

INSTRUCTION MANUAL

Plug-in Replacement Trip Unit for Masterpact M
Type STR-18M, 28M, 28D, 38S or 58U

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Firmware Revision: F1.05

1.0 INTRODUCTION

The AMP-SAFE-PRO™ is a plug-in, direct replacement trip unit for the STR trip units on the Merlin Gerin & Square D Masterpact M breakers.

The AMP-SAFE-PRO™ offers the following features:

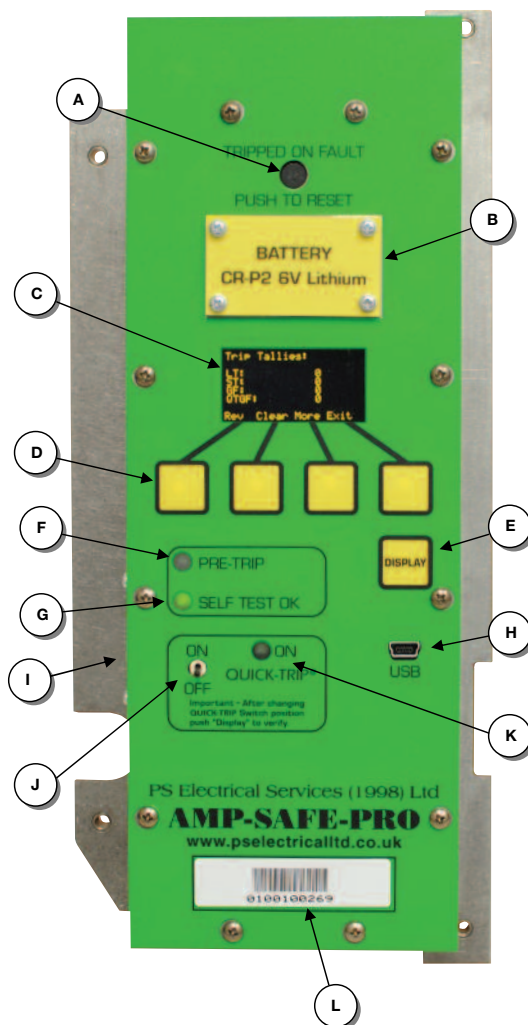
- User programmed to replace any of the versions of STR-18M, 28D, 38S or 58U trip units on IEC or UL rated Masterpact M breakers.
- A security code system protects against unauthorized changes to the settings.
- Includes the exact trip unit functions, settings and timecurrent-curves as the original STR trip unit.
- Includes the same information and alarm features as the original STR trip unit.
- Includes additional self-test features.
- No physical rating plug is required. The required rating plug value is a programmed setting.
- Includes the Quick-Trip™ arc flash reduction settings with an On/Off switch and LED on the front of the trip unit as a standard feature.
- An optional remote Quick-Trip™ On/Off switch and indicating light can also be connected.
- Easy access to the settings and last trip data is provided with an OLED graphic display and “smart” push buttons.
- The OLED display is easy to read in either low or high ambient light conditions.
- A USB port on the front of the trip unit provides for connection to a laptop computer for easy access to the settings and last trip data.
- A test port for connection to a secondary injection test set that performs actual Phase and Ground Fault tests, not simulated tests.
- Zone Select Interlocking (ZSI) and communications are not currently available.

2.0 QUALIFICATION TESTS

The AMP-SAFE-PRO™ was tested by an independent laboratory and found in compliance with the following standards:

- ANSI/IEEE C37.90.2-2004, RF Susceptibility
- ANSI/IEEE C37.90.1-2002, Surge Withstand
- EN61000-4-2 Electro-Static Discharge

3.0 GENERAL



3.1 Front View of AMP-SAFE-PRO™

A. Pop-out tripped indicator

This indicator is mechanically interlocked to the breaker mechanism and pops out when the breaker is tripped by the trip unit.

After a trip, the pop-out indicator must be pushed to the flush position before the breaker can be closed.

B. Battery Cover

To replace the battery, remove the four (4) 2-56 screws and battery cover, remove the old battery and insert a new CR-P2, 6 Volt Lithium battery.

Replace the battery cover and screws. See Section 8.0.

C. OLED Display

The display is normally off. Pushing the DISPLAY button (E) turns on the display.

D. “Smart” Push Buttons

These push buttons perform the functions indicated on the bottom of the OLED display.

E. DISPLAY Push Button

Pushing the DISPLAY button will turn on the display. If no buttons are pushed for 30 seconds, the display will turn off.

F. Red Pre-Trip LED

Depending on the magnitude of the largest Phase current, this LED will be:

- Off if less than 90% of LT Pick-Up
- Solidly on if greater than 90% but less than 105% of LT Pick-Up
- Flashing if greater than 105% of LT Pick-Up

G. Green Self Test OK LED

When the trip unit is powered up, this LED is on unless a problem is detected.

H. USB Connector

USB 2.0, Mini-B connector used by a laptop computer to transfer information.

I. Secondary Injection Test Port

Removing the test port cover on the left side of the trip unit allows connection of the secondary injection test set.

J. Local Quick-Trip™ on/off Switch

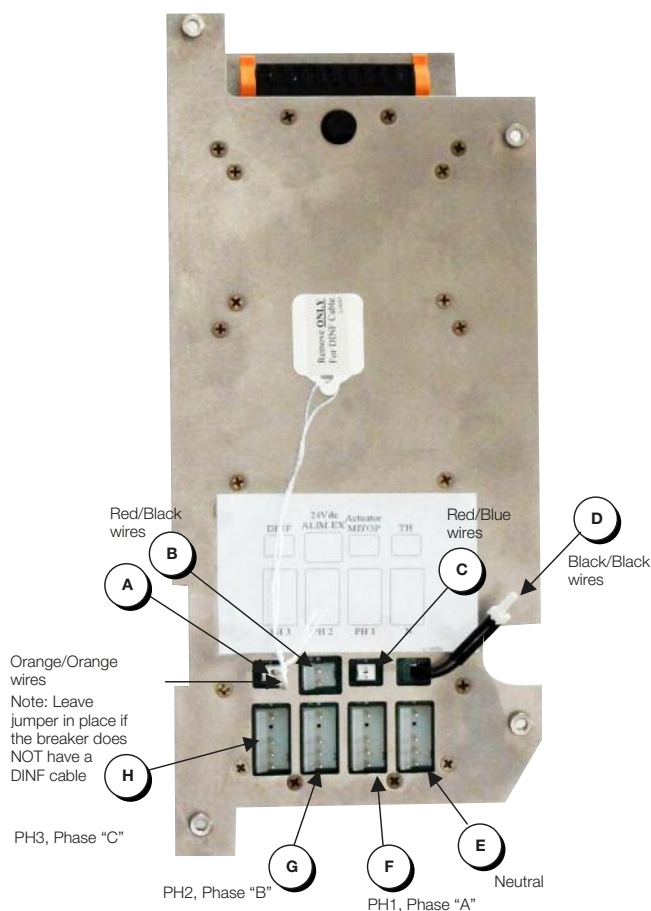
When this switch is in the on position, the QT-I and QT-GF functions are active for reduction of arc flash hazard.

K. Red Quick-Trip™ on LED

When this LED is on, the QT-I and QT-GF functions are active because either the local (J) or remote Quick-Trip™ switch is in the on position.

L. Serial Number

The AMP-SAFE-PRO™ serial number.



3.2 Rear View of AMP-SAFE-PRO™

A. DINF Instantaneous Connector

Not on all breakers. The DINF Instantaneous trip function is lower than the standard Instantaneous settings allowed for a particular CT rating.

The DINF Instantaneous trip function is only enabled for a short time while the breaker is closing. After the breaker is fully closed and latched, the DINF micro-switch defeats the DINF Instantaneous function.

Remove and discard the jumper when connecting the DINF cable.

If the breaker does not have a DINF cable, leave the jumper in place.

B. 24 Vdc ALIM EX Connector

Not on all breakers. This connector brings the auxiliary 24 Vdc control power to the trip unit.

C. MITOP Connector

This is the actuator connector.

D. TH Connector

Not on all breakers. This is the thermistor connector. If the breaker temperature as measured by the thermistor exceeds 105°C, an over temperature trip is initiated by the trip unit.

E. N Connector

Neutral CT connector.

F. PH1 Connector

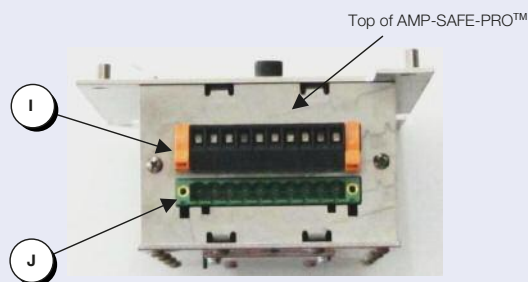
Phase "A" CT connector.

G. PH2 Connector

Phase "B" CT connector.

H. PH3 Connector.

Phase "C" CT connector.



3.3 Top View of AMP-SAFE-PRO™

I. Remote Quick-Trip™

See Section 6.2.

J. Auxiliary Wiring Connector

See Section 4.8.

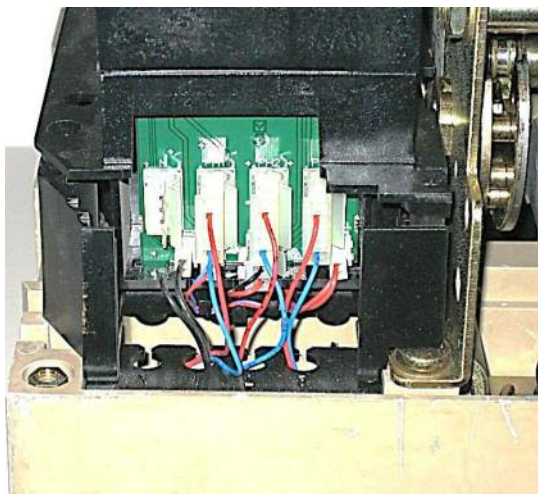
4.0 INSTALLING THE AMP-SAFE-PRO™

4.1 Remove Front Cover

Remove the five cover screws and remove the front cover.



Remove the bottom wire cover.



4.2 Disconnect STR Wiring

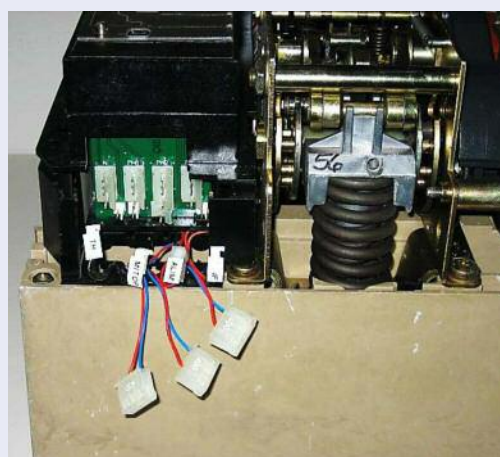
Lay breaker down onto the rear stabs.



Unplug the three (3) Phase CT connectors.

Unplug the Neutral CT connector if applicable.

Unplug the other connectors.



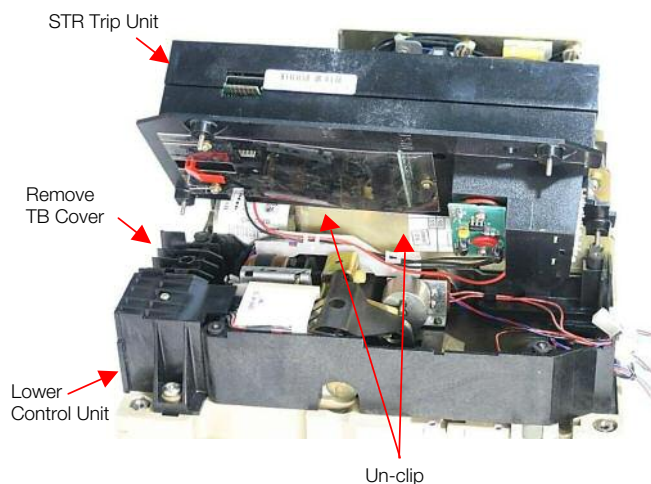
4.0 INSTALLING THE AMP-SAFE-PRO™

4.3 Remove the STR Trip Unit

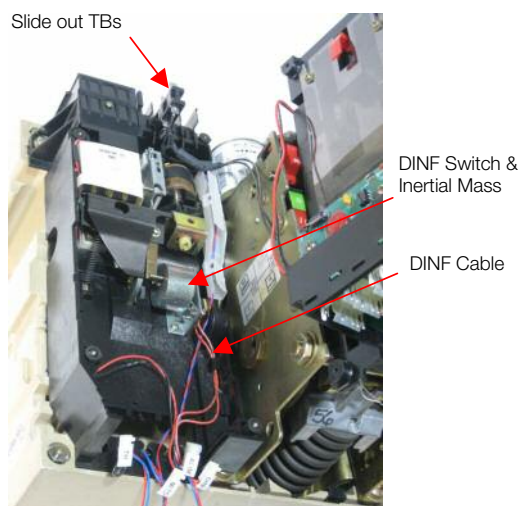
Remove the four (4) screws attaching the STR trip unit to the lower control unit.

Un-clip the two (2) wire-way latches and pull out the wires.

Remove the right terminal block cover.



Slide out the three terminal blocks from the lower control unit.



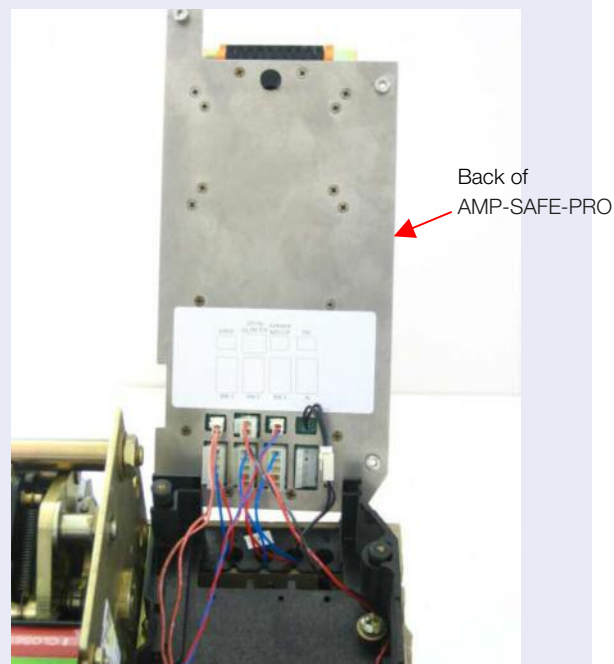
4.4 Connect CT Connectors to AMP-SAFE-PRO™

Connect the three (3) Phase CT connectors.

Connect the Neutral CT connector if applicable.

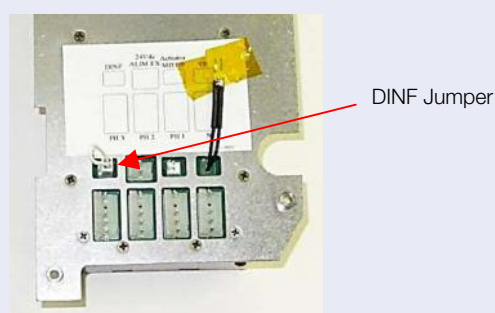
Connect the other connectors being very careful not to mix up the connectors.

See the wire color codes in Section 3.2.



For those breakers that do not have a DINF Switch and inertial mass, leave the jumper in the DINF connector.

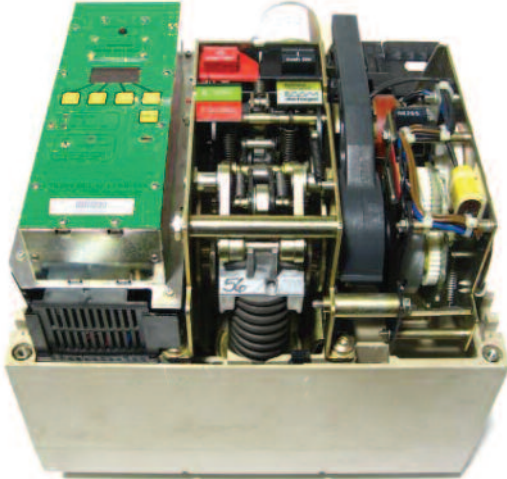
Otherwise, remove and discard the jumper and connect the DINF cable to the DINF connector.



4.0 INSTALLING THE AMP-SAFE-PRO™

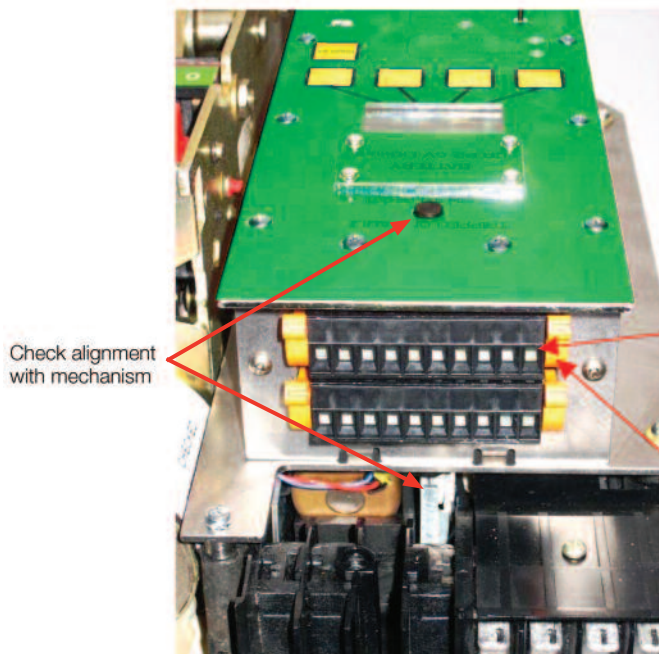
4.5 Attach the AMP-SAFE-PRO™ to Breaker.

Set the AMP-SAFE-PRO™ in place and attach using four (4) M3 X 16 Phillips screws.



4.6 Check Alignment of “Push-to-Reset” Rod.

Check for proper alignment of the back of the “Push-to-Reset” rod with the small reset piece in the lower control unit.

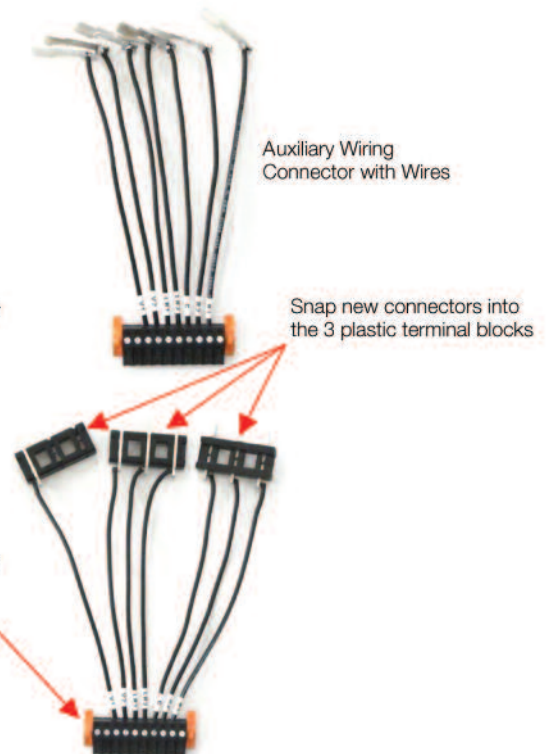


Snap the new terminals into the existing slide in plastic terminal blocks. Follow the connection diagram below. Make sure the terminals are fully seated in the plastic terminal blocks.

Insert the assembled auxiliary wiring connector into position on top of the AMP-SAFE-PRO.

4.7 Auxiliary Wiring Connections.

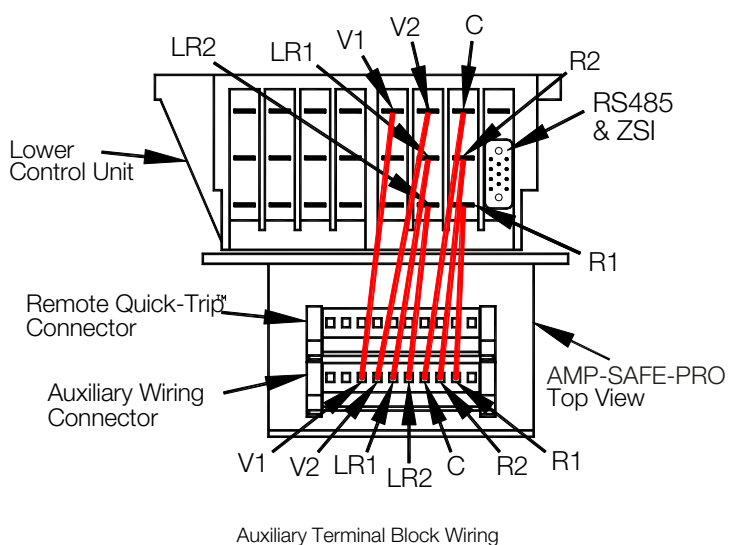
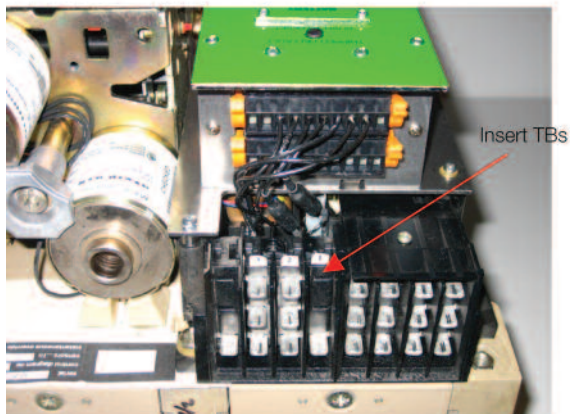
Snap the connectors out of the three (3) plastic terminal blocks. The plastic terminal blocks will be reused.



4.8 Insert the Auxiliary Terminal Blocks into the Lower Control Unit.

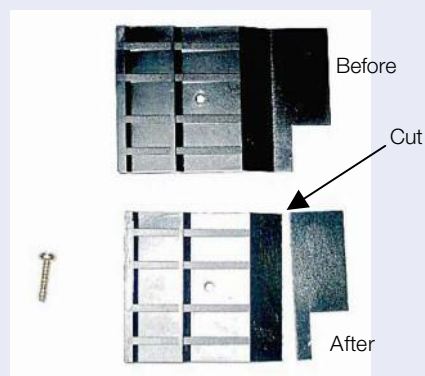
Insert the terminal blocks into their proper location in the lower control unit.

Follow the diagram below.

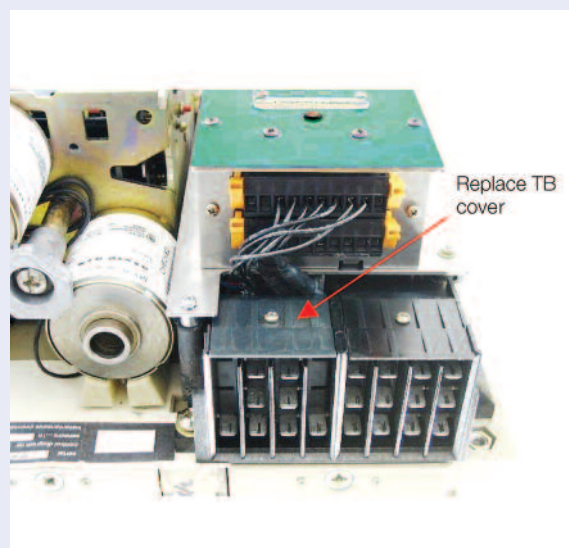


4.9 Modify and Install Terminal Block Cover.

Cut off the bottom portion of the right terminal block cover previously removed.



Replace the terminal block cover using the existing screw.



4.0 INSTALLING THE AMP-SAFE-PRO™

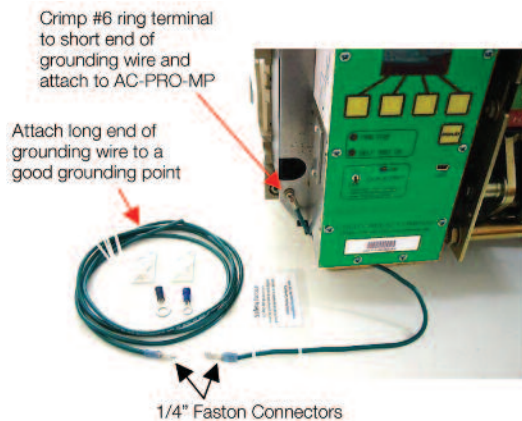
4.10 Ground the AMP-SAFE-PRO Trip Unit.

For safe and proper operation, the trip unit must be grounded.



Remove break-out

Remove the break-out from the bottom of the front cover to provide an opening for the ground wire.



Attach the short grounding wire to the lower left mounting screw of the AMP-SAFE-PRO.

Find a good grounding point on the switchgear near the breaker. Clean the attachment point of any substance that may prevent a good connection.

Route the long grounding wire from the breaker to the grounding point using cable ties and cable tie pads.

Trim any excess wire and use one of the lugs provided to connect the long ground wire to the ground point.

For a draw-out breaker leave enough slack at the breaker to allow the breaker to be racked out to the disconnect position.

After the breaker is installed, connect the Faston connectors. The Faston connectors allow the breaker to be removed without disturbing the ground connection.



When replacing the breaker front cover, route the short grounding wire so it passes through the breakout in the cover.

4.11 Replace Breaker Front Cover.

Replace the breaker front cover using the existing hardware.



5.0 ENTERING OR CHANGING SETTINGS

The AMP-SAFE-PRO™ is shipped un-commissioned and must be commissioned before placing in service.

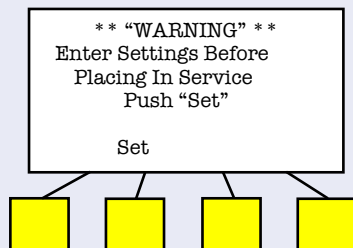
The push buttons and display on the front panel or the USB Interface with a laptop computer can be used to make the initial settings or change existing settings.

IMPORTANT

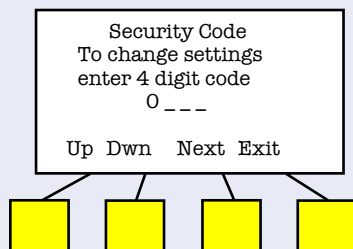
The trip unit will NOT FUNCTION as it is shipped from the factory. The user must first COMMISSION the unit as outlined in this Section to make it functional.

5.1 Using the Front Panel

Push the “DISPLAY” button to power up the trip unit. The following is displayed:



Push the “Set” button to display the security window:

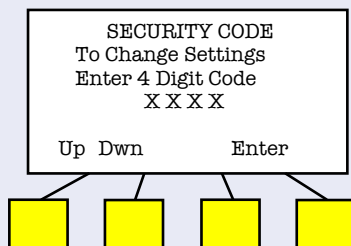


Please call PS Electrical on 01299 251 758

Push the “Up” or “Down” button to select the value of each digit.

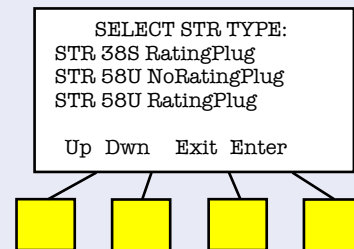
Use the “Next” button to advance to the next digit.

For the last digit, the following is displayed:



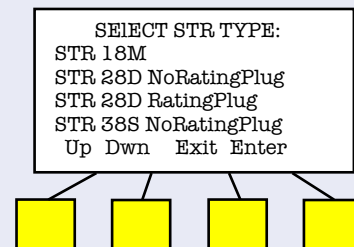
Push the “Enter” button after the last digit of the Security Code is entered.

The following is displayed:

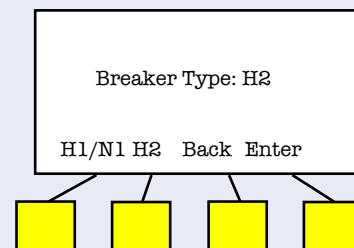


Push the “Up” or “Down” buttons until the desired STR trip unit type is flashing.

The other STR types are displayed by pushing the “Up” button several times



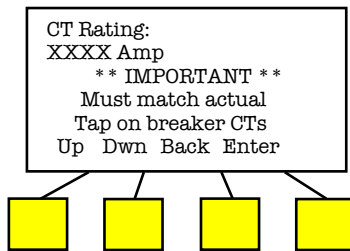
After pushing “Enter”, the following is displayed: (Not for 18M or 28D)



The H1/N1 breakers have standard or special interrupting rating and the H2 breakers have high interrupting rating.

5.0 ENTERING OR CHANGING SETTINGS

After pushing “Enter”, the following is displayed:

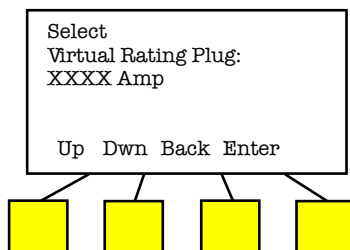


Use the “Up” and “Down” buttons to enter the correct CT Rating.

IMPORTANT

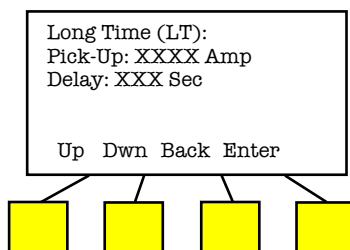
The CT Rating entered MUST match the rating of the CTs in the breaker.

After pushing “Enter”, the following is displayed: Not for 18M or non-rating plug versions)



Use the “Up” and “Down” buttons to enter the desired Virtual Rating Plug rating.

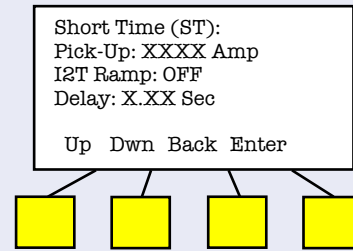
After pushing “Enter”, the following is displayed: (Not for 18M) non-rating plug versions)



Use the “Up” and “Down” buttons to enter the desired Long Time Pick-Up (LTPU) value.

After pushing “Enter”, use the “Up” and “Down” buttons to enter the desired Long Time Delay (LTD).

After pushing “Enter”, the following is displayed:
(Not for 18M or 28D)

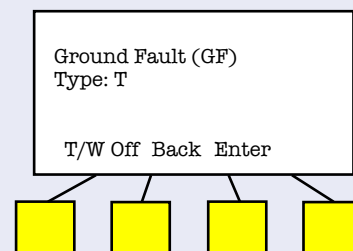


Use the “Up” and “Down” buttons to enter the desired Short Time Pick-Up (STPU) value.

After pushing “Enter”, use the “On” and “Off” buttons that appear to enter I2T ramp on or off.

After pushing “Enter”, use the “Up” and “Down” buttons to select the desired Short Time Delay (STD).

After pushing “Enter”, the following is displayed:
(Not for 18M or 28D)

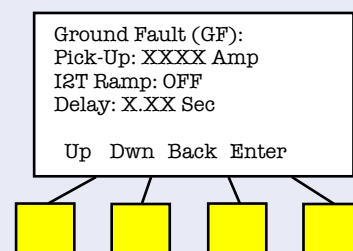


Use the “T/W” button to switch between the two types of Ground Fault protection.

“T” is for the normal 3-Wire or 4-Wire residual Ground Fault.

“W” is for source ground return Ground Fault.

After pushing “Enter”, the following is displayed:
(Not for 18M or 28D)



Use the “Up” and “Down” buttons to enter the desired Ground Fault (GFPU) Pick-Up value. The maximum

GFPU is 1200 Amp.

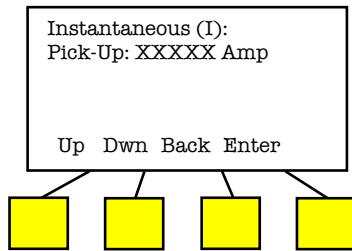
A GFPU setting less than 20% of the CT rating requires 24Vdc external power.

After pushing “Enter”, use the “On” and “Off” buttons that appear to enter I2T ramp on or off.

After pushing “Enter”, use the “Up” and “Dwn” buttons to select the desired Ground Fault Delay (GFD).

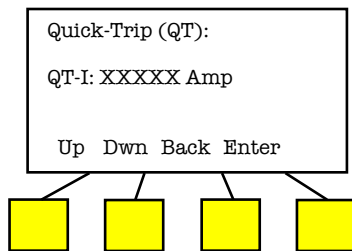
5.0 ENTERING OR CHANGING SETTINGS

After pushing "Enter", the following is displayed:



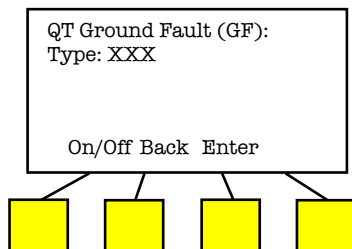
Use the "Up" and "Down" buttons to enter the desired Instantaneous Pick-Up (IPU) value.

After pushing "Enter", the following is displayed:



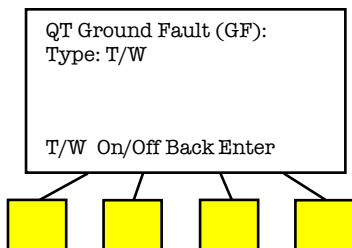
Use the "Up" and "Down" buttons to enter the desired Quick-Trip™ Instantaneous Pick-Up (QT-I) value. An off setting is not available.

After pushing "Enter", the following is displayed:
(Not for 18M or 28D)



Use the "On/Off" button to toggle between "On" or "Off" for the Quick-Trip™ Ground Fault function.

If the normal GF was previously set to "Off", the following will be displayed instead of the above display. (Not for 18M or 28D)



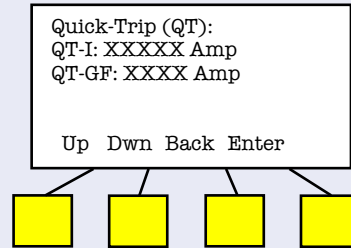
Use the "On/Off" button to turn the Quick-Trip™ Ground Fault function on or off.

Use the "T/W" button to select the type of Ground Fault.

"T" is for the normal 3-Wire or 4-Wire residual Ground Fault.

"W" is for source ground return Ground Fault.

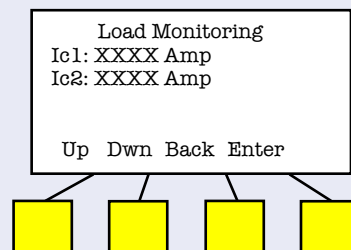
After pushing "Enter", the following is displayed:
(Not for 18M or 28D)



Use the "Up" or "Down" buttons to select the desired Quick-Trip Trip Ground Fault (QT-GF) Pick-Up value.

A QT-GF setting less than 20% of the CT rating requires 24Vdc external power.

After pushing "Enter", the following is displayed:
(Not for 18M, 28D or 38S)

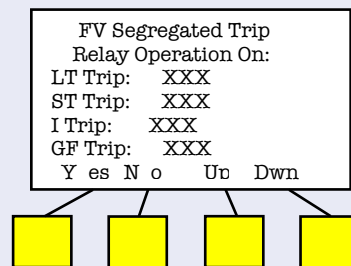


Use the "Up" or "Down" buttons to select the desired Load Monitoring 1 (Ic1) Pick-Up or scroll down to off.

Push the "Enter" button to go to Load Monitoring 2 (Ic2).

Use the "Up" or "Down" buttons to select the desired Ic2 Pick-Up or scroll down to off.

After pushing "Enter", the following is displayed:



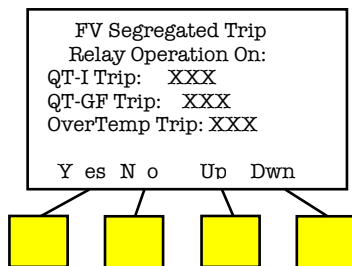
Use the "Up" or "Down" buttons to select the desired QuickUse the "Yes" or "No" buttons to select which combinations of protective functions will operate the FV Segregated Trip Relay.

The FV Segregated Trip Relay requires 24Vdc external power to operate.

Use the "Down" button to move to the next function.

5.0 ENTERING OR CHANGING SETTINGS

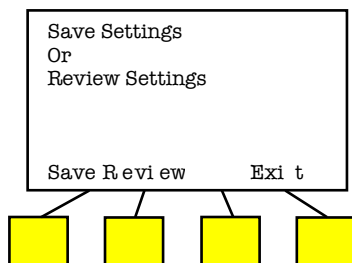
When the “Down” button is pushed after the “GF Trip” FV Segregated Trip Relay operation is selected, the following is displayed:



Use the “Yes” or “No” buttons to select which combinations of functions will operate the FV Segregated Trip Relay.

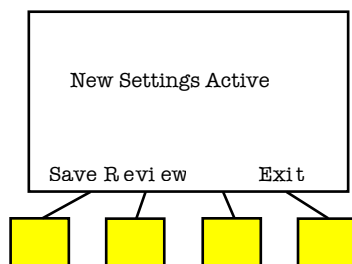
Use the “Down” button to move to the next function.

After setting the “OverTemp” function, pushing the “Down” button will display the following:



Pushing the “Review” button will review the settings just made and will allow changes to be made.

Pushing the “Save” button will save the settings into non-volatile memory and the following will be displayed for a short time:



5.2 Changing Time & Date

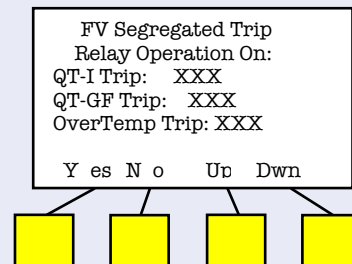
The trip events are time stamped using the time from an internal battery backed clock chip.

The clock chip is driven by a quartz-controlled oscillator. The clock accuracy is better than ± 1.53 minutes per month.

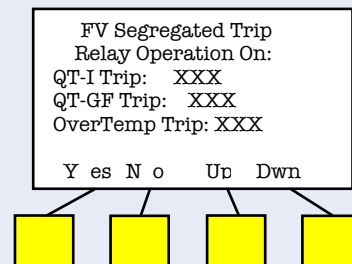
The clock does not automatically update for daylight savings time.

The clock battery has a 7 year life.

To view or change the time, push the “Display” button (and possibly the “Exit” button) to view the main screen:



Push the “Time” button to display the time and date: is displayed:



Where “hh:mm:ss” is the time of day in hour, minutes and seconds.

Where “MM:DD:YYYY” is the date in month, day and year.

To change the time, push the “Chng” button and follow the prompts.

5.3 Using the USB Interface

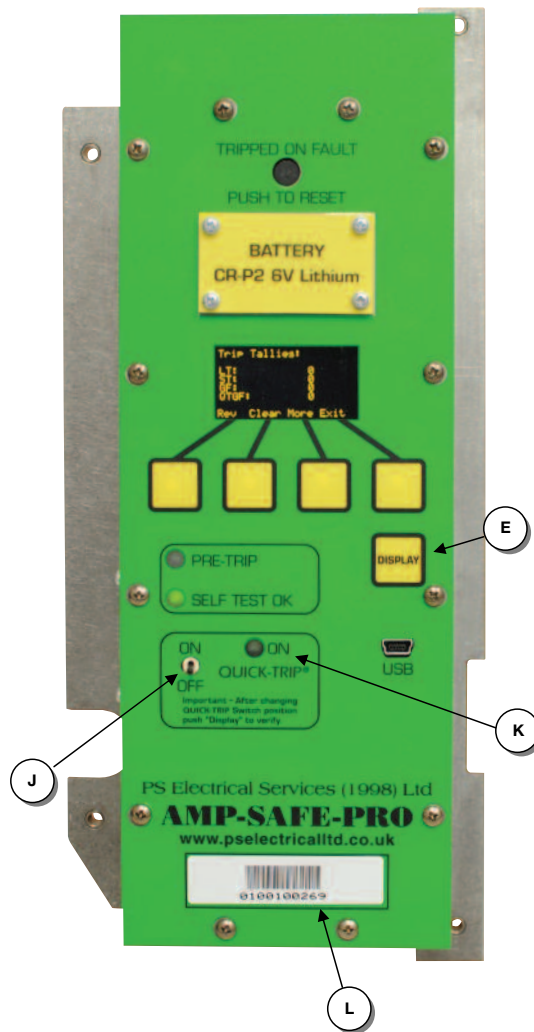
A USB 2.0, Mini-B connector on the front of the AMP-SAFE-PRO-PM™ trip unit is used to transfer information between the trip unit and a computer.

The USB interface can be used for the following:

- Upload settings to a computer.
- Upload last trip data to a computer.
- Download new settings from a computer to the trip unit.
- Download the latest revision of firmware from a computer to the trip unit.

Complete details will be provided at a future date.

6.0 QUICK-TRIP™ ARC FLASH REDUCTION



The Quick-Trip™ system (patents 7,646,575 & 7,889,474) is a manually controlled Zone Selective Interlock (ZSI) system. It can reduce trip times when turned on and allows selective coordination between circuit breakers when turned off.

If maintenance personnel must work on energized equipment, they will first turn the Quick-Trip™ system on at the breaker feeding the equipment. If a fault now occurs, the upstream breaker will trip quickly based on the Quick-Trip™ settings **reducing the Arc Flash Hazard to personnel.**

When the work is done, the Quick-Trip™ system is turned off and the original selective coordination is back in effect.

When Quick-Trip™ is on, the following settings are enabled:

- Quick-Trip Instantaneous (QT-I)
- Quick-Trip Ground Fault (QT-GF)

All other settings remain in effect.

The "QUICK-TRIP™ ON LED" provides positive indication that the Quick-Trip™ settings are active if the LED is on.

6.1 Local Quick-Trip™ Switch

The Quick-Trip switch on the front of the AMP-SAFE-PRO™ can be used to turn the Quick-Trip™ functions on or off.

J. Local Quick-Trip™ on/off Switch

Move this switch to the on position to make the QT-I and QT-GF functions active for reduction of arc flash hazard.

K. Red Quick-Trip™ on LED

When this LED is on, the QT-I and QT-GF functions are active because either the local (J) or remote Quick-Trip™ switch is in the on position.

If the trip unit is not powered-up because of low breaker current and no 24Vdc auxiliary control power to the breaker, the Quick-Trip™ on LED will not be illuminated with the switch in the on position.

To verify that the Quick-Trip™ function will be active as soon as the trip unit powers up with breaker current, push the "Display" button (E) to power the trip unit using the battery. The Quick-Trip™ on LED will illuminate.

IMPORTANT

A qualified engineer must determine the Quick-Trip™ settings, calculate the incident energy levels and determine the Hazard Risk Categories (HRC) with Quick-Trip™ both on and off.

6.2 OPTIONAL REMOTE QUICK-TRIP™ SWITCH

6.2 Optional Remote Quick-Trip™ Switch

The Quick-Trip™ can also be controlled by an optional remotely located on/off switch.

Either the local Quick-Trip™ switch on the front of the AMP-SAFE-PRO™ or the remote Quick-Trip switch can turn on Quick-Trip™. Both must be in the off position to turn Quick-Trip™ off.

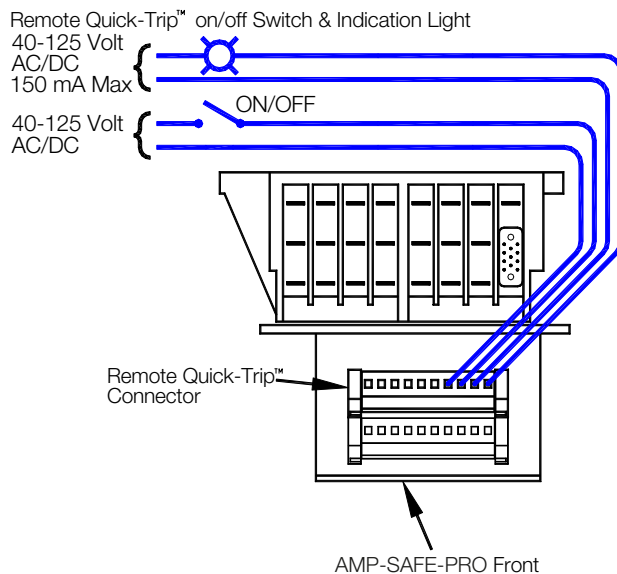
An indication lamp can also be remotely located. This lamp will be energized whenever Quick-Trip™ is on, either by the local on/off switch or the remote on/off switch.

The remote indication lamp must use 150 milli-Amp or less current.

A 40 to 137 Volt, AC or DC source is required for the remote Quick-Trip™ switch and the remote indication lamp.

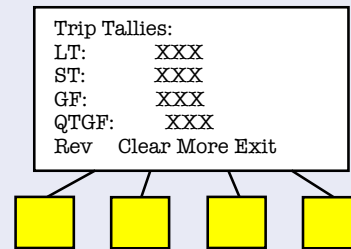
Connections for the remote Quick-Trip™ switch and the remote indication lamp are made to the remote

Quick-Trip™ connector on the top of the AMP-SAFE-PRO™

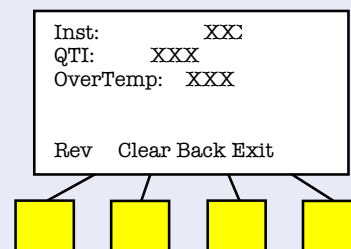


7.0 Retrieving Last Trip Data

Push the "Display" button to power up the trip unit. The following is displayed:

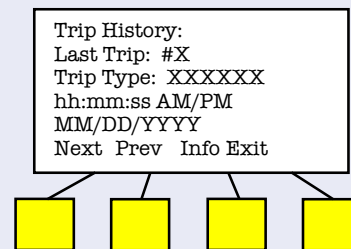


Push the "More" button to display the remaining trip functions:



Pushing the "Clear" button will start the procedure to clear all the last trip data.

Pushing the "Review" button to review the details of the latest trip:

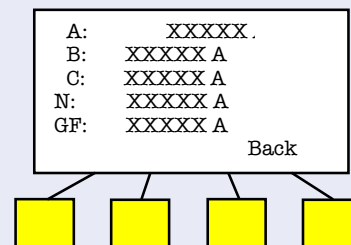


Where "hh:mm:ss" is the time of day of this trip in hour, minutes and seconds.

Where "MM/DD/YYYY" is the date of this trip in month, day and year.

Push the "Previous" button to display the prior trip.

Push the "Information" button to display the detailed information of the Phase, neutral & ground fault currents for this trip:



8.0 REPLACING THE BATTERY

8.0 Replacing the Battery

The battery can be easily replaced. Remove the four (4) 2-56 screws attaching the battery cover.



Remove the old battery and install a new CR-P2, 6 Volt Lithium battery.

Replace the battery cover.



9.0 Self-Test Feature

The AMP-SAFE-PRO continually performs self tests in the background.

If an internal problem is detected, the "Self Test OK" LED is turned off.

The internal self tests include:

- Watch dog timer
- Memory check sum
- Memory access error
- Low battery voltage
- Actuator connected

10.0 Primary Injection Testing

A primary injection test is recommended as the final test of the AMP-SAFE-PRO™. This tests the complete system.

If Ground Fault with the "T" option (residual) is used, GF must be temporarily turned off when single phase testing the other trip functions with a primary injection test set.

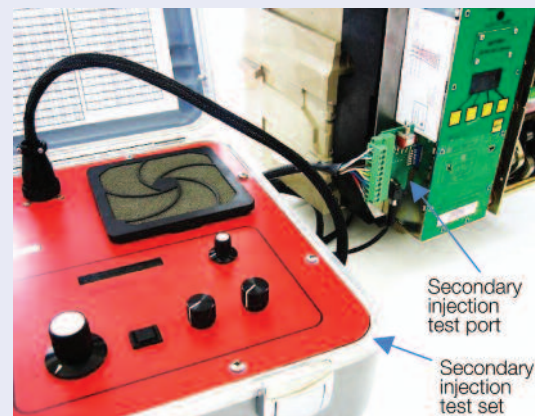
10.1 Secondary Injection Testing

The AMP-SAFE-PRO™ secondary injection test set provides a quick and easy way to test the AMP-SAFE-PRO™ trip units.

The test set does a true test of each Phase and can also test the Ground Fault function.

The test set plugs into a port on the left side of the test AMP-SAFE-PRO™.

Follow the instructions provided with the test set.



11.0 DINF INSTANTANEOUS TRIP

Some Masterpact M breakers have a DINF Instantaneous (DINF-I) feature. The DINF-I trip function is only enabled for a short time while the breaker is closing. After the breaker is fully closed and latched, the DINF-I trip function is disabled by the DINF micro-switch.

The DINF-I function is controlled with a micro-switch and inertial mass. They are located in the lower control unit as shown in Section 4.3. The connection to the AMP-SAFE-PRO trip unit is via connector "A" as shown in in Section 3.2.

Not all Masterpact M breakers are equipped with the DINF micro-switch and, therefore, the DINF-I trip function is never active.

The DINF-I Pick-Up settings are fixed depend on the CT rating as shown below.

CT Rating (Amp)	DINF-I Pick-Up (Amp)
250	2700
400	4300
600	6500
800	8600
1200	12,900
1600	16,700
2000	20,800
2500	26,900
3000	32,300
3200	19,200
4000	24,000
5000	30,000
6300	37,800

The DINF-I Pick-Up setting is not adjustable and is also not shown on the OLED display.

If the breaker does NOT have a DINF cable, leave the DINF jumper in place. See Section 4.4.

12.0 Warranty

The AMP-SAFE-PRO has a conditional 2-year warranty.

Please contact PS Electrical for full details.

13.0 Environmental Ratings

Ambient Temperature:

Trip Unit Electronics:

-4°F (-20°C) to 158°F (70°C)

OLED Display:

-22°F (-30°C) to 158°F (70°C)

Battery:

-4°F (-20°C) to 140°F (60°C)

Internal Clock Battery:

32°F (0°C) to 140°F (70°C)

Humidity:

95% non-condensing

Conformal Coating:

Acrylic conformal coating,

HumiSeal type 1A33

UL Component File #E105698

Enclosure:

14 Gauge, type 304 stainless steel

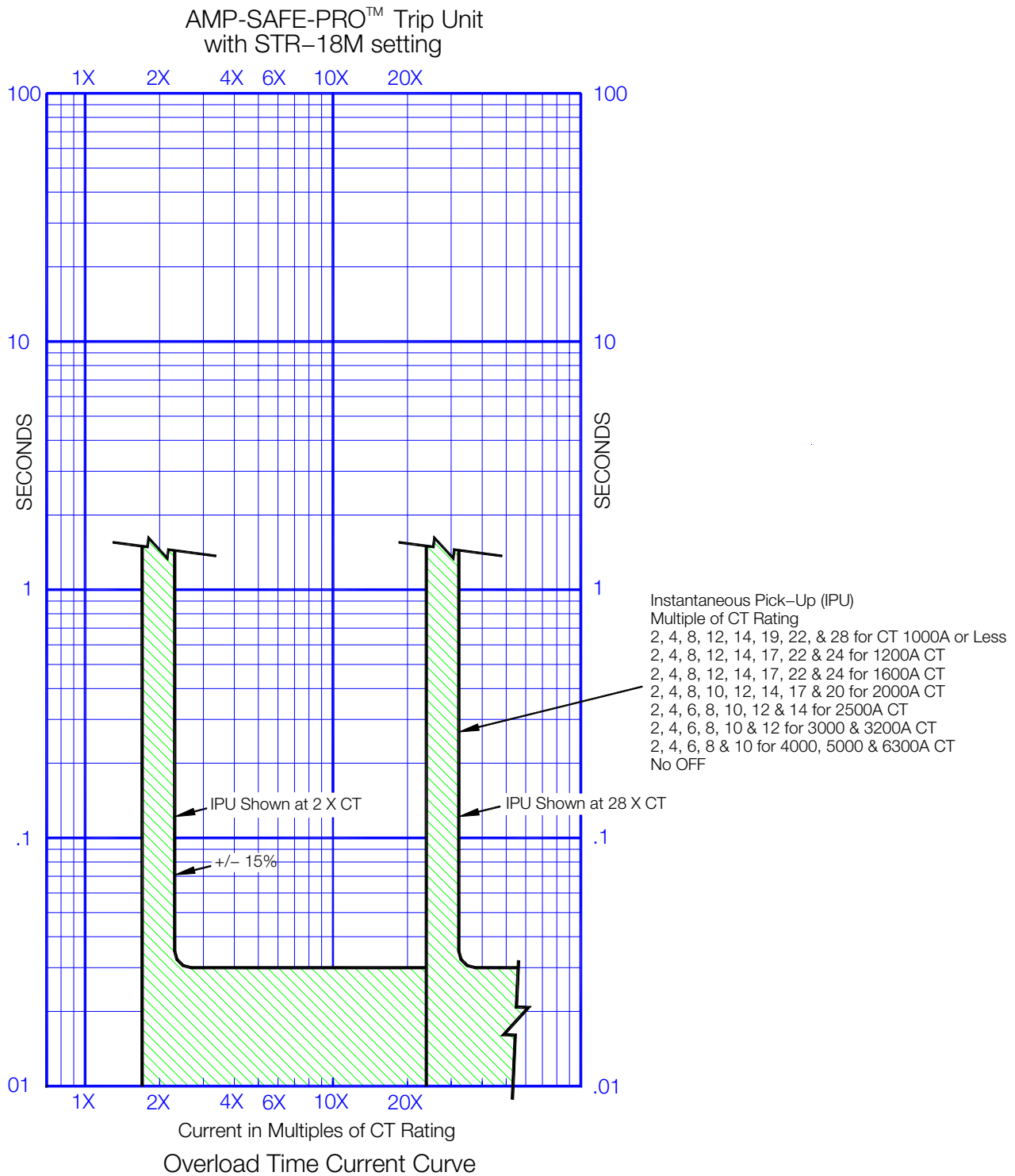
Battery:

Panasonic CR-P2

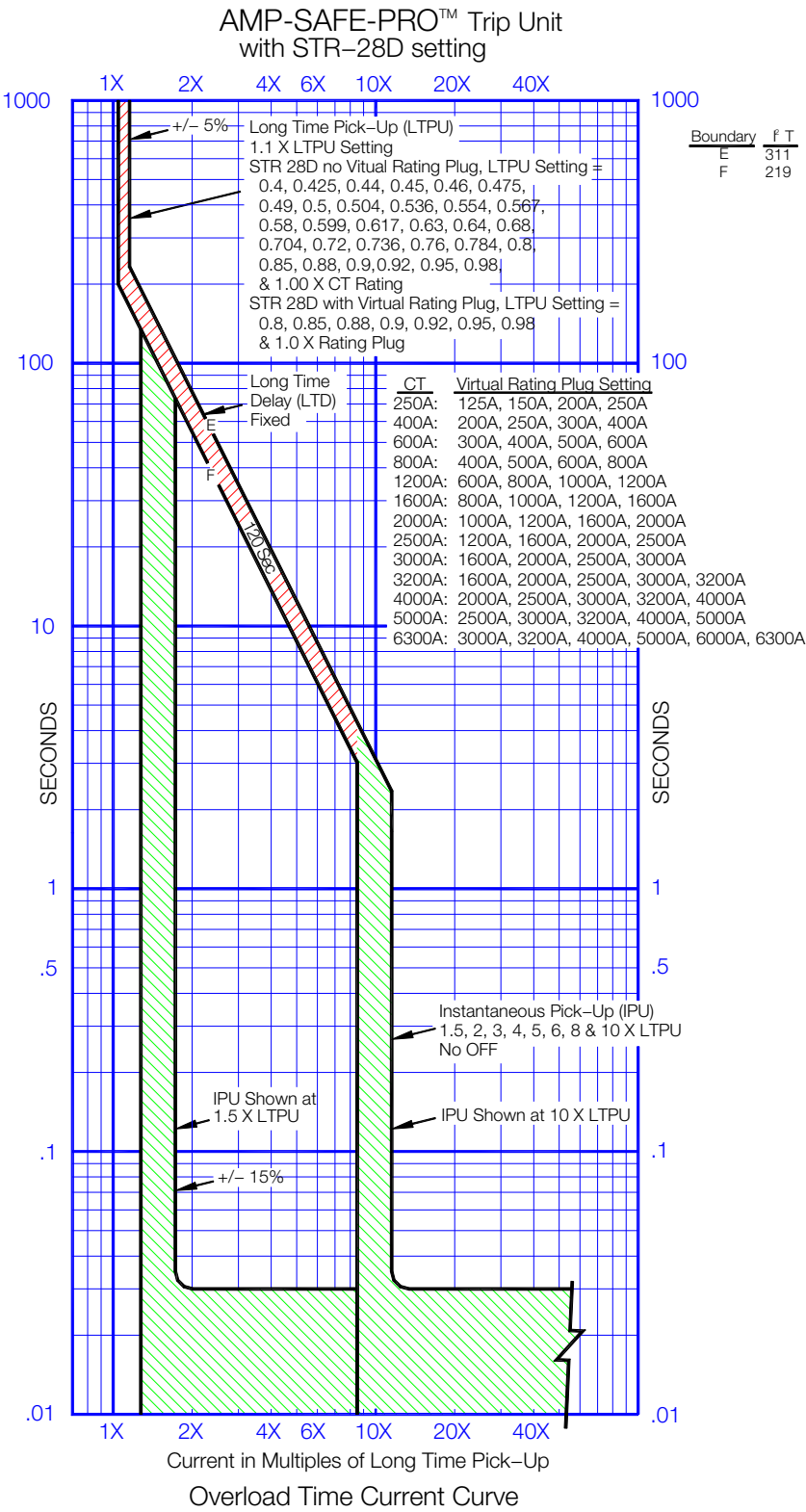
6 Volt, 1400 mAh Lithium

Non-Rechargeable

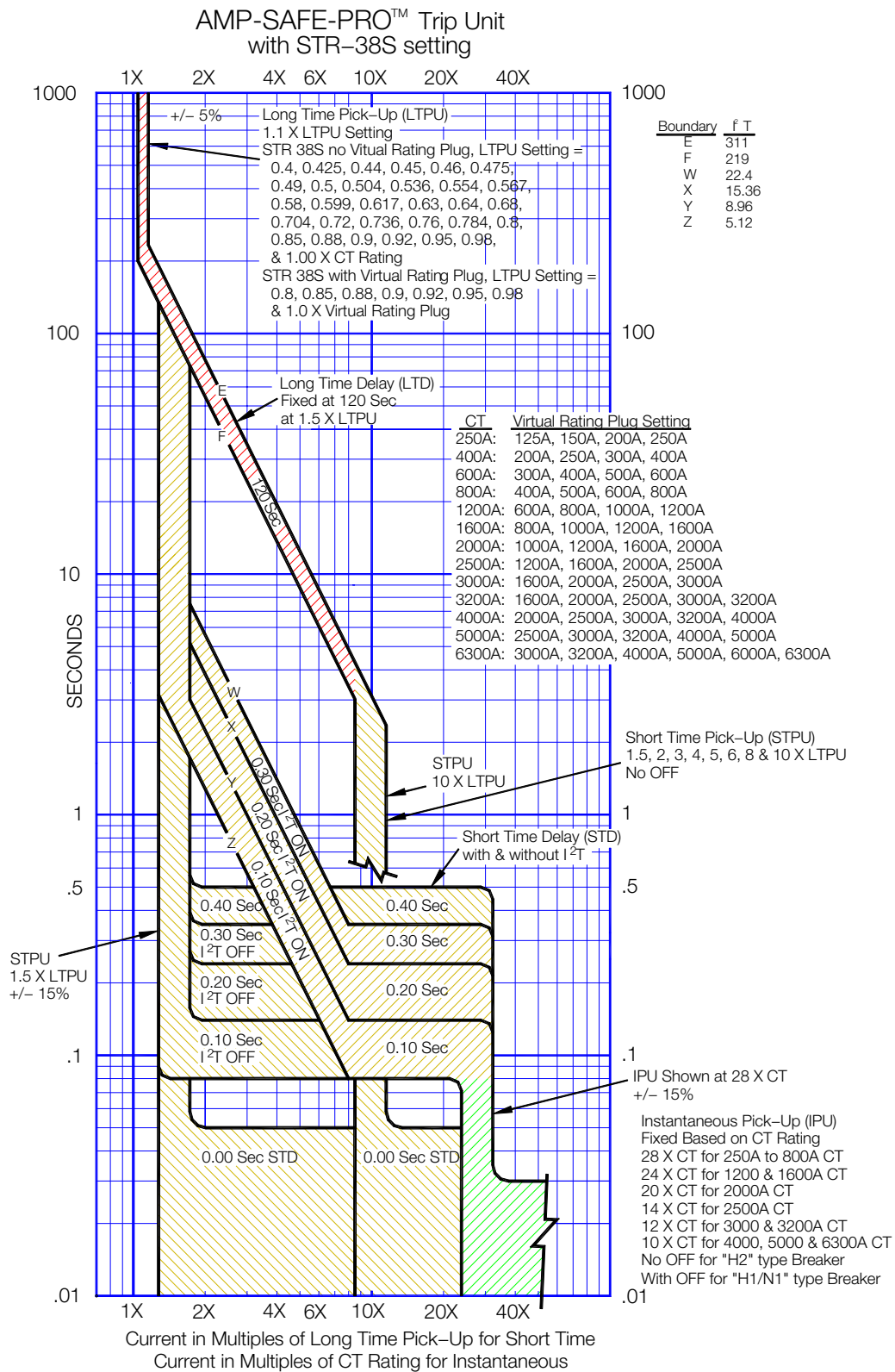
AMP-SAFE-PRO™ STR-18M TIME-CURRENT-CURVE



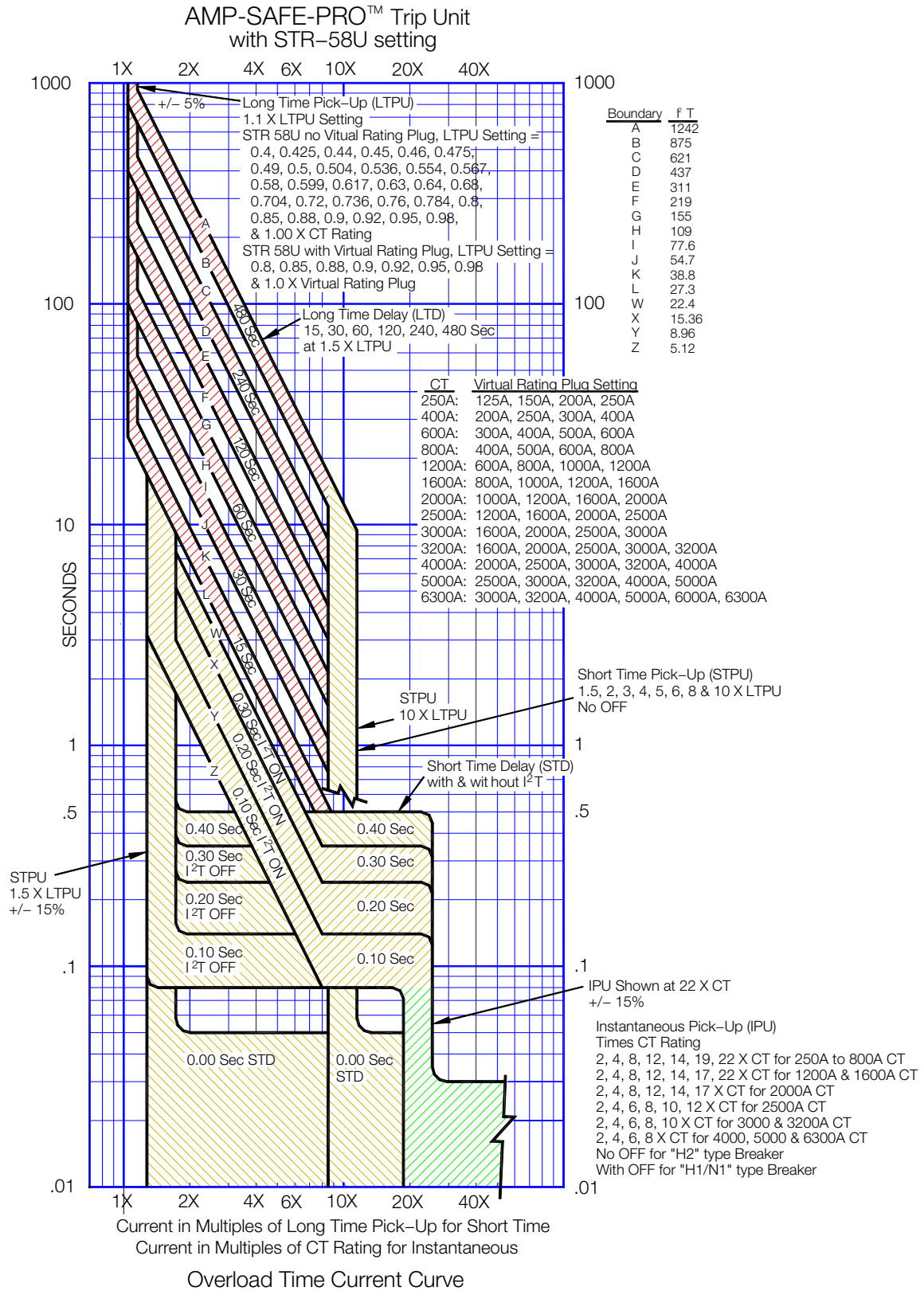
AMP-SAFE-PRO™ STR-28D TIME-CURRENT-CURVE



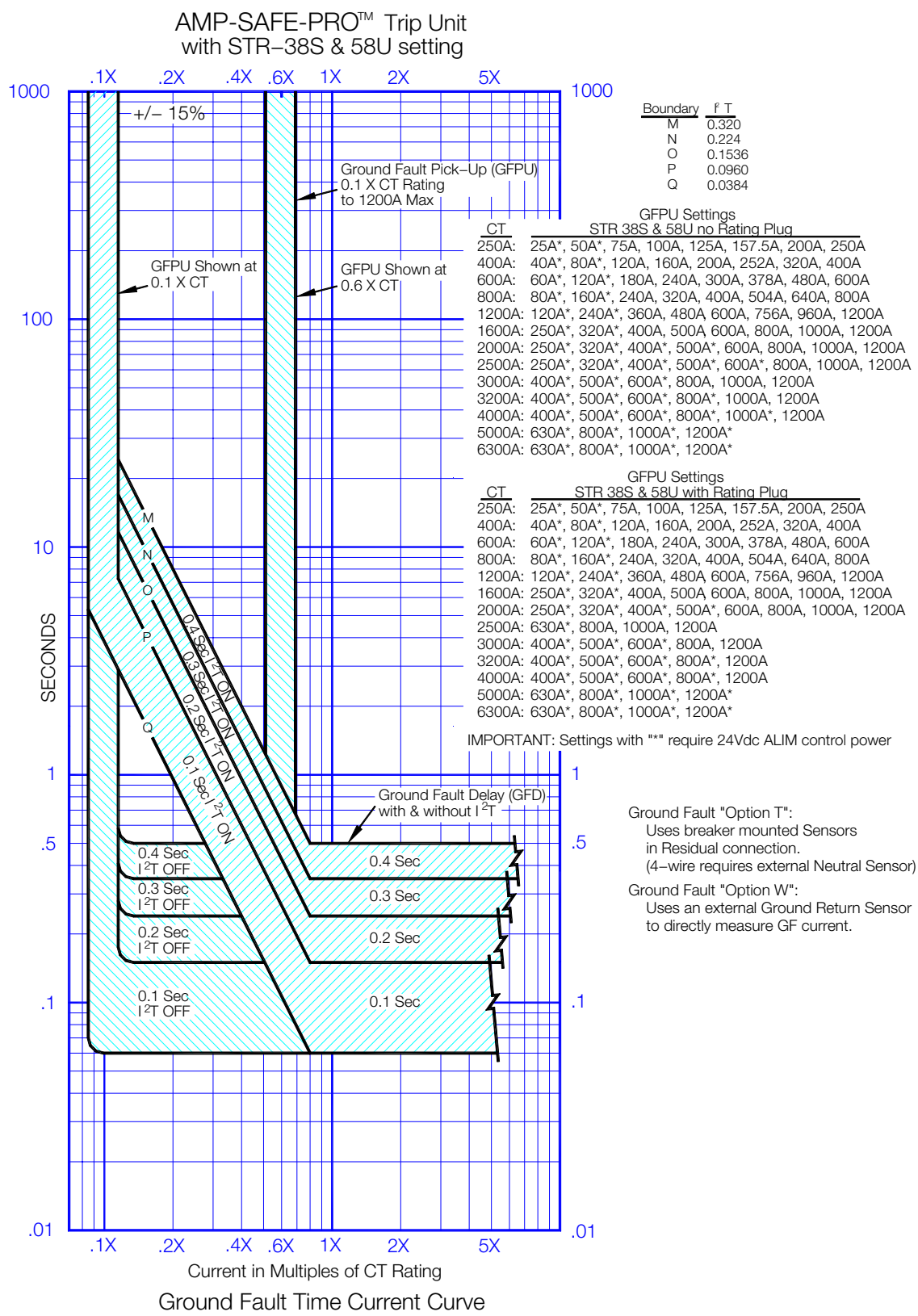
AMP-SAFE-PRO™ STR-38S TIME-CURRENT-CURVE



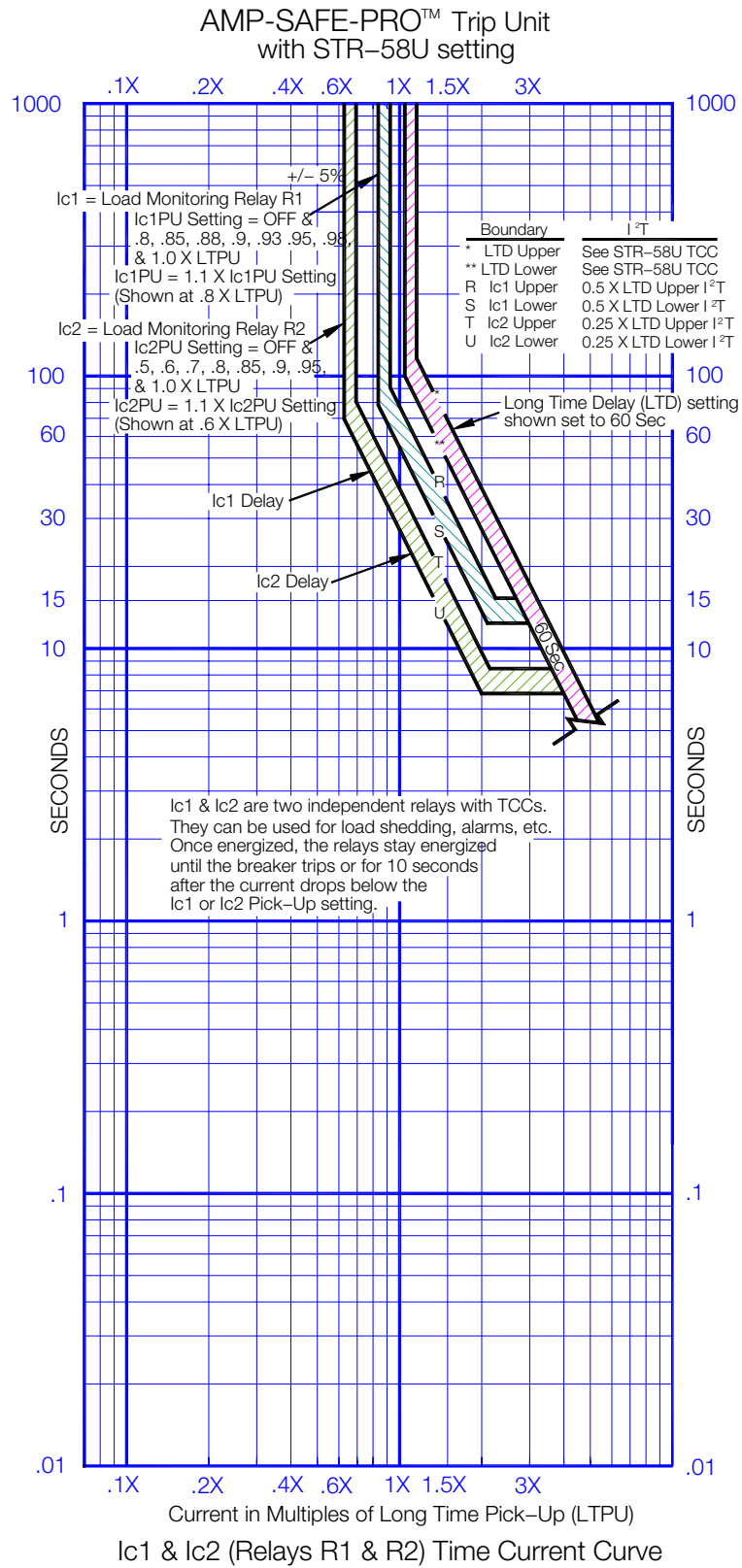
AMP-SAFE-PRO™ STR-58U TIME-CURRENT-CURVE



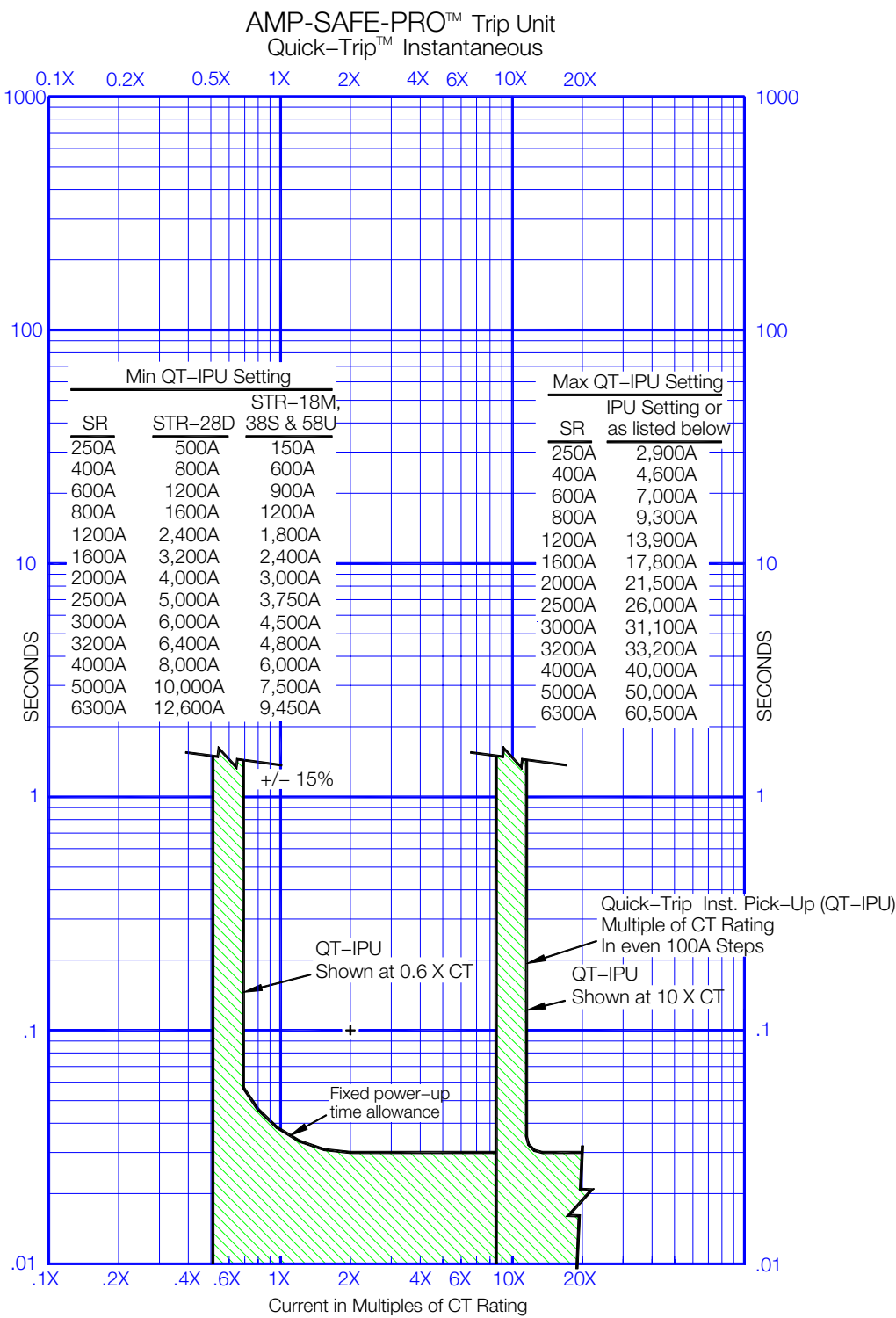
AMP-SAFE-PRO™ STR-38S & 58U GROUND FAULT TIME-CURRENT-CURVE



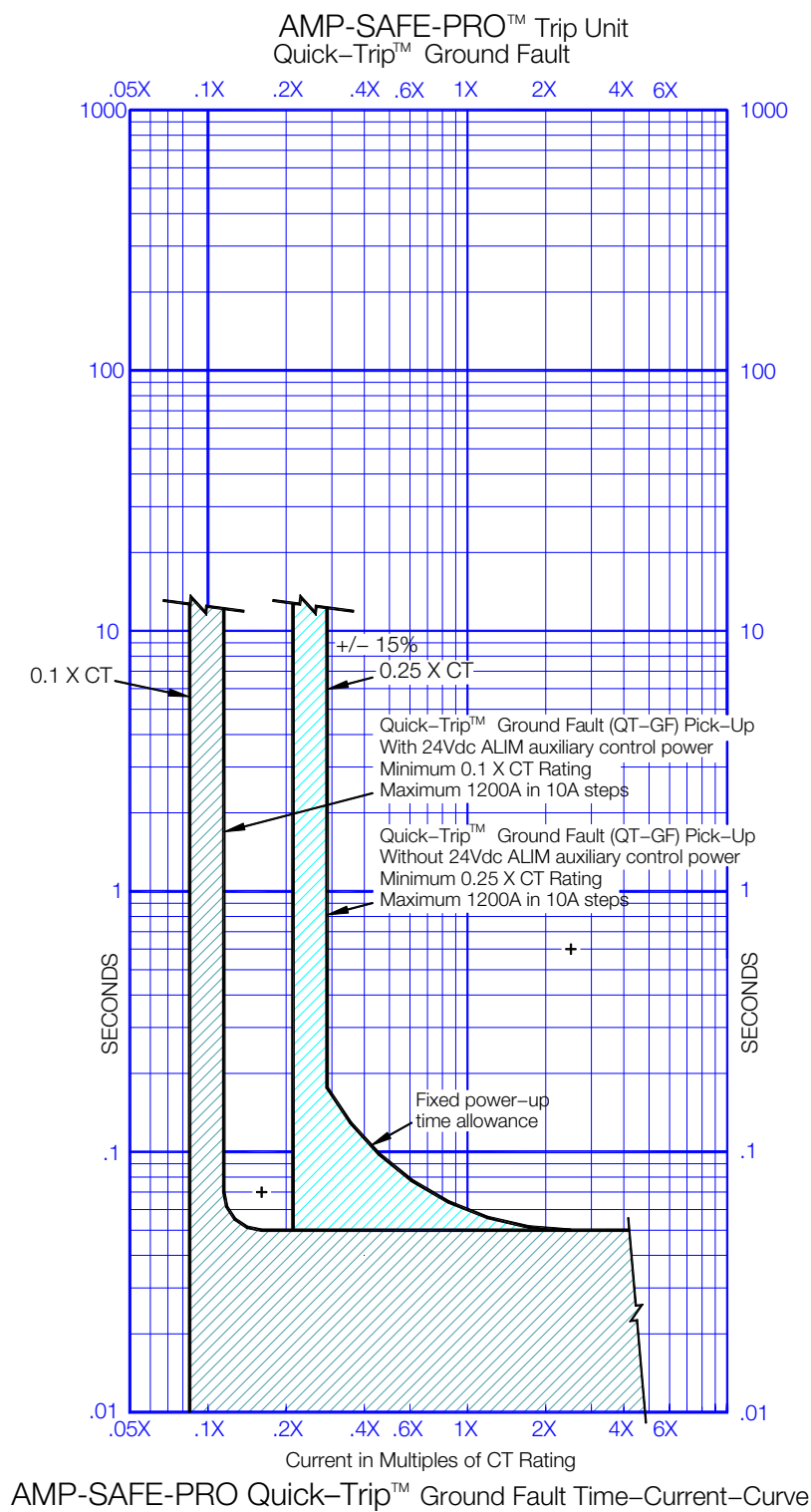
AMP-SAFE-PRO™ STR-58U LOAD MONITORING TIME-CURRENT-CURVE



AMP-SAFE-PRO™ QUICK-TRIP™ INSTANTANEOUS TIME-CURRENT-CURVE



AMP-SAFE-PRO Quick-Trip™ Instantaneous Time Current Curve





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