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 use is 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, achieving highly accurate flow control 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 turndown 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
GS16 Valve Outline Drawing

(Dimensions shown are in inches; do not use for construction)

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 SAIE J514-4

Valve Nominal Gas Flow Control Range: 22 to 13,608 kg/h (50 to 30,000 lb/h)
Parameters 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 26514 for operational limits.)
Gas Filtration Recommendations: < 0.1% of rated flow maximum at 50 psig (345 kPa) inlet pressure, 0 psig discharge
Heat Soak Rating: 125 °C for 6 hours, unpowered
Digital Input: DeviceNet™, CANopen
Metering Valve Leakage: < 100 ms
Position Loop Bandwidth: 40 rad/s at –6 dB at 24 Vdc
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)

Flow 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%*

Repeatability 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.
Temperature Analog Input: 0.009% of full-scale input demand (4–20 mA) per degree F
Drift 0.005% of full-scale input demand (4–20 mA) per degree C

Electrical Input Power: 24 Vdc (18–32 Vdc)
Specifications 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
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)

Temperature 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

Shock: EN 61000-6-4 (2001): Emissions for Industrial Environments
Vibration: US MIL-STD-810C Method 516.2, procedure 1 (10 G Peak, 11 ms duration, sawtooth waveform)
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:
EMC Directive: 2014/30/EU
ATEX Directive: 2014/34/EU
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

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

*—DeviceNet is a trademark of ODVA (Open DeviceNet Vendor Association, Inc.)
**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 may be interfaced to the turbine control via a 4–20 mA input and feedback signals or through a DeviceNet/CANopen network. The GS16 may 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 in² (645 mm²)
- 1.50 in² (968 mm²)
- 2.00 in² (1290 mm²)

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