

# TEST SET

I-AC-PRO-MP-TS

AC-PRO-MP<sup>®</sup> TRIP UNIT



## INSTRUCTION MANUAL

*Secondary Injection Test Set  
for AC-PRO-MP<sup>®</sup> Trip Units*

**URC** Utility Relay Company

Chagrin Falls, OH 44023  
Phone: 888.289.2864  
[www.utilityrelay.com](http://www.utilityrelay.com)

# Table of Contents

| Section  | Page |
|--|------|
| 1.0 Introduction .....   | 1    |
| 2.0 Overview .....   | 1    |
| 3.0 Test Set Controls .....  | 3    |
| 3.1 Power .....  | 3    |
| 3.2 Time Display .....   | 3    |
| 3.3 Timer Clear Push Button.....   | 3    |
| 3.4 Start Push Button and LED.....   | 3    |
| 3.5 Stop Push Button.....  | 3    |
| 3.6 Test Current Display .....   | 3    |
| 3.7 Current Preset Push Button.....  | 4    |
| 3.8 Amp Coarse Adjust.....   | 4    |
| 3.9 Amp Fine Adjust.....   | 4    |
| 3.10 Phase Selector.....   | 4    |
| 3.11 Frequency Selector .....  | 4    |
| 3.12 Contrast Push Button .....  | 4    |
| 4.0 Connecting to the AC-PRO-MP .....  | 6    |
| 5.0 Testing the AC-PRO-MP .....  | 7    |
| 5.1 Select the Frequency .....   | 7    |
| 5.2 Calculate Long Time Pick-Up (LT-PU) Test Current .....                   | 7    |
| 5.3 Long Time Pick-Up (LT-PU) Test.....                                      | 8    |
| 5.4 Long Time Delay (LT-D) Time Test .....                                   | 9    |
| 5.5 Calculate Short Time Pick-Up (ST-PU) Test Current .....                  | 10   |
| 5.6 Short Time Pick-Up (ST-PU) Test.....                                     | 10   |
| 5.7 Short Time Delay (ST-D) Test.....  | 11   |
| 5.8 Calculate Instantaneous Pick-Up (I-PU) Test Current.....                 | 11   |
| 5.9 Instantaneous Pickup (I-PU) Test .....                                   | 12   |
| 5.10 Calculate Ground Fault Pick-Up (GF-PU) Test Current .....               | 12   |
| 5.11 Ground Fault Pick-up (GF-PU) Test .....                                 | 13   |
| 5.12 Ground Fault Delay (GF-D) Test .....                                    | 14   |
| 6.0 Quick-Trip® Testing .....  | 14   |
| 6.1 Calculate Quick-Trip® Instantaneous Pick-Up (QT-I-PU) Test Current ..... | 14   |
| 6.2 Quick-Trip® Instantaneous Pick-Up (QT-I-PU) Test .....                   | 15   |
| 6.3 Calculate Quick-Trip® Ground Fault Pick-Up (QT-GF-PU) Test Current.....  | 15   |
| 6.4 Quick-Trip® Ground Fault Pick-Up (QT-GF-PU) Test .....                   | 16   |
| 7.0 Error / Fault Conditions.....  | 16   |
| 7.1 Current Error.....   | 16   |
| 7.2 Thermal Limit.....   | 16   |
| Figure 1 Control Panel Overview .....  | 2    |
| Figure 2 AC-PRO-MP Test Set Connections.....                                 | 5    |
| Figure 3 Test Set Connected to AC-PRO-MP .....                               | 6    |
| Figure 4 LT Delay Trip Times Chart .....                                     | 9    |
| Figure 5 STR-18M Time-Current-Curve .....                                    | 17   |
| Figure 6 STR-28D Time-Current-Curve.....                                     | 18   |
| Figure 7 STR-38S Time-Current-Curve .....                                    | 19   |
| Figure 8 STR-58U Time-Current-Curve.....                                     | 20   |
| Figure 9 STR-38S & 58U Ground Fault Time-Current-Curve .....                 | 21   |
| Figure 10 STR-58U Load Monitoring Time-Current-Curve .....                   | 22   |
| Figure 11 Quick-Trip® Instantaneous Time-Current-Curve.....                  | 23   |
| Figure 12 Quick-Trip® Ground Fault Time-Current-Curve .....                  | 24   |

### 1.0 Introduction

The Model B-291-MP secondary injection test set is a single-phase test set specifically designed for testing the operation of the AC-PRO-MP microcontroller based trip units manufactured by Utility Relay Co.

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

The B-291-MP test set can test pick-up and time delays of the various protection functions by driving current into the AC-PRO-MP on the secondary side of the CT circuit.

The test set will test AC-PRO-MP trip units programmed for 60 or 50 Hertz operation.

The test set will test the AC-PRO-MP trip system with the exception of the CTs and associated wiring harness.

**NOTICE**

The Model B-291-MP test set will:

- ONLY test the AC-PRO-MP trip units
- NOT test the AC-PRO trip units

**CAUTION**

**Secondary injection testing is not a substitute for primary injection testing that should be performed for any circuit breaker retrofit.**

For AC-PRO-MP



Not for AC-PRO



The standard AC-PRO test set cannot be used on the AC-PRO-MP trip unit because of the 0.1 Amp secondary current transformers (CTs) in the Masterpact MP breaker.

### 2.0 Overview

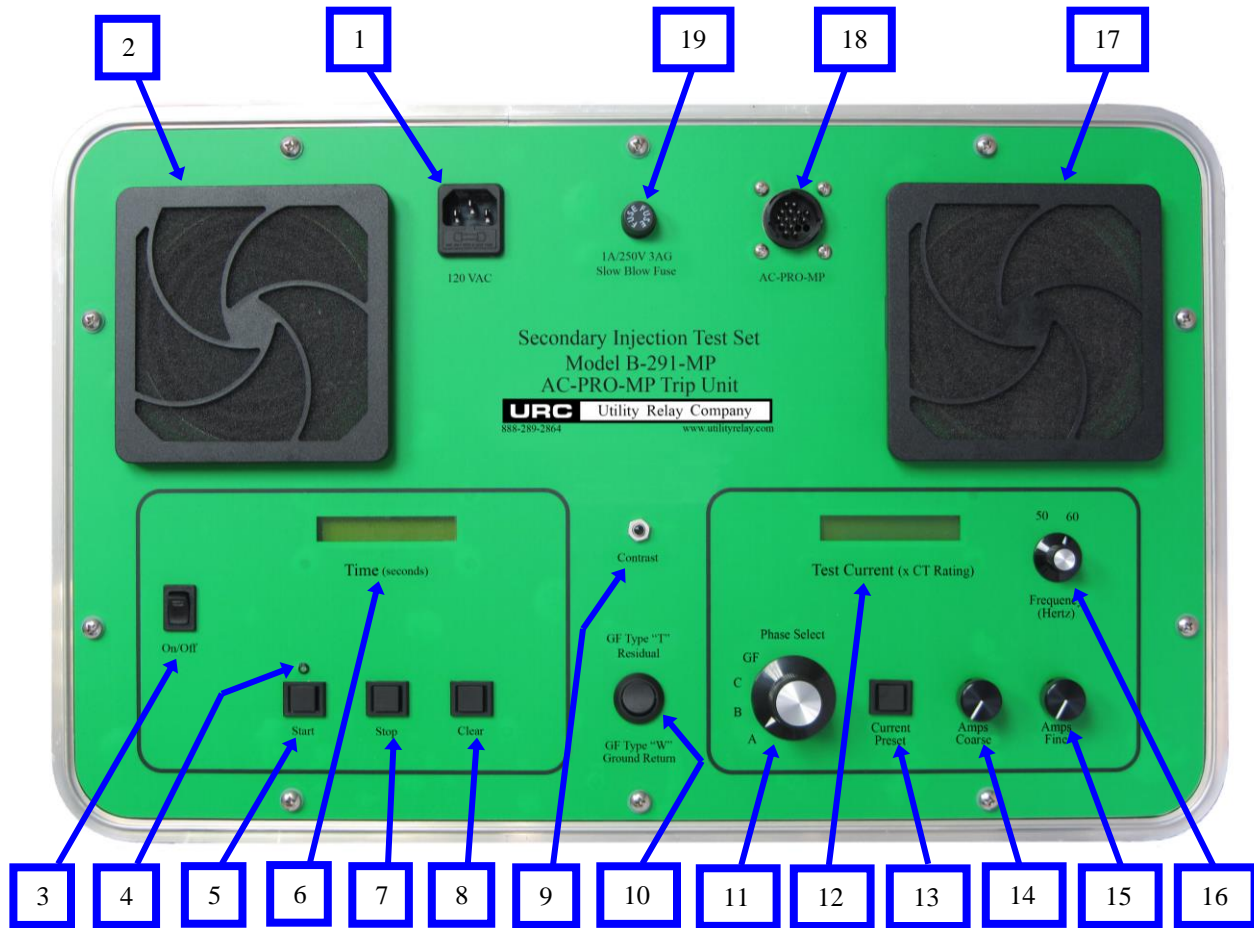
The basic function of the test set is to deliver an accurate level of AC current directly to the AC-PRO-MP trip unit under test and to verify the pick-up values and times required for the AC-PRO-MP to trip.

The technician running the test will operate the Start (5), Stop (7), Clear (8) and Current Preset (13) push buttons, adjust the Amp Coarse (14) and Amp Fine (15) potentiometers (pots), and adjust the Phase (11) and Frequency (16) Selector switches. The two displays (6 & 12) are used to indicate elapsed time in seconds and test current.

**NOTICE**

Numbers in parentheses refer to the labeled items in Figure 1.

Please reference the AC-PRO-MP instruction manual for complete installation, programming and operating instructions.



- |  |   |   |
|--|---|---|
| <p>1 Power Cable/Fuse Holder<br/>Power cable connector with main fuse. (120Vac 50/60Hz).</p> <p>2 Cooling Airflow Exhaust<br/>Cooling air for the test set exits via this filter opening. (Must not be blocked)</p> <p>3 Power ON/OFF Switch</p> <p>4 Start LED<br/>Illuminates when test current is flowing.</p> <p>5 Start Push Button<br/>Starts test current flow and starts the timer.</p> <p>6 Timer Display<br/>Displays elapsed time of test current flow in seconds.</p> <p>7 Stop Push Button<br/>Stops test current flow and freezes the timer.</p> | <p>8 Clear Push Button<br/>Resets the timer to zero.</p> <p>9 Contrast Push Button<br/>Hold this input in until the desired display contrast is reached.</p> <p>10 Ground Fault Type Switch<br/>Type "T", normal 4-wire residual GF. Type "W", used with a ground return CT.</p> <p>11 Phase Select Switch<br/>Selects one of the phases (A,B,C) or ground fault as the test current path.</p> <p>12 Current Display<br/>Displays measured true RMS current and Current Preset value in multiples of the CT rating.</p> <p>13 Current Preset Push Button<br/>When held, the current display indicates the setting of the Amp Coarse and Fine pots but does not send current to the trip unit.</p> | <p>14 Amp Coarse Pot<br/>Used to make large adjustments in the test current.</p> <p>15 Amp Fine Pot<br/>Used to make small adjustments in the test current.</p> <p>16 Frequency Select Switch<br/>This switch selects the AC frequency; 50 or 60 Hertz.</p> <p>17 Cooling Airflow Intake<br/>Cooling air for the test set enters via this filter opening. (Must not be blocked).</p> <p>18 AC-PRO-MP Test Harness Connector<br/>The AC-PRO-MP connects to the test set with the supplied wire harness and circuit board via this connector.</p> <p>19 Control Fuse Holder<br/>Control fuse. (1A, 250V, 3AG)</p> |
|--|---|---|

**Figure 1**  
**Control Panel Overview**

### 3.0 Test Set Controls

A brief description of the operation of the various test set controls is given below.

The numbers in parentheses refer to the labels in Figure 1.

#### 3.1 Power (3)

Power to the test set is controlled with the Power On-Off switch.

An AC cord is supplied with the test set. The recommended AC power source is 120V AC at either 50 or 60 Hz. The 120 VAC receptacle (1) also contains the 5 Amp, 250V, 5 x 20mm main power fuse.

#### 3.2 Time Display (6)

The test set will measure the time elapsed while current is being delivered to the AC-PRO-MP and display the time on the Timer display.

The displayed time is in seconds with 1/100 of a second resolution.

The time will stop accumulating when the AC-PRO-MP trips or when the Stop (7) push button is pushed.

The timer display is cleared when the Clear (8) push button is pushed.

#### 3.3 Timer Clear Push Button (8)

The Clear push button clears the Timer display (6).

#### 3.4 Start Push Button (5) and LED (4)

The Start push button starts the test current flow to the AC-PRO-MP and simultaneously starts the Timer (6).

The green LED located above the Start push button indicates test current flow.

#### 3.5 Stop Push Button (7)

The Stop push button stops the test current flow and simultaneously freezes the Timer (6).

#### 3.6 Test Current display (12)

The Test Current display indicates the RMS test current in multiples of the CT rating, going to the AC-PRO-MP during a test.

To determine the equivalent CT primary current, multiply the test set current by the CT rating entered into the trip unit.

**Example:**

If CT rating = 2000 Amp

And test current reading = 1.50

The equivalent primary current is:

$$1.50 \times 2000 = 3000 \text{ Amps primary}$$

### 3.7 Current Preset Push Button (13)

While the Current Preset push button is pushed, the test set will display the current setting (from the Amp Coarse and Fine adjust pots) in the Current display (12) without actually driving any current to the AC-PRO-MP.

The sum of the Amp Coarse (14) and Fine (15) pots is displayed in the Current display (12) and is continually updated while the Current Preset switch is pushed.

After the current pots are adjusted to the desired test current as seen on the display, release the Current Preset push button.

The test set limits the current set point level to 40.0 times the CT rating (4000%).

### 3.8 Amp Coarse Adjust (14)

The Amps Coarse adjustment quickly changes the test current to the trip unit or the test Current Preset. Clockwise rotation increases the value (from 0.00 Amp to 39.0 Amp).

### 3.9 Amp Fine Adjust (15)

The Amps Fine adjustment slowly changes the test current to the trip unit or the test Current Preset. Clockwise rotation increases the value (adds 0.00 Amp to 1.00 Amp to the Coarse adjustment current).

### 3.10 Phase Selector (11)

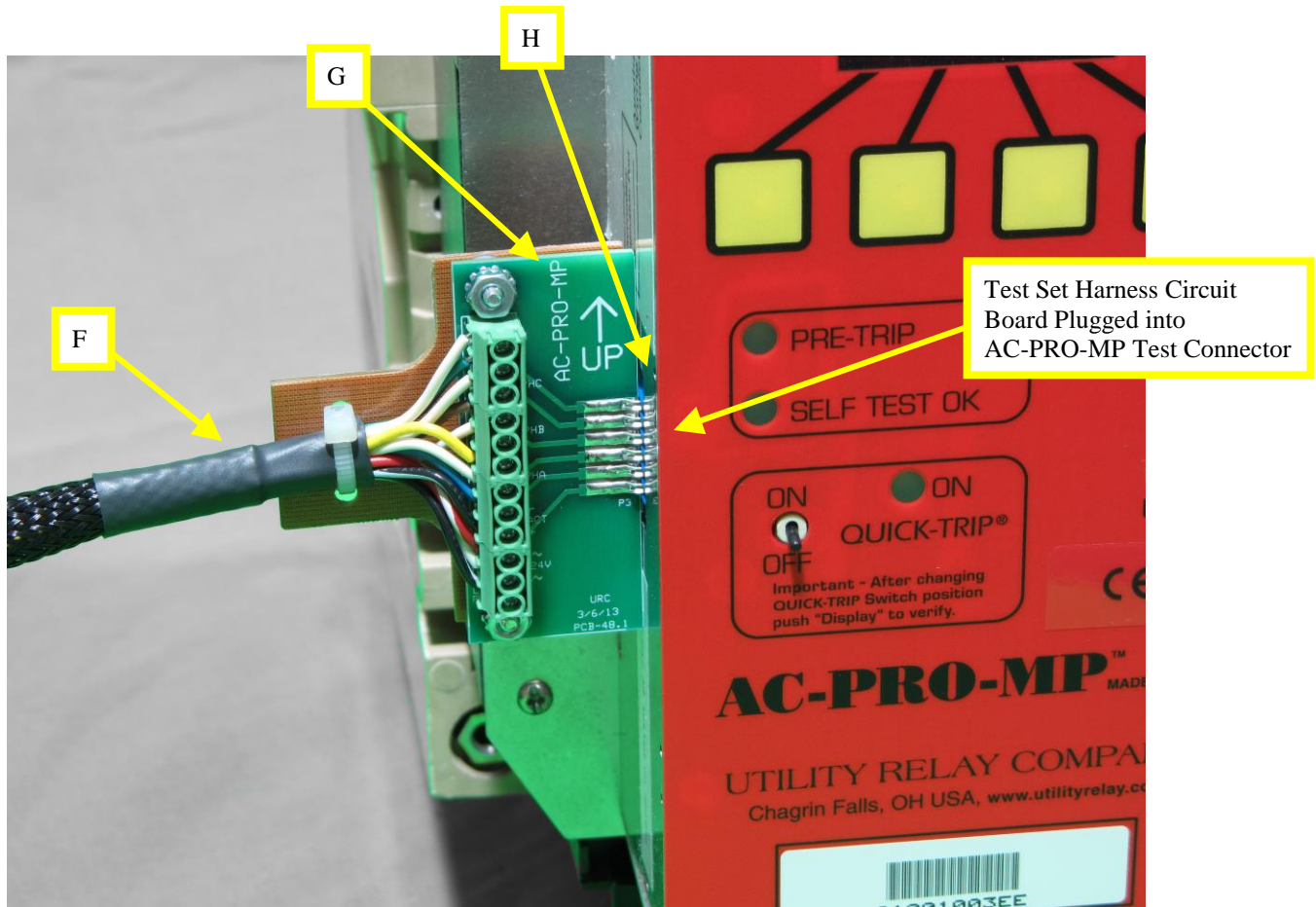
The Phase Select selector switch is used to select which phase of the AC-PRO-MP the test current is driven into. It selects between Phase A, Phase B, Phase C or Ground Fault.

### 3.11 Frequency Selector (16)

The Frequency selector switch is used to select the AC test current frequency. This is used to select either 50 or 60 Hz.

### 3.12 Contrast Push Button (9)

The Contrast push button changes the contrast of both the Timer (6) and Current (12) displays. The push button should be pushed until the desired contrast is seen in the displays.



- F) AC-PRO-MP Test Set Harness.
- G) Harness Circuit Board.
- H) Test Port on AC-PRO-MP.

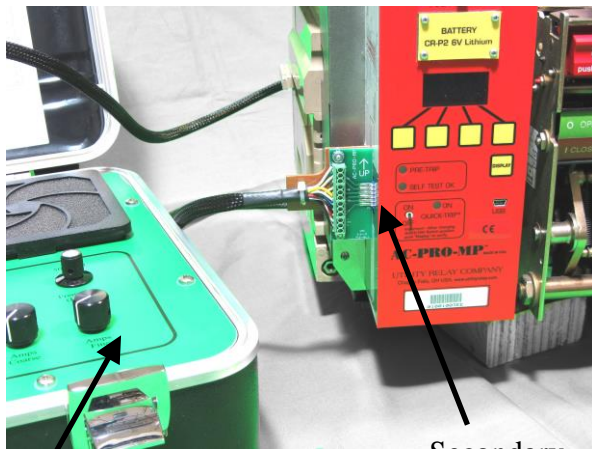
**Figure 2**  
**AC-PRO-MP Test Set Connections**

**4.0 Connecting to the AC-PRO-MP**



**Remove the breaker from service before connecting the secondary injection test set or performing any tests.**

**Failure to do so could result in serious injury or death.**



Secondary injection test set

Secondary injection test port

**Figure 3**

**Test Set Connected to AC-PRO-MP**

The following describes the connection of the test set to the AC-PRO-MP trip unit.



Letters in parentheses refer to the labeled items in Figure 2.

Numbers in parentheses refer to the labeled items in Figure 1.

- 1) Verify that the Power switch (3) is in the off position.
- 2) Connect the power cord to connector (1) on the test set. Plug the power cord into a 120Vac outlet.

- 3) Connect the round connector on the test set harness (F) to the connector on the test set marked “AC-PRO-MP” (18). Twist the outer ring clockwise to fully seat and lock the connector in place.

The test set harness circuit board (G) will plug into the port (H) on the left side of the AC-PRO-MP.

- 4) Remove the breaker front cover.
- 5) Remove the test port cover on the left side of the AC-PRO-MP.
- 6) Plug the test set harness (F) with circuit board (G) onto the AC-PRO-MP test port (H).
- 7) Once all connections are made the test set power can be turned on. The AC-PRO-MP will also power up.



The OLED display on the AC-PRO-MP is normally off.

Pushing the DISPLAY button on the AC-PRO-MP will turn the display on.

If no buttons are pushed for 30 seconds, the display will turn off.



## 5.0 Testing the AC-PRO-MP

The protective functions provided by the AC-PRO-MP depend on the type of STR trip unit the AC-PRO-MP is programmed to replace.

|         | <u>Protection Provided</u>  |
|---------|---|
| STR-18M | Instantaneous only  |
| STR-28D | Long Time (1 delay band)<br>Instantaneous   |
| STR-38S | Long Time (1 delay band)<br>Short Time<br>Instantaneous<br>Ground Fault                     |
| STR-58U | Long Time (6 delay bands)<br>Short Time<br>Instantaneous<br>Ground Fault<br>Load Monitoring |

Quick-Trip® arc flash reduction is a standard feature on all versions of the STR trip units. Only the STR types that have Ground Fault will have Quick-Trip® Ground Fault available.

See the Time Current Curves in Section 8 for each of the STR trip units.

### 5.1 Select the Frequency

Select the desired frequency of operation using the Frequency (16) selector switch.

This must match the AC-PRO-MP frequency setting.

## 5.2 Calculate Long Time Pick-Up (LT-PU) Test Current

Calculate the LT-PU test current as follows:

$$\text{LT-PU Test Current} = \frac{\text{LT Pick-Up in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 2000 \text{ Amp} \\ \text{LT pick-up} &= 1000 \text{ Amps, then} \\ \text{LT-PU Test Current} &= \frac{1000}{2000} = 0.50 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{LT pick-up} &= 3000 \text{ amps, then} \\ \text{LT-PU Test Current} &= \frac{3000}{3000} = 1.00 \text{ Amp} \end{aligned}$$

### 5.3 Long Time Pick-Up (LT-UP) Test

The Pre-Trip LED on the AC-PRO-MP is used to test LT-PU.

The Pre-Trip LED responds to the highest Phase current as follows:

| <u>Pre-Trip LED</u> | <u>Current</u>                               |
|---------------------|--|
| Off                 | Less than 90% of LT-PU                       |
| Solidly On          | Greater than 90% but less than 105% of LT-PU |
| Flashing            | Greater than 105% of LT-PU                   |

Test the LT-PU by verifying that the Pre-Trip LED turns solidly on at 90% of the LT-PU setting:

- 1) Hold down the Current Preset Button (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current display (12) shows about 80% of the LT-PU test current previously calculated. Release the Current Preset Button.
- 2) Set the Phase selector switch (11) to either Phase A, B or C.
- 3) Push the Start (5) button.
- 4) Using the Fine pot (15) increase the current until the Pre-Trip LED just turns on. This is 90% of the LT-UP setting.
- 5) Verify that the current display (12) on the test set reads 90% of the previously calculated LT-PU test current  $\pm 5\%$ .
- 6) Push the Stop (7) button.
- 7) If desired, test the LT-PU on the other two Phases in the same way.

| Long Time Delay Trip Times |          |         |        |        |        |        |       |       |       |
|----------------------------|----------|---------|--------|--------|--------|--------|-------|-------|-------|
| STR Type                   | LT Delay | % Error | 1.5X   | 2X     | 2.5X   | 3X     | 4X    | 5X    | 6X    |
| 28D                        | 120      | 15%     | 124.55 | 70.06  | 44.84  | 31.14  | 17.51 | 11.21 | 7.78  |
|                            |          | 0       | 108.30 | 60.92  | 38.99  | 27.08  | 15.23 | 9.75  | 6.77  |
|                            |          | -19%    | 87.72  | 49.34  | 31.58  | 21.93  | 12.34 | 7.90  | 5.48  |
| 38S                        | 120      | 15%     | 124.55 | 70.06  | 44.84  | 31.14  | 17.51 | 11.21 | 7.78  |
|                            |          | 0       | 108.30 | 60.92  | 38.99  | 27.08  | 15.23 | 9.75  | 6.77  |
|                            |          | -19%    | 87.72  | 49.34  | 31.58  | 21.93  | 12.34 | 7.90  | 5.48  |
| 58U                        | 15       | 15%     | 15.57  | 8.76   | 5.60   | 3.89   | 2.19  | 1.40  | 0.97  |
|                            |          | 0       | 13.54  | 7.61   | 4.87   | 3.38   | 1.90  | 1.22  | 0.85  |
|                            |          | -19%    | 10.97  | 6.17   | 3.95   | 2.74   | 1.54  | 0.99  | 0.69  |
|                            | 30       | 15%     | 31.14  | 17.51  | 11.21  | 7.78   | 4.38  | 2.80  | 1.95  |
|                            |          | 0       | 27.08  | 15.23  | 9.75   | 6.77   | 3.81  | 2.44  | 1.69  |
|                            |          | -19%    | 21.93  | 12.34  | 7.90   | 5.48   | 3.08  | 1.97  | 1.37  |
|                            | 60       | 15%     | 62.27  | 35.03  | 22.42  | 15.57  | 8.76  | 5.60  | 3.89  |
|                            |          | 0       | 54.15  | 30.46  | 19.49  | 13.54  | 7.61  | 4.87  | 3.38  |
|                            |          | -19%    | 43.86  | 24.67  | 15.79  | 10.97  | 6.17  | 3.95  | 2.74  |
|                            | 120      | 15%     | 124.55 | 70.06  | 44.84  | 31.14  | 17.51 | 11.21 | 7.78  |
|                            |          | 0       | 108.30 | 60.92  | 38.99  | 27.08  | 15.23 | 9.75  | 6.77  |
|                            |          | -19%    | 87.72  | 49.34  | 31.58  | 21.93  | 12.34 | 7.90  | 5.48  |
|                            | 240      | 15%     | 249.09 | 140.11 | 89.67  | 62.27  | 35.03 | 22.42 | 15.57 |
|                            |          | 0       | 216.60 | 121.84 | 77.98  | 54.15  | 30.46 | 19.49 | 13.54 |
|                            |          | -19%    | 175.45 | 98.69  | 63.16  | 43.86  | 24.67 | 15.79 | 10.97 |
|                            | 480      | 15%     | 498.18 | 280.23 | 179.34 | 124.55 | 70.06 | 44.84 | 31.14 |
|                            |          | 0       | 433.20 | 243.68 | 155.95 | 108.30 | 60.92 | 38.99 | 27.08 |
|                            |          | -19%    | 350.89 | 197.38 | 126.32 | 87.72  | 49.34 | 31.58 | 21.93 |

**Figure 4  
LT Delay Trip Times Chart**

**5.4 Long Time Delay (LT-D) Time Test**

To test the LT-D trip time:

- 1) The first step is to select an overload (OL) and calculate the LT-D test current.

LT-D Test Current  
= OL x LT-PU Test Current

Example:  
Desired Overload (OL) = 3X  
LT-PU Test Current = 0.50 Amp  
  
LT-D Test Current = 3 x 0.50 = 1.50 Amp

- 2) The easiest way to determine the LT-D trip time range is to use the chart in Figure 4.

Example:  
Desired Overload (OL) = 3X  
LT Delay Band = 120 Sec  
  
From LT Delay Trip Time Chart:  
LT Trip Time at 3X is 21.96 to 31.19 Sec.

- 3) Hold down the Current Preset Button (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current display (12) shows the previously calculated LT-D test current. Release the Current Preset Button.
- 4) Set the Phase selector switch (11) to either Phase A, B or C.
- 5) Push the Clear button (8) to reset the Timer (6) to zero.
- 6) Push the Start button (5) and quickly make any minor adjustments required to the Amp Fine (15) pot
- 7) When the AC-PRO-MP trips, the test set current will stop and the Timer (6) will freeze and display the total trip time.
- 8) Compare the trip time with the LT trip time chart in Figure 4.
- 9) Verify that the AC-PRO-MP saved the proper last trip data.
- 10) Repeat for the other two Phases if desired.

### 5.5 Calculate Short Time Pick-Up (ST-PU) Test Current

Calculate the ST-PU test current as follows:

$$\text{ST-PU Test Current} = \frac{\text{ST Pick-Up in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{ST pick-up} &= 12,000 \text{ Amp, then} \\ \text{ST-PU Test Current} &= \frac{12,000}{3000} = 4.00 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 1600 \text{ Amp} \\ \text{ST pick-up} &= 3430 \text{ Amp, then} \\ \text{ST-PU Test Current} &= \frac{3430}{1600} = 2.14 \text{ Amp} \end{aligned}$$

### 5.6 Short Time Pick-Up (ST-PU) Test

To test the ST-PU:

- 1) Hold down the Current Preset button (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 85% of the calculated ST-PU test current.
- 2) Set the Phase selector (11) to either Phase A, B or C.
- 3) Push the Start (5) button but leave the test current on only long enough to see if a ST trip occurs. If the current is left on long enough a LT trip will occur.

With 85% of ST-PU test current, a ST trip should NOT occur.

- 4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 115% of the calculated ST-PU test current.
- 5) Push the Clear (8) button to reset the Timer (6) to zero.
- 6) Push the Start (5) button.

With 115% of ST-PU test current, a ST trip should occur.

- 7) The test set current will stop and the Timer (6) will freeze displaying the trip time.
- 8) Repeat for the other two Phases if desired.

### 5.7 Short Time Delay (ST-D) Test

To test the ST delay trip time:

- 1) The first step is to select a test value. For example, 150% of the ST-PU. The test value is then 1.5 times ST-PU test current.

#### NOTICE

To accurately test the ST delay, the test value must be at least 115% of the ST-PU test current.

- 2) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current (12) display shows the test value calculated in step 1.
- 3) Set the Phase selector (12) to either Phase A, B or C.
- 4) Push the Clear (8) button to reset the Timer (6) to zero.
- 5) Push the Start (5) button.
- 6) When the AC-PRO-MP trips, the test set current will stop and the Timer (6) will freeze displaying the trip time.
- 7) Using the appropriate Time-Current-Curve, verify that the trip time is within the time band limits.
- 8) Verify that the AC-PRO-MP saved the proper last trip data.
- 9) Repeat for the other two Phases if desired.

### 5.8 Calculate Instantaneous Pick-Up (I-PU) Test Current

Calculate the I-PU test current as follows:

$$\text{I-PU Test Current} = \frac{\text{I-PU in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{I-PU} &= 24,000 \text{ Amps, then} \\ \text{I-PU Test Current} &= \frac{24,000}{3000} = 8.00 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 1600 \text{ Amp} \\ \text{I-PU} &= 6400 \text{ Amps, then} \\ \text{I-PU Test Current} &= \frac{6400}{1600} = 4.00 \text{ Amp} \end{aligned}$$

## 5.9 Instantaneous Pick-Up (I-PU) Test

To test the I-PU:

- 1) Hold down the Current Preset button (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 85% of the calculated I-PU test current.
- 2) Set the Phase selector (11) to either Phase A, B or C.
- 3) Push the Start (5) button but leave the test current on only long enough to see if an Instantaneous trip occurs. If the current is left on long enough a LT or ST trip will occur.

With 85% of the I-PU test current, an Instantaneous trip should NOT occur.

- 4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 115% of the calculated I-PU test current.
- 5) Push the Clear (8) button to reset the Timer (6) to zero.
- 6) Push the Start (5) button.

With 115% of the I-PU test current, an Instantaneous trip should occur.

- 7) The test set current will stop and the Timer (6) will freeze displaying the trip time.
- 8) Verify that the AC-PRO-MP saved the proper last trip data.
- 9) Repeat for the other two Phases if desired.

## 5.10 Calculate Ground Fault Pick-Up (GF-PU) Test Current

Calculate the GF-PU test current as follows:

$$\text{GF-PU Test Current} = \frac{\text{GF-PU in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{GF-PU} &= 600 \text{ Amp, then} \\ \text{GF-PU Test Current} &= \frac{600}{3000} = 0.20 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 1600 \text{ Amp} \\ \text{GF-PU} &= 1200 \text{ Amp, then} \\ \text{GF-PU Test Current} &= \frac{1200}{1600} = 0.75 \text{ Amp} \end{aligned}$$

## 5.11 Ground Fault Pick-Up (GF-PU) Test

- 1) Switch the selector switch (10) on the test set to the appropriate type of GF measurement used by this particular breaker:

Type “T” for residual GF

Type “W” for Ground Return GF

### NOTICE

The GF “T” setting is for normal 3-Wire or 4-Wire residual GF.

The GF “W” setting is for source ground return GF where a “ground return” CT is installed.

The “W” source ground return GF is usually used on main and tie breakers in double ended subs.

- 2) Hold down the Current Preset button (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 85% of the calculated GF-PU test current.
- 3) Set the Phase selector (11) to the “GF” position.
- 4) Push the Start (5) button but leave the test current on only long enough to see if a GF trip occurs.

With 85% of the GF-PU test current, a GF trip should NOT occur.

- 5) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 115% of the calculated GF-PU test current.
- 6) Push the Clear (8) button to reset the Timer (6) to zero.
- 7) Push the Start (5) button.

With 115% of the GF-PU test current, a GF trip should occur.

- 8) The test set current will stop and the Timer (6) will freeze displaying the trip time.
- 9) Verify that the AC-PRO-MP saved the proper last trip data.

## 5.12 Ground Fault Delay (GF-D) Test

To test the GF delay trip time:

- 1) The first step is to select a test value. For example, 150% of the GF-PU. The desired test current is then 1.5 times GF-PU test current.

### NOTICE

To accurately test the GF delay, the test value must be at least 115% of the GF-PU test current.

- 2) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current (12) display shows the test value calculated in step 1.
- 3) Set the Phase selector (11) to GF.
- 4) Push the Clear (8) button to reset the Timer (6) to zero.
- 5) Push the Start (5) button.
- 6) When the AC-PRO-MP trips, the test set current will stop and the Timer (6) will freeze displaying the trip time.
- 7) Using the GF Time-Current-Curve, verify that the trip time is within the time band limits.
- 8) Verify that the AC-PRO-MP saved the proper last trip data.

## 6.0 Quick-Trip® Testing

### 6.1 Calculate Quick-Trip® Instantaneous Pick-Up (QT-I-PU) Test Current

Calculate the QT-I-PU test current as follows:

$$\text{QT-I-PU Test Current} = \frac{\text{QT-I-PU in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{QT-I-PU} &= 18,000 \text{ Amp, then} \\ \text{QT-I-PU Test Current} &= \frac{18,000}{3000} = 6.00 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 1600 \text{ Amp} \\ \text{QT-I-PU} &= 7200 \text{ Amp, then} \\ \text{QT-I-PU Test Current} &= \frac{7200}{1600} = 4.50 \text{ Amp} \end{aligned}$$



## 6.2 Instantaneous Pick-Up (QT-I-PU) Test

To test the QT-I-PU:

- 1) Move the Quick-Trip selector switch on the AC-PRO-MP to Quick-Trip ON.
- 2) Hold down the Current Preset button (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 85% of the calculated QT-I-PU test current.
- 3) Set the Phase selector (11) to either Phase A, B or C.
- 4) Push the Start (5) button but leave the test current on only long enough to see if a QT-I trip occurs. If the current is left on long enough a LT or ST trip will occur.

With 85% of the QT-I-PU test current, a QT-I trip should NOT occur.

- 5) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 115% of the calculated QT-I-PU test current.
- 6) Push the Clear (8) button to reset the Timer (6) to zero.
- 7) Push the Start (5) button.

With 115% of the QT-I-PU test current, a QT-I trip should occur.

- 8) The test set current will stop and the Timer (6) will freeze displaying the trip time.
- 9) Verify that the AC-PRO-MP saved the proper last trip data.
- 10) Repeat for the other two Phases if desired.

## 6.3 Calculate Quick-Trip® Ground Fault Pick-Up (QT-GF-PU) Test Current

Calculate the QT-GF-PU test current as follows:

$$\text{QT-GF-PU Test Current} = \frac{\text{QT-GF in Amps}}{\text{CT Rating in Amps}}$$

Example:

$$\begin{aligned} \text{CT rating} &= 3000 \text{ Amp} \\ \text{QT-GF} &= 800 \text{ Amps, then} \\ \text{QT-GF-PU Test Current} &= \frac{800}{3000} = 0.27 \text{ Amp} \end{aligned}$$

Example:

$$\begin{aligned} \text{CT rating} &= 1600 \text{ Amp} \\ \text{QT-GF} &= 480 \text{ Amps, then} \\ \text{QT-GF-PU Test Current} &= \frac{480}{1600} = 0.30 \text{ Amp} \end{aligned}$$

## 6.4 Quick-Trip® Ground Fault Pick-Up (QT-GF-PU) Test

- 1) Switch the selector switch (10) on the test set to the appropriate type of GF measurement used by this particular breaker:
  - Type “T” for residual GF
  - Type “W” for Ground Return GF
- 2) Move the Quick-Trip selector switch on the AC-PRO-MP to Quick-Trip ON.

### NOTICE

The GF “T” setting is for normal 3-Wire or 4-Wire residual GF.

The GF “W” setting is for source ground return GF where a “ground return” CT is installed.

The “W” source ground return GF is usually used on main and tie breakers in double ended subs.

- 3) Hold down the Current Preset button (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 85% of the calculated QT-GF-PU test current.
- 4) Set the Phase selector (11) to the “GF” position.
- 5) Push the Start (5) button but leave the test current on only long enough to see if a QT-GF trip occurs.

With 85% of the QT-GF-PU test current, a QT-GF trip should NOT occur.

- 6) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 115% of the calculated QT-GF-PU test current.

- 7) Push the Clear (8) button to reset the Timer (6) to zero.

- 8) Push the Start (5) button.

With 115% of the QT-GF-PU test current, a QT-GF trip should occur.

- 9) The test set current will stop and the Timer (6) will freeze displaying the trip time.

- 10) Verify that the AC-PRO-MP saved the proper last trip data.

## 7.0 Error/Fault Conditions

### 7.1 Current Error

The test set monitors the current level while a test is in progress. Should the current level be outside of the expected range, a current error will occur and the test set will stop current flow and display “Current Error”.

The most likely causes for a "Current Error" are:

- 1) The trip unit is not powered up.
- 2) There are loose connections in the test cable.

After correcting the problem, push the Clear (8) button to clear the current error. After this, normal operation on the test set should be restored.

### 7.2 Thermal Limit

As a protective feature, the test set will stop delivering current and display a “Thermal Limit” message if high levels of test current remain for a prolonged time period. The timeout for the thermal limit shutdown begins when any test current exceeds eight amps.

If a thermal limit occurs it must be cleared by pressing the Clear (8) button. The test set will not allow a test to be restarted for about five seconds. Before restarting the test, verify that there are no loose connections.

AC-PRO-MP® Trip Unit  
With STR-18M setting

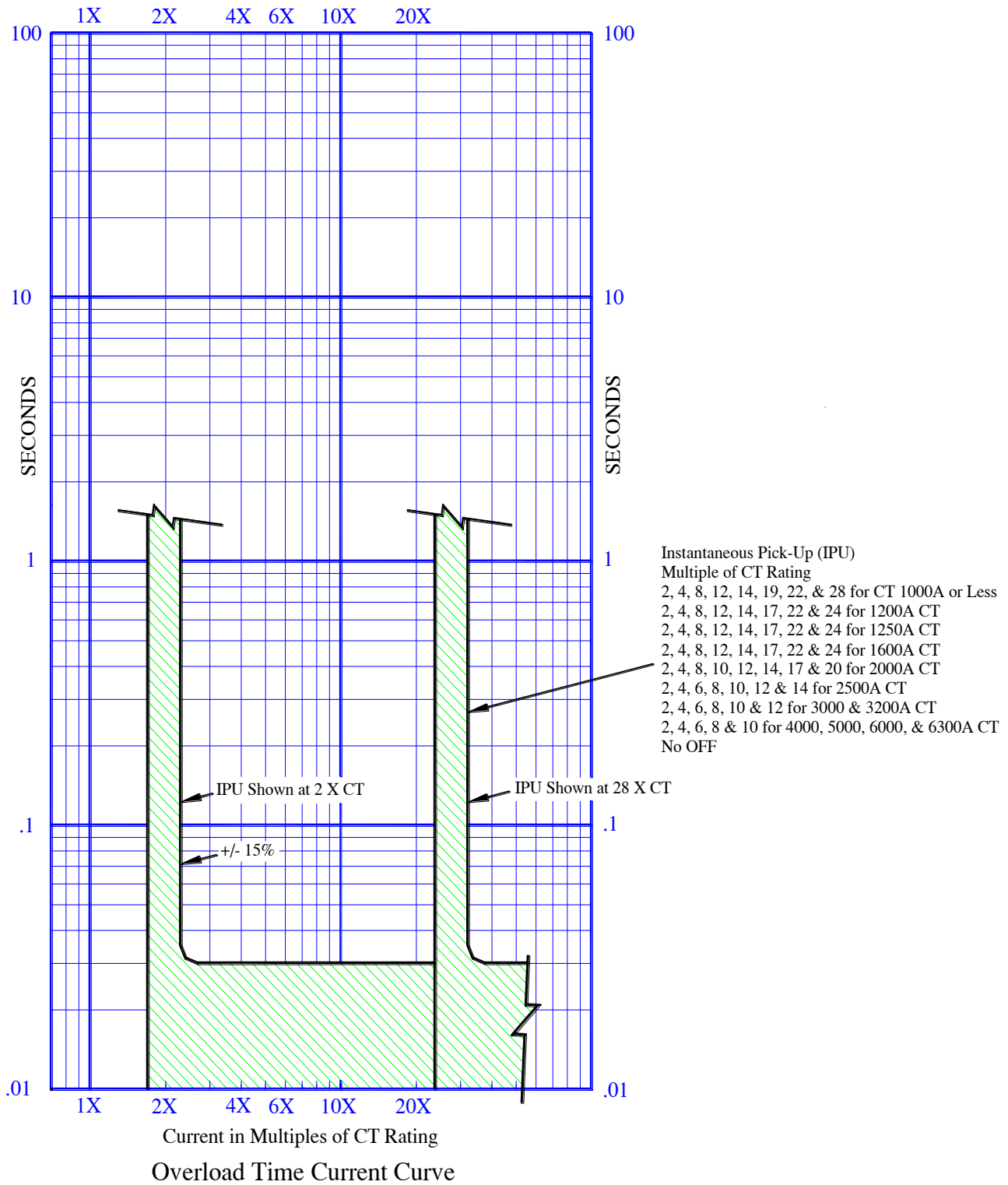
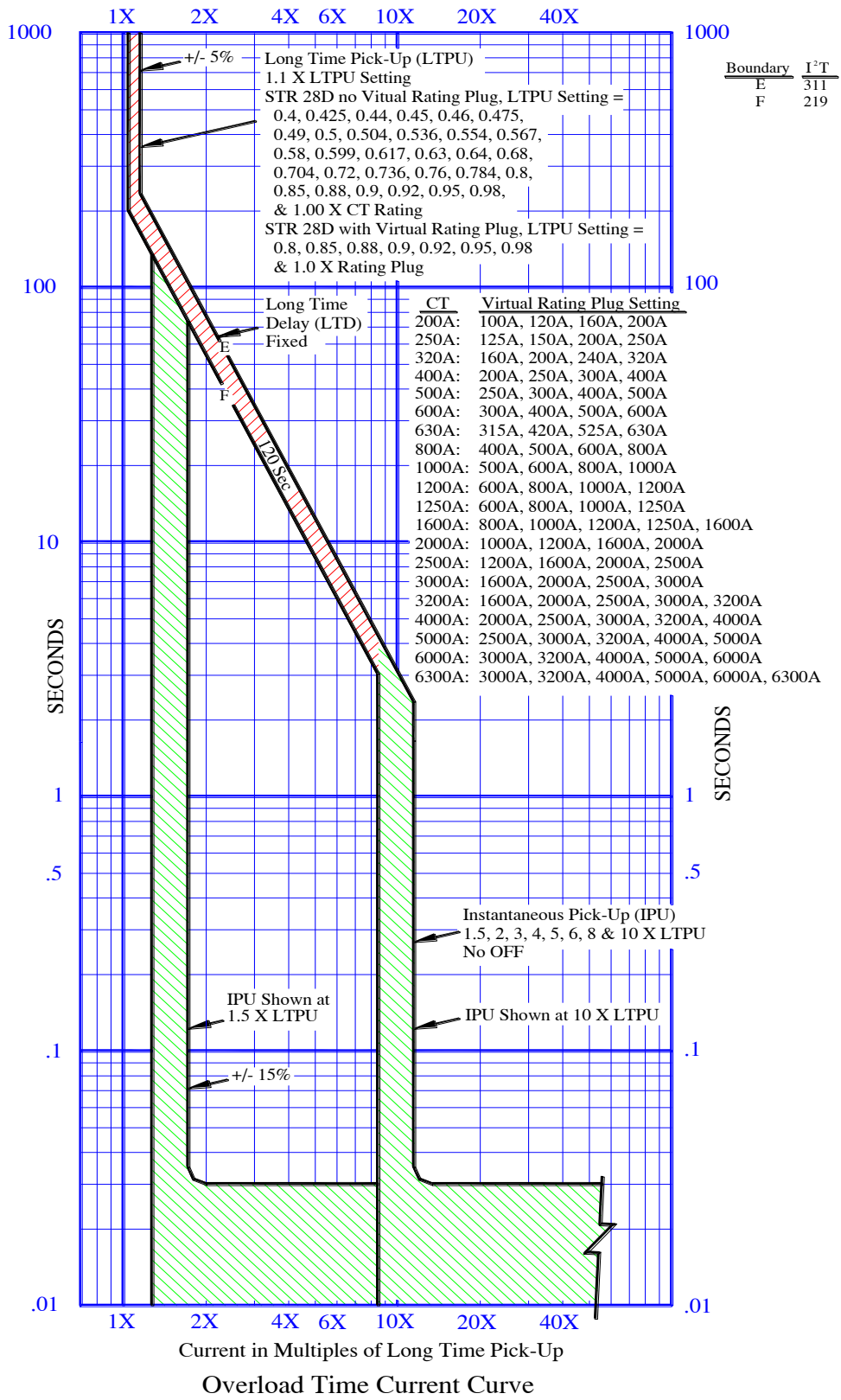


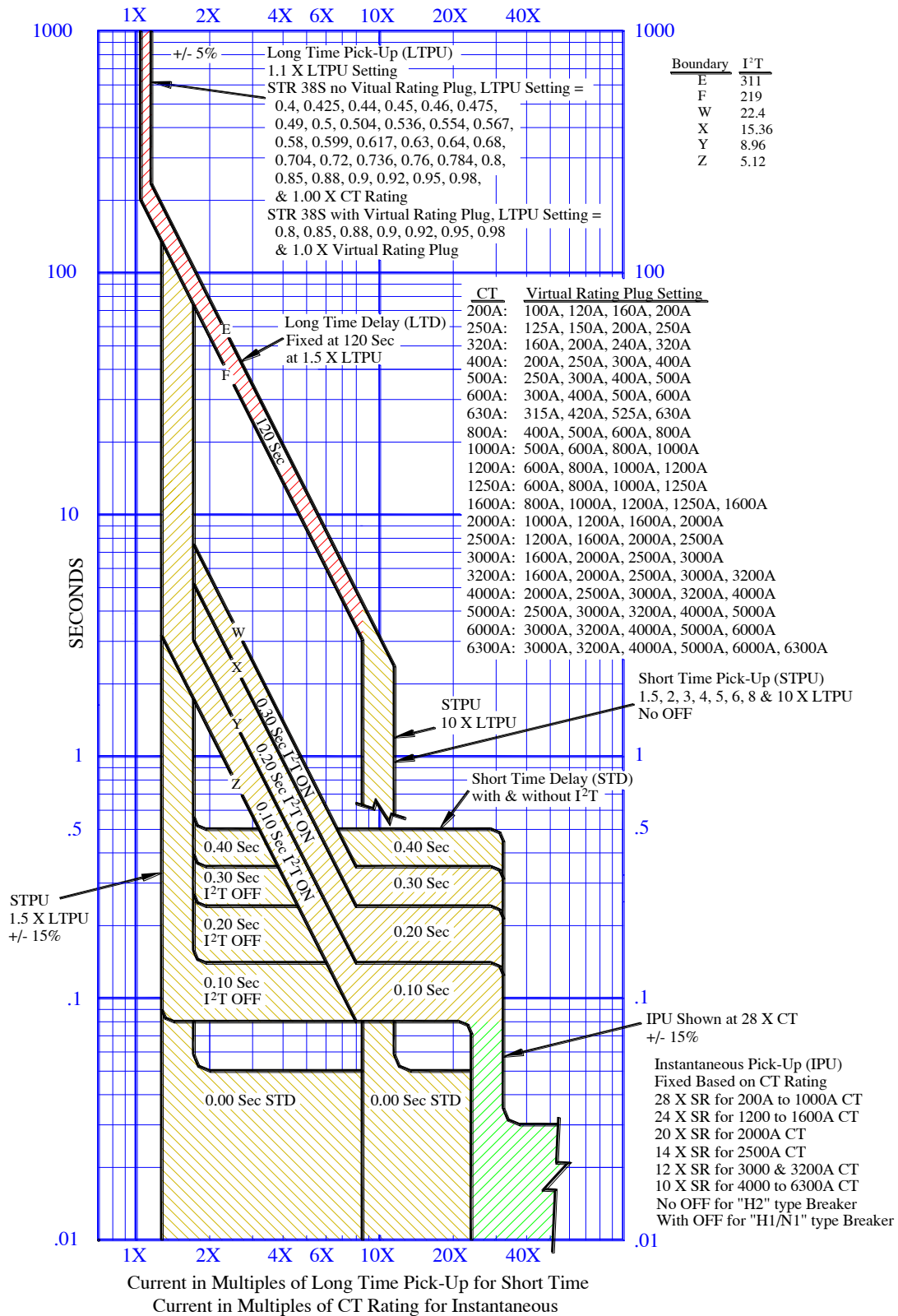
Figure 5  
AC-PRO-MP STR-18M Time-Current-Curve

### AC-PRO-MP® Trip Unit With STR-28D setting



**Figure 6**  
**AC-PRO-MP STR-28D Time-Current-Curve**

### AC-PRO-MP® Trip Unit With STR-38S setting



Overload Time Current Curve

**Figure 7  
AC-PRO-MP STR-38S Time-Current-Curve**

AC-PRO-MP® Trip Unit  
With STR-58U setting

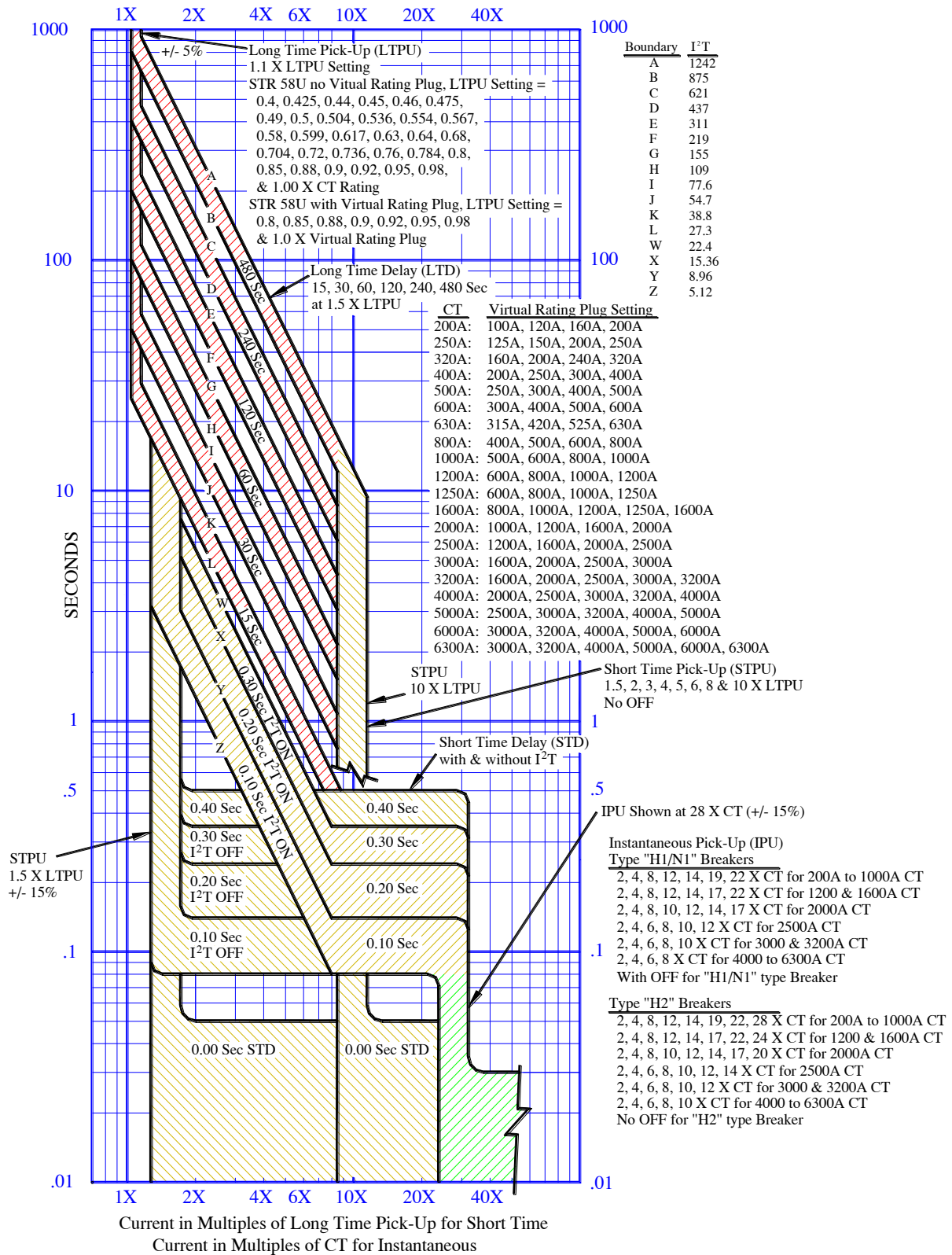


Figure 8  
AC-PRO-MP STR-58U Time-Current-Curve

AC-PRO-MP® Trip Unit  
With STR-38S & 58U setting

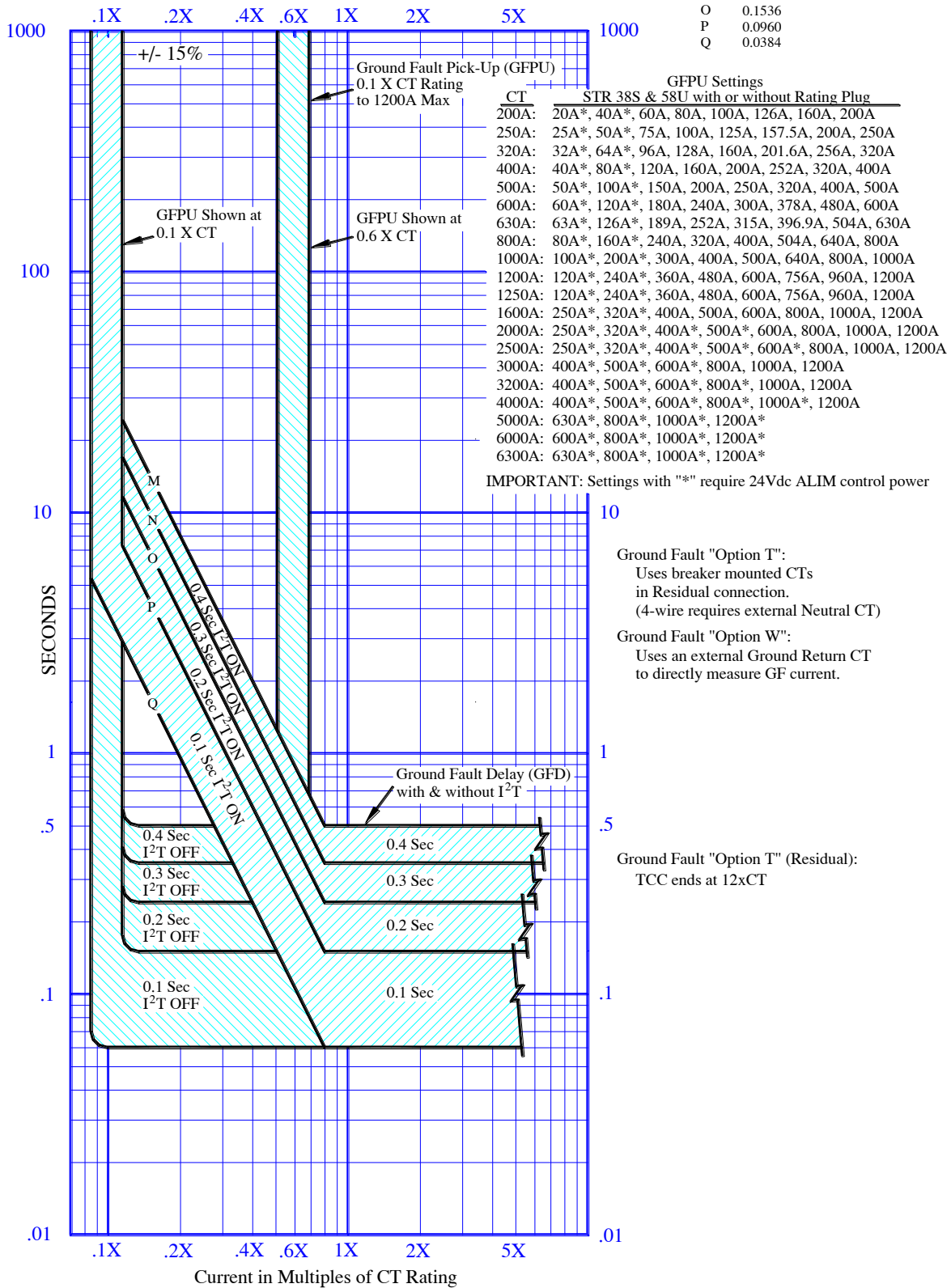
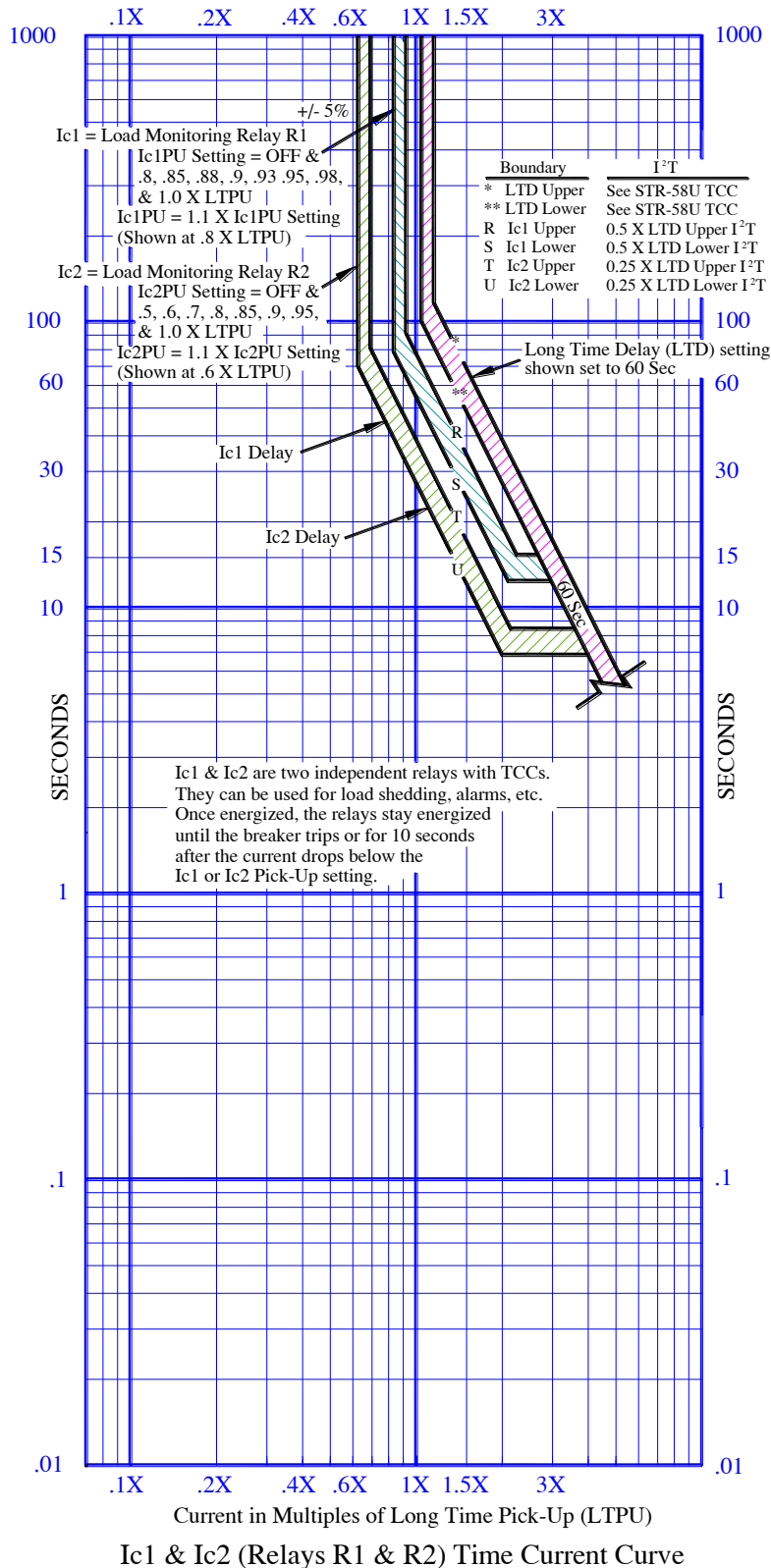


Figure 9  
AC-PRO-MP STR-38S & 58U Ground Fault Time-Current-Curve

AC-PRO-MP® Trip Unit  
with STR-58U setting



**Figure 10**  
**AC-PRO-MP STR-58U Load Monitoring Time-Current-Curve**



AC-PRO-MP® Trip Unit  
 QUICK-TRIP® Instantaneous

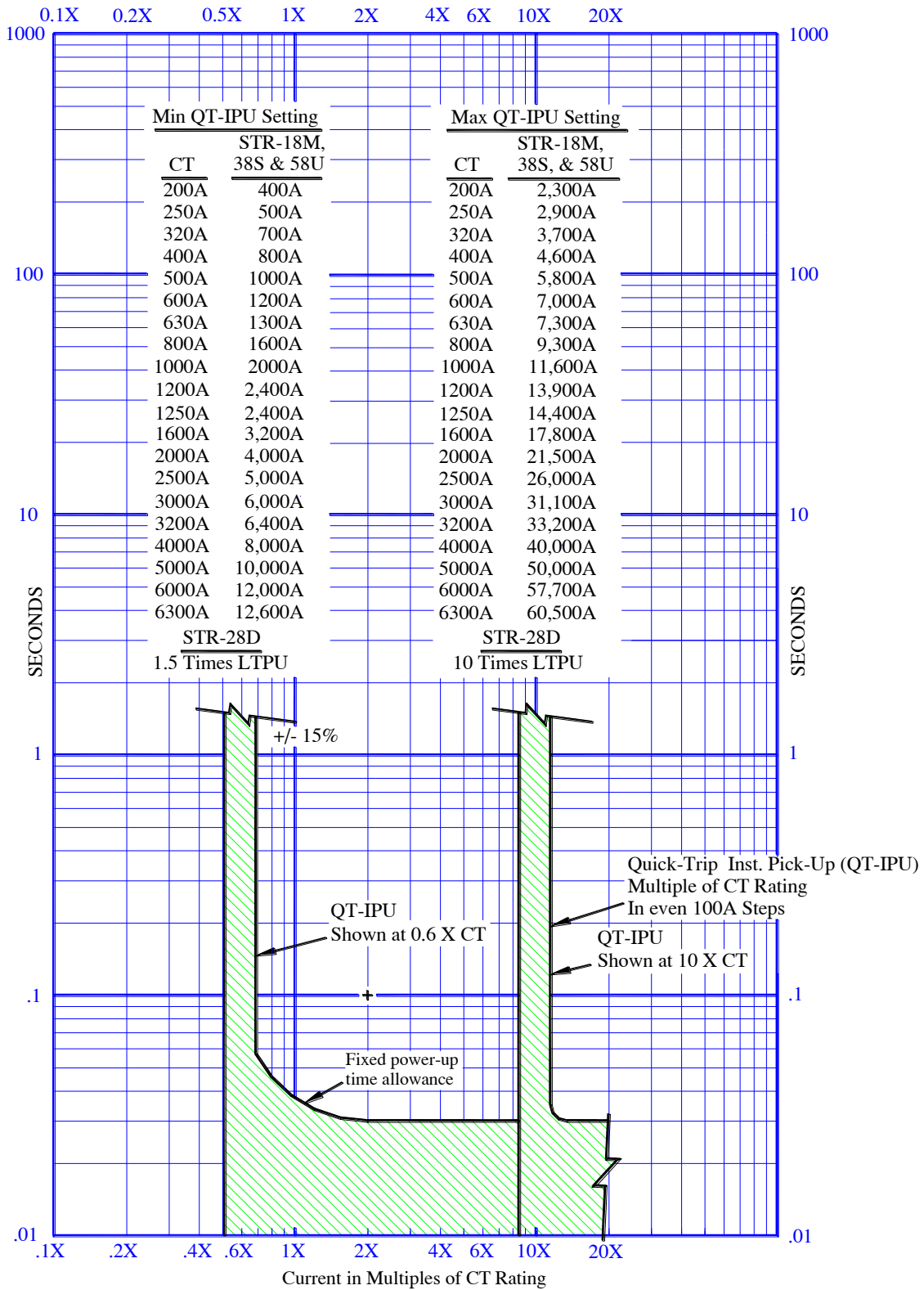


Figure 11  
 AC-PRO-MP Quick-Trip® Instantaneous Time-Current-Curve

AC-PRO-MP® Trip Unit  
 QUICK-TRIP® Ground Fault

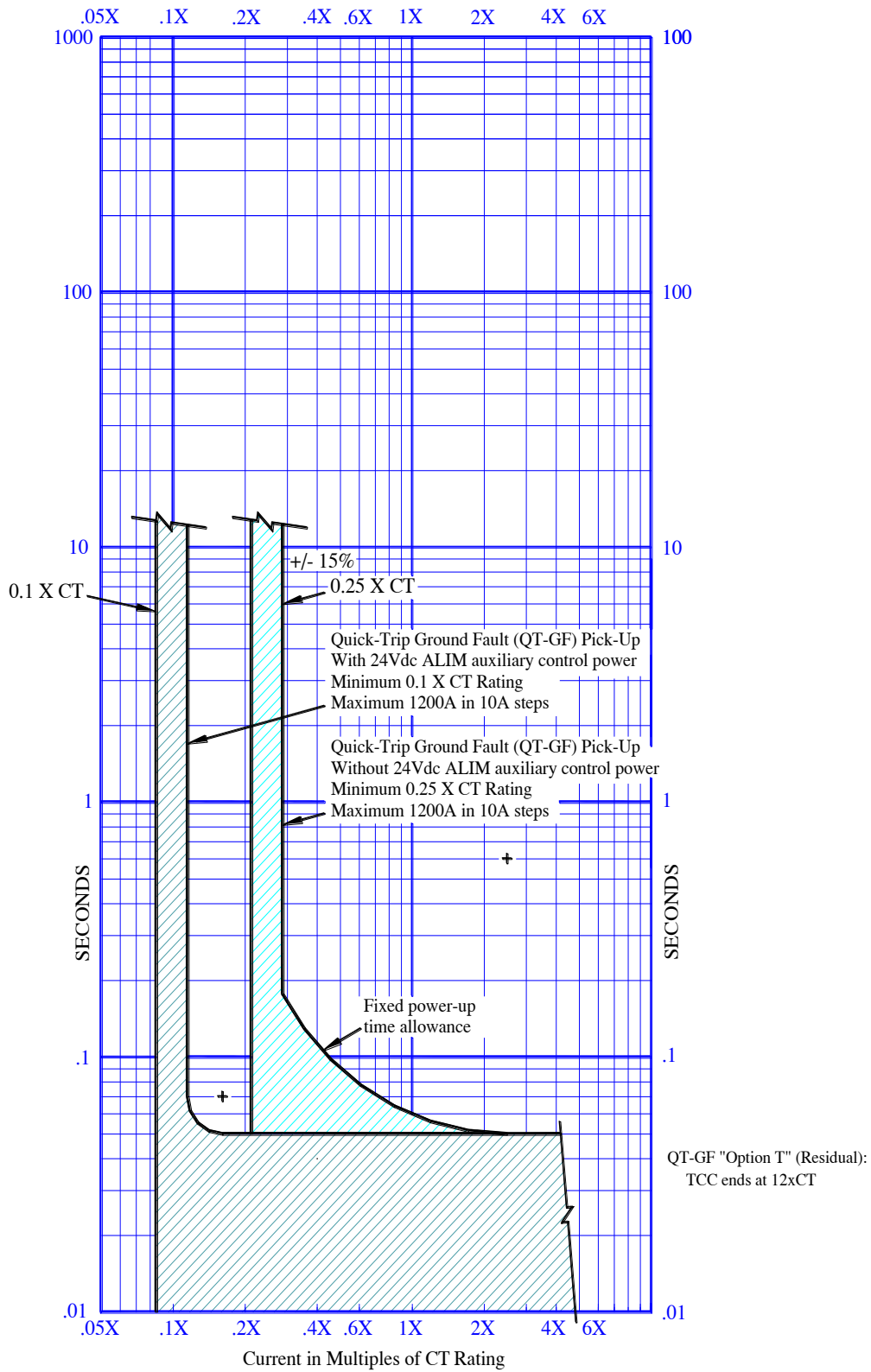


Figure 12  
 AC-PRO-MP Quick-Trip® Ground Fault Time-Current-Curve

This Page Intentionally Left Blank



**URC** Utility Relay Company



Chagrin Falls, OH 44023  
Phone: 888.289.2864  
[www.utilityrelay.com](http://www.utilityrelay.com)