 2nd rear communication port added ✓ New power supply with increased output rating and reduced dc inrush current (typically < 10A). (Model number hardware changed to suffix C) ✓ Wider setting range for Power and Sensitive Power protection. P>1/2 (reverse power) and P<1/2 (low forward power) maximum setting changed from 40 In to 300 In W (Vn=100/120 V) and from 160 In W to 1200 In W (Vn=380/480 V). Sen. –P>1/2 and Sen. P<1/2 maximum setting changed from 15In to 100In W (Vn=100/120 V) and from 60 In to 400 In W (Vn=380/480 V). There is also an additional setting for the Power and Sensitive Power protection to select the Operating mode as Generating or Motoring ✓ Wider setting range for the voltage dependent overcurrent protection. Volt Dep. OC V<1 and V<2 minimum setting changed from 20 to 5 V (Vn=100/120 V) and from 80 to 20 V (Vn=380/480 V). V Dep. OC k Set minimum setting changed from 0.25 to 0.1 ✓ Maximum overfrequency protection setting increased from 65 to 68 Hz	V2.06 or Later	P34x/EN T/D22

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
06 Cont.	A	A/C	Aug 2000	✔ Change to undervoltage stage 2 (V<2) setting range to correct an error. The setting range has been increased from 10-70 V to 10-120 V (Vn=100/120 V) so that it is the same as V<1 ✔ Change to neutral voltage displacement protection and directional SEF protection so that they are now not blocked by the voltage transformer supervision logic when the VN Input and ISEF> VN Pol are selected as Measured ✔ Includes all the improvements and corrections in 05F software except for 2 enhancements shown for 06B ✔ Minor bug fixes	V2.06 or Later	P34x/EN T/D22
	B	A/C	Oct 2002	✔ Correction to undervoltage stage 2 (V<2) setting range. The setting range has been increased from 10-70 V to 10-120 V (Vn=110/120 V) so that it is the same as V<1 ✔ Enhancements to IEC 60870-5-103 build to include private codes, monitor blocking and disturbance record extraction. New uncompressed disturbance recorder for IEC 60870-5-103 build only ✔ Improvement to the RTD start-up calibration routine ✔ Minor bug fixes	V2.06 or Later	P34x/EN T/D22
	C	A/C	Mar 2004	✔ Changes are the same as 05G	V2.06 or Later	P34x/EN T/D22
	D	A/C	Jun 2004	✔ For Courier/DNP 3.0/IEC 60870-5-103 builds only ✔ Correction to parity setting for MODBUS and DNP 3.0 when the relay is powered up ✔ Improvement to the self checking of the analogue channels and SRAM	V2.06 or later	P34x/EN T/D22

Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
06 Cont.	D	A/C	Jun 2004	✓ Minor bug fixes	V2.06 or later	P34x/EN T/D22
	E	A/C	Jul 2004	✓ For MODBUS builds only ✓ Changes as for D ✓ Improvement to the MODBUS driver to cope better with spurious data transmissions and failures of the relay to respond to commands where the server response time is fast ✓ Minor bug fixes	V2.06 or later	P34x/EN T/D22
	F	A/C	Jun 2005	✓ Changes are the same as 05K		
	G	A/C	July 2009	✓ This release is specific for Hydro Quebec (HQ) to provide a P343 relay with modified single phase sensitive power protection which uses B Phase to calculate sensitive power as apposed to A-Phase in the standard software versions.	V2.06 or later	P34x/EN T/D22
07	A	A/C	Apr 2003	✓ **Not released to production** ✓ Optional additional 4 analog inputs and 4 outputs (current loop inputs and outputs - CLIO) ✓ Additional setting to select the current inputs (IA-1, IB-1, IC-1 or IA-2, IB-2, IC-2) used for the breaker fail undercurrent ✓ Two new hardware configurations - (1) 32 Inputs, 16 Outputs, RTD, CLIO (2) 16 Inputs, 32 Outputs, RTD, CLIO ✓ Number of alarms increased from 64 to 96 (New Alarm Status 3 word - 32 bit) ✓ Additional user alarms. Previously 1 manual reset and 2 self reset user alarms, now 12 manual reset and 4 self reset user alarms ✓ Control Input states added to non volatile memory ✓ German language text updated ✓ Courier and MODBUS builds only	V2.09 or Later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
07 Cont.	A	A/C	Apr 2003	✓ Minor bug fixes	V2.09 or Later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)
	B	A/C	Oct 2003	✓ Power measurement limits added to prevent non zero values with no current and voltage. Also power factor measurements limited to +/-1 ✓ In the Commissioning Test menu the DDB status has been made visible on the front panel display ✓ Support for Trip LED Status and Alarm Status added to G26 data type for MODBUS register 30001 ✓ Correction to the CB trip/Close functionality via MODBUS so that local/remote setting in the CB Control menu is not ignored ✓ Correction to MODBUS auto event extraction which does not work correctly in versions 05 and 06 software ✓ Extension of the control input functionality to support pulse and latch operations in DNP3.0 ✓ DNP 3.0 object 10 added to class 0 poll ✓ Correction to DNP 3.0 time sync. operation so that it does not modify the season bit in the time stamp ✓ Improvement to the differential protection performance at low frequencies	V2.09 or Later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)
	B	A/C	Oct 2003	✓ Correction to the manual reset user alarms so that the event record shows the alarm turning off only when a reset command has been issued. Previously the "alarm off" event is produced once the initiating signal is removed ✓ Correction to the fault recorder window for current based trips so that it can terminate properly once the FAULT_REC_TRIG signal (DDB 288) is reset. Previously it needed to wait for Relay 3 to reset also before termination ✓ DDB 649 for pole slip reactance line start removed from the event list ✓ Minor bug fixes	V2.09 or Later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
07 Cont.	C	A/C	Mar 2004	✔ Resolved possible reboot caused by failure to time sync. from DNP 3.0 when IRIG-B is active which is also providing the time sync. Now, any failure of the DNP 3.0 to time sync. will only produce a maintenance record ✔ Correction to French, German and Spanish language menu text for generator differential IS2 setting [3004] which incorrectly refers to the setting as IS1 ✔ Correction to the alarm and trip indication of the faulted phase(s) for the second stage of the undervoltage and overvoltage protection in the fault record information on the relay LCD ✔ Correction to the C32CS error when extracting and saving an uncompressed disturbance record from the P34x through the front port using MiCOM S1 Studio. This only applies to P34x IEC 60870-5-103 protocol builds since this is the only communication option that supports uncompressed disturbance records. The error is caused by unavailable opto inputs or relay contacts being assigned to digital inputs in the Disturbance Recorder menu ✔ Resolved possible problem with disturbance recorder triggering which could cause loss of disturbance record data, temporary freezing of the user interface or loss of rear port communications ✔ Resolved unreliable MODBUS framing ✔ Resolved error code 0x 8D840000 ✔ Minor bug fixes	V2.09 or Later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)
	D	A/C	Jun 2004	✔ For Courier/DNP 3.0/IEC 60870-5-103 builds only ✔ Correction to parity setting for MODBUS and DNP 3.0 when the relay is powered up ✔ Improvement to the self checking of the analog channels and SRAM ✔ Minor bug fixes	V2.09 or later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
07 Cont.	E	A/C	Jul 2004	✓ For MODBUS builds only ✓ Changes as for D ✓ Improvement to the MODBUS driver to cope better with spurious data transmissions and failures of the relay to respond to commands where the server response time is fast	V2.09 or later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)
	E	A/C	Jul 2004	✓ Minor bug fixes	V2.09 or later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)
	F	A/C	Jun 2005	✓ Changes are the same as 05 K	V2.09 or later	P34x/EN T/E33 (ALSTOM) or P34x/EN T/F33 (AREVA)

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
30	A	J	Nov 2004	✓ Not released to production ✓ Enhanced main processor board ✓ Company name change. 'ALSTOM' changed to 'MiCOM' in default Plant Reference cell and 'ALSTOM P' changed to 'MiCOM P' for ASDU5 message type, IEC protocol ✓ User interface enhancements - larger 100x33 pixel graphical display of 3 lines x 16 characters + 2 new buttons, direct access keys ✓ Control input enhancements. Selection of latched or pulsed mode, control input labels added, disturbance recorder trigger from control inputs ✓ 16 PSL Timers (previously 8) ✓ Platform alarms mapped to the DDB (Alarm Status 3) ✓ Time synchronization using an opto input ✓ Opto input power frequency filter control, enabled/disabled ✓ Courier over EIA(RS)485 can be selected for the 1st rear port in addition to existing K-Bus configuration ✓ Transmission of the first rear port protocols (MODBUS/Courier/DNP3.0) using the fiber-optic port (IEC 60870-5-103 previously available) ✓ Uncompressed disturbance recording added for Courier/MODBUS/DNP 3.0 (added to IEC 60870-5-103 protocol in 05D, 06B software) ✓ Dual Characteristic DO/PU ratio Opto Inputs (DO/PU = 60/80% or 50/70%) ✓ 512 Event records (previously 250)	V2.11 or later	P34x/EN M/G44

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
30 Cont.	A	J	Nov 2004	✓ DNP3 evolution. Scan interval for binary inputs (object 01) reduced from 5s to 0.5s. Scan interval for analog inputs (object 30) reduced from 2s to 1s. Improved minimum step size of analog input dead bands ✓ MODBUS Time Transmission Format selectable as Standard or Reverse for transmission of byte order ✓ V/Hz Protection drop-off/pick-up (DO/PU) ratio changed from 95% to 98% ✓ DO/PU ratio changed from 95% to 98% for Over/Under Voltage protection. Trip threshold changed from 1.05, 0.95 Vs to 1 Vs for Over and Under Voltage and NVD protection. TMS setting of Under/Over Voltage protection reduced from 0.5 to 0.05 ✓ CT Supervision for 2nd set of 3 phase CTs. Previously only IA/IB/IC inputs supervised ✓ Default labels changed for the digital inputs and outputs in Input Labels and Output Labels menu. Changed to be more generic - Input Lx, Output Rx ✓ Correction to false frequency protection start at power-up ✓ IEC60870-5-103. Status of summer bit now works correctly in time sync command ✓ Minor bug fixes	V2.11 or later	P34x/EN M/G44
	B	J	Dec 2004	✓ Modification to prevent reboot when large number of control and settings are sent to relay in quick succession over DNP 3.0 ✓ Correction to 2nd rear comms. port channel failure for P34xxxxxxxxxxxJ relays only ✓ Minor bug fixes	V2.11 or later	P34x/EN M/G44

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
31	A	J	Apr 2005	✓ New relay model available, the P344 (80TE case only). The P344 is based on the P343 but has an additional neutral voltage input, VN2, to provide 2 measured neutral voltage protection functions (59N) for earth fault and interturn protection ✓ 4 stages of directional overcurrent protection (67). Previous P342/3/4 software versions included 2 stages of non directional overcurrent protection ✓ 1 stage of definite time negative phase sequence overpower protection (S2=I2xV2)(32NPS). This is used in China as an interlocking signal for the neutral voltage interturn protection ✓ Independent derived/measured neutral voltage protection (59N). P341/2/3 has 2 stages of measured and 2 stages of derived neutral voltage protection ✓ P344 has 2 measured neutral voltage inputs and so has 2x2 stages of measured and 2 stages of derived neutral voltage protection. Previous software versions included 2 stages of measured or derived neutral voltage protection ✓ 6 bands of generator abnormal frequency protection (81AB). Similar to P94x 81AB function ✓ 1 definite time stage of negative phase sequence overvoltage protection (47). Same as P14x (47) function ✓ 4 definite time stages of negative phase sequence overcurrent protection (46OC). Same as P14x (46OC) function ✓ P342/3 minimum three phase power settings reduced to 0.5%Pn, previously 2%Pn. P344 3 phase power setting range is as new P343 setting range ✓ 3 additional definite time delayed overfluxing protection stages. The inverse time overfluxing characteristic has been modified to make it more consistent with competitors and to aid future enhancements. The overfluxing protection now comprises of 1 definite time alarm + 1 inverse/DT trip stage + 3 definite time trip stages	V2.11 or later	P34x/EN M/G44

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
31 Cont.	A	J	Apr 2005	✓ Correction to DNP 3.0 software where settings download from MiCOM S1 Studio can fail for relays that have model dependent I/O configurations ✓ Minor bug fixes	V2.11 or later	P34x/EN M/G44
32	A	J	Mar 2006	✓ **Not released to production** ✓ Phase rotation function added. Can select phase rotation as ABC or ACB for all 3 phase current and voltage inputs. Can also individually select which 2 phases are swapped for any of the 3 phase current and voltage inputs. New menu column 'System Config' with phase rotation settings. 'Gen Diff' menu column moved to make way for 'System Config' menu ✓ In the disturbance recorder the maximum number of analogue channels that can be recorded is increased so that all analogue inputs can be recorded. Number of analogue channels is increased from 8 to 9/12/13 for P342/3/4 ✓ Number of PSL DDB signals increased from 1023 to 1408 and DDBs re-organised. This means that the PSL created in version 32 software is not compatible to PSL created in previous software versions and vice versa ✓ Setting Group selection via 2 new DDB signals makes it possible to select a setting group via any opto input or remotely via a Control Input. Previously, the 4 setting groups could be selected using fixed opto inputs, 1 and 2 ✓ An 'Any Trip' DDB has been created to allow any contact(s) to be used as the trip indication. Previously, the Any Trip signal was defined as operation of Relay contact 3. The Any Trip signal operates the Trip LED, initiates the breaker fail logic and maintenance counters and is used in the fault recorder logic ✓ Minor changes to description of CT and VT Ratio settings ✓ Number of maintenance records increased from 5 to 10	V2.14 or later	P34x/EN M/G44 P34x/EN AD/G54

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
32 Cont.	A	J	Mar 2006	✔ Inter frame gap added between frames in multi-frame transmission of DNP 3.0 messages to be compatible with C264 ✔ Correction to error in NPS directional overcurrent operating time delay. The excess in the operating time (always less than 1s) only occurs when set to directional ✔ Correction to intermittent incorrect IRIG-B status indication of 'Card Failed' with healthy IRIG-B source ✔ Minor bug fixes	V2.14 or later	P34x/EN M/G44 P34x/EN AD/G54
	B	J	May 2006	✔ Minor bug fixes	V2.14 or later	P34x/EN M/G44 P34x/EN AD/G54
	C	J	Oct 2006	✔ New P345 relay model. The P345 includes the same functions as the P344 plus 100% stator earth fault protection via low frequency injection. The P345 also includes a new front panel with 10 function keys and 10 associated programmable LEDs. All 18 of the P345 programmable LEDs are tri-color and can be set as red, yellow or green in the PSL. P345 not released to production. ✔ MODBUS allows individual 16 bit register pairs that make up 32 bit data to be accessed individually. ✔ Correction to fast operation of overcurrent protection with IEEE/US inverse time reset characteristic. ✔ Minor bug fixes	V2.14 or later	P34x/EN M/H65

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
32 Cont.	D	J	Dec 2006	✓ Correction to P34x Directional Sensitive Earth Fault (Forward or reverse) function. Function does not operate if SEF/REF Protection is initially disabled in the configuration column and SEF Mode is set to 'SEF' (default setting) when the relay is booted up. Correct operation will only occur when the SEF Mode setting is changed (submitted) and changed back to 'SEF' or the relay is rebooted with SEF/REF enabled in the configuration column. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65
	E	J	April 2007	✓ P343 IEC 61850 added. IEC 61850 not released to production. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65
	F	J/K	May 2007	✓ New P345 relay model released to production. The P345 includes the same functions as the P344 plus 100% stator earth fault protection via low frequency injection. The P345 also includes a new front panel with 10 function keys and 10 associated programmable LEDs. All 18 of the P345 programmable LEDs are tri-colour and can be set as red, yellow or green in the PSL ✓ Improvement made to 100% stator earth fault (64S) measurement algorithm to improve accuracy. '64S Series X' setting removed and new '64S Fail' DDB (1076) added. ✓ Correction to VT secondary ratio setting for 32 software relays, Vn = 380/480 V rating. With a 1:1 VT ratio on a 380/480 V P340 relay with 32 software installed after power up the analogue quantities are 4 times too large. The error is corrected by re-appying the VT secondary (which is showing the correct value) setting. ✓ Local time zone adjustments for daylight saving time added to Date and Time menu. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
32 Cont.	G	J/K	Sept 2007	✓ Correction to CT secondary ratio setting for 32F software relays. When relay is powered off and on the secondary CT ratio is applied incorrectly for a 5A rating such that currents measured are 5 times too small. CT ratio is applied correctly if settings re-applied when relay is powered on. ✓ Correction to incorrect year being set when date and time is set via the user interface with IRIG-B active. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65
	H	J/K	Nov 2007	✓ Correction to the CT ratio scaling for 32 software relays. If the CT ratio secondary settings are set to 5A and the relay rebooted, if the setting group is changed the CT secondary scaling reverts to 1A. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65
	J	J/K	Dec 2007	✓ IEC 61850 communications added. ✓ Support released for high break contacts and de-modulated IRIG-B in all P34x relays. P34x relays can be ordered with modulated or de-modulated IRIG-B and with 4 or 8 high break contacts depending on the model. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65
	K	J/K	May 2008	✓ Correction to VT ratio problem. The VT ratio, if modified, is reset back to default values when the P345 relay is rebooted. This in turn causes the measurements to effectively display 'secondary' quantities as it now has a 1:1 ratio. This problem does not affect protection operation because the relay operates on 'per unit' quantities, which are unchanged. The primary and secondary ratios are used to scale the measurements and settings for display, communication and recording. ✓ Minor bug fixes	V2.14 or later	P34x/EN M/H65

Relay type: P342/3/4/5 …						
Software version		Hardware suffix	Original date of issue	Description of changes	S1 compatibility	Technical documentation
Major	Minor					
33	A	J/K	June 2008	✔ Rotor earth fault protection added to P342/3/4/5 when CLIO card is fitted. Rotor earth fault function also requires P391 low frequency injection, coupling and measurement unit. ✔ DNP 3.0 enhancements: configurable points table, default variations, SBO timeouts, integer scaling, floating point analogue values, disturbance record extraction, remote settable deadbands and class assignment, configurable message length and timeouts, data link confirmation, alias control inputs. ✔ Support for Russian language added. This is now an order option. ✔ PSL positional data is now downloaded to the relay with the logic so that when the PSL is extracted from the relay the positional data of signals etc is the same as when downloaded. ✔ Support for set/reset latches in the PSL added. ✔ Minor bug fixes	V 3.0 (Studio) or later	P34x/EN M/I76
	B	J/K	March 2009	✔ Correction to ISEF and IN Secondary CT ratio scaling incorrectly being applied if both not set to the same value (1A or 5A) - P345 only, P341/2/3/4 not affected. ✔ Minor bug fixes	V 3.0 (Studio) or later	P34x/EN M/I76
	C	J/K	June 2009	✔ Correction to Residual O/V NVD protection where derived neutral voltage is used for all protection stages (VN>1/2/3/4/5/6) instead of VN>1/2 (derived), VN>2/3 (VN1 input, measured), VN>5/6 (VN2 input, measured, P344/5 only). This bug only affect 33B software. ✔ Minor bug fixes		

Relay type: P342/3/4/5 …						
Software version		**Hardware suffix**	**Original date of issue**	**Description of changes**	**S1 compatibility**	**Technical documentation**
Major	Minor					
35	A	J/K	Dec 2009	✓ Redundant Ethernet port option (IEC61850) ✓ IEC 61850 Phase 3 enhancements:Controls - Direct Control, Direct Control with enhanced security, Select Before Operate (SBO) with enhanced security, Eight Buffered Report Control Blocks and sixteen Unbuffered Report Control Blocks, Configurable Data Sets, Published GOOSE messages, Uniqueness of control, Select Active Setting Group, Quality for GOOSE, Address List, Originator of Control, Energy measurements and Reset controls for demand and thermal measurements using the MMTR Logical Node, Unit multipliers for all measurements. ✓ Read Only Mode for remote communications ports added ✓ Correction to DDB signal status not being available to 61850 model when events are configured to be filtered out ✓ Correction to some of the strings for the IEC 61850 Data Attributes under the 'NamPlt' Data Object under LLN0 (only) of some of the Logical Devices ✓ Minor bug fixes	V 3.0 (Studio) or later	P34x/EN AD/I86
35			Jan 2011	Rebranded from Areva to Alstom		P34x/EN AD/J86

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