

# M-7679 R-PAC



## Protection, Automation and Control System for Recloser, Switch, Sectionalizer and Advanced Distribution Automation Applications

### Protection and Control

- Over 30 Protection Elements for optimal protection of Power Distribution Systems
- Compatible with Three-Phase Ganged (Std) and Independent Phase Capable Switching devices such as Reclosers, Switches, Sectionalizers and Breakers (Optional)
- Four (std) or Six (optional) Low Energy Analog (LEA) or VT voltage inputs
- Recloser Settings Wizard assists in creating file for most common settings for Recloser applications
- Comprehensive I/O Matrix provides visual confirmation of enabled functions and selected outputs, improving security

### Automation/Communications

- Pre-built functions for Advanced Distribution Automation Applications including Recloser, Switch, Sectionalizer, and Loop Schemes
- Embedded Cyber Security features to implement NERC/CIP v5 requirements, including IPsec and RADIUS server security
- Front panel USB and SD Card ports for local programming and data transfer
- Optional single or dual Ethernet ports (copper or fiber) with simultaneous multi-user and multi-protocol support
- Protocols supported include:
  - MODBUS, DNP3.0
  - Optional: IEC 61850
  - Optional: IEC 60870-5-104
- Meets IEEE 1686 Password requirement
- One or two optional serial ports (TIA-232, TIA-485, or Serial Fiber)

### IPScom® – Uncomplicated Software for Complex Power System Applications

- Integrated Metering, DFR and PQ Visualization Tools
- Search and filtering tools for analysis of SOE, DFR and PQ records
- IPSlogic Programmable Logic

### Monitoring

- Recloser Status Monitoring tool displays real time reclosing sequence and fault clearing time
- Power Quality Monitoring up to the 63<sup>rd</sup> Harmonic including THD and TDD
- PQ Viewer (ITIC Curve)
- Sags, Swell and Sub-Synchronous Transient Detection
- Comprehensive suite of advanced diagnostic tools
- Advanced Data Logging and Load Profile Recorder
- 3500 Event Sequence of Events (SOE) Recorder
- 100 DFR quality records of up to 480 cycles with adjustable sampling rate up to 128 s/c

### Flexibility

- Two ways to upgrade your existing control:
- Beckwith Electric M-2979 Cabinet for replacement of select complete recloser or switch controls
- Beckwith Electric M-2400 series Adapters for retrofit of some of the most popular controls in the existing cabinet



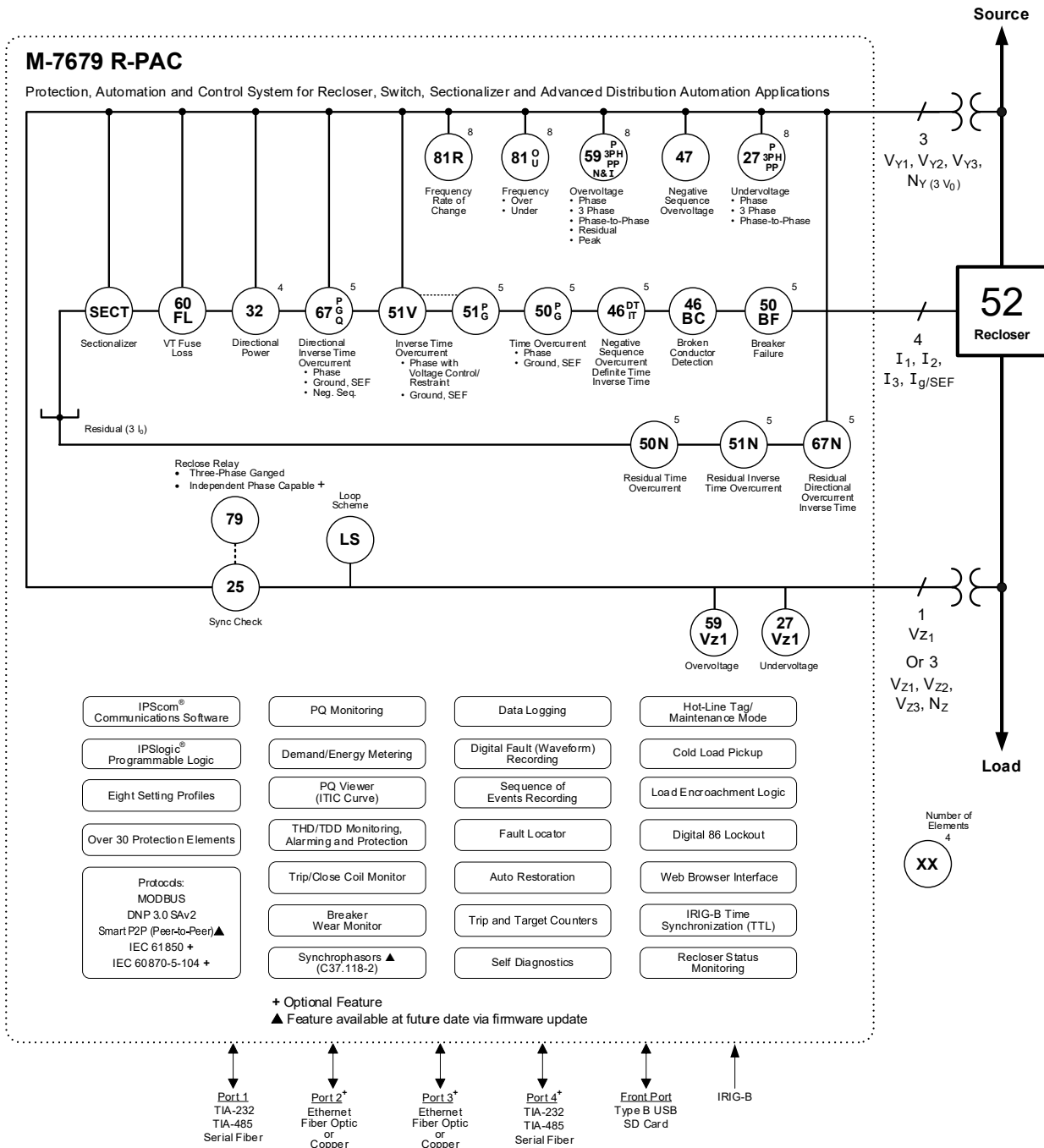


Figure 1 M-7679 R-PAC One-Line Functional Diagram

## Standard Control Features

- Over 30 protection functions
- Horizontal or Vertical Mounting
- 50 Hz or 60 Hz Frequency
- High (90 to 315 Vac/Vdc) or Low (18 to 60 Vdc) Power Supply
- Multi-Shot Auto Recloser, Three-Phase Reclose Operation
- Eight Setting Profiles
- Hot Line Tag
- Cold Load Pickup
- Load Encroachment Supervision
- Sequence Coordination
- Phantom Voltage
- Digital 86 Lockout
- Fault Locator
- Auto Restoration
- Sensitive Ground Indicator
- Three Phase Current Inputs plus one Ground or Sensitive Earth Current Input
- Three Phase Voltage Inputs plus one Sync Check Voltage Input
- Four User Programmable Digital Inputs
- Four User Programmable Digital Outputs
- Conformal Coated Circuit Boards
- Configurable Front HMI LEDs and Pushbuttons
- 12 Vdc Backup Power Input
- IPScm Communications Software
- IPSlogic Programmable Logic
- Reclosing Sequence Monitor and Recorder
- Recloser/Breaker Wear Monitor
- I/O Map
- Custom Curve Designer
- Compare Settings Tool
- Power Supply Monitor
- Trip/Close Coil Monitor
- Trip and Target Counters
- Digital Fault (Waveform) Recording
- Fault Event Records
- Synchrophasors (IEEE C37.118-2)▲
- Front Panel USB and SD Card ports
- IRIG-B Time Synchronization
- Custom DNP Mapping

- PORT 1 – Rear TIA-232
- Protocols Supported:
  - MODBUS
  - DNP3.0 SAV2
  - Smart P2P (Peer-To-Peer)▲
- IPsec (Internet Protocol Security)
- RADIUS Client Capability to manage local and remote access to the control
- Wide Variety of Communications Accessories
- Power Quality Monitoring
- ITIC Curve Violation Counters and Recording
- Data Logging
- THD/TDD Monitoring, Alarming and Protection
- Demand and Energy Metering
- Sequence of Events Recording
- Self-Diagnostics

## Optional Features

- Independent Phase Capable (Triple/Single) Recloser Operation
- Sectionalizer
  - Three Phase Ganged
  - Independent Phase Capable
- Option P: Single Phase/Two Phase Operation
- PORT 1 – Fiber Optic Available
- PORT 1 – Analog Output Module
- PORT 2 – Rear Ethernet Fiber Optic or Copper
- PORT 3 – Rear Ethernet Fiber Optic or Copper
- PORT 4 – TIA-232, TIA-485, or Fiber Optic
- Optional Protocols in addition to standard MODBUS and DNP3.0 (requires at least one Ethernet Port):
  - Add IEC 61850
  - Add IEC 60870-5-104
  - Add Combination IEC 61850 and IEC 60870-05-104
- Expanded I/O – Additional eight digital Inputs and eight digital Outputs for a total of 12 each
- Low Energy Analog (LEA) Inputs per C37.92. Configurations available: 4 LEA, 3 LEA + 1 VT, or 6 LEA

▲ Feature available at future date via firmware update / IPScm update

## M-7679 Mounting Options

### M-2400 Series Adapters

The M-2400 Series Adapters allow a simple, easy installation of the M-7679 into an existing cabinet to retrofit the following controls:

- M-2406 to retrofit the Eaton Cooper Form 6 (for 14-Pin or 19-Pin reclosers)
- M-2410 to retrofit the SEL 351R-2
- M-2411 to retrofit the SEL 351P-3/Panacea

Please refer to the applicable M-2400 Series Specification for additional information and ordering options.

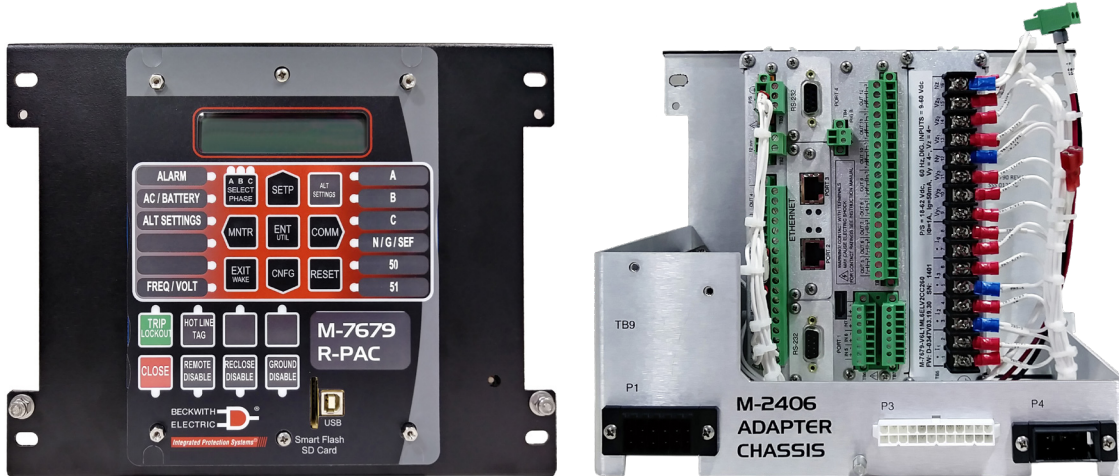


Figure 2 M-2406 Adapter Chassis

### M-2979 Recloser Control Cabinet



Figure 3 M-2979 Recloser Control Cabinet

Please see the M-2979 Recloser Control Cabinet Specification for additional information and ordering options.

## External Connections

The possible connections for the M-7679 R-PAC are shown in [Figure 4](#).

**▲CAUTION:** Any TB3 receptacle that is **NOT GREEN** indicates that a **Low Voltage Power Supply** is installed in the unit.

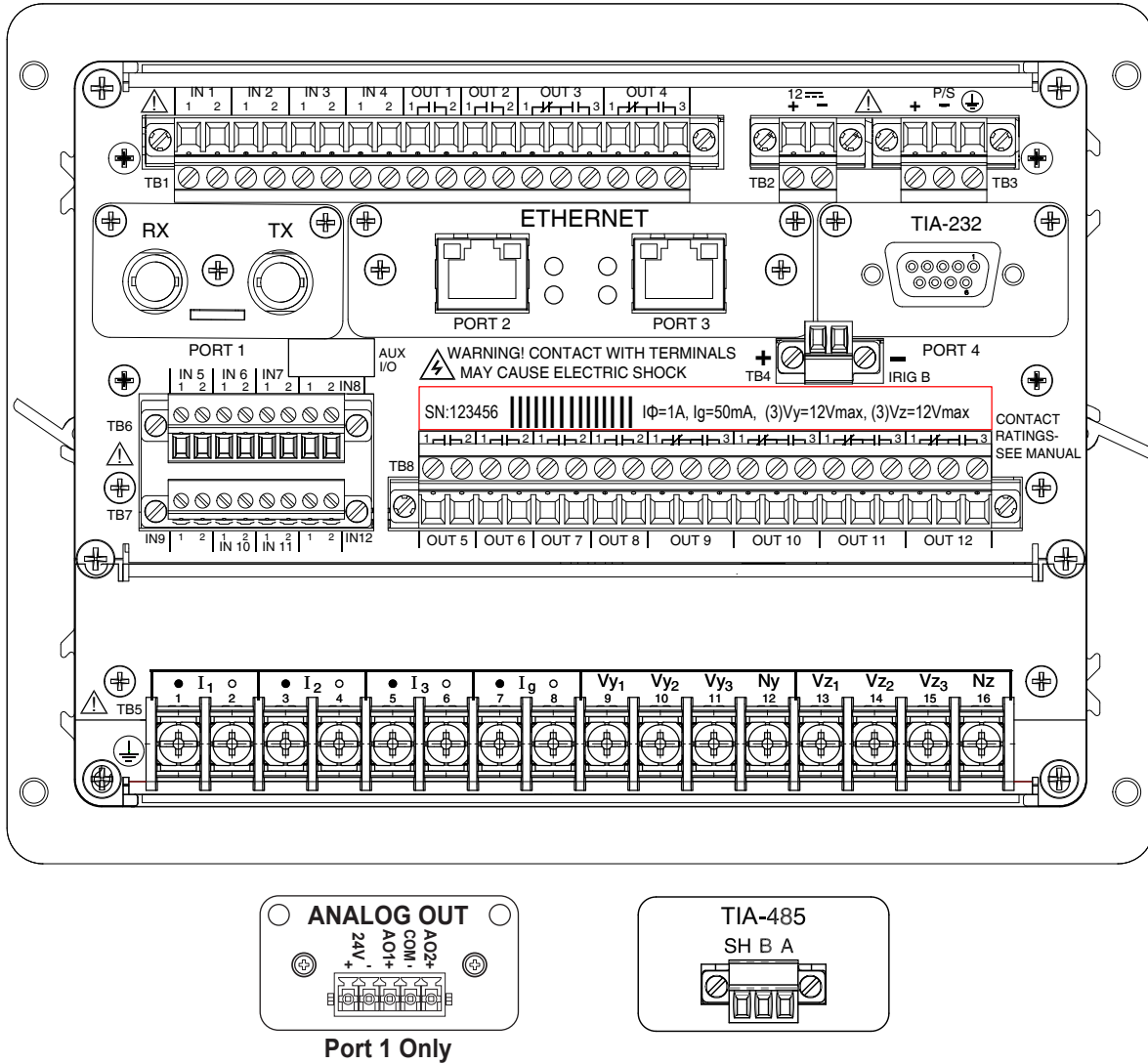


Figure 4 M-7679 Typical External Connections



**PROTECTIVE FUNCTIONS**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Sync Check</b>				
25	Reference Phase	A/B/C	–	–
	Undervoltage Permission			
	Dead Line/Dead Bus	Yes/No	–	–
	Dead Line/Live Bus	Yes/No	–	–
	Live Line/Dead Bus	Yes/No	–	–
	Live Line Minimum Voltage	0.0 to 200.0 V	0.1 V	±0.2 V or ±0.5%
	Live Bus Minimum Voltage	0.0 to 200.0 V	0.1 V	±0.2 V or ±0.5%
	Sync Check Permission			
	Max/Minimum Time Delay	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
	Minimum Voltage	10.0 to 300.0 V	0.01 V	±0.2 V or ±0.5%
	Maximum Voltage	10.0 to 300.0 V	0.01 V	±0.2 V or ±0.5%
	Angle Difference	0.00° to 90.00°	0.01°	±0.3°
	Magnitude Difference	0.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Frequency Difference	0.00 to 5.00 Hz	0.01 Hz	±0.02 Hz or ±2%
<b>Undervoltage</b>				
<b>Phase Undervoltage (#1 to #4 Elements) / 3 Phase Undervoltage (#5 to #8 Elements)</b>				
27	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
27 3PH	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	Auto Restoration	Enable/Disable	–	–
<b>Phase-to-Phase Undervoltage</b>				
27 PP	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Vz1 Undervoltage</b>				
27 Vz1	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Bus Side Voltage Supervision</b>				
<b>Bus Side Voltage Supervision</b>				
27B	Minimum Closing Voltage	0.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Supervision Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Directional Power (#1 to #4 Elements)</b>				
32	Pickup	-3.00 to +3.00 PU	0.01 PU	±0.02 PU or 3% @ PF = 0.2 to 1.0
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	Power	Real/Reactive	–	–

Each directional power element can be set as overpower or underpower.

The per unit pickup is based on the nominal secondary VT voltage and CT current settings.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Negative Sequence Overcurrent (#1 to #5 Elements)</b>				
<b>46 DT</b>	<b>Definite Time</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%
	Definite Time*	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
*The maximum Definite Time is reduced to 1.00 s if the pickup is > 20.00A for a 5A CT.				
<hr/>				
<b>46 IT</b>	<b>Inverse Time</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 16.00 A	0.01 A	±0.1 A or ±3%
	Electromechanical Reset Delay	Yes/No		
	Reset Coefficient	0.001 to 30.000 s	0.001 s	±0.01 s or ±1%
	TCC Modifiers			
	Time Adder	0.00 to 30.00 s	0.01 s	±0.01 s or ±1%
	Minimum Response			
	Time Adder	0.00 to 1.00 s	0.01 s	±0.01 s or ±1%
	IEC Curves Family (IEC 60255-151)	Inverse, Very Inverse, Extremely Inverse	–	–
	Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%
	IEEE Curves (C37.112)	Moderately Inverse Very Inverse Extremely Inverse		
	Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%
	US Curves	Moderately Inverse Standard Inverse Very Inverse Extremely Inverse Short Time Inverse	–	–
	Time Multiplier	0.05 to 15.00	0.01	±2 cycles or ±5%
	Traditional Recloser Curves	101; 102; 103; 104; 105; 106; 107; 111; 112; 113; 114; 115; 116; 117; 118; 119; 120; 121; 122; 131; 132; 133; 134; 135; 136; 137; 138; 139; 140; 141; 142; 151; 152; 161; 162; 163; 164; 165; 200; 201; 202		
	Time Multiplier	0.10 to 2.00	0.01	±2 cycles or ±5%
	Definite Time			
Time Multiplier	0.10 to 100.00	0.01	±2 cycles or ±5%	

**NOTE:** Recloser Curve selections (IEC, IEEE, US, and Traditional) are available for 46IT, not 46DT.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Broken Conductor Detection</b>				
46 BC	Pickup (I2/I1 ratio)	1 to 100%	1%	±3%
	Time Delay	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	Minimum I2 Level	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
<b>Negative Sequence Overvoltage</b>				
47	Pickup	0.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Breaker Failure</b>				
50 BF	Pickup Phase Current			
	1A CT (or 5 mA CT)	0.02 to 2.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 10.00 A	0.01 A	±0.1 A or ±3%
	Pickup Residual/ Ground Current			
	1A CT	0.02 to 2.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 10.00 A	0.01 A	±0.1 A or ±3%
	Pickup Sensitive Ground Current			
	1 mA CT	0.010 to 0.320 A	0.001 A	TBD
	10 mA CT	0.001 to 0.160 A	0.001 A	TBD
	50 mA CT	0.005 to 0.800 A	0.001 A	TBD
	200 mA CT	0.020 to 3.200 A	0.001 A	TBD
	Time Delay	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
	Retrip Delay	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).



**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Instantaneous/Definite Time Overcurrent (#1 to #5 Elements)</b>				
<b>50P</b>	<b>Phase Instantaneous/Definite Time Overcurrent</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%
	Definite Time*	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	*The maximum Definite Time is reduced to 1.00 s if the pickup is > 20.00A for a 5A CT.			
<b>50 HCL</b>	<b>High Current Lockout (#1 to #5 Elements)</b>			
	Phase	Enable/Disable		
	Reference Current			
	1A CT (or 5 mA CT)	0.10 to 100.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.50 to 500.00 A	0.01 A	±0.1 A or ±3%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>50N</b>	<b>Residual Instantaneous/Definite Time Overcurrent</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%
	Definite Time*	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	*The maximum Definite Time is reduced to 1.00 s if the pickup is > 20.00A for a 5A CT.			
<b>50 HCL</b>	<b>High Current Lockout (#1 to #5 Elements) with "3I<sub>0</sub>" HCL Operating Current Reference</b>			
	Residual/Ground	Enable/Disable		
	Reference Current			
	1A CT (or 5 mA CT)	0.03 to 100.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.15 to 500.00 A	0.01 A	±0.02 A or ±3%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>50G</b>	<b>Ground Instantaneous/Definite Time Overcurrent</b>			
	Pickup			
	1A Gnd CT	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A Gnd CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>50 HCL</b>	<b>High Current Lockout (#1 to #5 Elements) with "G" HCL Operating Current Reference</b>			
	Residual/Ground	Enable/Disable		
	Reference Current			
	1A Gnd CT	0.03 to 100.00 A	0.01 A	±0.02 A or ±3%
	5A Gnd CT	0.15 to 500.00 A	0.01 A	±0.1 A or ±3%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Inverse Time Overcurrent (#1 to #5 Elements)</b>				
<b>51P</b>	<b>Phase Inverse Time Overcurrent with Voltage Control/Restraint</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 16.00 A	0.01 A	±0.1 A or ±3%
	Load Encroachment Logic	Use/Do Not Use	–	–
	Voltage Control or Voltage Restraint	4.0 to 150.0 %	0.1 %	
<b>51N</b>	<b>Residual Inverse Time Overcurrent</b>			
	Pickup			
	1A CT (or 5 mA CT)	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A CT	0.10 to 16.00 A	0.01 A	±0.1 A or ±3%
<b>51G</b>	<b>Ground Inverse Time Overcurrent</b>			
	Pickup			
	1A Gnd CT	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A Gnd CT	0.10 to 16.00 A	0.01 A	±0.1 A or ±3%
	Electromechanical Reset Delay	Yes/No		
	Reset Coefficient	0.001 to 30.000 s	0.001 s	±0.01 s or ±1%
	TCC Modifiers Time Adder	0.00 to 30.00 s	0.01 s	±0.01 s or ±1%
	Minimum Response Time Adder	0.00 to 1.00 s	0.01 s	±0.01 s or ±1%
	IEC Curves Family (IEC 60255-151)	Inverse, Very Inverse Extremely Inverse		
	Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%
	IEEE Curves (C37.112)	Moderately Inverse Very Inverse Extremely Inverse		
	Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%
	US Curves	Moderately Inverse Standard Inverse Very Inverse Extremely Inverse Short Time Inverse		
Time Multiplier	0.05 to 15.00	0.01	±2 cycles or ±5%	
Traditional Recloser Curves	101; 102; 103; 104; 105; 106; 107; 111; 112; 113; 114; 115; 116; 117; 118; 119; 120; 121; 122; 131; 132; 133; 134; 135; 136; 137; 138; 139; 140; 141; 142; 151; 152; 161; 162; 163; 164; 165; 200; 201; 202			
Time Multiplier	0.10 to 2.00	0.01	±2 cycles or ±5%	
Definite Time				
Time Multiplier	0.10 to 100.00	0.01	±2 cycles or ±5%	

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Overvoltage</b>				
<b>59</b>	<b>Phase Overvoltage (#1 to #4 Elements) / 3 Phase Undervoltage (#5 to #8 Elements)</b>			
	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>59 3PH</b>	Auto Restoration	Enable/Disable	–	–
<b>Peak Overvoltage</b>				
<b>59I</b>	Pickup	100 to 150 %	1 %	±3 %
	Definite Time	0.01 to 140.00 s	0.01 s	±0.05 s
<b>Residual Overvoltage (#1 to #2 Elements)</b>				
<b>59N</b>	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Phase-to-Phase Overvoltage</b>				
<b>59 PP</b>	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Vz1 Overvoltage</b>				
<b>59 Vz1</b>	Pickup	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>VT Fuse-Loss Detection</b>				
<b>60 FL</b>	<b>AVT fuse-loss condition is detected by using the positive and negative sequence components of the voltages and currents.</b>			
	Time Delay	0.03 to 600.00 s	0.01 s	±0.01 s or ±1%
	Three Phase VT Fuse Loss Detection	Enable/Disable	–	–

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Directional Overcurrent (#1 to #5 Elements)</b>				
67P	<b>Phase Directional Overcurrent</b>			
	Operating Current	Phase Current		
	Phase Polarization Voltage	$V_1$		
67N	<b>Residual Directional Overcurrent</b>			
	Operating Current	$3I_0$		
	Phase Polarization Voltage	$V_{z1}, V_1, V_2, V_0$		
67G	<b>Ground Directional Overcurrent</b>			
	Operating Current	$I_g$		
	Phase Polarization Voltage	$V_{z1}, V_1, V_2, V_0$		
67Q	<b>Negative Sequence Directional Overcurrent</b>			
	Operating Current	Negative Sequence Current		
	Phase Polarization Voltage	$V_2$		

**67P, 67N, 67G, 67Q Settings**

Enabled Direction	No-Direction/Directional		
Minimum Polarization Voltage	5.0 to 20.0 V	0.01 V	$\pm 0.2V$ or $\pm 0.5\%$
Action if below	Trip/Block Trip		
Maximum Sensitivity Angle 1	$0^\circ$ to $359^\circ$	$1^\circ$	$\pm 1^\circ$
Maximum Sensitivity Angle 2	$5^\circ$ to $90^\circ$	$1^\circ$	$\pm 1^\circ$
Time Delay	Definite/Inverse	–	–

**Definite Time:**

Pickup

1A CT / 5mA CT/ 1A Gnd CT

5A CT / 5A Gnd CT

Definite Time\*

0.05 to 20.00 A      0.01 A       $\pm 0.02$  A or  $\pm 3\%$ 0.25 to 100.00 A      0.01 A       $\pm 0.1$  A or  $\pm 3\%$ 0.00 to 600.00 s      0.01 s       $\pm 0.01$  s or  $\pm 1\%$ 

\*67P, 67N, and 67Q: the maximum Definite Time is reduced to 1.00 s if the pickup is  $> 20.00$  A for a 5A CT.

■ **NOTE:** Function 67 Inverse Time Delay Specifications continued on next page.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Directional Instantaneous/Definite Time Overcurrent (Cont.)</b>				
<i>67P, 67N, 67G, 67Q Settings (Continued)</i>				
<i>Inverse Time:</i>				
	Pickup			
	1A CT / 5 mA CT/ 1A Gnd CT	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A CT / 5A Gnd CT	0.10 to 16.00 A	0.01 A	±0.1 A or ±3%
	Electromechanical Reset Delay	Yes/No		
	Reset Coefficient	0.001 to 30.000 s	0.001 s	±0.01 s or ±1%
	TCC Modifiers			
	Time Adder	0.00 to 30.00 s	0.01 s	±0.01 s or ±1%
	Minimum Response			
	Time Adder	0.00 to 1.00 s	0.01 s	±0.01 s or ±1%
	IEC Curves Family (IEC 60255-151)	Inverse, Very Inverse, Extremely Inverse		
	Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%
	IEEE Curves (C37.112)	Moderately Inverse, Very Inverse, Extremely Inverse		
	Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%
	US Curves	Moderately Inverse, Standard Inverse, Very Inverse, Extremely Inverse, Short Time Inverse		
	Time Multiplier	0.05 to 15.00	0.01	±2 cycles or ±5%
	Traditional Recloser Curves	101; 102; 103; 104; 105; 106; 107; 111; 112; 113; 114; 115; 116; 117; 118; 119; 120; 121; 122; 131; 132; 133; 134; 135; 136; 137; 138; 139; 140; 141; 142; 151; 152; 161; 162; 163; 164; 165; 200; 201; 202		
	Time Multiplier	0.10 to 2.00	0.01	±2 cycles or ±5%
	Definite Time			
	Time Multiplier	0.10 to 100.00	0.01	±2 cycles or ±5%

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Recloser Relay</b>				
79	<b>Three-Phase Ganged or Optional Independent Phase Operation:</b>			
	Ground Precedence	Yes/No	–	–
	Sequence Coordination Active For Trips	None/1/2/3	–	–
	Maximum Number of Phase Trips	1/2/3/4/5	1	–
	Maximum Number of Ground/Residual Trips	1/2/3/4/5	1	–
	Reset Time after Auto Reclose	1 to 1800 s	1 s	±0.01 s or ±1%
	Reset Time from Lockout	0 to 1800 s	1 s	±0.01 s or ±1%
	Reclose #1, #2, #3, #4	–	–	–
	Time Delay for Phase Fault	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
	Time Delay for Ground Fault	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Optional Independent Phase Operation (1 Phase Trip-1 Phase Lockout Mode):</b>				
Synchronized Phase Sequence	Yes/No	–	–	
Deactivate G/N Functions	Yes/No	–	–	
Trip All Phases for Multi-Phase Faults	Yes/No	–	–	
<b>79 Trip Reclose Sequence</b>				
Trip #1, #2, #3, #4, #5				
Function Element 1, 2, 3, 4, 5	50P, 50N, 50G/GS, 46DT, 51P, 51N, 51G/GS, 46 IT, 67P, 67N, 67G/GS, 67Q	–	–	–
<b>79 Drive to Lockout</b>				
Trip Sequence 1, 2, 3, 4, 5	50P HCL, 50G/GS or 50N HCL, IPSlogic	–	–	–
<b>79 Supervision</b>				
Blocking Functions	27 BSVS, 27Vz1, 25 Sync	–	–	–
Supervision Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%	–

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).



**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Frequency (#1 to #8 Elements)</b>				
81	Pickup	40.00 to 65.00 Hz	0.01 Hz	±0.02 Hz
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	Hysteresis	0.0 to 1.0 Hz	0.1 Hz	
	Undervoltage Block	Enable/Disable		
	Minimum Voltage	1.00 to 180.00 V	0.01 V	
	Minimum Load	Enable/Disable		
	1A CT (or 5 mA CT)	0.00 to 40.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.00 to 200.00 A	0.01 A	±0.1 A or ±3%
The pickup accuracy applies at a range of 57 to 63 Hz. Beyond this range the accuracy is ±0.1 Hz.				
	Auto Restoration	Enable/Disable		

<b>Rate of Change of Frequency (#1 to #8 Elements)</b>				
81R	Pickup	0.20 to 5.00 Hz/s	0.01 Hz/s	±0.02 Hz/s
	Definite Time	0.00 to 2.00 s	0.01 s	±0.01 s or ±1%
	Maximum Frequency	40.00 to 70.00 Hz	0.01 Hz	
	Minimum Current			
	1A CT (or 5 mA CT)	0.00 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A CT	0.00 to 100.00 A	0.01 A	±0.1 A or ±3%
	Minimum Voltage	0.00 to 300.00 V	0.01 V	
	Pickup Cycle Number	3 to 15	1	

<b>Breaker Monitor (#1 to #2 Elements)</b>				
BM	Breaker Wear	Life Remaining/Life Used		
	Breaker Open Arc Current Delay	0 to 2000 ms	1 ms	
	Arc Current Cycle	0 to 20 Cycles	1 Cycle	
	Pickup	1 to 100 %	1 %	±1%
	Time Delay	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	Preset Accumulators	0 to 60000 kA* Cycles	1 kA* Cycle	
	Timing Selection Method*	I <sup>1.5</sup> T, IT or I <sup>2</sup> T		

The Breaker Monitor feature calculates an estimate of the per-phase wear on the breaker contacts by measuring and integrating the current through the breaker contacts as an arc.

The per-phase values are added to an accumulated total for each phase, and then compared to a user-programmed threshold value. When the threshold is exceeded in any phase, the relay can set a programmable output contact.

The accumulated value for each phase can be displayed.

The Breaker Monitoring feature requires an initiating contact to begin accumulation, and the accumulation begins after the set time delay.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Inrush Harmonic Restraint</b>				
IHR	Inrush Harmonic Pickup	0.1 to 100%	0.1%	±1%
	Inrush Harmonic Dropout	0.1 to 100%	0.1%	±1%
	Inrush Active Time	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
<b>Trip/Close Circuit Monitoring</b>				
TCM	Time Delay	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
CCM	Time Delay	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
<i>Trip Coil and Close Coil input voltages are limited to the specifications in Table 5.</i>				
<b>Total Harmonic Distortion / Total Demand Distortion</b>				
THD	Operating Quantity	Current/Voltage		
	Limit	3.0 to 10.0 %	0.1%	±2%
	Time Delay	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
TDD	Operating Quantity	Current		
	Limit	3.0 to 10.0 %	0.1%	±2%
	Time Delay	0.00 to 600.00 s	0.01 s	±0.05 s or ±1%

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**OPTIONAL PROTECTIVE FUNCTIONS**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>	
<b>Sensitive Ground Instantaneous/Definite Time Overcurrent (#1 to #5 Elements)</b>					
50 GS	Sensitive Ground Pickup				
	1 mA Gnd CT	0.010 to 0.320 A	0.001 A	(TBD)	
	10 mA Gnd CT	0.001 to 0.160 A	0.001 A	(TBD)	
	50 mA Gnd CT	0.001 to 0.800 A	0.001 A	0.0015 A or ±3%	
	200 mA Gnd CT	0.020 to 2.500 A	0.001 A	(TBD)	
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%	
<i>Replaces Standard 50G Ground</i>					
50 HCL	<b>High Current Lockout (#1 to #5 Elements) with "G" HCL Operating Current Reference</b>				
	Residual/Ground	Enable/Disable	–	–	
	Reference Current:				
	1 mA Gnd CT	0.010 to 0.320 A	0.001 A	(TBD)	
	10 mA Gnd CT	0.001 to 0.160 A	0.001 A	(TBD)	
	50 mA Gnd CT	0.001 to 0.800 A	0.001 A	0.0015 A or ±3%	
	200 mA Gnd CT	0.020 to 2.500 A	0.001 A	(TBD)	
	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%	
<b>Sensitive Ground Inverse Time Overcurrent (#1 to #5 Elements)</b>					
51 GS	Sensitive Ground Pickup				
	1 mA Gnd CT	0.010 to 0.320 A	0.001 A	(TBD)	
	10 mA Gnd CT	0.001 to 0.160 A	0.001 A	(TBD)	
	50 mA Gnd CT	0.001 to 0.800 A	0.001 A	0.0015 A or ±3%	
	200 mA Gnd CT	0.020 to 2.500 A	0.001 A	(TBD)	
	Electromechanical Reset Delay	Yes/No			
	Reset Coefficient	0.001 to 30.000 s	0.001 s	±0.01 s or ±1%	
	TCC Modifiers				
	Time Adder	0.00 to 30.00 s	0.01 s	±0.01 s or ±1%	
	Minimum Response Time Adder	0.00 to 1.00 s	0.01 s	±0.01 s or ±1%	
	IEC Curves Family (IEC 60255-151) Inverse, Very Inverse, Extremely Inverse				
	Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%	
	IEEE Curves (C37.112) Moderately Inverse, Very Inverse, Extremely Inverse				
	Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%	
	US Curves Moderately Inverse, Standard Inverse, Very Inverse, Extremely Inverse, Short Time Inverse				
	Time Multiplier	0.05 to 15.00	0.01	±2 cycles or ±5%	
Traditional Recloser Curves	101; 102; 103; 104; 105; 106; 107; 111; 112; 113; 114; 115; 116; 117; 118; 119; 120; 121; 122; 131; 132; 133; 134; 135; 136; 137; 138; 139; 140; 141; 142; 151; 152; 161; 162; 163; 164; 165; 200; 201; 202				
Time Multiplier	0.10 to 2.00	0.01	±2 cycles or ±5%		
Definite Time					
Time Multiplier	0.10 to 100.00	0.01	±2 cycles or ±5%		
<i>Replaces Standard 51G Ground</i>					

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**OPTIONAL PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>	
<b>Sensitive Ground Inverse Time Overcurrent (#1 to #5 Elements)</b>					
<b>67</b> <b>GS</b>	Phase Polarization Voltage	Vz1, V1, V2, V0	–	–	
	Enabled Direction	No-Direction/Directional	–	–	
	Minimum Polarization Voltage	5.0 to 20.0 V	0.01 V	±0.2 V or ±0.5%	
	Action if below	Trip/Block Trip	–	–	
	Maximum Sensitivity Angle 1	0° to 359°	1°	±4°	
	Maximum Sensitivity Angle 2	5° to 90°	1°	±4°	
	Time Delay	Definite/Inverse	–	–	
	<b>Definite Time:</b>				
	Pickup 1 mA Gnd CT	0.010 to 0.320 A	0.001 A	(TBD)	
	Pickup 10 mA Gnd CT	0.001 to 0.160 A	0.001 A	(TBD)	
Pickup 50 mA Gnd CT	0.005 to 0.800 A	0.001 A	0.0015 A or ±3%		
Pickup 200 mA Gnd CT	0.020 to 2.500 A	0.001 A	(TBD)		
Delay	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%		
<b>Inverse Time:</b>					
Electromechanical Reset Delay	Yes/No				
Reset Coefficient	0.001 to 30.000 s	0.001 s	±0.01 s or ±1%		
TCC Modifiers					
Time Adder	0.00 to 30.00 s	0.01 s	±0.01 s or ±1%		
Minimum Response Time Adder	0.00 to 1.00 s	0.01 s	±0.01 s or ±1%		
IEC Curves Family (IEC 60255-151)	Inverse, Very Inverse, Extremely Inverse				
Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%		
IEEE Curves (C37.112)	Moderately Inverse, Very Inverse, Extremely Inverse				
Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%		
US Curves	Moderately Inverse, Standard Inverse, Very Inverse, Extremely Inverse, Short Time Inverse				
Time Multiplier	0.05 to 15.00	0.01	±2 cycles or ±5%		
Traditional Recloser Curves	101; 102; 103; 104; 105; 106; 107; 111; 112; 113; 114; 115; 116; 117; 118; 119; 120; 121; 122; 131; 132; 133; 134; 135; 136; 137; 138; 139; 140; 141; 142; 151; 152; 161; 162; 163; 164; 165; 200; 201; 202				
Time Multiplier	0.10 to 2.00	0.01	±2 cycles or ±5%		
Definite Time					
Time Multiplier	0.10 to 100.00	0.01	±2 cycles or ±5%		
<i>Replaces Standard 67G Ground</i>					

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**OPTIONAL PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Sectionalizer</b>				
(SECT)	<b>Three-Phase Ganged (Independent Phase Operation)</b>			
	<b>Fault Current Detection</b>			
	Function Element 1, 2, 3, 4, 5	50P, 50N, 50G/GS, 46DT	–	–
	Trigger	Fault Current Only/ Voltage Loss Only/ Fault Current with Voltage Loss (Voltage Restraint)	–	–
	Counts to Trip	1 to 4	–	–
	Reset Timer	0.01 to 600.00 s	0.01 s	±0.01 s or ±1%
	<b>Sequence Coordination Mode</b>			
	Function Element 1, 2, 3, 4, 5	51P, 51N, 46IT	–	–
	<b>Voltage Loss Detection</b>			
	Function Element 1, 2, 3, 4	27, 27PP	–	–
	<b>Inrush Current Restraint</b>			
	Initiate Restraint			
	Voltage Restoration to Normal Detection	59, 59PP	–	–
	Phase			
	Current Multiplier	0.01 to 60.00	–	–
Duration	0.01 to 300.00 s	0.01 s	±0.01 s or ±1%	
Ground				
Duration	0.01 to 300.00 s	0.01 s	±0.01 s or ±1%	

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

**OPTIONAL PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Distribution Automation Package (includes 79, SECT, Loop Scheme) Three-Phase Ganged or Independent Phase Operation (cont.)</b>				
<b>LS</b>	<b>Loop Scheme – Three-Phase Ganged or Independent Phase Operation</b>			
	Loop Scheme Application	Sectionalizing Recloser, Midpoint Recloser, or Tie Recloser	–	–
	<b>Sectionalizing and Midpoint Recloser:</b>			
	<b>Dead Line Sensing: (Undervoltage)</b>			
	Pickup – Source/Load	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	<b>Dead Line Sensing: (Undervoltage)</b>			
	Definite Time – Source/Load	0 to 600.00 s	0.01 s	±0.01 s* or ±1%
	Dead Line Timer – Source/Load	0 to 9000 s	1 s	±0.01 s* or ±1%
	LS Action on Dead Line Source/Load	Auto-Trip/ Change to Profile/ None	–	–
	<b>Live Line Sensing:</b>			
	(3 Phase Overvoltage)			
	Pickup – Source/Load	10.00 to 300.00 V	0.01 V	±0.2 V or ±0.5%
	(3 Phase Overvoltage)			
	Definite Time – Source/Load	0 to 600.00 s	0.01 s	±0.01 s* or ±1%
	Live Line Restore Window	0 to 9000 s	1 s	±0.01 s* or ±1%
	<b>Sectionalizing Recloser:</b>			
	LS Restore on Live Line Source/Load	Auto-Close/ Change to Profile/ None	–	–
	Restore Confirmed Timer	0 to 900 s	1 s	±0.01 s* or ±1%
	<b>Midpoint Recloser:</b>			
	LS Action on Live Line	(Options) 3 Phase Detection/ Return to Profile	–	–
Forward Power Detection	0.5 to 1000 1Ph W	0.1W	±0.01W or 0.5%	
Definite Time Timer	0 to 600 s	0.01 s	±0.01 s or ±1%	
<b>Sectionalizing and Midpoint Recloser: Loop Scheme Reset:</b>				
LS Reset On	Voltage Restored and No Fault/ IPSlogic/ Manual Close	–	–	
After Reset	Auto Close/ Return to Profile X with Fwd Power	–	–	
<b>Sectionalizing and Midpoint Recloser: After Loop Scheme Action:</b>				
Ground Trip Block	0 to 300 s	1 s	±0.01 s* or ±1%	
Reclosing Block	0 to 300 s	1 s	±0.01 s* or ±1%	

\*An additional measurement time of 1 cycle needs to be added to the measured time delay.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).



**OPTIONAL PROTECTIVE FUNCTIONS (cont.)**

Device Number	Function	Setpoint Ranges	Increment	Accuracy <sup>†</sup>
<b>Distribution Automation Package (includes 79, SECT, Loop Scheme) Three-Phase Ganged or Independent Phase Operation (cont.)</b>				
<b>LS</b>	<b>Loop Scheme (continued)</b>			
	<b>Tie Recloser:</b>			
	<b>Dead Line Sensing:</b> (3 Phase Undervoltage)			
	Pickup – Source 1/Source 2	10.00 to 300.00 V	0.01 V	±0.2V or ±0.5%
	Definite Time – Source 1/Source 2	0 to 600.00 s	0.01 s	±0.01 s* or ±1%
	Dead Line Timer –			
	Source 1/Source 2	0 to 9000 s	1 s	±0.01 s* or ±1%
	LS Action on Dead Line Source 1/Source 2	Auto-Close/ Change to Profile/ None	–	–
	<b>Live Line Sensing:</b> (3 Phase Overvoltage)			
	Pickup – Source 1/Source 2	10.00 to 300.00 V	0.01 V	±0.2V or ±0.5%
	Definite Time – Source 1/Source 2	0 to 600.00 s	0.01 s	±0.01 s* or ±1%
	Live Line Restore Window	0 to 9000 s	1 s	±0.01 s* or ±1%
	LS Action on Live Line	(Options) 3 Phase Detection/Return to Profile/Auto Open	–	–
	Directional Power Detection (Under power / Over power)	0.5 to 1000 1Ph W	0.1W	±0.01W or 0.5%
	Definite Time Timer	0 to 600 s	0.01 s	±0.01 s or ±1%
	<b>Dual Voltage Loss</b>	Auto-Trip	–	–
	<b>Tie Recloser: Loop Scheme Reset:</b>			
	LS Reset On	IPSlogic/ Manual Trip	–	–
	After Reset	Auto Open/ Return to Profile X with Fwd Power	–	–
	<b>Tie Recloser: After Loop Scheme Action:</b>			
	Ground Trip Block	0 to 300 s	1 s	±0.01 s* or ±1%
	Reclosing Block	0 to 300 s	1 s	±0.01 s* or ±1%
	Switch Profile	Profile 1 to 8	–	–
<b>Tie Recloser: LS Tie Supervision:</b>				
Block Tie Recloser Auto Close	Enable/ Disable	–	–	

\*An additional measurement time of 1 cycle needs to be added to the measured time delay.

<sup>†</sup>Select the greater of these accuracy values. For voltage accuracy specified, the range is (20 – 180 V).

## OPTIONAL PROTECTIVE FUNCTIONS (cont.)

### Option P – Distribution Automation Package Single Phase/Two Phase (includes 79, SECT, Loop Scheme)

#### DA Package – Single Phase/Two Phase

The Operation Type "DA Package – Single Phase/Two Phase" (designated as Option P) provides a control solution with enhanced functionality and flexibility to take full advantage of Single Phase and Independent Phase Capable reclosers. Newer Independent Phase Capable reclosers provide the option to utilize one or two poles. The M-7679 R-PAC can be used to operate a recloser on an unbalanced system, and is fully configurable to match the desired operational needs. One pole operation provides protection and control features specific to a single phase application. Two pole operation provides protection and control functions allowing for independent **or** two-phase ganged applications.

#### Hardware Requirements

To take full advantage of the separate poles and ensure compatibility of new features and functions, the user must order the appropriate hardware option. Voltage Input options **L4, H4, or X4** are restricted to **one pole** configurations. To utilize **two pole** configurations, Voltage Input options **L6, H6, or X6** are required.

#### Protection Functions and Features Redesigned for Option P

The protective functions of the standard M-7679 have been completely redesigned for the implementation of Single Phase/Two Phase Operation.

Option P – Protection, Automation, and Control Functions		
25 Sync Check	59 Phase Overvoltage	THD/TDD
27 Phase Undervoltage	81 Frequency	Close Block
27 VzS, 59 VzS	Cold Load Pickup	79 Recloser Relay
50P, 51P Overcurrent	Hot Line Tag	Sectionalizer
50BF Breaker Failure	Breaker Monitor	Loop Scheme

In addition, the following features have been updated:

- System Setup
- Metering Screens
- Status Screens
- Harmonics
- Counters
- Data Logging
- Sequence of Events
- IPSlogic

#### Protection Functions and Features Exclusive to Option P

**Settings Matrix** – The standard I/O Map is replaced with a Settings Matrix that is modified specifically for operation type "P". The Settings Matrix contains all of the functionality of the standard I/O map: copy I/O Profiles, Function setpoint hyperlinks, and Print/Print Preview functions.

**Load Current Present (LCP)** – The Load Current Present function is added as a profileable setting in both the "Settings Matrix" and "Setpoints" screen. This setting mimics a 50P element with pickup, time delay, output and blocking input selections available. This setting is used to indicate the presence of load current.

**Loss of Sensing (LOS)** – Without three phase voltages, the 60FL Fuse Loss Detection function is not available. To detect loss of potential on the sensing inputs, the Loss of Sensing Detection (LOS) function, with a corresponding Alarm, is available. Overcurrent and voltage pickups are embedded into the logic of the LOS algorithm. Loss of Sensing Detection requires that the Load Current Present function is enabled.

**High Current Alarm** – The High Current Alarm is a profileable setting including pickup and time delay settings. This alarm will assert when load current is approaching maximum circuit limits prior to an overcurrent trip.

**79 Recloser Relay (Option P)** – The 79 Recloser Relay function allows **one pole** or **two pole** operation. The 79 function with *two poles* allows the setting of each pole independently or ganged. Independent pole operation provides the functionality of two single pole reclosers, with different settings for each pole. All applicable functions used in independent operation have two separate elements, one dedicated for each pole. When **2PH Ganged Operation** is selected, both poles will operate ganged. If one pole opens then they both open, and if one pole closes they both close, regardless of the reason for opening or closing. The ganging of two poles is done electrically, in the same manner currently implemented in controls using ganged operation.

## OPTIONAL PROTECTIVE FUNCTIONS (cont.)

### Option P Protection Functions and Features – Considerations

Functions and features that require a balanced three phase system are not applicable. With a maximum of two phases used for protection functions and features, any functions, features, or algorithms that require a balanced three phase system (e.g., sequence components, residual current) are not available. Operation Type "P" can be considered as having **two** multifunction relays in one control.

■ **NOTE:** All Neutral (N), Ground (G)/Ground Sensitive (GS) functions are not available. Ground current connections ( $I_g$ ) require three phases.

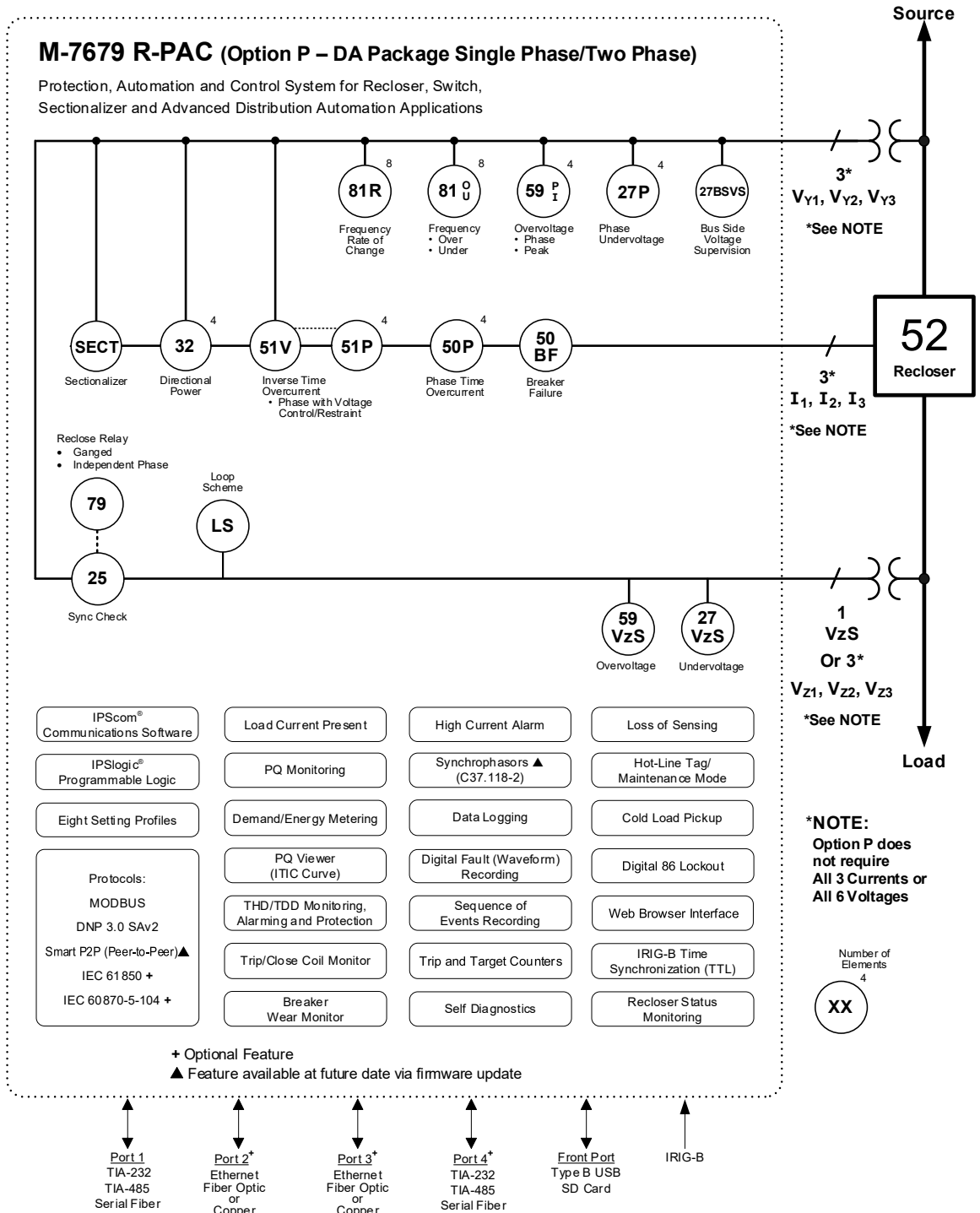


Figure 5 M-7679 Option P – One-Line Functional Diagram

## Introduction

The M-7679 R-PAC is a digital, Smart Grid ready, advanced Protection, Automation and Control System for Recloser, Switch, Sectionalizer and Power Distribution Applications that is compatible with most manufacturer’s switchgear and suitable for new installations or as a direct, easy-to-install, replacement for older recloser controls. It offers a comprehensive protection package with over 30 individual protection functions and up to eight setting groups for either Three-Phase Ganged or Independent Phase Capable reclosers. The M-7679 R-PAC features a high accuracy metering system with advanced recording and reporting functions as well as continuous data sampling at 128 samples per cycle.

By configuring various combinations of the slow-, fast-, and time-delay curve elements, the M-7679 R-PAC can allow as many as five Phase-to-Phase or Phase-to-Ground trips and four total reclosing operations. If required, individual phase or ground reclose intervals are user-settable with time-delays of up to 600 seconds. The settings for the different functions can be accomplished by using the IPScom S-7600 Communications Software or the front panel pushbuttons. For convenience and security, the M-7679 R-PAC offers an SD card reader. Programming can be done in the office and settings can be loaded using an SD card thus minimizing the time a user – needs to spend in front of the control.

## Overcurrent Protection

Up to five cumulative fast- and delay-curve operations provide phase and ground overcurrent protection. With a recloser CT ratio of 1000:1, for example, the phase overcurrent protection can have primary currents set as sensitive as 20 A for phase overcurrent and 5 A for ground overcurrent protection.

The M-7679 R-PAC offers over 50 different time curves plus four user programmable curves to facilitate coordination with other elements in the network. The phase or ground fast- and delay-curves can be set either with the user-designed curves or with the curve selection choices listed in [Table 1](#).

Use traditional Recloser Control curve modifiers to alter fast- and delay-curves (including US or IEC curves):

- Constant Time Adder – adds time to curve
- Time Multiplier (Dial) – shifts entire curve up or down in time
- Minimum Response Time – delays curve tripping for minimum time
- High Current Lockout – high set lockout maximum
- High Current Trip – closes on bolted fault

## Custom Overcurrent Protection

IPSlogic includes algorithms that allow user programmable customization of the overcurrent protection.

The M-7679 R-PAC supports the following curve selections:

Curve Category	Curve Selection
IEC Curves (IEC 60255-151)	Inverse, Very Inverse, Extremely Inverse
IEEE Curves (IEEE C37.112)	Moderately Inverse, Very Inverse, Extremely Inverse
Traditional Recloser Curves ■NOTE: (Newer curves are shown with the older curve designations in parentheses)	101 (A); 102 (1); 103 (17); 104 (N); 105 (R); 106 (4); 107 (L); 111 (8*); 112 (15); 113 (8); 114 (5); 115 (P); 116 (D); 117 (B); 118 (M); 119 (14); 120 (Y); 121 (G); 122 (H); 131 (9); 132 (E); 133 (C); 134 (Z); 135 (2); 136 (6); 137 (V); 138 (W); 139 (16); 140 (3); 141 (11); 142 (13); 151 (18); 152 (7); 161 (T); 162 (KP); 163 (F); 164 (J); 165 (KG); 200; 201; 202
US Curves	Moderately Inverse, Standard Inverse, Very Inverse, Extremely Inverse, Short Time Inverse
Definite Time	Definite Time
User-Designed Programmable Curves	Four Programmable Curves

Table 1 M-7679 R-PAC Curve Selection

## Reclosing Operation

When there is any breaker open operation due to a fault, the relay will close the breaker automatically without user intervention. The Reclosing Operation is achieved using the 79 function in conjunction with overcurrent functions (i.e. 50P, 50G/50GS, 50N, 46DT, 51P, 51G/51GS, 51N, 46IT, 67P, 67N, 67G/GS, 67Q).

The **Reclosing Sequence** is an extension of the single Reclosing Operation. In this instance, when a breaker opens and closes automatically, it will continue until a specified count is reached. Any overcurrent fault will cause a trip after the trip time expires, at which time the 79 function will start the **Reclose Interval**. Both the trip time and Reclose Interval are user settable.

At the end of the Reclose Interval the control will automatically send a close command to the breaker. This process will continue until the maximum number of trips is reached or until the fault clears, whichever occurs first. Once the maximum number of trips is reached, the control will automatically be placed in Lockout and prevent further operation until the unit is reset. The maximum number of trips is user settable. See the Instruction Book Setpoints Chapter for a detailed explanation of the Reclosing function.

## Power Quality Monitoring

Power Quality (PQ) events: sags, swells, voltage and current unbalances; real-time harmonic analysis of current and voltage for each phase, THD, phase voltage loss and variations, and ITIC excursion detection.

## Monitoring/Metering

Real-Time Metering – the following measured and calculated values are available in real-time:

- Instantaneous values of the current for three phases, ground or sensitive ground
- Line and phase voltages
- DC battery voltage
- Active, reactive, apparent single- and three-phase power, including directional\*
- Active energy received and delivered
- Demand metering on per-phase basis
- Reactive energy in quadrants I and III
- Single-phase and three-phase power factor\*
- Frequency and phase sequence
- Sequence current and voltage magnitudes

\*When the VT Configuration is set to any Delta Connection, only three phase power metering is displayed in the Primary and Secondary Metering screens. Individual phase power metering is grayed out, and the value displayed is "0".

<b>METERING ACCURACIES</b>			
Analog sources used for measurement traceable to NIST Standards, with certifications on file.			
<b>VOLTAGE ACCURACY</b>			
<b>Fundamental Metering</b>		Magnitude	Phase Angle
Voltage Range (0.167-10.0)	WYE	± 0.04%	± 0.3°
Voltage Range (5.0-300.0)	WYE	± 0.04%	± 0.7°
	OPEN DELTA	± 0.04%	± 0.7°
<b>RMS Metering</b>		Magnitude	Phase Angle
Voltage Range (0.167-10.0)	WYE	± 0.08%	± 0.7°
Voltage Range (5.0-300.0)	WYE	± 0.05%	± 0.7°
	OPEN DELTA	± 0.05%	± 0.7°
<b>Fundamental Sequence Voltage Accuracy</b>		Magnitude	Phase Angle
Voltage Range (0.167-10.0)	WYE 3V0Y, 3V0Z	± 0.02%	± 0.3°
	WYE V1Y, V1Z	± 0.10%	± 0.3°
	WYE V2Y, V2Z	± 0.06%	± 0.3°
Voltage Range (5.0-300.0)	WYE 3V0Y, 3V0Z	± 0.03%	± 0.7°
	WYE V1Y, V1Z	± 0.09%	± 0.7°
	WYE V2Y, V2Z	± 0.09%	± 0.7°
	OPEN DELTA 3V0Y, 3V0Z	± 0.02%	± 0.7°
	OPEN DELTA V1Y, V1Z	± 0.07%	± 0.7°
	OPEN DELTA V2Y, V2Z	± 0.04%	± 0.7°
<b>RMS Sequence Voltage Accuracy</b>		Magnitude	Phase Angle
Voltage Range (0.167-10.0)	WYE 3V0Y, 3V0Z	± 0.12%	± 0.7°
	WYE V1Y, V1Z	± 0.14%	± 0.7°
	WYE V2Y, V2Z	± 0.08%	± 0.7°
Voltage Range (5.0-300.0)	WYE 3V0Y, 3V0Z	± 0.01%	± 0.7°
	WYE V1Y, V1Z	± 0.09%	± 0.7°
	WYE V2Y, V2Z	± 0.09%	± 0.7°
	OPEN DELTA 3V0Y, 3V0Z	± 0.02%	± 0.7°
	OPEN DELTA V1Y, V1Z	± 0.07%	± 0.7°
	OPEN DELTA V2Y, V2Z	± 0.04%	± 0.7°
<p>■ <b>NOTE:</b> Voltage accuracy:                      &lt;0.3 % with temperature between -5° C and +50° C                      &lt;1.0 % with temperature below -5° C or above +50° C</p>			

Table 2 Metering Accuracies – Voltage



<b>METERING ACCURACIES</b>			
Analog sources used for measurement traceable to NIST Standards, with certifications on file.			
<b>CURRENT ACCURACY</b>			
<b>Fundamental Metering</b>		Magnitude	Phase Angle
CT Rating and Range	5 A (IA, IB, IC) (0.01-20.0 A)	± 0.02%	± 0.7°
	1 A (IA, IB, IC) (0.01-15.0 A)	± 0.03%	± 0.7°
	5 mA (IA, IB, IC) (0.0005-0.250 A)	± 3.0%	± 4.25°
	200 mA (IN) (0.01-3.0 A)	± 0.27%	± 2.0°
	50 mA (IN) (0.001-1.00 A)	± 1.1%	± 2.0°
	10 mA (IN) (0.001-0.200 A)	± 1.5%	± 2.0°
	1 mA (IN) (0.0005-0.250 A)	± 3.0%	± 4.25°
<b>RMS Metering</b>		Magnitude	Phase Angle
CT Rating and Range	5 A (IA, IB, IC) (0.04-12.0 A)	± 0.02%	± 0.7°
	1 A (IA, IB, IC) (0.01-12.0 A)	± 0.15%	± 0.7°
	5 mA (IA, IB, IC) (0.0005-0.250 A)	± 3.0%	± 4.25°
	200 mA (IN) (0.01-2.5 A)	± 0.5%	± 3.0°
	50 mA (IN) (0.005-1.00 A)	± 1.1%	± 3.0°
	10 mA (IN) (0.001-0.200 A)	± 1.6%	± 3.0°
	1 mA (IN) (0.0005-0.250 A)	± 3.0%	± 4.25°
<b>Fundamental Sequence Current Accuracy</b>		Magnitude	Phase Angle
Sequence Component & Current Range	3I0 / 3I1 / 3I2 (0.010-10.0 A)	± 0.5%	± 0.7°

Table 3 Metering Accuracies – Current

<b>METERING ACCURACIES</b>		
Analog sources used for measurement traceable to NIST Standards, with certifications on file.		
<b>FREQUENCY ACCURACY</b>		
Frequency Range (50 Hz & 60 Hz)	15 Hz – 100 Hz	± 0.02 Hz
<b>POWER ACCURACY</b>		
<b>Fundamental Metering</b>	Phase (Real W)	± 0.3 % @PF = 1.0, 0.87, 0.5
	Phase (Reactive var)	± 0.5 % @PF = 0.0, 0.87, 0.5
	Phase (Apparent va)	± 0.25 %
	Phase to Phase (Real W)	± 0.3% @PF = 1.0, 0.87, 0.5
	Phase to Phase (Reactive var)	± 0.5% @PF = 0.0, 0.87, 0.5
	Phase to Phase (Apparent va)	± 0.25%
<b>RMS Metering</b>	Phase (Real W)	± 0.3 % @PF = 1.0, 0.87, 0.5
	Phase (Reactive var)	± 0.5 % @PF = 0.0, 0.87, 0.5
	Phase (Apparent va)	± 0.25 %
	Phase to Phase (Real W)	± 0.3% @PF = 1.0, 0.87, 0.5
	Phase to Phase (Reactive var)	± 0.5% @PF = 0.0, 0.87, 0.5
	Phase to Phase (Apparent va)	± 0.25%

Table 4 Metering Accuracies – Frequency and Power

## Settings Groups

The M-7679 R-PAC has eight setting groups. Switch setting groups to properly account for prevailing power system conditions. For example if one breaker is dedicated for maintenance you can store the settings for all the feeders and use the appropriate group when that breaker is out of service for maintenance. All the functions shown in [Figure 1](#) (One-Line Diagram) are available in each settings group.

## Oscillographic Recording

The Oscillograph Recorder provides comprehensive data recording of voltages, currents, and status input/output signals for all monitored waveforms. The Oscillograph recorder stores 100 records of up to 480 cycles each regardless of the sampling rate (at 16, 32, 64, or 128 samples per cycle). Oscillograph data can be downloaded using any communications ports to any Windows® compatible computer running the IPScorn S-7600 Communications Software. Once downloaded, the waveform data can be examined, printed or used in generating reports. The waveform data is also available in COMTRADE file format.

The recorder may be triggered using either the designated protective function element or logic equations. When triggered, the recorder stores pre-trigger data, and then continues to store data for a user-defined post-trigger delay period. The post-trigger delay will range from 5 to 95% of the total record length.

## Live Oscillograph

The Live Oscillograph feature allows the user to view in real time the seven channels of oscillography with Power, Power Quality, Phasors and Harmonics.

## Sequence of Events

The M-7679 R-PAC keeps records of the last 3500 Sequence of Events with the following information:

- Pickup, trip, and extinction date and time, and fault duration
- Voltage and current signals for each phase, neutral and sensitive neutral during pre fault, trip and maximum or minimum depending on each case
- Trip cause
- Protection pickup elements that were activated
- Active group
- Fault directionality

## Fault Locator

The M-7679 R-PAC Fault Locator feature can reduce the time required to restore service due to a distribution system fault by providing an accurate estimate of the fault's location, even during periods of high customer load. The control integrates line impedance settings, fault type and fault conditions to calculate the fault location estimation. This feature works without requiring special instrument transformers, pre fault data, or communication to other devices.

## Fault Event Records

The M-7679 R-PAC can record and store up to 3,500 events related to the operation of protection functions, changes in configuration, states of the digital inputs and outputs, pickup and/or operation of protection functions, automated mechanism, statistics, etc.

## Front Panel

- LCD display, 2 rows, 20 characters per row, with configurable contrast
- Twelve programmable tricolor front panel LEDs
- Keyboard – 17 pushbuttons:
  - Eight programmable pushbuttons with programmable LEDs
  - Nine function pushbuttons

The M-7679 R-PAC includes Programmable Alarm LEDs to indicate any general overcurrent trip (TRIP), plus additional LEDs to indicate the type of overcurrent trip. The Fast-Curve LED indicates a Fast-Curve Trip.

## Recloser/Breaker Wear Monitor

The M-7679 R-PAC control records the amount of current carried in each phase each time the recloser trips. The control's operational logic employs an algorithm integrating the amount of unfiltered AC current at the time of each trip and the number of operations (close to open) as a method of calculating wear. The control uses this information to establish wear setpoints derived in accordance with IEEE C37.61-1973, and initiates a signal to assert an alarm or modify the recloser operation parameters, such as reducing the total number of reclose operations.

## Load Profile Trending (Extended Data Logging Feature)

The M-7679 R-PAC can store up to 25 parameters in non-volatile memory (instantaneous, maximum, and minimum with date and time stamping). These parameters include the instantaneous values and energy accumulator groups in time intervals between 0 and 3600 seconds, with 60 second steps. The M-7679 R-PAC has a storage capacity of up to 210,000 records.

## Synchrophasors▲

Synchrophasors improve system operation and reliability allowing operators to closely monitor the distribution network in real time to detect potential cascading voltage collapses before they occur. The M-7679 R-PAC supports the transmission of synchrophasors acting as a Phasor Measurement Unit (PMU) in compliance with IEEE C37.118-2. Phasor measurements taken at a selectable rate of up to 60 messages or frames per second can be transmitted to a Phasor Data Concentrator for user analysis in a wide-area monitoring and control system.

▲ Feature available at future date via firmware update

## Sensitive Ground Indicator

■ **NOTE:** The SGI algorithm was designed to work reliably on an ungrounded (3 wire) system or a balanced system where the Phase CTs are capable of accurately producing 1 mA Secondary output current.

High Impedance Faults (HIZ) do not produce enough fault current to allow detection by conventional overcurrent methods. Beckwith Electric has developed a proprietary logic that uses harmonic components of Ground Fault Current ( $I_G$ ) to implement the SGI feature.

This feature is available with Sensitive Ground Current Input options: 1 mA, 10 mA, 50 mA, or 200 mA. The M-7679 default  $I_g$  input is 50 mA. This input is adequate for grounded distribution systems. For ungrounded distribution systems an optional 10 mA  $I_g$  input is available to increase the sensitivity to detect a ground current fault.

User settings need to be fine-tuned in the field based on the collected non fault data for various distribution system grounding (ungrounded vs grounded) configurations. The maximum rating of the Ground CTs is listed in [Table 7](#).

For enhanced security, custom logic may also be created through the use of two additional configurable Global Logic blocks.

## Phantom Voltage

The M-7679 has the capability to calculate and provide three-phase voltage that is measured without having three voltages physically connected to the terminals of the M-7679. The following VT configurations are supported: Phantom Wye, Phantom Delta, and Open Delta.

**Phantom WYE** is supported for VT connection ONLY. The M-7679 will measure one analog voltage signal on any of the voltage terminals and will then calculate the two remaining corresponding balanced phase voltages.

**Example:** A voltage signal is applied to the terminal defined as Phase A. The M-7679 will calculate and provide all three balanced Line to Ground phase voltages.

**Phantom Delta** is also supported in the VT connection ONLY. The measured signal applied to one of the voltage terminals is assumed to be a Line to Line quantity. The M-7679 will then calculate the remaining two corresponding balanced Line to Line voltages.

**Example:** Line to Line voltage AB is applied to the Phase A terminal of the unit. The M-7679 will then calculate BC and CA and will provide all voltages.

**Open Delta** configuration is also supported in the VT connection ONLY. For example, if two voltage signals with a phase differential of 60 degrees are applied to 2 voltage terminals, with the remaining terminal grounded, the M-7679 will calculate and provide balanced Line to Line voltages AB, BC and CA derived from the two measured voltage signals. The M-7679 assumes proper polarity has been observed. The two measured signals come from Open Delta connected PTs.

**Example of Open Delta CA:**

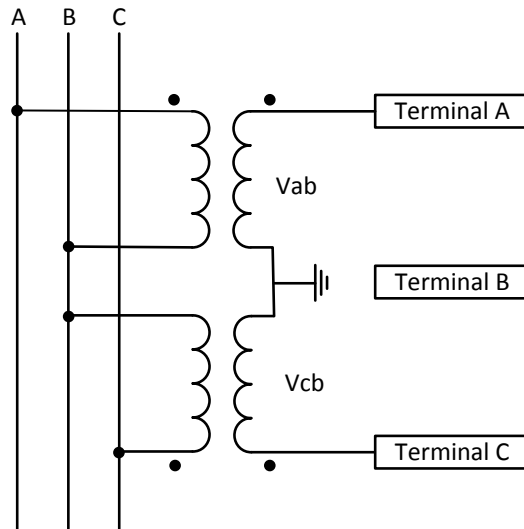


Figure 6 Open Delta CA Example Diagram

**Cyber Security**

The M-7679 R-PAC was designed from the ground up to help customers be NERC and Cyber Security compliant. The M-7679 R-PAC meets or exceeds the following standards:

Meets IEEE 1686-2007 Password requirement

FIPS180-2, 186-2

ISO/IEC 9798-4

RFC 2104, 3174, 3394

IPsec using Internet Key Exchange (IKE) Version 2, compliant with: RFC 2401, 2402, 2406, 2407, 2408, 2409, 2411, 2412, 3706.

RADIUS Server Support (optional), compliant with: RFC 2865 and 2866

**Smart Peer-to-Peer (P2P) Communications▲**

Smart P2P Communications is a peer-to-peer communication feature provided that shares operational status among peer devices within its local network. Smart P2P Communication can be used to implement pilot transfer schemes or advanced network reconfiguration algorithms. P2P communication can be done via Ethernet communications including multi-mode fiber optic link. The transmission rate for multi-mode fiber optic is dependent on the choice of fiber optic used, and the speed of the network. Select a suitable multi-mode fiber grade for the network application. Each grade has bandwidth and distance limitations. Distance can vary between 30 meters to 400 meters.

▲ Feature available at future date via firmware update.

**S-7600 IPScom Communications Software**

The S-7600 IPScom Communications Software enables local or remote communication between a Windows® based computer and the M-7679 R-PAC. It is a Windows application, which allows the user to interact with software modules in different languages. The S-7600 IPScom Communications Software makes efficient use of object-oriented programming, achieving a smooth and scalable design, and has an open data structure that allows maintenance and the incorporation of new functions.

The S-7600 IPScom Communications Software is a Windows application that provides an easy graphical interface to program and monitor the M-7679 R-PAC. The S-7600 Software provides a simple function programming interface, plus an easy-to-use settings wizard.

## Smart Flash SD Card Slot

Allows the user to perform the following functions locally without needing a laptop in field.

- Load Setpoints
- Save Setpoints
- Save Data Log
- Save Sequence of Events
- Save Oscillograph Records
- Clone Save
- Clone Load
- Firmware Update
- Save Metering Data
- Save Wake Screen Data
- Physical Security Key
- Bootloader Update

■ **NOTE:** The Smart Flash SD Card slot supports standard SD Memory Cards: **SD, SDHC, SDXC, and UHS-I** format. The following formats are **NOT** supported: SDUC, UHS-II, UHS-III, and UHS-I Express.

## Cold Load Pickup

The M-7679 R-PAC Cold Load Pickup feature provides the user with the ability to automatically adjust the M-7679 R-PAC Overcurrent protection elements to consider the duration of a loss of load and the recloser response to the loss of load. The Cold Load Pickup feature can tailor the recloser settings to allow the return of the load without tripping. The Cold Load Pickup feature continuously monitors recloser parameters to ascertain when the non-Cold Load Pickup settings can be restored.

## Selective Load Shedding Provides Improved System Response and Service Reliability

Modernizing existing recloser apparatus by retrofitting with the M-7679 R-PAC provides improvements to system response and service reliability. The Recloser Control can be set up to recognize critical loads and help stabilize system loading. Including underfrequency elements as components of the Recloser Control scheme allows segmenting the feeder to sustain maximum load and respond to system conditions during power transients. Recloser programming allow as much as six levels of frequency and time settings to coordinate with other devices during a power loss.

## General Specifications

### Power Supplies

The M-7679 R-PAC provides a choice of two main power supply input ranges: a low voltage range of 18 to 60 Vdc and a high range of 90 to 280 Vac or 90 to 315 Vdc. The M-7679 R-PAC also features a backup power supply input of 11 to 14 Vdc, that allows continued operation in case of main power supply loss.

▲ **CAUTION:** Any TB3 receptacle that is **NOT GREEN** indicates that a **Low Voltage Power Supply** is installed in the unit. Always refer to the unit label "Power Supply Ratings" for the applicable range.

Power Supply	Range	Burden
24/48 Vdc	18-60 Vdc	12 VA
125/220 Vdc/Vac (Optional)	90-280 Vac 90-315 Vdc	15 VA

Table 5 Power Supply Specifications

### AC Voltage Inputs

Voltage	Nominal	Maximum Continuous	Max Short Duration	Burden
Line to Neutral	120 Vac	300 Vac	600 Vac for 10 s	1M $\Omega$
Low Energy Analog	4 Vac	12 Vac	300 Vac for 10 s	1M $\Omega$

Table 6 AC Voltage Input Specifications

## AC Current Inputs

AC Current	I Nominal	I Continuous	I Short duration	Burden
Phase Current	1 A	4 A	100 A for 1 second	< 0.02 VA
	5 A	20 A	500 A for 1 second	< 0.10 VA
	5 mA	300 mA	5 A for 1 second	< 0.001 VA
Ground Current	1 A	4 A	100 A for 1 second	< 0.02 VA
	5 A	20 A	500 A for 1 second	< 0.10 VA
Sensitive Earth Fault (SEF)	1 mA	300 mA	5 A for 1 second	< 0.001 VA
	10 mA	1.5 A	20 A for 1 second	< 0.001 VA
	50 mA	1.5 A	100 A for 1 second	< 0.002 VA
	200 mA	1.5 A	100 A for 1 second	< 0.03 VA

Table 7 AC Current Input Specifications

## Digital Inputs (Opto-Isolated)

The M-7679 R-PAC includes four programmable inputs with capability for expansion up to twelve. These inputs must be externally wetted. The M-7679 R-PAC offers two voltage ranges. The wetting voltage can be either AC or DC.

■ **NOTE:** [Table 8](#) lists the Digital Input specifications for the latest M-7679 R-PAC hardware. If the product serial number is from #1 to 2000, refer to the M-7679 R-PAC Instruction Book, **Appendix D** for hardware specifications.

▲ **CAUTION:** Always refer to the unit label "Digital Input Ratings" for the applicable range.

Wetting Voltage	
Input	Pickup Range
Low	9 V AC/DC – 180 V AC/DC
High	180 Vdc – 300 Vdc
	180 Vac – 280 Vac

Table 8 Digital Input Specifications

## Output Contacts

The M-7679 R-PAC includes four output contacts expandable to twelve. Any of the protective functions can be individually programmed to activate any one or more of the four Programmable Output Contacts (OUT1 through OUT4). Any output contact can also be selected as pulsed or latched. IPSlogic can also be used to activate output relay contact. The output contacts are all rated per IEEE C37.90 (See Tests and Standards section for details).

**Output Reaction Time:** ≤8.2 ms.

The optional expanded I/O includes an additional eight Programmable Output Contacts (OUT5 through OUT12). These contacts are only configurable using IPScom Communications Software.

## Operation Frequency and Phase Rotation

Frequency: 60 Hz or 50 Hz

Tracking: 42 to 65 Hz

Phase Rotation: ABC or ACB

## Communications Ports

Unused communications ports can be disabled through software to comply with cyber security requirements.

Front – USB Port–Type B, Version 1.1 (Local Programming), SD Card

Rear – Communication Ports:

- Port 1 (standard) – Serial TIA-232, TIA-485, Fiber, or none
- Port 2/Port 3 (optional) – One or two Ethernet Ports, RJ45 10/100 BASE-T, or Fiber 100 BASE-FX (connector type: duplex ST, multimode fiber, wavelength 1300-nm)
- Port 4 (optional) – Serial TIA-232, TIA-485, Fiber, or none
- Ethernet Ports are auto-detect, auto-negotiable 10/100 Mbps, with support for multi-user rights for up to six concurrent users

Time Synchronization Port:

- IRIG - B (B000)
- Input level – TTL
- Input – Demodulated
- Isolation – 1,500 Vdc

## Optional Analog Output Module

The optional Analog Output Module is a current loop dual channel device capable of transmitting selected data as current from the M-7679 to third party utility grade devices. The module is configured using IPSCOM S-7600. The module contains two current loop outputs capable of providing two signal ranges, either 4-20 mA or 0-20 mA (configured individually per channel). The internal DC/DC power supply isolates the output loop from chassis and earth ground.

The module is installed in the rear communication Port 1 of the M-7679. Options for metering points include:

- Real, average and reactive power (in Watts or VAr) for each phase
- Magnitude of primary and apparent power in VA for each phase
- Primary magnitude of load side positive, zero, or negative sequence voltage
- Primary phase current or ground current magnitude

### Input

External Supply Voltage – 18 to 30 Vdc

Supply Current – 125 mA

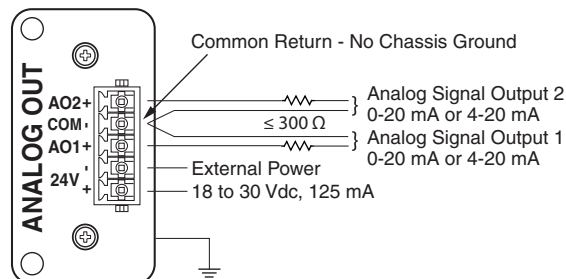
Transient Protected

### Output

Current Load Resistor – 300  $\Omega$

Up to 20 mA signal out – Accuracy  $\pm 0.2\%$  of FSR over range of -40C to +85C

No common connection to earth or chassis ground



▲ **CAUTION:** Return signal common must not be connected to ground. Damaging current will occur.

## Protocols

Serial Ports – MODBUS, DNP3.0

Ethernet Ports – MODBUS over TCP/IP and UDP, DNP3.0 over TCP/IP and UDP, IEC 61850 (optional), SmartP2P (Peer to Peer)▲, IEC 60870-5-104 (optional)

▲ Feature available at future date via firmware update

## Self-Diagnostics

The M-7679 R-PAC includes several self-diagnostic functions and routines that detect possible hardware failures. It also includes a manual test mode that is used to check if the LEDs, Inputs, Outputs, Display, and Keyboard are working properly.



### M-7679 Typical Connection Diagram

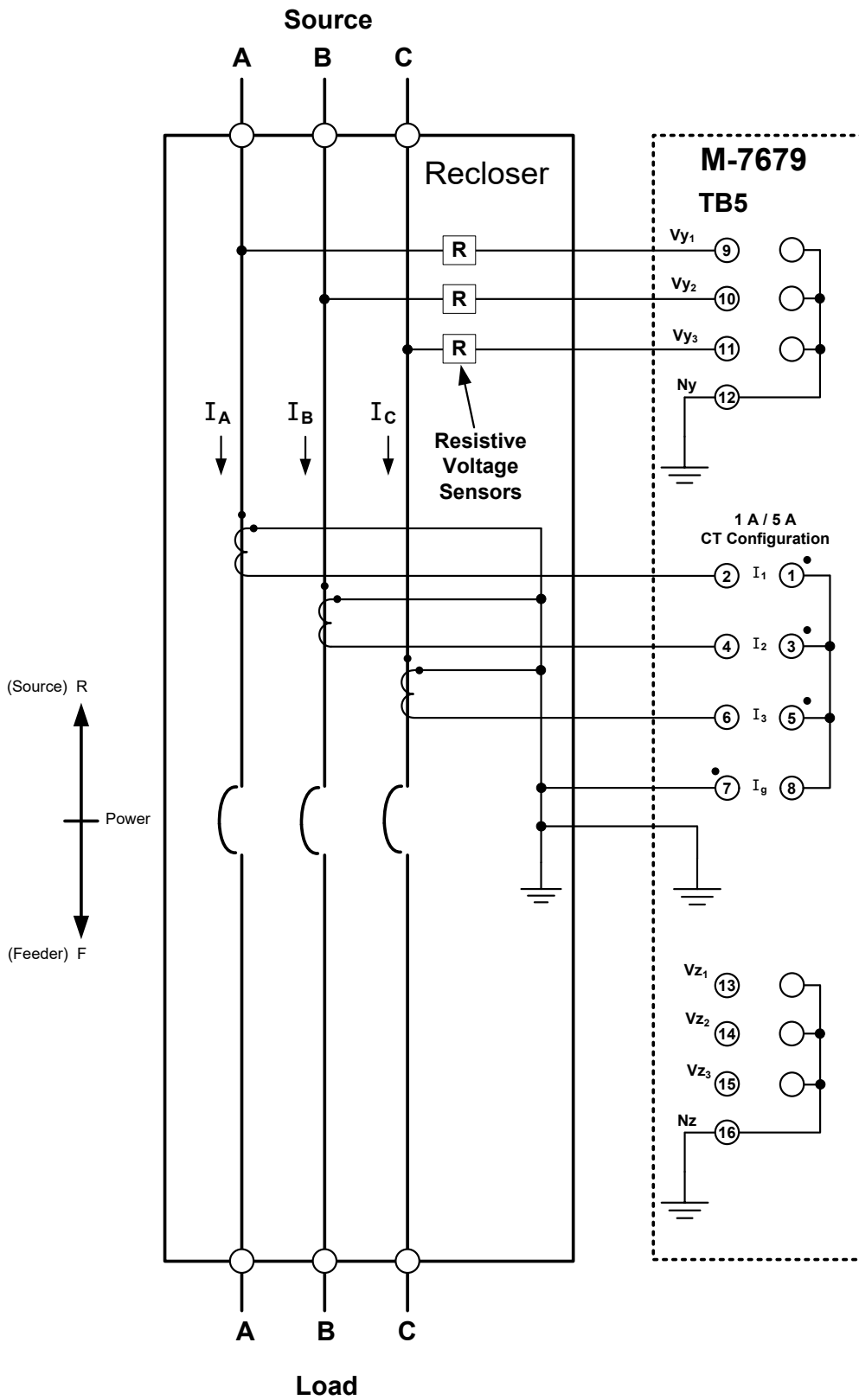


Figure 7 M-7679 Three-Line Connection Diagram

## Tests and Standards

The M-7679 R-PAC complies with the following tests and standards in accordance with EN 60255-26.

### Voltage Withstand

#### *Dielectric Withstand*

IEC 60255-27            2,000 Vac

#### *Impulse Voltage*

IEC 60255-27            ± 5,000 V-pk

#### *Insulation Resistance*

IEC 60255-27            > 5 G  $\Omega$

### Electrical Environment

#### *Surge Withstand Capability*

IEEE C37.90.1            ± 2.5 kV Oscillatory

IEEE C37.90.1            ± 4 kV Fast Transient Burst

#### *1 MHz Oscillatory Immunity*

IEC 61000-4-18            ± 2.5 kV Common Mode

IEC 61000-4-18            ± 2.5 kV Differential Mode

#### *Electrostatic Discharge Test*

IEEE C37.90.3            (± 8 kV) – Point Contact Discharge

IEEE C37.90.3            (± 15 kV) – Air Discharge

IEC 61000-4-2            (± 8 kV) – Point Contact Discharge

IEC 61000-4-2            (± 15 kV) – Air Discharge

#### *Radiated Field Immunity*

IEEE C37.90.2            35 V/m – 80 to 1000 MHz

IEC 61000-4-3            35 V/m – 80 to 1000 MHz

10 V/m – 1400 to 2700 MHz

#### *Conducted Field Immunity*

IEC 61000-4-6            10 V<sub>RMS</sub> – 150 kHz to 80 MHz

#### *Fast Transient Disturbance Test*

IEC 61000-4-4            ± 4 kV, 5 kHz

#### *Surge Immunity*

IEC 61000-4-5            ± 2 kV Common Mode

IEC 61000-4-5            ± 2 kV Differential Mode

#### *Voltage Interruption Immunity*

IEC 61000-4-11            (5 cycles AC / 50 ms DC)

## Output Contacts

IEEE C37.90	30 A make for 0.2 seconds at 250 Vdc Resistive
cULus 508	8 A carry at 120 Vac, 50/60 Hz
	6 A break at 120 Vac, 50/60 Hz
	0.5 A break at 48 Vdc, 24 VA
	0.3 A break at 125 Vdc, 37.5 VA
	0.2 A break at 250 Vdc, 50 VA

## Atmospheric Environment

### Temperature

■ **NOTE:** The LCD display's visible temperature range is -20° C to +70° C.

IEC 60068-2-1	Cold, -40° C (-40° F) (operating)
IEC 60068-2-2	Dry Heat, +85° C (+185° F) (operating)
IEC 60068-2-38	Damp Heat condensation / frost cycles +25° C, +65° C, -10° C @ 95%RH
IEC 60664-3	Conformal coat grade UV40-250 board protection -50° C (-58° F) to +125° C (+257° F) CAT IV

## Mechanical Environment

IEC 60255-21-1	Vibration response Class 1 (0.5 g ) Vibration endurance Class 1 (1 g )
IEC 60255-21-2	Shock response Class 1 (5 g ) Shock Withstand Class 1 (15 g ) Bump Endurance Class 1 (10 g )

## IP Protection Degree

IEC 60529	IP 50, Dust Protected ( <b>NOTE:</b> greater protection is available by installing the control in the M-2979 Control Cabinet.)
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## Compliance

cULus-Listed per 508	– NRGU.E128716 Industrial Control Equipment – NRGU7.E128716 Industrial Control Equipment Certified for Canada CAN/USA C22.2 No. 14-M91
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cULus-Listed per 508A – Table SA1.1 Industrial Control Panels

M-7679 R-PAC Recloser Control provides comprehensive multifunction protection, control, monitoring, communications and embedded cybersecurity for DER Interconnection Applications. The capabilities meet or exceed the relay-based protection and control requirements specified in ANSI/IEEE Std. 1547-2018, "IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces".

## Physical

5 Unit Height and 1/3 rack of 19"

**Environmental:** For flat surface mounting on a Type 1 enclosure, UL rated to 70° C surrounding air ambient.

**Size:** Vertical: 6.0" wide x 8.0" high x 6.22" deep (15.2 cm x 20.3 cm x 15.8 cm)

Horizontal: 9.47" wide x 5.20" high x 6.22" deep (24.1 cm x 13.21 cm x 15.8 cm)

**Approximate Weight:** 3.5 lbs (1.6 kg)

**Approximate Shipping Weight:** 5 lbs (2.27 kg)

## Recommended Storage Parameters

**Temperature:** 5° C to 40° C

**Humidity:** Maximum relative humidity 80% for temperatures up to 31° C, decreasing to 31° C linearly to 50% relative humidity at 40° C.

**Environment:** Storage area to be free of dust, corrosive gases, flammable materials, dew, percolating water, rain and solar radiation.

## Disposal and Recycling

### *Disposal of E-Waste for Beckwith Electric Products*

The customer shall be responsible for and bear the cost of ensuring all governmental regulations within their jurisdiction are followed when disposing or recycling electronic equipment removed from a fixed installation.

Equipment may also be shipped back to Beckwith Electric for recycling or disposal. The customer is responsible for the shipping cost, and Beckwith Electric shall cover the recycling cost. Contact Beckwith Electric for an RMA # to return equipment for recycling.

## Warranty

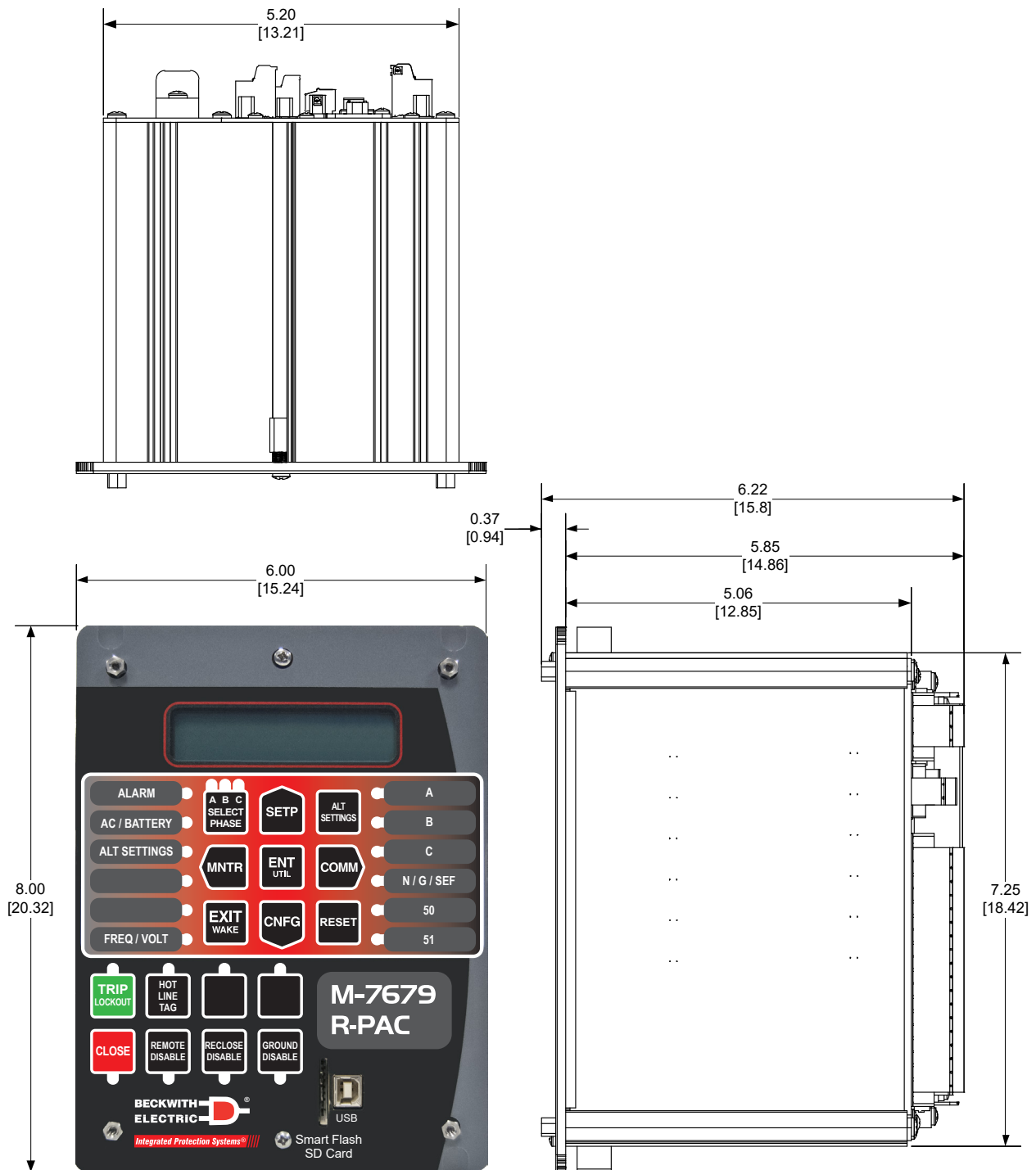
The M-7679 R-PAC is covered by a ten-year warranty from date of shipment.

## Trademarks

All brand or product names referenced in this document may be trademarks or registered trademarks of their respective holders.

*Specification subject to change without notice. Beckwith Electric has approved only the English version of this document.*

**M-7679 R-PAC – Specification**



*Figure 8 M-7679 Vertical Model External Dimensions*

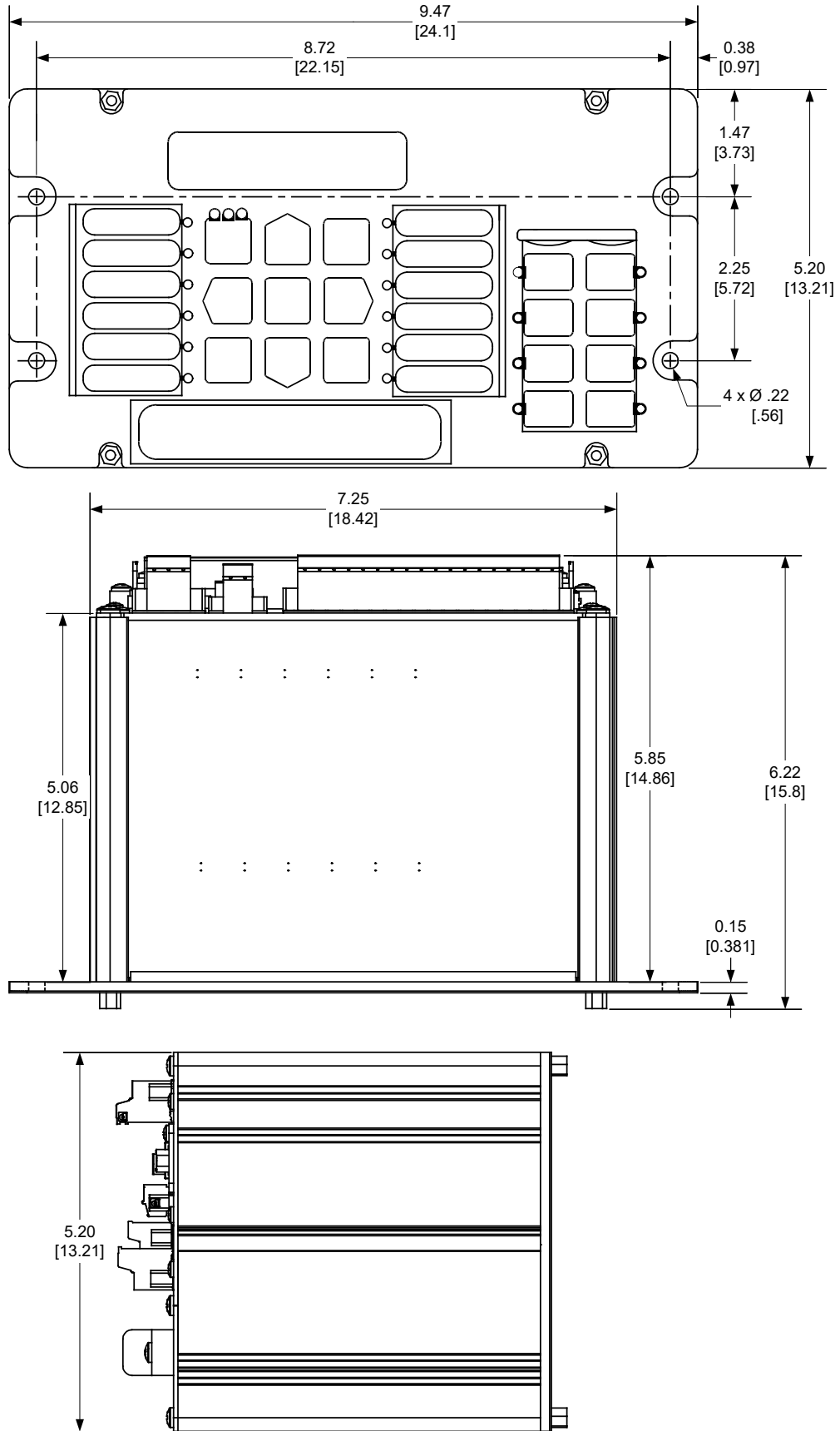


Figure 9 M-7679 Horizontal Model External Dimensions



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