3-Way Temperature Control Valve

Model G, Version G and Accessories

Typical applications

For engines, turbines, gearboxes and heat exchangers:

- Charge air cooling
- Secondary cooling systems
- Fuel and lube oil preheating
- Co-generation
- Engine jacket water

For refineries, chemical plants and oil reproduction:

- Waste heat boilers
- Product coolers
- Product heaters
- Product condensers



Pneumatic GG valve

Key benefits

- Ease of integration valve size matches pipe size, resulting in reduced installation time and installation costs
- Flexible design ports can be configured to suit installation
- Low pressure drop compared to other valve types
- Small physical size
- Hand wheel allows manual adjustment of valve (optional on pneumatic valve) - simplified set up and maintenance





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Overview

AMOT G valves are 3-way control valves consisting of a heavy duty rotary valve and either a quarter turn electric or pneumatic actuator. The valves provide a high degree of accuracy and repeatability for accurate temperature control and are equally accurate in mixing or diverting service over a wide flow range.

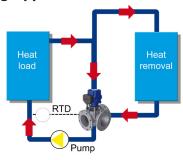
The heavy duty rotor design provides tight temperature control without high maintenance requirements. The system is available in three standard control configurations: electric; pneumatic; and electro-pneumatic, offering flexibility for most requirements. Designed

for high vibration service, the AMOT G valves are qualified to Lloyd's Marine Requirements for shipboard service. Valves can be directly mounted to reciprocating machinery, such as diesel engines, without vibration isolation. The heavy duty actuators are specially reinforced to provide vibration resistance.

The standard valves are suitable for a variety of fluids such as water, water/glycol, sea water, lubricating and hydraulic oils. Optional body materials are available for services involving synthetic or fire resistant oils, deionized water and ammonia or freon in oil.

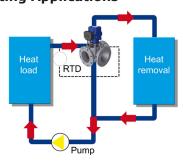
Applications

Mixing Applications



Lubricating 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.

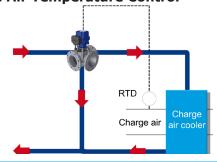
Diverting Applications



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, increasing efficiency, enhancing performance and helping to meet today's environmental requirements.

System Types

Electric Valve



Electric GG Valve

For the electric valve, the actuator of the G valve assembly uses an electric motor which rotates in either direction in response to the ON-OFF signals received. The motor drives a gearbox connected to the rotor shaft and turns the valve rotor clockwise or counter-clockwise, a maximum of 90 degrees. At the end of travel, limit switches are incorporated to isolate the electrical supply to the motor when the valve rotor has reached either end of the rotation. A feedback hall sensor is standard and provides position indication to the control system.

The electric actuator is a rugged, compact and lightweight quarter turn actuator having enclosure protection to IP67.

The actuator is powered by an electric motor driving a worm-type gearbox. The worm gearbox prevents reverse drive due to fluid forces. It is fitted with manual override as standard, enabling valve operation without power.

A thermal cutout is fitted preventing overheating. Limit switches at each end of stroke disconnect motor power when end stroke is reached. These can also be used for remote indication.

See page 15 for more information on the electric actuator.

Electric System

Probe 8060



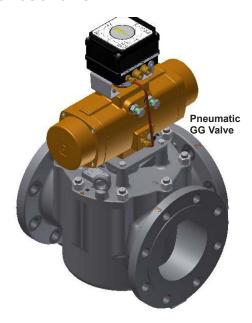
IP67 enclosure

The electric valve system incorporates the use of an electrically actuated three-way control valve with an electronic controller. The 8071D PID Controller can be either panel or wall mounted (see page 18 for more information). The system is completed with a temperature sensor type 8060 (see page 18 for details).

The electric G Valve system is simple to install with standard four core cable, and provides more accurate measurement and control than typical pneumatically operated systems.

System Types continued

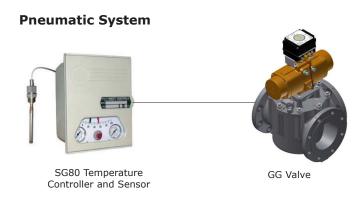
Pneumatic Valve



The pneumatic valve uses a spring return pneumatic actuator and positioner to control the rotation of the valve in response to an input signal from a pneumatic or electro-pneumatic control system. The pneumatic control system sends a pneumatic signal ranging from 0.21 to 1.03 bar (3 to 15 psi) to the actuator to correctly position the valve at the desired temperature setting. The pneumatic control system usually consists of a P+I pneumatic controller, sensor and the necessary air supply conditioning equipment (regulators, filters and water traps).

The pneumatic actuator is a rugged, quarter turn, double piston actuator operating on a scotch yoke principle.

The actuator is fitted with spring return as standard allowing fail-safe configuration if necessary. It is also fitted with a valve positioner enabling accurate and repeatable movement. See page 16 for more information on the pneumatic actuator.



The pneumatic valve system incorporates a pneumatically actuated three-way control valve with controller and integral temperature sensor, the SG80, which can be panel or wall mounted. For more information on the SG80, see page 20. The pneumatic G valve system is ideal when there is a lack of electricity or when a fail-safe system is needed.

Electro-Pneumatic System



The electro-pneumatic valve system combines both electric and pneumatic technology, consisting of a pneumatically actuated three-way control valve with an electro-pneumatic converter, type 8064A. See page 19 for more details.

The probe sends a resistance signal to the electronic controller, which in turn sends a 4 to 20mA signal to an I/P converter that converts this to a pneumatic signal.

The electro-pneumatic system combines the features and functionality of the AMOT electronic control system with the fail-safe action benefits of a pneumatically actuated valve.

Overview of Valve Body



Valve Body

Key features and benefits

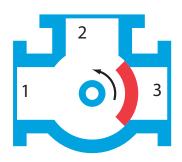
- Lightweight and compact
- Configurable ports allowing flexibility on installation
- Low pressure drop enables savings on either valve or pump size
- High accuracy providing better temperature control

Specification

Flow to:	720m³/hr For valves with higher flow rates see datasho	3,170 US gpm eet GEF_GPD_Temp_Control_Valve
Sizes:	Standard flow	High flow
	80mm - 200mm (3" - 8") For 250 mm (10") and above see Datasheet	80mm - 200mm (2" - 8") GEF_GPD_Temp_Control_Valve
Body material:	Ductile iron	High performance iron, for fresh water, lubricating oils
Seal material:	Flourocarbon (Viton, FKM)	
Flanges:	EN 1092, ASME and JIS standards.	
Maximum internal valve pressure:	10 bar	(145 psi)
Maximum temperature of fluid:	100°C	(212°F)
Vibration:	Exceeds the requirements of Lloyd's F Test Specification Number 1, 2002, V For both electric and pneumatic:	,, ,, ,,

Frequency range	Displacement	Acceleration	Lloyd's
5 - 25 Hz	+/- 1.6mm		+/- 1.6mm
25 - 100 Hz		+/- 5.0g (49 m/s ²)	+/- 4.0g (39 m/s ²)
100 - 300 Hz		+/- 1.0g (9.81 m/s²) 90 minute	No requirement

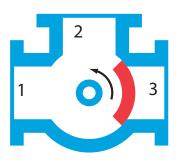
Modes of Operation - Electrically Actuated



The unique construction of the AMOT G valve provides total flexibility by allowing you to select the valve port positions most ideally suited to meet your application requirements. There are two main types of mode of operation: 90° rotor that allows either ports 1 or 3 to be selected as the common port; and 180° rotor that requires port 2 to be the common port. Arrow indicates valve movement with increasing temperature or mA, as viewed from above (see diagram). For electrically actuated valves, on loss of signal the actuator is set up by default to stop in its current position.

	Electric actua (switched live	tor input)	Electric actuat (4-20mA input)	or direct acting	Electric actua (20-4mA input	tor reverse acting
	Cold position	Hot position	4mA (cold)	20mA (hot)	20mA (cold)	4mA (hot)
Mode 32						
Mode 21			6			
Mode 12	6		6		6	
Mode 23						
Mode 13				<u></u>		<u></u>
Mode 31						

Modes of Operation - Pneumatically Actuated

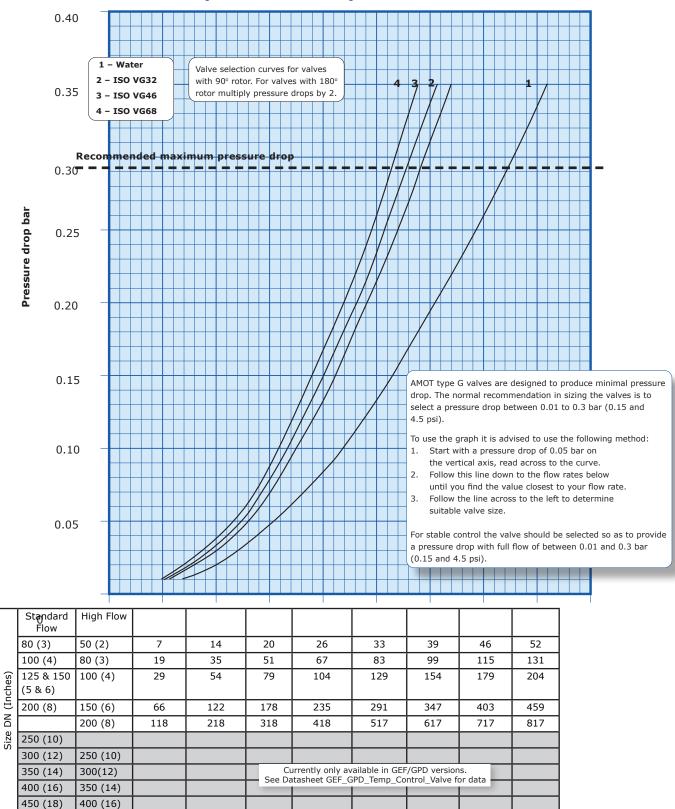


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	Pneumatic act	uator direct ac	ting	Pneumatic act	uator reverse a	cting
	3 PSI (cold)	15 PSI (hot)	No signal	15 PSI (cold)	3 PSI (hot)	No signal
Mode 32						
Mode 21	6					
Mode 12	6			6		· ·
Mode 23						
Mode 13		<u></u>			5	5
Mode 31						

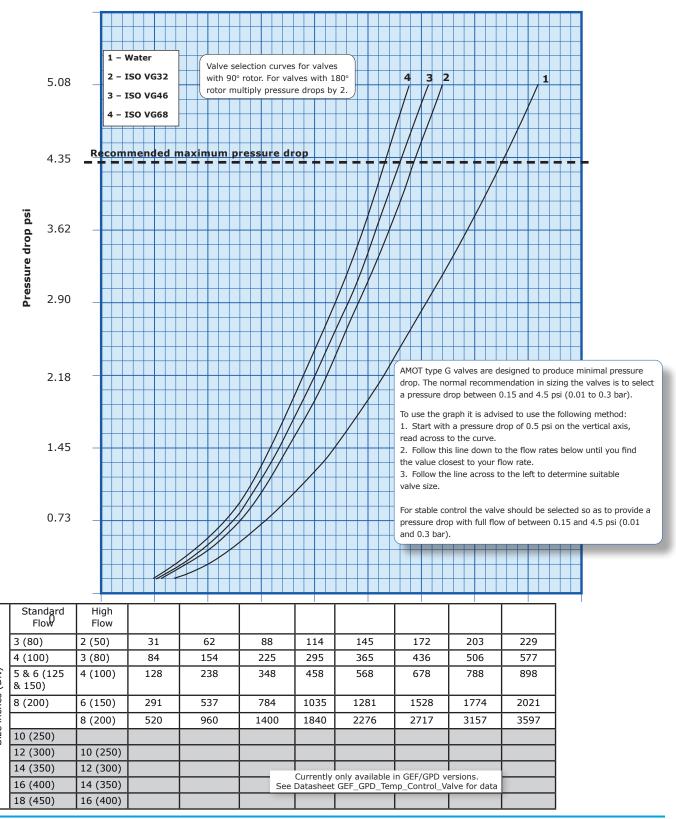
Valve Sizing (Metric units)

Valve Flowrate Selection (Flowrate m³/hr)



Valve Sizing (English units)

Valve Flowrate Selection (Flowrate USg/m)



Valve Sizing

Viscosity Correction

Example:

From the graph below:

100 cSt = correction factor of 0.68

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

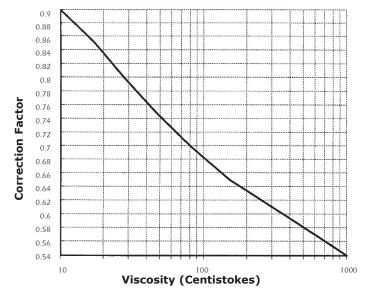
Some approximate viscosities (cSt) of SAE oils at 40°C (110°F) are shown below, based on leading oil manufacturers published data.

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 eg ISO VG46 is 46 centistokes at 40°C (104°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.

Viscosity Correction Curve (Fv)



Some approximate viscosities (cSt) of SAE oils at 40°C (104°F) are shown below, based on leading oil manufacturers' published data.

SAE Oil Viscosities

Engine	e 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

oils
cSt
22
46
100
150
460

Valve Sizing

Valve Sizing Calculations

Valve Flowrate

See the table below for examples of Kv and Cv:

Size DN (in)	Standard flow High flow	80 (3) 50 (2)	100 (4) 80 (3)	150 (6) 100 (4)	200 (8) 150 (6)	200 (8)	250 (10)	300 (12) 250 (10)	350 (14) 300 (12)	400 (16) 350 (14)	450 (18) 400 (16)
Kv	l	82	207	323	729	1296					
Cv		96	242	378	851	1513					

Currently only available in GEF/GPD versions. See Datasheet GEF_GPD_Temp_Control_Valve for data

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 0.3 bar (0.15 and 4.5 psi). **Note:** Kv and Cv values are applicable to 90° rotor versions only.

Kv is the flow coefficient in metric units. It is defined as the flow rate in cubic meters per hour (m^3/h) of water at a temperature of 16° celsius with a pressure drop across the valve of 1 bar. Cv is the imperial coefficient. It is defined as the flow rate in US Gallons per minute [gpm] of water at a temperature of 60° fahrenheit with a pressure drop across the valve of 1 psi. (Kv = 0.865 Cv / Cv = 1.156 Kv)

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

There are two other ways that this formula can be used to find the flow in m^3/h or pressure drop of a valve in bar:

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

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 US gallons/minute or pressure drop of a valve in PSI: \square \square

PSI:

$$Q = Cv \sqrt{\frac{Dp}{SG}}$$
 $Dp = \left[\frac{Q}{Cv}\right]^2 SG$

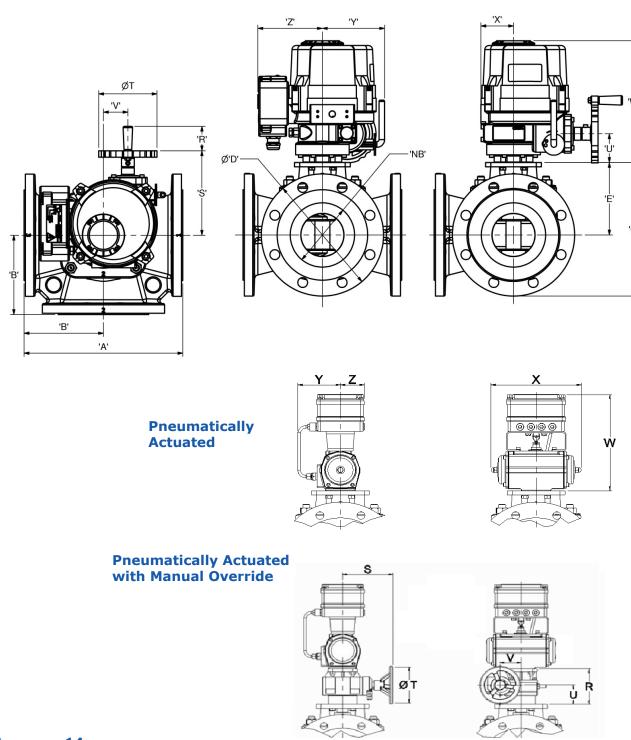
Valve Bypass Flowrates

The AMOT G Valve is not a tight shutoff valve. When used in a reasonably balanced pressure system there will be some small amounts 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.

Dimensions

Electrically Actuated with Manual Override



See page 14 for dimensions

Dimensions continued

Dimensions in mm

Valve Type			Valve	Body				Electrically Actuated									Р	neuma	tically	Actuate	d			Valve Type	
valve Type	NB	Α	В	С	D	E	R	s	Т	U	٧	w	Х	Υ	Z	R*	S*	T*	U*	V*	w	х	Υ	Z	valve Type
03GGS	80	280	140	207	200	107																			03GGS
03GGH	00	200	140	227	200	127																			03GGH
04GGS	100	300	150	242	229	128										95	123	100	52	52	245	192	95	53	04GGS
04GGH	100	300	130	281	224	169										95	123	100	32	52	245	192	95	55	04GGH
05GGS	125	340	170	296	254	169	57	197	136	67	57	284	76	145	151										05GGH
06GGS	150	370	185	312	285	169																			06GGS
06GGH	150	370	100	346	285	191										100									06GGH
08GGS	200	450	225	371	343	191										113	155	200	45	79	297	362	115	53	08GGS
08GGH	200	430	223	418	340	235										113									08GGH

Dimensions in inches

Value Tyme			Valve	Body			Electrically Actuated										Р	neuma	tically	Actuated	t			Value Tune	
Valve Type	NB	Α	В	С	D	E	R	s	Т	U	٧	w	х	Υ	Z	R*	S*	T*	U*	V*	w	х	Υ	Z	Valve Type
03GGS	3.00	11.02	5.51	8.15	7.87	4.21																			03GGS
03GGH	3.00	11.02	5.51	8.94	7.87	5.00																			03GGH
04GGS	4.00	11.81	5.91	9.53	9.02	5.04										3.74	4.84	3.94	2.05	2.05	9.65	7.56	3.74	2.00	04GGS
04GGH	4.00	11.01	5.91	11.06	8.82	6.65										3.74	4.04	3.94	2.00	2.03	9.05	7.50	3.74	2.09	04GGH
05GGS	5.00	13.39	6.69	11.65	10.00	6.65	2.24	7.76	5.35	2.64	2.24	11.18	2.99	5.71	5.95										05GGS
06GGS	6.00	14.57	7.28	12.28	11.22	6.65																			06GGS
06GGH	0.00	14.57	1.20	13.62	11.22	7.52										3.94									06GGH
08GGS	8.00	17.72	8.86	14.61	13.50	7.52										4.45	6.10	7.87	1.77	3.11	11.69	14.25	4.53	2.09	08GGS
08GGH	6.00	11.12	0.00	16.46	13.39	9.25										4.43									08GGH

^{*} Relevant only to pneumatic actuator with manual override version.

Bolthole dimensions are as per the relevant specification chosen in the model coding. Full dimensional details can be provided on request.

Overview of Electric Actuation



Electric Actuator

Key features and benefits

- Self-locking with minimum backlash in the transmission - prevents valve movement due to flow
- Auxiliary limit switches for user connection
- Manual override fitted as standard valve can be operated in event of power failure
- Two torque switches provide protection in event of actuator overloading

Specification

Power		115V ± 10% or 230V =	± 10%	50/60Hz single	ohase	
Limit switch	nes	Two open/close SPDT		250V AC, 10A		
Motor thern	nal protection	Fitted as standard				
Angular rot	ation	110° max		Quarter turn		
Position ser	ısor	Contactless half effect				
Cable entry		2 x M25 x 1.5		IP68 glands pro	vided	
Mechanical	stop	Two adjustable screws				
Manual ove	rride	Fitted as standard				
Materials		Steel, aluminum alloy,	aluminum l	oronze, polycarbo	nate	
External co	ating	Dry powder polyester				
Weatherpro	of enclosure	IP67, NEMA 4 and 6				
Ambient tei	mperature	-20°C to +70°C (Contact us for -40°C v	/ariants)	(-4°F to +158°F	.)	
Ambient hu	midity	90% RH max (non-con	densing)			
Anti-conder	nsation heater	7 - 10W				
Vibration re	esistance	5 - 100 Hz		5g		
		100 - 300 Hz		1g		
Performanc	e	Duty cycle 20°C	Stroke ti	me (secs)	Max curr	rent (A)
Standard	High flow		50 Hz	60 Hz	220V	110V
	50	Currently only available in GEF/	GPD versions.	See Datasheet GEF_GPI	D_Temp_Contro	l_Valve for data
80 - 200	80 - 200	65%	25	21	0.88	1.7
250 - 450	250 - 400	Currently only available in GEF/	GPD versions.	See Datasheet GEF_GPI	D_Temp_Contro	l_Valve for data

Electronic Positioner



Electronic Positioner

The AMOT actuator/valve positioner is configured to accept an industry standard 4-20mA position demand input signal, and uses this to operate internal solid state switching to drive the motor.

The microprocessor based unit uses the signal from the contactless position sensor to accurately position the actuator, taking into account motor response time and actuator overshoot.

The positioner is split into two parts, housed in the terminal box. There is a power module, in which all high voltage circuits are fully encapsulated to withstand high vibration, and a control board. This design allows for easy maintenance.

There are three LEDs on the terminal box on the side of the actuator, providing clear visual indication of actuator status. Two alarm outputs allow for remote fault monitoring.

User configuration allows:

- The input can be selected from 4-20mA,
 0-20mA, 0-5V, 0-10V and 2-10V by switches.
- 4-20mA output, which shows actual valve position, can be configured to retransmit the demand input signal.
- A switch allows for easy configuration of which end of stroke corresponds with a 4mA demand.
- The action on sensor fail can be selected from moving to either the 4mA or the 20mA positions, but is factory set to not moving.
- The deadband can be increased to aid performance with noisy input signals.
- When necessary, such as after maintenance, the actuator can be recalibrated at the touch of a button.

Overview of Pneumatic Actuation



Key features and benefits

- A rugged quarter turn, double piston, rack and pinion pneumatic actuator with spring return and valve positioner as standard.
- Can be configured fail-safe

Specification

Housing	Cast aluminum base, steel co	over and two part Polyurethane paint finish.
Supply pressure	6 to 8 bar	(90 to 115 psi)
Signal pressure	0.21 to 1.03 bar	(3 to 15 psi)
Pressure connections	G 1/4	(1/4 NPT)
Manual override	Optional	

How to Order

Use the table below to select the unique specification of your G valve:

Exa	mple Code	06GG	S	D	В	S	32	EA	В	CA	-AA	Code Description				
												Nominal Bore Size		Comments		
_		02GG										2 Inch (DN50)		High Flow Only		
	Valve	03GG										3 Inch (DN80)		,		
	Size &	04GG										4 Inch (DN100)				
	Model	05GG										5 Inch (DN 125) Standard Flow only				
	Houci	06GG										6 Inch (DN150)		Standard Flow Only		
		08GG										8 Inch (DN200)				
												Valve Flow Type (Refer to flow coefficient table for Cv/Kv data)				
	Valve Flo	ow S Si										Chandard Flow Value	Standard Flow Valve			
	Type		_ <u>5</u>									High Flow Valve				
I -			П									Body Material				
Valve Body Selection	Valve Body					8						Ductile Iron				
	D D												= 0	=1 . / =		
<u>ĕ</u>												Flange Class	Flange Standard	Flat / Raised Face		
Se.					Α							PN6	EN 1092	Raised		
× ×	Valve Fla	ange			В							PN10	EN 1092	Raised		
1 B	Connect		ndar	d	С							PN16	EN 1092	Raised		
ă	and Clas				F							125 lb (Flat Face)	ASME	Flat		
Š	and clas				J							150 lb	ASME	Raised		
ā					L M							10K	JIS	Flat		
>												5K	JIS	Flat		
	Rotor Type											Rotor Type				
	KOLOI I Y	þe				S						Standard Rotor				
l F												Rotor Po	Rotor Position Rotation Starting Fro			
												Cold Process	Hot Process	Cold Position		
	Valve Mode of Operation 12 23 31 21									Port 1	Port 2					
										Port 2	Port 3	Clockwise				
										Port 3	Port 1					
										Port 2	Port 1	Anticlockwise				
	32										Port 3		Port 2			
	13												Port 1	Port 3		
\vdash							10					Power Supply	Air Connection	Manual override		
							0	EA				100 -120 Vac 50/60Hz	-			
		valve Actuation Type						EB				200 - 240 Vac 50/60Hz		Fitted as Standard		
		Electric Actuator Power Supply						P1				- 200 - 240 Vac 30/00112	G1/4 (1/4" BSPP)			
							⊐	P2				-	1/4" NPT	Not Fitted		
							P3				-	G1/4 (1/4" BSPP)				
Ę	6 P3											-	1/4" NPT	Fitted		
Actuator Selection								74				Input Signal	Comments			
ĕ												Relays, Switched Live Su				
Š								Elec	A B			4-20mA	PPIY			
<u>-</u>	Actuator Control Input Signal							Ξ	C				On Increasing Temperature			
유												20-4mA				
ra								ne	1			3-15psi				
ฐ	ā 2											15-3psi				
•												Feedback Signal	Not andicable 6. A :	ata Cartal Inset Cine		
	Actuator Foodback Signal								. <u>.</u> 2	AA		None	Not applicable for Actuator Control Input Signal			
									늉			4-20mA Position Retransmit				
									<u>ë</u>	CA						
	□ EA □								ш —	EA		20-4mA Position Retransmit				
									Pne	00		None				
	Customer Special Options										-AA	Standard Product				
											_***	Customer Special Code Assigned				
ш												ppecial code /				

Accessories

PID Valve Controllers 8071/8072D and Solid State Relays 47581L001







Solid State Relay 47581L001



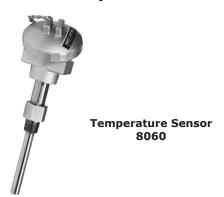
PID Controller 8071D

Key features and benefits

- Fully programmable PID-based control
 allows easy system configuration
- Universal inputs; RTD's, thermocouple, or standard 4-20mA signal gives maximum system design flexibility
- Can be operated in manual mode easy maintenance and set up

For further information and how to order these products see Datasheet_8071_2_D_47851.pdf

3-Wire PT100 Temperature Sensor - 8060



Key features and benefits

- 3 wire RTDs accurate temperature measurement
- Excellent long term stability
- Good linearity
- Can use standard 3-core cable

For further information and how to order this product see Datasheet_8060_temp_sensor.pdf

Accessories

Solid State Relay Module - 8073C



Relay Module

8073C

Key features and benefits

- IP67 enclosure
- Alternative to using two SSRs type 47581L001
- Good linearity
- Can use standard 3-core cable

The 8073C relay module incorporates two solid state relays with terminations in an IP67 enclosure. The 8073C is designed to be used with the 8071D controller logic outputs to drive voltages for the electrically actuated G valve. Features include: zerocrossing switching, relay and logic level inputs and IP67 enclosure.



For further information and how to order this product see Datasheet_8073C_SSR.pdf

Electro-Pneumatic Converter - 8064A



Key features and benefits

- High vibration resistance Lloyds 4G
- Suitable for longer pipe runs
- Fully adjustable for optimised system operation
- ATEX hazardous area certification



For further information and how to order this product see Datasheet_8064A_C_ elect_pneu_converter.pdf

Accessories

Electro-Pneumatic Converter - 8064C

Typical Application

8060



Electro-Pneumatic Converter - 8064C

Key features and benefits

- Accepts high supply pressure avoids use of additional regulator
- Factory set for ease of installation
- Low cost alternative to 8064A
- ATEX hazardous area certification



For further information and how to order this product see Datasheet_8064A_C_elect_ pneu_converter.pdf

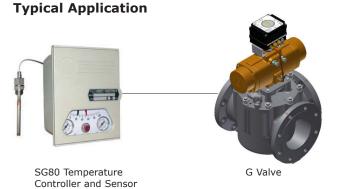
Pneumatic Indicator Controller - SG80



Pneumatic Indicator Controller **SG80**

Key features and benefits

- Complete stand alone controller, no other control components required - reduced system cost
- Easily removable components low maintenance
- Good dynamic response gives optimum engine performance
- Compatible with every type of pneumatic valve - flexible



For further information and how to order this product see Datasheet_SG80_Pneu_Ind_ Controller.pdf

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This product can expose you to chemicals including Lead, which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

