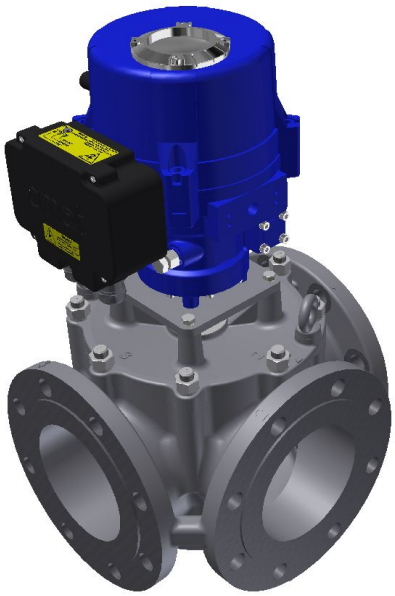
Model G Valve
(Electrically Actuated)

Operation, Installation and Maintenance Manual



Doc No: OMMGGE00217
Revision: 4
Date: MAY 2019

Section 1

Introduction

Contents

1.1 Scope

This Manual details the installation, operation and maintenance of the AMOT electrically actuated G Valve system.

Each item of equipment is described in a separate section as follows:

Actuator		Section 4
Valve Body		Section 3
PID Controller		Section 5 & OMM807100043
Temperature Sensor		Section 6

1.2 Safety

Certain operations within this manual are potentially hazardous and could cause injury to personnel or damage to equipment if the instructions are not carried exactly as described. Where a significant, potential hazard exists, the following text appears immediately before steps in the procedure that present a particular hazard:

WARNING

A Warning identifies a hazard that could cause injury to personnel. The text of the warning describes the hazard and details the precautions that must be applied before the next step of the procedure is carried out.

CAUTION

A Caution identifies a hazard that could cause damage to equipment. The text of the caution describes the hazard and details the precautions that must be applied before the next step of the procedure is carried out.

Note

A Note contains supplementary information that may be useful to the Operator before the next step of the procedure is carried out.

1.3 Maintenance

Maintenance of the valve and actuator should only be carried out by suitable trained and competent persons, and only after they have read and understood all applicable sections of this manual. Failure to observe this may result in damage to equipment or to injury of personnel.

1.4 Product Support

All necessary settings and, where appropriate, alterations inside the equipment are described in this Operating Manual. If any difficulties arise during start-up, you are asked not to carry out any unauthorised actions on the unit. You could endanger your rights under the equipment warranty.

For spares and service support, call the telephone number listed on the back cover of this Manual.

1.5 Typographical Conventions

Footnotes

Where space in the text or figures to place a note is restricted, a footnote is used. They consist of two parts:

- A mark indicating which part of the text or figure is affected by the note. This takes the form of a superscript number e.g. Abc [1].

[1] This footnote applies to the part of the text or figure, marked with a superscript number 1.

- A note in smaller font at the bottom of the affected page beginning with the corresponding number in the text (see bottom of page):

1.6 European Union Directives

1.6.1 EU Machinery Directive

The AMOT Model G Valve, as a component, is not considered to be a machine. To fully comply with the Directive however, the machine into which the valve is installed must comply with the requirements of the machinery directive before the valve is put into operation.

1.6.2 Low Voltage Directive

All version of Electric actuator described in this manual have been assessed against the requirements of the Low Voltage Directive, and have found to be in conformance.

1.6.3 EMC Directive

All version of Electric actuator described in this manual have been assessed against the requirements of the EMC Directive, and have found to be in conformance.

1.6.4 EU Pressure Equipment Directive

In its design application of a temperature control valve, the AMOT Model G Valve is defined as a Pressure Accessory under the terms of the EU Pressure Equipment Directive (PED).

Valves used with fluids defined as Group 2 in the Directive (such as water and lubricating oil) fall into the Sound Engineering Practice (SEP) category.

Some valves are also rated for use with Group 1 liquids under the SEP category.

Table 1 contains details of the groups each valve type falls into and the associated maximum working pressure of the valve.

Table 1 Pressure Equipment Directive Table

Valve Material	Valve Type	Flange Standard	Flange Class	EU directive (PED) suitable for liquids to group(s):	Maximum Working Pressure (BAR)
Ductile Iron	02GGH 03GGS 03GGH 04GGS 04GGH 05GGS 06GGS 06GGH 08GGS	EN1092	PN6	1 & 2 (SEP)	6
		JIS	5K		7
		EN1092	PN10		10
			PN16		
		ASME	125		
			150		
		JIS	10K		
	08GGH 10GGS	EN1092	PN6	2 (SEP)	6
		JIS	5K		7
		EN1092	PN10		10
			PN16		
		ASME	125		
			150		
		JIS ASME	10K 150		

Users who are uncertain as to the applicability of the Directive should contact AMOT before installation, particularly if using more hazardous (Group 1) fluids.

Section 2

System Overview

Contents

2.1 Description

The G Valve and its ancillary equipment are designed for the control of fluid temperature by 'diverting' or 'mixing' control techniques.

The valves can be used for fresh water, most lubricating oils and other liquids.

The compact construction of the G Valve enables unobstructed, full-bore flow, thus minimising pressure losses.

2.1.1 Features

The G Valve system has the following main features:

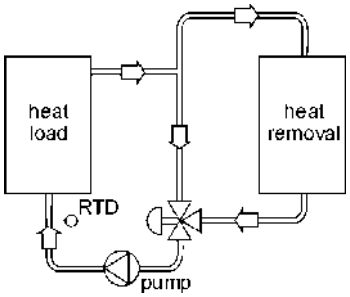
- Any direction of rotation.
- Any rotor-port configuration (most models).
- Compact construction.
- Low pressure drop.
- High accuracy (± 1° C or better).
- Mountable in any position.
- Manual override.
- Fluid temperature up to 100° C (212° F).
- Local valve position indication.

2.1.2 Typical Applications

Lubricating Oil Temperature Control

Lubrication oil temperature control is normally configured in a mixing application controlling the return temperature to the heat load.

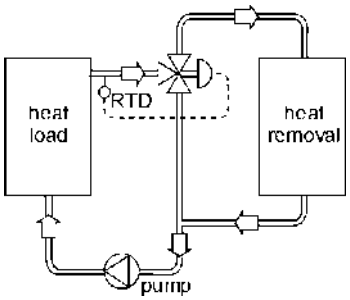
The temperature is normally measured as close as possible to the sump return.



Jacket Water Cooling

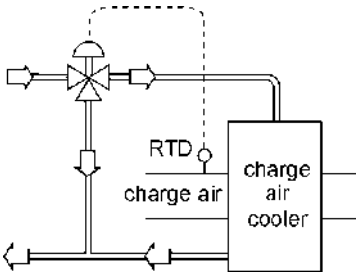
Jacket water cooling in diverting applications regulates the outlet coolant water temperature from a diesel or gas engine. The valve either sends water to a cooler or bypass loop, accurately maintaining the temperature.

The temperature is normally measured at the outlet from the heat source.



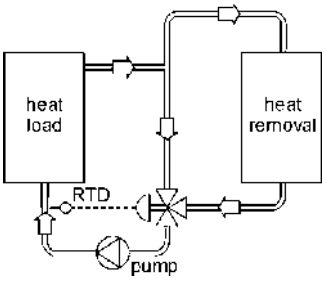
Charge Air Temperature Control

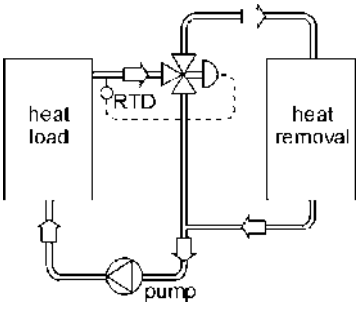
The intercooler is used to cool high temperature turbo charger air. In this application, the G Valve regulates the flow of cooling water through an intercooler, which can increase efficiency, enhance performance and help meet stringent environmental requirements



Central Cooling

For large flow central cooling, mixing or diverting applications where accurate temperature control is required. The capabilities of the G Valve provide the ideal solution.





2.2 Identification of Model Number

Example code		06	GG	S	D	B	S	32	E	B	B	CA	AA	**Code Description**	
Valve Body Selection														Nominal Bore Size	Comments
	Valve Size	02												2 inch (DN50)	High flow only
		03												3 inch (DN80)	
		04												4 inch (DN100)	
		05												5 inch (DN125)	Standard flow only
		06												6 inch (DN150)	
		08												8 inch (DN200)	
		10												10 inch (DN250)	Standard flow only
	Valve Model													Model Type	
			GG											Model G Valve	
	Valve Flow Type													Valve Flow Type	
				S										Standard Flow	
				H										High Flow	
	Valve Body Material													Body Material	
					D									Ductile Iron	
	Valve Flange Connection Standard and Class													Flange Class	Flange Standard / Comments
						A								PN6	EN 1092
						B								PN10	EN 1092
						C								PN16	EN 1092
						F								125	ASME
						J								150	ASME
						L								10K	JIS
						M								5K	JIS
	Rotor Type													Rotor Type	
							S							Standard Rotor	
	Valve Mode of Operation													Rotor Position Cold Process	Rotor Position Hot Process / Rotor starting from Cold Posn.
								12						Port 1	Port 2 / Clockwise
								23						Port 2	Port 3 / Clockwise
								31						Port 3	Port 1 / Clockwise
								21						Port 2	Port 1 / Anticlockwise
								32						Port 3	Port 2 / Anticlockwise
								13						Port 1	Port 3 / Anticlockwise
Actuator Selection	**Valve Actuation Type**								E					Actuator Type	
														EB Type Electric Actuator	
	Actuator Power Supply									A				Power Supply	
														100 – 120 Vac 50/60Hz	
										B				200 – 240 Vac 50/60Hz	
	Actuator Control Input Signal													Input Signal	
											A			Relays, Switched Live Supply	
											B			4-20mA (Cold to Hot)	
											C			20-4mA (Cold to Hot)	
	Actuator Feedback Signal													Feedback Signal	
												A		None	
												C		4-20mA (Cold to Hot) Position Retransmit	
												E		20-4mA (Cold to Hot) Position Retransmit	
	Other Options														
													A	Reserved	
	Customer Special Options													Options	
														-AA	Standard product
														-***	Customer special code assigned

2.3 Modes of Operation

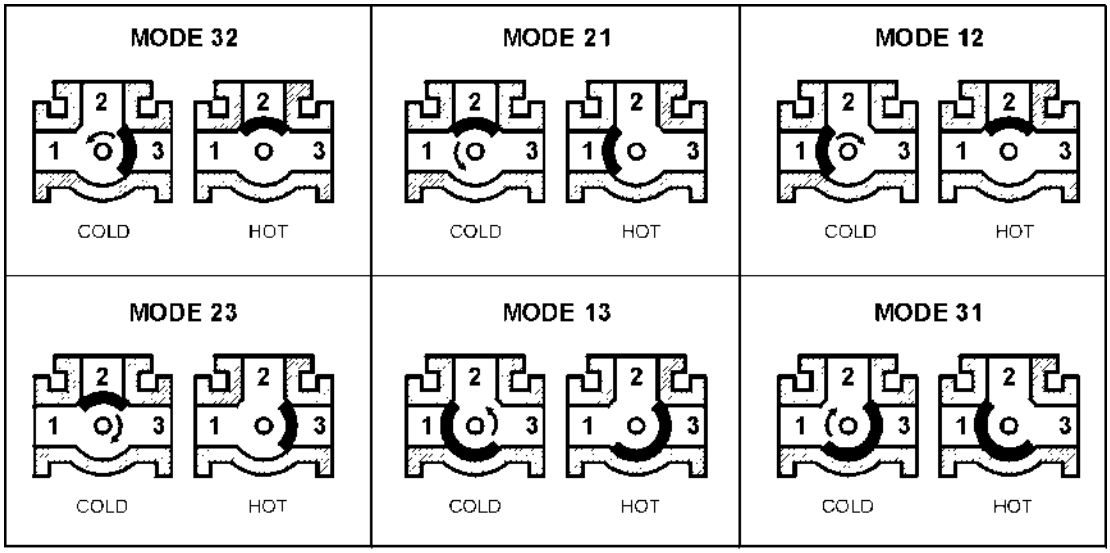


Fig 1 Modes of Operation

2.4 System Components

The system comprises of the following main components which are described in other sections of this manual:

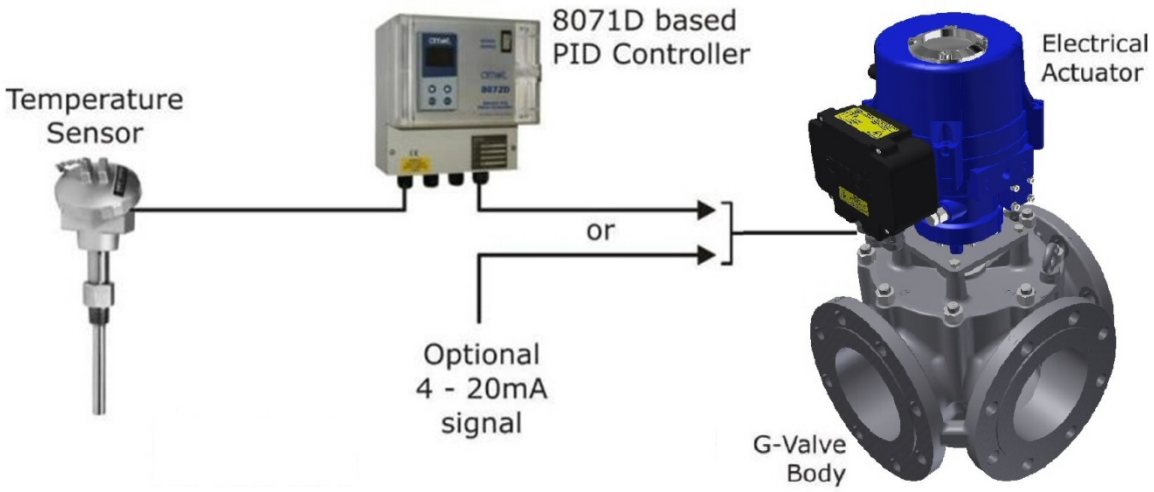


Fig 2 System Components

- Valve Body – Section 3
- Electric Actuator – Section 4
- PID Controller and accessories –Section 5
- Temperature Sensor –Section 6
- System Integration –Section 7

Section 3

Valve Body

Contents

3.1 Description

The G Valve is a compact and rugged 3-way control valve designed for temperature control using ‘diverting’ or ‘mixing’ techniques.

3.2 Installation

Refer to Section 7 (System Integration) for valve installation details.

3.3 Operation

CAUTION

Damage can be caused to the valve assembly if a cheater or extension bar is used on the hand wheel. Do not use any mechanical aid to turn the hand wheel.

Under normal conditions, the valve is operated electrically by the actuator. Manual operation is possible at any time by disengaging electrical drive with the actuator declutching lever and turning the hand wheel.

If the valve fails to operate correctly, refer to the troubleshooting guide in Section 8.

3.4 Maintenance

3.4.1 Dismantle and Assemble

Fig 3 General Arrangement

Dismantle Valve (refer to Fig 4, page 15)

It is possible to dismantle the valve without removing it from the pipework as follows:

Note

Ensure replacement seals are available before dismantling the valve (refer to Section 3.4.2 for spare parts detail).

WARNING

The valve may contain hot/pressurised fluid. Ensure the valve is isolated, drained and allowed to cool to a safe working level before dismantling.

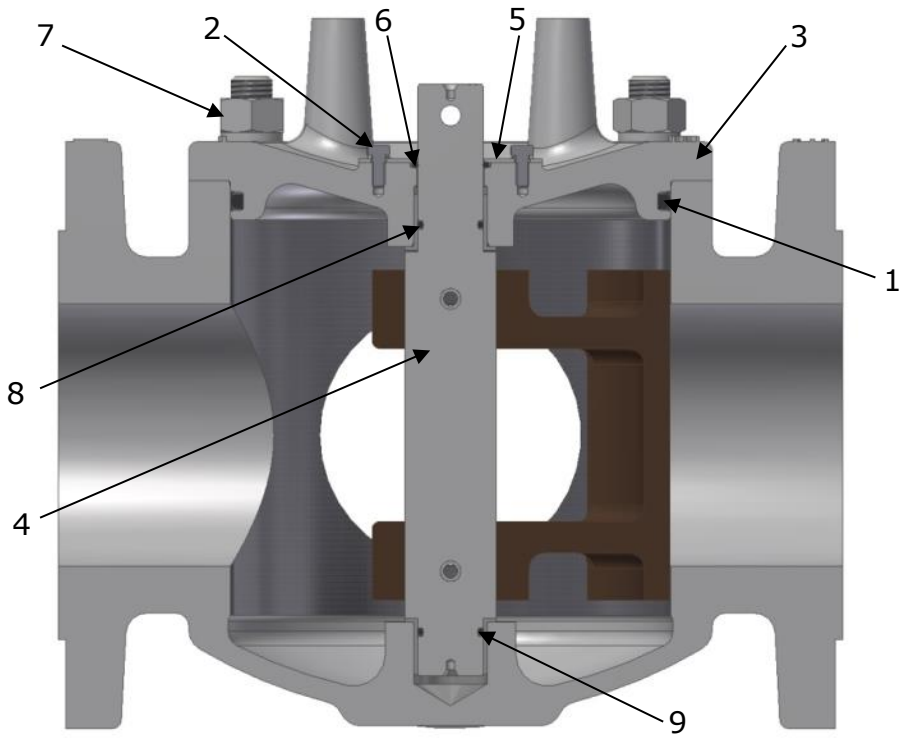


Fig 4 Section View (04GGH illustrated)

1 Switch off and isolate power to the actuator.

2 Using the hand wheel, turn the valve to the low temperature position.

3 Note position of actuator in relation to valve body.

WARNING

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

4 Remove the actuator from the valve body in accordance with Sect 4.9.1 (page 40).

5 Knock out the coupling pin Fig 14 (see page 41, (6)) and remove the coupling.

6 Back to Fig 4 (Page 15): remove screws and washers (2), remove retaining plate (5) and discard O Ring (6).

7 Mark adjacent points on the valve body and cover (3) to aid reassembly.

8 Remove the bolts (7) securing the valve cover (3).

9 Taking care that the rotor is not lifted off, carefully lift off the cover.

10 Remove and discard the cover O ring (1).

11 Remove the rotor assembly (4) from the valve body.

12 Remove and discard the upper and lower shaft O Rings (8 & 9)

13 Inspect the valve internals for wear, damage and cleanliness. Clean and replace if necessary.

Reassemble Valve (refer to Fig 4, page 15)

14 Apply Molykote® 55 O-Ring grease or similar to new upper and lower shaft O Rings (8 & 9) and fit to the rotor shaft.

15 Carefully insert the rotor assembly (4) into the valve body with the rotor in the low temperature position.

16 Apply Molykote® 55 O-Ring grease or similar to a new cover O ring (1) and fit to the cover (3).

17 Carefully position the cover (3) on the valve, aligning the marks made during disassembly.

18 Fit the nuts (7) and washers and tighten to:

M16 – 245 Nm

19 Apply Molykote® 55 O-Ring grease or similar to new O Ring (6), fit into groove and position retainer plate (5). Fasten in place with screws and washers (2).

20 Install the actuator onto the valve body in accordance with para. 4.9.1 (page40).

3.4.2 Recommended Spares

It is recommended that all the spares listed below are replaced each time the valve is disassembled. These are available in kit form (see servicing schedule, Section 9, page 81).

Note

All O rings are Viton

Valve Type 02GGH and 03GGS (Fig 4, page 15)

Ref	Description	Part Number (Qty)
1	O Ring, Cover	43636L002 (1)
6	O Ring, Top Seal	43709L002 (1)
8	O Ring, Upper Shaft	43727L002 (2)
9	O Ring, Lower Shaft	43727L002 (1)
	Coupling pin	43419L030 (1)

Valve Type 03GGH and 04GGS (Fig 4, page 15)

Ref	Description	Part Number (Qty)
1	O Ring, Cover	43630L002 (1)
6	O Ring, Top Seal	43655L002 (1)
8	O Ring, Upper Shaft	43615L002 (2)
9	O Ring, Lower Shaft	43615L002 (1)
	Coupling pin	43409L035 (1)

Valve Type 04GGH, 05GGS and 06GGS (Fig 4, page 15)

Ref	Description	Part Number (Qty)
1	O Ring, Cover	46980L002 (1)
6	O Ring, Top Seal	43613L002 (1)
8	O Ring, Upper Shaft	43726L002 (1)
9	O Ring, Lower Shaft	43726L002 (1)
	Coupling pin	43420L040 (1)

Valve Type 06GGH and 08GGS (Fig 4, page 15)

Ref	Description	Part Number (Qty)
1	O Ring, Cover	43638L002 (1)
6	O Ring, Top Seal	43607L002 (1)
8	O Ring, Upper Shaft	43607L002 (1)
9	O Ring, Lower Shaft	43600L002 (1)
	Coupling pin	43423L045 (1)

Valve Type 08GGH (Fig 4, page 15)

Ref	Description	Part Number (Qty)
1	O Ring, Cover	43603L002 (1)
6	O Ring, Top Seal	43607L002 (1)
8	O Ring, Upper Shaft	43611L002 (1)
9	O Ring, Lower Shaft	43611L002 (1)
10	O Ring, Lower Shaft	43600L002 (1)
	Coupling pin	43419L030 (1)

Section 4

Electric Actuator

Contents

Para

4.1 Description

4.1.1 Mechanical

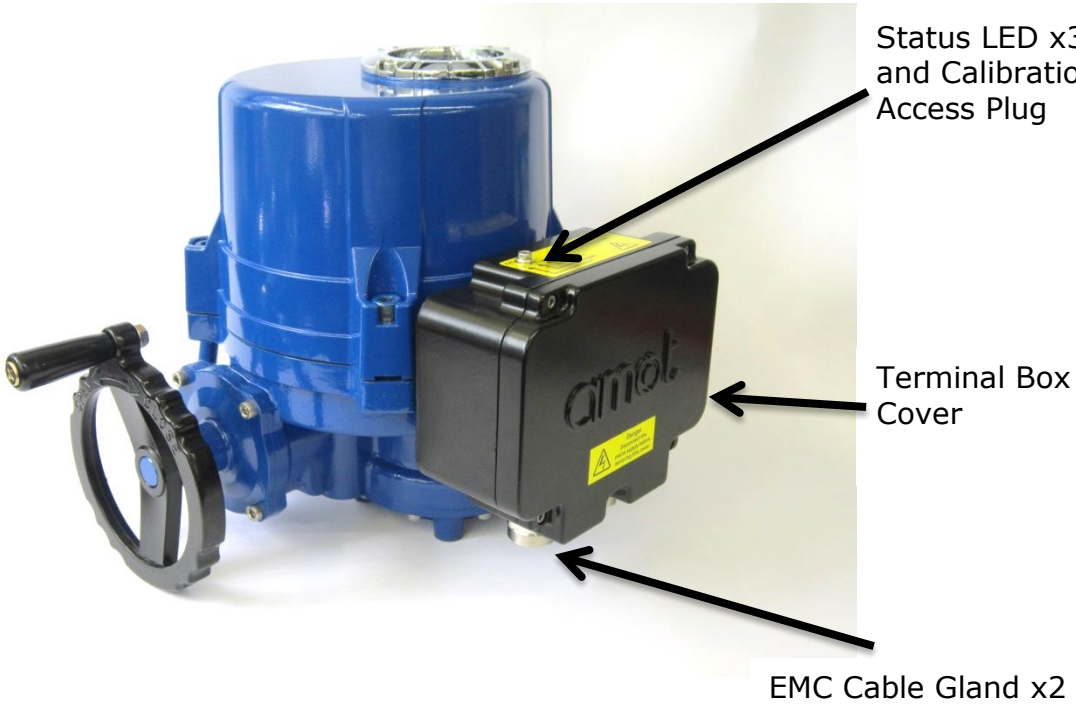


Fig 5 Actuator General Arrangement

The EB Electric Actuator is a rugged, compact and lightweight quarter-turn actuator providing enclosure protection to IP67. The actuator is powered by an electric motor driving a double-worm gear chain. The double-worm drive construction of the gearbox provides high reliability gearing whilst preventing fluid forces in the valve from reverse driving the actuator. Manual override is fitted as standard, enabling valve operation without electrical power. The manual override is automatically disengaged when electrical power is re-applied, preventing risk of injury from the handwheel.

4.1.2 Electrical

The actuator contains the following electrical equipment:

- Electric motor with integral bi-metallic cut-outs which disconnect the power to the motor if the temperature exceeds 150° C and reset when the motor cools to approx. 97° C.
- End of travel micro switches disconnect power to the motor when the end of travel is reached.
- Auxiliary micro switches operate just before the end of travel to provide indication signals.
- Torque limit micro switches disconnect power to the motor if a factory set torque is exceeded.
- Anti-condensation heater.
- Terminal strips for external connections.

4.1.3 Versions

The actuator is available in 115V ac and 230V ac versions, single phase only. All EB actuators have the option of a Positioner, which is fitted inside the terminal box (see Fig 6, page 21).

The internal wiring for the various options are illustrated in (Fig 7, page 23).

The external wiring is illustrated in the system wiring diagrams of Section 7, page 65 (System Integration).

4.1.4 Optional Positioner

An optional Positioner is available, to control the actuator from a 4-20mA input signal. The Positioner requires an optional Power Module to also be fitted.

The Actuator can be operated by direct mains switching or by a low level dc current or voltage input when the optional Positioner is installed in the Terminal Box.

Fig 6 shows the internal arrangement of the Terminal Box with the Positioner installed.

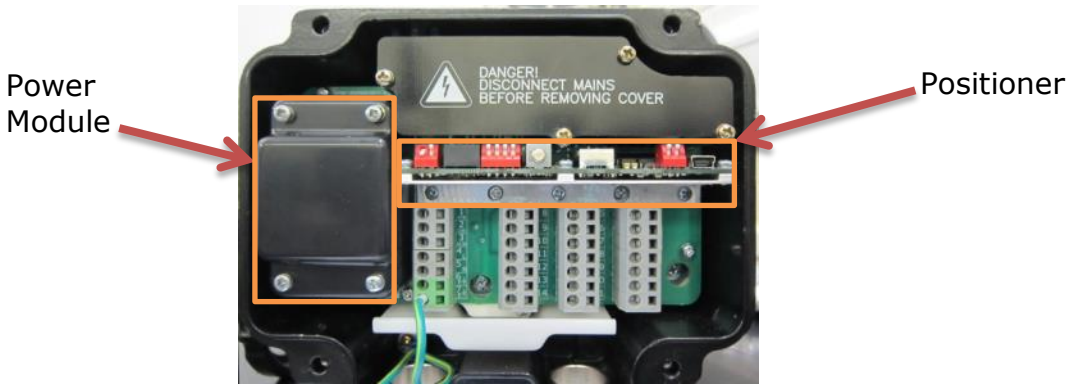


Fig 6 EB Actuator (Shown With Positioner)

The Positioner is a versatile, micro-processor controlled unit which is fully configurable for various control functions. The configuration of the unit is detailed in sections 4.5.1 (page 31) and 4.6 (page 33).

The main features of the Positioner are:

- Control of the actuator by an externally generated 4 – 20 mA signal.
- Actuator position indication available as 4 – 20 mA output (position re-transmission).
- Status indicator LEDs.
- Two Alarm output signals to indicate actuator status:
  - Alarm 1 normally closed, open for warning.
  - Alarm 2 normally closed, open for fault.

CAUTION

The Alarm Outputs are from Solid State Relays which can switch dc within the following specifications – 100mA maximum current, 40V maximum open circuit voltage. Actuator terminals 22 and 24 are for the positive connection.

4.1.5 Actuator Internal Wiring

For versions with a Positioner, versions are available with either 4-20mA position control or switched live control. The internal wiring is the same, with or without a Positioner.

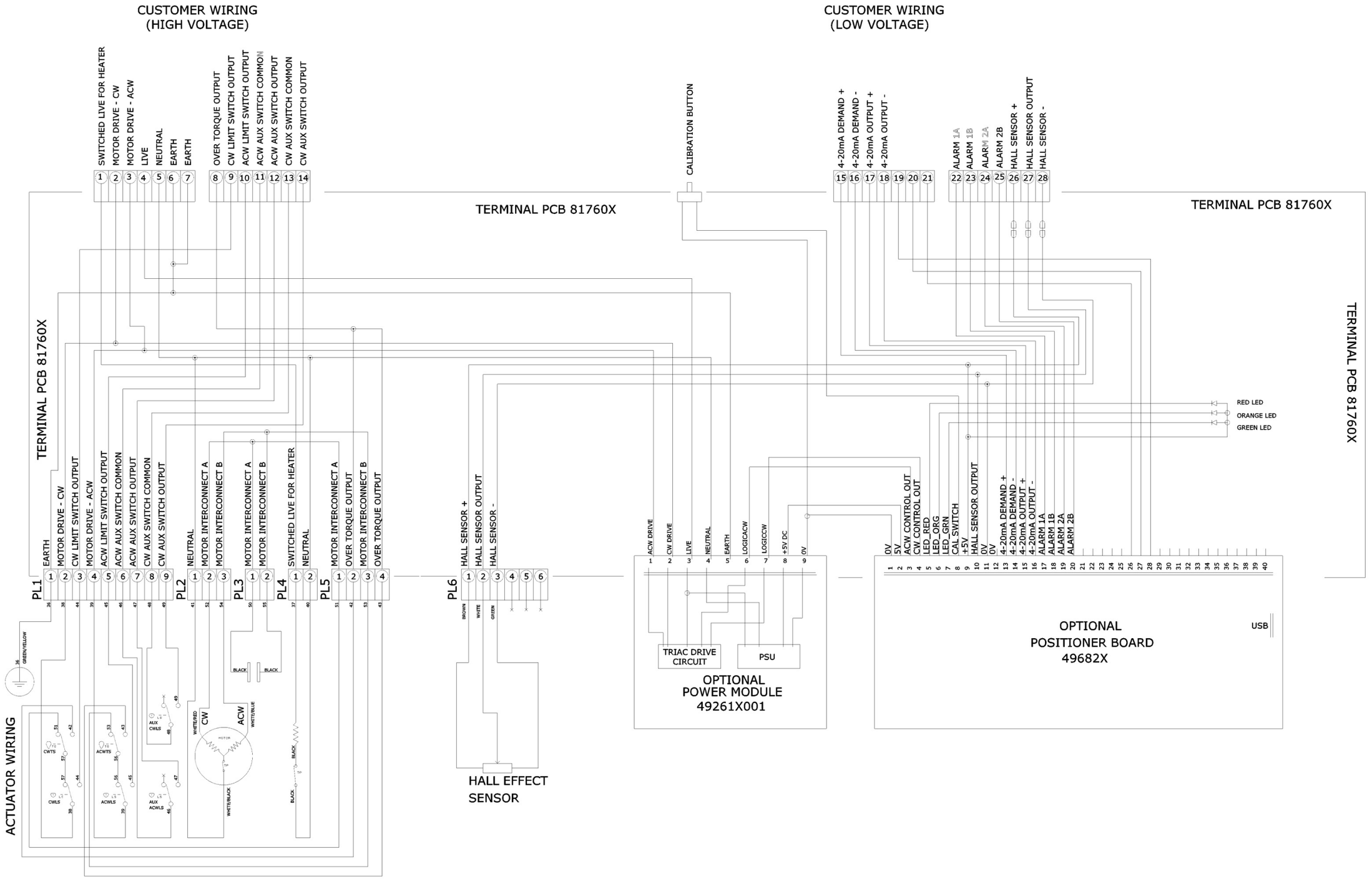


Fig 7 Wiring Diagram – EB Actuators

4.2 Identification of EB Actuator Model Number

Example code	EB	100	B	B	B	B	A	-AA	Code Description	
Actuator Type									Actuator Type	
	EB								Electric Actuator	
Size and Torque									Size and Torque	Comments
		100							100 Nm	
Voltage									Voltage	
			A						115 V ac	
			B						230 V ac	
Hardware Options									Hardware options	
				A					Without Positioner	
				B					Positioner fitted	
Control Signal									Control Signal	
					A				Switched live	
					B				4-20 mA (ACW to CW)	
					C				20-4 mA (ACW to CW)	
Feedback Signal									Feedback Signal	
						A			None	
						B			Position retransmit (Control signal B or D only)	
						C			Position retransmit (4-20 mA ACW to CW, Control signal A only)	
						D			Position retransmit (20-4 mA ACW to CW, Control signal A only)	
Extra Features									Extra Features	
							A		Not fitted	
Special Requirements									Special Requirements	
								-AA	Standard	
								-***	Customer special code assigned	

4.3 Mechanical Installation

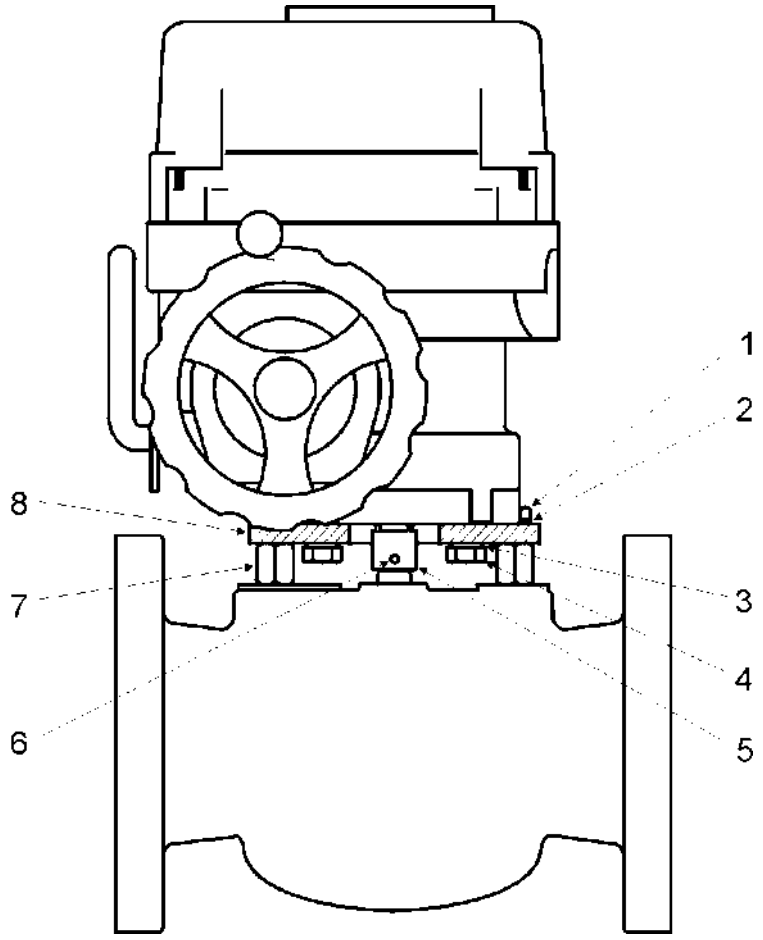


Fig 8 Actuator Mounting

The installation of the actuator to the valve body is achieved by the use of a mounting plate (Fig 8, item 8). It is attached to the underside of the actuator with bolts (Fig 8 items 3 and 4). The mounting plate, complete with actuator is then secured with bolts (Fig 8 items 1 and 2) to the valve body.

In the case of 02GGH, 03GGS, 04GGH and 06GGS, the mounting plate must be attached to the valve before the actuator is positioned and secured to the mounting plate.

WARNING

The actuator is heavy (16.6 kg). The appropriate manual handling precautions must be applied to prevent personnel injury.

The size of bolts and associated torque setting is dependent on the size of the valve. Throughout the removal and installation procedure, refer to Table 2 and Fig 8 for the relevant bolt sizes and torque settings:

Table 2 Actuator mounting bolt size and torque settings

Valve Size	Mounting Plate to Actuator Fig 8 (4)		Mounting Plate to Valve Body Fig 8 (1)	
	Bolt Size	Torque Setting	Bolt Size	Torque Setting
2 inch	M8	22 Nm	M8	22 Nm
3 inch	M8	22 Nm	M8	22 Nm
4 inch	M8	22 Nm	M8	22 Nm
6 inch	M8	22 Nm	M8	22 Nm
8 inch	M8	22 Nm	M8	22 Nm
10 inch	M8	22 Nm	M8	22 Nm

Note

By convention, the actuator is normally aligned on the valve with the cable entry glands positioned over the cold port. If the valve is to be installed in a location where access is restricted, the actuator may be fitted to the valve with the handwheel in any position.

4.4 Electrical Installation

The following precautions and limitations must be observed before electrical connection of the actuator.

CAUTION

Electrical power must not be supplied to both the open and close motor windings at the same time or overheating will occur. When power is applied to either the open or close windings, the other must be isolated.

If multiple actuators are controlled from the same DPDT control switch, it is possible that the first actuator to reach end of travel will reverse direction due to the supply being available from the common control switch. When several actuators need to be controlled in parallel with one 3 position control switch, each actuator must have separate contacts.

- Power supply must be free from excessive voltage transients (spikes).
- The power supply must be fused at 1.5 to 2 times the rated current.
- Check the Actuator nameplate and ensure the voltage is correct for the local supply.
- Use wire with the correct gauge and insulation (Follow standards prescribed by the relevant electrical regulations).

- The actuator chassis must be correctly grounded.
- Use the supplied EMC cable glands where possible for EMC compliance.
- All unused electrical entries must be blanked off with the appropriate plug.
- Make all splices or connections using the correct pin connector of terminal blocks.
- Ensure the connections comply with the appropriate installation wiring diagram in Section 7 (System Integration).
- Control lines must be correctly shielded.
- Keep the motor compartment clean and dry at all times.
- Where practical, high voltage signals should be kept separated from low voltage signals. Provision of 2 cable glands will assist with this.
- When the 4-20mA input and output signals are used, it is recommended that these signals are protected with 50mA quick blow fuses.

WARNING

Electrical connections to the Actuator must only be made by suitably qualified personnel.

Lethal voltages are present in the actuator presenting a shock hazard to personnel. Ensure the power supply to the actuator is isolated before the cover is removed.

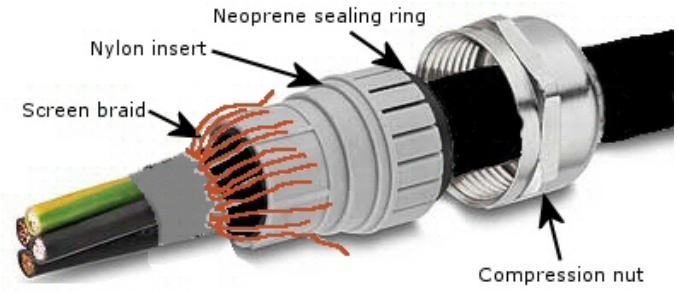


Fig 9 EMC Gland

4.4.1 Cable Glands

1 Route the cables through the EMC glands as follows:

- Disassemble the cable gland parts and slide the parts onto the cable in the following order:
  - Compression nut
  - Neoprene sealing ring
  - Nylon insert (sealing ring might be inside this part)
- Strip the cable outer insulation to expose sufficient conductor length and approx. 15-20 mm of braid.
- Pull back the screen braid approx. 15-20 mm over the outer sheath.

- Slide the nylon insert to align with the end of the exposed wires.
- Fold the screen braid back over the nylon insert as show in Fig 9.
- Push the cable through the gland body.
- Push the nylon insert and neoprene sealing ring fully into the body and align the anti-rotation guides.
- Push on the compression nut and tighten.

4.4.2 Wire Connection

2 Loosen the four captive screws that attach the cover to the Terminal Box.

3 Remove the Terminal Box cover taking care not to strain the earth bonding lead attached to it.

Note

Terminals 1 to 14 contain high voltage connections.

Terminals 15 to 28 contain low voltage connections.

4 Electrically connect the actuator in accordance with the System Wiring Diagrams in Section 7 (System Integration).

CAUTION

The terminal board is mounted on anti-vibration mountings and is therefore able to move under vibration. To avoid rubbing on the cables, ensure that the cables are routed over the cable guard. Refer to Fig 10.

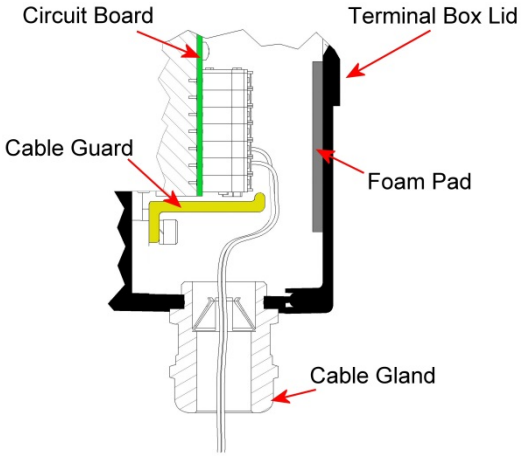


Fig 10 Cable routing

5 Set the DIP switches on the Positioner Board to the required configuration. Refer to the DIP switch description section 4.5.1, page 31.

6 Refit the Terminal Box cover and secure with the four captive screws.

7 Reinstate the electrical supply to the Actuator.

Note

Calibration is carried out in the factory. Further calibration should only be carried out after replacing a Positioner Board or sensors, or adjusting cams.

8 When using the optional Positioner, carry out the Option Configuration procedure. Refer to Section 4.6, page 33.

9 When using the optional Positioner, carry out the Calibration procedure if required. Refer to Section 4.7, page 38.

10 Check for correct operation of the Actuator.

4.4.3 Status LEDs & Alarm States

Note

The LEDs are only operational when the optional Positioner is installed.

Condition	LED			ALARM	
	Green	Amber	Red	1	2
Healthy	Flashing 1 Hz	Off	Off	Healthy	Healthy
Input out of range	Off	Flashing 2 Hz	Off	Fault	Healthy
Motor thermal trip	Off	Off	Flashing 2 Hz	Healthy	Fault
Position feedback fail	Off	Off	Flashing 2 Hz	Healthy	Fault
Factory setup mode	Flashing 2 Hz	Flashing 2 Hz	Flashing 2 Hz	Fault	Fault
Actuator calibration in progress	Flashing 2 Hz	Flashing 2 Hz	Flashing 2 Hz	Fault	Fault

Note

The alarm outputs (Positioner option only) are closed when healthy, for fail-safe reasons.

4.4.4 Electrical Position Feedback

A Hall sensor is fitted as standard to all versions of the EB actuator. Where a Positioner is also fitted, the Positioner uses the Hall sensor to determine the position of the actuator. With a Positioner fitted, 5V dc is applied to the connections of the Hall sensor, giving a dc voltage out. This voltage is fed into the Positioner, but may also be used to give an external position indication, provided that the signal is not loaded significantly. An impedance to 0V of not less than 100k ohms is recommended.

When no Positioner is fitted, the three Hall sensor terminals are not electrically connected to anything in the actuator, and may be used with any external circuit to give position indication. The Hall sensor is geared to the actuator output shaft such that it rotates about 270 degrees for a full quarter turn of the valve. This means that the output of the Hall sensor will never get fully to either 0V or 5V. Refer to section 4.9.8 on page 53 for connection details.

4.5 Positioner

An optional Positioner may be installed comprising two printed circuit boards mounted in the Terminal Box:

- Positioner Board, 49682X001 (Section 4.5.1)
- Power Module, 49261X001 (Section 4.5.2)

4.5.1 Positioner Board

The Positioner Board contains the following components:

- Processor
- Opto-isolators for inputs and outputs
- Calibration button
- DIP switches for configuration. Refer to Fig 11, Table 3 and Table 4.
- USB socket

DIP Switch Settings

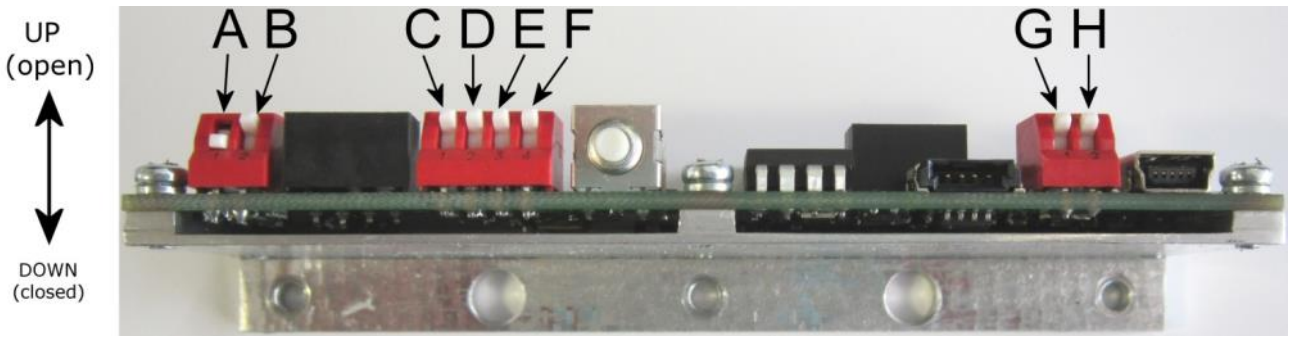


Fig 11 DIP Switches

Table 3 DIP Switches

Switch	Function	Up position	Down position
A	Voltage/current input selector (Refer to Table 4 below)	Voltage	Current
B	Input range selector (Refer to Table 4 below)	Low range	High range
C	Boot load selector	Normal operation	Select this position to enable software updates
D	Switched mains input option	Positioner controls motor movement	External switched mains input enabled
E	Direct/Reverse action selector	Direct action	Reverse action
F	Input offset selector (Refer to Table 4 below)	High Offset	Low Offset
G	Reserved for future development (CAN terminations)		
H			

Table 4 Input Range Selection

DIP Switch A	DIP Switch B	DIP Switch F	Input Range
Up	Up	Up	1 – 5 V
Up	Up	Down	0 – 5 V
Up	Down	Up	0 – 10 V
Up	Down	Down	2 – 10 V
Down	Up	Up	4 – 20 mA
Down	Up	Down	0 – 20 mA
Down	Down	Up	**DO NOT USE**
Down	Down	Down	**DO NOT USE**

4.5.2 Power Module

The Power Module generates the +5 V power supply required for the operation of the Positioner from the mains input supply (85 V – 265 V ac). It also contains the circuits to control the actuator motor.

4.6 Option Configuration (Positioner option only)

It is possible to change various configuration options, but for most applications, the default settings do not need to be changed. The available configuration options are:

1. Failsafe:
   a. Stop on loss of control signal (default)
   b. Move to 4mA position on loss of control signal
   c. Move to 20mA position on loss of control signal
2. mA output configuration:
   a. Retransmit the incoming position demand signal
   b. Output the actuator position (default)
   c. Output a position error signal (4mA represents no position error)
   d. Output a position error signal (12mA represents no position error)
3. Deadband:
   a. The deadband can be set to any integer value from 1% to 9%. The default value is 2%.

CAUTION

In the following instructions, <u>do not</u> select Elec Cal

The custom option settings are set using a PC running Windows and a standard USB cable type A to mini-B (not supplied) (Fig 12).

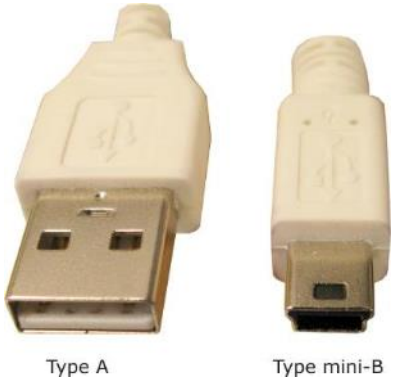


Fig 12 USB cable type A to mini-B

1 Connect the USB cable to the PC and to the Positioner board.

2 If an EB actuator has not been connected to the PC before, then the PC will need to install a Device Driver. This should happen automatically, but if not, a suitable Device Driver can be obtained from:

http://www.ftdichip.com/Drivers/VCP.htm

Note

This procedure may vary depending on the version of Windows used. Consult Windows help for accessing the device manager.

3 For more recent versions of Windows, click on the **Start** button, and then type Device Manager into the search box.

4 Alternatively, on the PC Desktop, right click **My Computer** and select **Properties** from the menu.

5 Click on the **Hardware** tab, and then the **Device Manager** button.

6 With the Device Manager started, click on the **+** or ▷ to the left of "Ports (COM & LPT)".

7 Look through the list for a line which starts "USB Serial Port (COM…", and make a note of the COM number.

8 Close the Device Manager window, and click **Cancel** on the System Properties window.

Note

Communication between the PC and the Positioner board requires a simple text only program, where keyboard inputs are sent to the Positioner, and characters are sent from the Positioner to the screen. For PCs with versions of Windows from 95 to XP, a built-in program called HyperTerminal can be used which serves this purpose. For other operating systems, it is necessary to acquire an alternative program. There are many Freeware options available on the internet, which can be found by using some of the following search terms:

- telnet client
- ssh client
- VT100 emulator
- xterm emulator

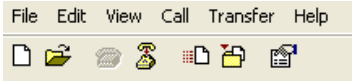
The remaining instructions in this section assume that HyperTerminal is used, but the same configuration settings and general operation applies to all programs.

9 Start HyperTerminal

10 If it shows a message "Unable to open COM…", click **OK** to continue. Check that the icons show the telephone with the handset on it as below:

Note

If you see the icons below, click on the phone with the lifted handset.

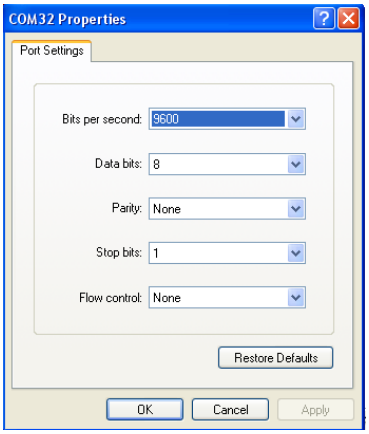


11 Click the **File** menu, and then **Properties**.

12 Click **OK** on the information message.

13 Click the arrow on the right of the Connect Using box, and scroll down to the COM number previously noted.

14 Click on the Configure button, and ensure that the following settings are shown (change if necessary):



Bits per second = 9600

Data bits = 8

Parity = None

Stop bits = 1

Flow control = None

15 Click **OK**, and **OK** again.

16 Click on the icon that shows a telephone with the handset down and the bottom left of the HyperTerminal window shows:

```
Connected
```

17 Press the Enter button on the PC, and the HyperTerminal shows a "**>**" cursor.

18 Type "MENU" and press enter. The display shows:

```
Press Y to confirm
>
```

Press "Y" and the following is displayed:

```
EB Positioner 81865X (Firmware Version 2.0)
Menu:
1. Elec Cal
2. Actuator Cal
3. Configure
4. Show Settings
5. Test Cal Soft Switch
6. Exit & Save Settings
>
```

The following options are displayed:

1. Elec Cal – Factory use only as special test equipment is required.
2. Actuator Cal – Performs the same calibration function as pressing the button on top of the terminal box (Fig 6, page 21).
3. Configure – Enables configuration items to be changed.
4. Show Settings – Displays the configuration settings.
5. Test Cal Soft Switch – Allows testing of both calibration buttons.
6. Exit – Saves any changes to the settings and exits.

19 Type "3" and press enter and the following is displayed:

```
Failsafe:
1=Stop, 2=4mA End, 3=20mA End
```

20 Type the number of the option to apply if the 4-20mA input signal is lost:

"1" to stop the actuator
"2" to drive it to the 4mA end
"3" to drive it to the 20mA end

21 Press enter and the display shows:

```
Re-Tx mode:
D: Actuator Demand, A: Actual Posn,
E: Error, B:Biases Error
```

22 Type the character of the option for the retransmission required as follows:

"D" to be the same as the input signal
"A" to show the position of the actuator
"E" to show how far the actuator is from the demanded position (4mA = no position error)
"B" to show how far the actuator is from the demanded position (12mA = no position error)

23 Press enter and the display shows:

```
System Deadband (1 to 9%)
D for default (2%)
```

24 Type a number key to set the required deadband percentage or "D" for the default 2%.

25 Press enter and the display shows:

```
Actuator End Stop Margin(%)
 0 or 5 only:>
```

For actuators controlled by switched live signals, enter 0. For all others, enter 5.

Note

Actuators which are controlled by a low level signal, such as 4-20mA stop short of the position limit cams, whereas switched live controlled actuators stop at the position limit cams. For switched live controlled actuators with a 4-20mA output, this setting adjusts what mA output value is given at the ends of stroke (3.11mA and 20.88mA or 4.0mA and 20.0mA).

26 The display now shows:

```
90/180 Threshold, 0 to 9
IF ALTERED RUN ACTUATOR CAL :>
```

27 Enter 2 for all versions of actuator.

28 The display now shows:

```
Config Complete

>

EB Positioner 81865X (Firmware Version 2.0)
Menu:
1.  Elec Cal
2.  Actuator Cal
3.  Configure
4.  Show Settings
5.  Test Cal Soft Switch
6.  Exit & Save Settings
>
```

29 Type "4" and press enter. The display shows the settings selected. An example is illustrated below:

```
Input Mode: 4-20mA
Direct/Reverse: DIRECT
Fail Mode: Stop
Re-Tx Mode: A
Deadband %: 2
Actuator End Stop Margin(%): 5
90/180 Threshold, 0 to 9: 2
>
```

30 If the settings are incorrect, repeat the configuration procedure from step 19. If the settings are correct, type "6" and press enter. The display shows:

```
Saving Settings…OK
>
```

31 Click the HyperTerminal icon with the telephone handset lifted to disconnect communications to the Positioner, and unplug the USB cable.

4.7 Calibration (Positioner option only)

The calibration of the Positioner is performed using software embedded in the unit. No other test equipment is required.

WARNING

The calibration procedure automatically drives the valve through its complete range of movement. Ensure personnel are kept clear to avoid injury.

CAUTION

The calibration procedure automatically drives the valve through its complete range of movement. Ensure that the system containing the valve will not be adversely affected by its operation during the calibration procedure.

1 Unscrew and remove the calibration plug and seal from the Terminal Box.

2 Insert a suitable tool in the hole to press and hold the calibration switch until the following procedure starts (greater than five seconds). It should be possible to feel the push button switch operating.

3 The calibration procedure sequence starts:

- # Red, amber and green status LEDs flash at 2 Hz.
- # Actuator drives to one end of stroke (limit switch operation) – Hall sensor sampled.
- # Actuator drives to other end of stroke (limit switch operation) – Hall sensor sampled.
- # Actuator drives to first end of stroke (limit switch operation) – stroke time measured.
- # Actuator drives to the following positions and checks for overshoot after motor power is cut:
  - 25%
  - 50%
  - 75%

4 On completion of the calibration sequence (status LEDs return to normal operational state), fit and tighten the calibration plug and seal on the Terminal Box.

Note

If the calibration plug screw and seal is not tightened sufficiently, or is damaged, then the IP67 sealing of the terminal box will not be achieved.

4.8 Operation

CAUTION

Damage can be caused to the valve assembly if a cheater or extension bar is used on the hand wheel. Do not use any mechanical aid to turn the hand wheel.

The actuator operates as soon as electrical power is applied, controlled by either an 8071D PID controller based system or an externally generated 4 – 20 mA signal for the optional Positioner.

Manual operation is possible at any time by performing the following (Fig 13):

With the actuator having been run by the motor and the motor not running:

Pull the lever towards the hand wheel.
Turn the hand wheel and release the lever.

The actuator is now in manual operation mode, whereby turning the hand wheel moves the actuator back and forth as required.

The actuator stays in manual mode until the motor is run, at which time, the lever flicks itself back to the auto position.

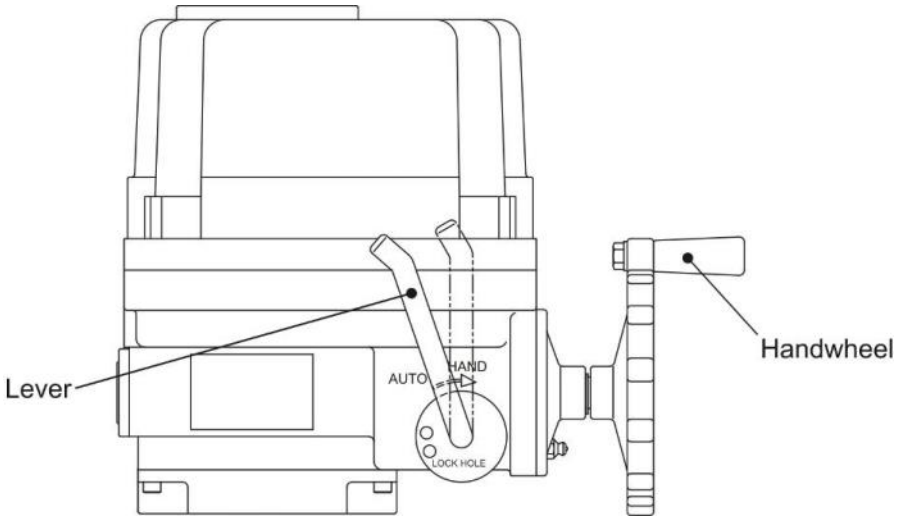


Fig 13 Auto/Manual operation

If the actuator fails to operate correctly, refer to the troubleshooting guide in Section 8.

4.9 Maintenance

The following maintenance tasks are described in this section:

- Removal and installation onto valve body (4.9.1 – page 40)
- Lubrication (4.9.2 – page 43)
- Sensor Mounting Bracket replacement (4.9.3 – page 43)
- Position Limit switch replacement (4.9.4 – page 45)
- Sensor replacement (4.9.5 – page 48)
- Position Limit switch adjustment (4.9.6 – page 48)
- Sensor adjustment (4.9.8 – page 53)
- Anti-condensation heater replacement (4.9.9 – page 54)
- Capacitor replacement (4.9.10 – page 56)

Note

The torque switches are set during actuator manufacture and require no adjustment. In the event of a torque switch failure the actuator must be returned to the manufacturer for repair.

4.9.1 Removal and Installation onto Valve Body

The size of bolts and associated torque setting is dependent on the size of the valve. Throughout the removal and installation procedure, refer to Table 5 and Fig 14 (page 41) for the relevant bolt sizes and torque settings:

Table 5 Actuator mounting bolt size and torque settings

<table>
<tr><th rowspan="2">Valve Type</th><th colspan="2">Mounting Plate to Actuator
Fig 14 (4)</th><th colspan="2">Mounting Plate to Valve Body
Fig 14 (1)</th></tr>
<tr><th>Screw Size</th><th>Torque Setting</th><th>Screw Size</th><th>Torque Setting</th></tr>
<tr><td>02GGH</td><td rowspan="4">M8 x 20</td><td rowspan="4">22 Nm</td><td rowspan="4">Csk M8 x 20
Secured with Loctite 2400 or equivalent</td><td rowspan="4">22 Nm</td></tr>
<tr><td>03GGS</td></tr>
<tr><td>04GGH</td></tr>
<tr><td>06GGS</td></tr>
<tr><td>03GGH</td><td rowspan="7">M8 x 20</td><td rowspan="7">22 Nm</td><td rowspan="7">M8 x 20</td><td rowspan="7">22 Nm</td></tr>
<tr><td>04GGS</td></tr>
<tr><td>05GGS</td></tr>
<tr><td>06GGH</td></tr>
<tr><td>08GGS</td></tr>
<tr><td>08GGH</td></tr>
<tr><td>10GGS</td></tr>
</table>

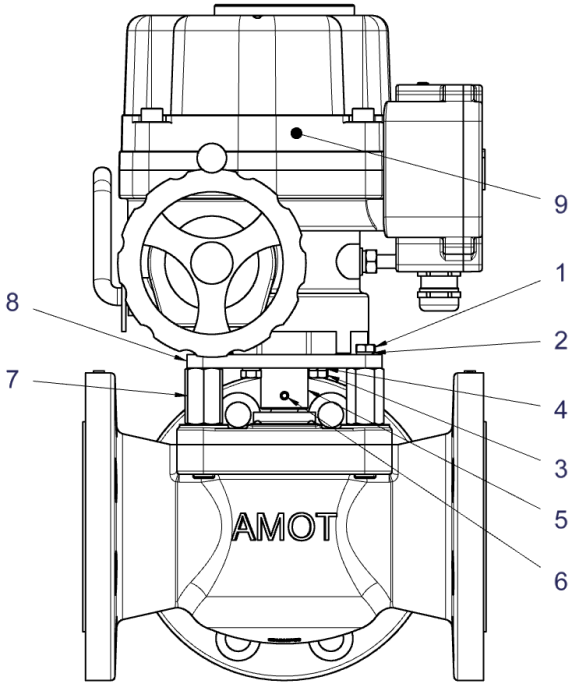


Fig 14 Actuator mounting

Removal

WARNINGS

Lethal voltages are present in the actuator presenting a shock hazard to personnel. Ensure the power supply to the actuator is isolated before the cover is removed.

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

The actuator case can be hotter than the ambient temperature. Care must be taken when handling the actuator to prevent burn injuries to personnel.

1 Switch off and isolate the actuator electrical supplies.

2 Manually operate the actuator to the low temperature position.

3 Remove the Terminal Box cover.

4 Label the wires to aid reassembly, disconnect from the Terminal Board and pull the cables clear from the EMC Glands.

5 Note which valve port the cable entry glands are positioned over.

6 Remove the four bolts and spring washers (Fig 14 items 1 and 2) securing the actuator mounting plate (Fig 14 item 8) to the valve. Where the four screws are not accessible, such as on valve types 02GGH, 03GGS, 04GGH, 05GGS and 06GGS, the lower four bolts and spring washers (Fig 14 items 3 and 4) should be removed.

WARNING

The actuator is heavy (EB100 – 16.6 kg). The appropriate manual handling precautions must be applied to prevent personnel injury.

7 Carefully lift the actuator complete with mounting plate from the valve. Note that when removing the actuator from valve types 02GGH, 03GGS, 04GGH, 05GGS and 06GGS, the mounting plate will remain in position on the valve. At this stage the mounting plate on these valve types can also be removed from the valve by removing the four countersunk screws (Fig 14 item 1).

Installation

1 On valve types 02GGH, 03GGS, 04GGH, 05GGS and 06GGS, if the mounting plate (Fig 14 item 8) has been removed, replace it using the four countersunk screws (Fig 14 item 1) tightened to the relevant torque setting detailed in Table 5 page 40. For all other valve types, ensure that the mounting plate is secured to the underside the actuator with the four bolts (Fig 14, item 4) tightened to the relevant torque setting detailed in Table 5 page 40.

2 Manually operate the actuator to the low temperature position.

WARNING

The actuator is heavy (EB100 – 16.6 kg). The appropriate manual handling precautions must be applied to prevent personnel injury.

3 Mount the actuator (complete with mounting plate where relevant) onto the valve body, with the cable entry gland positioned over the valve port noted during removal. Secure to the valve using the four bolts and washers (41 items 1 and 2), or for Valve Types 02GGH, 03GGS, 04GGH, 05GGS and 06GGS, to the mounting plate using the four bolts and washers (Fig 14 items 3 and 4).

4 Tighten the bolts to the relevant torque setting detailed in Table 5 page 40.

WARNING

The actuator wires carry lethal mains voltages. Actuator wiring must be isolated before feeding and connecting it to the actuator.

5 Ensure the actuator electrical power supplies are switched off and isolated.

6 Feed the electrical wiring through the required cable entry EMC Gland.

7 Connect the wires to the terminal board in accordance with the relevant system wiring diagram in Section 7 (System Integration).

8 Wind the hand wheel and ensure that movement is free and smooth over its full range of operation.

9 Energise the actuator power supply and control circuits and check for correct operation.

4.9.2 Lubrication

To enable the actuator to be mounted in any position, a totally sealed and permanently lubricated gear case is used. During long periods of storage, it is not unusual for a very small amount of lubricant to weep from shaft seals. In this event, wipe up the weeping lubricant with a clean cloth. During operation, the weeping should disappear.

4.9.3 Sensor Mounting Bracket replacement

Refer to Fig 15.

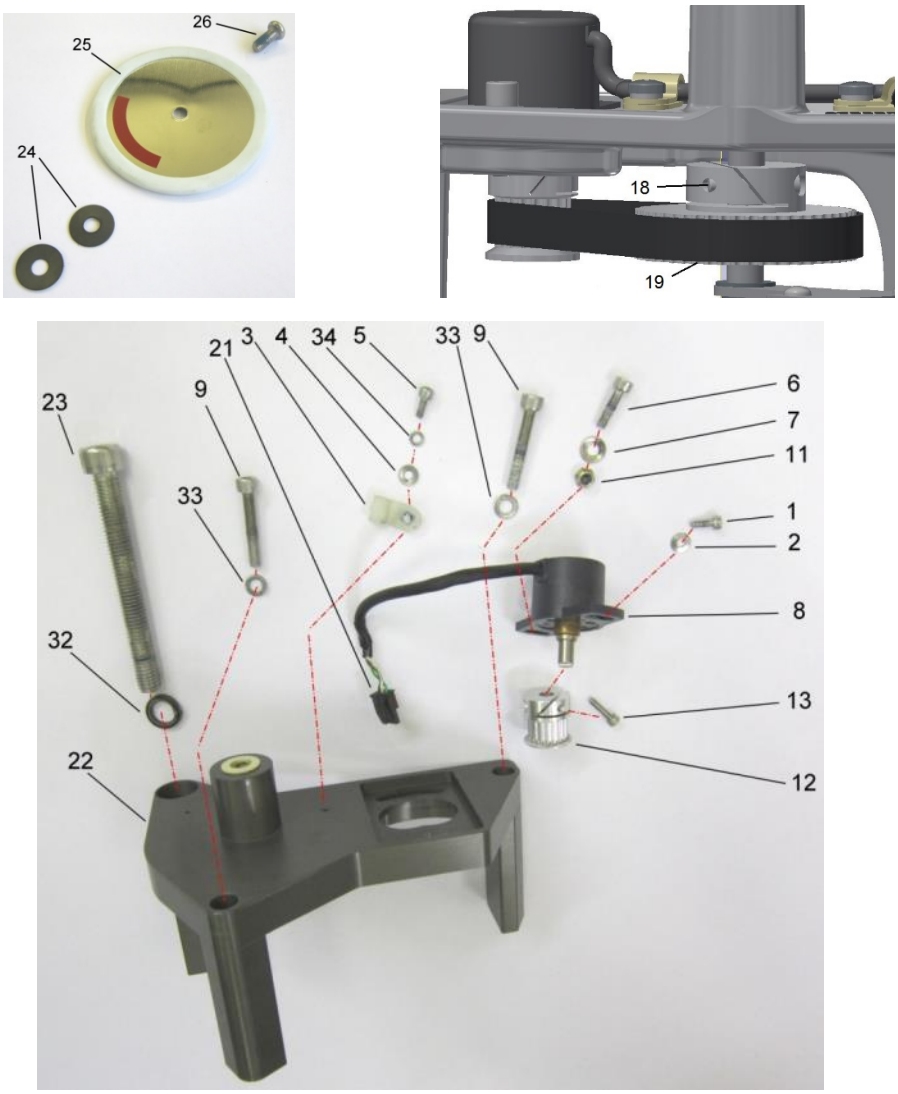


Fig 15 Sensor Mounting Bracket replacement

Remove Sensor Mounting Bracket

1 Loosen the socket head cap screws and carefully lift off the Actuator cover.

2 Remove the screw (26) in the centre of the position indicator disc (25) and remove the indicator disc and the Belleville washers (24) from the position indicator shaft.

3 Disconnect the Hall Sensor (8) at the in-line connector (21).

4 Remove the cable ties that secure the Actuator side Hall Sensor wiring to the Sensor Mounting Bracket (22).

5 Remove all P clips (3) securing the Hall sensor wiring to the Sensor Mounting Bracket.

6 Loosen the two cap screws (1) and (6) that secure the Hall Sensor (8) to the Sensor Mounting Bracket.

7 Move the Hall Sensor to de-tension the Timing Belt.

8 Remove the Timing Belt from the two Timing Pulleys (12) and (not shown).

9 Remove the M10 Sensor Mounting Bracket attaching screw (23).

10 Remove the two M5 Sensor Mounting Bracket attaching screws (9).

11 Remove the Sensor Mounting Bracket from the Actuator.

12 Loosen the cap screw (13) and remove the Hall Sensor Pulley from the shaft.

13 Remove the two cap screws (1) and (6) and two washers (2) and (7) to release the Hall Sensor from the Sensor Mounting Bracket. Note that the cap screw towards the centre of the actuator also has a stiffnut and washer (11 and 10) below the Sensor Mounting Bracket.

Fit Sensor Mounting Bracket

Note

When reassembling, all screws should be fitted using Loctite 2400 thread locking adhesive or equivalent.

1 Ensure the Timing Belt is positioned over the Position Indicator Shaft.

2 Position the Sensor Mounting Bracket in the Actuator and secure it with the M10 cap screw (23) and two M5 cap screws (9).

3 Using the hand wheel, turn the actuator to mid position.

4 Ensure that the cap screw on the Position Indicator Shaft Pulley is accessible to aid realignment of the Sensors.

5 Locate the Hall Sensor (8) onto the Sensor Mounting Bracket.

Note

The cap screw (6) towards the centre of the Actuator attaching the Hall Sensor to the Sensor Mounting Bracket has a further spring washer and stiff

nut (10, 11) underneath the Sensor Mounting Bracket. The stiff nut engages in a machined slot to prevent it turning.

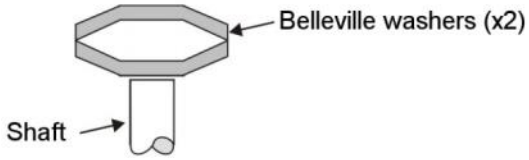
6 Fit the two caps crews (1) and (6) with spring washers (2) and (7) but do not fully tighten at this stage.

7 Fit the Hall Sensor Pulley (12) to the Hall Sensor shaft and secure with cap screw (13).

8 Connect the Hall Sensor in-line connector.

9 Refit all P clips and cable ties securing the Hall Sensor cable to the Sensor Mounting Bracket.

10 Refit the position indicator disc using screw (26), noting the correct orientation of the Belleville washers:



11 Carry out the Sensor Alignment procedure at Section 4.9.8 (page 53).

4.9.4 Position Limit Switch Replacement

CAUTION

During replacement of the limit switches, the actuator must be manually positioned. If the actuator is mounted on a valve which is installed in the pipework, it will affect the process flow of the system.

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

Position Limit Switch removal

1 Loosen the socket head cap screws and carefully lift off the cover.

2 Remove the Sensor Mounting Bracket as described in section 4.9.3.

3 Remove the Limit Switch Assembly as follows. Refer to Fig 16.

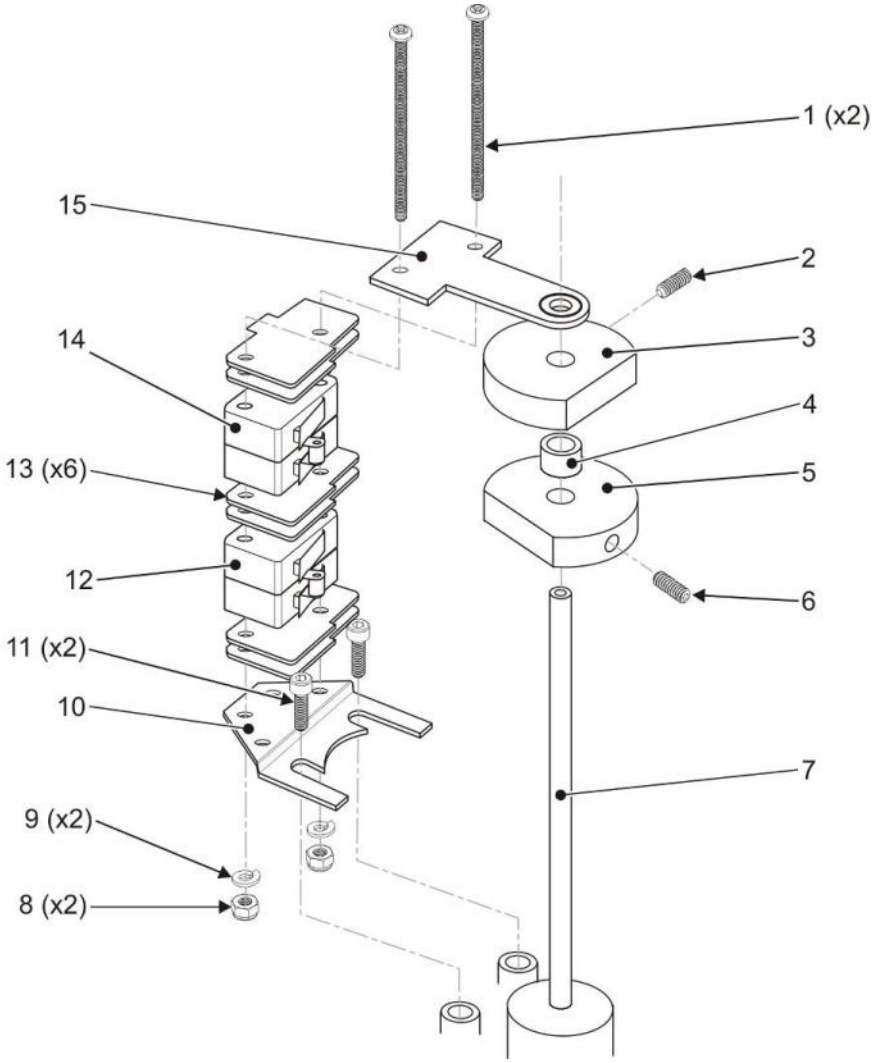


Fig 16 Limit Switch Assembly and Cams

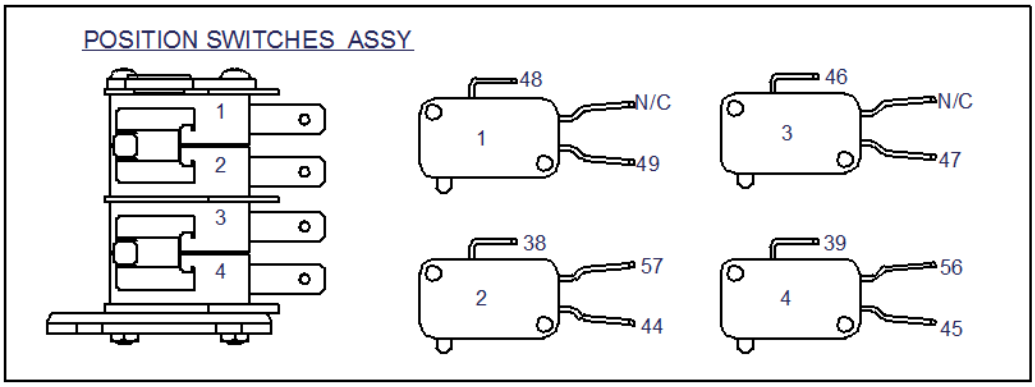
- Turn the manual drive handle as necessary to access the setscrews (2 and 6) in both the upper and lower limit switch cams (3 and 5).
- Undo the setscrews to loosen both upper and lower limit switch cams on the shaft.

CAUTION

When the two screws (11) securing the lower limit switch bracket (10) are unscrewed, they can damage the lower limit switch cam (5). The screws (11) must be undone evenly and in small increments whilst raising the limit switch assembly and cams to prevent the screws applying pressure to the underside of the cam.

- Turn the cams to access the lower limit switch bracket screws (11). Undo the screws evenly and in small increments whilst raising the limit switch assembly and cams together to prevent the screws damaging the lower cam.

- Remove the two screws (11) and slide the limit switch assembly, both cams and cam spacer (4) from the shaft (7).
- Note the position of the wires and disconnect the limit switch pair wires from the switches to be replaced (the switches identified as item 12 are the CW switches and item 14 are the ACW switches).



- Remove the two screws (1), nuts (8) and spring washers (9) and remove the required switch pair.

Fit Position Limit Switch

Note

When reassembling, all screws should be fitted using Loctite 2400 or equivalent.

1 Reassemble the limit switches complete with limit switch spacers (13) and secure with the two screws (1), spring washers (9) and nuts (8).

2 Connect the replacement limit switch pair wires to the switches. (See diagram)

3 Slide the cams and cam spacer (4) onto the position indicator shaft (7). Whilst viewing the actuator as illustrated, ensure the cam grubs crews are facing you when the flats face the switches.

4 Position the upper limit switch bracket (15) and slide down the shaft with the cams.

5 Whilst ensuring that the limit switch bracket (10) is as close to the position indicator shaft (7) as possible, secure the limit switch assembly with the two screws (11).

6 Refit the Sensor Mounting Bracket as described in section 4.9.3, page 43.

7 Carry out Position Limit Switch adjustment in accordance with Section 4.9.6 (page 48).

8 Carry out Sensor adjustment in accordance with Section 4.9.8 (page 53).

4.9.5 Sensor Replacement

This section covers the replacement procedure for the Hall Sensor.

- Disassemble the sensor bracket, and remove the Hall Sensor by following the steps in section 4.9.3.
- Fit the replacement Hall Sensor, and reassemble the sensor bracket by following the steps in section 4.9.3.
- Carry out the Sensor Alignment procedure at Section 4.9.8 (page 53).

4.9.6 Position Limit Switch Adjustment – Rotor Not Visible

The position limit switches and mechanical end stops are set by the manufacturer and should not need adjustment unless the cams or switches are replaced or disturbed. During manufacture, the limit switches are set up relative to the valve fully open and closed positions. The mechanical end stops are then set in position, a further one complete turn of the manual operating handle.

This procedure assumes that observation of the valve rotor is not possible (installed in pipework) and sets the limit switches relative to the factory set mechanical end stop positions.

CAUTION

During adjustment of the limit switches, the actuator must be manually positioned. If the actuator is mounted on a valve which is installed in the pipework, it will affect the process flow of the system.

Adjust the limit switches as follows (refer to Fig 17):

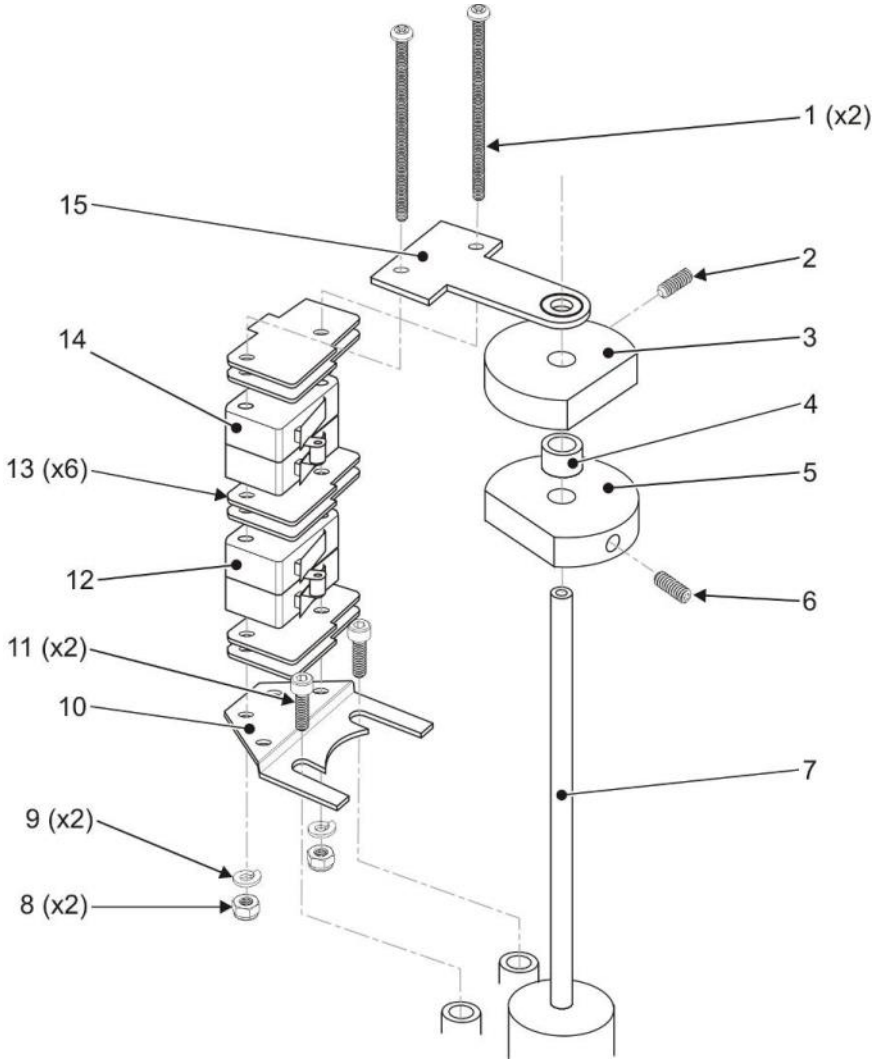


Fig 17 Limit Switch Adjustment

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Loosen the socket head cap screws and carefully lift off the cover.

Note

The cams are adjusted until the limit switches operate (indicated by an audible click). In conditions of high noise levels, an electrical continuity circuit should be connected across the relevant switch to give a visible indication of switch operation (refer to the wiring diagram Fig 7, page 23 for terminal numbers).

3 **ACW limit switch adjustment**:

1. Manually wind the actuator fully anti-clockwise to the mechanical end stop.
2. Wind the manual handle clockwise to take up backlash (approx. ¼ turn).
3. Wind the manual handle clockwise a further one complete turn.
4. Loosen the grub screw (6) in the lower limit switch cam (5).
5. Turn the cam until the limit switch is on the flat of the cam (switch not pressed).
6. Slowly turn the cam clockwise until the first switch just operates.
7. Tighten the grub screw (6).
8. Repeat from step 3 without loosening the cam grub screw to check that the first switch operates when the manual handle is turned two complete turns (after take-up of backlash).
9. Check that the second switch on the same cam operates after a further clockwise ½ turn of the manual handle.

Note

It is not possible to adjust the normal switch separately from the aux switch.

4 **CW limit switch adjustment:**

1. Manually wind the actuator fully clockwise to the mechanical end stop.
2. Wind the manual handle anti-clockwise to take up backlash (approx. ¼ turn).
3. Wind the manual handle anti-clockwise a further one complete turn.
4. Loosen the grub screw (2) in the upper limit switch cam (3).
5. Turn the cam until the limit switch is on the flat of the cam (switch not pressed).
6. Slowly turn the cam counter-clockwise until the first switch just operates.
7. Tighten the grub screw (2).
8. Repeat from step 3 without loosening the cam grubscrew to check that the first switch operates when the manual handle is turned two complete turns (after take-up of backlash).
9. Check that the second switch on the same cam operates after a further counter-clockwise ½ turn of the manual handle.

Note

It is not possible to adjust the normal switch separately from the aux switch.

5 Remove any electrical continuity circuits connected to the terminal board.

6 Ensure that the actuator cover O ring is correctly fitted and undamaged.

7 Refit the actuator cover and secure with the socket head cap screws.

CAUTION

Adjustment of the Position Limit Switches affects the calibration of the optional Positioner. If fitted, it must be re-calibrated before the actuator is brought into service (refer to Section 4.7, page 38).

8 If the optional Positioner is installed, perform a calibration procedure. Refer to Section 4.7, page 38.

9 Energise the actuator power supply and control circuits and check for correct operation.

4.9.7 Limit Switch Adjustment – Rotor Visible

The limit switches and mechanical end stops are set by the manufacturer and should not need adjustment unless the cams or switches are replaced or disturbed. During manufacture, the limit switches are set up relative to the valve fully open and closed position, a further one complete turn of the manual operating handle.

This procedure assumes that observation of the valve rotor is possible (not installed in pipework) and sets the limit switches relative to the rotor positions.

Adjust the limit switches as follows (refer to Fig 17, page 49)

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Loosen the socket head cap screws and carefully lift off the cover.

Note

The cams are adjusted until the limit switches operate (indicated by an audible click). In conditions of high noise level, an electric continuity circuit should be connected across the relevant switch to give a visible indication of switch operation. (refer to the wiring diagrams Fig 7, page 23)

3 **Open limit switch and end stop adjustment:**

3.1 Manually wind the actuator fully counter-clockwise until the rotor just covers the valve port. Refer to Fig 1, page 12.

3.2 If the actuator has a Positioner fitted, turn the hand wheel a further ¾ of a turn.

3.3 Loosen the grub screw (6) in the lower limit switch cam (5).

3.4 Turn the cam until the limit switch is on the flat of the cam (switch not pressed)

3.5 Slowly turn the cam clockwise until the first switch (Open limit switch `OLS`) just operates.

3.6 Tighten the grub screw (6).

Note

It is not possible to adjust AOLS separately from the OLS.

3.7 Slacken the nut on the mechanical end stop screw nearest to the hand wheel, and turn the screw counter-clockwise by approximately 10 turns.

3.8 Turn the hand wheel one turn counter-clockwise, and check that the port has not started to open. If it has, then turn the hand wheel clockwise until the port is just closed.

3.9 On the mechanical end stop adjuster nearest to the hand wheel, turn the screw clockwise until it stops. Tighten the nut.

4. Close limit switch and end stop adjustment:

4.1 Manually wind the actuator fully clockwise until the rotor just covers the valve port. Refer to Fig 1, page 12.

4.2 If the actuator has a Positioner fitted, turn the hand wheel a further ¾ of a turn.

4.3 Loosen the grubs crew (6) in the upper limit switch cam (3)

4.4 Turn the cam until the limit switch is on the flat of the cam (switch not pressed)

4.5 Slowly turn the cam counter-clockwise until the first switch (Open limit switch `OLS`) just operates.

4.6 Tighten the grub screw (6)

Note

It is not possible to adjust the AOLS separately from the OLS.

4.7 Slacken the nut on the mechanical end stop screw furthest from the hand wheel, and turn the screw counter-clockwise by approximately 10 turns.

4.8 Turn the hand wheel 1 turn clockwise, and check that the port has not started to open. If it has, then turn the hand wheel counter-clockwise until the port is just closed.

4.9 On the mechanical end stop adjuster furthest from the hand wheel, turn the screw clockwise until it stops. Tighten the nut.

CAUTION

Adjustment of the limit switches affects the calibration of the optional Positioner. If fitted, it must be re-calibrated before the actuator is brought into service.

5. If fitted, calibrate the positioner (refer to 4.7 , page 38)
6. Energise the actuator power supply and control circuits and check for correct operation.

4.9.8 Sensor Alignment

Refer to Fig 15 (Page 43) and Fig 18 (page 53).

This section details the adjustment procedure for the Hall Sensor.

Note

When reassembling, all screws should be fitted using Loctite 2400 or equivalent.

1 Using the hand wheel, turn the actuator to mid position.

2 Ensure that the cap screw (18) on the Position Indicator Shaft Pulley (19) is accessible to aid realignment of the Sensors.

3 Remove the Timing Belt from the pulleys as follows:

- Loosen the two cap screws (6) that attach the Hall Sensor to the Sensor Mounting Bracket.
- Move the Hall Sensor to de-tension the Timing Belt.
- Remove the Timing Belt from the Pulleys.

4 Hall Sensor Rough Alignment.

- Connect a 5 V ± 0.1 V dc power supply and voltmeter to the terminal board as follows:

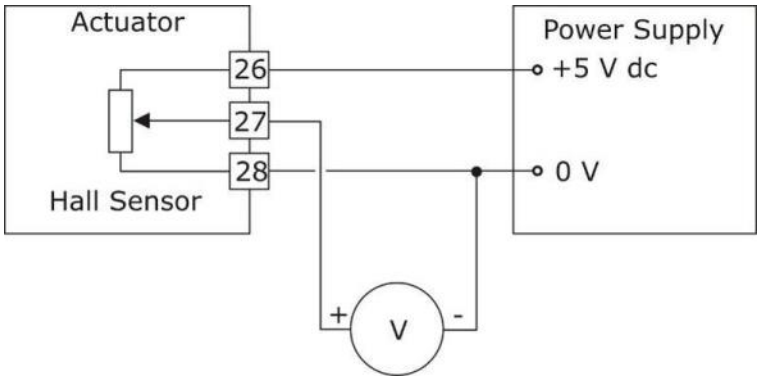


Fig 18 Electrical Connections for Sensor Alignment

- Turn the Hall Sensor Pulley until the voltmeter indicates 2.5 V ± 0.1 V.

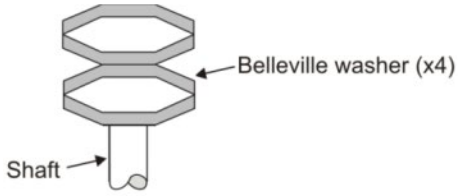
5 Fit and Tension the Timing Belt.

- Fit the Timing Belt over the two Pulleys taking care not to turn them excessively.
- Move the Hall Sensor to tension the Timing Belt and tighten the two cap screws (6). The belt should be tight enough to take up the slack, but no tighter. Belt tensioning tool, AMOT part number 81573X, can be used to aid sensor positioning.

6 Hall Sensor Fine Alignment.

- Using the handwheel, turn the actuator to each end stop and note the voltmeter readings. Turn the actuator until the voltmeter indicates the centre position of the two values.
- The voltmeter should indicate 2.5 V ± 0.1 V. If it does not, loosen the cap screw (18) and turn the Position Indicator Shaft Pulley (19) until the value is achieved then retighten the cap screw to a torque 1.8Nm (18).

7 Referring to Fig 15 (page 43), fit the two or four Belleville washers (24) onto the Position Indicator Shaft as indicated below:



8 Fit the Position Indicator Disc (25) and secure with the screw (26). Ensure that the position of the Actuator is indicated correctly. If not loosen the screw (26), turn the Disc and retighten the screw.

9 Perform a calibration procedure (Positioner option fitted only). Refer to Section 4.7, page 38).

4.9.9 Anti-Condensation Heater Replacement

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

Remove Heater

1 Switch off and isolate the actuator electrical power supply.

2 Loosen the socket head cap screws and carefully lift off the actuator cover.

3 Unscrew the motor strap and remove the bracket complete with heater (Fig 19).

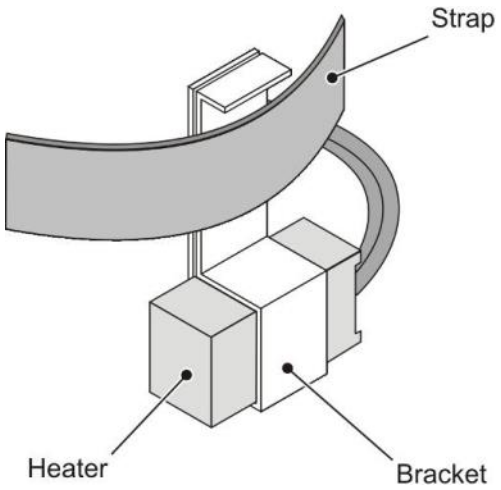


Fig 19 Anti-Condensation Heater

4 There is a connector fitted in-line with the heater wires, inside the main body of the actuator.

5 To allow for optimum access, remove the sensor mounting bracket, as described in 4.9.3 on page 43.

6 Locate the plug/socket connector for the heater, near to the base of the actuator.

7 Carefully cut any cable ties to allow the connectors to be separated, and the wiring to be removed.

Fit Heater

1 Carefully Replace the heater in the mounting bracket and position underneath the motor strap.

2 Position the replacement heater wires in the same positions as the removed heater.

CAUTION

To prevent crush damage to the capacitor, Do not over-tighten the motor strap.

3 Tighten the motor strap.

4 Reconnect the plug/socket.

5 Fit new cable ties in all the positions where original ties had been.

6 Re-fit the sensor bracket, as described in section 4.9.3 on page 43.

7 Ensure that the actuator cover O ring is correctly fitted and undamaged.

8 Refit the actuator cover and secure with the socket head cap screws.

9 Energise the actuator power supply and control circuits and check for correct operation.

4.9.10 Capacitor Replacement

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

Remove Capacitor

1 Switch off and isolate the actuator power supply.

2 Loosen the socket head cap screws and carefully lift off the actuator cover.

3 Disconnect the capacitor wires from capacitor connectors.

4 Slacken the motor strap from around the motor and capacitor.

5 Remove the capacitor and the anti-vibration block.

Fit Capacitor

1 Fit a new capacitor and position against the motor ensuring that it sits snugly on the anti-vibration block against the motor.

2 Connect the wires to the capacitor connectors.

CAUTION

To prevent crush damage to the capacitor, do not over-tighten the motor strap.

3 Tighten the motor strap.

4 Ensure that the actuator cover O ring is correctly fitted and undamaged.

5 Refit the actuator cover and secure with the socket head cap screws.

6 Energise the actuator power supply and control circuits and check for correct operation.

4.9.11 Terminal Board Replacement

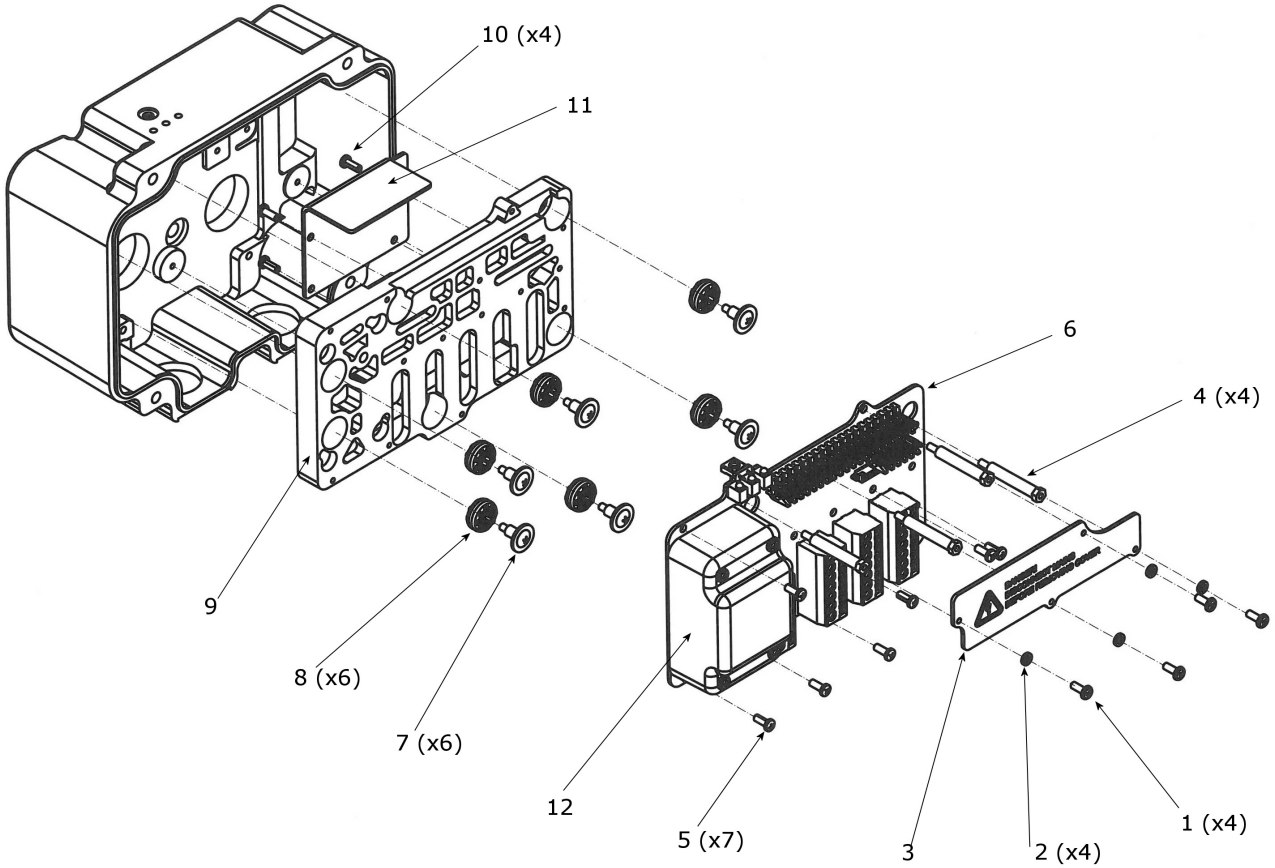


Fig 20 Terminal Board

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

Remove Terminal Board

1 Loosen the four captive screws that attach the cover to the terminal Box.

2 Remove the Terminal Box cover taking care not to strain the earth bonding lead attached to it.

3 Label the wires to aid reassembly, disconnect from the Terminal Board and pull the cables clear from the EMC Glands.

4 Remove four screws (1) and washers (2), taking care that pillars (4) do not turn with the screws (1). Remove wire cover (3).

5 If fitted, remove the Positioner by removing 3 screws and pulling the Positioner away from the terminal board.

6 Carefully remove the four pillars (4).

7 Remove the Power Module (12) or Power Module Cover by undoing the four screws (5) and pulling the unit away from the Terminal Board.

8 Remove the six shoulder screws (7). They will be retained under the terminal board.

9 Carefully hinge the terminal board out from the bottom, and then up to the horizontal position.

10 Remove the four screws (10) and the wire clamp plate (11).

11 Unplug the connectors from the terminal board (6), ensuring that all wires are numbered according to the terminal that they were installed in.

12 Remove the seven screws (5) and remove the terminal board.

Replace Terminal Board

1 Place the new terminal board in position, and loosely secure it with the seven screws (5).

2 Connect the actuator wires to the connectors on the terminal board (6).

3 Bend the wires behind the terminal board support plate (9) and spread them in the slot.

4 Place the wire clamp bracket (11) over the wires, and secure with four screws (10).

5 Apply a small amount of Loctite 2400 or equivalent to the threads on the six shoulder screws (7).

6 Locate the terminal board in the terminal box, and tighten the six shoulder screws (7).

7 Locate the four pillars (4) to the terminal board.

8 Tighten all seven screws (5) and pillars (4) taking care not to over tighten the pillars, as the thread can break off if too much torque is applied.

9 Re-fit the Power Module by aligning the 9 pins with the terminal board, and then tightening the four screws.

10 If a Positioner was originally fitted, re-fit it at this stage by aligning it with the connector on the terminal board and securing it with 3 screws.

11 Place the cover (3) in position, and secure with screws (1) and washers (2), using a small amount of Loctite 2400 or equivalent on the threads.

12 Re-fit the terminal box cover.

4.10 Storage

4.10.1 On-Site Storage

The following conditions must be applied when storing the actuator on site:

- Storage location must be clean, dry and free from excessive vibration and rapid temperature change.

- Permitted temperature range -20° C to +70° C.
- All covers must be fitted and secured.
- If electrical power is not connected, place a packet of desiccant in the motor compartment as follows:
    - Ensure that electrical power to the actuator is isolated.
    - Loosen the socket headed cap screws and carefully lift off the cover.
    - Place a packet of desiccant in the motor compartment.
    - Refit the cover and tighten the socket headed cap screws.
- Replace plastic conduit plugs with appropriate pipe plugs.

4.10.2 Warehouse Storage

The following conditions must be applied when storing the actuator in a warehouse:

- Storage location must be clean, dry and free from excessive vibration and rapid temperature change.
- All covers must be fitted and secured.
- Actuators must not be stored on any floor surface.
- Actuators must be stored upright with the motor compartment facing upwards.
- In areas of high humidity, place a packet of desiccant in the motor compartment as follows:
    - Ensure that electrical power to the actuator is isolated.
    - Loosen the socket headed cap screws and carefully lift off the cover.
    - Place a packet of desiccant in the motor compartment.
    - Refit the cover and tighten the socket headed cap screws.

4.11 Available Spares

The following is a list of available spares for the actuator.

Description	Part Number
Actuator Lid O ring	82434X001
Hall Sensor	82434X005
Heater (110V)	82434X006
Heater (220V)	82434X007
Capacitor (110V)	82434X010
Capacitor (220V)	82434X008
Position Limit Switch Set	82434X012
Handwheel Kit	82434X015
Belt replacement kit	81567X
Terminal PCB	81760X001
Power Module	49261X001
Positioner Board	49682X

Section 5

PID Controller

Contents

5.1 Controller Systems

The standard control systems for the electrically actuated G Valve are based upon the 8071D PID controller.

The 8071D is a compact, powerful and versatile PID controller. The inputs, outputs and internal functions are fully configurable and it is capable of meeting the needs of a wide variety of temperature control systems.

The 8071D can be used in a number of ways:

In conjunction with 2 solid state relays	
In conjunction with an 8073C-DDT solid state relay module	
Incorporated along with 2 solid state relays in an 8072D controller	

The installation, operation and maintenance of the 8071D and related equipment is fully detailed in AMOT publication OMM807100043.

The actuator can also be controlled by an external 4 – 20 mA generated signal applied to an optional Positioner.

Section 6

Temperature Sensor

Contents

6.1 Description

The 8060A temperature sensor is ideal for use with the 8071C and 8072C PID controllers and other PT100 applications. It is a 3 wire RTD with stainless steel thermal well and IP54 aluminium connection head. It is able to use standard 3-core cable and operates in the range –100 to 350° C (-150 to 600° F).

6.1.1 Identification of Model Number

Example code	8060A	1	2	Code Description
Conduit Thread				Size and Torque
		1		M20
		2		PG 13.5
		3		PG 16
		4		1/2” NPT
Installation Thread				Installation Thread
			2	1/2” BSP Tr
			3	1/2” NPT

6.2 Installation

When installing the temperature sensor, comply with the following:

- Position the sensor as close as possible to the point of control.
- Ensure the sensor is positioned at least 6 pipe diameters in length from any junction.
- Ensure the end 40mm of probe is a close as possible to the centre of the flow path.
- Do not run cables in very hot areas which can cause cable failure and inaccurate measurement.
- Avoid installation in areas of high vibration.
- Avoid installation into potential air pockets.
- Position the sensor in an accessible location for future maintenance access.
- Use heat transfer compound in thermal well.

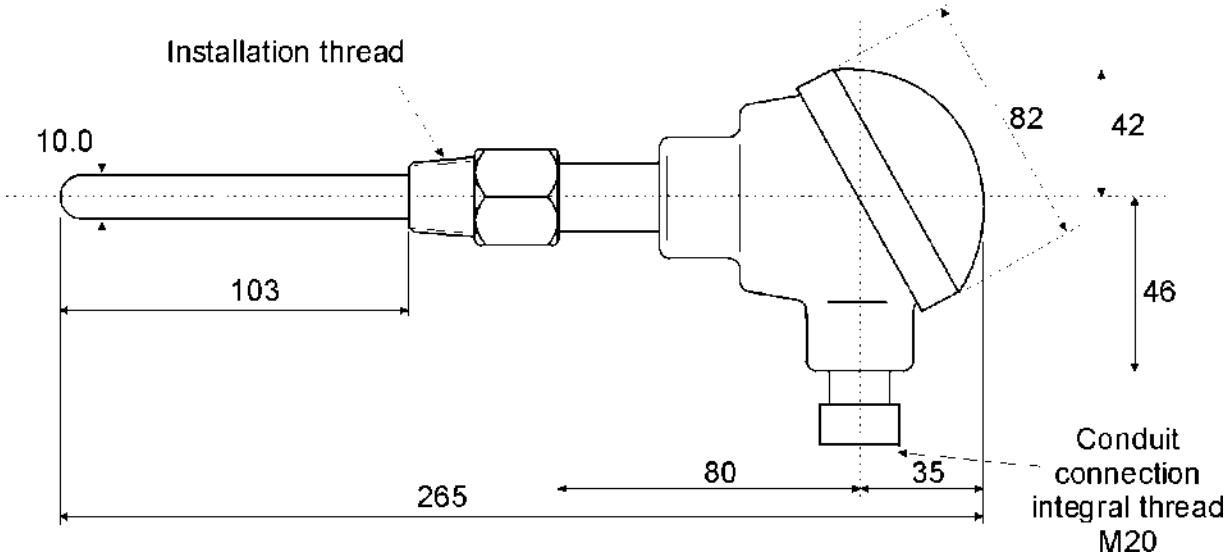


Fig 21 Temperature Sensor

Fig 22 Temperature Sensor Connections

6.3 Maintenance

No maintenance is possible, in the event of failure of the temperature sensor, replace with new item.

Section 7

System Integration

Contents

7.1 Installation Guidance Notes

The following section gives valve installation guidance notes, and manual operational instructions.

Prior to Installation

The AMOT GG Valve should be checked upon receipt for damage sustained during shipping. Contact AMOT (refer back page for contact details) in case of any concerns regarding the valve's integrity.

Handling Devices

WARNING

The valve, its components and its actuator are heavy. All lifting and moving equipment including cranes/hoists, lifting hooks, harnesses and slings etc. must be suitably rated to ensure safe handling.

Suitable support of the valve during lifting must be given to ensure safe relocation of the equipment.

Lifting provision for the larger valve assemblies is provided by means of a number of eyebolts on the valve cover.

The rotor itself can be lifted using a sling fed under the triangular web joining the rotor shaft boss to the rotor face.

Installation Recommendations

When installing the valve, the following factors must be considered:

- Position the valve as close as possible to the point where it can best effect control.
- Install a minimum of 6 pipe diameters in length from any intersection to ensure a good mix of fluids. Too great a distance may induce unnecessary time lags into the system affecting accuracy and stability of temperature control.
- Future maintenance is simplified if the valve is installed in the upright position in an accessible location. Ensure valve access is not limited for future maintenance.

- Do not install the valve in a position that inhibits the operation of the manual override handle or access to any electrical actuator connections.
- If possible, avoid installation in areas with a risk of water spray or extreme dirt.

Valve Installation

WARNING

Valve assemblies should be suitably supported back to a solid structure capable of bearing the load when installed into a system, especially when the valve is installed with the actuator on its side, or below the valve. It is not recommended that the weight of the valve assembly is supported by the adjoining pipework alone.

CAUTIONS

To ensure correct operation of the valve, the valve must not be subject to stresses from misaligned pipe attachment. Ensure that each valve flange is attached to one pipe at a time, and that the flange face to face, and centre to face dimensions are observed. If the pipework cannot be joined to the valve without causing stress to the valve, the pipe positions must be adjusted to suit.

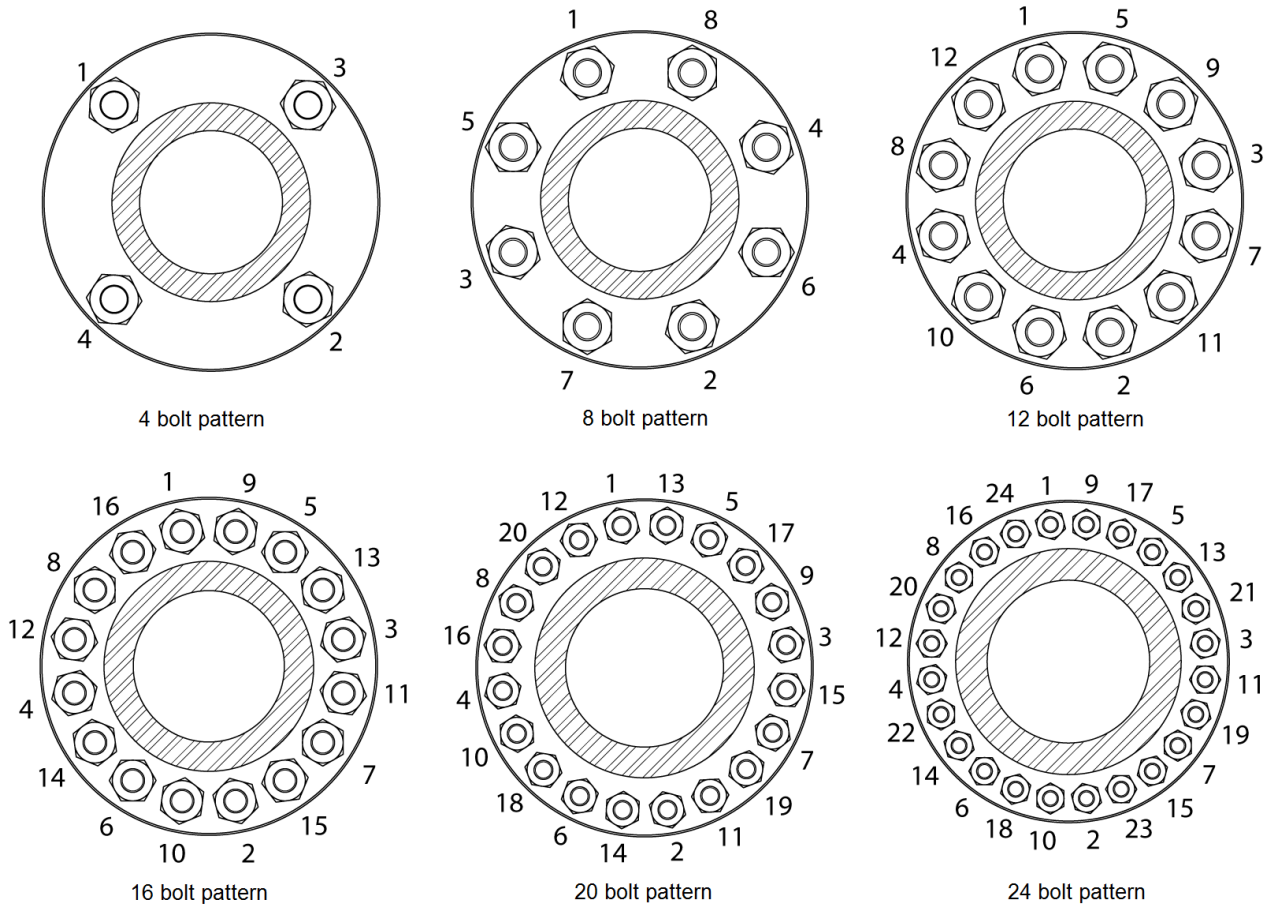
Ensure that any relevant information from the flange standard of the flange specification chosen are followed. e.g. bolting and gasket material requirements.

In situations where the valve has been subject to prolonged low temperatures, such as on-site or warehouse storage, great care must be taken to raise the temperature of the valve at a controlled rate of not more than 1°C/minute, in order to prevent damage to the component parts.

Contaminants such as large grit particles or swarf could damage the rotor or even prevent it from rotating in extreme cases. System fluid flowing through the G Valve must be suitably filtered to ensure uninterrupted functionality.

- If it is not already installed onto the valve, install the valve actuator as per the actuator installation instructions in Section 4.9.1.
- Ensure all flange faces, and valve internals are clean and free from any debris.
- For correct operation, ensure no debris is present on any of the valve externals.
- Insert one bolt (and washer, if fitting) through each hole of the connecting pipe flange.
- Centre the ring gasket on the flange face; the gasket OD should sit comfortably in the circumference created by the fitted bolts.

- Using suitable lifting and supporting equipment, fit the valve to the flanged pipe, ensuring the correct valve port is fitted.
- Use a suitable lubricant on the flange bolt threads to achieve the required coefficient of friction.
- Ensuring the flange gasket is seated correctly on the flange faces, fit the remaining washers to each bolt (if fitting), and fit and tighten the remaining nuts as per the relevant pattern shown in Fig 23, in at least 4 stages to compress the flange gasket uniformly. Note, stages 2 – 5 should be completed with a suitable calibrated torque wrench.
- The recommended final torque value should be based upon the bolt material, the bolt lubricant used, and the material and specification of the flange gasket used. See relevant flange standards for further information.



Tightening stages:

1. Finger Tight
2. 30% Final Torque
3. 60% Final Torque
4. 100% Final Torque
5. Final pass at 100% torque in a clockwise sequence

Fig 23 Bolt Tightening Pattern

Temperature Sensor Installation

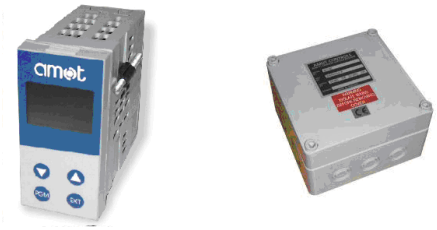
- Position as close as possible to the point of control.
- Ensure positioned at least 6 pipe diameters in length from any junction.
- Ensure the end 40 mm of probe is a close as possible to the centre of the flow path.
- Do not run cables in very hot areas which can cause cable failure and inaccurate measurement.
- Avoid installation in areas of high vibration.
- Avoid installation into potential air pockets.
- Position in an accessible location for future maintenance access.
- Use heat transfer compound in thermal well.

Controller Installation

The installation will be affected by the choice of controller components. Refer to manual OMM807100043 (PID Controllers) for specific installation details.

7.2 System Wiring Diagrams

The System wiring depends on the controller components selected for use. The following options are available:

8071D controller with 2 solid state relays		Fig 24, page 70
8071D controller with an 8073C-DDT solid state relay module		Fig 25, page 71
8072D controller		Fig 26, page 72 Fig 27, page 73
4 – 20 mA input with optional Positioner		Fig 28, page 74
Switched mains voltage input with optional Positioner		Fig 29, page 75

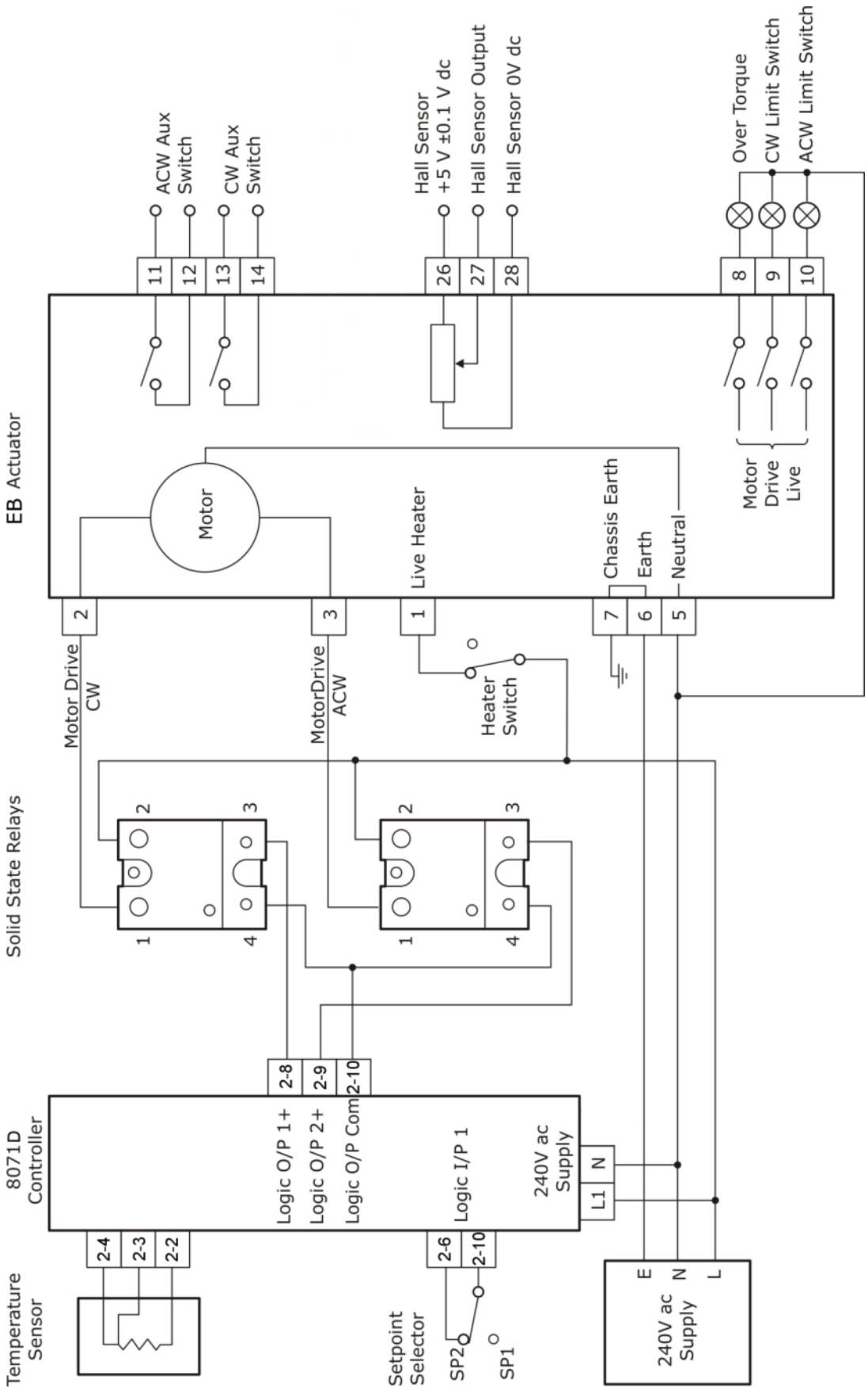


Fig 24 8071D controller with 2 solid state relays

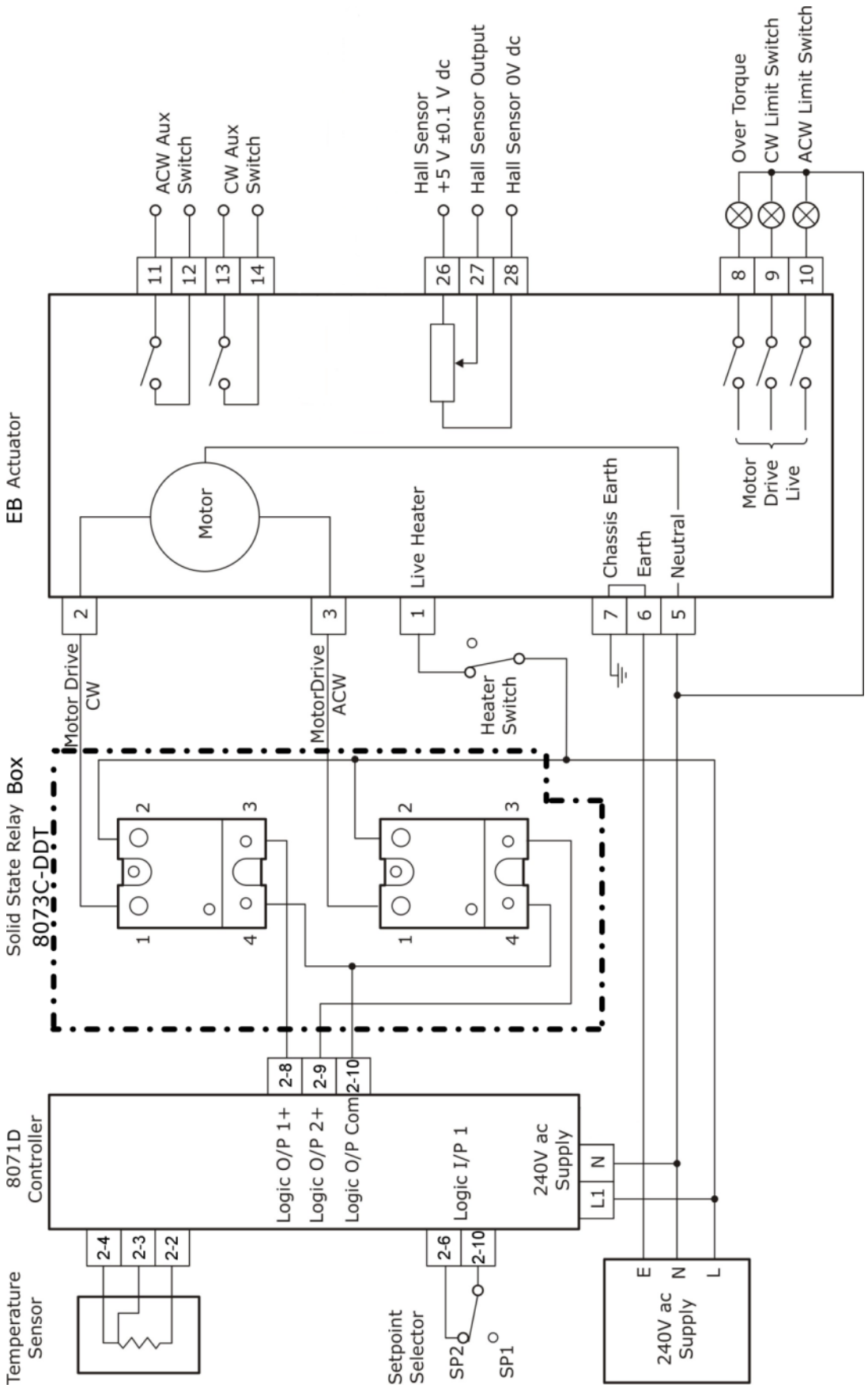


Fig 25 8071D controller with an 8073C-DDT solid state relay module

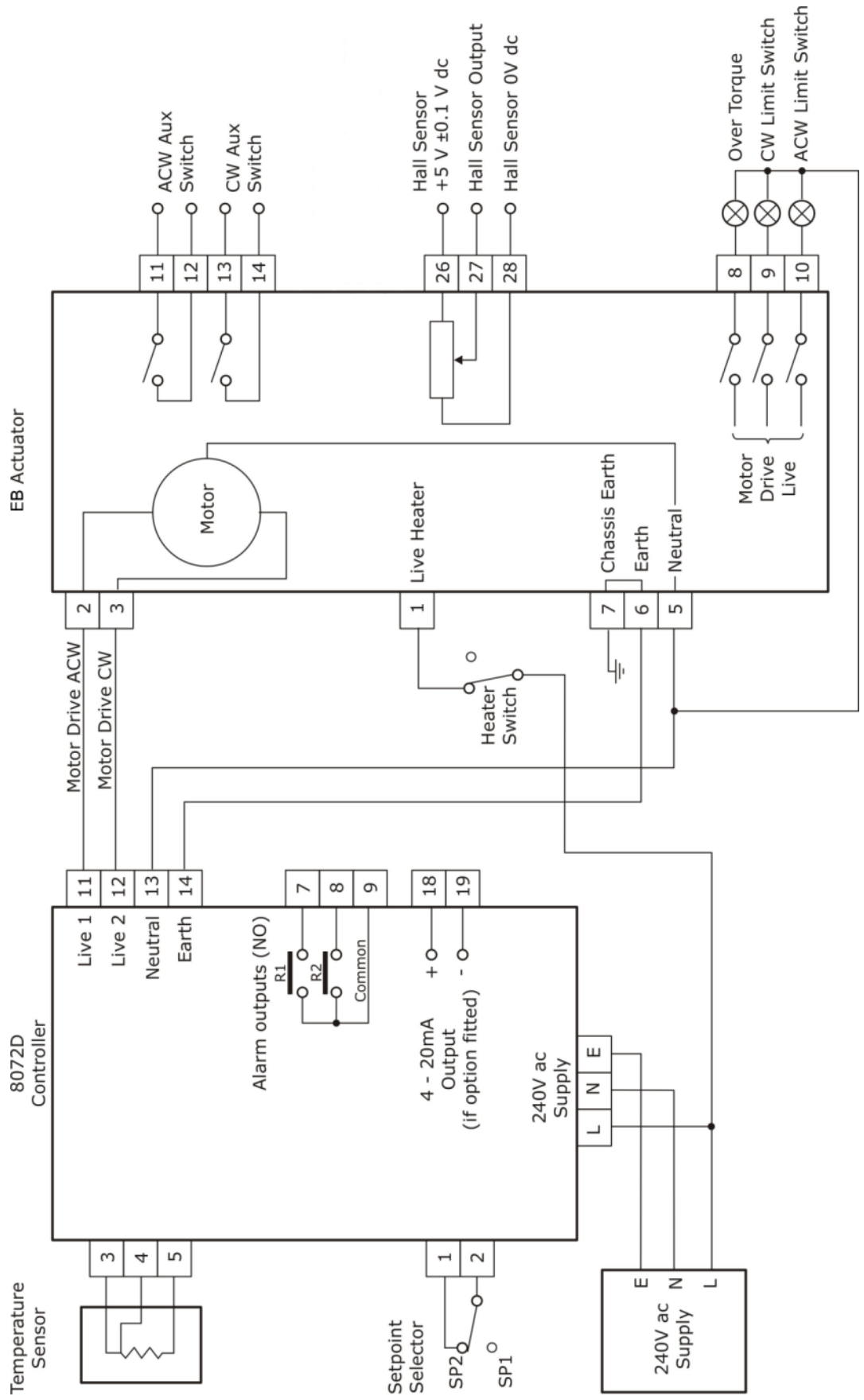


Fig 26 8072D controller

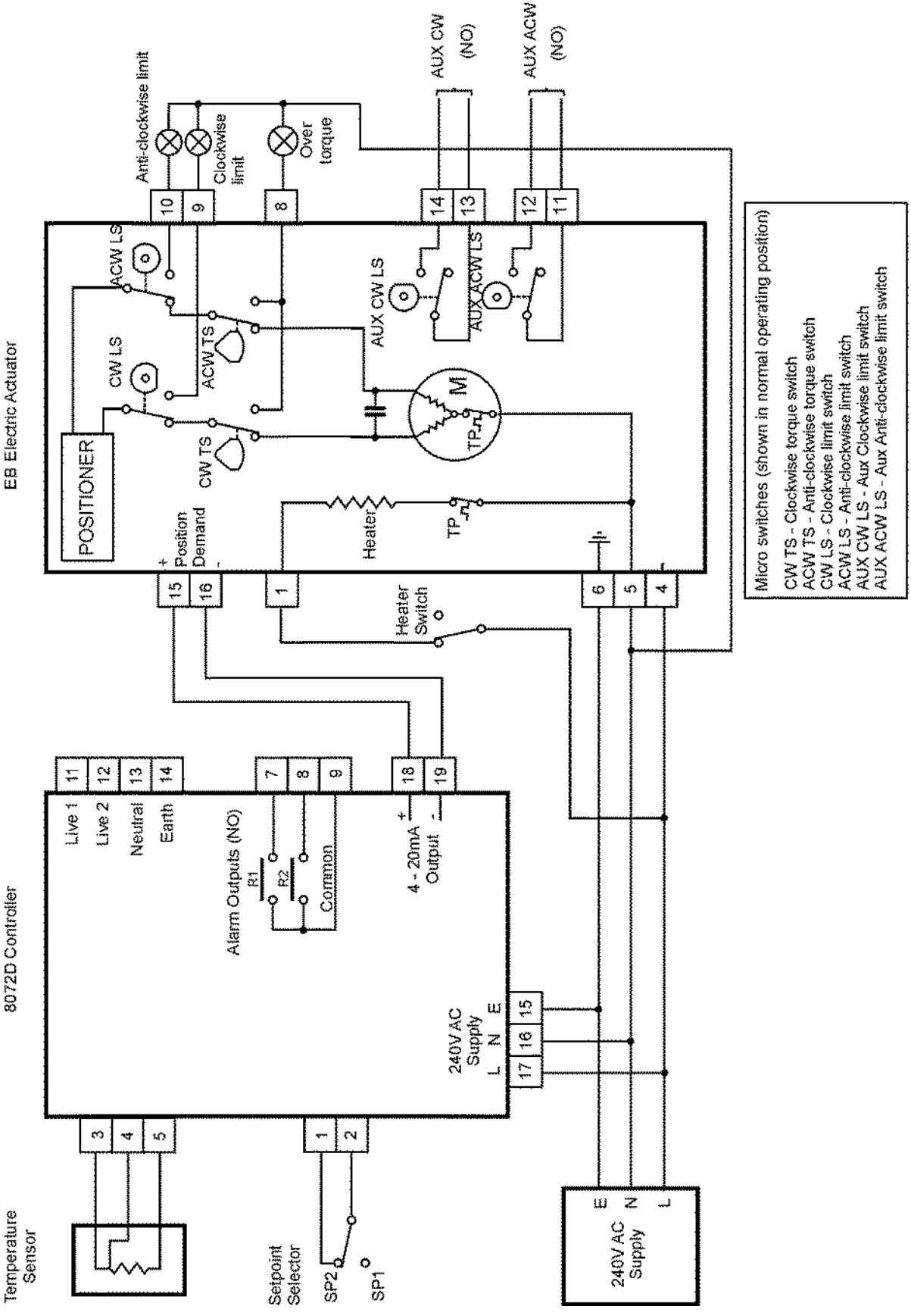


Fig 27 8072D controller (Actuator with Positioner)

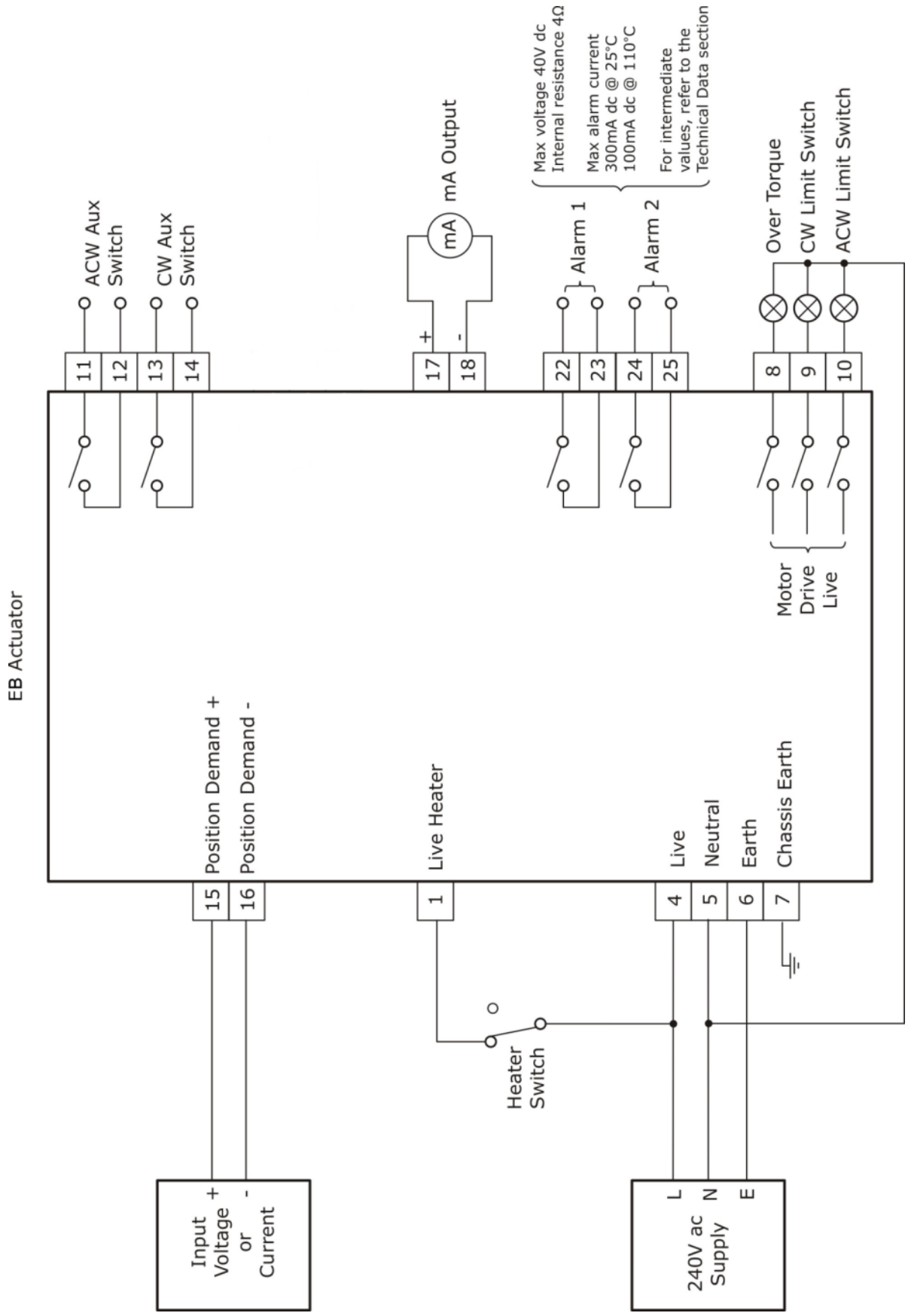


Fig 28 4 – 20 mA input with optional Positioner

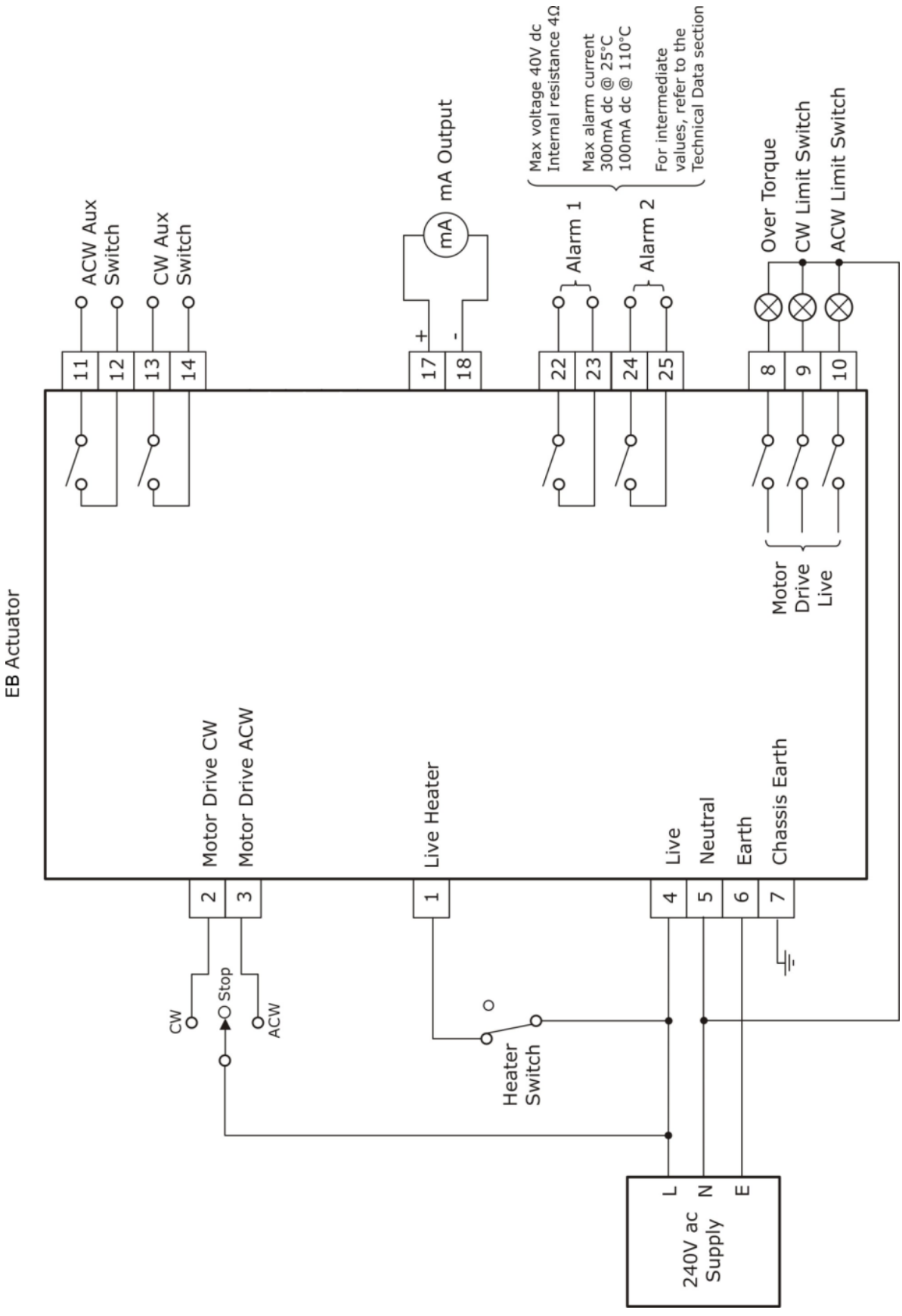


Fig 29 Switched mains voltage input with optional Positioner

Section 8

Troubleshooting

Contents

8.1 Checklist

The following table lists a number of possible faults that could be observed in the system, with the relevant diagnostic and remedial actions.

Fault Indication	Diagnostic Action	Remedial Action
Valve is oscillating or moving in large steps	Check PID values on PID Controller	Adjust PID values
	Check dead band settings on PID Controller	Adjust dead band settings
	Check location of temperature sensor is away from bends and junctions (section 7.1, page 65)	Move temperature sensor
	Check deadband setting of actuator (section 4.6, page 33)	Adjust deadband setting
	Switch off power, remove actuator lid, and check that gears or pulleys are tight (48, page 48)	Adjust gears or pulleys
	Check coupling pin (Fig 8, page 26, item 6)	Replace pin
Valve drives in one direction only	Check electrical connections	
	Check operation of relays	Replace relay
	Check power to actuator	
	Check control system and temperature sensor	
	Check setting of Hall Sensor (4.9.8, page 53)	Adjust position feedback sensor
	On Actuators with a Positioner, Check status of LED(s)	
Valve will not drive in	Check power supply	

either direction	Check actuator motor running	If motor running, replace shear pin between valve and actuator
		If not running, ensure local power supply is compatible with nameplate voltage and current rating.
	Check if motor overheated	Refer to "Motor overheating" below
	Check motor run capacitor	Replace capacitor
	EB: Check Power Module	Replace Positioner or Power Module
Valve operates slowly	Check mains voltage matches rating plate	
Incomplete travel	Check limit switch setting	Adjust
	Check for obstructions in valve	Clear obstructions
	Check mechanical stops on actuator	Adjust
	Check setting of Hall Sensor (4.9.8, page 53)	Adjust position feedback sensor
Motor overheating	Check if valve is oscillating	See "Valve is oscillating" above
	Check for obstructions in valve	Clear obstructions
	Check ambient temperature	Reduce ambient temperature
	Ensure local power supply is compatible with nameplate voltage and current rating.	
	Check electrical connections	
Moisture/Condensation	Check heater in actuator connected	Connect heater
	Check heater continually powered, not just when motor is running	Provide separate power supply
	Check actuator cover seal	Replace if required
	Check indicator window and seal	Replace if required
	Check all cable entries	Tighten if loose
	Ensure unused cable entries are plugged	Plug as required

8.2 EB Positioner Status Indicators

Note

LEDs are only operational when optional Positioner is installed.

Condition	LED			ALARM	
	Green	Amber	Red	1	2
Healthy	Flashing 1 Hz	Off	Off	Healthy	Healthy
Input out of range	Off	Flashing 2 Hz	Off	Fault	Healthy
Motor thermal trip	Off	Off	Flashing 2 Hz	Healthy	Fault
Position feedback fail	Off	Off	Flashing 2 Hz	Healthy	Fault
Factory setup mode	Flashing 2 Hz	Flashing 2 Hz	Flashing 2 Hz	Fault	Fault
Actuator calibration in progress	Flashing 2 Hz	Flashing 2 Hz	Flashing 2 Hz	Fault	Fault

Section 9

Servicing Schedule

Contents

9.1 Overview

In order to obtain maximum trouble free life from the G Valve, AMOT recommends that the following service schedule is adhered to.

9.2 Service Intervals

There is only one level of servicing defined, with servicing occurring every two years.

9.3 Service (every 2 years)

The service comprises two distinct actions – inspection, and replacement of key parts. Due to the complexity of the G Valve system, it is recommended that this service be carried out by an AMOT Service Engineer either onsite or at an AMOT manufacturing and service facility.

When the valve is due to be serviced, contact your nearest AMOT Service Centre (see back cover), for further arrangements.

Table 6 details the items that are to be inspected, and references where the procedure is in this manual for accessing those items. In all cases, check that there are no signs of wear or any other deterioration of the parts. Replace parts as necessary.

Table 6 Minor Service component inspection

Item description	Refer to section number
The inside walls of the valve body	3.4.1
The rotor	3.4.1
Wires in terminal box (EB actuator)	
Wires in actuator body	
Gears, Pulleys and belt in actuator body	Fig 15, page 43
Sleeve bearing in sensor bracket	
All screws and bolts (check that none are loose)	

Table 7 details the parts that are to be replaced, and references where the replacement procedure can be found in this manual.

Table 7 Service component replacement

Item description	**Refer to section number**
Valve body cover O Ring	3.4.1
Top Seal O Ring	3.4.1
Upper Shaft O Ring	3.4.1
Lower Shaft O Ring	3.4.1
Actuator lid O ring	(not shown)
Coupling Pin	Fig 8, page 26, item 6
Capacitor	4.9.10, page 56

Table 8 shows which spares kit to order.

Table 8 Spares Kit required

Kit description	**Kit part number**
2” HIGH FLOW, 115V ac	82379X021
3” STANDARD FLOW, 115V ac	
3” HIGH FLOW, 115V ac	82379X031
4” STANDARD FLOW, 115V ac	
4” HIGH FLOW, 115V ac	82379X041
5” STANDARD FLOW, 115V ac	
6” STANDARD FLOW, 115V ac	
6” HIGH FLOW, 115V ac	82379X061
8” STANDARD FLOW, 115V ac	
2” HIGH FLOW, 230V ac	82379X022
3” STANDARD FLOW, 230V ac	
3” HIGH FLOW, 230V ac	82379X032
4” STANDARD FLOW, 230V ac	
4” HIGH FLOW, 230V ac	82379X042
5” STANDARD FLOW, 230V ac	
6” STANDARD FLOW, 230V ac	

6” HIGH FLOW, 230V ac	82379X062
8” STANDARD FLOW, 230V ac	

9.4 AMOT Field Service

If a valve is required to be serviced or repaired on site, please contact your nearest AMOT Service Centre (see back cover) to arrange for an Engineer to visit.

Section 10

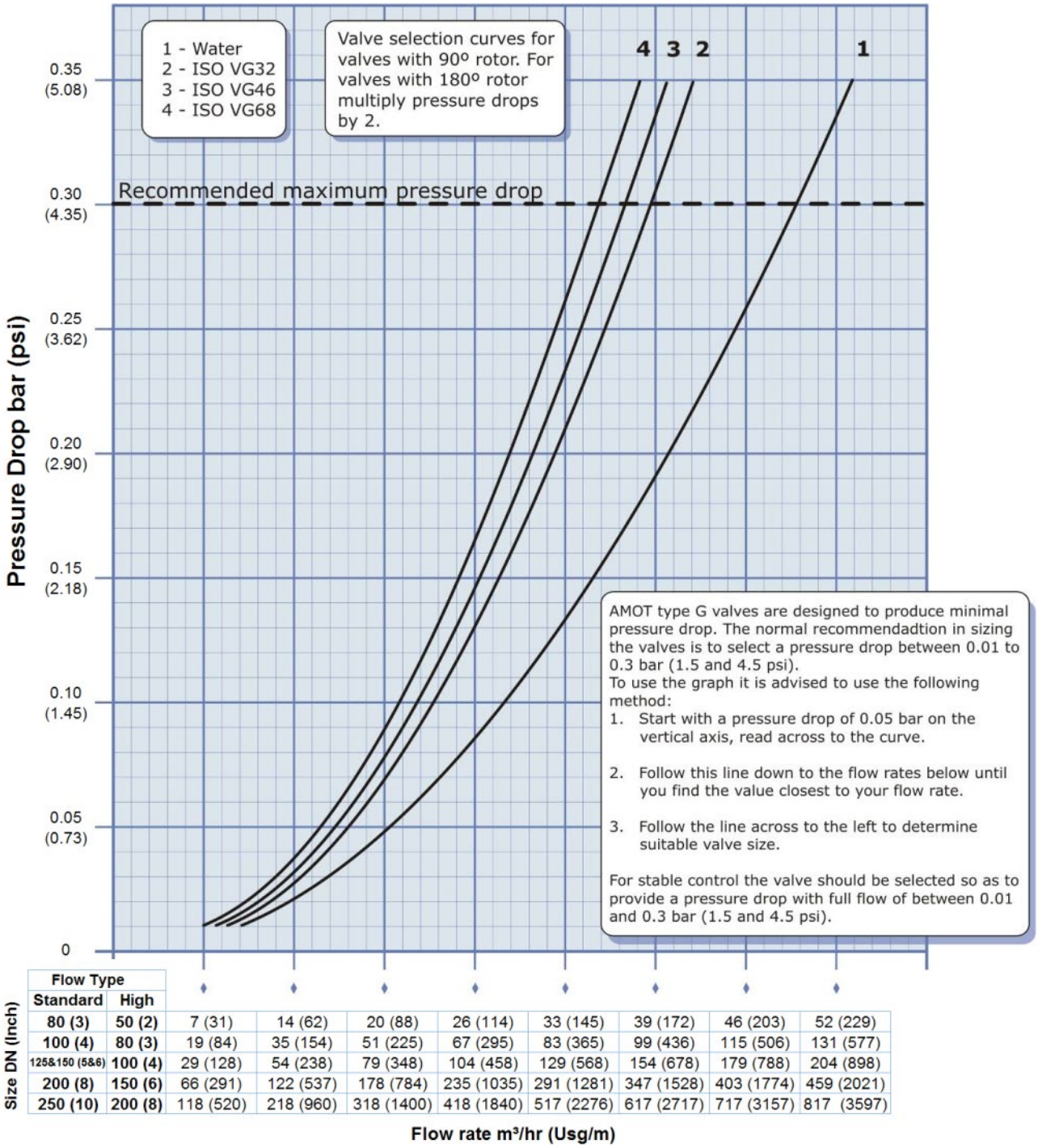
Technical Data

Contents

10.1 Selection of G Valve options

The selection of the G Valve for a particular application will have been completed during the original customer's purchasing procedure. The following information is included in this manual as a quick reference guide to G Valve selection options.

10.1.1 Valve Flow Rate Selection



Size DN (Inch)	Flow Type									
	Standard	High								
	80 (3)	50 (2)	7 (31)	14 (62)	20 (88)	26 (114)	33 (145)	39 (172)	46 (203)	52 (229)
	100 (4)	80 (3)	19 (84)	35 (154)	51 (225)	67 (295)	83 (365)	99 (436)	115 (506)	131 (577)
	125&150 (5&6)	100 (4)	29 (128)	54 (238)	79 (348)	104 (458)	129 (568)	154 (678)	179 (788)	204 (898)
	200 (8)	150 (6)	66 (291)	122 (537)	178 (784)	235 (1035)	291 (1281)	347 (1528)	403 (1774)	459 (2021)
	250 (10)	200 (8)	118 (520)	218 (960)	318 (1400)	418 (1840)	517 (2276)	617 (2717)	717 (3157)	817 (3597)

Flow rate m³/hr (Usg/m)

Fig 30 Valve Selection Curve

10.1.2 Viscosity Correction

For the selection of valves for more viscous fluids than water, the following must be calculated:

Viscosity:

Find the viscosity of the fluid in which the valve is to operate. The viscosity is normally expressed in Centistokes. Where ISO oil is used, the grade number is also the viscosity e.g.: ISO VG46 is 46 Centistokes at 40° C (110° F).

Viscosity Correction:

By using the correction graph below, the flow coefficient correction factor can be established. The correction figure obtained from the graph should then be multiplied by the original flow coefficient which can then be used in the standard valve sizing formulae (Sect 10.1.3).

Example: From the graph below, 100CST = correction factor of 0.68

0.68 x flow coefficient = corrected flow coefficient (Kv or Cv).

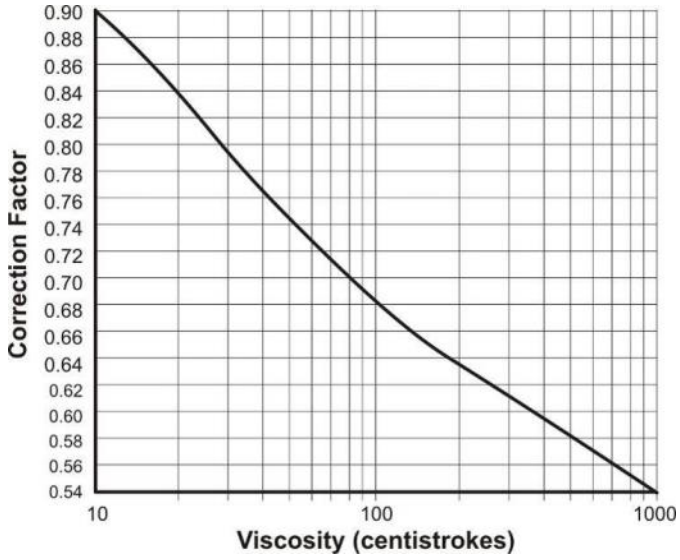


Fig 31 Viscosity Correction Graph

Some approximate viscosities (CST) of SAE oils at 40° C (110° F) are shown below, based on leading oil manufacturers published data:

ENGINE OILS	
Oil	**CST**
SAE 5W	6.8
SAE 10W	32
SAE 20	46
SAE 20W	68
SAE 30	100
SAE 40	150
SAE 50	220

GEAR OILS	
Oil	**CST**
SAE 75W	22
SAE 80W	46
SAE 85W	100
SAE 90	150
SAE 140	460

10.1.3 Valve Sizing Calculations

Pressure Drop

The G valve is designed to produce minimal pressure drop. The normal recommendation when determining the size of an AMOT G valve is a pressure drop between 0.01 and 0.1 bar (0.145 and 1.45 psi).

Note

Kv and Cv values are applicable to 90° rotor versions only. For 180° versions divide the pressure drop by 2.

Valve Flowrate

A Kv is the valve's flow coefficient. It is defined as the number of cubic metres of room temperature water that flows through the valve with a pressure drop of 0.069 bar (Cv is the imperial coefficient).

See the table below for examples of Kv and Cv for the G valves:

SIZE DN (Inch)	Standard Flow	80 (3)	100 (4)	125 (5)	150 (6)	200 (8)	250 (10)
	High Flow	50 (2)	80 (3)	-	100 (4)	150 (6)	200 (8)
	Kv	82	207	323		729	1296
	Cv	96	242	378		851	1513

The basic formula to determine the Kv of a valve is:

$$Kv = Q\sqrt{\frac{SG}{Dp}}$$

Q = Flow (m^3/h)
Dp = Pressure drop (bar)
SG = Specific gravity of fluid
Kv = Valve flow coefficient

The basic formula to determine the Cv of a valve is:

$$Cv = Q\sqrt{\frac{SG}{Dp}}$$

Q = Flow (US gallons/min)
Dp = Pressure drop (psi)
SG = Specific gravity of fluid
Cv = Valve flow coefficient

There are two other ways that this formula can be used to find the flow in m3/h or pressure drop of a valve in bar:

$$Q = Kv\sqrt{\frac{SG}{Dp}} \qquad Dp = \left(\frac{Q}{Kv}\right)^2 SG$$

There are two other ways that this formula can be used to find the flow in US gallons/minute or pressure drop of a valve in PSI:

$$Q = Cv\sqrt{\frac{SG}{Dp}} \qquad Dp = \left(\frac{Q}{Cv}\right)^2 SG$$

10.1.4 Bypass Flowrates

The AMOT G Valve is not a tight shutoff valve. When used in a reasonably balanced pressure system, there will be a small amount of leakage between ports. The actual amount of leakage will vary with the pressure difference between these ports. Consult AMOT for further information if the application is sensitive to leakage rates or if high pressure differences are likely to occur.

10.1.5 Valve Dimensions

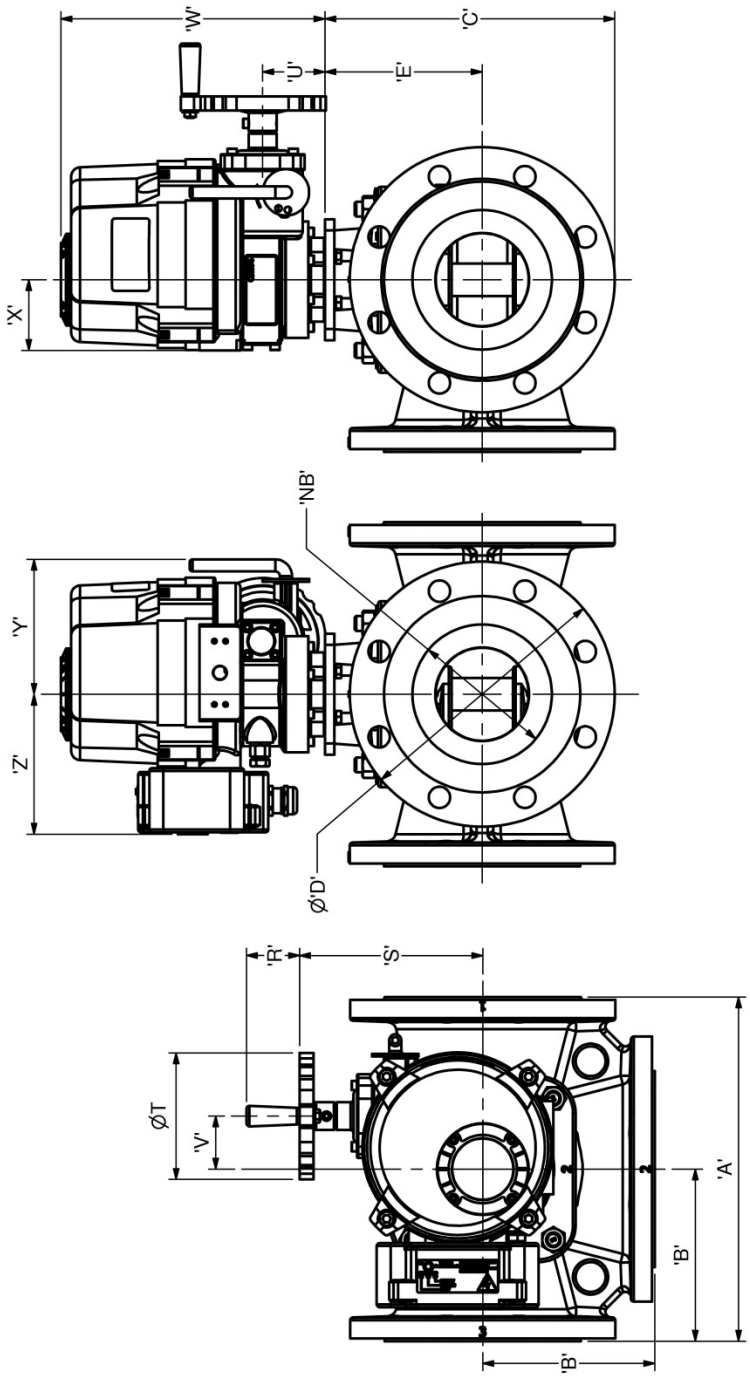


Fig 32 Valve Dimensions

Dimensions in mm

Valve Type	Valve Body						Actuator								
	NB	A	B	C	D	E	R	S	T	U	V	W	X	Y	Z
02GGH	50	230	115	170	165	87	57	197	136	67	57	284	76	145	151
03GGS	80	280	140	207	200	107									
03GGH				227	200	127									
04GGS	100	300	150	242	229	128									
04GGH				281	224	169									
05GGS	125	340	170	296	254	169									
06GGS	150	370	185	312	285	169									
06GGH				346	285	191									
08GGS	200	450	225	371	343	191									
08GGH				418	340	235									
10GGS	250	520	260	455	406	235									

Dimensions in Inches

Valve Type	Valve Body						Actuator								
	NB	A	B	C	D	E	R	S	T	U	V	W	X	Y	Z
02GGH	2	9.055	4.528	6.693	6.496	3.425	2.244	7.756	5.354	2.638	2.244	11.181	2.992	5.709	5.945
03GGS	3	11.024	5.512	8.150	7.874	4.213									
03GGH				8.937	7.874	5.000									
04GGS	4	11.811	5.906	9.528	9.016	5.039									
04GGH				11.063	8.819	6.657									
05GGS	5	13.386	6.693	11.654	10.000	6.654									
06GGS	6	14.567	7.283	12.283	11.220	6.654									
06GGH				13.622	11.220	7.520									
08GGS	8	17.717	8.858	14.606	13.504	7.520									
08GGH				16.457	15.984	9.252									
10GGS	10	20.472	10.236	17.913	15.984	9.2.5									

Note that bolt hole dimensions (quantity, angular deviation, diameter, PCD) meet the requirements of the individual flange standard selected in the model code (Section 2.2).

10.1.6 Valve Weights

The approximate weights of the valve complete with actuator are as follows:

Valve Type	Rotor Type	Valve Material	
		Ductile Iron	
		Kg	lbs
02GGH	90° Rotor	32	71
	180° Rotor	33	73
03GGS	90° Rotor	43	95
	180° Rotor	44	97
03GGH	90° Rotor	44	97
	180° Rotor	45	99
04GGS	90° Rotor	55	121
	180° Rotor	56	123
04GGH	90° Rotor	59	130
	180° Rotor	61	134
05GGS	90° Rotor	73	161
	180° Rotor	75	165
06GGS	90° Rotor	85	187
	180° Rotor	87	192
06GGH	90° Rotor	89	196
	180° Rotor	91	201
08GGS	90° Rotor	120	265
	180° Rotor	122	269

10.2 Technical Specifications

10.2.1 Actuator

Power supply

110 V/220 V ac ± 10%
50/60 Hz single phase

Motor thermal protection

Open 150°C nominal
Close 97°C nominal

Hall Sensor

5 V dc power supply
Linear voltage output

Limit Switches

Two x open/close SPDT
250 V ac, 10 A

Operating angle

110° max

Duty cycle

100% at 20°C

Conduit entry

CM25 x 1.5 mm

Mechanical stop

Two adjustable screws

Manual override

Automated declutching mechanism

Materials

Steel, Aluminium alloy, Bronze, Polycarbonate

External coating

Dry powder polyester

Weatherproof enclosure

IP66, NEMA 4 and 6

Ambient temperature

-20° C to +70° C

Ambient humidity

90% RH max (non-condensing)

Anti-condensation heater

7 – 10 W (including thermal protection;
Open 75°C nominal
Close 54°C nominal)

Vibration

5 – 100 Hz 4 g
100 – 300 Hz 1 g
(for defined period)[2]
5-300Hz 1g

Performance

Model	Max output torque	Stroke time (seconds)		Max current (Amps)	
		50 Hz	60 Hz	220 V	110 V
EB100	100 Nm	25	21	0.88	1.7

[2] Meets IACS Marine Class Specifications

Americas

AMOT USA
8824 Fallbrook Dr
Houston
Texas 77064
USA

Tel: +1 (281) 940 1800
Fax: +1 (713) 559 9419
Email: sales@amotusa.com

Asia and Australasia

AMOT China
Bd 7A, No 568, Long Pan Rd.
Malu Jiading
Shanghai 201801
China

Tel: +86 (0) 21 5910 4052
Fax: +86 (0) 21 5910 4050
Email: shanghai@amot.com

AMOT Singapore
10 Eunos Road 8 #12-06
Singapore Post Centre
Singapore 408600

Tel: +65 (0) 6408 6265
Fax: +65 (0) 6293 3307
Email: singapore@amot.com

Europe and Africa

AMOT UK
Western Way
Bury St Edmunds
Suffolk, IP33 3SZ
England

Tel: +44 (0) 1284 762222
Fax: +44 (0) 1284 760256
Email: info@amot.com

AMOT Controls GmbH
Rondenbarg 25
22525 Hamburg
Germany

Tel: +49 (0) 40 8537 1298
Tel: +49 (0) 40 8537 1331
Email: germany@amot.com

www.amot.com