

Section Q
TPC Control Processing Unit – Model TCPU
Operators Manual

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Q.1 Introduction

The SCAN-A-LINE™ TPC Control Processing Unit – Model TCPU {Figure Q.1-1} is a power supply, sensor signal routing and processing device that utilizes an analog output device [DA4 Module – Section MM or DA3 Module –Section LL] and Time Proportional Controller [TPC Module – Section RR] for control signal processing. Position control is provided through a pair of time proportional switches that connect to the output from the TPC Module. Position and deviation corrections are displayed via a bargraph mounted locally [BGA Option – Section GG] or remotely [BGA50 Option – Section GG]. Enclosed in a steel enclosure, the Model TCPU provides power for up to two SCAN-A-LINE™ EG-Series [Model EG-30A – Section B], Auto-Sync 10XAS-Series [Model 10XAS – Section C] or Model 10XAHR sensors. The Model TCPU may interconnect with other Harris Instrument Corporation processing units such as the General Processing Unit [Model GPU – Section R] or Multi-Purpose Processing Unit [Model MPPU – Section Z] as well as programmable logic controllers (PLCs) and many other third party process line controllers.

Q.1.a Functional Description

The Model TCPU is designed to provide well-regulated +12VDC and -12VDC power for up to two SCAN-A-LINE™ sensors via the MS-style circular connectors. All SCAN-A-LINE™ sensors except the Binocular Receiver 10XBR-Series (Model 10XBR) are compatible with the Model TCPU. The +12VDC and -12VDC supplies, and an additional +5VDC regulated source, provides power for the analog output device and TPC controller as well as Harris Instrument Corporation approved optional circuits (such as a sensor line driver or receiver).

Customer connections with the Model TCPU are available on a sixteen- or twenty-pin terminal strip (depending upon the types of options supplied with the Model TCPU) mounted on the inside-back panel of the Model TCPU [Section Q.4.d]. A tag at the connector specifies the individual connections. An optional terminal strip may also be used for various Model TCPU options that is mounted directly above the main board. Directional relay connections and Eddy Current Sensor input are available on the TPC Module board [Section RR] {Figure Q.1-2}.

The TPC Module Board is protected by a plastic cover panel {Figure Q.1-2}.

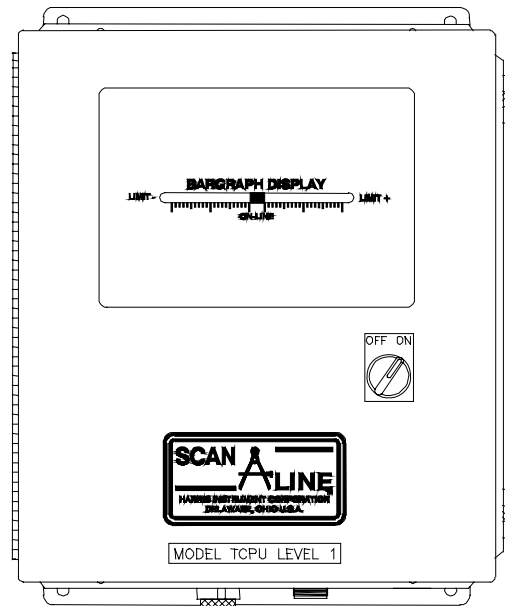


Figure Q.1-1: Model TCPU Level Three

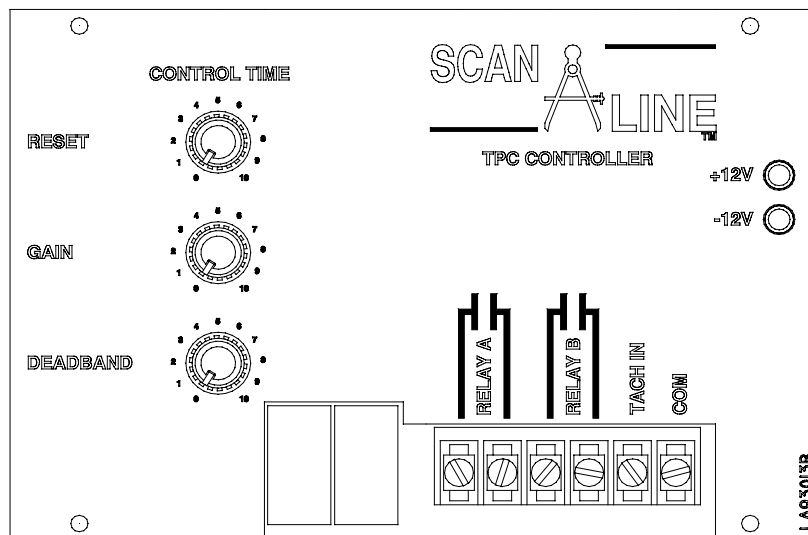


Figure Q.1-2: Model TCPU TPC Module Protective Panel

Q.2 Operational Considerations

The Model TCPU is designed to operate in an industrial environment and can readily tolerate average factory conditions. Commonsense considerations for protection and maintenance of the Model TCPU will ensure it's operation for years to come.

NOTE:

If any welding is to be performed near the Model TCPU, or anywhere on the process line where the Model TCPU is installed, disconnect ALL cables from the Model TCPU. This prevents system overload by the current generated from welding.

The Model TCPU is designed to operate with SCAN-A-LINE™ Auto-Sync [10XAS-Series – Section C], 10XAHR or EG-Series [Model EG-30A – Section B] sensors located within fifty linear cable feet [15.24m] of the unit. If the installation requires the Model TCPU to be located over fifty linear cable feet [15.24m] (and less than 4000 linear cable feet [1219m]) from the sensors, a sensor line receiver [LR Option – Section OO] must be mounted in the Model TCPU and a sensor line driver [LD Option – Section OO] mounted in the processing unit used to power the SCAN-A-LINE™ sensors; typically a General Processing Unit [Model GPU – Section R].

Q.2.a Temperature Range

Operational temperatures should fall in the range from 32°F to 122°F [0°C to 50°C]. Temperatures above 140°F [60°C] for prolonged periods of operation or storage can lead to the degradation of the integrated circuits in the Model TCPU. If temperatures outside the specified range are expected, special provisions should be made to protect the equipment.

Q.2.b Vibration Considerations

SCAN-A-LINE™ processors can tolerate reasonable amounts of shock and vibration. The major problem with vibration is the increase in probability of loose hardware and/or connectors. Mount the Model TCPU to a solid, fixed mounting where vibration is at a minimum. When high levels of vibration or shock are likely, shock absorbing mounts will reduce maintenance problems.

Q.3 Specifications for the Model TCPU

The electronics for the Model TCPU are housed in a steel enclosure. All enclosures are painted with corrosive resistant polane paint.

Q.3.a Power Requirements

The standard power requirements for the Model TCPU are 105VAC to 125VAC at 50Hz to 60Hz (117VAC 50-60Hz at an input current not to exceed 2.0Amp optimal). A 208VAC to 248VAC at 50Hz to 60Hz (220VAC 50-60Hz at an input current not to exceed 1.0Amp optimal) is available as an option for the Model TCPU (220 Option). The power line is filtered to suppress power line transient noise and power line induced RF interference. Quick disconnect power line connections are made directly to the internal power line filter inside the Model TCPU enclosure [Section Q.4.a]. The input power is fused with a 2Amp Slo Blo type 3AG fuse. Short circuits to the regulated supplies will usually cause a thermal shutdown of the regulators without causing the fuse to blow. See Figure Q.3-1 for fuse location.

NOTE:

All of the regulated supply voltages are momentary short circuit protected in the Model TCPU. Extended short circuit times may cause overheating and damage to the equipment. Input line power should be removed from the Model TCPU within five to ten minutes when cable damage occurs or a short circuit is suspected.

Q.3.b Power Output

All output power specifications are rated at 122°F [50°C] ambient temperature.

+12VDC:

Voltage Range	+11.75 to +12.25VDC
Load Current	1.25Amps cont. Max.
Regulation	±0.1% Max Line or Load

-12VDC:

Voltage Range	-11.75 to -12.25VDC
Load Current	Maximum 110mA continuous
Regulation	±0.1% Maximum Line or Load

+5VDC:

Voltage Range	+4.80 to +5.20VDC
Load Current	Maximum 1.00Amps continuous
Regulation	±0.1% Maximum Line or Load

Q.3.c Signal Output

The Model TCPU has several signal outputs available. The Quad Analog Output Device [DA4 Module – Section MM] or the Single-Sensor Analog Output Device [DA3 Module – Section LL] have several analog signals available for customer interface.

The VIDEO signals from 10XAS-Series sensors are 12VDC CMOS logic level signals that are converted to analog outputs by the Analog Output Device [DA4 Module or DA3 Module] and processed by the TPC Module. EG-Series sensors already output 0-10VDC analog signals and they are processed by the TPC Module as they come from the sensors.

The TPC Module itself has two directional relay contact closures for attachment to the directional control switches of the process line [Section RR.3.d and Section Q.4.b].

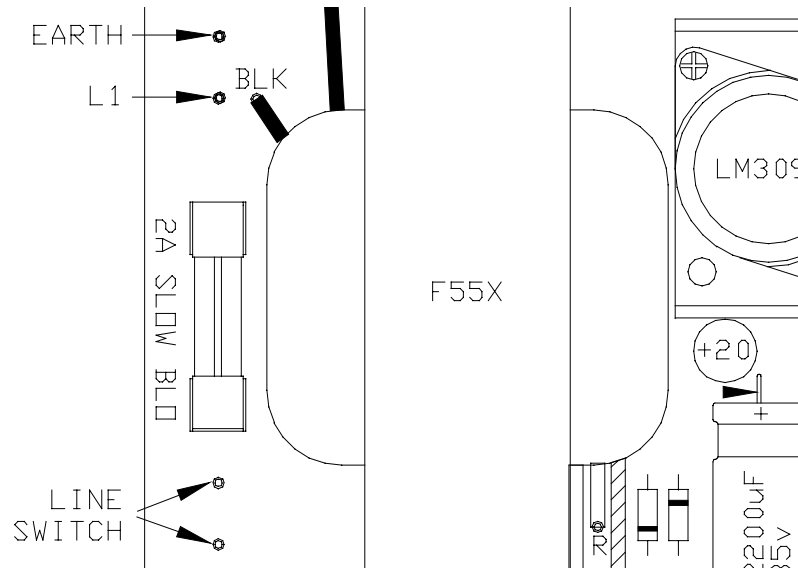


Figure Q.3-1: Slo-Blo Fuse Location on Model TCPU Main Board

Q.3.d Physical Dimensions

The Model TCPU is housed in a steel enclosure measuring 12 inches [305mm] wide by 14 inches tall [356mm] by 6 inches deep [152mm] (1200000 Series Drawings in Section Q.7). Sensor connections are located on the bottom panel through two-seven pin MS-style circular connectors (10XAS-Series) or through two-six pin MS-style circular connector (for EG-Series sensors or for interconnection between another processing unit). System power connects through a line cord strain relief connector to the left of the six-pin circular connector.

Q.3.e Eddy Current Sensor Specifications

Harris Instrument Corporation currently specifies an Omron® Model TL-X5C1-GE Eddy Current Sensor for the Model TCPU line speed input [ENC Option – Section XX]. This device requires a 12VDC to 24VDC power source (supplied by the Model TCPU power supply) and is a NPN normally-open (NO) open collector. A pull-up resistor between +12VDC sensor power and the TACH IN connection is supplied to produce 12VDC pulses from the Omron® Eddy Current Sensor. These pulses are used to trigger an adjustable one-shot pulse that modulates the units RESET timer.

Q.3.f Configurations & Options

The Model TCPU is available in several optional configurations to meet a variety of application requirements. The various configurations may be specified as follows:

Model Designation & Suffix	Description
Model TCPU Level One	Designates a TPC Control Processing Unit with Bargraph Display (BGA Option – Section GG) & Eddy Current Sensor (ENC Option – Section XX) for operation with EG-Series Sensors.
Model TCPU Level Two	Designates a TPC Control Processing Unit with Single-Sensor Analog Output Device (DA3 Module – Section LL), Bargraph Display (BGA Option – Section GG) & Eddy Current Sensor (ENC Option – Section XX) for operation with a single 10XAS-Series sensor.
Model TCPU Level Three	Designates a TPC Control Processing Unit with Quad Analog Output Device (DA4 Module – Section MM), Bargraph Display (BGA Option – Section GG) & Eddy Current Sensor (ENC Option – Section XX) for operation with single or dual 10XAS-Series sensor(s).
220	Indicates the Model TCPU is for 220VAC operation.
4/20	Indicates unit is installed with an isolated 4-20 milliamp current loop with isolated power supply (one required per 4-20 loop) for connection with a PLC that requires a 4/20 current loop input. See Section NN for more information.
AZ	Indicates the unit is configured with the Auto-Zero option (AZ Option) push-button. See Section MM. May be remote mounted. Model TCPU Level Three ONLY.
BGA50	Indicates the Bargraph Display is configured for remote operation (includes 50' [15.2m] cable). See Section GG for more information.
FEV	Indicates that the unit is configured with a First Edge Video Pre-Processor. This unit will detect the first object (edge) viewed as the first edge of the material, ignoring all other edges detected. Model TCPU Level Three Only.
INT	Indicates that the unit is configured for an internal time delay variation.
LCR	Indicates that the unit is configured with a Left/Center/Right Selector Switch. See Section UU for more information. Model TCPU Level Three Only
LDR	Indicates the unit is supplied with a Line Driver/Receiver to allow communication at distance greater than 50' [15.2m]; one each required. See Section OO for more information. Line Driver -LD, Line Receiver -LR.
OP	Indicates that the unit is configured with a Control Offset option. May be remote mounted.
RPF	Indicates that the unit is supplied with the Roll Position Feedback option. See Section ZZ for more information. Model TCPU Level Three ONLY.
Table Q.3-1: Options Available for Model TCPU Processing Unit	

Q.4 Installation

Mount the Model TCPU vertically, with the cable and power connections pointed towards the floor. The Model TCPU requires a good ground, so be sure to use the three-prong power cord for connecting system power. If running the power through conduit, ensure that the system power has an adequate ground.

Inspect all cables that will connect with the Model TCPU. Verify that the connectors are free of foreign materials and check the number of pins on each connector. Typically, the Model TCPU will connect seven-pin emitter cables for 10XA-Series sensors and six-pin emitter cables for EG-Series sensors. Processor interconnection cables, such as used to route the sensor signals from the Model TCPU to another controller (such as a Model MPPU), are typically connected through the spare access hole. Connect the proper cable(s) to the appropriate MS-style circular connector(s) on the bottom panel of the Model TCPU {See Figure Q.4-1}.

NOTE:

The Model TCPU Level One does not have a Feature Connector. Use the Spare Access Holes for connection with another processing unit.

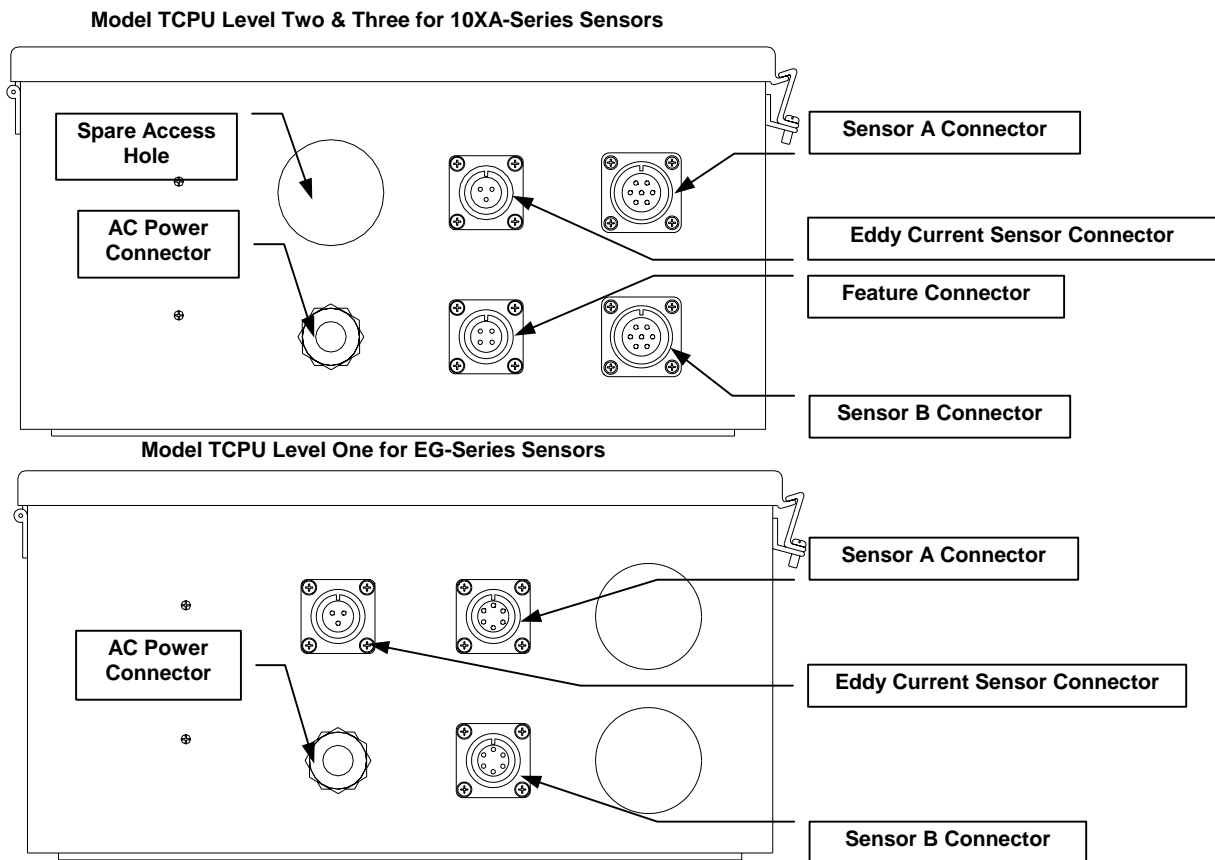


Figure Q.4- 1: Sensor Connections for Model TCPU Level One (bottom) & Model TCPU Levels Two & Three (top).

Q.4.a AC Power Connection

The Model TCPU comes standard with an three-prong AC power cord for 115VAC operation (or 220VAC with the 220 Option). Figure Q.4-2 shows the wire connections to the line filter located on the inside-bottom panel of the Model TCPU enclosure. If replacing the standard three-prong AC power cord with conduit or a 220VAC power cord, BE SURE THAT THE LINE AND NEUTRAL CONNECTIONS MATCH FROM THE POWER SOURCE SIDE TO THE POWER SUPPLY SIDE!

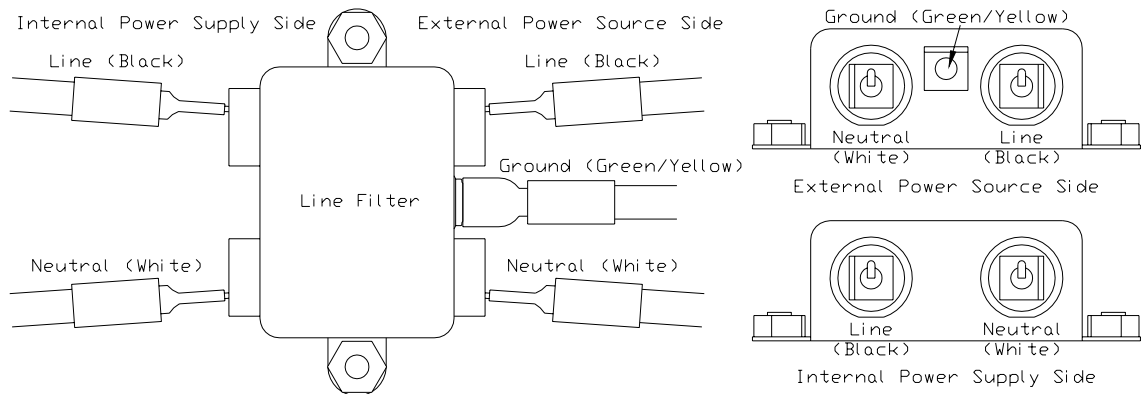


Figure Q.4-2: AC Power Connections to Line Filter in all Model TCPU processing units

Q.4.b Relay Connections

There are two relay contact closures (sometimes referred to as digital outputs) available on the Model TCPU for connection to the directional control switches {Figure Q.4-3}. These relay connections are rated at 250VAC 4Amps each into a resistive load. *No internal snubbing circuitry is provided for these connections.* It is suggested that any switching be done with shielded low voltage lines inside the Model TCPU while the higher voltage relays are located external to the processing unit to prevent RFI interference.

Relay A can be used for switching one directional control switch (typically for negative position control) and relay B for switching the other directional control switch (typically for positive position control). The relays can be accessed through the spare access hole on the bottom panel of the Model TCPU enclosure.

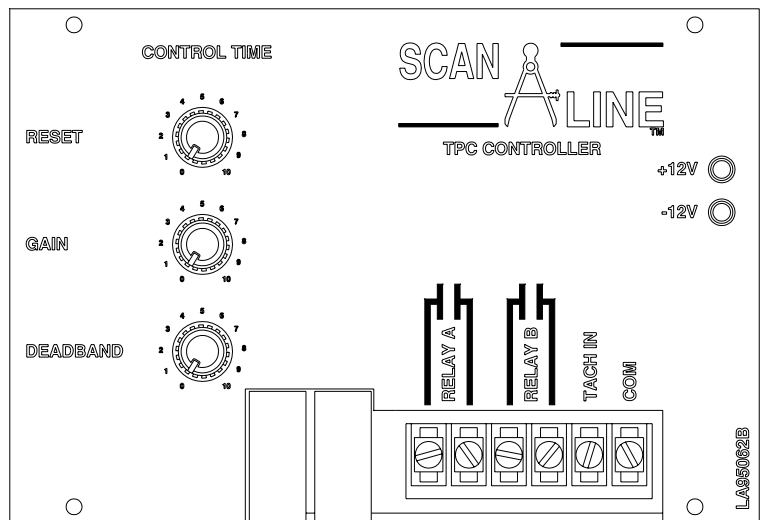


Figure Q.4-3: Relay Connections for Model TCPU

Q.4.c Eddy Current Sensor Connection

The Eddy Current Sensor used with the Model TCPU attaches to the TPC Module board TACH IN connections {Figure Q.4-3}. Typically, the Eddy Current Sensor will attach to the Eddy Current Sensor Connector MS-Style circular connector on the bottom panel of the Model TCPU enclosure {Figure Q.4-1} or it may have to be directly wired to the TACH IN and power connections inside Model TCPU processing unit (typically the case for customer supplied unit).

To connect the standard Omron® Eddy Current Sensor to the Model TCPU:

- 1) Be sure that system power is shut OFF to the processing unit.
- 2) Attach the BROWN wire (12VDC to 24VDC Power) to the Power connection Z-1 on the Customer Connections Terminal Strip {Figure Q.4-4};

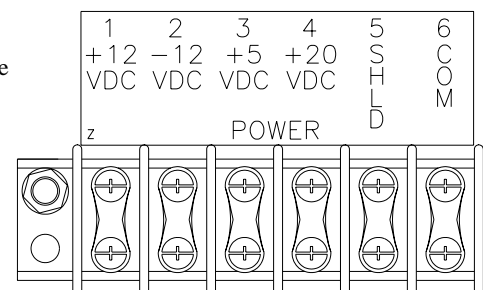


Figure Q.4-4: Power Connections for the Model TCPU and Tachometer

- 3) Attach the BLUE wire (0VDC COMMON) to the COM position (TB1-5) on the TPC Module Relay and Tachometer Terminal Strip (Figure Q.4-5);
- 4) Attach the BLACK wire (OUTPUT) to the TACH IN position (TB1-6) on the TPC Module Relay and Tachometer Terminal Strip (Figure Q.4-5).

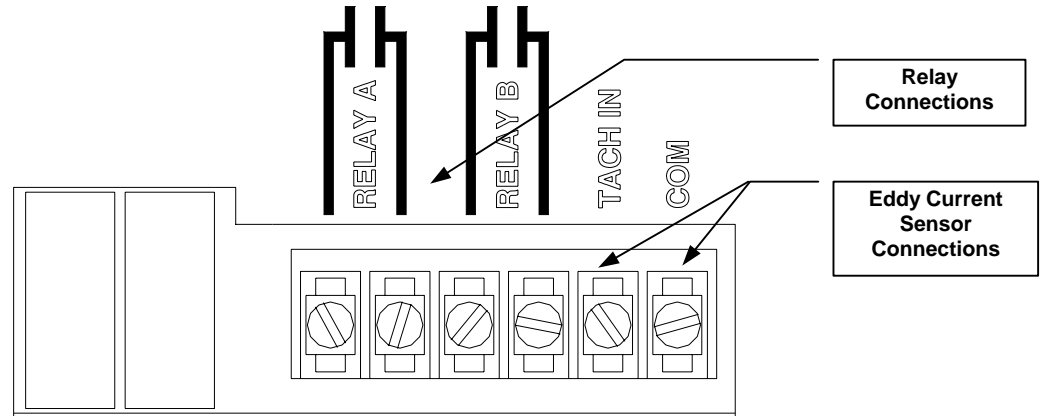


Figure Q.4-5: Relay & Tachometer Connections

Q.4.d Customer Connections

Customer connections, such as analog outputs and limit output signals are generally routed through the spare hole located above the power connection on the bottom panel of the unit for systems configured for 10XA-Series sensors or to the right of the sensor connections for systems configured for EG-Series sensors (Note that Model TCPU Level One has no feature connector). All other connections are attached to the sixteen- or twenty-pin terminal strip located on the inside-back panel of the processing unit.

Some Model TCPUs will have an optional second terminal strip mounted directly above the power supply. This terminal strip is for optional accessories (such as LCR Option). If the Model TCPU is connected to another processing unit via a sensor Line Driver/Receiver (LD & LR Options), connections are also located on the inside-front panel of both processing units.

Q.5 General Maintenance

Maintenance of the Model TCPU is relatively limited. Periodically check the cable connections for tightness. Check the power cable for cuts or splits. Regularly check the front panel latches for tightness to ensure the door stays closed. Wipe clean the Bargraph Display [BGA Option – Section GG] with a soft, slightly damp cloth when it becomes dirty.

Q.6 Trouble Shooting

CAUTION:

Hazardous voltages are present within the Model TCPU enclosure. Care should be taken when making any of the tests in this manual.

NOTE:

Procedures in this section will assist in determining whether or not the Model TCPU is operating within specifications. Always follow the instructions before replacing inoperative equipment. Installing a good spare part (sensor or other processing unit) in a defective system may cause unnecessary damage to the spare part.

Board level maintenance is NOT RECOMMENDED for the Model TCPU. If a problem is experienced with the Model TCPU, a few simple checks with a DC voltmeter can verify proper circuit function. A voltmeter with a 20VDC range is required. The meter should be able to measure within 1% and may be either analog or digital. Refer to Drawing #3689030 Rev. A in Section Q.7 for the locations of the test points on the Model TCPU Main Board.

No power to the Model TCPU. Sensors do not light.

Test 1: Check power line input voltage--external system power may be off or unit may be unplugged.

Test 2: If unit is plugged in and has appropriate power (see Section Q.3.b), check voltages at test points {Figure Q.6-1} on main board.

- Range meter to +20VDC.
- Connect negative lead (-) to Terminal Block 1 Pin 6 (TB1-6) and positive lead (+) to Terminal Block 1 Pin 3 (TB1-3).
- Voltage should read 12.00VDC \pm 0.25VDC.
- Connect negative lead (-) to Terminal Block 1 Pin 6 (TB1-6) and positive lead (+) to Terminal Block 1 Pin 2 (TB1-2).
- Voltage should read -12.00VDC \pm 0.25VDC.

Test 3: If voltages at test points are not appropriate and unit has power, remove power from the Model TCPU and test the 2Amp Slo Blo 3AG fuse next to the transformer on the main board. Replace fuse if bad.

Test 4: If fuse is good, system has power, and test points have appropriate voltage, remove all external sensor cables and any unpluggable customer connections (on inside back panel) and any unpluggable internal connections to option modules from the main board. Check voltages at test points again {Figure Q.6-1}. If voltages test appropriately with all cables disconnected, connect cables one at a time and check voltages as each cable, internal connection, and customer connection are completed.

If system fails when replacing a cable/internal connection/customer connection, a short circuit is indicated on the cable/connection just attached. If the short circuit is in a cable, replace the cable with a spare. If the short circuit is in a module, obtain a Return Authorization Number from Harris Instrument Corporation Service and return the module to the Harris Instrument Corporation Factory. If the short circuit occurs when reattaching a customer connection, check the cable for that connection, check the device using the cable, or replace the cable/device.

If this fails to solve the short circuit, contact Harris Instrument Corporation for technical assistance.

Various tests are available in the other sections of this manual for the different components of the Model TCPU (DA4 Module – Section MM, DA3 Module – Section LL, TPC Module – Section RR and BGA Option – Section GG). Refer to these sections for more information on trouble shooting these components.

After all cables, internal connections and customer connections check good and the other tests check positive, the Model TCPU is probably experiencing a component level failure. Component level trouble shooting of the Model TCPU is not covered in this manual. Please obtain a Return Authorization Number from Harris Instrument Corporation Service and return the Model TCPU to the Harris Instrument Corporation Factory.

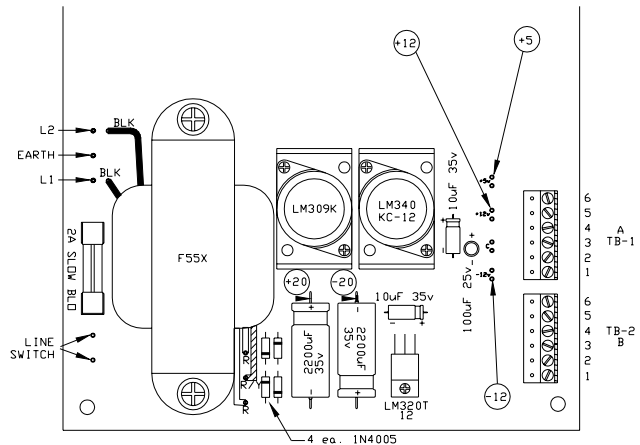


Figure Q.6- 1: Test Points on Model TCPU Main Board

Q.7 Related Drawings

The following pages contain various drawings for the components used in and with the Model TCPU. For schematic drawings of the Model TCPU circuitry, please contact Harris Instrument Corporation Engineering. For interior or exterior views of other configurations of the Model TCPU, please contact Harris Instrument Corporation Engineering. All mechanical drawings are available as AutoCAD® .DWG files for a minimal charge. Please contact Harris Instrument Corporation Sales.

Drawing #	Description	Drawing Format
1298191	<i>Model TCPU Level One Physical Dimensions</i>	<i>AutoCAD LT Rel. 3</i>
1298192	<i>Model TCPU Level Two Physical Dimensions</i>	<i>AutoCAD LT Rel. 3</i>
1298193	<i>Model TCPU Level Three Physical Dimensions</i>	<i>AutoCAD LT Rel. 3</i>
1398191 Pg. 1	<i>Model TCPU Level One Internal View</i>	<i>AutoCAD LT Rel. 3</i>
1398191 Pg. 2	<i>Model TCPU Level One Internal View Legend</i>	<i>AutoCAD LT Rel. 3</i>
1398192 Pg. 1	<i>Model TCPU Level Two Internal View</i>	<i>AutoCAD LT Rel. 3</i>
1398192 Pg. 2	<i>Model TCPU Level Two Internal View Legend</i>	<i>AutoCAD LT Rel. 3</i>
1398193 Pg. 1	<i>Model TCPU Level Three Internal View</i>	<i>AutoCAD LT Rel. 3</i>
1398193 Pg. 2	<i>Model TCPU Level Three Internal View Legend</i>	<i>AutoCAD LT Rel. 3</i>
3689030 Rev A	<i>Model TCPU Main Board Assembly</i>	<i>AutoCAD LT Rel. 3</i>

Table Q.7-1: Drawing Packet Information