Section P
PID Control Processing Unit – Model PCPU
Operators Manual

Section Table of Contents

P.1 Introduction

The SCAN-A-LINE™ PID Control Processing Unit – Model PCPU {Figure P.1-1} is a power supply, sensor signal routing and processing device that utilizes an analog output device [EG-Series sensor – Model EG-30A, DA3 Module – Section LL or DA4 Module – Section MM] and Proportional, Integral, Derivative control amplifier [PID Module – Section PP] for control signal processing. Position control is provided through an analog output signal that connect to proportional or servo valves that require closed loop process control. Position and deviation corrections are displayed via a Bargraph Display mounted locally [BGA Option – Section GG] or remotely [BGA/50 Option – Section GG]. Enclosed in a NEMA-type steel enclosure, the Model PCPU provides power for up to two SCAN-A-LINE™ EG-Series [Model EG-30A – Section B], 10XAS-Series – Section C or 10XHR-Series sensors. The Model PCPU will interconnect with other Harris Instrument Corporation processing units [Model GPU – Section R or Model MPPU – Section Z] as well as programmable logic controllers (PLCs) and/or other third party process controllers.

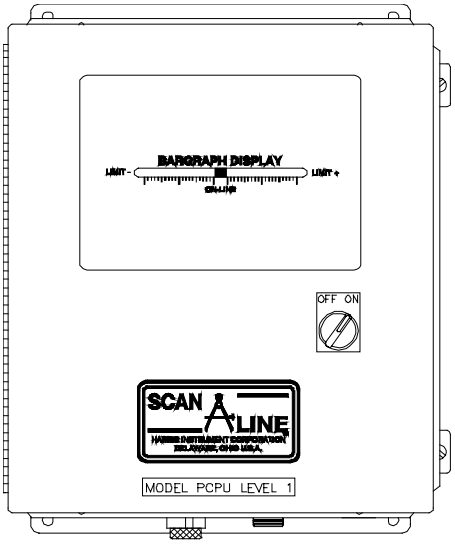

Figure P.1-1: Model PCPU Level 1

P.1.a Functional Description

The Model PCPU is designed to provide well-regulated +12VDC and -12VDC power for up to two SCAN-A-LINE™ sensors via the MS-style circular connectors. Most SCAN-A-LINE™ sensors are compatible with the Model PCPU. The +12VDC and -12VDC supplies, and an additional +5VDC regulated source, provides power for the analog output device and PID controller as well as optional circuits (such as a sensor line driver).

Customer connections with the Model PCPU are available on a sixteen- or twenty-pin terminal strips (depending upon the types of options supplied with the Model PCPU) mounted on the inside-back panel of the Model PCPU enclosure. A tag at the connector specifies the various connections [See Section P.7 for interior view drawings – 1300000 series].

Level	Description
Level 1	*For single or dual EG-Series sensors ONLY. Includes power supply, PID Module (Section PP), Bargraph Display (Section GG), 0 - 10VDC Edge Position Analog(s) and ±10VDC Position Control Analog Output.*
Level 1	*For single 10XAS-Series sensor ONLY. Includes power supply, PID Module (Section PP), Bargraph Display (Section GG), DA3 Module with 0 - 10VDC Width Analog & ±10VDC Centerline Position Analog Output, and ±10VDC Position Control Analog Output.*
Level 2	*For single or dual 10XAS-Series sensor. Includes power supply, PID Module (Section PP), Bargraph Display (Section GG), DA4 Module with 0 - 10VDC Edge Position Analogs & ±10VDC Centerline Position Analog Output, and ±10VDC Position Control Analog Output.*

Table P.1-1: Model PCPU Level Descriptions

P.2 Operational Considerations

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

NOTE:

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

The Model PCPU is designed to operate with SCAN-A-LINE™ 10X-Series or EG-Series sensors located within fifty linear cable feet [15.24m] of the unit. If the installation requires the Model PCPU to be located over fifty linear cable feet [15.24m] (and less than 4000 linear cable feet [1219m]) from the sensors, a line receiver (LR Option) must be mounted in the Model PCPU and a line driver (LD Option) mounted in the processing unit (typically a Model GPU Level 2 – Section R if applicable) used to power the SCAN-A-LINE™ sensors.

P.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 PCPU. If temperatures outside the specified range are expected, special provisions should be made to protect the equipment.

P.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 PCPU 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.

P.3 Specifications for the Model PCPU

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

P.3.a Power Requirements

The standard power requirements for the Model PCPU 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 PCPU. 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 PCPU enclosure. 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 P.3-1 for fuse location.

NOTE:

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

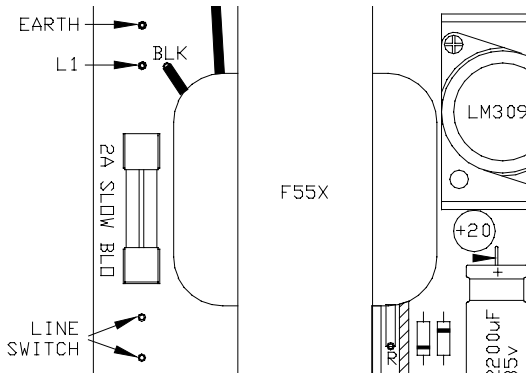

Figure P.3-1: Slo-Blo Fuse Location on Model PCPU Main Board

P.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	Maximum 1.25Amps continuous
Regulation	±0.1% Maximum 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

P.3.c Signal Output

The Model PCPU has several signal outputs available. The Quad Analog Output Device – DA4 Module (Section MM) also has several analog signals available for customer interface.

The VIDEO signals are 12VDC CMOS logic level signals that are processed by the PID Module (Section PP) and converted to analog outputs by the DA4 Module.

P.3.d Physical Dimensions

The Model PCPU is housed in a steel enclosure measuring 12 inches [305mm] wide by 14 inches [356mm] tall by 6 inches [152mm] deep. The Model PCPU Level 1 has two 6-pin MS-style circular connectors on the bottom panel for connection of EG-Series sensors (Section P.4.a). Sensor connections for 10XAS-Series sensors are located on the bottom panel through 7-pin MS-style circular connectors for Model PCPU Levels 2 (Section P.4.a). System power is connected through a IMC conduit cord grip located to the left of the sensor connectors on the bottom panel. Power lines attach to a Line Filter mounted on the bottom panel (Section P.4.b). See the 1200000 Series drawings in Section P.7 for more information on dimensions and connector locations.

P.3.e Optional Configurations

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

Model Number & Suffix	Description
220	*Indicates the Model PCPU 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 push-button option (AZ Option). See Section MM for more information. Model PCPU Level Three ONLY.*
AZ50	*Indicates the unit is configured with the Auto-Zero push-button option mounted remotely. See Section MM for more information. Model PCPU Level Three ONLY.*
BGA50	*Indicates the Bargraph Display (BGA Option) is configured for remote operation (includes 50' [15.2m] cable). See Section GG for more information.*
FEV	*Indicates that the unit is configured with First Edge Video Pre-Processing. This unit will detect the first edge and ignore all other edges. Dual-sensor systems ONLY. Model PCPU Level Three ONLY. See Section AC for more information.*
LCR	*Indicates that the unit is configured with a Left/Center/Right Selector Switch (LCR Option). See Section UU for more information. Model PCPU Level Three ONLY.*
OP	*Indicates that the unit is configured with a Control Offset multi-dial and potentiometer option (OP Option). See Section PP for more information.*
OP50	*Indicates that the unit is configured with a Control Offset multi-dial and potentiometer option that is mounted remotely. See Section PP for more information.*
RPF	*Indicates that the unit is supplied with the Roll Position Feedback option (RPF Module). See Section ZZ for more information. Model PCPU Level Three ONLY.*

Table P.3-1: Options for the Model PCPU

P.3.f Model PCPU Circuitry

The Model PCPU Level 1 contains the following (other circuitry may be present in the Model PCPU, depending upon options supplied with unit):

Linear Power Supply – HIC Part # 3689030 Rev. A, PID Module – 3693012 Rev. C,
Bargraph Display – 3693009 Rev. B, 16-position Customer Connections Terminal Strip

The Model PCPU Level 2 contains the same items as the Level 1, plus:

Single-Sensor Analog Output Device – HIC Part # 3694042

The Model PCPU Level 3 contains the same items as the Level 1, plus:

Quad Analog Output Device – HIC Part # 3695002 Rev. A

P.4 Installation

Mount the Model PCPU vertically, with the cable and power connections pointed towards the floor. The Model PCPU 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.

P.4.a Sensor Connection

Inspect all cables that will connect with the Model PCPU. Verify that the connectors are free of foreign materials and check the number of pins on each connector.

Typically, the Model PCPU will connect 7-pin emitter cables for 10XAS-Series and six-pin emitter cables for EG-Series sensors. Processor interconnection cables, used to route the sensor signals from the Model PCPU Level 2 and Level 3 to another controller (such as a Model MPPU), are typically connected through the 4-pin MS-style circular Feature Connector on the bottom panel. Connect the proper cable(s) to the appropriate MS-style circular connector(s) on the bottom panel of the Model PCPU {See Figure P.4-1 & Table P.4-1}.

PCPU Level	Sensor Type	Sensor A Connector	Sensor B Connector
Level 1	*EG-Series*	*A*	*B (if applicable)*
Level 2	*10XAS-Series,*	*C*	*N/A*
Level 3	*10XAS-Series*	*D*	*E*

Table P.4-1: Sensor Connections for Model PCPUs

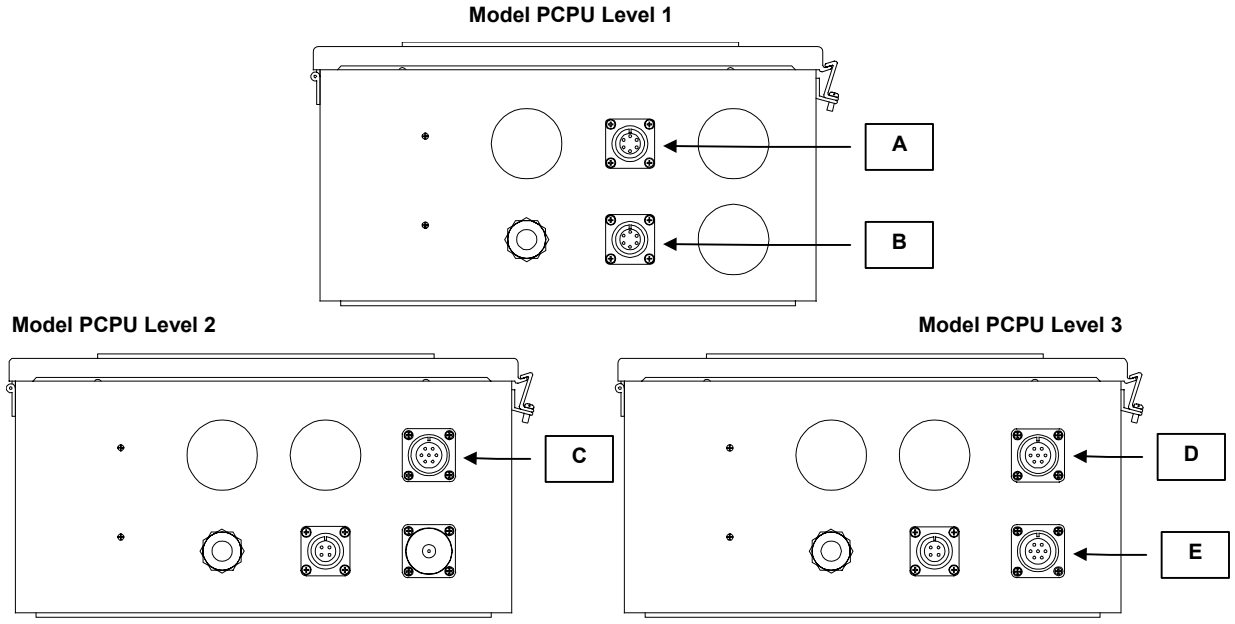

Figure P.4-1: Model PCPU Bottom Panel Sensor Connections

P.4.b AC Power Connection

The Model PCPU comes standard with an three-prong AC power cord for 117VAC operation (or 220VAC with the 220 Option). Figure P.4-2 shows the wire connections to the line filter located on the inside-bottom panel of the Model PCPU 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!

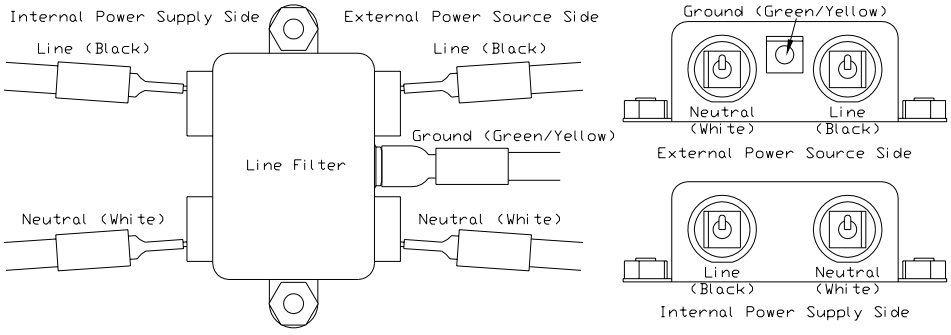

Figure P.4-2: AC Power Connections to Line Filter

P.4.c PID Module Connections

The Model PCPUs all contain a PID Module – Section PP for the processing of the sensor signals into a position control signal. Each PID Module has a six-position barrier strip {Figure P.4-3} for connection to the position control signal output, the linear position encoder input (optional) and a sensor FAULT relay (Model PCPU Level 2 or 3 only).

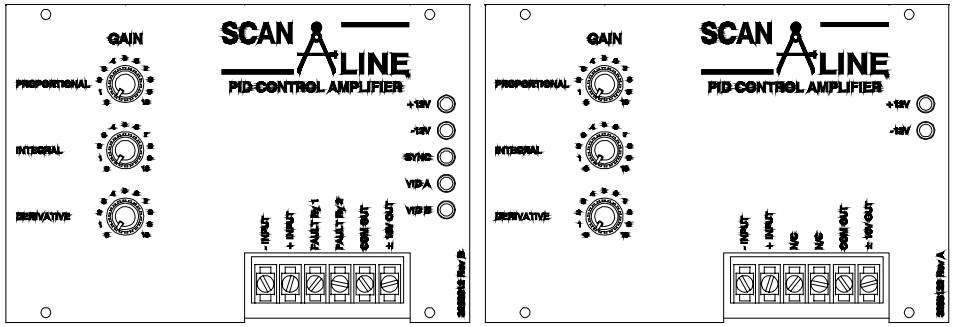

Figure P.4-3: PID Module Connections for Model PCPU (Level 1 right, Levels 2 & 3 left)

The position control connections are detailed in the PID Module – Section PP. Position TB1-5 is the Analog COMMON connector and position TB1-6 is the Analog Output connector {Figure P.4-4}. These connections are used for all levels of the Model PCPU.

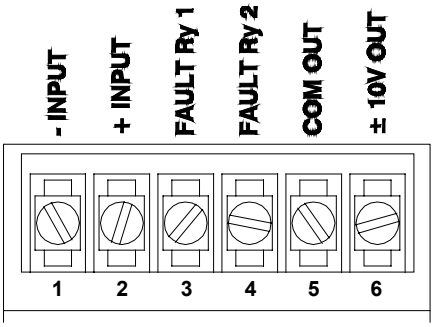

Figure P.4-4: PID Module TB1 Connections

There is a relay contact closure (sometimes referred to as digital output) available on the Model PCPU Levels 2 and 3 for sensor fault warning{Figure P.4-4}. Position TB1-3 and TB1-4 are the connections for the FAULT relay. This relay connection is a normally-open (N.O.) relay that is closed under normal operation and opens in the event of a sensor FAULT or system power failure. *No internal snubbing circuitry is provided for this connection*. It is suggested that any switching be done with shielded low voltage lines inside the Model PCPU with the higher voltage relays located external to the processing unit.

The Analog Input connections on the PID Module are only used with special order units (designated by an EVO number). This is an analog input from a linear position transducer. Position TB1-1 is the negative input and TB1-2 is the positive input. Both are rated for 0-10VDC @ 10mA maximum.

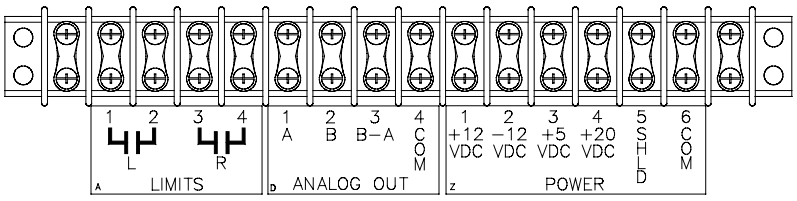

Figure P.4-5: Typical Customer Connections for Model PCPU

P.4.d Customer Connections

Customer connections, such as reference analog outputs and limit output signals, are generally routed through the spare hole located above the feature connector on the bottom panel of the unit. These connections are attached to the sixteen- or twenty-pin terminal strip located on the inside-back panel of the processing unit {Figure P.4-5}, though the control signal could be attached directly to the PID Module on the barrier strip.

Some Model PCPUs will have an optional second terminal strip mounted directly above the main board. This terminal strip is for optional accessories (such as AZ Option or LR Option). If the Model PCPU is connected to another processing unit via a Line Driver/Receiver (LD & LR Options), connections are also located on the inside-back panel of both processing units.

P.5 General Maintenance

Maintenance of the Model PCPU 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. If a Bargraph Display is installed, just wipe clean with a soft, slightly damp cloth when it becomes dirty.

P.6 Trouble Shooting

CAUTION:

Hazardous voltages are present within the Model PCPU 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 PCPU 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 PCPU. If a problem is experienced with the Model PCPU, a few simple checks with a DC voltmeter can verify proper circuit function. A voltmeter with a 300VAC and 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 P.7 for the locations of the various test points on the Model PCPU Main Board.

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

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

Test 2: Verify AC power voltage {Figure P.6-1}.

a) Range meter for 300VAC or greater.
b) Connect negative lead (-) to Line Filter External Source Side **NEUTRAL** and positive lead (+) to Line Filter External Source Side **LINE**.
c) Voltage should read between *109.25VAC and 120.75VAC* for 117VAC units and between *209VAC and 231VAC* for 220VAC units.

If AC Line Voltage does not fall between *109.25VAC and 120.75VAC* for 117VAC units and between *209VAC and 231VAC* for 220VAC units from the external source, modify your power for this unit to fall within these voltages.

d) Connect negative lead (-) to Line Filter Internal Supply Side **NEUTRAL** and positive lead (+) to Line Filter Internal Supply Side **LINE**.
e) Voltage should read between *109.25VAC and 120.75VAC* for 117VAC units and between *209VAC and 231VAC* for 220VAC units

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

a) Range meter to +20VDC.

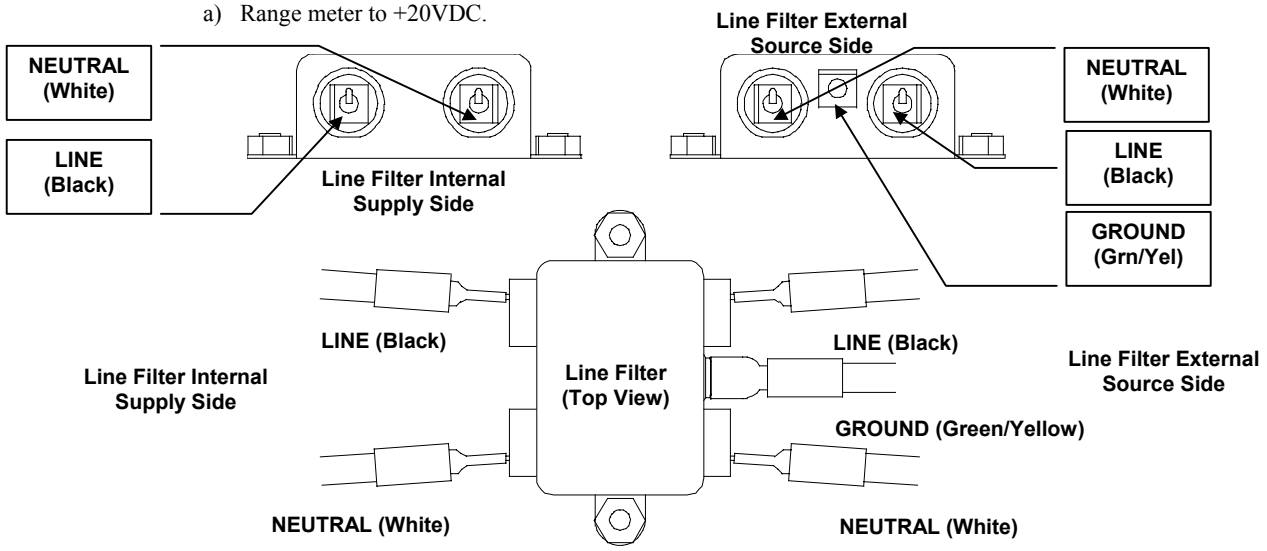

Figure P.6-1: Line Filter in Model PCPU

b) Connect negative lead (-) to Terminal Block 1 Pin 6 (TB1-6) and positive lead (+) to Terminal Block 1 Pin 3 (TB1-3).
c) Voltage should read 12.00VDC ±0.25VDC.

d) Connect negative lead (-) to Terminal Block 1 Pin 6 (TB1-6) and positive lead (+) to Terminal Block 1 Pin 2 (TB1-2).
e) Voltage should read -12.00VDC ±0.25VDC.

Test 4: If voltages at test points are not appropriate and unit has power, remove power from the Model PCPU and test the 2Amp Slo-Blo 3AG fuse next to the

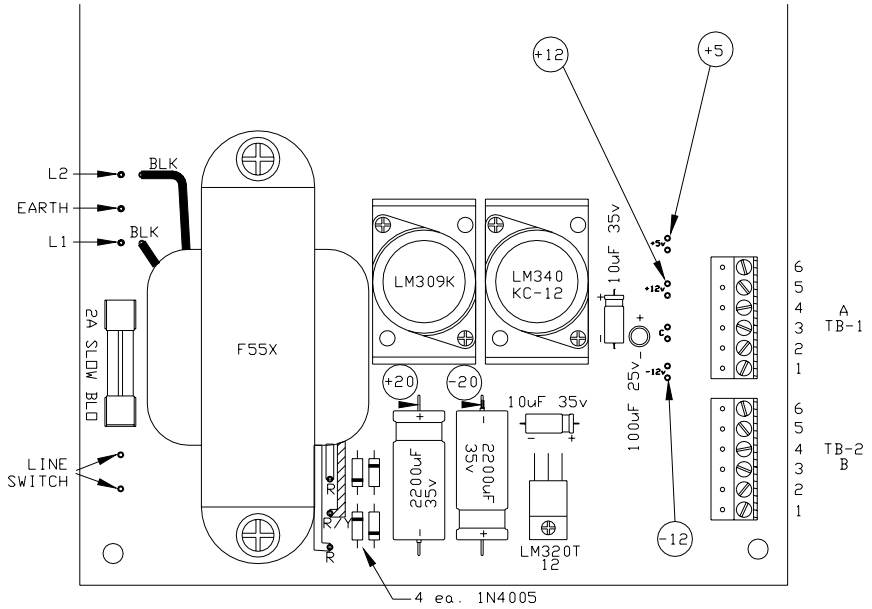

Figure P.6-2: Test Points on Model PCPU Main Board

transformer on the main board. Replace fuse if bad.

Test 5: 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 P.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 PCPU (DA4 Module – Section MM, DA3 Module – Section LL, PID Module – Section P, BGA Option – Section GG). Refer to these manual 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 PCPU is probably experiencing a component level failure. Component level trouble shooting of the Model PCPU is not covered in this manual. Please obtain a Return Authorization Number from Harris Instrument Corporation Service and return the Model PCPU to the Harris Instrument Corporation Factory.

P.7 Related Drawings

The following pages contain various drawings for the Model PCPU. For drawings of other configurations, 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
1298188	*Model PCPU Level 1 Dimensions*	*AutoCAD LT Rel. 3*
1298189	*Model PCPU Level 2 Dimensions*	*AutoCAD LT Rel. 3*
1298190	*Model PCPU Level 3 Dimensions*	*AutoCAD LT Rel. 3*
1398188 Pg. 1	*Model PCPU Level 1 Interior View*	*AutoCAD LT Rel. 3*
1398188 Pg. 2	*Model PCPU Level 1 Interior View Legend*	*AutoCAD LT Rel. 3*
1398189 Pg. 1	*Model PCPU Level 2 Interior View*	*AutoCAD LT Rel. 3*
1398189 Pg. 2	*Model PCPU Level 2 Interior View Legend*	*AutoCAD LT Rel. 3*
1398190 Pg. 1	*Model PCPU Level 3 Interior View*	*AutoCAD LT Rel. 3*
1398190 Pg. 2	*Model PCPU Level 3 Interior View Legend*	*AutoCAD LT Rel. 3*
3689030 Rev. A	*Linear Power Supply Main Board Assembly*	*AutoCAD LT Rel. 3*

Table P.7-1: Drawing Information