Ultraflow 150DI 6Pt I/O Board
OPERATIONS MANUAL

TELEDYNE MONITOR LABS
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TABLE OF CONTENTS

Page

TABLES 7 Figures

APPENDIX A, Specifications

- SIX POINT I/O BOARD ANALOG OUTPUTS
- SIX POINT I/O BOARD DIGITAL INPUTS
- SIX POINT I/O BOARD RELAY OUTPUTS
- SIX POINT I/O DEFAULT JUMPER SETTINGS

APPENDIX B, DRAWINGS

Description

6PT I/O PC Board location
6PT I/O WIRING DIAGRAM

SIX POINT I/O BOARD FOR 150DI SYSTEM

1.0 OVERVIEW

This manual describes the Six Point I/O Board (6PIO) in the UltraFlow 150DI system. The Six Point I/O Board option (P/N 1903-0550-02) is used as a Direct Interface feature in the Ultraflow 150DI where analog output and control signals are required directly from the Transducer Interface Enclosure (TIE) Assembly. The 6PIO is packaged under the Local User Interface (LUI) in the upper right hand corner of the TIE and is accessed by removing the thumb screws on the LUI panel. External connections are made by connecting to TB2 & TB3 on the external interface PC Board. See Appendix B for Wiring Diagram connections and board location.

The configuration of the 6PIO Board is software selectable using the PC to Modbus interface software supplied with the Ultraflow 150DI. (See Figure 1-0-1 below) You must be in the Sixpoint I/O tab. Other selections are made by placement of small jumpers located on the circuit board.

**Note:** The software provided uses a modified Modbus and is proprietary to TML.
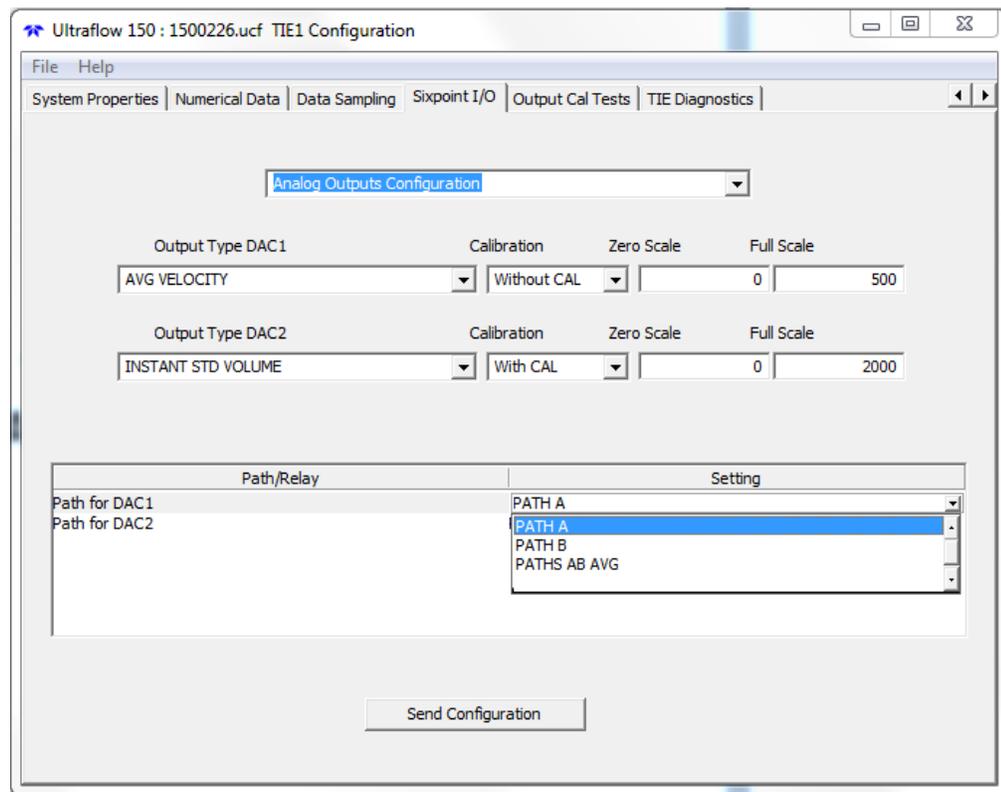
Figure 1-0-1

2.0 ANALOG OUTPUT DESCRIPTION

There are two independently isolated analog outputs, DAC 1 (Channel 1 or Out 1) & DAC 2 (Channel 2 or Out 2). They can be configured for anyone of 30 selections. (See selection types in the Output type pull down menu) The selections can be applied to Path A transducer set, Path B transducer set or Path AB Average. (See Figure 1-0-1)

You can select with calibration or without calibration mode values for DAC1 or DAC2 channels. If With CAL is selected, calibration values will be collected on that channel. Calibration data scaling for Zero, Span Low and Span High will be the same as the Normal mode scaling.

EXPANDED SCALING for Zero: Normal scaling calibration data will be present on the analog output along with Span Low & Span High but Zero scaling will be expanded for better resolution. Zero Mode Scaling will be +/- 10% of the full scale value.
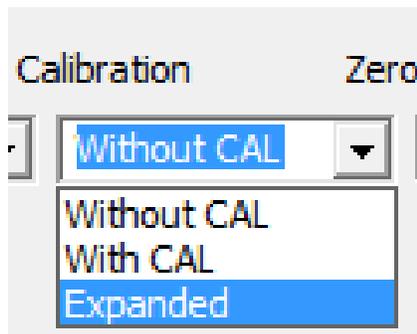
2.1 Zero Scale & Full Scale values

Zero scale-Defines the value that will create an analog output current of 4mA or 0mA (Depnding on JU9 jumper position explainied in next section).

Full Scale- Defines the value that will create an analog output current of 20mA.

These values must be representative of the Output Type chosen.

When your selections are complete you must click on the send configuration button.

2.2 <u>Analog Output Current Range Selection</u>

Two output current options are available from the 6PIO Board (either 4 – 20mA or 0 – 20mA). This range will apply to any Output Type selected above.

Both analog channels are configured identically and the current range selected by the placement of jumper JU9 on the 6PIO Board. Placing the removable jumper between the two *leftmost* pins of JU9 (or the "4" position) will select the 4 – 20mA range. Placement of the jumper between the two rightmost pins of JU9 (or the "0" position) will select the 0 – 20mA range. Position 4 is default and allows a live Zero.

Examples 1 and 2 below indicate how the Output type parameter, 6PIO Full Scale parameter and 6PIO jumper interactivity dictate the analog output response to the instrument measurement levels.

EXAMPLE 1:

If INSTANT STD VOLUME is selected *AND* Geometry Units are FT *AND* Flow Volume Units are /Minute *AND* (6PIO Full Scale = 2,000) *AND* (0/4 6PIO Jumper = 4):

4mA = 0 Cubic feet per minute

20mA = 2,000 Cubic feet per minute

EXAMPLE 2:

If AVG VELOCITY is selected *AND* Geometry Units are FT *AND* (6PIO Full Scale = 500) *AND* (0/4 6PIO Jumper = 0):

0mA = 0 FT/SEC

20mA = 500 FT/SEC

2.3 ANALOG OUTPUT ADJUSTMENT

The output current from each channel of the 6PIO may be measured at test points located on the board. The 0 – 20 or 4 – 20mA currents may be measured using a digital voltmeter to read the voltage across a 100Ω resistor at test points TP3 and TP4 for analog channel #1 (DAC1). 2.00 VDC between TP3 and TP4 indicates a 20mA output current. 0.40 VDC corresponds to a 4mA output.

To do this, wire jumpers must be installed between pins 6 & 7 (DAC1) and pins 9 & 10 (DAC2) on TB2, located on the external interface PC board which is mounted on the side of the TIE box. JU9 on the 6PT I/O PC Board must be in the "4" position. To adjust the 4mA output current, place jumper JU10 in the "Z" (Zero scale) position. Adjust Potentiometer R11 till .40 VDC is achieved. Put JU10 back in the "OFF" positon and place JU11 in the "FS" (Full Scale) position. Adjust Potentiometer R10 till 2.00 VDC is achieved. Place JU10 back into the "Z" position. You should get a voltage of 1.2 VDC. This is the mid range scale. Return both JU10 & JU11 to there off positions.

The analog channel #2 (DAC2) output is measured between test points TP10 and TP11. Voltage readings on channel #2 are the same as channel #1.
<div align="center">

2.00 VDC = 20mA

0.40 VDC = 4mA

</div>

Jumpers must be moved per DAC1 instructions. Potentiometer R23 & R22 are used for adjustment.

	TEST POINTS	ZERO ADJUST	FULL SCALE ADJUST
Channel #1 (DAC1)	TP3 – TP4	R11	R10
Channel #2 (DAC2)	TP10 – TP11	R23	R22

Table 2-3-1
Analog Output Channel Adjustment Details

2.4 Automatic Calibration Analog Output Sequence

The order of the Automatic Calibration Analog Output Sequence is shown below. The duration of each is programmable in seconds.

Order	Description	Duration
1st	ZERO Calibration	Selectable in seconds
2nd	Span low Calibration	Selectable in seconds
3rd	Span high Calibration	Selectable in seconds

Table 2-4-1
Automatic Calibration Sequence
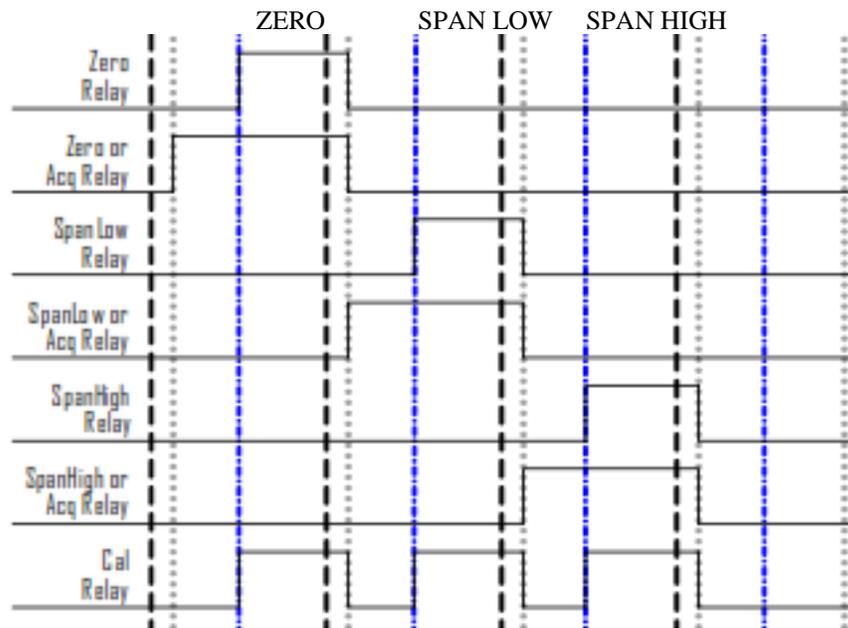
Figure 2-4-2
Analog Output Cal Cycle Sequence

3.0 DISCRETE ISOLATOR INPUTS

There are two discrete isolator inputs on the 6PIO Board. Both can be independently configured to operate from +5Vdc or Dry contacts: Jumper JU5 configures isolator #1 and JU6 configures isolator #2. They are also jumper configurable to perform the following functions:

Jumper Position	Function	Available Isolator
JU7 "A"	SPAN HIGH	ISO1
JU8 "A"	ZERO	ISO2
JU7 "B" or JU8 "B"	CALIBRATION CYCLE	ISO1 or ISO2
JU8 "C"	SPAN HIGH	ISO2
JU7 "C"	SPAN LOW	ISO1

Table 3-0-1
**Isolator Configuration Jumpers**

3.1 Other Jumpers

- **TEST ZERO SCALE (JU10):** This jumper is used to set both analog outputs to ZERO SCALE when placed in position "Z" (rightmost).

- **TEST FULL SCALE (JU11):** This jumper is used to set both analog outputs to FULL SCALE (20mA) when placed in the "FS" position (rightmost).

- **TEST ZERO SCALE AND TEST FULL SCALE:** When both of these jumpers (JU10 and JU11) are actuated simultaneously, both the analog outputs go to MID SCALE (12mA if the JU9 jumper is set to position "4", 10mA if the JU9 jumper is set to position "0").

- **JU1, JU2, JU3 and JU4:** These jumpers are used to set up internal measurement parameters for the 6PIO Board. These must remain in the positions detailed below for all 6PIO configurations.

Jumper Position	Function
JU9 "0"	Analog Outputs 0-20 mA
JU9 "4"	Analog Outputs 4-20 mA
JU10 "Z"	Test Zero Scale
JU11 "FS"	Test Full Scale
JU10 "Z" and JU11 "FS"	Test Mid Scale
JU1 & JU3 = 0	Internal Ranging (do not move)
JU2 & JU4 = 1	Internal Ranging (do not move)

Table 3-1-1
Other Output Jumper Configuration

4.0 RELAY OUTPUTS

Two relays are available K1 & K2. Contacts are SPDT (Form C). The configuration of the relays is software selectable using the PC to Modbus interface software supplied with the Ultraflow 150DI. (See Figure 4-0-1)
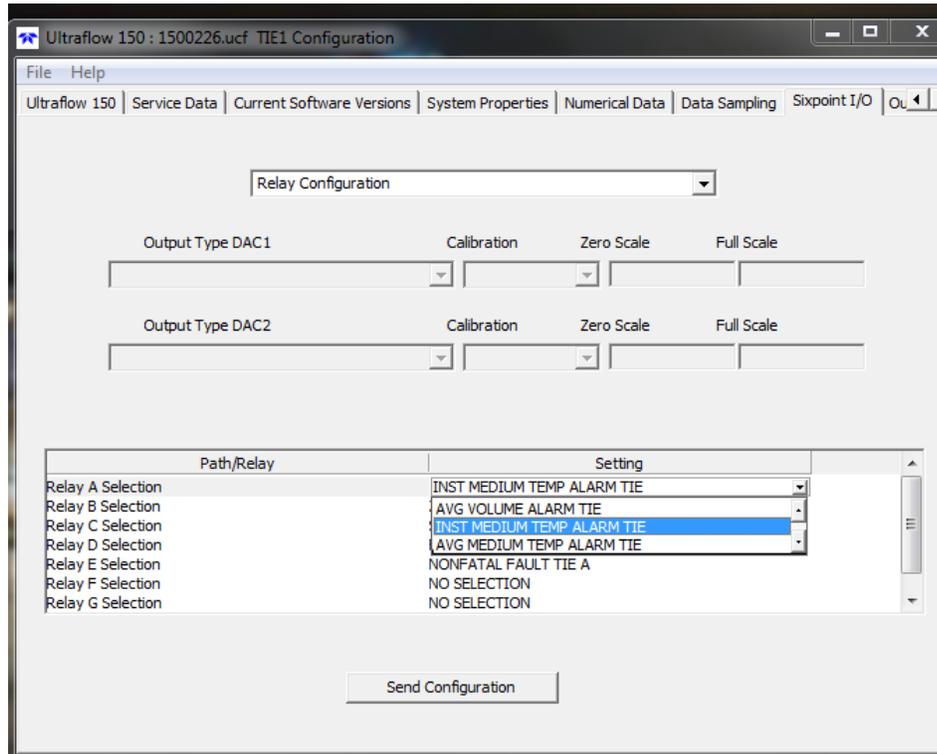
Figure 4-0-1

In the top pull down box you must select Relay Configuration. The lower window will display Path/Relay & Settiing menus. In the Path/Relay side the letters A through H represent jumper positions on the 6PT I/O PC Board, K1 (JU12) & K2 (JU13). On the right is where the settings for the jumper positions are selected. There are 42 different selections that can be made (See selection list). In order for a setting to work, for a particular jumper position, the jumper must be in that position.

Example:

K1 (JU12) jumper is in position A: In the settings for Relay A you select PURGE FAIL TIE A. If the purge system fails for TIE A, relay K1 will activate and send the alarm signal to the DAS or recording devices.

K2 (JU13) jumper is in position B: In the settings for Relay B you select CAL FAILURE TIE A. If the calibration fails on TIE A, relay K2 will activate and send the alarm signal to the DAS or recording devices.

NOTE: If both relay jumpers are in the same letter position, both relays will send out the same alarm.

When your selections are complete you must click on the send configuration button.

Table 4-0-2
Relay Function setting list

- NO SELECTION
- INST VOLUME ALARM TIE
- AVG VOLUME ALARM TIE
- INST MEDIUM TEMP ALARM TIE
- AVG MEDIUM TEMP ALARM TIE
- SPAN HIGH ON AO TIE
- SPAN LOW ON AO TIE
- ZERO ON AO TIE
- NORMAL ON AO TIE
- CAL ON AO TIE
- FATAL FAULT TIE A
- NONFATAL FAULT TIE A
- DATA VALID TIE A
- INTERFERENCE TEST TIE A
- PURGE FAILURE TIE A
- CAL FAILURE TIE A
- SN RATIO UPSTREAM ALARM TIE A
- SN RATIO DOWNSTREAM ALARM TIE A
- SN RATIO BOTH ALARM TIE A
- FATAL FAULT TIE B
- NONFATAL FAULT TIE B
- DATA VALID TIE B
- INTERFERENCE TEST TIE B
- PURGE FAILURE TIE B
- CAL FAILURE TIE B
- SN RATIO UPSTREAM ALARM TIE B
- SN RATIO DOWNSTREAM ALARM TIE B
- SN RATIO BOTH ALARM TIE B
- FATAL FAULT TIE A OR B
- NONFATAL FAULT TIE A OR B
- DATA VALID TIE A OR B

- INTERFERENCE TEST TIE A OR B
- PURGE FAILURE TIE A OR B
- CAL FAILURE TIE A OR B
- SN RATIO UPSTREAM ALARM TIE A OR B
- SN RATIO DOWNSTREAM ALARM TIE A OR B
- SN RATIO BOTH ALARM TIE A OR B
- SPAN HIGH OR ACQ ON AO TIE
- SPAN LOW OR ACQ ON AO TIE
- ZERO OR ACQ ON AO TIE
- NORMAL OR ACQ ON AO TIE
- CAL OR ACQ ON AO TIE

The contacts of each relay are jumper configurable for either N.O. or N.C. operation as per the following table.

RELAY	N.O.	N.C.
K1	JU14 "A"	JU14 "B"
K2	JU15 "A"	JU15 "B"

Table 4-0-3
Relay Contact Configuration Jumpers

5.0 INTERFACE CABLES

Two cables are needed to connect the 6PIO to external devices. One is a 4 conductor #20 AWG (0.5 mm^2) cable for connecting the contacts from the two relays. The other one Teledyne Monitor Labs recommends is a 6-pair #24 AWG (0.25 mm^2) shielded cable for connection to the two analog outputs and two isolators. This would leave two pairs as spares or for future use. See Wiring Diagram in Appendix B for details on external connections to the 6PIO PC Board.

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Appendix A
Six Point I/O Board Specifications

SIX POINT I/O BOARD ANALOG OUTPUTS

Number	2
Isolation Type	Optical & capacitive barriers; channel to channel, channel to circuit common & earth
Minimum Isolation Voltage	500Vpeak*, 500VDC*
Output Type	4-20mA with live 4mA zero, OR 0-20mA w/o live zero
Maximum Load Resistance	900 ohms
Maximum Offset	±0.05% of full scale
Total Output Error	±0.30% of full scale

SIX POINT I/O BOARD DIGITAL INPUTS

Number	2
Modes	Isolated and Non-isolated
Isolated Mode Minimum Isolation Voltage	500Vrms*
Isolated Mode Minimum Actuation Voltage	5VDC (user supplied)
Isolated Mode Maximum Actuation Voltage	24VDC (user supplied)
Isolated Mode Maximum Input Current	50mA @ 24VDC
Non-Isolated Mode Actuation Condition	Dry contact closure
Non-Isolated Mode Internal Operating Voltage	5VDC

SIX POINT I/O BOARD RELAY OUTPUTS

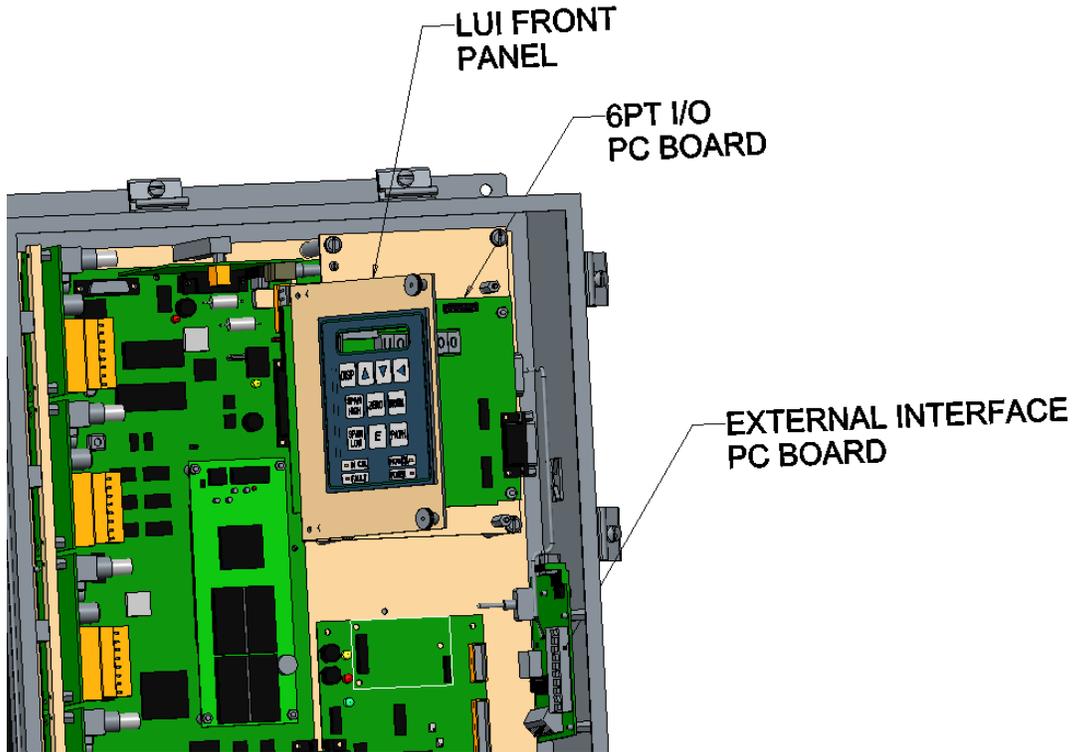| Number	2 SPST, N.O. (Single Pole Single Throw, Normally Open or Normally Closed [jumper selectable])
Minimum Isolation	500Vrms*
Maximum Contact Voltage	250VAC
Maximum Contact Current	1Amp AC, 1Amp DC

*I/O wires with respect to earth (common mode).
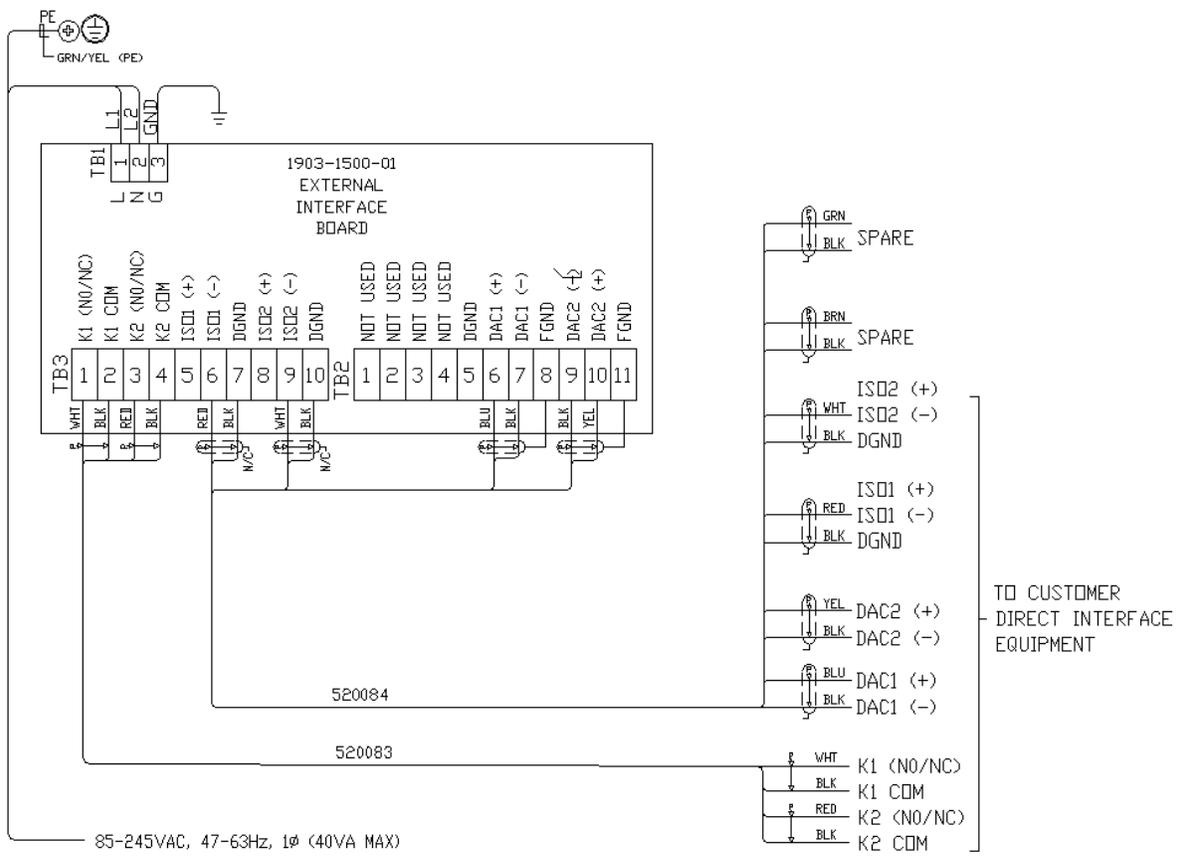
Six Point I/O Board (1860-0700) Jumper Settings

Jumper	Options (CircleConfiguration)	Default	Function
JU1	**0** 1	0	Hardware range for analog output #1
JU2	0 **1**	1	Hardware range for analog output #1
JU3	**0** 1	0	Hardware range for analog output #2
JU4	0 **1**	1	Hardware range for analog output #2
JU5	+5V **DRY**	DRY	ISO1 Actuation DRY contact or voltage (+5V)
JU6	+5V **DRY**	DRY	ISO2 Actuation DRY contact or voltage (+5V)
JU7	**A=SPAN HIGH** B=CAL CYCLE C=SPAN LOW	A	ISO1 Selection
JU8	**A=ZERO** B=CAL CYCLE C=SPAN HIGH	A	ISO2 Selction
JU9	**4** 0	4	Software range.ma outputs
JU10	**OFF** ZERO	OFF	Test Zero
JU11	**OFF** ZERO	OFF	Test Full Scale
JU12	H G **F** E D C B A	F	K1 relay closure condition
JU13	H G F E **D** C B A	D	K2 relay closure condition
JU14	B **A**	A	K1 relay contact type A=N.O. B=N.C.
JU15	B **A**	A	K2 relay contact type A=N.O. B=N.C.

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APPENDIX B

DRAWINGS

6PT I/O PC BOARD LOCATION

6PT I/O WIRING DIAGRAM