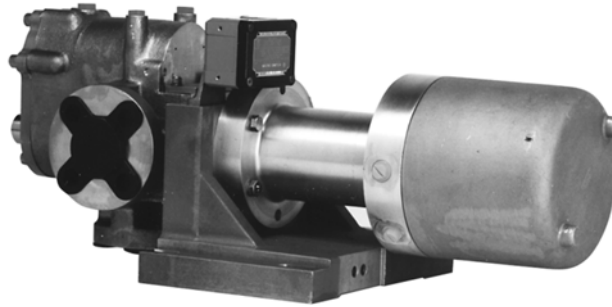


# 3151A Water Valve

## and EML100 Actuator

### Applications

The 3151A Water Valve/EML100 Actuator assembly is used as part of a gas-turbine nitrous oxide emission-reduction system. The unit meters water into an industrial gas turbine's combustion chamber, lowering combustion temperature. This assembly is designed to be used with the Woodward EM Digital Driver or Woodward 24 V DVP.



### Description

#### 3151A Water Valve

The 3151A Water Valve is intended for use with high-pressure centrifugal-type pumps and provides metered bypass flow for pump-stability and heat-balance considerations.

The water valve is primarily constructed of stainless steel. A replaceable, hardened, stainless-steel sleeve is located in the drain flange area of the valve housing, and protects the housing from cavitation damage. The sleeve can be rotated in one-quarter turn increments, or it can be replaced, to extend valve life when used in severe conditions.

Ceramic is used on metering valve and regulator valve parts to prevent galling and to resist erosion in an area subjected to high-velocity water streams.

These design features make the 3151A Water Valve highly resistant to erosion, corrosion, and cavitation.

The Water Valve is designed to meter up to 250 L/min (66 US gal/min) with input pressures from 2413 to 10 342 kPa (350 to 1500 psig). The minimum flow is 3.8 L/min (1 US gal/min), dependent on inlet pressure.

Flow accuracy is 5.0% of point or 0.5% of maximum flow, whichever value is greater.

Standard seal material allows operation with water temperatures up to 66 °C (150 °F). The minimum operating temperature is 0 °C (32 °F).

#### EML100 Actuator

The EML100 Actuator consists of a high performance brushless servomotor and a precision planetary gearbox with two resolver type shaft position sensors. The use of a high efficiency gearbox facilitates high servo system bandwidth. One resolver provides motor rotor position feedback and the other resolver(s) provides accurate output shaft position feedback. The gear train has a slip clutch to allow full speed impact into the rigid mechanical stops without damage.

The EM Driver controls the position of the EML100 actuator and water valve. Demand to the EM Driver is provided by a separate turbine control. The control may be calibrated so that the water valve closely follows the fuel-flow schedule to prevent unwanted water insertion during turbine load swings.

- All-electric water injection solution
- Used in gas-turbine nitrous oxide emission-reduction systems
- Fast response—accurate control
- Resists cavitation, erosion, and corrosion
- Models are available with certification for North American Hazardous Locations
- Models are available compliant with the applicable CE Directives: ATEX, PED, and Machinery



## Operation

The actuator operates proportionally with an electronic control. The water valve/actuator assembly is designed to meter water to a gas turbine as established by a predetermined flow versus valve position schedule. This function is accomplished by a variable-area-metering valve and a single-stage, throttling, delta-P regulator piston.

The variable-area-metering valve consists of a set of contoured ports located at one end of the metering sleeve. The opening of these ports is determined by the position of the metering-valve plunger controlled by the actuator. The single-stage regulator piston senses and controls the pressure drop across the metering ports so flow is unaffected by variations in valve inlet or discharge pressures.

## Specifications

### 3151A WATER VALVE

Minimum Flow

3.8 L/min (1 US gal/min)

Maximum Flow

250 L/min (66 US gal/min)

Water Pump Type

High pressure centrifugal

Minimum Supply Pressure

2413 kPa (350 psig)

Maximum Supply Pressure

10 342 kPa (1500 psig)

Maximum Bypass Pressure

345 kPa (50 psig)

Water Filtration

10 µm nominal

20 µm absolute

Degree-of-Flow Accuracy

Flow accuracy is either 5% of point or 0.5% of maximum flow—whichever is greater

Supply Temperature

66 °C (150°F) maximum, 0 °C (32 °F) minimum with standard seal material

### EML100 ACTUATOR

Slew Time

150 milliseconds

(10%–90% position on a 2–98% step)

Bandwidth

Greater than 6 Hz at –6 dB

### ENVIRONMENT

Ambient Temperature

–40 to +93 °C (–40 to +200 °F)

Vibration

US MIL-STD-810C, Method 514.2, category b.1, figure 514.2-II curve J (5 g's max. 5-2000 Hz)

Shock

US MIL-STD-810C, Method 516.2, half sine shock. Basic design-ground (20 g's for 11ms)

MTBO

50 000 hours

MTBF

100 000 hours

## ELECTRICAL

The EML100 actuator is designed to be used with the Woodward EM Digital Driver (see manual 26159) or Woodward 24 V DVP (see manual 26329).

### Electrical Motor Ratings

Input Voltage 28 Vdc nominal for EM Driver

24 Vdc nominal for DVP

Motor Current 37 A max phase current with an exponential decay and a time constant of 2.5 s to a maximum continuous phase current of 14.7 A

## INSTALLATION

See outline drawing for other information.

Conduit connections

Quantity 4, 0.500-14 NPTF female connections.

External Ground

#8, 0.164-32 UNF female thread

## Regulatory Compliance

### European Compliance for CE Marking:

These listings are limited only to those units bearing the CE Marking.

#### ATEX—Potentially Explosive Atmospheres Directive:

Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

Zone 1, Category 2, Group II G, Ex d IIB T3

This suitability is the result of ATEX compliance of the individual components:

EML100 Actuator per LCIE 01ATEX6033 X

**Note**—3151A Water Valve/EML 100 Actuator assemblies incorporating the minimum position switch are not suitable for use in an ATEX environment. See manual 40181 for all Special Conditions for Safe Use.

### Other European Compliance:

Compliance with the following European Directives or standards does not qualify this product for application of the CE Marking:

#### EMC Directive:

Not applicable to this product. Electromagnetic, EMC, passive devices are excluded from the scope of the 2014/30/EU Directive

#### Machinery Directive:

Compliant as partly completed machinery with Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery.

#### Pressure Equipment Directive:

Compliant as “SEP” per Article 4.3 to Pressure Equipment Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment.

### North American Compliance:

Suitability for use in North American Hazardous Locations is the result of compliance of the individual components:

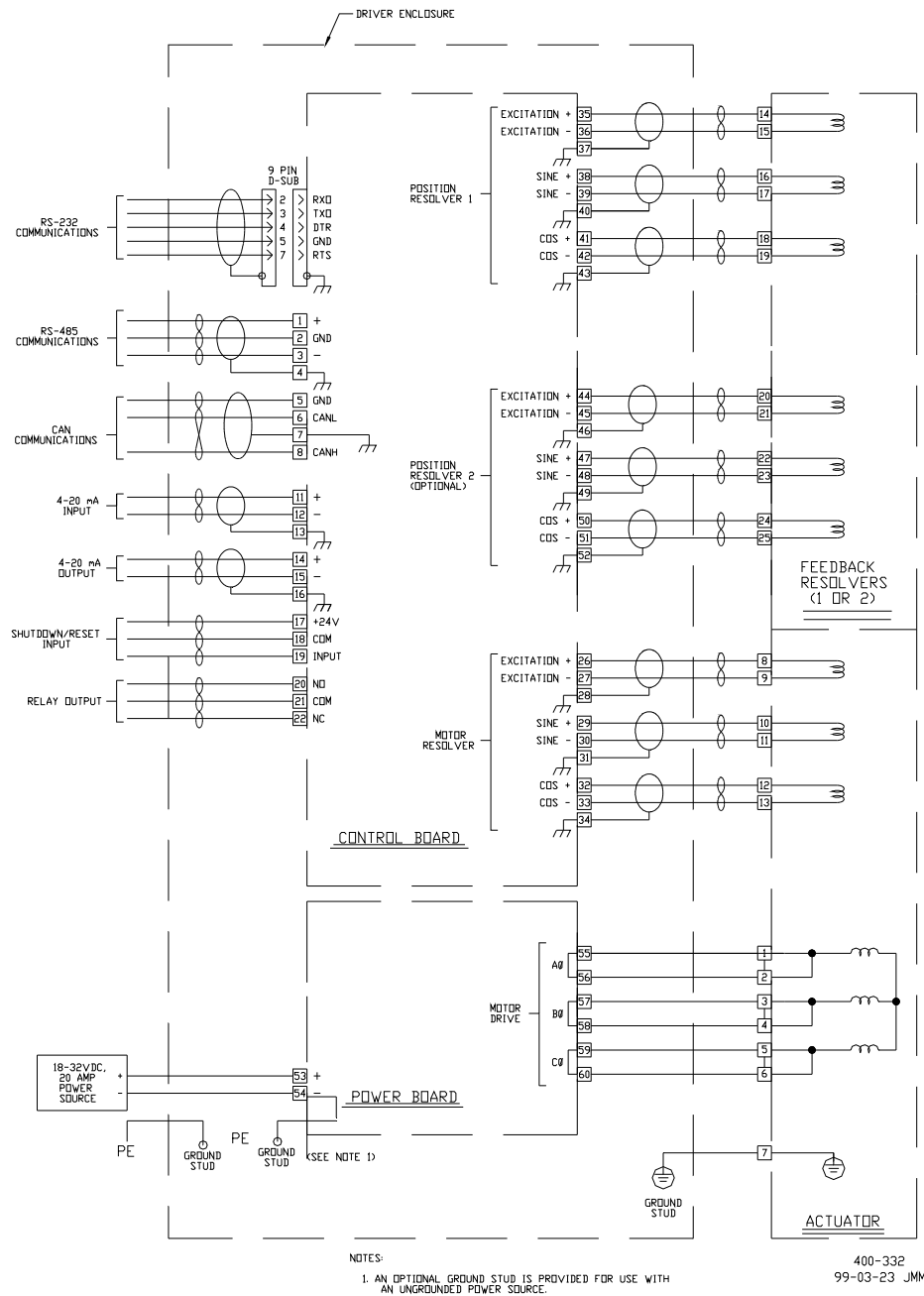
#### EML100 Actuator:

CSA Certified for Class I, Division 1, Groups C & D; Class I, Division 2, Groups B, C, D, T3C at 93 °C Ambient. For use in Canada and the United States. Certificate 1018524

#### Minimum Position Switch:

CSA Certified for Class I, Division 1, Groups C & D. For use in Canada.

UL Listed for Class I, Division 1, Groups C & D. For use in the United States.



Wiring Diagram (EM Driver shown)



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