

Section K
Digital Control Processing Unit – Model DCPU
Main Section Operators Manual

Section Table of Contents

K.1	Introduction	5
K.1.a	Functional Description	5
	PID Control	5
K.1.b	Manual Conventions	5
K.1.c	System Startup	6
	Configuring Windows® HyperTerminal™	6
	Verify Communications	6
K.2	Operational Considerations	7
K.2.a	Temperature Range	7
K.2.b	Vibration Considerations	7
K.2.c	Power Requirements	7
K.3	Specifications for the Model DCPU	8
K.3.a	Power Supply Specifications	8
K.3.b	Physical Dimensions	8
K.3.c	Peripherals (Optional)	9
	Linear Position Transducer – PTI Option	9
	Control Analog Amplifier – AMP Option	9
	Short-Haul Modems – 422 Option	9
	Stagger Wrap Function – SW Option	9
	Control Offset – OP Option	9
K.4	Installation	10
K.4.a	Sensor Connection	10
	Single-Sensor Systems	10
	Dual-Sensor Systems	11
K.4.b	Processor Interconnection – Feature Connector	11
K.4.c	Analog Outputs	11
	Error Analog Output	12
	Analog Output with AMP Option	12
	Analog Cables	12
K.4.d	Serial Communications	12
	RS-232 Communications Jumper	13
	Extended Serial Communications	13
	Communications Cable	13
	Data Entry Conventions	13
	Invalid Command Response	13
	Commands Listing	14
	Other Commands	14
	Queries Listing	15
	Other Queries	15
K.4.e	AC Power	16
	Internal Power	16
K.4.f	Peripherals (Optional)	16
	Linear Position Transducer	16
	Eddy Current Sensor	17
	Control Offset Pendant	17
K.4.g	Other Inputs & Outputs	17
	FAULT Open Collector Output	18
K.4.h	Control Analog Amplifier (Optional)	18
	Power Input/Output	19
	Jumper Settings	19
	Adjustments	19

K.5	LED Display/Keypad Interface	20
K.5.a	LED Display	20
K.5.b	Keypad Operation	20
	1 – Set P (Proportional) Term	21
	2 – Set I (Integral) Term	21
	3 – Set D (Derivative) Term	22
	4 – Scale Analog Output	22
	5 – Cal Mandrel Feedback (Linear Position Transducer)	22
	5 – Cal Control Offset (OP Option Pendant)	23
	6 – Cal Position	23
	7 – Cal Mandrel Center (Servo-Center)	23
	8 – Set Jog Voltage	24
	9 – Set BGA Sensitivity	24
K.6	Manual Controls	25
K.6.a	MODE Switch	25
	<i>Automatic Mode</i>	25
	<i>Manual Mode</i>	25
	<i>Center Mode</i>	25
K.6.b	GUIDE Switch	25
	<i>LEFT</i> Guide	26
	<i>RIGHT</i> Guide	26
	<i>CENTER</i> Guide	26
K.6.c	JOG Switch	26
K.6.d	TARGET Button	26
K.6.e	Bargraph Display	26
	Relative Strip Position Error	27
	Valid Strip Position (GO LED)	27
	Limit Display LEDs	27
K.6.f	Sensor FAULTs	27
K.7	System Adjustments	28
K.7.a	Micro-controller Reset Switch	28
K.7.b	Bargraph Display	28
K.7.c	Mandrel Center Polarity	28
K.7.d	Disabling Sensor FAULTs	28
K.7.e	Variable Line Speeds	28
K.7.f	System Tuning	29
	Connecting to the Control Valve	29
	Minimum System Gain	29
	Maximum System Gain	29
	Dynamic Tuning	29
	Integral Term Tuning	30
	Derivative Term Tuning	30
K.8	General Maintenance	31
K.8.a	Battery-backed RAM	31
K.8.b	Upgrades	31
K.9	Trouble Shooting	32
K.9.a	Power Tests	32
K.9.b	Diagnostic Lamps	34
	Voltage Lamps	34
	Micro-Controller Lamp	34
K.9.c	AMP Option Tests	34
	Error Analog Input Polarity	34

	K.9.d	TARGET Button	34
		Auto-Zero Function Verification	34
	K.9.e	Verify System Linearity	35
K.10		Appendix A – Control Loop Fundamentals	36
	K.10.a	PID Control Algorithm	36
		Proportional Control	36
		Integral Control	36
		Derivative Control	37
	K.10.b	Computer Sampling PID	37
		Anti-Reset Rewind	37
		System Sampling Times	37
K.11		Appendix B – RS-232 Customer Interface	38
	K.11.a	Setting System Baud Rate	38
	K.11.b	Operational Commands	38
		Stop Measurement Readings	38
		Start Measurement Readings	38
		Diagnostics Display	38
		Sensor FAULT Warning	38
	K.11.c	System Settings	39
		Help Screen Output	39
		System Date & Time	39
		Decimal Point Position	40
		Units of Measure	40
		Factory Default System Settings	40
		Video Pre-Processor Set-up	41
		Sensor Set-up	42
	K.11.d	Width Calibration Procedure	42
		Automatic Width Calibration Procedure	42
		Manual Width Calibration Procedure	44
	K.11.e	Limit Relays	44
		Limit Relay Cables	45
		GO Relay	45
		GO Relay Cable	45
		Absolute Limit Sensing Calibration	45
		Tolerance Limit Sensing Calibration	46
	K.11.f	Width Deviation Analog Output	47
		Setting the Target Value	47
		Width Deviation Analog Scaling Command	47
		Verify Width Deviation Analog Output	48
	K.11.g	Width Absolute Analog Output	49
		Width Absolute Analog Scaling Command	49
		Verify Width Absolute Analog Output	49
	K.11.h	Setting the Digital Filter Snap for Width Readings	50
		Digital Filter Snap Command	50
		Setting the Exponential Averaging Value	51
	K.11.i	Linear Position Transducer Manual Re-Calibration	51
		Transducer Manual Re-Calibration Procedure	52
K.12		Appendix C – Jumper Configurations	53
	K.12.a	Micro-Controller Board Jumpers	53
	K.12.b	Micro-Controller Board Reset Switch	53
	K.12.c	Video Pre-Processors	53
		UVP Module	53
		EVP Module	54

	K.12.d	Main Board Settings	56
		Jumper Settings	56
		Zero Adjust Potentiometers	57
	K.12.e	Control Analog Amplifier – AMP Option	57
K.13		Appendix D – Set-up Procedure Sequence	58
	K.13.a	PID Control Set-up	58
	K.13.b	Width Set-up	58
K.14		Appendix E – New Features	59
	K.14.a	New Software Features	59
	K.14.b	New Hardware Features	59
K.15		Related Drawings	60
		Drawing Packet	

K.1 Introduction

The SCAN-A-LINE™ Digital Control Processing Unit – Model DCPU is an internally microprocessor-controlled processing device that utilizes up to eight co-processors to perform proportional / integral / derivative (PID) position control in several control applications. The Model DCPU also supplies power to the sensors and signal routing. Enclosed in a NEMA-type steel enclosure (standard), the Model DCPU provides power for up to two SCAN-A-LINE™ 10X-Series sensors. The Model DCPU may interconnect with other Harris Instrument Corporation processing units [Model GPU – Section R for example] as well as programmable logic controllers (PLCs) and customer computers.

K.1.a Functional Description

The Model DCPU 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™ 10XAS-Series – Auto-Sync [Section C] and 10XBR-Series – Binocular Receiver [Section G] sensors are compatible with the Model DCPU. The +12VDC and -12VDC supplies, and an additional +5VDC regulated source, provide power for the on-board digital micro-controller as well as other Harris Instrument Corporation approved optional circuits.

Customer and internal connections with the Model DCPU are available on four six-position barrier strips (depending upon the types of options supplied with the Model DCPU) on the main board of the unit. Tags at the barrier strips specify the individual connections. Sensor and linear position encoder connections are available on the bottom panel of the processing unit enclosure.

Error analog output (± 10 VDC) is routed to the bottom panel of the processing unit. This error signal can be raw (direct output from the PID controller) or can be amplified with the optional amplifier (AMP Option).

Other customer connections consist of a VIDEO or SYNC FAULT open collector output and relay, RIGHT/LEFT Limit relay connections, optional edge position analogs (0-10VDC) and optional width analog. Optional inputs other than for the linear position transducer are also available (one digital input and one analog input).

PID Control

There are many good books written on the proper tuning of a Proportional/Integral/Derivative (PID) control loop. Most of these publications try to establish a common math model for correcting a dynamic process regardless of the many possible variables to be encountered. The SCAN-A-LINE™ Model DCPU provides a fully tunable ± 10 VDC error signal for driving proportional- and servo-valve equipment.

Input signals from the sensors [10XAS-Series – Section C or 10XBR-Series – Section G] are amplified for controlling proportional- or servo-valve controls. The standard power of the analog signal is approximately 0.1watts from the standard Model DCPU. The AMP Option output [Section K.4.c] can achieve approximately 2.5watts maximum.

K.1.b Manual Conventions

Throughout this manual section, there are many keyboard commands that will be used to signify command sequences. Different fonts will be used for the keyboard commands. The following table describes the commands and keystrokes.









Key	Description
	Space Bar on host computer
	Enter Key on host computer
	Command Sequence Start on host computer
	Query Sequence Start on host computer
	Backspace on host computer
	Caps Lock on host computer
	Keystroke on host computer
*S	Communications Software Response
	Mouse Action on Host Computer













Table K.1-1: Manual Conventions

K.1.c System Start-up

For this manual, the Windows® HYPERTERMINAL program will be used as an example communications program for interfacing with the Model DCPU. The Windows® HYPERTERMINAL communications program must be configured to operate with the Model DCPU.

Configuring Windows® HyperTerminal™

The following example on the next page is based upon the Microsoft® Windows® 95 HyperTerminal™ software program. This program is used because of the commonplace occurrence of it on most IBM-compatible personal computers today. Any DEC VT-100 (ANSI) compatible terminal emulation program can be used to communicate with the Model DCPU.

	HyperTerminal	Start HYPERTERMINAL.EXE (located in the START menu under Accessories).
		Enter DCPU in the Name: entry.
	Icon	Select an Icon to represent the DCPU connection and click OK .
	Phone Number Menu	DO NOT SELECT a phone number or modem. Pick the particular Direct to COM port in the Connect Using: List box (typically COM2 is used since COM1 is sometimes used for a mouse interface).
	Port Settings	Select 9600 in the Bits per Second drop-down list. Verify that data is set to 8 , parity to None and Stop Bits to 1 . Flow Control Should be set to None .
	Advanced...	Click on Advanced... to set the Advanced Port Settings . Verify that the Transmit buffer is set HIGH and the Receive buffer is set to Medium-High .
	File... Properties	Set the properties of the DCPU HyperTerminal session.
	DCPU Properties	Select the Settings Tab at the top of the DCPU Properties window.
	Emulation	Change the Emulation to VT100 to communicate with the DCPU .
	ASCII Set-up...	Select the ASCII Set-up button to set the ASCII Text . Select Echo Typed characters locally check box.
	File... Save As...	Save file as DCPU.HT for future use.
	OK	Click on OK to close the File dialog box.

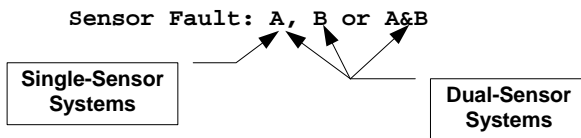
Now, whenever starting HyperTerminal™ to operate the Model DCPU, load the file **DCPU.HT** and the settings for the Model DCPU communication defaults will be available.

Verify Communications

If the Model DCPU is connected correctly to the host computer and the HyperTerminal™ or other communications software is configured properly, when power is applied to the Model DCPU the communications software should respond with:

Power up!

The Model DCPU is now ready to receive terminal commands [Section K.11]. If there is no material in the sensor window, the Model DCPU will output via the RS-232-2 communications port:



K.2 Operational Considerations

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

NOTE:

If any welding, cutting or other uses of gas or electric torches are to be performed near the Model DCPU, or anywhere on the process line where the Model DCPU is installed, disconnect ALL cables from the Model DCPU BEFORE performing those operations. This prevents system overload by the current generated from welding.

The Model DCPU is designed to operate with SCAN-A-LINE™ 10X-Series sensors located within fifty linear cable feet [15.2m] of the unit. If the installation requires the Model DCPU to be located over fifty linear cable feet [15.2m] (and less than 4000 linear cable feet [1219m]) from the sensors, a line receiver (LR Option) must be installed in the Model DCPU and a line driver (LD Option) mounted in the processing unit used to power the sensors [typically a Model GPU – Section R].

NOTE:

The Model DCPU is designed for operation within fifty linear cable feet [15.2m] of the sensors. Operations over fifty feet [15.2m] up to 4000 linear cable feet [1219m] MUST include a line receiver [LR Option – Section OO] in the Model DCPU and line driver [LD Option – Section OO] on the processing unit used to power the sensors [typically a Model GPU – Section R].

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

K.2.b Vibration Considerations

SCAN-A-LINE™ processing units 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 DCPU to a solid, fixed mounting where vibration is minimum. When high levels of vibration or shock are likely, shock absorbing mounts may reduce any problems.

K.2.c Power Requirements

The standard power requirements for the Model DCPU are 85VAC to 264VAC at 47Hz to 440Hz. The power supply will automatically adjust for voltages between 85VAC and 264VAC with no jumpers or switch settings necessary.

K.3 Specifications for the Model DCPU

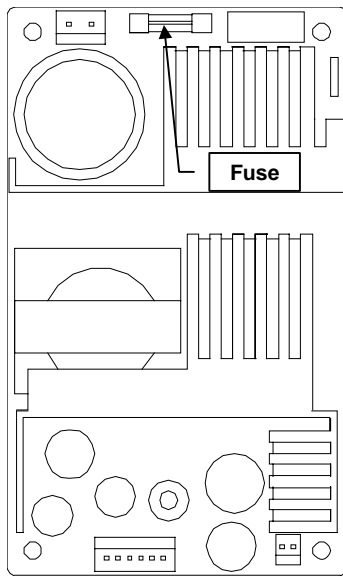


Figure K.3-1: Fuse Location on Switchable Power Supply

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

K.3.a Power Supply Specifications

The standard power has UL1950 and CSA C22.2 safety approvals and meets FCC Class B conducted as well as VDE 0878 PT3 Class B EMI conducted noise limits. 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 DCPU enclosure. The power supply for the Model DCPU is located under a red warning panel in the top-left corner inside the enclosure. See drawing # 1399014 Rev. A Pg. 1 in Section K.15 of this manual section for the power supply location.

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 K.3-1 for the power supply fuse location.

Some industrial power distribution systems can deliver voltages that fall outside these limits. This situation can be minimized by using a power drop that is separate from those supplying heavy equipment. Where wide fluctuation in power line voltages cannot be avoided, a Sola Line Regulating Transformer can overcome this problem. The CVS (sine wave) resonant types are more effective. Most SCAN-A-LINE™ systems require less than 250VA.

NOTE:

A good system earth ground can be helpful in reducing the possibility of interference from other electrical equipment. Care should be taken to insure that the SCAN-A-LINE™ earth ground is separate from the grounds used by other systems. This is most important when high current (ex. welding, cutting, etc.) and high voltage are involved.

All output power specifications in Table K.3-1 are rated at 122°F [50°C] ambient temperature. There are customer connections for these power outputs. These power connections are available ONLY FOR HARRIS INSTRUMENT CORPORATION APPROVED ACCESSORIES (such as line speed encoders, line drivers, etc.).

Maximum Power	60 Watts
Adjustment Range	-5, +10% minimum
Cross Regulation	±2% on output 1, ±5% on outputs 2 & 3
Hold-up Time	20ms at 60 Watt load & 115VAC nominal line
Overload Protection	5.7 to 6.7VDC on main output
Regulation	+12VDC = ±5% at 25°C, -12VDC = ±5% at 25°C, +5VDC = ±2% at 25°C
Maximum Load	+12VDC = 3 Amp, -12VDC = 0.7 Amp, +5VDC = 7 Amp
Ripple	+12VDC = 120mV, -12VDC = 120mV, +5VDC = 50mV
Table K.3-1: Power Specifications for Universal Power Supply	

K.3.b Physical Dimensions

The Model DCPU is housed in a NEMA-type steel enclosure, Hoffman part number A-1412CH or equivalent, painted with corrosive resistant polane paint. The weight of the unit varies slightly with selected options but is approximately 15.5 pounds [7kg]. The enclosure nominal dimensions are twelve inches wide by fourteen inches high by six inches deep [304mm by 356mm by 152mm] {See Drawing # 1299014 Pg. 1}.

Sensor connections to the Model DCPU are made on the bottom panel of the enclosure through MS-style circular connectors. The sensors connect to the two seven-pin bulkheads on the right side of the bottom panel of the processing unit {See Drawing # 12999014 Pg. 1 for **J1** & **J2**}. Power connections are made with the included power cord, or may be replaced with rigid conduit connections if necessary. A four-pin connector (the Feature Connector) on the bottom panel is for connecting a Model DCPU with another processing unit. Connectors are also available for the analog error voltage output, RS-232 communications and linear position transducer hookup.

K.3.c Peripherals (Optional)

There are three optional peripherals for the Model DCPU designed to allow the unit to operate in a Rewind Control System or in an Intermediate Strip Control System with Roll Position Feedback. Also, an optional error power amplifier is available to drive hydraulic proportional valves, etc..

Linear Position Transducer – PTI Option

The suggested linear position transducer that is optionally available with the Model DCPU in a Rewind Control System is the Celesco® Model PT510 (Celesco® Part # PT510-0020-111-1210). This unit has a twenty-inch [508mm] full stroke range with a 0-5VDC @ 10 Ohms output impedance. Harris Instrument Corporation recommends that this model (Celesco® Model PT510) be used with the Model DCPU.

Whichever linear position transducer is used attaches to a MS-style circular connector on the bottom-panel of the Model DCPU marked **P2** [Section K.4.f].

Control Analog Amplifier – AMP Option

The standard error analog output from the Model DCPU is not amplified (output is $\pm 10\text{VDC}$ @ 10mA). The Control Analog Amplifier – AMP Option provides an amplified $\pm 10\text{VDC}$ @ 0.1A maximum. The error analog output is routed to the AMP Option board, where it is amplified and then routed to the connector on the bottom panel of the processing unit.

Whether or not the AMP Option is provided, the error analog output generated by the Model DCPU is available on the bottom-panel of the unit at a MS-style circular connector labeled **P1** [Section K.4.c].

Short-Haul Modems – 422 Option

For extended serial communications operation [Section K.4.d], short haul modems are utilized to convert the RS-232 output to RS-422 inside the Model DCPU. This option is typically used only when width measurement is included in the Model DCPU. The RS-232 output is routed to a short-haul modem (RS-232 to RS-422 converter) and then is routed to the bottom-panel serial communications MS-Style connector labeled **P3** [Section K.4.d]. The Drawing # 1299014 Pg. 2 in Section K.15 details the pinouts of the MS-Style circular connector.

NOTE:

If the 422 Option is used in the Model DCPU, a second short-haul modem must be used at the other end of the communications cable, or the unit at the other end must be able to receive RS-422 serial communications.

Stagger Wrap Function – SW Option

The Model DCPU is configurable to allow a staggering of the coil on a rewind control system. Section KA of this manual (if applicable) details the SW Option. Included with the SW Option is information on the Eddy Current Sensor required for mandrel rotation information, also detailed in Section KA.

Control Offset – OP Option

Control Offset – OP Option provides a positive or negative offset to the control analog signal from the Model DCPU. The Control Offset potentiometer, mounted in a removable pendant, provides a voltage to the Model DCPU amplifier as a modification (offset) to the control signal. This allows minor tuning of the edge or centerline position control signal. The Auto-Zero Function [TARGET Button – Section K.6.d] is usually not used when the OP Option is installed to prevent any run out of operational range between the Control Offset multial and strip offset [Section K.6.f].

K.4 Installation

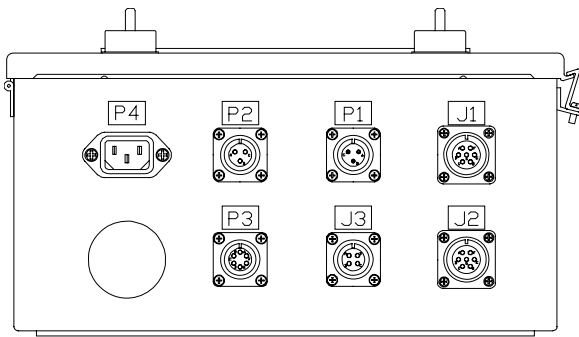


Figure K.4-1: Model DCPU Bottom Panel Connections

The Model DCPU provides up to twenty-four customer connections for power, analog output, relay contact closures and digital input/output. Depending upon configuration of the Model DCPU, some or all of these connections may be utilized and many are routed to MS-style circular connectors on the bottom panel of the unit.

Mount the Model DCPU vertically, with the cable and power connections pointed towards the floor. The Model DCPU 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 earth ground.

Inspect all cables that will connect with the Model DCPU. Verify that the connectors are free of foreign materials and check the number of pins on each connector. Typically, the Model DCPU will connect seven-pin emitter cables

for 10X-Series sensors. Processor interconnection cables, such as used to route the sensor signals from the Model DCPU to another controller (such as a Model GPU), are typically connected through the four-pin or six-pin 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 DCPU {See Figure K.4-1}. Check the accompanying sensor manual(s) for more information on connecting sensor cables.

K.4.a Sensor Connection

Inspect all sensor cable(s) that will connect with the Model DCPU (emitter-to-processing unit cables are supplied with the sensor). Verify that the connector(s) are free of foreign materials and check the number of pins on each connector. Check the cable(s) for physical damage (cuts or splits in insulation, malformed connectors, etc.). Typically, the Model DCPU will connect male 7-pin circular MS-style connectors on the emitter-to-processing unit cables for 10XAS-Series and 10XBR-Series sensors to the bottom panel of the processing unit.

Single-Sensor Systems

A single-sensor 10XAS-Series or 10XBR-Series system attaches to the top-right female 7-pin circular MS-style connector on the bottom panel of the Model DCPU marked **J1**. Typically, this sensor is called SENSOR A. The connector is keyed to insert in one direction {Figure K.4-2}.

Be sure that the power to the processing unit is OFF. Insert the female 7-pin end of the emitter-to-processing unit cable into the emitter male 7-pin circular connector on Sensor A and tighten securely. Insert the emitter-to-processing unit cable into the top-right female 7-pin circular MS-style connector {**J1** – Figure K.4-3} on the bottom panel of the processing unit, in the proper orientation, and tighten securely.

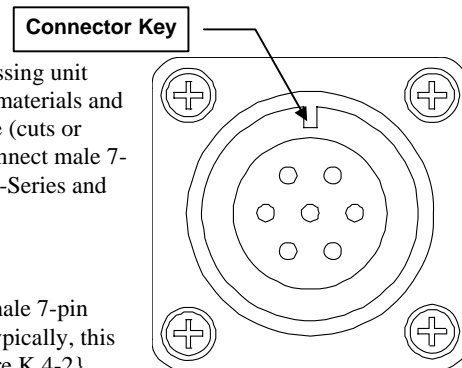


Figure K.4-2: Typical Emitter Connector

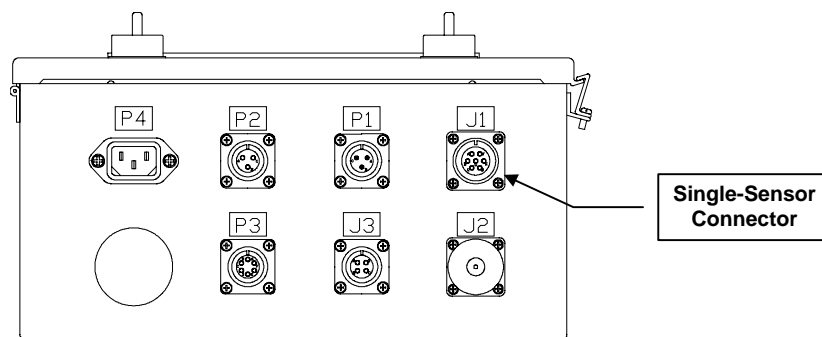


Figure K.4-3: Single-Sensor Connector

Dual-Sensor Systems

With a dual-sensor 10XAS-Series or 10XBR-Series, one sensor is designated as SENSOR A and one sensor is SENSOR B. These sensors attach to the female 7-pin circular MS-style connector on the bottom panel of the Model DCPU {Figure K.4-4}. Sensor A attaches to the top-right connector marked **J1**. Sensor B attaches to the bottom-right connector marked **J2**. Both connectors are keyed to insert in only one direction {Figure K.4-2}.

Be sure that the power to the processing unit is OFF. Insert the female 7-pin end of the emitter-to-processing unit cable for Sensor A into the emitter male 7-pin circular connector on Sensor A and tighten securely. Insert the Sensor A emitter-to-processing unit cable into the top-right female 7-pin circular MS-style connector (**J1**) on the bottom panel of the processing unit, in the proper orientation, and tighten securely. Repeat this for Sensor B, except to connect the processing unit end of the cable into the bottom-right connector (**J2**).

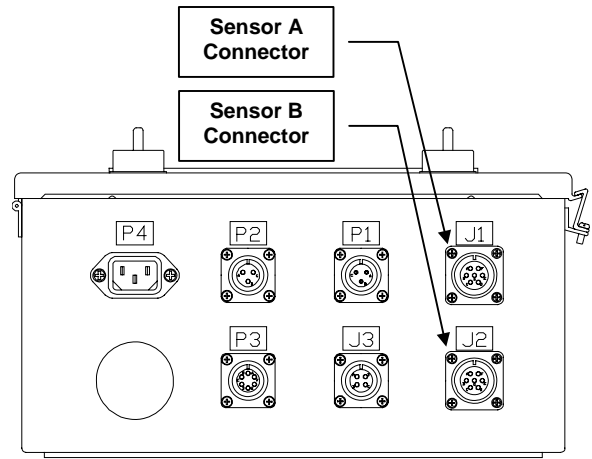


Figure K.4-4: Dual-Sensor Connectors

K.4.b Processor Interconnection – Feature Connector

Processor interconnection cables (or Feature Connector), used to route the sensor signals from the Model DCPU to another processing unit (such as a Model GPU or a Model MPPU), are typically connected through the female 4-pin MS-style circular Feature Connector (labeled **J3**) on the bottom panel of the Model DCPU {Figure K.4-5}. A cable is available from Harris Instrument Corporation Sales for processor interconnection or contact Harris Instrument Corporation Engineering for more information on building a cable.

K.4.c Analog Outputs

The Model DCPU is designed to output up to four various analog signals {Figure K.4-6}. These signals can be deviation or absolute analog with either bipolar or unipolar voltages. The Model DCPU utilizes terminal strip position Y4-3 for the error analog output.

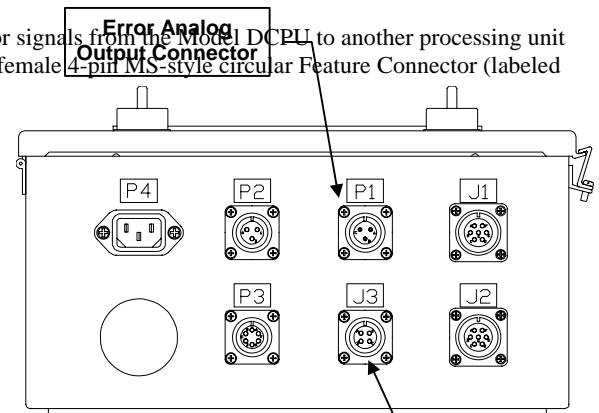


Figure K.4-5: Feature Connector

Pin #	Tag #	Typical Description	Designation
TB4-1	Y4-1	COMMON	COM
TB4-2	Y4-2	Custom Analog Output	ANALOG OUT 1
TB4-3	Y4-3	Deviation (Bipolar) Analog – ($\pm 10\text{VDC}$ @ 10mA max) Output	ANALOG OUT 2
TB4-4	Y4-4	Not used at this time.	ANALOG OUT 3
TB4-5	Y4-5	Not used at this time.	ANALOG OUT 4
TB4-6	Y4-6	COMMON	COM

Table K.4-1: Analog Output Customer Internal Connections

NOTE:

The terminal strip tag for this terminal block is located on the interior right side of the enclosure.

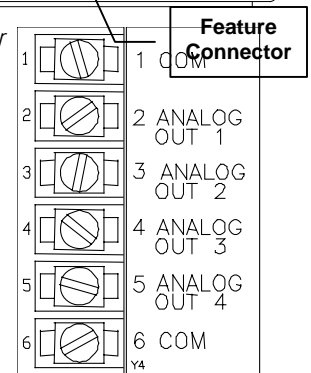


Figure K.4-6: Customer Analog Output Internal Connections

Error Analog Output

The Error Analog Output (or error analog output) provides a bipolar ($\pm 10\text{VDC}$) analog voltage proportional to the deviation of the detected position from the zero position. The zero position is selected by the operator with the TARGET – Auto-Zero button [Section K.6.d]. The maximum error analog output voltage will be $\pm 10\text{VDC}$ @ 10mA maximum for a deviation of X inches (operator entered value) from the zero position.

The customer connection on the bottom panel of the Model DCPU for the Error Analog Output is a male 3-pin MS-style circular connector (Figure K.4-5 & K.4-7) marked **P1**.

Pin #	Description	Designation
A	VALVE +	COMMON
B	EARTH	Optional
C	VALVE - (COMMON	Position Error Output

Table K.4-2: Error Analog Output Connector

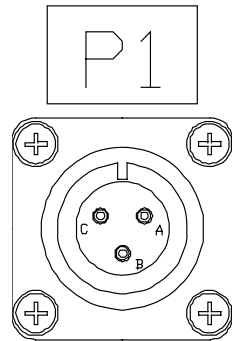


Figure K.4-7: Error Analog Connector - P1

Analog Output with AMP Option

The analog output with the AMP Option is also available through the connector on the bottom panel of the processing unit. It is routed from the Main Board terminal block to the AMP Option Board before passing to the connector.

Analog Cables

A 3-pin MS-style connector for the error analog output of the Model DCPU is provided with the unit. The wires for the analog output cable(s) should be a two-wire cable with drain (shield) grounded at the Model DCPU end only. The suggested cable for all analog outputs is the Belden® 8761.

Cables for analog signals should never be run through the conduit that contains power cables. Maximum length of analog cables is fifty feet [15.2m]. If the analog cables must be longer, Harris Instrument Corporation suggests the 4/20mA Converter – 4/20 Option.

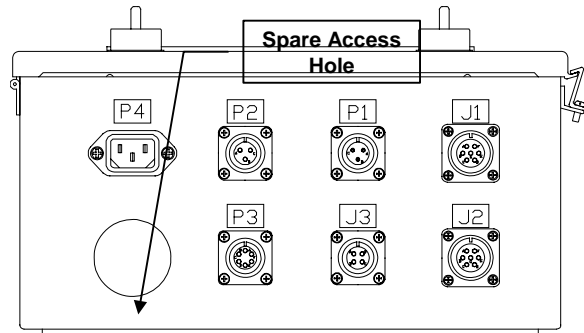


Figure K.4-8: Spare Access Hole

K.4.d Serial Communications

The Model DCPU has one dedicated serial communications output port (RS-232-2) for connection to the Remote Operator Interface – RI Option, RS-232 Customer Interface and for diagnostic output functions. Connection to the serial communications is available on the bottom panel of the unit via a male six-pin circular MS-style connector marked **P3** (Figure K.4-9).

The serial communications for the Model DCPU terminal emulation is based upon the *DEC VT-100 (ANSI) terminal emulation for the IBM PC®* for RS-232 communications. The RS-232 output communications port operates as the DCE, with the host computer as the DTE. Any ANSI terminal emulator will probably function with the Model DCPU as a terminal emulator, as well as many commercial communications software packages (such as PROCOMM®).

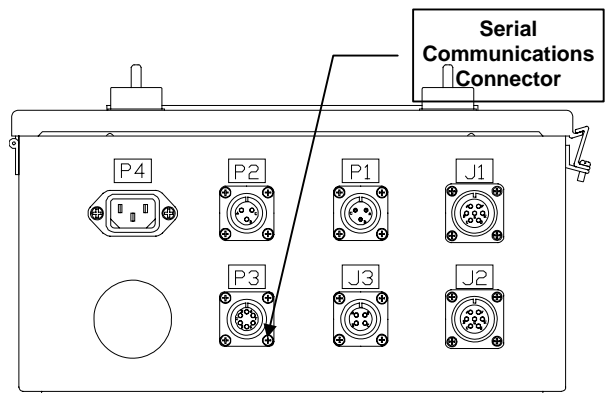


Figure K.4-9: Serial Communications Connector

Communications protocol for the serial output are RS-232C ASCII, six-characters with a decimal point, space padded with a carriage-return and line feed in a **10-bit frame** running:

**No Parity, Eight Data Bits and One Stop Bit (N,8,1)
with One Start Bit.**

The communications output is set for a baud rate of:

9600bps.

Serial communications port RS-232-1 and RS-232-2 are available via an Engineering Variance Order (EVO) for various protocols, output formats and devices (such as the RS-232 Customer Interface, serial printer or serial panel meter). Contact Harris Instrument Corporation Sales or Engineering for more information.

RS-232 Communications Jumper

The Model DCPU requires a jumper wire to be run from J4-4 (DTR) to J5-4 (CTS) on the Micro-Controller Board (Refer to Drawing # 1495172 Rev. C in Section K.15) for the operation of the RS-232 Customer Interface. This jumper should be installed from the factory on all Model DCPUs. If a problem is experienced with operation of the RS-232 Customer Interface, verify that this jumper is in place.

Extended Serial Communications

Typically, reliable serial communications output for the Model DCPU is limited to a maximum of seventy-five linear cable feet [22.8m]. This is the standard for all RS-232 communications. For reliable operations greater than seventy-five feet [22.8m] up to 4000 linear cable feet [1219m], short-haul modems (422 Option – Section ZG) will need to be installed.

NOTE:

Serial communications for the Model DCPU is limited to seventy-five linear cable feet [22.8m]. For reliable operation up to 4000 linear cable feet [1219m], the 422 Option [Section ZG] for short-haul modems is required.

Communications Cable

A connector for attaching to the RS-232 communications female six-pin MS-style circular connector on the bottom panel of the unit is provided {Figure K.4-10} labeled **P3**. This connector is detailed on Drawing # 1299014 Pg. 2 in Section K.15. A six-pin MS-style circular connector to DB-9 cable is detailed in Drawing # 3400001 in Section K.15.

The RS-232 output communications ports operate as a DCE, with the host computer as the DTE. Use the sample cable connector to plug into the Model DCPU RS-232 communications port. The pin configuration for the Model DCPU end of a remote connection cable are:

Pin #	Description	Code	Notes
Pin A	COMMON	COM	Data common
Pin B	Receive	RX	TX connection on host computer
Pin C	Transmit	TX	RX connection on host computer
Pin D	Data Terminal Ready	DTR	DTR connection on host computer
Pin E	Clear to Send	CTS	CTS connection on host computer
Pin F	Shields	SHD	Power common

Table K.4-3: Pinouts for Model DCPU RS-232 Connection

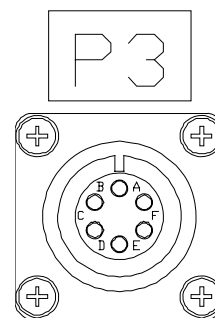


Figure K.4-10: RS-232 Connector – P3

This section details the operation of the commands for setup and configuration of the Model DCPU using the RS-232 communications interface via a host computer. Note that some form of terminal emulation software must be used to communicate with the Model DCPU (such as PROCOMM®).

Data Entry Conventions

There are two types of serial communications formats, a command and a query. A command sets a particular function in the Model DCPU and is initiated with an asterisk followed by the command data (for example: `*[B] [SPACE] [A] [B] [C] [D] [ENTER]`). The command entry is immediately echoed in the RS-232 data. A query returns a particular function's value via RS-232 (for example: `? [B] [SPACE] [ENTER]`), with the current value echoed in the RS-232 data.

All data entered in XXXXXX entries may be entered as 1 to 10 digits with a decimal point if necessary. The decimal point position on all displayed variables matches current customer selected decimal point position. Up to ten command sequences may be sent in rapid succession by the terminal device and the factory default command sequence.

Invalid Command Response

Any time an invalid command is sent via the RS-232 Customer Interface to the Model DCPU, the system will respond with a “What?” statement. The following example shows the Set Date command being used with the time command sequence.

```
*[B] [SPACE] [A] [B] [C] [D] [ENTER]
Command> *B ABCD
What?
```

Any time a “What?” response is received in the communications terminal software, check the command sequence that was previously entered and re-enter the command sequence properly.

Commands Listing

All Level 1 **commands** to the Model DCPU must be entered in *FULL CAPITAL LETTERS* preceded with an asterisk (*). The command sequencer is case sensitive, so setting the CAPS LOCK button ON with the host computer keyboard is suggested.

See Appendix B [Section K.11] for the information pertaining to the RS-232 Customer Interface. The Model DCPU RS-232 Customer Interface **commands** are as follows:

Command Sequence	Description
* [A] [H] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	XXXXXX = 10VDC Absolute Analog Output Strip Size
* [A] [L] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	XXXXXX = 0VDC Absolute Analog Output Strip Size.
* [B] [SPACE] [X] [X] [X] [X] [X]	Communications Port Two (RS-232-2) Baud Rate.
* [C] [1] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Calibrate First Standard at XXXXXX by required units of measure.
* [C] [2] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Calibrate Second Standard at XXXXXX by required units of measure.
* [E] [SPACE] [X] [X] [X] [X] [X] [X]	Tolerance at XXX.XXX (inches or millimeters).
* [F] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Snap Filter.
* [J] [X] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Input calibration values (manual calibration) [X=1 – 4]: 1 = First raw count, 2 = First calibration standard, 3 = Second raw count, 4 = Second calibration standard; XXXXXX is value for 1 – 4.
* [J] [5]	Re-calculates calibration coefficients from current settings.
* [K] [X]	Decimal Point Position: 0 = x, 1 = x.x, 2 = x.xx, 3 = x.xxx, 4 = x.xxxx.
* [L] [SPACE] [X] [X] [X] [X] [X] [X] [X]	LOWER (LO) Limit at XXXXXX.
* [M] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Date (Month/Day/Year).
* [N] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Time (Military format HH:MM:SS).
* [P] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Pulses per Unit for Line Speed Encoder (Tachometer) Input.
* [P] [1] [D] [1] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Set Proportional Term. XXXXXX = Proportional Value. Default = 1.00.
* [P] [1] [D] [2] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Set Integral Term. XXXXXX = Integral Value. Default = 0.00.
* [P] [1] [D] [3] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Set Derivative Term. XXXXXX = Derivative Value. Default = 0.00.
* [Q] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Set Exponential Averaging Value.
* [R] [X]	Sensor Designation (1 = Single 10XBR-Series, 2 = Single 10XAS-Series, 4 = Dual 10XAS-Series).*
* [R] [3] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Dual 10XBR-Series Sensor Designation with LED spacing value.
* [S]	Stop output of measurement readings.
* [T] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Set Deviation Target to XXXXXX.
* [U] [SPACE] [X] [X] [X] [X] [X] [X] [X]	UPPER (HI) Limit at XXXXXX.
* [V] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Deviation Analog Maximum Output.
* [W] [SPACE] [X] [X] [X] [X] [X] [X] [X]	Units of Measure (Inches [IN], Millimeters [MM]).
* [X] [X]	Set EVP Module Mode – 1 = Normal (Diagnostics) Mode, 2 = First Edge Mode, 3 = Filtered Video Mode. ¹
* [Y] [→] [SPACE] [X] [X] [X] [X] [X] [X] [X] [X]	Input Linear Position Transducer values (manual calibration) [X=1 – 4] : 1 = Recorded Close Measurement Raw Count, 2 = Close Measurement, 3 = Recorded Far Measurement Raw Count, 4 = Far Measurement; XXXXXX is value for 1-4. ³
* [Y] [5]	Perform Manual Linear Position Transducer Re-calibration based on values entered with Y1 through Y4. ³
* [Z] [SPACE] [X] [X] [X] [X] [X]	Centerline Deviation ($\pm 10VDC$) Analog Out. XXXX = \pm Deviation in units of measure. ²
* [F] [A] [C] [T] [O] [R] [Y]	Resets ALL Selectable Variables to Factory defaults.

Table K.4-4: Command Sequence Listing for Model DCPU RS-232 Customer Interface

¹ Jumpers may have be set on Video Pre-Processor for proper operation [Section K.12.c].

² Jumper JP6-1 & JP6-2 muse be closed for this function to operate.

³ Jumper JP6-7 & JP6-8 must be open for this function to operate.

Other Commands

There may be other commands associated with your system to perform non-standard functions. These functions would be documented in the Engineering Variance Order (EVO) documentation accompanying this manual. If you need more information about an associated EVO, contact Harris Instrument Corporation Engineering or Service.

Queries Listing

All Level 1 **queries** must be entered in FULL CAPITAL LETTERS proceeded with a question mark (?). The query sequencer is also case sensitive.

See Appendix B [Section K.11] for the information pertaining to the RS-232 Customer Interface. The Model DCPU RS-232 Customer Interface **queries** are as follows:

Query Sequence	Description
? A H	Returns current setting for Absolute High analog output.
? A L	Returns current setting for Absolute Low analog output.
? D	Output Diagnostic Data.
? E	Returns current Tolerance setting.
? F	Returns current Snap Filter setting.
? G	Start output of measurement readings.
? H	Output Help Screen.
? J X	Returns current calibration settings. X=1 – 4: 1 = First raw count, 2 = First calibration standard measurement, 3 = Second raw count, 4 = Second calibration standard measurement.
? K	Returns current Decimal Point Position: 0 = x, 1 = x.x, 2 = x.xx, 3 = x.xxx, 4 = x.xxxx.
? L	Returns current LOWER (LO) Limit.
? M	Returns current Date (Month/Day/Year) setting.
? N	Returns current Time (Military format HH:MM:SS) setting.
? P	Returns current Pulses per Unit setting for Line Speed Encoder (Tachometer) Input.
? P I D X	Returns current P, I or D Values. X = 1, 2 or 3; 1 = Proportional, 2 = Integral, 3 = Derivative.
? Q	Returns current Exponential Averaging Value.
? R	Returns current Sensor Designation (1 = Single 10XBR-Series, 2 = Single 10XAS-Series, 4 = Dual 10XAS-Series) [NOTE: Designation 3 does not return spacing value].
? T	Returns current Deviation Target setting.
? U	Returns current UPPER (HI) Limit.
? V	Returns current Deviation Analog Maximum Output setting.
? W	Returns current Units of Measure setting (Inches [IN], Millimeters [MM]).
? X	Returns EVP Module Mode – 1 = Normal (Diagnostics) Mode, 2 = First Edge Mode, 3 = Filtered Video Mode. ¹
? Y X	Returns current transducer calibration settings. X = 1 – 4: 1 = Close measurement raw count, 2 = Close measurement, 3 = Far measurement raw count, 4 = Far measurement. ³
? Z	Returns current Deviation Analog Output value setting. ²

Table K.4-5: Query Sequence Listing for Model DCPU RS-232 Customer Interface

¹ Jumpers may have be set on Video Pre-Processor for proper operation [Section K.12.c].

² Jumper JP6-1 & JP6-2 muse be closed for this function to operate.

³ Jumper JP6-7 & JP6-8 must be open for this function to operate.

Other Queries

There may be other queries associated with your system to return the values of non-standard functions. These queries and functions would be documented in the Engineering Variance Order (EVO) documentation accompanying this manual. If you need more information about an associated EVO, contact Harris Instrument Corporation Engineering or Service.

K.4.e AC Power

Information on the AC Power requirements for the Model DCPU can be found in Section K.3.a & K.4.e of this manual. This section deals with internal AC Power connections and the power cable (cord).

Internal Power

Internal power connections are available for +12VDC, -12VDC and +5VDC on a barrier strip located on the top of the main board inside the Model DCPU enclosure {Figure K.4-11}. These connections are available for HARRIS INSTRUMENT CORPORATION APPROVED ACCESSORIES ONLY. Short-haul modems, line speed encoders and sensor signal line drivers are a few of the possible accessories. Please contact Harris Instrument Corporation for more information on accessories approved for use with the Model DCPU.

Pin #	Tag #	Description
TB1-1	Y2-1	COMMON
TB1-2	Y2-2	-12VDC @ 0.7Amp Max
TB1-3	Y2-3	+12VDC @ 3Amp Max
TB1-4	Y2-4	+5VDC @ 7Amp Max
TB1-5	Y2-5	+5VDC @ 7Amp Max
TB1-6	Y2-6	COMMON

Table K.4-6: Internal Power Connections

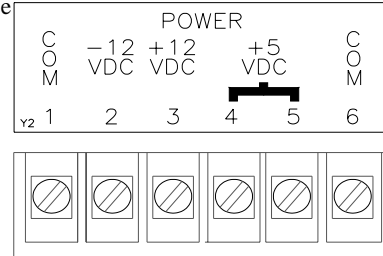


Figure K.4-11: Internal Power Connections

AC Power Cable

The Model DCPU comes standard with an Euro-style three-prong AC power cord for 115VAC operation. This cord connects to the Euro-style three-prong plug on the bottom panel of the unit marked **P4** {Figure K.4-12}. The internal power supply is capable of operating with voltages ranging from 85VAC to 264VAC at 50/60Hz.

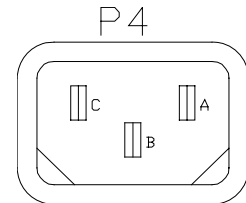


Figure K.4-12: AC Power Plug – P4

K.4.f Peripherals (Optional)

The Model DCPU provides for the optional input of a linear position transducer (for Rewind Control, Payoff Control or Intermediate Strip Control Systems), an Eddy current sensor (Rewind Control System with Stagger Wrap) or a Control Offset Pendant. The linear position transducer senses current mandrel (or guide roll) position and routes that information to the Model DCPU for processing. The Eddy current sensor is used to determine rewind mandrel revolutions. The Control Offset Pendant – OP Option provides a positive or negative offset to the control analog signal from the Model DCPU.

Linear Position Transducer

A position transducer input is utilized with the Model DCPU for Rewind Control or Roll Position Feedback. All position transducers are optional peripherals to the Model DCPU. Note that if a Control Offset Pendant is installed, a linear position transducer cannot be used. Please contact Harris Instrument Corporation Engineering for more information.

The Model DCPU will accept a Harris Instrument Corporation approved position transducer that operates with a 12VDC @ 10mA input and a 0-10VDC @ 10k Ohm output impedance maximum. Please contact Harris Instrument Corporation Engineering or Sales to utilize a specific model position transducer.

The linear position transducer for a Rewind Control System Model DCPU is attached to the mandrel and senses the position of the mandrel throughout its travel. The signal from the position transducer is then used to calculate the difference between the strip position and the mandrel position, which is then used to create the correction error signal.

The suggested linear position transducer for use with the Model DCPU is the Celesco® PT510 -0020-111-1210. This unit has a twenty-inch [508mm] full stroke range with a 0-5VDC @ 10 Ohms output impedance. Harris Instrument Corporation recommends that this model (Celesco® Model PT510) be used with the Model DCPU. Other full stroke ranges are available. The linear position transducer attaches to the female three-pin circular MS-style connector on the bottom of the unit {Figure K.4-13} labeled **P2**.

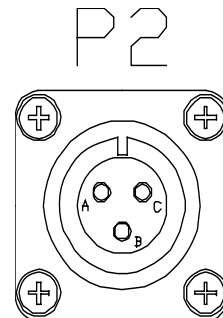


Figure K.4-13: Linear Position Transducer Connector – P2

Linear Position Transducer Cable

A cable is not provided with the Model DCPU for use with the Celesco® PT510. A wire diagram is located in Section K.15 (Drawing # 3498139 Rev. A). If a PT 510 or a different linear position transducer is to be utilized, see Drawing # 1299014 Pg. 2 in Section K.15 for information on Model DCPU linear position transducer input connector pinouts and wiring.

Eddy Current Sensor

The Eddy Current Sensor input is utilized with the Model DCPU for the Stagger Wrap Option – SW Option. Information on the Eddy Current Sensor can be found in Section KA (if applicable).

Control Offset Pendant

The Control Offset Option – OP Option provides a positive or negative offset to the control analog signal from the Model DCPU. Most SCAN-A-LINE™ control systems operate with one or two sensors. When edge guiding, the system determines the position of the strip from the edge positioned over the sensor. When centerline guiding, the centerline position of the strip is the physical center of the two sensors (or the single sensor with a narrow strip in a single-sensor system). The Control Offset function allows the operator to offset that centerline to one side or the other.

The Control Offset ten-turn multidial {Figure K.4-14} is attached to a 10Kohm potentiometer, which is typically mounted on a removable pendant {Figure K.4-15} that attaches to a female 3-pin circular connector on the bottom panel of the unit labeled **P2** {Figure K.4-16}. Note that the Control Offset Option is not compatible with the use of a linear position transducer (the linear position transducer also attaches to the **P2** connector. Please contact Harris Instrument Corporation Engineering for information on using the Control Offset Option with a linear position transducer.

The Control Offset potentiometer provides a voltage to the Model DCPU amplifier as a modification (offset) to the control signal. This allows minor tuning of the edge or centerline position control signal.

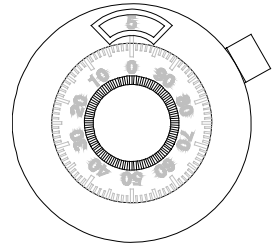


Figure K.4-14: Control Offset Precision Multi-Dial

CAUTION:

Operation of the Control Offset Function in conjunction with the Auto-Zero Function can cause the potentiometer to be run out of operational range. Be sure to reset the Control Offset potentiometer to zero offset (50 on the SCAN-A-LINE™ supplied potentiometer) BEFORE re-engaging the Auto-Zero Function. Please contact Harris Instrument Corporation Service for more information.

NOTE:

When used with the Bargraph Display, the control signal offset will offset the strip to the right (or left) and this will displayed on the bargraph as a shift of the strip to the right (or left).

K.4.g Other Inputs & Outputs

There is one digital input for an optional line speed encoder, three optional digital input connections and one open collector output available on the main board inside the Model DCPU enclosure {Figure K.4-17}. The optional digital inputs are available for product detectors, digital linear position transducers, or other digital input devices as configuration options. Depending upon configuration of the Model DCPU, some or all of these inputs may be used. Please refer to the Configuration EVO for more information on the configuration of this particular Model DCPU.

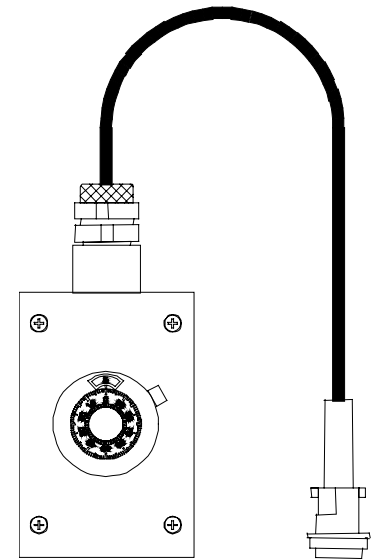


Figure K.4-15: Control Offset Pendant

NOTE:

The terminal strip tag for this terminal strip is located on the interior right side of the enclosure.

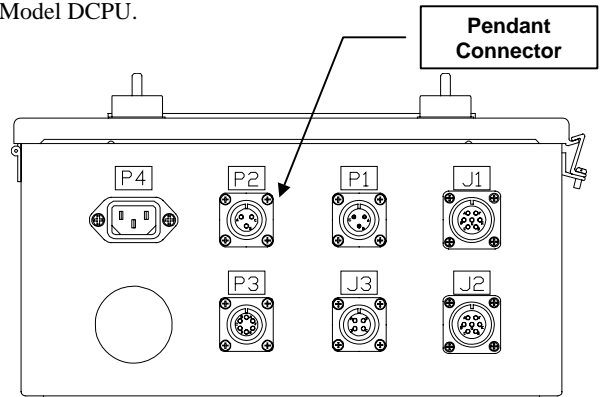


Figure K.4-16. Pendant Connector Location

Pin #	Tag #	Name	Description
TB3-1	Y3-1	COM: COMMON	COMMON
TB3-2	Y3-2	INPUT 1: 5VDC TTL	Reserved
TB3-3	Y3-3	INPUT 2: 5VDC TTL	Reserved
TB3-4	Y3-4	INPUT 3: 5VDC TTL @ 10kHz Max.	Reserved
TB3-5	Y3-5	INPUT 4: - 5VDC TTL	Reserved
TB3-6	Y3-6	FAULT Open Collector 1 rated 50VDC, sink up to 500mA (switches to GROUND to signal sensor FAULT)	Sensor VIDEO & SYNC FAULT Digital Output

Table K.4-7: Open Collector Customer Internal Connections

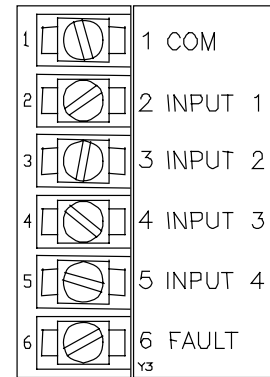


Figure K.4-17: Customer Open Collector & Digital Input Connections

The FAULT connection is accessed through the spare access hole on the bottom panel of the Model DCPU enclosure or with a circular connector included with the enclosure (optional connector – see Configuration EVO or option section for more information). All other connections on this terminal strip are reserved for special purpose inputs and are not used in standard Model DCPU configurations.

FAULT Open Collector Output

The sensor FAULT open collector output is designed to sink up to 500mA and is rated at 50VDC. The collector output switches to GROUND to signal a sensor FAULT condition.

K.4.h Control Analog Amplifier (Optional)

One very common option to the Model DCPU is an power amplifier for the error analog output (AMP Option). The error analog output [Section K.4.c] is routed to the Control Analog Amplifier (Part # 3699001) for amplification and then routed to the bottom panel circular connector **P1**.

Power input to the AMP Option is routed from the Internal Power Barrier Strip via two Molex-style connectors (Figure K.4-18). Inversion jumpers allows the inversion of the error analog output. An adjustment potentiometer is available for fine-tuning the output analog. Analog output connections are located on the barrier strip and are routed to the MS-style circular connector on the bottom panel marked **P1**.

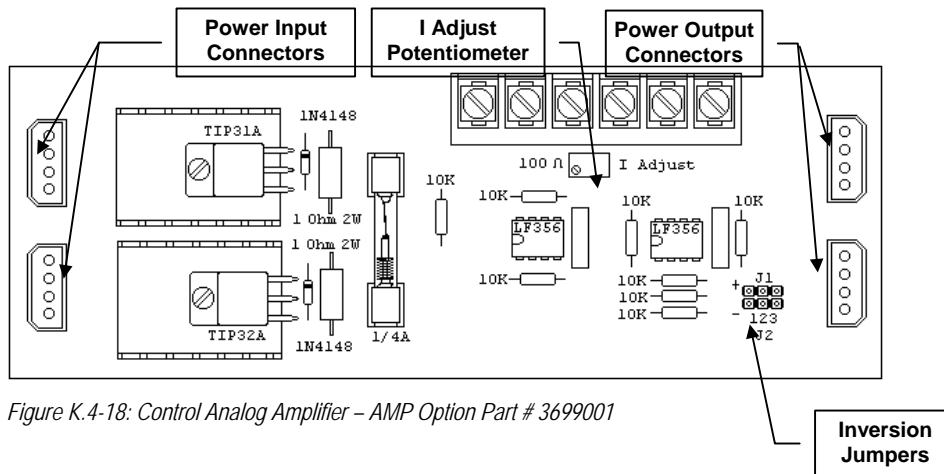


Figure K.4-18: Control Analog Amplifier – AMP Option Part # 3699001

Power Input/Output

Power input for the AMP Option comes from the Internal Power Connectors [Section K.4.e]. Two Molex-style connectors attach to the AMP Option board as shown in Figure K.4-19. Note that there are also two other connectors on the other end of the board that allow power output to Harris Instrument Corporation approved peripherals. All power specifications for internal power are listed in Sections K.3.c and K.4.e.

Pin #	Description
1	+5VDC
2	COMMON
3	-12VDC
4	+12VDC

Table K.4-8: Power Input/Output

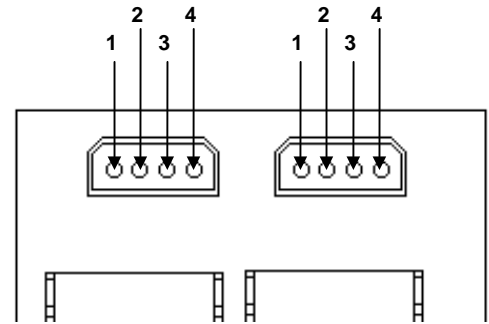


Figure K.4-19: Power Input to AMP Option

Jumper Settings

The jumpers on the AMP Option board allow the operator to invert the error analog input from the Model DCPU to the amplifier. Two three-position jumpers can be set in one of two ways.

Jumper Setting	Description
	Non-inverted Input
	Inverted Input

Table K.4-9: Jumper Settings for AMP Option – Part # 3699001

Adjustments

The Control Analog Output from the AMP Option board can be fine-tuned with the on-board potentiometer {Figure K.4-20}.

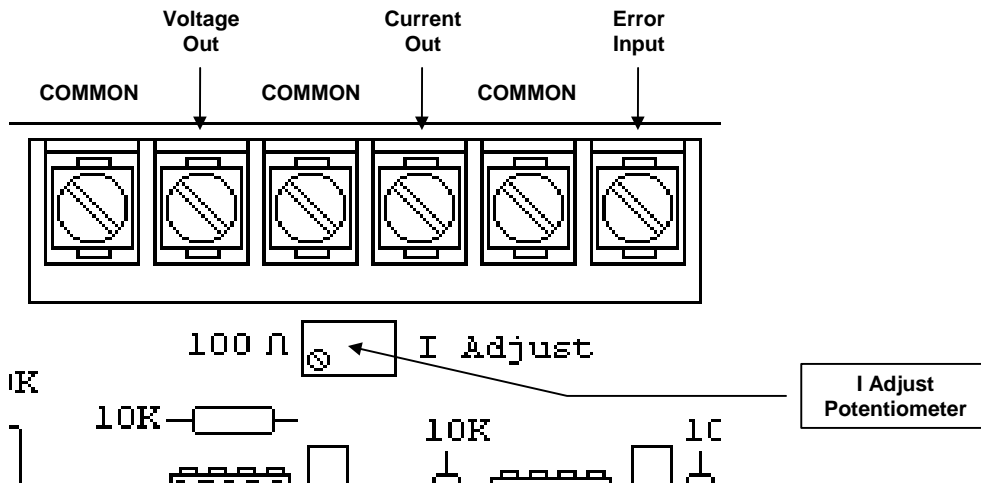


Figure K.4-20: AMP Option Barrier Strip

K.5 LED Display/Keypad Interface

The operator interfaces of the Model DCPU include the LED Display/Keypad setup interface, the Manual Controls Interface and the Remote Operator Interface, which includes both of the previous in a remote mount panel. Note that the entire sensor system (Model DCPU, single- or dual-sensors, peripherals, etc.) must be on-line and functioning before many of the procedures documented in this section can be performed. Power must be available to the Control System and all components must be operating properly. A sample piece of product (or facsimile thereof) must be obtained for several of these set-up and configuration procedures. This sample should be approximately the midway between the smallest and largest size of the material that will be run on the line.

Inside the door (front panel) of the Model DCPU is the LED Display/Keypad Operator Interface {Figure K.5-1}. This interface, consisting of a five-digit LED display, sixteen-button keypad and function legend, allows the set-up, configuration and adjustment of the main functions of the Model DCPU. Each function is detailed in this section. Note that if an Engineering Variance Order (EVO) applies to this unit, these functions may be altered. Check the EVO documentation for more information.

The LED Display/Keypad Interface has two distinct modes, the SETUP mode and the OPERATIONS mode. During the SETUP mode, the following variables can be set (each variable is described in the following sub-sections):

- 1) Set Proportional Term,
- 2) Set Integral Term,
- 3) Set Derivative Term,
- 4) Scale Analog Output,
- 5) Calibrate Mandrel Feedback,
- 6) Calibrate Position,
- 7) Calibrate Mandrel Center,
- 8) Set Jog Voltage,
- 9) Set BGA Sensitivity.

Variables 1 through 9 are also listed on the protective/mounting panel for the keypad.

The OPERATIONS mode is the standard operational mode of the unit. This is when the unit is controlling the line while in *Automatic Mode*. The LED Display will show the current strip position error in the red LEDs while in the OPERATIONS mode.

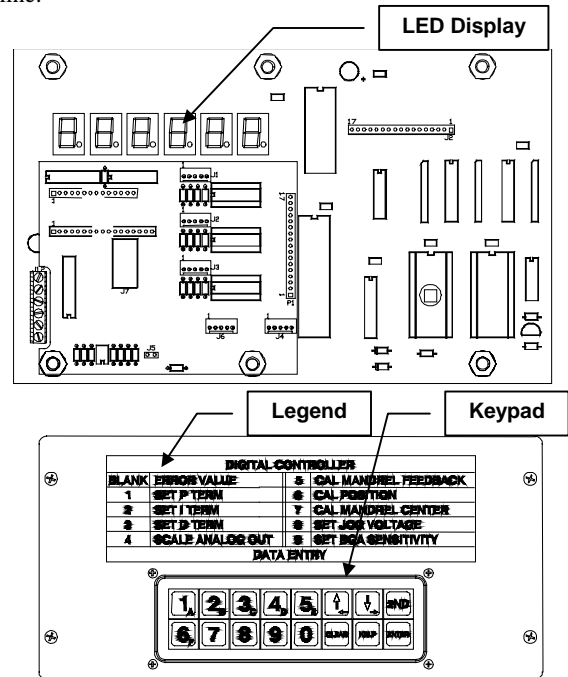


Figure K.5-1: Model DCPU LED Display/Keypad Interface

K.5.a LED Display

The six-digit LED Display consists of one green LED to the far left of the display and five red LEDs to the right of the green LED {Figure K.5-2}. During the SETUP routine, the display will show the current function on the green LED (far left LED) as a value 1 through F while simultaneously displaying the current variable value in the five red LEDs.

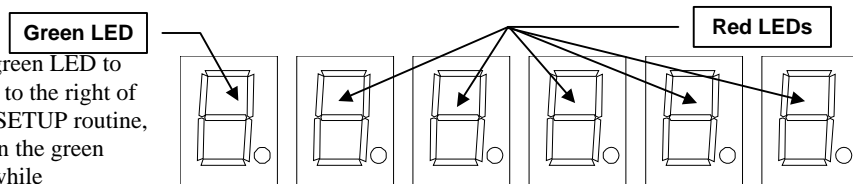









Figure K.5-2: Internal LED Display for Model DCPU

Note that if a negative value is entered with the keypad, it will not be displayed as a negative value during the SETUP routine. While in the OPERATIONS routine, a negative symbol will be displayed during negative control actions.

K.5.b Keypad Operation

The sixteen-button keypad on the Model DCPU LED Display/Keypad Interface allows the selection of the main set-up and control functions of the digital controller. The UP and DOWN arrow buttons allow “scrolling” through the various configuration functions of the Model DCPU (detailed in following sections).

To change a functions variable, press the UP arrow until the required function number is displayed with the green LED. Pressing the CLEAR button clears the current value displayed in the red LEDs and begins the data entry routine. Enter the new value with the numeric buttons. A negative number can be entered by pressing the UP arrow button during data entry. A decimal point can be entered by pressing the DOWN arrow button during data entry. To accept the new value, press the ENTER button. The new value is displayed in the red LEDs. Press the DOWN arrow key to return to the position error display (green LED shows no value).

Button	Description
	<i>CLEAR Button – Clears current variable displayed in red LEDs.</i>
	<i>ENTER Button – Accepts newly entered value displayed in red LEDs.</i>
	<i>NUMERIC Buttons – Data entry buttons for variable values.</i>
	<i>UP Button – "Scrolls" up through function variables from 1 to F; Also acts as minus (-) symbol during data entry.</i>
	<i>DOWN Button – "Scrolls" down through function variables from F to 1; Also acts as decimal point during data entry.</i>
	<i>HELP Button – No function at this time.</i>
	<i>2ND Button – No function at this time.</i>
<i>Table K.5-1: Keypad Functions of LED Display/Keypad Interface</i>	

1 – Set P (Proportional) Term

Try increasing the Proportional Term (Gain) until overshoot or oscillation begins. It is best to switch gains with the line stopped and also to begin with the Proportional Term setting around 1.00. The default setting for the Proportional Term is 1.00.

- 1) Press the UP or DOWN button until the "1" is displayed in the green LED of the LED Display.
The current Proportional Term value is displayed in the red LEDs.
- 2) Press the CLEAR button two (2) times to clear the previous setting.
The LED Display will flash and read 000.00.
NOTE: Once the old setting is cleared in this manner, a new value must be entered.
- 3) Enter the new value with the numeric buttons.
- 4) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

Initial Proportional Term Setting

- a) Position the sample strip near the center of the detection range.
- b) Press the TARGET (Auto-Zero) button.
- c) Displace the sample strip one inch [25.4mm] in one direction.
- d) Press the UP or DOWN button until the "1" is displayed in the green LED of the LED Display.
The default value of 1.00 should be displayed in the red LEDs. If not, press the CLEAR button two (2) times, enter 1.00 and press the ENTER button.
- e) Measure the error voltage output analog at connector **P1** pins A & B. It should read 1.00VDC ± the actual displacement accuracy.
- f) Press the CLEAR button twice. Now enter 2.00 and press ENTER.
- g) Check that the output voltage has doubled from step e. Return to step d and return the setting to 1.00.

2 – Set I (Integral) Term

The Integral Term will be most helpful at low line speeds. If the line seems to continually correct in one direction, wait and then correct in the same direction, try decreasing the Proportional Term (Gain) and increasing the Integral Term (Gain) by an equal percentage. Too much Integral Term will cause slow moving oscillations that increase in amplitude with time as the control gets out of phase with the process. This is a direct symptom too much Integral Term.

- 1) Press the UP or DOWN button until the "2" is displayed in the green LED of the LED Display.
The current Integral Term value is displayed in the red LEDs.
- 2) Press the CLEAR button two (2) times to clear the old setting.
The LED Display will flash and read 000.00.
NOTE: Once the old setting is cleared in this manner, a new value must be entered.
- 3) Enter the new value with the numeric buttons.
- 4) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

Initial Integral Term Setting

- a) Press the UP or DOWN button until the "2" is displayed in the green LED of the LED Display.
The default value of 0.00 should be displayed in the red LEDs. If not, press the CLEAR button two (2) times, enter 0.00 and press the ENTER button.
- b) The red LEDs should now display 0.00.

During line control adjustment, another value can be entered if some integral term is required for good process control.

3 – Set D (Derivative) Term

The Derivative Term (Gain) is helpful in correcting for high-speed position changes. Too much Derivative Term will cause “jittery” operation of the control valve as the system tries to correct for noise in the system. Increase the Derivative Term slowly, while backing off the Proportional Term in equal percentages. Even before the system begins to jitter, increasing overshoot is recognizable on fast corrections as the Derivative Term setting goes too high.

- 1) Press the UP or DOWN button until the "3" is displayed in the green LED of the LED Display.
The current Derivative Term value is displayed in the red LEDs.
- 2) Press the CLEAR button two (2) times to clear the old setting.
The LED Display will flash and read 000.00.
NOTE: Once the old setting is cleared in this manner, a new value must be entered.
- 3) Enter the new value with the numeric buttons.
- 4) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

Initial D Term Setting

- a) Press the UP or DOWN button until the "3" is displayed in the green LED of the LED Display.
The default value of 0.00 should be displayed in the red LEDs. If not, press the CLEAR button two (2) times, enter 0.00 and press the ENTER button.
- b) The red LEDs should now display 0.00.

4 – Scale Analog Output

This value determines what the overall control analog output gain is before it is amplified by the AMP Option (if applicable). A setting of 10 (default) gives a 10VDC output when there is 10 inches [254mm] of error. This setting affects the rate that a mandrel would return to center (in *Center Mode*) as well as the mandrel action in the *Automatic Mode*. The PID Terms are calculated after this gain setting in the *Automatic Mode*.

- 1) Press the UP or DOWN button until the "4" is displayed in the green LED of the LED Display.
The current Analog Output scale value is displayed in the red LEDs.
- 2) Press the CLEAR button two (2) times to clear the old setting.
The LED Display will flash and read 000.00.
NOTE: Once the old setting is cleared in this manner, a new value must be entered.
- 3) Enter the new value with the numeric buttons.
- 4) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

Initial Analog Output Scaling

- a) Press the UP or DOWN button until the "4" is displayed in the green LED of the LED Display.
The default value of 10.00 should be displayed in the red LEDs. If not, press the CLEAR button two (2) times, enter 10.00 and press the ENTER button.
- b) The red LEDs should now display 10.00.

5 – Cal Mandrel Feedback (Linear Position Transducer)

A Rewind (or Payoff) Control System configured with a linear position transducer must be “taught” the full range of throw of the mandrel. The mandrel zero position should be the start of the full stroke of the linear position transducer and the mandrel full movement position should be the end of the linear position transducer stroke (or close to it). A product sample (or standard) is required for the Calibrate Position procedure.

- 1) Press the UP or DOWN button until the "5" is displayed in the green LED of the LED Display.
The current Linear Position Transducer displacement value is displayed in the red LEDs.
- 2) Move the mandrel to the minimum transducer string length (mandrel 'zero' position).
- 3) Press the CLEAR button twice to store the mandrel 'zero' position (current mandrel position).
The LED Display will flash, signifying the calibration routine is functioning.
- 4) Move the mandrel to the maximum transducer string length position.
and carefully measure the displacement of the mandrel from the 'zero' position to the maximum position.
- 5) Enter the displacement measurement value with the numeric buttons (See NOTE below).
- 6) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

The Linear Position Transducer can be manually recalibrated with the RS-232 Communications Interface [Section K.11.i].

NOTE:

If the displacement measurement value in step 5 is greater than 50.00 the system will assume that the system calibration is in millimeters and the error display will show XXX.X. If the value is less than 50, the system will assume that it is in inches and the error display will show XX.XX.

5 – Cal Control Offset (OP Option Pendant)

On systems that use a Control Offset Pendant – OP Option, the Model DCPU must be calibrated to the control offset potentiometer.

- 1) Verify that the Control Offset Pendant is attached to connector P2.
- 2) Press the UP or DOWN button until the "5" is displayed in the green LED of the LED Display. The current control offset value is displayed in the red LEDs.
- 3) Turn the offset potentiometer dial to zero (0).
- 4) Press the CLEAR button twice to store the potentiometer 'zero' position. The LED Display will flash, signifying the calibration routine is functioning.
- 5) Turn the offset potentiometer to the maximum.
- 6) Enter the offset value with the numeric buttons (See NOTE below).
- 7) Press the ENTER button to accept the new value. The LED Display will stop flashing and show the new value in the red LEDs.

NOTE:

If the control offset value in step 6 is greater than 50.00 the system will assume that the system calibration is in millimeters and the error display will show XXX.X. If the value is less than 50.00, the system will assume that it is in inches and the error display will show XX.XX.

6 – Cal Position

The Model DCPU must be “taught” the entire range of the sensor system which will be viewing the product. A product sample (or standard) is required for the Position Calibration procedure. To perform this procedure, select a sample strip that is about half way between the maximum strip width and the minimum strip width.

NOTE:

Do NOT disconnect the linear position transducer. Make sure that the transducer is at the zero position and that the product is located at the normal operating passline.

- 1) If using a centerline guide system, select CENTER on the GUIDE Switch. If edge guiding, select the proper edge on the GUIDE Switch (either RIGHT or LEFT).
- 2) Locate the product sample, at the proper product passline, near the mandrel 'zero' side of the process line, but within the valid sensor field-of-view. If the sample position is valid, the green (GO) LED in the middle of the bargraph display will light and remain lit.
- 3) Press the UP or DOWN arrow buttons until the "6" is displayed in the green LED on the LED display.
- 4) Press the CLEAR button twice to store the current product sample position. The LED Display will flash, signifying the calibration routine is functioning.
- 5) Carefully measure the displacement of the product sample (in inches or millimeters) as you move it to the other side of the sensor field-of-view. Make sure that the green (GO) LED on the bargraph stays lit.
- 6) Enter the measured displacement value with the numeric buttons (displacement should be greater than or equal to the mandrel stroke range).
- 7) Press the ENTER button. The LED Display will stop flashing and the newly entered value is now shown in the red LEDs.

7 – Cal Mandrel Center (Servo-Center)

On Rewind (or Payoff) Control Systems, the centerline of the mill must be located for the Model DCPU for the *Center* Mode (Servo-Center) to function properly. This position is where the mandrel should be located in relation to the process line when loading or unloading a coil.

NOTE:

The Transducer Calibration MUST be performed BEFORE this procedure can be accomplished.

- 1) Press the UP or DOWN arrow buttons until the "7" is displayed in the green LED on the LED Display.
- 2) Press the CLEAR button. The display will flash and display the current position of the mandrel as indicated by the linear position transducer.
- 3) Move the mandrel to the desired "center" position.
- 4) Press the ENTER button. The display will stop flashing and the "Servo-Center" position will be displayed in the red LEDs of the LED Display.

8 – Set Jog Voltage

The JOG Switch on the front panel have a default value of 5.00VDC output when jogging IN or OUT. This function sets the voltage output when the JOG Switch is activated.

- 1) Press the UP or DOWN button until the "4" is displayed in the green LED of the LED Display.
The current JOG Voltage value is displayed in the red LEDs.
- 2) Press the CLEAR button two (2) times to clear the old setting.
The LED Display will flash and read 000.00.
NOTE: Once the old setting is cleared in this manner, a new value must be entered.
- 3) Enter the new value with the numeric buttons.
- 4) Press the ENTER button to accept the new value.
The LED Display will stop flashing and show the new value in the red LEDs.

9 – Set BGA Sensitivity

The Bargraph Display sensitivity can be adjusted with this keypad function. The number of LEDs that light on the BGA Option display can be adjusted for amount of difference between the detected strip position and a pre-determined strip position. This also affects the closure of the limit relays.

There is a GAIN control on the BGA Option board that is used to adjust the full-scale sensitivity of both the positive and the negative twenty-element bargraph LEDs. The Bargraph Display Sensitivity Setting is used to adjust the "GAIN" of the display through the LED Display/Keypad Interface. The sensitivity is fully adjustable from 0.1VDC to 10VDC full-scale. The setpoint for the positive and negative limit sensors is the same as the full-scale voltage. The bargraph element yellow limit LED will begin to flash as the full-scale voltage is approached. The limit relay will be energized when the appropriate yellow limit LED on the Bargraph Display are flashing. The limit relay contacts are brought to the barrier strip (Y5) on the main board of the processing [Section K.4.d].

- 1) Displace the sample strip material 1 inch [25mm]. Make sure not to move the linear position transducer's position.
- 2) Observe the number of red LEDs on the Bargraph Display that are lit. If they are flashing, then the GAIN for the Bargraph Display is set at least two times too high.
- 3) Press the UP or DOWN arrow buttons until the "9" is displayed in the green LED on the LED Display.
The LED Display shows the current Bargraph Sensitivity value.
- 4) Press the CLEAR button two (2) times to clear the current value.
The LED Display will flash.
- 5) Enter the new smaller value for the Bargraph Sensitivity with the numeric buttons for too many LEDs lit or a greater value for fewer LEDs lit.
- 6) Press the ENTER button.
The display will stop flashing and the new Analog Gain value will be displayed in the red LEDs of the LED Display. The Bargraph Display red LEDs will be lit to show a 1 inch [25mm] offset. If the first attempt is not what is required for a 1 inch [25mm] strip displacement, increase or decrease the GAIN value as in step 5 to get a proper response from the Bargraph Display.
- 7) Make sure that the Bargraph Display works in both directions by moving the sample strip material to the other side of the centerline (zero position) of the line and view the Bargraph Display reaction.

K.6 Manual Controls

The front panel of the Model DCPU is configured with several switches and buttons for manual control of the processing unit. Each switch and its function is detailed in this section. Note that if an Engineering Variance Order (EVO) applies to this unit, these switch functions may be altered. Check the EVO documentation for more information.

K.6.a MODE Switch

The MODE Switch on the front panel of the Model DCPU is designed for selecting *Automatic Mode* (the Model DCPU proportionally controls lateral position of the strip, TARGET Button operates in this mode), *Center Mode* (the mandrel on a Rewind Control System returns to the designated mill center point or Servo-Center) or *Manual Mode* (automatic, proportional control of strip position is disabled for manual adjustments and/or loading/unloading, the GUIDE & JOG Switches operate in this mode).

Automatic Mode

The *Automatic Mode* (MODE Switch 'AUTO' position – Figure K.6-1) of the Model DCPU is where the PID control of the lateral strip position occurs. The JOG Switch and GUIDE Switch *do not function* while in *Automatic Mode*, so care should be taken in attempting to change these while in *Automatic Mode*. The TARGET Button functions in this mode. The LED Display/Keypad will display the current strip error value in this mode. Functions available via the keypad can be manipulated while in *Automatic Mode*.

NOTE:

Changing keypad settings 1 through 7 while in Automatic Mode is NOT recommended.

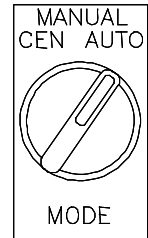


Figure K.6-1:

Manual Mode

While in *Manual Mode* (MODE Switch 'MANUAL' position – Figure K.6-2), the Model DCPU has no proportional control over the lateral position of the strip. Only the JOG Switch controlling strip position with JOG IN and JOG OUT defines the strip position. The TARGET Button and the GUIDE Switch are also activated in the *Manual Mode* to allow selection of the strip zero point (target) and for the selection of the guide point (left edge, centerline or right edge). The LED Display/Keypad display is blank and any functions available via the keypad can be performed while in *Manual Mode*.

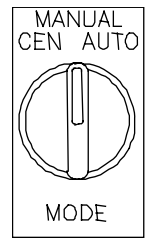


Figure K.6-2:
Manual Mode

Center Mode

The *Center Mode* (MODE Switch 'CEN' position – Figure K.6-3) of the Model DCPU returns the mandrel to the center position in relation to the process line. This mode is used to center the mandrel for the loading (or unloading with a Strip Entry Control System) of a coil.

The center position is calibrated with the Mandrel Center Calibration function via the LED Display/Keypad [Section K.5.b-7]. The speed of mandrel movement is controlled by the control analog gain setting (step 4 on the LED Display/Keypad Interface [K.5.b-4]).

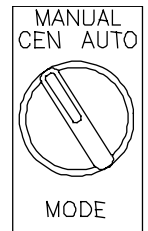


Figure K.6-3:
Center Mode

K.6.b GUIDE Switch

The GUIDE switch provides the operator with the ability to select the guide position. Typically, a centerline guide application will utilize this switch, i.e. a system where the sensors detect two edges. This could be a single-sensor centerline system {Figure K.6-4} or a dual-sensor centerline system {Figure K.6-5} The GUIDE Switch should be changed only while in *Manual Mode*.

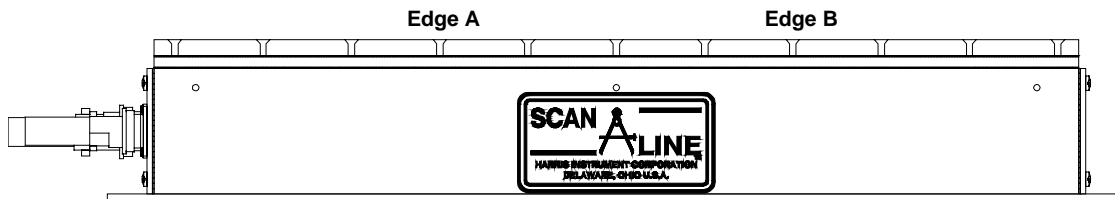


Figure K.6-4: Single-Sensor Centerline System

Emitter of Sensor A

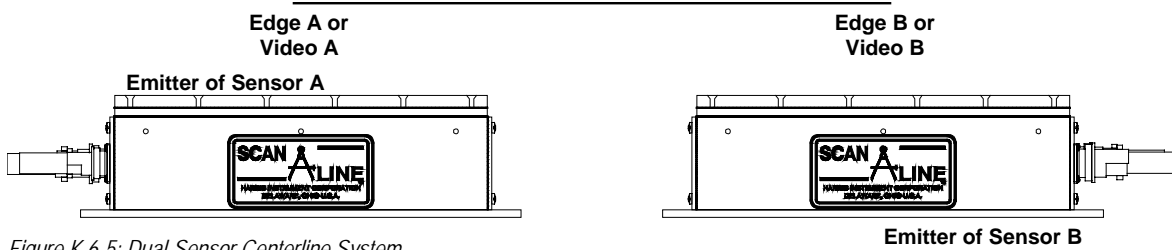


Figure K.6-5: Dual-Sensor Centerline System

LEFT Guide

Selecting LEFT Guide (GUIDE Switch ‘L’ Position – Figure K.6-6) while in *Manual Mode* will cause the unit to calculate the position of the left edge (or EDGE A) of the material only, ignoring the right edge position of the strip. This is useful when one of the strip edges is damaged, causing erratic operation while in centerline guide.

RIGHT Guide

Selecting RIGHT Guide (GUIDE Switch ‘R’ Position – Figure K.6-7) while in *Manual Mode* will cause the unit to calculate the position of the right edge (or EDGE B) of the material only, ignoring the left edge position of the strip. This is useful when one of the strip edges is damaged, causing erratic operation while in centerline guide.

CENTER Guide

Selecting CENTER Guide (GUIDE Switch ‘CENTER’ Position – Figure K.6-8) while in *Manual Mode* will cause the unit to calculate the strip position based upon the right edge and left edge of the product. The position of the right edge (or VIDEO A, EDGE A) is subtracted from the position of the left edge (VIDEO B, EDGE B) to derive the centerline position.

K.6.c JOG Switch

The JOG Switch {Figure K.6-9} allows the operator to “jog” or move the strip laterally across the process line. When the JOG Switch is turned to the left for JOG IN, the system will output a negative voltage (default 5.00VDC). When the JOG Switch is turned to the right for JOG OUT, the system will output a positive voltage (default 5.00VDC). The default voltage output when the JOG Switch is activated is operator-adjustable via the LED Display/Keypad Customer Interface [Section K.5.b-8].

K.6.d TARGET Button

Once the strip has been positioned on the line where the operator wants the strip to be run, that position can then be “zeroed” in with the TARGET Button. When the TARGET Button is depressed, the current strip position (whether the centerline, left edge or right edge) is stored and used as the zero position for further control functions.

The zero position stored with the TARGET Button is the base point for corrective actions. Any error from the zero point activates a directional position voltage in the opposite position of the error. This then steers the strip back to the zero position.

NOTE:

The TARGET Button fully operates while in Automatic Mode.

K.6.e Bargraph Display

The number of position LEDs that light on the BGA Option display can be to display the relative strip position error from TARGET. The number of diodes illuminated will represent how far the object moved from the TARGET guide point {Figure K.6-10}.

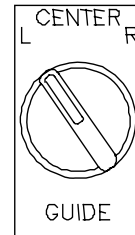


Figure K.6-6: LEFT Guide

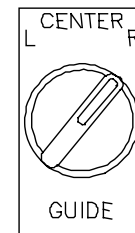


Figure K.6-7: RIGHT Guide

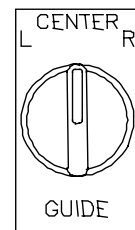


Figure K.6-8: CENTER Guide

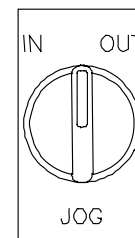


Figure K.6-9: JOG Switch

There are three types of LEDs on the Bargraph Display for the Model DCPU, which are listed below.

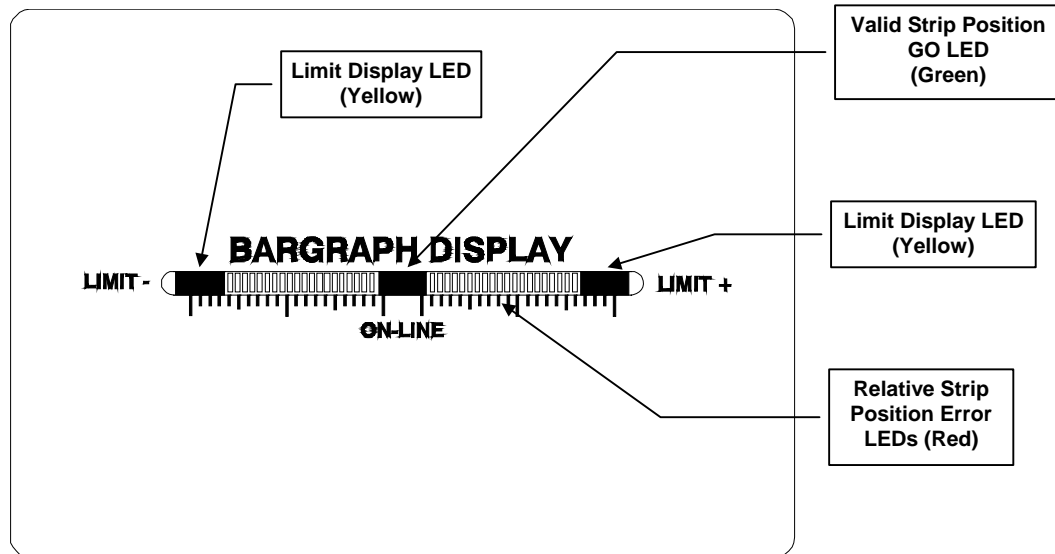


Figure K.6-10: Bargraph Display Features

Relative Strip Position Error

Relative Strip Error Position from TARGET – These red LEDs show a visual representation of the lateral strip error position from TARGET. These LEDs will begin to flash when centerline position error approaches maximum.

Valid Strip Position (GO LED)

Power ON/Valid Strip Position – This LED indicates that power has been applied to the unit and the sensors detect a normal operating condition (strip is visible to the sensors).

Limit Display LEDs

Limit Display & Control Action – every time a relay closure for strip position is activated, one of these yellow LEDs will flash briefly, showing the control action to the opposite side of the Lateral Strip Position LEDs. Also, when the strip position reaches the limit set with the Bargraph Sensitivity Function [Section K.5.b-9], the appropriate Limit Display LED will flash until the strip moves back within limits.

K.6.f Sensor FAULTs

The Model DCPU is designed with edge-counting circuitry that detects the number of edges sensed on a SCAN-A-LINE™ sensor(s). Sensed edges are processed and compared to the system set-up for the type and number of sensors attached to the Model DCPU. If more edges (or less edges) than expected are detected, the Model DCPU will alarm a VIDEO FAULT [Section K.4.g]. More edges may be detected by debris falling on the sensor, a cracked bezel or other interference in the sensor field-of-view. Less edges may be caused by the strip running out of the sensor field-of-view, a large interference in the sensor field-of-view or no material present in the sensor field-of-view.

A SYNC FAULT is activated if the Model DCPU does not receive a SYNC signal from the sensor(s). This can be caused by a cut cable(s), damaged sensor(s) or other physical defect in the sensor system.

A single (or transient) VIDEO or SYNC FAULT condition on the sensor (or sensor pair in a dual-sensor system) will cause the LED Display to flash. A series of 100 consecutive VIDEO or SYNC FAULT conditions will cause the Model DCPU to display a *HELP* message, hold the last good reading (error analog), the LIMIT and GO relays will open and the FAULT open collector will switch to ON (open collector switches to GROUND for a FAULT condition).

Information on disabling sensor FAULTs is available in Section K.7.d.

K.7 System Adjustments

The Model DCPU has several sets of jumpers for setting different configurations and functions. These jumpers are usually pre-set from the factory, though sometimes field maintenance will require the resetting of the jumpers. There are also two potentiometers located on the main board for adjusting the Digital-to-Analog Converters (DACs). The following sections will discuss the jumper settings and how they affect the Model DCPU processing unit.

K.7.a Micro-controller Reset Switch

A reset switch is supplied for the micro-controller that will re-initialize the processor {Figure K.7-1}. This is typically done when there is a system malfunction. Malfunctions can be caused by a power shortage or spike. Resetting the micro-controller will cause the Model DCPU to restart. If power has not been shut off to the system for more than thirty days, the system configuration variables should be loaded into memory and the unit will restart. Please contact Harris Instrument Corporation Service if resetting the micro-controller does not solve a malfunction.

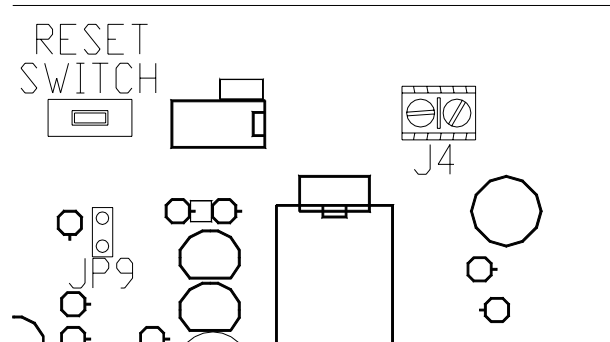


Figure K.7-1: Reset Switch Locations

K.7.b Bargraph Display

The most common use for the BGA Display is as a strip centerline or edge position indicator in a position control system. By setting a proper limit for strip position error, the strip position can be relatively matched on the display for an accurate representation of the strip position from Zero Position set with the TARGET Button. GAIN control adjustment are made with the Scale BGA Sensitivity function [Section K.5.b-7].

K.7.c Mandrel-Center Polarity

The *Center Mode* allows a “Servo-Center-style” action to center the mandrel with the process line on a Rewind Control System. The polarity (or direction that the system will move the mandrel to center it) is reversible with a jumper setting on the Micro-Controller Board (# 3695172 Rev. C). Install a jumper on **J6** pins 15 and 16 to reverse the polarity of the Mandrel Center output.

K.7.d Disabling Sensor FAULTs

The FAULT logic in the Model DCPU can be disabled by the operator. This can be used for many reasons, such as clear material edge detection problems. Disabling the FAULT promote hazardous conditions and should only be used by experienced, trained operators.

CAUTION:

Disabling the FAULT can possibly cause a hazardous steering or inaccurate or control conditions, as the processing unit will never register a sensor FAULT and will continue guiding, controlling and/or measuring on a possibly incorrect sensor signal. Caution should be used when disabling the FAULT logic and all personnel operating the Model DCPU should be made aware of the lack of sensor FAULT warning.

To disable FAULT logic, install a jumper on JP6 – pins 3-4 on the 3695172 Rev. B & C Micro-Controller board. With system FAULT disabled:

- All measurement readings are output (or displayed), whether valid or not;
- Limit Relays will NOT change because of a FAULT;
- FAULT warnings will NOT be downloaded via the RS-232 communications link;
- Analogs will NOT revert to a neutral state;
- Open Collector FAULT will NOT switch ON.

K.7.e Variable Line Speeds

The ideal Gain settings for one line speed may be a disaster at a different speed. Be sure that the system is tuned to remain stable at all line speeds expected to be encountered. The correction signal that is sent to a delivery mandrel will cause it to move at a velocity. The idea is to have the mandrel reach the proper position when the strip arrives to be wound up. The further the measurement point is from the mandrel, the greater is the danger that line speed variation will get the control out of phase. Less gain is required at lower speeds than at higher speeds. The product will get to the mandrel more slowly, so the mandrel must move more slowly to the right position. The lower gain setting for slow line speeds may be inadequate at top speed where rapid corrections are required.

CAUTION:

*Insure that the control system is **STABLE AT ALL ACCEPTABLE LINE SPEEDS** before releasing it for production use. If line speed problems still persist, please consult Harris Instrument Corporation Service for solutions.*

K.7.f System Tuning

This section will present a simple, mechanical approach to tuning the PID control of a strip centerline guide or edge position guide system. Because this method requires some trial and error, it may be helpful to schedule down-time for tuning.

It is not advisable to begin tuning with the most difficult or expensive product. It is helpful to understand the capabilities of the drive system that is to be controlled by the Model DCPU. Try to answer the following question to be sure that enough information is known about the system:

- 1) How small a error signal will cause the mechanical system to move?
- 2) How fast does a small signal move the system?
- 3) How fast does a full (10VDC) error signal move the system?
- 4) Is the top speed of the mechanical system (valves & hydraulics) the same in both directions?
- 5) What is the largest correction the system will have to make?
- 6) What is the fastest correction the system will have to make?

As with any automatic control system, take adequate precautions to ensure that the system will not make automatic corrections that could cause personal injury or damage to equipment. Most control systems will also lock out automatic control when there is no material present to be guided or when the line is not running. Mechanical limit switches can also be used to disable control and stop the line in the event of a crash.

CAUTION:

Be sure to observe ALL of the safety requirements particular to the installation site.

Connecting to the Control Valve

The error analog output is available on the bottom-panel connector labeled **P1** on pins A & B [Section K.4.c]. Before operating the line dynamically, be sure to verify proper control valve direction by momentarily connecting the error signal to the control valve coil. Does the mechanical system move in the proper direction to correct for the error created by moving the sample? If the direction was incorrect, reverse the polarity of the lines going to the AMP Option (and then to the **P1** connector).

Minimum System Gain

Enough gain is needed to produce a signal that will make the mechanical system (control valve) move when the minimum permissible error is present. First, establish how much error signal the minimum acceptable error produces. For example, move the sample strip material off center by 0.04 inch [1.0mm] from the zero (centerline) position. The error signal at **P1** pins A & B should be adequate to produce a mandrel movement. If there is not enough signal to move the mandrel, enter a higher value for the Proportional Term [Section K.5.b-1]. Make note of this setting. If the system adjustments go below this setting, you may not be able to correct for the maximum acceptable position error.

Maximum System Gain

Set the Proportional Term [Section K.5.b-1] to a large value (such as 5.00). Observe the mandrel for movement. If it is unstable and "chattering", reduce the value until the mandrel is again stable. If it is not unstable, increase the magnitude of the Proportional Term value until instability is observed. Find the highest setting possible for a quiet mandrel. Record this value as the maximum Proportional Term setting. Settings above this value will most likely cause the system to overcorrect or completely lose control under some circumstances.

Dynamic Tuning

For actual operation with a moving line, it is best to start with a Proportional Term [Section K.5.b-1] setting approximately half way between the maximum and minimum settings. Both the Integral Term [Section K.5.b-2] and the Derivative Term [K.5.b-3] should begin at 0.00. Most lines will guide reasonably well at these settings. Observe that the line is correcting in the proper direction and shows no signs of instability. Make sure that the controller is not overcorrecting. If a step error is introduced, the error should not over-compensate the mandrel position when correcting.

In fine tuning the system, it is best to study the results of the control action on the finished coil before making further adjustments. If errors are too large in general, first try increasing the Proportional Term value. Move half way towards the maximum gain value recorded earlier. The higher the Proportional Term, the more quickly an error will be corrected. As the Proportional Term gets too high, there will be a tendency to overcorrect, and finally a point of instability, where the line will oscillate. If this new setting seems to be unstable, or causes the coil to be more uneven, back off the Proportional Term for better correction.

Integral Term Tuning

After the best Proportional Term has been determined, observe the correction action for several minutes. If there is a general tendency to correct in the same direction every time, a small amount of Integral Term [Section K.5.b-2] may be introduced in 0.05 increments at a time to compensate for this trend. Too much Integral Term will lead to a slow oscillation of the line.

Derivative Term Tuning

Derivative Term [Section K.5.b-3] control is sometimes helpful at higher line speeds for strip guide applications. The Derivative Term can be used to provide a “kick-start” to a valve that sticks or a mandrel that has worn guides. Try a small amount of the Derivative Term to help catch step functions or sudden changes in strip position. Too much Derivative Term may cause high frequency instability in the guide mechanism. All corrections will tend to overcorrect, causing a generally more uneven coil face. These over-corrections will be even more evident at slower line speeds.

K.8 General Maintenance

Maintenance of the Model DCPU 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.

K.8.a Battery-backed RAM

The Model DCPU contains a battery for continuous power to the on-board random access memory (RAM) {Figure K.8-1}. This RAM is viable with the battery backup for approximately thirty (30) days. The Model DCPU will trickle-charge the battery for the battery-backed RAM when AC power is supplied to the system.

K.8.b Upgrades

The Model DCPU, because of its power and versatility, is a constantly evolving processing unit. Upgrades for both hardware and software are available from Harris Instrument Corporation Service and Engineering Departments. Enhancements of customer interfaces, inputs, outputs and other features are continually updated and improved. Contact Harris Instrument Corporation Service for more information on updating the software and/or hardware in your Model DCPU.

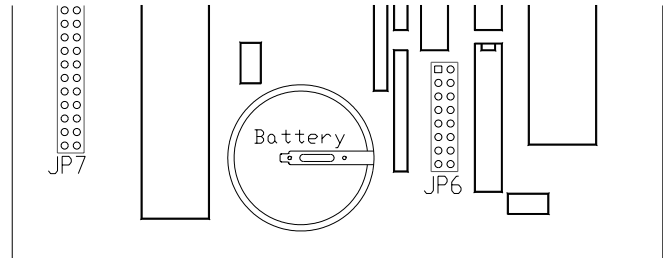


Figure K.8-1: Battery Location on Micro-controller Board

K.9 Trouble Shooting

CAUTION:

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

Board level maintenance is NOT RECOMMENDED for the Model DCPU. If a problem is experienced with the Model DCPU, in most cases contact Harris Instrument Corporation Service for an RMA to return the unit.

Check all cable and power connections to the Model DCPU. Make sure they are clean and free of contaminants. Reattach the cables and tighten securely.

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 Service for technical assistance.

K.9.a Power Tests

After all cables/internal connections/customer connections check good, the Model DCPU is possibly experiencing a component level failure. Check the various sections of this manual for trouble shooting information on other included options. Also perform any of the calibration and/or setup. Component level trouble shooting of the Model DCPU is not covered in this manual. Please obtain a Return Authorization Number from Harris Instrument Corporation Service and return the Model DCPU to the Harris Instrument Corporation Factory for maintenance or repair.

NOTE:

Procedures in this section will assist in determining whether or not the Model DCPU 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.

If a problem is experienced with the Model DCPU, a few simple checks with a DC voltmeter can verify proper circuit function. A voltmeter with a 20VDC and/or 300VAC range is required. The meter should be able to measure within 1% and may be either analog or digital.

No power to the Model DCPU. 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 K.9-1}.

- a) Range meter for 300VAC or greater.
- b) Connect negative lead (-) to Euro-Plug – Line Filter External Source Side **NEUTRAL (A)** and positive lead (+) to Line Filter External Source Side **LINE (C)**.
- c) Voltage should read between 85VAC and 264VAC.

If AC Line Voltage does not fall between 85VAC and 264VAC from the external source, modify your power for this unit to fall within these voltages.

Test 3: If unit is plugged in and has appropriate power (Tests 1 & 2), check internal DC voltages at test points {Figure K.9-2} on the Main Board.

- a) Range meter to +20VDC.
- b) Connect negative lead (-) to Power Terminal Block position **Y2-1** and positive lead (+) to Power Terminal Block position **Y2-4**.
- c) Voltage should read 5.00VDC ± 0.20 VDC.
- d) Connect negative lead (-) to Power Terminal Block position **Y2-1** and positive lead (+) to Power Terminal Block position **Y2-3**.
- e) Voltage should read +12.00VDC ± 0.25 VDC.
- f) Connect negative lead (-) to Power Terminal Block Position **Y2-1** and positive lead (+) to Power Terminal Block position **Y2-2**.
- g) Voltage should read -12.00VDC ± 0.25 VDC.

Test 4: If voltages at test points are not appropriate (or non-existent) and unit

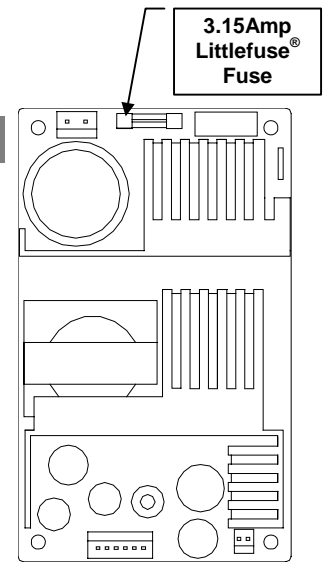


Figure K.9-3: Fuse Location on Universal Power Supply

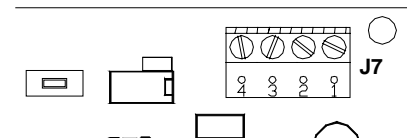


Figure K.9-4: Power Connector for Micro-Controller Board – # 3695172 Rev. C

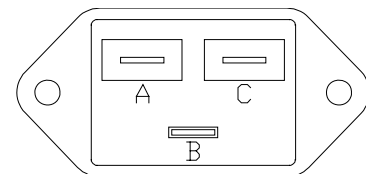


Figure K.9-1: Plug – Line Filter Pin-outs

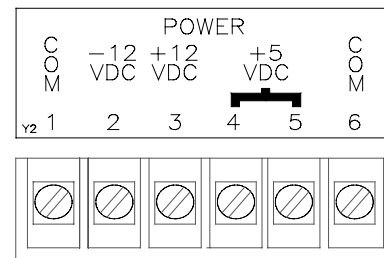


Figure K.9-2: Internal Power Connections

has proper AC power (Test 1, 2 & 3), remove power from the Model DCPU and test the 3.15Amp Littlefuse® fuse under the universal power supply protective panel {Figure K.9-3}. Replace fuse if bad.

Test 5: If fuse is good, system has proper power, and test points have appropriate voltage, test the power to the Micro-Controller board {Figure K.9-4}.

- a) Range meter to +20VDC.
- b) Connect negative lead (-) to Connector position **J7-4** and positive lead (+) to Connector position **J7-3**.
- c) Voltage should read $5.00VDC \pm 0.20VDC$.

Test 6: If fuse is good, system has proper power, test points have appropriate voltage and the Micro-Controller is receiving proper power, test the power connections to the sensor MS-style connectors {Figure K.9-5}.

- a) Verify meter range to +20VDC.
- b) Locate the Sensor A connector on the Main Board (J10).
- c) Connect negative lead (-) to Sensor A Connector position **J10-1** and the positive lead (+) to Connector position **J10-2**.
- d) Voltage should read $-12VDC \pm 0.25VDC$.
- e) Connect the negative (-) lead to Sensor A Connector position **J10-1** and the positive lead (+) to Connector position **J10-3**.
- f) Voltage should read $+12VDC \pm 0.25VDC$.
- g) Connect the negative (-) lead to Sensor A Connector position **J10-1** and the positive lead (+) to Connector position **J10-5**.
- h) Voltage should read $+12VDC \pm 0.2VDC$ when emitter is completely *uncovered* or $0VDC \pm 0.2VDC$ when emitter is completely *covered*.
- i) If dual-sensor system, repeat previous steps for the Sensor B Connector (J8).

Test 7: If fuse is good, system has proper power, test points have appropriate voltage, micro-controller is receiving proper voltage and sensor MS-style connectors are properly powered, remove all external sensor cables and any unpluggable customer connections (on inside back panel). Check voltages at test points again (Test 3). If voltages test appropriately with all cables disconnected, connect cables one at a time and check voltages as each cable, internal and customer connection are completed.

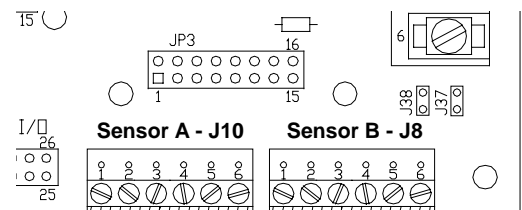


Figure K.9-5: Sensor Connectors on Main Board

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

K.9.b Diagnostic Lamps

There are four diagnostic lamps located inside the Model DCPU (Figure K.9-6) to assist in determining possible problems that may occur in the operation of the unit.

Voltage Lamps

Three of the diagnostic lamps on the Model DCPU main board light when the system voltages are correct. System voltages include +12VDC (+12 lamp), -12VDC (-12 lamp) and +5VDC (+5 lamp). The +12VDC and -12VDC voltages are for powering the sensors. If either of these lamps is not lit, the sensors are probably not receiving power. If either of these lamps is only dimly lit, the sensor cable may have a short circuit or the sensor itself may be experiencing a malfunction. The +5VDC voltage powers the unit micro-controller. If this lamp is not lit, the entire Model DCPU will not function. Please contact Harris Instrument Corporation for assistance in restarting the system.

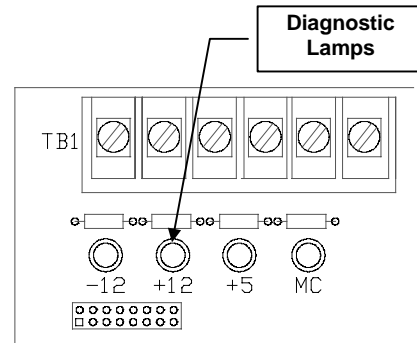


Figure K.9-6: Diagnostic Lamp Locations

Micro-Controller Lamp

The fourth lamp on the main board is the micro-controller operation lamp (MC lamp). It is the “heartbeat” of the Model DCPU as it flashes at each update of the display. If, while in measurement mode, this lamp is completely off, or the lamp stays lit, the micro-controller may be experiencing a malfunction. Attempt to restart the micro-controller by resetting the system [Section K.7.a] with the reset switch. If the reset does not help, please contact Harris Instrument Corporation Service for more information. Note that when the Model DCPU is not in an operational mode, the MC lamp will remain off (i.e. during setup).

This section covers the various controls for the Model DCPU. These not only consist of the front panel controls, but also the setup of the external tachometer (if applicable) and any other settings for the system.

K.9.c AMP Option Tests

The jumpers on the AMP Option board (Part # 3699001) allow the operator to invert the error analog input from the Model DCPU to the amplifier. Two three-position jumpers can be set in one of two ways.

- 1) Attach a voltmeter to connector P1 pins A & B.
- 2) Insure that the system control valve is connected to P1.
- 3) Check the output analog voltage as you displace the sample strip material. The analog voltage should swing to at least ± 8 VDC under load.
- 4) Insure that the mandrel control direction is correct for the error signal produced. If the control action is in the wrong direction, invert the polarity of the input to the AMP Option board by changing the jumper settings on the AMP Option board (Table K.9-7).

Error Analog Input Polarity

The jumpers on the AMP Option board (Part # 3699001) allow the operator to invert the error analog input from the Model DCPU to the amplifier. Two three-position jumpers can be set in one of two ways.

Jumper Setting	Description
	Non-inverted Input
	Inverted Input

Table K.9-1: Jumper Settings for AMP Option – Part # 3699001

K.9.d TARGET Button

Once the strip has been positioned on the line where the operator wants the strip to be run, that position can then be “zeroed” in with the TARGET Button. When the TARGET Button is depressed, the current strip position (whether the centerline, left edge or right edge) is stored and used as the zero position for further control functions. The zero position stored with the TARGET Button is the base point for corrective actions. Any error from the zero point activates a directional position relay in the opposite position of the error. This then steers the strip back to zero.

Auto-Zero Function Verification

- 1) Press the TARGET Button on the front panel of the unit.
- 2) Press the UP or DOWN arrow buttons until the green LED on the LED Display shows no value. The red LEDs should display a zero (0) value (plus or minus a small value or noise).
- 3) Displace the strip 1 inch [25mm]. Make sure not to move the linear position transducer position. The display should read a 1 inch [25mm] displacement (plus or minus a small value for noise).

K.9.e Verify System Linearity

On systems configured with a linear position transducer for matching mandrel position with strip position, this test will verify that the controller will move the mandrel to match the strip position.

- 1) Press the TARGET Switch on the front panel of the Model DCPU.
- 2) Check that the Bargraph Display has only the Green GO LED lit.
- 3) Move the mandrel and the sample strip material together in the same direction for the same amount of displacement. Try several positions over the entire range of the system. As long as they move together, the Bargraph Display will never have more than one red LED lit. If the center Green GO LED goes out, then the strip material has moved outside of the sensor range.

K.10 Appendix A Control Loop Fundamentals

Process control systems strive to keep any number of physical properties (such as temperature, position or pressure) at a desired level. To accurately perform such control tasks, a feedback control loop is most effective.

As shown in Figure K.10-1, feedback control loops generally include the following elements:

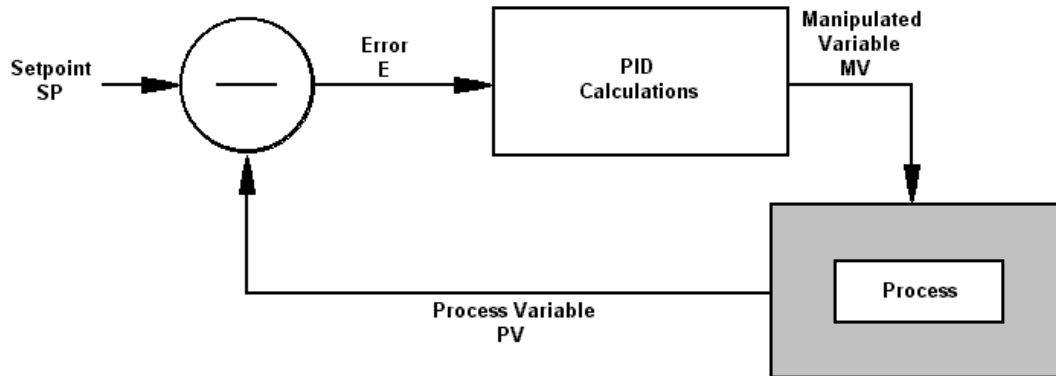


Figure K.10-1: Typical PID Control Loop

- 1) The Process itself, which for SCAN-A-LINE™ systems is the current position of the process strip material compared to the required position.
- 2) A Process Variable (PV) that is the factor of the process that we desire to control. The PV is measured by the SCAN-A-LINE™ sensor. The goal of control is to hold the PV fixed, or to vary it according to a pre-established pattern.
- 3) A Setpoint (SP) that is the desired value of the PV at this point in time, expressed in the same units as the PV.
- 4) An Error or deviation (e) that is the difference between the SP and the measured PV at any point in time (SP minus PV). The control loop tries to minimize this error value.
- 5) A Manipulated Variable (MV) that the control system changes in its attempts to force the PV to be equal to the SP. This, with SCAN-A-LINE™ systems, is a motor (or servo) error signal for positioning.
- 6) External Disturbances that are not directly in the control loop, but which affect the control system. An example with a SCAN-A-LINE™ system is intense ambient light interference (or strobe lights).

K.10.a PID Control Algorithm

There are many algorithms that can be used for a control system to determine what value to output to the Manipulated Variable (MV). Each has varying degrees of accuracy, difficulty of implementation, stability and response time.

Since 1940, when the first commercial Proportional/Integral/Derivative (PID) controller was introduced, the PID algorithm has become the most often used method in process control systems.

The continuous form of the PID equation is as follows:

$$MV = K_p * (e + (K_j * \int e dt) + (K_d * de/dt))$$

The PID equation can be described in terms of its three elements.

Proportional Control

With proportional control, the corrective action on the Manipulated Variable (MV) is directly related to the Error (e) by a simple factor K_p . The larger the error, the larger the output to the MV. This is simple and provides fast response. However, it is very likely that there will be a steady-state offset error between Setpoint (SP) and Process Variable (PV) that this form of control alone cannot eliminate.

Integral Control

Integral action is related to the sum of all past errors. A portion of this sum, determined by the K_j coefficient, is added to the control value for the MV. Integral action has the effect of accommodating process disturbances and load changes by forcing the sum of all past errors to zero. Integral control is able to correct for offset errors found in proportional-only controllers and provides good results for slowly changing processes. Integral control adversely affects stability.

Reset Rate describes the relationship between a controller's proportional and integral terms. It is measured by eliminating the derivative term by setting K_d to zero. Then a unity step change in the process error signal is introduced. The proportional term causes an immediate step from zero to K_p on the MV output of the controller. The integral term will cause a ramp output starting from the value K_p due to the accumulation of errors. The Reset Rate is derived from the time it takes for the output of the control to go from K_p to $2K_p$. This is the time it

takes for the integral term to yield the same output effect as the proportional term does immediately. The inverse of this time is the Reset Rate, expressed as number of repeats per second or minute of the initial proportional response.

Derivative Control

Derivative control is a function of the rate of change of the Error, determined by the Kd coefficient. Derivative control almost anticipates needed MV corrections, and provides good results for quickly changing processes. The derivative term provides more severe output changes when the PV causes the Error to move in the wrong direction, and a dampening response when the Error moves in the correct direction.

K.10.b Computer Sampling PID

The sampling time in seconds (T) of computer PID implementations can affect loop response. To maintain consistency, the sampling time is factored into the PID equation, and the sampled system equation becomes:

$$MV = K_p * (e_j + (K_j * T * \Sigma e) + ((K_d / T) * (e_j - e_{j-1})))$$

Because the derivative term is based on the difference between successive samples, this implementation is very sensitive to noise. Most systems use some form of weighted average of more than two samples to create more noise immunity.

Sensor Size	Sampling Rate
10XAS-10	0.01 seconds
10XAS-20	0.01 seconds
10XAS-30	0.015 seconds
10XAS-40	0.02 seconds

Table K.10-1: Sensor Sampling Rates

Anti-Reset Windup

A common problem with PID loops occurs when the time Error term is non-zero for long periods. The sum of past errors can build to a very large number. Even after the Error becomes zero, and the PV is at the SP, the integral terms can continue to drive the output, often keeping the output element in saturation and forcing the PV to pass the SP and continue to build process Error values.

Anti-reset windup is implemented by discontinuing the accumulation of errors while the control output is above a certain threshold. For example, if an output Digital-to-Analog (D/A) converter is in saturation, the error summation is discontinued.

System Sampling Times

The sampling times for SCAN-A-LINE™ systems are set by the emitter size.

Sensor Size	Sampling Times
10XAS-10	T = 0.010 seconds
10XBR-10	T = 0.010 seconds
10XAS-20	T = 0.010 seconds
10XBR-20	T = 0.010 seconds
10XAS-30	T = 0.015 seconds
10XBR-30	T = 0.015 seconds
10XAS-40	T = 0.020 seconds
10XBR-40	T = 0.020 seconds

Table K.10-2: Sensor Sampling Times

K.11 Appendix B RS-232 Customer Interface

The Model DCPU has several set-up and configuration functions and queries that are only available via the RS-232 Customer Interface [See Section K.4.d for command and query listings]. There are also many optional functions that can be set via this interface. There are also many optional functions that can be set via this interface.

K.11.a Setting System Baud Rate

The Model DCPU can communicate with the host computer at several baud rates, ranging from 1200bps to 19200bps, with the communications port (RS-232-2). To set the system baud rate:

```
* B [SPACE] X X X X X X [Enter]
Command> *B XXXXX
```

Note that changing this baud rate will not affect the two other communications ports (RS-232-0 & -1).

K.11.b Operational Commands

There are two operational commands and one system restoration command for the RS-232 Customer Interface as well as a sensor FAULT warning and diagnostic display.

Stop Measurement Readings

Typically, the Model DCPU will begin displaying width readings immediately after power-up. To configure the system it is generally acceptable to stop the readings to continue with the configuration. To stop the readings, enter the following:

```
* S [Enter]
```

The Model DCPU will display:

```
Command> *S
```

The Model DCPU is now ready to receive commands for system settings and configuration.

Start Measurement Readings

To start the measurement readings again, enter the following:

```
? G [Enter]
```

The Model DCPU responds with:

```
Command> ?G
xxxx (Readings)
```

Diagnostics Display

There are up to eight co-processors in the Model DCPU to store, hold and calculate readings from the sensors. These co-processor readings can be displayed for diagnostic purposes with the following command (only after stopping the readings output):

```
? D [Enter]
```

The Model DCPU responds with:

```
Command> ?D
0CNT, 1CNT, 2CNT, 3CNT, 4CNT, 5CNT, 6CNT, 7CNT, 8CNT, ANALOG, WIDTH, GUIDE
XXX., XXX., XXX., XXX., XXX., XXX., XXX., XXX., XXX., X.XX, X.XX, X.XX
```

This display will show up to eight counters, depending upon the configuration of the Model DCPU, and how many co-processors are installed in the processing unit.

The diagnostic display is a valuable tool in determining if the sensors are correctly set (type, and video pre-processor settings for the sensor type).

Sensor FAULT Warning

Any time there is a SENSOR or SYNC FAULT condition in the system, the RS-232 Customer Interface will display a FAULT warning in the terminal software. Typical FAULT warnings are:

Sensor Fault: A	Sensor A is experiencing a sensor FAULT,
Sensor Fault: B	Sensor B is experiencing a sensor FAULT
Sensor Fault: SYNC	Either Sensor is experiencing a SYNC FAULT.

A sensor FAULT in either sensor A or sensor B means that the sensor is detecting more or less edges than is expected by the Model DCPU. Review Section K.4.g for more information.

A SYNC FAULT on either sensor probably means that the cables to the sensor have been disconnected or broken, or that the sensor is experiencing a malfunction. Review the sensor manual section for more information [10XAS-Series – Section C, 10XBR-Series – Section

G].

If the condition lasts for up to 100 sensor updates, the HI, LO and GO relays will all open to announce a continuing sensor FAULT. Also, the FAULT open collector (Terminal Tag Y3-6) will switch to positive.

NOTE:

Sensor FAULT warnings WILL NOT be output if jumper JP6 pins 3-4 are closed [Section K.7.d].

K.11.c System Settings

There are many customer selectable settings for the Model DCPU RS-232 Customer Interface for such features as baud, upper and lower limits, analog outputs and sensor types. The following sub-sections show how to select these settings and a quick example for each setting.

All the procedures in this sub-section require that the terminal emulation software is operational and the host computer is communicating with the Model DCPU.

Help Screen Output

The command sequences and current system settings for the Model DCPU RS-232 Customer Interface can be displayed with the Help Screen command. It also shows the syntax and inputs for setting the system command sequence variables. The listing shown below also includes the settings and syntax for the Enhanced Video Pre-Processor – EVP Module.

```
*AH XXXXXX[CR] Set Absolute analog high, ?AH[CR] returns current setting.
*AL XXXXXX[CR] Set Absolute analog low; ?AL[CR] returns current setting.
*B XXXXXX[CR] Set baud rate.
*C1 XXXXXX - Calibrate to current standard at XXXXXX (inches).
*C2 XXXXXX - Calibrate to current standard at XXXXXX (inches).
?D[CR] - Output diagnostic.
*E XXXXXX[CR] - Sets the tolerance, ?E[CR] returns current setting.
*F XXXXXX[CR] - Sets snap filter, ?F[CR] returns current setting.
?G[CR] - Output measurement readings, *S[CR] Stop sending readings.
?H[CR] - (Help) Sends this output.
*Jx XXXXXX[CR] - Sets calibration values, x = 1-4, ?Jx[CR] returns current setting.
*J5[CR] - Re-calculates calibration coefficients from current settings.
*Kx[CR] - Sets decimal point, ?K[CR] returns current setting.
*L XXXXXX[CR] - Sets the low Limit, ?L[CR] returns current setting.
*M xx/xx/xx[CR] - Sets date, ?M[CR] returns current setting.
*N xx:xx:xx[CR] - Sets time, ?N[CR] returns current setting.
*P XXXXXX[CR] - Sets pulses per unit for tach, ?P returns current setting.
*Q XXXXXX[CR] - Set K factor for display averaging.
*Rx[CR] - Sets sensor configuration, ?R[CR] returns current setting.
*T XXXXXX[CR] - Sets target, ?T[CR] returns current setting.
*U XXXXXX[CR] - Sets the upper limit, ?U[CR] returns current setting.
*V XXXXXX[CR] - Sets deviation analog scaling, ?V[CR] returns current setting.
*W XXXXXX[CR] - Set unit of measure, ?W[CR] returns current setting.
*Xx[CR] - Sets video pre-processor mode, ?X[CR] returns current setting.
*FACTORY - Sets all selectable variables to default.
Command>
```

NOTE:

There are NO LOCKOUT CODES for system settings with the Model DCPU RS-232 Customer Interface. ALL SYSTEM SETTINGS ARE AVAILABLE through the host computer. If necessary, restricted access to the host computer can prevent unauthorized adjustment of the Model DCPU RS-232 Customer Interface.

System Date & Time

The system date and time may have to be set when the Model DCPU first arrives. The date and time are usually set at the factory, but if the processing unit is not powered for over thirty days, the battery-backed RAM may not be valid because of current drain. The time is adjusted in military standard time (i.e. 15:00:00 is 3:00PM).


Setting System Date & Time

To set the system date:



Command> *M MM/DD/YY




To set the system time:

           
Command> *N HH:MM:SS




Retrieving Current System Date & Time

The Model DCPU internal clock/calendar values can be retrieved with the Get Date / Time queries.

To retrieve the current date:

  
Command> ?M MM/DD/YY

To retrieve the current time:

  
Command> ?N HH:MM:SSXM

Decimal Point Position

The decimal point position for the measurement readings is customer selectable. Note that the position of the decimal point for the measurement readings is the same position for all customer selectable variables (i.e. analog output, calibration, etc.).

Setting Decimal Point Position

To set the decimal point position:

   
Command> *KX

The decimal point position values are:

0 = xxxxxx (no decimal point), 1 = xxxxx.x, 2 = xxxxx.xx, 3 = xxx.xxx and 4 = xx.xxxx

Retrieving Current Decimal Point Position

To retrieve the decimal point position:

  
Command> ?K X











Units of Measure

The Units of Measure that the serial communications will output is operator customizable to the application with the Units of Measure Command. Since the basic measurement unit for all Model DCPUs is in mils (0.001 inch = 1 mil inch), any other type of measurement unit must be converted. All Model DCPUs have a built-in conversion system to convert from mils to the customer selected unit of measure. The applicable units of measure are (terms in parentheses are the abbreviations for the particular measurement units):

Inches (IN), Millimeter (MM).

Setting Units of Measure

To set the Unit of Measure to inches:

         
Command> *W INCHES

To set the Unit of Measure to abbreviated millimeters:

     
Command> *W MM

Typically, setting the units of measure is performed immediately after the calibration of the unit, as the calibration routine can affect the units of measure. The default units of measure stored in the Factory Default System Settings is INCHES.

Retrieving Current Units of Measure

To retrieve the Unit of Measure:

  
Command> ?W XX

Factory Default System Settings

The Model DCPU contains a set of default system settings in the on-board EPROM for restoring the Factory Default System Settings. The factory default settings are restored to all system setting variables with the Factory Default System Settings command.

NOTE:

It is generally not necessary to restore factory default system settings unless the EPROM has been replaced.

The factory default system settings for the Model DCPU (with UVP Module and no options installed) are as follows:

Baud rate: 9600.00 The filter snap is set to: 0.05
Upper Limit: 80.00 Target: 50.00 Lower Limit: 20.00
Absolute Analog: 10.00=10 volts Target Deviation: 4.00=10 volts
Sensor setup is: Single Sensor Auto-Sync Emitter size is: 10000.00

Current system settings can be viewed with the individual queries.

Restoring Factory Default System Settings

The Factory Default System Settings can be retrieved from the EPROM and loaded into system battery-backed RAM with the following command:



NOTE:

It is generally not necessary to restore Factory Default System Settings unless the EPROM has been replaced.

The following message will be displayed after the Reset Factory Default System Settings command is entered:

**The DCPU is now clearing memory, please wait...
Power up!**

Video Pre-Processor Set-up

The Section K.12.c of the Model DCPU Manual details the jumper settings for the two available video pre-processors. Typically, the Universal Video Pre-Processor – UVP Module is used and this module requires no settings with the Level 1 Interface.

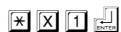
But the Enhanced Video Pre-Processor – EVP Module requires a software set-up routine to set the unit for one of three operational modes. The operational modes for the EVP Module are (Note: Jumpers may have to be set on the EVP Module and/or the micro-processor board for the proper operation of the video pre-processor. Refer to Section K.12.c of this manual):

NOTE:

Changing the operational mode of the EVP Module may cause improper operation of the Model DCPU. Contact Harris Instrument Corporation Service or Engineering for additional information.

Mode One: Diagnostics

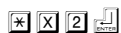
This mode is for diagnostic purposes only and is used for the detection of opaque materials. Activate this mode with the following:



Command> *X1

Mode Two: First Edge

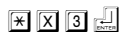
This is the First Edge video mode of this option for operation with transparent, translucent or loosely-woven materials. It will detect the first detected edge of the material and ignore any other edges (such as would be caused by printing or wrinkles). Activate this mode with the following command:



Command> *X2

Mode Three: Filtered Video

This is the Filtered Video mode for operation with transparent, translucent or loosely-woven materials, as well as for high light interference environments. This mode will filter the video signals to ensure that the edges are properly detected. Activate this mode with the following command:



Command> *X3

Retrieving Current EVP Module Mode

To retrieve the current EVP Module mode setting:



Command> ?X X

Sensor Set-up

The Model DCPU can operate with either 10XAS-Series or 10XBR-Series sensors in sizes ranging from the ten inch [254mm] 10X-10 to the forty-inch [1016mm] 10X-40.

Setting Sensor Type

Both the 10XAS-Series or 10XBR-Series sensor types can be used singly (single-sensor) or doubly (dual-sensor). Note that single Model 10XABR-10 sensor systems are not recommended.

To set the sensor type:



Command> *RX

[X] variable for setting sensor type:

1 = Single 10XBR-Series, 2 = Single 10XAS-Series, 3 = Dual 10XBR-Series and 4 = Dual 10XAS-Series.

NOTE:

When setting the Model DCPU RS-232 Customer Interface for operation with dual 10XBR-Series sensors, an extra variable of the separation between the outside-end LEDs of the emitters {Figure K.11-1}.

The Factory Default System Setting for sensor type is for a single 10XAS-Series sensor.

Setting Dual-Sensor 10XBR-Series Type

The 10XBR-Series sensor for dual-sensor operation requires the entering of an extra variable for the separation between the outside-end LEDs on the emitter {Figure K.11-1}. This separation value **MUST BE IN INCHES**, no matter what unit of measure is used for calibration and display/output. The native spacing of the LEDs in the emitters is one-tenth of an inch, so the basic separations must be entered in inches.

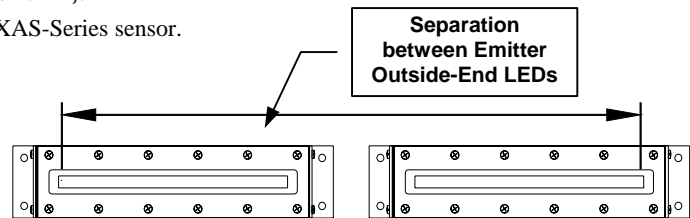


Figure K.11-1: Outside-End Emitter LED Separation

To set the dual 10XABR sensor separation with the sensor type:



Command> *R3 XXX.XXX

XXX.XXX is the separation between the outside-end emitter LEDs as shown in Figure K.11-1.

Retrieving Sensor Type

To retrieve the sensor type on all but dual-sensor 10XBR-Series sensors:



Command> ?R X

To retrieve the sensor type on dual-sensor 10XBR-Series sensors:



Command> ?R X XXX.XXX

K.11.d Width Calibration Procedure

There are two types of width calibration procedures, the Automatic Width Calibration and the Manual Width Calibration. The Automatic Width Calibration should be performed the first time the control system is installed. This creates the calibration values for the Model DCPU to use with the sensor setup. The Manual Width Calibration uses these calibration values in a manual input to re-calibrate the sensor system. Manual calibration can be performed at any time UNLESS the sensors have been moved or repositioned.

Automatic Width Calibration Procedure

Prepare for the calibration of the sensor(s) by obtaining two material samples (or calibration standards) that closely represent the maximum and minimum dimensions of the materials that will be measured by the SCAN-A-LINE™ system. These two samples should be premeasured in inches as accurately as possible for the Model DCPU RS-232 Customer Interface calibration.

NOTE:

If the emitter-to-receiver spacing (10XAS-Series and 10XBR-Series) or the emitter-to-product spacing (product passline with 10XAS-Series changes anytime after calibration, calibration must be performed again to take into account the changes in spacing.

Be sure to have the SCAN-A-LINE™ system completely installed, fully fixtured on-line and operational up to the point of calibration (sensors and processing unit functioning properly, power on to the system, etc.). All system and sensor set-up procedures except Analog Scaling [Sections K.11.f & K.11.g] and Limit Sensing [Section K.11.e] should be finished before calibrating the Model DCPU (i.e. setting the sensor type, decimal point position and date & time should all be performed prior to system calibration).

1) Start the terminal software that will be used to operate the Model DCPU and apply power to the Model DCPU.

XX.XX

- 2) Stop readings from the Model DCPU [Section K.11.b].



Command> *S

- 3) Place the maximum material sample in the sensor viewing area.

- 4) Begin the first phase of the calibration routine. Enter the actual pre-measured size (**in inches**) of the current standard with the Calibrate 1st Standard command. Include a decimal point as necessary.



Command> *C1 XX.XX

The Model DCPU will process the entry of the C1 variable and display:

1st CALIBRATION COMPLETE

Calibration to the first standard is complete.

- 5) Place the minimum material sample in the sensor viewing area.

- 6) Begin the second phase of the calibration routine. Enter the actual pre-measured size (**in inches**) of the current standard with the Calibrate 2nd Standard command. Include a decimal point as necessary.



Command> *C2 XX.XX

The Model DCPU will process the entry of the C2 variable and display:

2nd CALIBRATION COMPLETE

- 7) Calibration to the second standard is complete.

- 8) Begin readings again [Section K.11.b].



Command> ?G

The Model DCPU is now calibrated for measurement with the product passline of the current sensors. Any change in product passline (or the sensors position) may affect the calibration (except with 10XBR-Series sensors, where up to a fourteen inch [35.6cm] passline change may be allowable).

Review Calibration Values

The values stored during the Automatic Width Calibration Procedure can be accessed and recorded to perform a manual calibration [Section K.11.d]. The values stored are:

- 1) First raw count
- 2) First calibration standard measurement
- 3) Second raw count
- 4) Second calibration standard measurement

The raw counts, which are the sensor counts of the calibration standard, are stored during the Automatic Width Calibration Procedure. The calibration standard measurement is entered during the Automatic Width Calibration Procedure. The first raw count and first calibration standard measurement are for the first calibration standard and the second for the second calibration standard. To view the Calibration Values, perform the following procedure:

- 1) Start the terminal software that will be used to operate the Model MPPU and apply power to the Model MPPU.

Power Up!

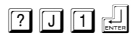
XX.XX

- 2) Stop readings from the Model MPPU [Section ZA.3.a].



Command> *S

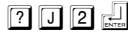
- 3) View the first raw count value.



Command> ?J1 XXXXXX

Record first raw count HERE: _____

- 4) View the first calibration standard measurement.



Command> ?J2 XXX.XXX

Record first calibration standard measurement HERE: _____

- 5) View the second raw count value.



Command> ?J3 XXXXXXX

Record second raw count HERE: _____

- 6) View the second calibration standard measurement.



Command> ?J4 XXX.XXX

Record second calibration standard measurement HERE: _____

By recording these values, you can manually calibrate your sensor system.

Manual Width Calibration Procedure

The values stored during Automatic Sensor Calibration can be entered manually for the recalibration of the Model DCPU with the system sensors. Recalibration should be performed when:

- 1) The EPROM has been replaced;
- 2) Any other components of the Model DCPU have been replaced.

These value are derived from the initial Model DCPU calibration with calibration standards.

Warning:

DO NOT MANUALLY CALIBRATE THE MODEL DCPU IF THE SENSORS HAVE BEEN REPOSITIONED OR MOVED. The calibration values will not be valid for the repositioned sensors and the system will not operate properly.

- 1) Start the terminal software that will be used to operate the Model DCPU and apply power to the Model DCPU.

Power Up!

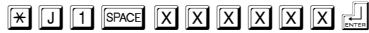
XX.XX

- 2) Stop readings from the Model DCPU.



Command> *s

- 3) Enter the first raw count value:



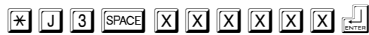
Command> *J1 XXXXXXX

- 4) Enter the first calibration standard measurement:



Command> *J2 XXX.XXX

- 5) Enter the second raw count value:



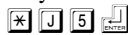
Command> *J3 XXXXXXX

- 5) Enter the second calibration standard measurement:



Command> *J4 XXX.XXX

- 6) Calibrate the system based on the previous *J entries:



Command> *J5 XXX.XXX

The Model DCPU has been manually calibrated.

K.11.e Limit Relays

There are three sets of relay (sometimes referred to as digital outputs) contact closures (two utilized for UPPER/LOWER limits, one for GO) located on the main board inside of the Model DCPU enclosure {Figure K.11-2 next page}. These relay contacts rated at 230VAC 5Amp (100VDC) maximum each into a resistive load.

NOTE:

The use of high voltage to the relays inside the Model DCPU can cause high amounts of Electro-Magnetic Interference (EMI). It is recommended that low voltage lines be used with an external high voltage relay.

Pin #	Tag #	Description
TB2-1	Y5-1	Upper Limit (HI) Normally Open [N.O.] Relay Contact, 230VAC @ 5AMP Max, 100VDC
TB2-2	Y5-2	Upper Limit (HI) N.O. Relay Contact, 230VAC @ 5AMP Max, 100VDC
TB2-3	Y5-3	GO N.O. Relay Contact 250VAC @ 5A Max.
TB2-4	Y5-4	GO N.O. Relay Contact 250VAC @ 5A Max.
TB2-5	Y5-5	Lower Limit (LO) N.O. Relay Contact, 230VAC @ 5AMP Max, 100VDC
TB2-6	Y5-6	Lower Limit (LO) N.O. Relay Contact, 230VAC @ 5AMP Max, 100VDC

Table K.11-1: Directional Position Relay Internal Connections

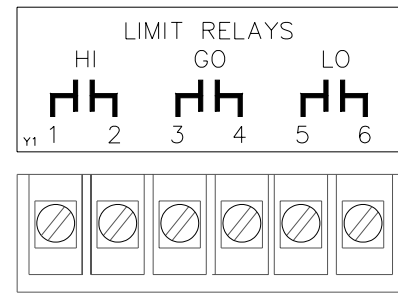


Figure K.11-2: Customer Relay Connections

These relays are Normally-Open (NO) contact closures. The RIGHT and LEFT relays will *CLOSE* when either limit is reached {Table K.11-2}. Limits are set with the RS-232 Communications Interface [Section K.11.e].

Action	HI Relay	GO Relay	LO Relay
Upper Limit Exceeded	X	O	O
Lower Limit Exceeded	O	O	X
Width Within Limits	O	X	O
VIDEO FAULT	O	O	O
SYNC FAULT	O	O	O

Table K.11-2: Limit & GO Relay Actions

Limit Relay Cables

Access to the limit relay contacts are on the internal barrier strip with the label RELAYs. The UPPER relay is on Y5-1 & Y5-2. The LOWER relay is accessed on Y5-5 & Y5-6. These connections can be accessed through the spare access hole on the bottom panel of the Model DCPU enclosure {Figure K.11-2}.

Wiring for the limit relays are customer supplied.

GO Relay

This relay is also a Normally-Open (NO) contact closure. This relay stays *CLOSED* unless the UPPER or LOWER relays are activated by the strip width (on systems with the measurement functions used) exceeding their preset limits {Table K.11-2}.

GO Relay Cable

The GO relay is on Y5-3 & Y5-4. The connection to this relay can be accessed through the spare access hole on the bottom panel of the Model DCPU enclosure {Figure K.11-2}.

Wiring for the relays are customer supplied.

Absolute Limit Sensing Calibration

Once the system has been calibrated, the measurements limits can be set. There are two different ways in which the limits can be set, either by an absolute value as described in this section or by a tolerance from target. There are two measurement limit settings for the Model DCPU (UPPER – HI and LOWER – LO). These settings tell the Model DCPU when to activate the HI and LO relay contacts.

NOTE:

Setting an Absolute Limit will override any current Tolerance Limit value setting. Setting the Absolute UPPER Limit value will override the UPPER limit value set with a previous Tolerance Limit setting (but not the LOWER limit setting).

Setting the UPPER (HI) Limit




To set the upper (HI) measurement limit:

Command> *U XX.XX

The Factory Default System Setting for the upper limit is 80.00.










Retrieving Current UPPER Limit Setting

To view the current upper (HI) measurement limit setting:

  
Command> ?U XX.XX

Setting the LOWER (LO) Limit




To set the lower (LO) measurement limit:

        
Command> *L XX.XX

The Factory Default System Setting for the lower limit is 20.00.

Retrieving Current LOWER Limit Setting

To view the current lower (LO) measurement limit setting:

  
Command> ?L XX.XX

Tolerance Limit Sensing Calibration

The Tolerance Limit Sensing must first have the Target value set. This is the “median” or required measurement value for the measured material. A tolerance value can then be set as a “plus-or-minus” value that will activate the UPPER limit relay when the target plus the tolerance value is measured (or will activate the LOWER limit when the target minus the tolerance is measured).

NOTE:

Setting the Tolerance Limit Sensing will override both the Absolute UPPER and LOWER Limit settings.

Set the Target Value

To set the target value:










- 1) Apply power to the measurement system.

Power up!
XX.XX

- 2) Stop readings from the system.

  
Command> *S




- 3) Set the target size value of the target material sample with the Set Target command.

        
Command> *T XX.XX

The target is now set. The Factory Default System Setting for the target is 50.00. Continue with setting of the limit tolerance value.

Retrieving Current Target Value










To view the current target size value:

  
Command> ?T XX.XX

Set Limit Tolerance

To set the limit tolerance value:




- 1) Set the limit tolerance value with the Set Tolerance command.

        
Command> *E XXXX

The target is now set. The Factory Default System Setting for the limit tolerance is 1, although the Absolute Limit default values are set when the system is first configured.

Retrieving Current Limit Tolerance Value

To view the current limit tolerance value:

  
Command> ?E XXXX

K.11.f Width Deviation Analog Output

The Model DCPU has two width analog outputs available as standard. One is absolute unipolar [Section K.11.g] and one is deviation bipolar. These outputs must be “scaled” to reflect customer materials and voltage output preferences. Refer to Section K.4.c for more information on the analog outputs of the Model DCPU and any EVO documentation for specific configuration information on the other types of analog outputs optionally available with this processing unit.

The Deviation Analog Output provides a bipolar analog voltage (-10VDC to +10VDC) proportional to the deviation of the detected measurement from the target measurement. The target and scaling factor are set with the RS-232 Customer Interface from the host computer. The maximum deviation analog output voltage will be ± 10 VDC for a deviation of X inches (user entered value) from the target value.

The following instructions are a basic guide for scaling the deviation analog to the target value and the deviation from target value. The values entered are not constant, but are dependent upon the application. Size values and voltages will vary from application to application. Be sure that the entire SCAN-A-LINE™ system (sensors and Model DCPU) is completely installed and fully functioning. Perform the set-up routines for sensor type and decimal point position [Section K.11.c] BEFORE beginning the setting of the deviation analog scaling value. Also perform width system calibration [Section K.11.d] BEFORE setting the deviation analog scaling value.

Setting the Target Value

The first procedure in scaling the deviation analog is to set the target value. The target value is the size value of the target material that the deviation analog function uses as a base point to determine the deviation value. Note that this value may already be set if using the Limit Tolerance as described in Section K.11.e.

To set the target value:

- 1) Apply power to the measurement system.

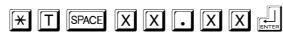
Power up!
XX.XX

- 2) Stop readings from the system.



Command> *S

- 3) Set the target size value of the target material sample with the Set Target command.



Command> *T XX.XX

The target is now set. The Factory Default System Setting for the target is 50.00. Continue with the scaling of the deviation analog output scaling routine.

Retrieving Current Target Value

To view the current target value:

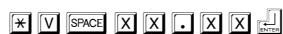


Command> ?T XX.XX

Width Deviation Analog Scaling Command

Once the target value is set, the scaling of the deviation analog output can be performed.

- 1) Enter the deviation value (the value that represents the difference between the target value and the maximum size material – i.e. four inches of deviation from target equals 10VDC). This value corresponds to the maximum deviation analog output (10VDC) for that difference. Use the Deviation Scaling command.



Command> *V XX.XX

The Factory Default System Setting for the deviation output is 4.00 = 10 volts.

Retrieving Current Deviation Analog Scaling Value

To view the current deviation analog scaling value:



Command> ?V XX.XX

Verify Width Deviation Analog Output

To verify the deviation analog output, be sure that the entire SCAN-A-LINE™ system (sensors and Model DCPU) is completely installed, fully functioning and powered on. Perform the set-up routines for sensor type and system calibration [Section K.11.c & K.11.d] BEFORE beginning the verification of the deviation analog output voltage.

Make sure the material currently on the line is at full line tension and at the proper product passline for the system calibration. Be sure that the unit is fully operational and powered on with the RS-232 Customer Interface software (whatever is used) taking readings from the sensor system.

To verify the deviation analog output:

- 1) Attach the digital voltmeter PLUS VOLTS lead to the **ANALOG OUT 1** terminal (Y4-2) and the COMMON lead to the **COM** terminal (Y4-1).
- 2) Check the measurement of the material currently on the line using the Model DCPU measurements in the communications software. For this example, the material on the line measures 14.5 inches.

14.5

- 3) Stop the readings from the Model DCPU.



COMMAND> *S

- 4) Set the target size value to the measurement of the material currently on the line (for this example, 14.5) with the Set Target command.



Command> *T 14.5

The target is now set.

- 5) Start readings from the Model DCPU.



COMMAND> ?G

14.5

14.5

- 6) Check the voltmeter for its current reading. The voltmeter should read 0VDC \pm 0.025VDC. If the voltmeter is off more than \pm 0.025VDC, the bipolar DAC must be adjusted:

- a) Locate potentiometer R5 on the main board inside the Model DCPU [Section K.12.d].
- b) With a small blade screwdriver, turn the potentiometer adjustment screw clockwise and view the reading on the voltmeter. Adjust the screw in the direction necessary to cause the bipolar analog voltage to read 0VDC with the target material.

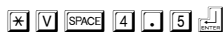
Once the voltmeter reads 0VDC \pm 0.025VDC, set the deviation scaling value.

- 7) Stop readings from the Model DCPU.



COMMAND> *S

- 8) Enter the deviation value, the value that represents the difference between the target value and the maximum size material (for this example, 4.5 inches of deviation from target equals 10VDC). This value corresponds to the maximum deviation analog output (10VDC) for that difference. Use the Deviation Scaling command.



Command> *V 4.5

- 9) Reset the Target value at 15.5 to verify the full operation of the deviation analog output.



Command> *T 15.5

The target is now set at 15.5.

- 10) Start readings from the Model DCPU.



COMMAND> ?G

14.5

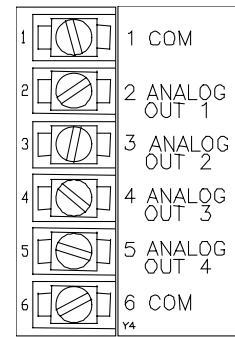
- 11) Check the voltmeter for a change in reading from 0VDC. The reading should be lower by a value equal to the volts per inch of deviation (For example, since the current material on the line is 14.5 inches and the deviation scaling value is 4.5 inches equals 10VDC and the current target value is 15.5 inches, the current material deviates from target minus one inch or -2.2VDC.).

Repeat this procedure with a target value smaller than the current material on the line to verify operation if necessary.

If the voltages are correct, the deviation analog is verified. If the voltages are not correct, repeat the set-up procedure and re-verify the voltages. If the voltages are still not correct, contact Harris Instrument Corporation Service for assistance.

K.11.g Width Absolute Analog Output

The Model DCPU has two width analog outputs available as standard. One is deviation bipolar [Section K.11.f] and one is absolute unipolar. These outputs must be “scaled” to reflect customer material and voltage output preferences. Refer to Section K.4.c for more information on the analog outputs of the Model DCPU and any EVO documentation for specific configuration information on the other types of analog outputs optionally available with this processing unit.



The Absolute Analog Output provides an unipolar analog voltage (0VDC to 10VDC at 10mA) of the absolute measurement of the strip material. The following instructions are a basic guide for scaling the absolute analog output.

Width Absolute Analog Scaling Command

Be sure that the entire SCAN-A-LINE™ system (sensors and Model DCPU) is installed and fully functioning. Perform the set-up routines for sensor type and decimal position [Section K.11.c & K.11.d] before beginning the scaling of the absolute analog. Perform the system calibration in Section K.11.d BEFORE proceeding with the absolute analog scaling routine.

- 1) Apply power to the measurement system.

Power up!
XX.XX

- 2) Stop readings from the system.



Command> *S

- 3) Enter the minimum size value that you wish to be represented by 0VDC with the Set Low Absolute Output command.



Command> *AL XX.XX

- 4) Enter the maximum size value that you wish to be represented by +10VDC with the Set High Absolute Output command.



Command> *AH XX.XX

The absolute analog output has been scaled. The Factory Default System Settings for the analog output is 0.00 = 0VDC and 100.00 = 10VDC.

Retrieving Current Absolute Analog Scaling Value

To view the current low absolute scaling value:



Command> ?AL XX.XX

To view the current high absolute scaling value:



Command> ?AH XX.XX

Verify Width Absolute Analog Output

To verify the absolute analog output, be sure that the entire SCAN-A-LINE™ system (sensors and Model DCPU) is completely installed, fully functioning and powered on. Perform the set-up routines for sensor type [Section K.11.c] and system calibration [Section K.11.d] BEFORE beginning the verification of the absolute analog output voltage. Make sure the material currently on the line is at full line tension and at the proper product passline for the system calibration and that power is on to the unit and the communications software is communicating correctly with the processing unit.

To verify the absolute analog output voltages:

- 1) Attach the digital voltmeter PLUS VOLTS lead to the **ANALOG OUT 4** terminal (Y4-5) and the COMMON lead to the **COM** terminal (Y4-6).
- 2) Check the measurement from the Model DCPU for the current measurement of the material on the line.

Use the current measurement value of the material on the line as a basis for verifying the scaling of the absolute analog (for example, the current measurement of the material on the line is 14.5 inches).

14.5










3) Stop the readings from the Model DCPU.

COMMAND> *S

Since the absolute analog output is 0VDC to 10VDC, the maximum size to be run on the line should be used to scale the high absolute analog (for example, the maximum material to be run on this line is 19 inches and the analog should read 10VDC).

4) Enter the minimum size value to be represented by 0VDC with the Set Low Absolute Output command (0VDC equals 9 inches).

Command> *AL 9.00

5) Enter the maximum size value to be represented by 10VDC with the Set High Absolute Output command (10VDC equals 19 inches).

Command> *AH 19.00

5) Start readings from the Model DCPU.

COMMAND> ?G

14.5

6) Check the voltmeter for its current reading. The voltmeter should read the result of the volts per unit multiplied by the size of the current material on the line (For example, since 19 inches equals 10VDC and 9 inches equals 0VDC, absolute voltage output is 1VDC per inch. Since the current material on the line is 14.5 inches, the absolute voltage output should be 5.5VDC±0.025VDC).

If the voltages are correct, the absolute analog is verified. If the voltages are not correct, repeat the set-up procedure and re-verify the voltages. If the voltages are still not correct, contact Harris Instrument Corporation Service.

K.11.h Setting the Digital Filter Snap for Width Readings

The Model DCPU contains a resolution enhancing feature called a Digital Filter Snap. The Digital Filter Snap is a self-adjusting, exponential averaging tolerance system that takes averages of the sensor readings and creates a tolerance factor for the sensor video signals. This helps the system display a steady output on the RS-232 Customer Interface measurement readings serial output. The Filter Snap is a useful tool to fine-tune the system performance.

NOTE:

The Digital Filter Snap should be adjusted when the Model DCPU is dithering measurement readings of a known size material. Adjusting the Filter Snap too low may cause fluctuating measurements on materials. Care should be taken in adjusting the Filter Snap. Please contact Harris Instrument Service for assistance in setting the Filter Snap.

The Filter Snap and Exponential Averaging value are customer adjustable. The Filter Snap can be set as zero (0) for no display width filtering. The Exponential Averaging value must be a positive number.

Digital Filter Snap Command

To set the Filter Snap, use the Set Filter Snap command:

Example: To set the Filter Snap for no filtering, enter the following:

The Model DCPU responds with:

*F 0

Example to set the Filter Snap On with the value of 0.05 inches, enter the following:

The Model DCPU responds with:

*F 0.05

The setting of the Snap Filter is dependent upon the display requirements of the system operators. The Factory Default System Settings for the Snap Filter is 0.05 inches [1.3mm].

Retrieving the Current Digital Snap Filter Value

To view the current digital snap filter value:

- 3) View the first raw count value.



Command> ?Y1 XXXXXX

Record First Raw Count Value HERE: _____

- 4) View the Close Measurement value.



Command> ?Y2 XXX.XXX

Record Far Measurement Value HERE: _____

- 5) View the second raw count value.



Command> ?Y3 XXXXXX

Record Second Raw Count Value HERE: _____

- 6) View the Far Measurement Value.



Command> ?Y4 XXX.XXX

Record Far Measurement Value HERE: _____

By recording these values, you can manually calibrate the linear position transducer.

Transducer Manual Re-calibration Procedure

The values stored during Automatic Transducer Calibration [Section K.5.b-5] can be entered manually for the re-calibration of the Model DCPU with the system transducer. Re-calibration should be performed when:

- 1) The EPROM has been replaced;
- 2) Any other components of the Model DCPU have been replaced.

These values are derived from the initial Model DCPU transducer calibration.

Warning:

DO NOT MANUALLY RE-CALIBRATE THE MODEL DCPU IF THE TRANSDUCER HAS BEEN REPOSITIONED, CHANGED OR MOVED. The calibration values will not be valid for the repositioned transducer and the system will not operate properly.

- 1) Start the terminal software that will be used to operate the Model DCPU and apply power to the Model DCPU.

Power Up!

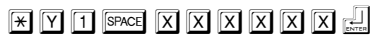
XX.XX

- 2) Stop readings from the Model DCPU.



Command> *S

- 3) Enter the first raw count value:



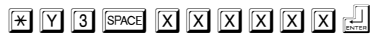
Command> *Y1 XXXXXX

- 4) Enter the Close Measurement:



Command> *Y2 XXX.XXX

- 5) Enter the second raw count value:



Command> *Y3 XXXXXX

- 5) Enter the Far Measurement:



Command> *Y4 XXX.XXX

- 6) Calibrate the system based on the previous *J entries:



Command> *Y5 XXX.XXX

The Model DCPU Linear Position Transducer has been manually re-calibrated.

K.12 Appendix C Jumper Configurations

There are several jumpers that are typically set at the factory for the configuration of the Model DCPU. Generally, these jumper settings will not need to be changed. If, however, the unit is updated or a spare unit is placed on-line, these jumpers may have to be set or changed.

K.12.a Micro-Controller Board Jumpers

The micro-controller board (Part #3695172 Rev. C) has one individual three-pin, two position jumper (JP2) and one 16-pin, eight-position jumper block (JP6). Jumper locations are shown in drawing # 1495172 Rev. C. The three-pin jumper (JP2) selects 32K RAM or 8K RAM for the on-board RAM memory. It is typically set from factory for 32K RAM. Check the Configuration EVO (if applicable) if the jumper is not factory set for 32K RAM.

Jumper JP6 is for selecting the interface style and many other options available to the Model DCPU. The following table describes the standard jumper configuration for this jumper block.

Jumper	Setting
JP6 1 & 2	OPEN – No Function with Model DCPU CLOSED – ± 10 VDC Output (Standard)
JP6 3 & 4	OPEN – Sensor FAULT detection (Standard) CLOSED – Disable all sensor FAULT detection
JP6 5 & 6	OPEN – No Function with Model DCPU (Standard) CLOSED for option
JP6 7 & 8	OPEN – Enables Linear Position Transducer (Standard) CLOSED for disabling Linear Position Transducer while in Automatic Mode
JP6 9 & 10	OPEN – No Function with Model DCPU CLOSED – PID Controller Enabled (Standard)
JP6 11 & 12	OPEN – For use with UVP Module (Standard) CLOSED – For use with EVP Module (Option)
JP6 13 & 14	OPEN – No Remote Display (Standard) CLOSED – Remote Display enabled (Option)
JP6-15 & 16	OPEN – Inverted Mandrel Center Polarity (Standard) CLOSED – Non-Inverted Mandrel Center Polarity
JP2	Top CLOSED – 8K RAM Installed Bottom CLOSED – 32K RAM Installed (Standard)

Table K.12-1: Micro-Controller Board Jumper Settings

K.12.b Micro-Controller Board Reset Switch

A reset switch is supplied for the micro-controller that will re-initialize the processor {Figure K.12-1}. This is typically done when there is a system malfunction. Malfunctions can be caused by a power shortage or spike. Resetting the micro-controller will cause the Model DCPU to restart. If power has not been shut off to the system for more than thirty days, the system configuration variables should be loaded into memory and the unit will restart. Please contact Harris Instrument Corporation Service if resetting the Model MPPU micro-controller does not solve a malfunction.

K.12.c Video Pre-Processors

The Model DCPU has so many operational variations that pre-processing of the video signals from the sensors is required to handle the many disparate applications.

Typically, a measurement system will use the Universal Video Pre-Processor Module – UVP Module (Part #3698016). Other applications, such as Clear Materials measurement or in high-light intensity environments, a different video pre-processor board may be installed, the Enhanced Video Pre-Processor – EVP Module (Part # 3696173 Rev. A).

UVP Module

The Universal Video Pre-Processor – UVP Module (Harris Instrument Corporation Part #3698016) operates with either Auto-Sync – 10XAS-Series sensors [Section C] or Binocular-Receiver – 10XBR-Series sensors [Section G]. It will detect the edges of the strip(s) based upon the setup and configuration of the board.

The UVP Module {Figure K.12-2} has eight two-pin jumpers (Jumpers J1 through J8) for inverting the sensor signals. These settings SHOULD NOT BE CHANGED by the operator unless under specific instructions from Harris Instrument Corporation personnel. Also on the board are two other two-pin jumpers (Jumper Set DUAL/SINGLE) for determining the number of sensor video signals that the Model MPPU is processing. A dual-sensor system is configured with the DUAL jumpers while a single-sensor system is configured with the SINGLE jumper. See drawing # 1498016 in Section K.15 for additional jumper information.

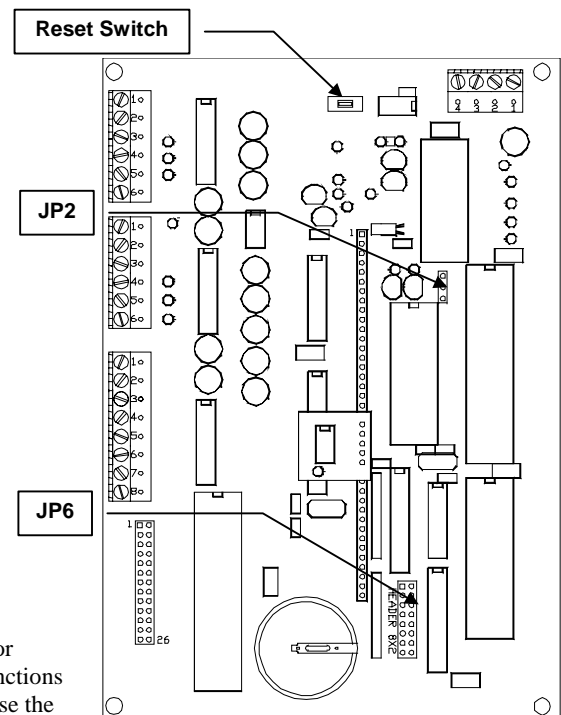


Figure K.12-1: Micro-Controller Board – Part # 3695172 Rev. C

Sensor Type	Application	#/Edges per Sensor	Sensor Mode Jumper
10XAS	One Strip Edge Guide	1	SINGLE
10XAS	One Strip Centerline Guide or Measurement on One Sensor	2	SINGLE
10XAS	Two Strip Measurement on One Sensor	4	SINGLE
10XAS	Two Strip Measurement on Two Sensors	2	DUAL
10XAS	Three Strip Measurement on One Sensor	6	SINGLE
10XAS	Three Strip Measurement on Two Sensors	3	DUAL
10XAS	Four Strip Measurement on One Sensor	8	SINGLE
10XAS	Four Strip Measurement on Two Sensors	4	DUAL
10XBR	One Strip Edge Guide	2	SINGLE
10XBR	One Strip Measurement on One Sensor	4	SINGLE
10XBR	One Strip Measurement on Two Sensors	2	DUAL

Table K.12-2: Edges Expected by UVP Module Video-Pre-Processor (See Figure K.12-2)

CAUTION:

Re-configuring this Video Pre-Processor can cause inaccurate measurements and/or gage performance. ANY re-configuring of this module should be performed only by Harris Instrument Corporation approved personnel. Contact Harris Instrument Corporation Service or Engineering for more information.

EVP Module

Many times, the UVP Module is not viable for certain conditions or applications. When the Clear Materials Option – CLR Option of the 10XAS-Series sensor is used with the Model DCPU or when intense ambient light conditions (such as strobe lights too near the sensor) interfere with the SCAN-A-LINE™ sensor, the Enhanced Video Pre-Processor – EVP Module (Harris Instrument Corporation Part # 3696173 Rev. A) is installed to compensate for these non-typical conditions. The special circuitry of the EVP Module allows the Model DCPU to recognize the first and last edge of clear materials as well as filtering out extraneous noise that can be caused by intense ambient, strobe or reciprocating light conditions.

The EVP Module {Figure K.12-3} has two sets of two three-pin, two-position jumpers, one set for selecting the number of edges detected by the Model DCPU for video FAULT and one set for selecting the fashion in which such edges are detected. Typically, these jumpers are set from the factory and will not need to be changed unless required by Harris Instrument Corporation Service personnel. See drawing # 1496173 Rev. A in Section K.15 for additional jumper information. There are two operational modes, and one diagnostic mode, for the EVP Option board.

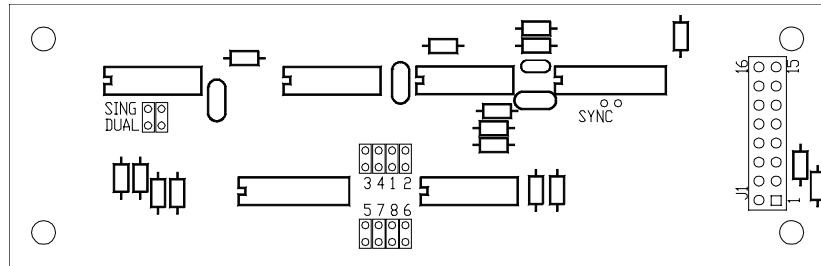


Figure K.12-2: Universal Video Pre-Processor Board Jumper Locations – Part # 3698016

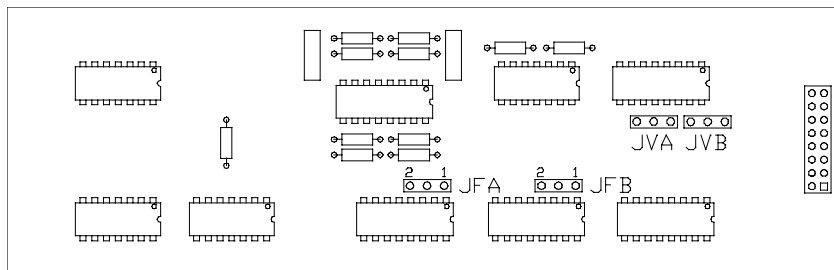


Figure K.12-3: Enhanced Video Pre-Processor Board Jumpers – Part # 3696173 Rev. A

Mode One: Diagnostics

This mode is for diagnostic purposes only and is used for the detection of opaque materials. The video signal output is normal and the sensor FAULTs operate as described in Section K.4.h except that sensor FAULTs up to 100 will be displayed as transient sensor FAULTs and over 100 will be displayed as a hard sensor FAULT. The RS-232 output will also register a hard sensor FAULT. This is typically the only mode where jumpers JFA & JFB are installed.

Mode Two: First Edge

This is the First Edge video mode of this option for operation with transparent, translucent or loosely-woven materials. It will detect the first detected edge of the material and ignore any other edges (such as would be caused by printing or wrinkles). Sensor FAULTs will be ignored up to 100 (displayed as transient FAULTs) and after 100 FAULTs, the display will update normally, the FAULT open collector will activate and the HI/LO/GO relays will open. The RS-232 output will also register a hard sensor FAULT. This mode will only operate on dual-sensor systems with the 10XAS-Series sensor.

Mode Three: Filtered Video

This is the Filtered Video mode for operation with transparent, translucent or loosely-woven materials, as well as for high light interference environments. This mode will filter the video signals to ensure that the edges are properly detected. Sensor FAULTs up to 100 will be displayed as transient FAULTs and over 100 will indicate a FAULT on the open collector and will open the GO relay. The display will update normally. The RS-232 output will also register a hard sensor FAULT. This mode operates with single- or dual-sensor systems with the 10XAS-Series sensor (or in some cases, 10XBR-Series sensors for alleviation of light interference).

CAUTION:

Using Model Two or Mode Three in a control application could be hazardous if the relay outputs and open collector FAULT output are not properly monitored.

Mode	Number of Sensors	#Edges per Sensor	FAULT Jumper
1 – Normal	Single 10XAS-Series Edge Guide	1	JFA-1
	Single 10XAS-Series Centerline Guide or Measurement	2	JFA-2
	Dual 10XAS-Series Centerline Guide or Measurement	1	JFA-1, JFB-1
2 – First Edge	Single 10XAS-Series Edge Guide	1	JFA, JFB Open
	Single 10XAS-Series Centerline Guide or Measurement	2	JFA, JFB Open
	Dual 10XAS-Series Centerline Guide or Measurement	1	JFA, JFB Open
3 – Filtered	Single 10XAS-Series Edge Guide	1	JFA, JFB Open
	Single 10XAS-Series Centerline Guide or Measurement	2	JFA, JFB Open
	Dual 10XAS-Series Centerline Guide or Measurement	1	JFA, JFB Open

Table K.12-3: JFA & JFB Jumper Settings for the EVP Module

Jumpers JVA & JVB

Sensor Scanning Direction	Sensor System	Direction Jumper
Outside Edges of Material Inwards	Dual 10XAS-Series	JVA-, JVB-
Inside of Material to Outside Edges	Dual 10XAS-Series	JVA+, JVB+

Table K.12-4: JVA & JVB Jumper Settings for the EVP Module

CAUTION:

Re-configuring this Video Pre-Processor can cause inaccurate measurements and/or gage performance. ANY re-configuring of this module should be performed only by Harris Instrument Corporation approved personnel. Contact Harris Instrument Corporation Service or Engineering for more information.

K.12.d Main Board Settings

There are eight two-pin jumpers and two top-adjust DAC potentiometers on the Model DCPU main board (Part # 3695123 Rev. C). These are used to activate, adjust and/or control the units analog inputs and outputs.

Jumper Settings

The jumpers on the Main Board {Figure K.12-4} are used to control the analog inputs (jumpers J34, JP6, J35, JP6) as well as the format of the analog outputs (jumpers J38 and J37). These jumpers should be set from the factory and should not be changed expect under instructions from Harris Instrument Corporation Engineering or Service personnel.

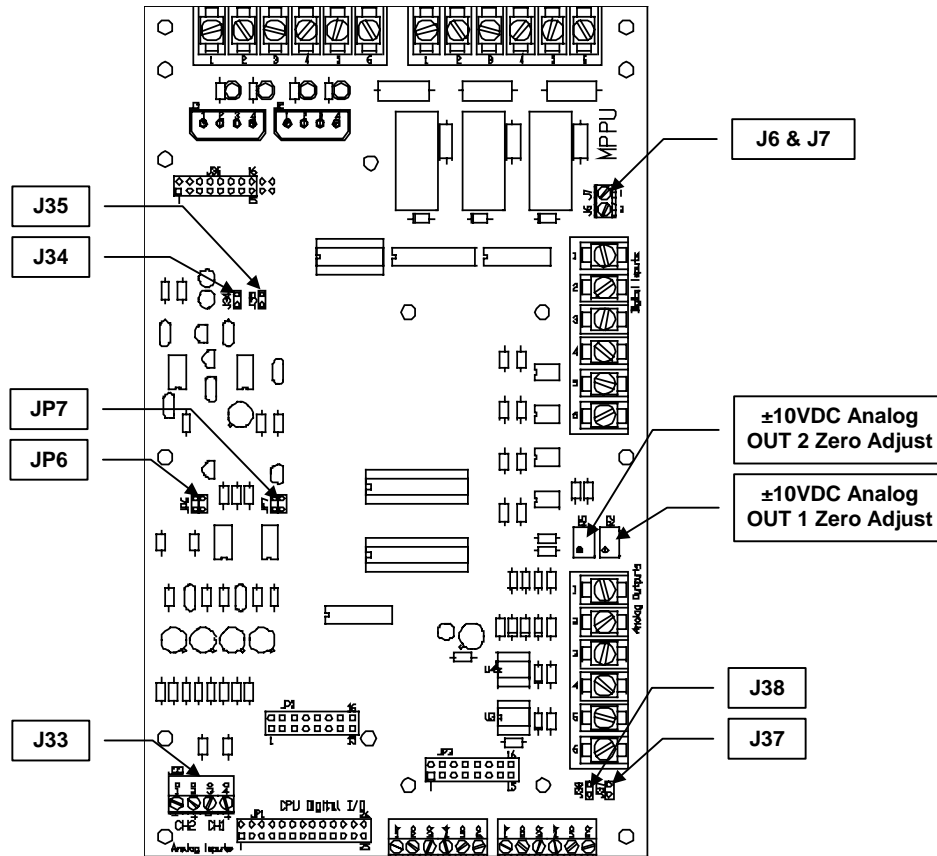


Figure K.12-4: Jumper Positions, Inputs & Potentiometers on Main Board – Part # 3695123 Rev. C

Jumper	Setting
J34	OPEN – Deactivate Analog Input Channel One (CH1) * CLOSED – Activate Analog Input Channel One (CH1)
JP7	Top Two CLOSED – 0 – 10VDC IN Bottom Two CLOSED – ±10VDC IN
J35	OPEN – Deactivate Analog Input Channel Two (CH2) * CLOSED – Activate Analog Input Channel Two (CH2)
JP6	Top Two CLOSED – 0 – 10VDC IN Bottom Two CLOSED – ±10VDC IN
J37	OPEN – ±10VDC Output on TB4-2 * CLOSED – 0 – 10VDC Analog Output on TB4-2 ¹
J38	OPEN – ±10VDC Output on TB4-3 * CLOSED – 0 – 10VDC Analog Output on TB4-3 ²
	* = Standard Factory Default Configuration ¹ = Chip U3 must be removed ² = Chip U4 must be removed

Table K.12-5: Model DCPU Main Board Jumper Settings – Part #3695123 Rev. C

Zero Adjust Potentiometers

The Main Board (Part #3695123 Rev. C) in the Model DCPU has two top-adjust potentiometers. The potentiometer locations are shown in Drawing # 1495123 in Section K.15. These potentiometers are used to set the bipolar DACs. Be sure to have the entire measurement system completely installed and operational BEFORE adjusting these potentiometers.

Potentiometer R2 is for setting the deviation bipolar analog for target and deviation gain. Refer to the Error Analog section [Section K.4.c] and in the applicable customer interface section of this manual (some references to EVO custom configurations may be applicable).

Potentiometer R5 for setting the deviation bipolar analog on the optional second deviation analog output. Refer to the deviation analog section [Section K.4.c] and in the applicable customer interface section of this manual (some references to EVO custom configurations may be applicable).

K.12.e Control Analog Amplifier – AMP Option

Jumper settings for the AMP Option are located in Section K.9.c.

K.13 Appendix D Set-up Procedure Sequence

The set-up of the Model DCPU with a sensor system is fairly straight forward. The following listing shows the suggested sequence of events for setting up the system. Note that the sensors must be installed on-line and functioning properly and that power must be applied to the Model DCPU. A host computer is also necessary for communication with the Model DCPU.

K.13.a PID Control Set-up

If the unit is configured for PID control only, the following set-up sequence is typically what is followed to configure the Model DCPU.

- 1) Verify all jumper settings for the Main Board [Section K.12.d], Micro-Controller Board [Section K.12.a] and Video Pre-Processor [Section K.12.c] before performing any set-up functions.
- 2) Set Communications for the RS-232 Customer Interface [Section K.11.a], if necessary.
 - a) Set the type of sensor, if not already factory performed [Section K.11.c].
- 3) Calibrate Linear Position Transducer or Control Offset [Section K.5.b-5].
- 4) Calibrate Mandrel Center position [Section K.5.b-7].
- 5) Calibrate Position (the sensor system) with the LED Display/Keypad [Section K.5.b-6].
- 6) Verify Auto-Zero Function [Section K.9.d].
- 7) Set Bargraph (BGA) Sensitivity [Section K.5.b-9].
- 8) Verify System Linearity [Section K.9.e].
- 9) Set Initial Proportional Term [Section K.5.b-2].
- 10) Set Initial Derivative Term [Section K.5.b-4].
- 11) Set Initial Integral Term [Section K.5.b-3].
- 12) Review any other manual sections [such as 10XAS-Series Sensors – Section C] for other information pertaining to system set-up.
- 13) Review any included Engineering Variance Order (EVO) documentation for other information pertaining to system set-up.

K.13.b Width Setup

If the unit is configured for PID control and width measurement, the following set-up sequence is typically what is followed to configure the Model DCPU.

- 1) Verify all jumper settings for the Main Board [Section K.12.d], Micro-Controller Board [Section K.12.a] and Video Pre-Processor [Section K.12.c] before performing any set-up functions.
- 2) Set Communications [Section K.11.a].
 - a) Set the type of sensor, if not already performed [Section K.11.c].
 - b) Set Decimal Point Position for width measurement data output [Section K.11.c].
 - c) Set Units of Measure [Section K.11.c].
 - d) Set the Limit Sensing – either Absolute Limit Sensing [Section K.11.e] or Tolerance Limit Sensing [Section K.11.e] for width HI/GO/LO limit relays.
- 3) Calibrate the sensor system for width measurement with the RS-232 Customer Interface [Section K.11.d].
- 4) Scale the width Deviation Analog Output [Section K.11.f].
- 5) Scale the width Absolute Analog Output [Section K.11.g].
- 6) Set the Digital Filter Snap [Section K.11.h].
 - a) Set the Exponential Averaging Value, if the Filter Snap is used [Section K.11.h].
- 7) Review any other manual sections [such as 10XAS-Series Sensors – Section C] for other information pertaining to system set-up.
- 8) Review any included Engineering Variance Order (EVO) documentation for other information pertaining to system set-up.

K.14 Appendix E New Features

Listed in this section are the newly added software and hardware features from software version 2199052 Rev. B to the current version 2199052 Rev. C.

K.14.a New Software Features

- 1) Addition of queries to the command structure. Queries allow the operator to retrieve various function values via the RS-232 Customer Interface [Section K.4.d].
- 2) Scaling of Control Offset Pendant [Section K.5.b-5].
- 3) Removal of the Scale RPF function, which is replaced by the Scale Analog Output function [Section K.5.b-4].
- 4) Change Jumper JP6- 7 & 8 to be open for Linear Position Transducer Operation.
- 5) Add Manual Transducer Re-Calibration Routine.

K.14.b New Hardware Features

- 1) Utilization of the Control Offset Pendant on the analog inputs [Section K.4.f].
- 2) Standardization of the Celesco® Model PT510-0020-111-1210 Linear Position Transducer as the standard position transducer for the Model DCPU [Section K.4.f].
- 3) Change of keypad on the LED Display/Keypad Interface to a rectangular version, rather than a square version. All functions of the new keypad are similar to previous versions.

K.15 Related Drawings

The following pages contain various drawings for the components used in and with the Model DCPU. For drawings of other configurations, please contact Harris Instrument Corporation Engineering. All mechanical drawings are available as AutoCAD® .DWG files for a minimal charge. All documentation is also available in Adobe® Acrobat™ .PDF portable document format upon request. Please contact Harris Instrument Corporation Sales.

Drawing #	Description	Drawing Format
1299014 Pg. 1	Model DCPU Exterior Dimensions	AutoCAD LT Rel. 3
1299014 Pg. 2	Model DCPU Typical Connections Descriptions	AutoCAD LT Rel. 3
1298220	OP Option Pendant Dimensions	AutoCAD LT Rel. 3
1399014 Rev. B Pg. 1	Model DCPU Interior View	AutoCAD LT Rel. 3
1399014 Rev. B Pg. 2	Model DCPU w/ AMP Option Interior View	AutoCAD LT Rel. 3
1493009 Rev. B	Bargraph Display Board Assembly for Model DCPU	AutoCAD LT Rel. 3
1495123 Rev. A	Digital Controller Main Board Assembly	AutoCAD LT Rel. 3
1495124	Digital Controller Co-Processor Board Assembly	AutoCAD LT Rel. 3
1495172 Rev. C Pg. 1	Digital Controller Micro-Controller Board Assembly	AutoCAD LT Rel. 3
1496173 Rev. A	Enhanced Video Pre-Processor (EVP Module) Board Assembly	AutoCAD LT Rel. 3
1498016	Universal Video Pre-Processor (UVP Module) Board Assembly	AutoCAD LT Rel. 3
1498198 Pg. 1	Switch/Keypad Interface & D/A Converter Board Assembly	AutoCAD LT Rel. 3
1498198 Rev. A Pg. 2	Switch/Keypad Interface & D/A Converter Board Connections	AutoCAD LT Rel. 3
1499001	Power Amplifier PW-1 Board Assembly	AutoCAD LT Rel. 3
1499004	LED Display/Keypad Board Assembly for Model DCPU	AutoCAD LT Rel. 3
2095123 Rev. 3	Main Board Schematic for use with 3695172 Rev. C *	AutoCAD LT Rel. 3
2095172 Rev. C	Micro-Controller Board Schematic *	AutoCAD LT Rel. 3
3400001	RS-232 Circular Connector to DB9 Cable Wire Diagram	AutoCAD LT Rel. 3
3498139 Rev. A	Linear Position Transducer Cable Wire Diagram	AutoCAD LT Rel. 3
4400003	OP Option Offset Pot Assembly	AutoCAD LT Rel. 3
<i>Table K.15-1: Drawing Information</i>		

* - NOTE: 'B' Size Drawing