



Installation and Operation Manual



Flo-Tech™ Integrated Actuator and Throttle Body

Flo-Tech 33/45/60/68/75

Manual 04141G



WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.



CAUTION

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.



IMPORTANT DEFINITIONS

WARNING—indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION—indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment.



NOTE—provides other helpful information that does not fall under the warning or caution categories.

Revisions—Text changes are indicated by a black line alongside the text.

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Chapter 1.

Installation and Operation

General Information

The Flo-Tech™ actuator/throttle body is a family of electrically-actuated throttle/valves which control fuel flow output. The flow output is a function of throttle position. The throttle position responds proportionally to the position command.

The Flo-Tech throttle body is available with 33, 48, 60, 68, and 75 mm bore sizes for various applications. Command input options come in PWM (pulse-width-modulated), 0–5 Vdc, 4–20 mA, and 0–200 mA. The position feedback output signal will vary from 0.5 ± 0.1 Vdc at minimum actuator position to 4.5 ± 0.1 Vdc nominal at maximum actuator position. The PWM command input version will return to minimum actuator position with a command of greater than 96% duty cycle.

Input Command	Input Range	Position Feedback Output	Nominal Actuator Range
PWM	10–90%	$0.5\text{--}4.5 \pm 0.1$ Vdc	0–70 degrees
0–5 Vdc	$0.5\text{--}4.5$ Vdc	$0.5\text{--}4.5 \pm 0.1$ Vdc	0–70 degrees
4–20 mA	5–19 mA	$0.5\text{--}4.5 \pm 0.1$ Vdc	0–70 degrees
0–200 mA	20–180 mA	$0.5\text{--}4.5 \pm 0.1$ Vdc	0–70 degrees

The Flo-Tech actuator requires a power supply of 9–32 Vdc. The supply must be capable of providing a sustained 25 W at steady-state and 50 W for transient state conditions for at least 0.25 seconds.



NOTE

To ensure proper start-up operation, make sure that power is applied to the Flo-Tech throttle for at least 200 ms before any position command is applied.

If power to the Flo-Tech will ever be disconnected to prevent battery drain (that is, after a period of key-switch on-time between engine starts), make sure that the command signal is also disconnected, and that the start-up sequence in the first sentence of this Note is again followed.

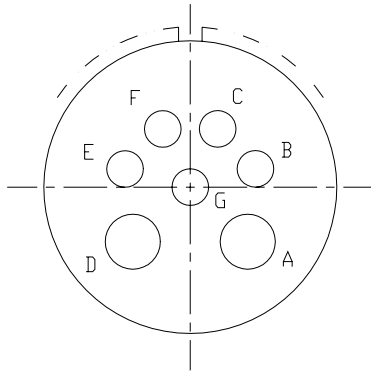
Application

The Flo-Tech throttle body is designed with flow shaping to assist in engine idle stability. The system will provide equivalent maximum flow rate. The system contains a return spring to fully comply with DOT 571.124 specifications.

The Flo-Tech throttle body is designed for direct replacement of manual throttle bodies. It requires no actuators or linkage.

Installation

The Flo-Tech actuator/throttle body may be engine-mounted in any position, in the coolest location possible. Each of the two mounting flanges on the body of the bore has four 10 mm through-mounting holes in a square 74 mm pattern. The base of the Flo-Tech throttle body has an optional bolt pattern that can be used for mounting or support. It uses four M8x0.125 bolts in an 88.9 mm square pattern. Flo-Tech connector options are shown in Figure 1-1. Outline drawings shown in Figure 1-2 describe the different Flo-Tech mounting configurations.



CONNECTOR WIRING

FRONT VIEW

PIN A: POWER (+) / RED
 PIN B: POSITION COMMAND (-) / BLUE
 PIN C: POSITION COMMAND (+) / ORANGE
 PIN D: POWER (-) / BLACK
 PIN E: POSITION FEEDBACK / WHITE
 PIN F: NO CONNECTION
 PIN G: NO CONNECTION

MAY BE PURCHASED FROM:

1. ITT CANNON
P/N: CA3101F-18-9P-A206
2. AMPHENOL BENDIX
P/N: ACS01AF18-9P(025)

MATING CONNECTOR MAY BE PURCHASED FROM:

1. ITT CANNON
P/N CA3106F-18-9S-A206
2. AMPHENOL BENDIX
P/N ACS06AF18-9S(025)

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Figure 1-1a. Bendix Round Connector

NOTES:

6 PIN DEUTSCH CONNECTOR

CONNECTOR PART #: DT04-6P-EP04
 WGC P/N 1634-177
 CONTACT PIN #: 0460-202-16141
 WGC P/N 1634-003
 LOCK WEDGE #: W6P
 WGC P/N 1634-963
 SEALING PLUG #: 114017
 WGC P/N 1635-117

MATING CONNECTOR REF INFO:

CONNECTOR: DT06-6S-EP04
 WGC P/N: 1634-179
 CONTACT SOCKET: 0462-201-16141
 WGC P/N: 1634-005
 LOCK WEDGE: W6S
 WGC P/N: 1634-965
 SEALING PLUG: 114017
 WGC P/N: 1635-117

1	POWER (+) / RED
2	POWER (-) / BLACK
3	POSITION COMMAND / BLUE WIRE
4	POSITION FEEDBACK / WHITE WIRE
5	NOT USED
6	POSITION COMMAND / ORANGE

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Figure 1-1b. Deutsch Connector

NOTES:

6 PIN PACKARD CONNECTOR

"WEATHER PACK" TYPE

CONNECTOR PART #: 12020786
 WGC P/N 1635-985
 SEAL PART #: 12015323
 WGC P/N 1635-173
 MALE PIN PART #: 12089040
 WGC P/N 1635-171
 MATING CONNECTOR #: 12020926
 WGC P/N 1635-991
 SEAL PART #: 12015323
 WGC P/N SAME AS ABOVE
 SOCKET CONTACT #: 12089188
 WGC P/N 1635-183
 PLUG #: 12010300
 WGC P/N 1635-181

A	POWER (+) / RED
B	POWER (-) / BLACK
C	NC
D	POSITION COMMAND (-) / BLUE
E	POSITION COMMAND (+) / ORANGE COMMAND
F	BUFFERED POSITION / WHITE OUTPUT

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Figure 1-1c. Packard 5-wire Connector

NOTES:

6 PIN PACKARD CONNECTOR
"WEATHER PACK" TYPE

CONNECTOR PART #: 12020786
WGC P/N 1635-985

SEAL PART #: 12015323
WGC P/N 1635-173

MALE PIN PART #: 12089040
WGC P/N 1635-171

MATING CONNECTOR #: 12020926
WGC P/N 1635-991

SEAL PART #: 12015323
WGC P/N SAME AS ABOVE

SOCKET CONTACT #: 12089188
WGC P/N 1635-183

PLUG #: 12010300
WGC P/N 1635-181

A	POWER (+) / RED
B	POWER (-) / BLACK
C	+5V / BROWN
D	GROUND / GREEN
E	PWM POSITION / ORANGE COMMAND
F	BUFFERED POSITION / WHITE OUTPPUT

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Figure 1-1d. Packard 6-wire Connector

NOTES:

6 PIN PACKARD CONNECTOR
"WEATHER PACK" TYPE

CONNECTOR PART #: 12020786
WGC P/N 1635-985

SEAL PART #: 12015323
WGC P/N 1635-173

MALE PIN PART #: 12089040
WGC P/N 1635-171

MATING CONNECTOR #: 12020926
WGC P/N 1635-991

SEAL PART #: 12015323
WGC P/N SAME AS ABOVE

SOCKET CONTACT #: 12089188
WGC P/N 1635-183

PLUG #: 12010300
WGC P/N 1635-181

A	POWER (+) / RED
B	POWER (-) / BLACK
C	GROUND / GREEN
D	POSITION COMMAND (-) / BLUE
E	POSITION COMMAND (+) / ORANGE
F	BUFFERED POSITION / WHITE OUTPUT

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Figure 1-1e. Packard 6-wire 0-5 Vdc Connector

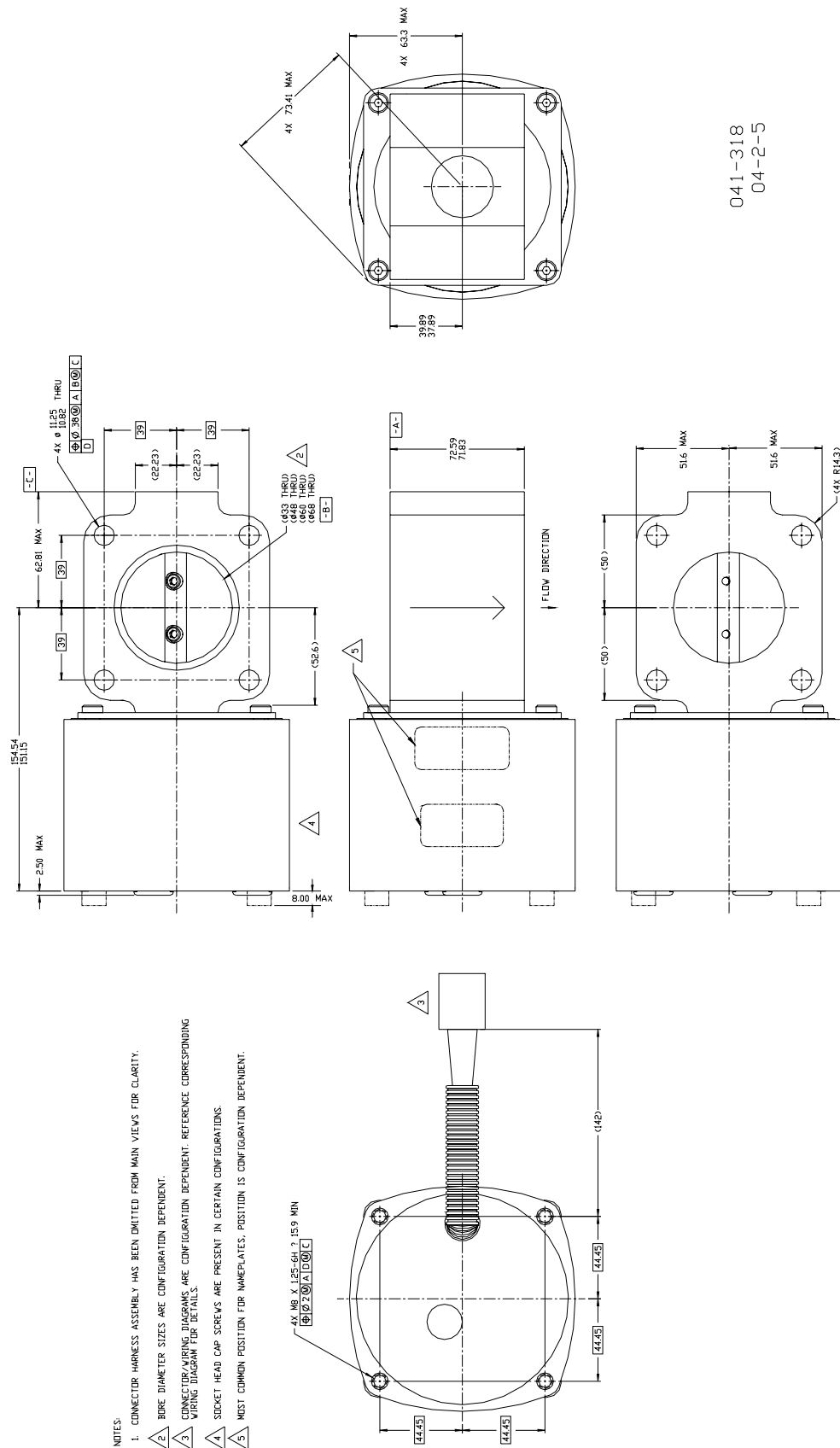


Figure 1-2a. Flo-Tech Outline Drawing (No Flange Mounting)

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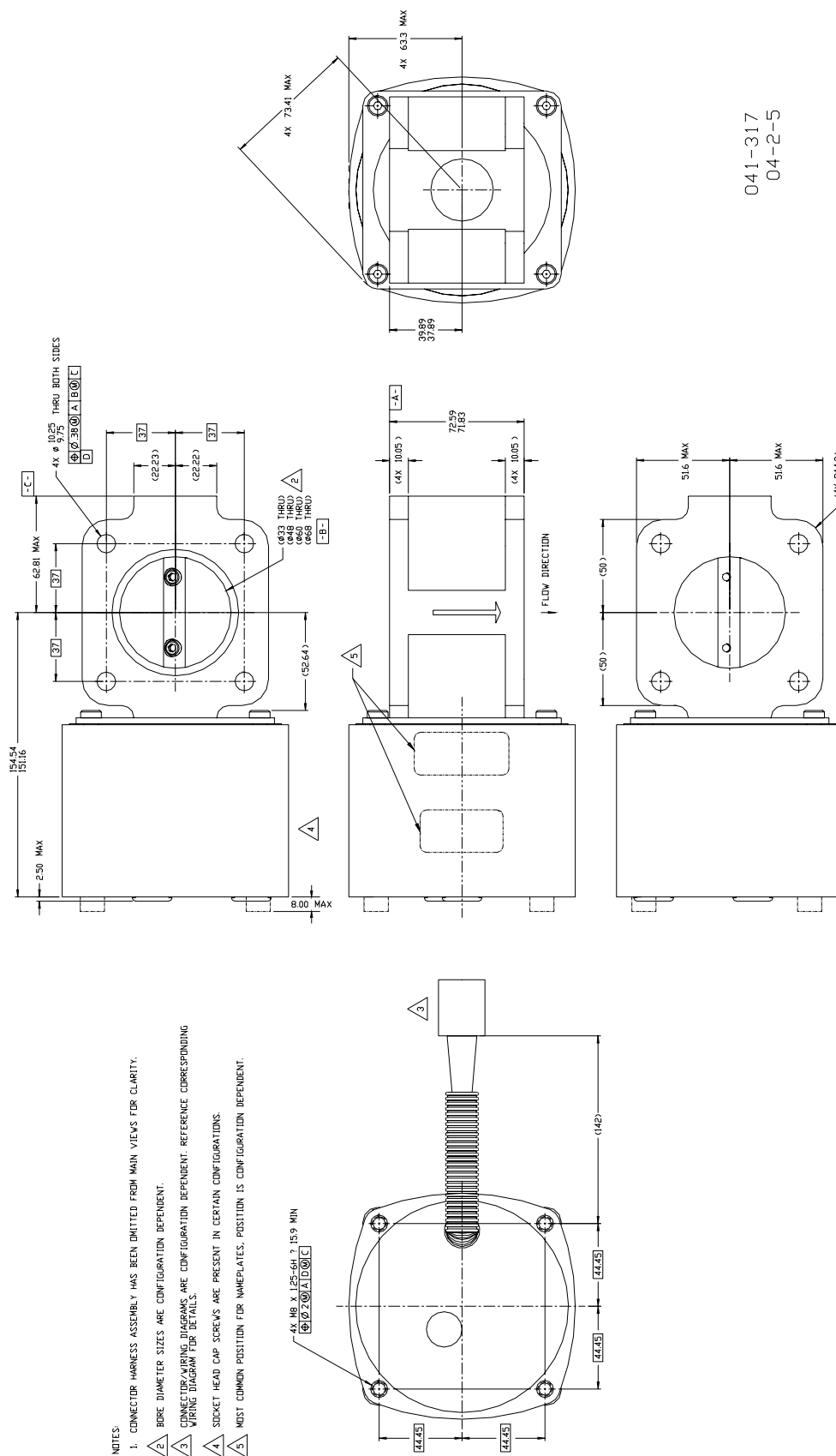
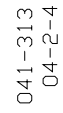


Figure 1-2b. Flo-Tech Outline Drawing (Standard Flange Mounting)



Woodward

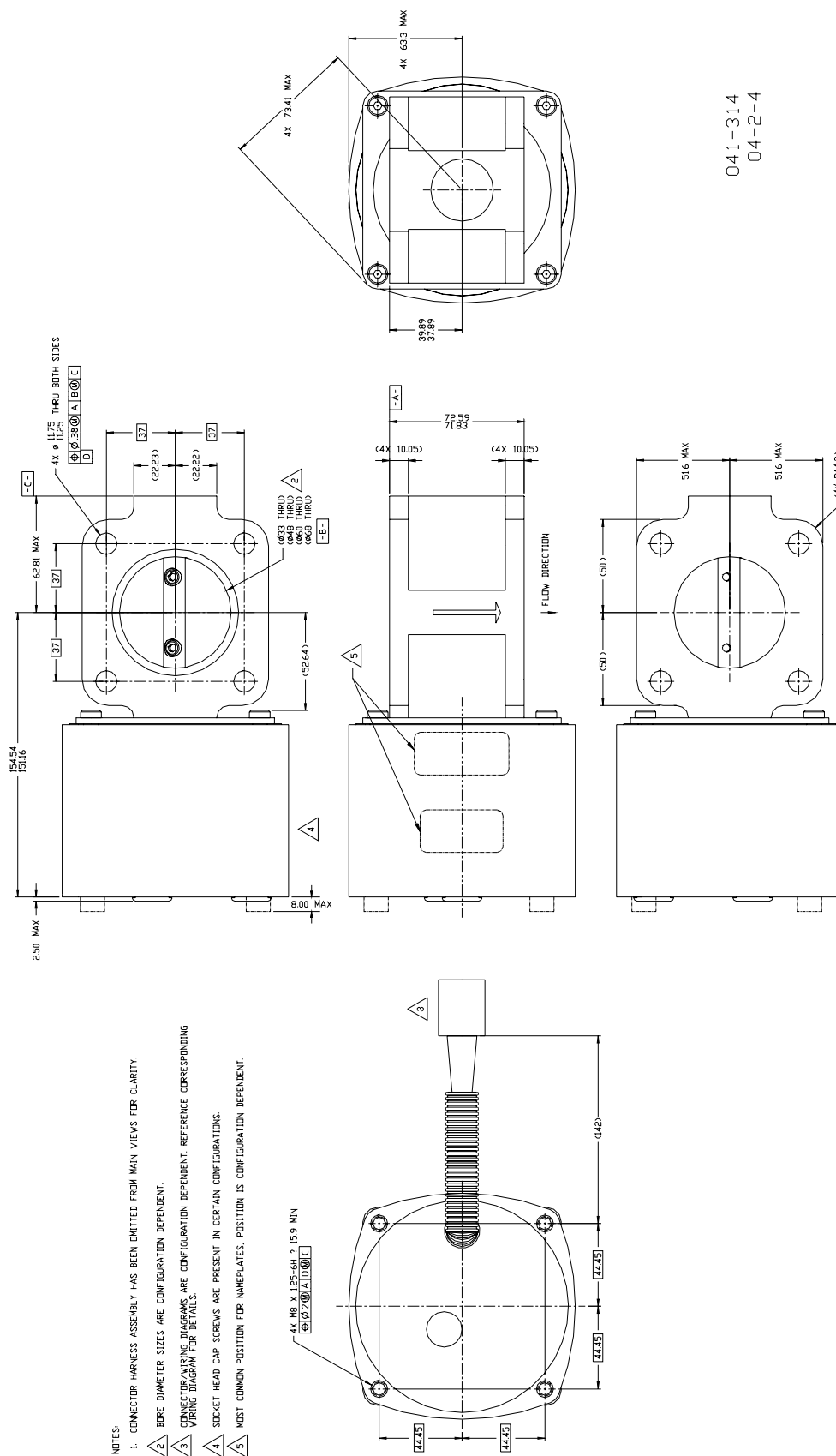
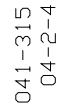


Figure 1-2d. Flo-Tech Outline Drawing (M10 Flange Mounting)



Woodward

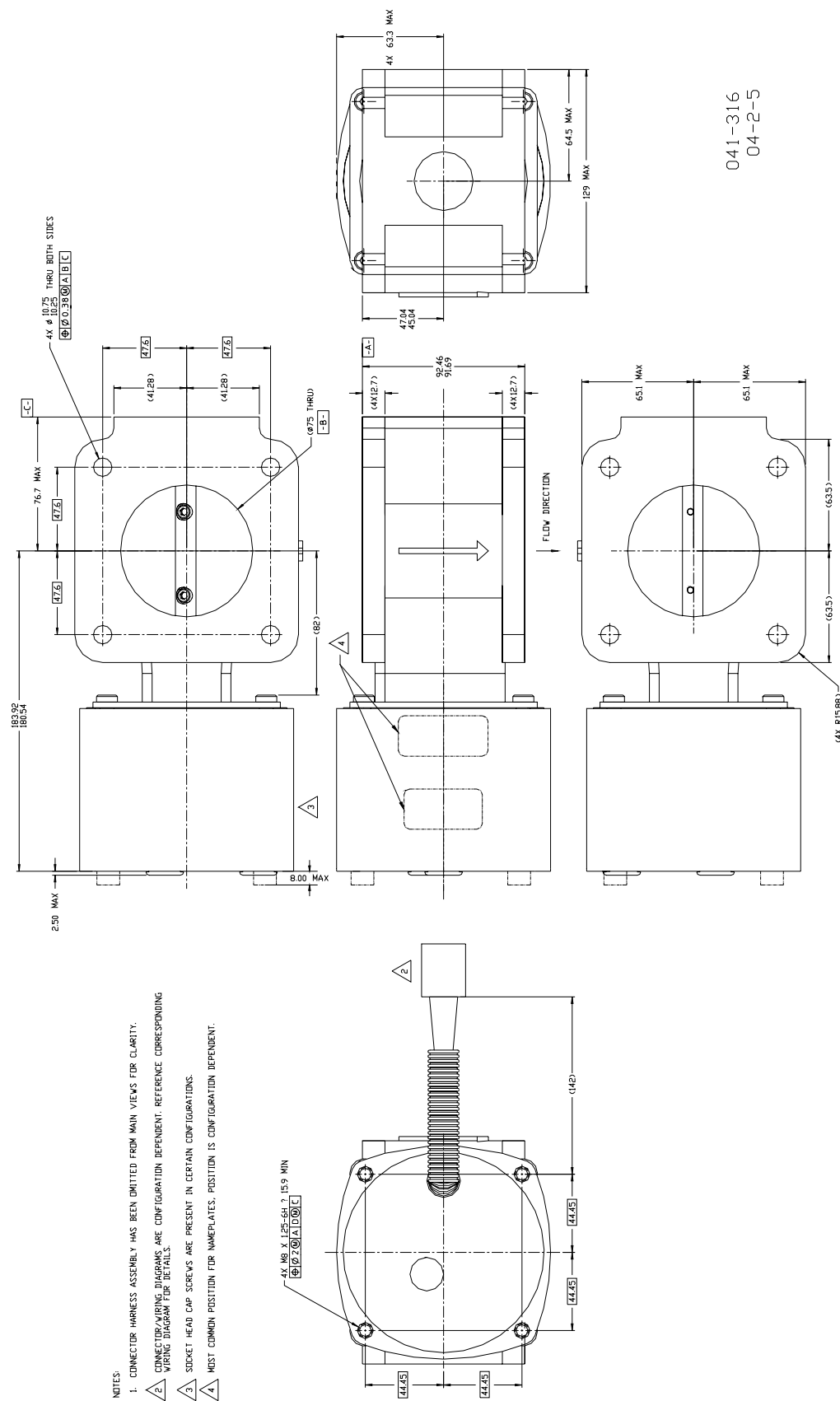
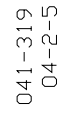


Figure 1-2f. Flo-Tech Outline Drawing (75 mm Flange Mounting)



Woodward

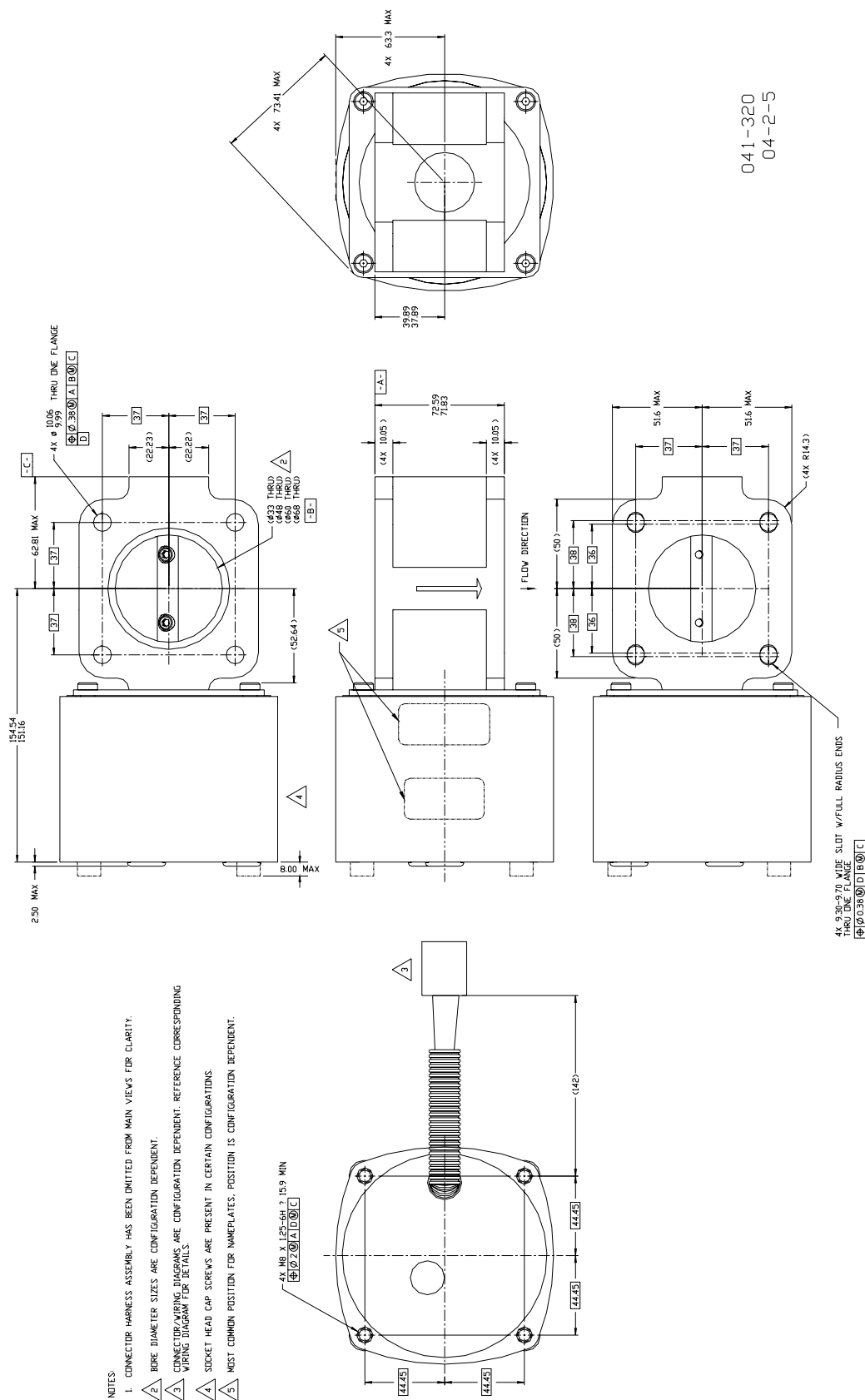


Figure 1-2h. Flo-Tech Outline Drawing (Bottom Slotted Flange Mounting)

Chapter 2. Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Replacement/Exchange

Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is also a flat rate structured program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Woodward facility as explained below (see “Returning Equipment for Repair” later in this chapter).

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

Flat Rate Repair

Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture

Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.



CAUTION

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.



NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

For assistance outside North America, call one of the following international Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
India	+91 (129) 230 7111
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (www.woodward.com) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811

Toll-free Phone (in North America)—1 (800) 523-2831

Email—icinfo@woodward.com

Website—www.woodward.com

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Product Training is available at many of our worldwide locations (standard classes). We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Product Training**.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface. For field service engineering assistance, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

General

Your Name _____
Site Location _____
Phone Number _____
Fax Number _____

Prime Mover Information

Engine/Turbine Model Number _____
Manufacturer _____
Number of Cylinders (if applicable) _____
Type of Fuel (gas, gaseous, steam, etc) _____
Rating _____
Application _____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Flo-Tech™ Control Specifications

Environment	
Weight	6 kg (13 lb)
Operating Temperature	–40 to +105 °C (–40 to +221 °F) housing temperature
Storage Temperature	–55 to +105 °C (–67 to +221 °F)
Operating Environment	Automotive Underhood—water, condensing and non-condensing petrochemicals (oil, fuel, exhaust emissions, gasoline, diesel, natural gas,...)
Media	The proper combustible mixture of engine intake air and natural gas or other Woodward approved media.
Vibration	
Sine Sweep	US MS 810C, M514.2 Curve J (Mod)
Random	US MS 202F, Method 214A, Cond. G
Temperature and Humidity	SAE J1455
Typical Control Characteristics	
Inputs	
Power Supply	9 to 32 Vdc (12/24 Vdc nominal) Must be able to supply 50 W for 0.25 seconds in transient conditions and 25 W continuous for steady state conditions.
Outputs	
Position Feedback:	
Nominal Actuator Range	0 to 70 degrees
Position Feedback Output	0.5–4.5 ± 0.1 Vdc
Working Pressures	14 to 345 kPa (2 to 50 psia)
Electrical Specifications	
Operating Voltage	9 to 32 Vdc (12/24 Vdc nominal)
Power Requirements	50 W for 0.25 s in transient conditions and 25 W continuous for steady state conditions.
Position Command	
Pulse Width Modulated	
Input Signal (PWM)	duty cycle range 10–90% duty cycle above 95% results in throttle closure input impedance 117.4 kΩ PWM frequency range 500–2000 Hz with amplitude 4–32 Vdc and 10 bit resolution
0–5 Vdc Input Signal	input range 0.5–4.5 Vdc input impedance 152.7 kΩ
4–20 mA Input Signal	input impedance 249 Ω
0–200 mA Input Signal	input impedance 35.7 Ω
Position Feedback	
Nominal Actuator Range	0° to 70°
Position Sensor Output	0.5–4.5 ± 0.1 Vdc @ 77 °F (25 °C)
Temperature Drift	Temperature drift from 25 to 105 °C or from 25 to –40 °C causes the internal position sensor calibration to shift. Under these conditions, the throttle plate starts to open at a sensor output of 0.8 Vdc and is fully open at a sensor output of 4.2 Vdc. The sensor output continues to track the command signal.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please include the manual number from the front cover of this publication.



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Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.