

IS200

Intrinsically Safe Electronic Actuator Positioner

Manufacturer and Approvals Details

The IS200 is manufactured and maintained solely by:

Orange Instruments Limited	Telephone	+44 (0)1604 790490
Lower Farm Road	Fax	+44 (0)1604 790690
Moulton Park	email	sales@orangeinstruments.co.uk
Northampton		
NN3 6XF		
United Kingdom		

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 (-40°C [Ta [+60°C)	
ATEX Directive Marking	E II 1 G Ga
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



Signed

Anthony G. McCormick
ATEX Manager
Orange Instruments

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

Harmonised Standards
EN 60079-0:2006
EN 60079-11:2007

Other Standards
EN 60079-26:2007

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

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

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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 2.5mm² 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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Iss c - Certificate number added. Iss D - Ta changed to -20 to +60

Iss E - Details of fail modes, timers and retrans. O/P added. Retrans. Signal barrier changed to KFD0-CC-Ex1

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Iss G - Stepping times range change to allow finer adjustment 15/11/2007

Iss H - CE Cert. of Conformity details added, Ta to -40degC, 60079:0,26 mods 25/06/2008

Iss J - Harmonised standards in C of C modified to meet current status 04/08/2008

ATEX Certified Equipment - Change Authority ATEX Manager ONLY

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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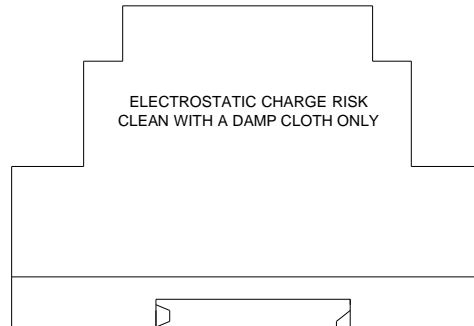
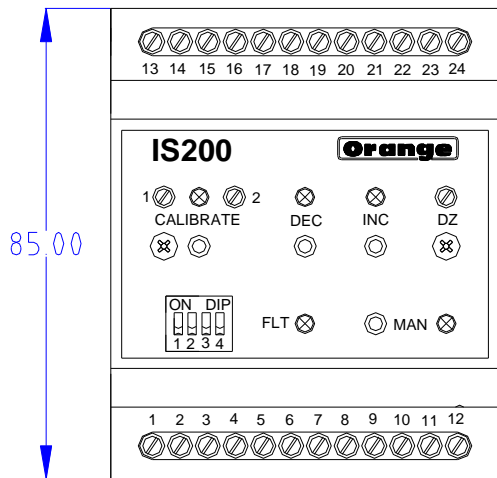
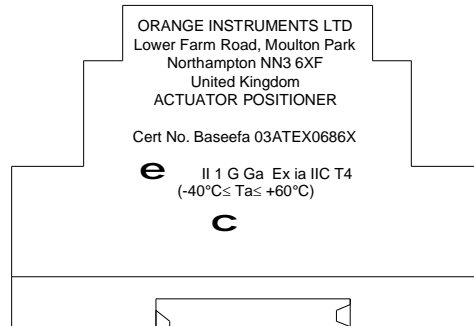
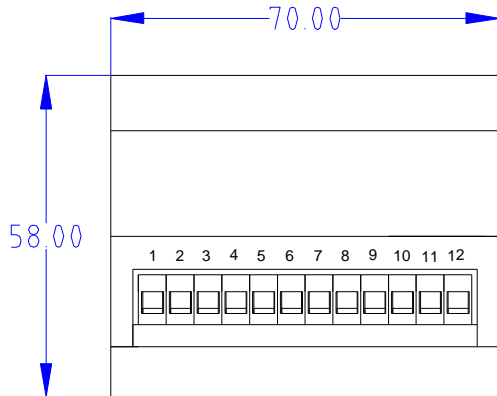
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Iss J - Harmonised standards in C of C modified to meet current status 04/08/2008

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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 (-40°C [Ta [+60°C) Ta = ambient temperature

IEC CENELEC

Zone 0 – continuous hazard present.
 Gas Group – IIC (hydrogen, acetylene, carbon disulphide)

North America
 Division 1
 Class 1A (Hydrogen)
 Class 1B (acetylene)

Surface temperature – T4 135°C – Ambient temperature -40°C to +60°C

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 Intrinsically 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

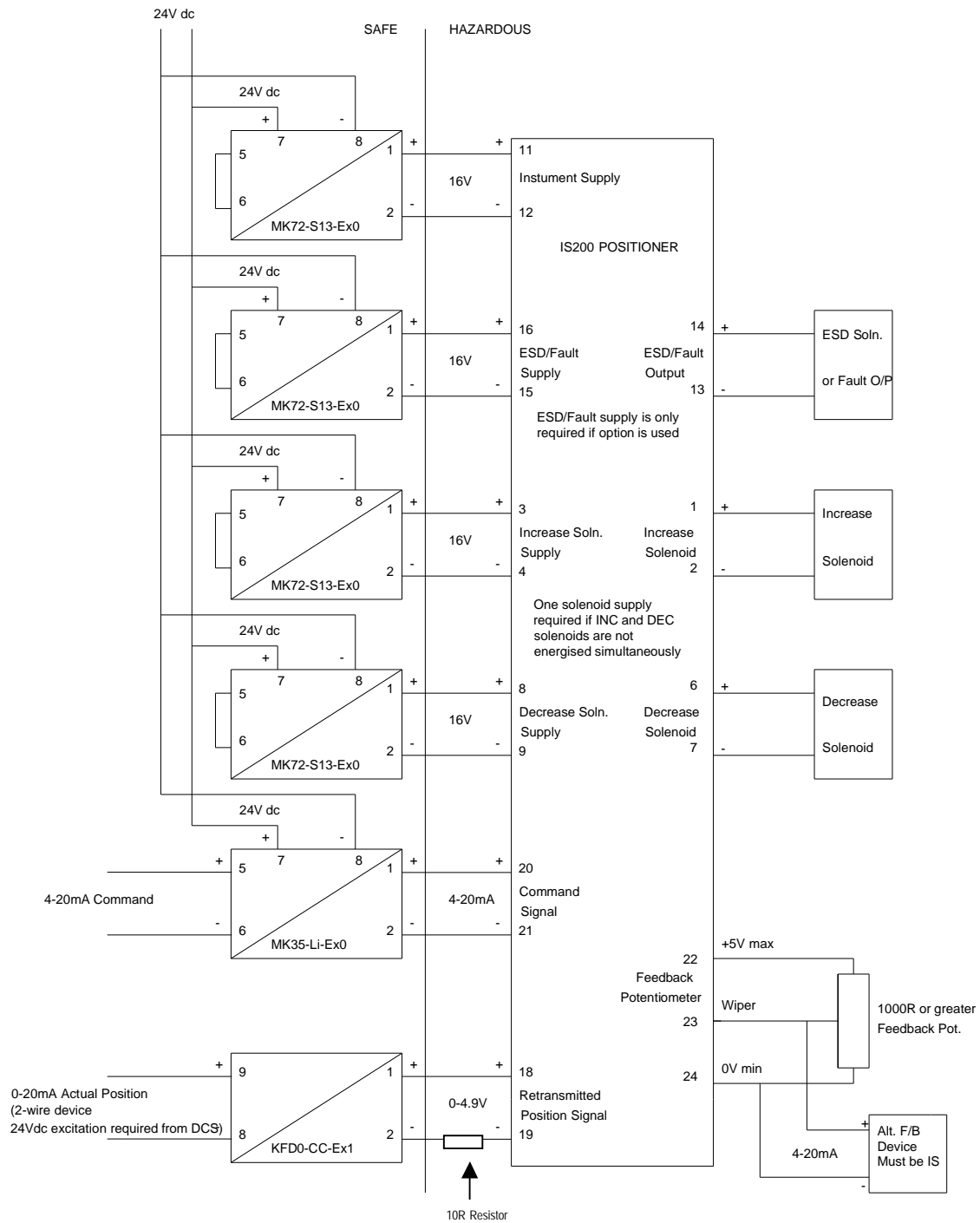
PERFORMANCE - the following applies to the IS200 only, characteristics of the feedback element, actuator system and isolating barriers response will have additional effects.

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

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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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1 **EC - TYPE EXAMINATION CERTIFICATE**

2 **Equipment or Protective System Intended for use in Potentially Explosive Atmospheres
Directive 94/9/EC**

3 EC - Type Examination Certificate Number: **Baseefa03ATEX0686X**

4 Equipment or Protective System: **Actuator Positioner Type IS200**

5 Manufacturer: **Orange Instruments Ltd**

6 Address: **Northampton, NN3 6XF**

7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Baseefa (2001) Ltd. Notified body number 1180, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential Report No. **03(C)0872**

9 Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014: 1997 + Amendments 1 & 2 EN 50020: 2002 EN 50284: 1999

except in respect of those requirements listed at item 18 of the Schedule.

10 If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC - TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12 The marking of the equipment or protective system shall include the following :

(Ex) II 1G EEx ia IIC T4 (-20°C<Ta<+60°C)

This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa (2001) Ltd. Customer Reference No. **1575**

Project File No. **03/0872**

This certificate is granted subject to the general terms and conditions of Baseefa (2001) Ltd. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

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R S SINCLAIR
DIRECTOR
On behalf of
Baseefa (2001) Ltd.



13

Schedule

14

Certificate Number Baseefa03ATEX0686X

15 Description of Equipment or Protective System

The **Actuator Positioner Type IS200** is designed to provide control signals for a solenoid actuator, in response to a signal from a control unit in a non hazardous area, and to provide an optional actual position signal back to the control unit. It comprises electronic circuits on two printed circuit boards, contained in a plastic enclosure. On two opposite sides of the enclosure base are rows of screw terminals for field connections, and on the top surface of the enclosure are LED's, switches, push buttons and potentiometer adjustment screws. The assembly provides a degree of protection in excess of IP20.

Input and Output Parameters

Terminal 11 wrt 12 (main supply to the apparatus):

$$U_i = 28V, I_i = 200mA, P_i = 1.35W, C_i = 0 \text{ and } L_i = 0.$$

Terminal 20 wrt 21 (incoming command signal):

$$U_o = 28V, I_o = 7mA, U_i = 28V, P_i = 1.2W, C_i = 0 \text{ and } L_i = 0.$$

Terminal 18 wrt 19 (repeated position signal, nominal 0-5V):

$$U_o = 28V, I_o = 200mA, P_o = 1.35W, U_i = 28V, I_i = 10mA, P_i = 100mW, C_i = 33nF \text{ and } L_i = 0.$$

Terminal 22 wrt 24 (supply to passive feedback potentiometer):

$$U_o = 10.5V, I_o = 200mA, U_i = 0, C_i = 33nF \text{ and } L_i = 0.$$

Terminal 23 wrt 24 (either feedback signal from passive potentiometer, or 4-20mA feedback signal):

$$U_o = 28V, I_o = 7mA, U_i = 28V, P_i = 1.2W, C_i = 0 \text{ and } L_i = 0.$$

Terminals 12, 19, 21 and 24 (the 0V of the apparatus) are linked together within the apparatus.

For terminals 1 to 4 (or 6 to 9, or 13 to 16):

Terminals 3 & 4 (or 8 & 9, or 15 & 16) are for connection to a supply, and 1 & 2 (or 6 & 7, or 13 & 14) are for the corresponding load connected to that supply.

Hence for each group of terminals: $U_i = U_o = 28V, I_i = I_o = 200mA, P_i = P_o = 1.35W, C_i = C_o$ and $L_i = L_o$.

Terminal groups 1 to 4, 6 to 9 and 13 to 16 form three separate circuits which are galvanically isolated from each other and from the other circuits.

16 Report Number

03(C)0872



17 Special Conditions for Safe Use

1. The apparatus housing is plastic which does not meet the conductivity requirements of EN 50284: 1999. Also the fixing screws on the top of the housing are connected to the 0V of the apparatus. Therefore the apparatus must be installed in an enclosure which is either metal not containing light metals, or is plastic meeting the conductivity requirements of EN 50284: 1999, and provides a degree of protection of at least IP20.

18 Essential Health and Safety Requirements

All relevant Essential Health and Safety Requirements are covered by the standards listed at item 9.

19 Drawings and Documents

Number	Issue	Date	Description
1357-015	D	9/1/2004	IS200 Actuator Positioner, General Assembly
1357-001	E	30/12/03	IS200 Intrinsically Safe Positioner, Circuit Diagram
1357-003	E	07/01/2004	Parts List, IS200 Positioner
1357-002	C	02/12/2003	Bottom PCB, Tracks
1357-016	C	26/11/2003	IS200 Actuator Positioner, PCB Layouts (Component Positions)



1 **SUPPLEMENTARY EC - TYPE EXAMINATION CERTIFICATE**

2 **Equipment or Protective System Intended for use in Potentially Explosive Atmospheres
Directive 94/9/EC**

3 Supplementary EC - Type Examination Certificate Number: **Baseefa03ATEX0686X/2**

4 Equipment or Protective System: **Actuator Positioner Type IS200**

5 Manufacturer: **Orange Instruments Ltd**

6 Address: **Northampton, NN3 6XF**

7 This supplementary certificate extends EC - Type Examination Certificate No. Baseefa03ATEX0686X to apply to equipment or protective systems designed and constructed in accordance with the specification set out in the Schedule of the said certificate but having any variations specified in the Schedule attached to this certificate and the documents therein referred to.

This supplementary certificate shall be held with the original certificate.

This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa Customer Reference No. **1575**

Project File No. **08/0126**

This certificate is granted subject to the general terms and conditions of Baseefa. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

A handwritten signature in black ink, appearing to read "R S Sinclair".

R S SINCLAIR
DIRECTOR
On behalf of
Baseefa

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Registered in England No. 4305578. Registered address as above.



13

Schedule

14

Certificate Number Baseefa03ATEX0686X/2

15 Description of the variation to the Equipment or Protective System

Variation 2.1

To permit changes to the circuit connected to terminals 18 and 19 to form a new unit known as IS200HART. For this unit C_i for terminals 18 and 19 is zero and the parameters for terminals 18 and 19 become as shown below:

$U_o = 28V, I_o = 200mA, P_o = 1.35W, U_i = 28V, I_i = 100mA, P_i = 1W, C_i = 0$ and $L_i = 0$.

Variation 2.2

To confirm that both the IS200 and the IS200HART are suitable for ambient temperatures down to $-40^{\circ}C$ instead of the $-20^{\circ}C$ shown originally, and comply with the requirements of EN60079-0:2006, EN60079-11:2007 and EN60079-26:2007, so they may now be marked (Ex) II 1 G Ga Ex ia IIC T4 ($-40^{\circ}C \leq T_a \leq +60^{\circ}C$).

Variation 2.3

To permit the IS200 to carry alternative name and company logo ACS604EEExia, Midland-ACS, and the IS200HART to carry alternative name and company logo ACS604EEExia HART, Midland-ACS.

16 Report Number

08(C)0126

17 Special Conditions for Safe Use

None additional to those listed previously

18 Essential Health and Safety Requirements

Compliance with the Essential Health and Safety Requirements is not affected by this variation.

19 Drawings and Documents

Number	Issue	Date	Description
3374-003	C	31/03/2008	IS200HART Base Board P521 Circuit
3374-004	D	18/04/2008	IS200HART Modem Board Circuit
3374-007	B	28/02/2008	IS200HART Parts List, Main & Top Boards
3374-008	B	31/03/2008	IS200HART Parts List, Modem Board
3374-005	B	20/06/2008	IS200HART, P521 Main Board Layout
3374-006	D	20/06/2008	IS200HART, P520 Modem Board Layout
3374-011	C	20/06/2008	IS200HART Actuator Positioner Boards P500, P520, P521 Layouts
3374-010	C	20/06/2008	IS200HART Actuator Positioner General Assembly
1357-015	F	25/06/2008	IS200 Actuator Positioner General Assembly