



NXCEX-6000  
February 20, 2020  
**OBSOLETE**

# 6000 Series NXC20EX, and NXC40EX Servos for Class 1 Division 2. Hazardous Locations





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## Health and Safety

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### SAFETY WARNINGS IN THIS MANUAL



In this manual, we indicate potential safety issues by this symbol:  
Please read the safety information before you do any task preceded by this symbol.

There are two levels of safety message: **WARNINGS** and **CAUTIONS**:



### **WARNING**

- Failure to observe a **WARNING** about the equipment described in this manual can cause property damage, severe injury, or death.



### **CAUTION**

- Failure to observe a **CAUTION** may cause minor injury or damage to equipment.

Health and Safety when using Fireeye NEXUS Combustion Control Systems.

**It is the responsibility of the owner or user to make sure that the equipment described herein is installed, operated and commissioned in compliance with the requirements of all national codes, and local jurisdictions that may prevail.**



## WARNINGS

1. When this equipment is fitted to an appliance, due regard must also be given to the requirements of that appliance.
2. Before attempting to install, commission or operate this equipment, you **MUST** read and fully understand all relevant sections of this manual. If in doubt about any requirements, please consult your supplier.
3. Repairs to the controller must only be carried out by the manufacturer or their appointed agents.
4. Installation, commissioning or adjustment of this product **MUST ONLY** be carried out by **SUITABLY TRAINED ENGINEERS** or **PERSONNEL QUALIFIED BY TRAINING AND EXPERIENCE**.
5. After installation or modifications to the installation, all functions of the equipment **MUST** be checked to make sure safe and reliable operation of the controller.

- The manufacturer of this equipment accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, commissioning or adjustment of operating parameters of the equipment.
- This equipment **must only** be fitted to burners as detailed in the contract specification. The supplier must approve in writing any change to the specification.
- **Do not** leave Control panels uncovered while power is ON. If it is essential to do so while rectifying faults, only personnel qualified by training and experience may be involved.
- The time any covers are off must be kept to a minimum, and warning notices **must** be posted.
- Before attempting any work on this equipment or any equipment connected to this equipment, the electrical supplies **must** be isolated.
- Safety interlocks **must not** be removed or overridden. Correct any faults detected before operating the controller.

**NOTE:** The manufacturer of this equipment has a policy of continual product improvement, and reserves the right to change the specification of the equipment and the contents of this manual subject to review by the certification body.



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## Manual overview.

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### Who is this Manual for?

This manual is intended for combustion system designers and engineers qualified by training, competence and experience. They might be involved in the design and specification of combustion systems, replacing system components or in the commissioning of new combustion curves.

### Scope of this Manual

In this manual, we cover the description, installation, maintenance, specification and approvals for NXC20EX and NXC40EX actuators suitable for use Hazardous Locations Class 1 Division2 Groups C & D. For all other issues, including the commissioning of combustion systems and fault finding, please refer to the Commissioning manual for the appropriate controller. This manual does not cover Operator instructions.

### Disclaimer

Nothing contained in this manual constitutes a warranty of any kind in respect of the machine or of the results to be achieved by its use. The only warranties given by Fireye in respect of any machine are those expressly given by Fireye or your supplier in the contract under which it sells the machine to its purchaser.

Warranty is void in the case that the equipment covered by this manual is operated outside of the instructions, specifications and approvals stated herein.

The information contained in this manual is believed to be accurate at the date of publication. However, Fireye give no guarantees in this respect, and reserves the right to alter future publications.



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**IMPORTANT: Please read the Health and Safety Issues before working on this equipment.**

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# 1. Introduction

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## 1.1 Outline.

The servos described in this manual are special system components, designed for application in combustion systems where the atmosphere may be of a hazardous nature for a limited time. The limit of application is identified on each device and given in the specification section of this manual.

This actuator type is fitted to combustion systems operating in an intermittent or continuous mode. It is most likely that the equipment will be permanently powered unless off-line for plant maintenance.

## 1.2 Controller compatibility.

Each device described in this manual is CANBus powered, and compatible with all Fireeye NEXUS 6000 series controllers and expansion modules.




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## 2. Description of Servos

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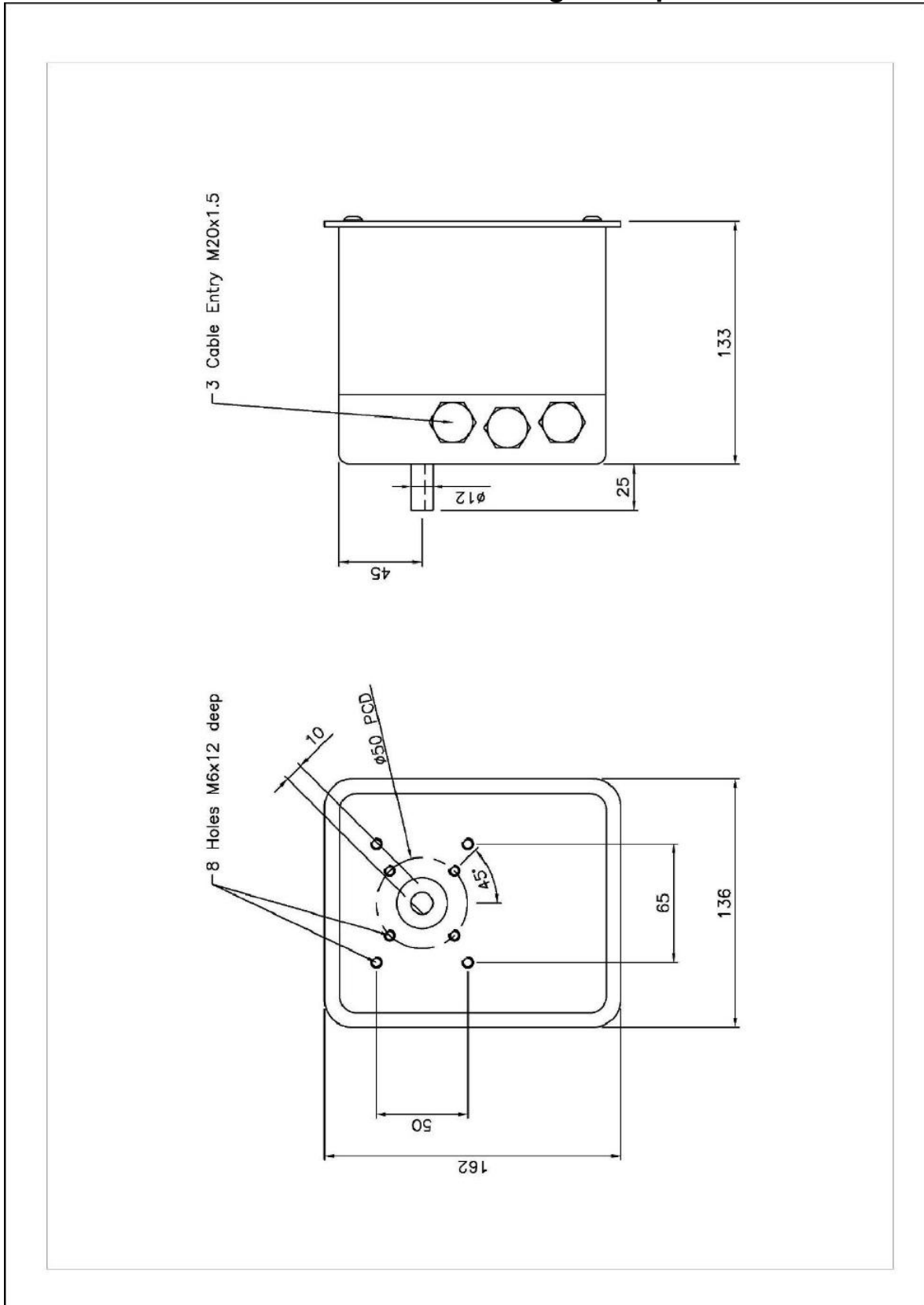
### 2.1 Servo types and specification.

The servo motors approved for Hazardous Location operation are NXC20EX and NXC40EX CANbus type, with 20Nm and 40Nm actuation force respectively.

#### 2.1.1 Servo specification.

|   |  |
|---|--|
| MotorType<br>Actuation time:  | 24V AC asynchronous servo chassis:<br>30 seconds for 90 degrees (50/60Hz)  |
| Interface to 6000 series controllers.   | ETC specific CANbus from the controller –<br><i>Terminals 1, 2 - 29. 5Va. c. maximum (50/60Hz). Terminals 3, 4 - Data (5V)</i>   |
| VA rating   | NXC20EX = 18 VA<br>NXC40EX = 18 VA   |
| Actuating torque  | NXC20EX = 31 Nm (driving), 41 Nm (holding)<br>NXC20EX = 23 ft lbs (driving), 30 ft lbs (holding)<br>NXC40EX = 46 Nm (driving), 51 Nm (holding)<br>NXC40EX = 34 ft lbs (driving), 37 ft lbs (holding) |
| Accuracy (as specified by EN12067)<br>Positioning Repeatability   | ± 0.3°<br>± 0.3°   |
| Protection Category<br>Operating temperature<br>Conduit/gland connections<br>Mounting orientation<br>Weight | IP66 (NEMA 4)<br>-4 °F to +140 °F (-20 °C to +60 °C)<br>M20 x 1.5<br>Any<br>7.5 lb (3.4kg)   |
| Suitability:  | USL, CNL – Class 1, Division 2, Groups A, B, C and D, OR non-hazardous locations only.<br>UL file E495355  |

## 2.1.2 Servo dimensions and mounting hole options.





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## 3. How to install and wire to the actuators

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This section contains basic installation information, wiring specification and connection details.

The process of installing the actuator(s) has 2 aspects:

- Mechanical fixing
- Electrical connection



### **WARNING**

#### **EXPLOSION OR FIRE HAZARD.**

- Hazard can cause damage to property, severe injury or death
- Do not connect or disconnect equipment unless power has been switched off, or the area is known to be non-hazardous.
- To prevent possible hazardous burner operation, you must verify the safety requirements each time a control is installed on a burner, or if the installation is modified in any way.
- The enclosure of the actuators has a non-conducting coating and may generate an ignition-capable level of electrostatic charges under extreme conditions. The user should ensure that the equipment is not installed in a location where it will be subjected to external conditions (such as high-pressure steam) which might cause a buildup of electrostatic charges on non-conducting surfaces.

#### **WHEN INSTALLING THIS PRODUCT:**

- Read these instructions carefully. Make sure you fully understand the product requirements. Failure to follow them could damage the product or cause a hazardous condition.
- Check the ratings given in these instructions to make sure the product suits your application.
- After installation is complete, check that the product operates as described in these instructions.



### **CAUTION**

- Wiring must comply with all methods as required for Class 1 Division 2, as per NEC and/or CEC.
- Loads connected to the 6000 series controllers must not exceed those listed in the specifications as given in this manual. Consider that if more than two of these actuator types are required then the NXCBH Canbus Hub will be required to provide the extra power for third and fourth actuators.
- Choose the actuator sizing carefully to ensure that they operate within their specification.
- Make sure that the actuator is connected to 'Earth', to maintain electrical safety and reduce the risk of electrostatic charging.



### 3.1 Mechanical fixing.

Brackets to support the weight of the actuator (7.5 lb) must be fabricated to suit the burner and valve/damper components.

The actuators are provided with M6 tapped screw holes into the body. The maximum depth of these holes is 12mm. The geometry of the actuator fixing holes is shown in the drawing 2.1.2. Specific attention should be paid to the alignment of the output shaft and the spindle of the valve or damper, because they must align 'centered'. Select a flexible coupling when variations in alignment are suspected.

### 3.2 Wiring Requirements.

This equipment must be installed using wiring methods as required for Class 1 Division 2 as per the NEC and/or CEC.

Please pay particular attention to the wiring requirements for the actuator. These will protect the equipment from electrical interference, earth loop problems, and damage to the controller and modules.

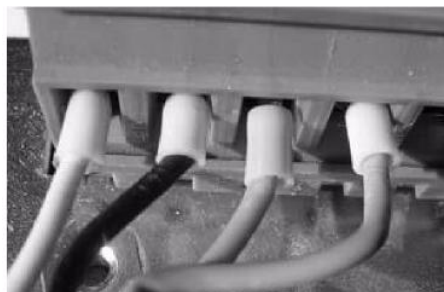
#### 3.2.1 General.

**WIRING INSTALLATION MUST BE CARRIED OUT BY A COMPETENT ELECTRICIAN.**

The main controller **MUST** be mounted within a 'burner cabinet' or similar panel in a designated 'safe' area, and **MUST** be earthed to the overall enclosure to ensure safe and reliable operation; use the largest cross-sectional area green/yellow earth wire available. **Do not use a green/yellow conductor for any purpose other than earth.** The metal body of all other component parts **MUST** be connected to earth using a green/yellow conductor.

To comply with EMC requirements, the controller and any optional units must be wired using the specified cable sizes, and screen connections, observing any maximum cable length limitations. Cabinet designers **MUST** segregate Line voltage and Extra Low Voltage (ELV) cables within the burner cabinet, distribution panels and conduits.

**The manufacturer of this equipment recommends the use of bootlace ferrules on all wire ends, as a "best practice".**



Bootlace ferrules

All cabling that operates at more than 50 V must be multi-strand, single core, PVC insulated, 16/0.2 mm (0.5mm<sup>2</sup>), and must meet the requirements of NEC and/or CEC.

For cables carried in conduit, secure all cables at both ends, using a suitable anchorage method in the cabinet. Ensure that cables, conduit and conduit connections meet the requirements for hazardous area operation. **No additional cable or conduit entry holes are permitted in the casing or cover of the actuator.**



Connect all signal cable 'braid' screens to earth using the screen termination clamps provided on the controller. Connect all cable screens to earth at the **controller only**, unless stated otherwise. Where CANBus wiring connects through one device to connect to another, terminals 5 and 6 are common to maintain screen continuity.

The equipment described in this manual has been tested for compliance to safety directives listed in the section headed 'Actuator specification'. However, after it has been connected to a burner and other associated controls, it is the responsibility of the installer to make sure the complete installation meets the requirements of the directives relevant to the particular installation.

### 3.2.2 Earth Connection.

All sections of the control system with metal enclosures **MUST** be connected to earth.

Connect at the tag showing the **Earth** symbol, inside the cover on the body of the device (see picture in 3.2.4). These connections are required to maintain the overall electrical safety of the installation and ensure the EMC performance of the equipment. Failure to comply with the wiring requirements will affect the performance of the system and may cause a hazardous condition to occur.

**DO NOT** use the screen of the signal cable to provide the electrical safety earth. You **MUST** make a separate earth connection using color coded earth wire of cross-sectional area 0.75mm<sup>2</sup> or greater, as permitted by conduit sizing.

|      | Alpha<br>(conductors) |       | Carol<br>(conductors) |   | Belden<br>(conductors) |   |
|------|-----------------------|-------|-----------------------|---|------------------------|---|
|      | 4                     | 2     | 4                     | 2 | 4                      | 2 |
| 300V | 25164                 | 25162 | ---                   |   | 9940                   |   |
| 600V | 25524                 | 25522 | C2688                 |   | 7895A*                 |   |

These types of cable may also employ a 'foil with drain wire'. This is **not** suitable as a screen because the cross section of the drain wire is insufficient to provide correct screening of the signals. Also, there is no provision to connect the foil or drain at the main controller.

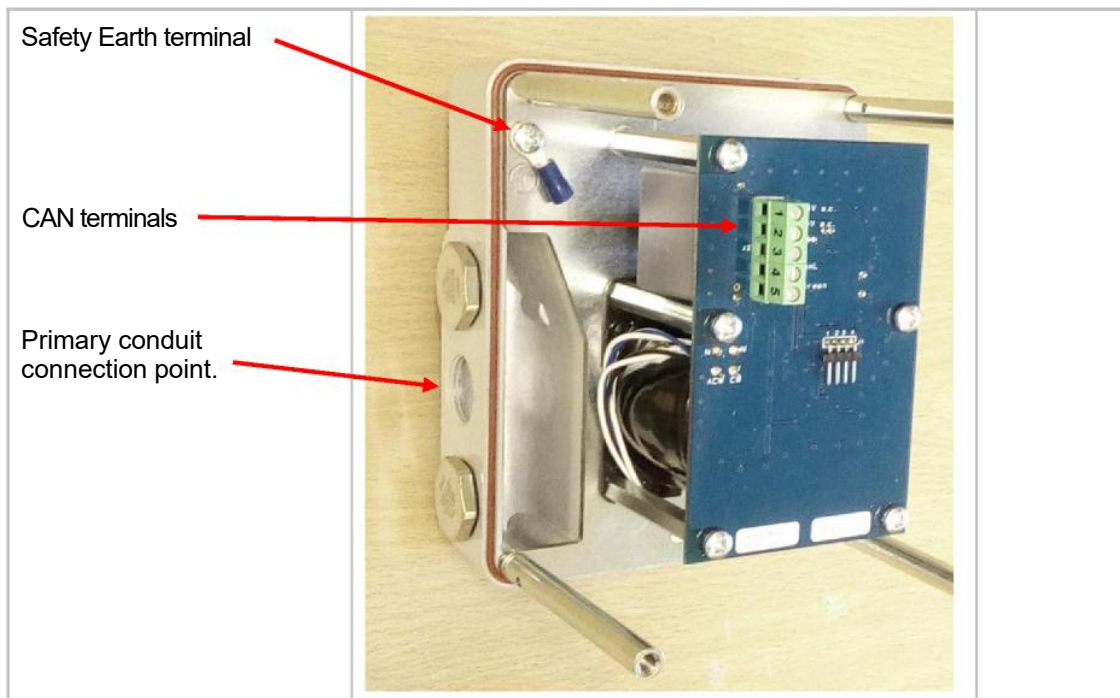
You must connect the ELV signal cable screens at the screen termination clamps only, unless stated otherwise in this manual. The screen termination clamps on the controller are only to allow connection of the cable screens to the main controller - they do not provide strain relief.

Terminal 5 in the actuator is for the termination of the cable screens and, where required, for continuity of the screen when actuators are connected in a daisy-chain configuration (see picture in 3.2.4).

### 3.2.4 Actuator terminal connections.

The terminals within the actuator follow the CANBus wiring system and are labelled to reduce the possibility of wiring errors. This information is in the table below:

| Terminal No. | Module   | Function      | Voltage Range |
|--------------|----------|---------------|---------------|
| 1            | Actuator | 24 Vac Supply | 24 – 29.5 Vac |
| 2            | Actuator | 24 Vac Supply | 24 – 29.5 Vac |
| 3            | Actuator | CAN +         | 0 – 5 V       |
| 4            | Actuator | CAN –         | 0 – 5 V       |



### 3.2.5 Conduit and gland connections.

The actuators described in this manual have been approved for use in Class 1, Division 2 locations and have IP66 (NEMA 4) enclosures. There are three threaded conduit or gland connection points on the actuators, two of which have Ex blanking plugs fitted. It is essential that Ex type conduit, connectors and gland systems are selected, to ensure safe operation can be maintained whilst this equipment is in operation in a hazardous area.

One of the connection points may be used as a test port, when required.



### **3.2.6 Actuator assembly - safety checks.**

- Ensure that all cable or conduit fittings are sealed correctly with reference to the manufacturer's specification.
- Before attempting to fit the cover, ensure that the mating edges of the actuator body and cover are not damaged. Deformed edges may cause further damage to the gasket material and so render the device unsuitable for operation in a hazardous area.
- When fitting the cover, ensure that cables do not become trapped or damaged by the cover.
- Ensuring that the O-rings under the cover screw heads are not damaged, then tighten the cover screws evenly to ensure that the cover is seated evenly onto the actuator base and red sealing gasket.

## 4. Selecting and setting up the actuators



### CAUTION

- Check actuators for any signs of damage before installation.
- Do not start the operation of the combustion system before properly setting the limiting cam positions.
- Protect actuators from shock or impact (e.g. dropping).
- Do not use the actuator as a load bearing device (e.g. stepping or climbing point).
- Permanent over-loading or jamming the movement of the actuator may damage it.

Actuators must be selected to match or exceed the load presented by the controlling valve or damper.

Mounting brackets must be accurately aligned to eliminate side load on the actuator output shaft.

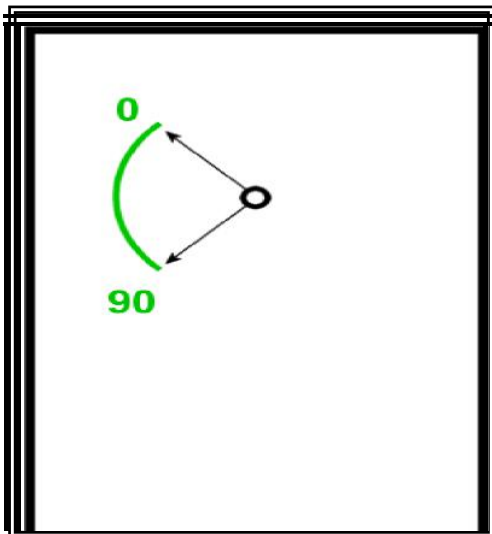
Fireeye recommend that the coupling between the actuator and the valve/damper is pinned to the shaft of both devices, after the actuator potentiometer and direction settings have been made

### 4.1 Valve Control Direction

Make sure that each actuator travels in the correct direction to match the mechanical configuration of the burner. The default setting is for an actuator to move anti-clockwise (looking at the end of the output shaft) when the actuator is driven 'UP'.

You can reverse this using Option parameters 5.0 to 5.9. The default is 0 for anticlockwise movement. Change it to a value of 1 for clockwise movement, as viewed looking onto the end of the actuator drive shaft.

The actuators are synchronous a.c. type.



## 4.2 Locking the Actuator to the Valve Shaft



### CAUTION

- After the position of the actuator shaft relative to the valve shaft is correctly set, each actuator **must** be locked to its valve shaft or air damper shaft.
- In order to prevent the joint between actuator and shaft moving, it is recommended that the device used to link the two items is pinned together. See the picture below.
- The actuator zero point cannot be adjusted. Before connecting to the valve shaft, first make sure the actuator direction is set, and it is driven to its minimum point.
- It is essential that the actuator and valve remain securely connected, to ensure safe operation of the equipment.

The Coupling and shaft have been drilled to size then a roll pin has been pressed into the holes to fix the angular position.



The actuator output shaft and the spindle of the valve or damper must run 'centered', select a flexible coupling when variations in alignment are suspected.



### **4.3 Closed position settings (P00).**

Each time a burner start-up sequence is initiated the controller will move the fuel and air damper actuators to their respective 'Closed' positions (P00), to prove correct actuator operation. The zero feedback position is preset at the factory to suit the majority of applications.



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## 5. Routine maintenance of the actuators

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### **WARNING**

#### **EXPLOSION OR FIRE HAZARD.**

- Hazard can cause damage to property, severe injury or death.
- Do not connect or disconnect equipment unless power has been switched off, or the area is known to be non-hazardous. More than one power supply disconnect may be involved.
- To prevent possible hazardous burner operation, you must verify the safety requirements each time a control is installed on a burner, or if the installation is modified in any way.
- The enclosure of the actuators has a non-conducting coating and may generate an ignition-capable level of electrostatic charges under extreme conditions. The user should ensure that the equipment is not installed in a location where it will be subjected to external conditions (such as high-pressure steam) which might cause a buildup of electrostatic charges on non-conducting surfaces.



### **CAUTION**

- Before starting any maintenance or service work. Check that all permits are in order and that safety and emergency procedures are clearly understood.
- Cleaning of the Actuators should be carried out with a damp cloth.
- On starting the burner, the actuator and all attached fittings/lever/rod assemblies etcetera, will start to move.
- After completion of any adjustment work, verify the proper function of all attached fittings/levers, etc.
- Never install or work on a defective actuator.

There are no user serviceable parts within the actuators, and the gearbox is manufactured with a permanent grease lubrication and thus maintenance-free.

Maintenance will be limited to the following:

- Verification of the position system.
- Checking of Safety Earth bonding to the connection point.
- Checking of the condition of cables, cable glands or conduit and conduit fittings.
- Checking the condition of the body, cover, seals and gaskets - between the body and cover.
- Seal test - Under constant temperature conditions, the time interval required for an internal pressure of at least 30mm (1.2") water gauge below atmospheric to rise to half the initial value, shall be not less than 90s.



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## NOTICE

When Fireeye products are combined with equipment manufactured by other and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

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## WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.

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FIREYE, Inc.  
3 Manchester Road  
Derry, New Hampshire 03038 USA  
[fireeye.com](http://fireeye.com)

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