Operating Manual
LabPRO™ Stream Selector
Rheodyne Control Number: 2320520A

January 1999

This manual is for the following model numbers:

Model Number	Control Option	Description
PR650-100	(-01,-02,-03 versions)	LabPRO Stream Selector PEEK

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I. INTRODUCTION

A. Description

1. The LabPRO™ Stream Selector contains a compact, automated valve. The Stream Selector is compatible with virtually all remote instruments and laboratory computer systems. The Eight-position, seventeen-port Stream Selector is available in PEEK (polyetheretherketone).

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 Stream Selector is shipped assembled and ready to use. The Stream Selector 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 Stream Selector

1. The following accessories are shipped with the unit:

   a) Hex Key(s)

   b) Jumper Wire(s)

   c) Universal Power Supply

   d) Power Line Cord

   e) Interface Cable

   f) 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 Stream Selector use only a *contact closure* or a *TTL switch.* Do not supply a voltage and current from your instrument to the Stream Selector or it will damage the Stream Selector 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 Stream Selector.

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

5. Use only plastic ferrules in the stator ports of the PEEK valve. Metal ferrules can cause irreparable damage to the plastic stator.

B. Warnings 

1. Do not submerge the LabPRO Stream Selector in liquids.

2. Confirm there is adequate ground between your instrument and the LabPRO Stream Selector. This is especially important with electrospray mass spectroscopy.

3. Plug Power Supply into LabPRO Stream Selector 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: 5.5 MPa, or 55 bar, or 800 p.s.i.

2. Wetted surfaces: PEEK, Kel-F, and an inert polymer.

3. Flow passages: 1.6 mm (0.063”).

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 3 for an illustration of the electrical connections.
2. Barrel connector for power input to the Stream Selector (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 Stream Selector 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) Models ending in –02 accept 1 or 2 line *pulse logic* (*TTL, contact closure*).
      (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)		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 # + Errors	N/A
-02	N/A	Std	N/A	Std	N/A	Std	N/A	Std		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 Stream Selector.

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 two positions of the Stream Selector. The circles represent the ports in the valve stator. The dark grooves are the connecting passages in the rotor seal.

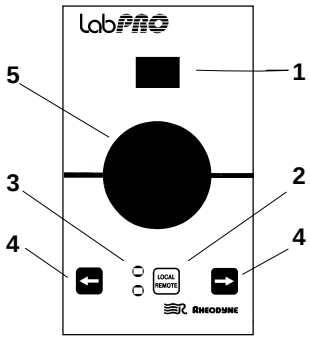


Fig. 1. Front view of LabPRO Stream Selector

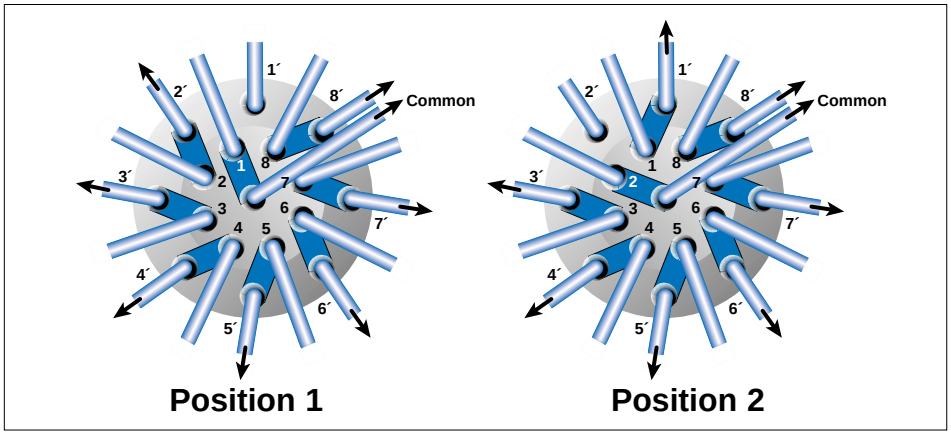


Fig. 2. Flow diagram of LabPRO Stream Selector.

B. Electrical and Communications Connections to Stream Selector

1. All electrical and communications connections to the Stream Selector are made in the rear of the unit (see Fig. 3):

2. Electrical Connections:

   a) Plug the Power Supply (1) male-barrel terminal (2) into the Two-Position Fluid Processor 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.

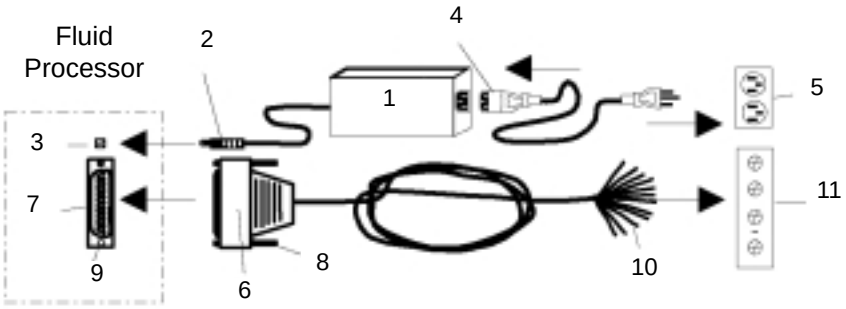


Fig. 3. Electrical and communications connections to Stream Selector.

3. Remote Communication Cable Connections:

   a) There are two ways to accomplish remote control of the Stream Selector:

      (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 Stream Selector. 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 Stream Selector to your instrument (see **Caution - III A.1**). See Figure 3.

(1) Plug the *Interface Cable* connector (6) into the 25-pin terminal (7) located on the rear of the Stream Selector. 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 Stream Selector and the appropriate *output* on your computer. See Figure 3.

(1) Plug the RS-232 or RS-485 *interface cable* connector (6) into the 25-pin terminal (7) located on the rear of the Stream Selector. 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 Stream Selector 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 Stream Selector part numbers.

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

a) This section outlines in detail the three options available for *line control*: 1 line, 2 line, or 4 line control.

b) 1 or 2 *line control* with *level logic*. The instrument used to control this model must have either one [1] or two [2] *TTL* or *contact closure outputs*. The output must also be *level logic*. You can choose to control the Stream Selector with one *event relay* (valve rotation only) or with two *event relays* (valve rotation and direction).

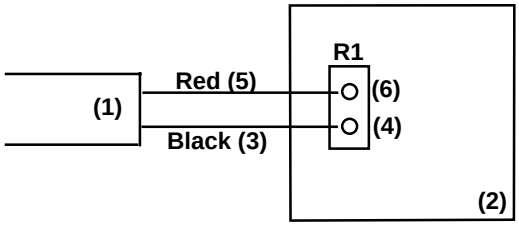


Fig. 4. One line control.

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

(a) One *event relay* required.

(b) Wiring the *interface cable* (1) to the instrument (2) with 1-*line control* (see Fig. 4):

(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.

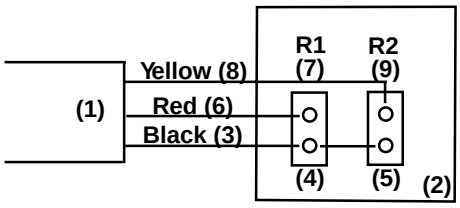


Fig. 5. Two line control.

(2) 2-Line *Level Logic* Control (controls the rotation of the valve on the first line and direction on the second line):

(a) Two *event relays* required.

(b) Wiring the *interface cable* (1) to the instrument (2) with 2-*line control* (see Fig. 5):

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

(ii) Connect the jumper wire (supplied) from the *ground terminal* (4) of the instrument event relay R1 to the *ground terminal* (5) of the instrument event relay R2.

(iii) Connect the red wire (6) to the control line (7) *terminal* of the instrument event relay R1.

(iv) Connect the yellow wire (8) to the control line (9) *terminal* of the instrument event relay R2.

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

c) 1 or 2-*line control* with *pulse logic*. The instrument used to control this model must have either one [1] or two [2] *TTL* or *contact closure outputs*. The output must also be *pulse logic*. You can choose to control the Stream Selector with one *event relay* (valve rotation only) or with two *event relays* (valve rotation and direction).

(1) 1-Line *Pulse Logic* Control (valve rotation only, 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 Fig. 4).

(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.

(2) 2-Line *Pulse Logic* Control (controls the rotation of the valve on the first line and direction on the second line):

(a) Two *event relays* required.

(b) Wiring the *interface cable* (1) to the instrument (2) with 2-*line control* is exactly the same as in *level logic* control (see Fig. 5).

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

(ii) Connect the jumper wire from the *ground terminal* (4) of the instrument event relay R1 to the *ground terminal* (5) of the instrument event relay R2.

(iii) Connect the red wire (6) to the control line (7) *terminal* of the instrument event relay R1.

(iv) Connect the yellow wire (8) to the control line (9) *terminal* of the instrument event relay R2.

(c) 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 model must have four (4) *TTL* or *contact closure outputs*. This method of control ensures direct access to the chosen valve position.

(1) 4-Line *BCD* Control (independent selection of any position):

(a) 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.*

(b) Wiring the *interface cable* (1) to the instrument (2) with 4-line *BCD* control (see Fig. 6):

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

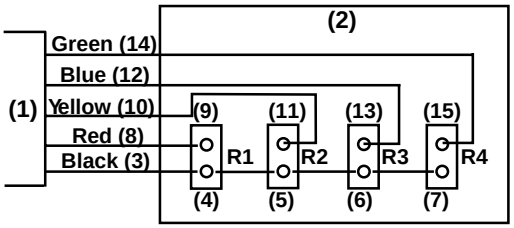


Fig. 6. Four line control.

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

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

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

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

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

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

5. Fittings

a) Stream Selector, designed with flat-bottom ports, uses 1/4-28 flanged or flange-less fittings.

b) Stream Selector can be used with 1/16” or 1/8” O.D. tubing.

VI. OPERATION

A. Control Panel Overview

1. The Stream Selector control panel is shown in Figure 10. 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)

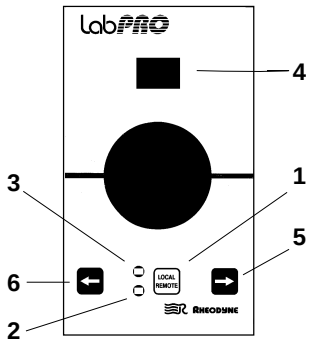


Fig. 9. LabPRO Stream Selector displays and manual selectors

B. Manual Operation

1. To operate the Stream Selector, manually connect the Power Supply to the Stream Selector as described in the Installation section (V).

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

   a) The Stream Selector 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 Stream Selector must be in Remote (automatic) mode to use any method of remote control (1 or 2 line *level logic*, 1 or 2 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 #8) pressing the forward button will move the valve 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 move the valve to the highest valve position (position #8).

C. Stream Selector Self Test

1. To confirm proper operation, the Stream Selector 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 Stream Selector in Local mode and simultaneously press the two "arrow" buttons located near the Local-Remote button for one second.

3. The Stream Selector 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 in detail the three options available for *line control*; 1, 2, or 4 *line control*.

   b) 1 or 2 *line control* with *level logic*. The instrument used to control this model must have either one [1] or two [2] *TTL* or *contact closure outputs*. The output must also be *level logic*. You can choose to control the Stream Selector with one *event relay* (valve rotation only) or with two *event relays* (valve rotation and direction).

      (1) 1-Line *Level Logic* Control (valve rotation only, 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 Fig. 4).

         (d) Important: when using 1-line *level logic* control you need to know which position the valve is in prior to starting an automated sequence. A simple way of accomplishing this is use the control panel to switch to local (manual) mode, move the valve to the desired initial condition, and then return the selector to remote (automatic) mode. 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 #3
50	Closed	Moves to position #4
60	Open	Moves to position #5
70	Closed	Moves to position #6
80	Open	Moves to position #7
90	Closed	Moves to position #8
100	Open	Moves to position #1

(2) 2-Line *Level Logic* Control (controls the rotation of the valve on the first line and direction on the second line):

(a) Two *event relays* are required.

(b) With *level logic*, the event relay R1 change in state (either Closed to Open/Open to Closed, or On to Off/Off to On, or Lo to Hi/Hi to Lo) will rotate the valve one position in the clockwise direction.

(c) With *level logic* the event relay R2 change in state (either Lo to Hi or Hi to Lo) will change the direction of the valve rotation to the opposite direction. If the contact is open (or Off or Hi) the direction will be clockwise. If the contact is closed (or On or Lo) the direction will be counterclockwise.

(d) Wiring the *interface cable* to the instrument with 2-*line control* (see Fig. 5).

(e) Important: when you are using 2-line *level logic* control you need to know the position of the valve prior to starting an automated sequence. A simple way of accomplishing this is to use the control panel to switch local (manual) mode, move the valve to the desired initial condition, and then return the Column Selector to remote (automatic) mode. If a power failure occurs the valve will remember its previous position and stay in that position upon restoration of power.

(f) 2-line *level logic* generic time programming examples follow. (Note: the actual programming will vary depending on the manufacturer of the HPLC used):

(g) Note: it is advisable to make the change of direction using a separate program step prior to the actual positional activation. The change of direction and positional activation can be made using a single programming step – however both relays must activate SIMULTANEOUSLY!

Program 1

Time	Relay 1	Relay 2	Comments
Initial	Open	Open	Valve in position #1
30	Closed	Open	Moves to position #2
30.1	Closed	Closed	Changes direction
30.2	Open	Closed	Moves to position #1
30.8	Open	Open	Changes direction
30.9	Closed	Open	Moves to position #2
40	Open	Open	Moves to position #3
60	Closed	Open	Moves to position #4
80	Open	Open	Moves to position #5
120	Closed	Open	Moves to position #6
120.1	Closed	Closed	Changes direction

c) 1 or 2 *line control* with *pulse logic.* The instrument used to control this model must have either one [1] or two [2] *TTL* or *contact closure outputs*. The output must also be *pulse logic*. You can choose to control the Stream Selector with one *event relay* (valve rotation only) or with two *event relays* (valve rotation and direction).

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

(a) With *pulse logic*, when the Stream Selector is powered ON, the default is clockwise rotation. However, the battery protected memory will remember if rotation had last been in the counterclockwise direction. Therefore it is best to know the initial position and direction of rotation when using this type of logic.

(b) The rotation of the valve is controlled by *event relay* R1. 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 Fig. 4).

(d) Important: when using 1-line *pulse logic* control you need to know which position the valve is in prior to starting an automated sequence. A simple way of accomplishing this is to use the control panel to switch to Local (manual) mode, move the valve to the desired initial condition, and then return the selector to Remote (automatic) mode. 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
60	Open	Moves to position #3
60.1	Closed	Cycles Pulse Logic
90	Open	Moves to position #4
90.1	Closed	Cycles Pulse Logic
120	Open	Moves to position #5
120.1	Closed	Cycles Pulse Logic

(2) 2-Line *Pulse Logic* Control (controls the rotation of the valve on the first line and direction on the second line):

(a) The rotation of the valve is controlled by event relay R1. 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.

(b) The direction of rotation is controlled by event relay 2. With *pulse logic* the direction of valve rotation will reverse 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). However if you desire to change direction, it is necessary to change the state once again prior to the next desired actuation of the valve.

(c) Wiring the *interface cable* to the instrument with 2-*line control* is exactly the same as in *level logic* control (see Fig. 5).

(d) Important: when you are using 2-line *pulse logic* control you need to know the position the valve is in prior to starting an automated sequence. A simple way of accomplishing this is use the control panel switch to local (manual) mode, move the valve to the desired initial condition, and then return the selector to remote (automatic) mode. If a power failure occurs the valve will remember its previous position and stay in that position upon restoration of power.

(e) 2-line *pulse logic* generic time programming examples follow. (Note: the actual programming will vary depending on the HPLC used):

Program 1

Time	Relay 1	Relay 2	Comments
Initial	Closed	Closed	Valve is in position #1
15	Open	Closed	Moves to position #2
30	Closed	Closed	Cycles pulse logic
30.1	Closed	Open	Changes direction
40	Open	Closed	Moves to position #1
40.1	Closed	Closed	Cycles pulse logic
60	Open	Closed	Moves to position #2
60.1	Closed	Closed	Cycles pulse logic
80	Open	Closed	Moves to position #3
80.1	Closed	Closed	Cycles pulse logic
100	Open	Closed	Moves to position #4

d) 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.

(1) 4-Line *BCD* Control (independent selection of any position):

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

(b) *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

(c) 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
3	Open	Open	Closed	Closed
4	Closed	Closed	Open	Closed
5	Open	Closed	Open	Closed
6	Closed	Open	Open	Closed
7	Open	Open	Open	Closed
8	Closed	Closed	Closed	Open

(d) Wiring the interface cable (1) to the instrument (2) with 4-line *BCD* control (see Fig. 6).

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

Program 1

Time	Relay 1	Relay 2	Relay 3	Relay 4	Comments
Initial	Closed	Open	Open	Closed	Valve is in position #6
10	Open	Closed	Closed	Closed	Moves to position #1
20	Closed	Open	Closed	Closed	Moves to position #2
30	Open	Open	Closed	Closed	Moves to position #3
40	Closed	Closed	Open	Closed	Moves to position #4
50	Open	Closed	Open	Closed	Moves to position #5
60	Closed	Closed	Closed	Open	Moves to position #8
70	Closed	Open	Open	Closed	Moves to position #6
80	Open	Open	Open	Closed	Moves to position #7

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 for serial bi-directional control and feedback.

3. Additionally, communications software is required to run a *serial communications* device. Software available to run the Stream Selector 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 Stream Selector 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 Fig. 3).

   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 Stream Selector 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 available commands for controlling the valve. Command descriptions follows:

```
Rheodyne Valve Control Unit Ver. X
    Valve Type:      8Ps 45dg 13.7:1
    Current Port:          1
    Port #:                1-8
    Home:                  H
    BIT:                   T
    CW:                    >
    CCW:                   <
    Enter Selection:
```

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

(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 Stream Selector 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 Fig. 3). **RS-485 is available only in Stream Selector models with part numbers ending in –03.**

b) Communication with the Stream Selector 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 Stream Selector 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 (5) from the Stator Ring (4). The Stator Face Assembly usually remains on the Stator.

   (4) Use the Hex key to remove three Stator Ring Screws (3) from the Stator Ring.

   (5) Remove the Stator Ring (4).

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

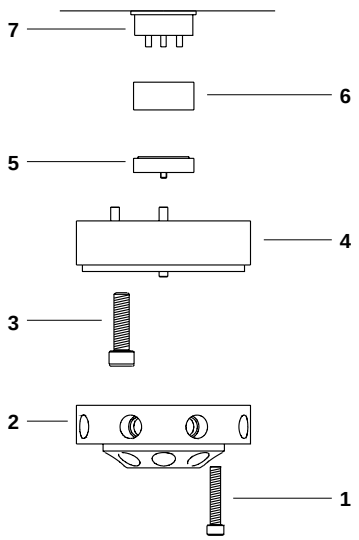


Fig. 11. Exploded view of valve.

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.

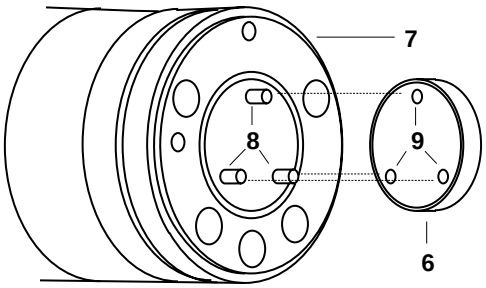


Fig. 12. Mounting new rotor seal.

(3) Replace the Stator Ring (4) so the two short pins on the ring enter the mating holes in the Body (7).

(4) Replace and tighten the three Stator Ring Screws (3). Tighten each an equal amount until the Screws are finger-tight, then turn another half turn.

(5) Mount the new Stator Face Assembly (5) onto the Stator (2). The two pins on the assembly fit into the mating holes in the Stator.

(6) Replace the Stator (2) and Stator Face Assembly (5) 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 finger-tight, 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 number is:

RheBuild Kit P/N	Use for Stream Selector Model
6501-999	PR650-100

G. Suggested Applications

1. The Stream Selector can be used in applications such as the following:

   a) Tablet Dissolution
      (1) As briefly described in Valve Plumbing in the Installation section (V), the Stream Selector used with a Rheodyne sample injector (7725(i) or 9725(i)) creates an efficient system for tablet dissolution.

      (2) The multiple ports of the Stream Selector allow convenient connections to a peristaltic pump leading to the dissolution baths. While one flow path is online with analysis components the other flow paths are ready in stand-by. A position change immediately connects another flow path to the analysis components.

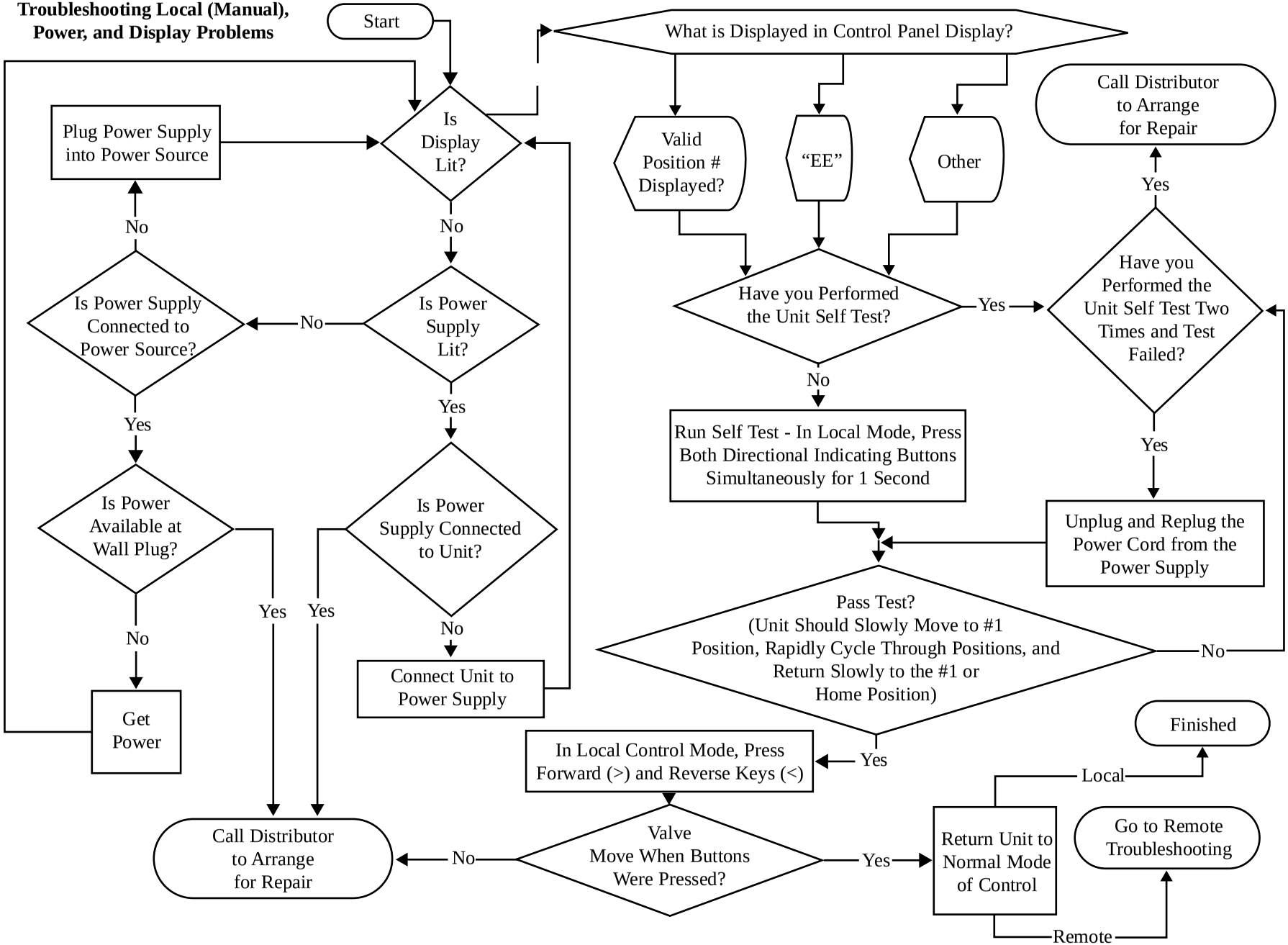
   b) Stream Selection
      (1) Monitor up to eight different streams such as reactors, process streams, and plant effluent lines.

      (2) Simultaneously recycling and selecting of eight different streams to minimize researcher's time.

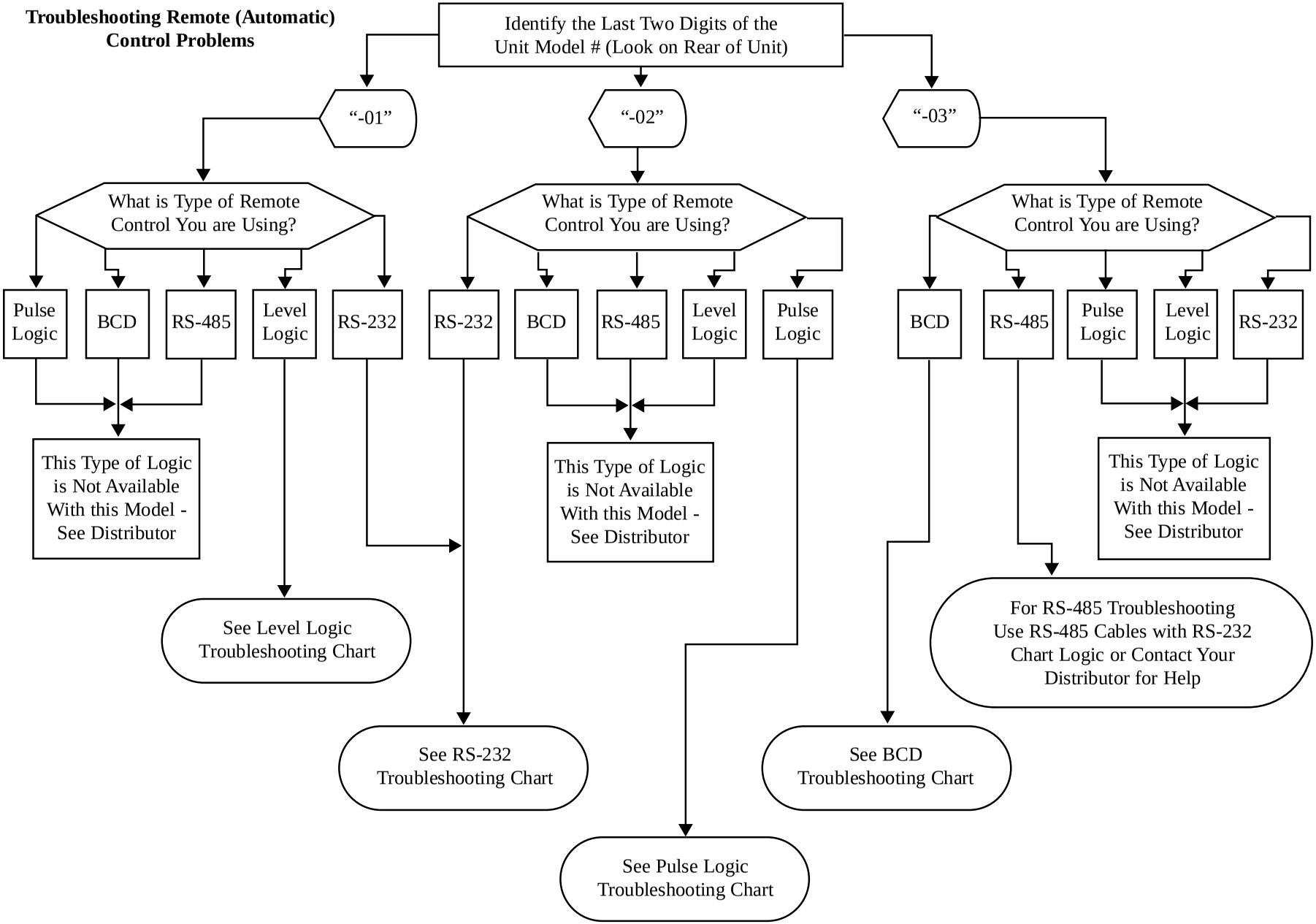
H. Troubleshooting

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 Stream Selector.	Confirm there is power at the source, and all electrical connections are secure.
	B: The program and/or wiring to control the Stream Selector is incorrect.	Check the program used to control the Stream Selector. 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** (page27) or **Troubleshooting Remote Control Problems** (page28).
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 27-32.
4: Remote Control Problems	**A:** Problems arise when attempting to use 1-line or 2-line Level Logic control.	See Flow Charts on Troubleshooting Remote Control 1 and 2 Line Level Logic (pages 29).
	B: Problems arise when attempting to use 1-line or 2-line Pulse Logic control.	See Flow Charts on Troubleshooting Remote Control 1 and 2 Line Pulse Logic (pages 30).
	C: Problems arise when attempting to use 4-line BCD control.	See Flow Charts on Troubleshooting Remote Control 4 Line BCD Logic (pages 31).
	D: Problems arise when attempting to use RS-232 control.	See Flow Charts on Troubleshooting Remote Control RS-232 Control Logic (pages 32).
	E: Problems arise when attempting to use RS-485 control.	See Flow Charts on Troubleshooting Remote Control RS-232 Control Logic (pages 32).

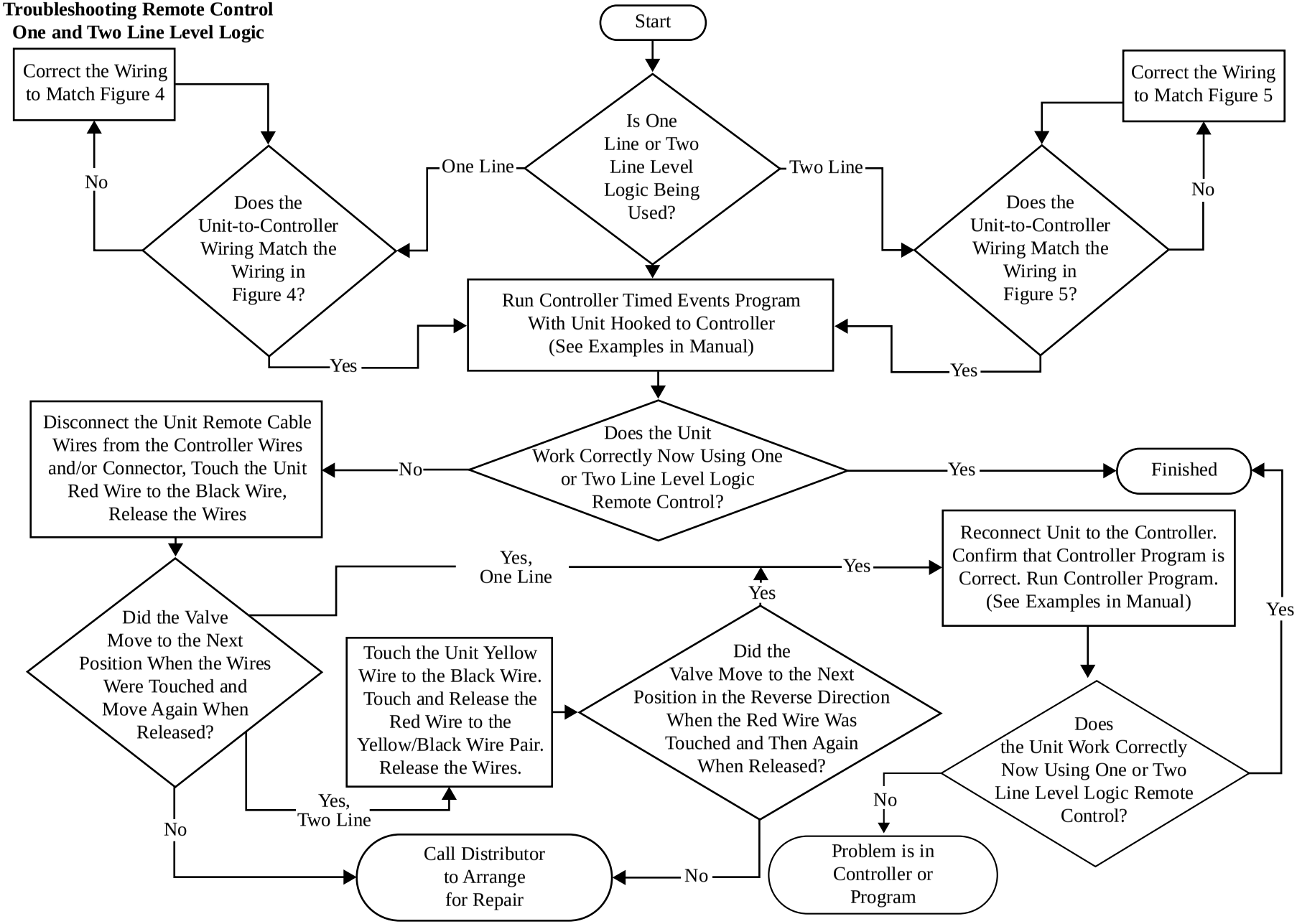
Troubleshooting Local (Manual), Power, and Display Problems



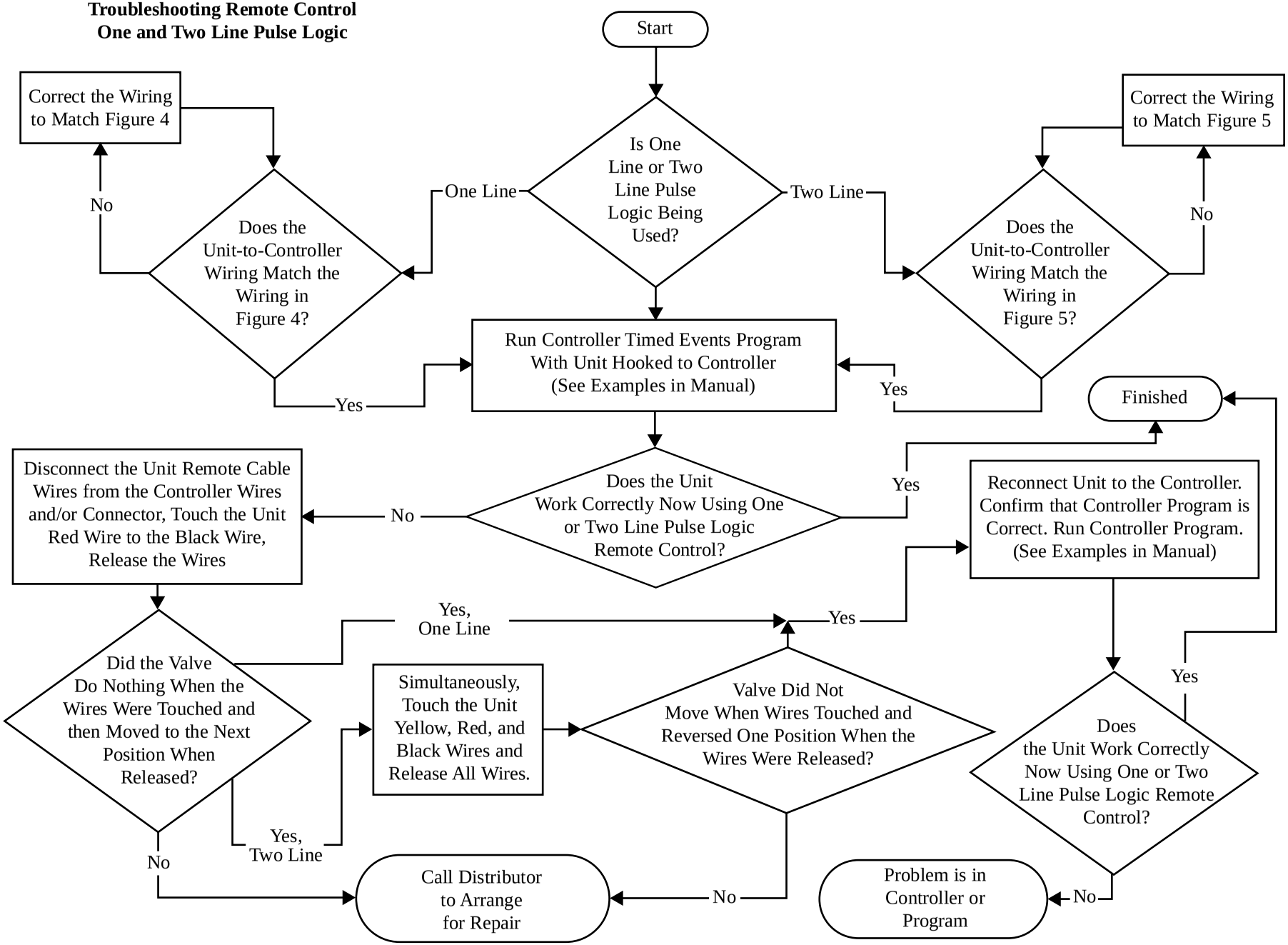
Troubleshooting Remote (Automatic) Control Problems



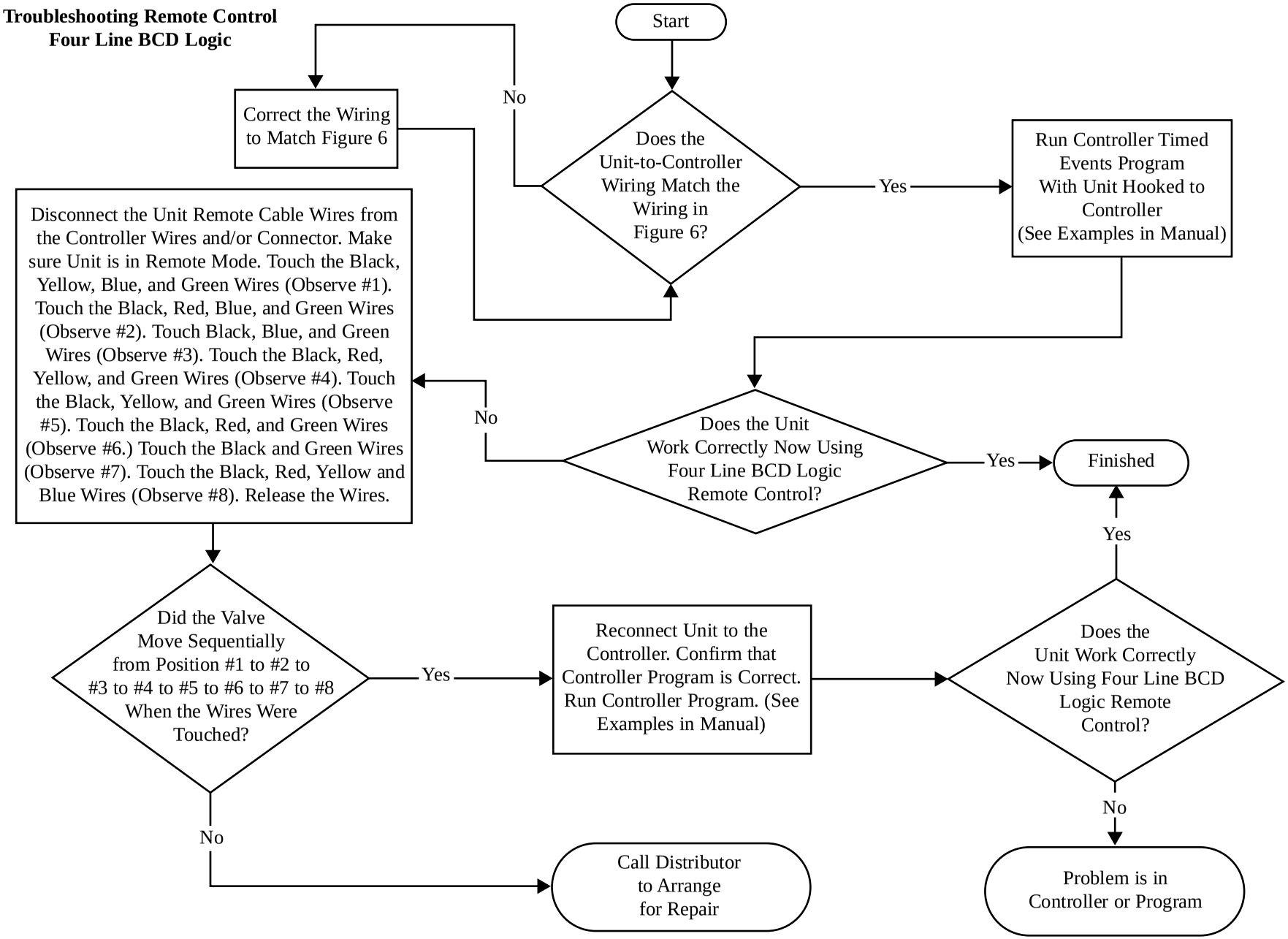
Troubleshooting Remote Control
One and Two Line Level Logic



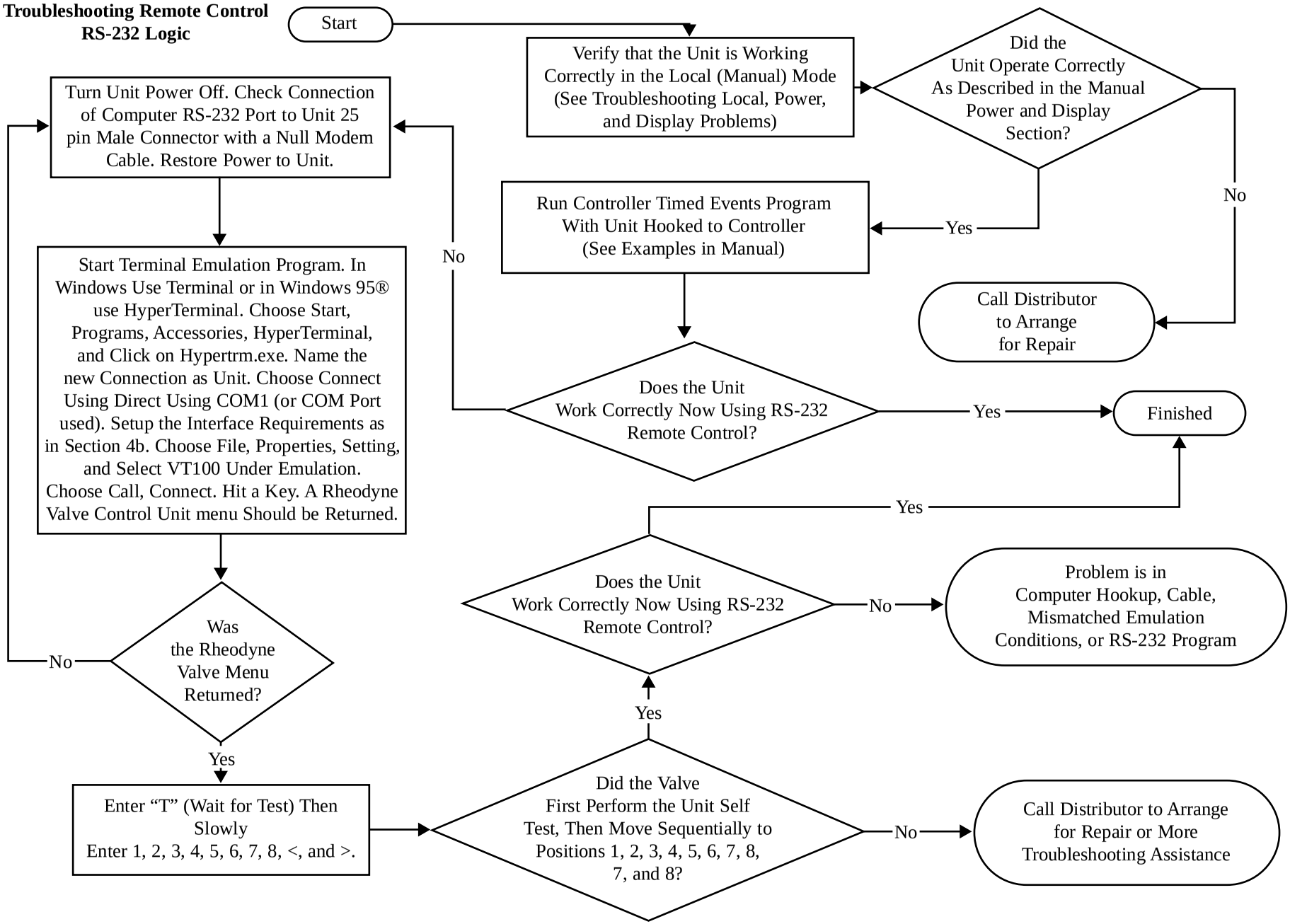
Troubleshooting Remote Control
One and Two Line Pulse Logic



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, GROUND/OPEN. 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.

Declaration of Conformity

Rheodyne, L.P., 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: **PR650-100**
Options: **All**

Approved by:

_____ _____

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

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