



# M-7651A D-PAC

**Protection, Automation  
and Control System  
for Power Distribution  
Applications**

## Protection

- Over 30 Protection Elements for optimal protection of Power Distribution Systems
- Ready to use advanced Protection Schemes for applications including Feeder Protection, Bay Control and DG Interconnection Protection
- 8 Setting Profiles
- Comprehensive I/O Matrix provides visual confirmation of enabled functions and selected outputs improving security
- Arc Flash Protection including:
  - Maintenance Mode
  - Reverse Interlock Bus Protection
  - (Optional) Optical with Overcurrent Protection
- Compatible with Optical Point or Loop Sensors

## Automation/Communications

- Front panel USB and SD Card ports for local programming and data transfer
- One or two optional serial ports (TIA-232, TIA-485 or Serial Fiber)
- 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
- Embedded Cyber Security features to implement NERC/CIP v5 requirements, including IPsec and RADIUS server security
- Meets IEEE 1686 Password requirement

## Control

- Four user programmable Inputs and Outputs, expandable to 12 Inputs and 12 Outputs, plus 19 Virtual Inputs
- User programmable front-panel LEDs and pushbuttons

## Monitoring

- 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
- Advanced Data Logging and Load Profile Recorder
- 3500 Event Sequence of Events (SOE) Recorder
- 100 DFR quality records of up to 480 cycles each with an adjustable sampling rate up to 128 s/c

## IPScom<sup>®</sup> – 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

## Flexibility

- Fast and easy retrofitting for most popular relays in existing cutouts using Beckwith's Adapter Panel Technology™



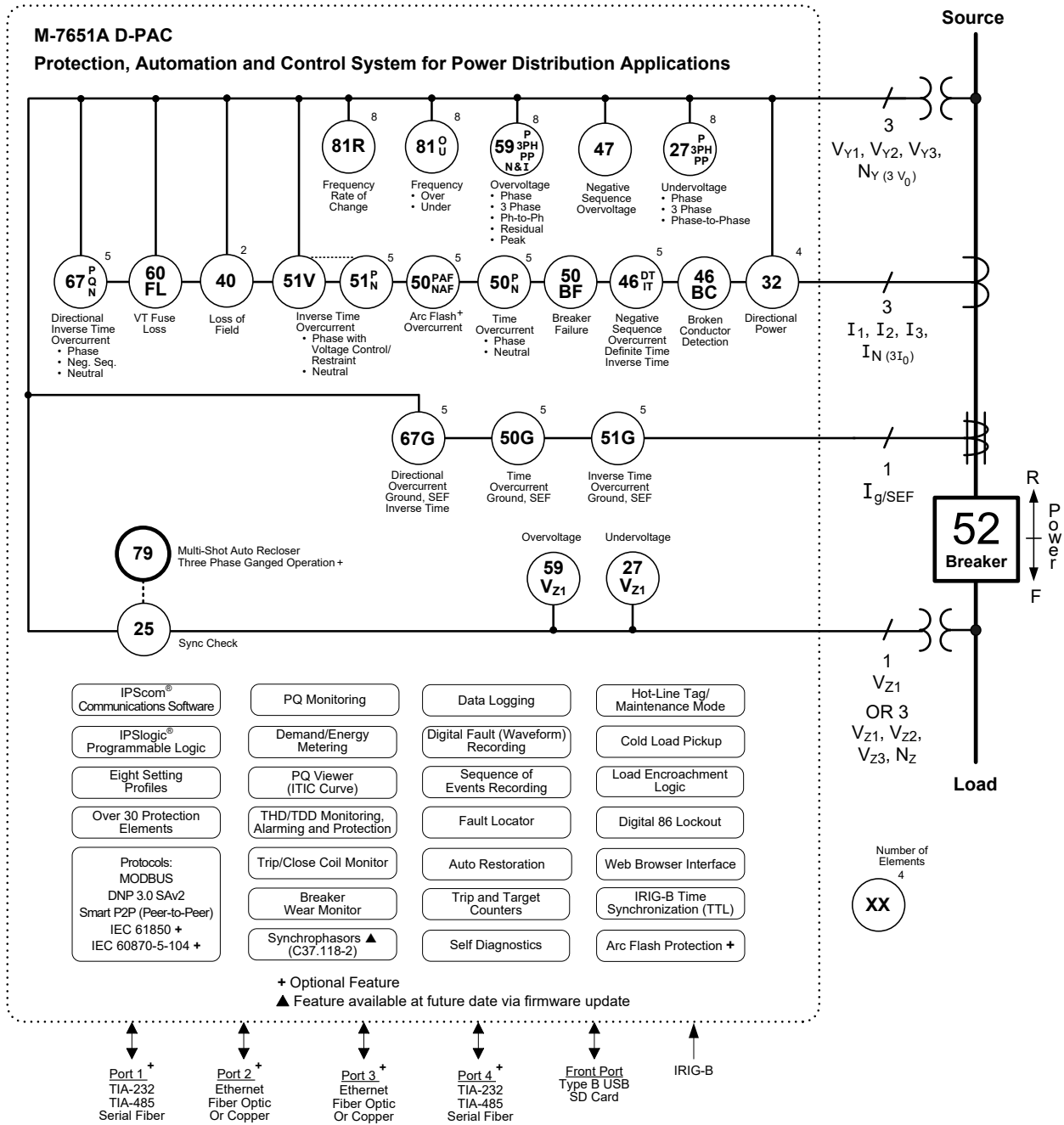


Figure 1 M-7651A D-PAC One-Line Functional Diagram

## 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
- Eight Setting Profiles
- Hot Line Tag/Maintenance Mode
- Cold Load Pickup
- Load Encroachment Supervision
- 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
- 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
- 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

- Multi-Shot Auto Recloser, Three-Phase Ganged Reclose Operation
- PORT 1 – TIA-232, TIA-485, or Fiber Optic
- 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
- Arc Flash detection
- M-2034 BECO Drive – contact Customer Technical Support for additional information and ordering options
- Clear Plastic Splash Guard (Horizontal)

## M-7651A Mounting Options

- 19" Rack Mount Adapter Panel
- Adapter Frames to mount the M-7651A into existing cutouts

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

### External Connections

The possible connections for the M-7651A D-PAC are shown in [Figure 2](#) and [Figure 3](#).

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

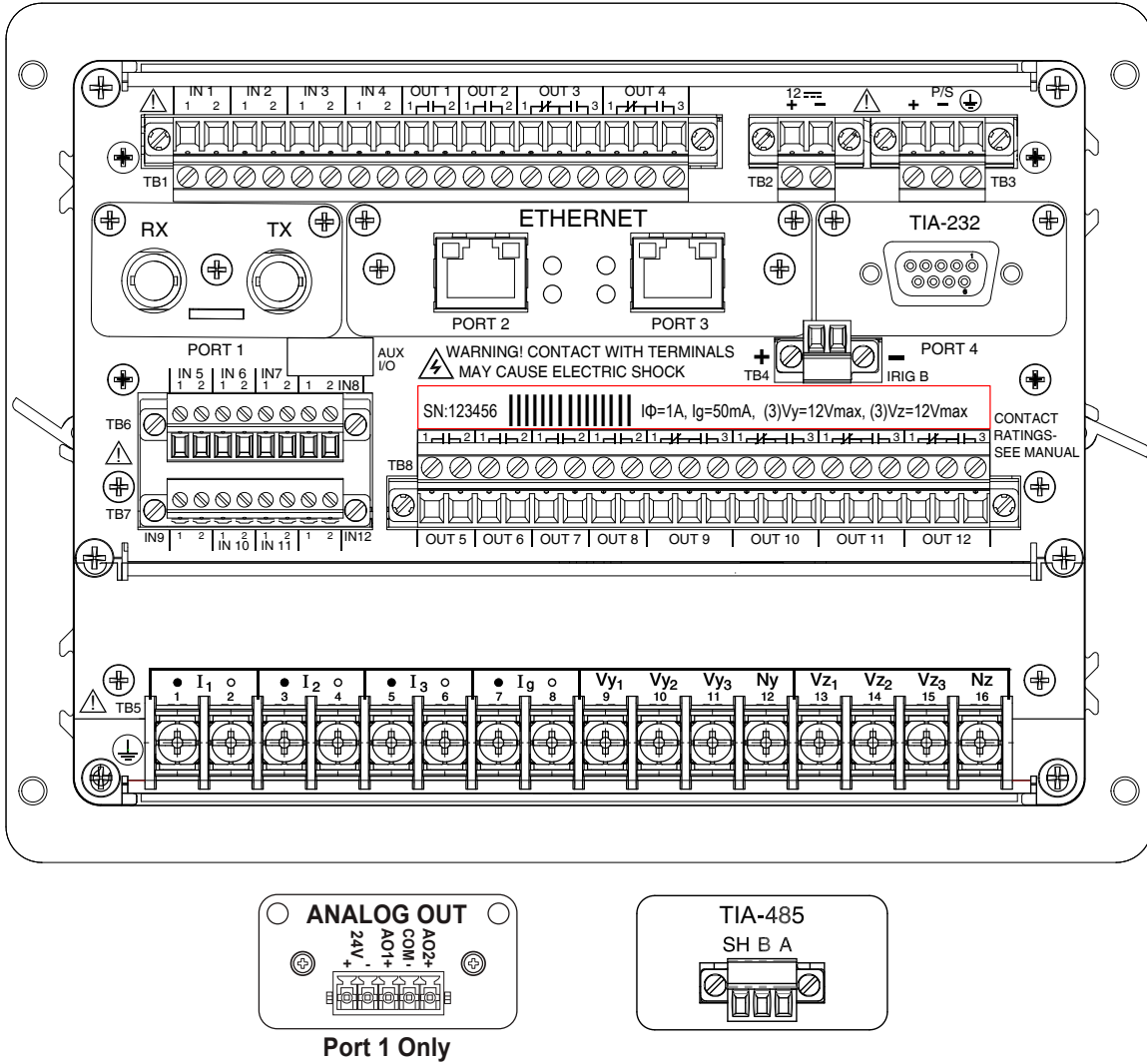


Figure 2 M-7651A External Connections (Typical configuration, other options are available)

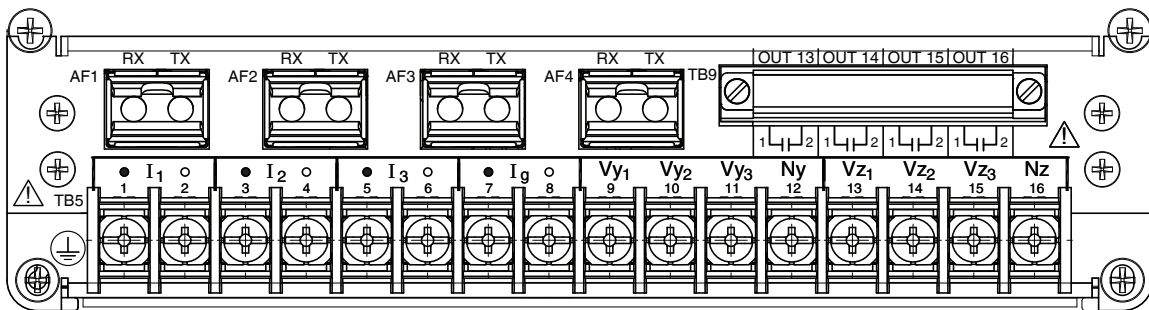


Figure 3 M-7651A External Connections (Optional Arc Flash Module)

**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>Loss of Field - Dual-zone Offset-mho Characteristic (#1 to #2 Elements)</b>					
40	Circle Diameter				
	1 A CT	0.5 to 500.0 $\Omega$	0.1 $\Omega$	$\pm 0.5 \Omega$ or $\pm 5\%$	
	5 A CT	0.1 to 100.0 $\Omega$	0.1 $\Omega$	$\pm 0.1 \Omega$ or $\pm 5\%$	
	Offset				
	1 A CT	-250.0 to 250.0 $\Omega$	0.1 $\Omega$	$\pm 0.5 \Omega$ or $\pm 5\%$	
	5 A CT	-50.0 to 50.0 $\Omega$	0.1 $\Omega$	$\pm 0.1 \Omega$ or $\pm 5\%$	
	Time Delay	0.01 to 300.00 s	0.01 s	$\pm 1$ Cycle or $\pm 1\%$	
	Time Delay with Volt. Ctrl.	0.01 to 300.00 s	0.01 s	$\pm 1$ Cycle or $\pm 1\%$	
	<i>Time delay with Voltage Control for each zone can be individually enabled.</i>				
	Voltage Control	5 to 180 V	1 V	$\pm 0.5$ V or $\pm 0.5\%$	
Directional Element	0° to 20°	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>Negative Sequence Overcurrent (#1 to #5 Elements)</b>				
<b>46 DT</b>	<b>Definite Time</b>			
	Pickup			
	1A 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>46 IT</b>	<b>Inverse Time</b>			
	Pickup			
	1A 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%

<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	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 (Sensitive 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%
	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	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	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	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	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	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	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%
<b>59 3PH</b>	Definite Time	0.00 to 600.00 s	0.01 s	±0.01 s or ±1%
	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	$3I_o$		
	Phase Polarization Voltage	$V_{Z1}, V_1, V_2, V_o$		
67G	<b>Ground Directional Overcurrent</b>			
	Operating Current	$I_g$		
	Phase Polarization Voltage	$V_{Z1}, V_1, V_2, V_o$		
67Q	<b>Negative Sequence Directional Overcurrent</b>			
	Operating Current	Negative Sequence Current		
	Phase Polarization Voltage	$V_2$		
	Enabled Direction	No-Direction/Directional		
	Minimum Polarization Voltage (% of nominal voltage)	2.0 to 10.0 %	0.1%	±3%
	Action if below	Trip/Block Trip		
	Maximum Sensitivity Angle 1	0° to 359°	1°	±1°
	Maximum Sensitivity Angle 2	5° to 90°	1°	±1°
	Time Delay	Definite/Inverse	–	–
	<b>Definite Time:</b>			
	Pickup			
	1A CT/Gnd CT	0.05 to 20.00 A	0.01 A	±0.02 A or ±3%
	5A CT/Gnd CT	0.25 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%

\*67P, 67N, and 67Q: the maximum Definite Time is reduced to 1.00 s if the pickup is > 20.00A 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>Inverse Time:</i>				
	Pickup			
	1A CT/Gnd CT	0.02 to 3.20 A	0.01 A	±0.02 A or ±3%
	5A CT/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>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	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	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>				
<b>50 GS</b>	Sensitive Ground Pickup			
	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>				
<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			
	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>				
<b>51 GS</b>	Sensitive Ground Pickup			
	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 GS</b>	Phase Polarization Voltage	V <sub>Z1</sub> , V <sub>1</sub> , V <sub>2</sub> , V <sub>0</sub>	–	–	
	Enabled Direction	No-Direction/Directional	–	–	
	Minimum Polarization Voltage (% of nominal voltage)	2.0 to 10.0 %	0.1%	±3%	
	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 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%		
<hr/>					
IEC Curves Family (IEC 60255-151)	Inverse, Very Inverse, Extremely Inverse				
Time Multiplier	0.05 to 1.00	0.01	±2 cycles or ±5%		
<hr/>					
IEEE Curves (C37.112)	Moderately Inverse, Very Inverse, Extremely Inverse				
Time Multiplier	0.10 to 25.00	0.01	±2 cycles or ±5%		
<hr/>					
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%		
<hr/>					
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%		
<hr/>					
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†
<b>Recloser Relay</b>				
79	<b>Three-Phase Ganged 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>Arc Flash</b>				
AF	<b>Arc Light:</b>			
	Definite Time	0.2 to 16.0 ms	0.1 ms	0.05 ms
	Time Delay	0.2 to 16.0 ms	0.1 ms	0.13 ms (60 Hz) 0.16 ms (50 Hz)
	Sensitivity	0 to 100% (Min/Max based on calibration results)	1%	–
	<b>Overcurrent:</b>			
	Peak Phase Pickup			
	1 A CT	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
	5 A CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%
	Peak Neutral Pickup			
	1 A CT	0.02 to 20.00 A	0.01 A	±0.02 A or ±3%
5 A CT	0.10 to 100.00 A	0.01 A	±0.1 A or ±3%	
10 mA CT	0.001 to 0.160 A	0.001 A	TBD	
50 mA CT	0.001 to 0.800 A	0.001 A	0.0015 A or ±3%	
200 mA CT	0.020 to 2.500 A	0.001 A	TBD	
Overcurrent Definite Time	0.2 to 16.0 ms	0.1 ms	0.13 ms (60 Hz) 0.16 ms (50 Hz)	
Overcurrent Time Delay	0.2 to 16.0 ms	0.1 ms	0.13 ms (60 Hz) 0.16 ms (50 Hz)	

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

## Introduction

The M-7651A D-PAC is a digital, Smart Grid ready, advanced Protection, Automation and Control System for 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 protection, automation and control systems. It offers a comprehensive protection package with over 30 individual protection functions and up to eight setting groups. The M-7651A D-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-7651A D-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-7651A D-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 relay.

## 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-7651A D-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
- Vertical Multiplier (time 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

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

The M-7651A D-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-7651A D-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
- 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°
<b>NOTE:</b> Voltage accuracy: <0.3 % with temperature between -5° C and +50° C <1.0 % with temperature below -5° C or above +50° C			

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°
	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°
<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°
	1A (IA, IB, IC) (0.01-12.0 A)	± 0.15%	± 0.7°
	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°
<b>Fundamental Sequence Current Accuracy</b>		Magnitude	Phase Angle
Sequence Component & Current Range	3I0 (0.010-10.0 A)	± 0.5%	± 0.7°
	3I1 (0.010-10.0 A)	± 0.5%	± 0.7°
	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-7651A D-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 eight channels of oscillography with Power, Power Quality, Phasors and Harmonics.

## Sequence of Events

The M-7651A D-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-7651A D-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-7651A D-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

M-7651A D-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-7651A D-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 breaker operation parameters, such as reducing the total number of breaker operations.

## Load Profile Trending (Extended Data Logging Feature)

The M-7651A D-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-7651A D-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-7651A D-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:** This feature is only available with 10 mA, 50 mA, or 200 mA Ground CT Configurations.

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. A 50 mA  $I_g$  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](#).

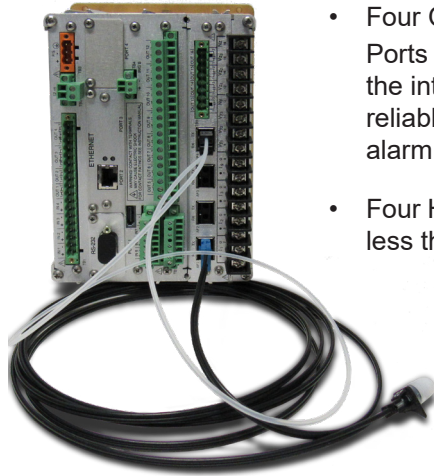
For enhanced security, custom logic may also be created through the use of two additional configurable Global Logic blocks.



## Optional Arc Flash Protection

The Arc Flash Protection option detects arc flash conditions in switchgear and operates circuit breakers to remove the current source from the arc, thus mitigating the potential damage to equipment.

Four Optical Transceiver Ports interface to transparent fiber optic loops and/or point sensors. The output of the Optical Transceiver is compared to a pickup value. When the signal remains above the pickup for a predefined time delay, the relay will activate the dedicated high speed outputs. A current supervision function is also available to prevent false trips caused by other light sources not related to arcing. To monitor the integrity of the fiber optic links, the optical transceivers will transmit a light pulse every 2 seconds and verify the presence/absence of the pulse. The unit will generate an alarm when a failure is detected.



- Four Optical Transceiver Ports – Fiber Optic Loop and/or Point Sensor Ports incorporate self-test circuitry to provide continuous monitoring of the integrity of optical sensors, fiber cables, and the control unit to ensure reliable operation. If a failure is detected, the M-7651A will generate an alarm to notify service personnel.
- Four High Speed Outputs – solid state output relays, with operating speed less than 4 ms.

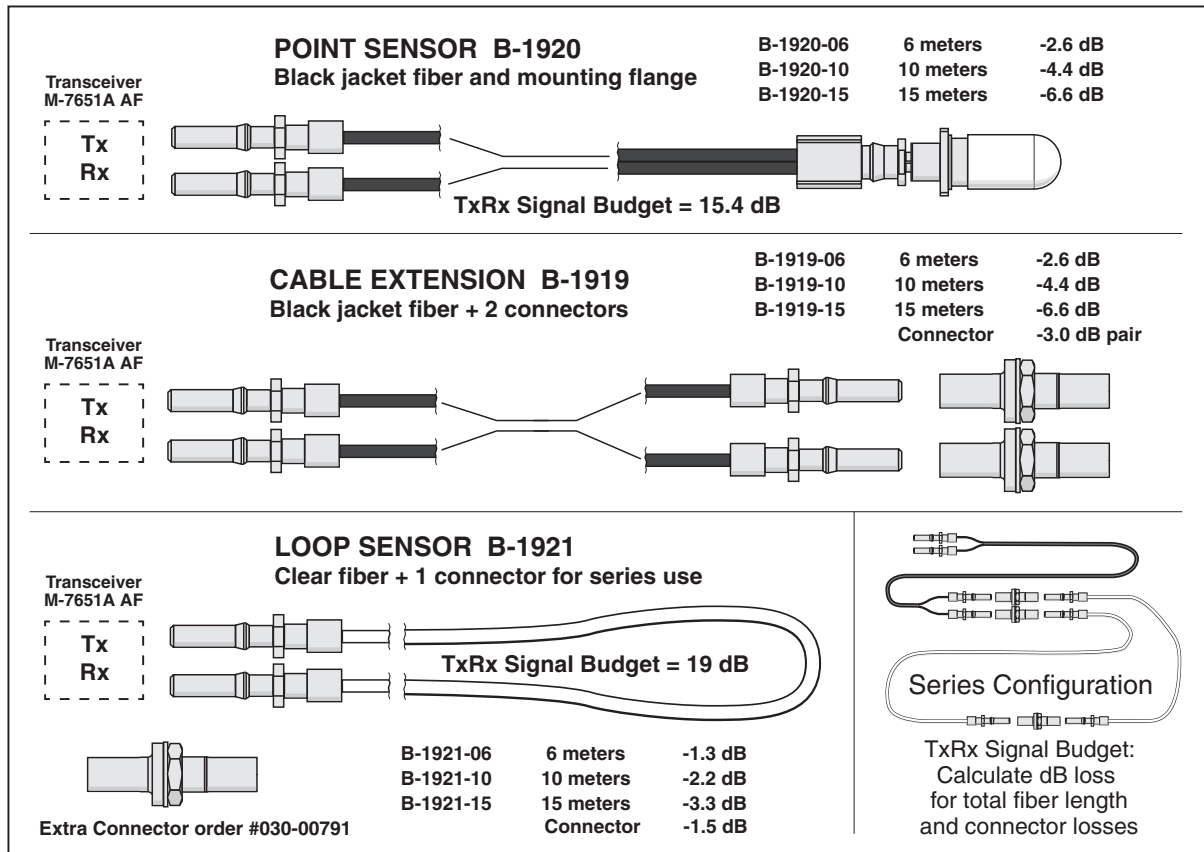


Figure 4 Arc Flash Loop Sensor & Point Sensor Configuration Options

The sensor cable extension reach for each transceiver port is limited by the loss of optical signal strength in the fiber and each connector. Loop Sensors have the same loss rate as jacketed Cable Extensions at 0.22 dB per meter of fiber. Note that while a 15 meter Loop Sensor is actually 15 meters of fiber, a 15 meter Cable Extension introduces 30 meters of fiber signal loss. Each inline connector absorbs 1.5 dB of the signal so it is recommended that no more than four be used per transceiver port. The transceiver port Signal Budget is 19 dB for Loop Sensors and 15.4 dB for Point Sensors. These budgets include the loss of the plug into the transceiver, so loss calculations are simplified to Signal Budget minus the sum of fiber and connector losses.

In practical terms, the limit for extending a 15 meter Point Sensor is a 10 meter Cable Extension. The total of 50 meters of fiber plus two connectors results in the loss of 14 dB from the Signal Budget of 15.4 dB.

For a Loop Sensor installation with one Cable Extension of 15 meters, installing two 15 meter Loop Sensors with one connector in series is acceptable because the sum of signal loss equals 17.7 dB from the Signal Budget of 19 dB. See [Figure 4](#) for an example illustration of a series configuration using only three connectors.

Maximum distance from the M-7651A can be reached using a 15 meter and a 10 meter Cable Extension with a 6 meter Loop Sensor. This configuration uses four connectors which are included with the Cable Extensions. The connector supplied with the Loop Sensor will not be needed.

**Arc Flash Module Additional Communication Capabilities**

The M-7651A Arc Flash Module is capable of publishing any high speed output trip, in addition to Arc Flash detection events. It can also be configured to subscribe to any other manufacturer’s Arc Flash boolean GOOSE message. This may be used in the internal M-7651A IPSlogic.

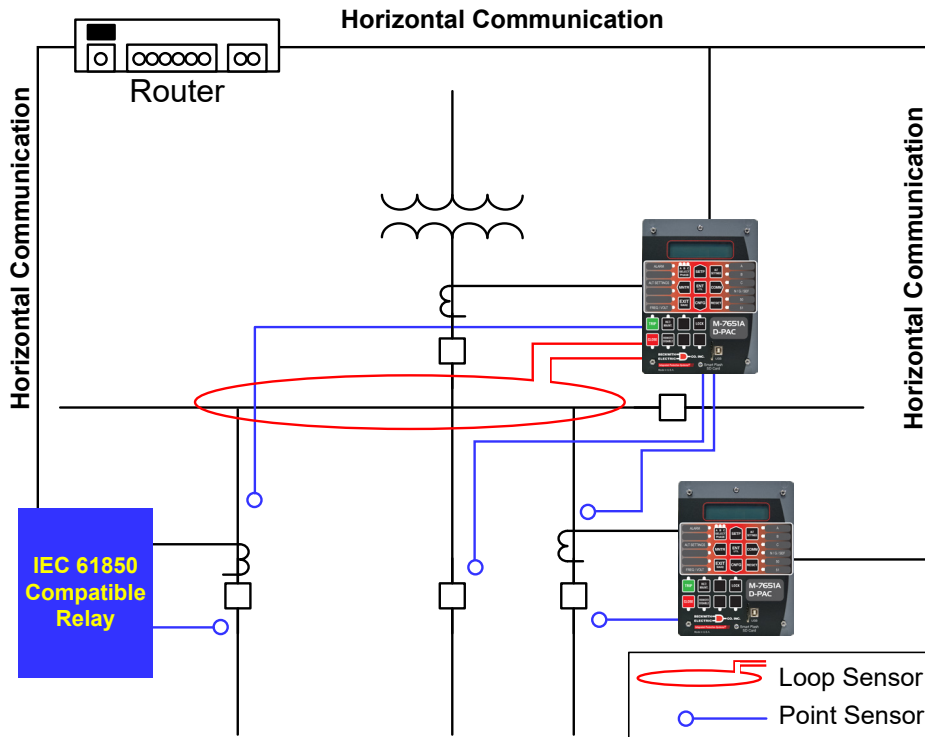


Figure 5 M-7651A Arc Flash Module Additional Communications Diagram

**M-7651A Arc Flash Module Trip Speed Examples**

The following screen captures illustrate the Trip speed of the M-7651A Arc Flash module high speed outputs, with Current Supervision enabled.

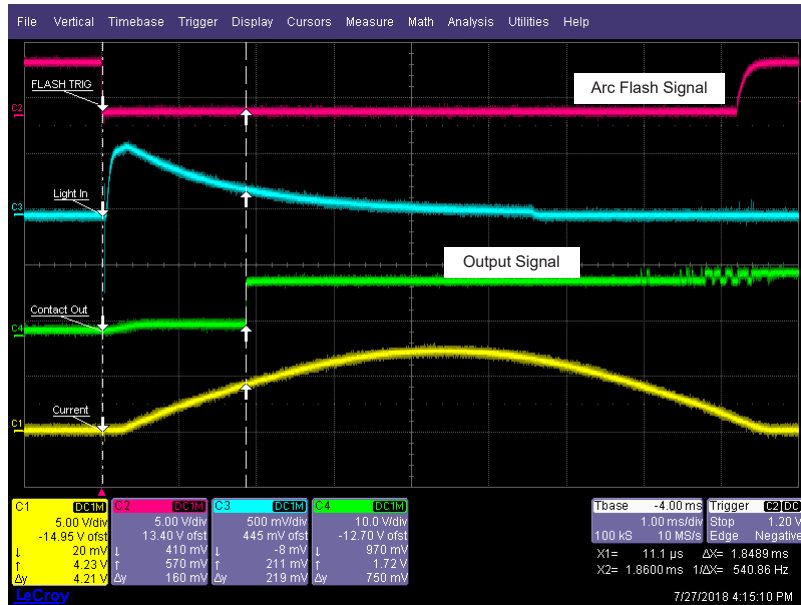


Figure 6 Arc Flash Outputs Trip Speed Example (Flash at 0° of 5 A current:  $\Delta t = 1.85 \text{ ms}$ )

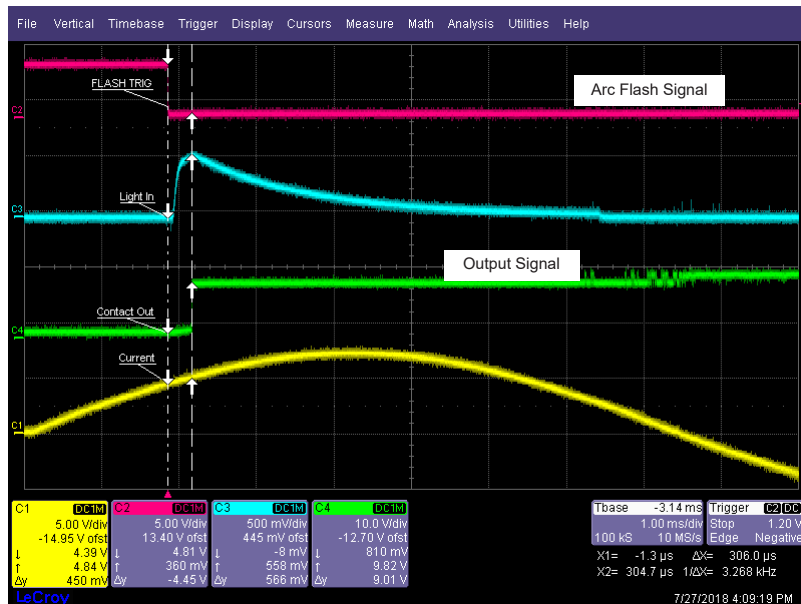


Figure 7 Arc Flash Outputs Trip Speed Example (Flash at 45° of 5 A current:  $\Delta t = 306 \mu\text{s}$ )

## Phantom Voltage

The M-7651A 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-7651A. The following VT configurations are supported: Phantom Wye, Phantom Delta, and Open Delta.

**Phantom WYE** is supported for VT connection ONLY. The M-7651A 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-7651A 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-7651A 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-7651A 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-7651A will calculate and provide balanced Line to Line voltages AB, BC and CA derived from the two measured voltage signals. The M-7651A assumes proper polarity has been observed. The two measured signals come from Open Delta connected PTs.

### Example of Open Delta CA:

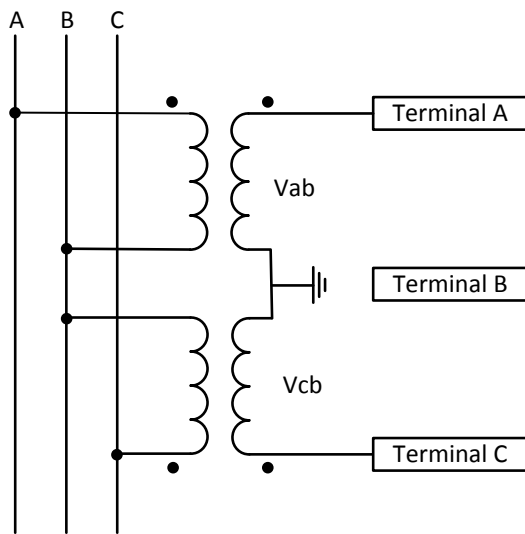


Figure 8 Open Delta CA Example Diagram

## Cyber Security

The M-7651A D-PAC was designed from the ground up to help customers be NERC and Cyber Security compliant. The M-7651A D-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-7651A D-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-7651A D-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-7651A D-PAC Cold Load Pickup feature provides the user with the ability to automatically adjust the M-7651A D-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 feeder protection apparatus by retrofitting with the M-7651A D-PAC provides improvements to system response and service reliability. The Protection, Automation and Control System can be set up to recognize critical loads and help stabilize system loading. Including underfrequency elements as components of the recloser feature 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-7651A D-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-7651A D-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	1MΩ
Low Energy Analog	4 Vac	12 Vac	300 Vac for 10 s	1MΩ

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-7651A D-PAC includes four programmable inputs with capability for expansion up to twelve. These inputs must be externally wetted. The M-7651A D-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-7651A D-PAC hardware. If the product serial number is from #1 to 2000, refer to the M-7651A D-PAC Instruction Book, **Appendix E** 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-7651A D-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:**  $\leq 8.2$  ms.

The optional expanded I/O includes an additional eight Programmable Output Contacts (OUT5 through OUT12). These contacts are only configurable using IPScm 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 (optional) – 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-7651A to third party utility grade devices. The module is configured using IPScm 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-7651A. 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

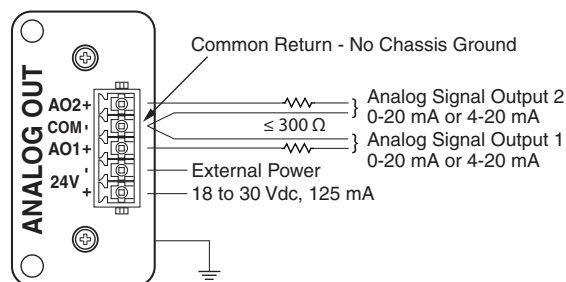
Transient Protected

### 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-7651A D-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.

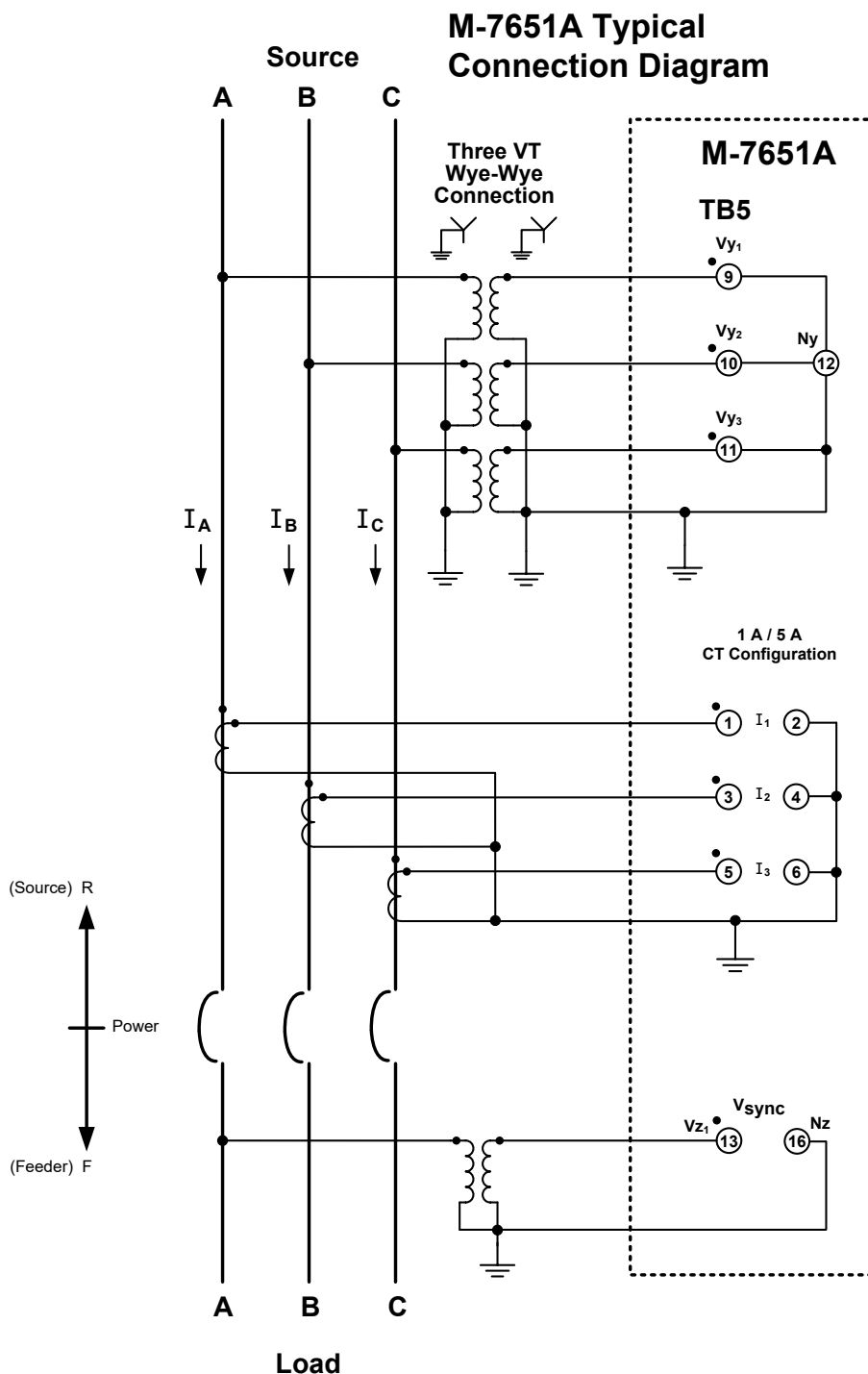


Figure 9 M-7651A D-PAC Three-Line Connection Diagram



## Tests and Standards

The M-7651A D-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% <sub>RH</sub>
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

■ **NOTE:** UL does not certify products intended to detect and mitigate an arc flash. Therefore, UL has not evaluated the functional performance of the M-7651A Arc Flash option. Protective relays that provide arc flash detection are primarily intended for the protection of equipment.

Product Safety – IEC 60255-27, CAT III, Pollution Degree 2

## DER Interconnection Applications Compliance

Beckwith Electric's M-7651A D-PAC Relay, suitable for Feeder, DER and Switchgear protection applications, 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

**Mounting:** The unit is a semi flush, 3U high design that can be panel mounted or mounted in a standard 19" rack mount with the optional Rack Mount Adapter Frame ([Figure 12](#)). Vertical mount units are also available.

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

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

Vertical: 6.0" wide x 8.0" high x 6.22" deep (15.2 cm x 20.3 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-7651A D-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.*

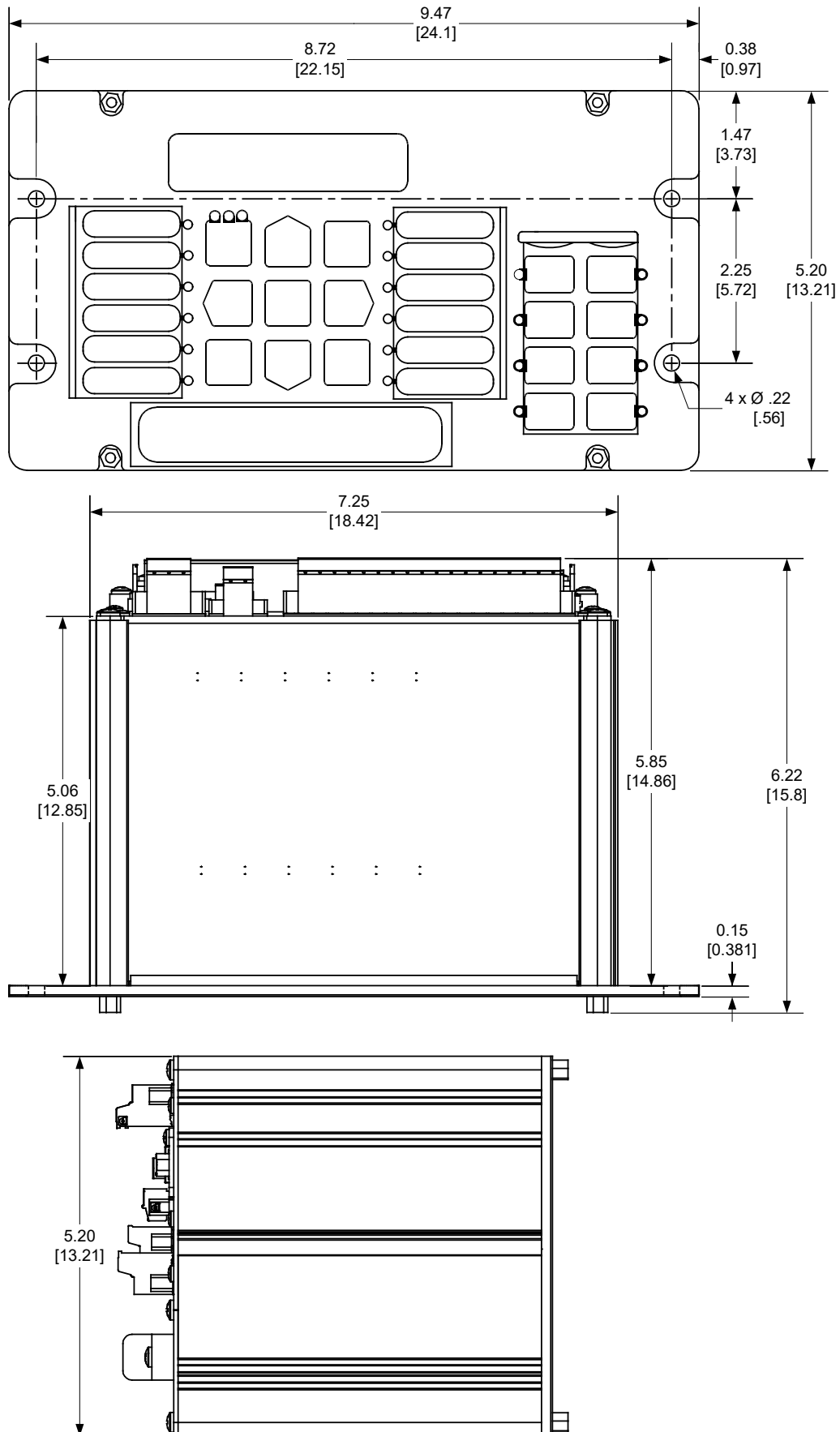


Figure 10 M-7651A D-PAC Horizontal Model Mounting Dimensions

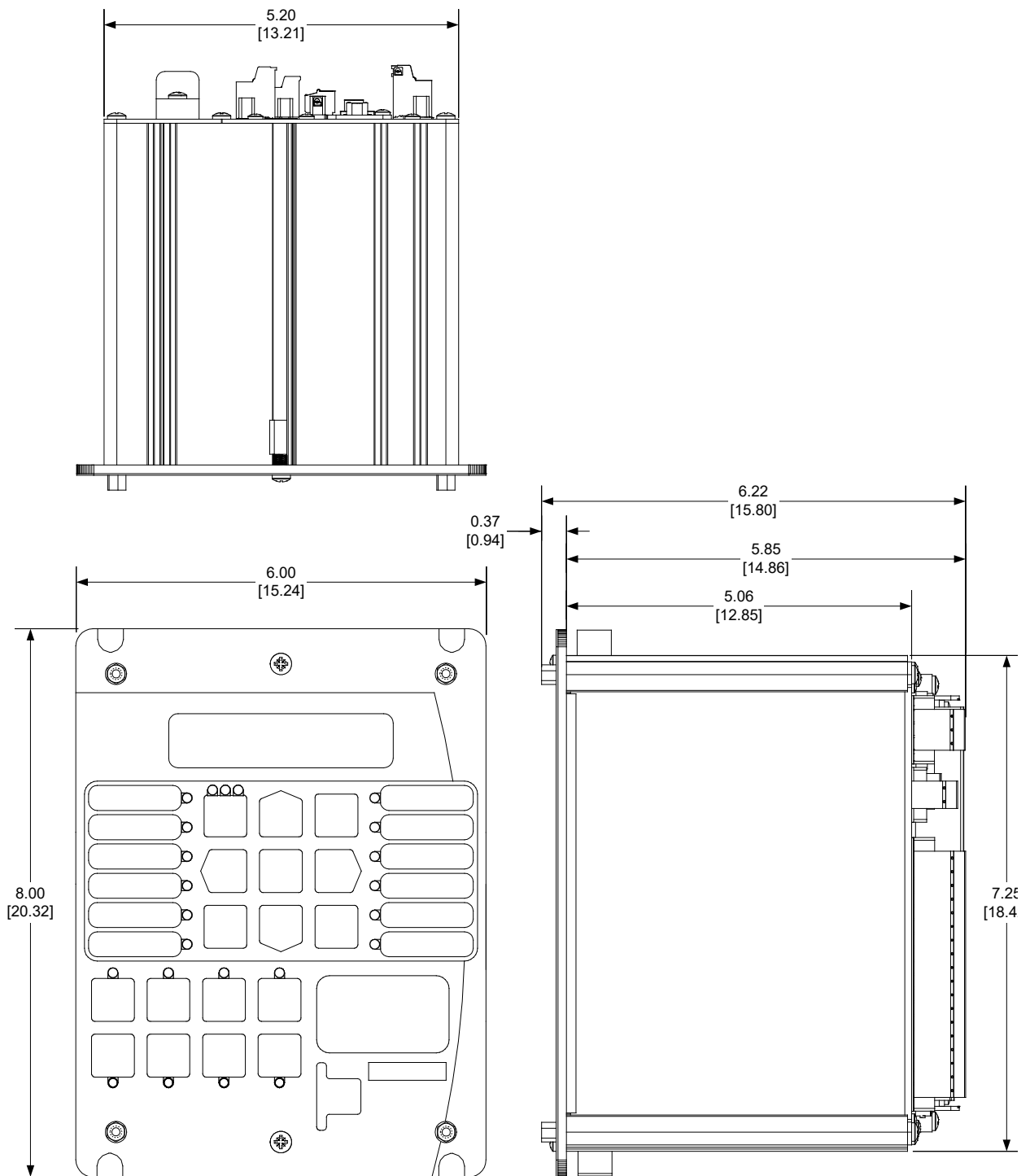


Figure 11 M-7651A D-PAC Vertical Model Mounting Dimensions

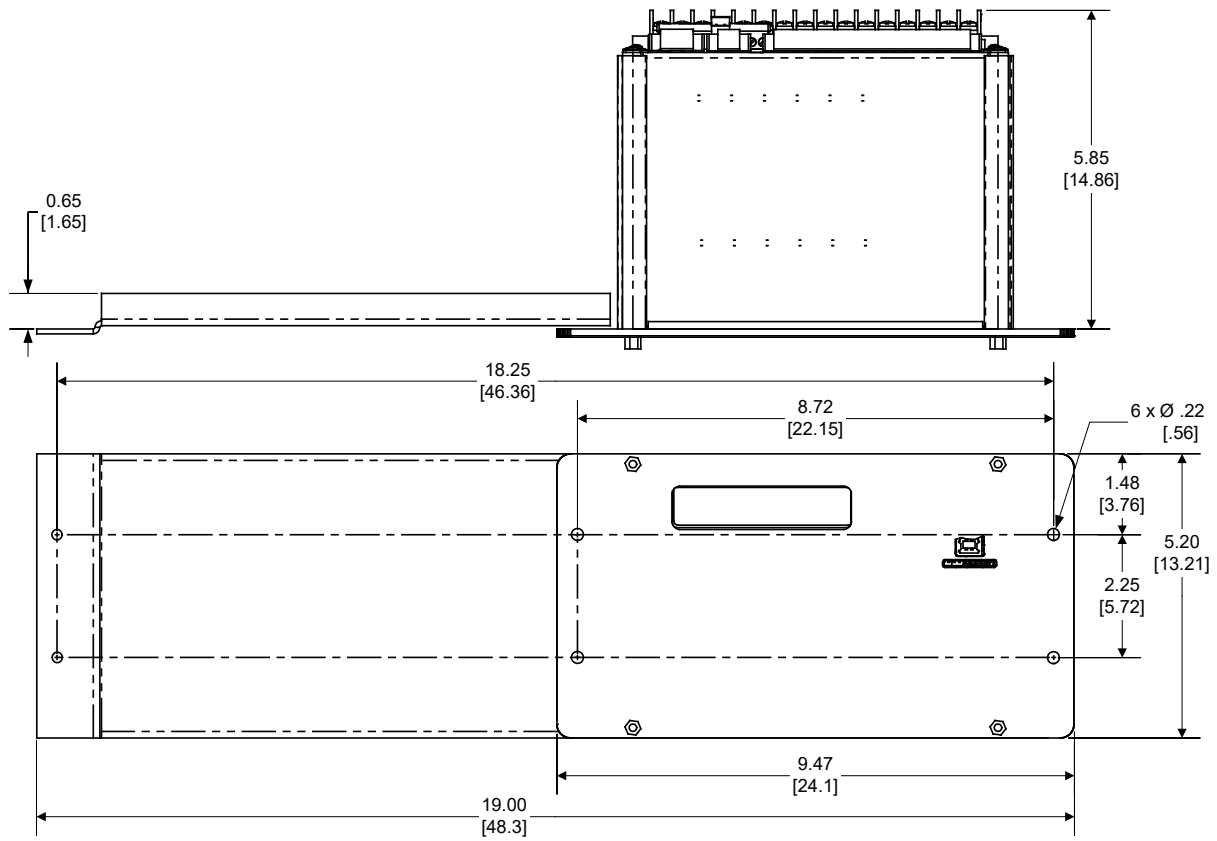


Figure 12 M-7651A D-PAC 19 Inch Rack Mount Adapter Frame Dimensions

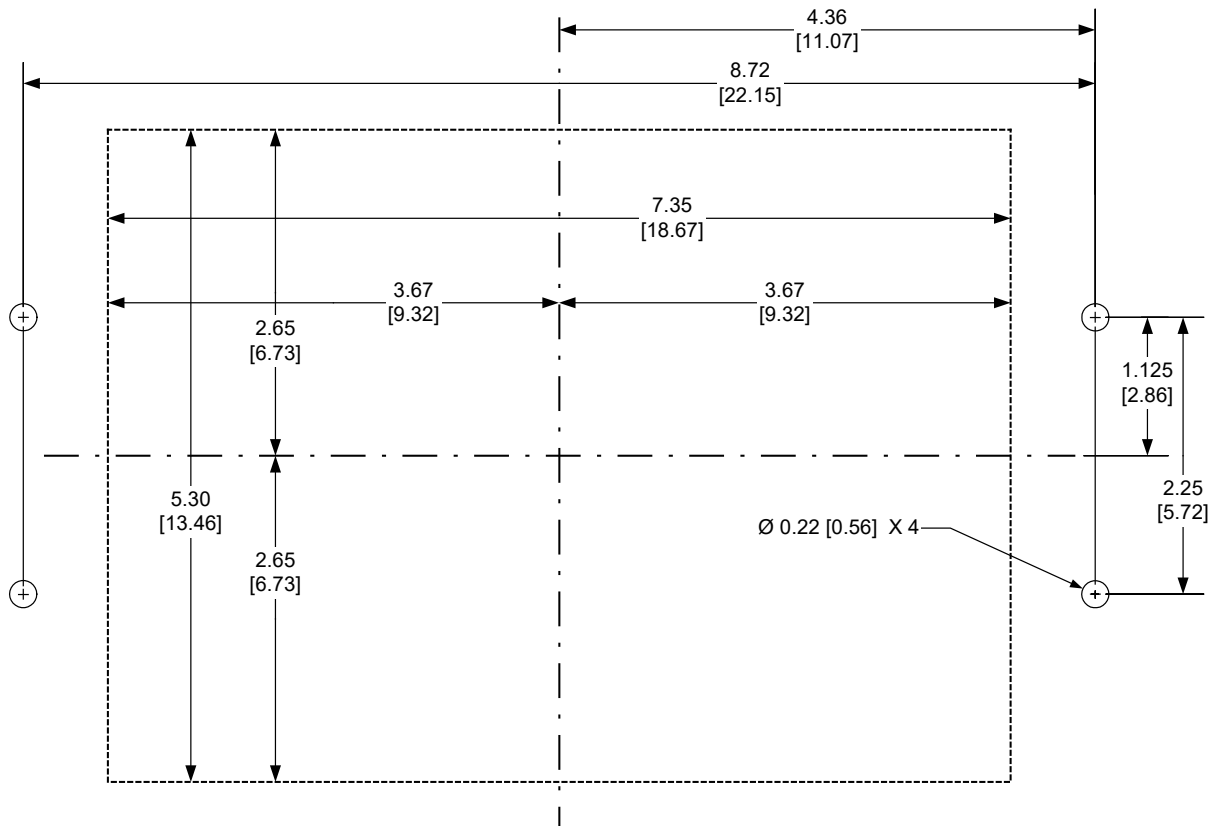
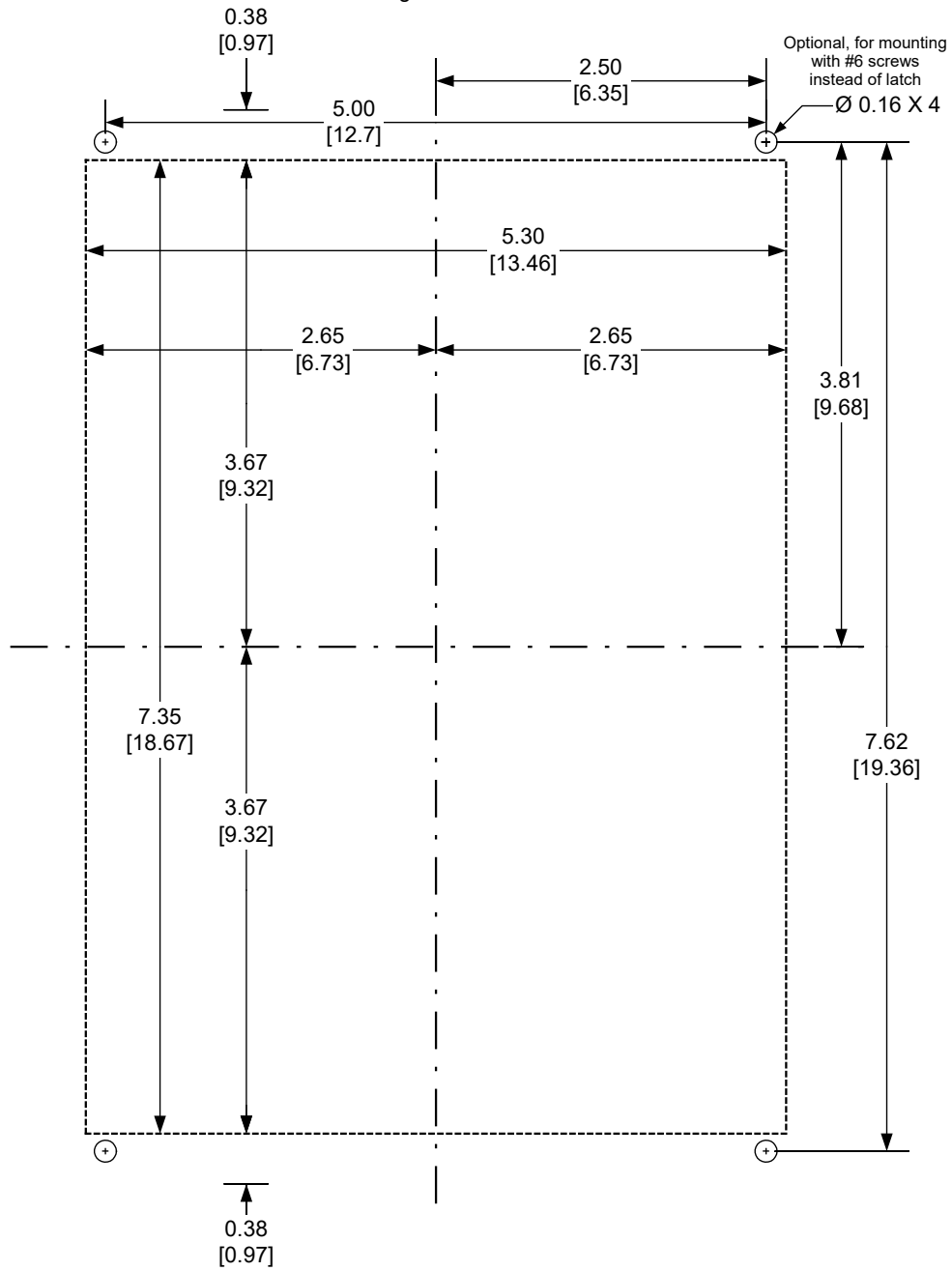


Figure 13 Horizontal Panel Mount Cutout Dimensions

Minimum Clearance For Case Mounting Latch



Minimum Clearance For Case Mounting Latch

Figure 14 Vertical Panel Mount Cutout Dimensions



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