BECKWITH ELECTRIC

Intertie/Generator Protection Relay M-3410A

Integrated Protection System®

M-3410A Panel Mount (Option P1)

M-3410A Vertical Panel (Option V1)

M-3410A Horizontal Panel (Option H1) and Rack Mount (Option H2)

- **Available in four different Mounting configurations shown above, plus Surface Mount (Option S1)**

- **Facilitates standardization for small/medium intertie and generator protection applications**

- **Microprocessor-based relay provides 15 protective relay functions, including Sync-Check, 2 programmable outputs and 2 programmable inputs**

- **Relay voltage inputs can be directly connected (no VT required) for voltages 480 V or less**

- **Local and remote serial communications (MODBUS protocol) capability for monitoring and control functions**

HUBBELL®

Protective Functions

- Sync-check with Phase Angle, ΔV and ΔF with dead line/dead bus options (25)
- Phase undervoltage (27) protection
- Ground undervoltage (27G) protection
- Dual-setpoint, single or three phase, directional power detection that can be selected as over/under power protection (32)
- Dual-zone, offset-mho loss-of-field for generator protection (40)
- Sensitive negative sequence overcurrent protection and alarm (46)
- Negative sequence overvoltage (47)
- Inverse time residual overcurrent (51N)
- Phase overcurrent with voltage restraint/control (51V) protection
- Phase overvoltage (59) protection
- Ground overvoltage (59G) protection
- Peak overvoltage (59I) protection
- VT fuse-loss detection and blocking (60FL)
- Reconnect enable for intertie protection (79)
- Four-step over/under frequency (81) protection

Standard Features

- 2 programmable outputs, 2 programmable inputs, and 1 self-test output
- Oscillographic recording (COMTRADE file format)
- Time-stamped sequence of events recording for 32 events
- Metering of Voltage, Current, real and reactive Power, Power Factor, Frequency, and Positive Sequence Impedance
- One RS-232 port (COM1) on front and one RS-232 or 485 port (COM2) on rear
- M-3810A IPScom for Windows Communications Software
- MODBUS protocol
- Supports both 50 and 60 Hz applications
- Accepts 1 A or 5 A rated CT inputs
- Relay voltage inputs can be directly connected (no VT required) for voltages ≤ 480 Vac
- Continuous Self-Diagnostics

Optional Features

- M-3801D IPSplot *PLUS* Oscillograph Analysis Software
- Horizontal (Option H1) and Vertical (Option V1) panel mount available (see dimensions Figure 9)
- 19" Rack Mount (Option H2) available (see dimensions Figure 8)
- Surface Mount (Option S1) available (see dimensions and connections Figure 10)
- Adapter Plate available for M-0290 and M-0296 Pride Protection Relay replacement (see dimensions Figure 11)

PROTECTIVE FUNCTIONS

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Sync Check				
25	Phase Angle Limit	0° to 90°	1°	±1°
	Upper Voltage Limit	100.0 to 120.0%*	0.1%	±0.5 V or ±0.5%
	Lower Voltage Limit	70.0 to 100.0%*	0.1%	±0.5 V or ±0.5%
	Delta Voltage Limit	1.0 to 50.0%*	0.1%	±0.5 V
	Delta Frequency Limit	0.001 to 0.500 Hz	0.001 Hz	±0.001 Hz or 5%
	Sync Check Time Delay	1 to 8160 Cycles	1 Cycle	
	Dead Voltage Limit	0.0 to 50.0%*	0.1%	±0.5 V or ±0.5%
	Dead Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles

* Of nominal voltage.

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. This function can only be enabled in line-to-line VT configuration and when functions 27G and 59G are not enabled.

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Phase Undervoltage				
27	Pickup #1, #2	4 to 100%*	0.1%	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles**

* Of nominal voltage.

** *When DFT is selected, the time delay accuracy is ±2 cycles. When RMS magnitude is selected, an additional time delay from 0 to +20 cycles may occur.*

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Ground Undervoltage				
27G	Pickup #1, #2	-3.00 to +3.00 PU	0.01 PU	±0.02 PU or ±2%*
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles

* Of nominal voltage, maximum of 600 V.

This function can only be enabled when the relay is configured in line-to-line VT and the 25 function is not enabled.

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Directional Power				
32	Pickup #1, #2	-3.00 to +3.00 PU	0.01 PU	±0.02 PU or ±2%*
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles

The per-unit pickup is based on nominal VT secondary voltage and nominal CT secondary current settings for currents less than 14 A (2.8 A). This function can be selected as overpower or underpower in the forward direction (positive setting) or reverse direction (negative setting). This function can also be selected for single phase detection for line-to-ground VT.

Minimum sensitivity of 100 mA for 5 A CT (real component of current).

* *Accuracy applies for a nominal current range of 2.5 A to 6 A (5 A CT) or 0.5 A to 1.5 A (1 A CT).*

Values in parentheses apply to 1 A CT secondary rating.

PROTECTIVE FUNCTIONS (*cont.*)

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Loss-of-Field (dual-zone offset-mho characteristic)				
40	Circle Diameter #1, #2	0.01 to 3.00	0.01 PU	±0.01 PU or ±5%**
	Offset #1, #2	-2.0 to 2.0	0.01 PU	±0.01 PU or ±5%**
27	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles
	Voltage Control (positive sequence)	4 to 100%*	0.1%	±0.5 V or ±0.5%
	Directional Element	Fixed at -13°	–	–

* Of nominal voltage.

** Accuracy applies for a nominal current range of 2.5 A to 6 A (5 A CT) or 0.5 A to 1.5 A (1 A CT).

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Negative Sequence Overcurrent				
46	**Definite Time**			
	Pickup	3% to 300%*	1%	±0.1 A or ±0.5%** (±0.02 A or ±0.5%)
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
	Inverse Time			
	Pickup	3% to 100%*	0.1%	±0.1 A or ±3%** (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse Time/Very Inverse/Extremely Inverse/IEC/$I_2^2t=K$		
	Time Dial Setting	0.5 to 11.0 0.05 to 1.1 (IEC) 1 to 95 ($I_2^2t=K$)	0.1 0.01 1	±3 Cycles or ±10%**
	For $I_2^2t=K$ Curve Only			
	Definite Maximum Time to Trip	600 to 65,500 Cycles	1 Cycle	±3 Cycles or ±10%**
	Reset Time (Linear)	4 minutes (from threshold of trip)		

* Of nominal current for currents less than 14 A (2.8 A).

** Accuracy applies for a nominal current range of 2.5 A to 6 A (5 A CT) or 0.5 A to 1.5 A (1 A CT), and for a pickup of >5%.

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Negative Sequence Overvoltage				
47	Pickup #1, #2	4 to 100%*	0.1%	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles

* Of nominal voltage.

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
Inverse Time Residual Overcurrent				
51N	Pickup	0.50 to 6.00 A (0.10 to 1.20 A)	0.1 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse Time/Very Inverse/Extremely Inverse/IEC		
	Time Dial			
	Standard Curves #1–#4	0.5 to 11.0	0.1	±3 Cycles or ±10%
	IEC Curves #1–#4	0.05 to 1.10	0.01	

Values in parentheses apply to 1 A CT secondary rating.

PROTECTIVE FUNCTIONS (*cont.*)

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	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 ±10%
	Voltage Control (VC)	4.0 to 150.0%*	0.1%	±0.5 V or ±0.5%
	or			
	Voltage Restraint (VR)	Linear Restraint	–	–

* Of nominal voltage.

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Phase Overvoltage			
(59)	Pickup #1, #2	100 to 150%*	0.1%	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles**

* Of nominal voltage.

** When DFT is selected, the time delay accuracy is ±2 cycles. When RMS magnitude is selected, an additional time delay from 0 to +20 cycles may occur.

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Ground Overvoltage			
(59G)	Pickup	4 to 150%*	1%	±0.5 V or ±0.5%
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles

* Of nominal voltage.

This function can only be enabled when the relay is configured in line-to-line VT and the 25 function is not enabled.

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Peak Overvoltage			
(59I)	Pickup	100 to 150%*	1%	±3%**
	Time Delay	1 to 8160 Cycles	1 Cycle	±3 Cycles

*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.

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	±2 Cycles

Device Number	Function	Setpoint Ranges	Increment	Accuracy†
	Reconnect Enable Time Delay			
(79)	Time Delay	2 to 65,500 Cycles	1 Cycle	±2 Cycles

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

Values in parentheses apply to 1 A CT secondary rating.

PROTECTIVE FUNCTIONS (*cont.*)

Device Number	Function	Setpoint Ranges	Increment	Accuracy[†]
	Over/UnderFrequency			
(81)	Pickup #1, #2, #3, #4	50.00 to 67.00 Hz (40.00 to 57.00 Hz*)	0.01 Hz	±0.03 Hz
	Time Delay #1,#2, #3, #4	2 to 65,500 Cycles	1 Cycle	±2 Cycles or ±0.01%

This range applies to 50 Hz nominal frequency models.

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. The accuracy is ±0.15 Hz for a range of 52 to 57 Hz, and 63 to 67 Hz (for 60 Hz nominal) and 42 to 47 Hz and 53 to 57 Hz (for 50 Hz nominal).

	Nominal Settings			
	Nominal Voltage	50 to 500 V*	1 V	–
	Nominal Current	0.50 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 Cycle or ±1%

* Maximum measured range for (25), (59), (59G) and (59I) function settings is ≤ 600 V.

** 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. When line-ground-to-line-line selection is applied, the nominal voltage selection should be the line-line nominal voltage (not line-ground nominal voltage).

Values in parentheses apply to 1 A CT secondary rating.

Description

The M-3410A Intertie/Generator Protection Relay is intended for the protection of the intertie between the utility and dispersed generation. It is also suitable for the protection of synchronous and induction generators. Communications and control features of the M-3410A are accomplished utilizing the M-3810A IPScom for Windows Communications Software.

Metering

The relay provides metering of voltages, currents, real power, reactive power, power factor, frequency and positive sequence impedance.

Metering Accuracies are:

Voltage: ±0.5 V or ±0.5%, whichever is greater (Range 0 to 600 V)

Current: 5 A rating, ±0.1 A or ±3%, whichever is greater (Range 0 to 14 A)
1 A rating, ±0.02 A or ±3%, whichever is greater (Range 0 to 2.8 A)

Power: ±0.02 PU or ±2%, whichever is greater

Frequency: ±0.03 Hz (from 57 to 63 Hz for 60 Hz models; from 47 to 53 Hz for 50 Hz models)

Oscillographic Recorder

The oscillographic recorder provides comprehensive data recording of all monitored waveforms, input contacts, and output contacts, storing up to 120 cycles of data. The total record length is configured for one or two partitions. A programmable post trigger delay (5 to 95%) is incorporated to capture breaker operation. The oscillograph is triggered remotely using the serial interface, designated status input signals, or M-3410A programmable output operations. Storage of oscillographic records is nonvolatile and will be retained even without power, as long as the on-board battery is healthy.

Oscillographic data can be downloaded using serial communication in Common Format For Transient Data Exchange (COMTRADE) format as specified by IEEE Standard C37.111-1999.

Sequence of Events

A total of 32 nonvolatile events can be stored. The recorded information includes the function(s) operated, the function(s) picked up, input/output contact status and time stamp. The events can be retrieved through the communications port. After the 32nd event is stored, additional events result in the oldest event being dropped (FIFO). The information is time-stamped to 1 ms resolution.

Calculations

Current and Voltage Values: Uses a discrete Fourier transform (DFT) algorithm on sampled (32 times per cycle) voltage and current signals to extract fundamental frequency phasors for calculations. The 59/27 function, when set for RMS measurement, uses a time domain algorithm to calculate the voltage magnitude.

Power Input Options

Nominal	Range	Burden
12/24 Vdc	9 to 36 Vdc	<5 VA
48 Vdc	36 to 75 Vdc	<5 VA
120 Vac/125 Vdc	85 to 150 Vac/Vdc	<7 VA

Sensing Inputs

3 Voltage Inputs: Rated nominal voltage of 69 Vac to 480 Vac, 60 Hz (50 Hz user configurable). Will withstand 600 V continuous voltage. Source voltages may be line-to-ground or line-to-line connected. Phase sequence ABC/ACB is selectable. Voltage transformer burden less than 0.25 VA at 120 Vac.

3 Current Inputs: Rated current (I_R) of 5.0 A or 1.0 A, 60 Hz (50 Hz user configurable). Will withstand $2I_R$ continuous current and 30 I_R for 2 seconds. Current transformer burden is less than 0.75 VA at 5 A for 5 A inputs, 0.3 VA at 1A for 1 A inputs.

Control/Status Inputs

The control/status inputs, INPUT1 and INPUT2, can be programmed to block any of the M-3410A functions and trigger the oscillograph recorder. The control/status inputs accept only dry contacts and are internally wetted (9 Vdc) by the relay's power supply. A minimum current of 1.3 mA is required to avoid spurious triggering of the input.

Output Contacts

The two programmable output relays, each with a contact, are rated as per IEEE C37.90-1989 for tripping: make 30 A for 0.2 seconds. Available hardware configurations include two normally open (Option B1), one normally open and one normally closed (Option B2), or two normally closed (Option B3) contacts. The contacts will carry 8 A, break 6 A at 120 Vac, break 0.1 A at 125 Vdc, inductive break 0.1 A. Also provided is a self-test alarm output contact (form "c") with a rating of 8 A at 120 Vac, 5 A at 30 Vdc, 125 Vdc 0.15 A resistive, 0.1 A inductive.

Any of the M-3410A protective functions can be individually programmed to activate the two programmable outputs. The user can configure the two outputs to either energize or de-energize to issue an output command.

The outputs (excluding the self-test) can have two modes of operation, LATCHING and NORMAL. The LATCHING mode requires an operator intervention to deactivate the outputs after the condition for operation has been removed. In the NORMAL mode, when the condition for tripping has been removed, the output(s) will deactivate automatically after the corresponding seal-in timers have expired.

Target/Status Indicators and Controls

The **RELAY OK** LED reveals proper cycling of the microprocessor. The **DIAGNOSTIC** LED provides indication of the error code (when flashing). The **OSC TRIGGER** LED indicates that the oscillograph has been triggered. The remaining eleven LEDs are used to indicate which protective function(s) have been tripped. **OUTPUT 1** and **OUTPUT 2** are used to indicate the status of the output contacts, and the output LEDs will illuminate when the output contact relays are tripped. The **TARGET/OUTPUT RESET** button resets the target LEDs if the conditions causing the operation have been removed. Holding the **TARGET/OUTPUT RESET** button displays the present pickup status of the M-3410A functions. The **TARGET/OUTPUT RESET** button will deactivate the tripped output contact if the **LATCHING** mode was selected. (If the seal-in timer has already expired, the output contact will deactivate immediately.)

Communication

Communications ports include a front panel RS-232 port (COM 1) and a rear port (COM 2) configurable to RS-232 or RS-485. The RS-232 ports are connected physically with a DB-9 connector, and the RS-485 port utilizes 4-wire interface mounting screw terminals.

M-3810A IPScom for Windows Communications Software utilizing the MODBUS communications protocol in RTU mode, implements serial, byte-oriented asynchronous communication with the M-3410A and provides the following functions:

- Interrogation and modification of setpoints
- Time-stamped sequence of events information for the 32 most recent events
- Real-time metering of all quantities measured
- Downloading of recorded oscillographic data
- Relay Setup

Tests and Standards

The M-3410A Intertie/Generator Protection Relay complies with the following type tests and standards:

Voltage Withstand

Dielectric Withstand

All terminals except power supply and status input contacts, 2500 Vac/3500 Vdc
Power Supply and Status Input Contacts:
IEC 60255-5   1,500 Vdc for power supply voltages (12, 24, 48 V inputs)
                  2500 Vac/3500 Vdc for power supply voltages (120 Vac/125 Vdc input)

Impulse Voltage

Power Supply Input Voltages, 120 Vac/125 Vdc:
IEC 60255-5   5,000 V pk, +/- polarity applied to each independent circuit to earth
                  5,000 V pk, +/- polarity applied between independent circuits
                  1.2 µs by 50 µs, 500 ohms impedance, three surges at every 5 second interval

Power Supply Input Voltages, 12, 24, 48 Vdc:
IEC 60255-5   3,000 V pk, +/- polarity applied to each independent circuit to earth
                  3,000 V pk, +/- polarity applied between independent circuits
                  1.2 µs by 50 µs, 500 ohms impedance, three surges at every 5 second interval

Insulation Resistance

IEC 60255-5   > 100 Megaohms

Electrical Environment

Electrostatic Discharge Test

IEC 61000-4-2   Class 4 (±8 kV) - point contact discharge and air discharge

Fast Transient Disturbance Test

IEC 61000-4-4   (±2 kV, 5 kHz) AC Power Supply Input
                 (±1 kV, 5 kHz) RS-232, RS-485 and ground

Surge

IEC 61000-4-5   (±2 kV, 1.2 µs by 50 µs line to ground) AC Power Supply Input
                 (±1 kV, 1.2 µs by 50 µs line to line) AC Power Supply Input
                 (±1 kV, 1.2 µs by 50 µs line to ground) RS-485 Port

Surge Withstand Capability

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

IEEE C37.90.1   2,500 V pk-pk Oscillatory applied to each independent circuit to earth
2002   2,500 V pk-pk Oscillatory applied between each independent circuit
                4,000 V pk Fast Transient burst applied to each independent circuit to earth
                4,000 V pk Fast Transient burst applied between each independent circuit

The signal is applied to the digital data circuits (RS-232 and RS-485) through capacitive coupling clamp.

Radiated Susceptibility

IEEE C37.90.2   25-1000 Mhz @ 35V/m
1995

Output Contacts

IEEE C37.90.0   Make 30 A for 0.2 seconds, off for 15 seconds for 2,000 operations
1989   Section 6.7.1, Tripping Output Performance Requirements

Atmospheric Environment

Temperature

IEC 60068-2-1   Cold, -20° C
IEC 60068-2-2   Dry Heat, +70° C
IEC 60068-2-3   Damp Heat, +40° C @ 93%$_{RH}$

Mechanical Environment

Vibration

IEC 60255-21-1   Vibration response Class 1, 0.5 g
                 Vibration endurance Class 1, 1.0 g

Shock

MIL-STD-810C   Method 516.2, Procedure 1, 11 ms, 15 g, 1/2 sine pulse, 3 pulses per axis

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

CE Safety Directive – EN61010-1-1993, CAT II, Pollution Degree 2

Physical

Panel Mount
Size: 12.20" high x 12.00" wide x 2.56" deep (30.99 cm x 30.48 cm x 7.27 cm)
Approximate Weight: 5 lbs, 11 oz (2.11 kg)
Approximate Shipping Weight: 9 lbs, 13 oz (4.48 kg)

Horizontal/Vertical Panel Mount
Size: 3.46" high x 10.50" wide x 11.63" deep (8.8 cm x 26.7 cm x 29.54 cm)
Approximate Weight: 6 lbs, 4 oz (2.84 kg)
Approximate Shipping Weight: 10 lbs, 4 oz (4.7 kg)

19" Rack Mount
Size: 3.46" high x 19.0" wide x 11.63" deep (8.8 cm x 48.26 cm x 29.54 cm)
Approximate Weight: 6 lbs, 15 oz (3.14 kg)
Approximate Shipping Weight: 10 lbs, 15 oz (4.96 kg)

M-0290 and M-0296 Adapter Plate
Size: 17.25" high x 7.31" wide x 11.63" deep (43.82 cm x 18.57 cm x 29.54 cm)
Approximate Weight: 7 lbs, 4 oz (3.23 kg)
Approximate Shipping Weight: 11 lbs, 15 oz (5.41 kg)

Environmental: For flat surface mounting on a Type 1 enclosure, cULus rated to 40°C surrounding air ambient.

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-3410A Instruction Book, Appendix F, Layup and Storage for additional information.

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.

Patent & Warranty

The M-3410A Intertie/Generator Protection Relay is covered by U.S. Patent 5,592,393.

The M-3410A Intertie/Generator Protection Relay is covered by a five year warranty from date of shipment.
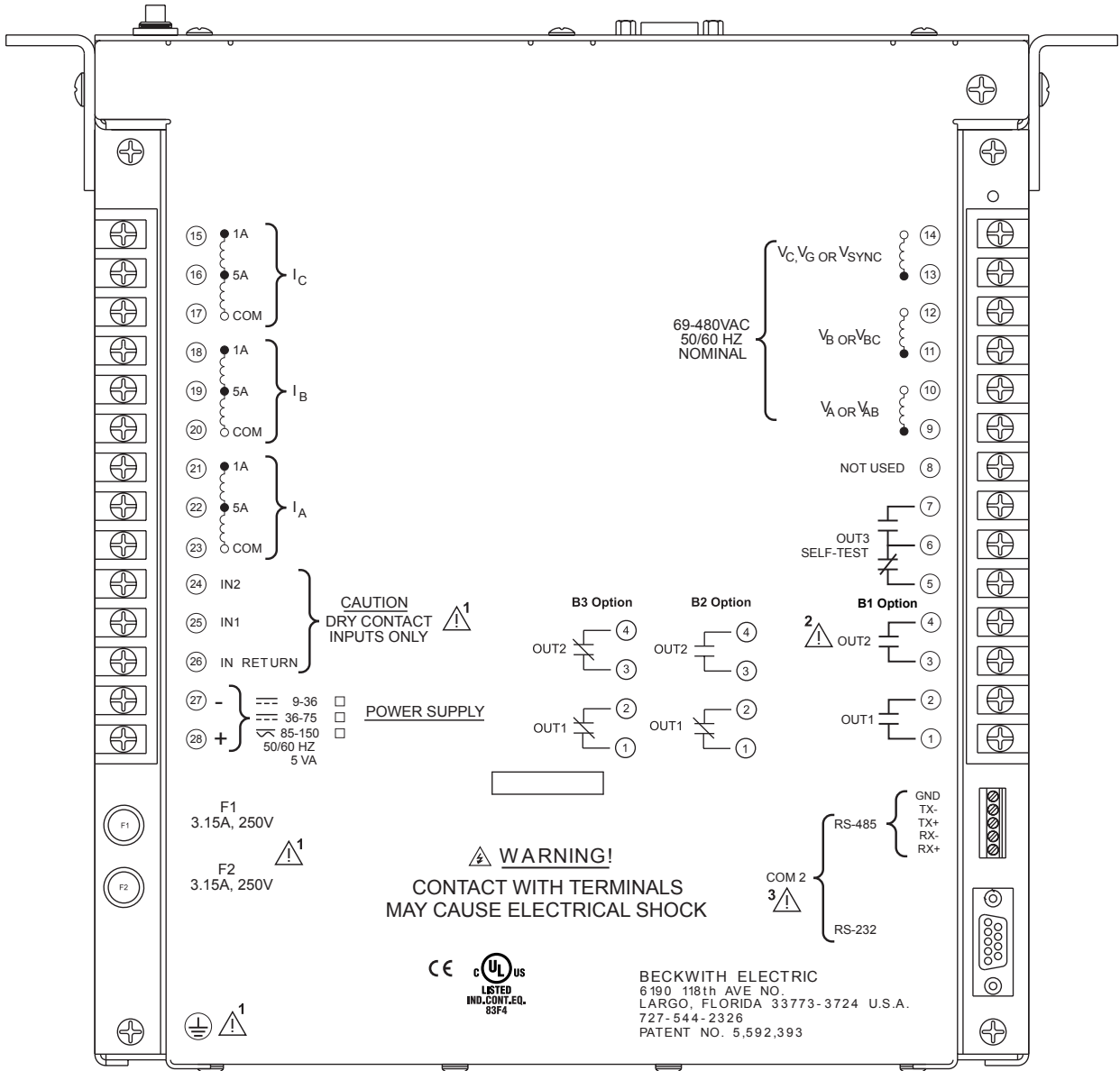
External Connections

M-3410A external connection points are illustrated in Figure 1, Standard Panel Layout External Connections and Figure 2 for the optional Horizontal and Vertical Panel External Connection Layouts.
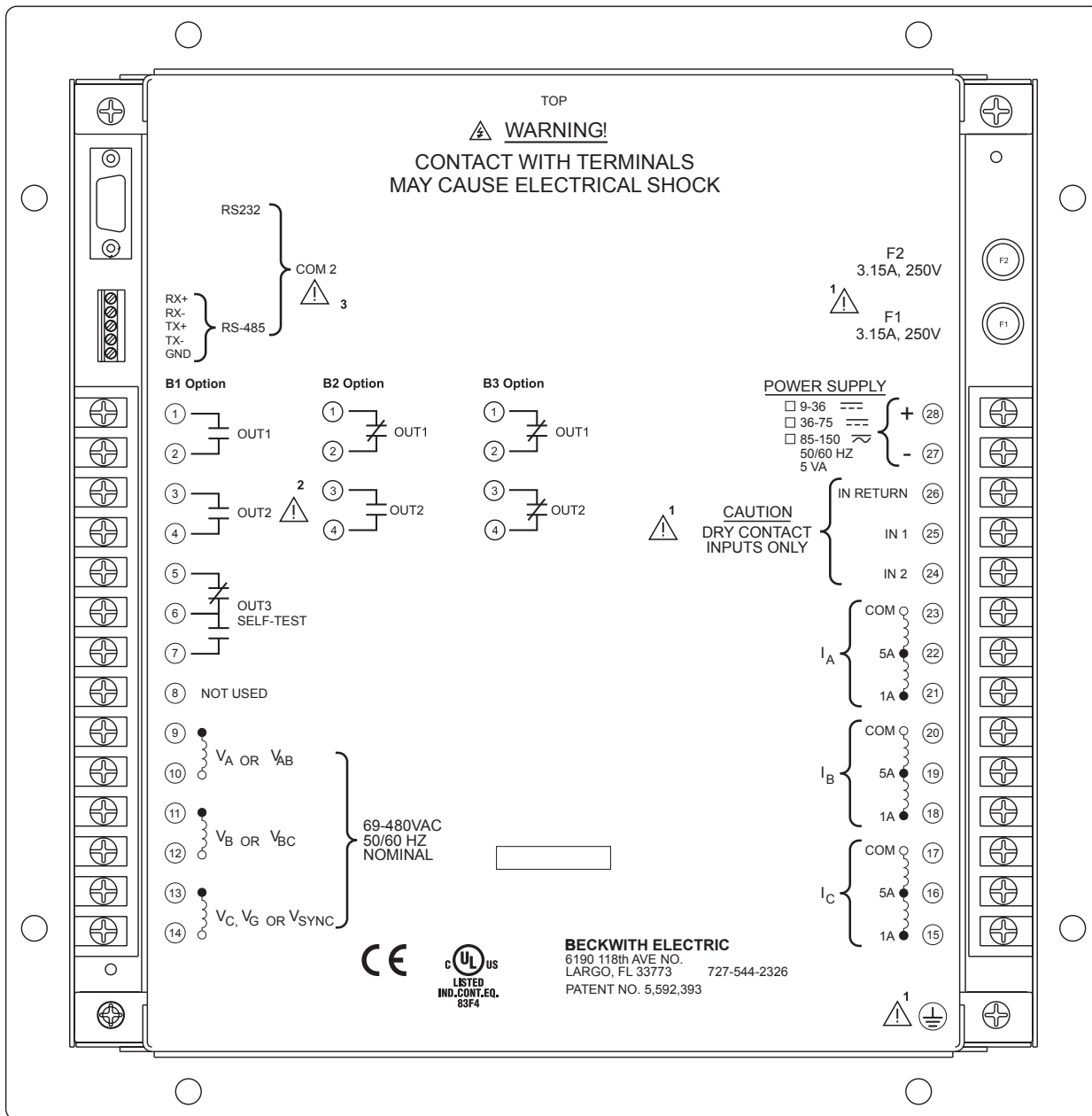
NOTES:

1. See M-3410A Instruction Book, **Section 2.3**, **External Connections**.

2. See M-3410A Instruction Book, **Section 3.1**, **Relay Configuration**, Output Contact Mode.

3. See M-3410A Instruction Book, **Section 2.8**, **Relay Remote Communication Setup (PC)**, COM2 Configuration.

Figure 1   Panel Mount (Option P1) External Connections

■**NOTES:**

1. See M-3410A Instruction Book, **Section 2.3**, **External Connections**.

2. See M-3410A Instruction Book, **Section 3.1**, **Relay Configuration**, Output Contact Mode.

3. See M-3410A Instruction Book, **Section 2.8**, **Relay Remote Communication Setup (PC)**, COM2 Configuration.

Figure 2   Horizontal (Options H1 and H2) and Vertical (Option V1) External Connections
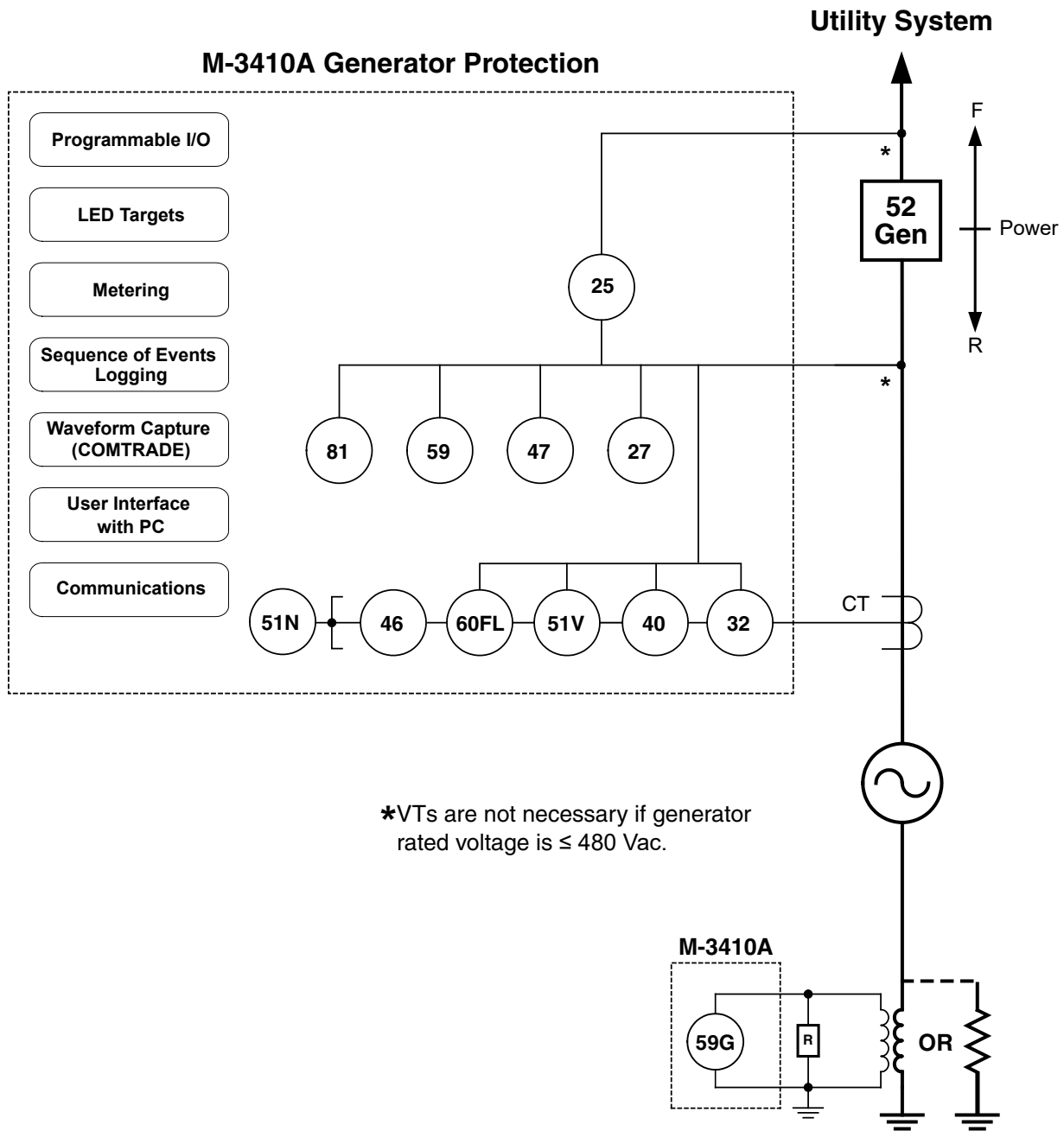
∗ VTs are not necessary if generator rated voltage is ≤ 480 Vac.

■ **NOTES:**

1. The 59G protective function is only available when the relay is configured to use line-to-line VTs and the 25 function is not enabled.

2. The 25 protective function is only available when the relay is configured to use line-to-line VTs and the 59G function is not enabled.

3. The 32 protective function in single phase detection mode is only available when the relay is configured to use line-to-ground VT.

Figure 3   Typical One-Line Diagram–Generator Protection
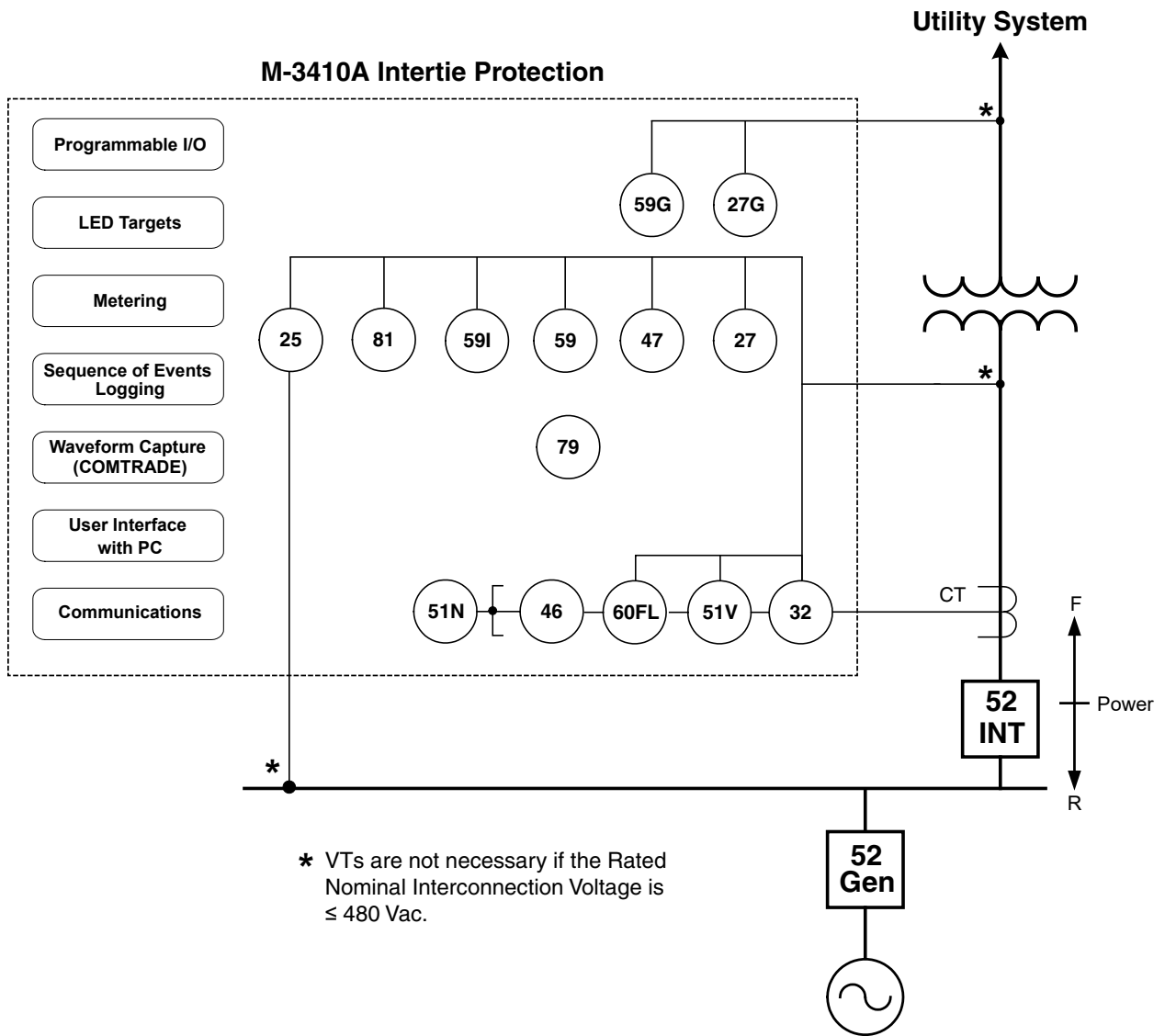
Figure 4   Typical One-Line Diagram–Intertie Protection
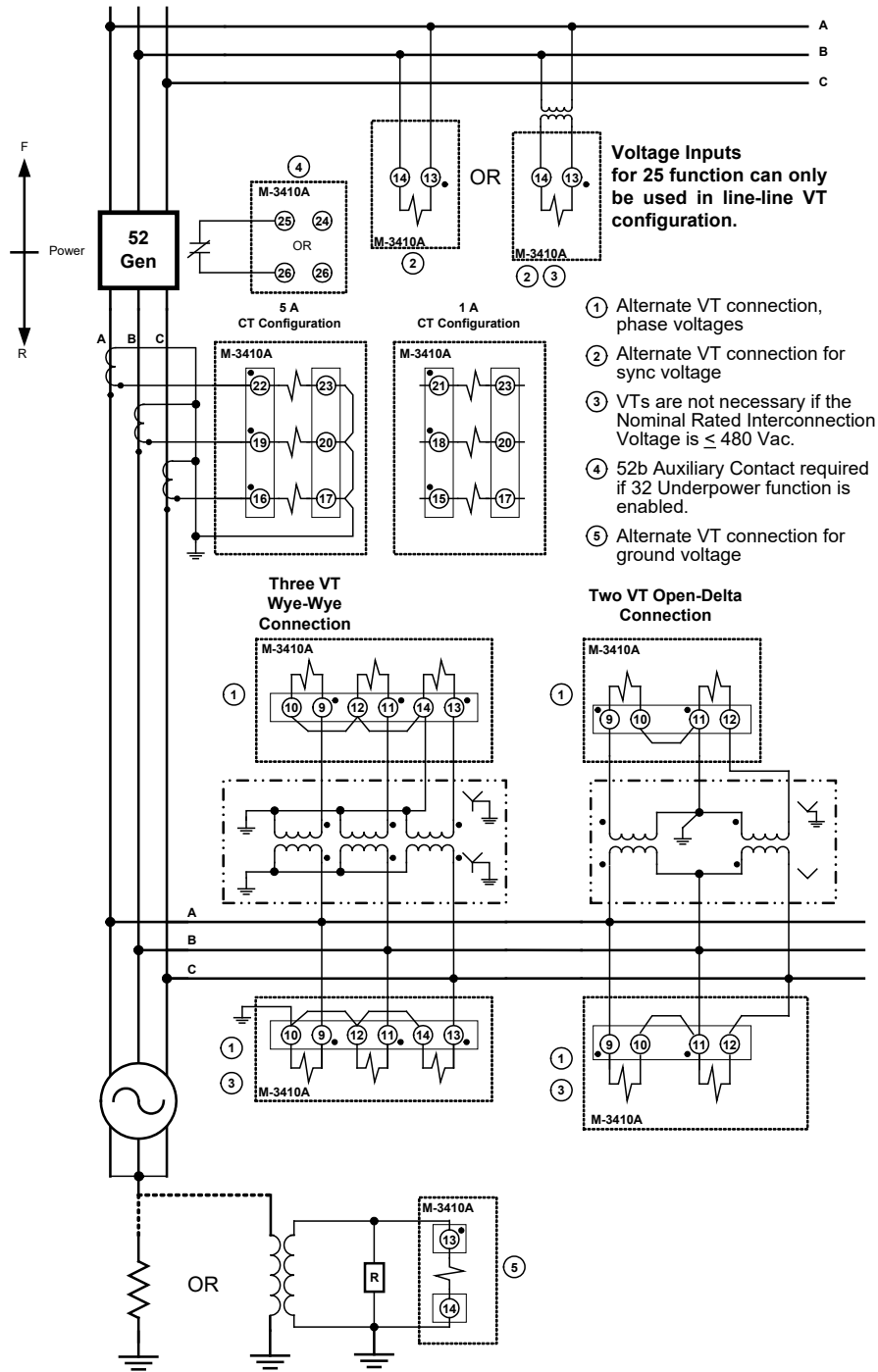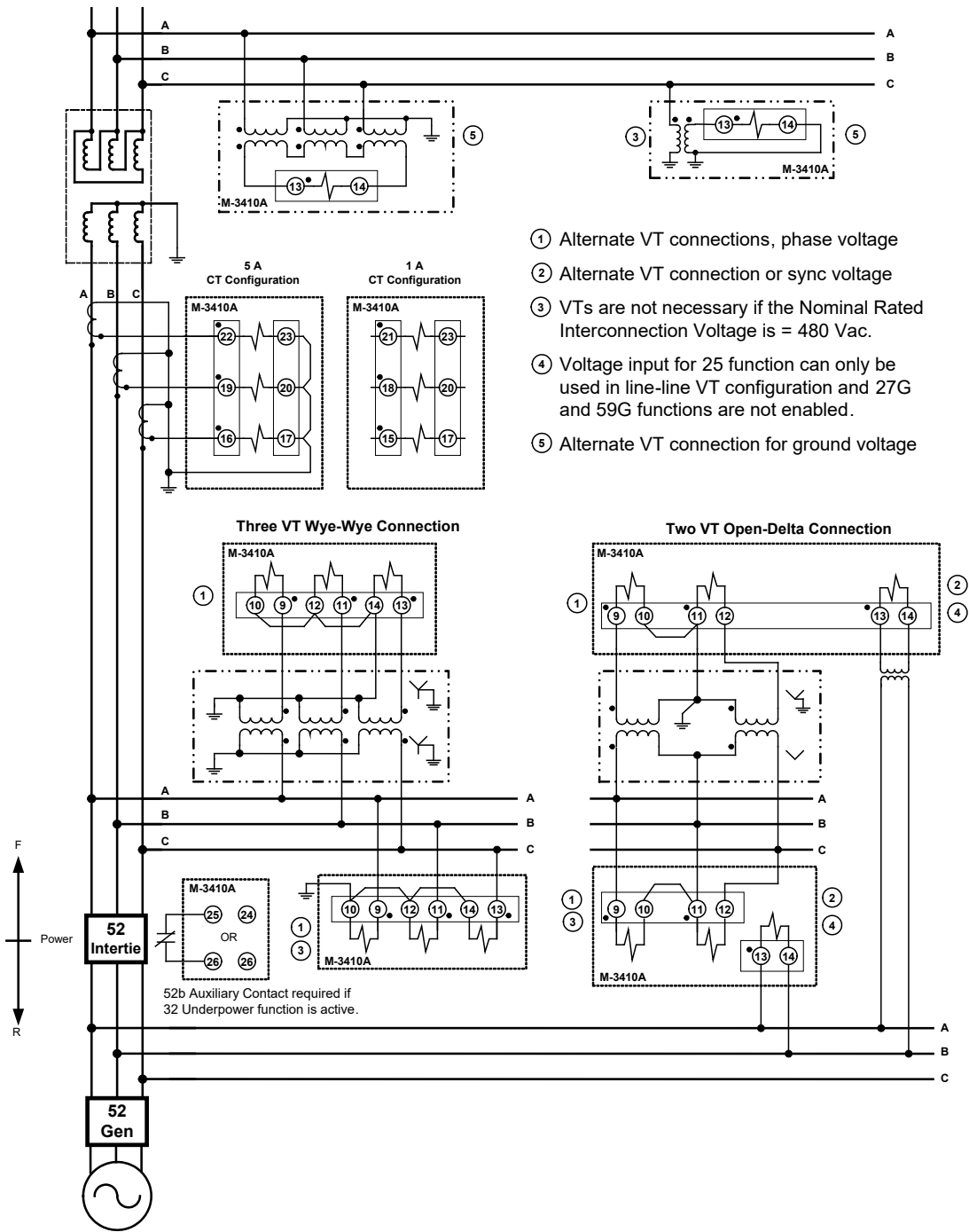
■**NOTES:**

1. The 27G and 59G protective functions are only available when the relay is configured to use line-to-line VTs and the 25 function is not enabled.

2. The 25 protective function is only available when the relay is configured to use line-to-line VTs and the 27G and 59G functions are not enabled.

3. The 32 protective function in single phase detection mode is only available when the relay is configured to use line-to-ground VTs.

M-3410A Typical Connection Diagram

Voltage Inputs for 25 function can only be used in line-line VT configuration.

① Alternate VT connection, phase voltages

② Alternate VT connection for sync voltage

③ VTs are not necessary if the Nominal Rated Interconnection Voltage is ≤ 480 Vac.

④ 52b Auxiliary Contact required if 32 Underpower function is enabled.

⑤ Alternate VT connection for ground voltage

5 A CT Configuration

1 A CT Configuration

Three VT Wye-Wye Connection

Two VT Open-Delta Connection

■ **NOTES:**

1. The 59G protective function is only available when the relay is configured to use line-to-line VTs and the 25 function is not enabled.

2. The 25 protective function is only available when the relay is configured to use line-to-line VTs and the 59G function is not enabled.

3. The 32 protective function in single phase detection mode is only available when the relay is configured to use line-to-ground VTs.

Figure 5   Typical Three-Line Diagram–Generator Protection

**M-3410A Typical
Connection Diagram**

① Alternate VT connections, phase voltage

② Alternate VT connection or sync voltage

③ VTs are not necessary if the Nominal Rated Interconnection Voltage is = 480 Vac.

④ Voltage input for 25 function can only be used in line-line VT configuration and 27G and 59G functions are not enabled.

⑤ Alternate VT connection for ground voltage

■NOTES:

1. The 27G and 59G protective functions are only available when the relay is configured to use line-to-line VTs and the 25 function is not enabled.

2. The 25 protective function is only available when the relay is configured to use line-to-line VTs and the 27G and 59G functions are not enabled.

3. The 32 protective function in single phase detection mode is only available when the relay is configured to use line-to-ground VTs.

Figure 6   Typical Three-Line Diagram–Intertie Protection

–17–
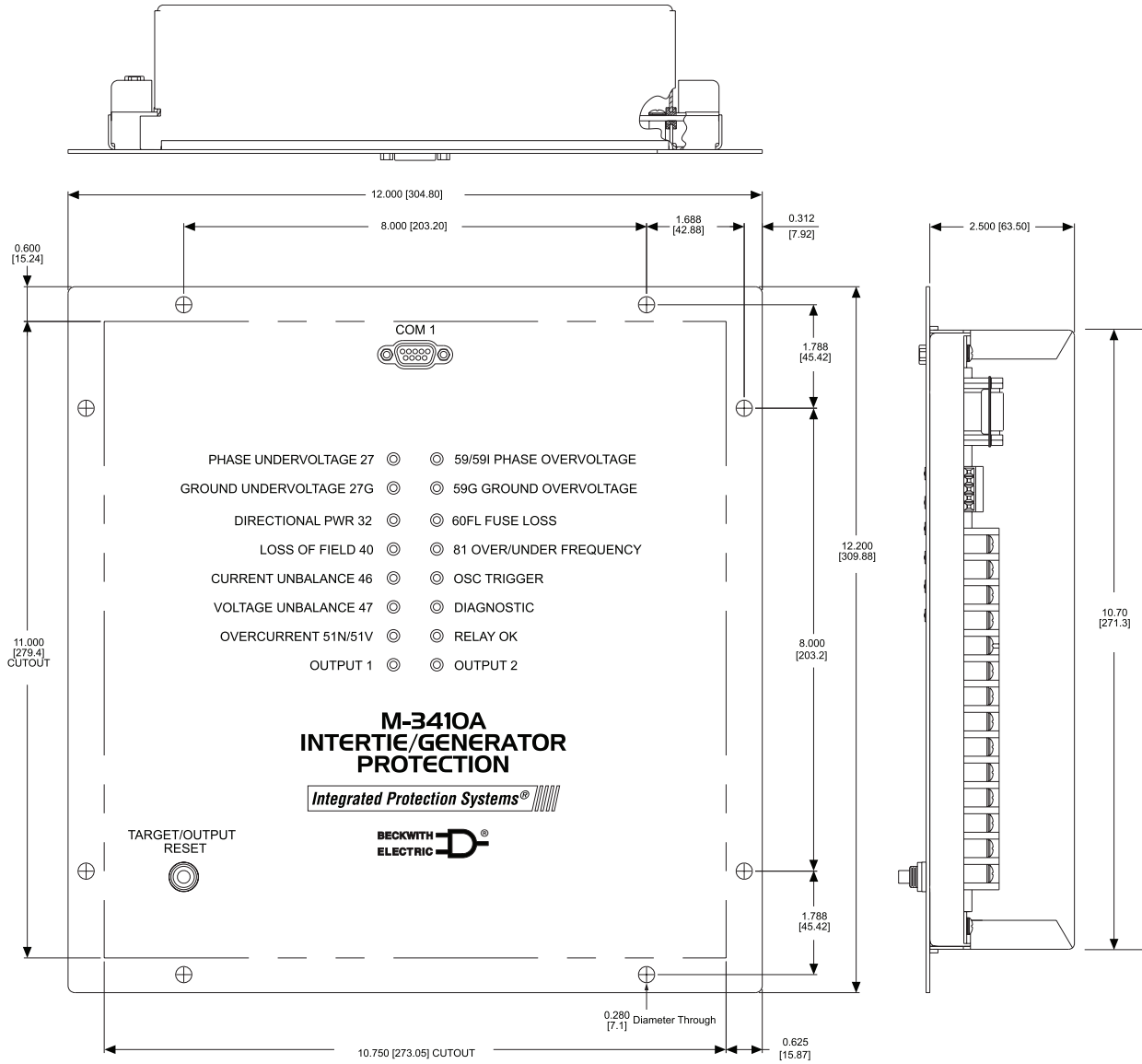
Figure 7   Panel Mount (Option P1) Mounting Dimensions
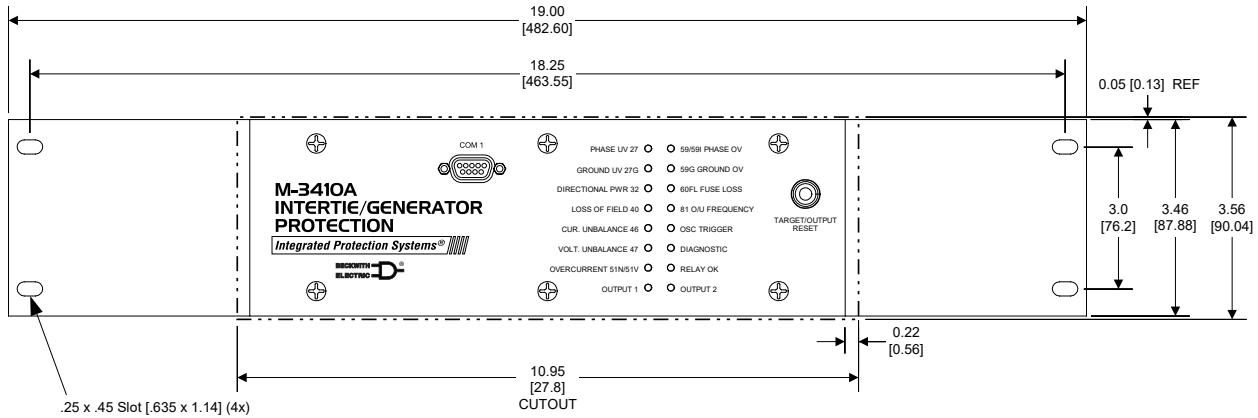
Figure 8   19" Rack Mount (Option H2) Dimensions
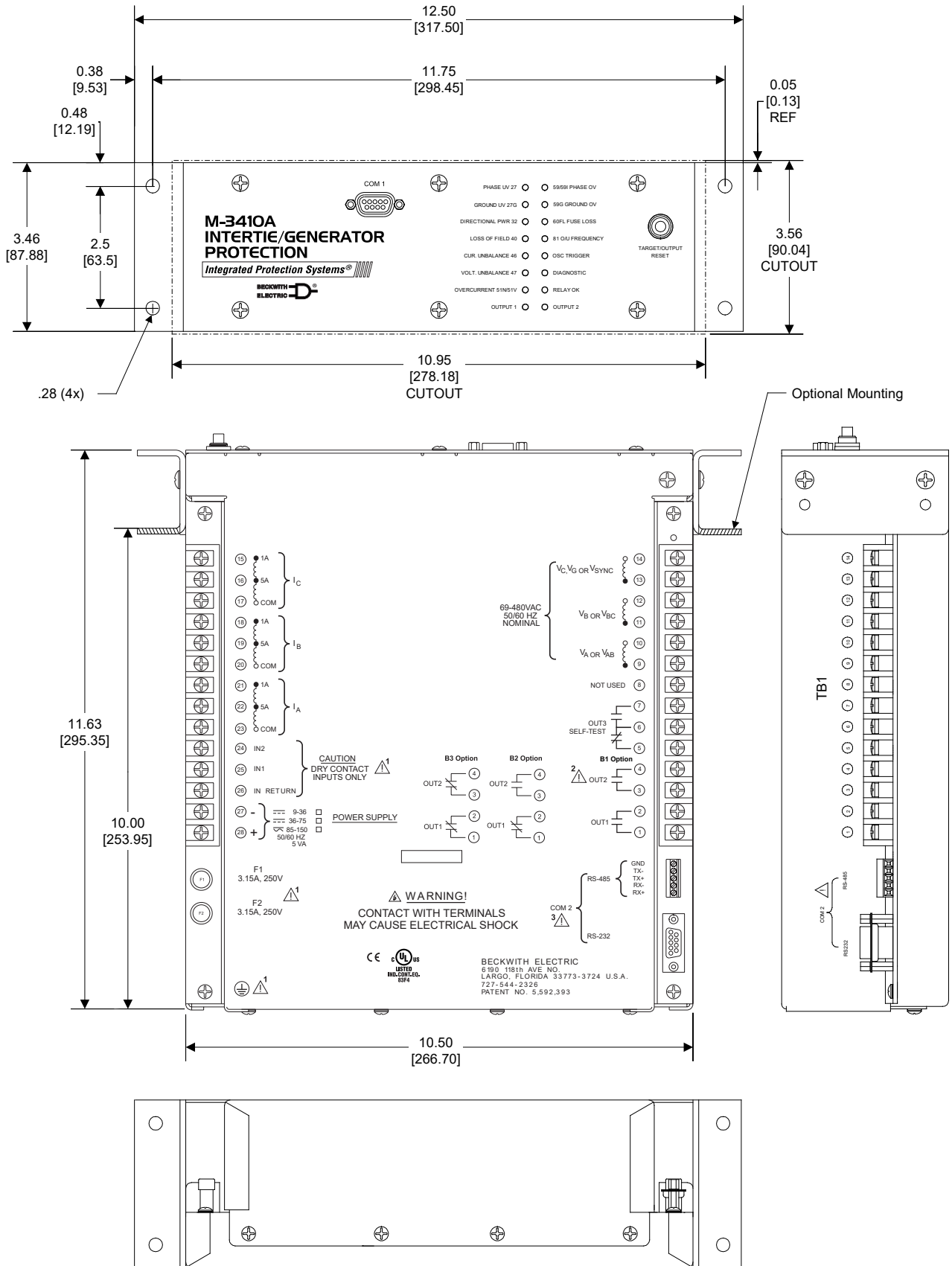
Figure 9   Horizontal (Options H1) and Vertical (Option V1) Mounting Dimensions
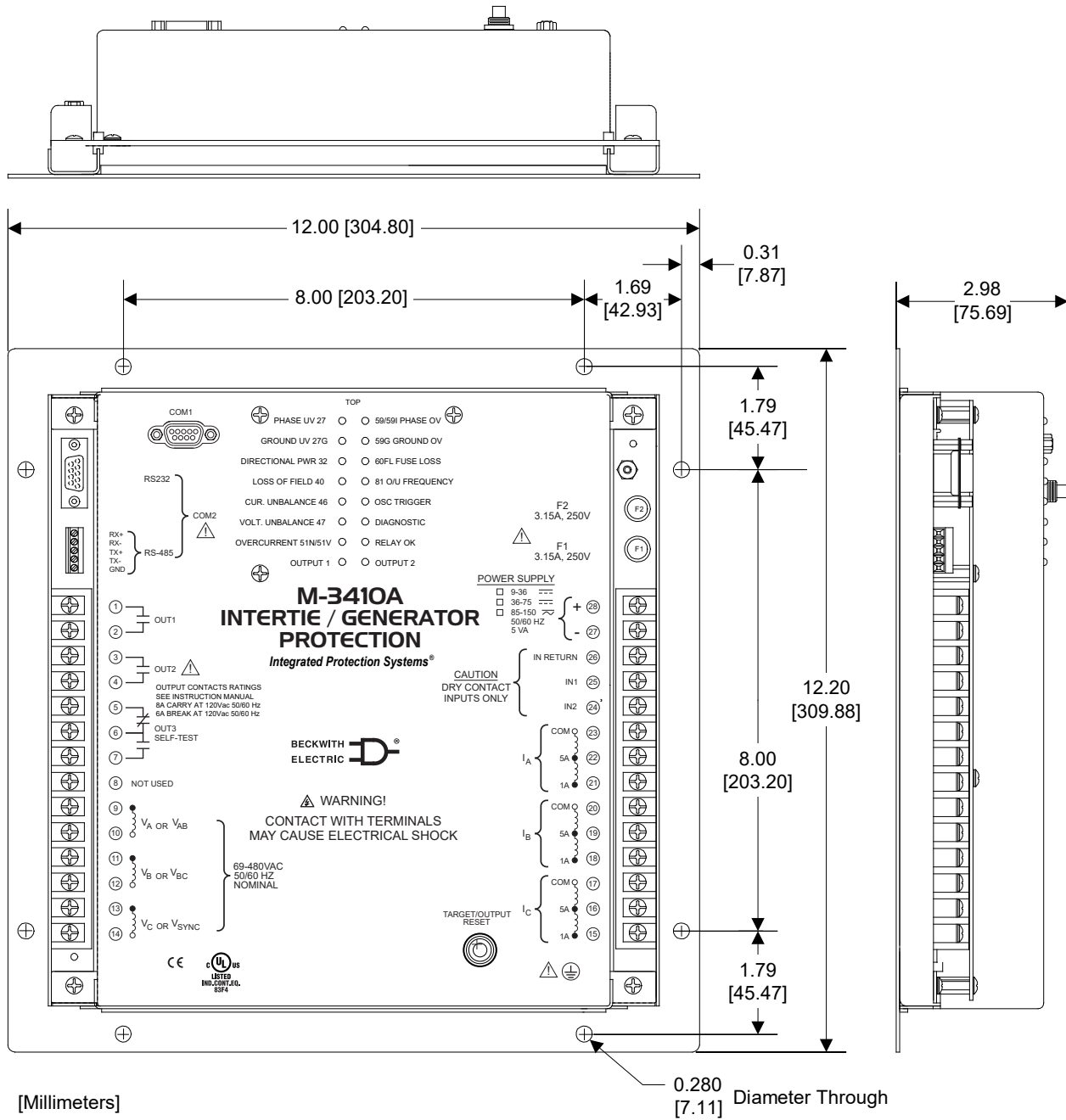
Figure 10   Surface Mount (Option S1) External Connections and Mounting Dimensions

7.31 [185.67]

.96 [24.51]

5.38 [136.65]

.28 [.71] (4x)

.32 [8.26]

TARGET/OUTPUT
RESET

PHASE UV 27   59/59I PHASE OV

GROUND UV 27G   59G GROUND OV

DIR PWR 32   60FL FUSE LOSS

LOSS OF FIELD 40   81 O/U FREQ

CUR. UNBAL. 46   OSC TRIGGER

VOLT. UNBAL. 47   DIAGNOSTIC

OVERCURRENT
51N/51V   RELAY OK

OUTPUT 1   OUTPUT 2

16.60 [421.64]

17.25 [438.15]

COM 1

**M-3410A
INTERTIE/
GENERATOR
PROTECTION**

Integrated Protection Systems® /////
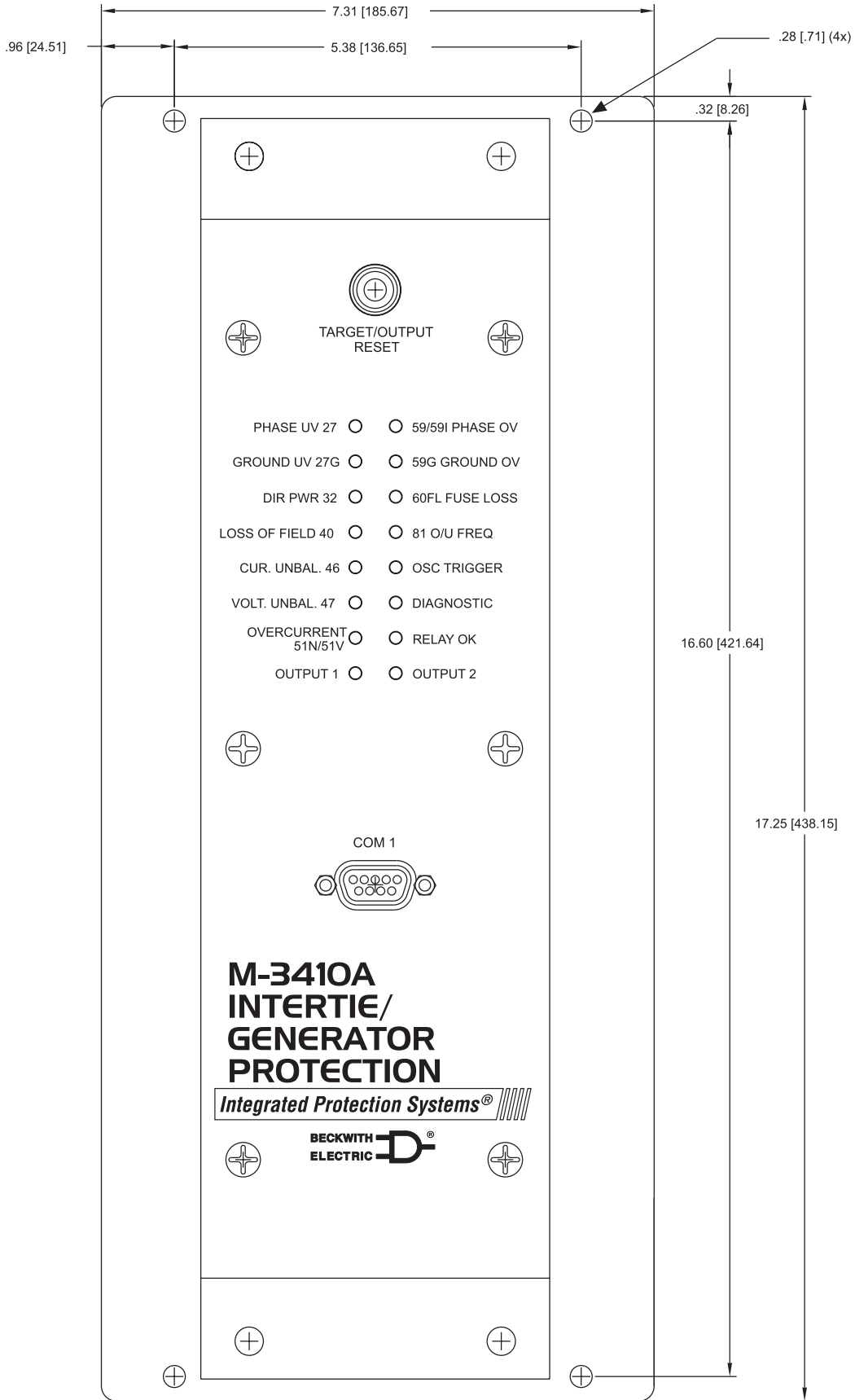
BECKWITH
ELECTRIC

Figure 11   M-0290 and M-0296 Replacement Adapter Plate Dimensions

TRADEMARKS

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

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

This Page Left Intentionally Blank

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.