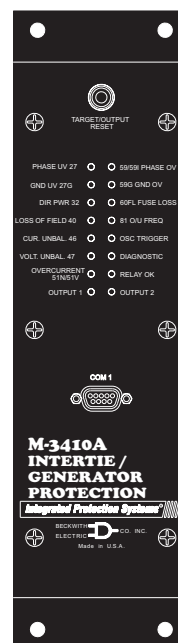


Intertie/Generator Protection Relay M-3410A

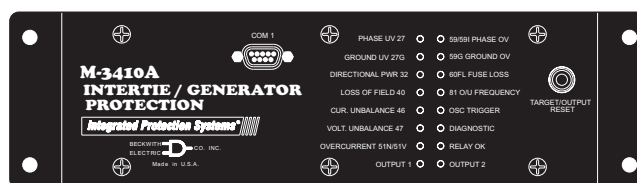
Integrated Protection System®



M-3410A Standard Panel



M-3410A Vertical Panel (Optional)



M-3410A Horizontal Panel (Optional)

- Available in four different Mounting configurations
- 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

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 neutral 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
- M-3811A IPScom For Palm OS® Communications Software
- MODBUS protocol
- Supports both 50 and 60 Hz applications
- Accepts 1A or 5 A rated CT inputs
- Relay voltage inputs can be directly connected (no VT required) for voltages ≤ 480 V ac
- Continuous Self-Diagnostics

Optional Features

- M-3801D IPSplot® PLUS Oscillograph Analysis Software
- Horizontal and Vertical panel mount versions available (see Figures 7, 9 and 10)
- Standard 19" Rack Mount Available (See Figure 8)
- Surface Mount Version available (See Figure 11)
- Adapter Plate available for M-0290 and M-0296 Pride protection relay replacement

PROTECTIVE FUNCTIONS

Device Number	Function	Setpoint Ranges	Increment	Accuracy
Sync Check				
25	Phase Angle Window	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.

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.

Ground Undervoltage				
27G	Pickup	4 to 100%*	1 %	± 0.5 V or ± 0.5%
	Time Delay	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.

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).

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%**
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles
27	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).

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%.

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.

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 IEC Curves #1-#4	0.5 to 11.0 0.05 to 1.10	0.1 0.01	±3 Cycles or ±10%

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 $\pm 3\%$ (± 0.02 A or $\pm 3\%$)
	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 $\pm 10\%$
	Voltage Control (VC) or	4.0 to 150.0%*	0.1%	± 0.5 V or $\pm 0.5\%$
	Voltage Restraint (VR)	Linear Restraint	—	—

* Of nominal voltage.

Phase Overvoltage				
59	Pickup #1, #2	100 to 150%*	0.1%	± 0.5 V or $\pm 0.5\%$
	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.

Ground Overvoltage				
59G	Pickup	4 to 150%*	1%	± 0.5 V or $\pm 0.5\%$
	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.

Peak Overvoltage				
59I	Pickup	100 to 150%*	1%	$\pm 3\%$ **
	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.

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

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.

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).

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 Package from a PC platform, or M-3811A IPScom For Palm OS® running on a Handspring™ Visor™ or Palm™ Handheld.

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 $\pm 0.5\%$, whichever is greater (Range 0 to 600 V)
Current:	5 A rating, ± 0.1 A or $\pm 3\%$, whichever is greater (Range 0 to 14 A) 1 A rating, ± 0.02 A or $\pm 3\%$, whichever is greater (Range 0 to 2.8 A)
Power:	± 0.02 PU or $\pm 2\%$, 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 either remotely using the serial interface, or 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 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 V dc	9 to 36 V dc	<5 VA
48 V dc	36 to 75 V dc	<5 VA
120 V ac/125 V dc	85 to 150 V ac/V dc	<7 VA

Sensing Inputs

3 Voltage Inputs: Rated nominal voltage of 69 V ac to 480 V ac, 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 V ac.

3 Current Inputs: Rated current (I_R) of 5.0 A or 1.0 A, 60 Hz (50 Hz user configurable). Will withstand $2 I_R$ 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 1 A 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 V dc) 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 ANSI/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 V ac, break 0.1 A at 125 V dc, inductive break 0.1 A. Also provided is a self-test alarm output contact (form 'c') with a rating of 8 A at 120 V ac, 5 A at 30 V dc, 125 V dc 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 programmable 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. 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 and a rear port user 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[™] or M-3811A IPScom For Palm OS[®] 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 Generator/Intertie Protection Relay complies with the following type tests and standards:

Voltage Withstand

Dielectric Withstand

All terminals except power supply and status input contacts, 2500 V ac/3500 V dc

Power Supply and Status Input Contacts:

IEC 60255-5 1,500 V dc for power supply voltages (12, 24, 48 V inputs)
 2500 V ac/3500 V dc for power supply voltages (120 V ac/125 V dc input)

Impulse Voltage

Power Supply Input Voltages, 120 V ac/125 V dc:

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 μ s by 50 μ s, 500 ohms impedance, three surges at every 5 second interval

Power Supply Input Voltages, 12, 24, 48 V dc:

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 μ s by 50 μ s, 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 μ s by 50 μ s line to ground) AC Power Supply Input
 (± 1 kV, 1.2 μ s by 50 μ s line to line) AC Power Supply Input
 (± 1 kV, 1.2 μ s by 50 μ s line to ground) RS-485 Port

Surge Withstand Capability

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

ANSI/IEEE 2,500 V pk-pk Oscillatory applied to each independent circuit to earth
 C37.90.1 2,500 V pk-pk Oscillatory applied between each independent circuit
 2002 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

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

Radiated Susceptibility

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

Output Contacts

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

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

UL-Listed per 508 – Industrial Control Equipment
UL Listed Component per 508A Table SA1.1 Industrial Control Panels
CSA-Certified per C22.2 No. 14-95 – Industrial Control Equipment
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)

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.

Patent & Warranty

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

The M-3410A Generator/Intertie 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.

Specification is subject to change without notice.

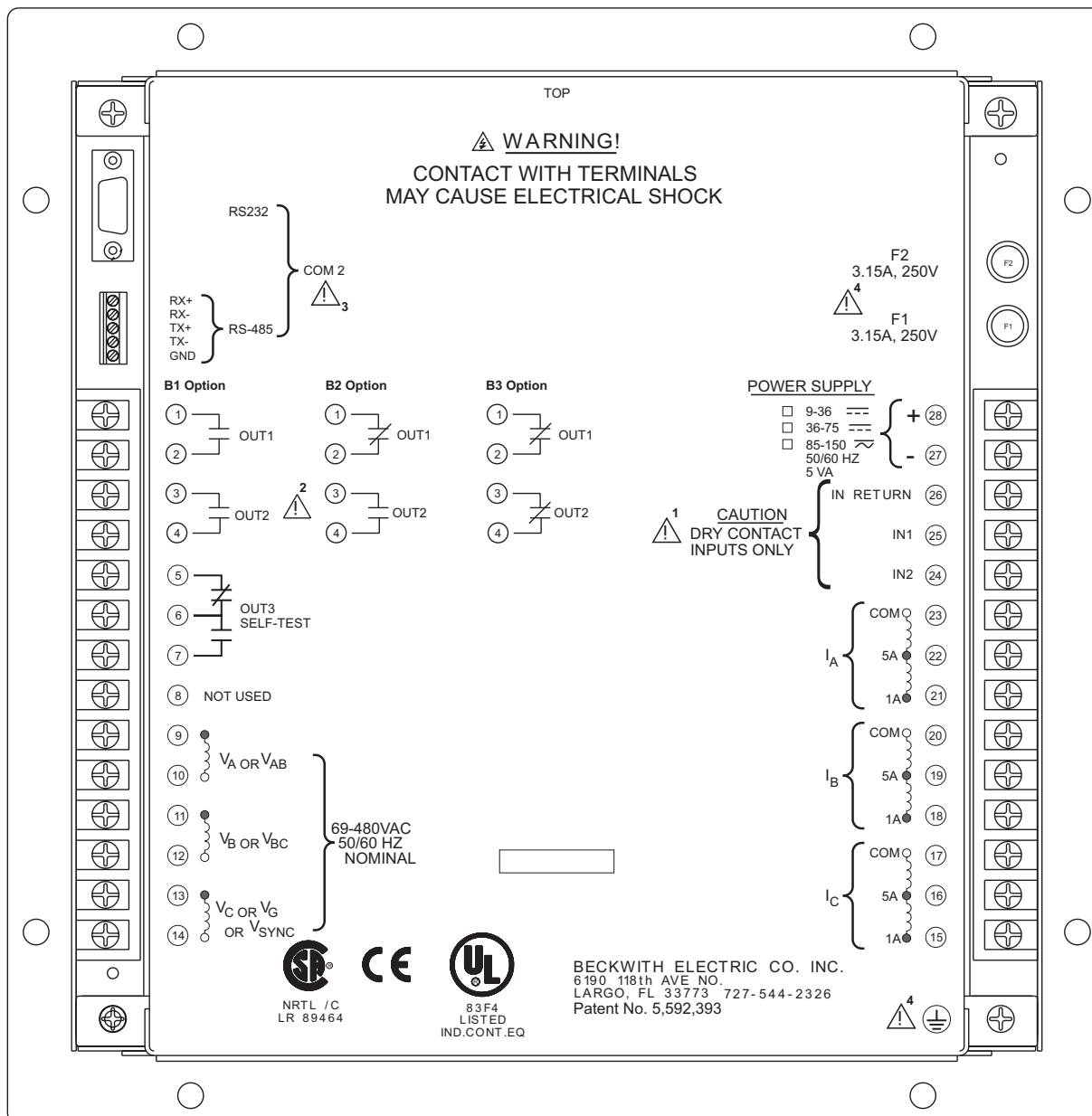


Figure 1 Standard Panel Layout External Connections

■ **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 2.9, Relay Remote Communication Setup (PC), COM2 Configuration.
4. See M-3410A Instruction Book, Section 2.3, External Connections.

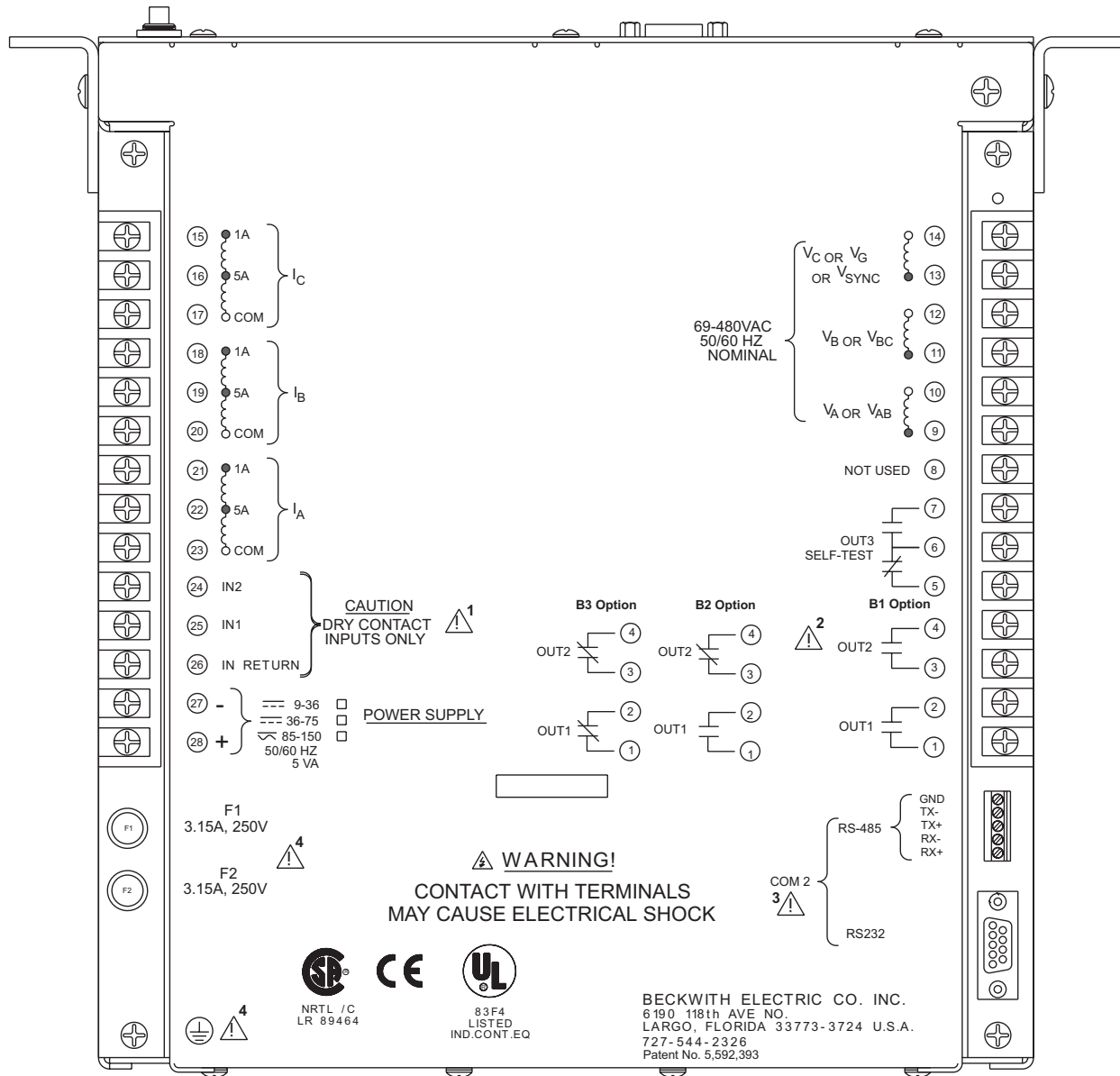


Figure 2 Optional Horizontal and Vertical Mount Panel External Connection Layout

■ 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 2.9, Relay Remote Communication Setup (PC), COM2 Configuration.
4. See M-3410A Instruction Book, Section 2.3, External Connections.

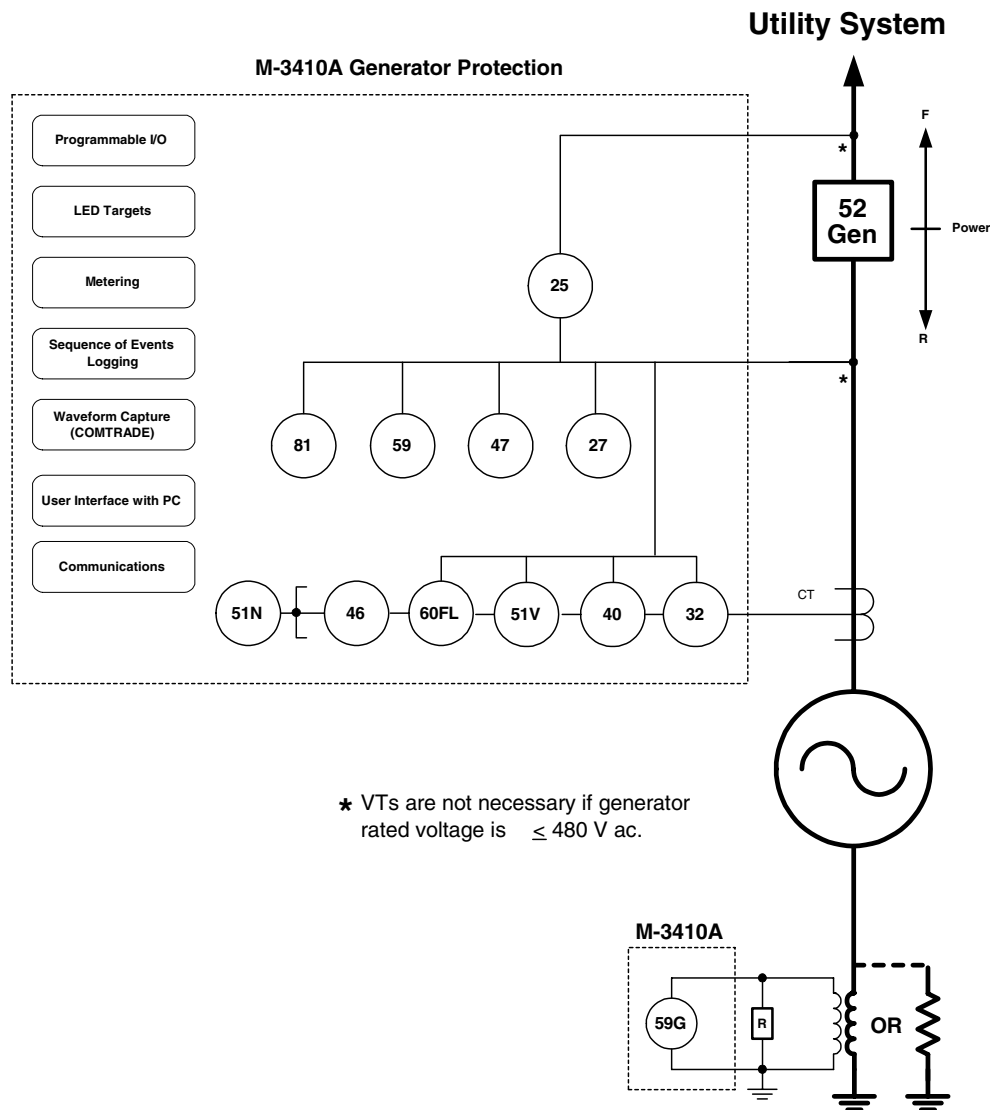


Figure 3 Typical One-Line Diagram—Generator Protection

■ **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.

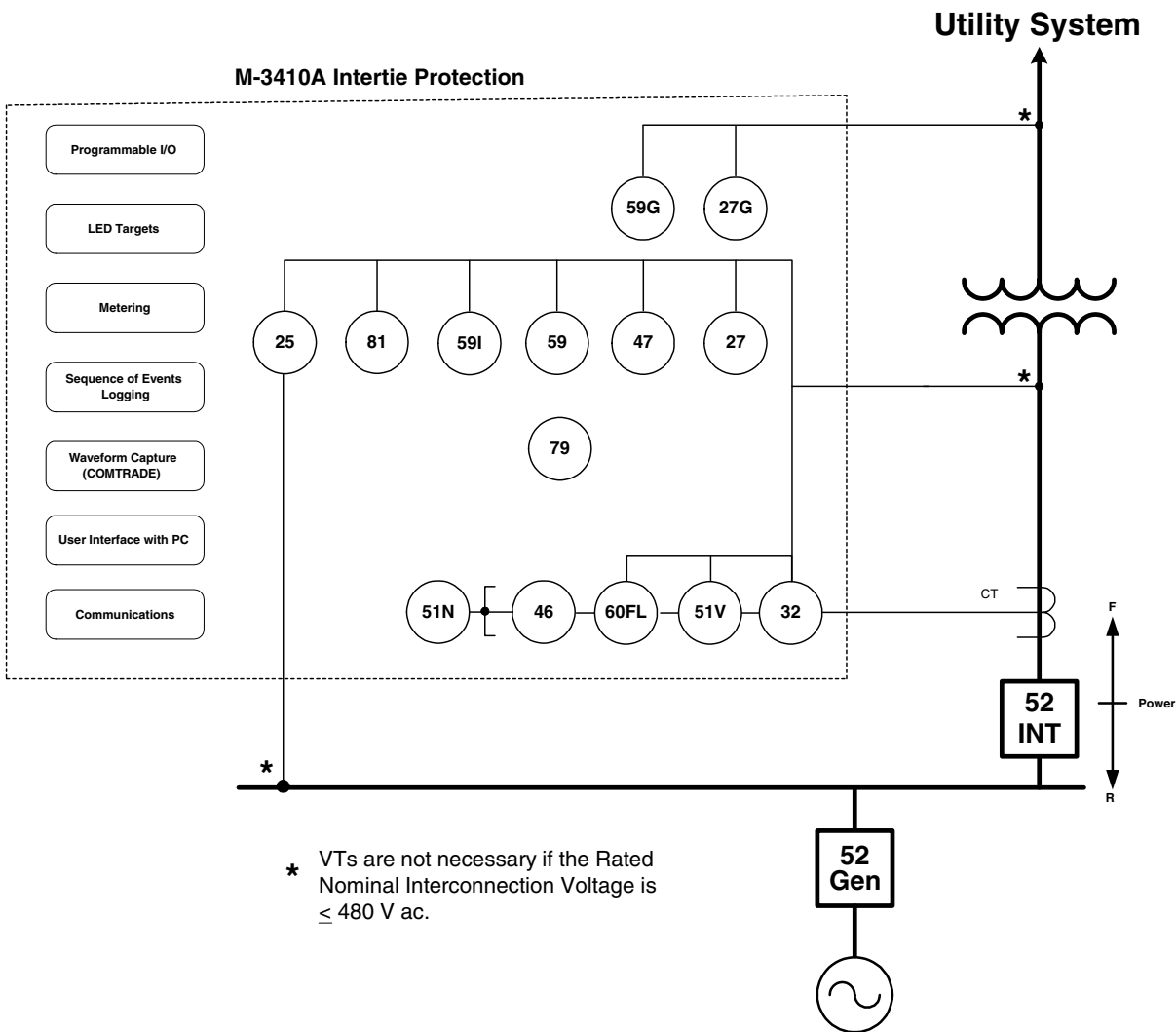


Figure 4 Typical One-Line Diagram—Intertie Protection

■ **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

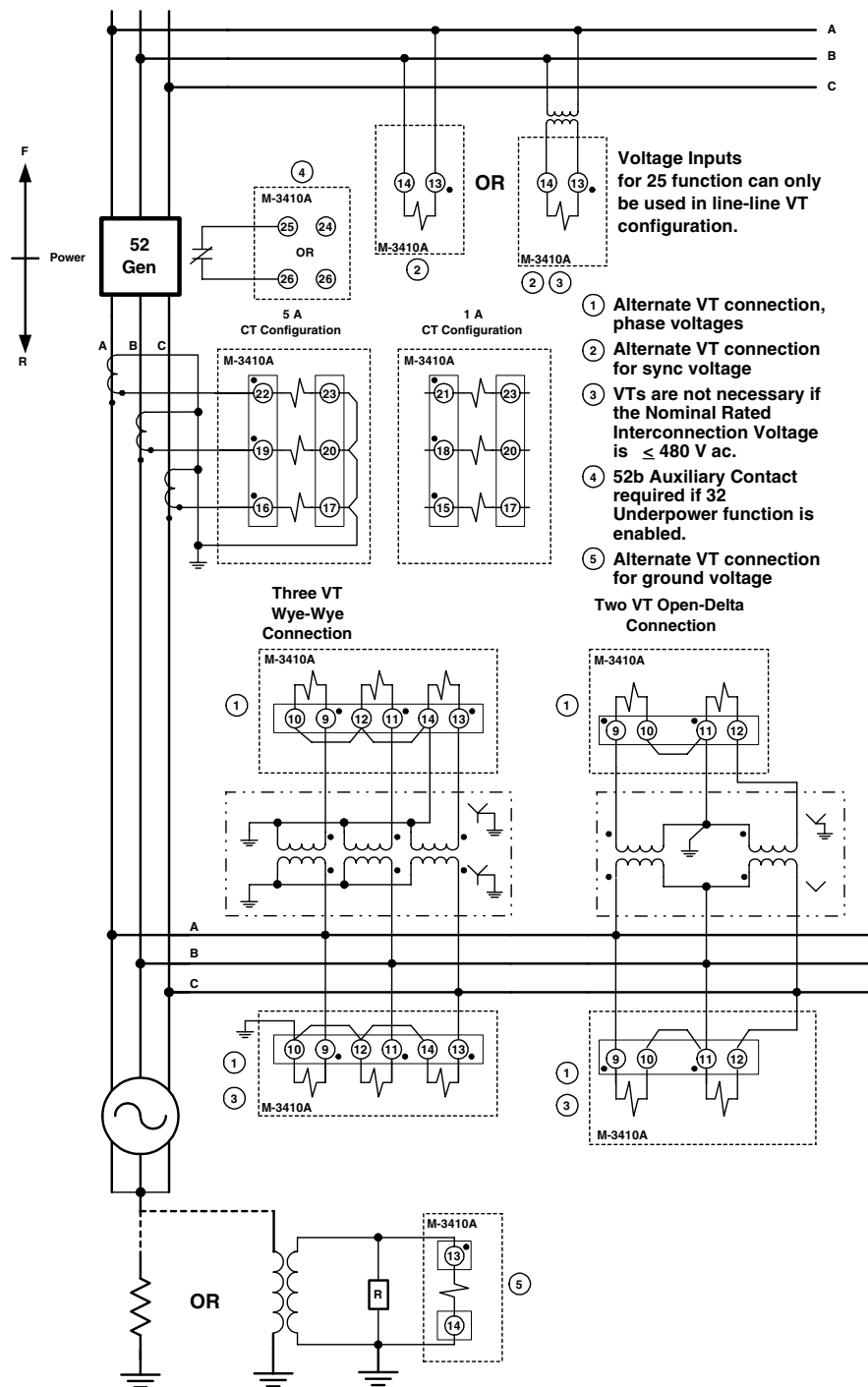


Figure 5 Typical Three-Line Diagram—Generator Protection

■ **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.

M-3410A Typical Connection Diagram

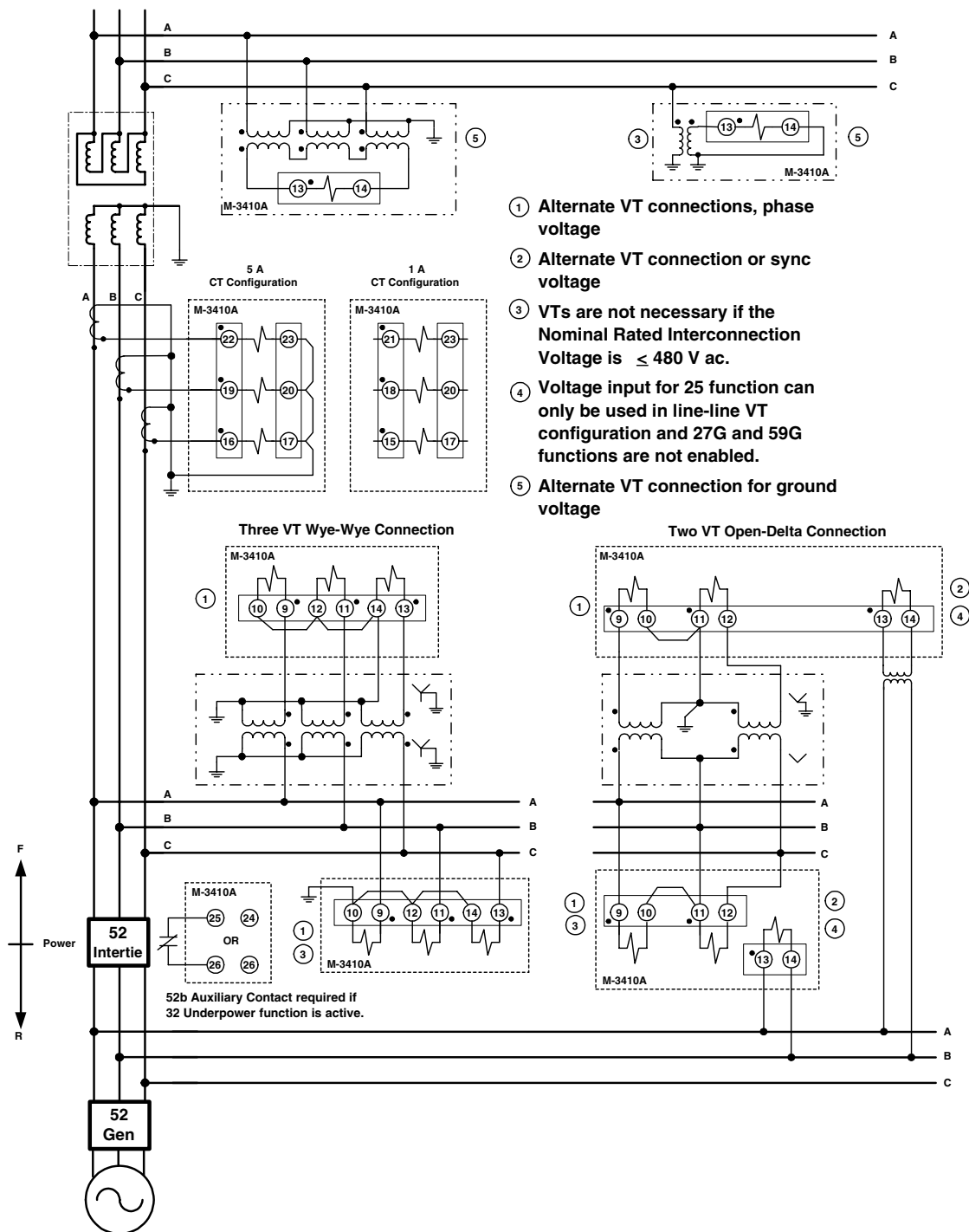


Figure 6 Typical Three-Line Diagram-Intertie Protection

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 Intertie/Generator Protection Relay

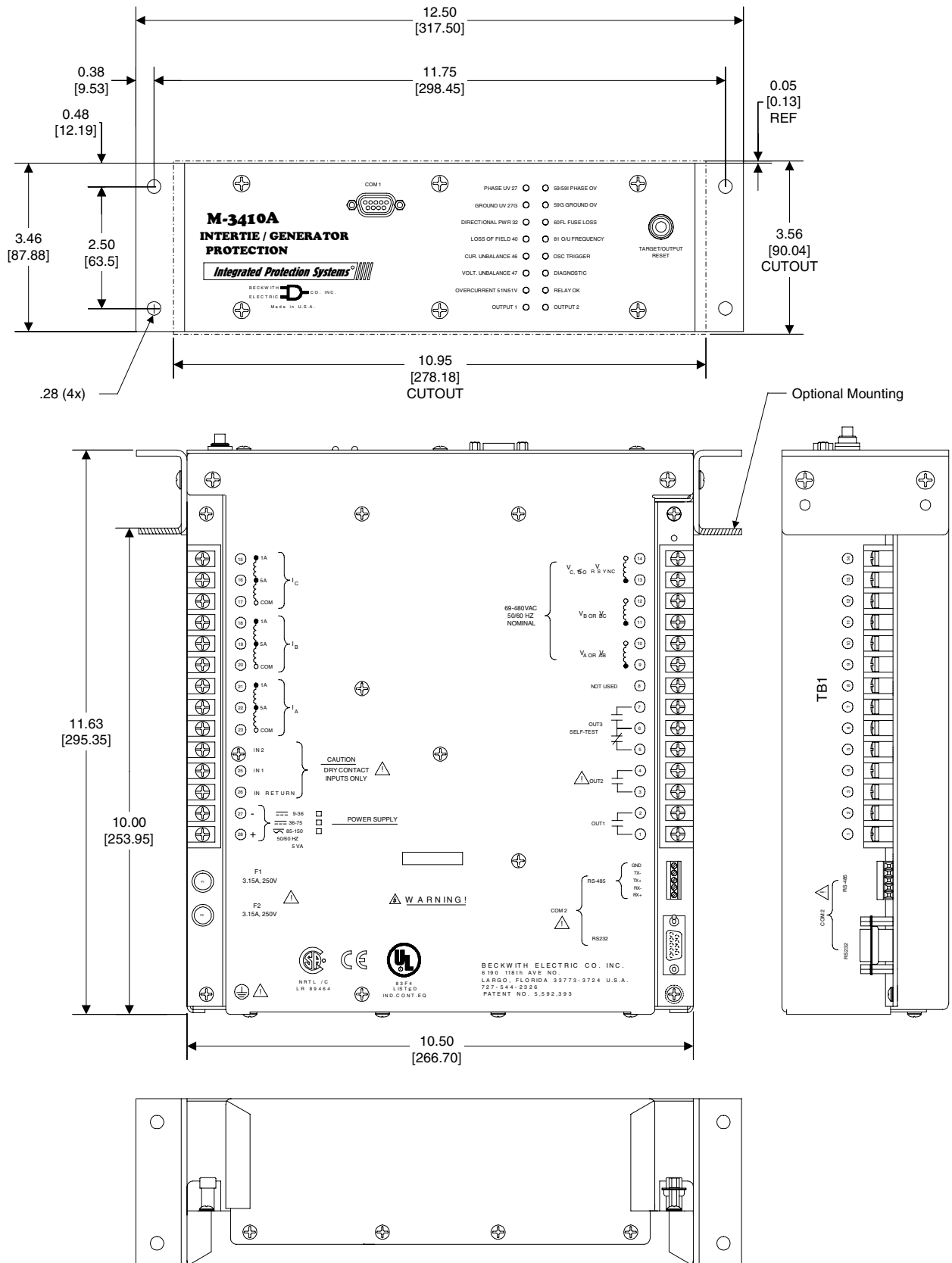


Figure 7 Optional Horizontal/Vertical Panel Mounting Dimensions

M-3410A Intertie/Generator Protection Relay

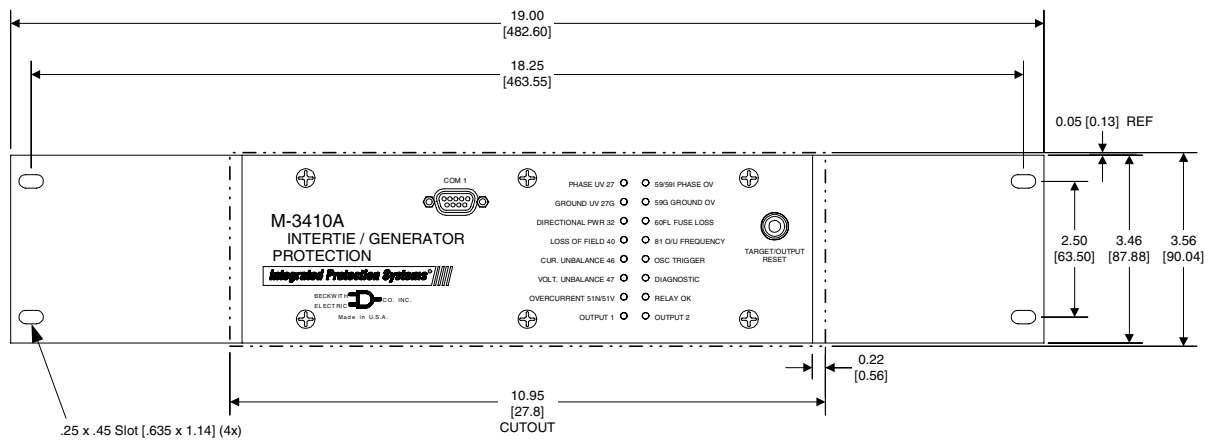


Figure 8 Standard 19" Rack Mount Dimensions

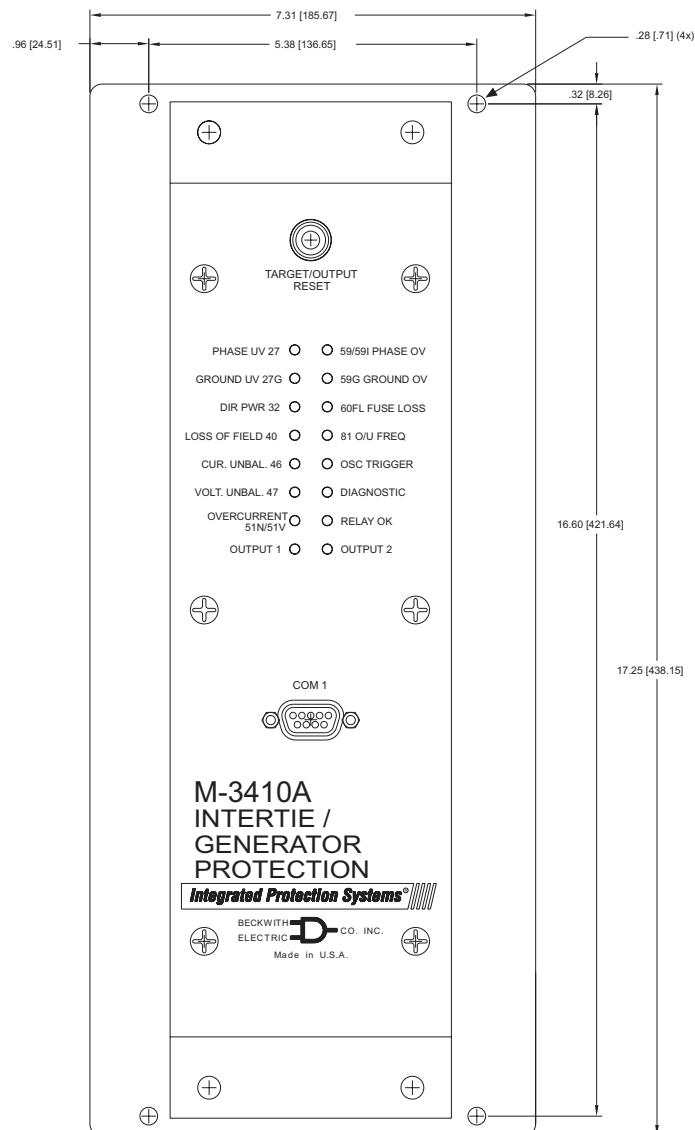


Figure 9 M-0290 and M-0296 Replacement Adapter Plate Dimensions

M-3410A Intertie/Generator Protection Relay

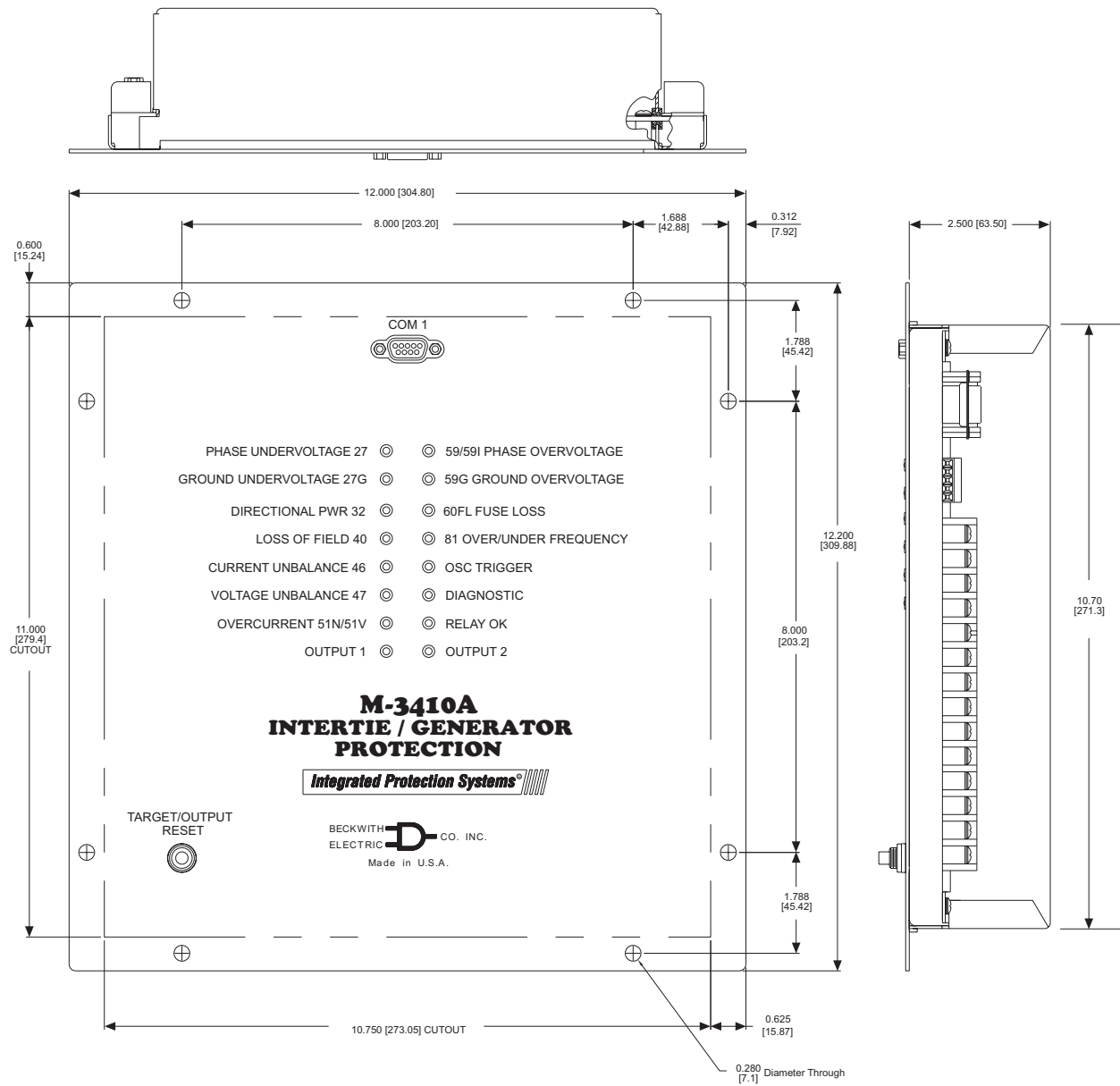


Figure 10 Standard Panel Mounting Dimensions

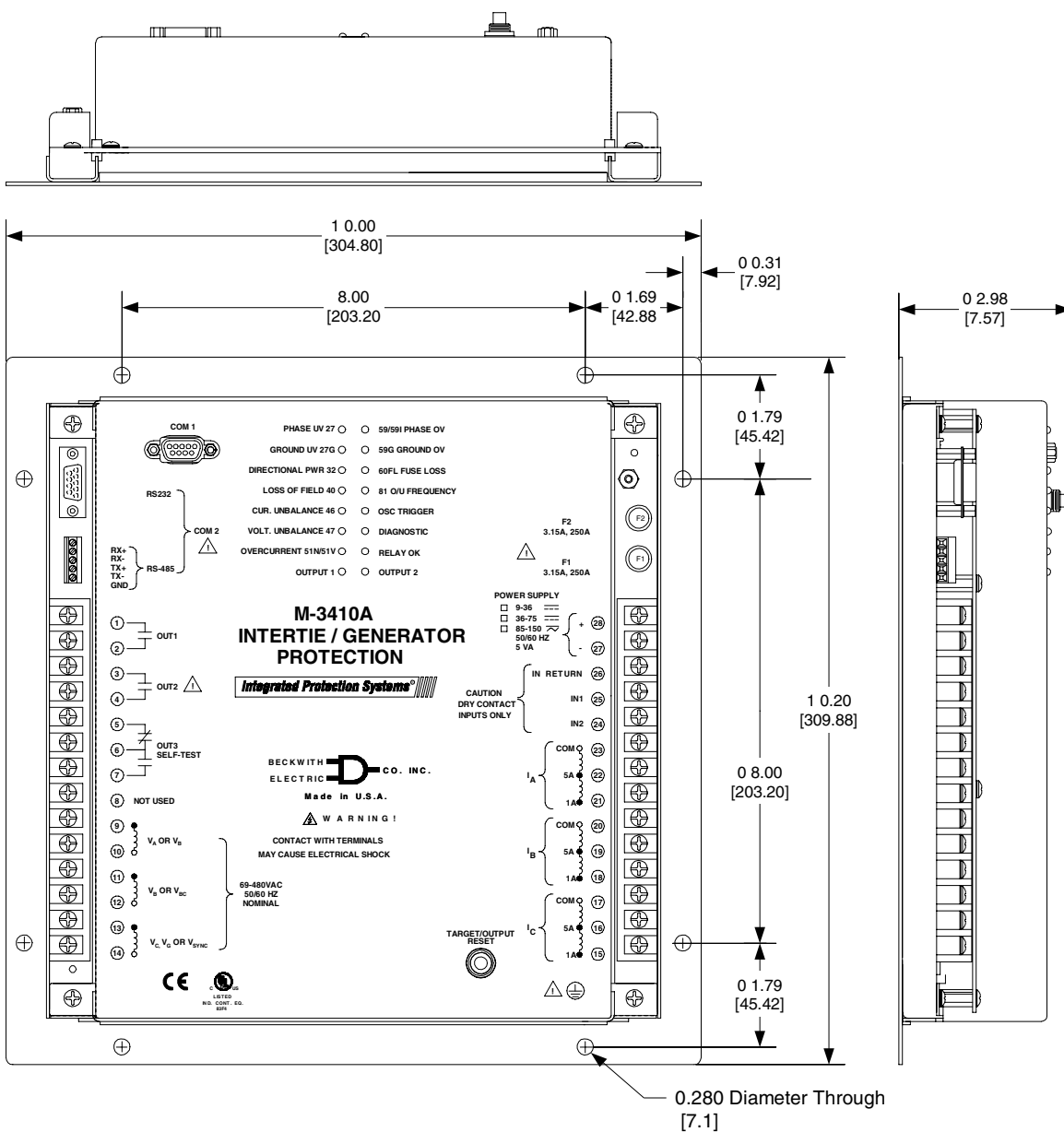


Figure 11 Surface Mount Version External Connections and Mounting Dimensions



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