Operating Manual
LabPRO™ Two-Position Fluid Processor and Double Three-Way Diverter

Rheodyne Control Number: 2320370D

June 1999

This manual is for the following model numbers:

Model Number	Control Option	Description
PR700-100	(-01, -02, -03 versions)	LabPRO 2-Position, 6-Port Stainless Steel
PR750-100	(-01, -02, -03 versions)	LabPRO 2-Position, 6-Port PEEK
PR700-102	(-01, -02, -03 versions)	LabPRO 2-Position, 10-Port Stainless Steel
PR750-102	(-01, -02, -03 versions)	LabPRO 2-Position, 10-Port PEEK
PR700-112	(-01, -02, -03 versions)	LabPRO 2-Position, 6-Port Preparative Scale Stainless Steel
PR750-112	(-01, -02, -03 versions)	LabPRO 2-Position, 6-Port Preparative Scale PEEK
PR700-104	(-01, -02, -03 versions)	LabPRO Double Three-Way Diverter Stainless Steel
PR750-104	(-01, -02, -03 versions)	LabPRO Double Three-Way Diverter PEEK

Rheodyne LLC • A Unit of IDEX Corporation • 600 Park Court • Rohnert Park, CA 94928 • USA
Phone 707-588-2000 • Fax 707-588-2020
www.rheodyne.com

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I. INTRODUCTION

A. Description

1. The LabPRO™ Two-Position, Six-Port and Ten-Port Fluid Processors and Double Three-Way Diverters contain compact, automated valves. The Fluid Processors and Diverters are compatible with virtually all remote instruments and laboratory computer systems. The Two-Position Fluid Processors and Double Three-Way Diverters are available in both PEEK (polyetheretherketone) and stainless steel versions.

B. Customer Service

1. If you need assistance in sales, technical information, applications or repair please contact your local Rheodyne distributor. Authorized Rheodyne distributors are trained and knowledgeable in the Rheodyne product line.

C. Warranty

1. All Rheodyne products are warranted against defects in materials and workmanship for a period of one-year following the date of shipment by Rheodyne. Rheodyne will repair or replace any Rheodyne product that fails during the warranty period due to a defect in materials or workmanship at no charge to the customer.

2. The product must be returned to Rheodyne's factory in original packaging or equivalent, transportation prepaid. Damage occurring in transit is not covered by the warranty.

3. This limited warranty is Rheodyne's sole warranty of its products, and all other warranties of merchantability or fitness for any particular purpose are hereby disclaimed. Under no circumstances will Rheodyne be liable for any consequential or incidental damages attributable to a claimed failure of a Rheodyne product, even if Rheodyne has been placed on notice of possibility of such damages.

II. UNPACKING

A. General

1. The LabPRO Two-Position Fluid Processor and Double Three-Way Diverter are shipped assembled and ready to use. The Two-Position Fluid Processor or Diverter and the accessories are shipped together.

2. Inspect for damage and/or shortage.

3. Keep the original packaging in case the unit must be returned to the factory.

B. Supplied With The LabPRO Two-Position Fluid Processor and Double Three-Way Diverter

1. The following accessories are shipped with the unit:
   a) Fitting sets for all the ports
   b) Hex Key(s)
   c) Jumper Wire(s)
   d) Universal Power Supply
   e) Power Line Cord
   f) Interface Cable
   g) Operating Manual

C. Terminology Appendix

1. All terms appearing in *italics* can be found in Appendix A: “Electronic Definitions in Non-Electronic Terms.”

III. IMPORTANT OPERATING NOTICES 

A. Cautions

1. For connections from your instrument to the Two-Position Fluid Processor or Double Three-Way Diverter use only a *contact closure* or a *TTL switch.* Do not supply a voltage and current from your instrument to the Two-Position Fluid Processor or Double Three-Way Diverter or it will damage the Two-Position Fluid Processor or Double Three-Way Diverter circuitry.

2. Rinse the valve after using buffer solutions to prevent the formation of crystals that can scratch the sealing surfaces.

3. Use only the supplied Power Supply for connection to the Two-Position Fluid Processor or Double Three-Way Diverter.

4. Operate within temperature range, 4°-40°C only.

5. When using the PEEK valve use only plastic ferrules in the stator ports. Metal ferrules can cause irreparable damage to the plastic stator.

B. Warnings

1. Do not submerge the LabPRO Two-Position Fluid Processor or Double Three-Way Diverter in liquids.

2. Confirm there is adequate ground between your instrument and the LabPRO Two-Position Fluid Processor or Double Three-Way Diverter. This is especially important with electrospray mass spectroscopy.

3. Plug Power Supply into LabPRO Two-Position Fluid Processor or Double Three-Way Diverter first, then plug Power Supply into AC power source. When disconnecting, unplug at AC power source first.

IV. SPECIFICATIONS

A. Unit:

1. Temperature range: 4°-40° C, non-condensing.

2. Weight: 2.3 kg (5.0 lb.).

3. CE Mark represents:

   a) EMC certification (EN50082-1) and

   b) EMI certification (EN 50081-1).

B. Valve:

1. Maximum pressure:

   Models PR700-100, PR750-100, PR700-102, PR750-102, PR700-104, PR750-104: 35 MPa (345 bar, 5000 p.s.i.)

   Models PR700-112, PR750-112: 21 MPa (207 bar, 3000 p.s.i.)

2. Wetted surfaces:

   Models PR700-100, PR700-104: Stainless Steel, PEEK, and alumina ceramic.
   Models PR700-102, PR700-112: Stainless Steel and PEEK.
   Models PR750-100, PR750-104: PEEK and alumina ceramic.
   Models PR750-102, PR750-112: PEEK.

3. Flow passages:

   Models PR700-100, PR750-100, PR700-104, PR750-104: 0.4 mm (0.015”) and 0.5 mm (0.018”).
   Models PR700-112, PR750-112: 1.0 mm (0.040”).
   Models PR700-102, PR750-102: 0.6 mm (0.024”) and 0.5 mm (0.018”).

4. Ports: accept 10-32 male threaded fittings.

5. Not recommended for use with concentrated HNO_3 or concentrated H_2SO_4.

C. Electrical Connections:

1. See Figure 5 for an illustration of the electrical connections.

2. Barrel connector for power input to the Two-Position Fluid Processor or Double Three-Way Diverter (attached to power supply).

3. *Universal power supply* input is 100-240VAC, 50-60 Hz, output is 24VDC, 1.7A.

4. *Input/output* from the Two-Position Fluid Processor or Double Three-Way Diverter is through a 25 pin d-subminiature connector.

D. Control and Communication

1. *Line Control*

   a) *Input:*

      (1) Models ending in –01 accept 1 or 2 line *level logic* (*TTL, contact closure*). 2 line *level logic* is not recommended for LabPRO Two-Position Fluid Processors or Double Three-Way Diverters.

      (2) Models ending in –02 accept 1 or 2 line *pulse logic* (*TTL, contact closure*). 2 line *pulse logic* is not recommended for LabPRO Two-Position Fluid Processors or Double Three-Way Diverters.

      (3) Models ending in –03 accept 4 line *BCD* (*TTL, contact closure*).

   b) *Output:* For all models it is 6 line *TTL*.

2. *Serial Communication* (bi-directional, including position number and error codes)

   a) RS-232 is included with models ending in –01 and -02.

   b) RS-485 is included with models ending in –03.

3. The following table summarizes the control options:

Table 1. Summary of Control Options.

	Inputs							Outputs		
	Line Control					Serial Control		Line	Serial	
Models Ending in	1 Line (1 event relay)		2 Line (2 event relays) **Not Recommended**		4 Line BCD (4 event relays)	RS-232	RS-485	6-line TTL	RS-232	RS-485
	Level	Pulse	Level	Pulse						
-01	Std	N/A	Std	N/A	N/A	Std	N/A	Std	Position #	N/A
-02	N/A	Std	N/A	Std	N/A	Std	N/A	Std	+ Errors	N/A
-03	N/A	N/A	N/A	N/A	Std	N/A	Std	Std	N/A	Position # + Errors

V. INSTALLATION

A. General Description

1. Figure 1 shows a front view of the Two-Position Fluid Processor and Double Three-Way Diverter.

2. The Numeric Display (1) shows the number of the valve position.

3. The Local-Remote button (2) controls the manual or remote position selection.

4. The Mode indicator lights (3) show the selection mode.

5. The Manual Operation buttons (4) move the position of the valve when in Local mode.

6. The valve (5) is located to provide easy access to the liquid end should servicing be required. The supplied Rheodyne fittings match the valve's material of construction.

7. Figure 2 shows a schematic flow diagram of the 6-port valve. Figure 3 shows the flow diagram of the 10-port valve. Figure 4 shows the flow diagram of the Double Three-Way Diverter. The circles represent the ports in the valve stator. The dark grooves are the connecting passages in the rotor seal. The valve rotates 60° between positions one and two.

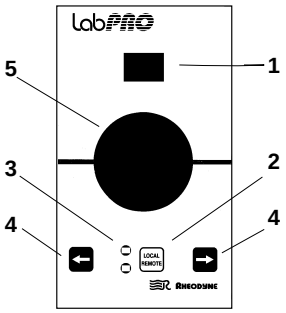


Fig. 1. Front view of LabPRO Two-Position Fluid Processor and Double Three-Way Diverter.

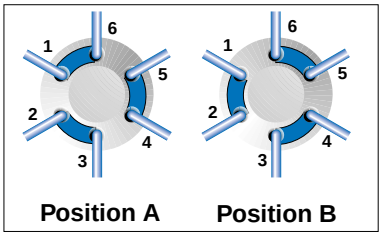


Fig. 2. Flow diagram of LabPRO Two-Position, Six-Port valve.

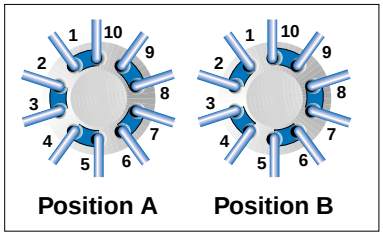


Fig. 3. Flow diagram of LabPRO Two-Position, Ten-Port valve.

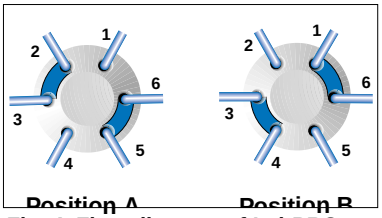


Fig. 4. Flow diagram of LabPRO Double Three-Way Diverter.

B. Electrical and Communications Connections to Two-Position Fluid Processor and Double Three-Way Diverter

1. All electrical and communications connections to the Two-Position Fluid Processor and Double Three-Way Diverter are made in the rear of the unit (see Figure 5):

2. Electrical Connections:

   a) Plug the Power Supply (1) male-barrel terminal (2) into the Two-Position Fluid Processor or Double Three-Way Diverter female port (3).

   b) Plug the IEC 320 connector (4) of the Power Line Cord into the Power Supply (1).

   c) Plug the opposite end of the Power Line Cord into a properly grounded power source (5). The LabPRO *Universal Power Supply* can be operated from *inputs* of 100-240 VAC, 50-60 Hz. The *output* is 24VDC, 1.7A.

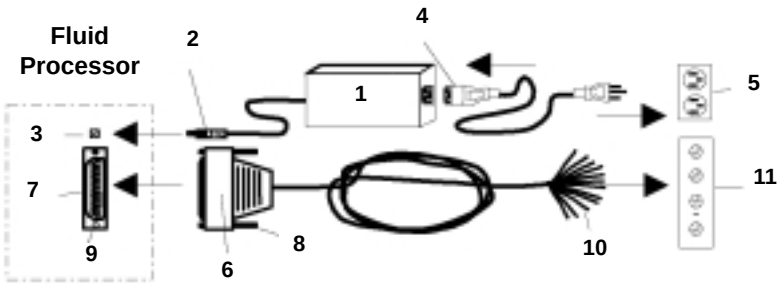


Fig. 5. Electrical and communications connections to Two-Position Fluid Processor and Double Three-Way Diverter.

3. Remote Communication Cable Connections:

   a) There are two ways to accomplish remote control of the Two-Position Fluid Processor or Double Three-Way Diverter:

      (1) *Line control* using the interface cable with *contact closures* or *TTL* relays.

      (2) *Serial communication* using RS-232 or RS-485 cables and software.

b) For *line control* use the supplied 25-pin *Interface Cable*. The Cable is plugged into the 25-pin terminal on the Two-Position Fluid Processor or Double Three-Way Diverter. The loose wires on the opposite end of the Cable are wired to an appropriate *output* device on your instrument, such as an *External Event Relay* or a *Time Function Switch*. The *output* must be either *contact closure* or *TTL* in order to connect the Two-Position Fluid Processor or Double Three-Way Diverter to your instrument (see **Caution - III A.1**). See Figure 5.

(1) Plug the *Interface Cable* connector (6) into the 25-pin terminal (7) located on the rear of the Two-Position Fluid Processor or Double Three-Way Diverter. Tighten the connector screws (8) into their mating terminal ports (9).

(2) Connect the color coded *Interface Cable* wires (10) to the instrument controller *contact closures* or *TTL* relay (11), as described in more detail in the next section "Input Line Control."

c) For *serial communication* the *interface cable* is replaced with RS-232 (P/N 5123-067) or RS-485 cable. The serial cable is connected between the 25-pin terminal on the Two-Position Fluid Processor or Double Three-Way Diverter and the appropriate *output* on your computer. See Figure 5.

(1) Plug the RS-232 or RS-485 *interface cable* connector (6) into the 25-pin terminal (7) located on the rear of the Two-Position Fluid Processor or Double Three-Way Diverter. Tighten the connector screws (8) into their mating terminal ports (9).

(2) Connect the opposite end of the RS-232 or RS-485 *interface cable* (not shown) into the instrument controller computer port, as described in more detail in the next section.

(3) The last two digits (-01, -02, -03) of the Two-Position Fluid Processor or Double Three-Way Diverter part number specify the different *inputs* that can be used for *remote control*. See Table 1 for complete details on *inputs* and *outputs* for different Two-Position Fluid Processor or Double Three-Way Diverter part numbers.

4. *Input Line Control* (controlling with a *contact closure* or *TTL* relay).

a) This section outlines in detail the three recommended options available for *line control*: 1 line *level logic*, 1 line *pulse logic*, and 4 line BCD.

b) 1 *line control* with *level logic*. The instrument used to control this model must have one [1] *TTL* or *contact closure output*. The output must also be *level logic*. You can control the Two-Position Fluid Processor or Double Three-Way Diverter with one *event relay* (valve rotation). The 1 *line control* with *level logic* method of control is the easiest means of controlling the Two-Position Fluid Processor or Double Three-Way Diverter.

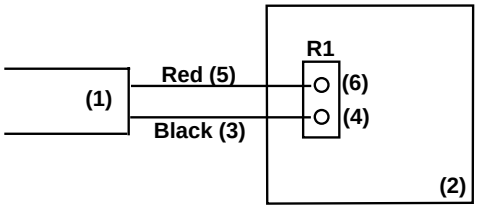


Fig. 6. One line control.

(1) 1 Line *Level Logic* Control (valve rotation, the simplest control):

(a) One *event relay* required.

(b) Wiring the *interface cable* (1) to the instrument (2) with 1 *line control* (see Figure 6):

(i) Connect the black wire (3) to the *ground terminal* (4) of the instrument event relay R1.

(ii) Connect the red wire (5) to the control line (6) *terminal* of the instrument event relay R1.

(iii) See the Operation section (VI) for typical commands and examples of programming with this type of control.

c) 1 *line control* with *pulse logic*. The instrument used to control this model must have one [1] *TTL* or *contact closure output*. The output must also be *pulse logic*. You can control the Two-Position Fluid Processor or Double Three-Way Diverter with one *event relay* (valve rotation).

(1) 1 Line *Pulse Logic* Control (valve rotation, the simplest control):

(a) One *event relay* required.

(b) Wiring the *interface cable* (1) to the instrument (2) with 1 *line control* is exactly the same as in *level logic* control (see Figure 6).

(i) Connect the black wire (3) to the *ground terminal* (4) of the instrument event relay R1.

(ii) Connect the red wire (5) to the control line (6) *terminal* of the instrument event relay R1.

(iii) See the Operation section (VI) for typical commands and examples of programming with this type of control.

d) 4 line *BCD* control. The instrument used to control this method must have four [4] *TTL* or *contact closure ouputs*. This method of control ensures direct access to the chosen valve position. 4 line *BCD* control is described in Appendix C: "Using Four Line BCD Remote Control."

5. Column Plumbing Connections

a) Locate the column connector fittings and tubing supplied with the Two-Position Fluid Processor and Double Three-Way Diverter.

b) Installing fittings:

(1) Using Rheodyne RheFlex® stainless steel fittings

(a) Cut the stainless steel tubing to the desired length assuring that the ends are deburred and straight, and that the inner passage is fully open.

(b) Bend the tubing to fit into the valve inlet and outlet. It is important to leave a minimum of 1.91 cm (0.75") straight section prior to any bends when using stainless tubing. This will allow you to conveniently remove the nuts.

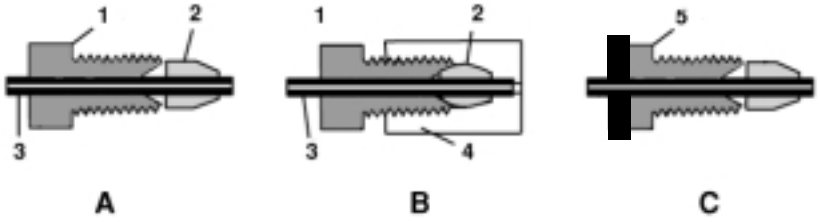


Fig. 7. Cut-away view of fittings installation.

(c) Place the nut (1) and ferrule (2) with the threaded portion of the nut and tapered portion of the ferrule onto the tubing (3) as shown in Figure 7A.

(d) Insert the tubing (3) into the valve port (4) as shown in Figure 7B.

(e) While firmly pressing the tubing, hand-tighten the nut as tight as possible.

(f) Use the supplied wrench to tighten the nut additional three, 90 degree turns. The ferrule will compress to form a seal as shown in Figure 7B.

(2) Using RheFlex PEEK fittings

(a) PEEK RheFlex nuts and ferrules should be used with the PEEK Two-Position Fluid Processor or Double Three-Way Diverter.

(b) Cut the PEEK tubing to the desired length assuring that the ends are clean and straight, and that the inner passage is fully open.

(c) Bend the tubing to fit into the valve inlet and outlet.

(d) Place the nut (5) and ferrule (2,6) with the threaded portion of the nut and tapered portion of the ferrule onto the tubing (3) as shown in Figure 7A and 7C.

(e) Insert the tubing (3) into the valve port (4) as shown in Figure 7B.

(f) While firmly pressing the tubing, hand-tighten as tight as possible using the ChromTRAC™ knob on the PEEK nut (see Figure 7C).

(3) Non-Rheodyne fittings

(a) We recommend using genuine Rheodyne fittings with the Two-Position Fluid Processor and Double Three-Way Diverter.

(b) If you plan to use any fittings or connectors from another manufacturer, assure that they are the correct types for the appropriate Two-Position Fluid Processor or Double Three-Way Diverter valve. Using an incorrect type of fitting could result in dead volumes (causing loss of resolution due to band broadening) or damage to the valve.

(c) When using the PEEK valve use only plastic ferrules in the stator ports. Metal ferrules can cause irreparable damage to the plastic stator.

c) Valve Plumbing:

(1) Plumb the six-port valve, used as an injection valve, as diagramed in Figure 8. Connect a sample loop (not supplied) between Ports 1 and 4. Before connecting the column to the valve, flush mobile phase through the valve in both positions. After flushing the valve, turn back to Position 1 (LOAD) and connect the column.

(2) If the valve is used as a switching valve, refer to the various applications shown in Appendix B: “Typical Two-Position LabPRO Applications.”

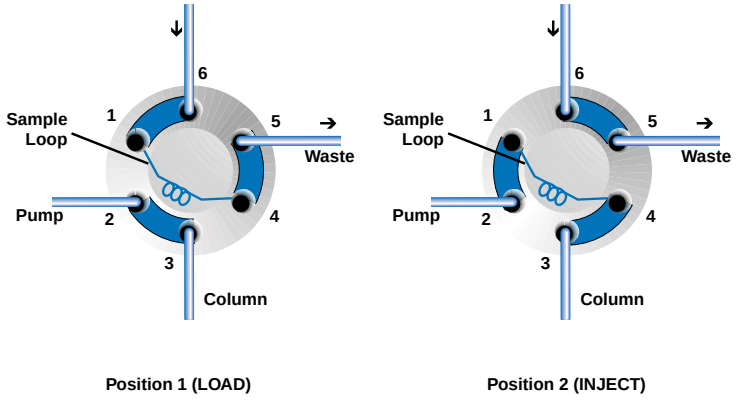


Fig. 8. Injection valve flow path as viewed from stator.

VI. OPERATION

A. Control Panel Overview

1. The Two-Position Fluid Processor and Double Three-Way Diverter control panel is shown in Figure 9. Display and operations are:

   a) Local-Remote button (1)

   b) Remote indicator light (2)

   c) Local indicator light (3)

   d) Valve/column position [LED] (4)

   e) Manual forward position selector button (5)

   f) Manual reverse position selector button (6)

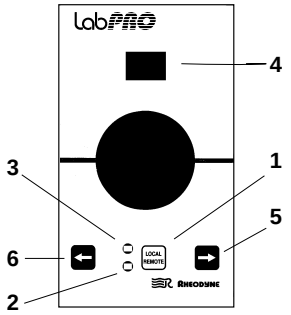


Fig. 9. LabPRO Two-Position Fluid Processor and Double Three-Way Diverter displays and manual selectors.

B. Manual Operation

1. To operate the Two-Position Fluid Processor or Double Three-Way Diverter, manually connect the Power Supply to the Two-Position Fluid Processor or Double Three-Way Diverter as described in the Installation section (V).

2. Pressing the Local-Remote button (1) selects either Local (manual) or Remote (automatic) operation.

   a) The Two-Position Fluid Processor or Double Three-Way Diverter must be in Local (manual) mode to use the manual (forward or backward) position selection buttons. Manual mode can be confirmed by observing that the local indicator light (3) is illuminated.

   b) The Two-Position Fluid Processor or Double Three-Way Diverter must be in Remote (automatic) mode to use any method of remote control (1 line *level logic*, 1 line *pulse logic*, 4 line *BCD*, RS-232, or RS-485). Remote mode can be confirmed by observing that the remote indicator light (2) is illuminated.

3. The LED display (4) indicates the active valve/column position.

4. Pressing the forward position selector button (5) moves the valve one position in the clockwise (or numerically higher) direction each time that the button is depressed.

a) If the valve is in highest position (position #2) pressing the forward button will not move the valve to position #1. The reverse button must be used to relocate to position #1.

5. Pressing the reverse position selector button (6) moves the valve one position in the counterclockwise (or numerically lower) direction each time that the button is depressed.

a) If the valve is in lowest position (position #1), pressing the reverse button will not move the valve to the highest valve position (position #2). The forward button must be moved to relocate to position #2.

C. Two-Position Fluid Processor and Double Three-Way Diverter Self Test

1. To confirm proper operation, the Two-Position Fluid Processor and Double Three-Way Diverter can be put through a "self test." This test is a valuable diagnostic tool to help determine potential problems for remote and automatic operational control.

2. To perform a "self test," put the Two-Position Fluid Processor or Double Three-Way Diverter in Local mode and simultaneously press the two "arrow" buttons located near the Local-Remote button for one second.

3. The Two-Position Fluid Processor or Double Three-Way Diverter will move *slowly* to the number 1 (home) position then rapidly cycle through all available positions and *slowly* return to the number 1 position.

4. If "EE" (ERROR) appears in the numeric display, refer to Troubleshooting section under Operation section (VI.G.).

D. Remote or Automatic Operation

1. *Input Line Control* (controlling with a *contact closure* or *TTL* relay)

a) Remote control can be accomplished via either discrete line (*TTL* or *contact closure*) or *serial communication* control. This section outlines 1 *line control* in detail. 4 line *BCD* is detailed in Appendix C: "Using Four Line BCD Remote Control."

b) 1 *line control* with *level logic*. The instrument used to control this model must have one [1] *TTL* or *contact closure output*. The output must also be *level logic*. You can control the Two-Position Fluid Processor or Double Three-Way Diverter with one *event relay* (valve rotation). The 1 *line control* with *level logic* method of control is the easiest means of controlling the Two-Position Fluid Processor or Double Three-Way Diverter.

(1) 1 Line *Level Logic* Control (valve rotation, the simplest control):

(a) One *event relay* is required.

(b) With *level logic* a change in state, (either closed to open or open to closed, either On to Off or Off to On, either Lo to Hi or Hi to Lo), will rotate the valve one position in the clockwise direction.

(c) Wiring the *interface cable* to the instrument with 1 *line control* (see Figure 6).

(d) If a power failure occurs the valve will remember its previous position and stay in that position upon restoration of power.

(e) 1 line *level logic* generic time programming examples follow. (Note: the actual programming will vary depending on the manufacturer of the instrument used):

Program 1

Time	Relay 1	Comments
Initial	Open	Valve is in position #1
30	Closed	Moves to position #2
40	Open	Moves to position #1

c) 1 *line control* with *pulse logic*. The instrument used to control this model must have one [1] *TTL* or *contact closure output*. The output must also be *pulse logic*. You can control the Two-Position Fluid Processor or Double Three-Way Diverter with one *event relay* (valve rotation).

(1) 1 Line *Pulse Logic* Control (valve rotation only, the simplest control):

(a) One *event relay* is required.

(b) With *pulse logic* the valve will rotate one position in the clockwise direction when the state is changed in a specific manner (Closed to Open, On to Off, or Lo to Hi). Nothing will happen when the state is changed in the opposite manner (Open to Closed, Off to On, or Hi to Lo). It is necessary to change the state once again prior to the next desired actuation of the valve. For example, to change the valve position twice, three changes in state are necessary.

(c) Wiring the *interface cable* to the instrument with 1 *line control* is exactly the same as in *level logic* control (see Figure 6).

(d) If a power failure occurs the valve will remember its previous position and stay in that position upon restoration of power.

(e) 1 line *pulse logic* generic time programming examples follow. (Note: the actual programming will vary depending on the manufacturer of the instrument used):

Program 1

Time	Relay 1	Comments
Initial	Closed	Valve is in position #1
30	Open	Moves to position #2
30.1	Closed	Cycles Pulse Logic
30.5	Open	Moves to position #1

Program 2

Time	Relay 1	Comments
Initial	Closed	Valve is in position #2
30	Open	Moves to position #1
30.1	Closed	Cycles Pulse Logic
30.5	Open	Moves to Position #2

d) 4 line *BCD* Control is described in Appendix C: "Using Four Line BCD Remote Control."

E. Serial Communication

1. *Serial communication* (RS-232 and RS-485) allows random access positioning and feedback (position and error messages) through standard communication protocols.

2. A computer equipped with the proper interface (usually COM1 or COM2 or an additional communications board containing more communications ports) is required.

3. Additionally, communications software is required to run a *serial communications* device. Software available to run the Two-Position Fluid Processor and Double Three-Way Diverter will be posted on the LabPRO website (www.labpro.com).

4. RS-232 serial communication.

   a) RS-232 is a standard 4-line communication protocol requiring no hardware handshaking. To control the Two-Position Fluid Processor or Double Three-Way Diverter with RS-232 communication use a standard 25-pin female to female serial cable with a null modem (Rheodyne P/N 5123-067) as described in the Installation section (V) (see Figure 5).

   b) Interface requirements are as follows:

      (1) Terminal Emulation: VT100

      (2) BAUD rate: 9600

      (3) # Data Bits: 8

      (4) # Stop Bits: 1

      (5) Parity: None

      (6) Hardware Handshaking: None

   c) Using a standard terminal emulator, the Two-Position Fluid Processor or Double Three-Way Diverter will return a menu, which indicates the current status and acceptable commands for controlling the valve. An example of the RS-232 menu is shown in Figure 10.

d) Lines 1 and 2 in Figure 10 show the firmware version and the valve type. Line 3 indicates the valve position or “EE” for error. Lines 4 through 8 describe the

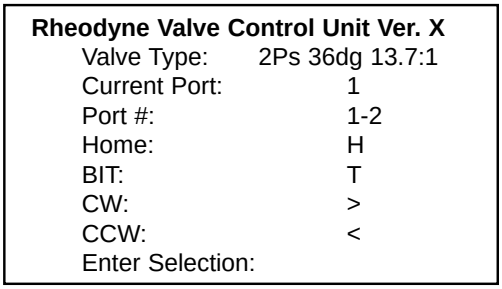


Fig. 10. Ten-Port RS-232 terminal communications protocol.

available commands for controlling the valve. Command descriptions follows:

(1) Sending a number corresponding to any available position will rotate the valve to the designated position.

(2) Sending “H” or “h” will command the valve to find the “home” position at a reduced speed (this is useful after an error has occurred).

(3) Sending “T” or “t” will indicate a “self test.” This test cycles through all available positions to confirm proper operation.

(4) Sending “>” or “.” will rotate the valve one position in the clockwise (CW) direction.

(5) Sending “<” or “,” will rotate the valve one position in the counterclockwise (CCW) direction.

5. RS-485 serial communication.

a) To control the Two-Position Fluid Processor or Double Three-Way Diverter with RS-485 communication use a standard 25-pin female to female serial cable with a null modem as described in the Installation section (V). The serial cable is connected to the 25-pin terminal at the back of the unit (see Figure 5). **RS-485 is available only in Two-Position Fluid Processor or Double Three-Way Diverter models with part numbers ending in –03.**

b) Communication with the Two-Position Fluid Processor or Double Three-Way Diverter unit through RS-485 is similar to the RS-232 scheme except a different cable is required. The interface requirements and return menu are identical to RS-232 as described in preceding sections VI. E. Serial Communication. The RS-485 cables are not standard but must conform to the

pin outs, as follows:

Host Computer	LabPRO Function	LabPRO J2 Connector Pin Outs
Receive +	Transmit +	J2-20
Receive -	Transmit -	J2-19
Transmit +	Receive +	J2-4
Transmit -	Receive -	J2-5
Ground	Ground	J2-7
CTS -	Detect	J2-6

c) All pin numbers refer to the 25-pin d-subminiature connector on the rear of the Two-Position Fluid Processor or Double Three-Way Diverter enclosure.

F. Maintenance and Troubleshooting

1. Electrical Maintenance

   a) There is no maintenance required for electronic components.

   b) If an electrical problem is encountered, please consult the electrical installation and troubleshooting sections of the manual. If the problem persists contact your authorized Rheodyne dealer for assistance.

2. Valve Maintenance

   a) With normal use the valve will give many thousands of actuations without trouble. The main cause of early failure, which is seen as valve leakage, is abrasive particles in the sample and/or mobile phase or crystallization of buffer solutions. Either can cause scratches on the rotor seal and stator face assembly.

b) Valve Disassembly

(1) To disassemble the valve, refer to Figures 11 and 12 and proceed as follows:

(2) With the Hex Key provided, remove the Stator Screws (1) from the Stator (2).

(3) Remove the Stator and Stator Face Assembly (3) from the Stator Ring (5). The Stator Face Assembly usually remains on the Stator.

(4) For 10-port valve, use the Hex key to remove three Stator Ring Screws (4) from the Stator Ring.

(5) Remove the Stator Ring (5).

(6) Remove the Rotor Seal (6) from the valve Body (7).
The Rotor Seal is mounted on three pins, and can be pulled off.

c) Valve Reassembly

(1) Refer to Figures 11 and 12 and proceed as follows:

(2) Mount the new Rotor Seal (6) with the slots facing the Stator (2). The three pins (8) on the Shaft Assembly fit into the mating holes (9) in the Rotor Seal only one way.

(3) Replace the Stator Ring (5) so the two short pins on the ring enter the mating holes in the Body (7).

(4) For 10-port valve, replace and tighten the three Stator Ring Screws (4). Tighten each an equal amount until the Screws are fingertight, then turn another half turn.

(5) Mount the new Stator Face Assembly (3) onto the Stator (2). The three pins on the assembly fit into the mating holes in the Stator only one way.

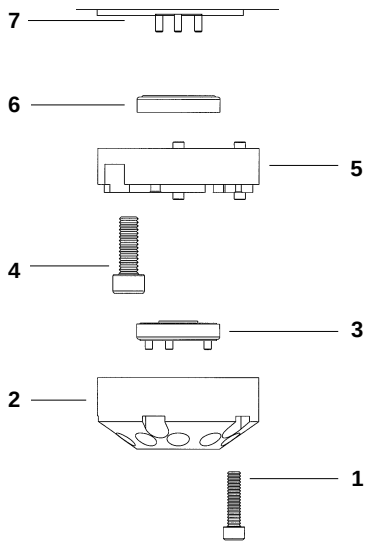


Fig. 11. Exploded view of valve.

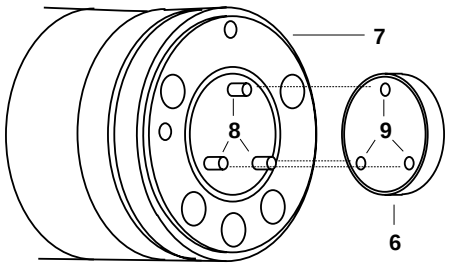


Fig. 12. Mounting new rotor seal.

(6) Replace the Stator (2) and Stator Face Assembly (3) on the valve so that the pin in the Stator Ring enters the mating hole in the Stator.

(7) Replace the Stator Screws (1) into the Stator. Tighten each an equal amount until the screws are fingertight, then turn another half turn.

3. Valve Spare Parts

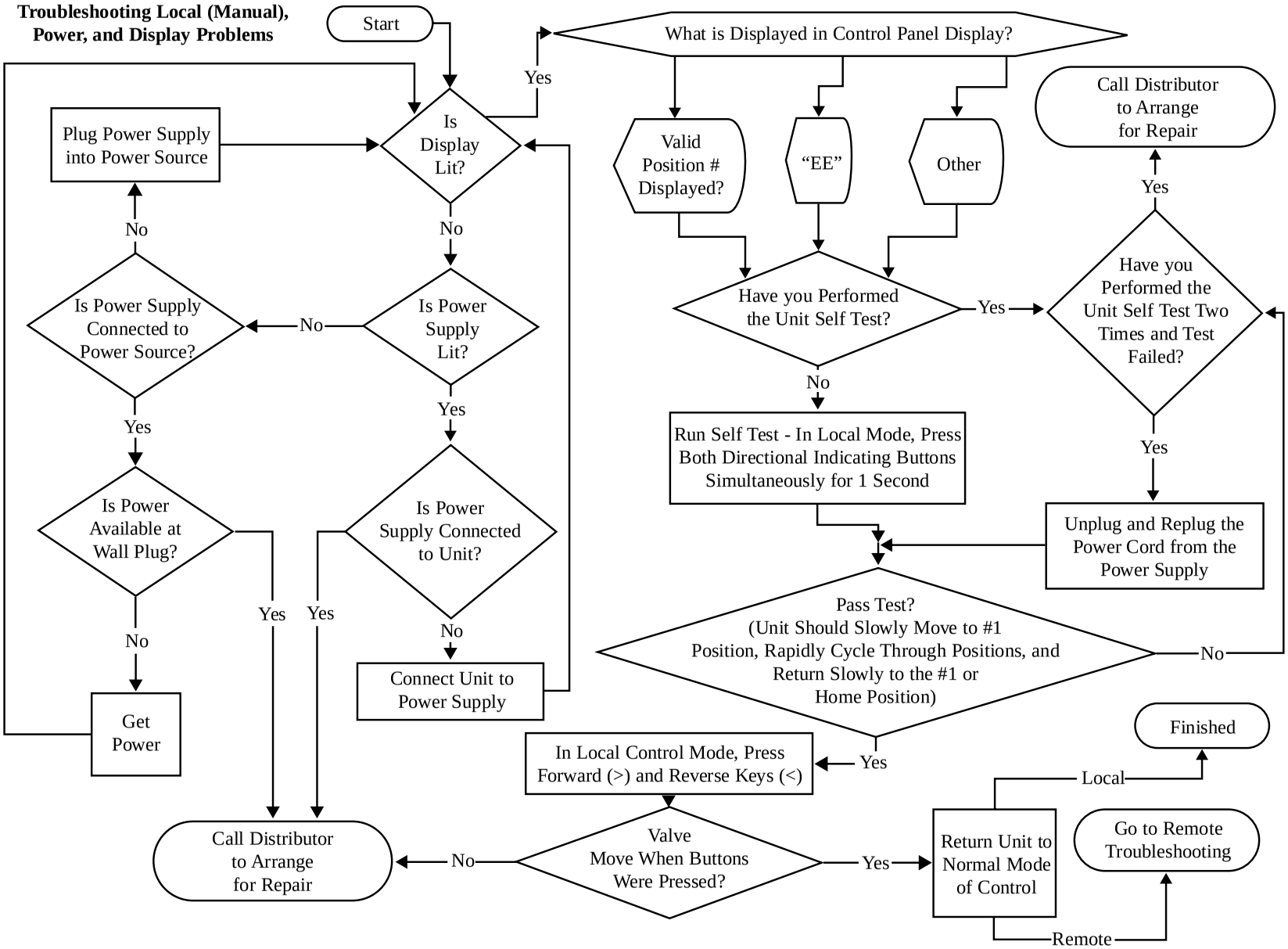
a) All parts needed to maintain the valve are contained in a Rheodyne RheBuild™ Kit. The kit includes: rotor seal, stator face assembly, and hex key(s).
Note: -01, -02, -03 versions of the same model number all use the same RheBuild Kit. The kit part numbers are:

RheBuild Kit P/N	Use for Two-Position Fluid Processor and Double Three-Way Diverter Model
7501-999	PR700-100 and PR750-100
7502-999	PR700-102 and PR750-102
7112-999	PR700-112 and PR750-112
7004-999	PR700-104 and PR750-104

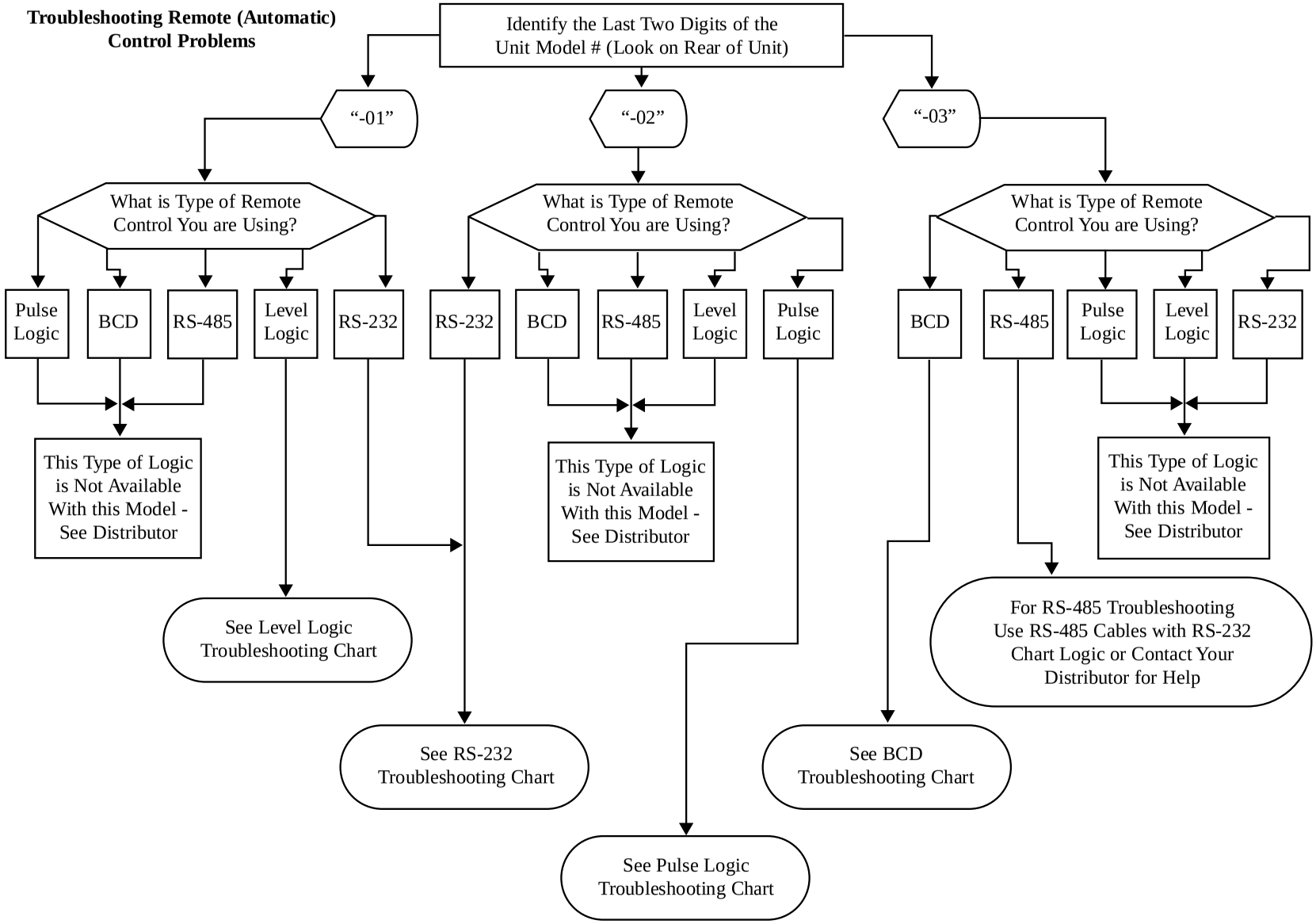
G. Troubleshooting

Symptom	Cause	Solution
1: Valve leaks between the stator and stator ring or from a port.	**A:** The rotor seal and stator face assembly have been damaged by abrasive particles in the sample and/or mobile phase or crystallization of buffer solutions.	Replace the rotor seal and stator face assembly. Filter sample and mobile phase. Flush the valve frequently to prevent crystallization of buffer solutions.
	B: The pressure rating of the valve has been exceeded.	Confirm that the pressure increase is not caused by a blockage in the flow path. If no blockage, lower the flow rate or change the column to decrease the pressure.
	C: The port is damaged and a nut and ferrule cannot seal correctly.	Replace the stator. Consult a Rheodyne distributor for part number.
2: Valve is not rotating.	**A:** There is no power to the Two-Position Fluid Processor.	Confirm there is power at the source, and all electrical connections are secure.
	B: The program and/or wiring to control the Two-Position Fluid Processor is incorrect.	Check the program used to control the Two-Position Fluid Processor. Review the wiring as detailed in the installation section.
	C: Attempting to rotate the valve using the control panel positional selector keys - nothing happens.	Set the control panel control mode to Local (manual) mode and press the appropriate positional selector key.
	D: Attempt to rotate the valve forward from position 2 to 1 or in reverse from 1 to 2 using the control panel positional selector keys - nothing happens.	In Local (manual) mode you cannot rotate forward from 2 to 1 (must rotate in reverse direction) or from 1 to 2 (must rotate in forward direction).
	E: Attempting to rotate the valve using the computer control mode (with either TTL, contact closure, RS-232 or RS-485) - nothing happens.	Verify that the Remote (automatic) mode is selected on control panel.
	F: Attempting to rotate the valve using the computer control mode (with either TTL, contact closure, RS-232 or RS-485) and Remote (automatic) mode is selected on control panel - nothing happens.	Verify that you have programmed the computer or instrument control software correctly and that the device is outputting a correct output (either TTL, contacts, RS-232 or RS-485) and type of logic (level, pulse, BCD) is available.
	G: Additional Problems.	See **Troubleshooting Local (Manual), Power, and Display Problems** (page 23) or **Troubleshooting Remote Control Problems** (page 24).
3: After running the Self Test (see Section VI. C) "EE" is displayed in the numeric display.	**A:** The electronics are not responding correctly.	See Troubleshooting flowcharts on pages 23-28.
4: Remote Control Problems	**A:** Problems arise when attempting to use 1 line Level Logic control.	See Flow Charts on Troubleshooting Remote Control 1 Line Level Logic (page 25).
	B: Problems arise when attempting to use 1 line Pulse Logic control.	See Flow Charts on Troubleshooting Remote Control 1 Line Pulse Logic (page 26).
	C: Problems arise when attempting to use 4 line BCD control.	See Flow Charts on Troubleshooting Remote Control 4 Line BCD Logic (page 27).
	D: Problems arise when attempting to use RS-232 control.	See Flow Charts on Troubleshooting Remote Control RS-232 Control Logic (page 28).
	E: Problems arise when attempting to use RS-485 control.	See Flow Charts on Troubleshooting Remote Control RS-232 Control Logic (page 28).

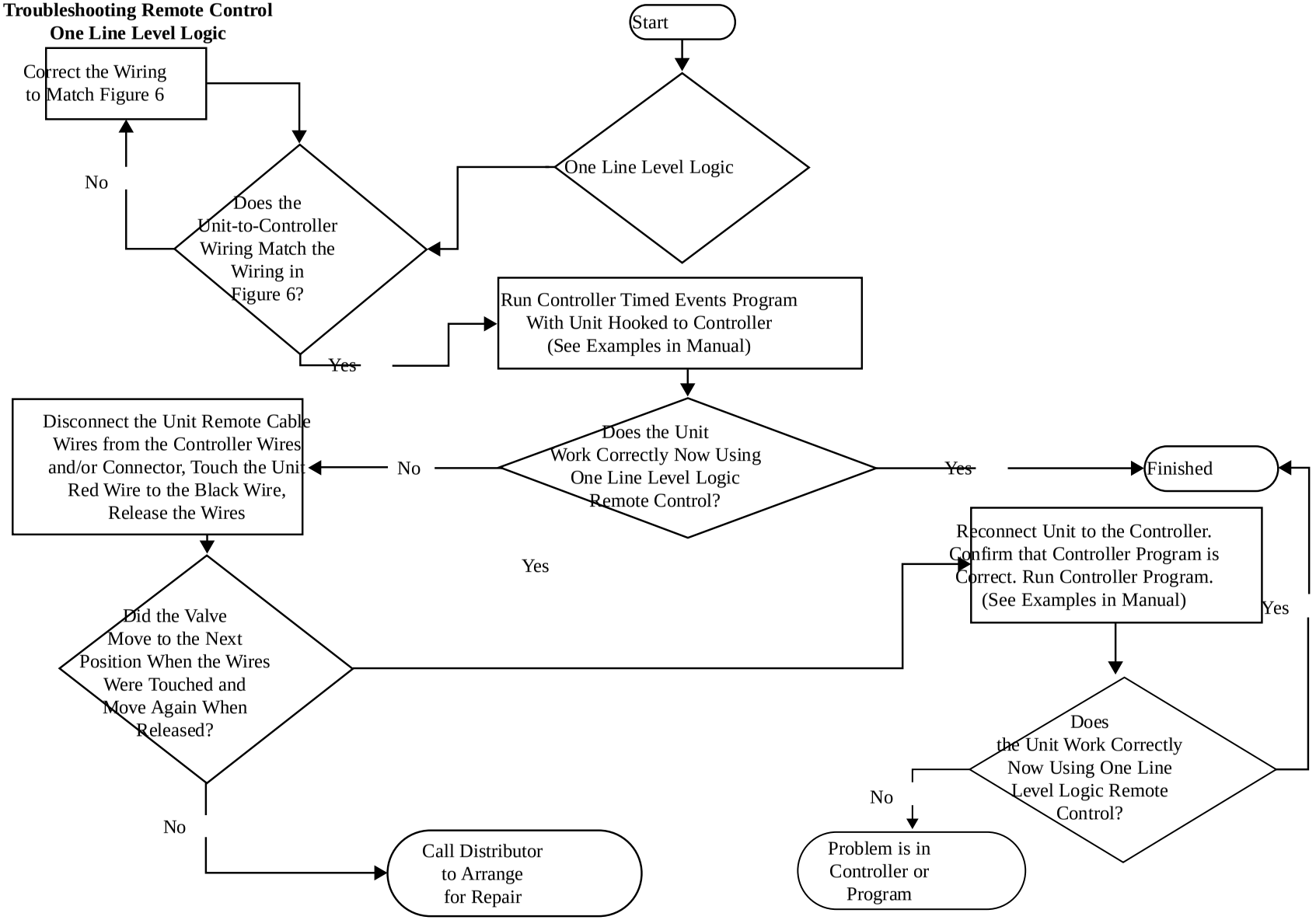
Troubleshooting Local (Manual), Power, and Display Problems



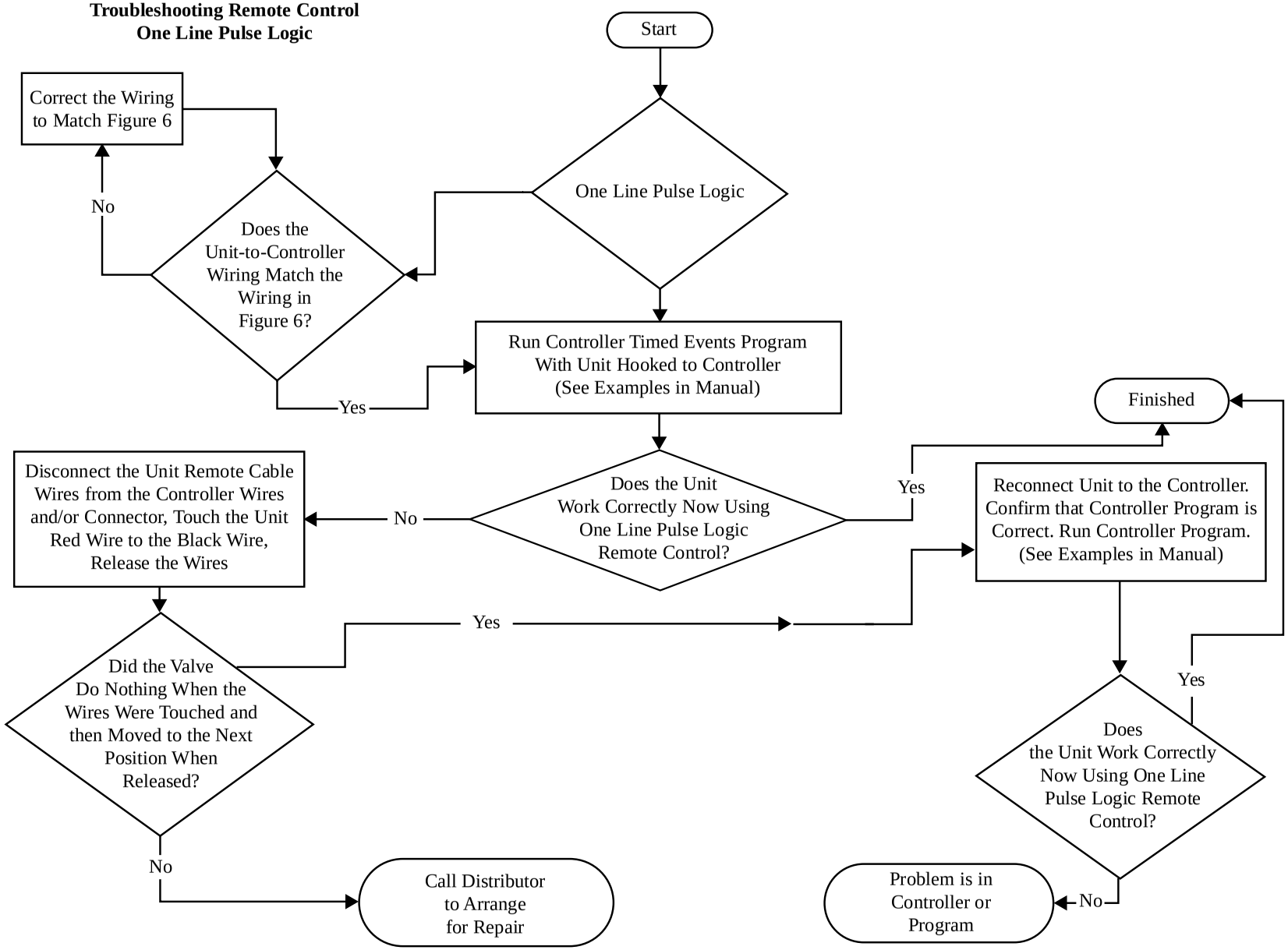
Troubleshooting Remote (Automatic) Control Problems



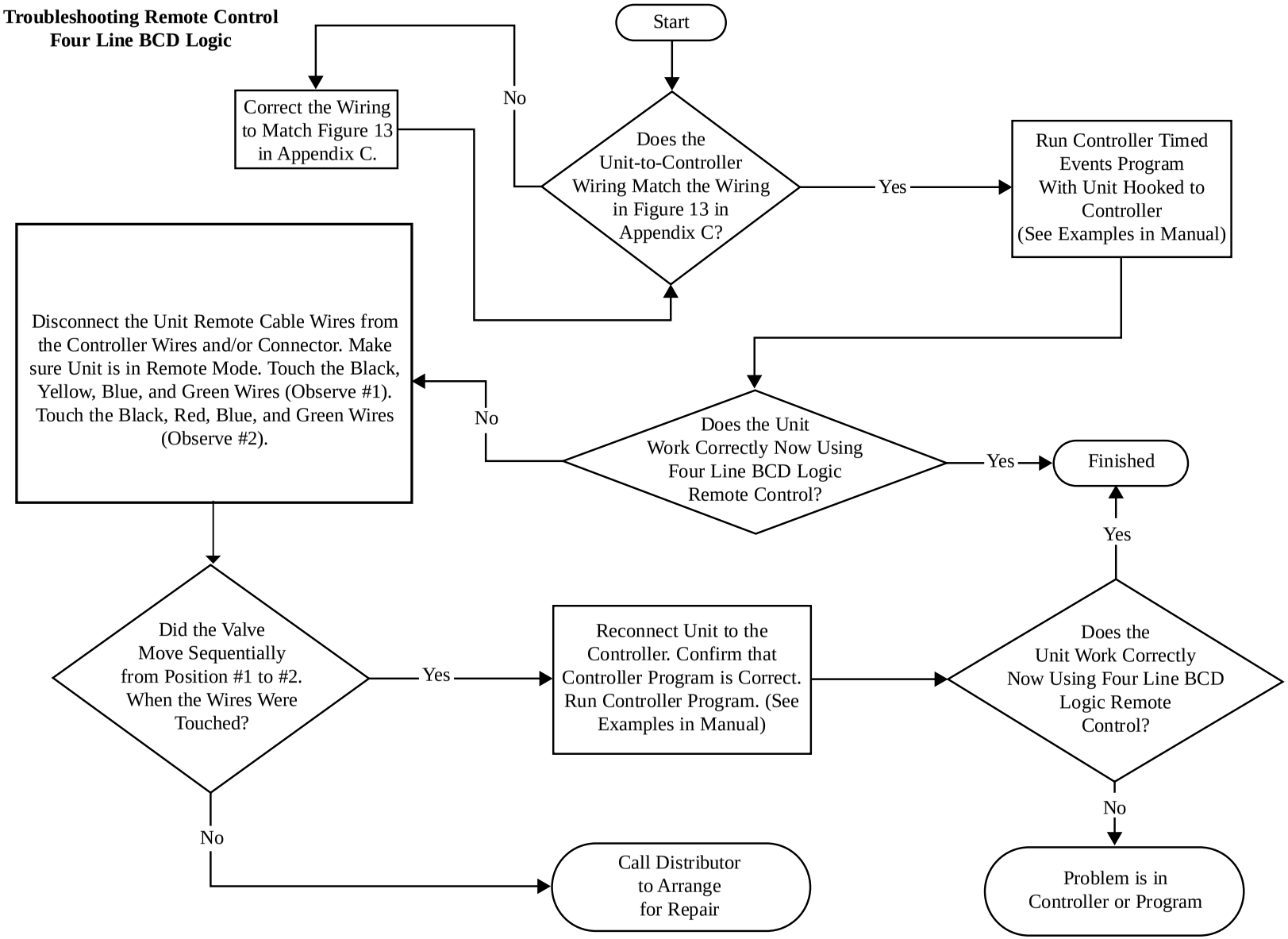
Troubleshooting Remote Control
One Line Level Logic



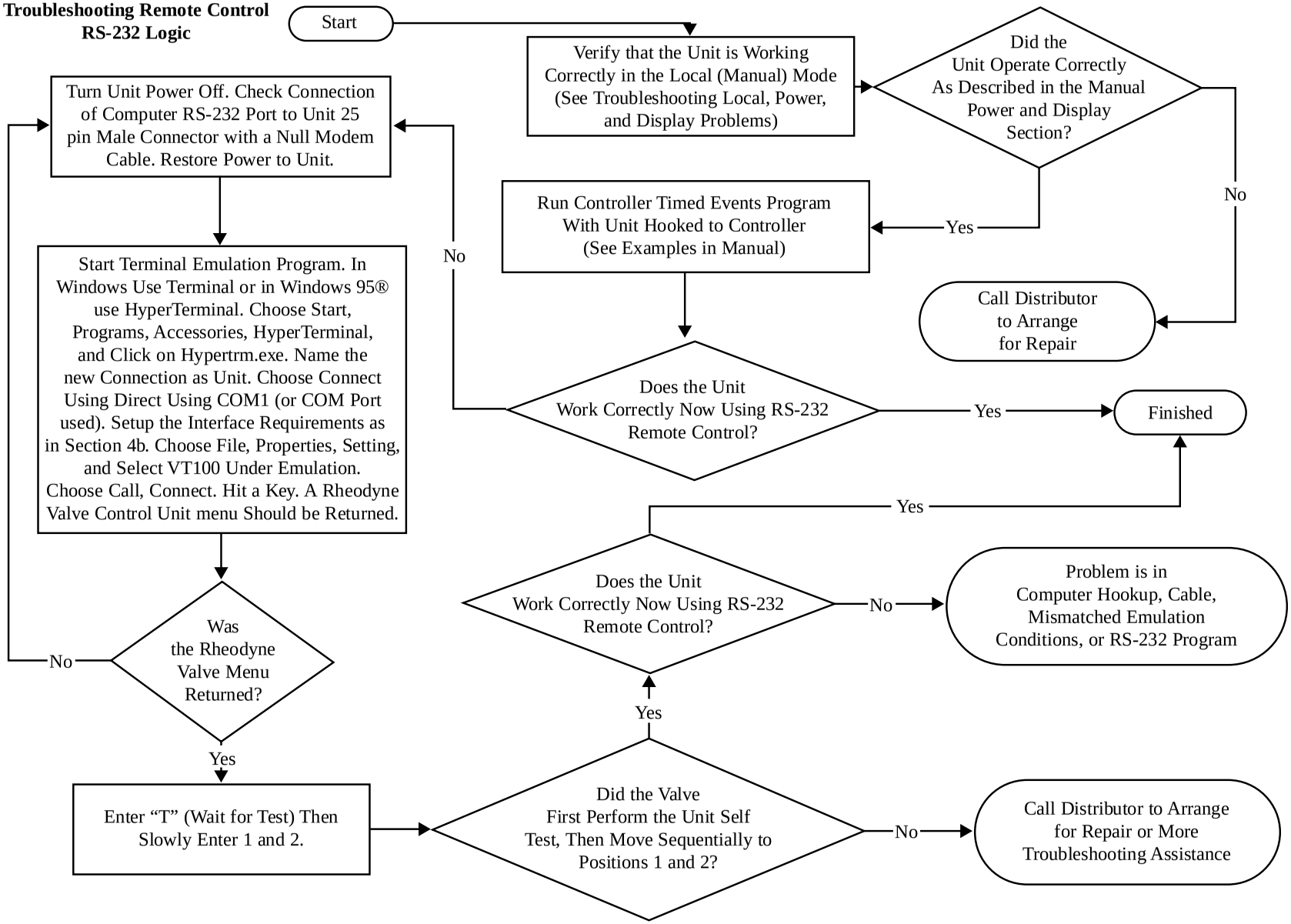
Troubleshooting Remote Control
One Line Pulse Logic



Troubleshooting Remote Control
Four Line BCD Logic



Troubleshooting Remote Control RS-232 Logic



Appendix A. Electronic Definitions in Non-Electronic Terms

BCD
Abbreviation for Binary Coded Decimal. A system of representing numbers in a code using 0 and 1. For example, in a 4 bit code, the number 5 would be 0101.

CCW
Abbreviation for counterclockwise.

Contact Closure
The correct term is open collector or relay. It simply means there is no connection when the circuit is open. The line is either grounded (LO) or not (OPEN).

Cord Set
The electrical power cord to connect the power supply to an electrical wall outlet. The one provided with the LabPRO is for North America.

CW
Abbreviation for clockwise.

Event Relay
See External Event Relay.

External Event Relay
These are the terminals on the instrument where the interface cable is wired. They are also known as Timed Event Terminals, External Event Terminals or Time Functions Switches. Each relay has two terminals. When the relay is a TTL, one is ground, the other is HI/LO (+5 volts/0 volts). When the relay is a contact closure either terminal can be ground, the other is to the control line.

Ground
Common reference point required between two or more devices.

Input
The electrical communication coming into a device. For example, the LabPRO requires either a TTL, contact closure or serial communication.

Interface Cable
The multi-wire cable connecting the LabPRO to the controlling instrument.

Level Logic
Type of electrical signal. In reference to the LabPRO, any change in the control signal's logic state will cause the valve to move one position.

Line Control
A remote control scheme employing separate wires. Each wire is used with a common ground to send signals controlling the instrument.

Logic State
The terminal at the Event Relay is in either one or the other state in the following pairs, HI/LO, OPEN/CLOSE, OFF/ON, OPEN/GROUND. For example, in a contact closure switch the relay is either grounded (GROUND) or not (OPEN).

Output
The electrical communication coming out of a device. For example, the LabPRO has two outputs available, they are serial communication or five feedback lines. The serial communication is via a special cable. The five feedback lines are via the provided interface cable. Four of the lines on the interface cable are BCD position feedback lines and are represented by the following wire colors:

Grey - Feedback 3
White - Feedback 2
Purple - Feedback 1
Orange - Feedback 0

The fifth line is brown and is the Busy/Done feedback (LO=Busy, HI=Done).

Pulse Logic
Different from level logic in that in pulse mode the position of the valve changes only on the rising edge of a change in the control signal, i.e., from LO to HI or closed to open.

Random Access
The valve can be programmed to move directly to the designated position. For example, from position 1 to position 4 in one step rather than move sequentially requiring three program steps. This is available with 4 Line BCD and with Serial Communication.

Serial Communication
A way of communicating with a computer. LabPRO offers both RS-232 and RS-485 options. A special cable is required to connect the LabPRO to your computer if you are using serial communication. RS-232 cable (P/N 5123-067) is different from RS-485 cable.

State
See Logic State

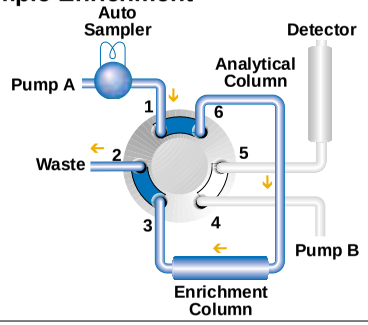
Terminal
The position at the Event Relay where the wire is connected. Each Event Relay has two terminals.

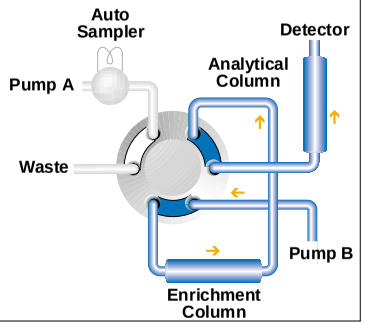
TTL
Abbreviation for Transistor-Transistor-Logic, also called digital logic. A control line is either HI (+5 volts) or LO (0 volts). Typical OFF state of an instrument's TTL switch is HI.

Universal Power Supply
A "black box" or adaptor that converts electrical power from a wall socket to usable power to run the LabPRO. In the case of the LabPRO power supply, the input required is 100-240 VAC, 50-60 Hz. The output of the power supply to run the LabPRO is 24 VDC.

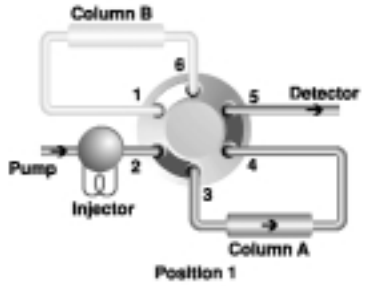
Appendix B. Typical Two-Position LabPRO™ Applications - 6-Port

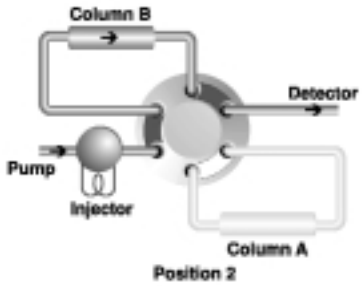
Sample Enrichment





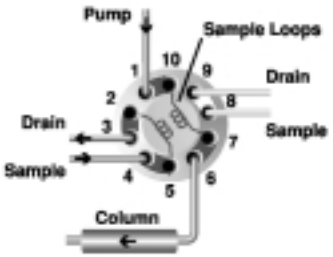
Two Column Selection

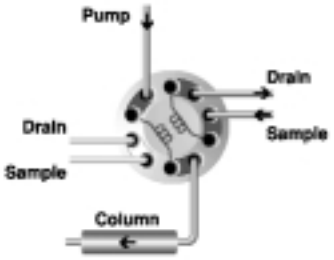




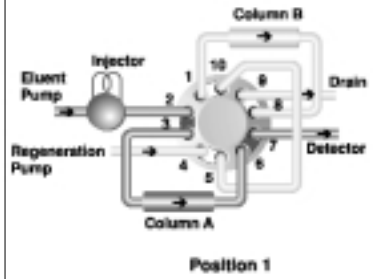
Typical Two-Position LabPRO™ Applications - 10 Port

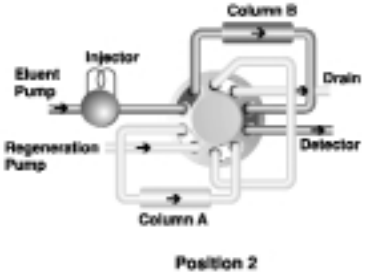
Sample Loop Selection





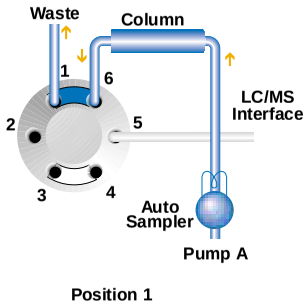
Alternating Column Regeneration

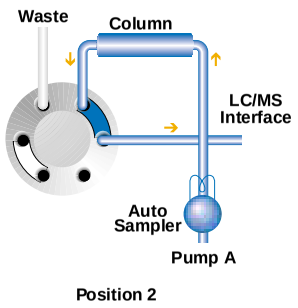




Typical Double Three-Way Diverter Application

LC/MS System





Appendix C. Using Four Line BCD Remote Control

I. 4 line *BCD* control. The instrument used to control this model must have four [4] *TTL* or *contact closure outputs*. This method of control ensures direct access to the chosen valve position.

A. 4 Line *BCD* Control (independent selection of any position):

1. Four *event relays* required. The relays must be capable of simultaneous operation. The position of the valve is dictated by the *states* of the four *event relays.*

2. Wiring the *interface* cable (1) to the HPLC (2) with 4 line *BCD* control (see Figure 13):

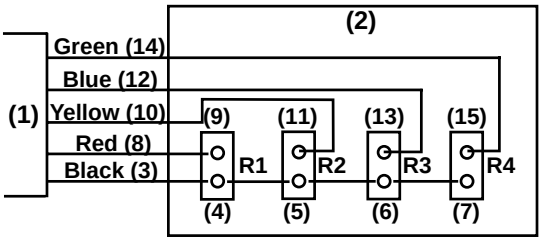


Fig. 13. Four line control.

a) Connect the black wire (3) to the *ground terminal* (4) of the HPLC event relay R1.

b) Connect the jumper wires (supplied) from the *ground terminal* (4) of the HPLC event relay R1 to the *ground terminals* (5, 6, and 7) of the HPLC event relays R2, R3, and R4.

c) Connect the red wire (8) to the control line *terminal* (9) of the HPLC event relay R1.

d) Connect the yellow wire (10) to the control line *terminal* (11) of the HPLC event relay R2.

e) Connect the blue wire (12) to the control line *terminal* (13) of the HPLC event relay R3.

f) Connect the green wire (14) to the control line *terminal* (15) of the HPLC event relay R4.

Appendix C. Using Four Line BCD Remote Control (Continued)

3. *BCD* outputs work using binary logic (2^0=1, 2^1=2, 2^2=4, 2^3=8), therefore when activated the relays will produce the following outputs:

	External Event or Relay #			
	1	2	3	4
Number Produced	1	2	4	8

4. When numerous relays are turned on SIMULTANEOUSLY these numbers become additive, so they can be programmed, as follows:

Desired Valve Position #	External Event or Relay #			
	1	2	3	4
1	Open	Closed	Closed	Closed
2	Closed	Open	Closed	Closed

5. A 4 line BCD generic time programming example follows. (Note: the actual programming will vary depending on the manufacturer of the instrument used):

Time	Relay 1	Relay 2	Relay 3	Relay 4	Comments
Initial	Closed	Open	Closed	Closed	Valve is in position #2
10	Open	Closed	Closed	Closed	Moves to position #1
20	Closed	Open	Closed	Closed	Moves to position #2

Declaration of Conformity

Rheodyne LLC, located at
600 Park Court
Rohnert Park, California 94928
Phone: (707) 588-2000, Fax (707) 588-2020

declares under our sole responsibility that the product LabPRO, a multiple position motorized valve unit, to which this declaration relates is in conformance with the following standards:

EN 50081-1: 1992
EN 50082-1: 1992

following the provisions of the 89/336/EEC Electromagnetic Compatibility Directive.

Models: **PR100-101, PR100-102, PR100-105, PR100-106**
PR500-101, PR550-101, PR700-100, PR750-100
PR703-100, PR753-100, PR700-102, PR750-102
PR700-107, PR750-107, PR700-112, PR750-112
PR700-104, PR750-104

Options: **All**

Approved by:

_____ _____

James C. Noonan, President and CEO **date**

Rheodyne LLC • A Unit of IDEX Corporation • 600 Park Court • Rohnert Park, CA 94928 • USA
Phone 707-588-2000 • Fax 707-588-2020
www.rheodyne.com