Valtek StarPac Intelligent Control Systems

GENERAL INFORMATION

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Valtek® StarPac® Intelligent Control Systems. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating, or performing any maintenance on the valve.

More detailed installation, maintenance and operation instructions are included in the StarPac manual; refer to it when more information is needed.

Separate Flowserve Installation, Operation and Maintenance (IOM) manuals cover the valve (IOM 1 or IOM 27), actuator (IOM 2 or IOM 31) and positioner (IOM 45) portions of the system and other accessories. Refer to the appropriate instructions when this information is needed.

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly adhered to. Modifying this product, substituting non-factory parts, or inferior parts, or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.

WARNING: Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.

Unpacking

1. While unpacking the StarPac system, check the packing list against the materials received. Lists describing the system and accessories are included in each shipping container.
2. When lifting the system from the shipping container, position lifting straps to avoid damage to tubing and mounted accessories. Valves up through 6-inches may be lifted by the actuator lifting ring. On larger systems, lift unit using lifting straps or hooks through the yoke legs and outer end of body.

   WARNING: When lifting a valve/actuator assembly with lifting straps, be aware the center of gravity may be above the lifting point. Therefore, support must be given to prevent the valve/actuator from rotating. Failure to do so can cause serious injury to personnel or damage to nearby equipment.
3. In the event of shipping damage, contact the shipper immediately.
4. Should any problem arise, contact a Flowserve representative.

INSTALLATION

Valve Installation

The StarPac Intelligent Control System valve is installed in the same manner as a conventional control valve and according to industry standards. Refer to the appropriate valve installation, operation, maintenance instructions for proper installation procedures.

If the StarPac system is being installed in an insulated process line, do not place more than four inches of insulation around the StarPac pressure or temperature sensors; otherwise the sensors may not operate properly. In addition, NEVER insulate the StarPac electronics assembly or remote-mounted temperature/pressure sensors (when used).

CAUTION: Do not insulate the StarPac electronics housing or remote-mounted pressure or temperature sensors; otherwise excessive heat may build up and affect operation.

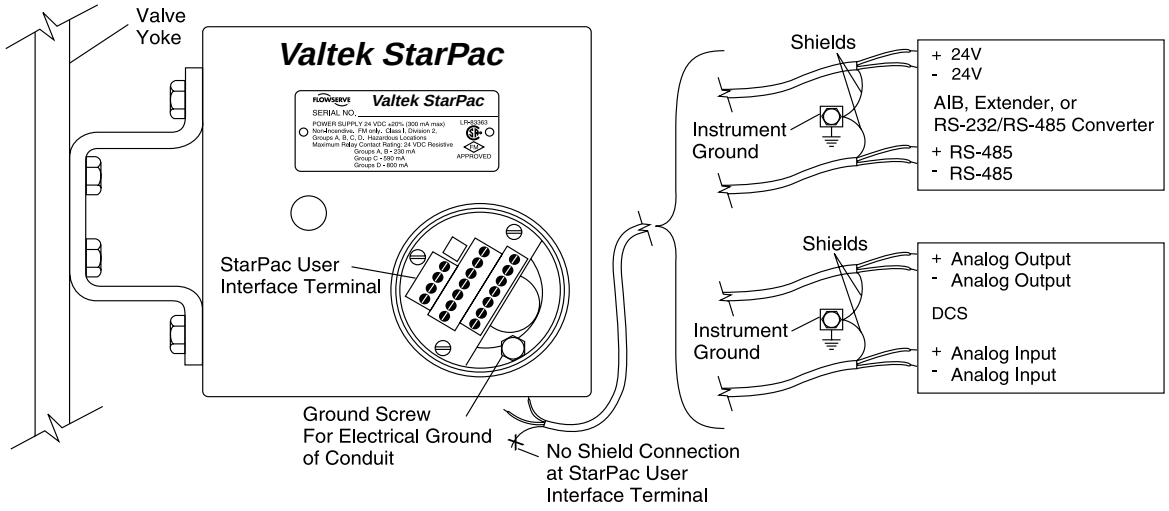

Figure 1: Shielded Wire Diagram

Wiring and Grounding Guidelines

This section will help achieve a maximum 'noise-free' environment and performance with a StarPac unit.

Shielding Versus Grounding

All signals to the StarPac system should be in shielded cables. Shields must be tied to a ground at only one end of the cable to provide a place for environmental electrical noise to be removed from the cable. A ground wire unlike a shield is attached at both ends to provide a continuous path for electrical conductivity.

Grounding Screw

The green grounding screw by the user interface terminal block should be used to provide the unit with an adequate and reliable earth ground reference. This ground should be tied to the same ground as the electrical conduit. Additionally, the electrical conduit connecting to the StarPac unit should be earth grounded at both ends of its run. **The green grounding screw must not be used to terminate signal shield wires.**

24VDC Power

The 24VDC connection points will work best with shielded twisted pair wire with the shield wire connected only at the source. The input power is isolated within the StarPac system and may be referenced to whatever level is necessary. **The 24VDC power supply should not be connected to earth ground.**

RS-485 Communication

RS-485 wiring requires the use of a shielded twisted pair cable, which is grounded only at the source and not in the StarPac unit. (For maximum performance, wire should have a characteristic impedance of 120 ohms.) These signals are referenced to the StarPac internal system ground; hence this is the main fault path should one of the isolation points fail. Therefore, care must be taken to ensure the RS-485 cable is wired correctly.

The RS-485 allows only a 7 to 12V common mode voltage differential between stations. Flowserve's Valtek RS-232 to RS-485 converter is not a grounded connection. PCs with internal RS-485 cards, on the other hand, are often grounded. If another ground communication device is on the network, a fault condition will almost certainly exist due to transient and steady state differences in ground potential.

4 - 20 mA Command Input, Auxiliary Input, and Feedback Output

These signals are isolated, but shielded twisted pair wire should be used to reduce crosstalk from other signals. The shield should be connected only at the source.

4 - 20 mA I/P Output

This signal is not isolated from the StarPac internal system ground and will provide a fault path if the I/P or connecting wires become grounded. Shielded twisted pair wire should be used with the shield connected in I/P.

Discrete Inputs and Outputs

These signals are isolated, but because they are frequently used to switch high voltage (120VAC), they should be run in separate shielded wire paths away from the other StarPac signals.

AIB and RS-232 to RS-485 Converter Connection

When connecting a StarPac system to a communication device, no shield or ground connections exist. Hence, the 24VDC power and RS-485 communication shield drain wires must be connected to a convenient ground near the AIB or converter.

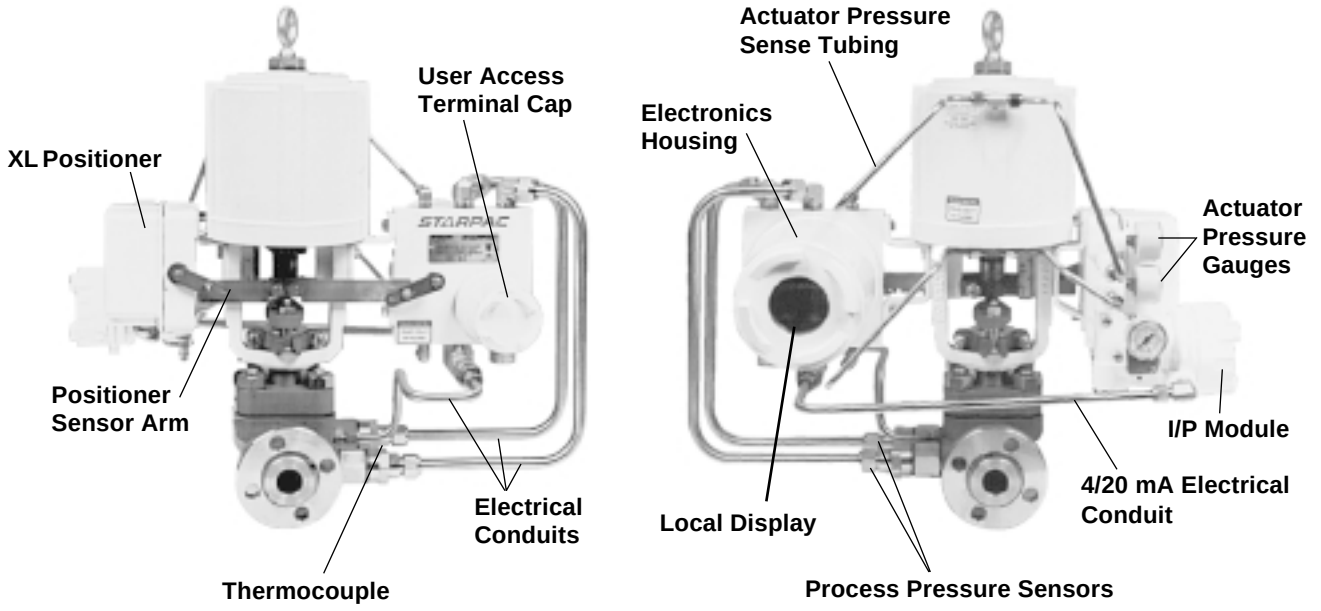

Figure 2: StarPac Intelligent Control System Components

Wiring The StarPac System

All electrical connections must be done according to local and industry electrical codes. Flowserve recommends a shielded cable be used for the RS-485 command signal wire (i.e., Belden 9841 or equivalent).

When connecting multiple StarPac systems, a parallel daisy-chain wiring pattern is used. Connect the StarPac branch lines to the main line, keeping branch lines as short as possible. The total length of wiring should not exceed 4,000 feet (1,200 meters) without the use of repeaters.

Avoid devices producing electrical 'noise' while installing the cable.

CAUTION: The following procedure should be performed on the bench or with the unit isolated so that unexpected valve stroking will not adversely affect the process.

WARNING: The following procedures may cause the valve to stroke, causing pressures and temperatures to vary from their norms. Notify appropriate personnel that the valve may stroke unexpectedly. Flowserve suggests that the system be isolated from the process, if installed in line.

Four StarPac system models are available: SP, SPJS SPJD and NT. The electronics model for a system is most easily identified by the face plate of the local display. If the black cover of the face plate has printed information with an 'ABC' table for the display parameters, the system contains SP electronics package.

If the black cover of the face plate shows only the StarPac and Valtek logos, the system is an SPJS, SPJD, or NT unit. The SPJS and SPJD models are identical except that the SPJD version has two Modbus ports. To tell the difference, remove the cover on the user access terminal. If the user interface terminal block has 18 connections, the unit is a SPJS electronics package; if the terminal block has 20 connections, it is the SPJD or NT package.

Model	Local Display	User Interface Block	Software
SP	Numeric Only	18 Terminals	StarTalk
SPJS	Alphanumeric	18 Terminals	StarTalk for Windows
SPJD	Alphanumeric	20 Terminals	StarTalk for Windows
NT	Alphanumeric	20 Terminals	StarTalk for Windows

***NOTE**: StarTalk and StarTalk for Windows® interface software packages use different communication protocols and are not compatible. Contact a Flowserve representative for more information about upgrade options.*

To connect the wiring to the StarPac system, refer to Figures 1, 2, 3 and Table I, and proceed as follows.

1. Remove the StarPac user interface housing cover (small cap).

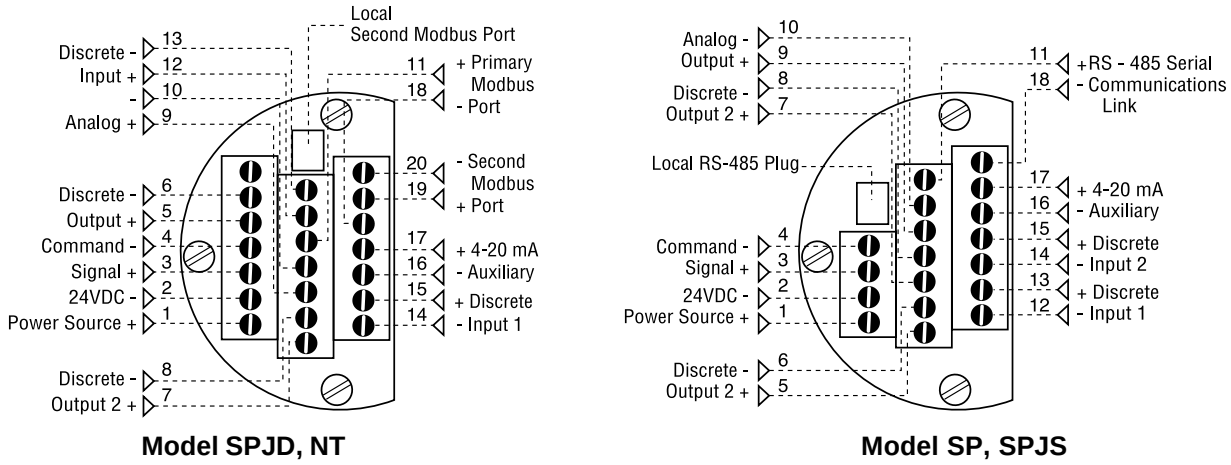

Figure 3: User Interface Terminal Pinouts

WARNING: Do not remove the electronic housing cover in flammable atmospheres; otherwise possible injury to personnel or equipment may occur.

2. Connect the required wires to the terminal interface block and computer as described in Figure 3 and Table I. (The system must have 24 VDC power and signal cable for operation.)

   ***NOTE**: The StarPac system remembers the operating mode setting (automatic or manual) from the last time the unit had power. When power to the system is turned on again, the unit will resume operation in the previous mode.*

   Normally the StarPac system arrives from the factory set in the manual operating mode. This means a command signal will position the valve the same as a conventional control valve, providing a plug position proportional to the 4 - 20 mA signal.

   To avoid upsetting the process because of improper operating mode selection:

- Ensure that the system arrived from the factory with the proper operating mode setting in the shop prior to installation by connecting the air supply and command signal, then turning on the power and looking at the mode value on the local display, or;
- Set the proper operating mode for the particular application in the shop prior to installation by selecting the desired operating mode from the Tuning/ Tune screen in the StarTalk software, or;
- Ensure that the block valves in the process line around the StarPac system are closed and the process is diverted around the unit.

3. Turn on the 24 VDC power to the unit, and verify that the StarPac system has been correctly wired by checking the following:

- 24 VDC power is at least 300 mA and between 21.6 and 27.0 VDC

Table I: User Interface Terminal Connections

Signal	Positive Term. No.	Negative Term. No.
24 VDC power	1	2
Valve command signal	3	4
Primary RS-485 communication link (Port A)	11	18
RS-485 communication link (second / Port B)	19	20
Auxiliary input (4 - 20 mA)	17	16
Analog output (4 - 20 mA)	9	10
Discrete input 1 – switch/ solenoid monitoring (discrete mode source input)	13	12
Discrete input 2 – switch/ solenoid monitoring	15	14
Discrete output 1 (malfunction alarm contact)	5	6
Discrete output 2 (special)	7	8

- Polarity is correct
- Local display is on; if not, check the power supply or reset switch

  The StarPac local display should now be on, indicating the following:

- Valve stem position
- Setpoint signal
- Process flow value (gas or liquid)
- Temperature of process
- Upstream (P_1) and downstream (P_2) pressures

  At this point the StarPac unit is installed and will operate as a conventional control valve receiving a 4 - 20 mA command signal from a DCS, or other device, and stroking the valve accordingly.

Before additional work can be done with the StarPac system (configured, calibrated and operation mode changed, etc.) a RS-485 communication cable must be connected to the unit and RS-485 communication port on a computer with the StarTalk software. See the StarPac manual for more information.

4. Replace the StarPac user interface housing cover.

System Default Configurations

StarPac systems are shipped from the factory ready for installation and operation. Rarely do the units need to be reconfigured prior to operation. Table II lists the factory default communication/failure mode settings. If these settings are not correct for the equipment being used, proceed to the following sections.

Table II: Factory Default Mode Settings

Description	Setting
Address	1
Parity	odd
Baud Rate	19,200
Modbus Communication Mode	RTU
RS-485 Termination Resistor	Installed
Failure Mode Setting	Pass through command signal on loss of power

Selecting Correct Address Setting

If the StarPac system is the only unit on the communication network, the default address (1) is acceptable.

If multiple StarPac systems will be operating on the same communication network, each unit must have a unique address. Before changing the address, use the StarTalk software to determine what other devices are on the existing line. (Remember to include devices that may be temporarily off line.)

If the default address setting needs to be changed, refer to Figures 4 and 5, Table III and Changing Communication Settings section, and make the necessary change.

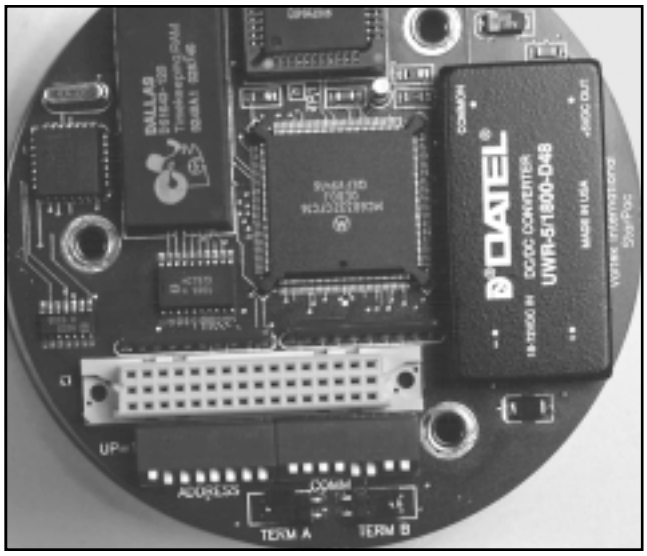

Figure 4: Dip Switch Blocks

Selecting Correct Baud Rate Setting

StarPac systems support baud rates of up 57,600 baud. However, both the StarPac system and StarTalk software are shipped from the factory set to 19,200 baud.

If the default baud rate setting needs to be changed, refer to Figures 4 and 5, Table IV and Changing Communication Settings section, and make the necessary change.

Selecting Correct Modbus Transmission Mode

Two transmission modes exist in a Modbus system, ASCII and RTU (default). Use the ASCII mode when transmitting information through a device that uses ASCII control codes; for example, a modem. Use the RTU mode when connecting directly to both devices; for example, an RS-485 interface card wired directly to a StarPac system.

If the default Modbus transmission mode setting needs to be changed, refer to Figures 4 and 5, Table IV and Changing Communication Settings section, and make the necessary change.

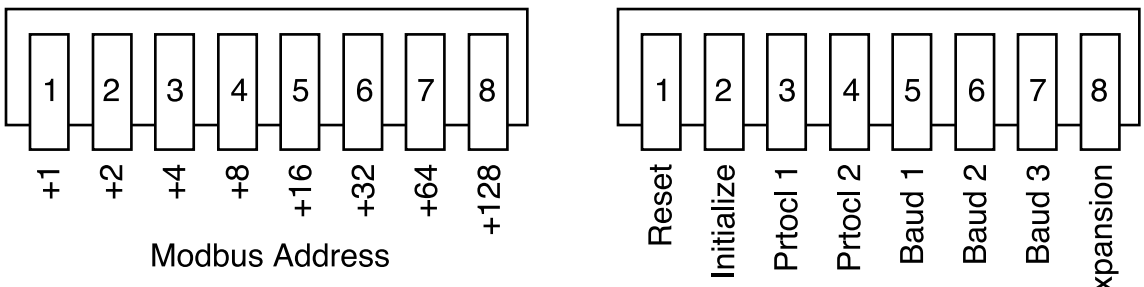

Figure 5: Dip Switches with Labels

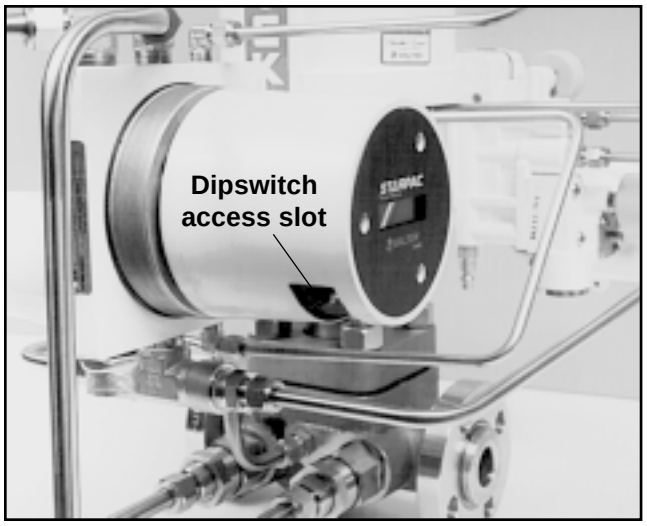

Figure 6: Dip Switch Access

Selecting Proper RS-485 Termination Resistor Setting

A termination resistor must be installed on the two most remote devices on the network, counting the host computer as any other device.

(For example, a single StarPac system and the RS-485 driver in the host computer would each require the termination resistor to be installed. If four StarPac systems were on the network with a host computer, decide which of the two devices have the most combined cable length between them. These two devices should have the termination resistors installed. The termination resistors should be disabled in the devices not considered to be the most remote using the instructions in the next section. Using more than two termination resistors in a network can cause the RS-485 communications to operate erratically or fail.)

If the RS-485 termination resistor needs to be changed, refer to Figure 5, Table IV and Changing Communication Settings section, and make the necessary change.

Changing Communications Settings

If the StarPac system communication settings (address, parity, baud rate, Modbus transmission mode, and RS-485 termination resistor) need to be changed; refer to Figures 4 and 5 and Table IV and proceed as follows.

WARNING: Never remove the StarPac electronics housing cover in explosive atmospheres; otherwise, nearby personnel and equipment could be injured.

CAUTION: Properly ground yourself before handling the sensitive StarPac electronics; otherwise unseen damage to components may occur.

1. If the StarPac system is installed in line, make sure that taking it and the valve off line will not adversely affect the process.

Table III: Address Dip Switch Settings

1	2	3	4	5	6	7	8	Switch no. on address block 1 = up = off 0 = down = on
1								Adds 1 to address value
	1							Adds 2 to address value
		1						Adds 4 to address value
			1					Adds 8 to address value
				1				Adds 16 to address value
					1			Adds 32 to address value
						1		Adds 64 to address value
							1	Adds 128 to address value

NOTE: *Down means toward the circuit board; up means away from the circuit board.*

2. Turn off the 24VDC power to the StarPac System.
3. Remove the large cover from the StarPac electronics housing. (See Figure 2.)
4. Make the required dip switch changes (address, parity, baud rate, and Modbus transmission mode) according to Tables III and IV. These switches are visible through the window cut in the lower side of the shroud. (See Figure 5.)
   a. The first dip switch block (marked address) defines the Modbus address of the StarPac system using binary coded decimal numbers (switch 1 = 1; 2 = 2; 3 = 4; 4 = 8; 5 = 16; 6 = 32; 7 = 64; 8 = 128). The switches that are up (off condition) define the address, refer to Table III. For example, set address 11 by putting switches 1, 2, and 4 (1 + 2 + 8 = 11) up (off condition) and 3, 5, 6, 7, and 8 down (on condition).
   b. The second dip switch block sets the parity, baud rate and Modbus transmission mode.

   NOTE*: This block also contains initialization and reset switches described later. Parity changes are also done by using the switches marked PRTOCL 1 and 2 as shown in Table IV.*

   c. Set the baud rate by using the switches marked BAUD 1, 2, and 3 as shown in Table IV.
   d. Set the Modbus transmission mode with the switch marked EXPAN. When the switch is up (off), the transmission mode is RTU. When the switch is down (on), transmission mode is ASCII.

   NOTE: *If the StarPac unit has a dual communication port (model SPJD or NT), the single set of DIP switches configures both ports. All of the communication parameters are the same including the address of two ports. The identical address settings should not conflict because separate ports are isolated and independent for use on different networks.*

Table IV: Protocol Dip Switch Settings

Switch Label								Description
Reset	Init	Protocol 1	Protocol 2	Baud 1	Baud 2	Baud 3	Expan	
0								Reset (halt processor)
1								Normal Operation *
	0							Initialize on Startup
	1							Normal Startup
		0	0					No Parity
		1	0					Even Parity
		0	1					No Parity
		1	1					Odd Parity *
				0	0	0		Invalid
				1	0	0		1200 Baud Rate
				0	1	0		2400 Baud Rate
				1	1	0		9600 Baud Rate
				0	0	1		19200 Baud Rate *
				1	0	1		31250 Baud Rate
				0	1	1		38400 Baud Rate
				1	1	1		57600 Baud Rate
							0	ASCII Trans. Mode
							1	RTU Trans. Mode *

* default factory settings

5. The jumper for the termination resistor labeled TERM (see Figure 4) is located at the end of the protocol dip switch block. Place the jumper over both pins if the termination resistor is needed, and over one pin for storage if it is not.

   ***NOTE**: If the StarPac unit has a dual communication port (model SPJD or NT) the termination resistor jumper for the second port is located 90 degrees clockwise from the jumper described above and can only be accessed by removing the white protective plastic shroud from the electronics assembly. Note second port jumper only needs to be set according to requirements of the second network.*

6. When the required communication settings have been made, replace the white shroud (if removed) and the large StarPac electronic housing cover.

Changing the Power Failure Setting

On loss of power, the StarPac is factory set to pass the command signal to the I/P (unless ordered otherwise). This configuration causes the system to assume a traditional control valve mode and respond to an external 4 - 20 mA command signal. During loss of power and if the application warrants, the StarPac system can be configured to fail using the fail-safe spring(s) inside the cylinder actuator. This is accomplished by changing the power failure setting as described below. (Refer to Figures 2, 6, 7 and 8.)

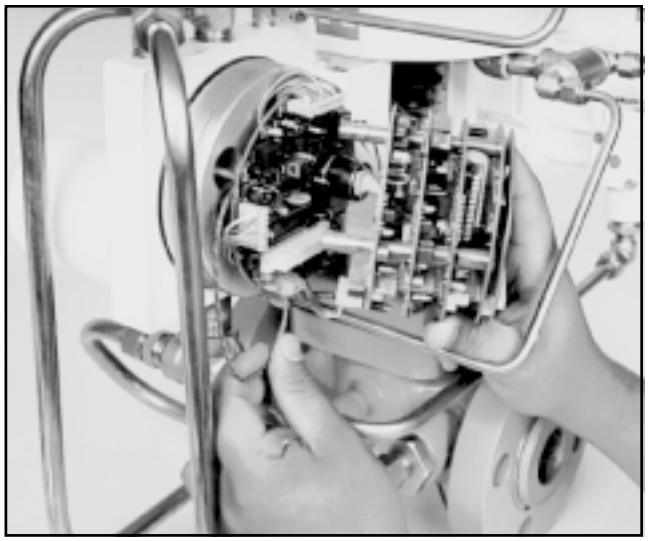

Figure 7: Removing Board Stack

WARNING: Never remove the StarPac cover in explosive atmospheres; otherwise potential injury may result to personnel and equipment.

CAUTION: Properly ground yourself before handling the StarPac electronics; otherwise the sensitive components may be damaged.

1. If the StarPac system is currently installed in-line, make sure that the StarPac system (including valve) can be taken off line in the current process.
2. Turn off the 24-volt power supply and disconnect the supply air to the StarPac valve.
3. Remove the large electronic housing cover from the StarPac unit.

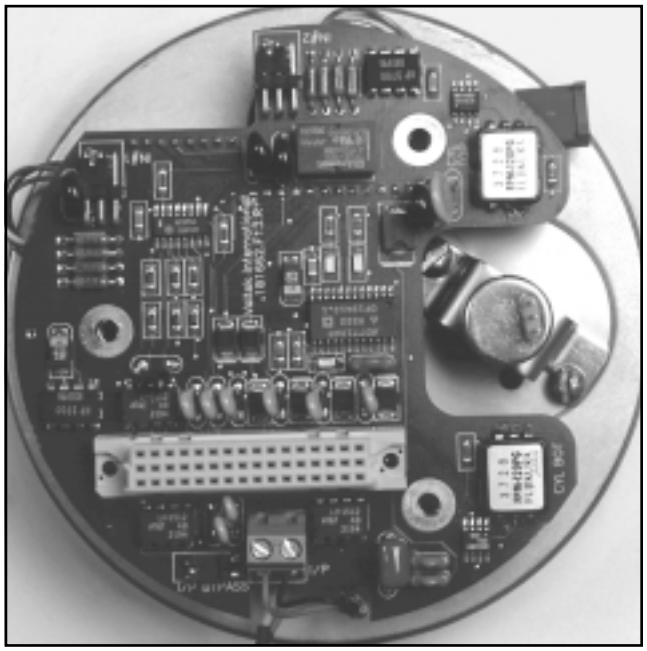

Figure 8: NT Failure Jumper Location

Figure 9:
Shroud Retaining Screws / Local Display

4. Remove the white plastic protective shroud from the electronic assembly by removing the two screws from the display end of the assembly. For NT units, locate the jumper I/P Bypass at the edge of Analog board number 1. (Refer to Figure 8 and proceed to step 9.)
5. Next, for SP units only, remove the third screw that holds the board stack in place.
6. Carefully grasp the computer boards and gently pull them away from the housing.
7. Locate the jumper on the bottom board (shown in Figure 8), labeled J105. Remove the jumper from the two pins and reinsert it onto only one pin for storage if wanting the valve to fail immediately per the actuator fail-safe spring configuration. To reactivate the manual failure mode place the jumper over the two pins labeled J105.
8. Carefully reinstall the top four computer boards onto the assembly. Be certain the computer board connector pins are lined up and securely attached to the bottom board connector. Be certain the top boards are in line with the bottom board.
9. Replace the protective shroud, install and tighten the three computer board assembly retaining screws.
10. Replace the StarPac electronics assembly cover.

Resetting or Initializing the StarPac

The 'Reset' and 'Initialize' switches are the first two dip switches on the second switch block (see Figure 4). On rare occasions it may be necessary to reset or initialize the embedded software program on the StarPac system to stop abnormal operation or clear persistent errors. This includes errors sometimes caused by brief power interruptions, or resetting the software after changing the EPROM.

The reset switch forces the StarPac system through the startup and diagnostics sequence that the system normally goes through on system power up, and it initializes the program execution to the starting instruction. The startup sequence also checks internal CPU registers and all of the volatile and nonvolatile RAM. While initializing the system the local display shows the version number of the EPROM currently installed in the system. The last thing done by a reset is to clear and initialize the watchdog timer on the CPU.

A reset can be done by powering the unit down for five seconds or more and reconnecting the power, or by resetting the system by pushing the 'Reset' switch down (on) for five seconds and then moving the switch back up (off).

***NOTE**: If the reset switch is left down (on) the CPU will be halted until the switch is moved up (off).*

The 'Initialize' switch (no. 2 or labeled INIT on the PC board) resets some of the internal work registers to known values and resets the EPROM checksum. The switch also sets the command or setpoint source to receive a 4 - 20 mA analog signal. The 'Initialize' switch is only accessed by the CPU during a reset.

An initialization is done by setting the INIT switch down (on) and then resetting the CPU as described above. After an initialization the system is left in the calibration mode, which is an out of service mode, meaning that the system will not respond to normal commands. StarTalk software must be used to put the system back into an operating mode. The command or setpoint source must also be reset to digital if that is the normal operating source.

If the INIT switch is left down (on), the system will startup in the calibration mode each time power is lost to the unit or the Reset switch is put in the on position. This feature can be beneficial if it is desired to manually reset the system after a power outage to ensure safe startup.

If the system must be reset using the dip switch as described above or initialized, refer to Figure 4 and proceed as follows:

1. Make sure that the StarPac system and valve can be taken off line without disrupt the process.
2. Remove the large cover from the StarPac electronic housing.

   WARNING: Never remove the StarPac cover in explosive atmospheres; otherwise potential injury may result to personnel and equipment.

3. Perform the desired actions as described above to reset or initialize the system.

   CAUTION: Properly ground yourself before handling the StarPac electronics; otherwise the sensitive components may be damaged.

4. Replace the StarPac electronic housing cover.

Reading Local Display

The local display on StarPac models SPJS, SPJD or NT displays two lines of information about the system and the process. The top line of the display has two functions: the left side is a description of the variable displayed on the second line. The right side of the top line has information on the current mode of operation MAN = manual, AUT= automatic, and CAL = calibrate (or out of service), OVR = over range, TRP = tripped.

The second line of the local display shows process or valve information as configured using the StarTalk II software.

An 'A' flashing on the right side of the display indicates there currently is an alarm condition. An 'E' flashing indicates an error condition. Generally at this point, these problems are caused by one or more of the following three conditions:

1. Air supply is not turned on to system
2. The 4 - 20 mA signal is not turned on, or is not being received by system.
3. The system has just been initialized or is operating in the calibration mode. The alarm signal will cease when the system is reconfigured or set to the proper mode.

For more information, refer to StarPac manual section on alarms and errors.

Adjusting Display View

The StarPac alphanumeric local display has an adjustment to allow some changes to the display for optimum visibility.

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CAUTION: Properly ground yourself before handling the StarPac electronics; otherwise the sensitive components may be damaged.

This adjustment is made by removing the plastic shroud and adjusting the blue trim potentiometer until the display is visible. Replace the plastic shroud, secure in place and replace the large StarPac electronic housing when done.

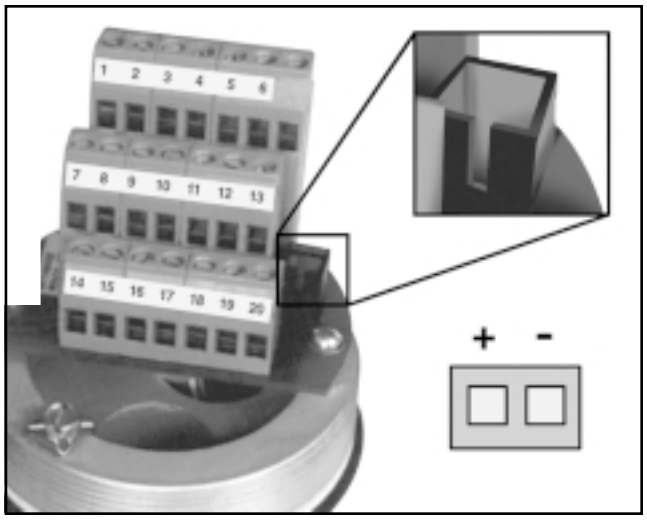


Figure 10: Local RS-485 Connector

Table V: Hardware Specifications

Power Supply	24 VDC ±10%, 300 mA maximum
RS-485 length	Up to 4000 feet (22-26 AWG)
4–20 mA input	232 ohms, 500 V isolation
4–20 mA output drive	up to 750 ohm load, 500 V isolation
Output contact rating	1 amp at 110 VAC (for Division II areas the ratings are reduced to 24VDC resistive load: Groups A & B- 230 mA; Group C- 590 mA; Group D- 800 mA)
Discrete inputs	26.6 kohm, 75 V DC or AC (peak-peak) rising, 22 V DC or AC (peak-peak) falling with 180 V maximum.

Local RS-485 Connector

A local RS-485 connector is located on the user terminal block (Figure 9) to allow ease of direct field interfacing to the StarPac system. This connection is a parallel connection to the RS-485 port terminals (11, 18) on the user interface terminal block. On StarPac models SPJD and NT, this is connected only to Port B.

***NOTE**: The StarPac can only communicate to one master device on a communication port. When using the local interface, one of the RS-485 screw interface wires may need to be disconnected to prevent a conflict in communications.*

A plug connector is available from the factory that will allow an interface cable to be established. (Request Part No. 83213.FOT from Flowserve Advanced Product Development Group.) The connector's crimp terminals are made for 22-26 AWG wire. Note the correct polarity of the terminals as shown in Figure 9.

Procedure for Upgrading to StarPac NT

Prior to making this upgrade, make sure that a current copy of the system's .CCT file is saved and available. Refer to the StarTalk software manual for details about saving configuration tables if unfamiliar with this procedure. Those converting from older SP DataStream models will first need to save a .TBL file for the system and then use the Flowserve Advanced Product Development Configuration File Conversion Utility program for Windows to convert the old parameter table to a compatible Modbus file. Follow the prompted procedure to make this conversion.

NOTE: *This file must be created by a StarTalk 2.0x version. (Please contact a Flowserve representative with any questions.)*

The upgrade kit consists of the following parts: StarPac NT boardstack w/EPROM, NT User Interface Assembly, Hallpot Mounting Bracket and new StarTalk software. (If upgrading from an SP DataStream Model, a plastic shroud should also be included.)

Upgrade Instruction

1. Disconnect all power sources and air supply to the unit.
2. Disconnect all wiring to the user terminal block of the StarPac. (Mark each wire pair for ease of re-installation into new terminal block.)
3. Remove the large electronics cap (turn counter clockwise) and take off the plastic shroud by removing the three assembly screws from the electronics module.
4. Remove the old electronics module by first unplugging the top three circuit boards. Remove the next board by carefully disconnecting the eight-wire pressure sensor connector from the bottom of the board and the three-wire hallpot connector from the top of the hallpot. Unplug the board from the remaining bottom board. Remove the last board by disconnecting all of the interface connectors and thermocouple wires. Next, use a $1^1/_{16}$-inch allen wrench to loosen the hallpot shaft connector set screw. Rock the board slightly while pulling straight out from the board to disengage the actuator pressure sensors from their standoffs and the hallpot shaft.
5. Remove the three screws attaching the use interface terminal block to the base. Pull the old interface wiring back through the base. (Twist the two white plastic connectors against the wires and push them into the hole in the base while pulling from the terminal block side.)
6. All of the old StarPac electronics and user terminal have now been removed. The pressure cables, thermocouple wires, and the black and red two-wire I/P cable should be left on electronic side of the base.
7. Cut off the small white two-pin connector from the I/P cable, leaving between $1^1/_2$ to $1^3/_4$-inch of the cable extending from the base. Strip the wire ends approximately $^1/_4$-inch.
8. Remove the hallpot position sensor from the old StarPac board by removing the $^1/_2$-inch nut and locking washer. Discard the fiber washer. Attach the hallpot into the new mounting bracket by aligning the three connector pins on the top of the hallpot with the notched leg of the new mounting bracket. The shaft of the hallpot extends into the 'U' of the bracket.

   CAUTION: Over tightening the mounting nut will put excessive strain on the metal case of the hallpot and may cause damage.
9. Begin installing the new NT components by first replacing the new user terminal block. This is done by gently twisting the two brown connectors back against the attached wires and pushing these connectors through the hole in the base from the small cover side to the large electronics side. Replace the three small mounting screws to secure the user terminal block to the base.
10. Attach the new hallpot mounting bracket by first removing the screw that is nearest to the center of the base. The un-notched end of the hallpot bracket uses this screw hole. Loosen the opposite screw three full turns to allow the notched end of the bracket to swing into place under the screwhead. Insert the hallpot shaft into the coupling. Rotate the bracket into place and reinsert the removed screw.

    Check that the coupling is centered in the base hole and does not touch the sides of the hole before tightening the screws. *Do not tighten the hallpot shaft set screw at this time.*

    The coupling cover is spring loaded to provide a positive force on the feedback arm and this method allows installation of the bracket without affecting the spring load.
11. Unplug the new NT bottom board from the rest of the stack. Plug the two interface connectors from the user interface into their appropriate connectors on the bottom of this board. Twisting the connector once, prior to plugging it into the board, will keep the wires bundled together and out of the way. Also, folding the wires flat against the base will keep them from pushing the board away from the base.
12. Carefully align the two actuator pressure transducer nipples into their pressure standoffs and press firmly on the top of the two transducers to seat

them into the standoffs and hold the board in place. The board is properly seated when the pressure standoffs are almost flush against the bottom of the board.

CAUTION: Do not twist or bend the board once the nipples are plugged in or they may break. Using one of the assembly screws to hold the board in alignment while attaching the other wires and boards will help prevent this.

13. Attach the I/P cable wires to the two-screw terminal block marked 'I/P,' (red wire to the positive terminal and black wire to the negative terminal). Notice that this is a plug-in terminal block and may be unplugged without removing the wires.
14. Detach the second NT board from the new stack. Attach the three-wire hallpot harness from the new stack into the hallpot connector. The small 'ears' on the outer edges of the new brown plug should point to the outside edge of the hallpot.
15. Plug the process sensor connector into the J4 connector on the bottom of this board. On older StarPac models this connector is a single soldered eight-pin connector. The more recent models have two sensor cables which are terminated separately with crimped on pins and a brown housing. For the separated cable arrangement, be sure to plug the correct sensor into the correct half of the board connector (P_1 to P_1 and P_2 to P_2 section).
16. Plug the board into the bottom board mounted on the base while making sure all pins are aligned. Use an assembly screw to temporarily hold the board in place.
17. Attach the thermocouple wires to the two-screw terminal block on this board, noting the correct polarity. Red wire to 'R' and yellow wire to 'Y.' If additional wire length is needed, gently pull more wire from the base. Also, bend the wires close to the terminal block (excessive looping is not needed due to the notches cut in the boards).
18. Plug in the remaining boards. (Be sure to check the alignment of the pins.) Secure the board stack together by placing the one spacered assembly screw in the upper right hand corner.
19. Set the dip switches on the digital board to match the settings on the old board stack.

    NOTE: *This step does not apply when upgrading from the DataStream model.*
20. Reaffirm that all connections are properly aligned and secure.
21. Reattach field wiring to the user interface terminals.
22. Apply 24 VDC power. The liquid crystal display should display the version number and then the default display mode.
23. Establish communications and use the StarTalk software to upload the saved .CCT file for this system into the new NT module. (If updating from an older StarPac DataStream model, use the file conversion utility to convert the old .TBL file into a compatible Modbus file.)
24. With the air supply shut off, the valve should be either fully closed or fully opened, depending on the failure spring action ordered. Use the configuration menu to set the LCD to display the position continuously. Rotate the hallpot shaft until the displayed value for position is within a few percentages of either zero percent (if the valve is closed) or 100 percent (if the valve is open). Tighten the hallpot connector set screw. (*Alternate method*: If access to the set screw is difficult due to the alignment of the takeoff arm, connect the air supply and stroke the valve 50 or 100 percent open as indicated on the valve stroke plate. Adjust the hallpot shaft to an indicated position reading of 50 or 100 percent, then tighten the set screw. Care must be taken if this method is used to ensure that the ADC values of the position feedback do not go out of range at either end of stroke.) Once this has been adjusted correctly, if the boardstack needs to be replaced, redoing the setting is not needed unless the hallpot itself is damaged.

    NOTE: *If the position values displayed decrease rather than increase when the valve strokes open, the three-wire hallpot connector is reversed and needs to be unplugged and rotated 180°.*
25. Replace the plastic shroud and the remaining two assembly screws. Make sure all wiring is beneath the shroud and that no wires are trapped between the bottom board and the vibration isolators in which the assembly screws attach.
26. Turn the air supply back on to the actuator.
27. After verifying that stroking the valve is safe, use the calibration menu to first recalibrate the actuator pressure sensor, and then perform a valve stroke calibration. During this calibration, watch the position ADC values to ensure that the hallpot adjustment is not at its limit on either end of stroke. (If needed, readjust the hallpot shaft setting to keep the shaft rotation within the operating range of the hallpot, then recalibrate.)
28. Secure both the large electronics and the smaller interface covers.
29. Use the StarTalk software to calibrate the process sensors and verify the other operational parameters of the system. *Do not forget to reconfigure the LCD to display the desired variables.*
30. Return the system to operation.

SYSTEM MAINTENANCE

Flowserve recommends that the StarPac system calibration and maintenance work be done once every six months. If after checking the calibration of the StarPac, a component is determined to be defective the following section will help with the component replacement.

The following items may be needed to install, start up and calibrate the StarPac system electronics.

- Power supply: 24 VDC regulated ±2.4 VDC, 300 mA
- StarTalk software (proper version for the electronics being used)
- Computer with internal or external RS-485 communication adapter
- RS-485 connection cable
- Digital volt meter with 4 - 20 mA range
- Air supply: 50 psig (3.4 bar) minimum, 80 - 100 psig (6.3 - 7.8 bar) preferred; coalescing air filter required
- Gauges or the ability to accurately determine process pressures and valve air supply pressures
- 4 - 20 mA command source
- Thermocouple calibrator or simulator with 0 - 932° Fahrenheit (0 to 500° Celsius) range

Mechanical Subsystem Maintenance

Refer to the appropriate Flowserve Installation, Operation & Maintenance (IOM) instructions for details on the repair and maintenance of the control valve positioner and actuator components. Please refer to the manufacturers' manuals for maintenance and operation instructions for non-pneumatic actuators, e.g., electric or electro-hydraulic actuators.

At first glance the additional tubing and connections of the StarPac system may appear to make standard valve maintenance more difficult and complex. The following instructions will show a maintenance method that will make this task much easier. Please note that most of the additional tubing attached to the StarPac system is electrical conduit and does not contain process fluid.

WARNING: The process line must be depressurized and drained of process fluid, and decontaminated prior to working on the internal valve components. Failure to do so may cause serious injury to personnel.

1. Depressurize the line, decontaminate the valve (if needed) and shut off the air supply to the valve positioner.
2. Disconnect the four actuator air tubes from the positioner and StarPac system.
3. Disconnect the four mounting bolts that attach the StarPac system bracket and positioner bracket.
4. Disconnect the follower arms from the StarPac base and positioner. This is done by removing the follower arm nut and washer and pulling the arm off the shaft. Notice that this shaft connection is keyed and that the shafts are slightly spring loaded.
5. The actuator subassembly is now isolated and is removed by loosening the bonnet bolts and lifting the actuator away from the body.

   The StarPac system tubing holds the StarPac base and positioner in place, eliminating the need to disconnect wiring or air connections.
6. Standard valve maintenance may now be done on the actuator or valve body components. Refer to the Flowserve IOM instructions for details on such things as trim or packing replacement. If the trim needs to be replaced, use the same trim number and characteristic as the original trim, or the flow calculations could be affected. If a trim size change is needed, contact a Flowserve representative to find out about flow calibration options.
7. Reassemble the system by reversing the above steps. Be sure to follow the procedures outlined in the Flowserve IOM instructions for valve reassembly. Make sure when reconnecting the follower arms that the arms fit correctly on the keyed shafts and have a positive spring action.
8. Turn on the air supply to the valve and check for leaks in the reattached actuator tubing lines. Check the calibration of the positioner for proper operation. Refer to Flowserve IOM 24 instructions for details on calibrating the Beta positioner.
9. Turn on power to the StarPac system. Use the StarTalk software to check the system calibration and do a valve stroke calibration to reset the StarPac's position feedback. Refer to the Calibration section of the StarPac manual.

Position Feedback System

The position feedback linkage of the StarPac system is a critical part of the flow metering ability of the system. This linkage is used to calculate the valve's C_V for a given stroke. This linkage should be lubricated and checked periodically for tight, smooth operation. The follower arm should operate smoothly with no binding and have a positive spring loading on the arm. Inspect the follower arm pin for excess wear and replace if needed. The takeoff arm attached to the stem clamp must be firmly secured to the stem clamp and perpendicular to the actuator stem. If this takeoff arm is canted or misaligned, problems may occur with positioner calibration and the position reading on the StarPac may go out of range.

On rotary actuators, make sure the adjustment linkage locknut is tight and has no excessive play in the ball joints. The rotary shaft clamp must be tight and should not freely rotate on the shaft.

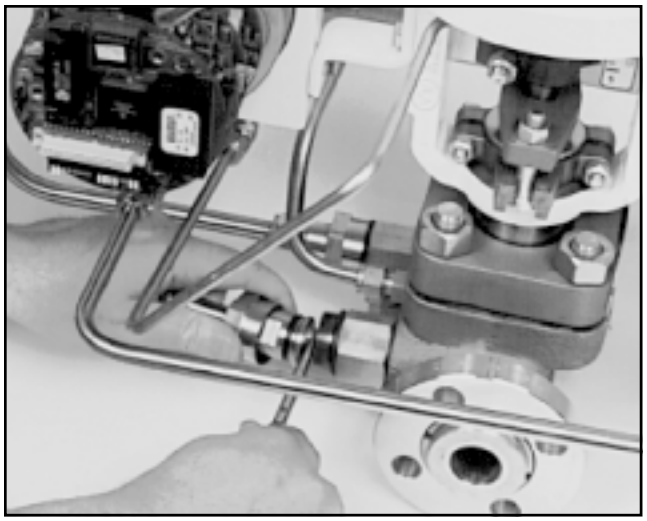


Figure 11: Disconnecting Lemo Connector

Pressure Sensor Replacement

Standard StarPac pressure sensors are installed

directly into the control valve body. Before they can be removed, the process line must be depressurized and drained of all fluids and the valve decontaminated.

To replace a pressure sensor, refer to Figure 10 and proceed as follows.

WARNING: The process line must be depressurized and drained of process fluid, and decontaminated prior to working on the internal valve components. Failure to do so may cause serious injury to personnel.

WARNING: If optional pressure sensor extensions are included, the sensor will be located in a sensor housing located in the tubing line and not in the sensor housing located on the valve body. This section of the tubing contains process fluid and must be drained and decontaminated before the sensor is removed. The procedure for sensor removal and replacement will be similar to that outlined below.

(Refer to alternate sensor information when this type of sensor is included with system.)

1. Depressurize and decontaminate the line and valve. Loosen the tubing nuts on the conduit leading to the pressure sensor, if applicable.
2. Loosen the sensor nut.
3. Gently pull the conduit and sensor nut approximately $^1/_2$ to $^3/_4$-inch from the sensor. Release the locking sleeve of the Lemo™ connector by moving the collar away from the sensor (use needle nose pliers). Remove the connector from the sensor and swing the sensor conduit out of the way.
4. Unscrew the sensor from the sensor boss.

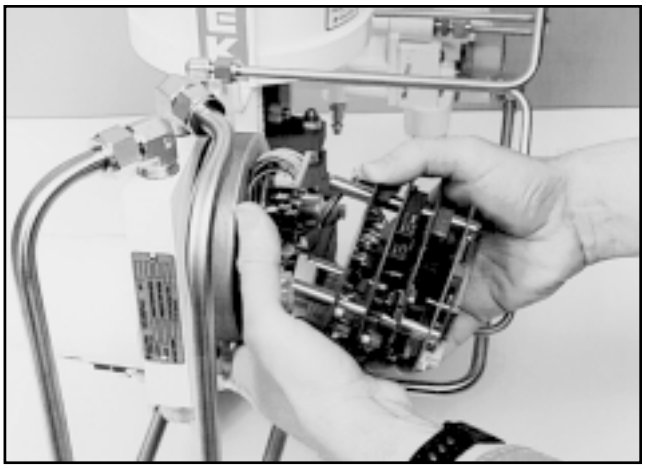


Figure 12: Board Removal

5. Remove the sensor O-ring or gasket and replace with a new one. Make sure the environmental O-ring seal is in good condition and in place on the new sensor.
6. Install the new sensor into the sensor port making sure the O-ring or gasket remains properly in place while tightening the sensor. Tighten the sensor until it seats metal-to-metal at the gasket section of the sensor port, assuring the proper compression of the process O-ring or gasket seal.
7. Align the red dots on the sensor and connector, and reconnect the Lemo connector. Fully seat the connector until the locking sleeve latches. Replace the sensor nut and tighten.
8. Pressurize the valve body to make sure the sensors are properly seated before attaching the sensor conduit and tightening.
9. Reattach the conduit lines and securely tighten the fittings.

Temperature Sensor Replacement (Model NT)

The StarPac temperature sensor (middle sensor on the valve body) does not penetrate the wall of the control valve; therefore, replacement does not require that the process line be drained.

To replace a StarPac temperature sensor, refer to Figure 14 and proceed as follows:

1. Disconnect the power and air supply to the unit.
2. Remove the large StarPac electronics assembly cover.

   WARNING: Never remove the StarPac's electronics assembly covers if explosive atmospheres are present.
3. Remove the plastic shroud by unscrewing the two assembly screws.
4. Unplug the temperature wires from the computer board and undo the thermocouple wire.

5. Loosen the conduit nuts containing the temperature sensor wire. Remove the conduit, pulling the sensor wires out of the tubing.
6. Remove the temperature sensor by unscrewing it from the body.
7. Screw the new sensor into the body. Tighten firmly.
8. Reinstall the stainless steel fitting and conduit, feeding the sensor wire through to the StarPac computer board.
9. Cut the temperature wire about $3^1/_2$-inches from the StarPac housing. Strip the wire about $^1/_4$-inch from the end.
10. Reconnect the temperature wires to computer board.
11. Replace the StarPac electronics assembly shroud and secure the two-board assembly screws. Assure that no wires are trapped between the bottom circuit board and the rubber vibration isolators.
12. Turn on the power supply to the unit again.

    Warning: Do not turn on (energize) the StarPac unit in explosive atmospheres with the assembly cover removed. Injury to personnel could result.
13. Communicate to the system using the StarTalk software and verify the data for that particular valve.
14. Replace the large StarPac cover and restore the air supply to the unit.
15. Check the sensor calibration.

Temperature Sensor Replacement (Model SPxx)

The StarPac temperature sensor (middle sensor on the valve body) does not penetrate the wall of the control valve; therefore, replacement does not require that the process line be drained.

To replace a StarPac system temperature sensor, refer to Figures 2, 12, 13, and 14 and proceed as follows.

1. Disconnect the power and air supply to the unit.
2. Remove the large StarPac electronics assembly cover.

   WARNING: Never remove the StarPac electronics assembly cover if explosive atmospheres are present; otherwise, injury to personnel can occur.
3. Separate the top four boards from the bottom computer board, by first removing the three computer board assembly screws and sliding off the plastic shroud. Carefully grasp the top four computer boards and pull them away from the bottom board while holding it in place. Disconnect the three-wire hallpot and eight-wire pressure sensor harness connectors and set the four boards aside.
4. Disconnect the temperature sensor wires from the terminal block 'J102' on the bottom computer board.
5. Loosen set screw on the hallpot base connector.
6. Disconnect the three remaining wire harness connections and carefully remove the bottom computer board from the StarPac system housing base. Some resistance will be felt as the air-pressure connections disengage.
7. Loosen the conduit nuts containing the temperature sensor wire. Remove the conduit, pulling the sensor wires out of the tubing.
8. Remove the temperature sensor by unscrewing it from the body.
9. Screw the new sensor into the body. Tighten firmly.
10. Reinstall the stainless steel fitting and conduit, feeding the sensor wire through to the StarPac computer board.
11. Install the bottom computer board on StarPac system housing base, being careful to connect the two air-pressure connections and hallpot arm to their appropriate places. **Do not tighten the set screw now**. Reconnect the three wire harness connections. Cut new temperature sensor wire to length and attach it to terminal block, noting polarity.
12. Reattach the remaining top four computer boards, being certain to reconnect the two wire harness connections and the interface connections.
13. Replace at least one of the three computer board assembly screws and tighten to hold stack in place.
14. Turn on the power supply to the unit again.

    WARNING: Do not turn on (energize) the StarPac unit in explosive atmospheres with assembly cover removed. Injury to personnel may result.
15. Communicate to the system using StarTalk software and verify the data for that particular valve.
16. Use the *Configuration* menu of StarTalk software to set the local display to show *Position*. Adjust the hallpot shaft (arrow in Figure 13) within five percent of the valve's actual position. (Since the valve's air supply is shut off, this will be either 100 percent open or closed.) Tighten the hallpot set screw.
17. Replace the StarPac electronics assembly shroud and secure the three board assembly screws. Assure that no wires are trapped between the bottom circuit board and the rubber vibration isolators.
18. Replace the StarPac electronic housing cover and restore the air supply to the unit.
19. Check the sensor calibration, following the procedure outlined in the Calibration section of the StarPac manual, if needed. A stroke calibration will need to be done to finish calibrating position feedback; refer to the StarPac manual.

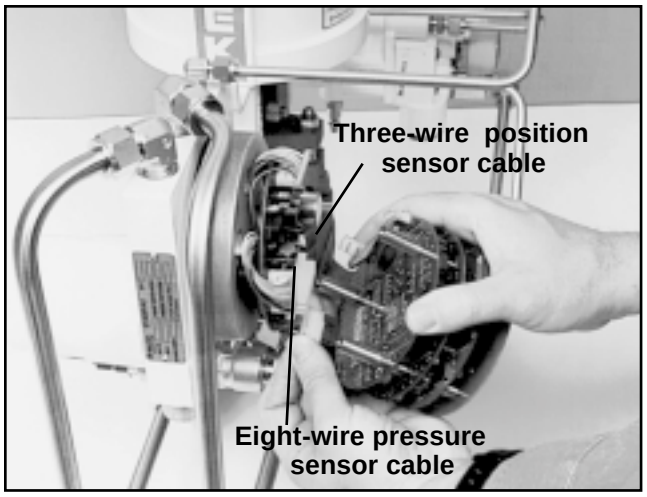


Figure 13: Removing Top Four Boards

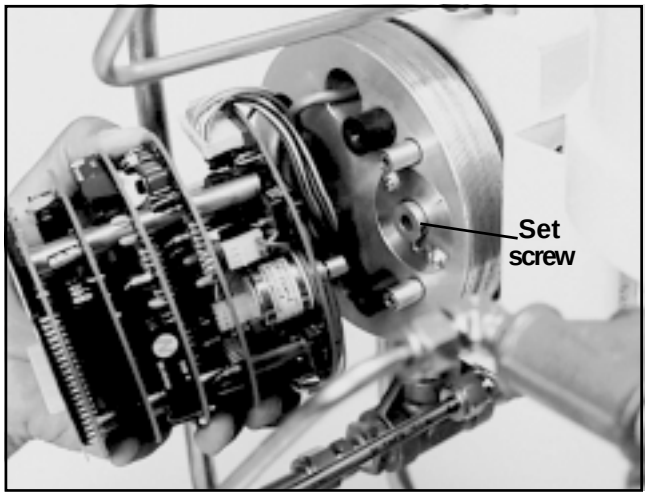


Figure 14: Position Sensor Alignment (Model SPxx)

Board Stack Replacement (Model NT)

Inside the electronic housing cover and under the white plastic shroud of a StarPac unit are five printed circuit boards, together referred as the board stack. This design allows each board to have a single purpose, which simplifies troubleshooting and diagnostic procedures. (Refer to Figure 7 on page 7.)

If, after consulting with the local Flowserve or factory representative, the StarPac system's computer board stack is found defective and needs replacement, proceed as follows. (Prior to proceeding, make sure a copy of the configuration .CCT file is saved and available.)

1. Disconnect the power and air supply to the unit.
2. Remove the StarPac electronics assembly cover.

   WARNING: Never remove the StarPac electronics assembly cover if explosive atmospheres are present; otherwise, injury to personnel can occur.
3. Remove the plastic shroud by unscrewing the three board assembly screws. Carefully grasp the top four computer boards and pull them away from the bottom board holding it in place. Disconnect the three-wire hallpot and eight-wire process harness connectors and set the four computer boards aside.
4. Unplug the temperature sensor wires from the terminal block marked 'T/C' on the second computer board.
5. Disconnect the three remaining wire harness connections and carefully remove the bottom computer board from the StarPac housing base. Some resistance will be felt as the air pressure connections disengage.
6. Unplug the new NT bottom board from the rest of the stack. Plug the two interface connectors from the user interface into their appropriate connectors on the bottom of this board. Twisting the connector once prior to plugging it into the board will keep the wires bundled together and out of the way. Also, folding the wires flat against the base will keep them from pushing the board away from the base.
7. Carefully align the two actuator pressure transducer nipples into their pressure standoffs and press firmly on the top of the two transducers to seat them into the standoffs and hold the board in place. The board is properly seated when the pressure standoffs are almost flush against the bottom of the board.

   CAUTION: To avoid damaging the nipples, do not twist or bend the board once the nipples are plugged in. ***(Using one of the assembly screws to hold the board in alignment while attaching the other wires and boards will help prevent this.)***

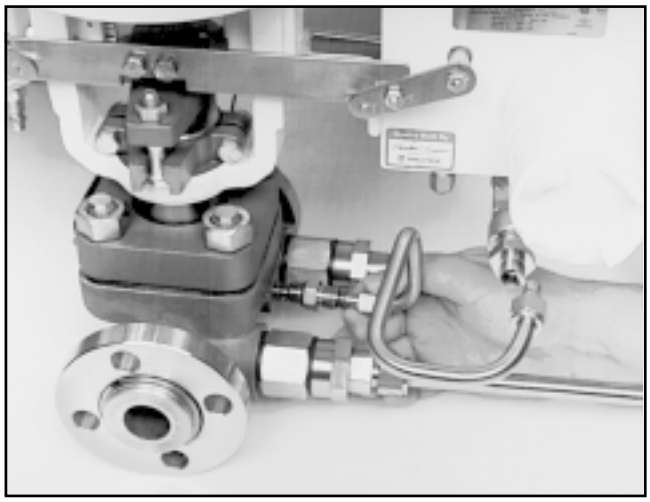


Figure 15: Thermocouple Installation

8. Attach the I/P cable wires to the two-screw terminal block marked 'I/P.' (Red wire to the positive terminal and black wire to the negative terminal.)
9. Detach the second NT board from the new stack. Attach the three-wire hallpot harness from the new stack into the hallpot connector. The small 'ears' on the outer edges of the new brown plug should point to the outside edge of the hallpot.
10. Plug the board into the bottom board, mounted on the base, making sure all pins are aligned. Use an assembly screw to temporarily hold the board in place.
11. Plug the thermocouple wires into the two-screw terminal block on this board, noting the correct polarity. Red wire to 'R' and yellow wire to 'Y.' If additional wire length is needed, gently pull more wire from the base. Also, bend the wires close to the terminal block (excessive looping is not needed due to the notches cut in the boards).
12. Plug the process sensor connector into the J4 connector on the bottom of this board. On older StarPac models this connector is a single soldered eight-pin connector. On more recent models have two sensor cables which are terminated separately with crimped on pins and a brown housing. If the cable arrangement has been separated, be sure to plug the correct sensor into the correct half of the board connector (P_1 to P_1 and P_2 to P_2 section).
13. Plug in the remaining boards. (Be sure to check the alignment of the pins.) Secure the board stack together by placing the one spacered assembly screw in the upper right hand corner.
14. Set the dip switches on the digital board to match the settings on the old board stack.
15. Reaffirm that all connections are properly aligned and secure.
16. Apply 24 VDC power. The liquid crystal display should display the version number and then the default display mode.
17. Establish communications and use the StarTalk software to upload the saved .CCT file for this system into the new NT module.
18. Replace the plastic shroud and the remaining two assembly screws. Make sure all wiring is beneath the shroud and that no wires are trapped between the bottom board and the vibration isolators in which the assembly screws attach.
19. Turn the air supply back on to the actuator.
20. After verifying that stroking the valve is safe, use the calibration menu to first recalibrate the actuator pressure sensor, and then perform a valve stroke calibration. During this calibration, watch the position ADC values to ensure that the hallpot adjustment is not at its limit on either end of stroke. (If needed, readjust the hallpot shaft setting to keep the shaft rotation within the operating range of the hallpot, then recalibrate.)
21. Secure both the large electronics and the smaller interface covers.
22. Use the StarTalk software to calibrate the process sensors and verify the other operational parameters of the system.
23. Return the system to operation.

Board Stack Replacement (Models SPxx)

Inside the electronic housing cover and under the white plastic shroud of a StarPac unit are five printed circuit boards, together referred to as the board stack. This design allows each board to have a single purpose, which simplifies troubleshooting and diagnostic procedures.

If, after consulting with the local Flowserve or factory representative, the StarPac system's computer board stack is found defective and needs replacement, refer to Figures 2, 7, 13 and 14 then proceed as follows.

NOTE: *Make sure a current copy of the configuration file exists.*

1. Download or find a backup copy of .CCT File.
2. Disconnect the power and air supply to the unit.
3. Remove the StarPac electronics assembly cover.

   WARNING: Never remove the StarPac electronics assembly cover if explosive atmospheres are present; otherwise, injury to personnel can occur.
4. Remove the plastic shroud by unscrewing the three board assembly screws. Carefully grasp the top four computer boards and pull them away from the bottom board holding it in place. Disconnect the three-wire hallpot and eight-wire process harness connectors and set the four computer boards aside.
5. Disconnect the temperature sensor wires from the terminal block marked 'J102' on the bottom computer board.
6. Loosen the set screw on the hallpot base connector. Refer to Figure 13.
7. Disconnect the three remaining wire harness connections and carefully remove the bottom computer board from the StarPac housing base. Some resistance will be felt as the air pressure connections disengage.
8. From the new computer board stack, install the bottom computer board on the StarPac device

housing base, being careful to connect the two air-pressure connections and hallpot arm to their appropriate places. **Do not tighten the set screw now**. Reconnect the three wire harness connections. Attach the temperature sensor wires to the terminal block, noting polarity.

9. Reattach the remaining top four computer boards, being certain to reconnect the two wire harness connections. Properly line up and fully seat the interface connections.
10. Replace at least one of the three computer board assembly screws and tighten to hold the stack in place.
11. Turn on the power supply to the unit again.

    WARNING: Do not turn on (energize) the StarPac unit in explosive atmospheres with the assembly cover removed. Injury to personnel may result.
12. Use the StarTalk software to apply a stored configuration table for the StarPac unit. Refer to the Technician Support section of the StarPac manual for details.
13. Use the Configuration menu of StarTalk software to set the local display to show Position. Adjust the hallpot shaft (arrow in Figure 14 within five percent of the valve's actual position (since the valve's air supply is shut off, this will be either 100 percent open or closed). Tighten the hallpot set screw.
14. Replace the StarPac electronics assembly shroud. Tighten the three shroud retainer screws. Restore the air supply to the unit.
15. Replace the StarPac electronics housing cover.
16. After the new computer boards have been replaced, the unit will need to be recalibrated following the procedures listed in the Calibration section of the StarPac manual. Use Stroke Calibration Section to finish calibrating the position feedback.
17. Reset the operational parameters to bring the system back into service.

EPROM Replacement

Occasionally the need may arise to replace the EPROM of the StarPac. The EPROM contains the operating program code for the StarPac system. (If the StarPac system has a special feature or custom program EPROM, ensure that the new electronics board stack has the proper EPROM.) The EPROM from the old board can be traded with the EPROM on the new board if needed. If the digital board of the faulty system is suspected to be damaged, a replacement EPROM can be ordered from a Flowserve representative. The bill of material for the system will contain the unique part number for the special EPROM.

If the EPROM needs to be replaced, refer to Figures 4 and 5 then proceed as follows.

CAUTION: This procedure should only be done by personnel trained in the proper handling of sensitive electronic components.

1. Make sure the valve is either by-passed or in a safe condition.
2. Turn off the 24 VDC power to the StarPac and air supply to the actuator.
3. Remove the StarPac electronics housing cover.

   WARNING: Never remove the StarPac electronics assembly cover if explosive atmospheres are present; otherwise, injury to personnel can occur.
4. Remove three circuit board assembly screws and lift the protective shroud off the board assembly.
5. Carefully unplug the local display board (top) from the rest of the board assembly. This exposes the digital board with the EPROM. The EPROM is located in a square holder at the edge of the board.
6. Remove the old EPROM by using a PLCC extraction tool. Notice that two opposite corners of the EPROM socket are slotted. The fingers of the tool slide all the way into these slots. The fingers of the tool should catch under the corners of the EPROM. Squeeze the tool to extract the EPROM and pull it out from the socket.
7. Carefully remove the new EPROM from its protective carrier. Handle the EPROM carefully by the corners and use whatever anti-static precautions are available. A typical method is to keep one hand on a grounded metal item and handle the device with the other hand. The static sensitive device is protected once it is in its socket. Notice that the EPROM has one corner trimmed, one top edge beveled, and a dot cast into the top. Align the EPROM in the socket so that the dot and beveled edge face the small square silk-screened on the edge of the PC board. The trimmed corner should be on the left as shown by the silk-screen outline.

   CAUTION: The StarPac contains sensitive electronic components. Use proper antistatic (grounding) precautions when handling the EPROM and insert properly or the EPROM may be damaged.
8. Firmly press the EPROM into the socket. It should be slightly below the edges of the socket to be fully seated.
9. On the dip switch, located next to the bus connector, set switch 2 INIT on by toggling the switch down.
10. Carefully plug the top display board back on the stack making sure all pins are aligned in the bus socket.

11. Replace the protective shroud over the board assembly, aligning the window in the shroud over the display. Make sure none of the interconnection wiring at the base of the board assembly protrudes outside the shroud. Replace the three circuit board assembly screws and tighten snugly.
12. Turn the power on to the StarPac system. Toggle the 2 INIT switch back to its up position. (This can be reached from the side of the board and does not require removing the display board again.) The local display should display zeroes on SP models or the word 'CAL' on SPJ and NT models.
13. Replace the StarPac electronic housing cover.
14. Restore power to the StarPac and the air supply to the actuator.
15. The StarPac system can now be connected with the StarTalk software to make whatever configuration changes are needed.

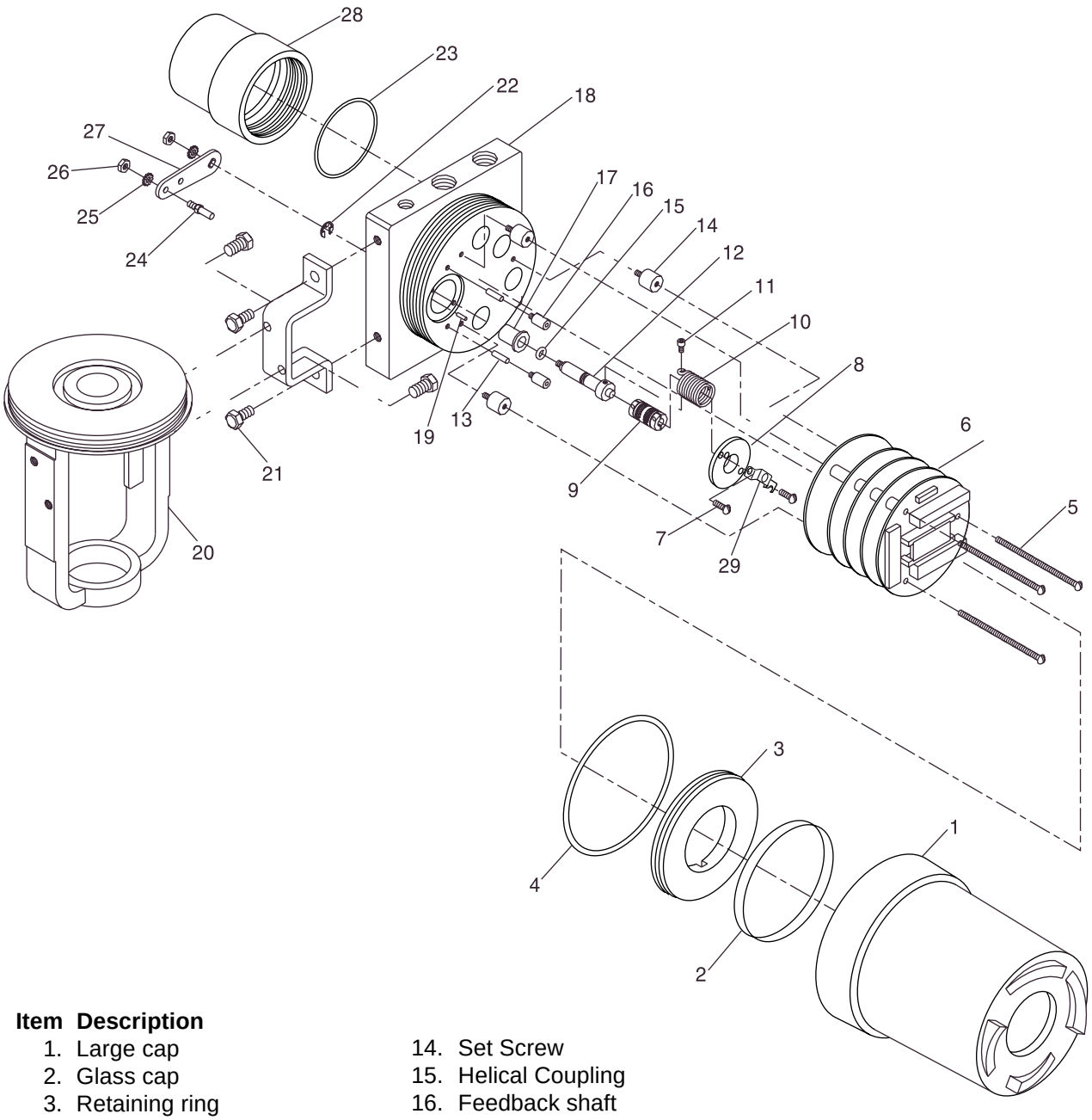
    The system has been reset to its initialization defaults. The StarPac will remain in a startup test mode, signified by zeroes on the local display or CAL, until the system is connected to the StarTalk software for the first time. The non-volatile RAM containing the system's parameter table is not affected by changing EPROMs so recalibration should not be needed. Because of the internal initialization that takes place in the StarPac unit when this procedure is done, an error can be detected during the reset. This will be cleared and may be ignored if it is not ongoing (signified by a continuously flashing error display).
16. The system now can be returned to service.

Table VI: StarPac Accessories

Description	Number
Converter, RS232/RS485, 110, 220 VAC	10055963
StarPac Analog Interface (8 Channel), 24 VDC	10069207
Power Supply, DIN rail-mounted, 110 VAC to 24 VDC	10079519

Table VII: Linear Actuator Follower Arms

Actuator Size (inches)	Stroke (inches)	Spud (inches)	Follower Arm Kit
25	1/4	2.00	10043879
25	3/8	2.00	10043879
25	1/2	2.00	10037613
25	3/4 - 1 1/2	2.00	10037613
50	1/2 - 1 1/2	2.00	10037613
50	1/2 - 2 1/2	2.62	10044111
50	3	2.62	10037614
100	3/4 - 3	2.62 - 2.88	10037614
100	3/4 - 4	3.38 - 4.75	10037615
100	5 - 8	3.38 - 4.75	10037616



Item	Description
1.	Large cap
2.	Glass cap
3.	Retaining ring
4.	Large O-ring
5.	Electronic stack screws
6.	Bushing
7.	Shroud
8.	StarPac Electronics
9.	Hallpot feedback sensor
10.	Hallpot bracket
11.	Hallpot screw
12.	Spring bracket
13.	Spring
14.	Set Screw
15.	Helical Coupling
16.	Feedback shaft
17.	Vibration isolator
18.	Feedback shaft O-ring
19.	Pressure Connector
20.	Flame Arrestor
21.	Groove pin
22.	Mounting bracket
23.	Mounting bolt
24.	Valve yoke
25.	Housing
26.	Retaining ring
27.	Follower arm
28.	Follower pin
29.	Lock washer
30.	Follower pin nut
31.	User interface terminal
32.	User interface screws
33.	Small cap O-ring
34.	Small cap

Figure 16: Exploded View

StarPac Spare Parts Kits

See StarPac exploded view (Figure 16) for item numbers.

Kit 1 - StarPac Housing Replacement
Part No. 10055770

Item No.	Description	Quantity
1	Large cap	1
2	Glass cap	1
3	Retaining ring	1
4	Large cap O-ring	1
11	Electronic stack screws	2
12	Spring bracket	1
13	Spring	1
14	Set screw	1
15	Helical coupling	1
16	Feedback shaft	1
17	Vibration isolator	3
18	O-ring	1
19	Pressure connector	2
20	Flame arrestor	2
21	Groove pin	2
25	Housing	1
26	Retaining ring	1
33	Small cap O-ring	1
34	Small cap	1

Kit 2 - NT Electronics Replacement Kit
Part No. 10059202

Item No.	Description	Quantity
5	Electronic stack screws	3
6	Bushing	1
8	NT electronics stack w/EPROM	1

Kit 3 - NT User Interface Replacement Kit
Part No. 10059203

Item No.	Description	Quantity
31	User interface terminal	1
32	User interface screws	3

Kit 4 - Hallpot Replacement Kit
Part No. 10059205

Item No.	Description	Quantity
9	Hallpot feedback sensor	2
10	Hallpot bracket	1
11	Hallpot screws	1

Kit 5 - NT Shroud Replacement Kit
Part No. 10070583

Item No.	Description	Quantity
5	Electronic stack screws	3
6	Bushing	1
7	Shroud	1

Kit 6 - NT Electronics Upgrade Kit
Part No. 10202761

Item No.	Description	Quantity
5	Electronic stack screws	3
6	Bushing	1
7	Shroud	1
8	NT electronics stack w/EPROM	1
10	Hallpot bracket	1
11	Hallpot screws	2
31	User interface terminal	1
32	User interface screws	3

NOTE: *If hallpot is required, order hallpot replacement kit (Kit 4).*

Kit 7 - Replacement Helical Coupling
Part No. 10052650

Item No.	Description	Quantity
15	Helical Coupling	1

Kit 8 - Follower Pin Assembly for Linear Actuators
Part No. 10036685

Item No.	Description	Quantity
28	Follower pin for linear actuators	1
29	Lock washer	1
30	Follower pin nut	1

Kit 9 - I/P Wire Replacement Kit
Part No. 10055394

Description	Quantity
I/P wire	1

Pressure and Temperature Sensor Spare Part Kits

See Body-mount Sensor Configurations (Figure 17) and Remote-mount Sensor Configuration (Figure 18) for item numbers.

Pressure Sensor Gasket Kits

NOTE: *Kits 1 thru 4 will service two body or two remote-mount pressure sensors from any one of the pressure sensor configuration drawing numbers listed below each table.*

Kit 1 - Viton O-ring Replacement Kit
Part No. 10061027

Item No.	Description	Quantity
6	Environmental O-ring, Viton	2
8	Environmental O-ring, Viton	4
10	O-ring seal, Viton	2
20	Environmental O-ring, Viton	2
21	O-ring seal, Viton	2

Configuration Drawing Numbers: 83883, 83891, 83904, 83884, 83892, 101565, 83887 83900, 127586, 83888, 83901

Kit 2 - Spiral Wound Gasket Replacement Kit
Part No. 10061028

Item No.	Description	Quantity
6	Environmental O-ring, Viton	2
8	Environmental O-ring, Viton	4
10	O-ring seal, Viton	2
20	Environmental O-ring, Viton	2
21	Spiral wound gasket seal	2

Configuration Drawing Numbers: 83938, 83890, 122670, 83886, 83903, 127563, 83899, 127632

Kit 3 - PTFE Gasket Replacement Kit
Part No. 10061029

Item No.	Description	Quantity
6	Environmental O-ring, Viton	2
8	Environmental O-ring, Viton	4
10	PTFE gasket seal	2
20	Environmental O-ring, Viton	2
21	PTFE gasket seal	2

Configuration Drawing Numbers: 122513, 127565

Kit 4 - Kalrez O-ring Replacement Kit
Part No. 10061113

Item No.	Description	Quantity
6	Environmental O-ring, Viton	2
8	Environmental O-ring, Viton	4
10	O-ring seal, Kalrez™	2
20	Environmental O-ring, Kalrez	2
21	O-ring seal, Kalrez	2

Configuration Drawing Numbers: 83885, 83889, 127665, 83893, 83902

Pressure Sensor Hardware Kits

Kit 5 - Pressure Sensor Connection Kit, Div II Non-incendive Configuration
Part No. 10061022

Item No.	Description	Quantity
3	Swagelok nut	2
4	Swagelok ferrules	2
5	Sensor nut	2
6	Environmental O-ring, Viton®	2
7	Division II sensor fitting	2

NOTE: *Kit will service two pressure sensors. For class I, Division II, Group A, B, C, & D.* See Table XII for Tubing.

Kit 6 - Pressure Sensor Connection Kit, Div I Configuration
Part No. 10061023

Item No.	Description	Quantity
13	Division I sensor fitting	2
5	Sensor nut	2
6	Environmental O-ring, Viton	2

NOTE: *Kit will service two pressure sensors. For class I, Division I, Groups B, C, & D.*

Kit 7 - Remote Mount Pressure Sensor Hardware Kit
Part No. 10061025

Item No.	Description	Quantity
3	Swagelok nut	4
4	Swagelok ferrules	4
15	Temperature extended fitting	2
19	Adapter fitting	2

NOTE: *Kit will service two remote-mount pressure sensors. See Table XII for tubing. (Wet-leg tubing wall thickness must be 0.065-inch).*

Kit 8 - Remote Mount Pressure Sensor Hardware Kit with Purge and Isolation Valves
Part No. 10061026

Item No.	Description	Quantity
3	Swagelok nut	4
4	Swagelok ferrules	4
15	Temperature extended fitting	2
16	Purge valve	2
17	Isolation valve	2
19	Adapter fitting	2

NOTE: *Kit will service two remote-mount pressure sensors. See Table XII for tubing. (Wet-leg tubing wall thickness must be 0.065-inch).*

Kit 9 - Explosion Proof Union Fitting
Part No. 10007238

Item No.	Description	Quantity
14	Explosion proof union	1

Kit 10 - Pressure Sensor Electrical Cable Replacement Kit
Part No. 10061117

Item No.	Description	Quantity
1	Electrical connector cable	1
22	Four-pin connector	1
23	Wire crimp terminal	4

NOTE: *Kit will service two pressure sensors.*

Kit 11 - Pressure Sensor Electrical Extension Cable
Part No. 10054518

Description	Quantity
Electrical connector extension cable	1

Kit 12 - Pressure Sensor Calibration Kit
Part No. 10061118

Description	Quantity
Pressure sensor calibration fixture	1
Electrical connector extension cable	2
O-ring seal, Viton	2

NOTE: *Two sensors can be calibrated simultaneously with this kit.*

Kit 13 - DP Cell Manifold Replacement
Part No. 10203723

Description	Quantity
Valve manifold	1

Temperature Probe Kits

See temperature sensor configurations drawing for item numbers.

Kit 14 - Standard Temperature Probe Replacement, Div II Configuration
Part No. 10055955

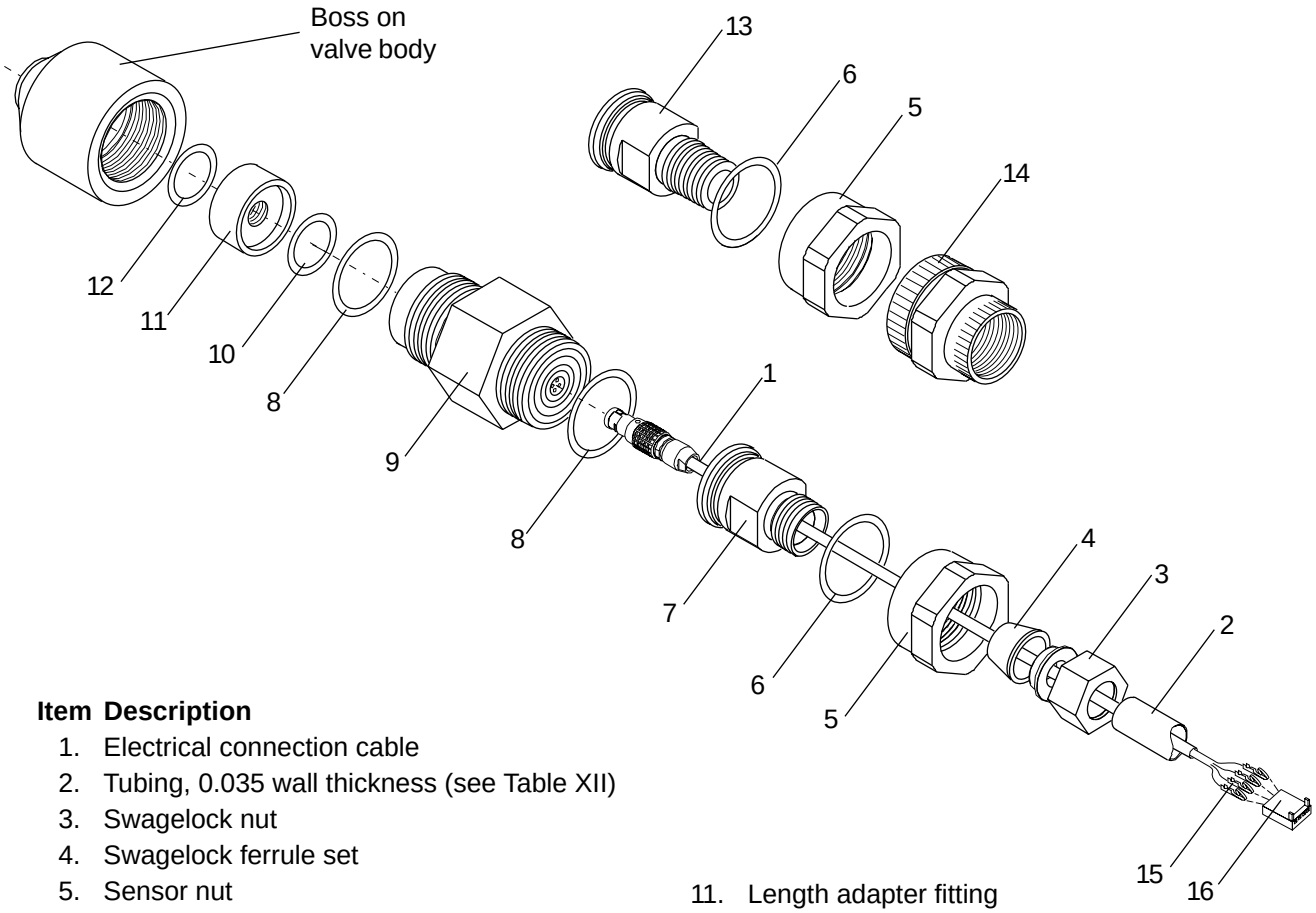
Item No.	Description	Quantity
2	Standard temperature probe	1

Kit 15 - Standard Temperature Probe Replacement, Div I Configuration
Part No. 10070891

Item No.	Description	Quantity
2	Standard temperature probe	1
6	Adapter fitting	1
7	Adapter fitting	1

Kit 16 - Through Hole Temperature Probe Replacement
Part No. 10065272

Item No.	Description	Quantity
2	Through hole temperature probe	1



Item Description

1. Electrical connection cable
2. Tubing, 0.035 wall thickness (see Table XII)
3. Swagelock nut
4. Swagelock ferrule set
5. Sensor nut
6. Environmental O-ring
7. Division II sensor fitting
8. Environmental O-ring
9. Pressure sensor
10. O-ring seal
11. Length adapter fitting
12. O-ring seal
13. Division I sensor fitting
14. Explosion-proof union
15. Wire crimp terminals
16. Four-pin connector

Figure 17: Body-mount Sensor Configurations

Kit 17 - Pressure Sensor Adaptor Kit
Part No. 10203061

Description	Quantity
PTFE cap for flush-mount sensors	1

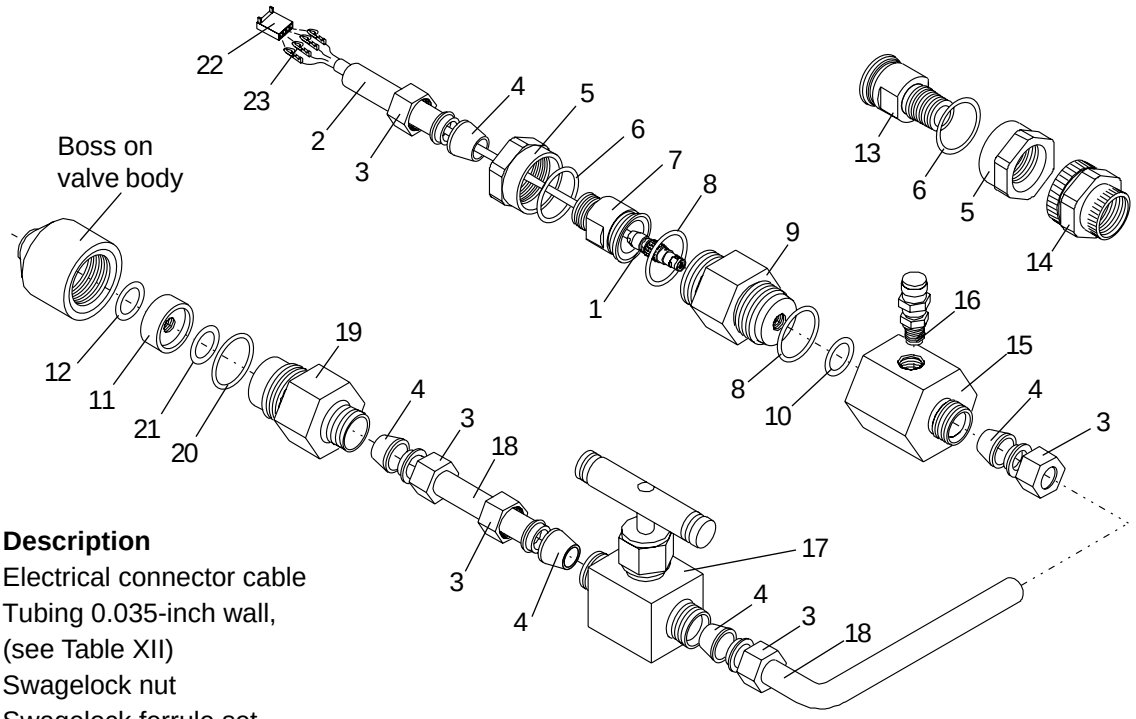
Kit 18 - Pressure Sensor Adaptor Kit
Part No. 10070892

Description	Quantity
Pressure sensor length adapters w/Viton O-rings	1

Kit 19 - Pressure Sensor Adaptor Kit
Part No. 10070893

Description	Quantity
Pressure sensor length adapters w/spiral-wound gaskets	1

NOTE: *In July of 1993, the sensor manufacturer shortened the process end of the pressure sensors. If the StarPac uses the longer style sensors, order one of the above adapter kits with the new sensor purchase. Each kit will service two pressure sensors.*



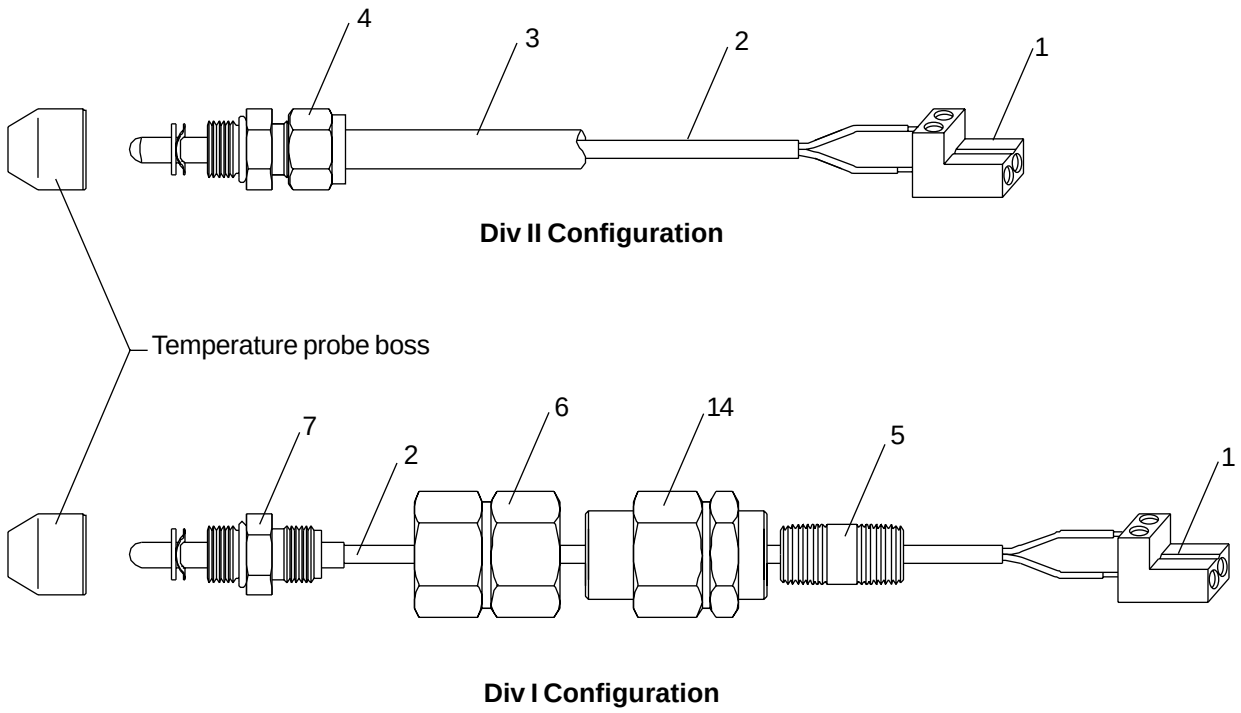
Item Description

1. Electrical connector cable
2. Tubing 0.035-inch wall, (see Table XII)
3. Swagelock nut
4. Swagelock ferrule set
5. Sensor nut
6. Environmental O-ring
7. Division II sensor fitting
8. Environmental O-ring
9. Pressure sensor
10. O-ring seal
11. Length adapter fitting
12. O-ring seal
13. Division I sensor fitting
14. Explosion-proof union
15. Temperature extended fitting
16. Purge valve
17. Isolation valve
18. Wet-leg tubing, 0.065-inch wall, (see Table XII)
19. Adapter fitting
20. Environmental O-ring
21. O-ring seal
22. Four-pin connector
23. Wire crimp terminals

Figure 18: Remote-mount Sensor Configurations

Table IX: Standard Pressure Sensor

Description	Diaphragm Material
	316 Stainless Steel
Pressure sensor, 0-25 PSIA	10062971
Pressure sensor, 0-50 PSIA	10062972
Pressure sensor, 0-100 PSIA	10062957
Pressure sensor, 0-150 PSIA	10062963
Pressure sensor, 0-300 PSIA	10062974
Pressure sensor, 0-500 PSIA	10062965
Pressure sensor, 0-1000 PSIA	10062960
Pressure sensor, 0-1500 PSIA	10062975
Pressure sensor, 0-3000 PSIA	10062977
Pressure sensor, 0-5000 PSIA	10062978
Pressure sensor, 0-7500 PSIA	10091198



Item	Description
1.	Two-pin connector
2.	Temperature probe
3.	Tubing, 0.035 wall, (see Table XII)
4.	Swagelock tube fitting
5.	Stainless steel pipe
6.	Adapter fitting
7.	Adapter fitting
14.	Explosion-proof union

Figure 19: StarPac Temperature Sensor, Flush-mount Version

Table X: 316 Stainless Steel Tubing

Description	Diaphragm Material
	316 Stainless Steel
Pressure sensor wire tubing (0.50-inch diameter 0.035-inch thick)	10045503
Temperature extended wet leg tubing (0.50-inch diameter 0.065-inch thick)	10055784
I/P wire and thermocouple tubing (3/8-inch diameter, 0.035-inch thick)	10013367

On remote mount pressure sensor configurations, the wet-leg tubing must have a wall thickness of 0.065-inch.

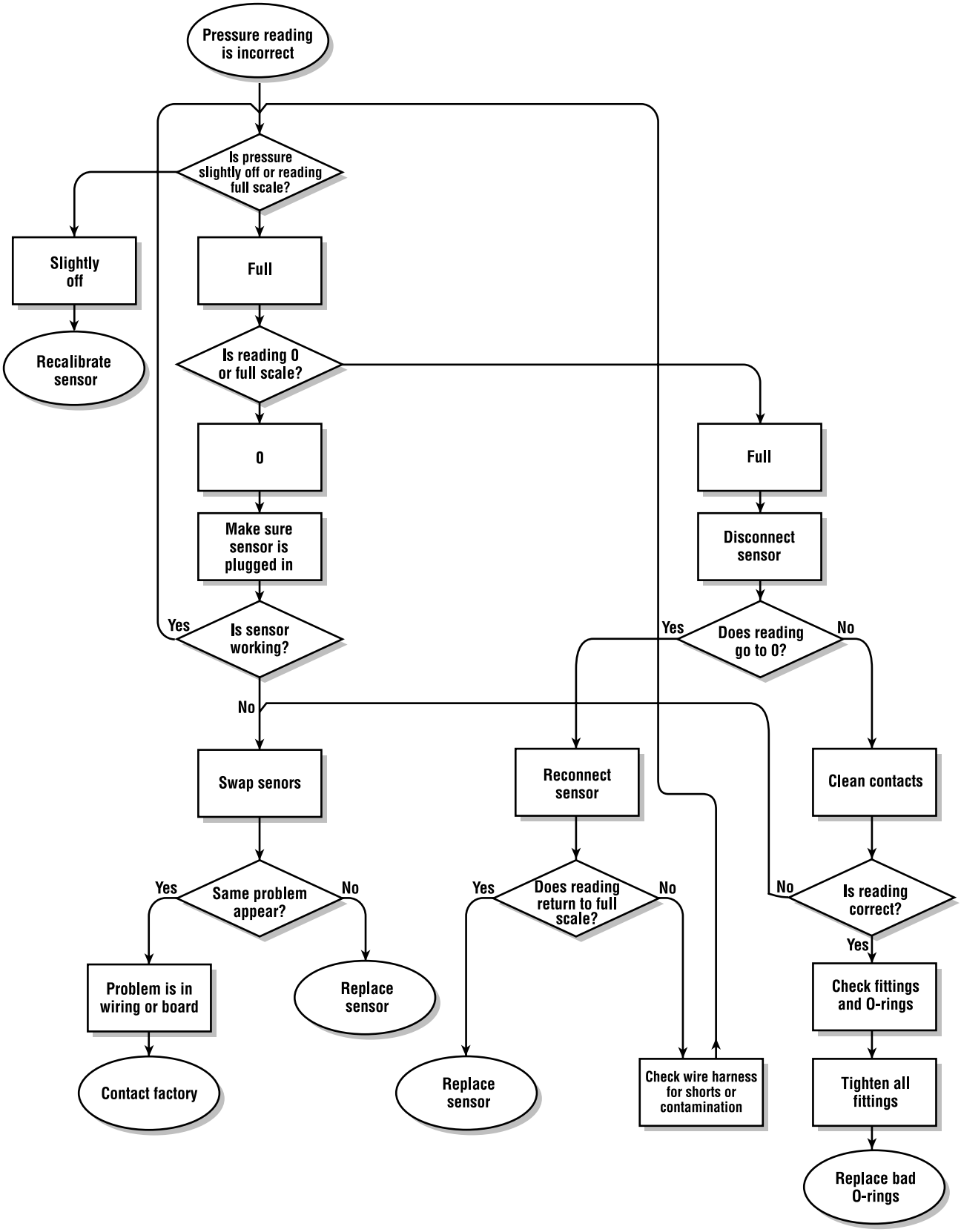


Figure 20: Sensor Troubleshooting Chart

Troubleshooting StarPac Intelligent Control Systems

Failure	Probable Cause	Corrective Action
Local display not on	1. 24 VDC not on or set correctly 2. Incorrect wiring polarity 3. Interface connections on bottom are not correct	1. Verify power supply is outputting 24 VDC (+3 volts) at terminals 1 and 2 2. Check wiring for correct polarity 3. Make sure connections are correctly aligned and fully plugged in
Local display has black showing dimly	1. RESET switch was left down or system not completely initialized	1. Set RESET switch to up position or boxes completely reinitialize system
Erratic communications	1. Multiple units have same address on network line 2. Proper polarity not maintained 3. Individual units not properly wired 4. Termination jumper not installed	1. Change each unit to a unique, sequential address (refer to Address Setting in Maintenance section) 2. Check all network connections for correct positive and negative connections 3. Begin with shortest RS-485 run, checking polarity and communication; continue checking units throughout network 4. Install termination jumper on two most distant devices
StarPac does not respond to analog commands	1. StarPac still in initialize mode 2. I/P not connected	1. Be certain the INIT switch is up, then change the mode in the tuning screen 2. Be certain the two-wire cable is connected on the bottom board
StarPac data is not correct	1. Improper configuration file was loaded onto system	1. Find the correct file for this system and send to the StarPac; refer to the Utility or Technician sections of the StarPac manual
Valve position reading is not correct	1. Hallpot connection not tight 2. Stroke not calibrated 3. Hallpot shaft is at end of stroke	1. Tighten hallpot connection set screw 2. Calibrate valve stroke; refer to Calibration section 3. Readjust hallpot shaft connection; make sure shaft does not reach rotation stop in either direction
Stem position decreases when valve opens	1. Hallpot wiring harness is installed backwards	1. Reverse three-wire harness

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For more information about Flowserve, contact www.flowserve.com or call USA 972 443 6500

Regional Headquarters

1350 N. Mt. Springs Prkwy.
Springville, UT 84663
Phone 801 489 8611
Facsimile 801 489 3719

12 Tuas Avenue 20
Republic of Singapore 638824
Phone (65) 862 3332
Facsimile (65) 862 4940

12, av. du Québec, B.P. 645
91965, Courtaboeuf Cedex,
France
Phone (33 1) 60 92 32 51
Facsimile (33 1) 60 92 32 99

Quick Response Centers

5114 Railroad Street
Deer Park, TX 77536 USA
Phone 281 479 9500
Facsimile 281 479 8511

104 Chelsea Parkway
Boothwyn, PA 19061 USA
Phone 610 497 8600
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1300 Parkway View Drive
Pittsburgh, PA 15205 USA
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Facsimile 412 787 1944