Specification Package
for
Rheodyne EV Driver Board
(PN 5123-111)

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Table of Contents

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Proprietary Letter

This document provides the Information necessary for the configuration and operation of the Rheodyne EV Driver Board for all EV models ***except*** the EV Cabinet Column Selector.

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1.0 OVERVIEW

This document provides information necessary for the configuration and operation of the Rheodyne EV Driver Board. It can be remotely controlled either by RS-232, or multiple forms of external line control. The forms of line control are:

1. Standard 4-Line BCD
2. Inverted 4-Line BCD
3. 1-Line Level Logic*
4. 1-Line Pulse Logic

*If valve is a two-position unit then a HIGH, (OFF, or OPEN) on the 1-Line control moves the valve to position one and a LOW, (ON, CLOSED, or GROUND) on the 1-Line control always moves the valve to position two

2.0 DRIVER BOARD COMPONENT DESCRIPTIONS

This section describes in detail the board switches and connectors, followed by some configuration examples. See Figure 1 for a schematic of the board.

2.1 Power Supply

The EV Driver Board requires a 24 to 36 VDC power supply with a minimum of 1.6 amps of current. It connects to connector J1 on the board. The power connector required by the board is a 2.5mm x 5.5mm x 9.4mm cable mount jack.

2.2 Model Number Selection Switch (S1) and Bank Switch (SW3-1,2)

The EV Driver Board must be configured to control a given model number. This is accomplished by setting switches S1 and SW3 located next to each other on the topside of the EV Driver Board.

S1 is a 16 position hexadecimal switch, which is used to select one of 16 model numbers. SW3 is a set of eight independent switches where the first two, 1 and 2, are used for model selection. Depending on the state of 1 and 2 (ON or OFF) one of four banks, each containing 16 model numbers, is used. Use a small slotted screwdriver to set the switches.

The settings for switches 1 and 2 at SW3 and a list of current valves with the S1 and SW3 position required by each are illustrated below.

SW3-1	SW3-2	Bank
On	On	0
Off	On	1
On	Off	2
Off	Off	3

Model #	Description	Selection Switch (S1)	Bank (SW3)
EV100-105	6-Position, 7-Port, 1/16”, Low Pressure	3	0
EV100-106	6-Position, 7-Port, 1/8”, Low Pressure	4	0
EV500-101	Two Channel Selector with By-Pass, SS	6	0
EV501-100	3-Column Selector, SS, Low Profile	5	0
EV501-104	6-Column Selector, SS, Low Profile	7	0
EV550-101	Two Channel Selector with By-Pass, PEEK	6	0
EV551-100	3-Column Selector, PEEK, Low Profile	5	0
EV551-104	6-Column Selector, PEEK, Low Profile	7	0
EV700-100	2-Position, 6-Port, SS	9	0
EV700-102	2-Positon, 10-Port, SS	A	0
EV700-104	Double Three-Way Diverter, SS	B	0
EV700-105	6-Position Selector, SS	1	1
EV700-107	10-Position Selector, SS	C	0
EV700-112	2-Position, 6-Port, SS, Large Bore	D	0
EV750-100	2-Position, 6-Port, PEEK	9	0
EV750-102	2-Positon, 10-Port, PEEK	A	0
EV750-104	Double Three-Way Diverter, PEEK	B	0
EV750-105	6-Position Selector, PEEK	1	1
EV750-107	10-Position Selector, PEEK	C	0
EV750-112	2-Position, 6-Port, PEEK, Large Bore	D	0
MRA100-000	Mass Rate Attenuator	2	1

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2.3 Board Address Switch (S2)
Located at the rear of the EV Driver Board is a 90-degree mounted 16-position rotary switch (S2) used only in serial control. It is used to configure the EV Driver Board for a given address when the unit is used on a serial programmable multidrop bus (or series). This switch is used to separate itself from other EV units on the same bus. The address switches must be set uniquely in order not to crash the serial bus. Once configured, the processor will only read this switch on power up initialization and store that address. For example, if the S2 switch is set to 4 at power up, and then switched to 6, the processor will still act as if its address is 4. After reading the switch upon power up initialization, the processor will then only respond to communications using that address and ignore all others.

2.4 Board Configuration Switch (SW3)
Switch SW3 consists of eight two-position switches whose functions are independent. Below lists the function and setting of each switch:

SW3-1 and SW3-2: Used to set one of four banks, each containing one of 16 model numbers as described in section 2.2.

SW3-3: Used to configure the board for either serial program control or line control. Switch description below:

SW3-3	**Type of Control**
On	RS-232 control via J2
Off	Line control via J5

SW3-4: Used to select the Baud rate for serial control given SW3-3 is On. If SW3-3 is Off (line control), this switch is ignored. Switch description below:

SW3-4	**Communication Speed**
On	9600 Baud
Off	19200 Baud

SW3-5 and SW3-6: Used to select the mode of line control via J5 given SW3-3 is set to Off. If SW3-3 is set to On (serial control), then this switch is ignored. Switch description below:

SW3-5	**SW3-6**	**Line Control**
On	On	Standard (non-inverted) 4-Line BCD Control
On	Off	Inverted 4-Line BCD Control
Off	On	1-Line Pulse Control
Off	Off	1-Line Level Logic (*)

*If valve is a two-position unit then a HIGH, (OFF, or OPEN) on the 1-Line control moves the valve to position one and a LOW, (ON, CLOSED, or GROUND) on the 1-Line control moves the valve to position two.

SW3-7: Needs to be ON for the Rheodyne display.

SW3-8: Available for future expansion.

Configuration examples of SW3: A dash (-) means that the state of the switch (either On or Off) does not matter.

1. Program control of a valve profile in library bank 0 using RS-232 (19200 Baud)

SW3:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	On	On	On	Off	-	-	On	-

2. Line control of a valve profile in library bank 0 using standard (non-inverting) 4 line BCD.

SW3:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	On	On	Off	-	On	On	On	-

3. Line control of a valve profile in library bank 0 using 1-Line Level Logic.

SW3:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	On	On	Off	-	Off	Off	On	-

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2.5 Connectors:

J1: Input power port to EV Driver Board. Connector type: Mouser 163-5003. Pin descriptions below:

Pin #	Description
1	Power (+24VDC to +36VDC)
2	Ground

J2: Multipurpose power, control and serial communication port. Connector type: 3M 3440-6302. Pin descriptions below:

Pin #	Description
1	Ground
2	Ground
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used
8	Not used
9	Not used
10	Not used
11	Chassis to Ground
12	Reset In
13	Chassis to Ground
14	RS-232 Receive
15	RS-232 Transmit
16	RS-232 DSR-IN
17	RS-232 DTR
18	Ground
19	External Address Bit 0
20	External Address Bit 1
21	External Address Bit 2
22	External Address Bit 3
23	Power (+24VDC to +36VDC)
24	Power (+24VDC to +36VDC)
25	Power (+24VDC to +36VDC)
26	Power (+24VDC to +36VDC)
27	Ground
28	Ground
29	Ground
30	Ground

J3: Front Panel Connector. Used to interface with the EV front panel for local control and testing. Connector type: Molex 22-03-2071. Pin descriptions below:

Pin #	Description
1	Ground
2	Remote/Local Toggle Switch
3	Counter Clockwise Actuation Switch
4	Clockwise Actuation Switch
5	+5VDC Pull Up for Remote/Local Status LED
6	Remote/Local Status LED control line
7	Pull down ground for Remote/Local Status LED

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J4: Rocket Valve Sensor Feedback port. Connector type: AMP 103669-5. Pin descriptions below:

Pin #	Description
1	+5VDC
2	Rocket Valve Encoder board Sensor line 0
3	Rocket Valve Encoder board Sensor line 1
4	Rocket Valve Encoder board Sensor line 2
5	Rocket Valve Encoder board Sensor line 3
6	Ground

J5: Remote Line Control and Status Feedback port. Connector type: Beau 905907 Driver Board header connector and Beau 900907 pluggable Driver Board terminal block. Pin descriptions below:

Pin #	Description
1	Position Control Line 3
2	Position Control Line 2
3	Position Control Line 1
4	Position Control Line 0
5	Done Feedback Indicator
6	Error Feedback Indicator
7	Ground

J6: Rocket Valve motor drive port. Connector type: Molex 22-11-2082. Pin descriptions below:

Pin #	Description
1	Motor A+
2	Motor A+
3	Motor B+
4	Motor B+
5	Motor A-
6	Motor A-
7	Motor B-
8	Motor B-

J7: Front Panel Status Display port. Connector type: 3M 2520-5002UB. Pin descriptions below:

Pin #	Description
1	Display Segment 0
2	Display Segment 1
3	Display Segment 2
4	Display Segment 3
5	Display Segment 4
6	Display Segment 5
7	Display Segment 6
8	Display Segment 7
9	Display Segment 8
10	+5VDC
11	Display Segment 9
12	Display Segment 10
13	Display Segment 11
14	Display Segment 12
15	Display Segment 13
16	Display Segment 14
17	Display Segment 15
18	+5VDC
19	Ground
20	+24 VDC

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J8: Option Power switch interface port. Connector type: PDI TCP-002-396. Pin descriptions below:

Pin #	Description
1	Power (+24VDC to +36VDC
2	Ground

3.0 REMOTE OPERATIONAL CONTROL

Remote control can be accomplished by either serial communications or line (TTL or contact closure) control. If it is desired to control the unit using the serial port, then the unit must be interfaced via the J2 connector. This connector permits communication control via RS-232. If the unit is to be controlled via line control then, J5 must be used.

3.1 Serial Communication

Two serial communication interfaces are available via switch selection and the DSR line (J2-16). If switch SW3-3 is set to On, then the unit is configured for serial program control. Given SW3-3 is set to On, if the microprocessor detects a logic "1" on the DSR (J2-16), then the unit sets up for RS-232 control. Baud rate is selected via switch SW3-4. If SW3-4 is set On then the internal USART is configured for 9600 Baud, if SW3-4 is set Off, then the USART is configured for 19200 Baud. The basic interface information is listed below:

Protocol	VT100
Baud Rate:	9600 or 19200
# of Data bits:	8
# of Start bits:	1
# of Stop bits:	1
parity:	None

3.1.1 RS-232

The RS-232 communication interface is listed below:

Connector Pin #	Function
J2-15	Transmit
J2-14	Receive
J2-16	DSR (Data Set Ready)
J2-17	DTR (Data Terminal Ready)
J2-18	Ground

RS-232 communication is achieved by connecting the EV unit to a RS-232 port using a NULL modem configuration. The NULL modem is used to cross route the receive and transmit pins of the EV to the transmit and receive pins of the master computer and cross the DTR and DSR lines of the EV with the DSR and DTR lines of the computer. For RS-232 communication, a high (+5VDC to +15VDC) must be applied to the EV DSR line. The interface required between the EV and the computer to achieve RS-232 communication is illustrated below.

Computer COM Port			EV J2		
DB9	DB25	Description	30-Pin Dual Line		Description
2	3	RX	15		TX
3	2	TX	14		RX
4	20	DTR	16		DSR
6	6	DSR	17		DTR
5	7	GND	18		GND

To communicate with EV, the user must have the appropriate software loaded on the master computer. These libraries handle all of the low level software handshaking required. The user would then only make the high level function calls and handle the user interface part of the program. The user can write their own drivers to do all the software handshaking required by the protocol. Contact factory for detailed protocol information (Reference # 2320903).

3.2 Line Control

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Line control is implemented via the J5 connector using TTL, contact closure, open collector, or line logic up to +24VDC and ground. The two basic modes of line control are 1-Line control and 4-Line BCD control. 1-Line control can be implemented using Level Logic or Pulse Logic. BCD control can be implemented as Standard (non-inverted) or Inverted BCD.

NOTE: Two-position EV's are factory set with 1-line level control logic. Multi-position EV's (more than 2-positions) are factory set with 4-line standard BCD control logic.

3.2.1 Status Feedback lines

In the two basic control modes there are two lines of status feedback, an Error indicator line and a Done indicator line.

DONE	0EV is busy. Error indicator line NOT valid.
DONE	1EV is not busy (DONE). Error feedback line is valid.
ERROR	0No error detected during last motion process
ERROR	1Error detected during last motion process

3.2.2 1-Line Control

This is the simplest method of remotely controlling the unit if line control is desired. It is also the best way to control two position valves due to the nature of the two possible states of the input signal.

Level Logic

To implement 1-line control Level Logic, the following switches on SW3 must be set as listed below:

SW3-3	Off	Program/Line Control set to Line Control.
SW3-5	Off	Line Control Mode set to 1-Line Control.
SW3-6	Off	1-Line Control Select set to Level Logic.

Control pins for this mode:

Move:	J5-4
Direction:	J5-3

The logic employed depends on the number of positions of the valve. If the valve is a two position unit, then setting J5-4 (Position Control Line 0) to ground (logic LO) always sets the valve to position two. J5-4 set to open, or +5 to +24VDC (logic HI) always sets the valve to position one. If the valve is a multi position unit, then the valve moves to the next adjacent position with every change of state on J5-4. If the valve has no hardware limits (i.e. physical spots) or software limits (built into the profile), then it will continue moving one position clockwise with every change of state on J5-4. If the valve is limited then when the unit reaches its last position, it will then reverse directions (counter clockwise) and move to the previous position. It will continue in this direction until it reaches position one and then reverse again going to the clockwise direction.

For multi position valves, J5-3 (direction bit) can be used to override the direction of actuation. The direction can be controlled for valves employing 360 degrees as follows:

J5-3	**Direction**
0	Counter Clockwise
1	Clockwise

If the valve unit has software limits, and the valve is at the limit when the Move pin detects a change of state, then the EV Driver Board will ignore the Direction pin and automatically reverse its direction. If the valve is NOT software limited, then changing the state on the Direction pin will change the direction on the next valve actuation.

Pulse Logic

To implement 1-line control Pulse Logic, the following switches on SW3 must be set as listed below:

SW3-3	Off	Program/Line Control set to Line Control.
SW3-5	Off	Line Control Mode set to 1-Line Control.
SW3-6	On	1-Line Control Select set to Pulse Logic.

This is similar to Level Logic control except the valve will actuate one position on the rising edge of a signal on the Move line. The direction will change on the rising edge of a signal on the Direction line. The same rules apply regarding the Direction pin

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when the valve has software limits except that the Direction pin must see a rising edge in order for the valve to change its course of direction.

3.2.3 4-Line BCD Control

This mode enables the user to actuate the valve randomly to any position available. If using Line Control, it is the best control method for multi position valves.

Standard or Non Inverted 4-Line BCD Logic

To implement Standard (non inverted) BCD logic, the following switches on SW3 must be set as listed below:

SW3-3	Off	Program/Line Control set to Line Control.
SW3-5	On	Line Control Mode set to 4-Line BCD.
SW3-6	On	4-Line Control set to the Standard (Non inverted) mode

Control pins for this mode:	**Pin #**
Position 3 Control Line	J5-1
Position 2 Control Line	J5-2
Position 1 Control Line	J5-3
Position 0 Control Line	J5-4

In this mode the valve unit can be moved from any position to any other position available for that particular valve. The logic is based on a non-inverted or standard Binary Coded Decimal (BCD) format. The command format is a standard BCD format as listed below where 0 = Logic Lo (Ground), and 1 = Logic Hi (Open or +5VDC to +24VDC):

Position	**J5-1**	**2**	**3**	**4**
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

NOTE: If the Four Position Control Lines are set to a BCD code that represents a position not available on a given model number, then that code is ignored and nothing happens until a new code is detected that is appropriate for the given valve.

Inverted 4-Line BCD Logic

This is essentially the same scheme as the Standard BCD Logic with the exception that the control lines are inverted. In other words, to move the valve to position one the inverted BCD code required on J5-1 through J5-4 is 1 1 1 0. To move the valve to position 6 the inverted code is 1 0 0 1. To implement Inverted BCD logic, the following switches on SW3 must be set as listed below:

SW3-3	Off	Program/Line Control set to Line Control.
SW3-5	On	Line Control Mode set to 4-Line BCD.
SW3-6	Off	4-Line Control set to Inverted BCD

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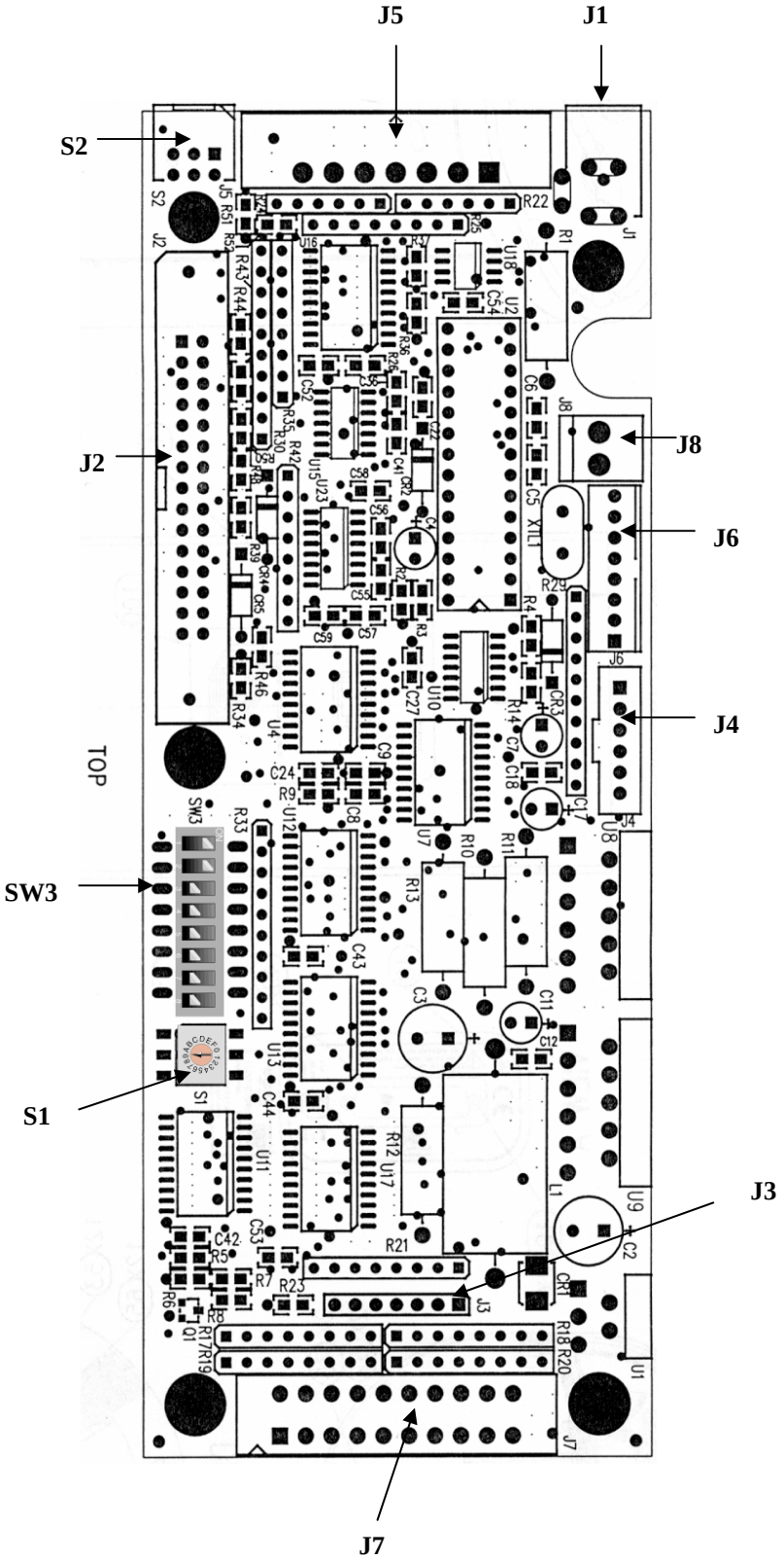
Fig. 1. Schematic of EV Driver Board



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