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IS200 Intrinsically Safe Actuator Positioner

Operation, Installation and Maintenance Manual

Manufacturer and Approvals Details

The IS200 is manufactured and maintained solely by:

Orange Instruments Limited
Lower Farm Road
Moulton Park
Northampton
NN3 6XF
United Kingdom

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The IS200 has the following specific approvals

Name and Type	ACTUATOR POSITIONER TYPE IS200
Certificate Number	Baseefa 03ATEX0686X
Specific Marking of Explosion Protection	Ex ia IIC T4 Ga(-40ºC ≤Ta ≤ +60ºC)
ATEX Directive Marking	⟨Ex⟩ II 1 G
Notified body	Baseefa 1180

Features

- Simple two-step calibration
- 4-20mA current command signals and current or potentiometer feedback signal.
- Actual position calibrated output
- MANUAL mode
- Stepping mode with adjustable ON and OFF times
- Selectable solenoid drive for failsafe operation
- Selectable default operation on command signal/feedback signal break
- ESD solenoid output / Fault output relaxed by control signal breaks

EC Declaration of Conformity

CE

Manufacturer
Orange Instruments Limited
Lower Farm Road
Moulton Park
Northampton NN3 6XF
United Kingdom

Notified body
Baseefa 1180
Rockhead Business Park
Staden Lane, Buxton
Derbyshire SK17 9RZ
United Kingdom

Signed

Anthony G. McCormick
ATEX Manager
Orange Instruments

Harmonised Standards
EN 60079-0:2012
EN 60079-11:2012

Other Standards

Equipment description
Actuator Positioner Type IS200
⟨Ex⟩ II 1 G Ex ia IIC T4 Ga
(-40°C≤Ta≤+60°C)

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Iss J – Harmonised standards in C of C modified to meet current status 04/08/2008
Iss K - Markings changed to meet EN 60079-0:2012 02/10/2103
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Operation

The IS200 is designed for the closed loop positioning of electro-hydraulic actuators.
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 IS200 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.
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 IS200 is housed in a small DIN rail mounted polyester enclosure measuring 85 x 70 x 58h. The circuit boards are coated with a resist layer that protects the track from moderate condensation and mould growth problems. Connections are via screw terminals with a capacity of 2.5mm^2 but the use of ferrules or crimps is recommended. All adjustments are accessible on the front panel of the enclosure.

Wiring

To comply with the IS Certification the IS200 must be wired as shown in the circuit on Page 7. Wiring should be completed by suitably trained personnel taking into account the following notes:

- To ensure RFI compliance the analogue signals MUST 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.
- Ensure that all supply and signal barriers are present and correctly connected and supplied with power from the safe area.

Positioner set-up

The solenoid sense and command signal default mode are set up by a sequence of push button operations at power up. These operations will affect the outputs to the solenoids so it is important that the actuator is isolated hydraulically during these operations to avoid unwanted movement of the actuator. Note that a low value resistor, 10R, might be required in the negative lead, Terminal 19, of the retransmitted signal output to reduce instability in the IS200 / barrier loop.

Setting solenoid operating sense

If the actuator has a spring assisted return to a default position it may be necessary to change the sense of the output solenoid such that at the desired balance point one of the solenoids is energised thus holding the actuator position against the spring. A one-off operation of the positioner will store the choice in non-volatile EEPROM memory.

1. Hold in the CALIBRATE pushbutton and apply power to the positioner.
2. The CALIBRATE LED will light continuously and pressing the manual DECREASE and INCREASE pushbuttons will cause the appropriate DECREASE and INCREASE LEDS to “toggle” on and off.
3. Select the pattern of LEDs to reflect what is required at balance e.g. for an actuator that fails downscale the DECREASE LED should be lit.
4. When satisfied press the CALIBRATE button again.
5. Remove power from the positioner.

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Setting the command signal break default operation

The positioner can be configured to move to a default position or freeze at the current position in the event of the command or feedback signal faults. These faults are characterised as:

a) the command falling below 1mA - command signal break
b) the potentiometer wiper showing less than 0.25V - potentiometer maximum or wiper break
c) the potentiometer wiper showing more than 4.7V - potentiometer minimum break.

A one-off operation of the positioner will store the choice in non-volatile EEPROM memory.

1. Hold in the MANUAL pushbutton and apply power to the positioner.
2. The MANUAL LED will light continuously and pressing the manual DECREASE and INCREASE pushbuttons will cause the appropriate DECREASE and INCREASE LEDS to “toggle” on and off.
3. Select the DECREASE LED on for drive downscale on fault,
4. Select the INCREASE LED on for drive upscale on fault.
5. Leave both LEDs off to select freeze at the current position on fault.
6. When satisfied press the MANUAL pushbutton again.
7. Remove power from the positioner.

Setting the stepping option timers

If stepping operation is required, the ON and OFF timers for the open and close solenoids have to be set. This operation is best performed when the actuator hydraulics are isolated but the settings can be trimmed during normal operation of the system. Minimum ON / OFF times 20mS. Maximum ON / OFF times 11 seconds.

1. Set DIP switch 3 to ON. This selects timer setting mode. Manual mode is selected automatically.
2. Set DIP switch 1 to ON. *Do not select DIP switches 1 and 2 ON together.* The DECREASE LED will flash and the decrease solenoid will operate. Adjust CAL1 potentiometer to vary the ON time and CAL2 potentiometer to vary the off time. Time the on/off transition over a few cycles to obtain the required result.
3. Press the CALIBRATE button to store the decrease step timer values.
4. Set DIP switch 1 to OFF.
5. Set DIP switch 2 to ON. *Do not select DIP switches 1 and 2 ON together.* The INCREASE LED will flash and the increase solenoid will operate. Adjust CAL1 potentiometer to vary the ON time and CAL2 potentiometer to vary the off time. Time the on/off transition over a few cycles to obtain the required result.
6. Press the CALIBRATE button to store the increase step timer values.
7. Set DIP switch 1 to OFF.
8. Set DIP switch 3 to OFF.
9. The stepping option can be selected by setting DIL switch 4 ON.
10. The above sequence, or part of it, can be selected at any time during normal operation but the actuator will move during the adjustment so hydraulic isolation is advised.

First time operation

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. Press the Auto/Manual Switch. Check that the Auto/Manual LED is lit.
3. Operate the Open and Close buttons and confirm that the actuator moves as required.
4. The system must be calibrated before automatic mode is selected.

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Calibration

Calibration can only be carried out local to the IS200 unit so it is essential to have either purged the area or to use IS signal injection and measuring equipment. An alternative is to use the remote DCS to inject and read the actual position signal and transfer the information by handheld radio. If this approach is used ensure that the radio is operated 2m or more from the IS200 and associated wiring.

A command signal is required, normally in the range 4-20mA (Terms 20+ and 21-) and a DVM with a 0-10V range to read the retransmitted position signal (Terms 18+ and 19-).

1. Press the CALIBRATE button, and hold until the CALIBRATE LED goes out. When the button is released, the CALIBRATE LED will flash briefly once per second and the Manual LED will light.
2. The positioner has been switched automatically into Manual, non-stepping mode so use the INCREASE / DECREASE buttons to set the actuator to the required position for the minimum, 4mA command signal. This position can be either fully open or fully close, or indeed anywhere in the mechanical range of the actuator.
3. Set the command signal to 4mA.
4. Adjust the CAL1 potentiometer to give the required output for the chosen position. Note that this not need be 0V to match the command signal, but can be any value in the range 0-5V.
5. Press and hold the CALIBRATE button until the CALIBRATE LED goes out. Release the button and the CALIBRATE LED will flash twice briefly every second.
6. Use the INCREASE and DECREASE buttons to set the actuator to the required position for the maximum, 20mA command signal. As before, this can be any position within the mechanical range of the actuator.
7. Set the command signal to 20mA.
8. Adjust the CAL1 potentiometer to give the required output for the chosen position. Note that this not need be 5V to match the command signal, but can be any value in the range 0-5V.
9. Press and hold the CALIBRATE button until the CALIBRATE LED goes out. Release the button to complete the calibration sequence and the Manual LED will extinguish.

General operation

When calibration has been completed the IS200 reverts to automatic mode and to stepping operation if DIL switch 4 is set ON. The actuator should now follow the command signal input and move to the desired position.
If there is any instability in positioning, particularly if the hydraulic flow rate is high, then the DEADZONE potentiometer can be set progressively clockwise, half a turn at a time, until stable positioning following a step change can be achieved.

If the command signal or the feedback signal becomes faulty then the selected fail mode will operate. The actuator will either freeze position, drive down or drive up and the control to the ESD solenoid will be removed. The system will recover to normal operation when the signals are re-instated. If an ESD solenoid is not required then the ESD output can be used as a system fault output to the remote DCS if driven through a suitable barrier. If the unit is in "stepping mode" (DIL switch 4 = ON) then failure mode drive can be either in the selected stepping mode or, if DIL switch 1 is ON, then the unit will fast-fail to its default position.

All calibration parameters are stored within the processor EEPROM and are restored each time the controller is powered up. The controller will respond to current command and feedback signal conditions within 100mS of power being applied to the system

Maintenance

The outside of the enclosure can be cleaned using a damp cloth. Do not use solvents. Do not open the enclosure whilst a hazard is present.

No internal parts are user serviceable and component level repairs should not be attempted. If a fault occurs then please return the unit to the Manufacturers describing the nature and circumstances of the problem.

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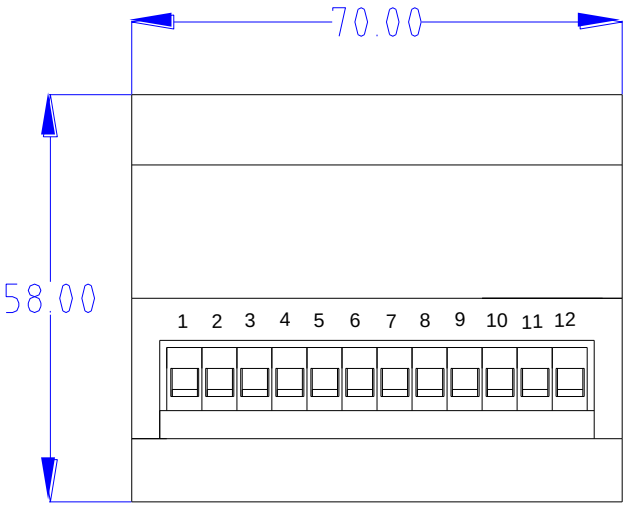
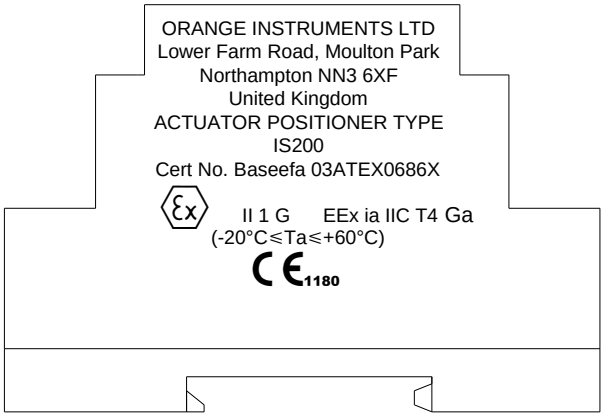
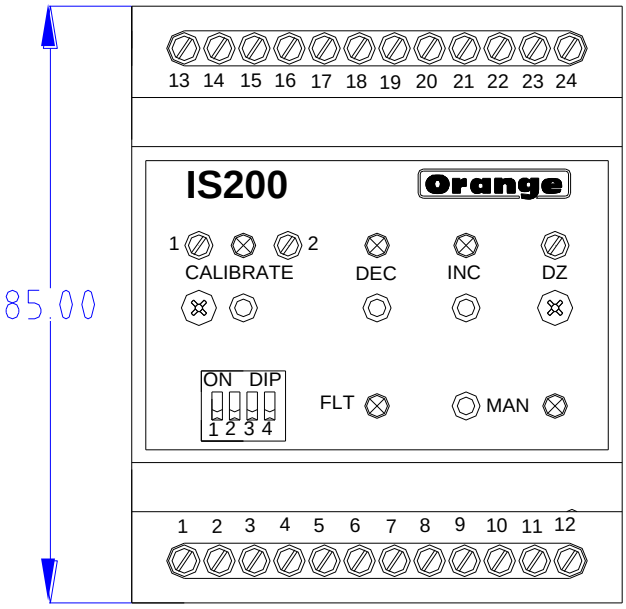
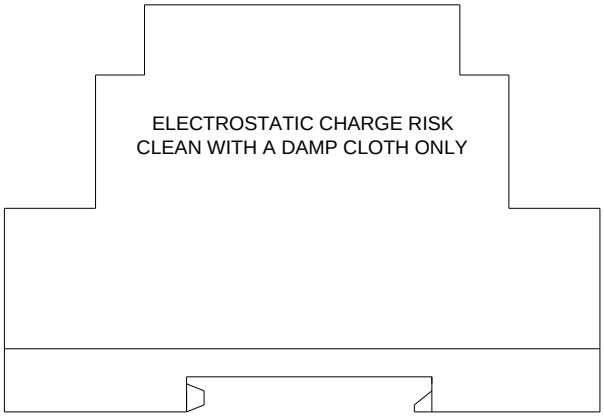
IS200 dimensions and front panel









Enclosure can be fitted on Standard Symmetric EN50054 component mounting rail – 35 x 7.5. Use purpose-designed tool for adjusting small potentiometers.

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Zone of Operation

The IS200 is an intrinsically safe device approved for operation in the following environment according to Specific Marking of explosion protection:

Ex ia IIC T4 Ga (-40ºC ≤Ta ≤ +60ºC) Ta = ambient temperature

IEC CENELEC	*North America*
Zone 0 – continuous hazard present.	Division 1
Gas Group – IIC (hydrogen, acetylene, carbon disulphide)	Class 1A (Hydrogen)
	Class 1B (acetylene)

Surface temperature – T4 135ºC – Ambient temperature -40ºC to +60ºC

Physical Description

Size – 70mm wide, 58mm high, 85mm deep
Weight – 0.25kg
Enclosure – Lexan (Top cover), Noryl (Base section)
Equipment rating – IP40

Specification

Note that all supplies and signals to and from safe areas MUST pass through appropriate Instrinsically Safe barriers before connection to the IS200. See circuits on Page 7.

COMMAND SIGNAL INPUT
4-20mA nominal 240R input impedance

ANALOGUE POSITION OUTPUT SIGNAL
0-4.9V can be calibrated anywhere in this range – 10R resistor required in loop

FEEDBACK SIGNAL INPUT
Potentiometer 3-wire, any value greater than 200R
4-20mA nominal 240R input impedance

SWITCHED OUTPUTS x 3
PhotoMOS relays. Maximum load 130mA each.

INSTRUMENT SUPPLY
24V dc nominal safe area supply via an IS power supply

SOLENOID SUPPLY
24V dc nominal safe area supply via an IS power supply

USER ADJUSTMENTS
DEC Button to close actuator in Manual
INC Button to open actuator in Manual
MAN Button to toggle auto/manual mode
CAL Button to selects Calibrate mode and store calibration data
DIP Switch 1 - Set stepping timers – DECREASE ON and OFF (Select fast-fail during normal operation)
DIP Switch 2 - Set stepping timers – INCREASE ON and OFF
DIP Switch 3 - Stepping timers setting mode select
DIP Switch 4 - Select stepping mode

Minimum ON	time	5mS.	Minimum OFF	time	500mS
Maximum ON	time	300mS	Maximum OFF	time	150 Seconds

DZ Potentiometer to set positioning dead zone - clockwise to increase
CAL1 Calibration adjustment and ON time for stepping mode
CAL2 Adjustment for OFF time for stepping mode

PERFORMANCE - the following applies to the IS200 only, characteristics of the feedback element, actuator system and isolating barriers response will have additional effects.

Conversion	10 bit max normal conversion range (4-20mA) = 1 in 800.
O/P switch res.	+/-1 bit theoretically, modified to up to +/-5% of span by dead band .
Accuracy (Theo.)	0.125% span based on conversion resolution of 1 in 800.

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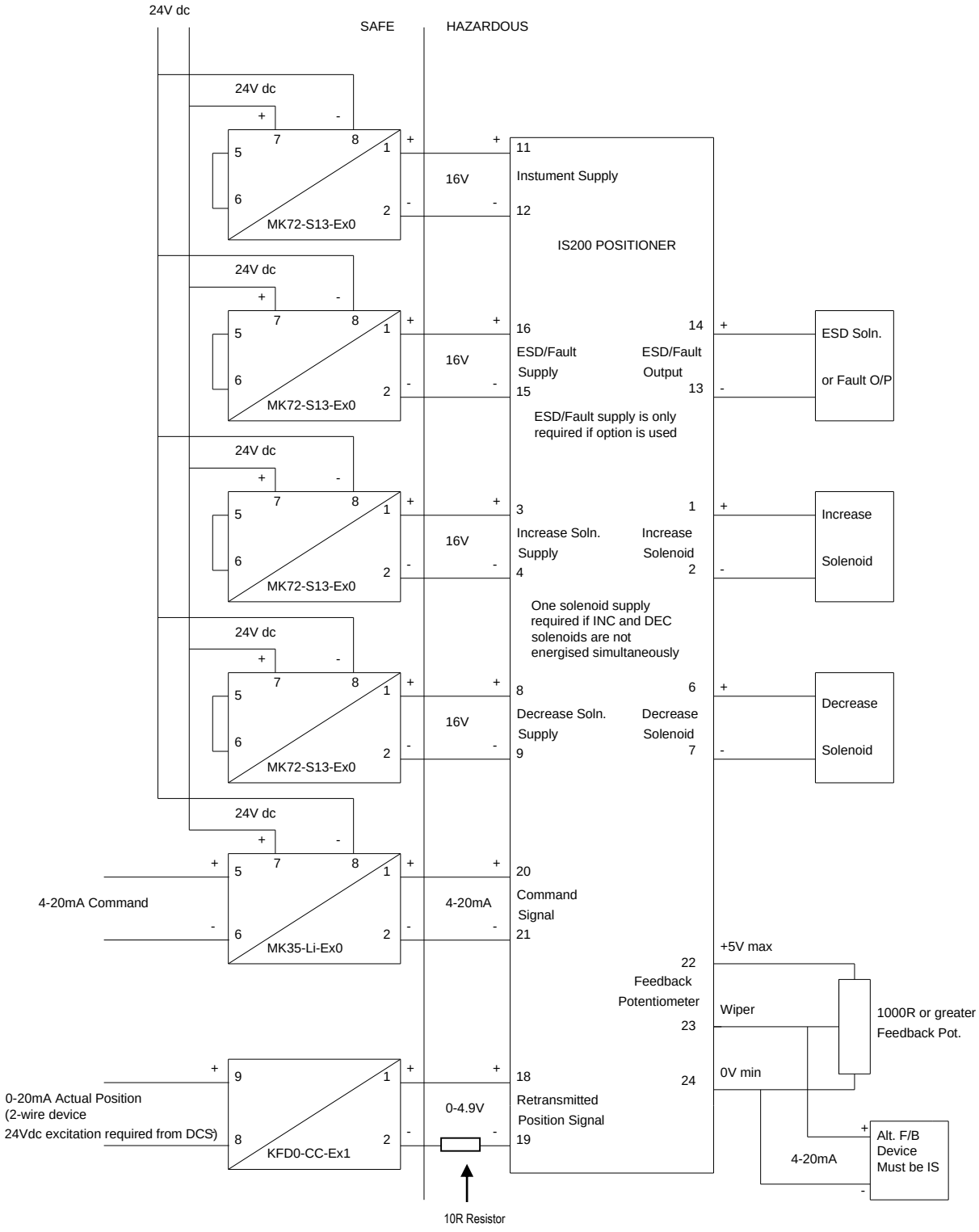
Accuracy (actual) 0.5% span based on 25% turn down of feedback range.

Typical system wiring diagram for an Intrinsically Safe installation



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IS200 Terminal Descriptions

All wiring should be in suitable braided or armoured cable with blue outer casing or sleeving. Terminate braids *at one end only* to local metal enclosures.

Terminal	*Description*	*Voltage*	*Comment*
1	Increase Solenoid +ve output	<16V	Always at supply potential
2	Increase Solenoid –ve output	<16V	Set to 0V to energise solenoid
3	Increase Solenoid Supply +ve	<16V	Must be an isolated, IS supply
4	Increase Solenoid Supply 0V	0V	
5	No connection		
6	Decrease Solenoid +ve output	<16V	Always at supply potential
7	Decrease Solenoid –ve output	<16V	Set to 0V to energise solenoid
8	Decrease Solenoid Supply +ve	<16V	Not required if only one solenoid
9	Decrease Solenoid Supply 0V	0V	is ever energised at one time
10	No connection		
11	Instrument Supply +ve	<16V	Must be an isolated, IS supply
12	Instrument Supply 0V	0V	
13	ESD Solenoid/Fault -ve output	<16V	Set to 0V to energise solenoid
14	Increase Solenoid +ve output	<16V	Always at supply potential
15	Increase Solenoid Supply 0V		
16	Increase Solenoid Supply+ve	<16V	Must be an isolated, IS supply
17	No connection		
18	Actual position signal +ve	<5V	Scaled to actuator movement
19	Actual position signal -ve	<5V	Fit 10R resistor in loop
20	Command signal +ve (4-20mA)	<5V	240R shunt
21	Command signal -ve (4-20mA)	<5V	
22	Feedback potentiometer maximum	5V	Potentiometer >1000R
23	F/B potentiometer wiper / 4-20mA +ve <5V		Current signal optional - IS source
24	F/B potentiometer minimum / 4-20mA -ve	<5V	

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