INSTRUCTION MANUAL

AC Trip Unit
Injection Test Set

Secondary Injection Test Set
AC-PRO-II® & AC-PRO®

Secondary Injection Test Set
for AC-PRO-II® & AC-PRO® Trip Units

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For latest version, visit:
http://www.utilityrelay.com/Side_Bar/Instruction_Manuals.html

1.0 Introduction

The Model B-292 Secondary Injection Test Set is a single-phase test set specifically designed for testing the operation of the AC-PRO and AC-PRO-II microcontroller-based trip units manufactured by Utility Relay Company.

The earlier version test set with the "Red" panel, can only be used to test the AC-PRO. It cannot be used to test the AC-PRO-II.

The test set can test pick-up and time delays of the various protection functions by driving current into the trip unit on the secondary side of the CT circuit.

The test set will test 60, 50, 40 or 25 Hertz AC-PRO trip units. (The AC-PRO-II can be set for either 50 Hertz or 60 Hertz).

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

Important:
Secondary injection testing is not a substitute for primary injection testing. URC recommends primary injection testing for all circuit breaker retrofits.

2.0 Overview

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

Note: Numbers in parentheses refer to the labeled items in Figure 4.

Please reference the AC-PRO and AC-PRO-II users manuals for complete trip unit instructions.

Figure 1: Test Set Exterior

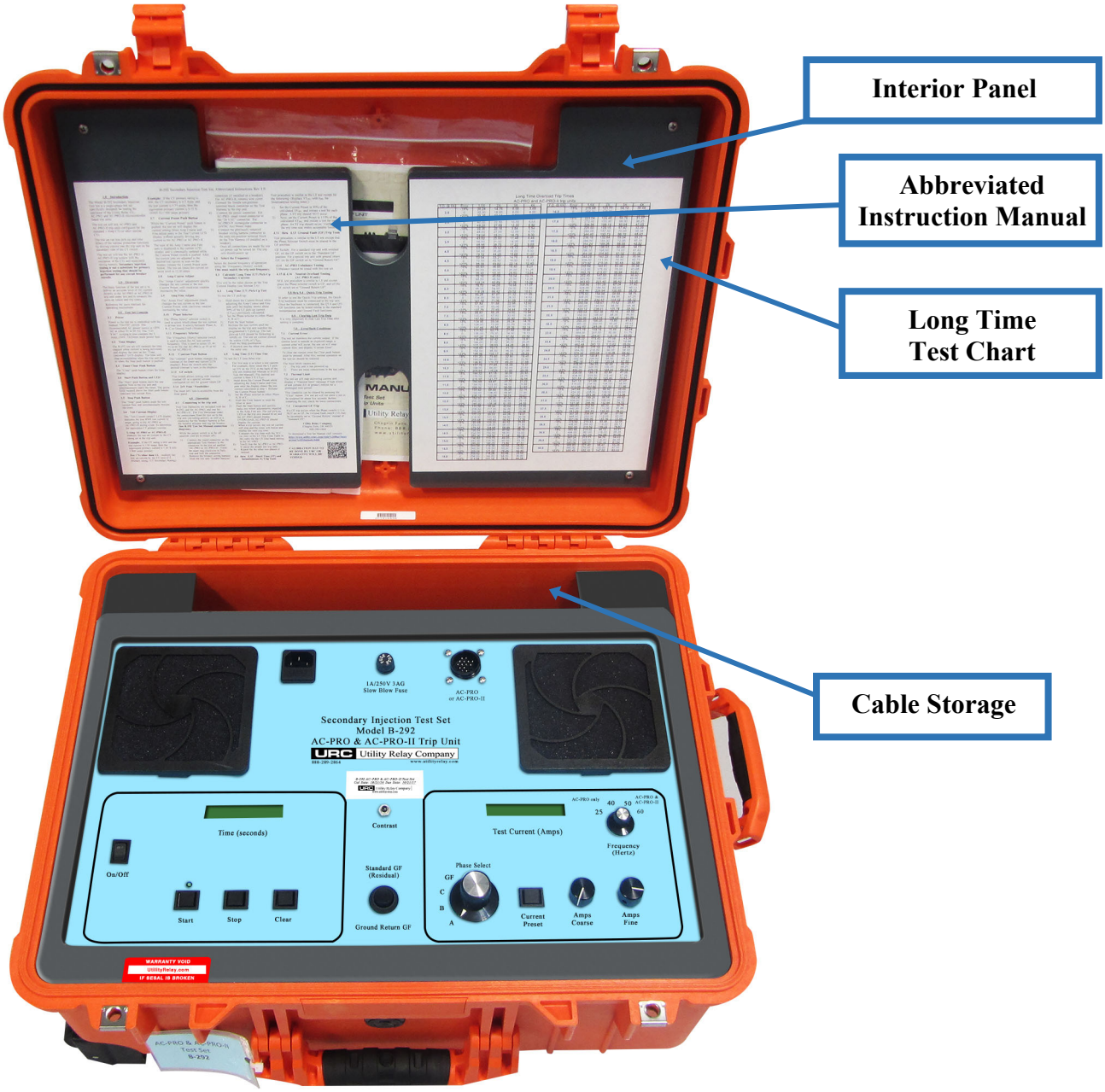


Figure 2: Test Set Case Interior

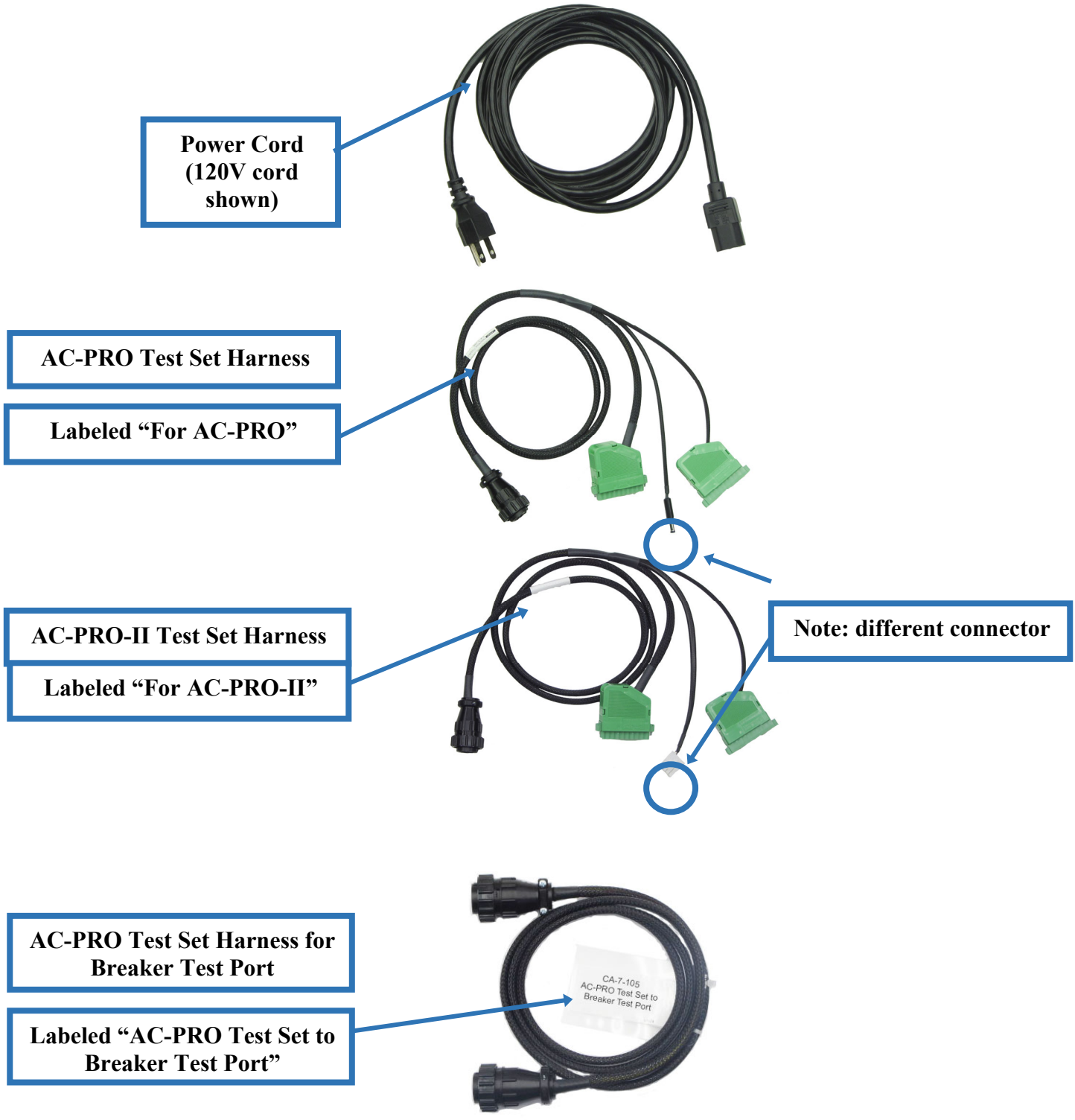
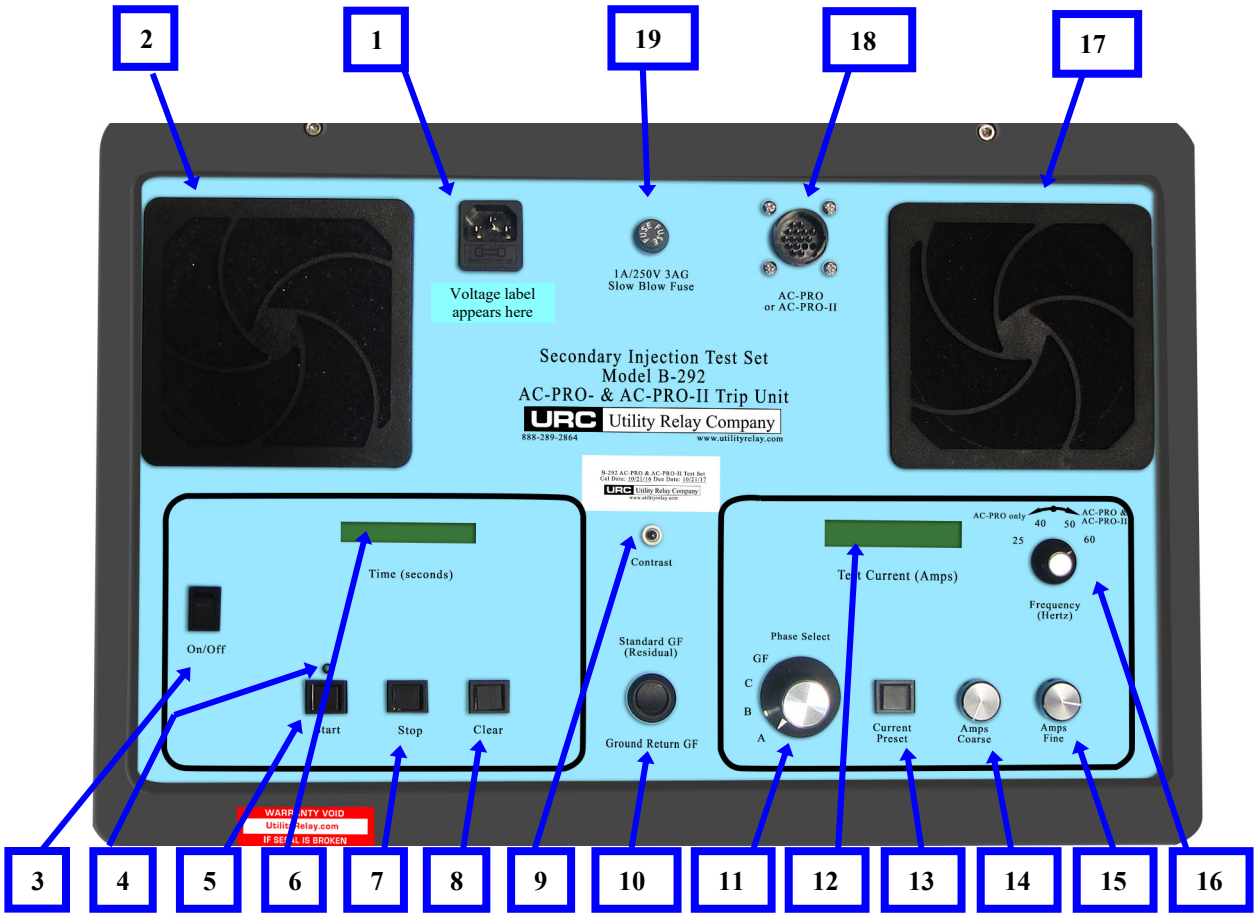


Figure 3: Test Set Cables



1 Power Cable/Fuse Holder
Power cable connector with main fuse. Note: ONLY connect a power source that matches the test set label. (two test set versions are available, 120VAC OR 250VAC)

2 Cooling Airflow Exhaust
Cooling air for the test set exits via this filter opening (must not be blocked).

3 Power ON/OFF Switch

4 Start LED
Illuminates when test current is flowing.

5 Start Push Button
Starts test current flow and starts the timer.

6 Timer Display
Displays elapsed time of test current flow in seconds.

7 Stop Push Button
Stops test current flow and freezes the timer.

8 Clear Push Button
Resets the timer to zero.

9 Contrast Push Button
Hold this button in until the desired display contrast is reached.

10 Ground Fault Type Select Switch
Selects between Standard Residual GF or Ground Return GF.

11 Phase Select Switch
Selects one of the phases (A,B,C) or ground fault as the test current path.

12 Current Display
Displays measured true RMS current and Current Preset value.

13 Current Preset Push Button
When held, the current display indicates the setting of the Amp Coarse and Fine pots but does not send current to the trip unit.

14 Amp Coarse Pot
Used to make large adjustments in current.

15 Amp Fine Pot
Used to make small adjustments in current.

16 Frequency Select Switch
This switch selects the AC frequency; 25, 40, 50 or 60 Hertz for AC-PRO. 50 or 60 Hertz for AC-PRO-II.

17 Cooling Airflow Intake
Cooling air for the test set enters via this filter opening (must not be blocked).

18 AC-PRO or AC-PRO-II Test Harness Connector
The trip unit connects to the test-set with the supplied wire harness via this connector.

19 24V Fuse / Fuseholder (fuse is rated 1A/250V, 3AG slow blow fuse)

Figure 4: 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 Figure 4.

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 AC power source can be 50 or 60Hz. ONLY connect a power source that matches the test set label. A 120VAC OR a 250VAC version of the test set is available (different versions). The receptacle also contains the 5 x 20mm main power fuse (rated 5A for 120V version, rated 3A for 250V version).

3.2 Time Display 6

The test set will measure the time elapsed while current is being delivered to the trip unit, 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 a trip occurs 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 (8) push button clears the Timer display.

3.4 Start Push Button and LED 5 4

The Start push button starts the test current flow to the trip unit 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 true RMS test current in Amps, going to the AC-PRO or AC-PRO-II during a test.

To determine the equivalent CT primary current:

1-Amp AC-PRO or AC-PRO-II…multiply the test set current by the CT Primary rating set in the trip unit.

For example:
If the CT primary rating is 600 and the test current is 1.50 amps, then the equivalent primary current is:

1.50 x 600 = 900 amps primary

0.5 Amp Example…multiply the test set current by the CT Ratio (CT Primary Rating ÷ CT Secondary Rating).

For example:
If the CT Primary Rating is 600, the CT Secondary Rating is 0.5A, and the test current is 0.75 amps, then the equivalent primary current is:

0.75 x (600 ÷0.5) = 900 amps

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT secondary rating.

****** IMPORTANT ******

The B-292 test set displays Current in Amps, which is most suitable for AC-PRO-II with CT secondary settings of 1-Amp. If the AC-PRO-II Phase and Neutral CT secondary settings are not 1-Amp, this must be considered when determining the equivalent primary current. Additionally, if the Phase and Neutral CT secondary settings are different values, these settings should be temporarily changed for secondary injection testing purposes.

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 (12) display without actually driving any current to the trip unit.

The sum of the Amp Coarse (14) and Fine (15) pots is displayed in the Current (12) display 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 13.50 amps.

3.8 Amp Coarse Adjust 14

The Amps Coarse adjustment quickly changes the test current to the trip unit or the test Current Preset, with clockwise rotation increasing the value.

3.9 Amp Fine Adjust 15

The Amps Fine adjustment slowly changes the test current to the trip unit or the test Current Preset, with clockwise rotation increasing the value.

3.10 Phase Selector 11

The Phase Select selector switch is used to select which phase of the trip unit the test current is driven into. It selects between Phase A, Phase B, Phase C or Ground Fault (Neutral).

3.11 Frequency Selector 16

The Frequency selector switch is used to select the AC test current frequency. This is used to select either 25, 40, 50 or 60 Hz for AC-PRO. The selections for AC-PRO-II are 50 or 60 Hertz.

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.

3.13 Ground Fault Type Selector Switch 10

The GF Type Selector switch selects between the standard "residual" ground fault trip unit and the special "ground return" ground fault trip unit.

For AC-PRO, the option label on the front of the AC-PRO indicates if that trip unit is the special factory-configured "ground return" type, with a “GR” suffix in the trip unit part number.

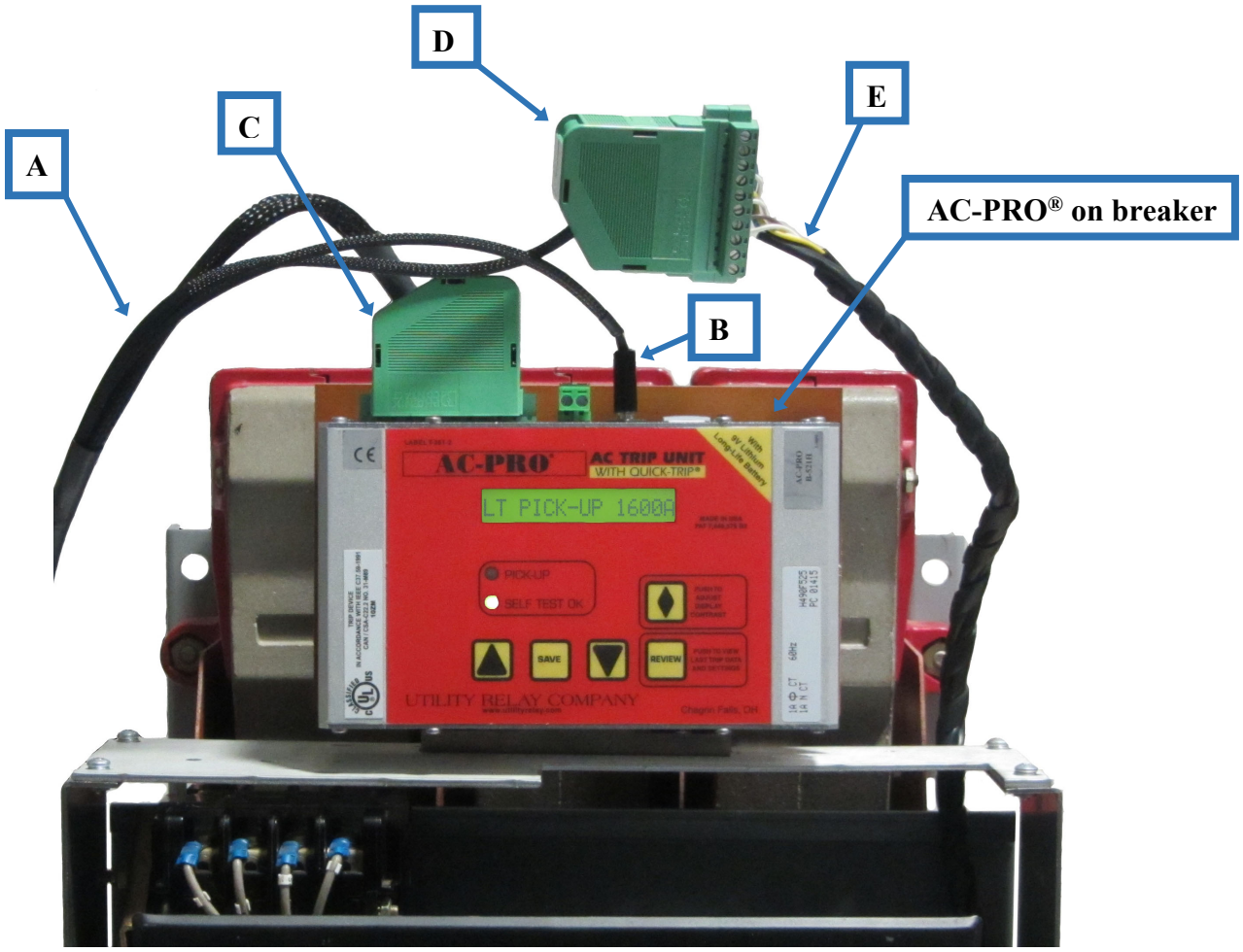
For AC-PRO-II, Ground Fault Type is a user setting. It can be set to Residual (standard) or Ground Return.

Push the GF Type Selector switch so the correct type of ground fault is selected.

Note: When the GF Type Switch is set to standard “residual” and Phase switch is set to A, B, or C, current is injected into the phase current input and returned through the neutral current input (to result in zero GF current). When the GF Type switch is set to “ground return” and Phase Switch is set to A, B, or C, current is injected into the Phase input only.

3.14 24V Fuse / Fuseholder 19

The main 24V fuse is accessible from the front panel. The fuse is rated 1A/250V max, type 3AG slow blow fuse.



A) AC-PRO Test Set Harness

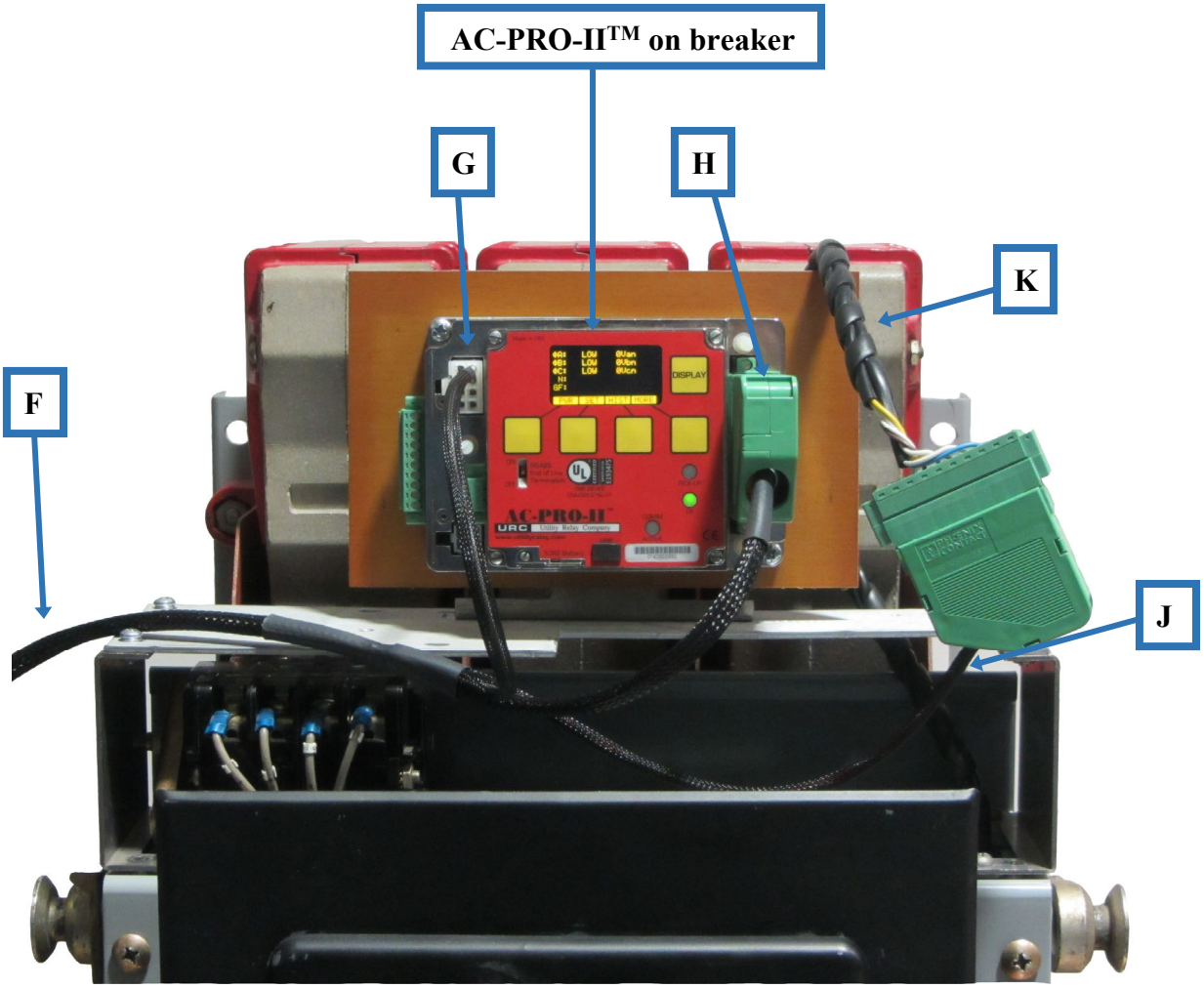
B) Test Set Power Plug to AC-PRO

C) Test Set AC-PRO Harness Main Connector

D) Test Set AC-PRO Harness Actuator Connector

E) Circuit Breaker Wiring Harness (previously connected to the AC-PRO)

Figure 5: AC-PRO Breaker Test Set Connections



F) AC-PRO-II Test Set Harness

G) Test Set Power Plug to AC-PRO-II (Remove the cover (not pictured) to gain access to the connector)

H) Test Set AC-PRO-II Harness Main Connector (Remove the wire guard (not pictured) to gain access to the connector)

J) Test Set AC-PRO-II Harness Actuator Connector

K) Circuit Breaker Wiring Harness (previously connected to the AC-PRO-II)

Figure 6: AC-PRO-II Breaker Test Set Connections

4.0 Operation

The following describes the operation of the test set. Note: Letters in parentheses refer to the labeled items in Figure 5 and Figure 6.

4.1 Connecting to AC-PRO or AC-PRO-II

The B-292 Test Set includes two Test Harnesses, one for AC-PRO and one for AC-PRO-II. The Test Harness (A) or (F) makes the connections from the test set to the trip unit (including power (B or G)). It also provides a connector for connection to the breaker harness (E) or (K) to allow the AC-PRO or AC-PRO-II to fire the breaker actuator and trip the breaker. See Figure 5 and Figure 6.

While the Power (3) switch is in the off position (red LED in switch off):

1) Connect the round connector on the Test Harness (A) or (F) to the connector on the test set marked "AC-PRO or AC-PRO-II" (18). Twist the outer ring clockwise to fully seat and lock the connector.
2) Remove the breaker wiring harness from the "breaker harness" connector on the trip unit (if installed on a breaker). For AC-PRO-II remove the wire guard (not pictured).
3) Connect the female ten-position terminal block connector (C) or (H) on the Test Harness to the trip unit.
4) AC-PRO: Connect the small round connector on the Test Harness (B) to the "24 VAC auxiliary power" jack.
   AC-PRO-II: Connect the white rectangular connector on the Test Harness (G) to the "24VDC Aux Power" input (after removing the connector cover).
5) Connect the previously removed breaker wiring harness connector to the male ten-position terminal block on the Test Harness Actuator Connector (D) or (J) (if installed on a breaker).
6) Once all connections are made the test set power can be turned on. The trip unit should also power up.

4.1.1 AC-PRO-GR, Ground Return Trip Unit

When testing a special AC-PRO trip unit with "ground return" ground fault, or AC-PRO-II with Ground Fault Type set to "Return", see Section 3.13.

4.2 Select the Frequency

Select the desired frequency of operation using the Frequency (16) selector switch. **This must match the trip unit frequency.**

4.3 Calculate Long Time (LT) Pick-Up Secondary Current

Calculate the secondary LT pick-up current (LT_{SPU}) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$LT_{SPU} = \frac{\text{LT Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the LT pick-up is 800 amps, then

$$LT_{SPU} = \frac{800}{1600} = 0.50 \text{ amp}$$

Example: If the CT Primary rating is 1600 and the LT pick-up is 1600 amps, then

$$LT_{SPU} = \frac{1600}{1600} = 1.00 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$LT_{SPU} = \frac{\text{LT Pick-Up}}{\text{CT Primary Rating}} \times 0.5$$

Example: If the CT Primary rating is 1600 and the LT Pick-Up is 800 amps, then

$$LT_{SPU} = \frac{800}{1600} \times 0.5 = 0.25 \text{ amp}$$

Example: If the CT Primary rating is 1600 and the LT Pick-Up is 1600 amps, then

$$LT_{SPU} = \frac{1600}{1600} \times 0.5 = 0.50 \text{ amp}$$

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT Secondary Rating.

Note: If Phase CT and Neutral CT do not have the same Secondary Rating (i.e. if both not 1-Amp), temporarily turn off Ground Fault Protection in the Trip Unit when performing Long Time, Short Time, and Instantaneous Tests.

4.4 Long Time (LT) Pick-Up Test

To test the LT pick-up:

1) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current (12) display shows about 90% of the LT pick-up current (LT_{SPU}) previously calculated.
2) Set the Phase selector (11) to either Phase A, B or C.
3) Push the Start (5) button.
4) Increase the test current until the display on the AC-PRO or AC-PRO-II matches the programmed LT pick-up. The red pick-up LED on the AC-PRO or AC-PRO-II should be flickering or solidly on. The test set current should be within ±10% of LT_{SPU}.
5) Push the Stop (7) button.
6) If desired, test the other two phases in the same way.

4.5 Long Time (LT) Time Test

To test the LT time delay trip:

1) The first step is to select a test current. For example, three times the LT pick-up (3X on the TCC in Figure 9 or Figure 12). The desired test current is then 3 X LT_{SPU}.

Note, to accurately test the LT delay, the test current must be at least 110% of the LT pick-up.

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 current calculated in step 1. Release the Current Preset (13) button.
3) Set the Phase selector (11) 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 and quickly make any minor adjustments required to the Amp Fine (15) pot. The red pick-up LED should be on. AC-PRO should display "OVERLOAD". AC-PRO-II should display the current value.
6) When the trip unit trips, the test set current will stop and the Timer (6) will freeze and display the total trip time.
7) Compare the trip time with the TCC in Figure 9 or Figure 12 for the LT time band setting in the AC-PRO or AC-PRO-II. The trip time can also be verified against the LT Test Chart on the inside panel of the test set case. The LT Test Chart is also available at: http://www.utilityrelay.com/PDFs/Product%20Manuals/AC-PRO_&_AC-PRO-II_LT_Trip_Times.pdf
Verify that the trip unit saved the proper last trip data.
8) Repeat for the other two phases if desired.

4.6 Calculate Short Time (ST) Pick-Up Secondary Current

Calculate the ST secondary pick-up current (ST_{SPU}) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$ST_{SPU} = \frac{\text{ST Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the ST pick-up is 6400 amps, then

$$ST_{SPU} = \frac{6400}{1600} = 4.00 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$ST_{SPU} = \frac{\text{ST Pick-Up}}{\text{CT Primary Rating}} \times 0.5$$

Example: If the CT Primary rating is 1600 and the ST pick-up is 6400 amps, then

$$ST_{SPU} = \frac{6400}{1600} \times 0.5 = 2.00 \text{ amp}$$

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT Secondary Rating.

Note: If Phase CT and Neutral CT do not have the same Secondary Rating (i.e. if both not 1-Amp), temporarily turn off Ground Fault Protection in the Trip Unit when performing Long Time, Short Time, and Instantaneous Tests.

4.7 Short Time (ST) Pick-Up Test

To test the ST pick-up:

1) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 90% of the calculated $ST_{SPU.}$
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.

   A ST trip should NOT occur.

4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 110% of the calculated $ST_{SPU.}$
5) Push the Clear (8) button to reset the Timer (6) to zero.
6) Push the Start (5) button.

   A ST trip should occur. The test set current will stop and the Timer (6) will freeze displaying the trip time.

7) Verify that the trip unit saved the proper last trip data.
8) Repeat for the other two phases if desired.

4.8 Short Time (ST) Test

To test the ST time delay trip:

1) The first step is to select a test current. For example, 150% of the ST pick-up. The desired test current is then 1.5 X ST_{SPU}.

   Note, to accurately test the ST delay, the test current must be at least 110% of the ST pick-up.

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 current calculated in step 1.
3) Set the Phase selector (11) 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 or AC-PRO-II trips, the test set current will stop and the Timer (6) will freeze displaying the trip time.
7) Compare the trip time with the TCC in Figure 9 or Figure 12 for the ST time band setting in the AC-PRO or AC-PRO-II.
8) Verify that the trip unit saved the proper last trip data.
9) Repeat for the other two phases if desired.

4.9 Calculate Instantaneous (I) Pick-Up Secondary Current

Calculate Instantaneous secondary pick-up current (I_{SPU}) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$I_{SPU} = \frac{\text{I Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and Instantaneous pick-up is 9600 amps, then:

$$I_{SPU} = \frac{9600}{1600} = 6.00 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$I_{SPU} = \frac{\text{I Pick-Up}}{\text{CT Primary Rating}} \text{ X } 0.5$$

Example: If the CT Primary rating is 1600 and Instantaneous pick-up is 9600 amps, then:

$$ST_{SPU} = \frac{9600}{1600} \text{ X } 0.5 = 3.00 \text{ amp}$$

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT Secondary Rating.

Note: If Phase CT and Neutral CT do not have the same Secondary Rating (i.e. if both not 1-Amp), temporarily turn off Ground Fault Protection in the Trip Unit when performing Long Time, Short Time, and Instantaneous Tests.

4.10 Instantaneous (I) Pick-Up Test

To test Instantaneous pick-up:

1) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 90% of the calculated I_{SPU}.
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 I trip occurs. If the current is left on long enough a LT or ST trip will occur. If ST is on, it is best to temporarily turn it off.

   An I trip should NOT occur.

4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 110% of the calculated I_{SPU}.
5) Push the Clear (8) button to reset the Timer (6) to zero.
6) Push the Start (5) button.

   An I trip should occur. The test set current will stop and the Timer (6) will freeze displaying the trip time.

7) Verify that the AC-PRO or AC-PRO-II saved the proper last trip data.
8) Repeat for the other two phases if desired.

4.11 Calculate Ground Fault (GF) Pick-Up Secondary Current

Calculate the GF secondary pick-up current (GF_{SPU}) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$GF_{SPU} = \frac{\text{GF Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the GF pick-up is 1200 amps, then:

$$GF_{SPU} = \frac{1200}{1600} = 0.75 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$GF_{SPU} = \frac{\text{GF Pick-Up}}{\text{CT Primary Rating}} \text{ X } 0.5$$

Example: If the CT Primary rating is 1600 and the GF pick-up is 1200 amps, then:

$$GF_{SPU} = \frac{1200}{1600} \text{ X } 0.5 = 0.38 \text{ amp}$$

Note: If the Neutral CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific Neutral CT Secondary Rating.

4.12 Ground Fault (GF) Pick-Up Test

Verify that the Ground Fault Type (10) selector switch is in the correct position for the AC-PRO or AC-PRO-II being tested.

To test the GF pick-up:

1) Set the Phase selector (11) switch to GF.
2) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 90% of the calculated GF_{SPU}.
3) Push the Start (5) button but leave the test current on only long enough to see if a GF trip occurs.

   A GF trip should NOT occur.

4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 110% of the calculated GF_{SPU}.
5) Push the Clear (8) button to reset the Timer (6) to zero.
6) Push the Start (5) button.

   A GF trip should occur. The test set current will stop and the Timer (6) will freeze displaying the trip time.

7) Verify that the trip unit saved the proper last trip data.

4.13 Ground Fault (GF) Time Test

To test the GF time delay trip:

1) The first step is to select a test current. For example, 150% of the GF pick-up. The desired test current is then 1.5 X GF_{SPU}.

   Note, to accurately test the GF delay, the test current must be at least 110% of the GF pick-up.

2) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Display (12) shows the test current 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 trip unit trips, the test set current will stop and the Timer (6) will freeze displaying the trip time.
7) Compare the trip time with the TCC in Figure 10 or Figure 13 for the GF time band and I^2T settings in the AC-PRO or AC-PRO-II.
8) Verify that the trip unit saved the proper last trip data.

4.14 AC-PRO Unbalance Testing

The AC-PRO Unbalance function cannot be tested with this test set.

4.15 Calculate Neutral Overload (NOL) Pick-Up Secondary Current

Calculate the secondary NOL pick-up current (NOL_{SPU}) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$NOL_{SPU} = \frac{\text{NOL Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the NOL pick-up is 800 amps, then

$$NOL_{SPU} = \frac{800}{1600} = 0.50 \text{ amp}$$

Example: If the CT Primary rating is 1600 and the NOL pick-up is 1600 amps, then

$$NOL_{SPU} = \frac{1600}{1600} = 1.00 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$NOL_{SPU} = \frac{\text{NOL Pick-Up}}{\text{CT Primary Rating}} \times 0.5$$

Example: If the CT Primary rating is 1600 and the NOL Pick-Up is 800 amps, then

$$NOL_{SPU} = \frac{800}{1600} \times 0.5 = 0.25 \text{ amp}$$

Example: If the CT Primary rating is 1600 and the NOL Pick-Up is 1600 amps, then

$$NOL_{SPU} = \frac{1600}{1600} \times 0.5 = 0.50 \text{ amp}$$

Note: If the Neutral CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific Neutral CT Secondary Rating.

4.16 Neutral Overload (NOL) Pick-Up Test (AC-PRO-II only)

To test the NOL pick-up:

1) Temporarily turn Ground Fault protection OFF in the trip unit.
2) Confirm the GF Switch (10) is in the "Ground Return GF" position.
3) Confirm the Phase Select Switch (11) is in the GF position.
4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current (12) display shows about 90% of the NOL pick-up current (NOL_{SPU}) previously calculated.
5) Set the Phase selector (11) to GF.
6) Push the Start (5) button.
7) Increase the test current until the display on the AC-PRO-II matches the programmed NOL pick-up. The test set current should be within ±10% of NOL_{SPU}.
8) Push the Stop (7) button.

4.17 Neutral Overload (NOL) Time Test (AC-PRO-II only)

To test the NOL time delay trip:

1) The first step is to select a test current. For example, three times the NOL pick-up (3X on the TCC in
2) Figure 15). The desired test current is then 3 X NOL_{SPU}.

Note, to accurately test the NOL delay, the test current must be at least 110% of the NOL pick-up.

3) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots until the Current (12) display shows the test current calculated in step 1. Release the Current Preset (13) button.
4) The GF Switch (10) should still be in the "Ground Return GF" position and the Phase selector (11) should still be set to GF.
5) Push the Clear (8) button to reset the Timer (6) to zero.
6) Push the Start (5) button and quickly make any minor adjustments required to the Amp Fine (15) pot. The AC-PRO-II should display the current value.
7) When the trip unit 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 TCC in
9) Figure 15 for the NOL time band setting in the AC-PRO-II.
10) Verify that the trip unit saved the proper last trip data.

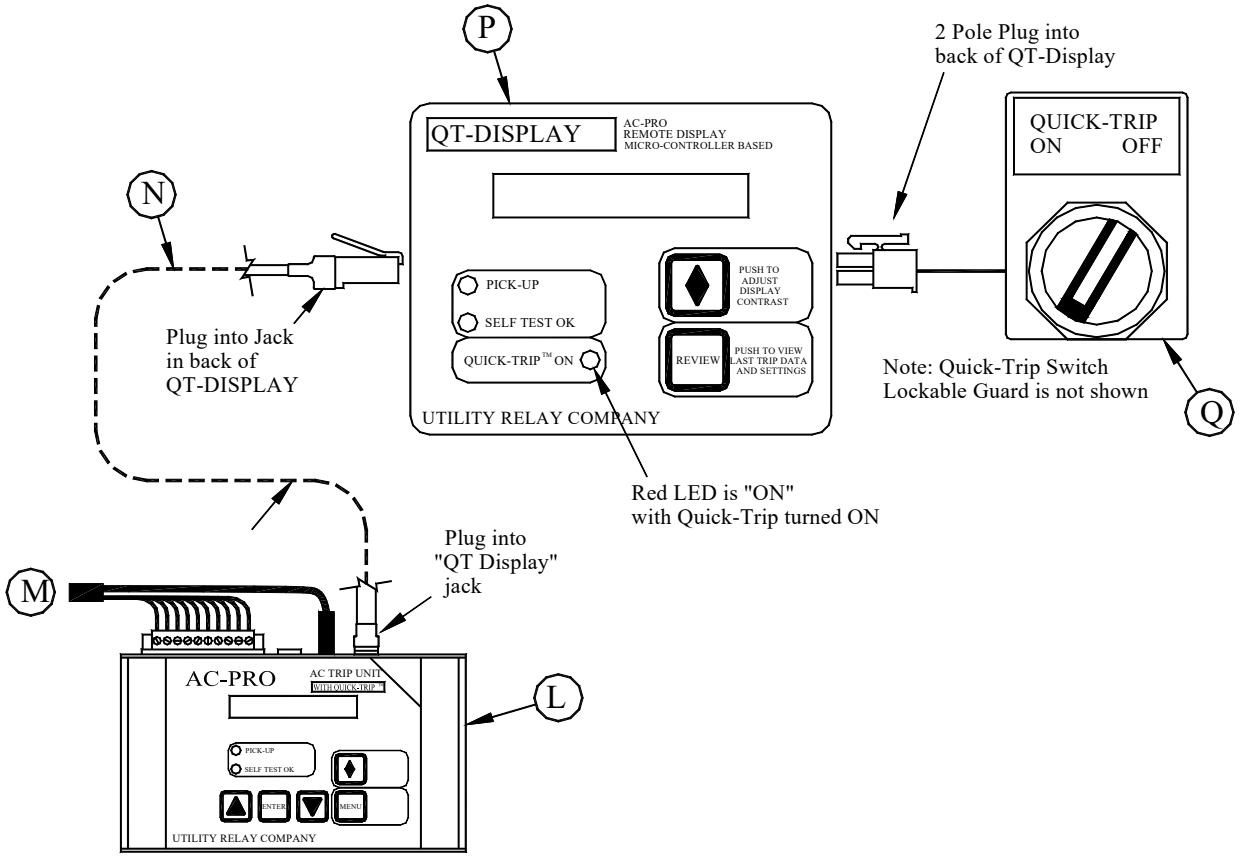


Figure 7: AC-PRO Quick-Trip Testing Connections

L) AC-PRO® Trip Unit

M) AC-PRO Test Set Harness

N) AC-PRO Shielded Cable: 8/C Shielded cable with modular connectors

P) QT-DISPLAY (for AC-PRO)

Q) Quick-Trip® ON/OFF Selector Switch (for AC-PRO)

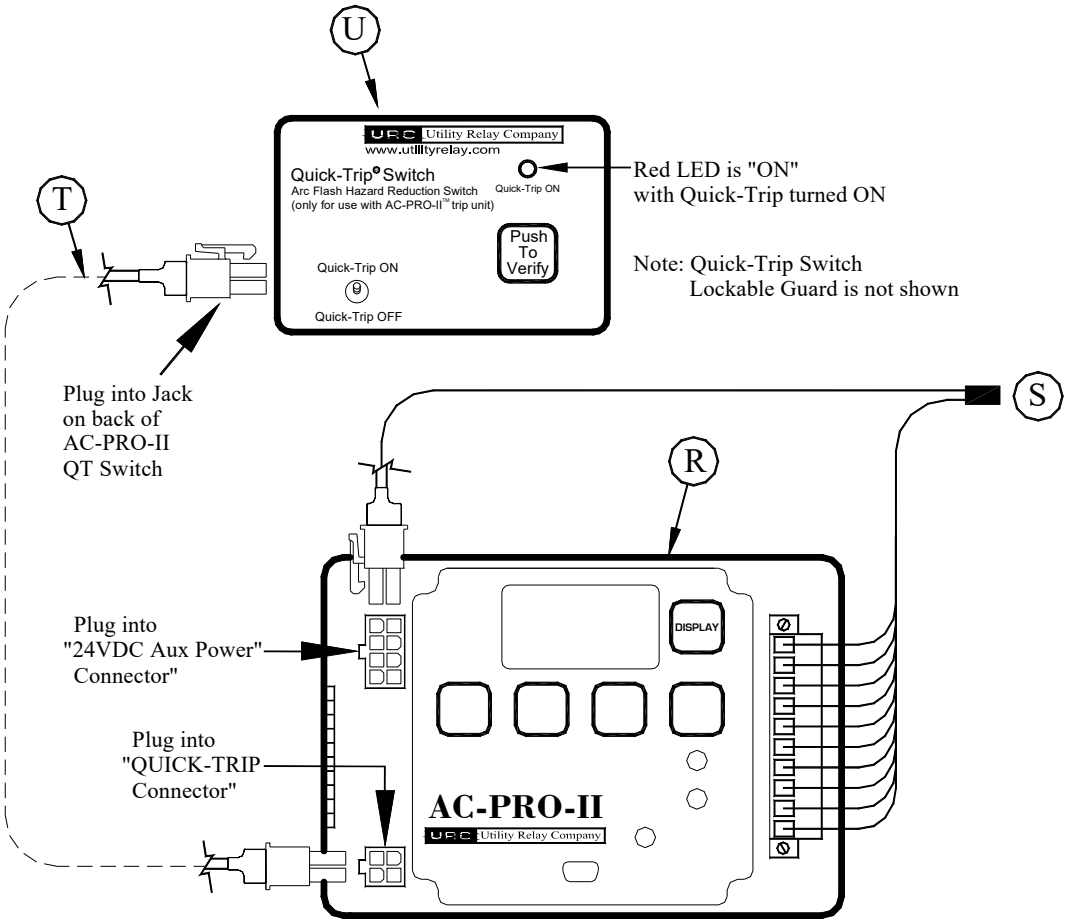


Figure 8: AC-PRO-II Quick-Trip Testing Connections

R) AC-PRO-II® Trip Unit

S) AC-PRO-II Test Set Harness

T) AC-PRO-II 4/C Quick-Trip cable

U) AC-PRO-II Quick-Trip® Switch

5.0 Quick-Trip® Testing

In order to test the Quick-Trip® settings, the QT-DISPLAY (P) and Quick-Trip ON/OFF Selector switch (Q) must be connected as shown in Figure 7 or Figure 8.

5.1 Calculate Quick-Trip Instantaneous (QT-I) Pick-Up Secondary Current

Calculate the QT-I secondary pick-up current (QT-ISPU) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$\text{QT-I}_{SPU} = \frac{\text{QT-I Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the QT-I pick-up is 9600 amps, then:

$$\text{QT-I}_{SPU} = \frac{9600}{1600} = 6.00 \text{ amp}$$

For 0.5 Amp AC-PRO or AC-PRO-II:

$$\text{QT-I}_{SPU} = \frac{\text{QT-I Pick-Up}}{\text{CT Primary Rating}} \times 0.5$$

Example: If the CT rating is 1600 and the QT-I pick-up is 9600 amps, then:

$$\text{QT-I}_{SPU} = \frac{9600}{1600} \times 0.5 = 3.00 \text{ amp}$$

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT Secondary Rating.

Note: If Phase CT and Neutral CT do not have the same Secondary Rating (i.e. if both not 1-Amp), temporarily turn off Ground Fault Protection in the Trip Unit when performing Quick-Trip Instantaneous Tests.

5.2 Quick-Trip Instantaneous (QT-I) Pick-Up Test

To test the QT-I pick-up:

1) AC-PRO: Connect the Quick-Trip Display (P) and the Quick-Trip ON/OFF Selector switch (Q) as shown in Figure 7.

   AC-PRO-II: Connect the AC-PRO-II Quick-Trip switch (U) as shown in Figure 8.

2) Set the Quick-Trip ON/OFF Selector switch (Q) or (U) to ON.
3) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 90% of the calculated QT-ISPU.
4) Set the Phase selector (11) to either Phase A, B or C.
5) Push the Start (5) button but leave the test current on only long enough to see if a QT-I trip occurs.

   A QT-I trip should NOT occur.

6) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 110% of the calculated QT-ISPU.
7) Push the Clear (8) button to reset the Timer (6) to zero.
8) Push the Start (5) button.

   A QT-I trip should occur. The test set current will stop and the Timer (6) will freeze displaying the trip time.

9) Verify that the trip unit saved the proper last trip data.
10) Set the Quick-Trip ON/OFF Selector switch (Q) or (U) to OFF.
11) Push the Start (5) button but leave the test current on only long enough to see if a QT-I trip occurs.

    A QT-I trip should NOT occur.

12) Repeat for the other two phases if desired.

5.3 Calculate Quick-Trip Ground Fault (QT-GF) Pick-Up Secondary Current

Calculate the QT-GF secondary pick-up current ($QT\text{-}GF_{SPU}$) as follows:

For 1-Amp AC-PRO or AC-PRO-II:

$$QT\text{-}GF_{SPU} = \frac{\text{QT-GF Pick-Up}}{\text{CT Primary Rating}}$$

Example: If the CT Primary rating is 1600 and the QT-GF pick-up is 1200 amps, then:

$$QT\text{-}GF_{SPU} = \frac{1200}{1600} = 0.75 \text{ amp}$$

For 0.5-Amp AC-PRO or AC-PRO-II:

$$QT\text{-}GF_{SPU} = \frac{\text{QT-GF Pick-Up}}{\text{CT Primary Rating}} \times 0.5$$

Example: If the CT Primary rating is 1600 and the QT-GF pick-up is 1200 amps, then:

$$GF_{SPU} = \frac{1200}{1600} \times 0.5 = 0.38 \text{ amp}$$

Note: If CT Secondary Rating is different than 1.0 or 0.5, use the 0.5 example above and replace 0.5 with the specific CT Secondary Rating.

5.4 Quick-Trip Ground Fault (QT-GF) Pick-Up Test

Verify that the Ground Fault Type (10) selector switch is in the correct position for the AC-PRO or AC-PRO-II being tested.

To test the QT-GF pick-up:

1) AC-PRO: Connect the Quick-Trip Display (P) and the Quick-Trip ON/OFF Selector switch (Q) as shown in Figure 7.
   AC-PRO-II: Connect the AC-PRO-II Quick-Trip switch (U) as shown in Figure 8.
2) Set the Quick-Trip ON/OFF Selector switch (Q) or (U) to ON.
3) Set the Phase Selector (11) switch to GF.
4) Hold down the Current Preset (13) while adjusting the Amp Coarse (14) and Fine (15) pots to 90% of the calculated $QT\text{-}GF_{SPU}$.
5) Push the Start (5) button but leave the test current on only long enough to see if a QT-GF trip occurs.

   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 110% of the calculated $QT\text{-}GF_{SPU}$.
7) Push the Clear (8) button to reset the Timer (6) to zero.
8) Push the Start (5) button.

   A QT-GF trip should occur. The test set current will stop and the Timer (6) will freeze displaying the trip time.

9) Set the Quick-Trip ON/OFF Selector switch (Q) or (U) to OFF.
10) Push the Start (5) button but leave the test current on only long enough to see if a QT-GF trip occurs.

    A QT-GF trip should NOT occur.

11) Verify that the trip unit saved the proper last trip data.

6.0 Clearing Last Trip Data

It is very important to clear the Last Trip Data from the trip unit after testing is complete. Leaving the Last Trip Data in the trip unit will later cause confusion for operating personnel. Follow the Instructions in the AC-PRO or AC-PRO-II trip unit Instruction Manual.

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”.

To clear the current error the Clear (8) button must be pressed. After this, normal operation on the test set should be restored after the reason causing the error is corrected.

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.

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.

7.3 Unexpected GF Trip

If a GF trip occurs when the Phase Selector (11) switch is NOT set to GF, the Ground Fault Type (10) selector switch may be incorrectly set to "Ground Return" instead of "Standard GF".

8.0 Specifications

Dimensions: 22.1" L x 17.9" W x 10.4" D
(560mm x 455mm x 265mm)

Weight: 39 lbs (17.7 kg)

Power Requirement:
120V, 3A or 250V, 2A
Note: Power source MUST match label
(the 120V and 250V are different versions of the test set)

Current output:
Single-phase, 0-13.5A.
Frequency: 25, 40, 50, or 60 Hertz

Current Display: 0.01 Amp resolution

Time Display: 0.01 Second resolution

Case Information:

- IP67 Water Resistant and Dust-proof
- Chemical Resistant
- Impact-resistant Construction
- Copolymer Polypropylene Compound

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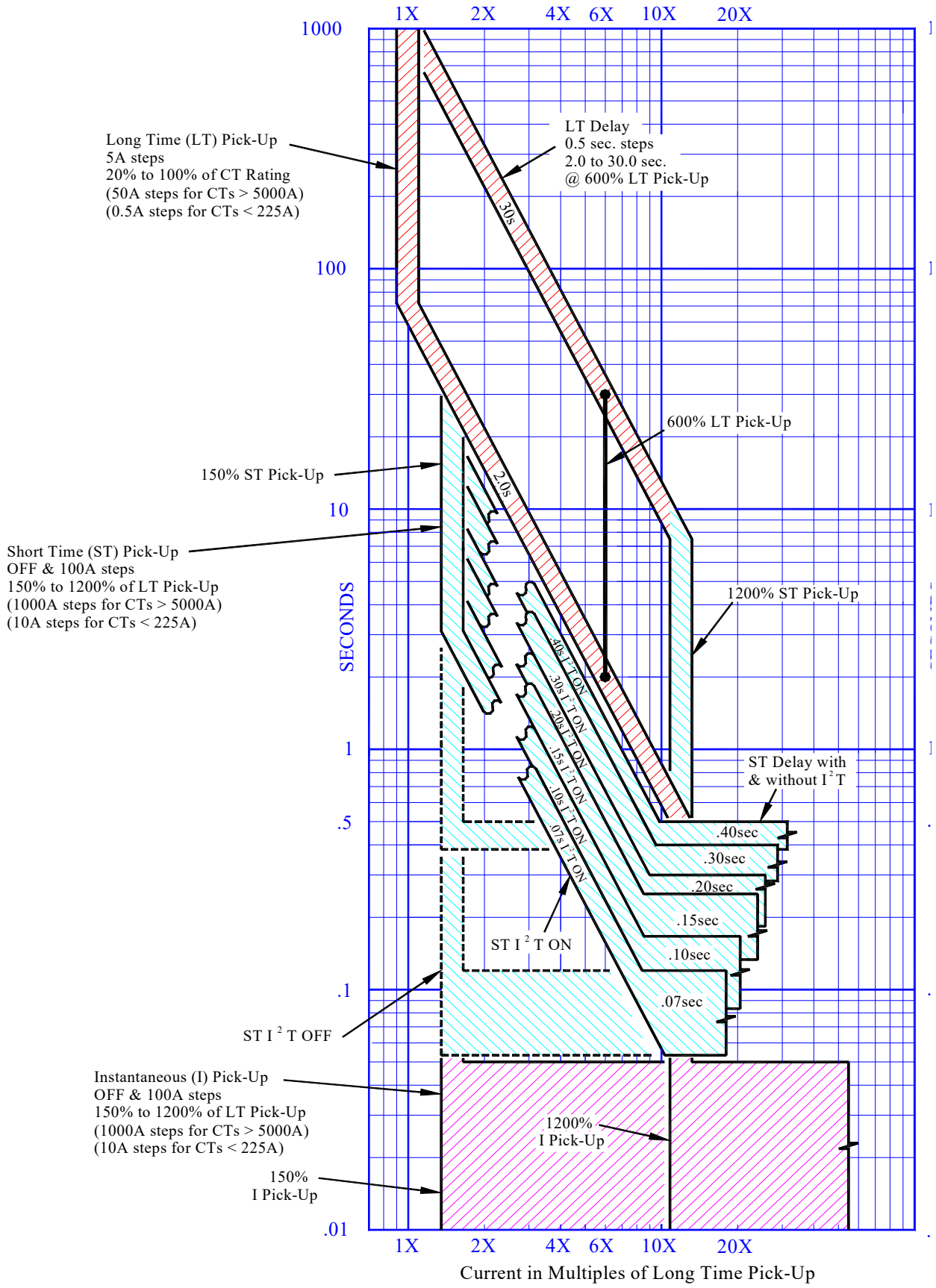


Figure 9: AC-PRO Overload TCC

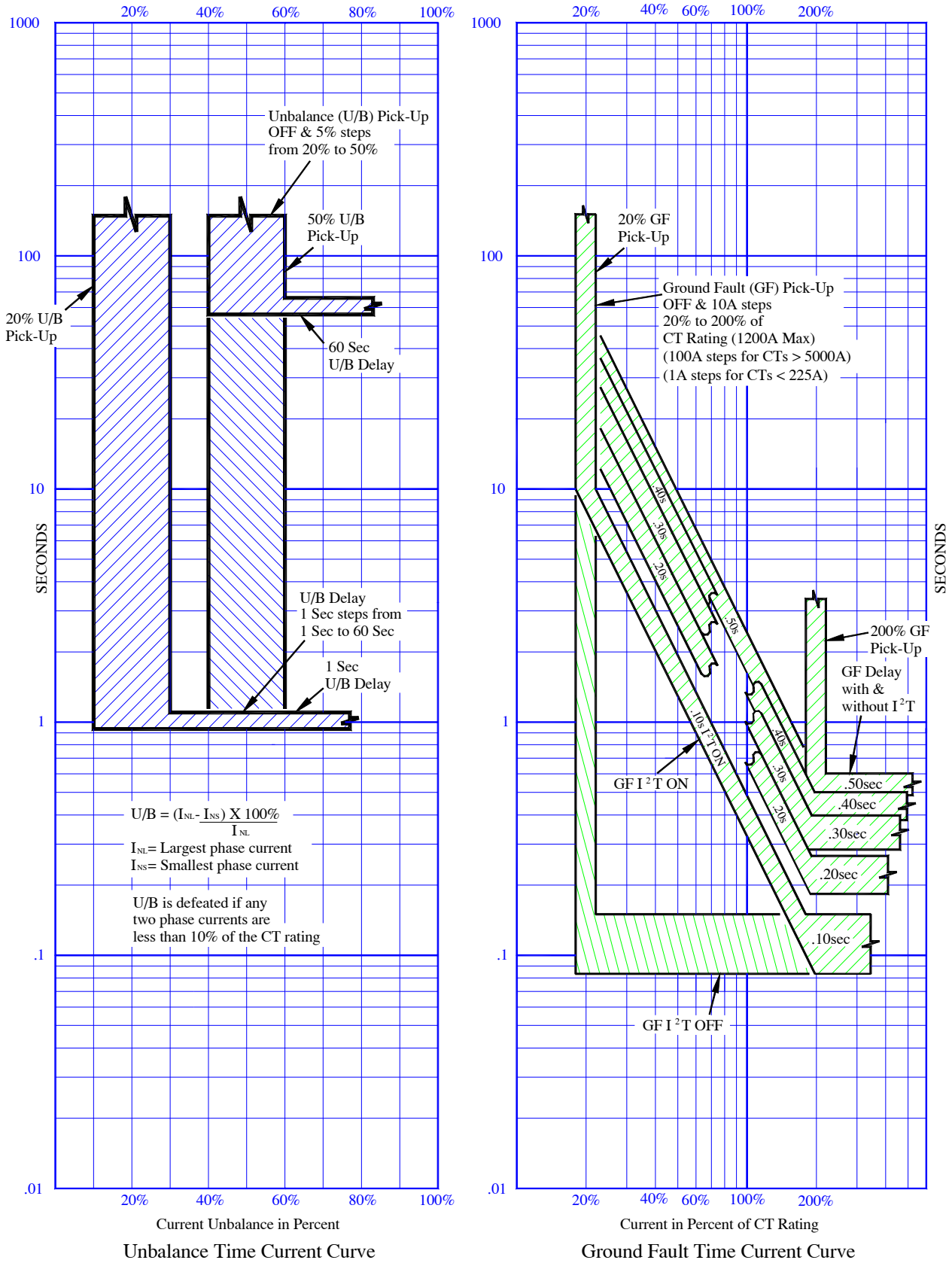
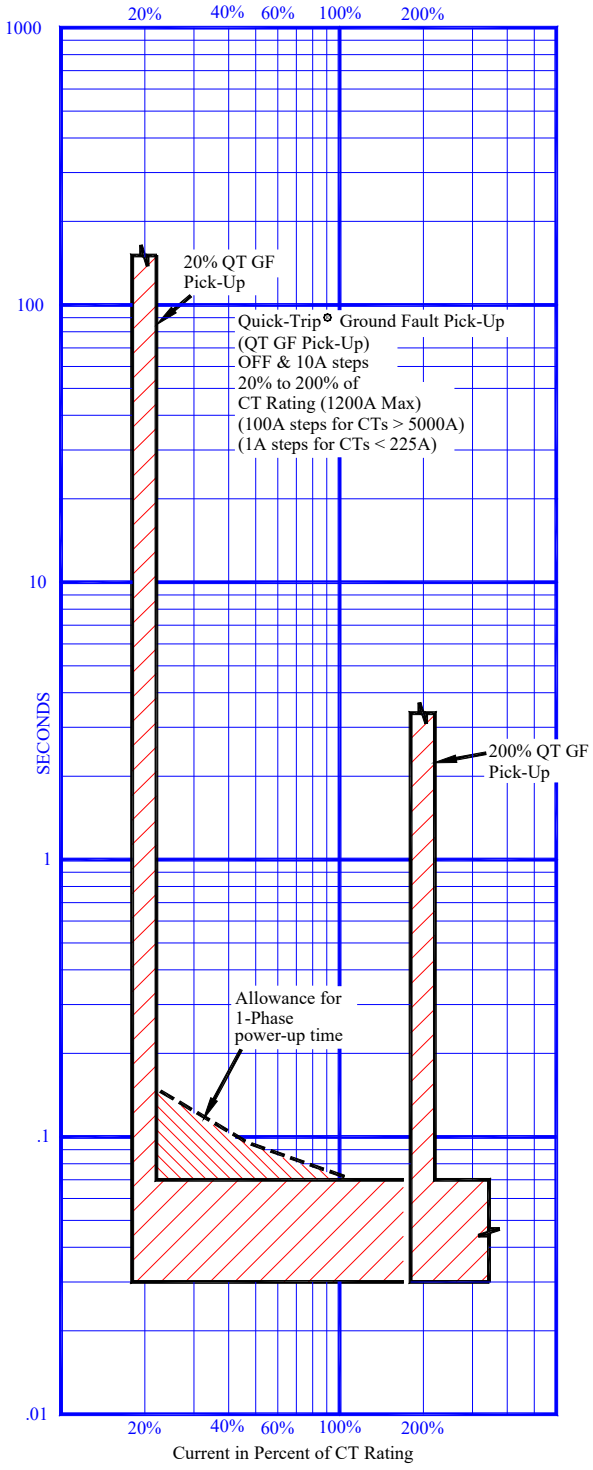
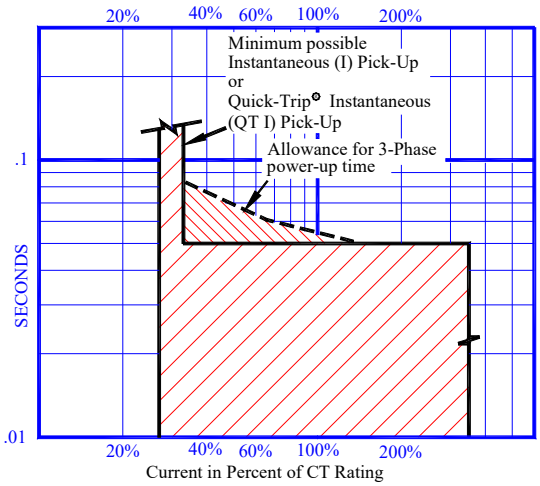


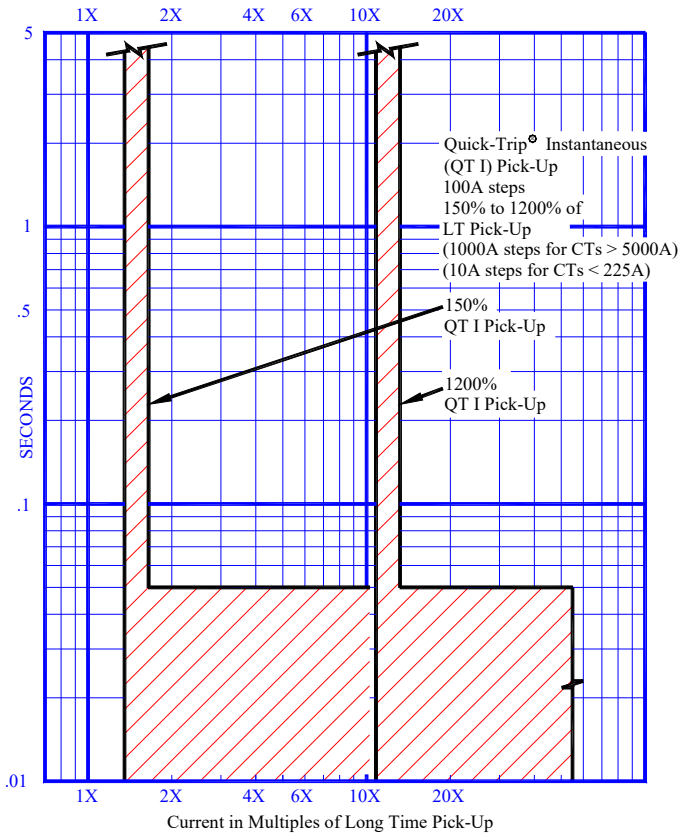
Figure 10: AC-PRO Unbalance TCC & Ground Fault TCC



Quick-Trip® Ground Fault Time Current Curve



Instantaneous Allowance for 3-Phase Power-Up Time
For Very Low QT-I Settings



Quick-Trip® Instantaneous Time Current Curve

Figure 11: AC-PRO Quick-Trip TCC

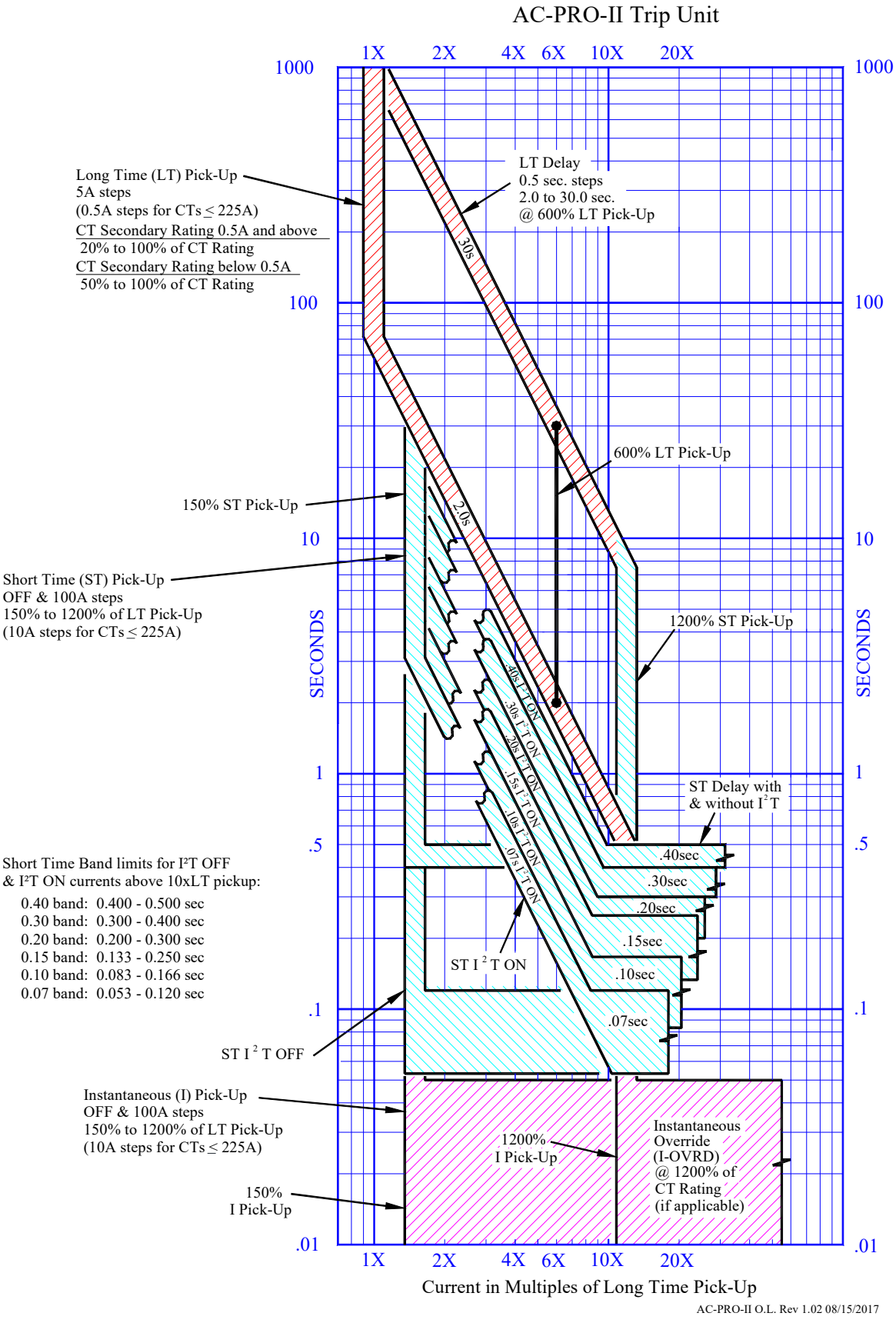


Figure 12: AC-PRO-II Overload TCC

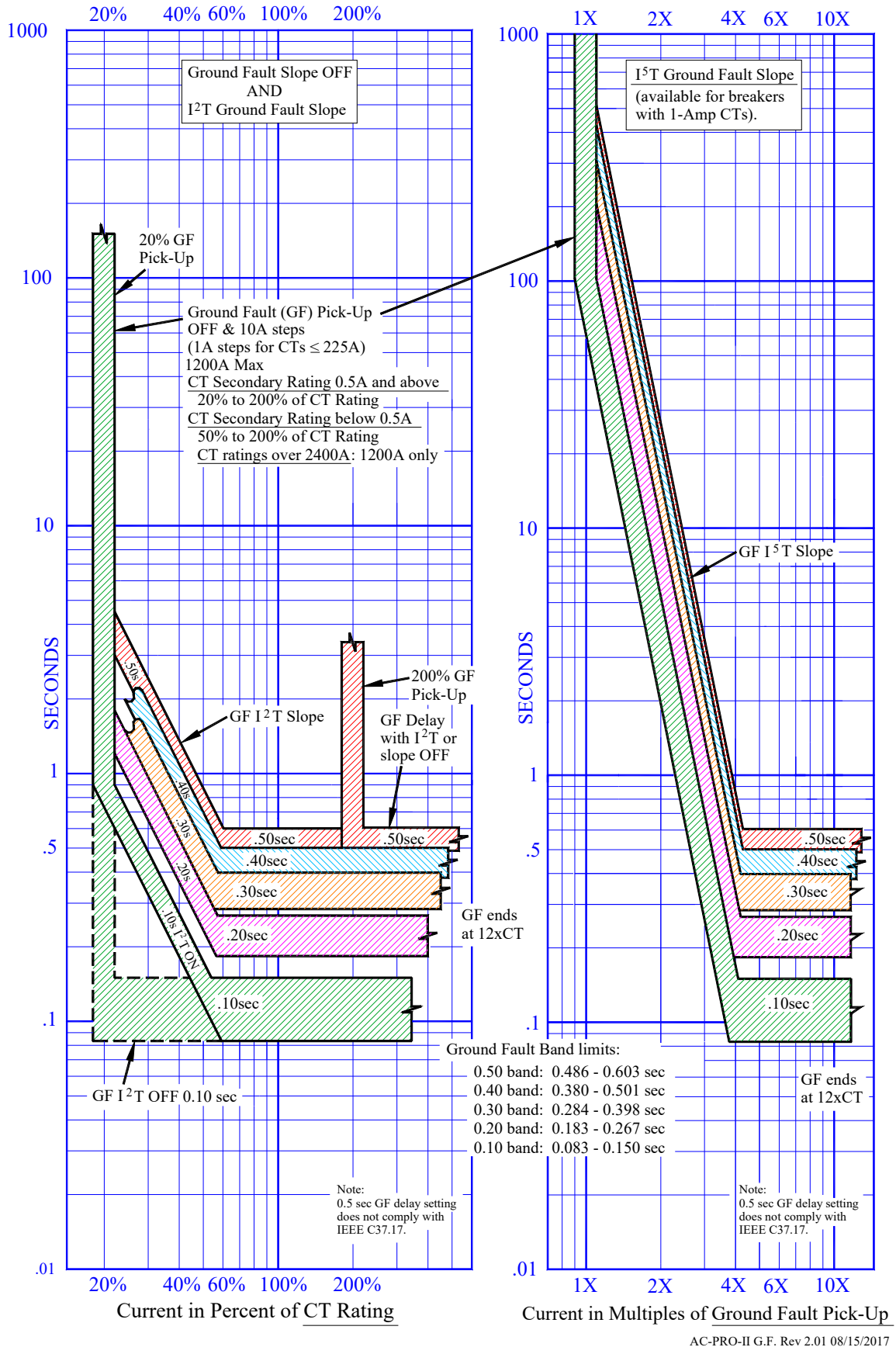


Figure 13: AC-PRO-II Ground Fault TCC

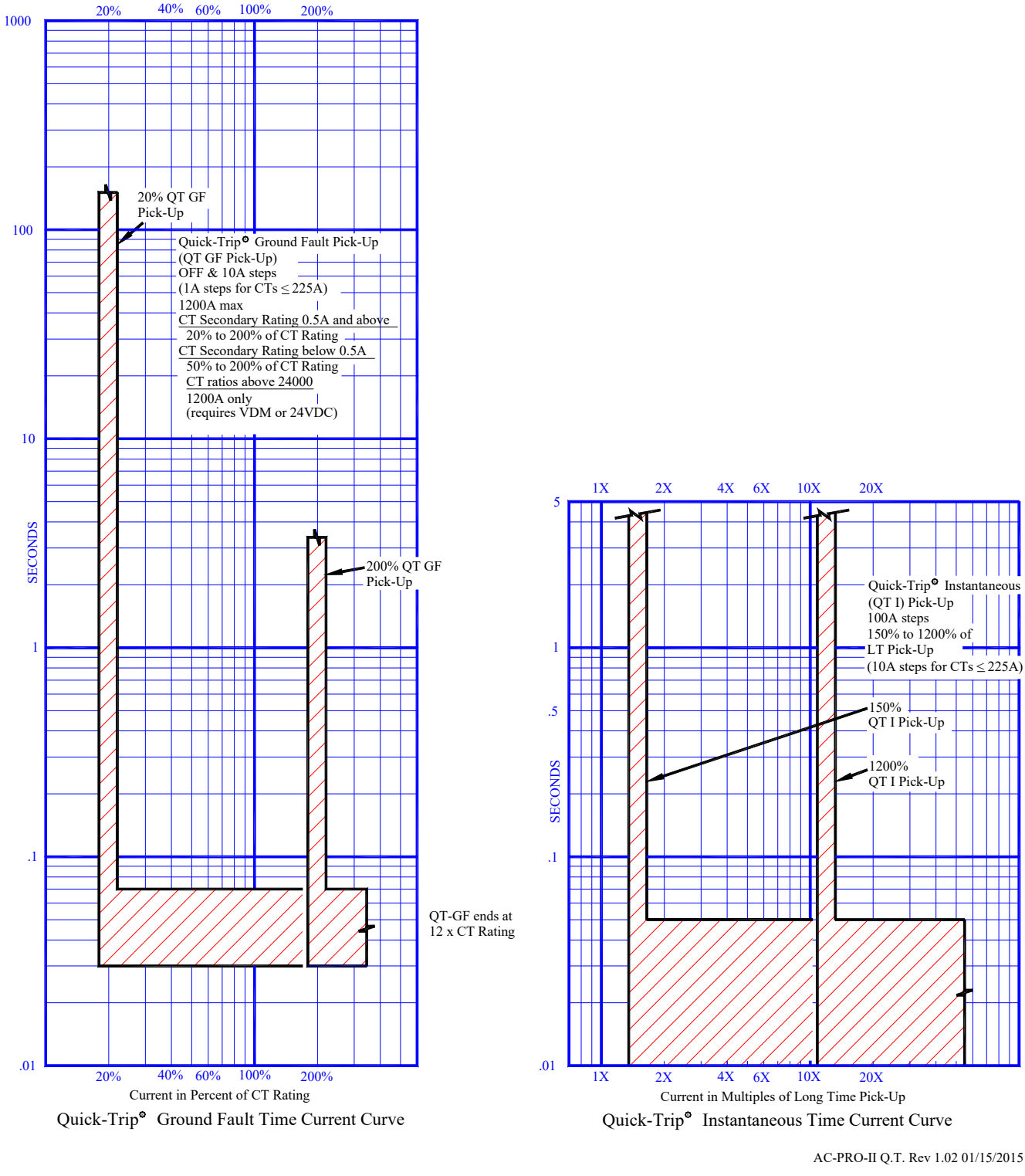


Figure 14: AC-PRO-II Quick-Trip TCC

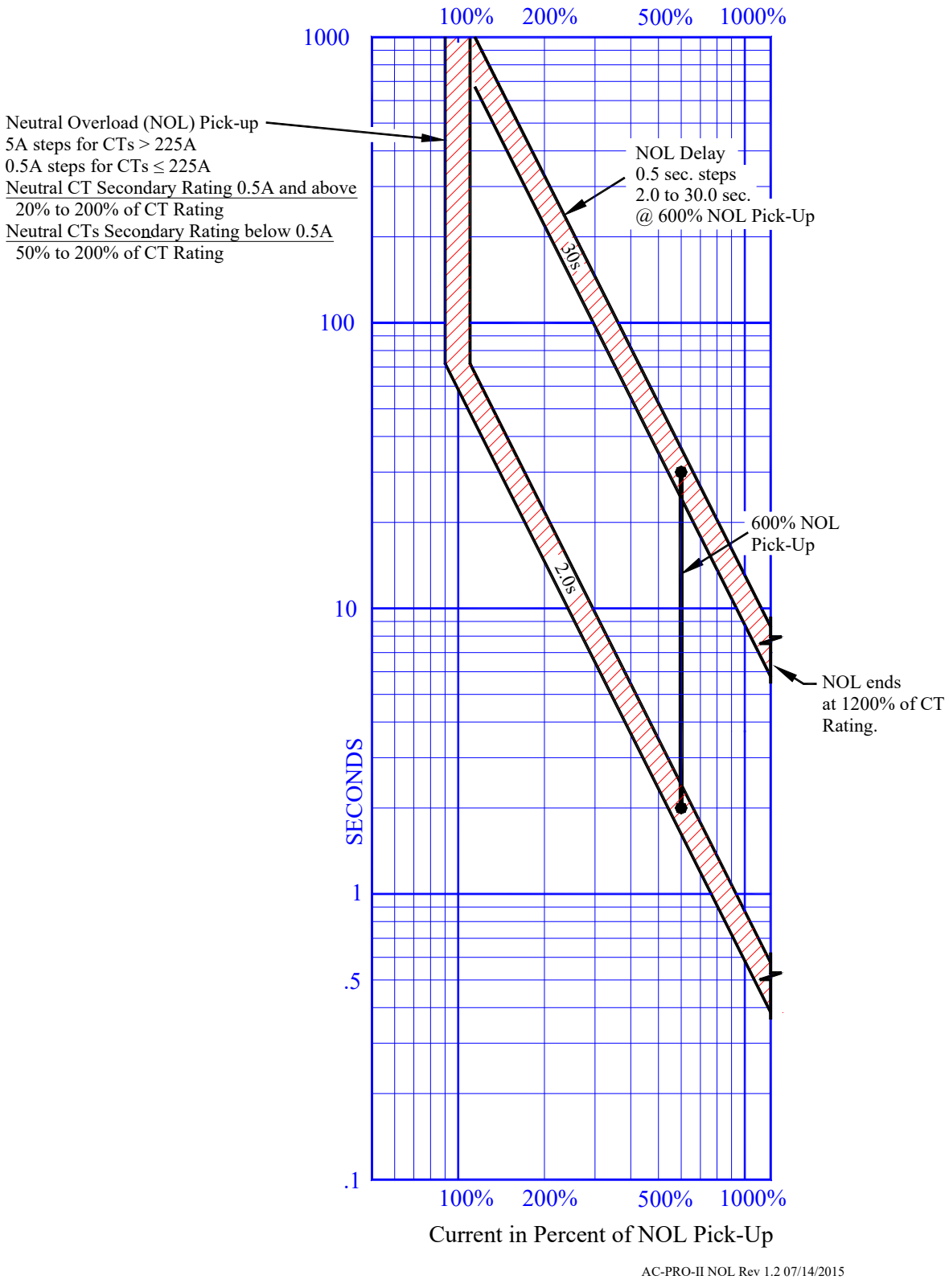


Figure 15: AC-PRO-II Neutral Overload TCC

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