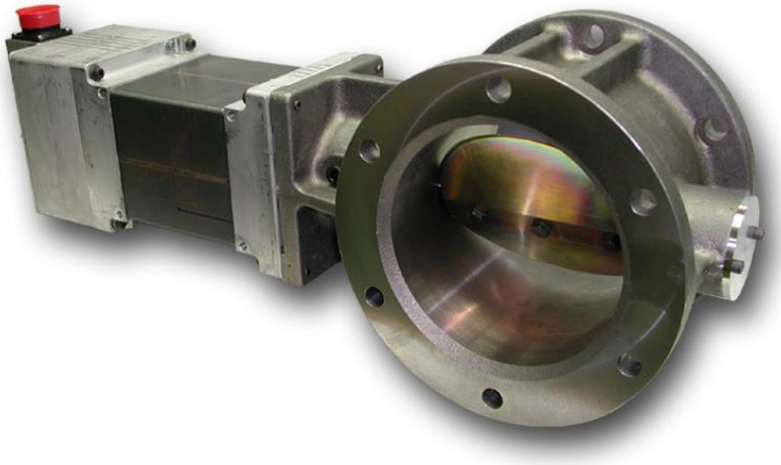
WOODWARD

Product Manual 26203
(Revision A, 7/2016)
Original Instructions



180HT
Integrated Actuator and Throttle Body

Installation and Operation Manual

General Precautions

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.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Contents

WARNINGS AND NOTICES II

ELECTROSTATIC DISCHARGE AWARENESS III

REGULATORY COMPLIANCE IV

CHAPTER 1. GENERAL INFORMATION 1
Introduction 1
Valve Flow Coefficient (Cv) 1
Cv (Flow Coefficient) 2

CHAPTER 2. INSTALLATION 4
Unpacking 4
Mounting 4

CHAPTER 3. TROUBLESHOOTING 5
Introduction 5
When the Governor is at Fault 5

CHAPTER 4. SERVICE OPTIONS 6
Product Service Options 6
Woodward Factory Servicing Options 7
Returning Equipment for Repair 7
Replacement Parts 8
Engineering Services 8
How to Contact Woodward 9
Technical Assistance 9

180HT VALVE SPECIFICATIONS 10

DECLARATIONS 11

Illustrations and Tables

Figure 1-1. Cv vs Angle for the 180HT Valve 2
Figure 1-2. Outline Drawing of 180HT 3

Table 1-1. 180HT Cv (Flow Coefficient) vs. Angle 2

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

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.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

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.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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.**

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*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Regulatory Compliance

General Installation and Operation Notes and Requirements:

Refer to the ProAct™ Digital Plus actuator manual (26112) for complete actuator listing information and regulatory requirements.

Other European Compliance:
Compliance with the following European Directive does not qualify this product for application of the CE Marking:

Pressure Equipment Directive 2014/68/EU:	Exempt per Article 2.j of 2014/68/EU where pressure is not a significant design factor
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.

WARNING

EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 2.

AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

Chapter 1.
General Information

Introduction

The 180HT is a 180 mm bore, electrically-actuated, butterfly throttle valve designed to provide speed governing for natural gas engines. The throttle is designed to govern the flow of the air-fuel mixture to the cylinders over the engine's entire load and speed profile. The device is comprised of a butterfly valve, actuator, and driver integrated into one stand-alone package, easing installation and service for the end-user. The actuator used for this application is a ProAct™ Digital Plus, Model IV limited angle torquer (LAT).

The HT designation stands for High Temperature, which indicates that this valve has been designed for use between the turbocharger and aftercooler rather than downstream of the aftercooler, which is a more typical location for an air throttle. This requirement significantly elevates the air-fuel temperature and has had a considerable influence on the overall design. The 180HT is not designed to operate with hydrogen sulfides from landfill or sour gas.

The valve has been constructed to contain the air-fuel mixture under normal operating conditions. It is also designed to withstand pressures due to abnormal situations, such as an engine backfire. A single dynamic shaft seal has been used with no provision for an overboard drain feature. If leakage occurs across the seal, it will vent to atmosphere rather than be captured in a cavity between the valve and actuator.

Valve Flow Coefficient (Cv)

The valve's ability to handle fluid flow can be described in terms of its flow capacity or flow coefficient (Cv) at various openings. Figure 1-1 shows the flow gain characteristics of the 180HT valve. This curve, combined with the following equation, enables the end-user to estimate the valve opening at various flow conditions. The valve is limited to 75 degrees of rotation by the actuator's internal mechanical stops.

For further assistance, consult the Woodward engineering department.

$$Cv := \frac{Q \cdot 0.00976}{P_1} \cdot \sqrt{\frac{(T_1 + 460) \cdot P_1 \cdot Sg}{P_1 - P_2}}$$

Where:
Cv = Flow Coefficient
Q = Mass Flow (PPH)
Sg = Specific Gravity of Gas (use 1.0 for air)
T1 = Upstream Gas Temperature (Degrees °F)
P1 = Inlet Pressure (psia) [1 psi = 6.895 kPa = 0.06895 bar]
P2 = Downstream Pressure (psia)

IMPORTANT

Note: P2 must be greater than 0.528 * P1 or flow becomes choked. If P2 is less than 0.528 P1, then use P2= 0.528*P1.

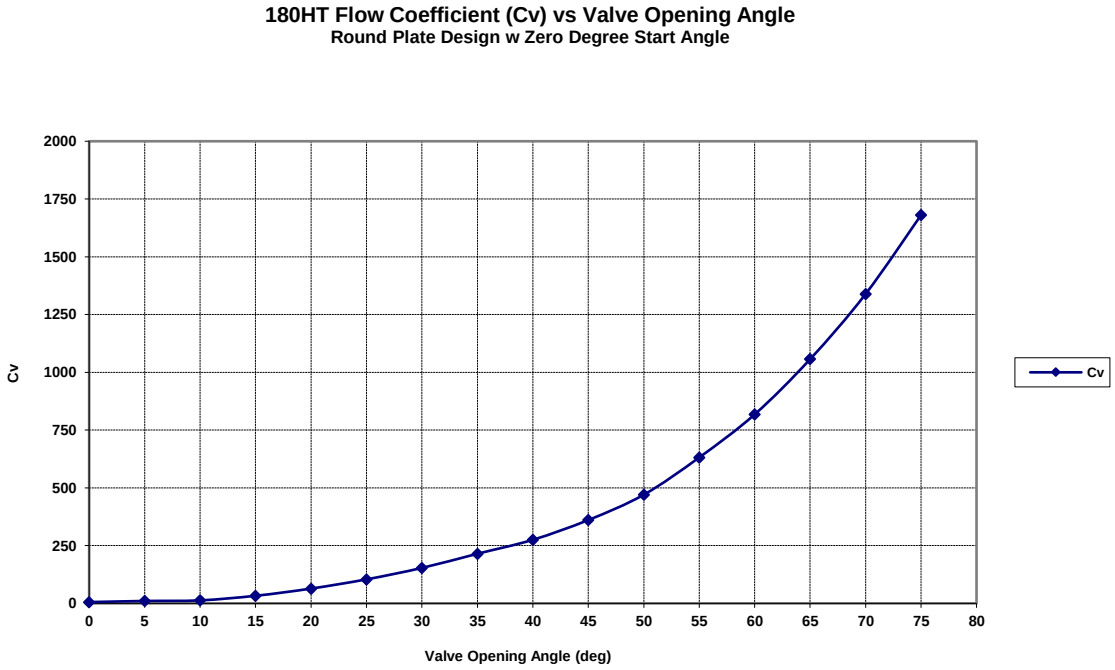


Figure 1-1. Cv vs Angle for the 180HT Valve

IMPORTANT **These flow coefficients were determined using the test setup described in ANSI/ISA-S75.02-1996 "Control Valve Capacity Test Procedure".**

Cv (Flow Coefficient)

Valve Opening Angle	Cv
0	5.7
5	10.4
10	13.1
15	32.8
20	64.1
25	104.0
30	153.5
35	214.8
40	275.3
45	360.8
50	470.3
55	631.6
60	818.0
65	1057.2
70	1339.0
75	1680.8

Table 1-1. 180HT Cv (Flow Coefficient) vs. Angle

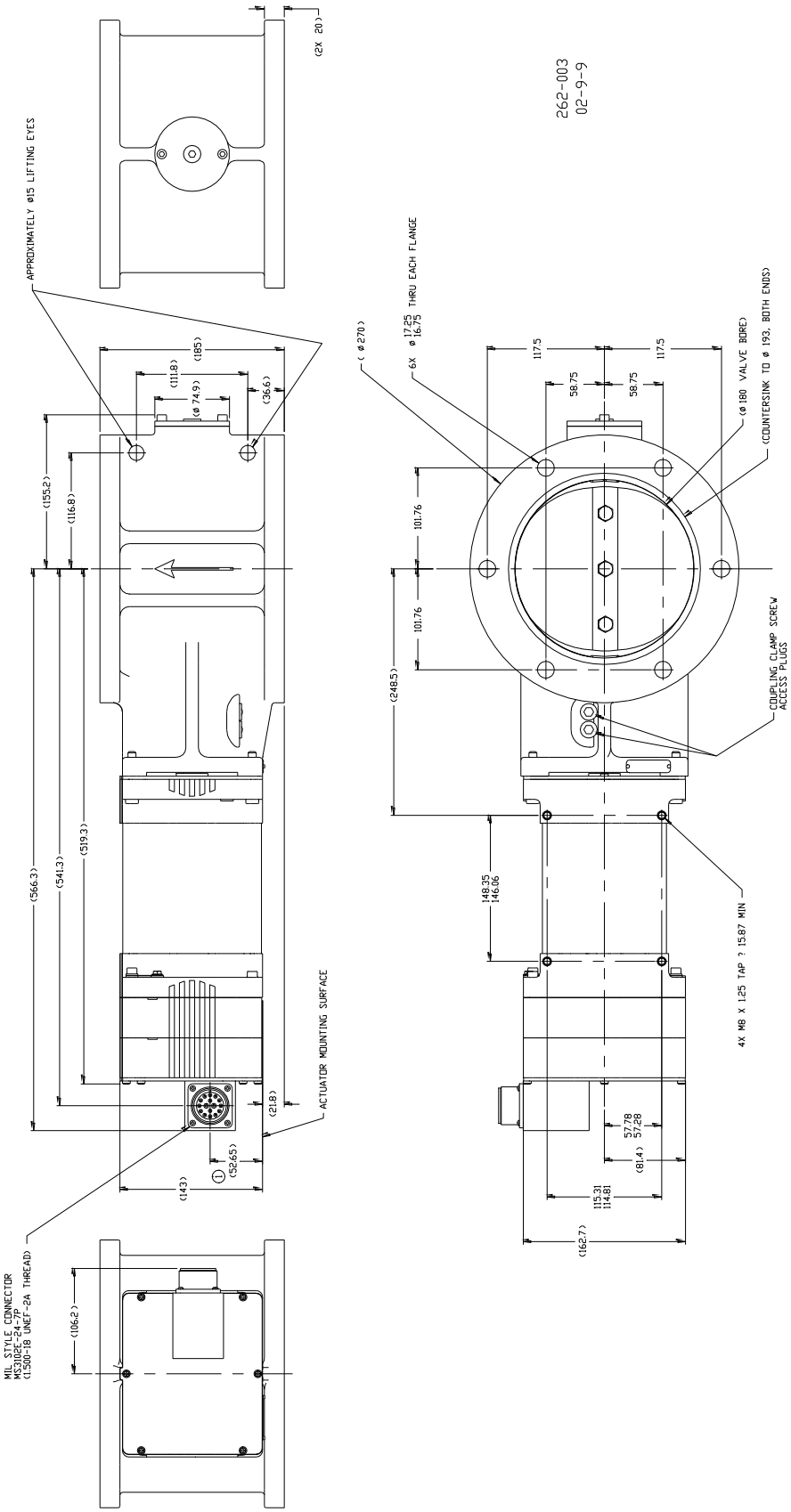


Figure 1-2. Outline Drawing of 180HT

Chapter 2. Installation

Unpacking

Be careful when unpacking the device. Check the driver for signs of damage, such as bent or dented panels, scratches, and loose or broken parts. Notify the shipper and Woodward if damage is found.

Mounting

Since the 180HT weighs approximately 54 kg (120 lb), two holes have been provided in the top of the valve body to act as lifting eyes. These features are shown on the outline drawing (Figure 1-2).

For wiring, and thermal considerations regarding the actuator, refer to the installation procedure in the ProAct™ Digital Plus actuator manual (26112).

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 2 applications.

NOTICE

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*.

The 180HT has been designed to be supported by the valve flanges. However, additional support is required to minimize vibrational loads to the actuator. The end user must provide the necessary brackets using the four M8 tapped holes located in the base of the actuator for this purpose.

Locate the appropriate customer-supplied gaskets on both sides of the valve body. Install the six bolts on both flanges and tighten evenly to a torque recommended by the engine manufacturer. The relationship between the valve body and the actuator has been pre-set by Woodward, therefore no adjustments are required by the end user. No valve maintenance by the end user is required.

Chapter 3. Troubleshooting

Introduction

Improper engine operation is often the result of factors other than governor operation. The following paragraphs are provided to give tips about engine problems, which can resemble governor problems. Make sure the engine is operating correctly before making any changes in the governor.

Attempting to correct engine or load problems with untimely governor adjustment can add to the problems involved with solving improper operation.

Most governor problems are corrected by carefully repeating the calibration procedure given in the governor manual. There are no adjustments available within the valve.

If possible, isolate the governor from the engine to determine if the problem is with the governor and not with the engine or the load on the engine.

Governor system faults are usually caused by problems in the installation. Carefully review all the wiring connections, the power supply, and the ProAct™ Digital Plus actuator before making any adjustments to the control box. The throttle valve should be considered as a possible control problem if it was not removed during installation.

Fuel supply, pressure regulators, carburetors, and ignition conditions can present problems, which resemble governor problems.

When the Governor is at Fault

If the engine will not start, the following problems may exist:

- Verify that any “open for shutdown” contacts are closed.
- Make sure the start fuel limit is not preventing adequate airflow.
- Verify that the 12 or 24-volt power supply is present at the appropriate governor terminals.

Chapter 4.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

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

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 a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor 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 Full-Service Distributor.

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 within 60 days, a credit for the core charge will be issued.

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 for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- 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.

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.

NOTICE

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*.

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.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. 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.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service 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 information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

For assistance, call one of the following 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.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

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:

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
Control/Governor #1	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #2	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #3	
Woodward Part Number & Rev. 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.

180HT Valve Specifications

Operating Temperature Range	–40 to +85 °C (–40 to +185 °F)
Storage Temperature Range	–55 to +125 °C (–67 to +257 °F)
Gas Inlet Temperature	–40 to +215 °C (–40 to +419 °F)
Humidity Qualification Test Level	Tested at 25 to 60 °C, 85 to 95% RH, 5 cycles at 24 hours/cycle (test derived from DNV C.N2.4, Damp Heat)
Vibration Qualification Test Level	0.1 G^2/Hz Random, 10–2000 Hz, 12.8 Grms, 3 hours/axis (test derived from MS202F, Method 214A, Test Condition D)
Shock Qualification Test Level	40 G, 11 ms sawtooth pulse (test derived from US MIL-STD810C, M516.2,P1)
Mass/Weight	54 kg (120 lbs)
Maximum Inlet Pressure	10 bar (145 psig)
Maximum Pressure Differential	3.8 bar (55.1 psid)

Regulatory Compliance
Note: Refer to the ProAct Digital Plus actuator manual (26112) for actuator compliance

Other European Compliance:
Compliance with the following European Directive does not qualify this product for application of the CE Marking:

Machinery Directive:	Compliance as a component with 98/37/EC COUNCIL DIRECTIVE of 23 July 1998 on the approximation of the laws of the Member States relating to machinery.
Pressure Equipment Directive:	Exempt per Article 1-3.10

Declarations

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
2006/42/EC

File name:	00183-04-EU-MD-02-01
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Address:	3800 Wilson Ave Loveland, CO 80538 USA
Model Names:	180HT Integrated Actuator and Throttle Body
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

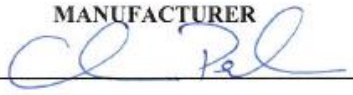
The person authorized to compile the technical documentation:

Name: Dominik Kania, Managing Director
Address: Woodward Poland Sp. z o.o., ul. Skarbowa 32, 32-005 Niepolomice, Poland

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward Governor Company of Loveland and Fort Collins, Colorado that the above referenced product is in conformity with Directive 2006/42/EC as partly completed machinery:

MANUFACTURER



Signature

Christopher Perkins
Full Name

Engineering Manager
Position

Woodward Inc., Fort Collins, CO, USA
Place

21 - JUL - 2016
Date

Document: 5-09-1182 (rev. 16)

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26203A.

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

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.