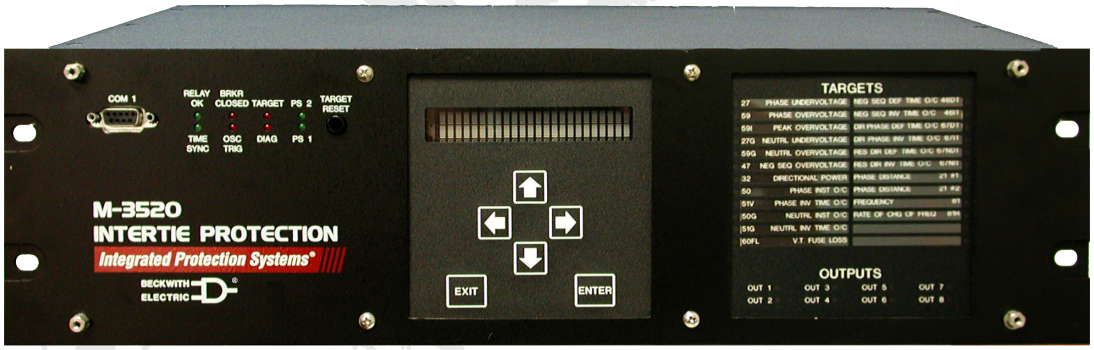
BECKWITH ELECTRIC®

PROTECTION

Intertie Protection M-3520

Integrated Protection System®



Unit shown with optional HMI and Target modules

- **Integrated Protection System for DER Intertie, providing:**
  - **Loss of parallel utility operation protections**
  - **Abnormal power flow protections**
  - **Comprehensive suite of phase and ground fault backed protections**
  - **Abnormal operating protections**
  - **Reconnect and Sync Check functions**
- **Microprocessor-based Intertie Protection Relay integrates protection, metering, monitoring and waveform capture**
- **Provides 18 base protective relay functions and 3 optional protective functions**
- **Local and remote serial communications capabilities, plus IRIG-B interface**

HUBBELL®

Standard Functions

- Sync check with Phase, ΔV and ΔF with deadline/deadbus options (25)
- Phase undervoltage (27) protection
- Neutral over/undervoltage (59G/27G) protection
- Sensitive dual-setpoint, reverse power detection (32)
- Sensitive negative-sequence overcurrent protection and alarm (46)
- Negative sequence voltage (47)
- Instantaneous overcurrent (50) protection
- Instantaneous neutral overcurrent (50G) protection
- Three-phase inverse time overcurrent (51V) with voltage control/voltage restraint
- Neutral inverse time overcurrent (51G) protection
- Phase overvoltage (59) protection
- Peak overvoltage (59I) protection
- VT fuse-loss detection and blocking (60FL)
- Directional inverse and definite time phase overcurrent (67)
- Directional inverse and definite time neutral overcurrent (67N)
- Reconnect enable (79)
- Over/Underfrequency (81 O/U)

Optional Functions

- Dual-zone phase distance protection for phase fault backup (21)
- Out of Step (78)
- Rate of change of frequency (81R)

Standard Features

- Eight programmable outputs and six programmable inputs
- Oscillograph recording
- 32-target storage
- Metering of all measured parameters
- Three communications ports (two RS-232, one RS-485)
- Standard 19" rack-mount design
- Removable printed circuit board and power supply
- Both 50 and 60 Hz models available
- Both 1 and 5 Amp rated CT inputs available
- M-3822 IPScom® Communications Software
- IRIG-B time synchronization

Optional Features

- Redundant power supply
- M-3915 Target Module
- M-3931 Human-Machine Interface Module
- M-3801D IPSplot® *PLUS* Oscillograph Analysis Software
- 4-Wire RS-485 Connection

STANDARD FUNCTIONS

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Sync Check			
25	Phase Angle Limit	0° to 90°	1°	±1°
	Upper Voltage Limit	60 to 140 V	1 V	±0.5 V or ±0.5%
	Lower Voltage Limit	40 to 120 V	1 V	±0.5 V or ±0.5%
	Delta Voltage Limit	1.0 to 50.0 V	0.1 V	±0.5 V
	Delta Frequency Limit	0.001 to 0.500 Hz	0.001 Hz	±0.0007 Hz or 5%
	Sync Check Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Dead Voltage Limit	0 to 60 V	1 V	±0.5 V
	Dead Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

Sync Check may be operated as a stand-alone function or supervised by 79 (reconnect). Various combinations of input supervised hot/dead closing schemes may be selected.

	Undervoltage			
27	Pickup #1, #2	5 to 180 V	1 V	±0.5 V or ±0.5% ±0.8 V or ±0.75%*
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

** When line-ground to line-line is selected.*

	Neutral Undervoltage			
27G	Magnitude	5 to 180 V	1 V	±0.5 V or ±0.5%
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

	Reverse/Forward Power			
32	Pickup #1, #2	-3.000 to +3.000 PU	0.001 PU	±0.002 PU or 2%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	+16 Cycles or ±1%

The per-unit pickup is based on nominal VT secondary voltage and nominal CT secondary current settings. Single phase detection may be selected for line-to-ground connected VTs. This function can be selected as either overpower or underpower in the forward direction (positive setting) or reverse direction (negative setting).

	Negative Sequence Overcurrent			
46	**Definite Time**			
	Pickup	0.10 to 20.00 A (0.02 to 4.00 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to + 3 Cycles or ±3%
	Inverse Time			
	Pickup	0.50 to 5.00 A (0.10 to 1.00 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial	0.5 to 11.0 0.05 to 1.10 (IEC curves)	0.1 0.01	±3 Cycles or ±5%

	Negative Sequence Overvoltage			
47	Pickup #1, #2	5 to 180 V	1 V	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

†Select the greater of these accuracy values. Values in parentheses apply to 1 Amp CT secondary rating.

STANDARD FUNCTIONS (cont.)

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Instantaneous Phase Overcurrent			
50	Pickup	1.0 to 240.0 A (0.2 to 48.0 A)	0.1 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Time Delay	2 Cycles	—	±2 Cycles
	Instantaneous Neutral Overcurrent			
50G	Pickup	0.5 to 240.0 A (0.1 to 48.0 A)	0.1 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Time Delay	2 Cycles	—	±2 Cycles
	The 50G can be supervised by the ground directional element (if 67N option is selected).			
	Inverse Time Neutral Overcurrent			
51G	Pickup	0.25 to 12.00 A (0.05 to 2.40 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curve	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial	0.5 to 11.0 0.05 to 1.10 (IEC curves)	0.1 0.01	±3 Cycles or ±5%
	The 51G can be supervised by the ground directional element.			
	Inverse Time Overcurrent, with Voltage Control or Voltage Restraint			
51V	Pickup	0.50 to 12.00 A (0.10 to 2.40 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curve	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial	0.5 to 11.0 0.05 to 1.10 (IEC curves)	0.1 0.01	±3 Cycles or ±5%
	Voltage Control (VC) or Voltage Restraint (VR)	5 to 180 V Linear Restraint	1 V —	±0.5 V or ±5% —
	Overvoltage			
59	Pickup #1, #2	5 to 180 V	1 V	±0.5 V or ±0.5% ±0.8 V or ±0.75%*
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	** When line-ground to line-line is selected.*			
	Neutral Overvoltage			
59G	Pickup	5 to 180 V	1 V	±0.5 V or ±0.5%
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Peak Overvoltage			
59I	Magnitude	1.05 to 1.50 PU	0.01 PU	±0.03 PU*
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

Instantaneous voltage magnitude response; intended for ferroresonance protection.

**For fundamental (60 Hz/50 Hz) signal only. For distorted input signals, the accuracy degrades as the order of the harmonic signal increases. The accuracy applies to voltages below 180 V.*

†Select the greater of these accuracy values. Values in parentheses apply to 1 Amp CT secondary rating.

STANDARD FUNCTIONS (cont.)

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	VT Fuse-Loss Detection			
60 FL	A VT fuse loss condition is detected by using the positive and negative sequence components of the voltages and currents. VT fuse loss output can be initiated from internally generated logic or from input contacts.			
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Phase Directional Overcurrent			
67	**Definite Time***			
	Pickup	1.0 to 240.0 A (0.2 to 48.0 A)	0.1 A	±0.1 A or 3% (±0.02 A or 3%)
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Inverse Time			
	Pickup	0.50 to 12.00 A (0.10 to 2.40 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curve	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial Setting	0.5 to 11.0 0.05 to 1.10 (IEC curves)	0.1 0.01	±3 Cycles or ±5%
	Phase Directional Element			
	Maximum Sensitivity (Torque) Angle (MSA)	0° to 359°	1°	
	Residual Directional Overcurrent			
67N	**Definite Time***			
	Pickup	0.5 to 240.0 A (0.1 to 48.0 A)	0.1 A	±0.1 A or 3% (±0.02 A or ±3%)
	Time Delay	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Inverse Time*			
	Pickup	0.25 to 12.00 A (0.05 to 2.40 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curve	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial	0.5 to 11.0 0.05 to 1.10 (IEC Curves)	0.1 0.01	±3 Cycles or ±5%
	Ground Directional Element			
	Max. Sensitivity Angle (MSA)	0 to 359°	1°	
	Polarization**	1 to 5	1	
	Reconnect Enable Time Delay			
79	Reconnect Delay	2 to 65500 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

**High speed operation results when delay programmed for one cycle; response time = less than 1-1/2 cycles. Directional sensing for 67DT or 67IT may be disabled. Sensitivity at MSA is 0.5 VA, uses Positive Sequence Voltage and current for polarization, prefault memory 8 cycles.*

**Directional control for 67NDT or 67NIT may be disabled.*

*** Polarization can be zero sequence, negative sequence, current (polarized) or dual polarized. Polarizations 1, 3 and 5 shall not be used with L-L and L-G to L-L VT selection. When using polarizations 4 or 5, MSA is not applicable and should be set to zero.*

Reconnect timer starts when all outputs designated as trip outputs dropout.

†Select the greater of these accuracy values. Values in parentheses apply to 1 Amp CT secondary rating.

STANDARD FUNCTIONS (cont.)

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Frequency			
81	Pickup #1, #2, #3, #4	50.00 to 67.00 Hz 40.00 to 57.00 Hz*	0.01 Hz	±0.02 Hz
	Time Delay #1,#2, #3, #4	2 to 65,500 Cycles	1 Cycle	-2 to +3 Cycles or ±1%

The pickup accuracy applies to 60 Hz models at a range of 57 to 63 Hz, and to 50 Hz models at a range of 47 to 53 Hz. Beyond these ranges, the accuracy is ±0.1 Hz.

**This range applies to 50 Hz nominal frequency models.*

OPTIONAL FUNCTIONS

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Phase Distance (dual-zone mho characteristic)			
21	Circle Diameter #1, #2	0.1 to 100.0 Ω (0.5 to 500.0 Ω)	0.1 Ω	±0.1 Ω or ±5% (±0.5 Ω or ±5%)
	Offset #1, #2	-100.0 to 100.0 Ω (-500.0 to 500.0 Ω)	0.1 Ω	±0.1 Ω or ±5% (±0.5 Ω or ±5%)
	Impedance Angle #1, #2	0° to 90°	1°	±1°
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%
	Out of Step (mho characteristic)			
78	Circle Diameter	0.1 to 100.0 Ω (0.5 to 500.0 Ω)	0.1 Ω	±0.1 Ω or 5% (±0.5 Ω or 5%)
	Offset	-100.0 to 100.0 Ω (-500.0 to 500.0 Ω)	0.1 Ω	±0.1 Ω or 5% (±0.5 Ω or 5%)
	Impedance Angle	0° to 90°	1°	±1°
	Blinder	0.1 to 50.0 Ω (0.5 to 250.0 Ω)	0.1 Ω	±0.1 Ω or 5% (±0.5 Ω or 5%)
	Time Delay	1 to 8160 Cycles	1 Cycle	±1 Cycle or ±1%
	Trip on mho Exit	Enable/Disable		
	Pole Slip Counter	1 to 20	1	
	Pole Slip Reset	1 to 8160 Cycles	1 Cycle	±1 Cycle or ±1%
	Rate of Change of Frequency			
81R	Pickup #1, #2	0.10 to 20.00 Hz/Sec	0.01 Hz/Sec	±0.05 Hz/Sec or ±5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	+20 Cycles
	Negative Sequence Voltage Inhibit	0 to 99%	1%	±0.5%
	Nominal Settings			
	Nominal Voltage	60 to 140 V	1 V	—
	Nominal Current	0.5 to 6.00 A	0.01 A	—
	VT Configuration	Line-Line Line-Ground Line-Ground to Line-Line*		
	Seal-In Delay	2 to 8160 Cycles	1 Cycle	-1 to +3 Cycles or ±1%

**When line-ground to line-line is selected, the relay internally calculates the line-line voltage from the line-ground voltages for all voltage-sensitive functions. This line-ground to line-line selection should only be used to a VT nominal secondary voltage of 69 V (not 120 V).*

†Select the greater of these accuracy values. Values in parentheses apply to 1 Amp CT secondary rating.

Configuration Options

The M-3520 Intertie Protection Relay can be purchased with standard protective functions or as a base system with reduced functionality. The user can also select optional protective functions as required to expand the functionality of the Standard Protection System or Base System to satisfy specific application needs. The optional Human-Machine Interface (HMI) Module, Target Module, and redundant power supply are available for either configuration.

Metering

The relay provides metering of voltages (phase, neutral and sequence quantities), currents (phase, neutral and sequence quantities), real power, reactive power, power factor and impedance measurements.

Metering Accuracies are:

Voltage: ±0.5 V or ±0.5%, whichever is greater
±0.8 V or ±0.75%, whichever is greater (when line-ground to line-line is selected)

Current: 5 A rating, ±0.1 A or ±3%, whichever is greater
1 A rating, ±0.02 A or ±3%, whichever is greater

Power (real and reactive): ±0.01 PU or ±2%, whichever is greater

Frequency: ±0.02 Hz (from 57 to 63 Hz for 60 Hz models; from 47 to 53 Hz for 50 Hz models)

Oscillographic Recorder

The oscillograph recorder provides comprehensive data recording of all monitored waveforms, storing up to 170 cycles of data. The total record length may be user-configured for 1, 2, 3 or 4 partitions. The sampling rate is 16 times the power system nominal frequency (50 or 60 Hz). The recorder is triggered either via the designated status inputs, trip outputs, or via serial communications. When untriggered, the recorder continuously stores waveform data, keeping the most recent data in memory. When triggered, the recorder stores pre-trigger data, then continues to store data in memory for a user-defined, post-trigger delay period.

Target Storage

A total of 32 targets can be stored. Recorded information includes the type of function(s) operated, the functions picked up, input/output contact status, timer status, and phase and neutral currents at the time of trip.

Calculations

Current and Voltage Values: Uses discrete Fourier transform algorithm on sampled (16 times per cycle) voltage and current signals to extract fundamental frequency phasors for calculations.

Power Input Options

Nominal 110/120/230/240 Vac, 50/60 Hz, or nominal 110/125/220/250 Vdc. UL rating 85 Vac to 265 Vac and from 80 Vdc to 288 Vdc. Burden 20 VA at 120 Vac/125 Vdc. Withstands 300 Vac or 300 Vdc for 1 second.

Nominal 24/48 Vdc, operating range from 18 Vdc to 56 Vdc. Burden 20 VA at 24 Vdc and 20 VA at 48 Vdc. Withstands 65 Vdc for 1 second.

Unit is available with an optional redundant power supply.

Sensing Inputs

Five Voltage Inputs: Rated nominal voltage of 60 Vac to 140 Vac, 60 Hz (50 Hz optional). Withstands 240 V continuous voltage and 360 V for 10 seconds. Source voltages may be line-to-ground or line-to-line connected. Phase sequence ABC/ACB is selectable. Voltage transformer burden less than 0.2 VA at 120 Vac.

Four Current Inputs: Rated current (I_R) of 5.0 A or 1.0 A (optional), 60 Hz (50 Hz optional). Withstands 2 I_R continuous current and 100 I_R for 1 second. Current transformer burden is less than 0.5 VA at 5 A (5 A option), or 0.3 VA at 1 A (1 A option).

Control/Status Inputs

The control/status inputs, INPUT1 through INPUT6, can be programmed to block any of the relay functions, trigger the oscillographic recorder or operate one or more outputs. The control/status inputs are designed to be connected to dry contacts and are internally wetted with a 24 Vdc power supply. To provide breaker status LED indication on the front panel, the INPUT1 control/status input contact should be connected to the 52b breaker status contact. The minimum current value to initiate/pickup an Input is ≥25 mA.

Output Contacts

The eight programmable output contacts (six form 'a' and two form 'c'), the power supply alarm output contact (form 'b'), and the self-test alarm output contact (form 'c') are all rated as per IEEE C37.90 (See Tests and Standards section for details).

Any of the relay functions can be individually programmed to activate any one or more of the eight programmable output contacts.

Target/Status Indicators and Controls

The **RELAY OK** LED reveals proper cycling of the microcomputer. The **BRKR CLOSED** LED illuminates when the breaker is closed (when the 52b contact is open). The **OSC TRIG** LED indicates that oscillographic data has been recorded in the unit's memory. The corresponding **TARGETS** LED will illuminate when any of the relay functions trip. Pressing and releasing the **TARGET RESET** pushbutton resets the **TARGET** LED if the conditions causing the operation have been removed. Pressing and holding the **TARGET RESET** pushbutton will allow elements or functions in pickup to be displayed. The **PS1** and **PS2** LEDs remain illuminated as long as power is applied to the unit and the power supply is operating properly. The **TIME SYNC** LED will illuminate when a valid IRIG-B signal is applied, and time synchronization has been established.

Communication

Communications ports include rear panel RS-232 and RS-485 ports, a front panel RS-232 port, and an IRIG-B port. The communications protocol implements serial, byte-oriented, asynchronous communication, and provides the following functions when used with the Microsoft Windows compatible M-3822 IPScom® Communications Software package. MODBUS and BECO 2200 protocols are supported using:

- Setpoint interrogation and modification
- Time-stamped trip target information for the 32 most recent events
- Real time metering of all quantities measured
- Downloading of recorded oscillographic data (not available with MODBUS protocol)

IRIG-B

The relay can accept either modulated or demodulated IRIG-B time clock synchronization signal. The IRIG-B time synchronization information is used to correct the hour, minutes, seconds and milliseconds information.

Human-Machine Interface (HMI) Module (optional)

Local access to the relay is provided through an optional M-3931 HMI Module, allowing for easy to use, menu-driven access to all functions via a 6-button keyboard and a 2-line by 24 character alphanumeric display. Features of the HMI Module include the following:

- User-definable access codes providing three levels of security
- Interrogation and modification of setpoints
- Time-stamped trip target information for the 32 most recent events
- Real-time metering of all quantities measured

Target Module (optional)

An optional M-3915 Target Module provides 24 target and 8 output LEDs. Appropriate **TARGET** LEDs illuminate when the corresponding function trips. The targets can be reset with the **TARGET RESET** pushbutton if the trip conditions have been removed. The **OUTPUT** LEDs indicate the status of the programmable output contacts. The module connects to the M-3520 Intertie Protection unit.

Type Tests and Standards

M-3520 Intertie Protection Relay complies with the following tests and standards:

Voltage Withstand

Dielectric Withstand

IEC 255-5	3,500 Vdc for 1 minute applied to each independent circuit to earth
	3,500 Vdc for 1 minute applied between each independent circuit
	1,500 Vdc for 1 minute applied to IRIG-B circuit to earth
	1,500 Vdc for 1 minute applied between IRIG-B to each independent circuit
	1,500 Vdc for 1 minute applied to RS-485 circuit (2-wire) to earth
	1,500 Vdc for 1 minute applied to RS-485 circuit (2-wire) to each independent circuit

Impulse Voltage

IEC 255-5	5,000 V pk, +/- polarity applied to each independent circuit to earth
	5,000 V pk, +/- polarity applied between each independent circuit
	1.2 X 50 µs, 500 Ohms impedance, three surges at 5 second intervals

Insulation Resistance

IEC 255-5	>40 MegaOhms

Electrical Environment

Electrostatic Discharge Test

IEC 1000-4-2	Class 4 (8 kV) – point contact discharge

Fast Transient Disturbance Tests

IEC 1000-4-4	Class 4 (4 kV, 2.5 kHz)

Surge Withstand Capability

IEEE C37.90.1	2,500 V pk-pk Oscillatory applied to each independent circuit to earth
1989	2,500 V pk-pk Oscillatory applied between each independent circuit
	5,000 V pk Fast Transient applied to each independent circuit to earth
	5,000 V pk Fast Transient applied between each independent circuit

Radiated Susceptibility

IEEE C37.90.2	25–1000 MHz @ 35 V/m
1987	

Output Contacts Ratings

IEEE C37.90	30 A make for 0.2 seconds at 250 Vdc resistive
UL 508	8 A carry at 120 Vac, 50/60 Hz
	8 A carry at 120 Vac, 50/60 Hz
	6 A break at 120 Vac, 50/60 Hz
	0.1 A break at 125 Vdc
	0.1 A break at 120 Vac

Atmospheric Environment

Temperature

IEC 68-2-1	Cold, -20° C for 96 hours
IEC 6-2-2	Dry Heat, +70° C for 96 hours
IEC 68-2-3	Damp Heat, +40° C @ 93%$_{RH}$, for 96 hours

Mechanical Environment

Vibration

IEC 255-21-1	Vibration response Class 1, 0.5 g Vibration endurance Class 1, 1.0 g

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

cULus-Listed per 508A – Table SA1.1 Industrial Control Panels

External Connections

External connection points and connection information are illustrated in Figures 1, 2, and 3, on the following pages.

Physical

Size: 19.00" wide x 5.21" high x 10.20" deep (48.3 cm x 13.2 cm x 25.9 cm)

Mounting: The unit is a standard 19", semiflush, 3-unit high, rack-mount panel design, conforming to ANSI/EIA RS-310C and DIN 41494, Part 5 specifications. Vertical mounting is also available.

Contact Beckwith Electric for optional GE L-2/Westinghouse FT-41 retrofit panel vertical mounting details.

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

Approximate Weight: 17 lbs (7.7 kg)

Approximate Shipping Weight: 25 lbs (11.3 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.

See M-3520 Instruction Book, Appendix E, Layup and Storage for additional information.

Patent & Warranty

The M-3520 Intertie Protection Relay is covered by U.S. Patents 5,592,393 and 5,224,011.

The M-3520 Intertie Protection Relay is covered by a five year warranty from date of shipment.

Specification subject to change without notice.

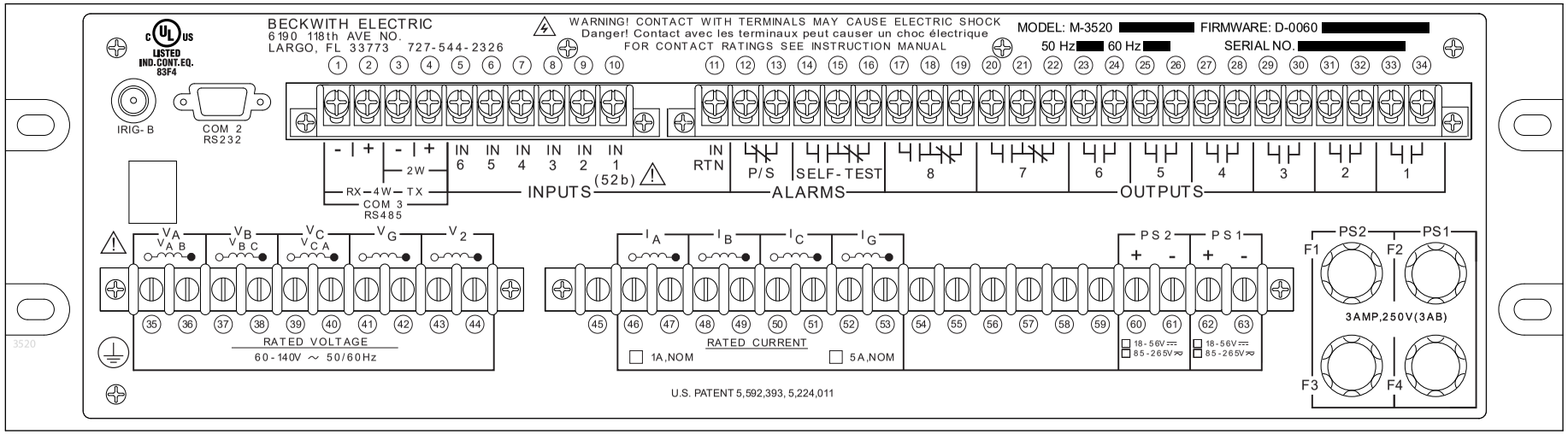
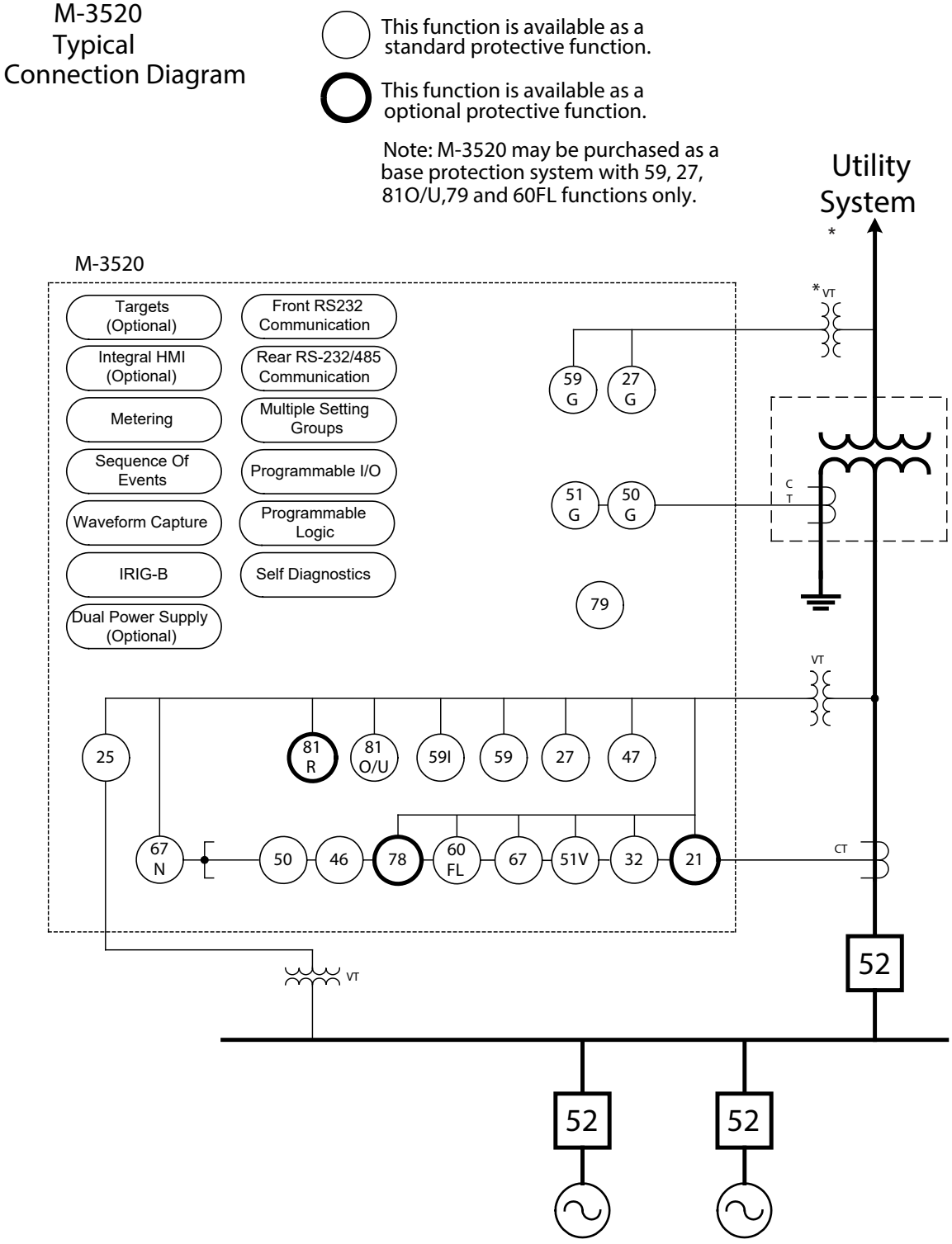


Figure 1 External Connections

■NOTES:

1. Output contacts #1 through #4 contain special circuitry for high-speed operation, and close 4 ms faster than outputs #5 through #8. Outputs #1 through #6 are form "a" contacts (normally open), and Outputs #7 and #8 are form "c" contacts (center tapped "a" and "b" contacts).
2. To comply with UL listing requirements, terminal block connections must be made with #22–12 AWG solid or stranded copper wire inserted in an AMP #324915 (or equivalent) connector. Wire insulation must be rated at 75°C minimum. Terminal block connections 1 through 34 must be tightened to 12 in-lbs torque. Terminal block connections 35 through 63 must be tightened to 8.0 in-lbs, minimum, 9.0 in-lbs, maximum torque. **Over torquing may result in terminal damage**.
3. ONLY dry contacts must be connected to inputs (terminals 5 through 10 with 11 common) because these contact inputs are internally wetted. **Application of external voltage on these inputs may result in damage to the unit.**
4. All relays are shown in the de-energized state, and without power applied to the relay.
5. The power supply relay (P/S) is energized when the power supply is functioning properly.
6. The self-test relay is energized when the relay has performed all self-tests successfully.



■**NOTE**: *Voltage Transformer (VT) connection may be either broken delta or single, line to ground VT depending on application (for ungrounded system).

Figure 2 Typical One-Line Connection Diagram

M-3520 Typical Three-line Connection Diagram

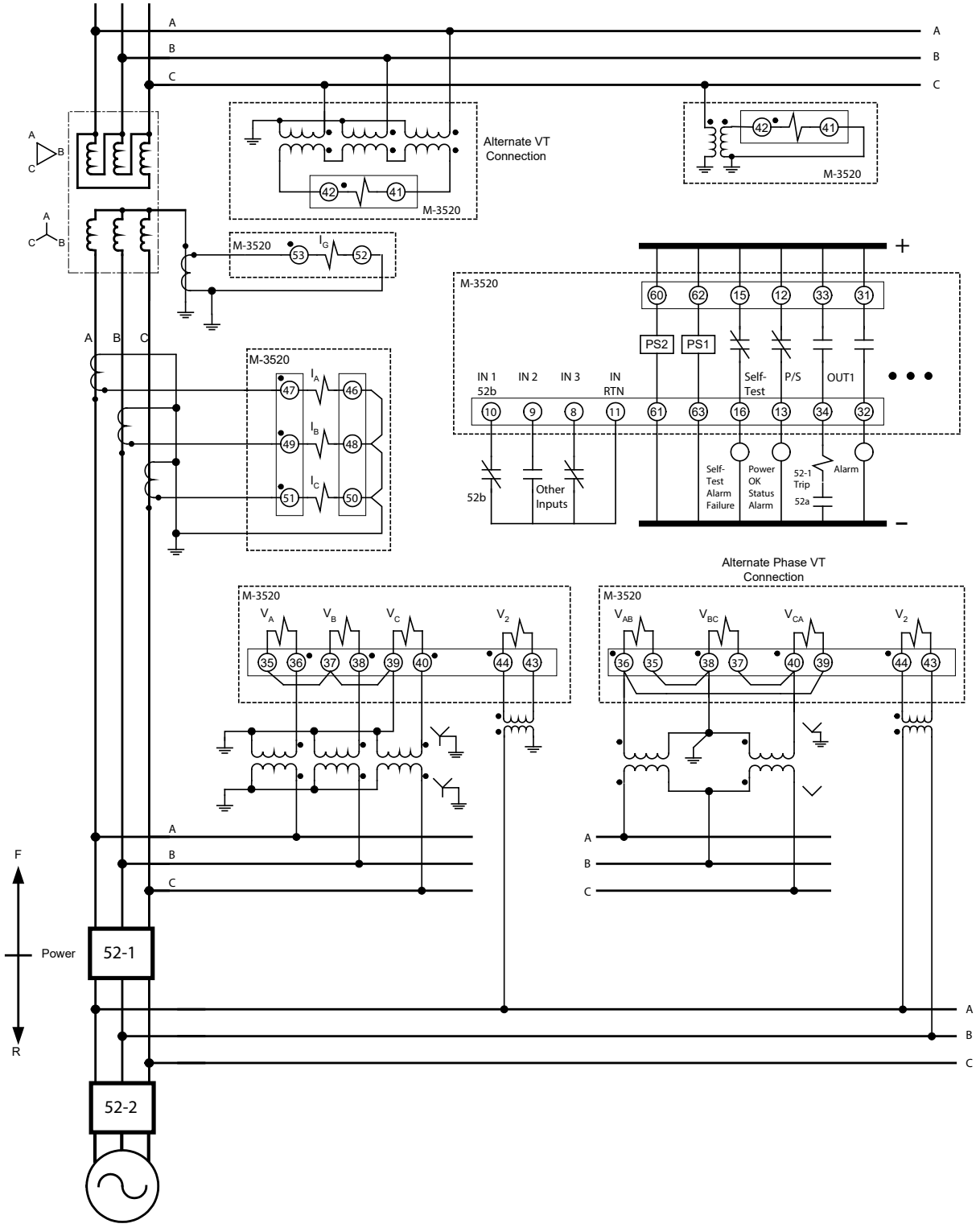
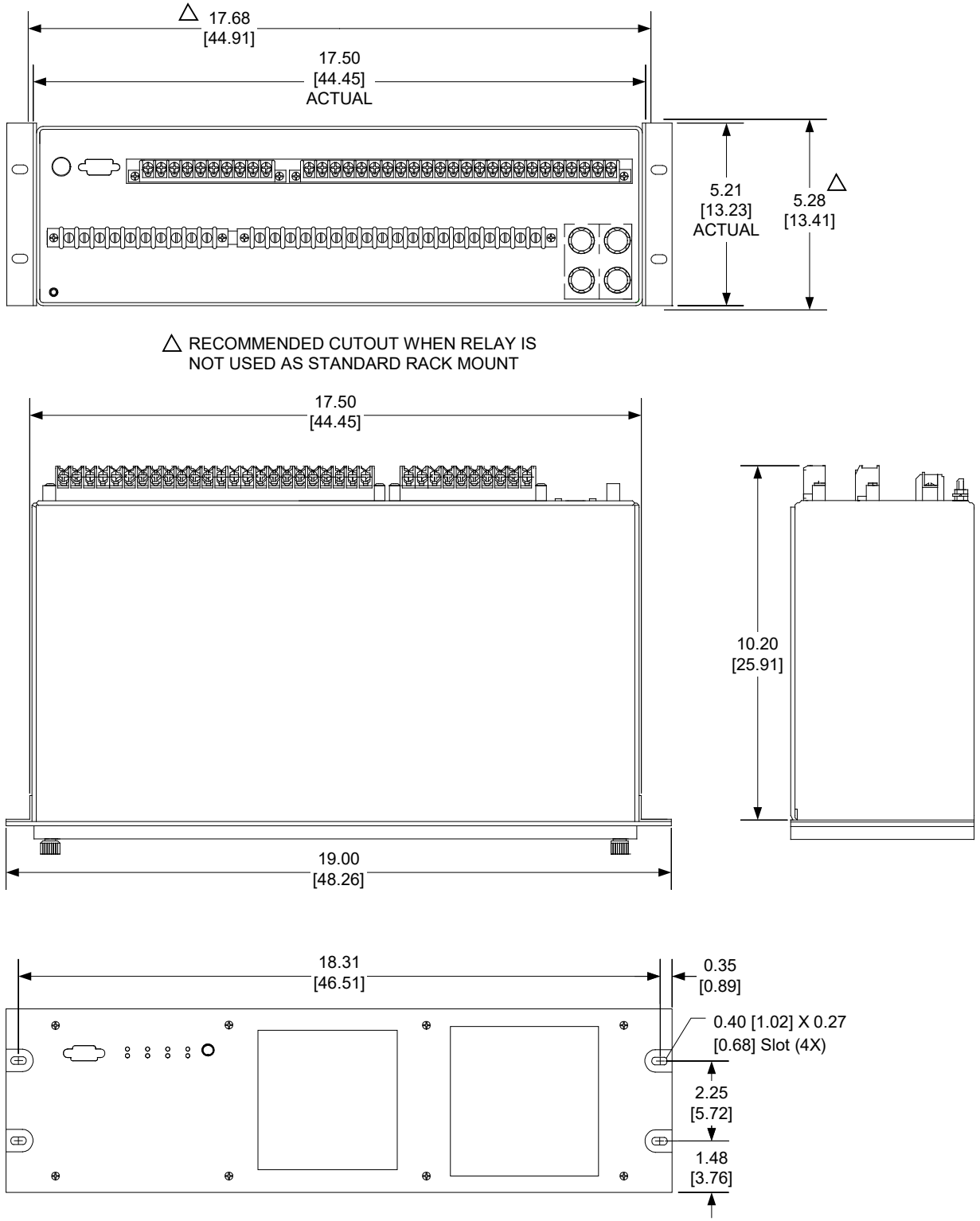


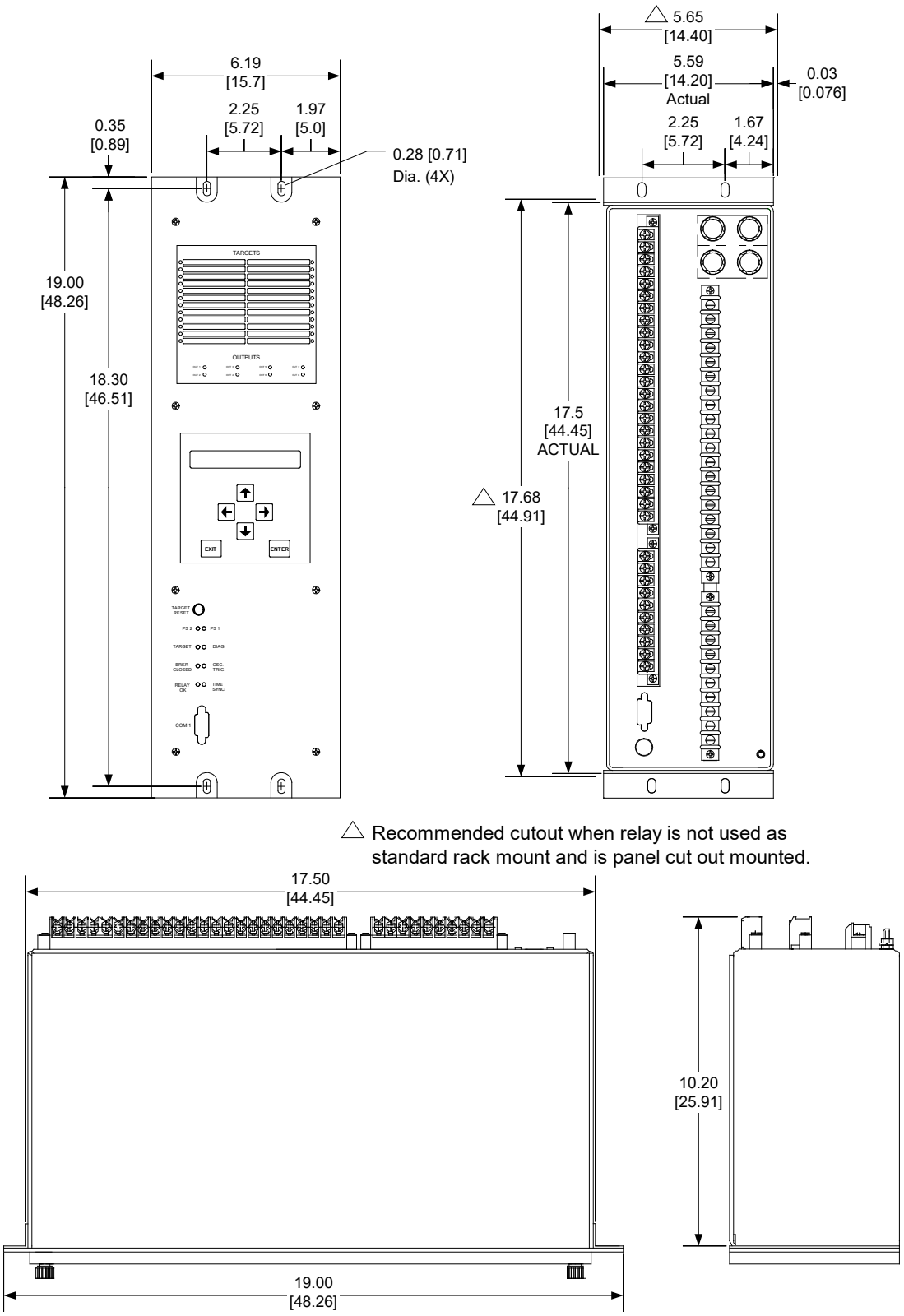
Figure 3 Typical Three-Line Connection Diagram



Standard 19" Horizontal Mount Chassis

■ **NOTE**: Dimensions in brackets are in centimeters.

Figure 4 Horizontal Mounting Dimensions



■ **NOTE**: Dimensions in brackets are in centimeters.

Figure 5 Vertical Mounting Dimensions

BECKWITH ELECTRIC
6190 118th Avenue North • Largo, Florida 33773-3724 U.S.A.
PHONE (727) 544-2326
beckwithelectricsupport@hubbell.com
www.beckwithelectric.com
ISO 9001:2015

A proud member of the Hubbell family.

800-3520-SP-16 11/23