

OPERATING & MAINTENANCE MANUAL

TVC Positioner



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Features

- Large backlit liquid crystal display
- Communication via infra red keypad
- Simple two-step calibration
- Calibration trim for fine adjustment
- 4-20mA current command signals and current or potentiometer feedback signal.
- Actual position 4-20ma calibrated output
- Three way isolation for command and actual position signals
- MANUAL mode
- Stepping mode with adjustable ON and OFF times
- Selectable solenoid drive sense for failsafe operation
- Selectable default operation on command signal/feedback signal break
- ESD solenoid output on fault - 24Vdc open drain
- Fault output - 24Vdc open drain
- Hydraulic pump drive controlled by demand or external pressure sensors
- External fault contact monitoring
- Selectable interlock between ESD and fault outputs
- Low power - normal operation less than 3W
- Direct mounting within Compact Ex d Enclosure System

The TVC can be used in any positioning system relying on the on-off control of the position driver including electro-hydraulic actuators and reversing ac motors (with the addition of suitable relays or contactors). The TVC can accept positional feedback from a three-wire potentiometer or a position transducer with a current output. The TVC is mounted to a special chassis plate and fitted within an Exd enclosure. All field and customer wiring is taken through a close-coupled Exe enclosure. Comprehensive power supply and signal isolation allows connection to any user DCS system without the need for further signal isolation.

This handbook describes the configuration and operation of the basic TVC. Other hardware and firmware options will be described in additional sections published separately.

Operation

First Time Operation

Please read this handbook before operating the TVC. The instrument will have been set up during factory trials so please avoid changing any parameters until you have gained some familiarity with the operation of the positioner.

WARNING !!

The actuator and associated mechanical equipment connected to it could possibly move in an unpredictable manner during initial calibration. Ensure that all personnel take appropriate precautions.

1. Ensure that any end of travel limit switches and mechanical stops are correctly adjusted before operation.
2. Apply power and provide the 4-20mA command signal.
3. Use the IR900 to enter Manual Mode.
4. Operate the actuator in manual and confirm that the actuator moves as required.
5. Return to automatic mode and confirm that the actuator follows the demand signal and that a suitable actual position retransmitted signal is produced.
6. At this stage, the accuracy of the calibration and the response of the system can be assessed and recalibration and modification to the control parameters can be considered.

The instrument compares two analogue signals, one representing the desired position (command signal) and the other representing the actual position (feedback signal) of the actuator.

A difference between these two signals will cause one of the TVC outputs to operate, driving the actuator to the desired position.

A positional dead-zone may be adjusted to overcome "hunting" problems associated with mechanical overrun of the actuator and further band edge hysteresis adjustments refine this setting.

The speed of transit of the actuator can be reduced by selecting the stepping mode that provides independently adjustable on and off times for the open and close solenoid operation.

Physical

The TVC is mounted on a chassis plate and housed within an Exd enclosure. The circuit boards are coated with a resist layer that protects the track from moderate condensation and mould growth problems. Connections within the EXd enclosure are by factory assembled 0.1" connectors and must not be disturbed or re-wired. The only internal hardware configuration adjustment is the jumper link selection of either sinking or sourcing excitation of the retransmitted actual position signal and is usually set to customer requirements on order. The TVC requires the Intrinsically Safe (Exia') IR900 keypad for calibration, configuration and manual operation.

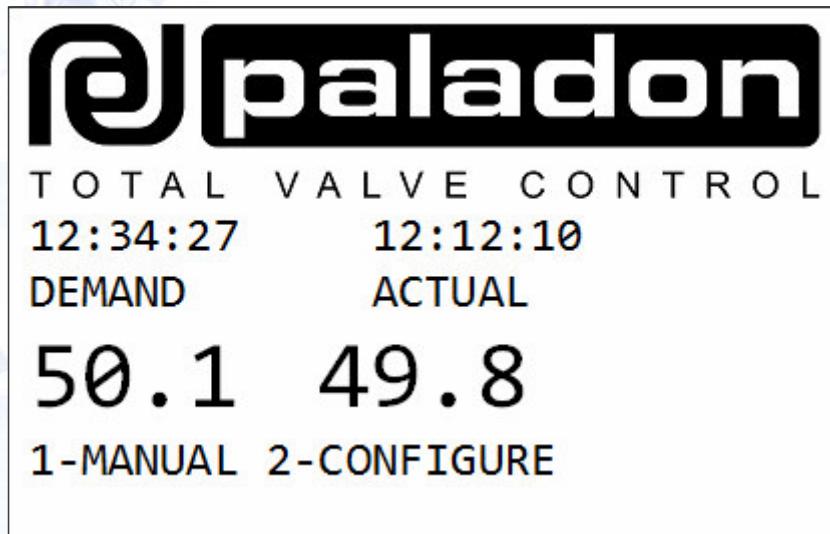
Wiring

Wiring to the Exe enclosure terminals should be completed by suitably trained personnel taking into account the following notes:

- To ensure RFI compliance the analogue signals should be routed in copper braided screened cables with a fill factor density of at least 0.7.
- The screens should be terminated to the metal of the actuator housing, ideally at a suitable metal cable gland.
- Signal cables should be routed separately from power and switching conductors.

Normal Positioner Operation

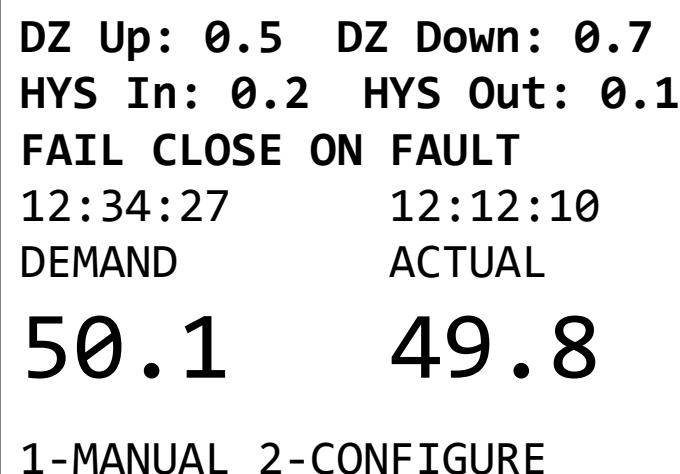
When the TVC is first switched on the display will show the normal running status:



The Paladon Systems logo is displayed over the first three lines. The first text line shows the time as hrs:mins:secs (24 hour clock) followed by the date as dd:mm:yy. The main display shows the current demand signal as a percentage of the full range, normally 4-20mA followed by the actuator stroke as a percentage of the full stroke. In normal operation the display will reflect changes in the demand signal and the position of the actuator.

Alternative Displays

Pressing key * on the IR900 keypad removes the Paladon Systems logo and displays the current **dead zone** and **band edge hysteresis** data and the current **fail-mode** setting:

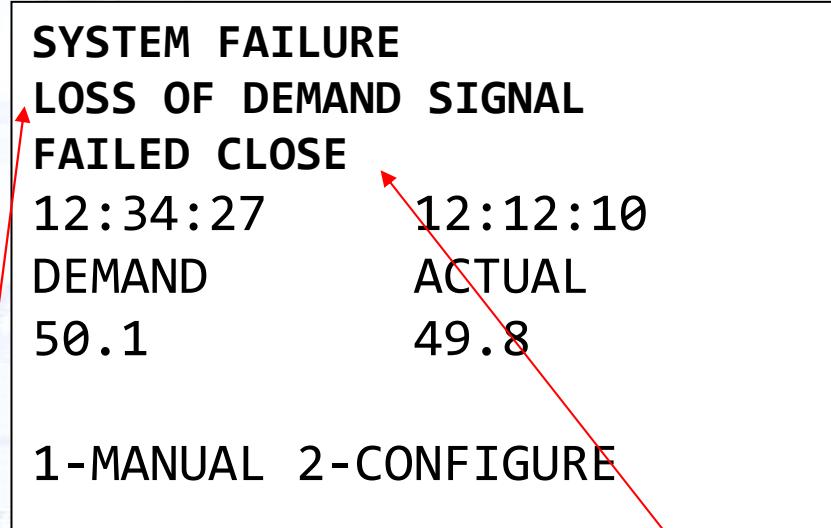


The display toggles back to the Paladon Systems logo with a further press of the * key on the IR900.

Faults

In the event of a positioning fault, the first three lines will detail the fault and the response of the actuator.

Note: The failed system information will be reset to a normal display when the fault condition has been resolved.



Descriptions Line Can Include	Positioner Fault Line
LOSS OF DEMAND SIGNAL LOSS OF F/B SIGNAL FAILURE TO POSITION EXTERNAL FAULT INPUT	FAILED CLOSE FAILED OPEN FAILED STAY PUT GO TO POSN. ON FAULT

Main Display LED Indicators

There are 8 LED indicators above the main display and they have the functions, running clockwise from top right:

CLOSE <input type="checkbox"/> 8	1 <input type="checkbox"/> OPEN
FAULT <input type="checkbox"/> 7	2 <input type="checkbox"/> MANUAL
ENABLED <input type="checkbox"/> 6	3 <input type="checkbox"/> STEP
<input type="checkbox"/> 5	4 <input type="checkbox"/> ESD

1. OPEN – lit when the open solenoid is energised
2. MANUAL – lit when the TVC is in manual mode
3. STEP – lit when stepping mode has been selected
4. ESD – lit when the ESD output is energised – this may be ‘fail-safe i.e. energised healthy’
5. Future use
6. ENABLED – lit when the enable contact has been made, enabling access to manual and configuration
7. FAULT – lit when there is a fault within the TVC system– this may be ‘fail-safe i.e. energised healthy’
8. CLOSE – lit when the close solenoid is energised

Access To The Manual & Configuration Systems

An external volt free contact closure enables access to the manual and configuration modes of the TCV. The contact should be MADE to enable. The contact switches a 24Vdc input excited from the common bulk supply to the TVC. LED 6 is lit if the TVC is enabled for manual operation or configuration. If an attempt is made to access manual (Key 1) or configuration (Key 2) using the IR900 without the enable contact being made then the following display will be seen for 10 seconds. The positioner will continue to operate in automatic mode:

ACCESS NOT ENABLED	
CHECK INPUT 4	
12:34:27	12:12:10
DEMAND	ACTUAL
50.1	49.8
1-MANUAL 2-CONFIGURE	

Entering Manual Mode

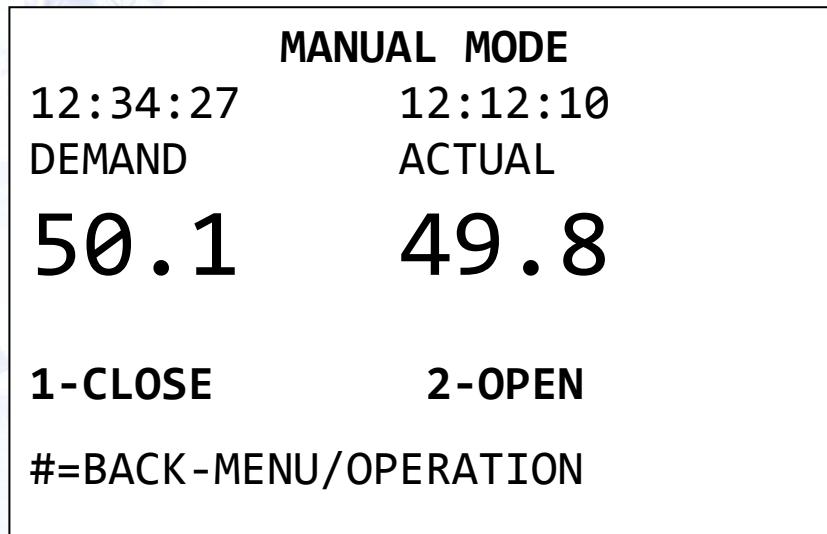
If the TVC input 4 is made and Key 1 is pressed on the IR900 then the following display is seen:

ENTER MANUAL MODE
PASSCODE
DISPLAY REVERTS
IN 45 SECONDS

If a correct 4-digit pass code is not entered by the IR900 within the time shown, then the display will revert to the normal auto mode when the timer reaches zero. Note that the actuator will remain stationary at the last auto position during the pass code entry sequence.

Manual Mode

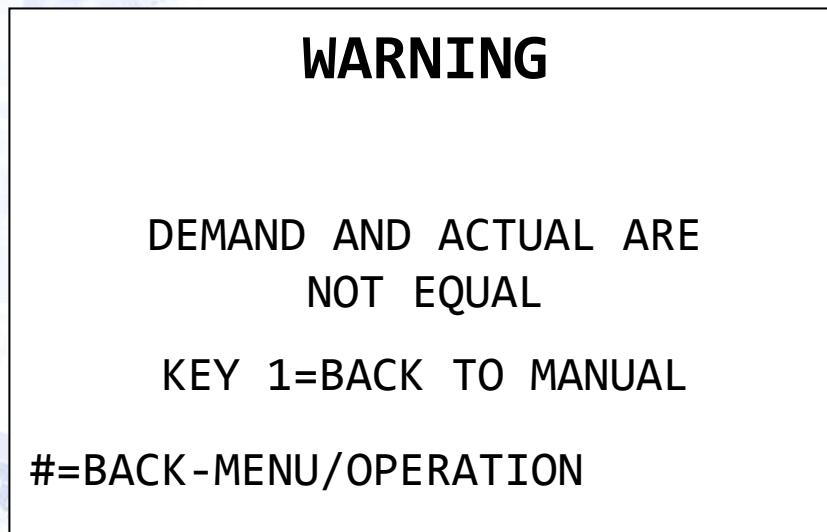
After a successful pass code entry the following screen is displayed and LED 2 is illuminated:



Keys 1 and 2 on the IR900 control the opening and closing of the actuator. The actual solenoids operated will depend on the **Solenoid Sense** setting for the particular hydraulic circuit used in the actuator. All system fault monitoring is disabled in manual mode thus enabling further diagnostics of a known faulty system. Pressing the # key starts the exit routine from manual mode.

Returning To Auto Mode

Pressing the # key does not immediately switch operation to auto. An intermediate screen is displayed to warn if the actual position deviates more than the current dead zone setting from the current demand signal. This protection will protect the process from a step change in flow and allow a smooth transfer to auto.



Key 1 will return to manual mode and key # will show the auto mode display. LED will extinguish and the positioner will go into automatic operation with fault monitoring re-established.

Entering Configuration Mode

**ENTER CONFIG. MODES
PASSCODE**

**DISPLAY REVERTS
IN 45 SECONDS**

If the TVC is not enabled then the same warning message, as described for manual mode entry above, will be shown. If enabled, automatic positioning is suspended and the actuator is left in its stay put position, and the pass code entry display, above, will be shown. Entry of the correct pass code within the time indicated will allow entry to the main configuration menu.

CONFIGURATION MENU

- 1 - CALIBRATION**
- 2 - CALIBRATION TRIM**
- 3 - INST. SET UP MENU**
- 4 - UTILITIES MENU**

#=BACK-MENU/OPERATION

Key 1 to 4 selects one of the options shown and key # returns the display and operation to automatic mode.

Calibration

Calibration is a two-stage procedure requiring control of the demand signal to the TVC and a means of measuring the retransmitted signal from the unit. The actuator and valve may need to be isolated from the process as full stroke operation of the actuator is required. It is usually best if the demand signal injection and the actual retransmitted position signal monitoring is done locally to the TVC and actuator.

Select Calibration by pressing key 1

MANUAL CALIBRATION
KEY*=START/NEXT STAGE

#=BACK-MENU/OPERATION

Pressing key # will return the display to the Configuration Menu. Pressing key * will start the calibration procedure at the '**low end**' i.e. the **actuator stroke to be associated with the 4mA demand signal**, (often the closed position.)

MANUAL CALIBRATION

KEY*=START/NEXT STAGE

LOW END DEMAND:	0719
ACT:	0738
RETRANS:	0518

#=BACK-MENU/OPERATION

The descriptions are in reverse contrast and the numeric values, the internal bit conversion values, are in normal contrast. The low end calibration procedure is as follows:

1. Set the demand signal to the low end value, usually 4mA.
2. Use Key 1 (close) or Key 2 (open) to position the actuator to the desired position.
3. Monitor the retransmitted actual position signal with a suitable DVM on current range.
4. Use Key 4 to reduce the retransmitted output or Key 5 to increase it.
5. Note that the last low end calibrated value for the retransmitted signal is used.
6. Press Key # to complete the operation.

Press Key * to continue to the 'high end' calibration

MANUAL CALIBRATION
KEY*=START/NEXT STAGE
LOW END DEMAND: 0719
ACT: 0738 RETRANS: 0518

HIGH END DEMAND: 3615
ACT: 3702 RETRANS: 2565

#=BACK-MENU/OPERATION

The descriptions are in reverse contrast and the numeric values, the internal bit conversion values, are in normal contrast. The high end calibration procedure is as follows:

7. Set the demand signal to the high end value, usually 20mA.
8. Use Key 1 (close) or Key 2 (open) to position the actuator to the desired position.
9. Monitor the retransmitted actual position signal with a suitable DVM on current range.
10. Use Key 4 to reduce the retransmitted output or Key 5 to increase it.
11. Note that the last high end calibrated value for the retransmitted signal is used.
12. Press Key # to complete the operation.

Press the * Key to continue to the calibration confirmation procedure.

MANUAL CALIBRATION

**KEY * TO CONFIRM
CALIBRATION**

**KEY # - LEAVE WITHOUT
SAVING CALIBRATION**

If the calibration is confirmed then scaling factors are calculated and all are saved to EEPROM.

Calibration Trim

This facility allows the calibration at the low demand end (normally valve closed) to be finely adjusted, typically for seating of valves, without having to go through a full calibration.

CALIBRATION TRIM
SET DEMAND AT LOW-4mA
KEY1 CLOSE KEY2 OPEN

LOW END DEMAND: 0719
ACT: 0738 RETRANS: 0518
KEY # - LEAVE WITHOUT
SAVING CALIBRATION

The trim adjustment procedure is as follows:

1. Set the demand signal to the low end value, usually 4mA.
2. Use Key 1 (close) or Key 2 (open) to position the actuator to the desired position.
3. Press Key # to complete the operation.

Instrument Set-up Menu

These sub-menu allow the set up of the positioner to suit the hydraulic hardware, the control signals and the process control required.

INSTRUMENT SETUP MENU

- 1 - SOLENOID SENSE
 - 2 - INST. FAIL MODE
 - 3 - PUMP CONTROL
 - 4 - SET STEPPING MODE
 - 5 - SET DEADZONE, HYST
 - 6 - MORE CHOICES
- #=BACK-MENU/OPERATION

A further selection appears if Key 6 is pressed:

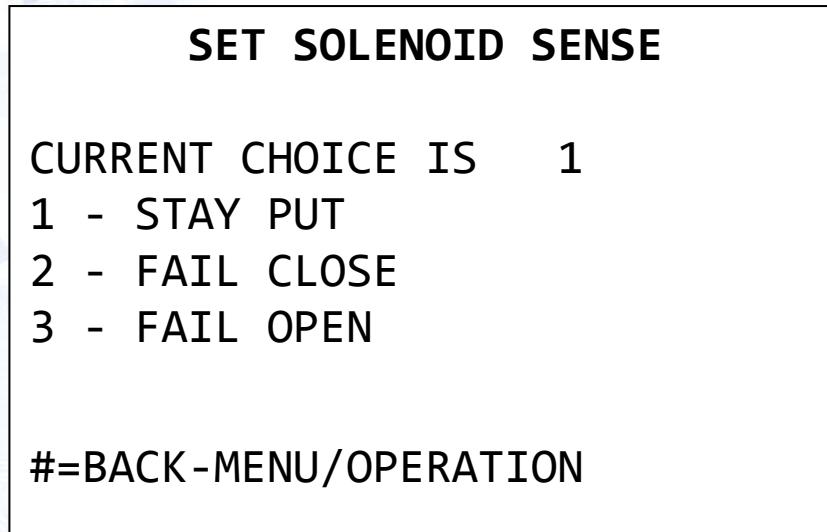
SETUP MENU - PAGE 2

- 1 - SET I/P,O/P SENSE
- 2 - SET FAULT MATRIX
- 3 - SET DEMAND DIR'N

#=BACK-MENU/OPERATION

Solenoid Sense Selection

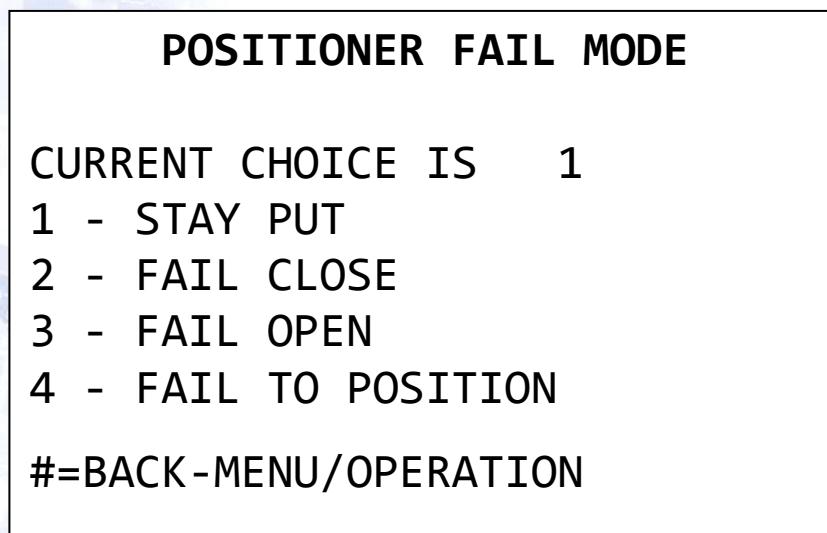
This allows the matching of the solenoid control with the particular hydraulic circuit used and is normally a one-off adjustment completed during factory tests. The open and closed solenoids can be assigned to cause flow either when energised or when de-energised. This allows the three common hydraulic configurations, stay put, fail close or fail open, under fault conditions. The following screen is displayed:



The current selection is shown and pressing Keys 1-3 will select a new setting. Pressing Key # will return to the main Set up Menu and save any changes.

Instrument Fail Mode

The TVC can detect failures in the systems connected. The demand or actual position feedback signals are monitored and an alarm is set if they stray outside the normal 4-20mA range – the detection points are less than 1mA or greater than 21mA. The time taken to position is monitored and an alarm set if position has not been attained. An external contact input, possibly monitoring hydraulic pressure unit operation is also monitored. Any or all of these points can cause the positioner to fail to a predetermined position – see Fault Matrix Selection below for further details. This menu sets the fail position:

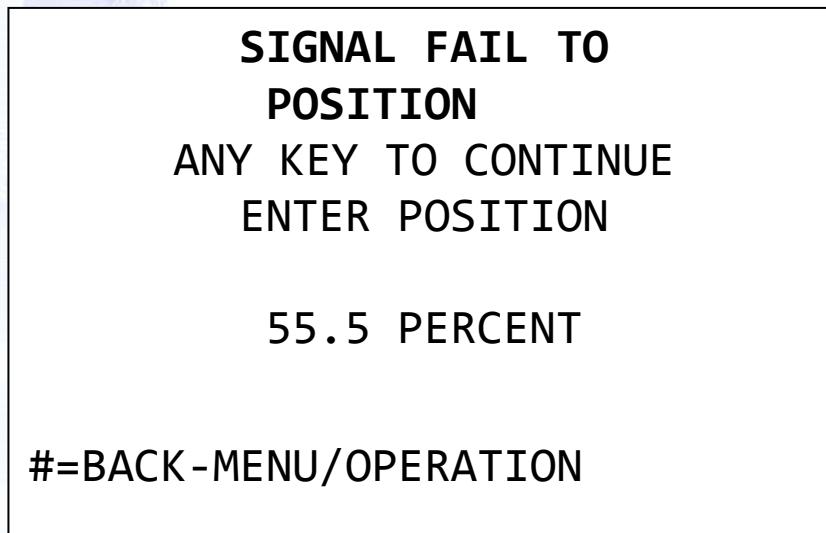


The current selection is shown and pressing Keys 1-4 will select a new setting. Pressing Key # will return to the main Set up Menu and save any changes. In most cases, the fail mode will be associated with the state of the hydraulic flow with the solenoids de-energised.

1. Stay put – normal for a double acting system where both solenoids are de-energised when the actuator is at the required position.
2. Fail close – normal for an actuator with a mechanical spring or hydraulic accumulator to close with the solenoids de-energised.
3. Fail open – normal for an actuator with a mechanical spring or hydraulic accumulator to open with the solenoids de-energised.
4. Fail to position would normally be used on a double acting system where the process required a particular fail position.

Choice 4 - Fail To Position

The final choice requires the setting of the stroke position that the actuator would drive to on fault.



The current fail position is displayed. Pressing any key will place a flashing cursor on the value, waiting for a position to be entered in the range 00.0 to 99.9%. The value can be changed by repeating the process and the operation can be finished and the value saved by pressing Key #

Pump Control

The TVC can oversee the control of the hydraulic power unit pump supplying the hydraulic circuit to the actuator system. This menu lists the choices available for that control and the associated settings.

PUMP CONTROL MODES

CURRENT CHOICE IS 1

- 1 - NO PUMP CONTROL
- 2 - ON DEMAND
- 3 - PRESSURE SWITCHES
- 4 - PRESSURE TX

#=BACK-MENU/OPERATION

The current selection is shown and pressing Keys 1-4 will select a new setting. Pressing Key # will return to the main Set up Menu and save any changes.

1. **No Pump Control** – this is selected for systems with a ring-main type hydraulic supply.
2. **On Demand** – this would be selected for systems with some local hydraulic accumulation and a low to moderate duty cycle. The pump would start to operate when the actuator was caused to move either by a change in demand signal or in manual operation. The control is sensitive to the particular solenoid sense set for the system thus the pump would not run for actuator closing if *fail close* was selected or fail open if *fail open* was selected. Similarly, the pump would not run if the system had detected a system fault as described above. There is also an overrun time associated with mode that can be set if this pump control is selected.
3. **Pressure Switches** – external contact inputs 1 and 2 can be used as low pressure and high pressure controls respectively. These switches, fitted within the hydraulic system, will stop the pump at high pressure and start it again at low pressure. The sense of the inputs can be set in the *Input and Output Sense Setting* below.
4. **Pressure Transmitter** – the pressure switches mentioned above can be replaced with a pressure transmitter, connected to Internal Analog Input 2. A further menu sets the low and high switching for this transmitter.

Choice 2 – Set Pump On Demand Run On Time

ON DEMAND PUMP RUN-ON TIME

ANY KEY TO CONTINUE

RUN-ON TIME 005 SECS

#=BACK-MENU/OPERATION

The current run on time is displayed. Press any key to start and enter the required time in the range 0 to 999 seconds. The entry can be changed by repeating the procedure and the operation can be finished and the values saved by pressing Key #.

Choice 4 – Pump Control Pressure Transmitter Set Points

**PRESSURE TRANSMITTER
PUMP CONTROL
ANY KEY TO CONTINUE**

LOW PRESS 170 BAR
HIGH PRESS 210 BAR

#=BACK-MENU/OPERATION

The current pressure set points are displayed. Press any key to start and enter the required low and high pressure set points in the range 0 to 999 Bar. The entries can be changed by repeating the procedure and the operation can be finished and the values saved by pressing Key #.

Set Stepping Mode

The TVC can operate its control solenoids intermittently in order to slow down the actuator speed in situations where the process cannot tolerate sudden changes in flow. This stepping mode applies preset on and off times to both the close and open solenoids, giving the option for different speed operation for opening and closing.

STEPPING MODES

CURRENT CHOICE IS 1
1 - STEPPING ON
2 - STEPPING OFF
3 - SET STEP TIMES

#=BACK-MENU/OPERATION

The current stepping mode is displayed. Press Keys 1-3 to select the required option. Pressing the # Key saves the selection and returns the display to the main Set up Menu. Selecting 3 opens a new menu:

SOLENOID STEP TIMES

ANY KEY TO CONTINUE
 CURRENT OPEN TIMES
 ON: 500mS OFF: 060s
 CURRENT CLOSE TIMES
 ON: 500mS OFF: 060s

#=BACK-MENU/OPERATION

The current on and off times are shown. Pressing any key (other than #) sets a flashing cursor on the OPEN TIME – ON selection and further key presses will enter a value in the range 0 to 999mS. Pressing any key (other than #) then selects the OPEN TIME – OFF and further key presses will enter a value in the range 0 to 999s – note the different units from the ON time. The OFF TIMES can be selected in a similar manner. Repeated pressing of the # Key will skip other entries and return the display to the Set up Menu, saving any changes.

Set Deadzone and Band Edge Hysteresis

The deadzone allows an area of control of the actuator position where no movement takes place. Such a zone is required in systems that have on-off control of the hydraulic control elements due to magnetic and mechanical delays inevitable with such components. Control is enhanced by having two settings, one for the open direction and one for the close direction solenoid operations. The hysteresis value provides an additional suppressed band, active only on entry into the deadzone to reduce instability due to conversion and arithmetical errors in the positioner. The deadzone is expressed in percent of full stroke of the actuator whilst the hysteresis is a notional value.

SET DEADZONE AND HYST

ANY KEY TO CONTINUE
 OPEN DEADZONE: 00.7
 CLOSE DEADZONE: 00.6
 HYSTERESIS OPEN: 005
 HYSTERESIS CLOSE: 005

#=BACK-MENU/OPERATION

The current deadzone and hysteresis values are shown. Pressing any key (other than #) sets a flashing cursor on the first value, which can then be changed. Subsequent presses of the # Key pass through each value without change and , eventually, the display returns to the main Set up Menu.

Instrument Set-up Menu Page 2

Options are on a second page, accessed by pressing Key 6

Set Input and Output Sense

The TVC has four digital inputs, internally pulled high to the 24V instrument supply and four open drain outputs acting as low-side switches using the 24V instrument supply. This setpoint allows the inactive state to be set for both inputs and outputs. Pressing Key 1 sets a normal state, inputs pulled high, outputs not energised, and Key 2 set the reverse condition. If Key # is pressed the display will return to the second page of the Set up Menu, otherwise the key press is ignored but subsequent Key presses of 1, to select normal, or 2 (or any other key), to select reverse, will modify all four outputs and inputs sequentially.

Note that if editing is started then all values have to be re-entered. The display automatically returns to the second page of the Set up Menu when the final output is changed.

SET I/P AND O/P SENSE			
KEY 1=NORM	KEY 2=REV		
PRES L NOR	PRES H NOR		
EXT FL NOR	ENABLE NOR		
ESD OP NOR	FLT OP NOR		
PUMP NOR	STATUS NOR		
#=BACK-MENU/OPERATION			

Setting the Fault Matrix

The TVC has four main fault conditions, divided between positioning faults and external faults, and four possible reactions to a fault condition:

Positioning Faults

1. Demand signal out of range – normally a break
2. Actual position feedback out of range – normally a break
3. Failure to position within a preset time

External Faults

1. External fault contact

Possible Actions

1. Change actuator position or control – stay put, fail up, down or to position
2. Change state of Emergency Shutdown Output
3. Change state of Fault Output
4. Alert operator with a display message and LED changes

This option can associate Positioning Faults and External Faults with any of these four actions.

FAULT ACTION MATRIX

SEL=1-4, CNG=1/2, NXT=*

ACTION	POSN.	EXT.
1.POS 'NER	ON	OFF
2.ESD O/P	ON	OFF
3.FLT O/P	OFF	ON
4.DISPLAY	ON	ON

#=BACK-MENU/OPERATION

The matrix can be inspected without change by just pressing the # Key to exit to the second page of the Set up Menu. Keys 1-4 select the positioner action, followed by Keys 1 or 2 to change the choice. The selections for Positioner and External Faults have to be completed for each action. Key * terminates the entry for each choice.

Setting Actuator Direction

The positioner needs to know what solenoid operates to move the actuator towards the set 4mA demand signal, as it is possible to set the fully open position equivalent to 4mA.

DEMAND DIRECTION

CURRENT CHOICE IS 1

- 1 - 4mA AT CLOSE
- 2 - 4mA AT OPEN

#=BACK-MENU/OPERATION

Keys 1 or 2 will change the choice and Key # will return the display to the second page of the Set up Menu.

Utilities Menu

The final item in the Main Configuration Menu is the Instrument Utilities Settings. Pressing Key 4 from the Configuration Menu enters the Utilities Menu.

UTILITIES MAIN MENU
1-SET DATE AND TIME
2-SET MISC TIMERS
3-SET MANUAL PASSCODE
4-SET CONFIG PASSCODE
5-FORCE RETRANS O/P
6-MORE CHOICES
 #=BACK-MENU/OPERATION

Pressing Keys 1-6 will access the listed choices and Key # will return the display to the Main Configuration Manu.

Set Date and Time

The TVC has a real time clock equipped with a short term back up in the event of power loss.

DATE AND TIME
TIME 12:10:54
DATE 03:09:10
 #=BACK-MENU/OPERATION

Pressing Key # returns the display to the Utilities Menu. Pressing any other key starts the editing process by placing a flashing cursor on the hours display. Key in the required time, hh:mm, as prompted by the cursor. A further press of the # key will return to the Utilities Menu, leaving the date unchanged, but pressing any other key will start the editing process of the date, dd:mm:yy. The display returns automatically to the Utilities Menu on completion of editing the date.

Set Miscellaneous Timers

The TVC has a number of utility timers that can be reset if desired. These are normally set during factory testing and should only be adjusted after fully understanding the function of the timer and any consequences of the change.

SET MISC. TIMERS

1.POSN. TIME S	030
2.ENABLE WARN S	010
3.TRIM PULSE .1S	003
4.P-CODE WAIT S	050
5.B'LIGHT TIME S	010

#=BACK-MENU/OPERATION

Pressing Key # returns the display to the Utilities Menu. Pressing Keys 1-5 selects the timer to be edited and places a flashing cursor on the first digit.

1. **Time To Position** – this is the time in seconds allowed for the actuator to move to the desired position before a positioning fault is set. This should be set to at least 50% more than the full stroke time of the actuator to avoid spurious alarms. This timer will be suspended if the positioner is in stepping mode due to the very long potential stroking times.
2. **Operator Entry Enable Warning Time** – this is the time in seconds that a warning will show on the display if an attempt is made to enter Manual or Configuration modes without the external enable contact being made.
3. **Trim Pulse** – this is the ‘on’ time pulse length, in 100mS increments. During the Calibration operation it may be necessary to finely position the actuator using the key pad. This timer sets a short ON pulse followed by 5 times the pulse time OFF pulse. The resulting pulse train can position the actuator more precisely than a continuous pulse.
4. **Pass Code Entry Timer** – this is the down count timer in seconds associated with Manual or Configuration pass code entry.
5. **Backlight Timer** – The display backlight is normally off but will light on any key press from IR900 key pad. The display will stay lit for the duration of this timer.

Manual Mode Pass Code

Manual Mode entry is protected by a four digit pass code.

SET MANUAL PASSCODE

ANY KEY TO CONTINUE

CURRENT CODE 1234

#=BACK - MENU/OPERATION

Press Key # to return to the Utilities Menu. Press any other key to start editing the pass code. The display returns to the Utilities Menu automatically after the entry is complete.

Configuration Mode Pass Code

Configuration Mode entry is protected by a four digit pass code.

SET CONFIG PASSCODE

ANY KEY TO CONTINUE

CURRENT CODE 1234

#=BACK - MENU/OPERATION

Press Key # to return to the Utilities Menu. Press any other key to start editing the pass code. The display returns to the Utilities Menu automatically after the entry is complete.

Force Retransmitted Signal Output

This option is included to acts as a check for the outgoing signal loop from the positioner. This can be useful in checking problems in the signal interface on the process DSC.

FORCE RETRANS. OUTPUT
ENTER O/P IN mA
12.0
#=BACK - MENU/OPERATION

Entering a value in mA will cause that current to be output by the suitably calibrated TVC. Key # returns the display to the Utilities Menu.

Normal Operation - Fault Detection and Logging

In normal operation the TVC positioner will cause the actuator to position to the demand signal within the dead zone set and output an actual position signal. The system will detect faults in demand and feedback signals and changes to the external fault input and take preset actions in event of these faults. None of the fault conditions are latched within the TVC and any fault action will clear automatically the fault is rectified.

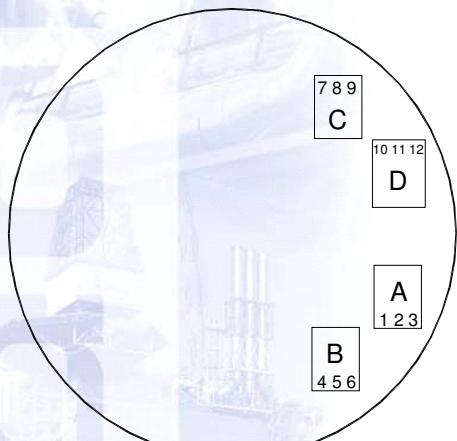
Any faults, power up events and entry into the Manual or Configuration modes will be logged in a simple log of 255 events. The log can be inspected in the Utilities Menu

Maintenance and Fault-Finding

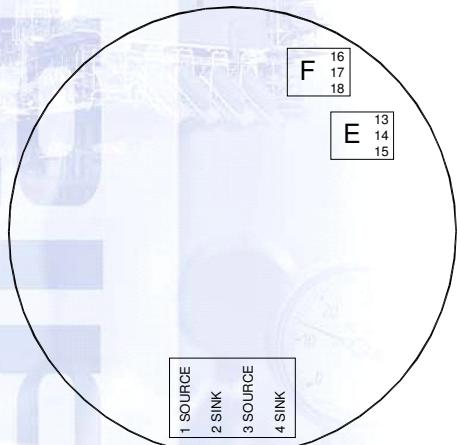
1. The vast majority of first time use failures are a result of incorrect electrical connections or compatibility problems in control signals. Remember, the positioner and actuator system will have been tested before shipment, so double-check all electrical connections and signal excitation sense against drawings and descriptions *specific to the particular installation* before any power is applied.
2. In fault-finding the system, always work from the known towards the unknown. Operating the system in Manual Mode confirms a large part of the system as being ok – hydraulics, power to the positioner, general TVC operation. If the manual mode display shows correct variations of the demand and actual position signals then these signals are also proved, similarly for the retransmitted actual position signal.
3. At the most basic level, disconnect the actuator solenoids – **ALWAYS** with the TVC power OFF – and operate the solenoids directly with 24Vdc. This will isolate hydraulic problems from electrical control ones.
4. The current loops in and out of the TVC are isolated from each other and the instrument supply so there will be no problems with crossed grounds and no need for external isolators.
5. There is a need to check on the excitation of the retransmitted signal form the TVC. This is the only hardware adjustment on the instrument and comprises of a set of jumper links on the third board down from the display board. The instrument will have to be removed from the enclosure:

- a) Unscrew the two captive fixings at the top and bottom of the instrument.
 - b) Carefully pull out the instrument part-way until the jumper links are visible on the lower edge of the board
 - c) From the left, the link positions are
 - Sourcing, 1 and 3 excitation from the TVC
 - Sinking, 2 and 4 excitation from the external DSC
 - d) Replace the TVC in the enclosure before re-applying power.
6. Problems in instability and precision of positioning can be addressed by adjustment of the dead zone and hysteresis bands or, more directly, by adjusting the speed of the actuator via hydraulic flow regulation. Positional overshoot is caused by a failure of the control solenoids to act quickly enough to stop the actuator where required. Slowing down the actuator stroke speed is the ONLY way of improving positional accuracy.
7. Reversed demand signal loops or incorrect connection of external fault devices can cause a failure to operate in automatic mode when there is, apparently, no fault seen in manual mode. Check the fault display, input and output sense setting and the fault matrix setting against the required fault environment.
8. In the event of 'losing' the manual and configuration mode pass codes, there is a back door.
- a) Set the demand signal to 0mA, or temporarily disconnect
 - b) Enter the Configuration Mode and use the pass code 8765
 - c) Go to the Utilities Menu and reset the pass code as required.
 - d) Reconnect and reset the demand signal
9. The TVC is not user serviceable. In the event of suspected failure:
- a) check all the advice above to eliminate external system faults
 - b) produce a full failure report as possible, with times, dates, photographs, logs etc – anything to help us to understand the environment surrounding the failure
 - c) carefully remove the TVC from the EX2010 housing and unplug the free sockets
 - d) package the unit in anti-static bubble wrap and a good solid outer box and return to the supplier

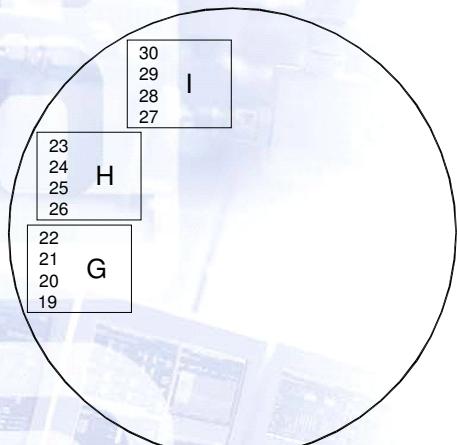
TVC Appearance



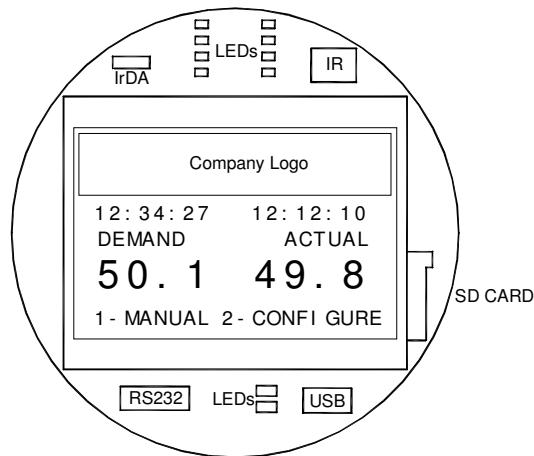
2. Processor/Analog Board



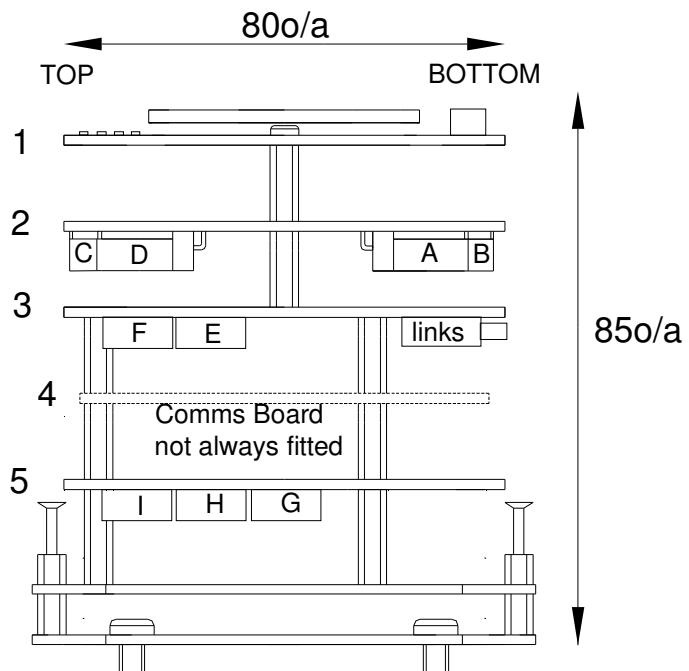
3. Analog Output Board



Note – elevation is rotated by 90°



1. Display Board



5. Power and Digital I/O board

All boards are shown in upper view - connectors are underneath

Physical Description

Size with chassis plate – 80mm wide, 80mm high, 85mm deep

Weight with chassis plate – 0.25kg

Specification

COMMAND SIGNAL INPUT

4-20mA nominal 160R input impedance, fully isolated

ANALOGUE POSITION OUTPUT SIGNAL

0.5-22mA can be calibrated anywhere in this range, normally 4-20mA, fully isolated

Sourcing – 750R load, Sinking – max excitation 30V

FEEDBACK SIGNAL INPUT

Potentiometer 3-wire, any value greater than 200R

4-20mA nominal 160R input impedance – signal common with instrument supply

SOLENOID OUTPUTS x 2

Maximum 2A for each output PWM with 12 bit resolution, 24Vdc common with instrument supply

SWITCHED OUTPUTS x 4

Maximum 1A for each output – low side switched 24Vdc common with instrument supply

CONTACT CLOSURE INPUTS X 4

Internally pulled high to instrument power supply.

INSTRUMENT AND SOLENOID SUPPLY

24V dc nominal (15-28V absolute maximum range) – 2.8W excluding solenoids

100mA maximum current drawn in normal use

USER ADJUSTMENTS

All adjustments via IR900 Infra Red Keypad

INTERNAL LINKS

Retransmitted actual position excitation

Link 1 and 3 – sourcing, internal excitation from isolated 24Vdc supply

Link 2 and 4 – sinking external excitation, maximum 30Vdc

ENVIRONMENT

Operating temperature -40°C to +59°C ambient

Storage temperature -40°C to +115°C

PERFORMANCE - the following applies to the TVC only, characteristics of the feedback element and actuator system response will have additional effects.

Conversion 12 bit max normal conversion range (4-20mA) = 1 in 4000.

O/P switch res. +/-1 bit theoretically, modified to up to +/-5% of span by dead band .

TVC Terminal Descriptions

Note – Always use specific drawings and hook-up diagrams supplied with the job for site wiring. The descriptions below are for information only.

Connections are made via up to nine 3 and 4 way polarised 0.1" free sockets. The free sockets are marked A to I as are the printed circuit board pin headers. Double check all connections when removing or replacing the TVC from the enclosure.

No.	Conn.	Description	Voltage	Comment
1	A	24V dc instrument supply, feedback excitation	24Vdc	Not usually connected
2	A	Feedback signal +ve – 4-20mA into 160R	3.2V	
3	A	Feedback signal –ve – instrument 0V	0V	Common inst. Supply
4	B	Uncommitted analog internal input 4 – 160R	3.2V	Not usually connected
5	B	Uncommitted analog internal input 3 – 160R	3.2V	Not usually connected
6	B	Pressure TX +ve – 4-20mA into 160R	3.2V	For pump control and P.S.
7	C	External analog inputs EMC ground	0V	Connect to good signal ground
8	C	Demand signal +ve – 4-20mA into 160R	3.2V	Isolated analog input
9	C	Demand signal -ve	0V	
10	D	Uncommitted analog isolated input 1 – 160R	3.2V	Not normally connected
11	D	Uncommitted analog isolated input 2 – 160R	3.2V	Not normally connected
12	D	Uncommitted analog isolated input 3 – 160R	3.2V	Not normally connected
13	E	Retrans. actual position signal +ve 4-20mA	24V	Can be sinking or
		sourcing		
14	E	Retrans. actual position signal -ve	3.2V	Isolated output
15	E	Retrans. Signal EMC ground	0V	Connect to good signal ground
16	F	Foundation Fieldbus data +ve	3.3V	Not usually connected
17	F	Foundation Fieldbus data -ve	3.3V	Not usually connected
18	F	Fieldbus Signal EMC ground	0V	Connect to good signal ground
19	G	Instrument and solenoid supply +ve	24Vdc	
20	G	Instrument and solenoid supply -ve	0V	
21	G	Close solenoid -ve switched	24Vdc	Solenoid +ve to +24V
22	G	Open Solenoid -ve switched	24Vdc	Solenoid +ve to +24V
23	H	ESD solenoid output -ve switched	24Vdc	Output +ve to +24Vdc
24	H	Fault output -ve switched	24Vdc	Output +ve to +24Vdc
25	H	Pump control output -ve switched	24Vdc	Output +ve to +24Vdc
26	H	Remote status output -ve switched	24Vdc	Output +ve to +24Vdc
27	I	Pump control low press switch +ve	24Vdc	Switch to inst. 0V
28	I	Pump control high press switch +ve	24Vdc	Switch to inst. 0V
29	I	External fault input +ve	24Vdc	Switch to inst. 0V
30	I	Operator enable input +ve	24Vdc	Switch to inst. 0V

Spares Kit Ordering & Additional Service Support

When requesting service support or ordering spares kits, please provide the following contract details:

- Actuator Serial Number (6 or 7 digit number with a RFPL prefix)
- Paladon Contract Number (5 digit number with an ACCP, ACE, ACP, ACSP, CCP, CE, CGH, CP, CPC or CSP prefix)
- General Arrangement or Control Schematic Drawing Number
- Full Actuator Model Number(s) and Descriptions
- Tag Number(s)

Please contact your nearest Paladon representative as detailed below:

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