AC-PRO Retrofit Kit

Retrofit Kit Instructions for FPE / Federal Pioneer /Cemco H1, H2 & H3 14″ Frames

Low Voltage Breaker

Including Instructions for AC-PRO+ Communications

Instructions for:

- **Manual Reset Actuator**
- **Mechanical Reset Actuator**

Utility Relay Co.
Chagrin Falls, Ohio 44023
Phone: 888-289-2864 Fax: 440-708-1177
www.utilityrelay.com

LIMITED WARRANTY

Utility Relay Co., Ltd. warrants that every AC-PRO and ZERO-Hertz trip unit and related retrofit kit components (herein collectively referred to as "product") shall be free from defects in material and workmanship, and will perform as described in Utility Relay Company's sales literature and Instruction Manuals, under normal use and service for a period of (2) two years from date of invoice. EXCEPT AS SET FORTH HEREIN, IT IS EXPRESSLY AGREED THAT THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND THERE IS NO OTHER WARRANTY, EXPRESS, IMPLIED OR STATUTORY, BY UTILITY RELAY CO., LTD. WITH REFERENCE TO THE PRODUCT.

Should any warranty claim arise within the warranty period, contact Utility Relay Co., Ltd. at 888-289-2864 and do the following:

1. **Provide a complete description of the problem with the trip unit or retrofit kit component.**
2. **Provide the Serial Number located on the back of the trip unit from the warranted retrofit kit.**
3. **Obtain a Returned Materials Authorization number (RMA) and return shipping instructions.**
4. **Promptly return the defective material to Utility Relay Company.**

Warranty Disclaimer and Liability Limitation

As the sole and exclusive remedy, Utility Relay Co., Ltd. will repair or replace the trip unit and/or retrofit component(s) at no cost to the customer during the warranty period. The customer is liable and shall pay for shipment of defective products back to Utility Relay Co., Ltd. In no event shall Utility Relay Co., Ltd. be liable for any special, incidental or consequential damages.

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1. **Any product which has been disassembled (except to replace batteries), repaired, tampered with, altered, changed, or modified by persons other than Utility Relay Company's own authorized service personnel unless repair by others is made with the written consent of Utility Relay Company.**
2. **Defects or damage to the Product resulting from wear, tear, misuse, negligence, improper storage, improper testing, impacts, or use with non-approved accessories.**
3. **Products used for any other purpose other than originally intended by Utility Relay Company.**

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ILLUSTRATIONS

FPE
H1, H2 & H3 14” Frame

1.0 General

All possible contingencies, which may arise during the installation, operation or maintenance, and all details and variations of this equipment, are not necessarily covered by these instructions.

1.1 Inspection

Carefully inspect the retrofit kit on arrival. If any damage is found, file a claim with the carrier and contact Utility Relay Co. for replacement parts.

Verify that this is the correct kit for the circuit breaker being retrofitted.

Check the contents of the retrofit kit package against the kit bill of material to make sure that all the required parts are included.

Thoroughly read and understand these installation instructions as well as the AC-PRO trip unit instruction manual before proceeding with the retrofit.

2.0 Initial Breaker Tests

Before starting the retrofit, perform a visual/mechanical inspection and an electrical test of the breaker to determine its condition.

Refer to the breaker manufacturer's instruction manual and accepted test standards such as the NETA Maintenance Specifications or Pearl Reconditioning Standards to verify that the breaker is in acceptable mechanical and electrical operating condition.

As a minimum, perform the following:

a) Close and trip operation of the breaker.
b) Measure contact resistance of each pole.
c) Measure insulation resistance from pole to pole, from pole to frame and across open contacts.
d) Check contact compression.
e) Check for sufficient finger cluster spring tension at the rear stabs.

Rectify any abnormalities found. Clean and lubricate the breaker as required.

3.0 Remove Existing Trip Devices

1) If the breaker is equipped with overloads they must be removed.

2) For the breakers with OEM electronic protection the trip unit, trip coil, CTs/related hardware and wiring must be removed.

4.0 Install Current Transformers

4.1 Install 600 & 800 Amp CTs and New Shunts

The existing CTs (or overloads) must be replaced with the CTs provided. The installation procedure is the same for all CTs.

Refer to Figures 9 or 10 as applicable to complete the following:

1) Remove the lower finger assemblies.

2) Remove the overload coils and load side stabs. The braided strap connection may have to be undone to remove the coil.

3) Check for burrs on the copper connection. All BURRS MUST BE REMOVED.

4) Reinstall the load side stabs using two (2) 3/8-16 X 2-1/4 full thread hex cap screws with a lock washer and a flat washer under the head. The hardware must be tight but use care to prevent breaking the support molding.

5) For 600 Amp breakers loosely attach the CU-155 top shunt using two (2) 1/4-20 X 5/8 socket head screws and Belleville washers.

For 800 Amp breakers loosely attach the CU-156 top shunt using the existing hardware.

6) Loosely attach the CU-154 bottom shunt to the previously installed 3/8-16 X 2-1/4 hex cap screws using two (2) 3/8-16 hex nuts, flat washers and lock washers.

7) For 600 Amp breakers slide the CT and a silicone rubber washer on the CU-014 spacer shunt as shown in Figure 9.

For 800 Amp breakers slide the CT and a silicone rubber washer on the CU-138 spacer shunt as shown in Figure 10.

8) Slide the CU-014 (CU-138) spacer shunt/CT assembly between the CU-154 bottom shunt and the CU-155 (CU-156) top shunt and attach using a 3/8-16 X 2-1/2 HC screw, flat washer and lock washer.

IMPORTANT:	**Make sure the silicone rubber washer is not pinched between the spacer and shunt.**

9) Securely tighten all hardware.

10) Replace the lower finger assemblies.

4.2 Install 1600/2000 Amp CTs and New Shunts

On each pole, refer to Figure 11 for the following:

1) Attach the CU-180 Back Shunt to the CU-179 Shunt Post using one (1) 3/8-16 X 1 FH screw. Tighten firmly for a good electrical connection.

2) Slide the rubber washers and CT on the CU-179 shunt post. Use the silicone rubber washers on each side of the CT.

IMPORTANT:	**The CT's should be held in position to prevent them from rotating and possibly shorting the terminals.**

3) Attach the CU-178 Front Shunt to the CT/Shunt Post assembly using one (1) 3/8-16 X 1-1/4 HCS, flat washer & lock washer. Do not fully tighten at this time.

4) Install the CT/copper assembly using the hardware previously removed.

5) Securely tighten all hardware.

IMPORTANT:	**Verify that the silicone rubber washers are not pinched between the shunt post and other copper details.**

4.3 Install 1600 Amp CTs on Federal Pacific of Canada Breakers

This model of breaker has one solid piece of copper for shunt and back stab. In this case the CTs must be put around the fingers on the back stab of the breaker.

Refer to Figure 12 for the following:

1) **Remove the two (2) screws holding the finger assembly in place. Save for later re-assembly.**

2) **Place the CT on the stab. Because of the wiring bundle, place the CT on the top stab of A & C Phase and bottom stab of B Phase.**

3) **Re-install the finger assemblies. It may be necessary to slide the CT left and right to reach the screws holding the fingers.**

4) **Center the CTs and use RTV silicone to hold the CTs in place.**

5.0 Install Trip Paddle

Select the mounting location for the actuator assembly that best suits the breaker being retrofitted.

For breakers with a long enough trip bar the following configuration may be used, see Figure 4 or 6 for the following:

1) **Loosely attach the BR-223 trip paddle to the BR-222 trip bar clamp using two (2) 8-32 X 3/8 Phillips screws and lock washers.**

2) **Slide the BR-222/BR-223 assembly over the left end of the trip bar as shown in Figure 4. Do not fully tighten the screws at this time.**

For breakers with trip bars that are too short to use the above configuration the original trip paddle may be reworked using the process below. See Figure 8 for the following:

1) **Remove the existing trip paddle from the trip bar.**

2) **Drill two (2) 7/32 holes in the trip paddle as illustrated.**

3) **Attach trip paddle BR-200 to the original trip paddle using two (2) 10-32 X 3/8 Phillips screws, lock washers and hex nuts.**

4) **Reinstall the trip paddle assembly on the breaker using the original hardware.**

6.0 Manual Reset Actuator

6.1 Install Actuator

Refer to Figures 3 & 4 for the following:

1) **Replace the standard actuator rod with the 6 inch rod provided and transfer all of the related hardware.**

   Use caution since the plunger is spring loaded.

2) **Install the bracket BR-185-1 on the actuator using three (3) 10-32 X 3/8 P.H. screws and lock washers.**

3) **Attach bracket BR-196 to the actuator assembly from the previous step using two (2) 1/4-20 X 1/2 H.C. screws and lock washers (note the orientation).**

4) **Select the best location to install the actuator assembly for the specific breaker(s) being retrofitted then drill two (2) 9/32” holes as shown in Figure 3 for the installation.**

5) **If required, align the trip paddle assembly with the center of the actuator mounting location and tighten the hardware.**

6) **Attach the actuator assembly to the frame in the selected location using the 1/4-20 X 3/4 H.C. screws, lock washers and hex nuts.**

Note: If there is a terminal block on the frame brace where the actuator is to be installed use the 1/4-20 X 3/4 flat head screws provided. For proper alignment, clamp the actuator bracket to the frame brace and countersink both brackets together.

6.2 Adjust Actuator

Refer to Figure 4 for the following:

1) **Reset the actuator and charge the breaker. Adjust the position of the actuator rod by screwing it in or out until the end of the rod is 1/64” from the trip paddle.**

2) **Trip the actuator by striking the reset knob. Lock the actuator rod in position by tightening the 10-32 set screw with an Allen wrench.**

3) **Adjust the actuator rod stop-nuts so, when tripped, the travel is within the limits of the trip bar movement.**

4) **Reset the actuator and close the breaker. If the breaker will not close re-adjust the position of the actuator rod for more clearance to the trip paddle.**

5) **Trip the actuator by lightly striking the reset knob. The breaker should trip.**

6.3 Verify Trip Free Operation of the Manual Reset Actuator

It is very important to verify that with the manual reset actuator in the trip position it will keep the breaker trip free.

1) **Attempt to close the breaker without resetting the actuator; the breaker should trip free, if not, increase the actuator rod travel.**

2) **Repeat the adjustments until completely satisfied with the operation of the actuator.**

IMPORTANT:	**WHEN THE ACTUATOR IS IN THE TRIP POSITION (NOT RESET), THE BREAKER MUST TRIP FREE.** **THE SET SCREW IN THE PLUNGER MUST BE TIGHTENED TO ENSURE THAT THE ACTUATOR ROD REMAINS IN PROPER ADJUSTMENT.**

7.0 Mechanical Reset Actuator

7.1 Install Actuator

Refer to Figures 5 & 6 for the following:

1) **If the BR-222/BR-223 trip paddle was used center it on the intended mounting location of the actuator and firmly tighten the hardware.**

2) **Replace the standard actuator rod with the 4-1/2 inch rod provided in the kit. Replace the standard stop nuts with a single nylock nut and transfer the plastic tip.**

   Use caution since the plunger is spring loaded.

3) **Attach the BR-185-1 and BR-256-1 brackets to the actuator; use three (3) 10-32 X 3/8 P.H. screws and lock washers.**

4) **Attach BR-196 bracket to the BR-185-1 bracket from the previous step using two (2) 1/4-20 X 1/2 H.C. screws and lock washers.**

5) **Fit the BR-194 reset link into place on the actuator rod and install the second nylock nut, finger tight only.**

6) **Fit the BR-195 reset lever into place over the "pin" of the BR-194 reset link then install the reset lever in the pivot bracket as follows: fit the clevis pin into the pivot bracket from the left side then install three spacers HW-0203-4, next the reset lever and finally a single spacer HW-0203-4 on the right side of the reset lever. If the reset lever pivots freely the "E" clip can be installed on the clevis pin.**

7) **Select a mounting location for the actuator assembly that will align the reset lever with the breaker's movable contact link. Drill two (2) 9/32" diameter holes located as shown in Figure 5.**

Note for breakers that have a terminal block mounted on the frame brace; clamp the actuator bracket to the frame brace and countersink them together to accept 1/4-20 x 3/4 F.H. screws.

8) **Attach the actuator assembly to the breaker's frame brace using the 1/4-20 X 3/4 H.C. screws (or 1/4-20 X 3/4 F.H. screws if required), lock washers and hex nuts.**

7.2 Adjust Actuator

Refer to Figure 7 for the following:

1) **Temporarily remove the reset nut (to allow adjustment of the actuator rod) and loosen the 10-32 setscrew in the actuator plunger and reset the actuator.**

2) **Adjust the stop nut to allow about 1/4” of travel.**

3) **With the breaker tripped and the actuator reset, adjust the actuator rod for about 1/4” clearance to the trip paddle. *Charge* the breaker and adjust the clearance to the trip paddle to about 1/64”. Trip the actuator and tighten the 10-32 set screw that locks the actuator rod in place.**

IMPORTANT:	**THE SET SCREW IN THE PLUNGER MUST BE TIGHTENED TO ENSURE THAT THE ACTUATOR ROD REMAINS IN PROPER ADJUSTMENT.**

7.3 Verify Trip Free Operation of Mechanical Reset Actuator Assembly

It is very important to verify that the trip adjustment of the mechanical reset actuator assembly will keep the breaker trip free if the actuator fails to reset properly on breaker opening.

1) **Trip the actuator then attempt to close the breaker, it must trip free. If required adjust the stop nuts for additional travel. Test the breaker until satisfied. Reinstall the reset link (if removed) and reset nut.**

IMPORTANT:	**With the actuator in the tripped position (not reset), the breaker MUST TRIP FREE.**

7.4 Adjust Reset of Mechanical Reset Actuator Assembly

1) **Adjust the reset nut until the reset lever touches the breakers movable contact piece and then snug it approximately one additional rotation.**

2) **Close the breaker then trip the actuator using a fresh 9 Volt battery. The actuator should be reset when the breaker has opened (verify the plunger is seated). If the actuator didn't seat tighten the reset nut another full turn and re-test. After the final adjustment operate the breaker several times to verify reliable operation.**

8.0 AC-PRO Installation

Refer to Figures 1 & 2 for the following:

1) **Attach BR-001 bracket and BR-027 shield to the back of the AC-PRO using two (2) 8-32 X 3/8 screws and lock washers as shown in Figure 2.**

2) **Set the trip unit in position and mark the location of two (2) mounting holes.**

3) **Drill & tap two (2) 8-32 holes in the locations marked.**

4) **Attach the trip unit/bracket assembly to the breaker top mechanism platform using two (2) 8-32 X 1/2 Phillips screws, and lock washers in the two (2) previously tapped holes.**

9.0 Wiring

Use the wiring harness provided to make the connections to the CTs and the actuator. See Figure 13 for the front mounted CTs wiring diagram. Refer to Figure 14 for rear mounted CTs that are staggered.

The wiring harness plugs into the top of the AC-PRO. Be sure to tighten the two plug retaining screws after the wiring is complete.

Shorten the wires and tubing as required and use the cable ties and holders provided to make a clean installation. Make sure the wires will not be pinched, cut or chaffed by any moving parts or sharp edges.

9.1 Color Codes and Connections

For front mounted CTs the wiring harness connector color code and connections are as follows from left to right:

Terminal #	Wire Color	Use
1	Red (R)	Actuator "+"
2	Black (B)	Actuator "-"
3	Blue (L)	Phase "A" "Dot"
4	White (W)	Phase "A" Tap
5	Yellow (Y)	Phase "B" "Dot"
6	White (W)	Phase "B" Tap
7	Brown (N)	Phase "C" "Dot"
8	White (W)	Phase "C" Tap
9	Green (G)	Neutral "Dot" (4W & GF only)
10	White (W)	Neutral Tap (4W & GF only)

For staggered rear mounted CTs (where Phase A and C CTs are on the Line side and Phase B CT is on the Load side) the wiring harness connector color code and connection are as follows from left to right:

Terminal #	Wire Color	Use
1	Red (R)	Actuator "+"
2	Black (B)	Actuator "-"
3	Blue (L)	Phase "A" "Dot"
4	White (W)	Phase "A" Tap
5	Yellow (Y)	Phase "B" Tap
6	White (W)	Phase "B" "Dot"
7	Brown (N)	Phase "C" "Dot"
8	White (W)	Phase "C" Tap
9	Green (G)	Neutral "Dot" (4W & GF only)
10	White (W)	Neutral Tap (4W & GF only)

IMPORTANT: Phase "B" CT wires are reversed for proper GF Polarity.

9.2 Current Transformer Connections

Each set of CT wires in the wiring harness is housed inside an individual PVC tube for added physical protection and to simplify the wiring process.

Connect to the #10-32 lugs using the ring tongue terminals provided. Make sure that the same tap is used on all three CTs.

9.3 Neutral Current Transformer

A neutral CT is only required on a 4-wire system with the ground fault function on.

On a 3-wire system, a neutral CT is not required even if the ground fault function is on.

The neutral CT and neutral wiring assembly are provided with the neutral CT kit.

Make sure the neutral CT tap is the same as used on the breaker CTs.

9.4 Actuator Connection

Route the red and black wires from the actuator to the "ACTUATOR" terminal block on the trip unit. Trim the wires to an appropriate length. Use the protective sleeving on the wires.

Connect the red actuator wire to the "+" terminal on the wiring harness trip unit connector. Similarly, connect the black actuator wire to other terminal on the trip unit.

9.5 Ground Trip Unit

Ground the trip unit as follows: (See Figure 2)

1) **Attach one end of the #14 SIS wire to the trip unit using a #10 ring terminal.**

2) **Attach the other end of the #14 SIS wire to the breaker frame using a #10 ring terminal. Make sure the wire will not be pinched, cut or chaffed by any moving parts or sharp edges.**

10.0 Final Test

Perform a final electrical test of the breaker as indicated in Section 2.

A primary injection test is recommended as the final test of the AC-PRO retrofit. See Section 11 "TESTING" in the AC-PRO instruction manual for complete details.

11.0 Communications

The following instructions are for the communications option using the AC-PRO+:

11.1 Install PT Module

The PT Module mounts on the "top of the frame" as shown in Figures 15 and 16.

1) **Attach the BR-030-1 bracket to the PT Module using two (2) 8-32 X 3/8 Phillips screws and lock washers.**

2) **Attach bracket BR-713 shield to the PT Module using two (2) 8-32 X 3/8 nylon R.H. screws and lock washers.**

3) **Using the PT Module/bracket assembly as a guide, mark the location of the two (2) mounting holes. Drill two (2) 9/32 holes where marked.**

4) **Attach the PT Module/bracket assembly to the breaker using two (2) 1/4-20 X 3/4 HCS, lock washers and hex nuts.**

11.2 Install Fuse Block for PT Module

1) **Attach the 3-pole fuse block to the breaker as close to the line side stabs as possible.**

2) **Drill and tap two (2) 8-32 holes using the fuse block as a guide.**

3) **Attach the fuse block to the back of the breaker using two (2) 8-32 X 3/8 P.H. screws and lock washers.**

11.3 Communications Wiring

Refer to Figure 17 for the following:

1) Voltage Input

Determine the line side of the breaker and drill and tap a 10-32 hole in each of the three line side poles.

Use #14 SIS wire from the bus taps to the 3-pole fuse block. *It is very important to maintain the proper phasing*.

Use #18 MTW wire from the 3-pole fuse block to the PT Module. Use fiberglass sleeving to protect the wires.

2) Ground Input

Connect a #18 MTW wire from the "Ground" terminal of the PT Module to the breaker frame.

3) PT Module Harness

Plug the PT Module cable into the bottom of the AC-PRO+ trip unit and the PT Module.

Use cable ties and holders to make a clean installation.

4) Breaker Position Indication

As an option, connect an unused "a" contact in the breaker auxiliary contacts to the two position input terminals on the PT Module.

This will provide the breaker open or closed information to the communications system.

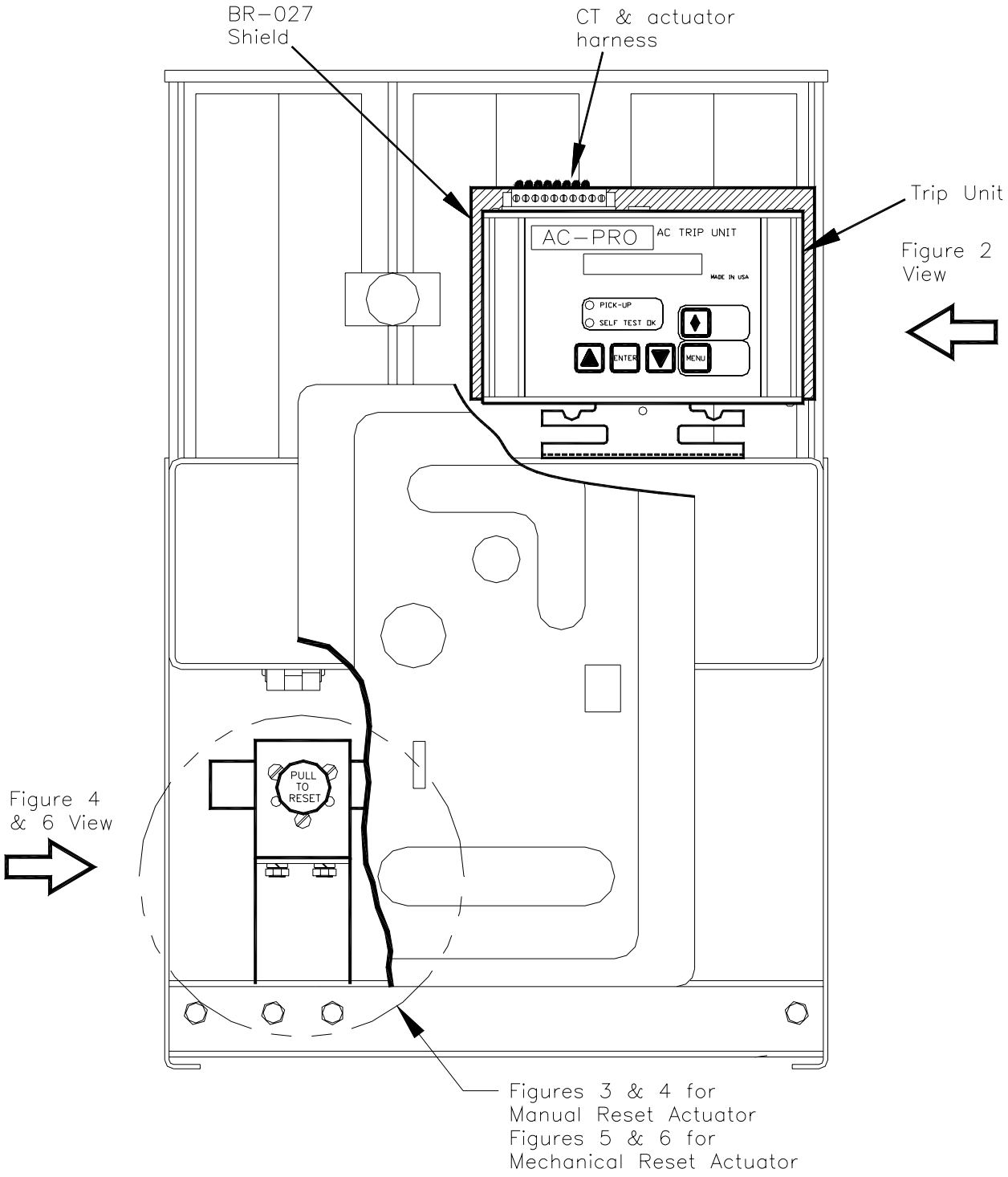

FIGURE 1
Front View

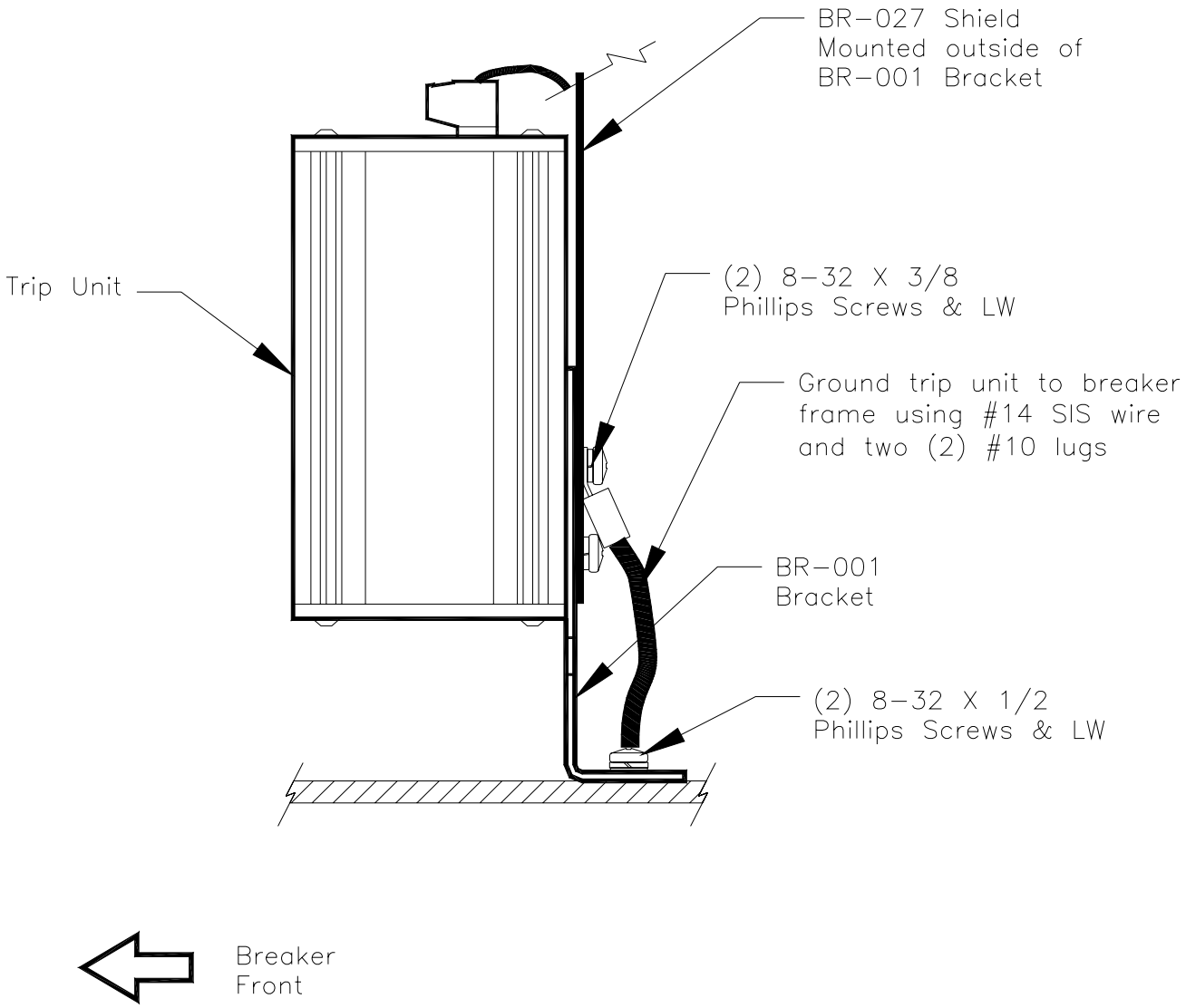

FIGURE 2
Trip Unit Installation

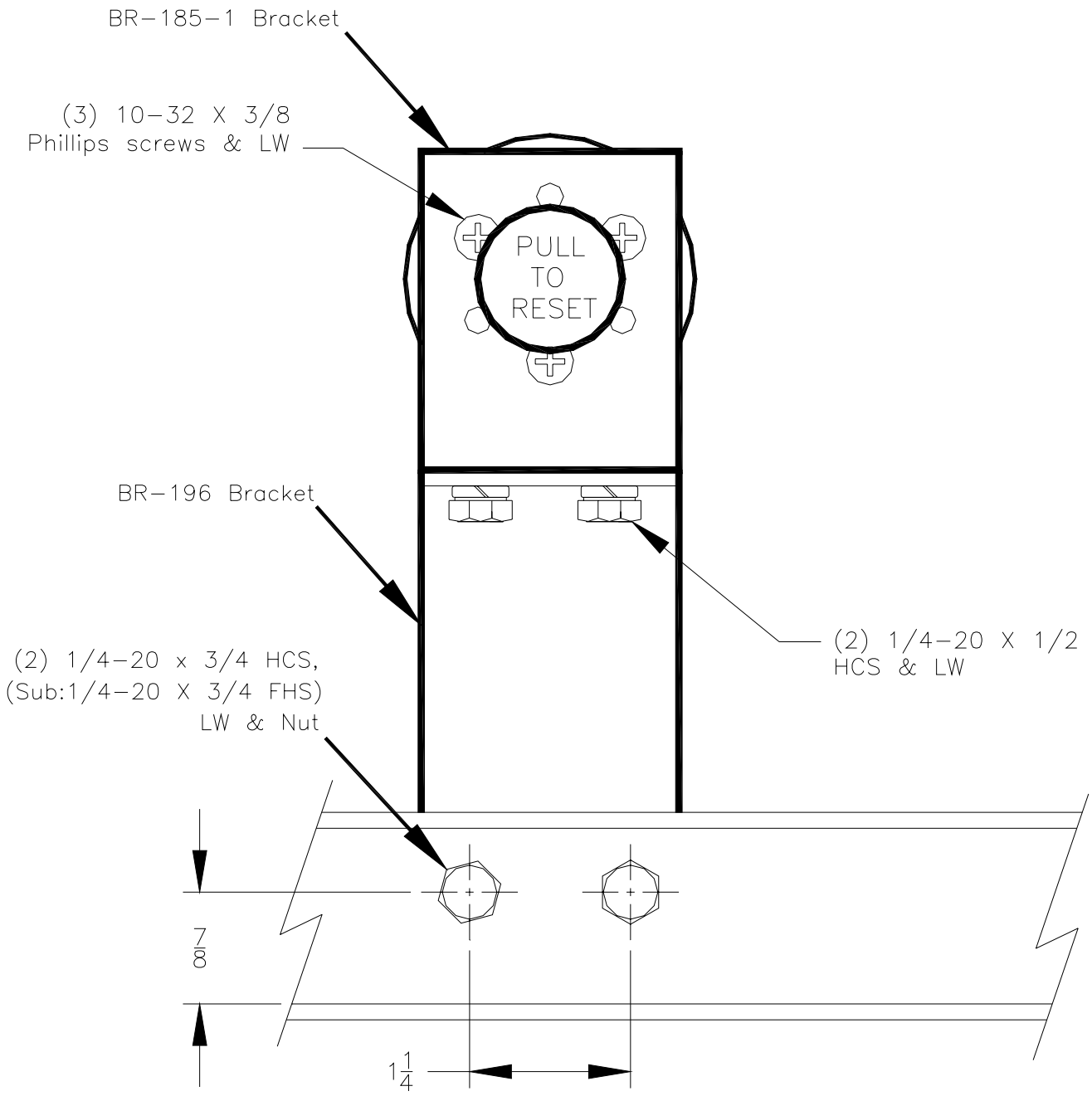

FIGURE 3
Manual Reset Actuator
Front View

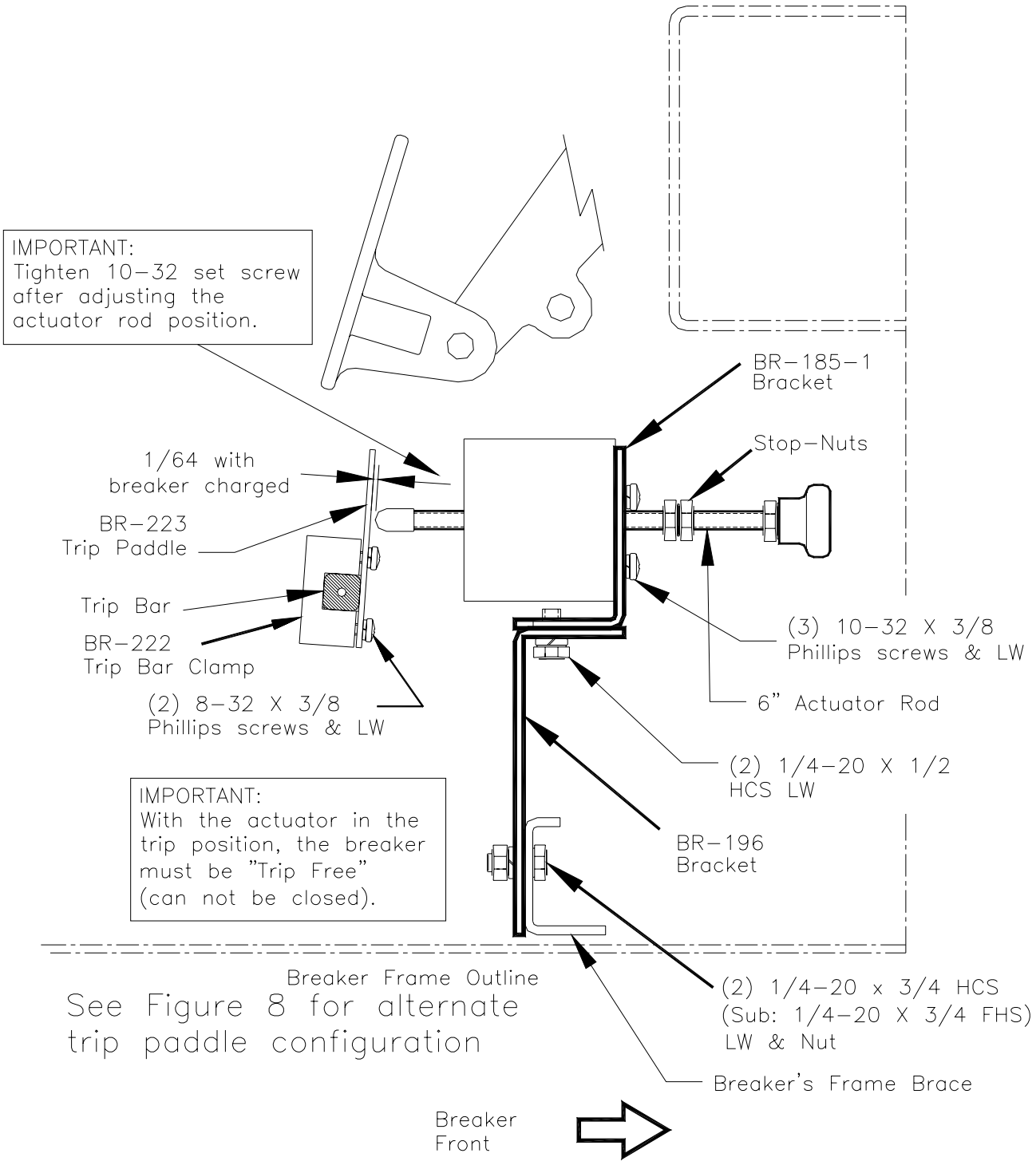

Figure 4
Manual Reset Actuator/Trip Paddle Installation
Right Side View

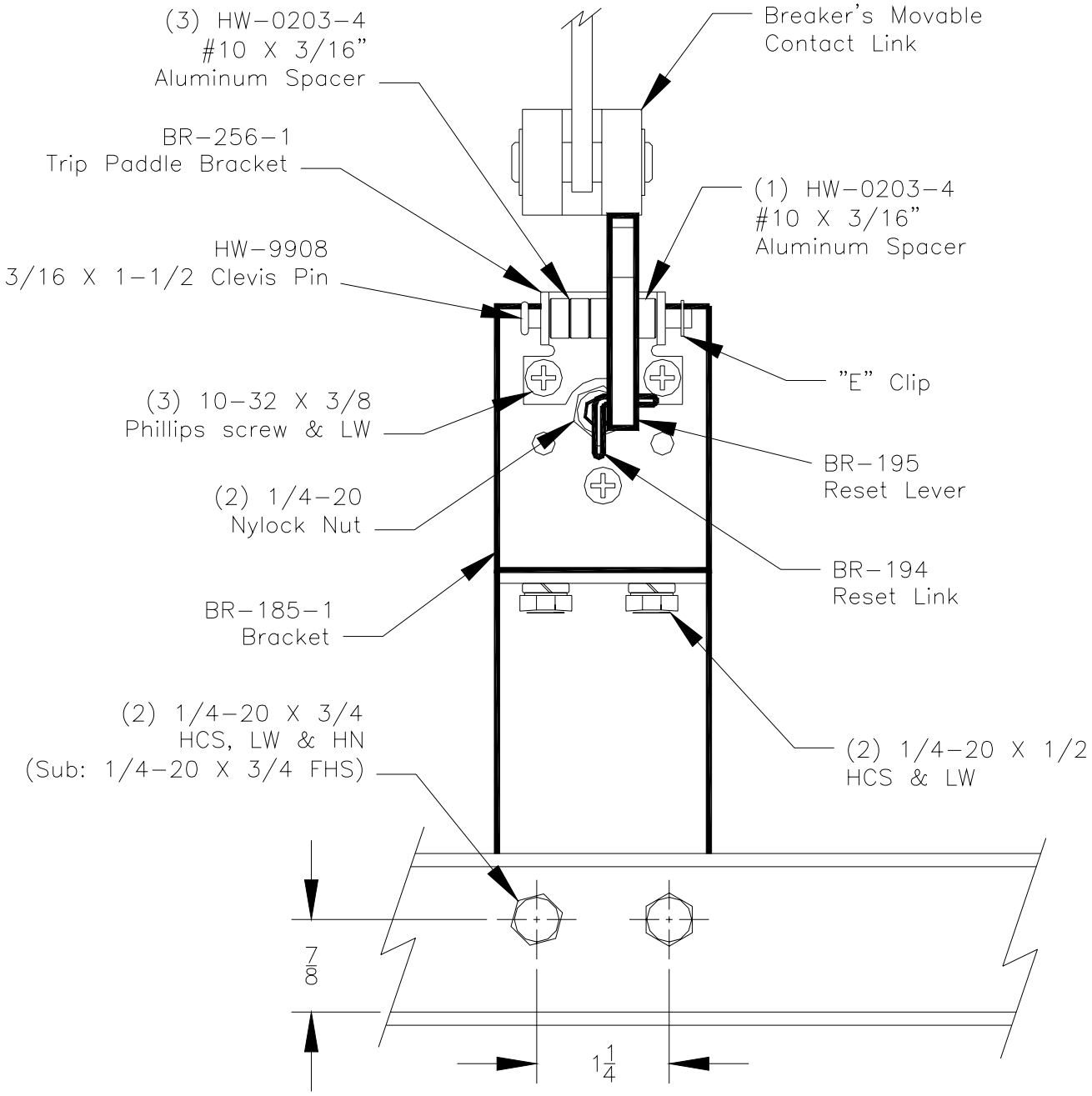

FIGURE 5
Mechanical Reset Actuator
Front View

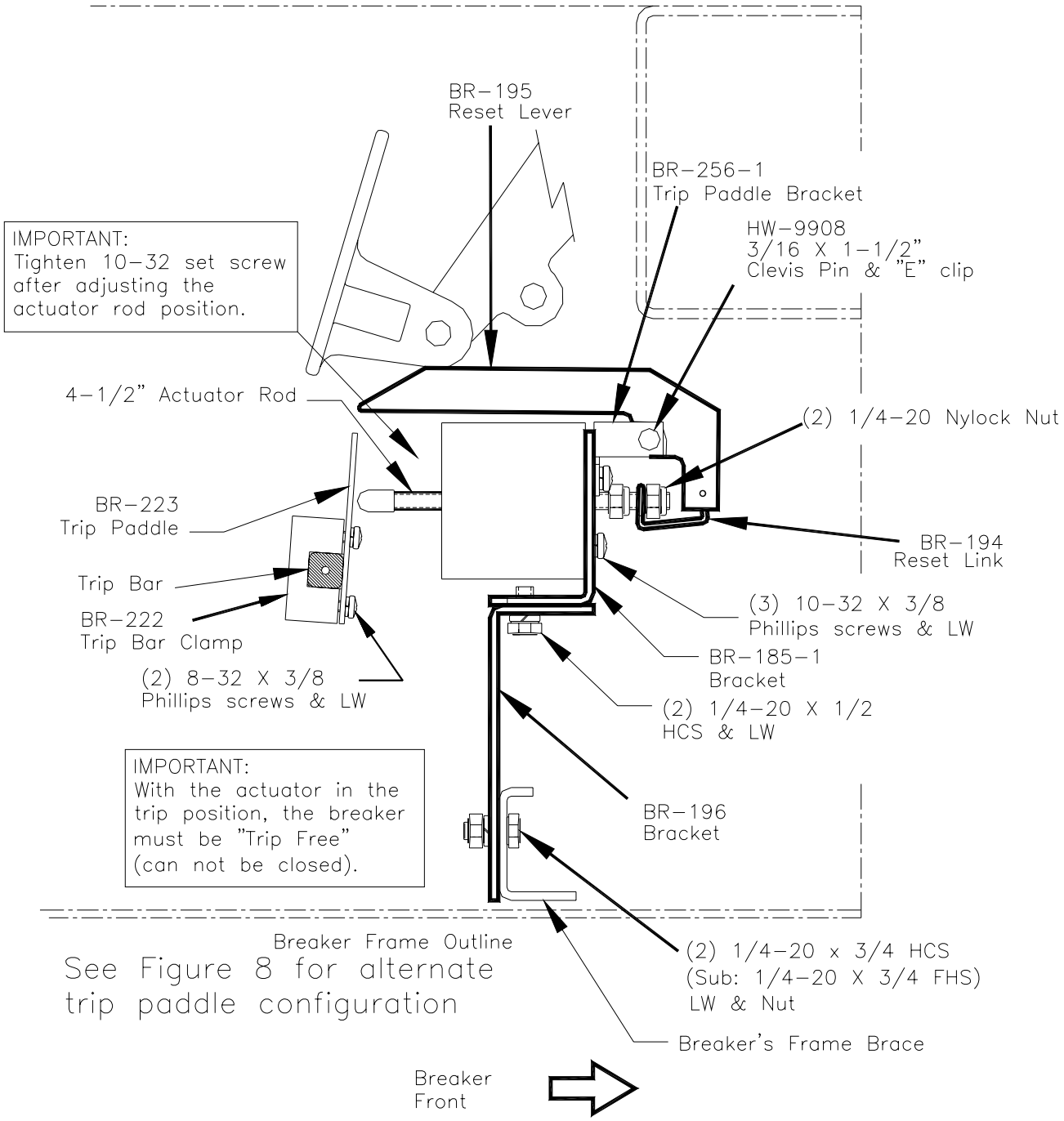

FIGURE 6
Mechanical Reset Actuator
Right Side View

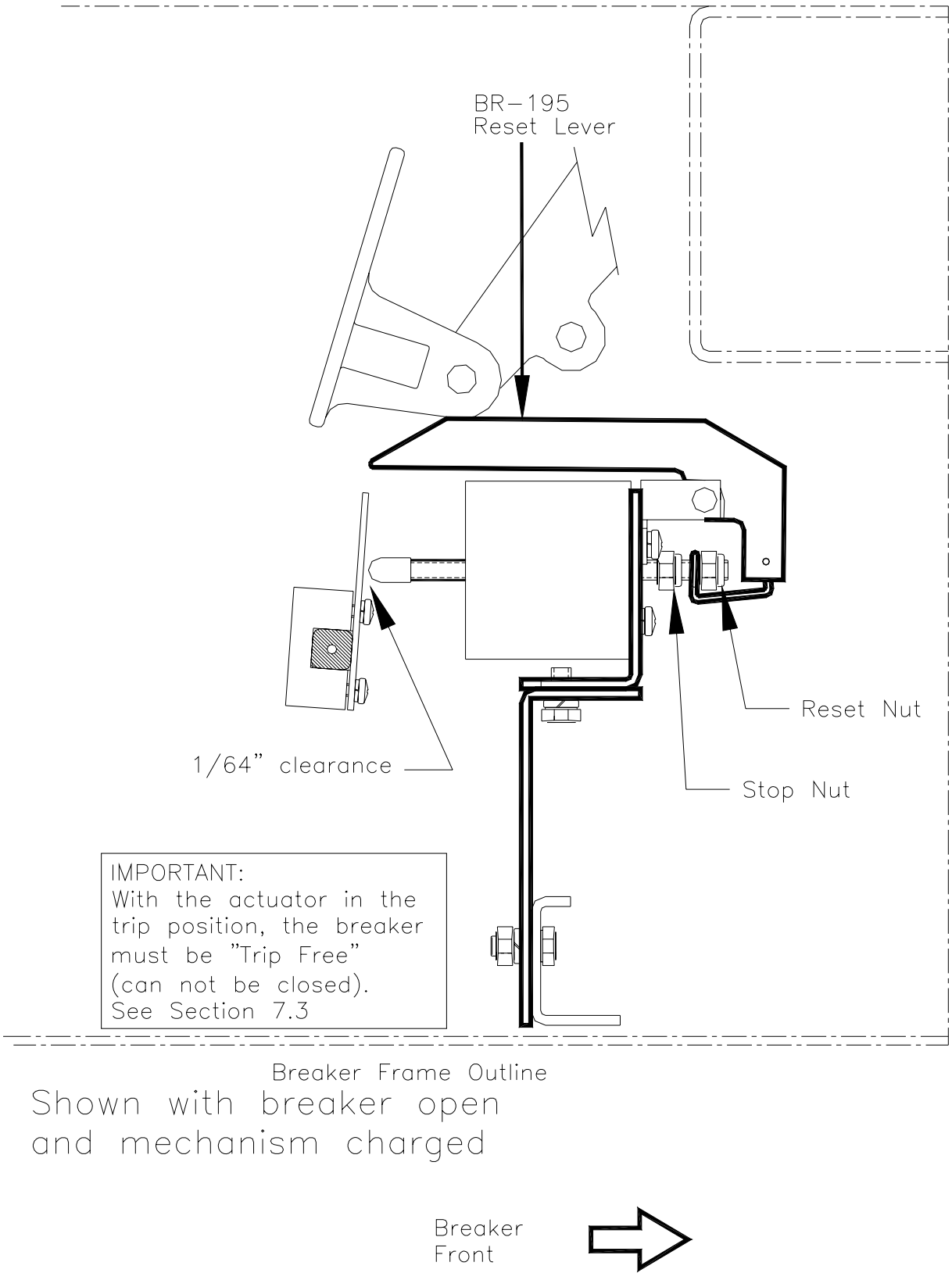

FIGURE 7
Mechanical Reset Actuator Adjustment

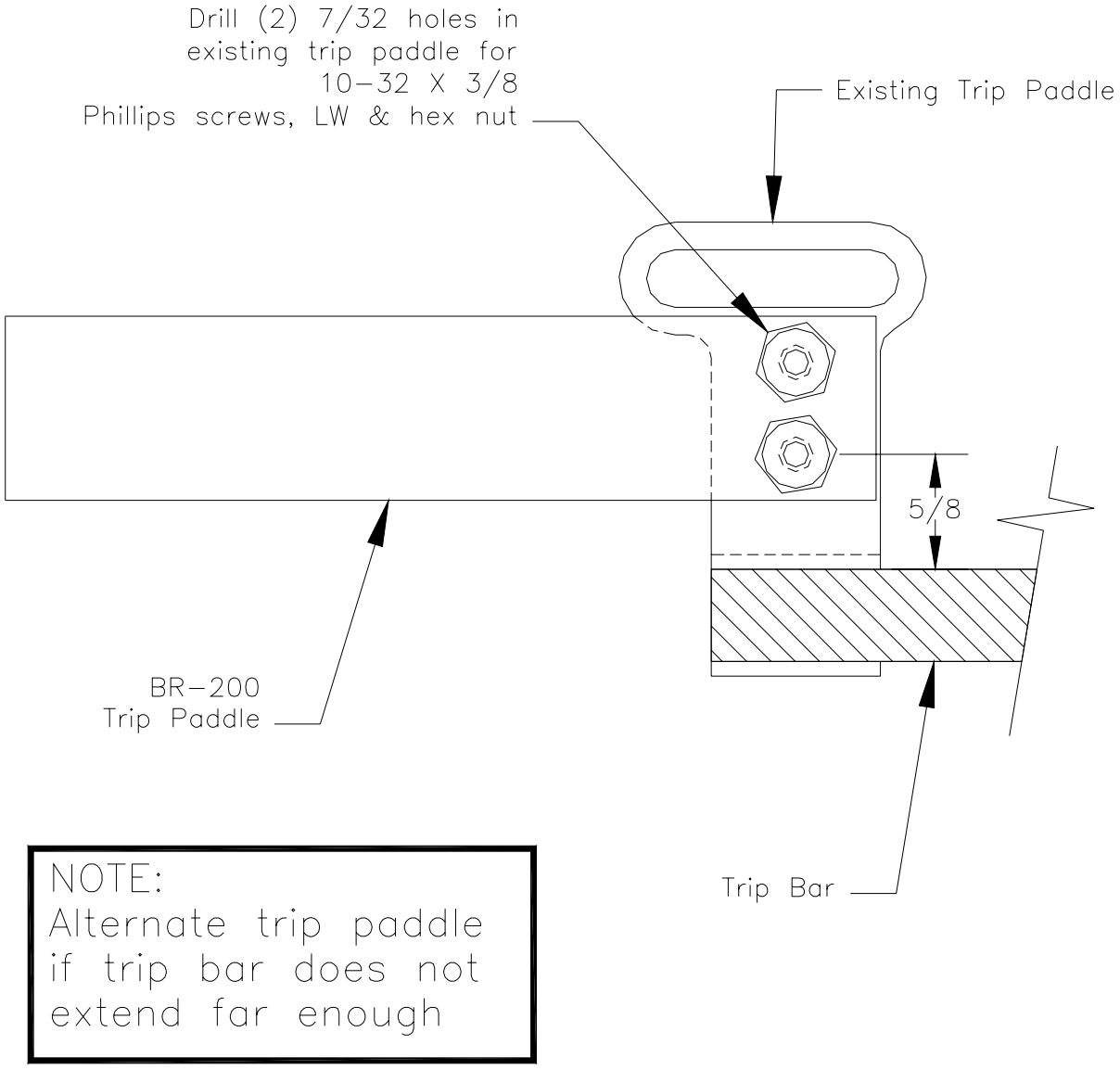

FIGURE 8
Trip Paddle Extension

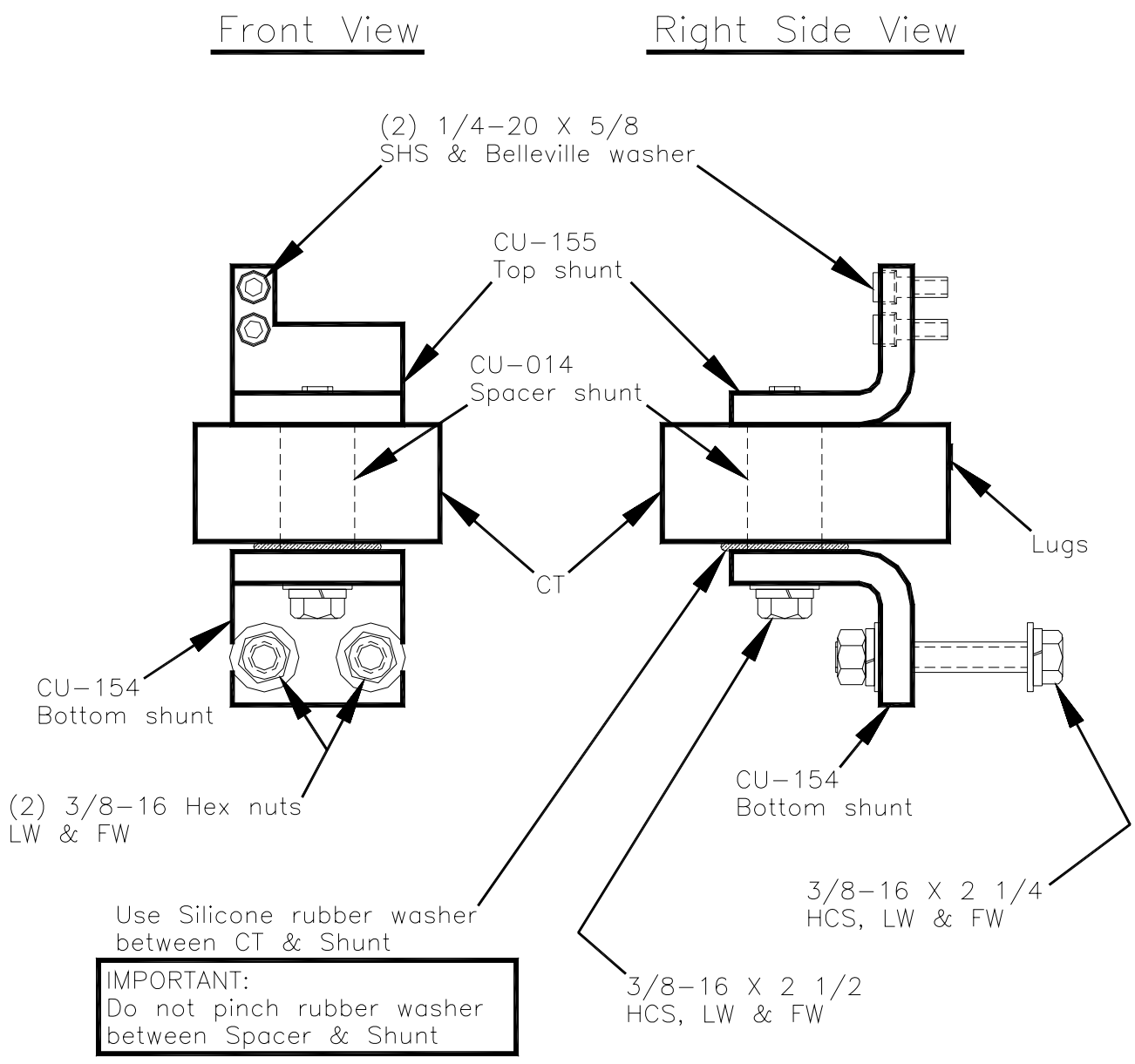

FIGURE 9
600 Amp CT Installation

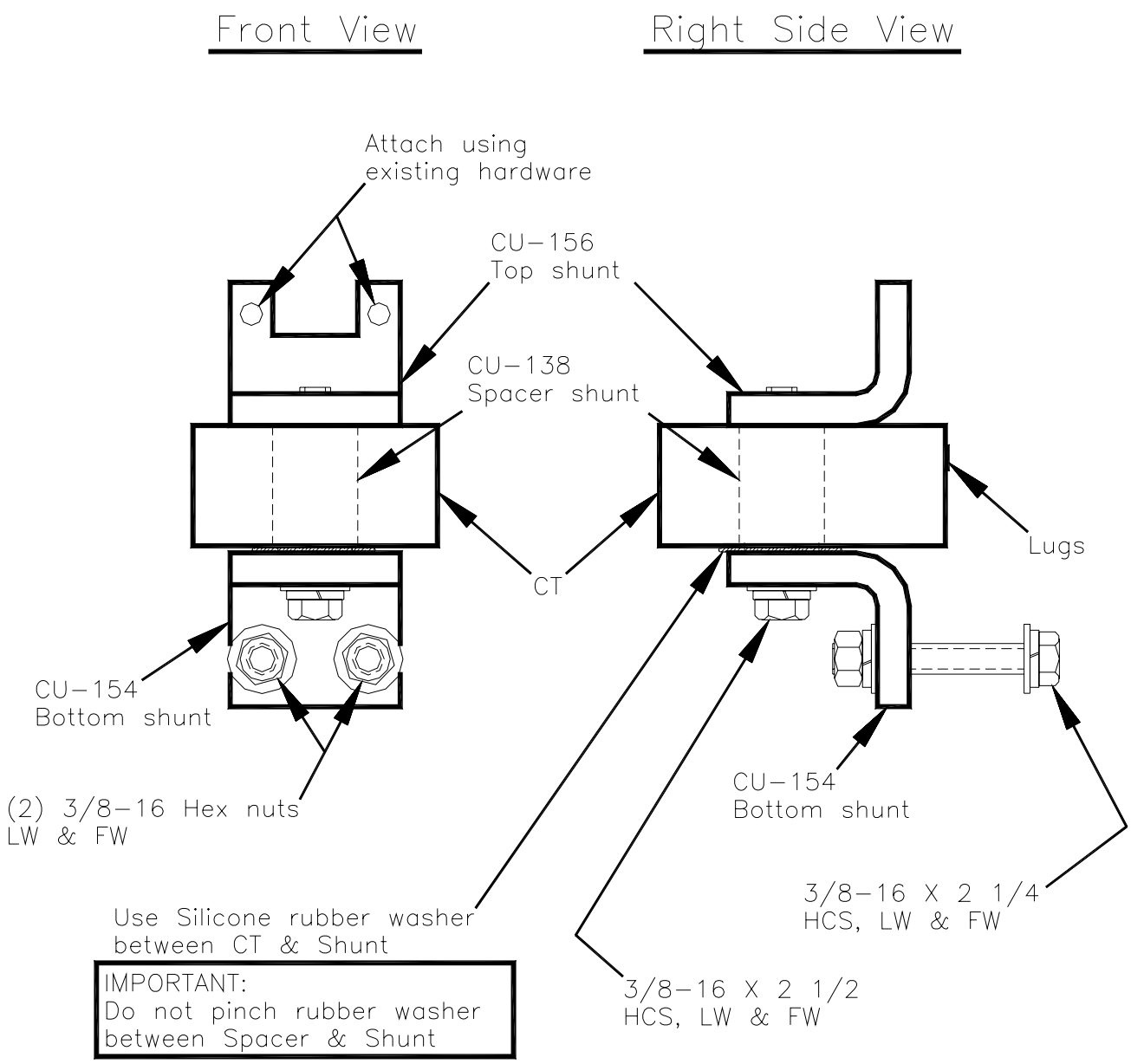

FIGURE 10
800 Amp CT Installation

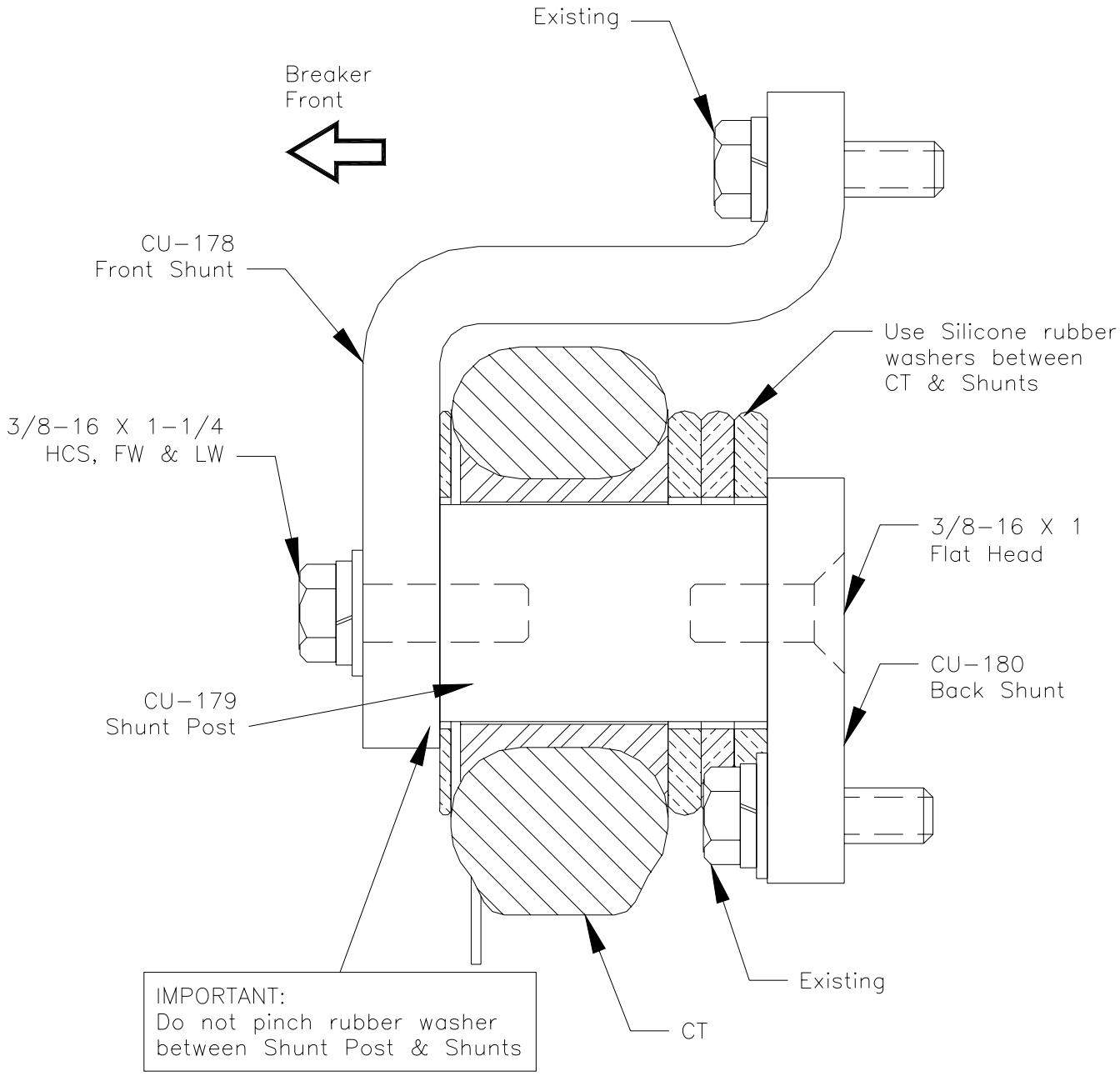

FIGURE 11
1600/2000 Amp CT Installation

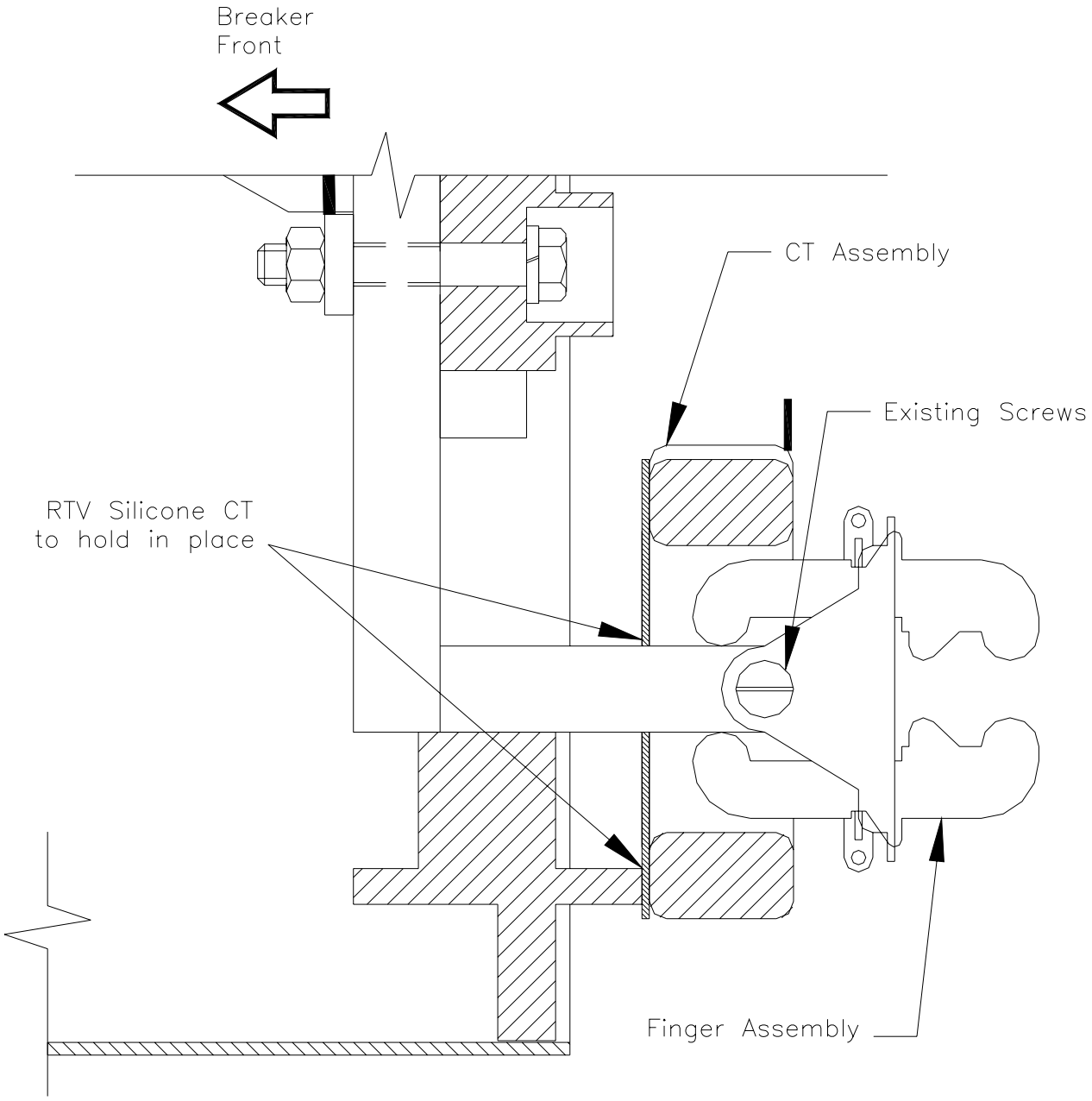

FIGURE 12
1600 Amp CT Installation
for Federal Pacific of Canada Breaker

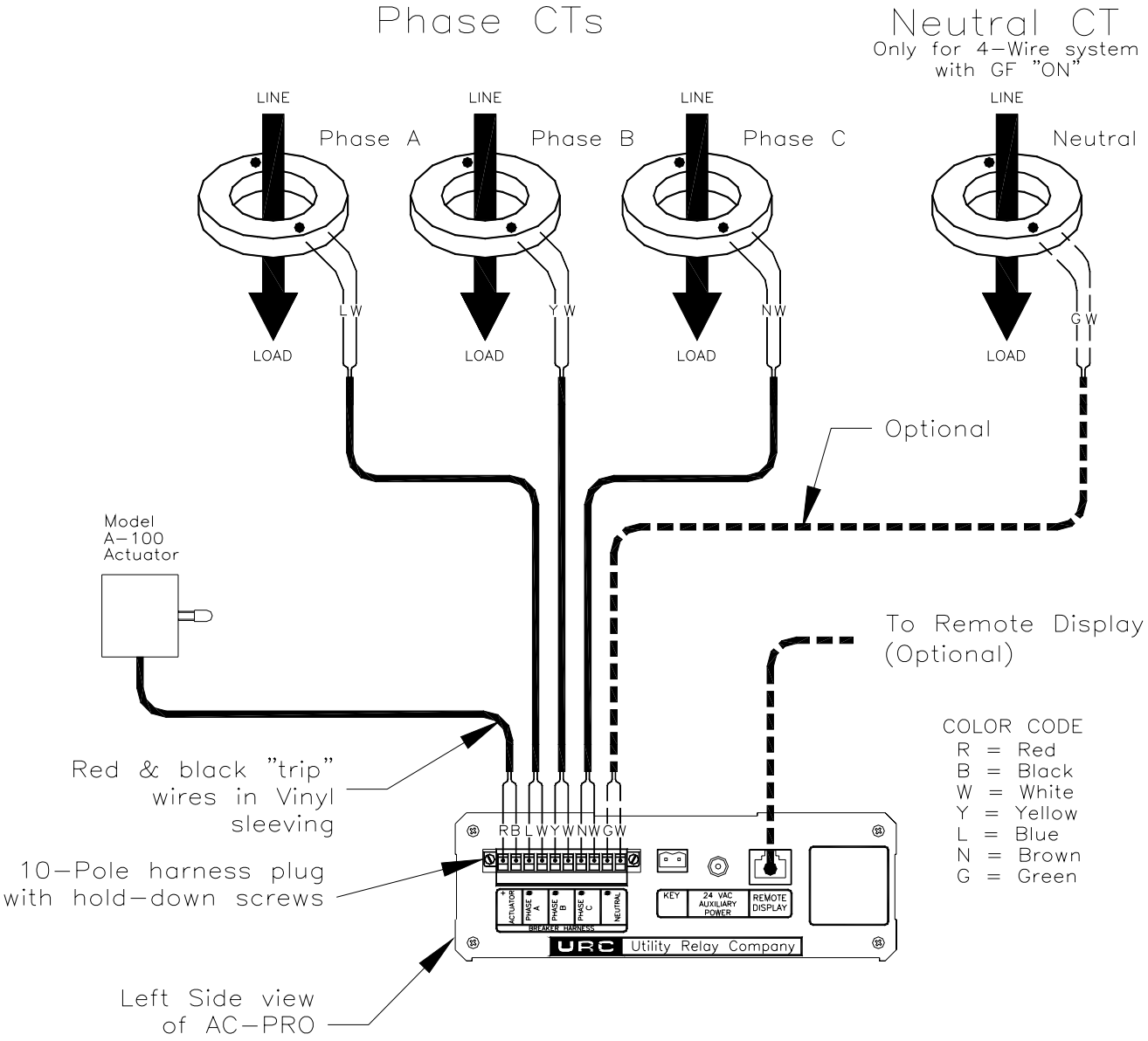

FIGURE 13
Wiring Diagram
Front Mounted CTs

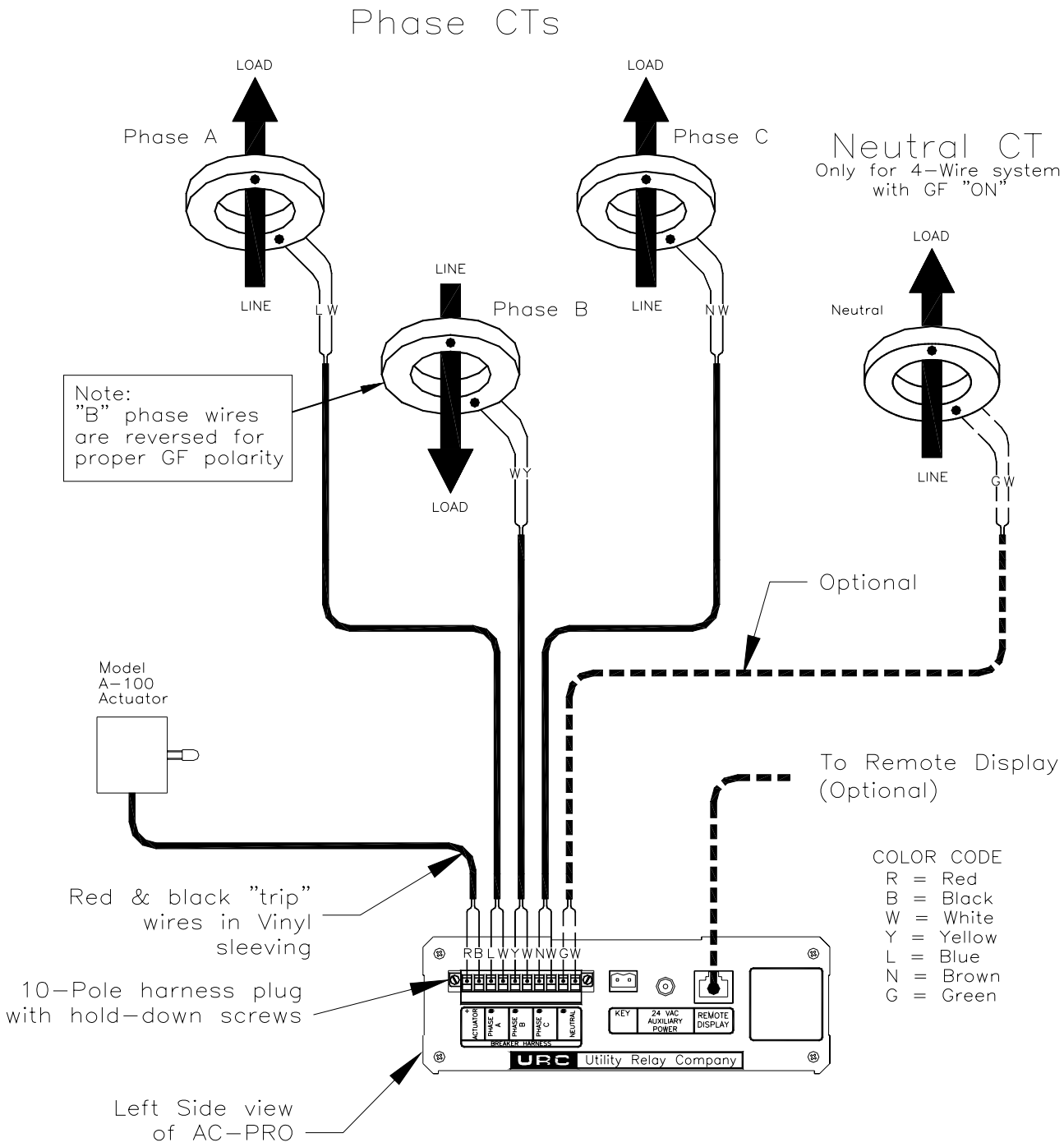

FIGURE 14
Wiring Diagram
Rear Mounted/Staggered CTs
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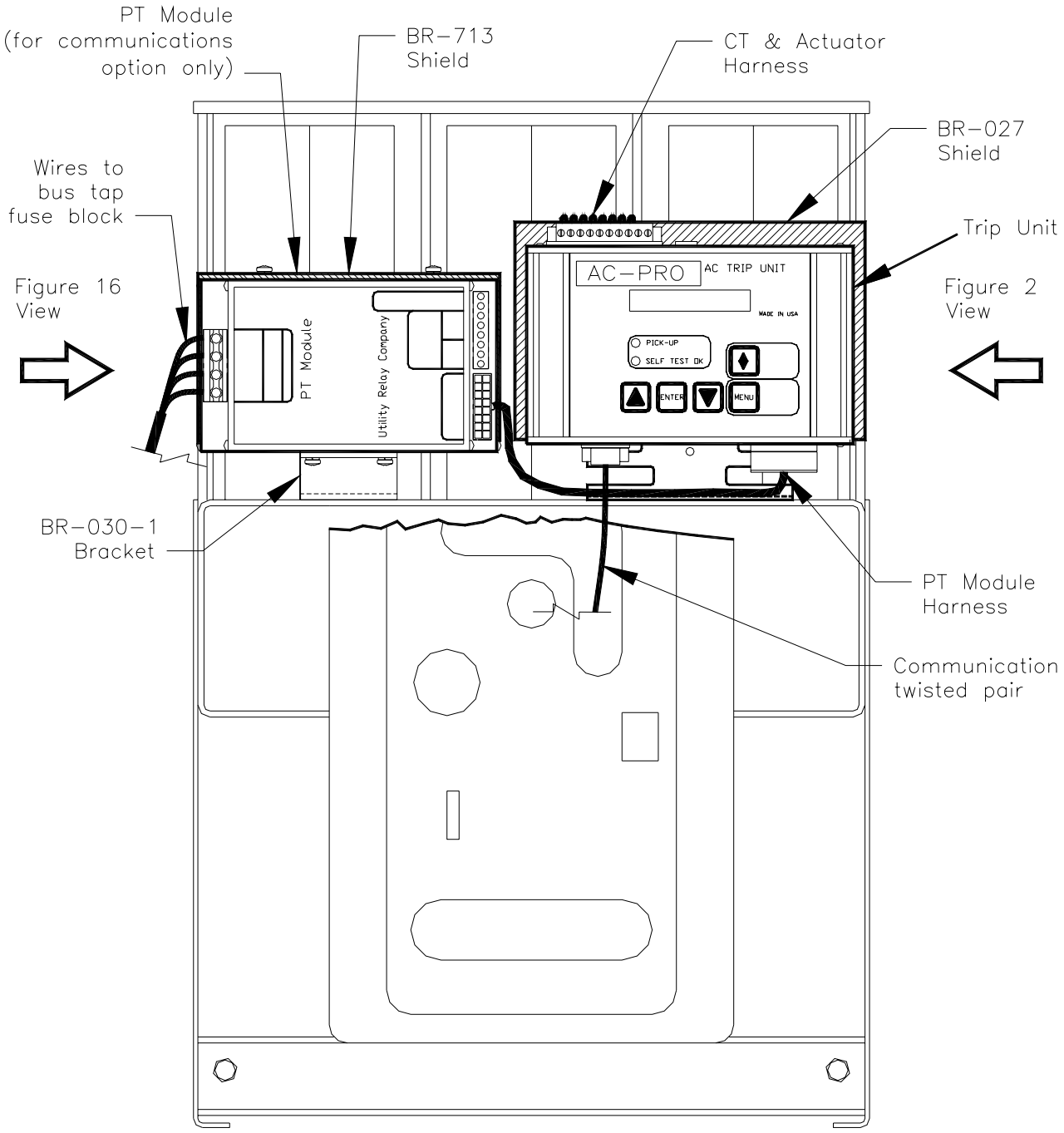

FIGURE 15
Front View with Communications

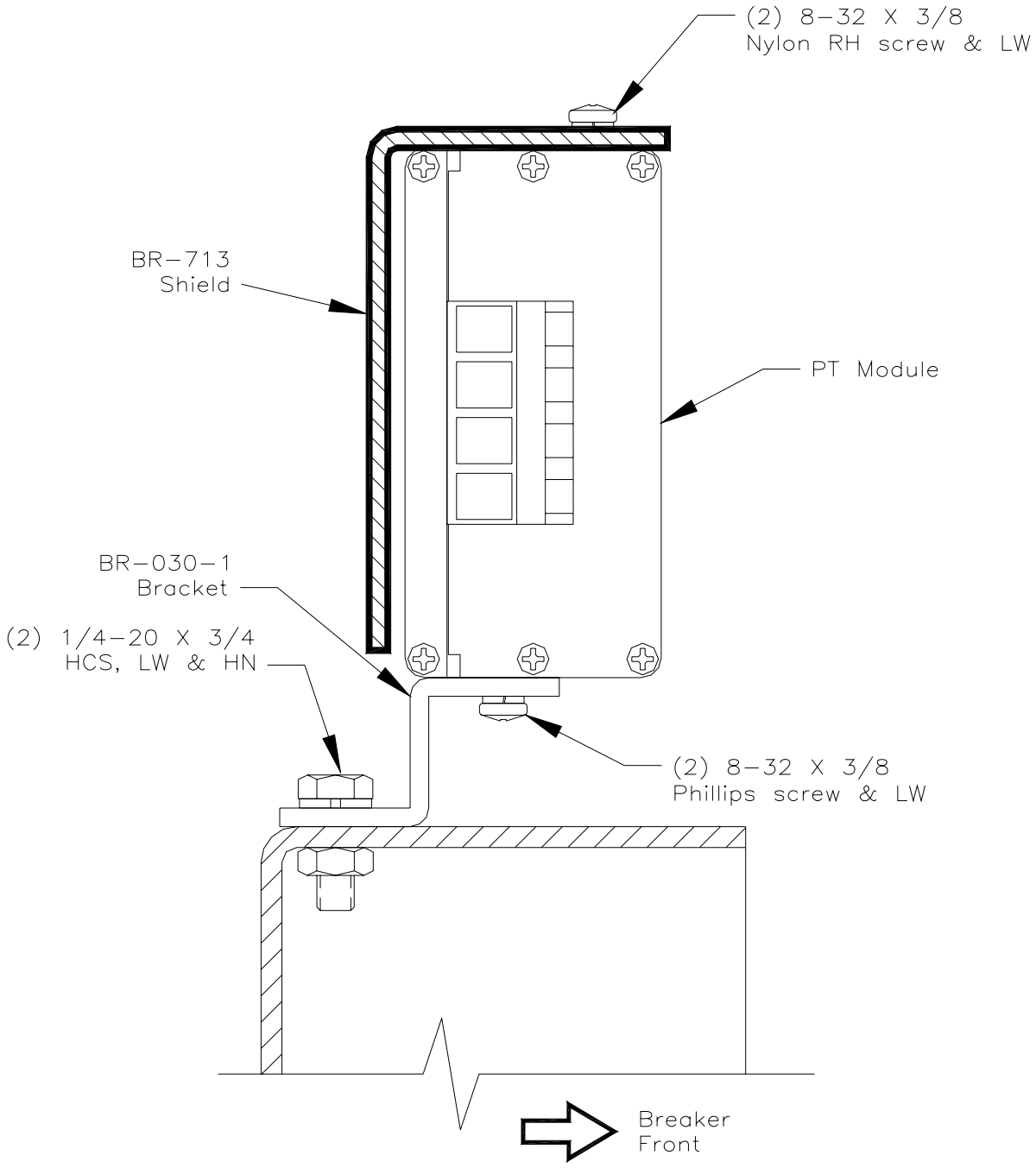

FIGURE 16
PT Module Installation

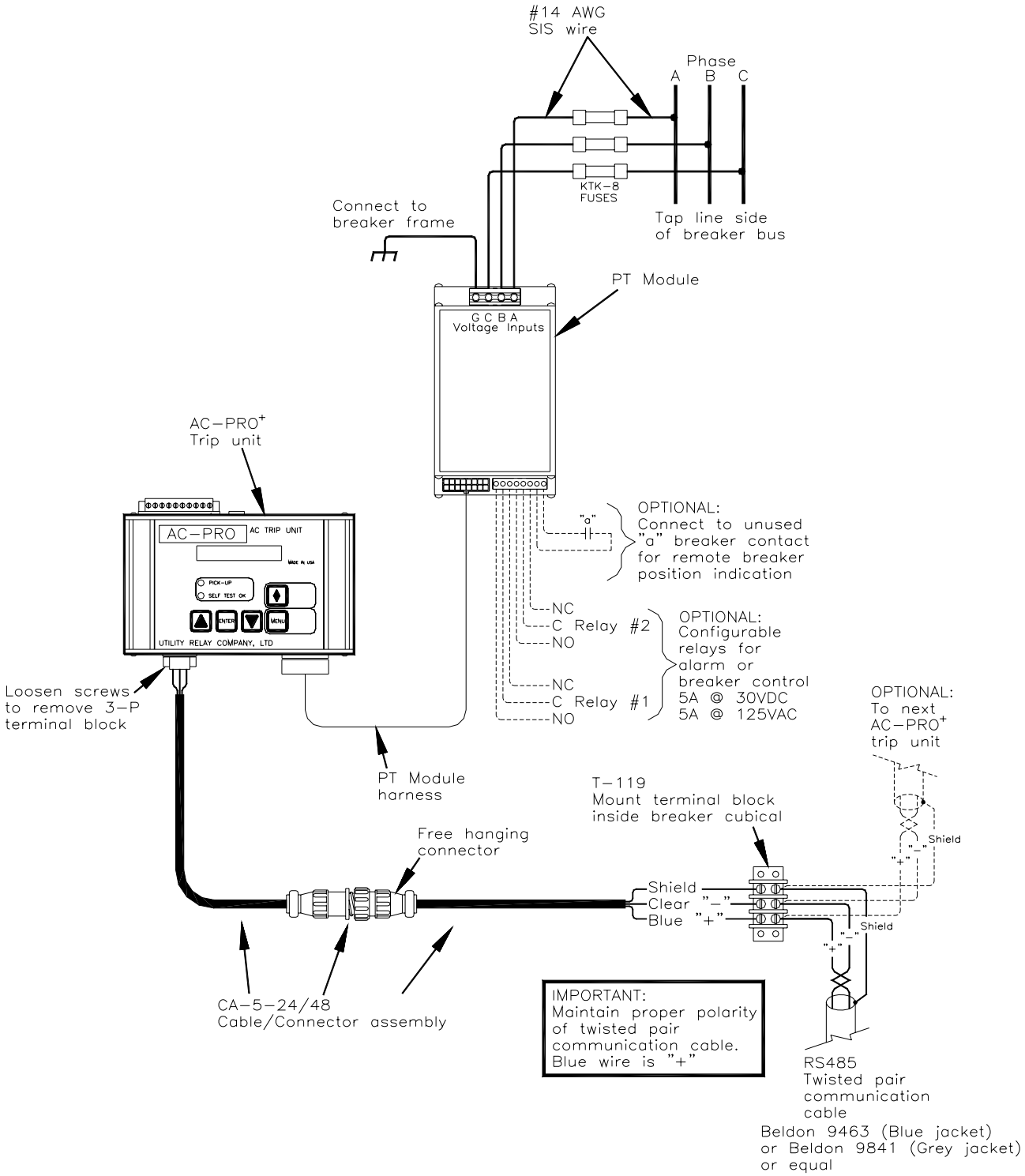

FIGURE 17
Communications Wiring