

# GS16 Gas Valve

## with On-board Driver

### Applications

The Woodward GS16 gas valve is suitable for use on industrial gas turbine engines with maximum power ratings between 10 and 50 MW. The assembly provides a reliable, cost-effective interface between electronic control systems and gas turbines used in electrical power generation, compressor, or mechanical drive applications. The valve assembly can be used for base turbines or in multiple valve configurations in Dry Low Emission turbines.

### Description

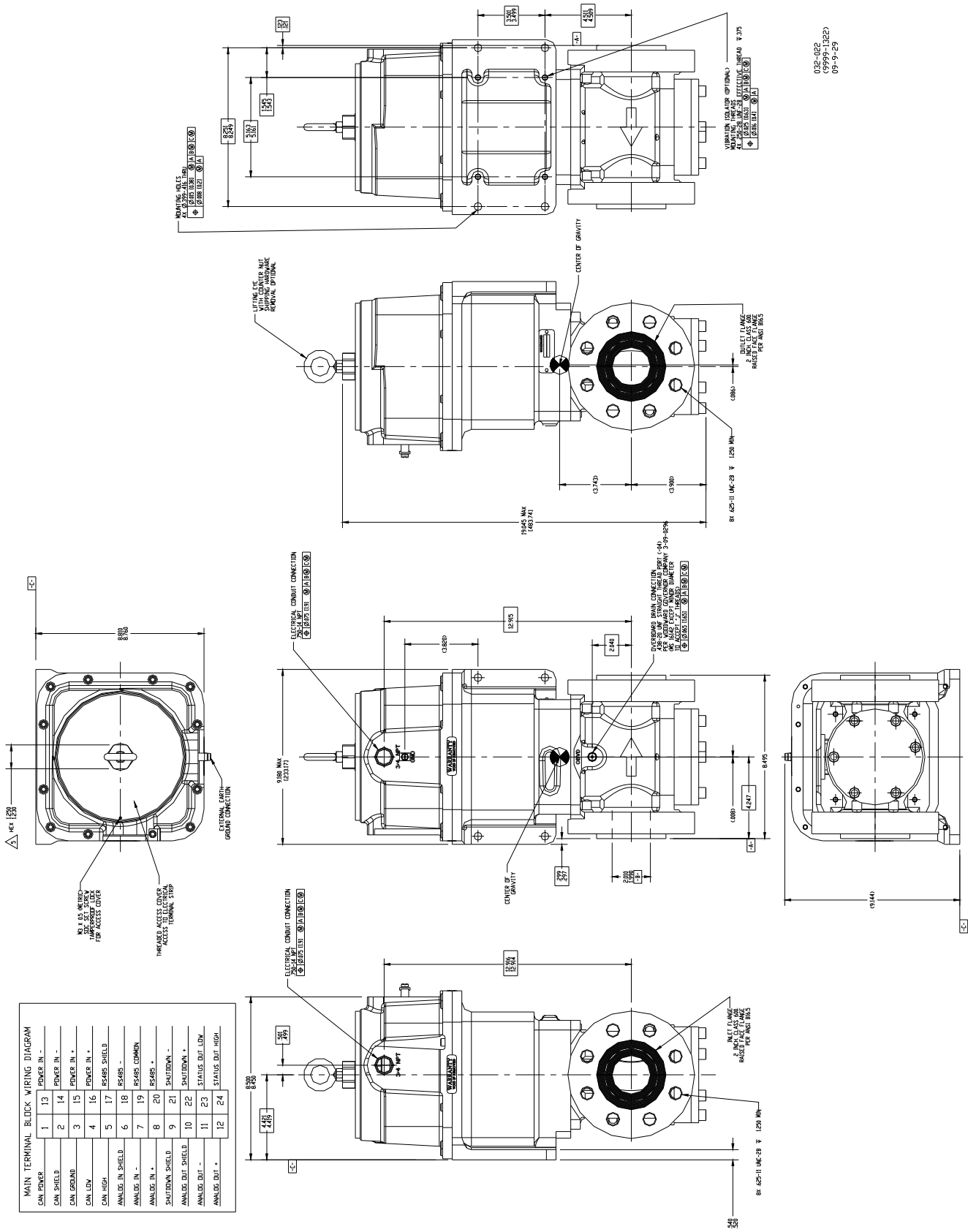
The GS16 valve assembly combines a highly robust Woodward self-cleaning metering valve with a high-torque actuator to ensure extended operation in all types of gaseous fuel service. The valve assembly features an on-board electronic controller module for ease of system packaging and installation

The GS16 is an electrically actuated fuel valve with an on-board electronic position controller. Highly accurate flow control is achieved by the use of a spherical fuel metering element with a precision machined fuel metering port. A seal shoe is loaded against the spherical valve element to allow accurate flow area control and the achievement of positive flow shut-off. The use of rare earth permanent magnets in an efficient electromagnetic circuit results in high actuation forces while minimizing package size. The closely integrated mechanical design eliminates backlash and provides virtually infinite valve positioning resolution.

The self-cleaning, shear-type metering action keeps the metering port free from performance-limiting deposits of gas condensates, contaminants, and system debris. The valve utilizes a single moving part with the fuel metering element, actuator rotor, and position feedback resolver mounted on a single solid-piece shaft. Accurate flow versus input signal characteristics are achieved on each valve version by precision forming of the valve metering port, the use of extended valve travels, and a high-precision resolver for valve position feedback. The GS valves can achieve flow turn-down ratios in excess of 100 to 1 and a positive flow shut-off rating exceeding the requirements of ANSI B16.104 Class III.



- Highly accurate fuel flow metering
- Single moving part for reliable performance
- All-electric actuation
- On-board driver
- Fast dynamic response
- Robust self-cleaning valve
- Gas flow shut-off in conformance with ANSI B16.104 Class III
- Digital and/or 4–20 mA analog signal interfaces
- Discrete fault output and independent shutdown
- Certified for use in Hazardous Locations



For detailed information, see Woodward manual 26514.

## Specifications

### Gas Connections

Inlet and Discharge flanges per ANSI B16.5 Class 600, 2.0 Inch (8 bolt with 0.625-11 UNC internal threads).  
Overboard Vent tubing connection port per SAE J514-4

<b>Valve Parameters</b>	Nominal Gas Flow Control Range:	22 to 13 608 kg/h (50 to 30 000 lb/h)
	Gas Supply Pressure:	345 to 5171 kPa (50 to 750 psig)
	Minimum Pressure Differential:	138 kPa (20 psid) recommended for specified flow control accuracy
	Maximum Pressure Differential:	(Reference product manual 26228 for operational limits.)
	Gas Filtration Recommendations:	25 µm Absolute
	Metering Ports (Maximum Area):	645 mm <sup>2</sup> , 968 mm <sup>2</sup> , and 1290 mm <sup>2</sup> (1.00 in <sup>2</sup> , 1.50 in <sup>2</sup> , and 2.00 in <sup>2</sup> )
	Heat Soak Rating:	125 °C for 6 hours, unpowered
	Digital Input:	DeviceNet™ */CANopen
	Metering Valve Leakage:	< 0.1% of rated flow maximum at 50 psig (345 kPa) inlet pressure, 0 psig discharge
	Slew Rate:	< 100 ms
	Position Loop Bandwidth:	40 rad/s at -6 dB at 24 Vdc
	Gas Connection:	2.00 inch (50.8 mm) RF flanges per ANSI B16.5 Class 600
	Flange to Flange Dimension:	8.50 inches ( 215.9 mm) nominal
	Materials:	Stainless steel housing and internal parts in contact with gas NACE MR0175-2000 compliant
	Weight:	48 kg (105 lb)

\*—DeviceNet is a trademark of ODVA (Open DeviceNet Vendor Association, Inc.)

<b>Flow Accuracy</b>	With Analog Input Signal:	The lesser of ± 5% of point or ± 2% of full scale over 100:1 flow range*
	With Digital Input Signal:	± 2% of point from 5% to 100%*

\* **Note**—The specified accuracies apply to the effective metering port area provided by the valve at a given position demand signal. Actual gas mass flow may be affected by variations in fuel gas conditions and properties.

<b>Repeatability</b>	With Analog or Digital Input Signal:	The lesser of ± 2.5% of point or ± 1% of full scale from 2% to 100% of the rated flow range.
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<b>Temperature Drift</b>	Analog Input:	0.009% of full scale input demand (4–20 mA) per degree F 0.005% of full scale input demand (4–20 mA) per degree C
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<b>Electrical Specifications</b>	Input Power:	24 Vdc (18–32 Vdc)
	Steady State Current:	< 2.0 A typical, 5.0 A maximum
	Maximum Transient Current:	12 A for 100 ms maximum to the controller
	Electrical Connections:	Field Wires enter junction through 0.750-14 NPT threaded conduit connection Terminal blocks in integral junction box, stud for external ground
	Valve Position Demand Signal:	4–20 mA current signal into 249 Ω impedance, DeviceNet or CANopen interface
	Valve Pos. Instrumentation Signal:	4–20 mA current signal into <500 Ω impedance, DeviceNet or CANopen interface
	Shut-down/Reset Command:	Close contact to run, open to shut down
	System Fault Output:	Isolated FET for direct control connection with or without interposing relays
	Maximum Current:	500 mA (10 µA leakage)

<b>Temperature</b>	Ambient:	-40 to +93 °C (-40 to +200 °F)
	Fuel temperature:	-40 to +93 °C (-40 to +200 °F)
	Unpowered Heat Soak:	125 °C, 2 hours

### Environmental Specifications

Electromagnetic Compatibility (EMC):	EN 61000-6-2 (2001): Immunity for Industrial Environments EN 61000-6-4 (2001): Emissions for Industrial Environments
Shock:	US MIL-STD-810C Method 516.2, procedure 1 (10 G Peak, 11 ms duration, sawtooth waveform)
Vibration:	US MIL-STD-810C, Method 514.2, Procedure I, Figure 514.2-2, Curve AR (2 G test from 10 to 2000 Hz)
Humidity:	US MIL-STD-E-8593, paragraph 4.6.2.3.3
Salt Fog:	US MIL-STD-810, Method No. 509
Ingress Protection:	IP56 per EN 60529

### Regulatory Compliance

#### European Compliance for CE Marking:

<b>EMC Directive:</b>	2004/108/EC
<b>Pressure Equipment Directive:</b>	97/23/EC, (Category II)
<b>ATEX Directive:</b>	94/9/EC per LCIE 02 ATEX 6049 X Zone 1, Category 2, Group IIG, Ex d IIB T3 Zone 2, Category 3, Group IIG, Ex nA IIC T3

#### Other European and International Compliance:

Compliance with the following European Directive does not qualify this product for application of the CE Marking:  
**Machinery Directive:** Compliant as partly completed machinery with 2006/42/EC  
**GOST-R:** Certified for use in explosive atmospheres within the Russian Federation per GOST-R certificate POCC US.ГБ04.В01303 as 1ExdIIBT3, 2ExnAIIIT3.

#### North American Compliance:

**CSA:** CSA Certified for Class I, Division 1, Groups C and D, T3, and Class I, Division 2, Groups A, B, C, and D, T3 at 93 °C ambient for use in Canada and the United States

## On-board Driver

The valve driver and wiring terminal box are integral with the valve assembly, eliminating interconnecting wiring, reducing package size requirements, and lowering the installed cost. The on-board driver can be interfaced to the turbine control via a 4–20 mA input and feedback signals or through a DeviceNet/CANopen network. The GS16 can be configured to accept both the 4–20 mA signal and DeviceNet/CANopen position command in a redundant configuration. With this arrangement, if either demand signal fails, the driver will switch to the healthy input demand signal. The valve driver operates with an 18 to 32 Vdc power supply.

The on-board valve driver performs the following functions:

- Fast and accurate closed loop position control of the gas valve in response to the 4–20 mA or DeviceNet/CANopen input command signal
- Actual valve position feedback via 4–20 mA or DeviceNet/CANopen
- Independent remote shutdown input
- Valve/Driver fault output

The driver includes protection and alarm indications for the following faults:

- Analog input out of range
- Feedback—open wire and short
- Input power out of range
- Position error
- Internal driver faults
- Actuator open/short
- Driver overcurrent

All faults indications are available through the DeviceNet/CANopen connection or through an RS-232 connection when using an analog control interface.

## Fuel Flow

Gas fuel flow control is normally achieved by the accurate scheduling of metering valve port area, based on values for gas properties, operating pressures, and temperature. The GS16 valve is factory calibrated under flow at full flow and pressure conditions to provide an accurate valve metering to the input demand signal. Flow equations for the GS16 valves are located in the GS16 manual. These can be used to set up the valve for any site-specific conditions.

## Internal Metering Port Sizes

The GS16 is available with three different standard port sizes to optimize valve performance for various flow and pressure drop requirements. Standard port geometric areas are:

- 1.00 in<sup>2</sup> (645 mm<sup>2</sup>)
- 1.50 in<sup>2</sup> (968 mm<sup>2</sup>)
- 2.00 in<sup>2</sup> (1290 mm<sup>2</sup>)

The standard metering ports are contoured to provide approximate square law relationships between commanded position and effective area.



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