

INTERFACES

IRIG-B (De-modulated)

IRIG-B Interface (De-modulated)	
Use	External clock synchronization signal
Standard	IRIG 200-98 format B00X
Connector	BNC
Cable type	50 Ohm coaxial
Isolation	Isolation to SELV level
Input signal	TTL level
Input impedance at dc	10 k ohms
Accuracy	< +/- 1 s per day

1PPS GPS input

1PPS GPS input	
Use	1 PPS time signal from GPS
Standard	Proprietary (needs connection to P594)
Connector	IEC 874-10 BFOC 2.5 –(ST®) (Just 1 for Rx)
Fiber type	Multimode 50/125 µm or 62.5/125 µm
Accuracy	Maximum absolute error between the actual GPS time and the rising edge of the 1PPS signal: better then ±50 ns
Wavelength	850 nm

Download/Monitor port

Front parallel port	
Use	For firmware downloads or monitor connection
Standard	Compatible with IEEE1284-A
Connector	25 pin D-type female connector
Isolation	Isolation to ELV level
Protocol	Proprietary
Constraints	Maximum cable length 3 m

Rear serial port

Rear serial port	
Use	For SCADA communications (multi-drop)
Standard	EIA(RS)485
Connector	General purpose block, M4 screws (2 wire)
Cable	Screened twisted pair (STP)
Supported Protocols	Courier
Isolation	Isolation to ELV level
Constraints	Maximum cable length 1000 m

Rear Ethernet port (copper)

Rear Ethernet port (copper)	
Main Use	IEEE C37.118 synchrophasor communications
Alternative Use	IEC 61850 or DNP3 SCADA communications
Standard	IEEE 802.3 10BaseT/100BaseTX
Connector	RJ45
Cable type	Screened twisted pair (STP)
Isolation	1.5 kV
Supported Protocols	IEEE C37.118, IEC 61850, DNP3.0
Constraints	Maximum cable length 100 m

Rear Ethernet port (fiber including redundancy option)

Rear Ethernet port (fiber)	
Main Use	IEEE C37.118 synchrophasor communications
Alternative Use	IEC 61850 or DNP3 SCADA communications
Connector	IEC 874-10 BFOC 2.5 –(ST®) (1 each for Tx and Rx)
Standard	IEEE 802.3 100 BaseFX
Fiber type	Multimode 50/125 µm or 62.5/125 µm
Supported Protocols	IEEE C37.118, IEC 61850, DNP3.0
Optional Redundancy Protocols Supported	Rapid spanning tree protocol (RSTP) Self-healing protocol (SHP) Dual homing protocol (DHP)
Wavelength	1300 nm

100 Base FX Transmitter characteristics

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.

Conditions: $T_A = 0^{\circ}\text{C}$ to 70°C , $V_{CC} = 4.75\text{ V}$ to 5.25 V

100 Base FX Receiver characteristics

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.

Conditions: $T_A = 0^{\circ}\text{C}$ to 70°C , $V_{CC} = 4.75\text{ V}$ to 5.25 V

MEASUREMENTS AND RECORDING

Phasor Measurement Accuracy

Phasor Measurement Accuracy	
Total Vector Error (TVE)	< 1% (typically)
Reference conditions	$F_n \pm 5$ Hz

Phasor Reporting Rates

Phasor Reporting Rates	
Reporting rates for 60 Hz	10, 12, 15, 20, 30, 60 frames per second - settable
Reporting rates for 50 Hz	10, 25, 50 frames per second - settable

General

General Measurement Accuracy	
General measurement accuracy	Typically $\pm 1\%$, but $\pm 0.5\%$ between 0.2 - 2 In/Vn
Current	0.05 to 3 In $\pm 1.0\%$ of reading
Voltage	0.05 to 2 Vn $\pm 1.0\%$ of reading
Power (W)	0.2 to 2 Vn and 0.05 to 3 In $\pm 5.0\%$ of reading at unity power factor
Reactive power (Vars)	0.2 to 2 Vn to 3 In $\pm 5.0\%$ of reading at zero power factor
Apparent power (VA)	0.2 to 2 Vn 0.05 to 3 In $\pm 5.0\%$ of reading
Energy (Wh)	0.2 to 2 Vn 0.2 to 3 In $\pm 5.0\%$ of reading at zero power factor
Phase	0° to 360° $\pm 0.5\%$
Frequency	45 to 65 Hz ± 0.025 Hz

Disturbance Records

Disturbance Records Measurement Accuracy	
Maximum record duration	10.5 s
No of records	Typically a minimum of 50 records at 1.5 seconds (no of records dependent on record duration setting)
Magnitude and relative phases accuracy	$\pm 5\%$ of applied quantities
Duration accuracy	$\pm 2\%$
Trigger position accuracy	$\pm 2\%$ (minimum Trigger 100 ms)

Event, Fault & Maintenance Records

Event, Fault & Maintenance Records	
Record location	The most recent records are stored in battery-backed memory
Viewing method	Front panel display or S1 Studio
Extraction method	Extracted via the communication port
Number of Event records	Up to 512 time tagged event records
Number of Fault Records	Up to 15 *
Number of Maintenance Records	Up to 10

***Note:** *The P847 models B&C do not have any protection elements and with the default PSL schemes fitted will not generate any fault records. As it may be possible to trigger fault records if the PSL is changed, however, information on the fault recorder and associated functionalities is included for completeness.*

STANDARDS COMPLIANCE

EMC Compliance: 2004/108/EC

Compliance with the European Commission Directive on EMC is demonstrated using a Technical File.
Compliance with EN50263:2000 was used to establish conformity.

Product Safety: 2006/95/EC:

Compliance with the European Commission Low Voltage Directive (LVD) is demonstrated using a Technical File.

Compliance with EN 60255-27: 2005 was used to establish conformity:



R&TTE Compliance

Radio and Telecommunications Terminal Equipment (R&TTE) directive 99/5/EC.

Conformity is demonstrated by compliance to both the EMC directive and the Low Voltage directive, to zero volts.

UL/CUL Compliance

Canadian and USA Underwriters Laboratory

File Number E202519



MECHANICAL SPECIFICATIONS

Physical Parameters

Physical Measurements	
Case Type	80TE (Models B & C)
Weight	15.5 kg
Dimensions in mm (w x h x l) (80TE case)	413.2 x 177 x 270 (with secondary cover fitted)
Mounting	Front of panel flush mounting

Enclosure Protection: IEC 60529:1992

Enclosure Protection	
Against dust and dripping water (front face)	IP52 as per IEC 60529:1999
Protection for sides of the case	IP30 as per IEC 60529:1999
Protection for rear of the case	IP10 as per IEC 60529:1999

Mechanical Robustness

Mechanical Robustness	
Vibration test per IEC 60255-21-1:1996	Response: class 2, Endurance: class 2
Shock and bump immunity per IEC 60255-21-2:1995	Shock response: class 2, Shock withstand: class 1, Bump withstand: class 1
Seismic test per IEC 60255-21-3: 1995	Class 2

TERMINALS

AC Current and Voltage Measuring Inputs

AC Current and Voltage Measuring Inputs	
Use	For CT and VT inputs
Terminal Location	Located on heavy duty (black) terminal block, at rear
Connection type	Threaded M4 terminals, for ring lug connection
Protection	CT inputs have integral safety shorting, upon removal of the terminal block

General Input/Output Terminals

General Input/Output Terminals	
Use	For power supply, opto-inputs, output contacts and RP1 rear communications
Terminal Location	Located on general purpose (grey) blocks, at rear
Connection type	Threaded M4 terminals, for ring lug connection

Case Protective Ground Connection

Case Protective Ground Connection	
Use	For case protective ground only
Terminal Location	Two stud connections at rear
Connection type	Threaded M4 terminals
Special conditions	Must be grounded for safety. Minimum earth wire size 2.5 mm ²

RATINGS

AC Measuring Inputs

AC Measuring Inputs	
Nominal frequency	50 and 60 Hz (settable)
Operating range	45 to 65 Hz
Phase rotation	ABC or CBA

AC Current

AC Current	
Nominal current (I _n)	1 A and 5 A dual rated
Nominal burden per phase	< 0.2 VA at I _n
AC current thermal withstand	Continuous: 4*I _n , 10 s: 30*I _n , 1 s: 100*I _n linear to 64*I _n (non-offset ac current)

AC Voltage	
Nominal voltage	100 to 120 V phase-phase
Nominal burden per phase	< 0.02 VA at V _n
Thermal withstand	Continuous: 2*V _n , 10 s: 2.6*V _n

Auxiliary voltage (V_x)

Auxiliary voltage (V _x)	
Ordering options	Type 1: 24-48 V dc, Type 2: 48-110 V dc + 40-100 V ac, Type 3: 110-250 V dc + 100-240 V ac
Operating range, type 1	19 to 65 V dc
Operating range, type 2	37 to 150 V dc, 32 to 110 V ac
Operating range, type 3	87 to 300 V dc, 80 to 265 V ac
Ripple	<12% for a dc supply (compliant with IEC 60255-11:1979)

Field Output Voltage

Field Output Voltage	
Voltage	48 V dc regulated
Current limit	112 mA maximum output

Nominal burden

Nominal burden	
Quiescent burden	11 W
Additions for energized binary inputs	Per opto input: 0.09 W (24 to 54 V), 0.12 W (110/125 V), 0.19 W (220/120 V)
Additions for energized binary outputs	Per energized output relay: 0.13 W

Power-up

Power-up	
Time to power up	< 11 s

Power-up	
Battery Backup	Mounting: Front panel, Type: ½ AA, 3.6 V Lithium Thionyl Chloride Battery
Battery Type	Type: ½ AA, 3.6 V Lithium Thionyl Chloride Battery (SAFT advanced: LS14250)
Battery Life	>10 years (based on 90% energization time)

Power Supply Interruption

Power Supply Interruption	
Standard	IEC 60255-11:2008
V _x = 24 – 48 V dc Quiescent / half load	20 ms at 24 V 50 ms at 36 V 100 ms at 48 V
V _x = 24 – 48 V dc Full load	20 ms at 24 V 50 ms at 36 V 100 ms at 48 V
V _x = 48 – 100 V dc Quiescent / half load	20 ms at 36 V 50 ms at 60 V 100 ms at 72 V 200 ms at 110 V
V _x = 24 – 48 V dc Full load	20 ms at 36 V 50 ms at 60 V 100 ms at 85 V 200 ms at 110 V
V _x = 110 – 250 V dc Quiescent / half load	50 ms at 110 V 100 ms at 160 V 200 ms at 210 V
V _x = 110 – 250 V dc Full load	20 ms at 85 V 50 ms at 98 V 100 ms at 135 V 200 ms at 174 V
V _x = 40 – 100 V ac Quiescent / half load	50 ms at 27 V for 100% voltage dip
V _x = 40 – 100 V ac Full load	10 ms at 27 V for 100% voltage dip
V _x = 100 – 240 V ac Quiescent / half load	50 ms at 80 V for 100% voltage dip
V _x = 100 – 240 V ac Full load	50 ms at 80 V for 100% voltage dip

*Maximum loading = all digital inputs/outputs energized
Quiescent or 1/2 loading = 1/2 of all digital inputs/outputs energized*

Output Contacts

Standard Contacts	
Use	General purpose relay outputs for signaling, tripping and alarming
Rated voltage	300 V
Maximum continuous current	10 A
Short duration withstand carry	30 A for 3 s, 250 A for 30 ms

Standard Contacts	
Make and Break, dc resistive	50 W
Make and Break, dc inductive	62.5 W (L/R = 50 ms)
Make and Break, ac resistive	2500 VA resistive ($\cos \phi = \text{unity}$)
Make and Break, ac inductive	2500 VA inductive ($\cos \phi = 0.7$)
Make and Carry, dc resistive	30 A for 3 s, 10000 operations (subject to the above limits)
Make, Carry and break, dc resistive	4 A for 1.5 s, 10000 operations (subject to the above limits)
Make, Carry and break, dc inductive	0.5 A for 1 s, 10000 operations (subject to the above limits)
Make, Carry and break ac resistive	30 A for 200 ms, 2000 operations (subject to the above limits)
Make, Carry and break ac inductive	10 A for 1.5 s, 10000 operations (subject to the above limits)
Loaded contact	1000 operations min.
Unloaded contact	10000 operations min.
Operate time	< 5 ms
Reset time	< 5 ms

Watchdog Contacts

Watchdog Contacts	
Use	Non-programmable contacts for relay healthy/relay fail indication
Breaking capacity, dc resistive	30 W
Breaking capacity, dc inductive	15 W (L/R = 40 ms)
Breaking capacity, ac inductive	375 VA inductive ($\cos \phi = 0.7$)

Fiber defect connector (watchdog relay – redundant Ethernet version)

Fiber Defect Contacts	
Use	Non-programmable contacts for Ethernet fiber healthy/fail indication
Connection method	Phoenix cage type retention
Rated voltage	250 Vac
Rated continuous current	5 A
Make current	Max. 30 A and carry for 3 s
Breaking capacity AC	1500 VA resistive ($\cos \phi = \text{unity}$) 1500 VA inductive ($\cos \phi = 0.5$)
Breaking capacity, DC	50 W, 250 Vdc resistive 25 W, inductive (L/R = 40 ms)

Opto-isolated digital inputs

Opto-isolated digital inputs (opto-inputs)	
Rated nominal voltage	24 to 250 V dc
Operating range	19 to 265 V dc
Withstand	300 V dc
Options	The opto-inputs with programmable voltage thresholds may be energized from the 48 V field voltage, or the external battery supply

Nominal pick-up and reset thresholds:

Nominal Battery voltage	Logic levels: 60-80% DO/PU	Logic Levels: 50-70% DO/PU
24/27 V	Logic 0 < 16.2 V : Logic 1 > 19.2 V	Logic 0 < 12.0 V : Logic 1 > 16.8
30/34	Logic 0 < 20.4 V : Logic 1 > 24.0 V	Logic 0 < 15.0 V : Logic 1 > 21.0 V
48/54	Logic 0 < 32.4 V : Logic 1 > 38.4 V	Logic 0 < 24.0 V : Logic 1 > 33.6 V
110/125	Logic 0 < 75.0 V : Logic 1 > 88.0 V	Logic 0 < 55.0 V : Logic 1 > 77.0 V
220/250	Logic 0 < 150 V : Logic 1 > 176.0 V	Logic 0 < 110.V : Logic 1 > 154.0 V

Recognition time

Recognition time	
With half-cycle ac immunity filter removed	< 2 ms
With filter on	<12 ms

Note: Opto-inputs operated with filtering removed are more susceptible to EM interference and precautions should be taken to minimize pickup on the external wiring.

ENVIRONMENTAL CONDITIONS

Ambient Temperature Range

Ambient Temperature Range	
Compliance	IEC 60068-2-1: 2007 and 60068-2-2: 2007
Operating temperature range (96 hours)	-40°C to +85°C (-40°F to +185°F)
Storage and transit temperature range	-40°C to +85°C (-40°F to +185°F)

Ambient Humidity Range

Ambient Humidity Range	
Compliance	IEC 60068-2-78: 2001 and IEC 60068-2-30: 2005
Durability	56 days at 93% relative humidity and +40°C
Damp heat cyclic	six (12 + 12) hour cycles, 93% RH, +25 to +55°C

Corrosive Environments

Corrosive Environments	
Compliance	IEC 60068-2-60: 1995, Part 2, Test Ke, Method (class) 3
Industrial corrosive environment/poor environmental control, mixed gas flow test	21 days exposure to elevated concentrations of H ₂ S, NO ₂ , Cl ₂ and SO ₂ at 75% relative humidity and +30°C

TYPE TESTS

Insulation

Insulation	
Compliance	IEC 60255-27: 2005
Insulation resistance	> 100 MΩ at 500 V dc (Using only electronic/brushless insulation tester)

Creepage Distances and Clearances

Creepage Distances and Clearances	
Compliance	IEC 60255-27: 2005
Pollution degree	3
Overvoltage category	III
Impulse test voltage	5 kV

High Voltage (Dielectric) Withstand

High Voltage (Dielectric) Withstand	
IEC Compliance	IEC 60255-27: 2005
Between all independent circuits	2 kV ac rms for 1 minute
Between independent circuits and protective earth conductor terminal	2 kV ac rms for 1 minute
Between all case terminals and the case earth	2 kV ac rms for 1 minute
Across open watchdog contacts	1 kV ac rms for 1 minute
Across open contacts of changeover output relays	1 kV ac rms for 1 minute
Between all D-type EIA(RS)232 contacts and protective earth	1 kV ac rms for 1 minute
Between all screw-type EIA(RS)485 contacts and protective earth	1 kV ac rms for 1 minute
ANSI/IEEE Compliance	ANSI/IEEE C37.90-1989
Across open contacts of normally open output relays	1.5 kV ac rms for 1 minute
Across open contacts of normally open changeover output relays	1 kV ac rms for 1 minute
Across open watchdog contacts	1 kV ac rms for 1 minute

Impulse Voltage Withstand Test

Impulse Voltage Withstand Test	
Compliance	IEC 60255-27: 2005
Between all independent circuits	Front time: 1.2 μs, Time to half-value: 50 μs, Peak value: 5 kV, 0.5 J
Between terminals of all independent circuits	Front time: 1.2 μs, Time to half-value: 50 μs, Peak value: 5 kV, 0.5 J
Between all independent circuits and protective earth conductor terminal	Front time: 1.2 μs, Time to half-value: 50 μs, Peak value: 5 kV, 0.5 J

Exceptions: EIA(RS)232 ports and EIA(RS485) ports and normally-open output contacts

ELECTROMAGNETIC COMPATIBILITY (EMC)

1 MHz Burst High Frequency Disturbance Test

1 MHz Burst High Frequency Disturbance Test	
Compliance	IEC 60255-22-1: 2007 2008, Class III
Common-mode test voltage	2.5 kV
Differential test voltage	1.0 kV

Exception: EIA(RS)232 ports

100 kHz Damped Oscillatory Test

100 kHz Damped Oscillatory Test	
Compliance	EN61000-4-18: 2006: Level 3, 100 kHz and 1 MHz
Common-mode test voltage	2.5 kV
Differential mode test voltage	1.0 kV

Immunity to Electrostatic Discharge

Immunity to Electrostatic Discharge	
Compliance	IEC 60255-22-2: 1996 Class 3 and Class 4,
Class 4 Condition	15 kV discharge in air to user interface, display, and exposed metalwork
Class 3 Condition 1	8 kV discharge in air to all communication ports
Class 3 Condition 2	6 kV point contact discharge to any part of the front of the product

Electrical Fast Transient or Burst Requirements

Electrical Fast Transient or Burst Requirements	
Compliance	IEC 60255-22-4: 2002 and EN61000-4-4:2004. Test severity Class III and IV
Applied to auxiliary supply and all other inputs except for EIA(RS)232)	Amplitude: 2 kV, burst frequency 5 kHz (class III)
Applied to auxiliary supply and all other inputs except for EIA(RS)232)	Amplitude: 4 kV, burst frequency 2.5 kHz (class IV)
Applied directly to auxiliary	Amplitude: 4 kV, burst frequency 5 kHz (class IV)

Surge Withstand Capability

Surge Withstand Capability	
Compliance	IEEE/ANSI C37.90.1: 2002
Condition 1	4 kV fast transient and 2.5 kV oscillatory applied common mode and differential mode to opto inputs (filtered), output relays, CTs, VTs, power supply, field voltage
Condition 2	4 kV fast transient and 2.5 kV oscillatory applied common mode to communications, IIRIG-B

Surge Immunity Test

Surge Immunity Test	
Compliance	IEC 61000-4-5: 2005 Level 4

Surge Immunity Test

Pulse duration	Time to half-value: 1.2/50 μ s
Between all groups and protective earth conductor terminal	Amplitude 4 kV
Between terminals of each group	Amplitude 2 kV

Exception: EIA(RS)232 ports

Immunity to Radiated Electromagnetic Energy**Immunity to Radiated Electromagnetic Energy**

Compliance	IEC 60255-22-3: 2000, Class III
Frequency band	80 MHz to 1 GHz
Spot tests at	80, 160, 450, 900 MHz
Test field strength	10 V/m
Test using AM	1 kHz / 80%
Compliance	IEEE/ANSI C37.90.2: 2004
Frequency band	80 MHz to 1 GHz
Waveform	1 kHz 80% am and am pulse modulated
Field strength	35 V/m

Radiated Immunity from Digital Communications**Radiated Immunity from Digital Communications**

Compliance	EN61000-4-3: 2002, Level 4
Frequency bands	800 to 960 MHz, 1.4 to 2.0 GHz
Test field strength	30 V/m
Test using AM	1 kHz / 80%

Radiated Immunity from Digital Radio Telephones**Radiated Immunity from Digital Radio Telephones**

Compliance	IEC 6100-4-3: 2002
Frequency bands	900 MHz and 1.89 GHz
Test field strength	10 V/m

Immunity to Conducted Disturbances Induced by Radio Frequency Fields**Immunity to Conducted Disturbances Induced by Radio Frequency Fields**

Compliance	IEC 61000-4-6: 1996, Level 3
Frequency bands	150 kHz to 80 MHz
Test disturbance voltage	10 V

Magnetic Field Immunity**Magnetic Field Immunity**

Compliance	IEC 61000-4-8: 1994 Level 5 IEC 61000-4-9/10: 1993 Level 5
IEC 61000-4-8 test	100 A/m applied continuously, 1000 A/m applied for 3 s
IEC 61000-4-9 test	1000 A/m applied in all planes

Magnetic Field Immunity	
IEC 61000-4-10 test	100 A/m applied in all planes at 100 kHz/1 MHz with a burst duration of 2 s

Conducted Emissions

Conducted Emissions	
Compliance	EN 55022: 1998
Test 1	0.15 - 0.5 MHz, 79 dB μ V (quasi peak) 66 dB μ V (average)
Test 2	0.5 – 30 MHz, 73 dB μ V (quasi peak) 60 dB μ V (average)

Radiated Emissions

Radiated Emissions	
Compliance	EN 55022: 1998
Test 1	30 – 230 MHz, 40 dB μ V/m at 10 m measurement distance
Test 2	230 – 1 GHz, 47 dB μ V/m at 10 m measurement distance

P847B&C WIRING DIAGRAMS

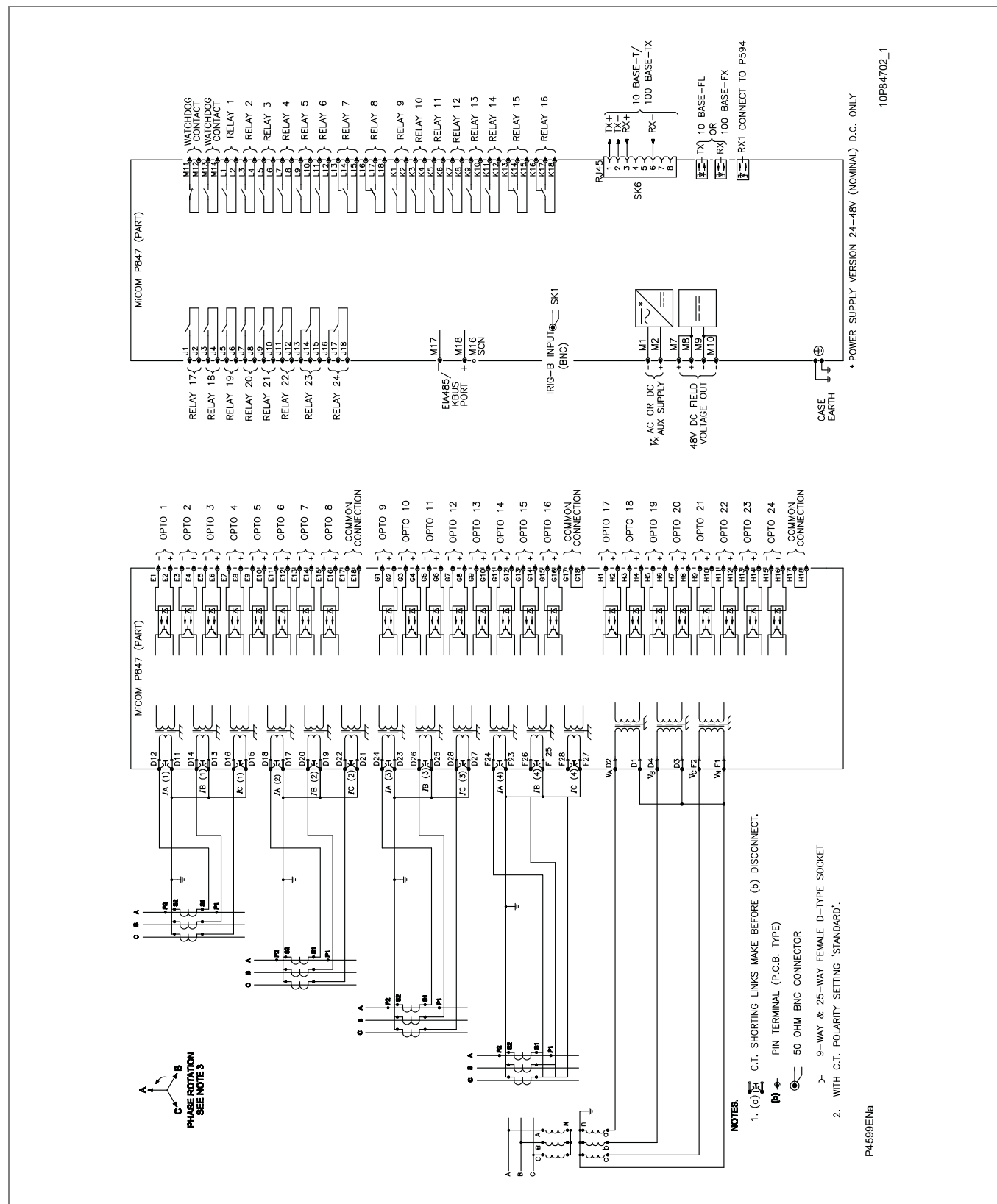


Figure 1: P847 B external connection diagram

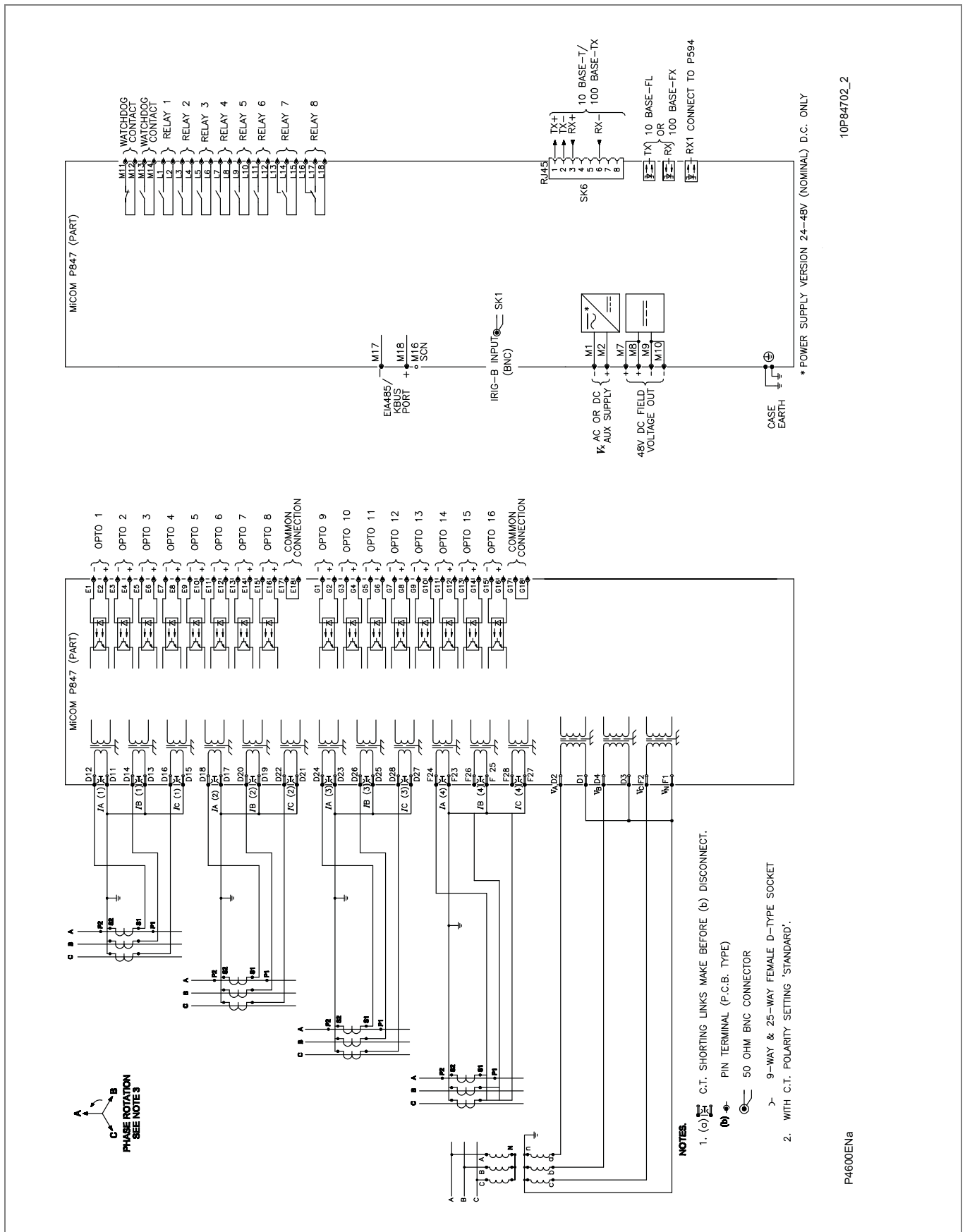


Figure 2: P847 C external connection diagram

ORDERING OPTIONS

Options	P847							**	
Variants Order No.									
Model									
Phasor Measurement Unit									
Nominal auxiliary voltage									
24 - 48 Vdc	1								
48 - 110 Vdc (40 - 100 Vac)	2								
110 - 250 Vdc (100 - 240 Vac)	3								
In/Vn rating									
1n = 1 A/5 A : Vn = 100 - 120 Vac, 4 CT & 3 VT (60TE)	1								
1n = 1 A/5 A : Vn = 100 - 120 Vac, 12 CT & 3 VT (80TE)	2								
Hardware options									
Ethernet (100 Mbps) plus IRIG-B (De-modulated)	B								
Redundant Ethernet Self-Healing Ring + Demodulated IRIG-B	H								
Redundant Ethernet Rapid Spanning Tree Protocol + Demodulated IRIG-B	K								
Redundant Ethernet Dual Homing Star + Demodulated IRIG-B	M								
Product Options									
8 Inputs & 8 Outputs + Backup Protection (60TE)	A								
16 Inputs & 8 Outputs (80TE)	B								
24 Inputs & 24 Outputs (80TE)	C								
Protocol options									
K-Bus	1								
IEC 61850 + Courier via rear RS485 port	6								
DNP3.0 Over Ethernet with Courier rear port K-Bus/RS485 protocol	8								
Mounting									
Flush / Panel mounting	M								
19" Rack mounting (80TE only)	N								
Language									
English, French, German, Spanish	0								
English, French, German, Russian	5								
Chinese, English or French via HMI, with English or French only via Communications port	C								
Software version									
Date and application dependant	**								
Customer specific options									
Standard version	0								
Customer version	A								
Hardware version									
K = XCPU2	K								