Kurz Instruments, Inc.

Model 452FT
Insertion Flow Transmitter User Guide
360170 Rev. A

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INTRODUCTION

The Kurz Instruments 452FT series of insertion mass flow transmitters are point velocity sensing devices. The flow element is a constant temperature thermal anemometer which intrinsically measures the process fluid Reynolds number. The net meter response is mass rate per unit area. The engineering output may be scaled to represent standard velocity, standard volumetric flow or mass rate. Density changes are automatically accounted for negating the need for pressure and temperature compensation. A complete description of how and what the thermal anemometer measures can be found in Appendix A. The units must be calibrated in the gas type to be measured or may be correlated from Air calibrations if available.

The 452FT is a 3, 4 or 5-wire device whose 4- 20 mA output current is directly proportional to the flow rate. The unit is available as 24 VDC, 115 VAC @ 50 to 60 Hz, or 230 VAC @ 50 to 60 Hz powered. The 4-20 mA output can be nonisolated self-powered or isolated loop-powered. The typical configuration has all the electronics in one enclosure, known as the TA configuration, or with just the sensor and a terminal wiring board in a separate enclosure from the electronics in the TS configuration. Both cases are shown in the field wiring diagrams. The TS configuration is used where the sensor enclosure ambient temperature is expected to exceed 60 °C, allowing the electronics to be mounted separated in a cooler place.

Additional product description, specifications, outline drawings and explanation of part numbers can be found in the product brochure at the end of this section.

Important Issues for Accurate Flow Measurements

- Duct Velocity Profile Correction:
  - Does velocity profile change with dampers, fans, valves, etc. where the sensor is measuring?

- Sensor Insertion Location:
  - What part of the profile is to be measured?

- Duct Area:
  - Sensor blockage, reducing the effective area.

- Field Calibration:
  - With the FT, field calibration is limited to a Zero and Span adjustment. Changing the calibration as a function of velocity to account for velocity profiles is not available on the FT model, see model 155 for these features.

- Sensor Pitch or Orientation to the Flow:
  - Is the flow arrow pointing in the same direction as the flow?

- Medium to be Measured:
  - Was the unit calibrated in the medium to be measured?
  - Is the medium composition highly variable?
  - Does the medium change phase?
  - Can material build up on the sensor?

Answers to many of these question can be found in this manual or its appendices. Kurz customer service may also be contacted for assistance (408-646-5911 or FAX 408-646-1033). This user manual covers installation, operation, calibration and maintenance information.

INSTALLATION

WARNING: Your warranty will be voided if your unit is not installed in accordance with this user guide. Make sure you read and thoroughly understand the installation portion of this guide before you attempt to install your unit. If you have any questions, contact your Kurz customer service representative before attempting installation.

Mounting

The 452 insertion flow transmitter is generally mounted with a compression fitting into a duct or on a flange (See Figure 1). See the product brochure (DCN 367029) for Kurz mounting accessories. It is important for the mounting design to consider the force that will be exerted on the probe support or flange when the process fluid is under pressure. The insertion depth depends on the duct size and sensor size. Our recommended placement criteria are also in the brochure. The sensor blockage, used to establish the duct area where the measurement is made is specified in DCN 364002 included in Appendix C.

For transmitter separate versions (TS) there are two enclosures. The one with the sensor mounts as described above and contains just a sensor wire terminal board. The second enclosure contains the bridge electronics and is mounted via its conduit ports or a mounting bracket. This bracket has four 1/4" holes with 2.50" square spacing (see the brochure). It is important to know that the sensor serial number must be matched with the bridge board and its linearizer. These three parts are not interchangeable unless recalibrated.

Things to watch out for:

- If the process being monitored has moving valves or other flow profile disturbances you should keep your distance from them to obtain the best performance. About 30 duct diameters are needed to have the profile within about 1% of a long run velocity profile.

- When the dew point is close to your operation temperature, and/or you have a saturated gas in un-insulated ducting and condensation occurs on the walls, do not mount the sensor pointing in a downward angle. Pointing the sensor up or at the least horizontal will prevent condensation from reaching the sensor element and causing false high flow readings as the heated element evaporates the condensate.

Field Wiring

There are up to four issues for the proper wiring installation of the Kurz 452FT:

- Safety Grounding and Explosion Proof enclosure connections.
- DC or AC power requirements and connection.
- Analog Output configuration and wiring of the 4-20 mA signal.
- Sensor wiring for transmitter remote (TS) units.

Please read the complete text of the sections and study the wiring diagrams which are relevant to your model before performing the installation.

Safety

To ensure compliance with General Safety requirements the metal enclosures must be grounded to minimize the chance of electrical shock. For Explosive Atmospheres, proper grounding minimizes the chance of sparks occurring (ignition sources) outside an enclosure at its mechanical interfaces if a fault current was to flow. Both internal and external grounds are available, see the wiring diagrams at the end of this section. Units which are 24 VDC powered are wired according to DCN 342014 and those which are 115/230 VAC 50/60 Hz are wired according to DCN 342016.

For hazardous gas areas, wiring going into and out of the explosion proof enclosures must be done through a conduit seal or cable gland rated for explosion proof applications (Class 1 Div. 1 or Zone 1) attached directly to the enclosure. These seals are not needed for nonincendive designs (Class 1 Div. 2 or Zone 2).

For hazardous areas it is important to not connect or disconnect any wiring when the circuit is energized, the resulting spark could cause ignition.

Typical Hook-Up Wiring Diagrams

For both the AC & DC powered versions of the 452FT, typical summarized wiring diagrams for most applications are available as defined in Table 1.

TABLE 1

Typical Wiring Diagrams

4-20 mA Analog Output Configuration	Input Power	Interconnection Wiring Configuration	See Figure#
Nonisolated Only Self-Powered	115 VAC or 230 VAC 50 Hz - 60 Hz	Separate Shielded 3-Wire Power and Shielded 2-Wire Signal Out Cables	Figure# 2
Nonisolated Only Self-Powered	24 VDC	Single Shielded 3-Wire Power and Signal Out Cable	Figure# 3
Nonisolated Only Self-Powered	24 VDC	Separate Shielded 2-Wire Power and Shielded 2-Wire Signal Out Cables	Figure# 4
Nonisolated or Isolated Loop-Powered	115 VAC or 230 VAC 50 Hz - 60 Hz	Separate Shielded 3-Wire Power and Shielded 2-Wire Signal Out Cables	Figure# 5
Nonisolated or Isolated Loop-Powered	24 VDC	Single Shielded 3-Wire Power and Signal Out Cable	Figure# 6
Nonisolated or Isolated Loop-Powered	24 VDC	Separate Shielded 2-Wire Power and Shielded 2-Wire Signal Out Cables	Figure# 7

24 VDC Powered Flow Transmitters

The 24 VDC power is a nominal voltage since all circuits have a regulated supply and will work between 18 and 28 VDC. You may also use an unregulated power supply with 50 to 60 Hz ripple as long as the instantaneous voltage is between 18 and 28 VDC. Surge currents during sensor warm up could require up to 660 mA and will fall off after it warms up in about 30 seconds. At no flow the current will be about 0.2 A and about 0.5 A for high flow rates (12,000 SFPM). The power is protected against reverse polarity so if no current flows or there is no output signal you may want to check the polarity against the wiring diagram, DCN 342014.

The flow transmitter is isolated from ground to avoid ground loop currents. However, the 24 VDC power and 4-20 mA signal have MOVs (metal oxide varistors) to clamp voltage spikes going into the unit. These are 39 V nominal (voltage level at 1 mA) and do not conduct significant current below about +/- 30 VDC relative to ground. Consequently, it is a good idea to have the 24 VDC power grounded to prevent leakage currents on the MOVs, which can cause an error in the flow measurement if occurring on the 4-20 mA signal.

AC Powered Units

The 115 VAC @ 50 to 60 Hz and the 230 VAC @ 50 to 60 Hz units are factory wired to the voltage range ordered. The transformer jumpers and fuse may be changed as required. See the field wiring diagram DCN 342016 for the details. The voltage must be nominal +10/ -20 % for proper operation. The 115 V unit requires a 0.3 A connection and uses a slow blow fuse of the same rating. The 230 V unit is half this. All wiring to the AC power supply interface board must be routed through the holes provided in the PCB before connection to the terminal strips to prevent the wires from catching in the threads of the explosion proof lid. The internal ground can be made via the AC power plug or a 10-32 stud on the PCB. There is no power disconnect means for this unit.

Analog Output

The 4-20 mA linear output of the 452FT is jumper selectable for a self powered, nonisolated only signal or a loop powered nonisolated or isolated signal. The positive output terminal is diode protected against reverse voltage. The jumper settings for the 4-20 mA mode are found on the linearizer board which is found in the opposite enclosure chamber to that of the power and signal hook up terminals.

A self powered, nonisolated output is the factory setting. To use it in this mode, the receiving current should be sensed with an isolated input to avoid ground loop currents. This isolated input is often just a differential mode receiver. The 4-20 mA circuit has a 7 V compliance at the full 20 mA current. The internal voltage supply which powers the loop current limits the maximum load resistance to 500 Ω or a 10 V load. In this mode, the negative lead of the 4-20 mA circuit is internally connected to the 24 VDC negative lead. So, it is possible to wire the unit in three wire mode (See Figure 3). That is to use the negative power lead also for the 4-20 mA return lead.

As a loop powered 4-20 mA output (See Figures 5, 6, & 7), the jumper setting on the linearizer board must be changed. This configuration is useful when nonisolated current sensing is used or larger load resistance is needed. For example, with a 24 V power supply, you can drive 800 Ω. Do not exceed 30 VDC on the loop powered interface or you may have leakage current from the protective MOVs causing an error in the measurement. In summary, a loop powered configuration places a customer provided DC power source, the 452FT output and load resistance(s) all in series.

Transmitter Separate (TS) Configurations

The wiring of the TS configuration has a few more constraints since you must wire up the 5 sensor wires too. The most important thing about the TS wiring configurations (see sheet two of DCN 342014 and sheet two of DCN 342016) is keeping the 5 wires going to the proper terminals. The second most important thing is to make sure the linearizer PCB is plugged into the bridge board with both rows of pins properly mated. When connecting the 5 wires to the lower bridge board for the sensor, the terminals must be tight. Over torquing the connectors can damage them or components' surface mounted on the bridge board. When the linearizer is reinstalled, its two pin 4-20 mA connector must be above the same type two pin connector on the bridge.

The 5-wire sensor connection must use quality wire whose resistance per lead is less than 1 Ω. Each wire must match the resistance of the other wires within 0.01Ω so the lead length correction will work properly. This procedure is needed to ensure the factory calibration and temperature compensation holds up in the field. If the individual wires do not meet the matching specification, their length must be trimmed or extended until they match. The terminal strips for the bridge board are limited to 14 AWG wire which limits the TS configuration to about 400 ft between sensor and electronics (see wiring diagram). Longer lengths would need a wire splice from the larger wire size to 14 AWG to fit the bridge terminals. Again to get access to the bridge terminals, the linearizer PCB must be unplugged from the bridge. Be careful when reinstalling the

linearizer that the plug-in connector pins mate properly.

To maintain the CE compliance of the product when in the TS configuration one must maintain a good shield around the 5 wires. This can be done with ridged conduit between the sensor junction box and the sensor electronics enclosure. Conduits that seal directly to the enclosure are still needed to meet the explosion proof ratings. Or a braided shield multiconductor cable between the two enclosures. Peripherally bonded shielded cable glands are required for cable connections. Hawk, makes a whole line of cable glands for shielded cable, some have explosion proof ratings too. Please contact Kurz Instruments, Inc. Customer Service if you need information in this area or other aspects of the installation.

Optional Power-On Surge Check

Once the mechanical and electrical installation is complete and checked you may safely apply power. Buy monitoring the 4-20 mA signal during power on you can get a rough idea if the unit is working properly. A fast chart recorder, scroll mode digital storage scope or fast milliampere meter should be connected to the 4-20 mA signal. When power is first applied, you will typically see the signal go to a very high value, hold for up to a few seconds then exponentially decay to the present flow value in about 20 seconds. This occurs because the heated velocity sensing element is initially cold and is warming up. After it warms up, momentarily cycling the power will not produce a turn on surge as large as when it has been off for 5 minutes or longer.

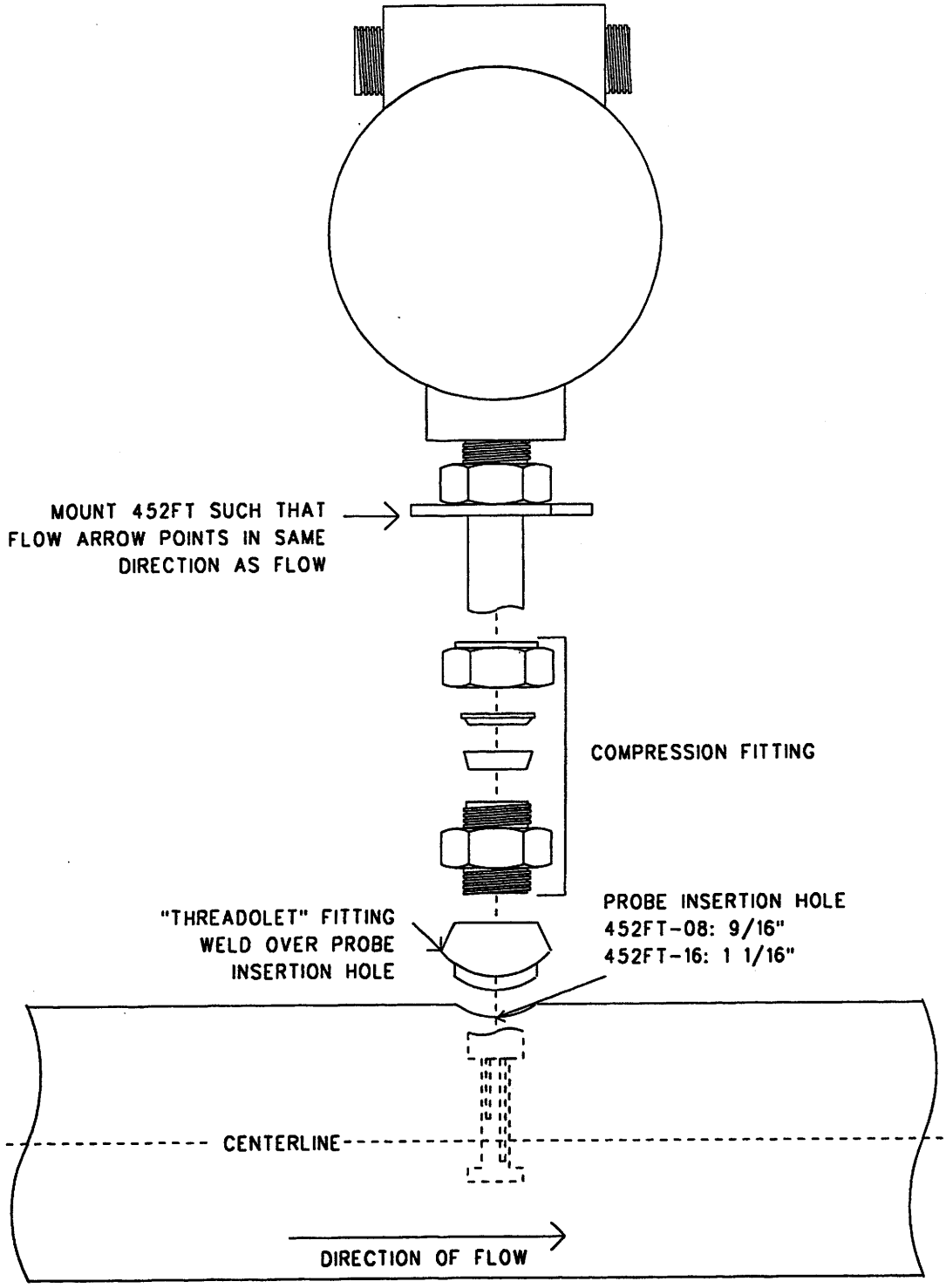

FIGURE 1 MODEL 452FT INSTALLATION WITH COMPRESSION FITTING

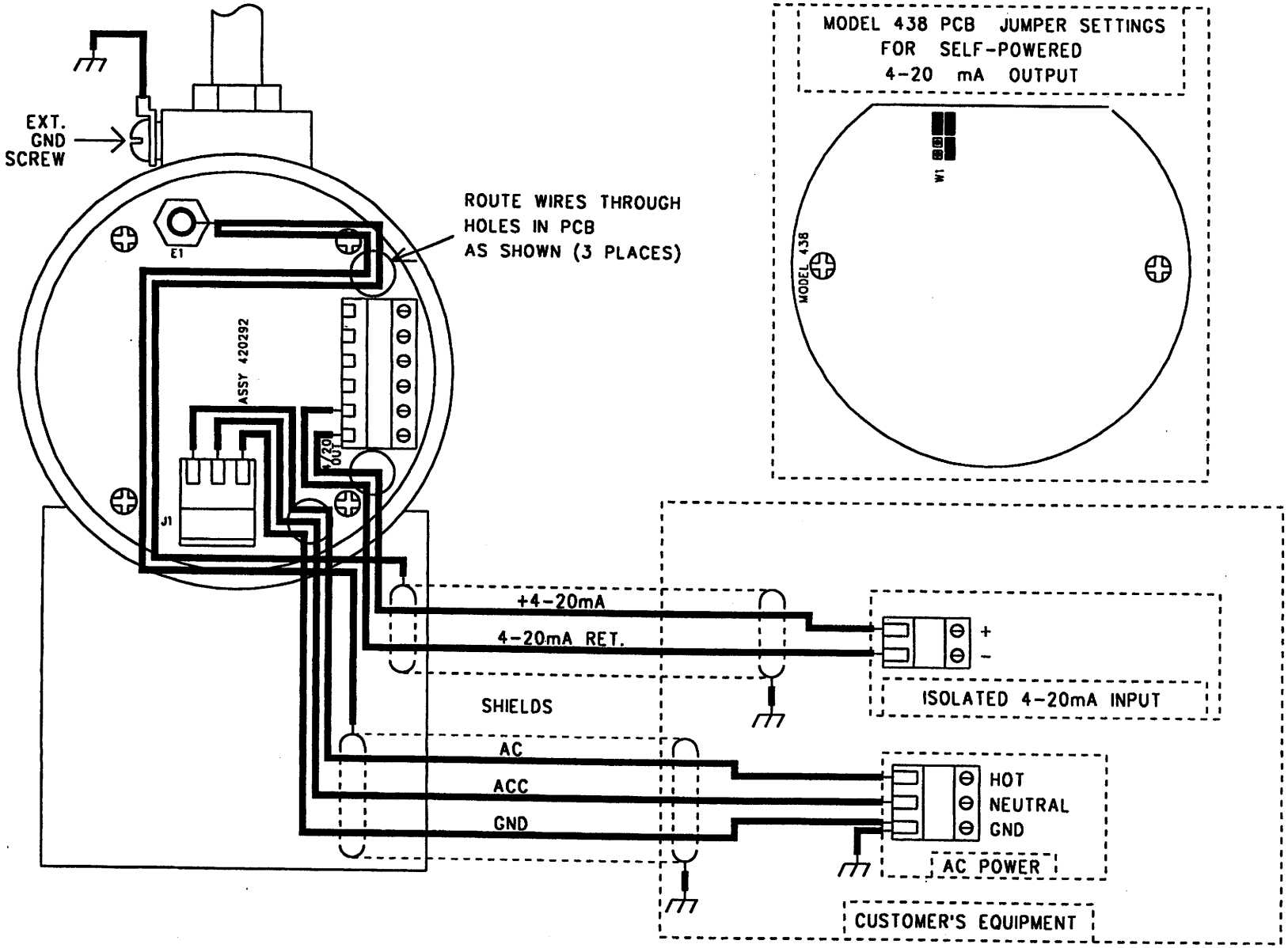

FIGURE 2 TYPICAL HOOK-UP FOR A.C. POWERED MODEL 452FT WITH NON-ISOLATED SELF-POWERED 4-20mA OUTPUT

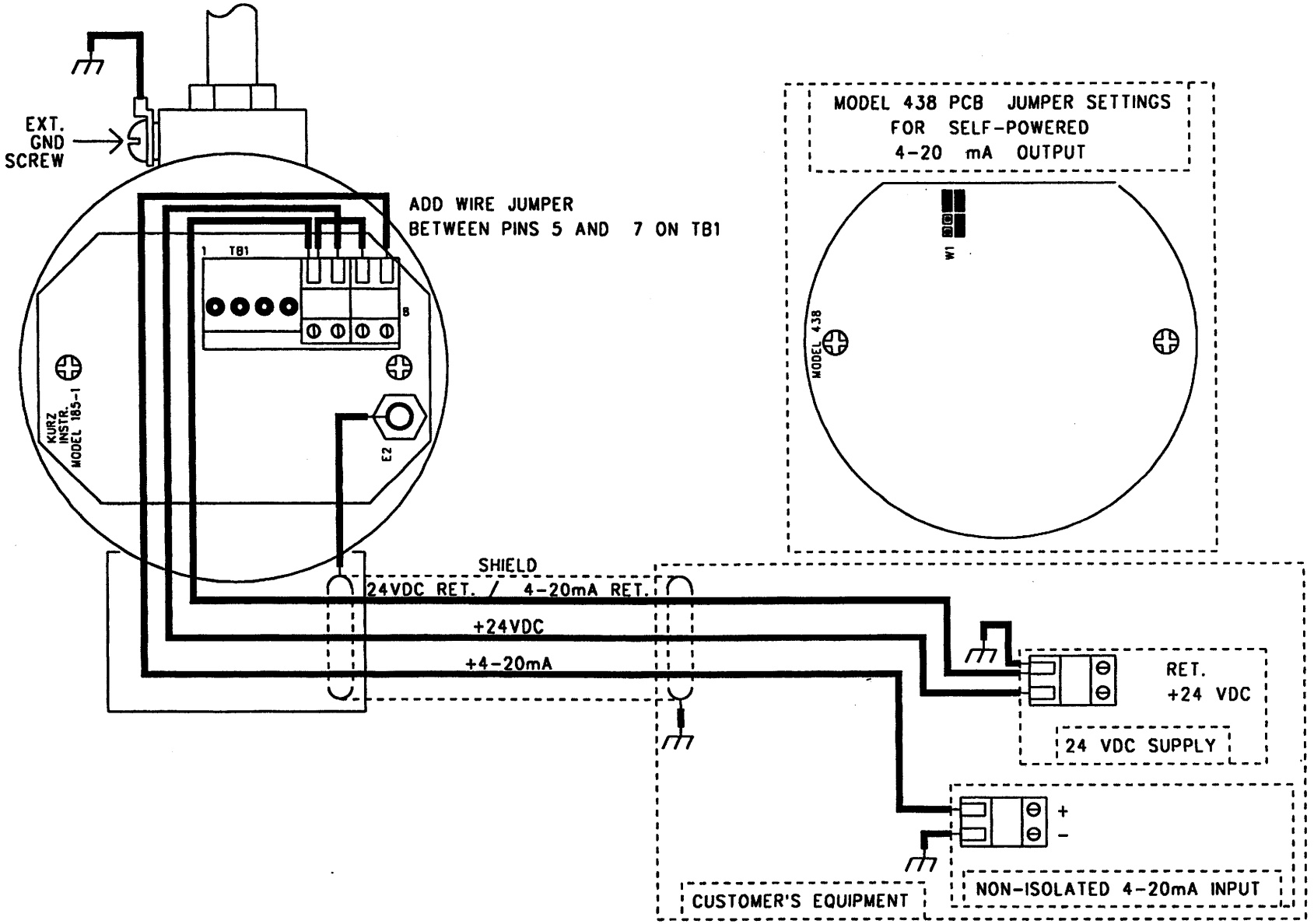

FIGURE 3 TYPICAL 3-WIRE HOOK-UP FOR 24 VDC POWERED MODEL 452FT WITH NON-ISOLATED SELF-POWERED 4-20mA OUTPUT

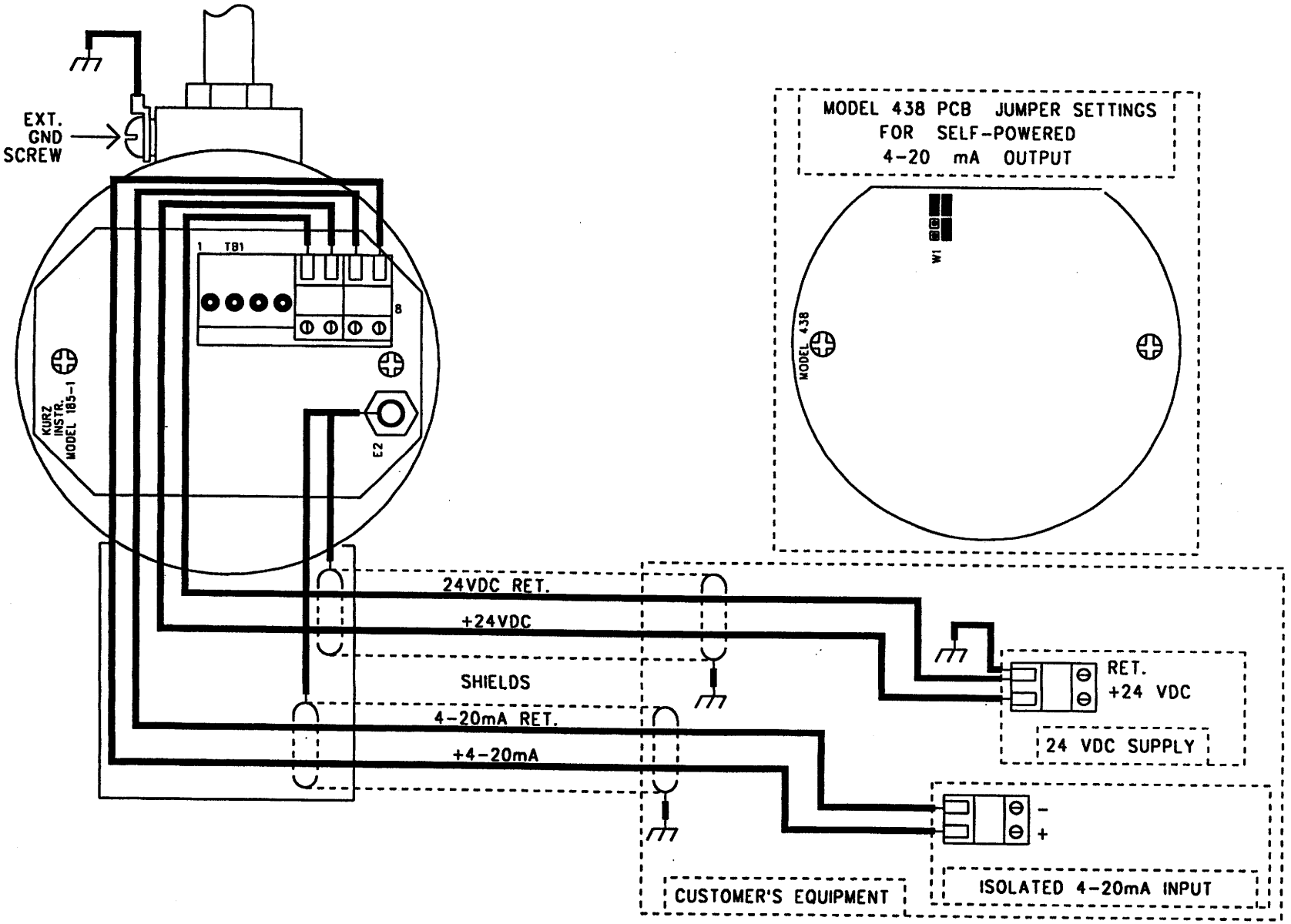

FIGURE 4 TYPICAL 4-WIRE HOOK-UP FOR 24 VDC POWERED MODEL 452FT WITH NON-ISOLATED SELF-POWERED 4-20mA OUTPUT

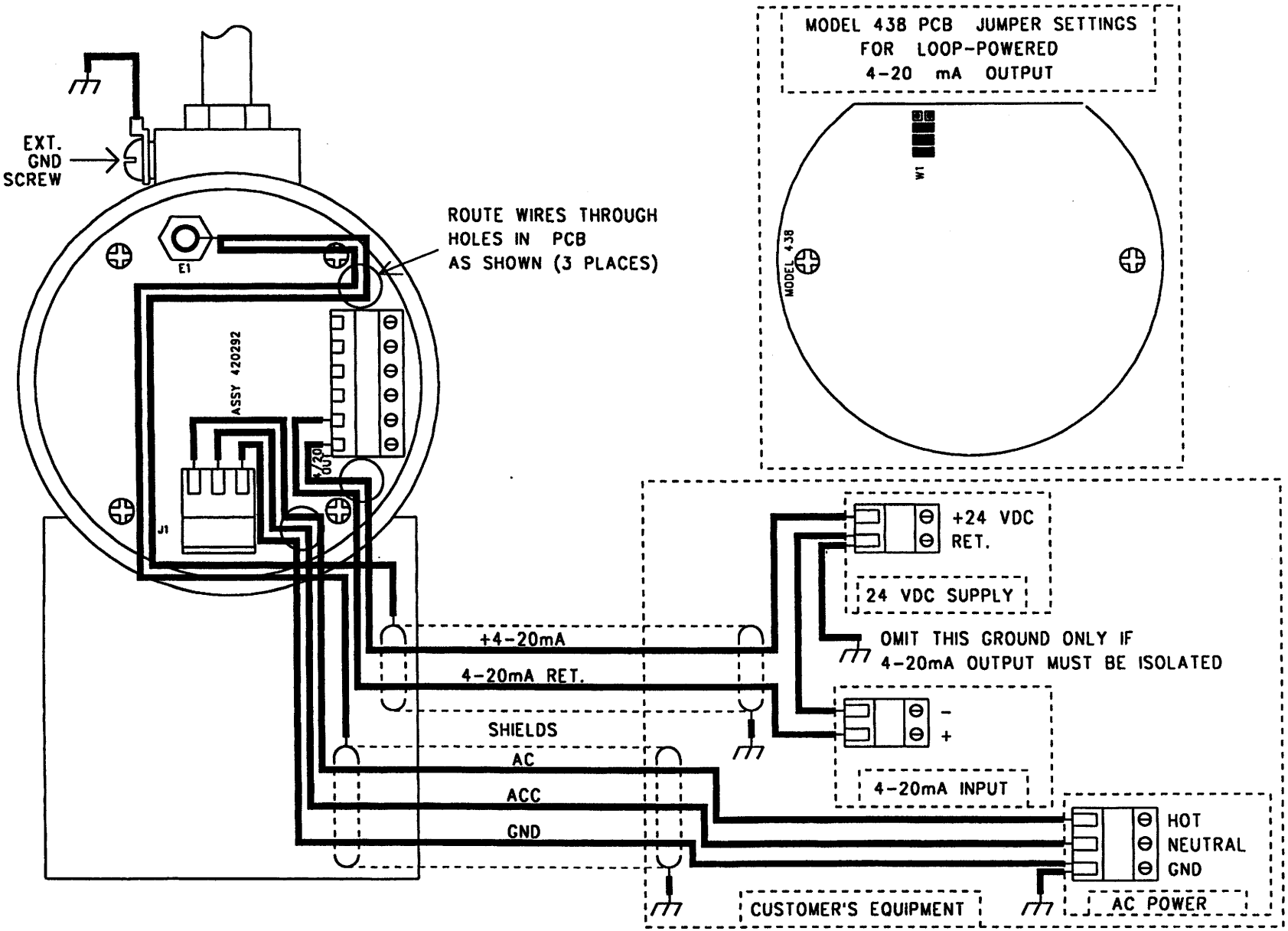

FIGURE 5 TYPICAL HOOK-UP FOR A.C. POWERED MODEL 452FT WITH LOOP-POWERED 4-20 mA OUTPUT

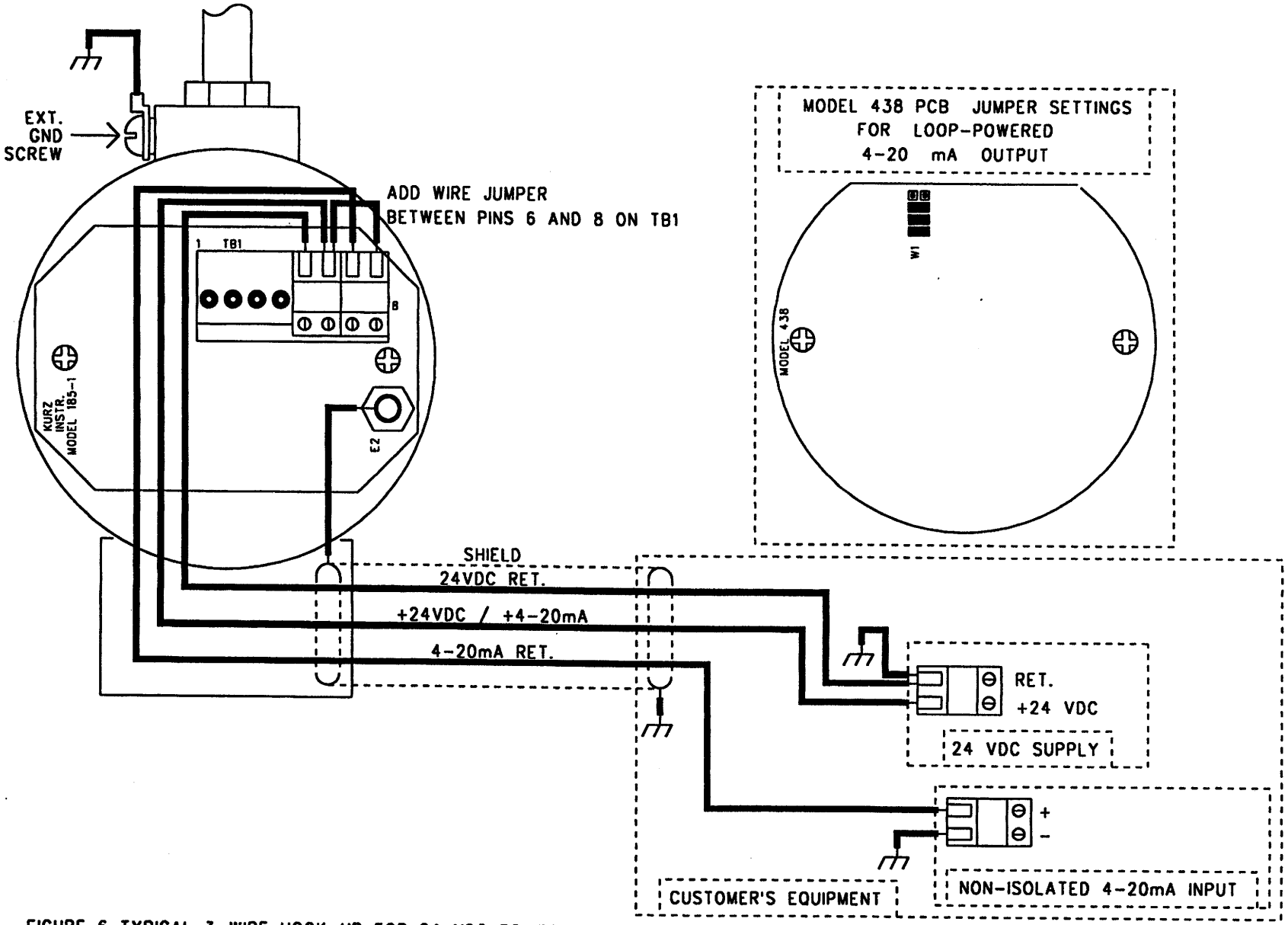

FIGURE 6 TYPICAL 3-WIRE HOOK-UP FOR 24 VDC POWERED MODEL 452FT WITH NON-ISOLATED LOOP-POWERED 4-20mA OUTPUT

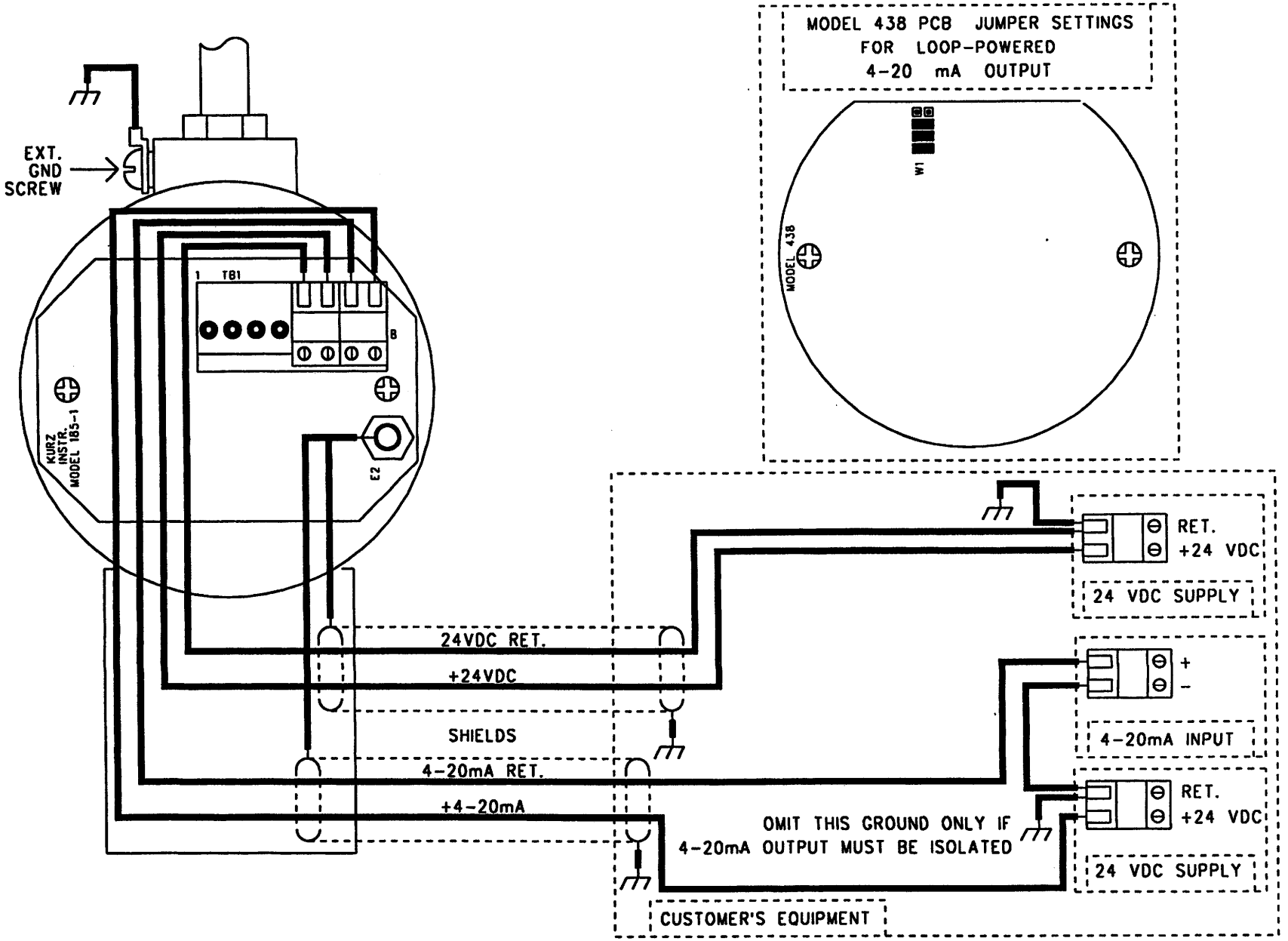

FIGURE 7 TYPICAL 4-WIRE HOOK-UP FOR 24 VDC POWERED MODEL 452FT WITH LOOP-POWERED 4-20mA OUTPUT