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1.0 Introduction

Opti-Trip II RMS is a state of the art, micro-controller based trip unit intended for use on 600 Volt class draw out air circuit breakers.

The trip unit is a digital design using a Motorola HC7llE9, 8-bit micro-controller and a 16-character liquid crystal display (LCD).

The trip unit provides 3-phase over-current and fault protection. Ground over-current protection is also available.

The trip unit is "direct acting" since it does not require an external power source to perform it's protection function. Power is taken directly from the currents the trip unit is monitoring by way of a set of current transformers (CTs).

Every effort was made to design and produce a reliable, accurate and "user friendly" trip unit.

****IMPORTANT****
The trip unit will NOT FUNCTION as it is shipped from the factory. The user must first COMMISSION the unit as outlined in section 5.0 to make it functional.

As part of the manufacturing quality control, each trip unit is "burned in" under load for a nominal 4-day period at 150°F ambient.

1.1 Options

The following options are available:

a) Ammeter display.

b) Ground fault protection for 3-phase, 3-wire or 4-wire systems.

c) 25Hz, 40Hz and 50Hz units.

1.2 Model Designation

The first two digits of the trip unit serial number contains the model number designation as follows:

Model #	Trip Function	Ammeter Option	Frequency	Communications Option
00XXXXX	LSI	NO	60HZ	NO
01XXXXX	LSIG	NO	60HZ	NO
04XXXXX	LSI	YES	60HZ	NO
05XXXXX	LSIG	YES	60HZ	NO
10XXXXX	LSI	NO	50HZ	NO
11XXXXX	LSIG	NO	50HZ	NO
14XXXXX	LSI	YES	50HZ	NO
15XXXXX	LSIG	YES	50HZ	NO
20XXXXX	LSI	NO	25HZ	NO
21XXXXX	LSIG	NO	25HZ	NO
24XXXXX	LSI	YES	25HZ	NO
25XXXXX	LSIG	YES	25HZ	NO
30XXXXX	LSI	NO	40HZ	NO
31XXXXX	LSIG	NO	40HZ	NO
34XXXXX	LSI	YES	40HZ	NO
35XXXXX	LSIG	YES	40HZ	NO
44XXXXX	LSI	YES	60HZ	YES
45XXXXX	LSIG	YES	60HZ	YES
54XXXXX	LSI	YES	50HZ	YES
55XXXXX	LSIG	YES	50HZ	YES
64XXXXX	LSI	YES	25HZ	YES
65XXXXX	LSIG	YES	25HZ	YES
74XXXXX	LSI	YES	40HZ	YES
75XXXXX	LSIG	YES	40HZ	YES

"XXXXX" contains the unique serial number as well as the date of manufacture code.

2.0 Features

Opti-Trip II RMS offers the following features:

a) True RMS current sensing.

b) Displays last trip data.

c) All settings are made directly in amps or in seconds.

d) An alarm relay is standard.

e) Security System.

f) Ease of coordination is provided with settings that are made in extremely small increments.

g) Plug-in wiring harness to reduce installation time and eliminate wiring errors.

h) 16 Character display

i) Small physical package.

2.1 Features

Opti-Trip II RMS uses one of the latest Motorola micro controller chips available to perform the RMS calculations and to implement the logic functions.

Each of the three phase currents and the ground current (if applicable) are sampled at a 0.521 milli-second rate during the sample period. For each sample period, the micro controller performs the RMS calculation by squaring the current samples, summing the square values and then taking the square root of the resulting sum. This value is then multiplied by the current transformer tap rating to arrive at the current in amps.

The RMS calculation is performed individually for each phase and for the ground fault current (if applicable).

2.2 Ground Fault Filtering

For those units equipped with the GF feature, a 60Hz (50Hz, 40Hz or 25Hz as applicable) band-pass filter is incorporated in the GF circuit.

The band-pass filter is intended to reduce the possibility of nuisance GF trips due to the presence of 3rd harmonic currents (or multiples of the 3rd harmonic). The 3rd harmonic currents can indicate a GF when, in reality, none exists.

2.3 16 Character Display

A 16-character dot matrix liquid crystal display (LCD) is the interface between the trip unit and the user.

The dot matrix LCD is extremely versatile because it is capable of displaying not only numbers but also letters and symbols.

The LCD is used for the following purposes:

1) Entering the CT tap rating and making the pick-up and time delay settings with prompts from the display.

2) Displaying on demand, the CT tap rating and the various pick-up and delay settings.

3) Displaying on demand, the reason for the last trip along with the phase and ground (if applicable) currents at the time of trip.

4) Displaying the breaker phase and ground currents (if applicable) under normal operation.

******NOTE******

With the LCD and just a few push buttons, an extremely large number of settings can be accessed.

The LCD has a low level backlight that can be activated by holding in the "TARGET RECALL" push button. This feature is useful in low ambient light conditions.

2.4 Display Last Trip Data

After a breaker trip, the trip unit will save the trip data in its non-volatile EEPROM memory. The last trip data is then displayed for 30 seconds after the trip and it can be recalled later. This data is written over with the data from the next trip event.

The last trip data consists of the type of trip (i.e., LT, ST, I or GF as applicable), phase current on applicable phase and ground current (if applicable) at the time of trip.

See section 7.0, "Target Recall" for further information.

2.5 Current Transformers

The CTs that are provided with the trip unit are specifically designed to provide both the signal and power required by the trip unit.

The trip unit will power-up with less than 20% of the rated CT tap current through a single CT. This current is below the lowest pick-up setting.

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

Current inputs from sources other than the CTs designed for the trip unit may damage the internal circuits in the trip unit.

Do not attempt to directly use current sources such as relay test sets, motor overload test sets, setups incorporating variable transformers, etc.

In order to provide the greatest range in pick-up setting, the standard CTs are tapped.

Standard ratings and taps are:

Breaker Frame Size	CT Full Rating	CT Tap Rating
225	225	175
600	600	300
800	800	400
1600	1600	800
2000	2000	1000
3000	3000	1500
3200	3200	1600
4000	4000	2000

Non-standard CT ratings may also be provided by special arrangement with the factory.

2.6 Actuator

The trip unit is designed to function with either the Joslyn Model MR", manual reset actuator or the Joslyn Model "AR", automatic reset actuator.

The trip unit discharges an internal capacitor to trip the actuator. This trip energy is 25V on a 500uF capacitor, which provides a considerable margin above the maximum trip requirements of either the "MR" or "AR" actuator.

2.7 Battery

A 7-cell, 110mAh, high temperature Nickel-Cadmium battery is incorporated in the trip unit. The battery is under a 5mA trickle charge whenever the trip unit is powered-up.

- The battery is **not** involved in the protective functions of the trip unit.
- **The trip unit will provide protection even with the battery removed.**

- The battery is **not** required to maintain any of the memory devices in the trip unit.

The battery provides the following features:

1) Target Recall
2) Last Trip Data
3) Commissioning (without the use of the optional auxiliary power pack)
4) Alarm Relay

The battery will slowly self discharge if the breaker is not in service (i.e., spare, N/O tie breaker, etc.) or if the normal load on the breaker is **less** than 20% of the CT tap rating. Under these conditions, it is recommended that the trip unit should have an auxiliary power pack connected. The auxiliary power pack will provide the trickle charge for the battery.

Under normal operating conditions, the battery is expected to operate properly for a minimum of seven years. Since the ambient temperature has the greatest effect on battery life, a high temperature rated battery is used to minimize this effect. Battery failure is indicated when the battery fails to hold a charge.

The condition of the battery can be checked in the following manner:

1) If the breaker was not in service or if the normal load on the breaker was less than 20% of the CT tap rating, connect the auxiliary power pack to the trip unit for a 24 hour period to charge the battery.

2) With the breaker not in service and the auxiliary power pack disconnected (i.e., the trip unit is not powered-up), press the "TARGET RECALL" push button and step through all the settings with the "SETTINGS REVIEW" push button.

   If the trip unit goes through the entire settings twice in a row without shutting off (except after the last setting), then the battery is in satisfactory condition.

   If the unit shuts off in the middle of the settings then the battery should be replaced/charged.

Note: If the "SETTINGS REVIEW" push button is not pressed for 30 seconds the trip unit will automatically shut off.

After the Instantaneous pick-up setting, the unit will automatically shut off.

The battery can be replaced. The trip unit can be returned to the factory authorized repair center for battery replacement.

Units with a serial number above XX35000 have a battery with a connector that plugs onto the printed circuit board.

2.8 Neutral Current Transformer

A neutral CT is only required if the trip unit is equipped with the GF feature and the breaker is installed on a 4-wire system.

The neutral CT is installed on the neutral conductor as shown in Figure 15.1.

Polarity is very important. If either the neutral CT or any of the phase CTs are reversed, a nuisance GF trip will occur.

3.0 External Connections

All external connections are made using three, plug-in terminal blocks as described below (also see Fig. 15.1 and 15.2 for the external wiring/connection diagrams).

3.1 Breaker Wiring Harness (Right Side of Trip Unit)

The **Breaker Wiring Harness has a 10-pole, polarized terminal block that plugs into the right side** of the trip unit. The connections are as follows from top to bottom:

Terminal #	Wire Color	Use
10	Red	Actuator "+"
9	Black	Actuator "-"
8	Red w/Blue Tag	Phase "A" CT
7	Black	Phase "A" CT (Polarity Dot)
6	Red w/Yellow Tag	Phase "B" CT
5	Black	Phase "B" CT (Polarity Dot)
4	Red w/Brown Tag	Phase "C" CT
3	Black	Phase "C" CT (Polarity Dot)
2	Red w/Green Tag	Neutral CT
1	Black	Neutral CT (Polarity Dot)

The actuator wires and each set of the CT wires in the Breaker Wiring Harness are housed inside an individual PVC tube for added physical protection and to simplify the wiring process.

The neutral CT wiring is part of the neutral CT installation kit and is only required with ground fault on a 4-wire system. The ground fault function on a **3-wire** system does not require a neutral CT.

The "CT ends" of the breaker wiring harness connect to the #10-32 CT lugs using ring tongue terminals. The **black wire** connects to the **common lug** with the polarity dot. The wiring harness should be shortened as required to suit the application.

NOTE: Identifying wire tags are at connector end of wiring harness.

3.2 Auxiliary Connections (LOWER Left Side of Trip Unit)

The **7-pole, Auxiliary Connection terminal block plugs into the lower LEFT side** of the trip unit (see Fig. 15. 1 and 15. 2). The connections are as follows from top to bottom:

Terminal #	Use
1	Key Switch
2	Key Switch
3	RS485 Port "-"
4	RS485 Port "+"
5	Alarm N/C
6	Alarm Common
7	Alarm N/O

3.3 Auxiliary Power (UPPER Left Side of Trip Unit)

The **3-pole, Auxiliary Power terminal block plugs into the UPPER left side** of the trip unit (see Fig. 15.1 and 15.2). This terminal block is part of the auxiliary power pack. The connections are as follows:

Terminal	Use
1	24VDC + (or 24VAC)
2	24VDC - (or 24VAC)
3	**No** Connection

****IMPORTANT****

The 3-pole Auxiliary Power plug must be plugged into the UPPER left side of the trip unit ONLY.

The trip unit may be DAMAGED if the Auxiliary Power plug is plugged into a wrong position.

4.0 Security Key

The trip unit contains a security feature that only allows someone familiar with the operation of the trip unit to commission the trip unit or make changes to the settings.

The **"Security Key"** is simply a short jumper wire that is connected to terminals #1 and #2 of the Auxiliary Connection terminal block (see Fig. 15.1).

To turn the security key **"ON":**

Place a jumper wire between terminal #1 and #2 of the 7-pole Auxiliary Connection terminal block.

To turn the security key **"OFF":**

Remove the jumper wire between terminal #1 and #2 of the 7-pole Auxiliary Connection terminal block.

As an option, terminal #1 and **#**2 of the 7-pole Auxiliary Connection terminal block can be wired to a customer supplied key operated switch.

5.0 Commissioning

When **Opti-Trip II** is first placed in service, it must be commissioned. All the information required for the trip unit to operate properly must be entered before the trip unit will function.

******IMPORTANT******
When first placed in service, the trip unit will not function until all the required information is entered.

After the **Opti-Trip II RMS** system is installed on the breaker, the trip unit must be commissioned as follows:

1) Power-up the trip unit (see Section 5.1)
2) Close the security key (see Sections 5.2 & 4.0)
3) Make settings (see Sections 5.3 to 5.13)

5.1 Power-Up the Trip Unit

The trip unit can be powered-up in the following two ways.

a) **Internal Battery**

Press "TARGET RECALL" to power-up the trip unit using the internal battery.

When on battery power, the trip unit will shut off if none of the 4 cluster push buttons are pressed for 30 seconds. It is, therefore, best to have all the desired setting readily available before commissioning the unit when using the battery.

If the unit shuts down during the commissioning process, the process must be started again from the beginning.

If the battery charge is low, it is best to use the auxiliary power pack as described below.

b) **Power Pack**

Plug the auxiliary power pack into a 120V **AC** outlet.

Plug the cable into the upper end of the left side terminal block. (See the external wiring diagram Fig. 15.1)

Using the power pack, the unit will stay energized as long as necessary to complete the commissioning process.

When the trip unit is energized, the following will alternate on the display:

ENTER DATA

SERIAL # XXXXXXX

MODEL LSI **or** **MODEL LSIG**

Where "XXXXXXX" represents the model code and the unique serial number for the trip unit. See section 1.2.

Press the "SETTING REVIEW" push button to continue.

5.2 Security Key

The following will be displayed:

SECURITY KEY OFF

Close the security key. See section 4.0.

5.3 CT Tap Setting

After the security key is closed, the following will be displayed:

CT RATING XXXXA

Where "XXXX" represents the CT tap rating in amps. The CT tap rating can range from 100 amps to 4000 amps in 5 amp steps.

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct CT tap rating is displayed.

******IMPORTANT******
The trip unit will not operate properly unless the correct CT tap rating is entered. Verify that all of the phase CTs and the neutral CT (if applicable) are on the same tap.

Press the "ENTER" push button to continue.

5.4 LT Pick-Up Setting

The following will be displayed:

LT PICK UP XX.XA

The LT Pick-Up setting ranges from 40% to 100% of the CT tap rating in steps of 5 amps. **This provides 193 LT Pick-Up settings for a 1600 amp CT tap rating.**

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct LT Pick-Up setting is displayed.

Press the "ENTER" push button to continue.

5.5 ST Delay Setting

The following will be displayed:

LT DELAY XX.XSEC

Where *"***XX.X***"* represents the LT **Delay** band. The LT Delay band is labeled by the number of seconds to trip at **6** times the LT Pick-Up setting.

The LT Delay setting ranges from 2.5 to 30 seconds in steps of 0.5 seconds. **This provides 56 LT Delay bands.**

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct LT Delay setting is displayed.

Press the "ENTER" push button to continue.

5.6 ST Delay Setting

The following will be displayed:

ST PICK-UP OFF

If the ST function is **not desired,** press the "ENTER" push button and go to Step 5.9.

If the ST function **is desired,** press the "INCREASE" push button and the following will **be** displayed:

ST PICK-UP XXXXA

Where *"XXXX"* represents the ST Pick-Up in amps.

The ST Pick-Up setting ranges from 150% to 1200% of the LT Pick-Up setting in 100 amp steps. **This provides 169 ST Pick-Up settings for a 1600 amp CT tap rating.**

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct ST Pick-Up setting is displayed.

Press the "ENTER" push button to continue.

5.7 ST Delay Setting

If the ST function was not turned off in section 5.6, then the following will be displayed:

ST DELAY .XXSEC

Where *".XX"* represents the ST Delay.

The ST Delay settings are .07, .10, .15, .20 and .35 seconds.

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct ST Delay setting is displayed.

Press the "ENTER" push button to continue.

5.8 ST I^2T

If the ST function is not off, then the following will be displayed:

ST I^2T OFF

If the I^2T ramp is **not desired,** press the "ENTER" push button to move to the next setting.

If the ST I^2T ramp **is desired,** press the "INCREASE" push button. The following will be displayed:

ST I^2T ON

Pushing the "DECREASE" push button will turn the ST I^2T ramp off again.

Press the "ENTER" push button to continue.

5.9 I Pick-Up Setting

The following will be displayed:

I PICK-UP
XXXXXA

Where *"XXXXX"* represents the I Pick-Up in amps.

The I Pick-Up setting ranges from 150% to 1200% of the LT Pick-Up setting in steps of 100 amps. **This provides 169 I Pick-Up settings for a 1600 amp CT tap rating.**

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct I Pick-Up setting is displayed.

If the I function is **not desired** and the ST function is **not off,** press the "DECREASE" push button until the following is displayed:

I PICK-UP OFF

******NOTE******
Having both the ST and I functions off at the same time is not allowed by the trip unit.

Press the "ENTER" push button to continue.

If the trip unit does not have the GF function jump to step 5.13.

5.10 GF Pick-Up Setting

If the trip unit has the ground fault function, the following will be displayed:

GF PICK-UP OFF

If the GF function is **not desired,** press the "ENTER" push button and go to Step 5.13.

If the **GF** function **is desired,** press the "INCREASE" push button and the following will be displayed:

GF PICK-UP
XXXXA

Where *"XXXX"* represents the **GF** Pick-Up setting in amps.

The GF Pick-Up setting ranges from 20% to 60**%** of the CT tap rating in steps of 10 amps. **This provides 65 GP Pick-Up settings** for a 1600 amp CT tap rating.

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct **GF** Pick-Up setting is displayed.

Press the "ENTER" push button to continue.

5.11 GF Delay Setting

If the GF function is not off, then the following will be displayed:

GF DELAY .XXSEC

Where *"XX"* represents the GF Delay.

The GF Delay settings are .10, .20, .30, .40 and .50 seconds.

Press and hold the "INCREASE" or "DECREASE" push button as required until the correct GF Delay setting is displayed.

Press the "ENTER" push button to continue.

5.12 GF I^2T

If the GF function is not off, then the following will be displayed:

GF I^2T OFF

If the I^2T ramp is **not desired,** press the "ENTER" push button to move to the next step.

If the GF I^2T ramp **is desired,** press the "INCREASE" push button. The following will be displayed:

GF I^2T ON

Pushing the "DECREASE" push button will turn the GF I^2T ramp off again.

Press the "ENTER" push button to continue.

5.13 Exit Procedure

The following will be displayed:

PUSH "ENTER" IF

SETTINGS OK

PUSH "REVIEW" TO

REVIEW SETTINGS

If it is desired to review the setting, push the "REVIEW" push button. Make any changes necessary using the "INCREASE" or "DECREASE" push buttons. As before, use the "ENTER" push button to move to each new setting.

If the settings are as desired, push the "ENTER" push button and the settings will be saved in the non-volatile EEPROM memory.

The following will be displayed:

REMOVE KEY TO

COMMISSION UNIT

Remove the "key". See section **4.0.**

If the commissioning process was performed using the internal battery, the unit will turn itself off.

If the commissioning process was performed using the power pack, the following will be displayed:

LO CURRENT

Unplug the power pack from both the 120V outlet and from the trip unit.

The commissioning process is complete.

6.0 Changing Settings

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

While it is possible to make changes to the settings with the breaker in service, it is strongly recommended that THE BREAKER SHOULD BE REMOVED FROM SERVICE while making these changes since the trip unit will not be functional during this process.

After the trip unit is commissioned, settings can easily be changed in the following manner.

Close the security key. See section 4.0.

Power up the trip unit by pressing "TARGET RECALL" or by using the auxiliary power pack as described in section 5.0, commissioning.

Press the "SETTINGS REVIEW" push button.

Make any changes necessary using the "INCREASE" or "DECREASE" push buttons. Use the "ENTER" push button to move to each new setting.

After going through all the settings, the following will be displayed.

PUSH "ENTER" IF

SETTING OK

PUSH "REVIEW" TO

REVIEW SETTINGS

If it is desired to review the setting, push the "REVIEW" push button. Make any changes necessary using the "INCREASE" or "DECREASE" push buttons. As before, use the "ENTER" push button to move to each new setting.

If the settings are as desired, push the "ENTER" push button and the settings will be saved in the non-volatile EEPROM memory.

If the trip unit loses power during this process, the old settings will be retained.

The following will be displayed:

REMOVE KEY TO

COMMISSION UNIT

Remove the "key". See section 4.0.

The Settings have been changed.

7.0 Target Recall

Opti-Trip II RMS has an especially useful "target recall" system.

After a breaker trip, the trip unit will display the type of trip such as LT, ST, I or GF (if applicable) and then the phase currents and ground current (if applicable) at the time of trip followed by the present settings. This information is saved in the non-volatile EEPROM memory and is available immediately after a trip or even many months thereafter.

******NOTE******
Only the data from the last trip is saved. The second time the breaker trips, the new trip data is written over the first trip data.

The target recall feature can be used with the trip unit energized or de-energized as follows:

a) With the trip unit de-energized

When the breaker is open or there is insufficient current through the breaker to power-up the trip unit, press the "TARGET RECALL" push button.

The following will be displayed if there was no last trip.

NO LAST TRIP

If there was a last trip, the following will be displayed.

LAST TRIP LT or **LAST TRIP ST** or **LAST TRIP I** or **LAST TRIP GF**

PHASE A XXXXX A

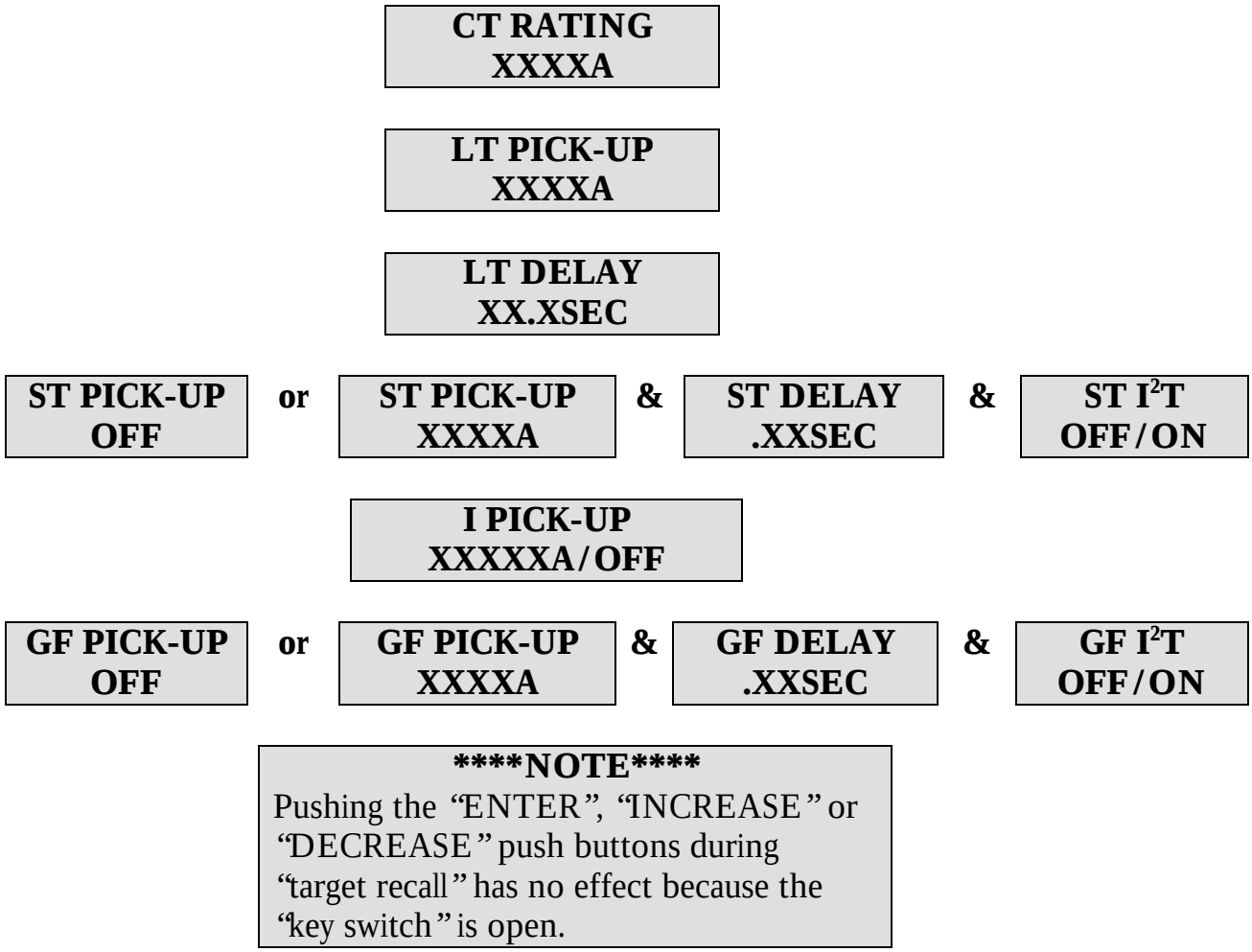
PHASE B XXXXX A

PHASE C XXXXX A

GROUND XXXXX A

Where "XXXXX" is the respective instantaneous RMS value of the phase currents at the time of trip and "XXXX" is the value of ground current at the time of trip (if applicable).

Press the "SETTINGS REVIEW" push button and the present settings will be displayed in the following sequence by pressing the "SETTINGS REVIEW" push button.



******NOTE******

Pushing the "ENTER", "INCREASE" or "DECREASE" push buttons during "target recall" has no effect because the "key switch" is open.

When pushing "SETTING REVIEW" after the last setting, the trip unit will turn itself off. If the "SETTINGS REVIEW" push button is not pressed for about 60 seconds, the trip unit will turn itself off.

b) With the trip unit energized.

When the breaker is in service and there is sufficient current to power-up the trip unit (no overload conditions in progress), push the "SETTINGS REVIEW" push button. The trip unit will display the last trip data and the present settings as outlined above.

8.0 Normal Operation

a.) Breaker Current Less than 20% of CT Tap Rating:

If the breaker current is less than 20% of the CT tap rating, the display will be blank.

b) Breaker Current Greater than 20% of CT Tap Rating:

If the breaker current is greater than 20% of the CT tap rating but less than the LT pick-up value or GF pick-up value (if applicable), the following will be seen on the display.

Without ammeter option:

The display will show "NO OVERLOAD"

With ammeter option:

The display will alternately show the phase currents. Any phase current less than 10% of the CT tap rating will not be displayed.

9.0 Alarm Relay

The trip unit is equipped with an alarm relay as a standard feature.

The alarm relay is a latching relay with a form "C" contact. The alarm relay is latched closed on a trip.

The relay is latched open the next time the trip unit is energized. That is, when the "TARGET RECALL"" push button is pressed or the breaker is closed again and is carrying current greater than 20% CT tap rating.

See Section 12.0 for the alarm relay contact ratings.

10.0 Testing

A "primary injection" test is recommended as the initial test of the **Opti-Trip II RMS** retrofit.

10.1 Step 1: Commission the Trip Unit

Before proceeding with the normal primary injection tests, the trip unit must be commissioned to make it functional. See section 5.0 for the commissioning procedure. It is best to use the final pick-up and time delay settings if they are known. If not, use typical settings for the primary injection test.

If the auxiliary power pack was used for commissioning, remember to unplug it for the primary injection test.

10.2 Step 2: Defect GF (if so equipped)

If the trip unit is equipped with the ground fault function, it will be necessary to defeat ground fault trip to test the remainder of the functions. There are two ways to defeat ground fault trip as outlined below:

1) Turn GF to off as described in section 6.0**,** "Changing Settings". Remember to turn **GF** back on again after the test.

2) Defeat **GF** trip one time only **by:**

   a) The trip unit should **not** be powered-up.

   b) Close the security **key.** See section 4.0**.**

   c) Push and hold both the "ENTER" and "SETTINGS REVIEW" push buttons.

   d) Push the "TARGET RECALL" push button. The following will be displayed:

GF DEFEATED

REMOVE <KEY> TO

CONTINUE

e) Remove the security key. The following will be displayed:

GF DEFEATED

f) The unit will remain on battery power for 30 seconds after the "TARGET RECALL" push button was pressed. **The test must be started during this time.**

g) The GF function will be on the next time the trip unit is energized.

10.3 Step 3: Check Power-Up and Verify Proper CT Setting

Before proceeding with the normal primary injection test, check the power-up and CT ratio for each phase as follows:

Power-Up:
Temporarily defeat the ground fault function (if so equipped) and inject a current equivalent to 20% of the CT rating. The trip unit should be functioning at this value of current.

CT Ratio:
If equipped with the "ammeter" option, inject a current equivalent to the CT rating and verify that the current displayed on the LCD corresponds with the injected current.

If not equipped with the "ammeter" option, inject a current equivalent to 90% of the LT pick-up setting. The trip unit should display "NO OVERLOAD". Next increase the current to 110% of the LT pick-up setting. After a short period of time, the trip unit should display "OVERLOAD".

CT Connections:
Since the trip unit will display the currents by phase, it is important to verify that each of the wires in the Breaker Wiring harness was connected to the proper CT.

This can be easily verified if the trip unit is equipped with the ammeter option.

10.4 Step 4: Primary Injection Tests

Proceed with the normal primary injection test to verify the pick-up and time delay of the various trip functions. The pick-up and time values should be within the tolerance band of the **Opti-Trip II RMS** time-current curves.

10.5 Step 5: Erase Last Trip Data

After completing the primary injection test, it is important to erase the last trip data from the memory of the trip unit.

******IMPORTANT******
Erase the last trip data from the memory of the trip unit after completing the primary injection tests.

It may also be necessary to erase the settings entered during commissioning setup required for the test.

To erase the memory in the trip unit after completing the primary injection tests, perform the following:

1) The trip unit should not be powered-up.

2) Close the security key. See section **4.0.**

3) Push and hold both the "INCREASE" and "DECREASE" push buttons.

4) Push the "TARGET RECALL" push button. The following will be displayed:

ERASE COM FLAG?

5) If the settings made during the commissioning procedure are to be erased, press the "INCREASE" push button. If the settings are **not** to be erased, push the "DECREASE" push button.

6) The following will be displayed:

ERASE LAST TRIP?

7) If the last trip data is to be erased, press the "INCREASE" push button. If the data is **not** to be erased, push the "DECREASE" push button.

8) The following will be displayed:

REMOVE <KEY> TO

CONTINUE

9) Remove the security key.

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

If the last trip data is not erased after the primary injection test, the operating personnel may later assume that the breaker interrupted a fault as some time in the past when they use the "TARGET RECALL" feature.

11.0 Communications

Please contact factory.

12.0 Ratings

Ambient Temperature:

Trip Unit: -4°F (-20°C) to 150°F (65°C)

LCD Display:

Standard Temp, Super Twist:
32°F (O°C) to 122°F (50°C)

Extended Temp, Standard Twist:
-4°F (-20°C) to 150°F (65°C)

Humidity:

95% non-condensing

Conformal Coating:

Silicone, fungus resistant, Nominal 2 to 5 mil Miller-Stephenson MS460A (no CFCs)

Current Transformers:

Specially designed with 0.5 amp rated secondary

Enclosure:

Extruded aluminum housing
6.6" X 4.15" X 1.8" nominal overall dimensions

Alarm Contacts:

5A, 1/6HP @ 125, 250V AC
1A, 30V DC
0.24A, 125V DC

13.0 Warranty

A conditional 2-year warranty is offered for the Opti-Trip II trip unit.

Full details of the warranty are provided in Joslyn Hi-Voltage Corporation warranty G.705-008.

14.0 Time-Current Curve

The Time-Current curve is shown in Figure 15.3.

The curves are shown on a 4 x 5 log-log graph with seconds in the vertical direction and normalized current in the horizontal direction.

The phase currents are shown as multiples of the LT pick-up setting. The ground currents are shown as a percentage of the CT tap rating.

Tolerance for the bands is ± 10% in the current direction and ± 23% in the time direction.

The curves for the following time bands:

LT
ST I^2T
GF I^2T

are based on the following equation:

$$I^2T = \text{Constant}$$

Where: I is current in amps
T is time to trip in seconds (center of the band)

14.1 LT Trip Time

For phase overload currents, the above equation can be restated as follows:

$$T = TBC_{LT} / X^2$$

Where: T is time to trip in seconds (center of the band)
X is current in multiples of the LT pick-up setting

TBC_{LT} is the LT Time Band Constant=36 X LT time band setting

******NOTE******
The LT Time Band Constant (TBC^{LT}) =
36 X The LT Time Band Setting in seconds.

EXAMPLE #1:

CT Rating	1600A
LT pick-up	1200A
LT time band	20S
Test Current	3600A

TBC_{LT} = 36 X LT Time Band Setting = 36 X 20 = 720

and X = 3600A / 1200A = 3

therefore:

trip time =

$T = TBC_{LT} / X^2$ or $720/3^2 = 720/9 = 80$ seconds

****NOTE****

To determine the LT trip time by calculation:

1. Calculate the LT Time Band Constant (TBC_{LT})
2. Calculate "X" where
   $X = \frac{\text{(test current)}}{\text{(LT Pick-Up Setting)}}$
3. Solve the equation:
   Trip time (sec) = TBC_{LT} / X^2

14.2 ST Trip Time

With I^2T **OFF** or for currents greater than 10 X LT Pick-Up Setting, the ST trip time is a constant equal to the ST Time Band setting.

With I^2T **ON** and for currents less than 10 X LT Pick-Up Setting, the ST trip time is determined by the following equation:

$$T = TBC_{ST} / X^2$$

Where: T is time to trip in seconds (center of the band)
X is current in multiples of the LT pick-up
TBC_{ST} is the ST Time Band Constant

******NOTE******

The ST Time Band Constant (TBC_{LT})
35 for the .35S Time Band
20 for the .20S Time Band
15 for the .15S Time Band
10 for the .07S Time Band
7 for the .07S Time Band

EXAMPLE #2:

CT Rating	1600A
LT pick-up	1200A
ST pick-up	6000A
ST time band	.20S I^2T *ON*
Test Current	7200A

$TBC_{ST} = 20$
$X = 7200A / 1200A = 6$

therefore:
trip time = $T = TBC_{ST} / X^2$ or $20 / 36$ .556 seconds

****NOTE****
To determine the ST I^2T trip time by calculation:
1. Determine the ST Time Band Constant (TBC_{ST})
2. Calculate "X" where
   X = (Test Current) / (LT Pick-Up Setting)
3. Solve the equation:
   trip time (sec) = TBC_{ST} / X^2

14.3 GF Trip Time

With I^2T **OFF** or for currents greater than the CT tap rating; the GF trip time is a constant equal to the GF Time Band setting.

With I^2T **ON** and for currents less than the CT tap rating, the GF trip time is determined by the following equation:

$$T = TBC_{GF} / X_{GF}^2$$

Where: T is time to trip in seconds (center of the band)
X_{GF} is current / CT tap rating
TBC_{GF} is the GF Time Band Constant

****NOTE****
The GF Time Band Constant (TBC_{GF}) =
.50 for the .50S Time Band
.40 for the .40S Time Band
.30 for the .30S Time Band
.20 for the .20S Time Band
.10 for the .10S Time Band

EXAMPLE #3:

CT Rating	1600A
LT pick-up	1200A
GF pick-up	480A
GF Time Band	.20S I^2T ON
Current	640A

TBC_{GF} = .20
X_{GF} = 640A / 1600A = .40

therefore:
trip time = T = TBC_{GF} / X^2 or .20 / $(.40)^2$ or .20 / .16 = 1.25 seconds

****NOTE****
To determine the GF I^2T trip time by calculation:
1. Determine the GF Time Band Constant (TBC_{GF})
2. Calculate "X_{GF}" where
   X_{GF} = Test Current / CT Tap Rating
3. Solve the equation:
   trip time (sec) = TBC_{GF} / X_{GF}^2

15.1 External Wiring

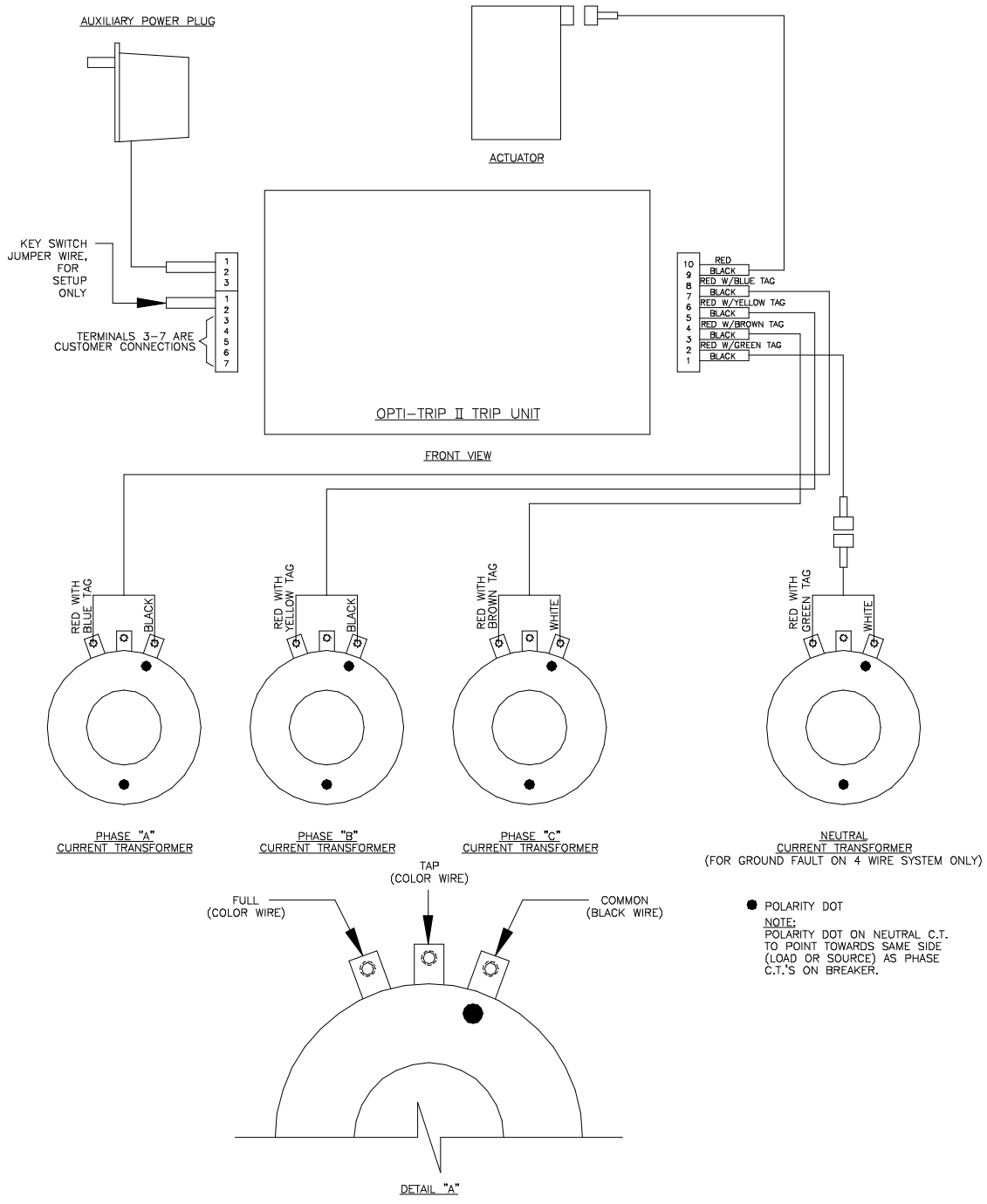
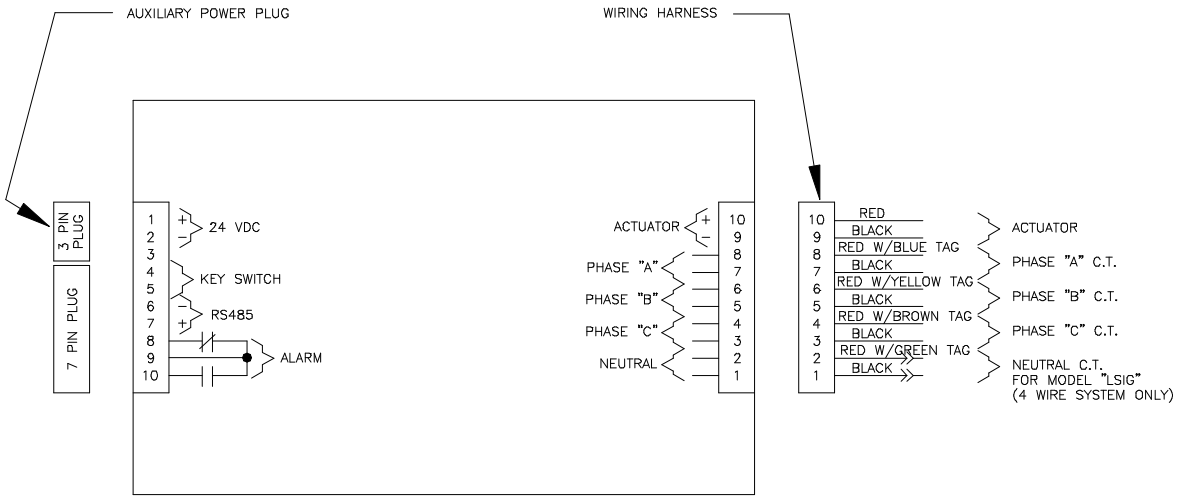


Figure 15.1

15.2 External Connections



FRONT VIEW OF OPTI-TRIP II

Figure 15.2

15.3 Time Current Curve

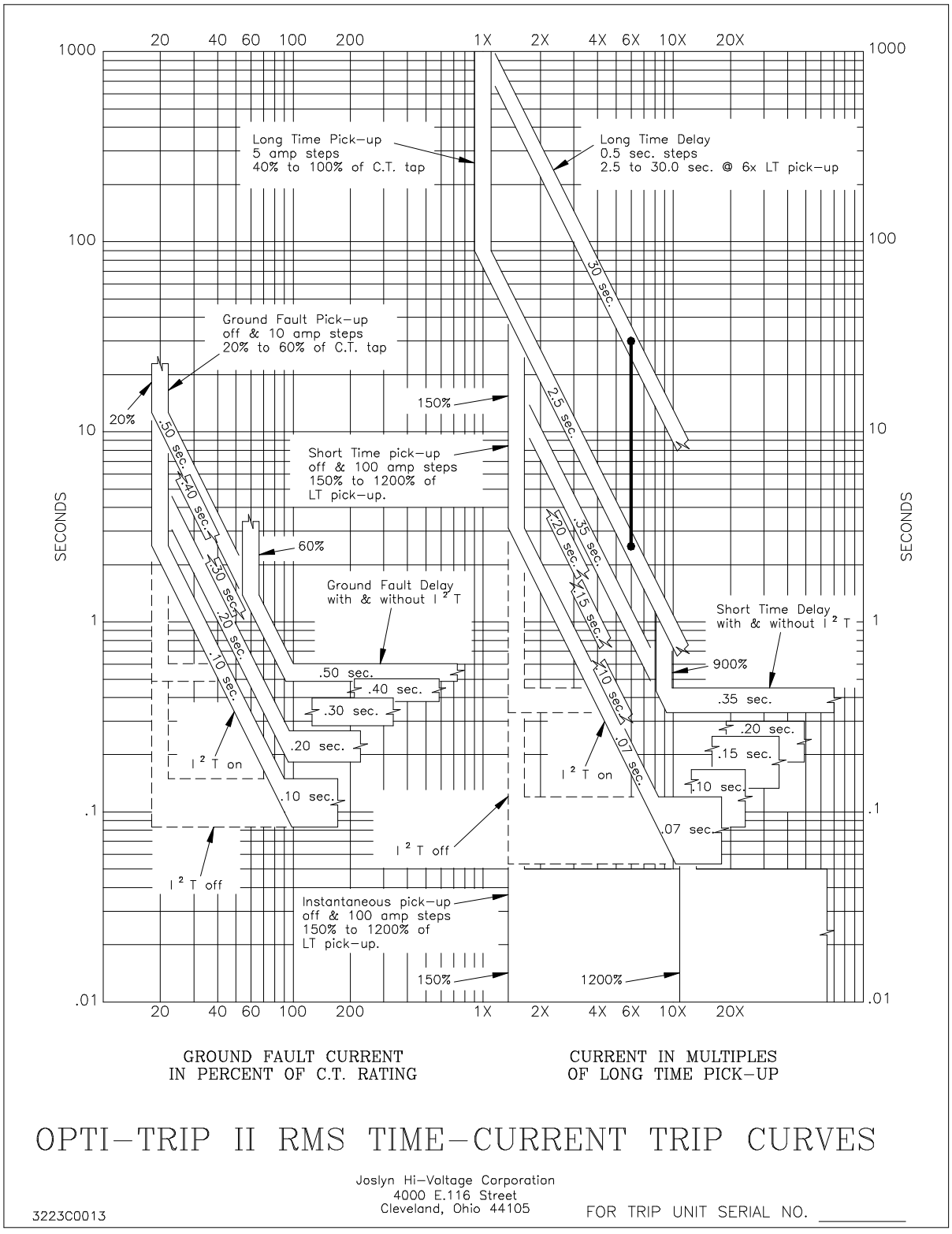


Figure 15.3

16.0 Revisions

Rev	Date	Description	ECN
1	7/31/96	Revised Documentations for new wiring harness pgs. 9, 33,34 Added revisions sheet updated Table of Contents	