AUTOFLAME®
Combustion Management Systems



AUTOFLAME
SERVOMOTORS GUIDE

12.08.2024

Autoflame Engineering Ltd.
Unit 1-2 Concorde Business Centre
Airport Industrial Estate
Wireless Road, Biggin Hill
Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Web: www.autoflame.com

AUTOFLAME SERVOMOTORS GUIDE

12/08/2024

This manual and all the information contained herein is copyright of Autoflame Engineering Ltd. It may not be copied in the whole or part without the consent of the Managing Director.

Autoflame Engineering Ltd.'s policy is one of continuous improvement in both design and manufacture. We therefore reserve the right to amend specifications and/or data without prior notice. All details contained in this manual are correct at the time of going to print.

Important Notes

A knowledge of combustion related procedures and commissioning is essential before embarking in work on any of the MM / EGA systems including servomotors. This is for safety reasons and effective use of the MM / EGA system. Hands on training is required. For details on schedules and fees relating to group training courses and individual instruction, please contact the Autoflame Engineering Ltd. offices at the address listed herein.

Short Form - General Terms and Conditions

A full statement of our business terms and conditions are printed on the reverse of all invoices. A copy of these can be issued upon application, if requested in writing.

The System equipment and control concepts referred to in this Manual MUST be installed, commissioned and applied by personnel skilled in the various technical disciplines that are inherent to the Autoflame product range, i.e. combustion, electrical and control.

The sale of Autoflame's systems and equipment referred to in this Manual assume that the dealer, purchaser and installer have the necessary skills at their disposal. i.e. A high degree of combustion engineering experience, and a thorough understanding of the local electrical codes of practice concerning boilers, burners and their ancillary systems and equipment.

Autoflame's warranty from point of sale

- Two years on all electronic and electro-mechanical equipment, assemblies and components.
- One year on all EGA systems and UV & IR scanners, including parts, components, cells and sensors.

The warranty assumes that all equipment supplied will be used for the purpose that it was intended and in strict compliance with our technical recommendations.

Autoflame's warranty and guarantee is limited strictly to product build quality, and design. Excluded absolutely are any claims arising from misapplication, incorrect installation and/or incorrect commissioning.

Contents

IMPORTANT SAFETY NOTES 5

1. AUTOFLAME SERVOMOTORS 6

1.1. Servomotor Sizes 7

2. SMALL SERVOMOTORS 8

2.1. Specifications 8

2.2. External View 9

2.3. Dimensions 10

3. LARGE SERVOMOTOR 11

3.1. Specifications 11

3.2. External View – Metal Housing 12

3.3. Dimensions – Metal Housing 13

3.4. External View – Polycarbonate Housing 14

3.5. Dimensions – Polycarbonate Housing 15

4. 4-20mA SMALL & LARGE SERVOMOTORS 16

5. INDUSTRIAL UNIC SERVOMOTORS 20

5.1. Specifications 21

5.2. External Drawings 22

5.3. UNIC05 23

5.4. UNIC10 24

5.5. UNIC20 & UNIC40 25

5.6. Manual Operation 26

5.7. Solid State Relays 27

5.8. Industrial Servomotors 4-20mA 28

6. ATEX APPROVED SERVOMOTORS 29

6.1. ATEX Certification 29

6.2. ATEX Approved Small Servomotors 31

6.3. ATEX Approved Large Servomotors 33

6.4. ATEX Approved Industrial Servomotors 35

7. SERVOMOTORS MOUNTING BRACKETS 37

7.1. Small Servomotor Mounting Bracket and Coupling 38

7.2. Large Servomotor Mounting Bracket and Coupling 39

7.3. UNIC05 Mounting Bracket and Coupling 40

7.4. UNIC10 Mounting Bracket and Coupling 41

7.5. UNIC20 / UNIC40 Mounting Bracket and Coupling 42

8. INSTALLATION 43

8.1. Overview 43

8.2. Wiring 44

8.3. Adjusting the Servomotor's Position 45

8.4. Servomotor Feedback Voltage 46

8.5. Servomotors with Autoflame Gas Valves 47

8.6. Servomotor Flying Leads and Connectors 48

9. MAINTENANCE AND TROUBLESHOOTING 49

IMPORTANT SAFETY NOTES



Servomotors must be installed, wired, commissioned, and adjusted by an Autoflame trained and certified technician.

Any person installing, wiring, commissioning or adjusting the servomotors without undergoing proper Autoflame training and without full understanding of the Micro Modulation MM system might put themselves and others in a seriously dangerous situation that can result in serious injury or even death and may cause permanent equipment failure and substantial property damage.

Some of the wiring connections are live, make sure to totally and safely isolate the mains power before undergoing any work related to the servomotors. Failure to do so can result in fatal injury.

Servomotors are supplied by the factory set at 0.0° position. Remember that this position may not necessarily position the valve or damper at 0.0° or a closed position. This must be physically checked. Failure to check this can have seriously dangerous consequences.

This guide must be read in conjunction with the relevant MM system manual.

1. AUTOFLAME SERVOMOTORS

Autoflame servomotors are rotary type electric actuators, used with Autoflame's Mk8 MM and Mini Mk8 MM Micro Modulation systems to achieve the ultimate positioning accuracy for boiler and burner applications, which in turn guarantees unmatchable control, precision, accuracy, efficiency, repeatability and reliability.

Autoflame offers three standard types of servomotors; small, large and industrial, each of which can be used for all control channels. Autoflame fuel and FGR valves require small or large servomotors only. All servomotors can be configured to drive clockwise or counterclockwise to open/close a valve or damper. The servomotors can be installed in any orientation.

The servomotors applications include:

- Main, primary, or secondary air damper.
- Forced draught damper.
- Induced draught damper.
- Gas and/or oil fuel control valves.
- Fuel atomisation.
- FGR valve/damper.
- Feedwater valve.
- Draught control damper.
- TDS control valve.
- Bottom Blowdown Valve.
- NOx reduction systems.

Autoflame servomotors offer the following features:

- Ultra-high accuracy level.
- Lightweight.
- Compact design suitable for narrow spaces.
- Simple structure maximises reliability.
- Can be mounted straight into Autoflame gas or oil valves/dampers.
- Mounting bracket available for use with third party valves/dampers.
- Easy access to wiring terminals for installation, maintenance and testing.
- Simple wiring connection using a terminal block integrated into the servomotor.
- Optional flying lead connector for quick, trouble free installation and replacement.
- 2 years limited warranty.



1.1. Servomotor Sizes

The following servomotors are available.

Servomotor Type	Max. Torque Nm	Max. Torque ft.lb
Small	4	3
Large	25	18
UNIC05	40	30
UNIC10	98	72
UNIC20	196	145
UNIC40	392	289

The load that the servomotor is used to drive should not exceed the maximum torque rating of the servomotor. With Autoflame supplied valves, the correct servomotor size is already specified by Autoflame.

To correctly size an Autoflame servomotor for use with a third party valve or damper, the torque required to drive that valve or damper should be checked. This is in order to select a servomotor with sufficient torque to drive the damper reliably. Please check the manufacturer's specifications for that valve or damper to check the torque requirements.

If this is unknown or the data is not available, then it is necessary to check the torque required to drive the valve/damper using a torque meter. The torque should be measured when the valve/damper is fully loaded. For example, for an air damper that will be when the fan motor / VSD is driven at maximum speed. It is recommended that a nominal 20% is added to the measured torque value to determine the type of servomotor required for the application. This nominal 20% takes into account any factors such as dust, rust, and lack of lubrication experienced between service intervals which can make the valve/damper require more torque.

$$Servomotor\ Torque\ = Measured\ torque\ at\ max.load\ x\ 1.2$$

For example if the measured torque to drive an air damper at full load is 19Nm;

$$Servomotor\ Torque\ = 19\ x\ 1.2 = 22.8Nm$$

Therefore a large servomotor may be selected for this damper.

2. SMALL SERVOMOTORS

Small servomotors provide a maximum torque of up to 4Nm, they are compact, lightweight, extremely durable and can be used for variety of applications including controlling air dampers, gas and oil fuel valves. The housing is made from high impact Acrylonitrile Butadiene Styrene (ABS) for lighter weight and easier installation.

ATEX approved version with metal housing is also available for use in hazardous environments where explosion proof equipment is necessary.

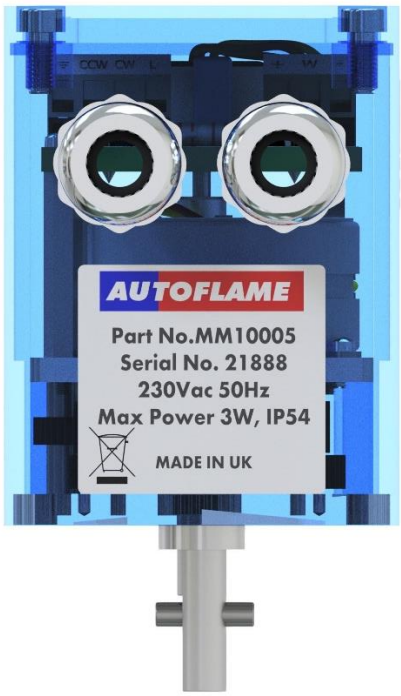
The following small servomotors are available:

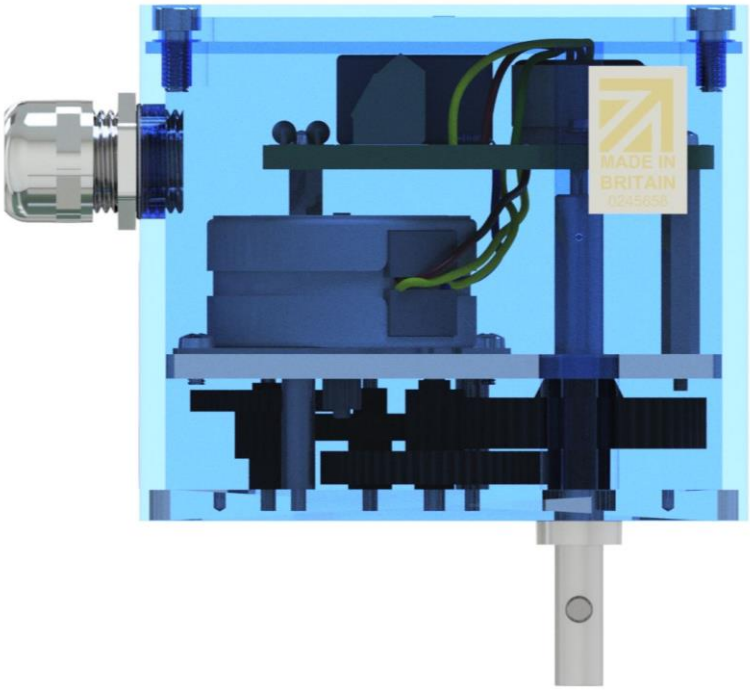
Voltage – V AC	Frequency	Supplied Wiring Glands	Part #
230	50Hz	2x PG11 Metal Glands	MM10005
110	60Hz	2x M20 - 1/2" NPSM Adaptors	MM10005/A
24	50Hz	1x M20 - 1/2" NPSM and Blanking Plug	MM10005/C
24	60Hz	1x M20 - 1/2" NPSM and Blanking Plug	MM10005/D
110	50Hz	2x M20 - 1/2" NPSM Adaptors	MM10005/E

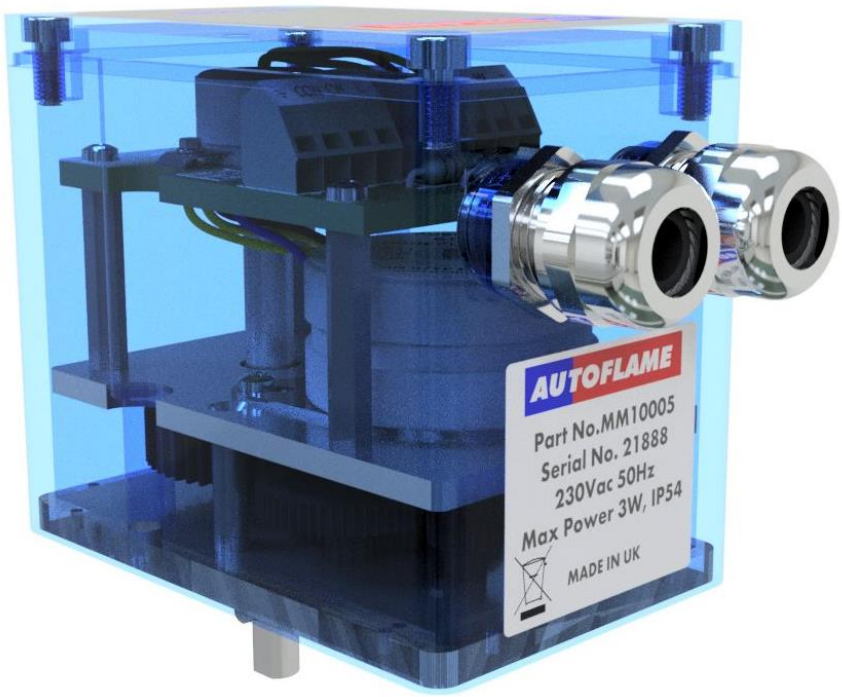
2.1. Specifications

Supply voltage	AC - Dependant on part number
Output torque at shaft	4Nm (3ft lbs)
Rotation angle	360°
Operation angle	-6° to 96°
Accuracy	Up to 0.1°, 900 positions available
Max. rated power	3W
Min. operation temperature	0˚C (32° F)
Max. operation temperature	60° C (140° F)
Ingress Protection rating	IP54, NEMA3
Mounting angle	360°
Positioning	MM drive
Drive motor	Synchronous
Body material	High Impact Polycarbonate
Gear material	Polyoxymethylene
Plates material	Aluminium
Screws material	Stainless Steel
Dimension (L x W x H)	100 x 84 x 65.5 mm
Wiring connection (230V)	PG11 gland
Wiring connection (24V, 110V)	½” conduit adaptor and blanking plug
Lid screws	4 x M4 x10 Stainless steel socket head
Lid screw torque	0.2 to 0.4 Nm
Body mounting screws	2 x M5 x 25 Stainless socket head
Body mounting torque	1.2 – 2.6 Nm
Shipped Weight	0.55 kgs. (1.2 lbs)

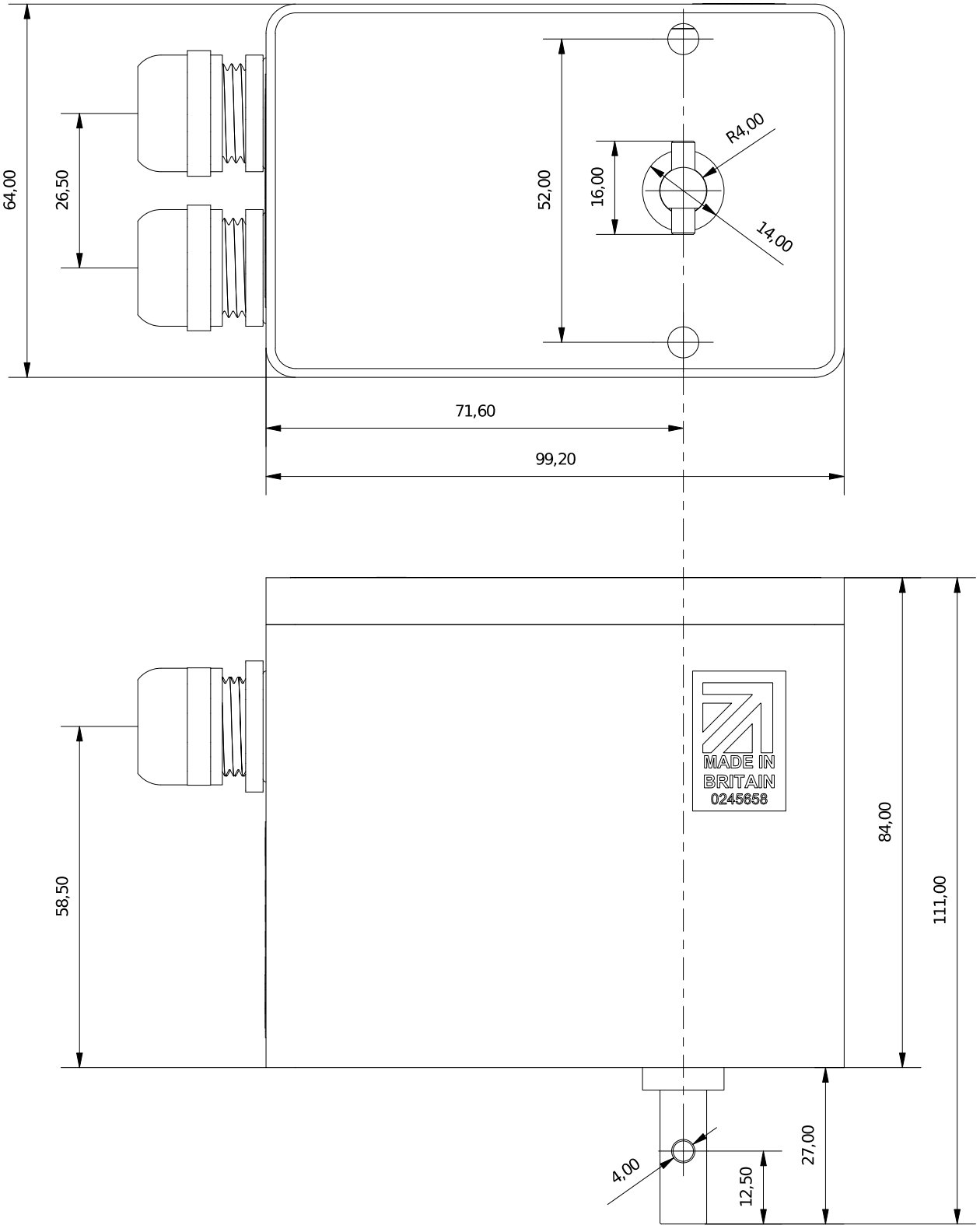
2.2. External View







2.3. Dimensions



All dimension in millimetres: 1 inch = 25.4 mm

3. LARGE SERVOMOTOR

Large servomotors provide a maximum torque of up to 25Nm, they are extremely durable and can be used for a variety of applications including controlling air dampers, gas and oil fuel valves, FGR, feedwater valves and many other applications.

Large servomotors are available in metal (powder coated mild steel) housings as well as an option for high impact Acrylonitrile Butadiene Styrene (ABS). ATEX approved versions are also available for hazardous environments where the use of explosion proof equipment is required.

Housing	Voltage - AC	Frequency	Supplied Wiring Glands	Part #
Polycarbonate	230V	50/60Hz	2x PG11 Glands	MM10400
Polycarbonate	230V	50/60Hz	1x PG11 - 1/2" NPSM & 1x Blanking Plug	MM10400/NPSM
Polycarbonate	110V	50/60Hz	2x PG11 Glands	MM10400/A
Polycarbonate	24V	50/60Hz	1x PG11 - 1/2" NPSM & 1x Blanking Plug	MM10400/D
Metal	230V	50/60Hz	2x PG11 Glands	MM10004
Metal	230V	50/60Hz	1x PG11 - 1/2" NPSM & 1x Blanking Plug	MM10004/NPSM
Metal	110V	50/60Hz	2x PG11 Glands	MM10004/A
Metal	24V	50/60Hz	1x PG11 - 1/2" NPSM & 1xBlanking Plug	MM10004/D

3.1. Specifications

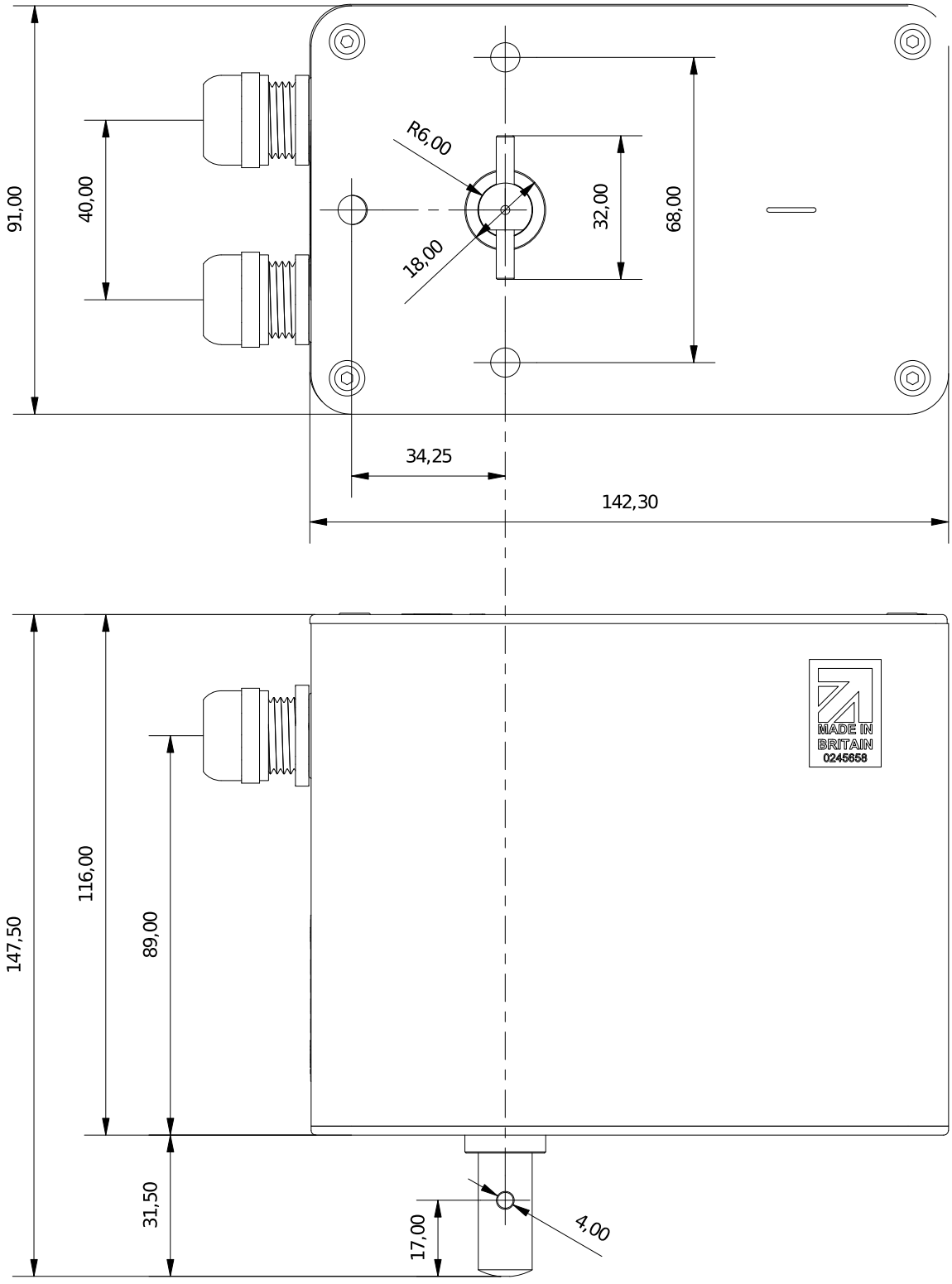
Supply voltage	AC - Dependant on part number
Output torque at shaft	25Nm (18ft lbs)
Rotation angle	360°
Operation angle	-6° to 96°
Accuracy	Up to 0.1°, 900 positions available
Max. rated power	9W
Min. operation temperature	0˚C (32° F)
Max. operation temperature	60° C (140° F)
Ingress Protection rating	IP65, NEMA4
Mounting angle	360°
Positioning	MM drive
Drive motor	Synchronous
Housing material (polycarbonate)	High Impact Polycarbonate
Housing material (metal version)	Mild steel CR4 with Interpon 700 Industrial Powder Coat
Gear material	708M40T mild steel
Plates material	Aluminium
Screws material	Stainless Steel
Dimension (L x W x H)	See relevant drawing
Wiring connection (230V)	PG11 gland
Wiring connection (24V, 110V)	½” conduit adaptor and blanking plug
Lid screws	4 x M4x10 Stainless steel socket head
Lid screw torque	0.2 to 0.4 Nm
Body mounting screws	2 x M5x25 Stainless socket head
Body mounting torque	1.2 – 2.6Nm
Shipped Weight (Polycarbonate)	1.75 kgs. (3.85 lbs)
Shipped Weight (Metal version)	1.85 kgs. (4.1 lbs)

3.2. External View – Metal Housing



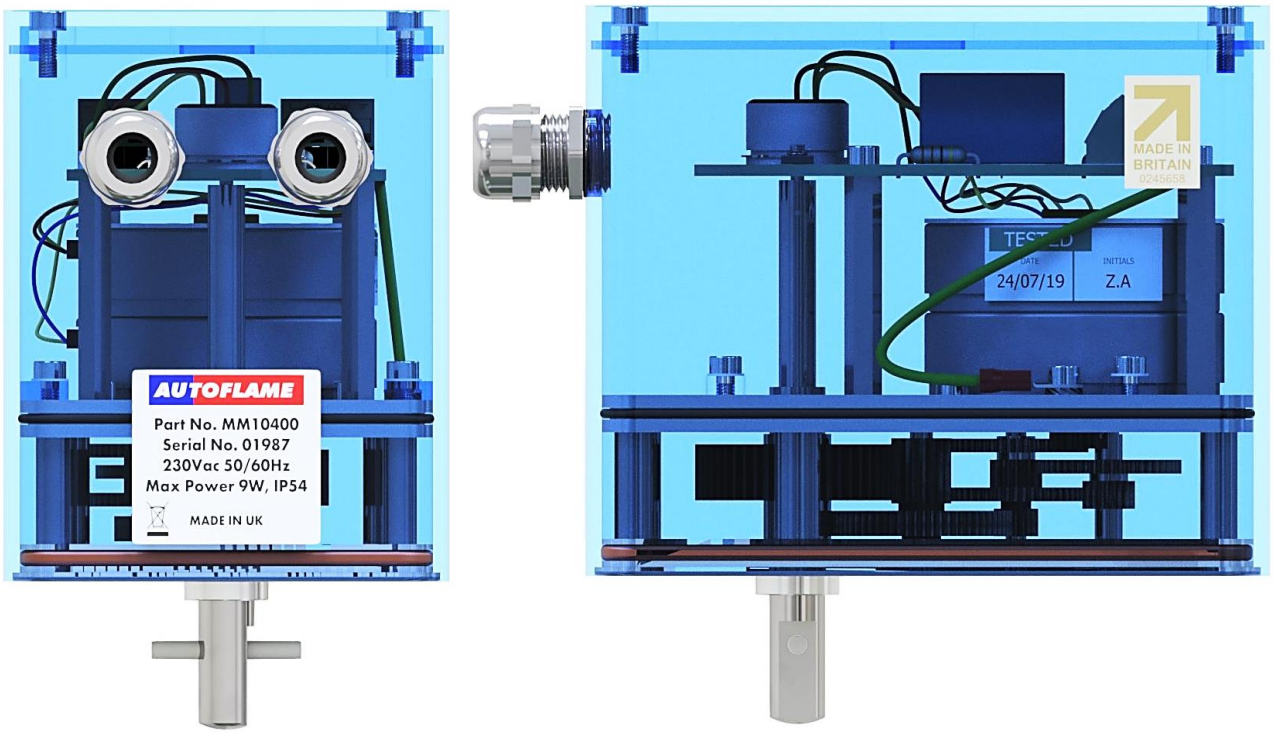


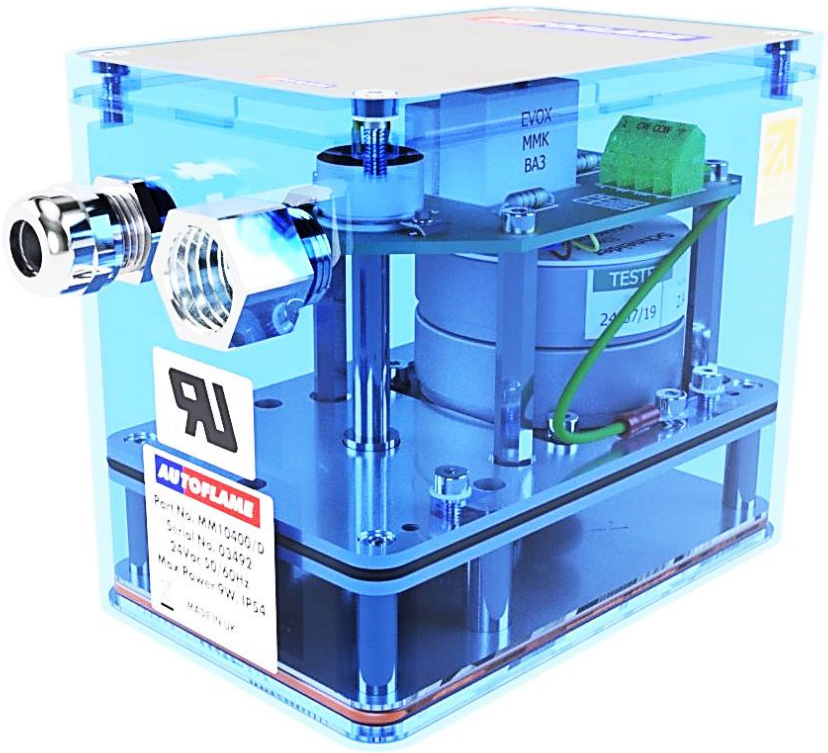
3.3. Dimensions – Metal Housing



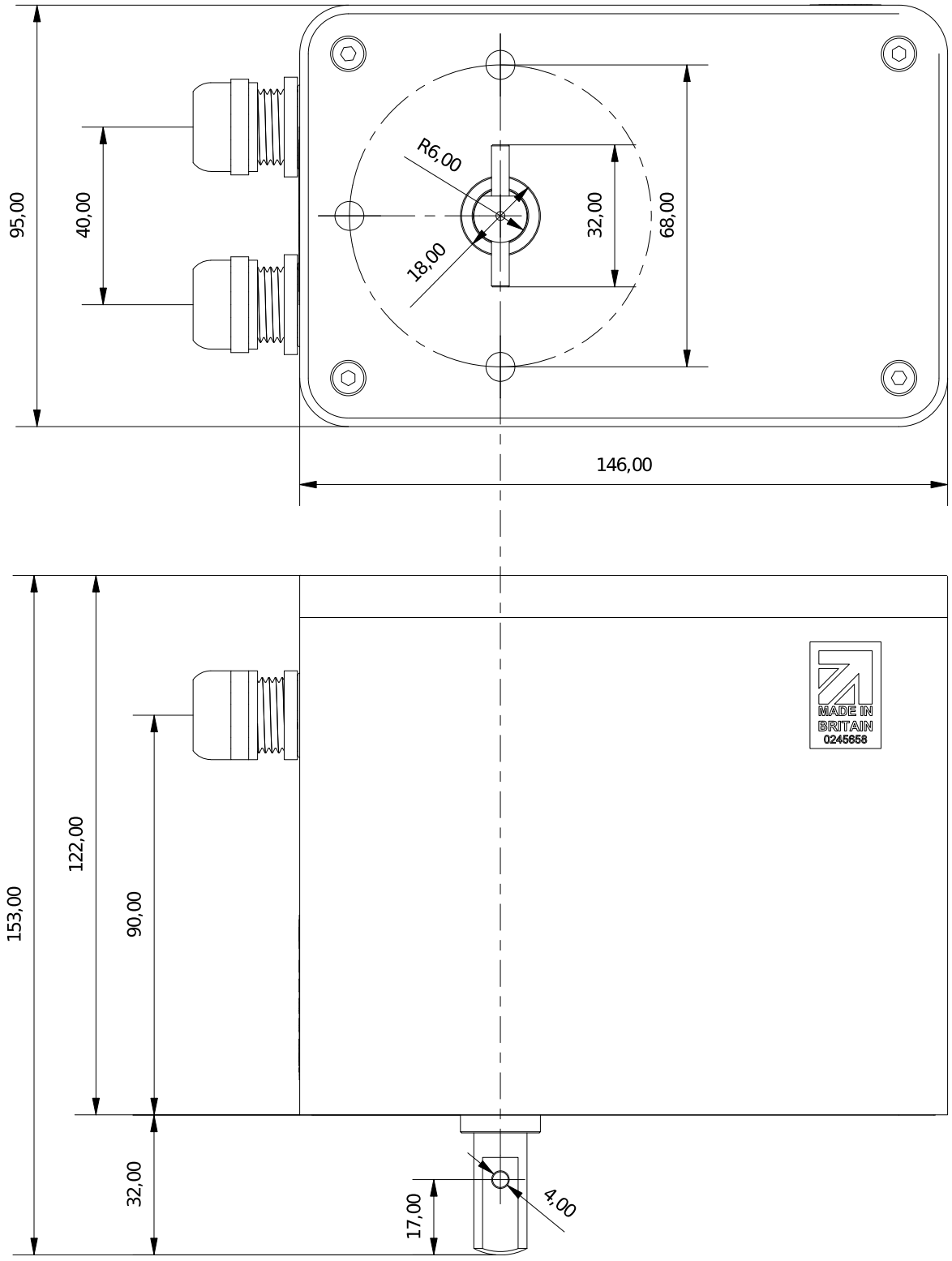
All dimension in millimetres: 1 inch = 25.4 mm

3.4. External View – Polycarbonate Housing





3.5. Dimensions – Polycarbonate Housing



All dimension in millimetres: 1 inch = 25.4 mm

4. 4-20mA SMALL & LARGE SERVOMOTORS

The Autoflame 4-20mA servomotors operate off 110V or 230V mains and are controlled by a 4-20mA current loop interface. Utilizing a popular interface allows the product to be easily integrated with existing systems.

An internal controller interprets the 4-20mA current loop input, driving the motor to the corresponding angle. A potentiometer monitors this angle and outputs the present position of the rotor as a 4-20mA signal. In normal operation, the servomotor position can be precisely controlled within a 90º arc. Its operating range is selected during installation from two available options (clockwise or anticlockwise).



Figure 1 Mechanical Construction

The Autoflame 4-20mA Servomotors come from the factory set to 230V input and with the drive shaft set to operate in a clockwise direction from a horizontal starting position when viewed from the bottom as shown in Figure 1 above.

Two cables provide connection to the device, 1 for power and 1 for signals. Each cable is secured through a clamped cable gland and soldered directly to the PCB. The connections are shown in Table i/Table ii below.

Cable 1 (4 Core - Signal)		
Pin	**Colour Code**	**Connection**
1	Green	4-20mA Input-
2	Yellow	4-20mA Input+
3	Red	4-20mA Output+
4	Blue	4-20mA Output-

Table i - Signal Cable Pinout

Cable 2 (3 Core - Power)		
Pin	**Colour Code**	**Connection**
1	Brown	Live
2	Blue	Neutral
3	Yellow/Green	Earth

Table ii - Power Cable Pinout

To change the required voltage, the Mains Select switch is toggled (see Figure 2). Ensure that the correct voltage is selected before applying mains voltage. Note that applying 230V with the switch set to 110V will cause the mains fuse on the unit to blow.

Voltage – V AC	Frequency	Fitted Wiring Glands	Part #
230/110	50/60Hz	2x PG11 Clamped Metal Glands	MM14205 (Small)
230/110	50/60Hz	2x PG11 Clamped Metal Glands	MM14204 (Large)

To change the required voltage, the Mains Select switch is toggled (see Figure 2). Ensure that the correct voltage is selected before applying mains voltage. Note that applying 230V with the switch set to 110V will cause the mains fuse on the unit to blow.



Figure 2 - Selecting Mains Voltage

With mains voltage applied, the green PWR LED should be lit. If there is no 4-20mA signal applied to the unit, the red FAULT LED will also be lit. A full list of the error conditions is provided in
Table iii.



Figure 3 - PWR LED On

If a signal greater than 4mA is applied the motor will drive to the required angle, where 4mA represents 0° and 20mA represents 90°.

The start angle (0° position) is altered by putting the unit into calibration mode. This is achieved by moving the CAL switch to the left. In this mode, the variable POT may be altered using a suitable screwdriver. This drives the motor round whilst keeping the input current as 4mA, placing the shaft in a new start position. When the drive shaft is in the appropriate position, the CAL switch is moved back to the right to return the unit to normal mode. The unit will now drive as before, but from this new start angle.

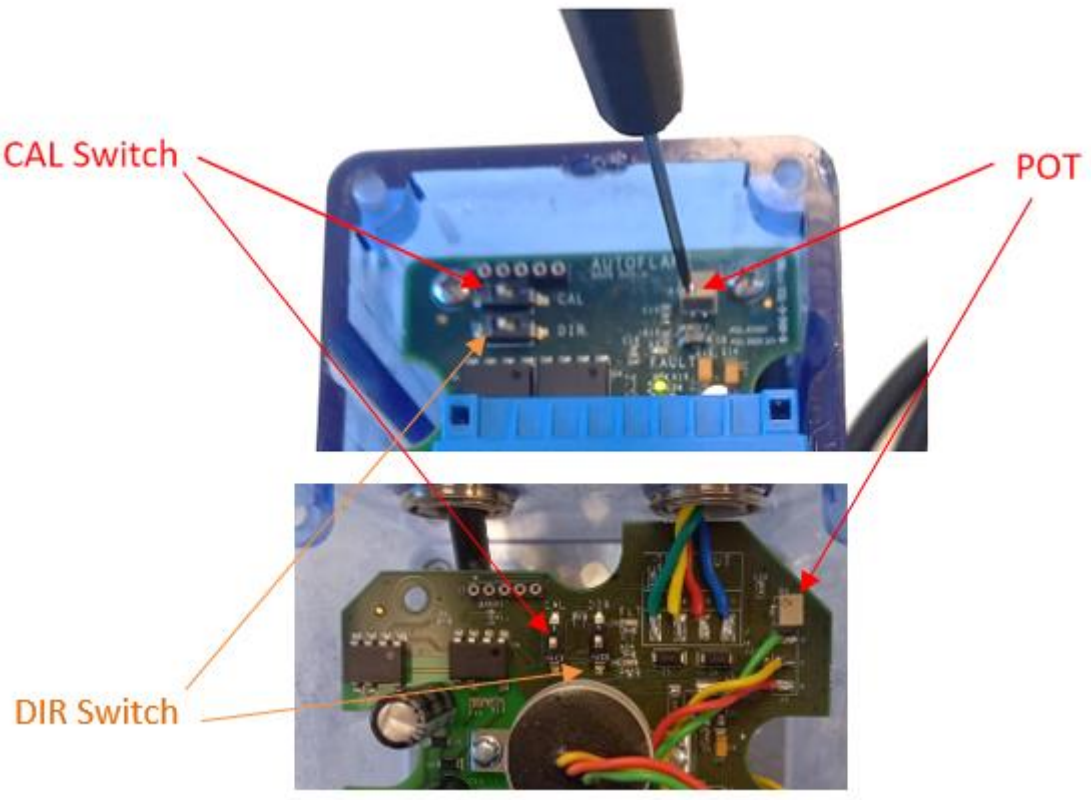


Figure 4 - Calibration Mode

Whilst in CAL mode, the DIR switch may be changed to alter the direction of rotation. The unit will rotate 90° clockwise, or anti-clockwise from the start position for the two positions of the DIR switch.
Note that changing the DIR switch when not in CAL mode has no effect on the operation of the unit unless you are close to the unusable zone as described below.

The unusable zone is a limitation to the angles to which the drive shaft zero position may be set. This is due to the potentiometer, which detects the change in angle of the drive shaft, having a dead zone in its feedback.

The factory setting of the potentiometer has the zero at the opposite side to the dead zone as shown in Figure 5. This gives plenty of margin for driving 90° clockwise or anti-clockwise without hitting the dead zone. If the zero position is changed in CAL mode, the software ensures that you still have 90° worth of rotation for the direction in which you are set to move.

If when changing the DIR switch in CAL mode, the drive shaft rotates, it is to move the shaft into the configurable zero range for that particular direction. This maximizes the available orientations for mounting the servomotor as shown below.

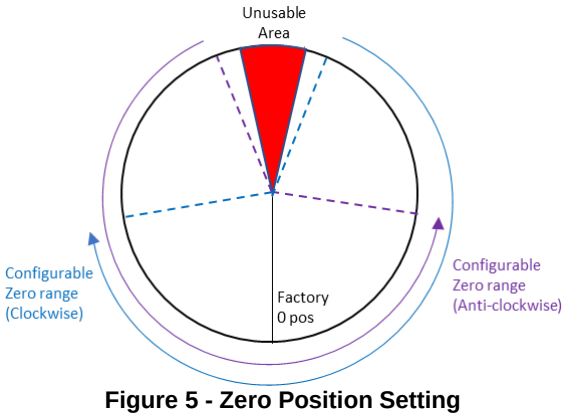


Figure 5 - Zero Position Setting

Once set up, the unit will drive to a given angle as required by a 4-20mA signal on the Yellow and Green wires, where 4mA represents 0° and 20mA represents 90°.

The corresponding 4-20mA angle of the potentiometer is produced on the Red and Blue wires and may be used to monitor that the servomotor is driving to the desired angle by confirming that the feedback control current matches the drive control current.

The unit has a red FAULT LED which indicates the following errors.

LED Status	Meaning
Off	Unit operating correctly
On (Constant)	Input 4-20mA signal low or missing
2 flashes	Servomotor position fault (outside of the commissioned operating range of 0 to 90 degrees +/- 3 degrees tolerance
3 flashes	Servomotor movement error – servomotor must make movement in the correct direction when driving, fault occurs after 1 second with no appropriate movement
4 flashes	Software error
5 flashes	Calibration data bad – the stored calibration values are out of range or failed error checking
6 flashes	Program memory checksum failed

Table iii - Fault Conditions

5. INDUSTRIAL UNIC SERVOMOTORS

The industrial servomotor is a rotary type, electric actuator for use with the MM systems. It is available in 4 sizes with torque output ranging from 40 to 400Nm. The UNIC servomotors can be used for air dampers and water valves.
A 4-20mA version of the UNIC servomotors is available for use on the analogue channels on the MMs as well as for controlling feedwater valves.

The industrial servomotors feature:

- Light, compact design.
- High torque output.
- Built-in thermal protector to prevent motor burnout by overloading.
- Easy to install and suitable for use in narrow spaces.
- Simple structure design.
- Mounting bracket and coupling available for direct mounting onto air dampers or valves.
- Manual operation is possible with the included manual crank handle.
- Simplified wiring using internal terminal block.
- Available in 230V, 110V AC for use with the Mk8 MM and Mini Mk8 MM.
- 24V DC version available for use with Autoflame Bottom Blowdown modules.
- ATEX approved version is available for hazardous environments.
- 4-20mA version for use with MM analogue output channels.

The following UNIC servomotors are available:

UNIC	Voltage V AC	Torque Nm	Torque ft lb	Part #
UNIC05	230	40	30	MM10070
UNIC05	110	40	30	MM10070/110
UNIC05	120	40	30	MM10070/120
UNIC10	230	98	72	MM10072
UNIC10	110	98	72	MM10072/110
UNIC10	120	98	72	MM10072/120
UNIC20	230	200	148	MM10074/B
UNIC20	120	200	148	MM10074/B/110
UNIC40	230	400	295	MM10078
UNIC40	110	400	295	MM10078/110

* Note: Solid state relays are recommended to be used with UNIC 20 and UNIC 40. (MM90070/RK)

24V DC version is available for use with Autoflame Bottom Blowdown Modules:

UNIC	Voltage V DC	Torque Nm	Torque ft lb	Part #
UNIC05	24	40	30	BBA10070
UNIC10	24	68	50	BBA10072

5.1. Specifications

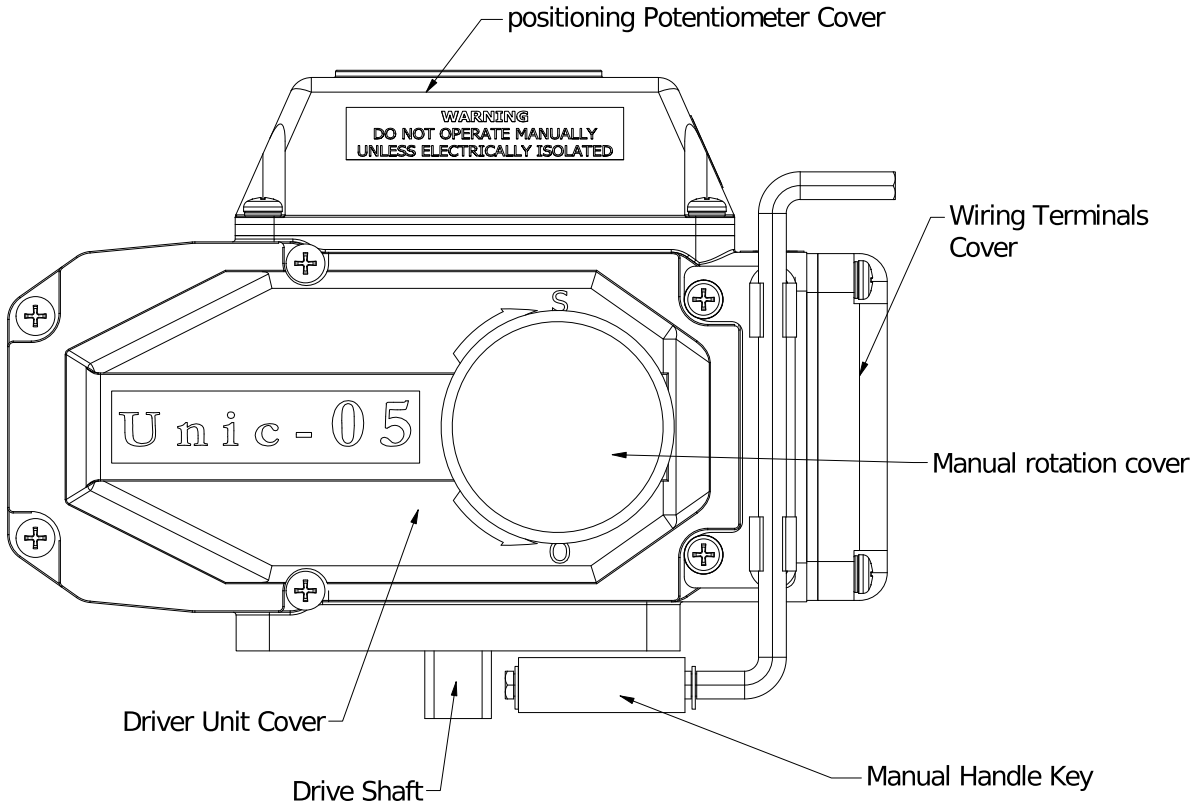
The following specifications are universal for all the UNIC servomotors:

Operation angle	0.0° to 90.0°
Drive Time (0° to 90°)	15 to 30 seconds @ 50Hz (nominal)
Accuracy	Up to 0.5°, 180 positions available
Max. rated power	9W
Min. operation temperature	-25°C (-13° F)
Max. operation temperature	55° C (131° F)
Ingress Protection rating	IP65 (NEMA4X)
Protector	Thermal protector
Stop	Mechanical type (open/close)
Mounting angle	360°
Positioning	MM drive
Drive motor	Synchronous
Insulation Resistance	100mΩ/ 500VDC
Withstand Voltage	1500VAC/ minute
Manual Operation	Crank handle included
Housing material	Die cast aluminium ADC - 12
Finish	Industrial baking varnish
Dimension (L x W x H)	See relevant drawing
Wiring connection	2x ½" BSPP (male) to ½" NPSM (female)

The following specifications are unique for each UNIC servomotor:

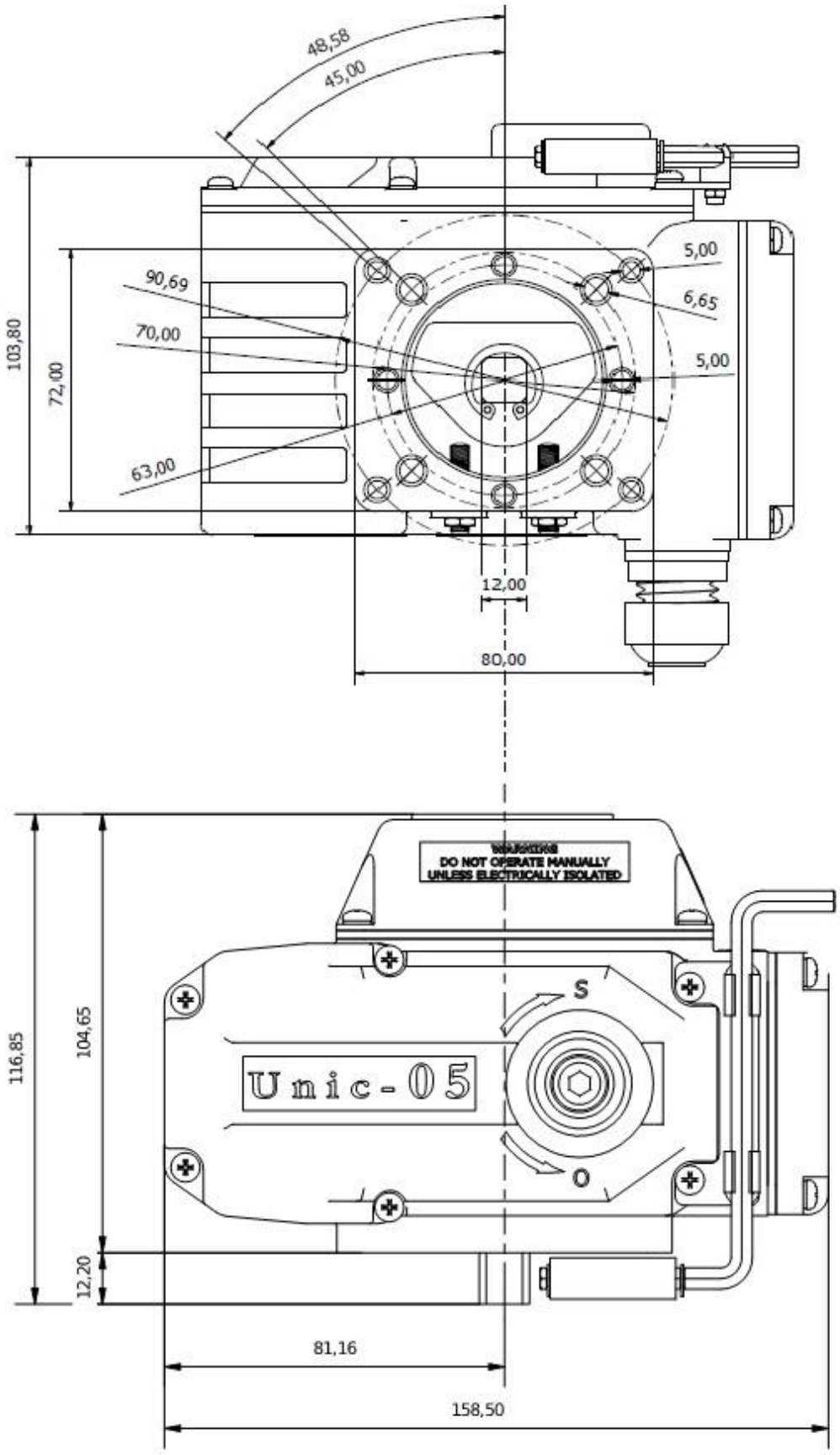
	UNIC05	UNIC10	UNIC20	UNIC40
Torque at shaft	39.2Nm (29 Lb.ft)	98Nm (72 Lb.ft)	196Nm (145 Lb.ft)	392Nm (289 Lb.ft)
Drive motor	8W	20W	30W	90W
Wight	2.3Kg	4.5Kg	7.8Kg	8.5Kg
Rotation angle	360	90	90	90
Mechanical stopper	-	Adjustable	Adjustable	Adjustable
Rated current (230V version)	0.25/0.30A	0.30/0.35A	0.50/0.55A	0.7/0.9A
Rated current (120V version)	0.6/0.7A	0.60/0.65A	1.0/1.1A	1.6/1.8A
Rated current (110V version)	0.7/0.9A	0.65/0.70A	1.1/1.2A	1.8/2.0A

5.2. External Drawings



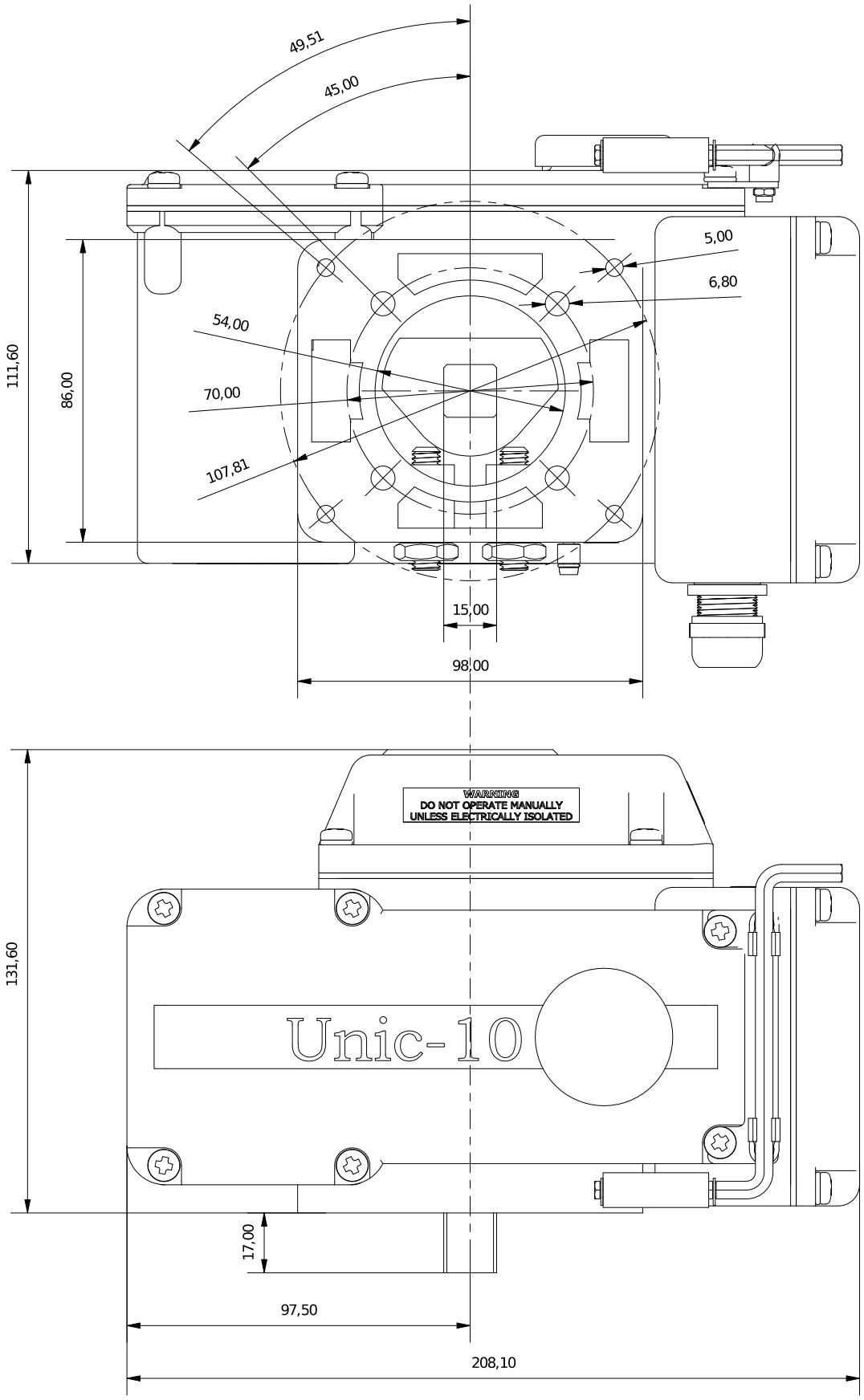


5.3. UNIC05



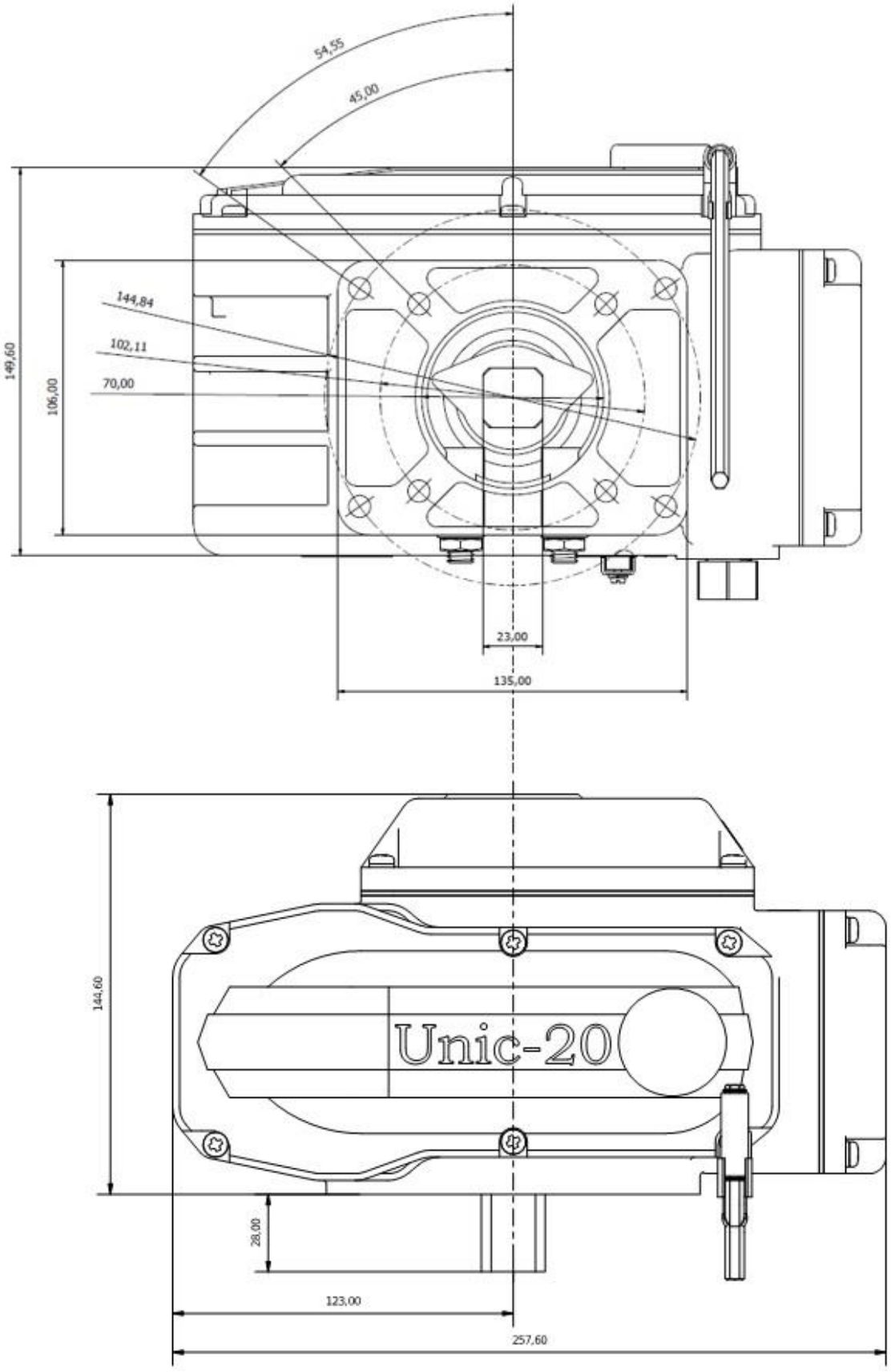
All dimension in millimetres: 1 inch = 25.4 mm

5.4. UNIC10



All dimension in millimetres: 1 inch = 25.4 mm

5.5. UNIC20 & UNIC40



All dimension in millimetres: 1 inch = 25.4 mm

5.6. Manual Operation

Autoflame UNIC servomotors can be turned manually. Before starting manual operation, the power to the servomotor must be isolated/ switched off, failing to do so can cause serious injury and will permanently damage the servomotor.

I. Remove rubber cap covering the manual drive port.
II. insert the manual handle key into the hexagonal port.
III. Turn the manual handle clockwise, the shaft moves in the CLOSE direction.
IV. Turn the manual handle counterclockwise, the shaft moves in the OPEN direction.



Important Notes:

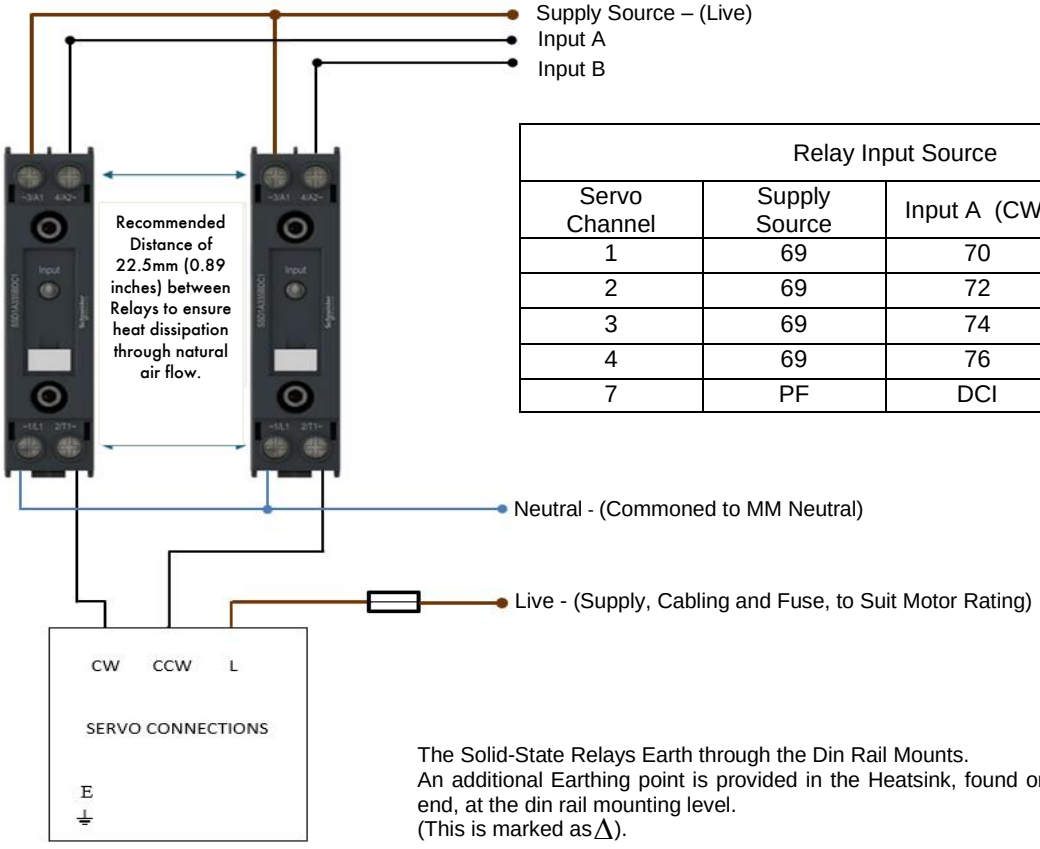
- Do not over-turn the handle with excessive force or if the valve/damper is stuck/showing abnormal resistance; this will cause permanent damage to the servomotor and damper/valve.
- If power is not disconnected when driven manually, then the servomotor will try to automatically drive to its original position during manual operation. This will damage the servomotor and may cause physical injury.
- UNIC 10, 20 & 40 servomotors rotation is limited to 90°, overdriving the servomotors can cause permanent damage.

5.7. Solid State Relays

Solid-State Relays are recommended for use with the Unic 20 and Unic 40, mains driven Servomotors.
The original kit was (MM10070/RK) – this has been superseded by using 2 individual Din Rail Mountable, Solid-State Relays (MM90070/RK).
(Please Note: A Pair of individual relays are required per Unic 20 or Unic 40 servo).



MM90070/RK



Relay Input Source			
Servo Channel	Supply Source	Input A (CW)	Input B (CCW)
1	69	70	71
2	69	72	73
3	69	74	75
4	69	76	77
7	PF	DCI	DCD

The Solid-State Relays Earth through the Din Rail Mounts.
An additional Earthing point is provided in the Heatsink, found on the input end, at the din rail mounting level.
(This is marked as Δ).

5.8. Industrial Servomotors 4-20mA

The UNIC industrial servomotors are available as special version that can be controlled using an analogue 4-20mA input signal, which enables the servomotors to be controlled via the analogue current signal from the MM.

The following channel outputs can be used on the MM to drive the 4-20mA UNIC servomotors:

MM system	Channel
Mk8 MM	Ch5, Ch6, Feedwater servomotor/VSD analogue output
Mini Mk8 MM	Ch4

The following 4-20mA UNIC servomotors are available:

UNIC Size	Voltage V AC	Torque Nm	Torque ft lb	Part #
UNIC10	230	98	72	MM10073
UNIC10	120	98	72	MM10073/120
UNIC20	230	200	148	MM10079
UNIC20	120	200	148	MM10079/120
UNIC40	230	400	295	MM10080
UNIC40	110	400	295	MM10080/110
UNIC40	120	400	295	MM10080/120

With a Mk8 MM, it is also possible to utilise these motors for channel 1-4 operation, if used via a Universal I/O module.

Please Note:

The 4-20mA versions of the Industrial servomotors can only be used in the supplied configuration, when used with the Autoflame controller or I/O module.

The default settings for these motors are 4mA = Closed, 20mA = Open

There is a switch that can reverse the drive of the servo, BUT this does not reverse the feedback output, which is required for the MM to function correctly,
If this has to be used in reverse for any reason, then a 4-20mA Signal Inverter would be required on the Feedback from the motor to the MM. This would need to be accurate and repeatable.

Also, it is extremely important that these motors are mounted correctly and that the directional control and operation of the servo is as required and expected.
The Industrial Servomotors have a square drive shaft, and so it is the user's responsibility that the mounting of these to any valve or damper assembly is correct, and not misaligned by 90, 180 or 270 degrees, as these motors can only have a driven range of 90 degrees, and damage can be caused as a result of incorrect alignment.

6. ATEX APPROVED SERVOMOTORS

Special versions of Autoflame servomotors are available with ATEX approval for use in hazardous environments where Explosion Proof equipment is required.

6.1. ATEX Certification

The following instructions are specific to hazardous area installations (in accordance with IEC 60079-0:2011 clause 30) The following instructions relevant to safe use in a hazardous area apply to equipment listed in section 6 of this manual:

- Positioning Motors are covered by certificate numbers:
  - Small Servo Motors: Sira 16ATEX4241X Issue 1
  - Large Servo Motors: Sira 09ATEX4140X Issue 5
  - Industrial Servo Motors: Sira 09ATEX4265X Issue 1

- The certification marking is as follows:
  - *(Servomotor's Part Number)* Positioning Motors
  - II 3G
  - Ex nA nL IIC T4
  - Ta = - 20°C to + 40°C
- Entity parameters of the Motor terminal (J2):
- The equipment may be used in zone 2 with flammable gases and vapours with apparatus groups IIA, IIB & IIC and with temperature classes T1, T2, T3 & T4.
- The equipment is only certified for use in ambient temperatures in the range -20ºC to +40ºC and should not be used outside this range.
- Installation shall be carried out in accordance with the applicable code of practice by suitably trained personnel
- There are no special checking or maintenance conditions other than a periodic check.
- With regard to explosion safety, it is not necessary to check for correct operation.
- The equipment contains no user-replaceable parts and is not intended to be repaired by the user. Repair of the equipment is to be carried out by the manufacturer, or their approved agents, in accordance with the applicable code of practice.
- Repair of this equipment shall be carried out in accordance with the applicable code of practice.
- If the equipment is likely to come into contact with aggressive substances, e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected thus ensuring that the type of protection is not compromised.
- The certificate number has an 'X' suffix which indicates that special conditions of installation and use apply. Those installing or inspecting this equipment must have access to the contents of the certificate or these instructions. The conditions listed in the certificate are reproduced below:
  - Do not open, maintain or service in an area where an explosive atmosphere may be present.
  - All cable entry holes shall be fitted with either a certified cable gland or a certified stopping plug that is suitable for the application.
  - The area in which the equipment is to be used shall be a minimum of Pollution degree 2 as defined in IEC 60664-1.
  - "Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value at the motor assembly supply terminals to the equipment".

  - The equipment must be mounted on a metallic frame that has earth bonding facility.
- To ensure IP65 rating the servomotor must be installed using the provided servomotor to valve gasket and mounting screws tightened to a minimum torque of 2.6Nm and servomotor lid screws to a minimum 1.2Nm.
- Atex approved Cable glands must be used, the enclosure has M20 tapped holes for this purpose.
- Atex certified cables must be used to comply with approval.
- An Atex approved isometric safe opto-isolator must be used on the low voltage circuit between the servomotor and the MM.
- The terminals shall be fitted with wires that have cross sectional area falling within the following limitations:
  - Conductor cross section area min. 0.25 mm^2 and max. 1.5 mm^2
  - Conductor cross section AWG min. 26 and max. 14
  - Tightening torque, min 0.5 Nm and max 0.6 Nm
- Insulated ferule type connectors or equivalent connectors shall be used for external connections.
- The potentiometer connections (+V, 0V and W) shall only be terminated to an Autoflame MM Controller.

6.2. ATEX Approved Small Servomotors

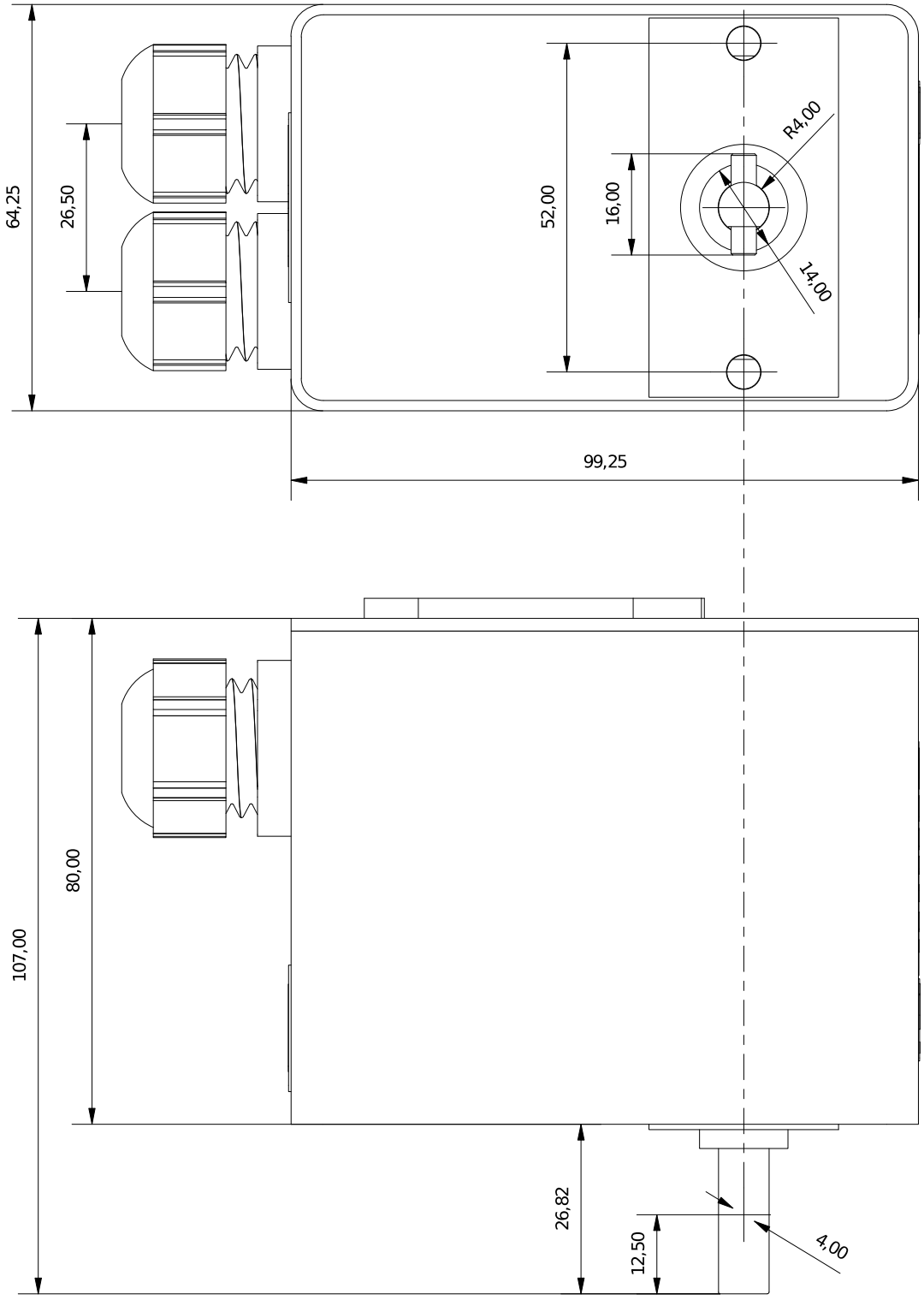
The following ATEX approved small servomotors are available:

Voltage V AC	Frequency	Torque Nm	Supplied Wiring Glands	Part #
230	50Hz	4	2x PG11 ATEX Glands	MM10005/EXP
230	50Hz	4	1x PG11 - 1/2" NPSM ADAPTOR, 1x ROUND INSERT CHROME 20mm (for PG11 Hole)	MM10005/EXP/NP1
230	50Hz	4	2x PG11 - 1/2" NPSM ADAPTOR	MM10005/EXP/NP2
230	60Hz	4	2x PG11 ATEX Glands	MM10005/B/EXP
230	60Hz	4	2x PG11 – ½" NPSM ADAPTOR	MM10005/B/EXP/N2
110	60Hz	4	2x PG11 – ½" NPSM ADAPTOR	MM10005/A/EXP
110	50Hz	4	2x PG11 – ½" NPSM ADAPTOR	MM10005/E/EXP
24	50Hz	4	2x PG11 – ½" NPSM ADAPTOR	MM10005/C/EXP
24	60Hz	4	2x PG11 – ½" NPSM ADAPTOR	MM10005/D/EXP



ATEX approved small servomotor

Note: ATEX certified glands must be used for the ATEX approval to apply to the servomotor.



All dimension in millimetres: 1 inch = 25.4 mm

6.3. ATEX Approved Large Servomotors

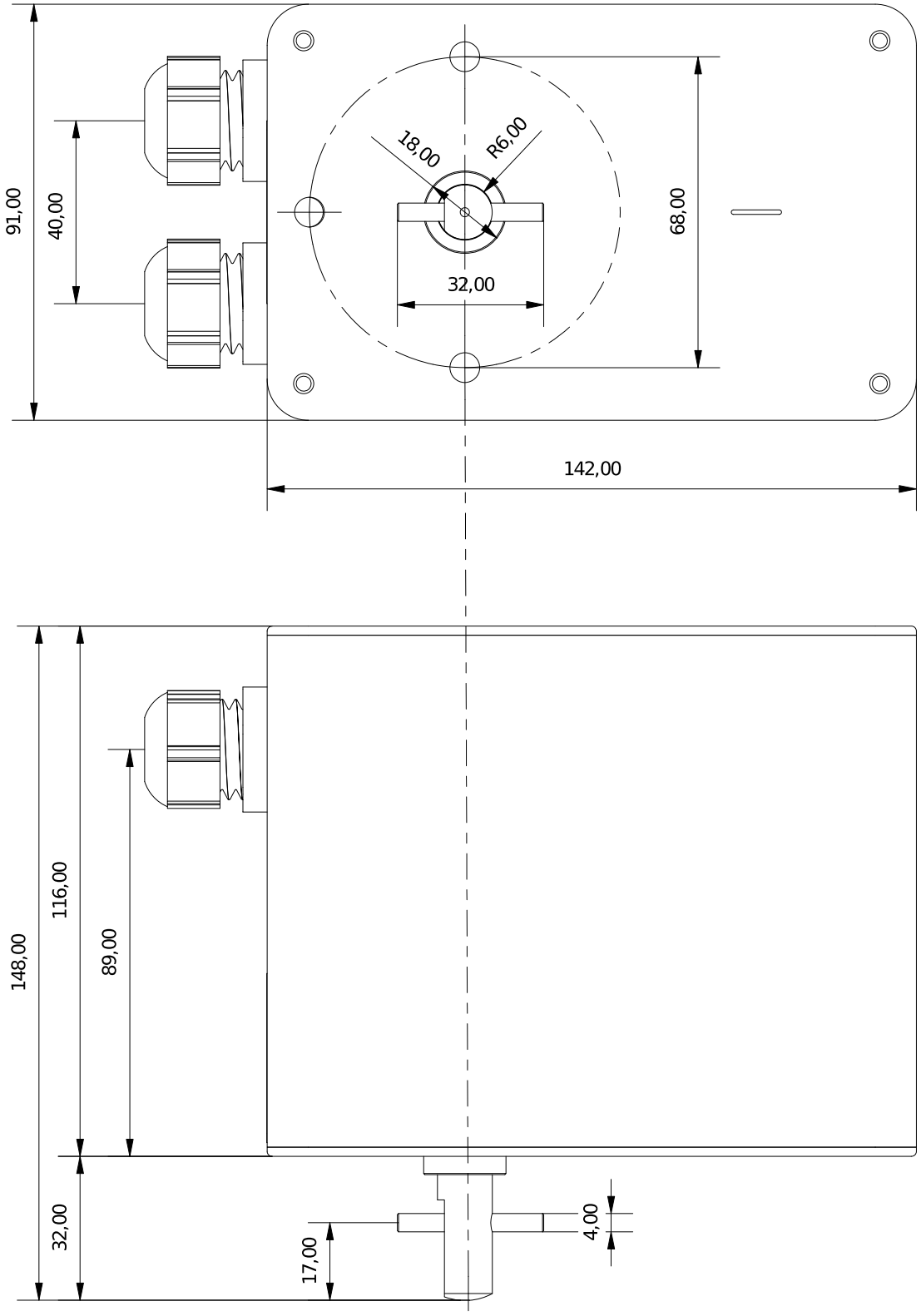
The following ATEX approved large servomotors are available:

Voltage - AC	Frequency	Torque Nm	Supplied Wiring Glands	Part #
230V	50/60Hz	25	2x M20 ATEX Glands	MM10004/EXP
110V	50/60Hz	25	2x M20 ATEX Glands	MM10004/A/EXP
24V	50/60Hz	25	2x M20 ATEX Glands	MM10004/D/EXP



ATEX approved large servomotor

Note: ATEX certified glands must be used for the ATEX approval to apply to the servomotor.



All dimension in millimetres: 1 inch = 25.4 mm

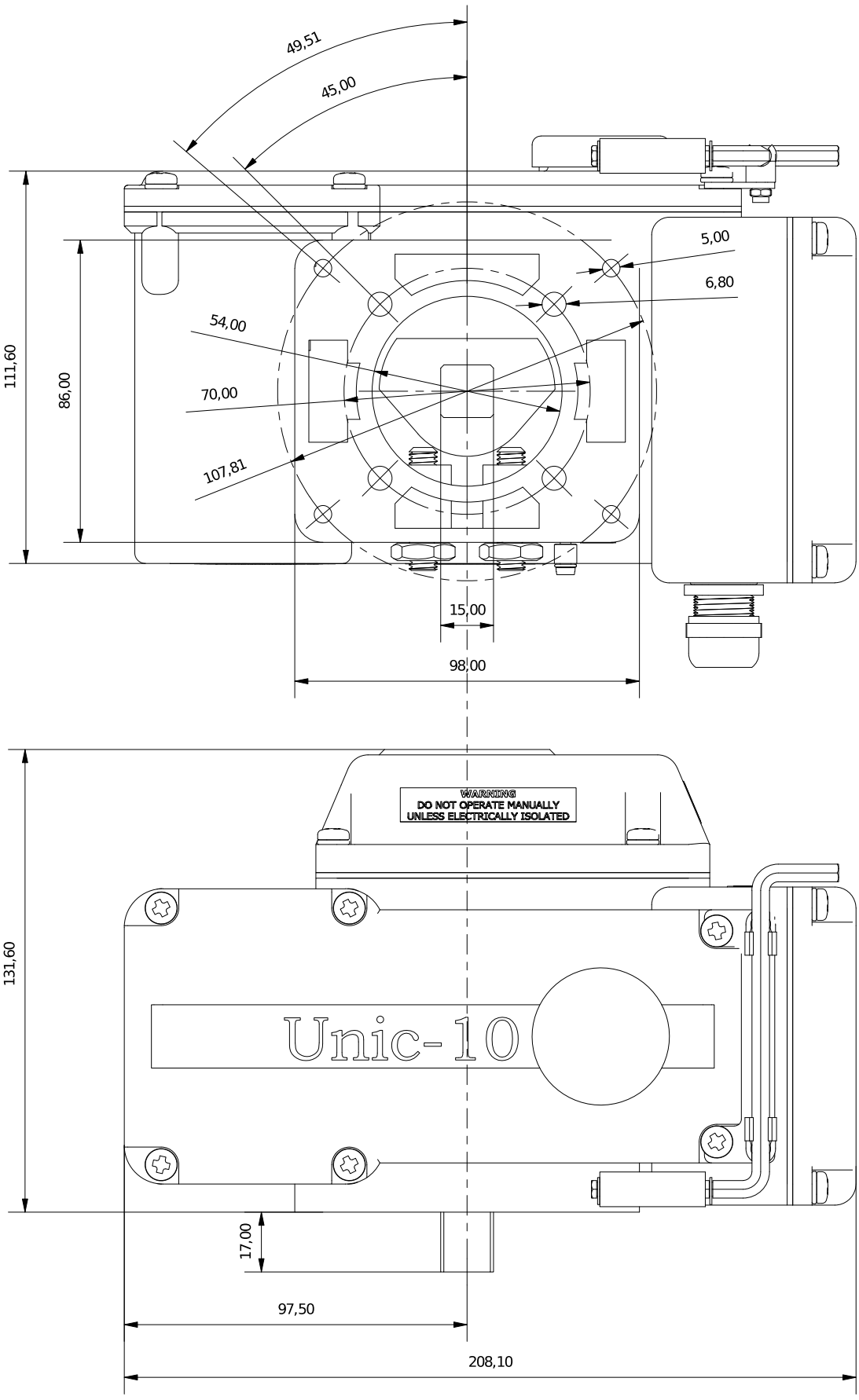
6.4. ATEX Approved Industrial Servomotors

An ATEX approved Industrial UNIC10 servomotor is available.

Voltage AC	Frequency	Torque	Supplied Wiring Glands	Part #
230V	50/60Hz	98	-	MM10072/EXP
120V	50/60Hz	98	-	MM10072/110/EXP



UNIC10 Servomotor – ATEX



All dimension in millimetres: 1 inch = 25.4 mm

7. SERVOMOTORS MOUNTING BRACKETS

Servomotors mounting brackets and couplings are used to mount the Autoflame servomotor to third party valves or dampers.

The servomotor can be mounted directly, and the supplied screws are used to fix the servomotor to the bracket. The coupling is used to connect the servomotor's shaft and pin to the valve or damper, this uses a circular connector, this can be easily drilled on site to suit the shaft of the damper or the valve using HSS drill bit.

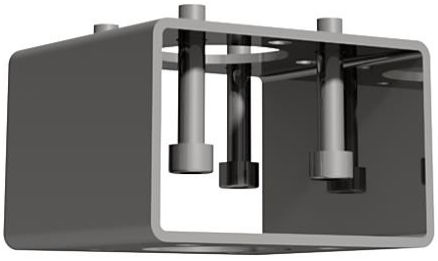
Servomotor Size	Bracket and Coupling part #
Small Servomotor	SP10015
Large Servomotor	SP10016
Industrial Servomotor UNIC05	SP10028/05
Industrial Servomotor UNIC10	SP10028/10
Industrial Servomotor UNIC20/40	SP10028/20

I. Ensure that the servomotor is not powered.
II. Move the damper/valve by hand and make sure that it is free to move.
III. Set the damper/valve at the closed position.
IV. Make sure that the shaft is smooth in motion and there is no decentring/ inclination.
V. Mount the servomotor to the bracket and secure using the supplied screws.
VI. Mount this assembly to the damper/valve ensuring that the damper/valve is in the fully closed position and then tighten the bolts and make sure that the assembly is fully secure.



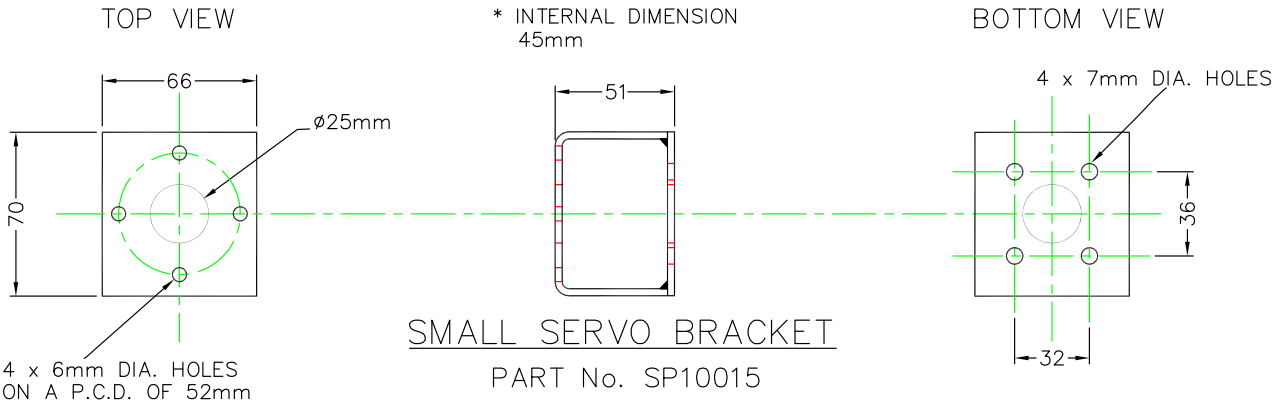






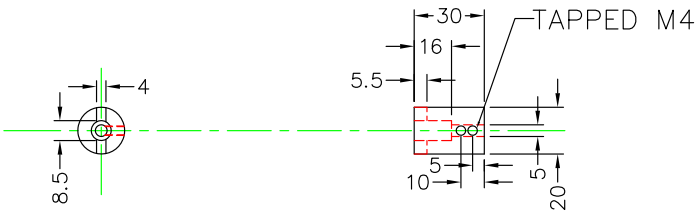
7.1. Small Servomotor Mounting Bracket and Coupling





SMALL SERVO BRACKET

PART No. SP10015

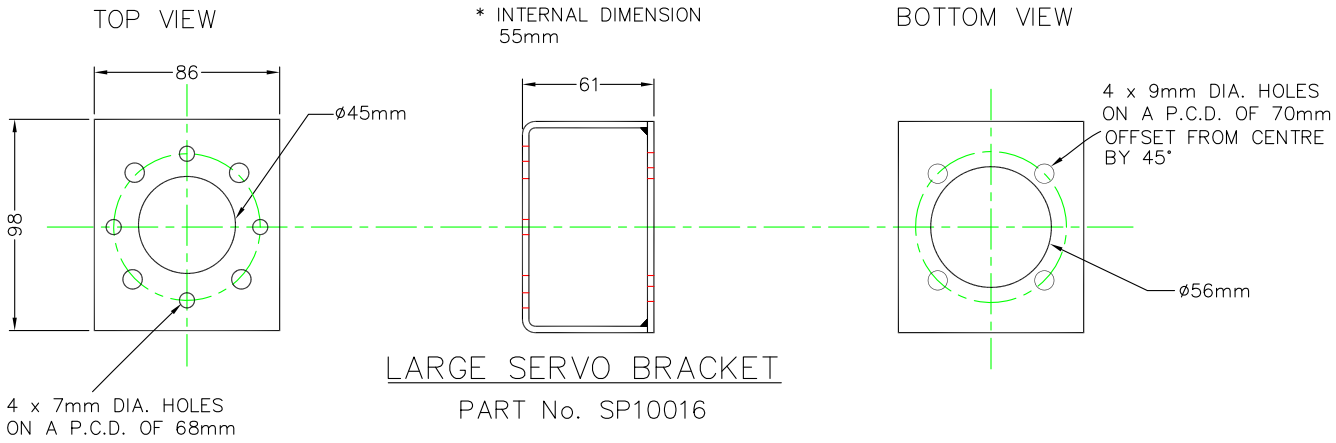


SMALL SERVO COUPLING

PART No. SP10015/C (COUPLING ONLY)

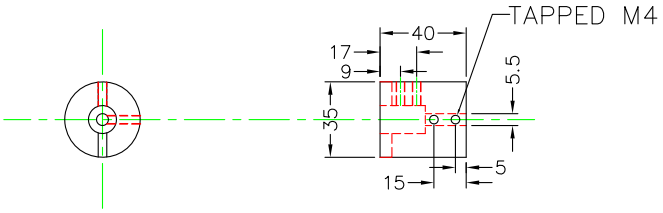
7.2. Large Servomotor Mounting Bracket and Coupling





LARGE SERVO BRACKET

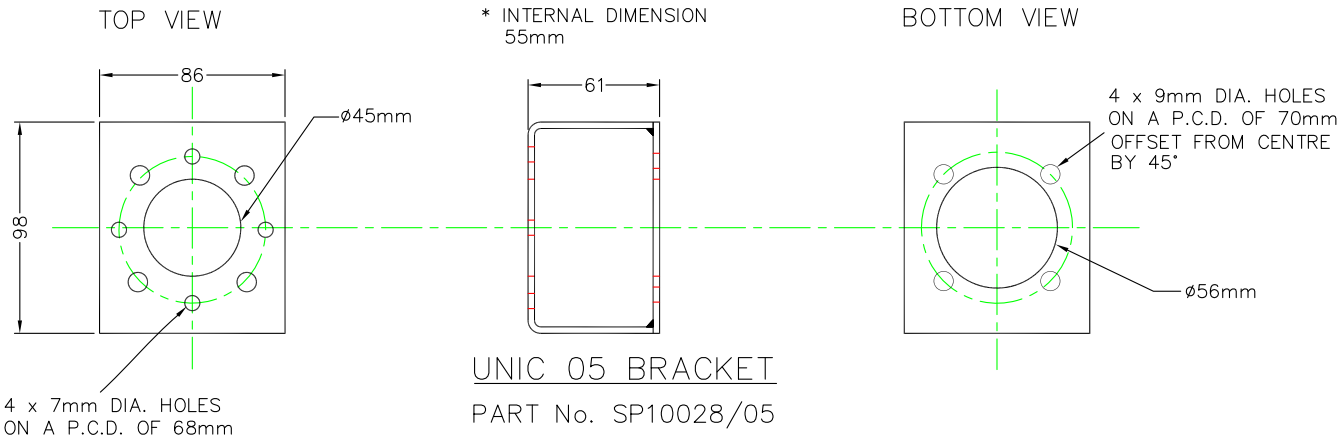
PART No. SP10016



LARGE SERVO COUPLING

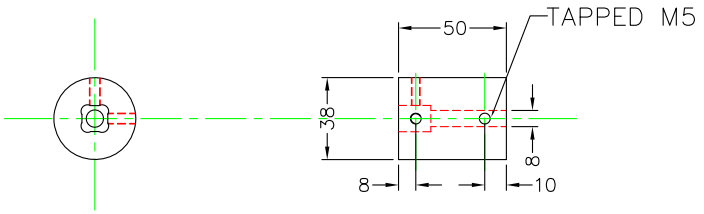
PART No. SP10016/C (COUPLING ONLY)

7.3. UNIC05 Mounting Bracket and Coupling



UNIC 05 BRACKET

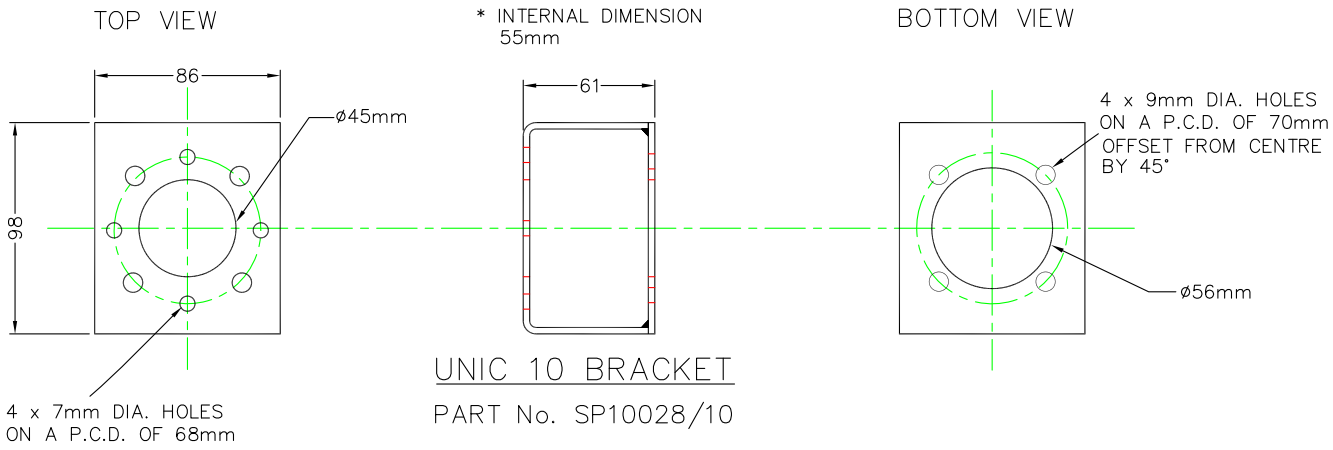
PART No. SP10028/05



UNIC 05 COUPLING

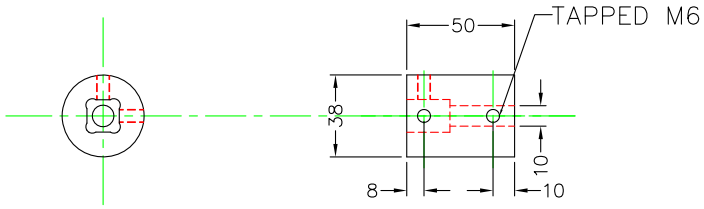
PART No. SP10028/05/C (COUPLING ONLY)

7.4. UNIC10 Mounting Bracket and Coupling



UNIC 10 BRACKET

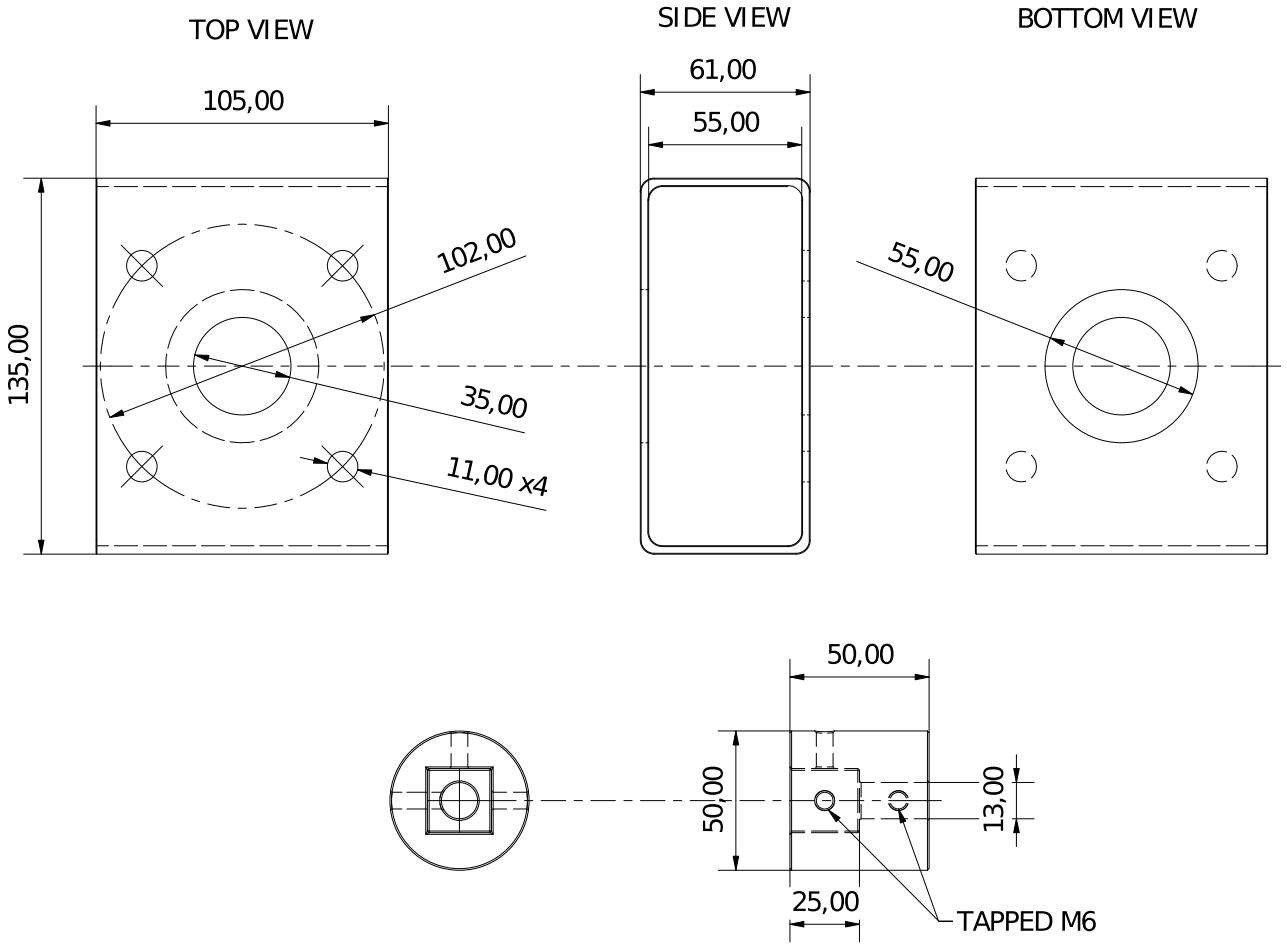
PART No. SP10028/10



UNIC 10 COUPLING

PART No. SP10028/10/C (COUPLING ONLY)

7.5. UNIC20 / UNIC40 Mounting Bracket and Coupling



8. INSTALLATION

8.1. Overview

Autoflame servomotors are supplied set at 0.0° position as standard. It is crucial to remember that this position may not necessarily position the damper at 0.0° or a closed position automatically. This must be physically checked.

Viewing the shaft end-on from the potentiometer end, all servomotors drive in:

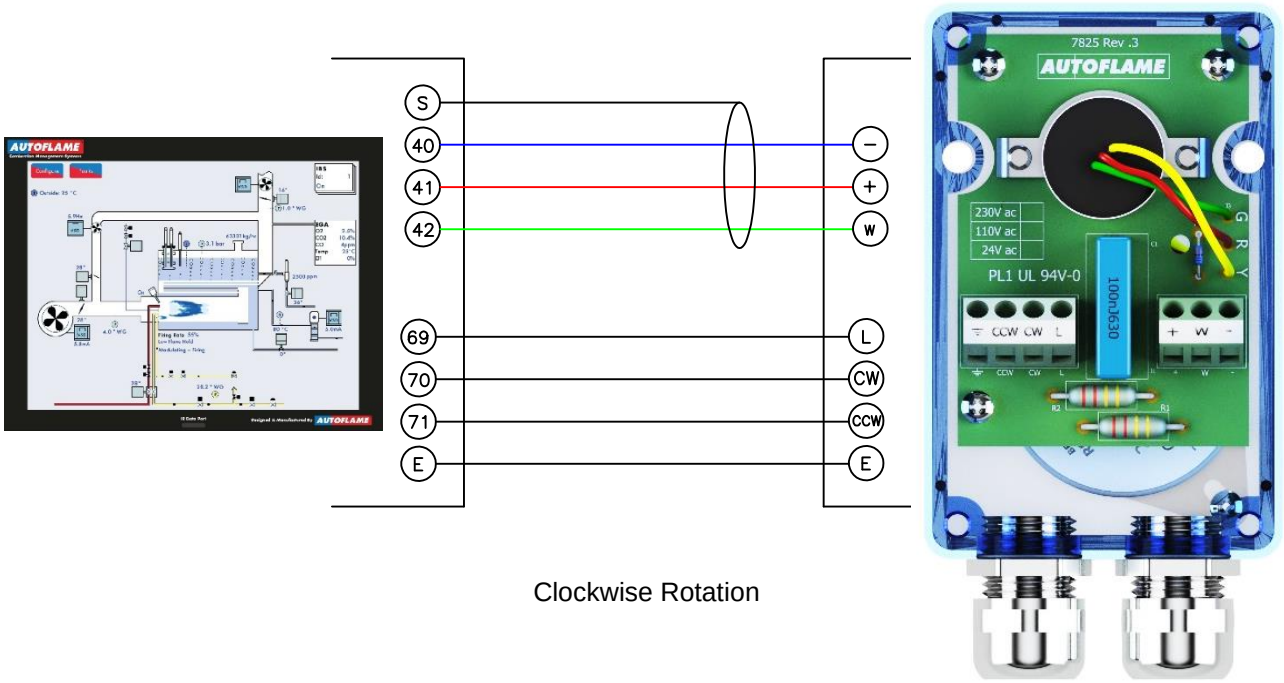
- Clockwise direction if power is applied between the LIVE and CW terminals.
- Counterclockwise if the power is applied between the LIVE and CCW terminals.

The operation of fuel valves and air dampers is often such that they open in a clockwise direction. If the operation needs to be reversed, it is necessary to swap various wiring connections between the MM and the servomotor.

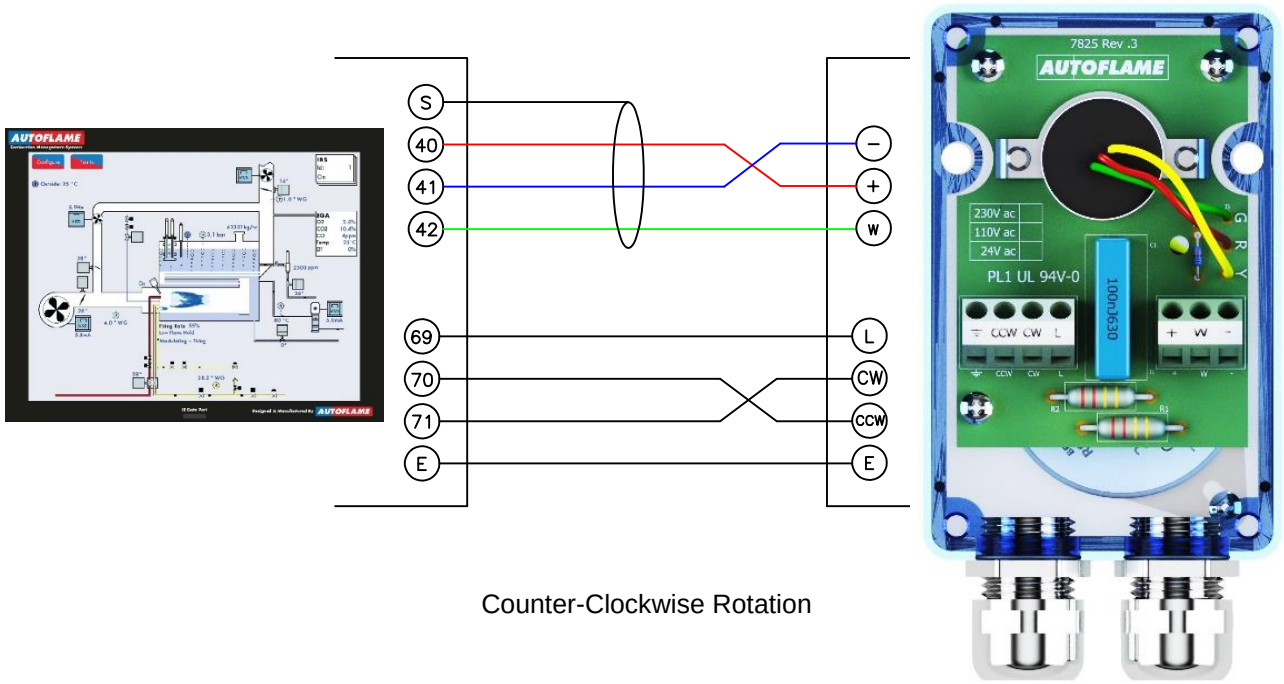
DO NOT ASSUME THAT THE SERVOMOTORS HAVE BEEN PREVIOUSLY SET CORRECTLY

8.2. Wiring

The servomotors can be configured to rotate in clockwise or counterclockwise direction, please refer to the wiring diagram below as an example for wiring a small servomotor to Channel 1 on a Mk8 MM.



Clockwise Rotation



Counter-Clockwise Rotation

8.3. Adjusting the Servomotor's Position

When commissioning a system, it is essential to set up each servomotor. A tamper proof screwdriver is required (Part # SP10002 – can be ordered directly from Autoflame).

Usual fuel control valves and air dampers operate from 0° to 90.0° angular degrees. The MM system can drive the servomotors through 360.0º degrees, but it will only display from -6.0° to 96.0° degrees.

All Channel readings displayed on the MM are in angular degrees. It is necessary to adjust the positioning potentiometer in the servomotor so that the MM reads 0.0° when the relevant valve/damper is at its fully closed position. The technician must physically check the mechanical position of the dampers and valves, whilst all servomotors are set to 0.0° before leaving the factory since this may have changed during shipping.

Please see the relevant MM manual for the servomotors commissioning procedure.

I. Remove the servomotor's terminal cover by loosening the 4 screws holding the cover.

II. On Autoflame gas, oil and gas/oil piggy-back valves it is necessary to remove the servomotor. Manually position the oil/gas valve slot to its closed position. Observe the position of the drive pin on the servomotor.

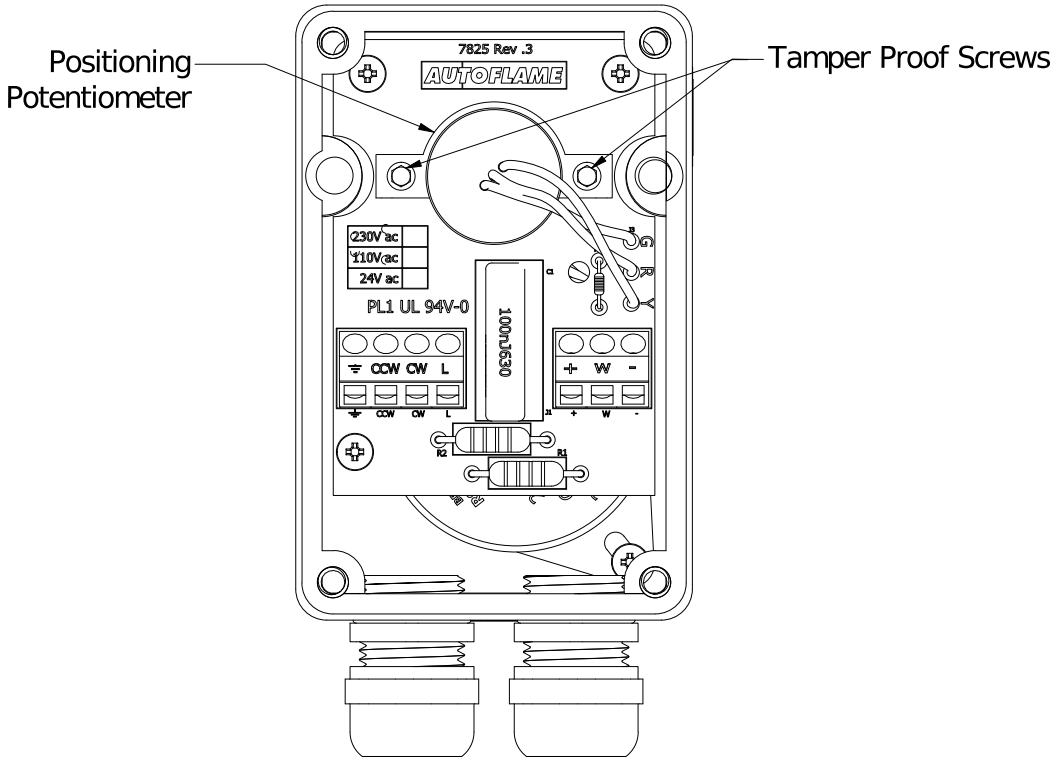
III. Use the relevant channel up/down buttons on the MM to position the pin so that when the servomotor is reassembled to the valve it is in line with the slot

IV. In the MM commission screen, use the relevant channel up/down buttons to position the channel to its physically closed position.

V. Reassemble the servomotor to the valve.

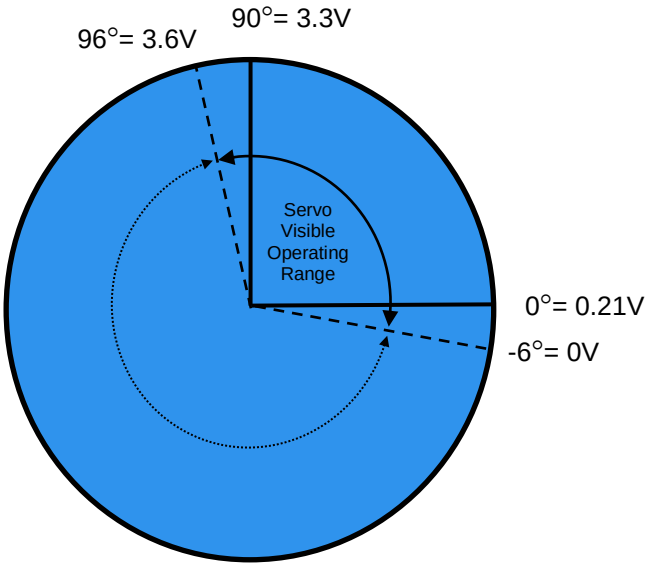
VI. Loosen the two tamper proof screws just enough to enable the potentiometer to rotate. Rotate the potentiometer clockwise or counter clockwise by hand until the relevant channel reads 0.0°. Tighten the two tamper proof screws gently until the potentiometer is secure. Do not over tighten the screws. Check that the display still reads 0.0. If incorrect repeat the adjustment process.

VII. Use the external position indicator to ensure the valve is in the fully closed position.

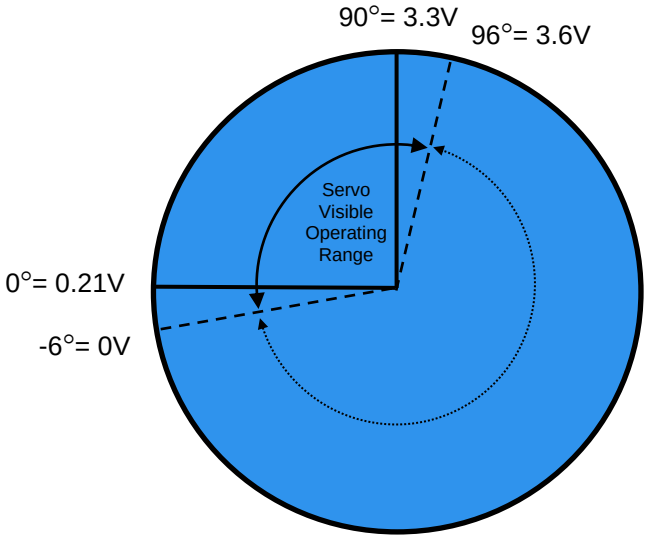


8.4. Servomotor Feedback Voltage

In applications where the servomotor is not positioned close to the display then it is possible to measure the feedback voltage from the servomotor in order to ensure that 0.0° is displayed. By testing the DC voltage between the blue and green wires (wiper and 0V) on the servomotor low voltage terminals this will read 0.21V DC when the reading on the display is 0°. The same can be done for when the servomotor is at 96.0° where the voltage will be 3.6V.



Standard Direction



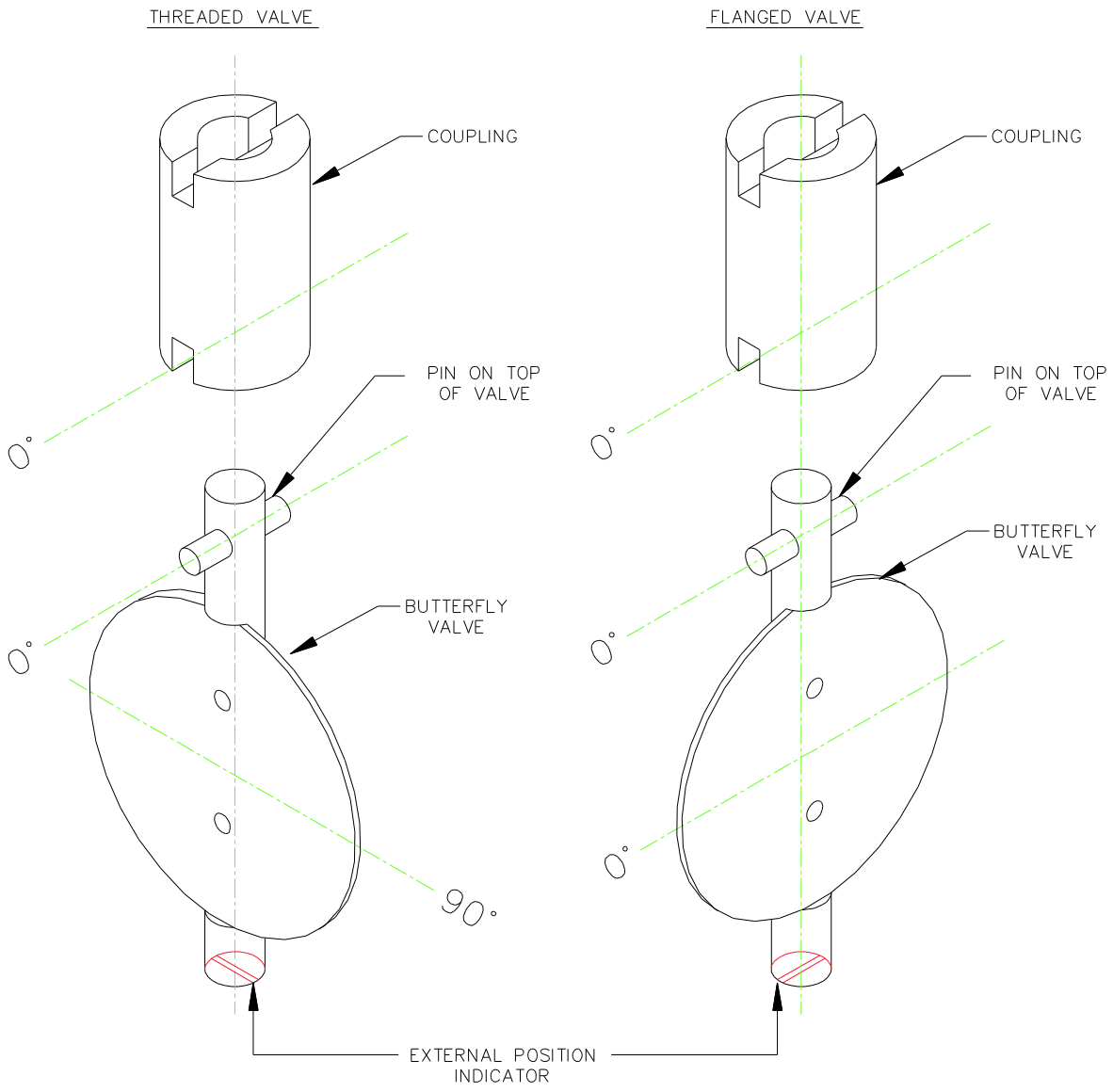
Reversed Direction

8.5. Servomotors with Autoflame Gas Valves

On threaded valves, the pin on the top of the valve is 90° opposite from the position of the butterfly valve.

On flanged valves, the pin on the top of the valve is in line with the position of the butterfly valve.

For both valves the external visual position indicator is in line with the position of the butterfly valve. Regardless of the type of valve being used, the servomotor is dispatched from the factory with the potentiometer in the zero position. The same servomotor will be correct for both types of valve, as the servomotor for the threaded valve is mounted at 90° different from the flanged valve.



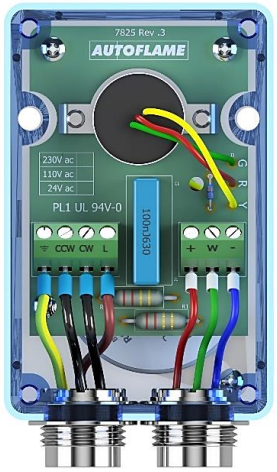
8.6. Servomotor Flying Leads and Connectors

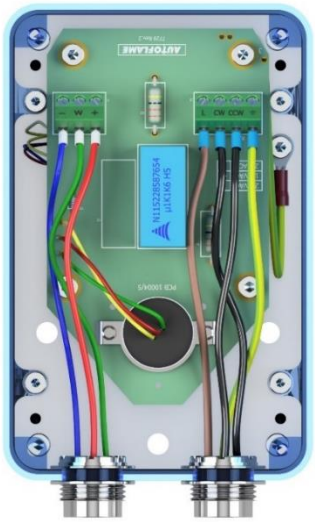
An enclosure mounted connectors and flying leads kit is available for easy installation and replacement of the servomotors. This is available for small and large servomotors only. This kit provides IP65/NEMA4 ingress protection to the servomotors. the wires are screened, and they provide protection for the servomotor's signal from electrical noise and interference.

The kit includes:

- 1x 3m (10ft) flying lead for position signal.
- 1x 3m (10ft) flying lead for power and drive.
- 1x servomotor enclosure mounted connector for position signal.
- 1x servomotor enclosure mounted connector for power and drive.

Kit for use with	Part #
Small servomotor	SP8305
Large servomotor	SP8304







9. MAINTENANCE AND TROUBLESHOOTING

It is good practice to check the Autoflame equipment periodically for the integrity of the installation. An important aspect of the system installation is the mechanical assemblies associated with the servomotors, i.e. mounting brackets and couplings. The servomotor checks could include:

- Overall mechanical soundness – check for corrosion or mechanical damage.
- Couplings and associated linkages should be tight.
- Any associated set screws and fixings should be securely fastened.
- Mechanical pins (roll pins, split pins) should not show signs of corrosion and fatigue.
- When the burner is off and power has been securely isolated, remove the servomotor from the damper/valve and ensure that the damper/valve does not require excessive torque to operate. Make sure the servomotor is working within its recommended torque rating.

When installing a servomotor, please pay attention to the following:

- Do not stand on the servomotors as this may cause internal damage to the servomotor's electrical components leading to a system failure.
- Do not disassemble or remove any of the components of the servomotors as this will affect the integrity of the servomotor. This will also void any warranty that may apply to the unit.
- Unless the servomotor has been supplied with NEMA4 (IP65) fixings, it is important that the servomotor is not subjected to an environmental condition exceeding the standard NEMA3 (IP54) rating.
- Make sure to tighten the servomotor's cover screws according to the torque specified in this manual, over tightening can damage the seals and the ingress protection rating may not apply.

The servomotors do not have a torque limiter, so it will continue to drive regardless of the load, make sure the damper/valve is not stuck, also make sure the servomotor is not driven beyond the angle that the damper/valve allow, otherwise a permanent damage can be cause to the damper, servomotor or both.

Troubleshooting

If the servomotor does not rotate electrically, one of the following could be the cause:

- Power is switched off – check live supply voltage.
- Wire/terminals are disconnected – replace wire or properly connect on terminals.
- Supply voltage is too low/high or incorrect – check the voltage with a meter.
- No switched neutral – remove switched neutral connection and wire link to earth for both directions.
- Effect of the terminal protector (due to a high/low ambient temperature or blocked damper) – lower/raise the ambient temperature or manually open/close the damper when power is removed from the motor.

Maintenance

- Lubrication: The small servomotor gears do not require any lubrication. The large servomotors are lubricated using Mobil Mobilith SHC 220 Red Lithium Grease. The industrial UNIC servomotors are lubricated with di-sulfied molybdenum grease (MOS2) and are pressure proofed, no further lubrication is required for any of the servomotors.
- Periodical Test: In case the motor is very seldom rotated or after a long period of rest, it is recommended to test the servomotor periodically. Remove power to the servomotor and check manual operation as described in this manual.

Warranty

All servomotors are covered under 2 years limited warranty.

AUTOFLAME
SERVOMOTORS GUIDE
12.08.2024

Autoflame Engineering Ltd.
Unit 1-2 Concorde Business Centre
Airport Industrial Estate, Wireless Road
Biggin Hill, Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Website: www.autoflame.com

AUTOFLAME®
Combustion Management Systems