

Feeder Protection Relay

F-PRO

Product Overview

F-PRO is the family of numerical multifunction relays suitable for transmission, distribution and industrial solutions. It provides complete feeder protection with current, voltage and frequency elements which can suit the requirements for variety of power automation applications.

This product family is included with metering, communications, fault logs, disturbance recordings, sequence of events with 1ms time stamp resolution for analysis.

Flexible I/O options, draw out construction of the relay cases, easy mounting and user friendly settings make easy maintenance and less time consumption to the end users.

F-PRO can be integrated in to Serial (IEC 60870-5-103, Modbus RTU/ASCII, DNP3 Level2) and Ethernet based communication (IEC 61850, DNP3 Level2 TCP/UDP) with selectable electrical or fiber ports. This product is also enabled with Parallel Redundancy Protocol (PRP, IEC 62439-3) – optional while ordering.

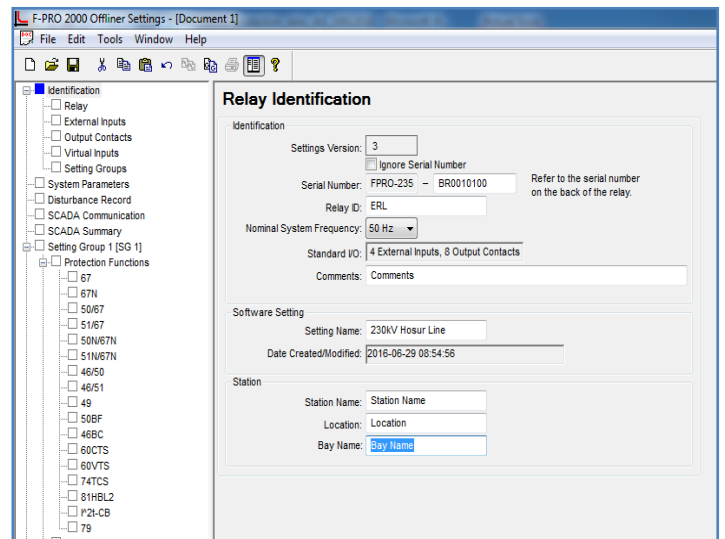
Application

F-PRO provides current, voltage and frequency protections for Line, Generator, Motor, Bus bar, Reactor, Capacitor, etc., Rear side communication capability allows integration in to Smart Grid such as Substation Automation, Monitoring system and SCADA.



Measurements & Monitoring

- Phase Voltages and Currents
- Phase to Phase Voltages
- Residual Voltage and Current
- Sequence Voltages and Currents
- Frequency and Phase Angles
- Active Power, Reactive Power and Power factor
- Total Harmonic Distortion (THD)
- I² t accumulated for CB Maintenance
- I² t for last operation
- Percentage Thermal State
- Monitoring - status of External Inputs and Relay Outputs
- Monitoring - status of Prologics and Virtual Inputs



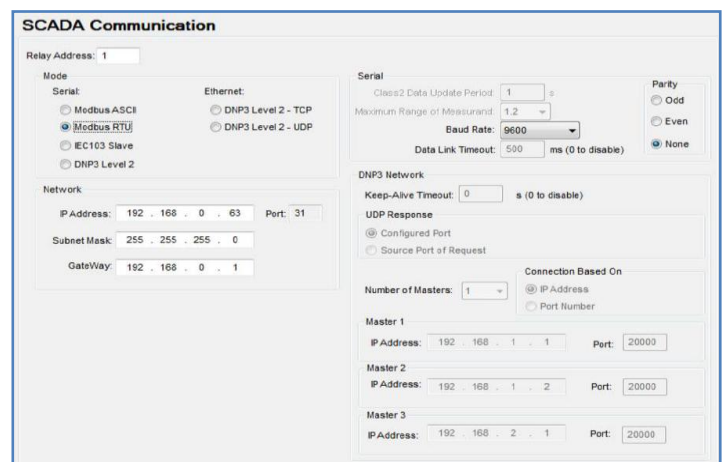
Communication Interface

Front : USB 2.0 port

Rear : RS485, Ethernet - Cu/FO (Refer ordering sheet)

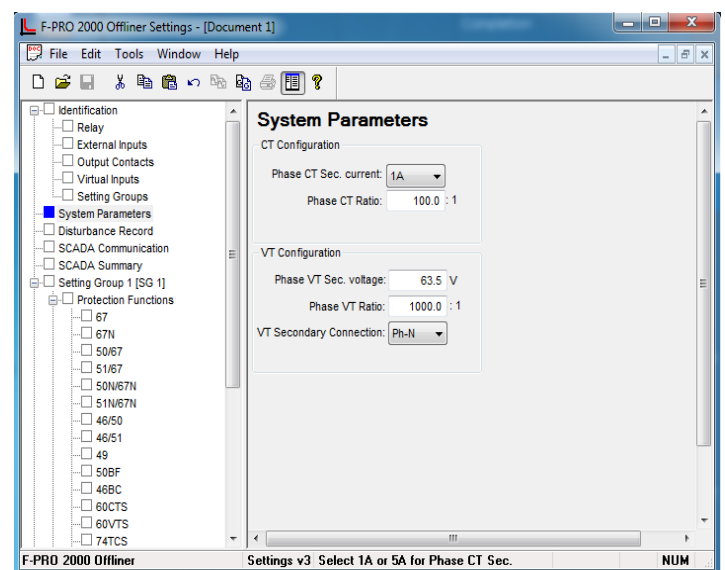
Communication Protocol

- Modbus RTU / ASCII
- IEC60870-5-103
- DNP3 Level2 Serial / TCP / UDP
- IEC 61850
- IEC 62439-3(PRP) – (Only for F-PRO297 & 298)



Functional Overview

- Site selectable 1A or 5A CT secondary ratings
- Programmable VT Secondary ratings
- Programmable IEC & ANSI inverse/DT/User defined curves
- Programmable Self/Hand Reset Output Contacts
- Programmable Self and Hand reset LEDs
- 20 Fault Logs
- 1000 Event Records with 1ms time tag
- 20 Disturbance Records
- 4 or 8 Setting Groups
- Multilevel Password Protection
- 7 / 13 Programmable LEDs & 1 fixed LED for Healthy Indication
- Programmable Frequency (50Hz or 60 Hz)
- 2 X 16 character alphanumeric LCD (For F-PRO215, 216, 235 & 295)
- 128 X 64 Graphical LCD (For F-PRO297 & 298)
- 4 / 14 Programmable External Inputs
- 8 / 14 Programmable Output Contacts
- Time Synchronization through PPM / SNTP / IRIG-B
- Modulated / Un-Modulated IRIG-B inputs are user configurable

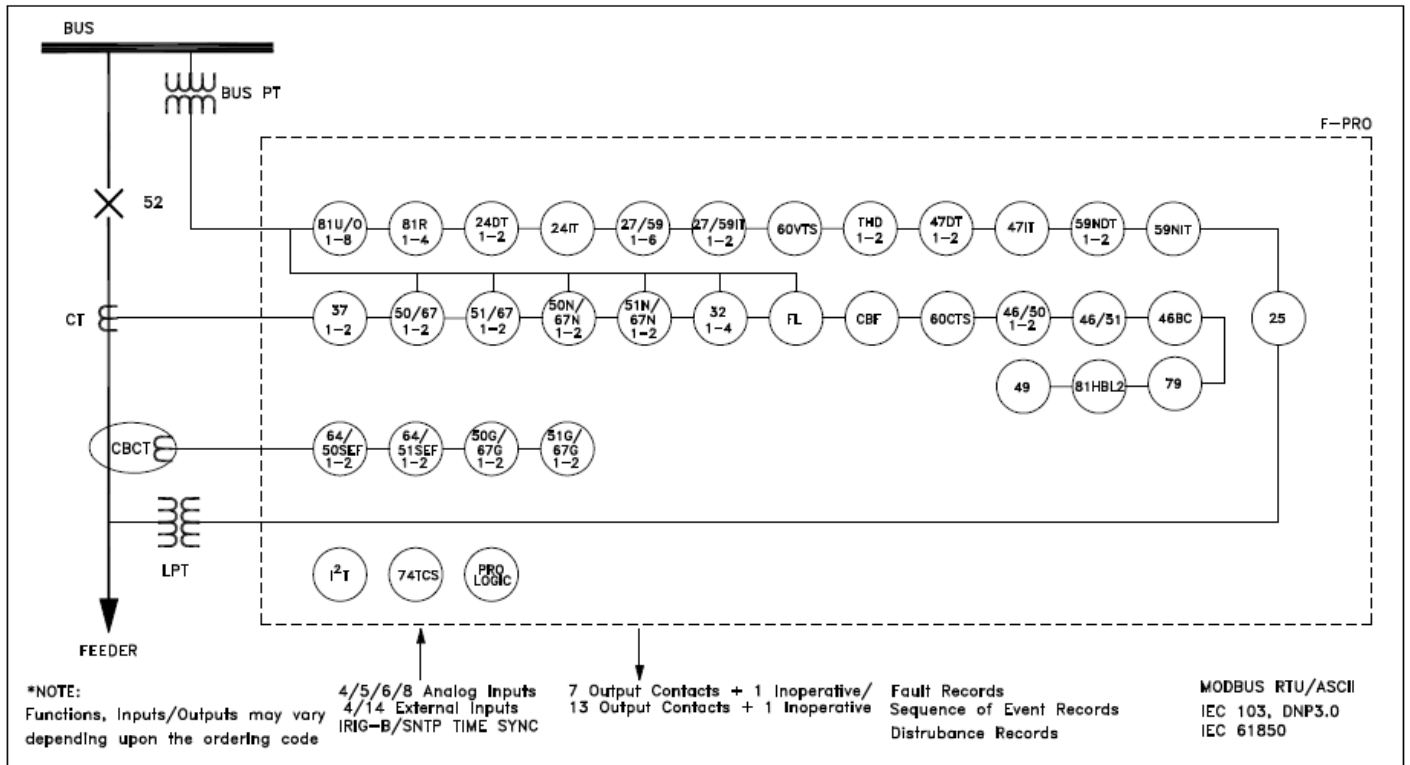


Variants and Protection Functions

SL.NO.	ANSI NO.	PROTECTION FUNCTION DETAILS	F-PRO 215	F-PRO 216	F-PRO 235	F-PRO 295	F-PRO 297	F-PRO 298
1	24DT	Definite Time Over Flux				✓(2)	✓(2)	✓(2)
2	24IT	Inverse Time Over Flux				✓(1)	✓(1)	✓(1)
3	25/27/59	Synchro Check				✓(1)		✓(1)
4	27/59 DT	Phase Definite Time Under/Over Voltage			✓(6)	✓(6)	✓(6)	✓(6)
5	27/59 IT	Phase Inverse Time Under/Over Voltage			✓(2)	✓(2)	✓(2)	✓(2)
6	46/50	Instantaneous Negative Sequence Over Current	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
7	46/51	IDMTL Negative Sequence Over Current	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
8	46BC	Broken Conductor (I2/I1)	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
9	47DT	Negative Sequence Definite Time Over Voltage				✓(2)	✓(2)	✓(2)
10	47IT	Negative Sequence Inverse Time Over Voltage				✓(1)	✓(1)	✓(1)
11	49	Thermal Over Load	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
12	37	Instantaneous Phase Undercurrent					✓(2)	✓(2)
13	50	Instantaneous Phase Over Current	✓(2)	✓(2)				
14	50BF	Breaker Failure	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
15	50G	Measured Instantaneous Neutral Over Current	✓(2)	✓(2)				
16	50N	Derived Instantaneous Neutral Over Current	✓(2)	✓(2)				
17	50/67	Instantaneous Phase Over Current			✓(2)	✓(2)	✓(2)	✓(2)
18	50G/67G	Measured Instantaneous Neutral Over Current					✓(2)	
19	50N/67N	Derived Instantaneous Neutral Over Current			✓(2)		✓(2)	✓(2)
20	51	IDMTL Phase Over Current	✓(1)	✓(1)				
21	51/67	IDMTL Phase Over Current			✓(2)		✓(2)	✓(2)
22	51G	Measured IDMTL Neutral Over Current	✓(1)	✓(1)				
23	51G/67G	Measured IDMTL Directional Over Current					✓(2)	
24	51N	Derived IDMTL Neutral Over Current	✓(1)	✓(1)				
25	51N/67N	Derived IDMTL Neutral Over Current			✓(2)		✓(2)	✓(2)
26	59GDT	Measured Residual Definite Time Over Voltage				✓(2)		
27	59GIT	Measured Residual Inverse Time Over Voltage				✓(1)		
28	59NDT	Derived Residual Definite Time Over Voltage				✓(2)	✓(2)	✓(2)
29	59NIT	Derived Residual Inverse Time Over Voltage				✓(1)	✓(1)	✓(1)
30	60CTS	Current Transformer Supervision			✓(1)		✓(1)	✓(1)
31	60VTS	Voltage Transformer Supervision			✓(1)	✓(1)	✓(1)	✓(1)
32	64/50SEF	Instantaneous SEF/REF		✓(2)		✓(2)	✓(2)	✓(2)
33	64/51SEF	IDMTL SEF/REF		✓(2)		✓(2)	✓(2)	✓(2)
34	67	Directional Function For Phase Over Current			✓(1)		✓(1)	✓(1)
35	67SEF	Directional Function For SEF				✓(1)	✓(1)	
36	67N	Directional Function For Derived Neutral Over Current			✓(1)			
37	67N/67G	Measured IDMTL Neutral Over Current					✓(1)	✓(1)
38	74TCS	Trip Circuit Supervision	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)
39	79	Multishot Auto Reclose	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
40	81HBL2	Inrush Detection	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
41	81R	Rate of Change of Frequency Protection				✓(4)	✓(4)	✓(4)
42	81 U/O	Under / Over Frequency Protection				✓(8)	✓(8)	✓(8)
43	32	Directional Power Protection					✓(4)	✓(4)
44	I _t	CB Monitoring	✓(1)	✓(1)	✓(1)		✓(1)	✓(1)
45	THD	THD Measurements				✓(2)	✓(2)	✓(2)
46		Fault Locator						✓
47	Hardware	No. Of CT'S	4	5	3	1	5	4
48		No. Of VT'S			3	5	3	4
49		No. of LED'S	8	8	8	8	14	14
50		No. of Output Relays	8	8	8	8	14	14
51		No. of External Inputs	4	4	4	4	14	14
52		Enclosure Size	E6	E6	E6	E6	E8	E8

Note: (✓) denotes number of stages.

Protection & Control Function Diagram



Detailed Specifications

Item

Quantity/Specs

Notes

General

Operate Time 1.0 to 1.5 cycles including relay output operation

Memory Settings and records are stored in non-volatile memory
Records are stored in a circular buffer

ProLogic™ 20 statements per setting group 5 inputs per ProLogic™ statement

Recording

Transient (Fault) 32 s/c oscillography of all analog and external input channels
Record Length : 1 to 10 / 20 sec
Pre-fault Length : 0.1 to 0.5sec

Events 1000 events with 1ms resolution
A compressed event record can be created for 1000 events with manual trigger.

Record Capacity 20 records of a combination of transient & event records

Auxiliary Power Supply

Nominal	Operating range
24 Vdc & 48 Vdc	20 to 60 Vdc
110 Vdc & 220 Vdc	80 to 300 Vdc
	80 to 250Vac

External Inputs

4 / 14 External inputs	Pick up level
24 Vdc	19 Vdc
48 Vdc	38 Vdc
110 Vdc	88 Vdc
220 Vdc	175 Vdc

Continuous Rating

CT Circuit	: 4 X In AC (4 A for 1A CT) (20A for 5A CT)
SET CT Circuit:	2 X In AC
VT Circuit	: 175 VAC

Burden

AC Current Input	: <0.1VA @ 1A ; <0.5VA @ 5A
AC SEF Current	: <1VA @1A, <2VA@5A
AC Voltage Input	: <0.15VA @63.5V AC <0.3VA @110V AC
External Input	: <0.2W @110V DC
Power Consumption	: <12VA (AC) & <12W(DC)

CASE SIZE	CUT OUT		BEZEL	
	A	B	C	D
E6	159	150	177	155.5
E8	159	201.50	177	207.50

Note:

1. All dimension are in mm and are measured equidistant from center line
2. Maximum depth of equipment inside the panel is 225.0mm

Analog Inputs

Rated current (In)	: 1A or 5A AC - Site Selectable
Rated Voltage (Vn)	: 63.5/69V AC PN or 110/120V AC PP
Frequency	: 50Hz / 60Hz (Site Selectable)

Digital Outputs

Carry Continuous:	8A AC or DC
Make & Carry	: 30A AC or DC for 0.2seconds 5000VA AC Resistive Load
Break	: 1250 VA AC Resistive Load 50W DC Inductive Load @L/R <40msec with 110V DC

Short time Thermal Rating

CT circuit	: 100A for 1 sec (1A CT) & 200A for 1sec (5A CT)
SEF CT circuit	: 4 X In for 1 sec
VT circuit	: 200 VAC for 10 seconds

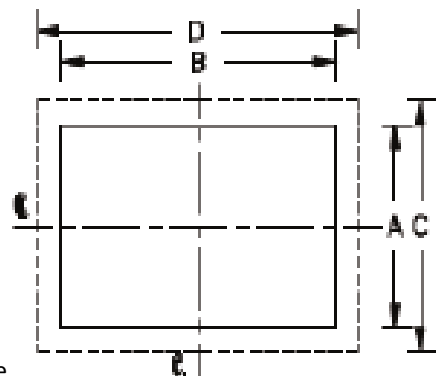
Physical Dimensions

Weight

E6 Case:	4.50Kgs – For F-PRO215, 216, 235 & 295
E8 Case:	6.0Kgs – For F-PRO297 & 298

Dimensions

E6 case	: 177mm(H) x 155.5mm(W) x 225.0mm(D)
E8 case	: 177mm(H) x 207.5mm(W) x 225.0mm(D)



Overall F-PRO Accuracies

Current	±2.5% of inputs from 0.1 to 1.0 x nominal current (I_N) ±1.0% of inputs from 1.0 to 4.0 x nominal current (I_N)
Voltage	±1.0% of input from 0.01 to 2.0 x nominal voltage (V_N)
Directional Phase Angle	±3.0° of set Value
Frequency Elements	±0.01Hz (fixed level) ±0.01Hz/sec (df/dt)
Sync Check Elements	±0.2 degrees
Timers	±3ms of set value
Inverse Over current Timers	±2.5% or ±1 cycle of selected curve
Definite Over current Timers	±2.5% or ±1 cycle non-directional ±2.5% or ±1 cycle directional
Frequency Timer	±2.5% of set value plus 2.5 cycles of inherent delay (fixed level) non-directional at 2xpickup, error<40ms(df/dt) at 0.1Hz/s above pickup, error<100ms

Detailed Environmental Tests

Standard	Description of the Test	Test Points	Test Level
IEC 60255-26:2013 Cl.No.7.2.3	Electrostatic Discharge	Enclosure Air Enclosure contact	+/- 8 kV +/- 6 kV
IEC 60255-26:2013 Cl.No.7.2.4	Radiated Interference (Electromagnetic Field Immunity)	Enclosure ports	10 v/m : 80-1000 MHz: 1.4 GHz - 2.7 GHz
IEC 60255-26:2013 Cl.No.7.2.5	Electrical Fast Transient	Ac/Dc power ports AC voltage & current ports External I/P & O/P ports	+/- 4 kV
IEC 60255-26:2013 Cl.No.7.2.6	Slow Damped Oscillatory / High Frequency Disturbance / 1 MHz Burst Disturbance	Ac/Dc power ports AC voltage & current ports External I/P & O/P ports	+/- 2.5kV (CM) +/-1kV (DM)
IEC 60255-27:2013 Cl.No.10.6.4.2	Impulse Voltage	Ac/Dc power ports AC voltage & current ports External I/P & O/P ports	+/- 5 kV
IEC 60255-27:2013 Cl.No.10.6.4.3	AC Dielectric Voltage	Ac/Dc power ports AC voltage & current ports External I/P & O/P ports	2kVrms / min, 50/60Hz
IEC 60255-27:2013 Cl.No.10.6.4.4	Insulation Resistance Test	Ac/Dc power ports AC voltage & current ports External I/P & O/P ports	>100MΩ @ 500V/min

Standard	Description of the Test	Test Points	Test Level
IEC 60068-2-1	Cold Test– Operational		-25°C / 16Hrs
IEC 60068-2-1	Cold Test– Storage		-40°C / 16Hrs
IEC 60068-2-2	Dry Heat Test– Operational		+55°C / 16Hrs
IEC 60068-2-2	Dry Heat Test– Storage		+70°C / 16Hrs
IEC 60068-2-14	Change of Temperature		-25°C & +55°C / 5Cycles
IEC 60068-2-30	Cyclic Temperature		+25°C & +55°C / 5Cycles
IEC 60068-2-78	Damp Heat Steady State		+40°C / 240Hrs
IEC 60255-21-1 Class 1	Vibration		10Hz to 150Hz, 1.0g, 1.0 Octave/min, 20 Sweep cycle/axis
IEC 60255-21-2 Class 1	Shock and Bump		5g and 15g
IEC 60255-21-3 Class 1	Siesmic		5Hz to 35Hz, 1.0g, 1.0 Octave/min, 1 Sweep cycle/axis

INTENTIONALLY LEFT BLANK

INTENTIONALLY LEFT BLANK

WORKS:

Easun Reyrolle Ltd.,
#98, Sipcot Industrial Complex,
Hosur 635126,
India
Tel: +91 4344 401600/01/02
Fax: +91 4344 276397
E-Mail: hosur@easunreynolle.com

ERLPhase Power Technologies Ltd.,
74 Scurfield Blvd,
Winnipeg, MB, R3Y 1G4
Canada
Tel: +1 204-477-0591
Fax: +1 204-478-1697
E-Mail: info@erlphase.com

The policy of ERL is continuous improvement and development. The Company therefore reserves the right to supply equipment which may differ slightly from that described and illustrated in this publication (E00005R05).

Technical Support: techsupport@easunreynolle.com / support@erlphase.com

www.easunreynolle.com / www.erlphase.com

