

TitanEX

TitanHP

Mighty Valve

Demonstration Kit

Installation and Operation
Of

TitanEX Low-Pressure Valves with BCD Logic Firmware

TitanHP High-Pressure Valves with Level Logic, Dual Pulse, or BCD Logic Firmware

Mighty Valves with Level Logic, Dual Pulse, or BCD Logic Firmware

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Notice of Proprietary Information

The demonstration kit contains control specifications for TitanEX/HP and Mighty Valve PCB as well as hardware necessary for control.

This information is proprietary to Rheodyne LLC, and is provided by Rheodyne as a service to assist Rheodyne OEM customers in the development of drive and control circuitry to be used in conjunction with Rheodyne motorized valves. By requesting and accepting this information, the recipient agrees to make no other use of this information, and not to disclose this information to persons not in the development of such control circuitry.

This information is provided as a convenience to Rheodyne OEM customers for the sole purpose of allowing them drive and control Rheodyne motorized valves. This information is not warranted in any way.

The user of this information assumes full and complete responsibility for any circuitry developed by the user.

Rheodyne assumes no obligation to update this information at any time in the future.

Introduction

This document describes installation and operation of TitanEX/HP and Mighty Valve driver board PCBs. It contains cabling and power supply connection details for both driver boards. Note that the TitanEX/HP and Mighty Valve driver boards are not interchangeable although their appearance is similar. Control for the two valve types is also dissimilar and the user must refer to the specific section of this document regarding the appropriate valve type.

Please contact Rheodyne LLC for any additional drawings or information that you may require. Engineering documents can be sent electronically in the following formats: Pro E, SolidWorks, Step, IGES, DXF, or DWG depending on specific document.

Rheodyne part numbers for the TitanEX/HP and Mighty Valve use the following conventions:

Platform	Part Number (Where X represents a place holder)
TitanEX (low pressure valve)	MLP77X-XXX
TitanHP (high pressure valve)	MHPXXXX-500-X
Mighty Valve (high pressure valve)	79XX-500-X or 99XX-500-X
Prototype Valves (low or high pressure)	TRXXXXXXXX

1.0 Contents

The TitanEX, TitanHP and Mighty Valve Demonstration Kit (Figure 1) contain the following:

1. Universal Power Supply

Input 100-240 VAC, 50-60 Hz

Output 24 VDC, 1.7A

2. Power Line Cord (specific to country of Demonstration Kit purchase)

3. Power Supply Adapter Cable. Rheodyne P/N 7900-901

4. Control Cable, Rheodyne P/N 7770-051

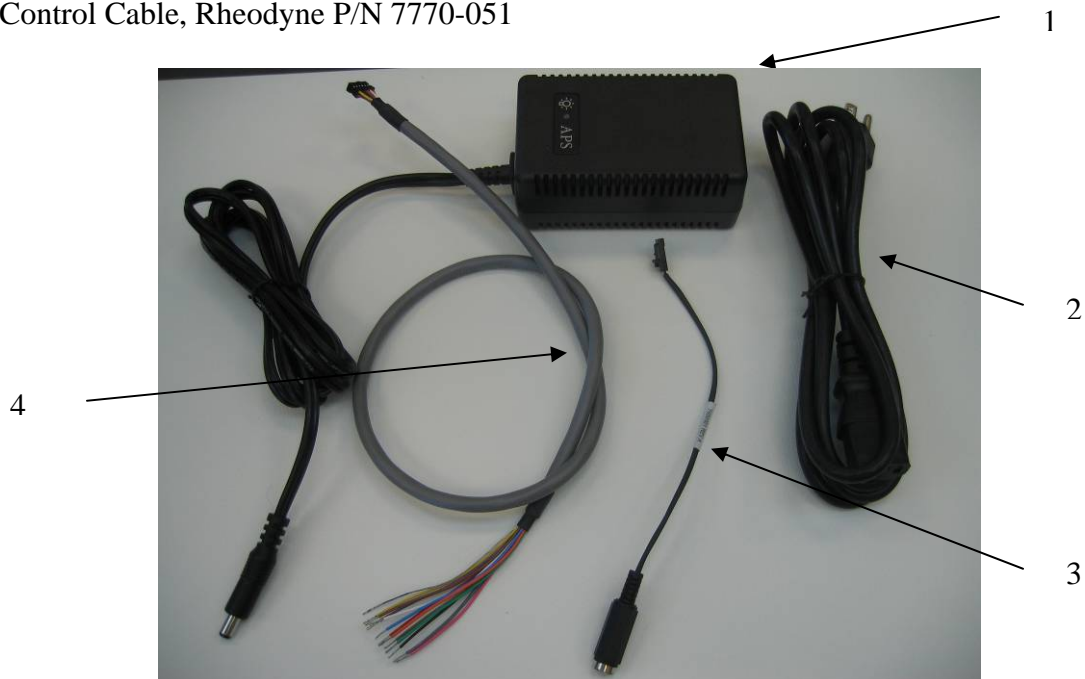


Fig. 1. Contents of Demonstration Kit

2.0 Power connections for TitanEX/HP and Mighty Valve PCB

For 24VDC power to TitanEX/HP PCB 7770016 or Mighty Valve (MV) PCB 7900501, connect the 2-pin connector of the Adapter Cable (P/N 7900-901) to J1 on the Driver Board (TitanEX/HP Fig. 2, MV Fig. 3). Plug the male-barrel connector of the Universal Power Supply to the female-barrel connector of the adapter cable. Plug the IEC 320 connector of the AC power line cord into the power supply body (brick). Plug the opposite end of the power line cord into a properly grounded power source (When ready to apply power!).

3.0 Connectors/Pin-Outs for TitanEX/HP Driver PCB

3.1 Driver Board to Motor Connection

In the unlikely event that a valve is received with the driver board disconnected, connect the TitanEX/HP valve 10-pin connector housing (Molex P/N 50-57-9410) to the 10-pin Molex Connector Header (Molex P/N 70543-0009) located on the rear of Titan Printed Circuit Board (PCB, Rheodyne P/N 7770016) also referred to as “driver board”.

3.2 Control Cable Connections

Connect the 12-pin Molex housing (Molex P/N 51110-1260) of control cable to the driver board header J4. Align notch in header to tab in housing. The crimp used on the wires is Molex terminal female 24-30 AWG crimp P/N 50394-8100.

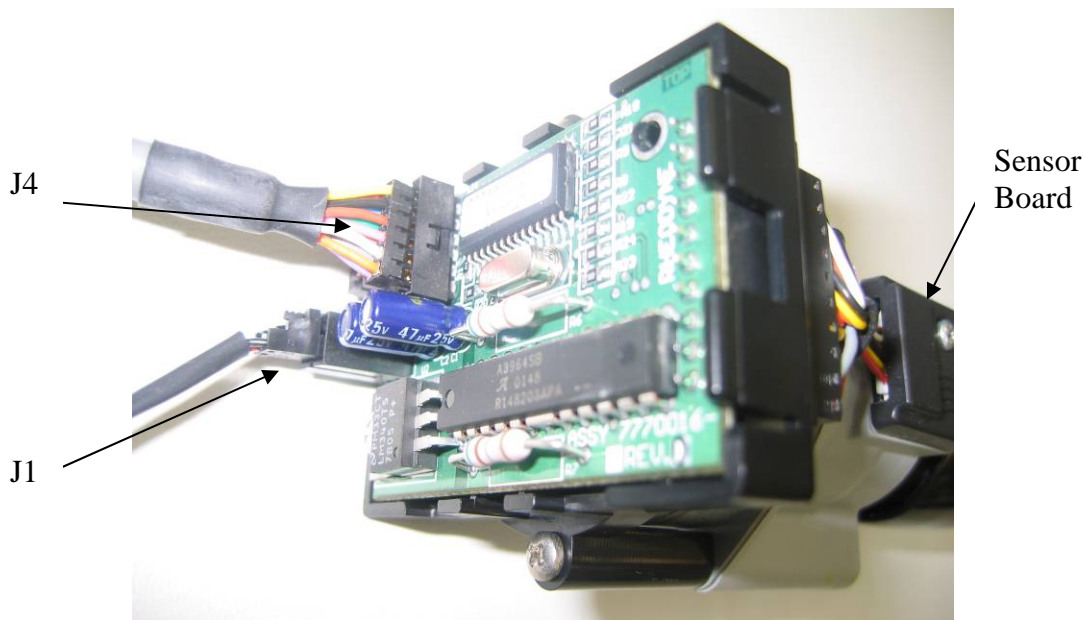


Fig. 2. Driver Board, Control Cable and Power Supply Connections for the TitanEX/HP PCB.

3.3 Instrument Control

For instrument control, connect the color-coded wire with the tinned ends of control cable (P/N 7770-051) to the instrument-controlled relay using contact closures (with one side grounded) or TTL. When the relay is closed, it will see ground potential. When it is open, the signal will be pulled high with internal pull-up resistors located on the driver board.

3.4 Pin-Outs and Control Cable Wire Connections

The following table show the inputs and outputs (pin-outs) of the 12-pin header (on PCB) which connects to the 12-pin housing side of the control cable for BCD, TTL (level logic), and dual-pulse firmware. The firmware programmed into the microcontroller accepts the inputs or Commands (CMD), positions the valve, checks to verify that the

valve has achieved the desired position and sends Feedback (FB) signals so the user can verify that the valve has moved to the new position.

<i>Pin</i>	<i>Color*</i>	<i>Function in BCD FW</i>	<i>Function in TTL (level) FW</i>	<i>Function in dual-pulse FW</i>
J4-1	Orange	BCD FB0 (LSB)	Reserved	Reserved
J4-2	Violet	BCD FB1	Reserved	Reserved
J4-3	White	BCD FB2	Reserved	Reserved
J4-4	Grey	BCD FB3 (MSB)	Reserved	Reserved
J4-5	Pink	ErrorFB	ErrorFB	ErrorFB
J4-6	Tan	Reserved	Reserved	Reserved
J4-7	Brown	DoneFB	DoneFB	DoneFB
J4-8	Green	BCD CMD3 (MSB)	Level Logic Input	Pulse A Input
J4-9	Black	GND	GND	GND
J4-10	Blue	BCD CMD2	Reserved	Pulse B Input
J4-11	Yellow	BCD CMD1	Position B Feedback	Position B Feedback
J4-12	Red	BCD CMD0 (LSB)	Position A Feedback	Position A Feedback

***Color Designation is for the Control Cable (P/N 7770-051).**

LSB = Least Significant Bit

MSB = Most Significant Bit

The Done Feed Back (FB) signal on the TitanEX/HP driver board will be low or ~ 0 VDC when the valve is transitioning between ports. When the valve reaches the designated port, the Done FB line will be high or 5 VDC.

The Error Feedback (Error FB) signal will go high or ~ 5 VDC when there is an error sensed by the microcontroller. Normally this line will be low or ~ 0 VDC when the valve and driver are functioning properly.

4.0 Logic Diagrams for TitanEX/HP

4.1 TitanEX/HP 4-bit Binary Coded Decimal (BCD) Control

The following BCD Logic Diagram shows the input states for controlling multi-position valves. All four inputs are internally pulled up meaning they will be in the logic high state if no signal is applied. These inputs accept either TTL, CMOS, or contact closure signals. BCD logic consists of four digital lines. It is most often used for controlling multi-position valves, although it can be used for two-position valve control as well.

Using four lines, it is possible to position a valve to a maximum of fifteen positions ($2^4 = 16 - 1$ (command zero is always ignored) = 15 max positions). Each position is encoded using a four-bit binary digital logic:

Command (CMD) or Feedback (FB) 0 ($2^0=1$)

Command (CMD) or Feedback (FB) 1 ($2^1=2$)

Command (CMD) or Feedback (FB) 2 ($2^2=4$)

Command (CMD) or Feedback (FB) 3 ($2^3=8$)

Command (Input)				Position Of Valve	Feed Back (Output)			
3 (MSB)	2	1	0 (LSB)		3 (MSB)	2	1	0 (LSB)
Pin 8	Pin 10	Pin 11	Pin 12		Pin 4	Pin 3	Pin 2	Pin 1
Low	Low	Low	High	1	Low	Low	Low	High
Low	Low	High	Low	2	Low	Low	High	Low
Low	Low	High	High	3	Low	Low	High	High
Low	High	Low	Low	4	Low	High	Low	Low
Low	High	Low	High	5	Low	High	Low	High
Low	High	High	Low	6	Low	High	High	Low

Continued for 10-Position Valves

Low	High	High	High	7	Low	High	High	High
High	Low	Low	Low	8	High	Low	Low	Low
High	Low	Low	High	9	High	Low	Low	High
High	Low	High	Low	10	High	Low	High	Low

The BCD logic input voltage levels are:

High or 5 VDC (open contacts of a relay) or

Low or 0 VDC (closed contacts to ground)

Caution: Do not apply 24VDC to logic lines.

4.2 TitanHP Level Logic Control

The following table depicts operation and control for level logic firmware (see **Section 3.4** for pin-outs and wire colors for control cable P/N 7770-051).

High or ~5 VDC (or open contacts of a relay)

Low or ~0VDC (closed contacts to ground)

Level Logic Input (Pin J4-8)	Position	Pos A FB (Pin J4-12)	Pos B FB (Pin J4-11)
High	A (Load)	Low	High
Low	B (Inject)	High	Low

Note: A Low or ~ 0 VDC output from the Pos A and Pos B FB lines denotes that the position has been achieved.

Caution: Do not apply 24VDC to logic lines.

4.3 TitanHP Dual Pulse Logic Control

The following table depicts operation and control for dual pulse logic firmware (see **Section 3.4** for pin-outs and wire color for control cable P/N 7770-051).

Note: The Pulse-A and Pulse-B inputs are an electrical pulse. Initially, the line will start from a High (~ 5 VDC) or open connection to ground followed by a short transition period to a **Low** (~ 0 VDC) or closed connection to ground and then back to a **High** of (~ 5 VDC) or open connection to ground.

Command Input		Position of Valve	Feedback	
Pulse-A (Pin J4-8)	Pulse-B (Pin J4-10)		Pos A (Pin J4-12)	Pos B (Pin J4-11)
Pulse	None	A (Load)	Low	High
None	Pulse	B (Inject)	High	Low

Note: A Low or ~ 0 VDC output from the Pos A and Pos B Feed Back lines denotes that Position has been achieved.

Caution: Do not apply 24VDC to logic lines.

5.0 Connectors/Pin-Outs for Mighty Valve Driver PCB

5.1 Driver Board to Motor Connection:

In the unlikely event that a valve is received with the driver board disconnected, connect the Mighty Valve DB9-Male Connector to the DB9-Female Connector located on rear of Mighty Valve (Rheodyne P/N 7900501) Printed Circuit Board (PCB) also referred to as “Driver Board”.

5.2 Control Cable Connections

Connect the 12-pin Molex housing (Molex P/N 51110-1260) of control cable to the driver board header J4. Align notch in header to tab in housing. The crimp used for the wires is Molex terminal female 24-30 AWG crimp P/N 50394-8100.

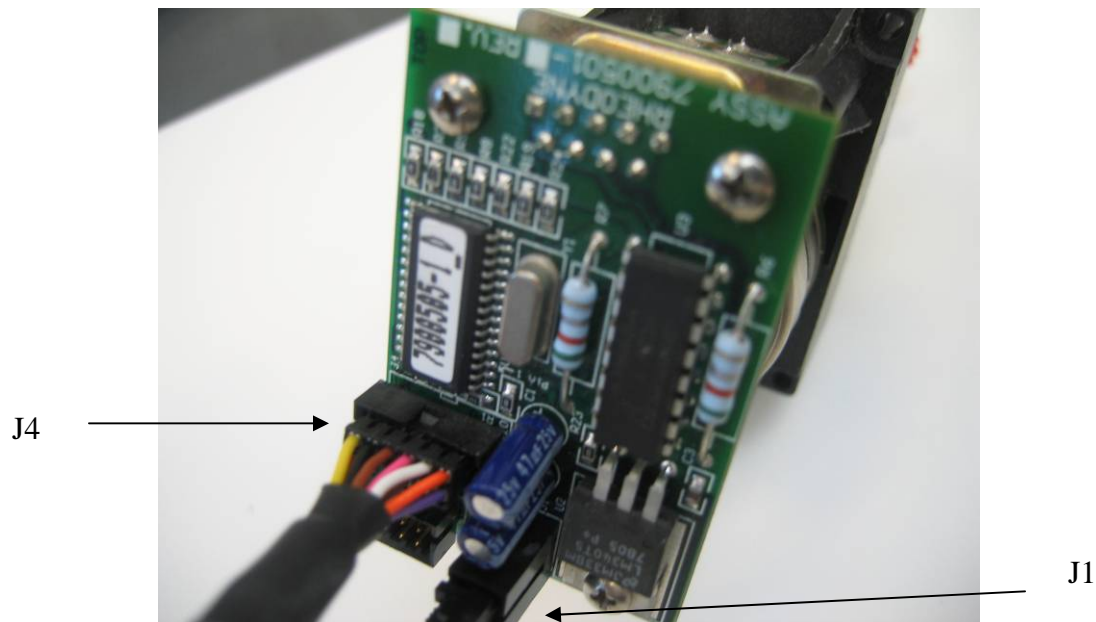


Fig. 3 Driver Board, Control Cable and Power Supply Connections for the Mighty Valve (PCB) Driver Board shown for reference.

5.3 Instrument Control

For instrument control, connect the tinned ends of color-coded-wires of control cable (P/N 7770-051) to the instrument-controlled relay using contact closures (with one side grounded) or TTL (see Section 5.4 to determine which wires will be used). When the relay is closed, it will see ground potential. When it is open, the signal will be pulled high with internal pull-up resistors located on the driver board.

5.4 Might Valve Pin-Out and Control Cable Wire Connections

The following table shows the Mighty Valve inputs and outputs from the 12-pin header on the driver board to the 12-pin housing side of the control cable. Note that the particular firmware used (level logic, pulse logic, or dual-pulse logic) is factory

programmed and cannot be changed by the end user. Thus, a valve programmed with level logic firmware is not compatible with pulse logic or dual-pulse logic and cannot be changed.

Control Cable Wire Connections:

Pin	Wire Color Control Cable 7770-051	Function in Level Logic FW	Function in Pulse FW	Function in Dual-Pulse FW
J4-1	Orange	Not Used	Not Used	Not Used
J4-2	Violet	Not Used	Not Used	Not Used
J4-3	White	Not Used	Not Used	Not Used
J4-4	Grey	Not Used	Not Used	Not Used
J4-5	Pink	Not Used	Not Used	Not Used
J4-6	Tan	Not Used	Not Used	Not Used
J4-7	Brown	Done FB	Done FB	Done FB
J4-8	Green	Level Logic Input	Not Used	Dual-Pulse Input Pos A
J4-9	Black	Ground	Ground	Ground
J4-10	Blue	Not Used	Pulse Input	Dual-Pulse Input Pos B
J4-11	Yellow	Pos 2 FB	Pos 2 FB	Pos 2 FB
J4-12	Red	Pos 1 FB	Pos 1 FB	Pos 1 FB

The Done Feedback (FB) signal on the Titan Driver Board will be Low or ~ 0 VDC when the valve is transitioning between Ports. When the valve reaches the designated port the Done FB goes High or ~ 5 VDC.

There is no dedicated Error Feed Back (FB) line implemented on the Mighty Valve Driver Board. However, if the desired position is not reached, the Done FB line will remain low and neither Pos FB line will be asserted, thus indicating an error condition.

6.0 Logic Diagrams for Mighty Valve Firmware

6.1 Mighty Valve Level Logic Inputs and Feedback

High or ~5 VDC (open contacts of relay) or

Low or ~0VDC (closed contacts to ground potential).

Level Logic Input (Pin J4-8)	Position	Pos 1 FB	Pos 2 FB
High	1 (Load)	Low	High
Low	2 (Inject)	High	Low

Note: A Low or ~0VDC output from the Pos 1 and Pos 2 Feed Back lines denotes that Position has been achieved.

Caution: Do not apply 24VDC to logic lines.

6.2 Mighty Valve Pulse Logic Inputs and Feedback

The pulse input is an electrical pulse. Initially, the line will start from a **High** (~ 5 VDC) or open connection to ground followed by a short transition period to a **Low** (~ 0 VDC) or closed connection to ground and then back to a **High** of (~ 5 VDC) or open connection to ground. For pulse logic, each pulse causes a change of position (from position 1 to 2 or vice versa).

High or ~5 VDC (open contacts of relay) or
Low or ~0VDC (closed contacts to ground potential).

Pule Logic Input	Position of Valve (if starting from Inject)	Pos 1 FB	Pos 2 FB
1 st Pulse	1 (Load)	Low	High
2 nd Pulse	2 (Inject)	High	Low

Note: A Low or ~0VDC output from the Pos 1 and Pos 2 Feed Back lines denotes that Position has been achieved.

Caution: Do not apply 24VDC to logic lines.

6.3 Mighty Valve Dual-Pulse Logic Inputs and Feedback

The Pulse-A and Pulse-B inputs are an electrical pulse. Initially, the line will start from a **High** (~ 5 VDC) or open connection to ground followed by a short transition period to a **Low** (~ 0 VDC) or closed connection to ground and then back to a **High** of (~ 5 VDC) or open connection to ground.

High or ~5 VDC (open contacts of relay) or
Low or ~0VDC (closed contacts to ground potential).

Command Input		Position of Valve	Feedback	
Pulse-A (Pin J4-8)	Pulse-B (Pin J4-10)		Pos A (Pin J4-12)	Pos B (Pin J4-11)
Pulse	None	A (Load)	Low	High
None	Pulse	B (Inject)	High	Low

Note: A Low or ~0VDC output from the Pos 1 and Pos 2 Feed Back lines denotes that Position has been achieved.

Caution: Do not apply 24VDC to logic lines.