



Product Manual 04176
(Revision G, 8/2015)
Original Instructions

ProAct™ II Electric Powered Actuator and Driver

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

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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.



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

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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.

Chapter 1.

General Information

Introduction

The ProAct II driver converts either a 0–200 mA, 4–20 mA, 4–13 mA, 11–20 mA, PWM, or a 0–5 V control signal from a Woodward electronic control into a specific actuator position. The driver provides a feedback of 0.5–4.5 V corresponding to actuator position.

The ProAct II driver comes in two different package configurations: a sealed aluminum box with conduit fittings for wiring, and a sheet metal box with grommet holes for wiring. The sealed box is IP56 capable and is designed for skid-mounted applications. The sheet metal box is designed for skid or control box mounted applications in an additional enclosure for protection from the elements. Both units have the same power supply requirements, vibration capability, and system response.

The ProAct II drivers require a separate electrical supply of 20–32 Vdc. The supply must be capable of providing a sustained 6 A and a peak 12 A for up to two seconds for the driver.

The ProAct actuator provides up to 5.4 J (4.0 ft-lbs) transient and 2.7 J (2.0 ft-lbs) steady state of work to move the fuel-setting lever on the engine. The actuators have position feedback.

Engine stability and response are set by the controlling device, not by the actuator and driver. Follow the instructions for the controlling device while setting up the engine control system.

The following configurations are available for the position command input.

Input Signal	Nominal Input Range	Actuator Output for Input Range	Package Configuration	Woodward Part Number
5–32 volt 1 kHz PWM push-pull source	10% to 90% duty cycle	0% to 100% actuator position	IP56 box w/ conduit connectors	See Application Note 51499
0 to 200 mA	20 to 160 mA	0% to 100% actuator position	IP56 box w/ conduit connectors	
4 to 20 mA	4 to 20 mA	0% to 100% actuator position	IP56 box w/ conduit connectors	

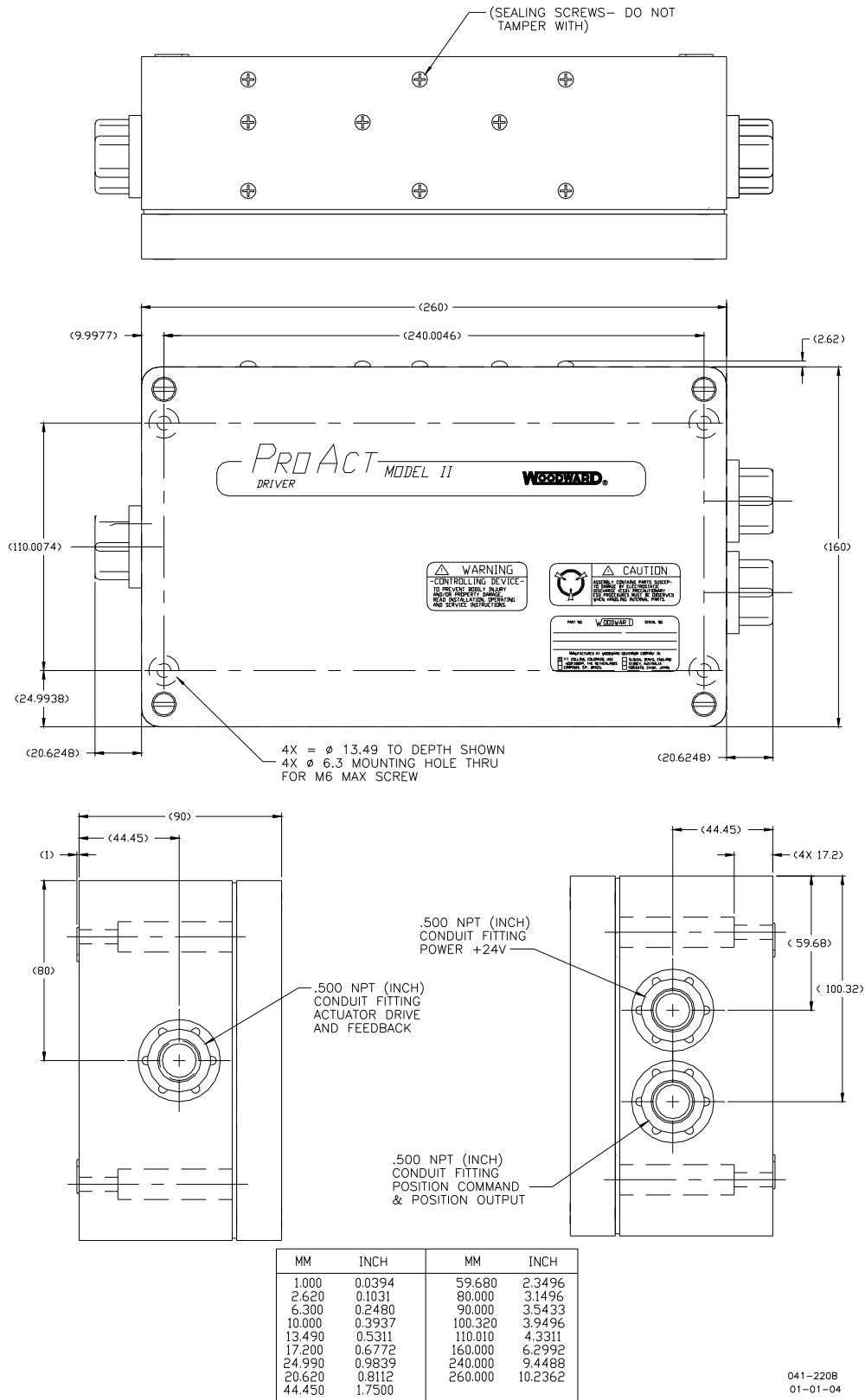


Figure 1-1. Outline Drawing of ProAct II Driver with IP56 Box

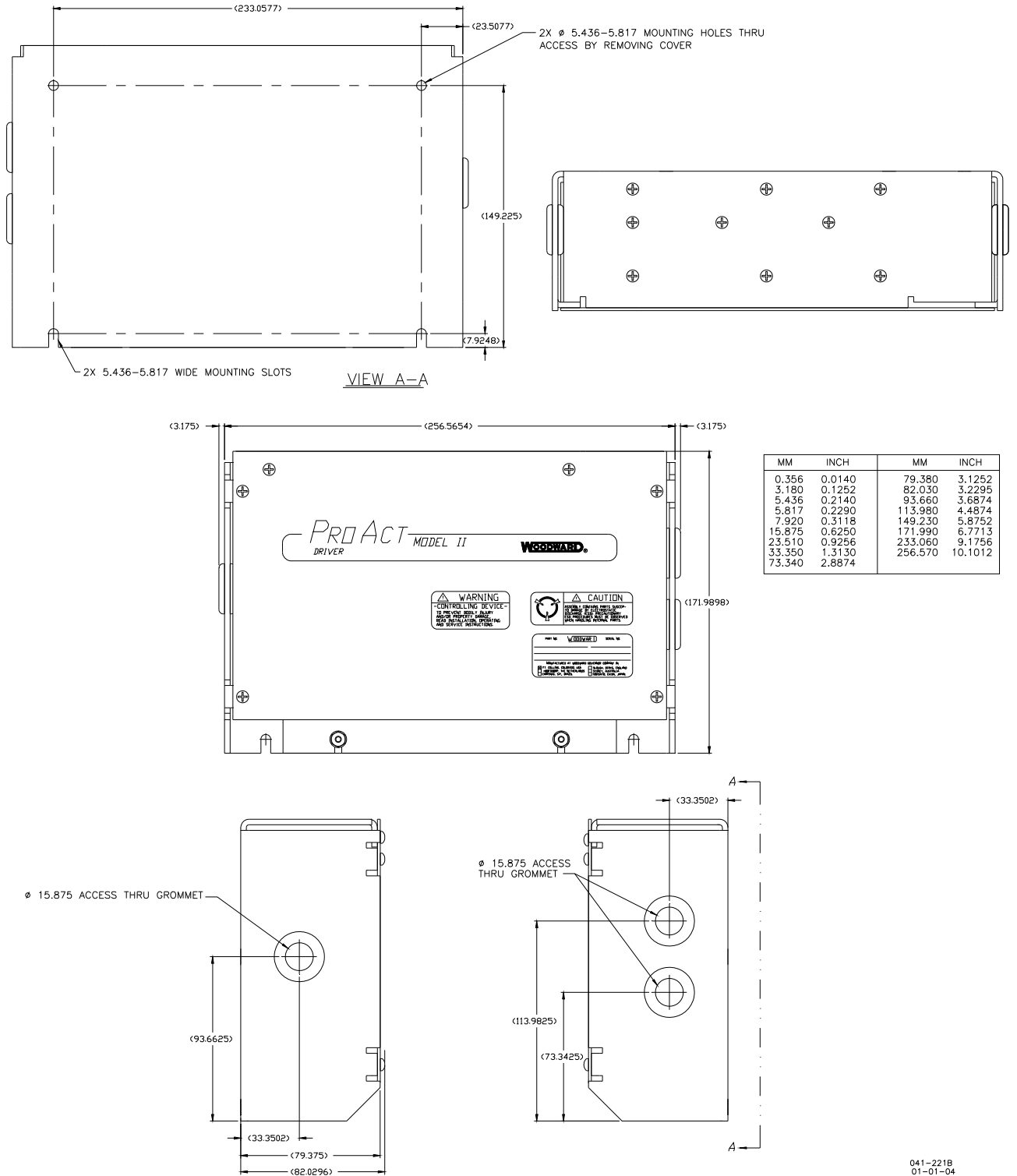


Figure 1-2. Outline Drawing of ProAct II Driver with Sheet Metal Box

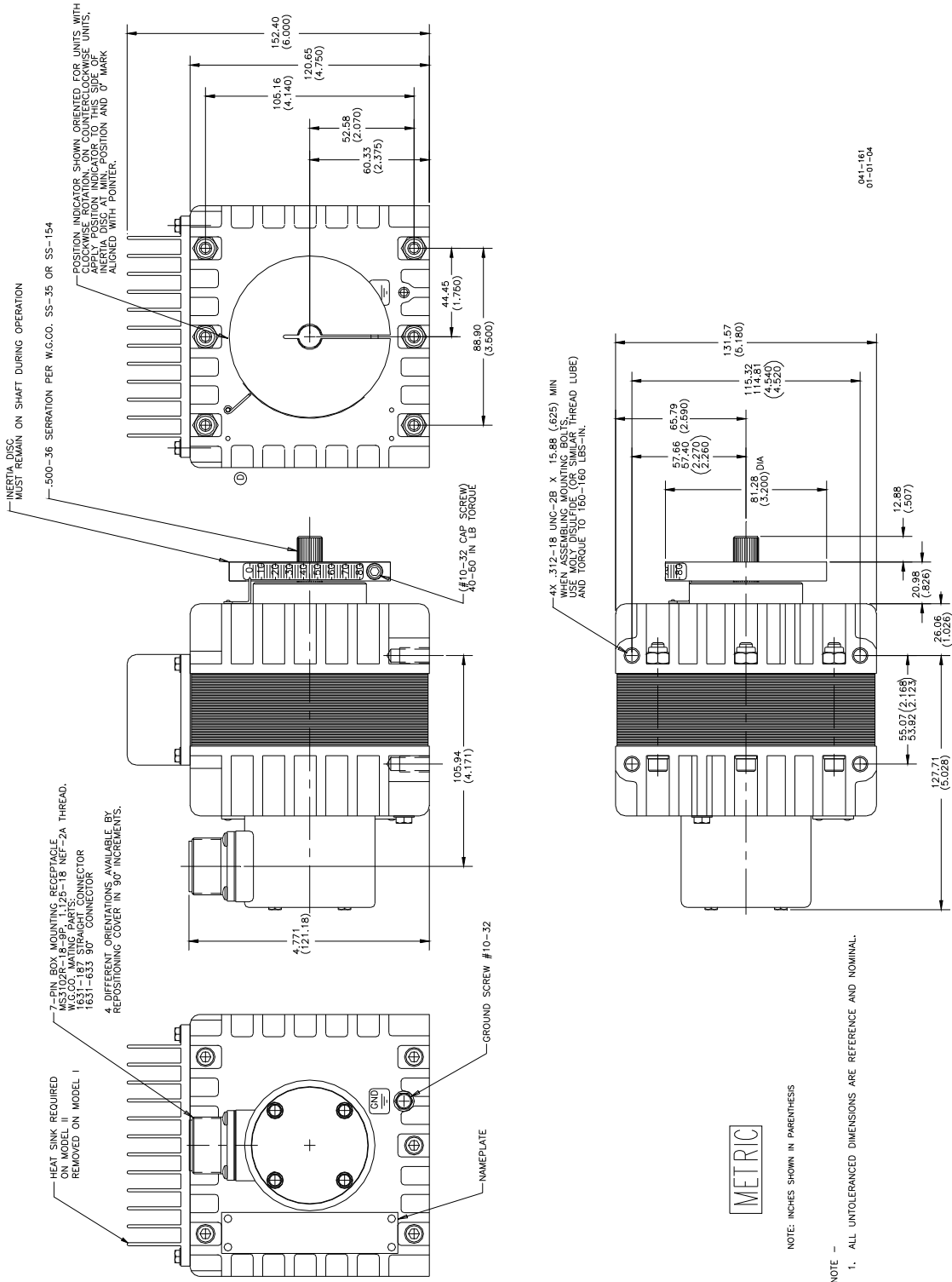
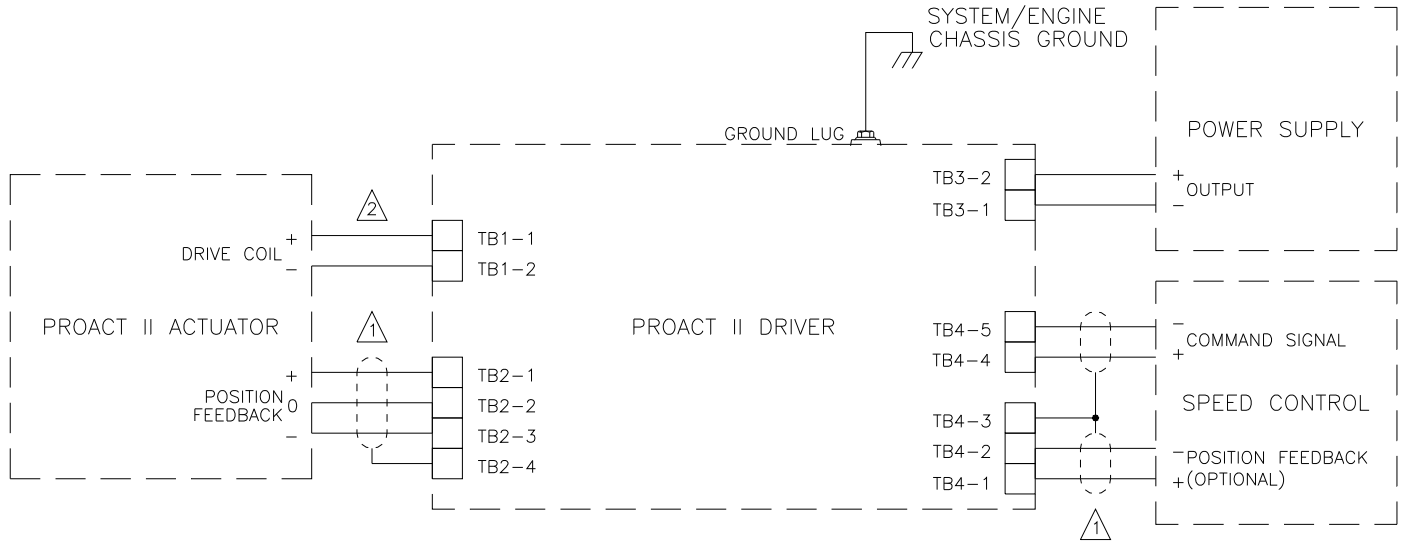


Figure 1-3. Outline Drawing of ProAct Actuator

(converted this AutoSketch file into a .dwg file...AutoCAD)



- 1 Shielded wires are to be twisted conductors with shield grounded at driver end only.
- 2 Refer to line length/driver wire gauge table.

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Figure 1-4. Plant Wiring Diagram

Chapter 2. Installation

Unpacking

Be careful when unpacking the electronic driver. 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

The driver box is designed to operate within an ambient temperature range of -40 to $+70$ °C (-40 to $+158$ °F).

The driver is capable of withstanding the following vibration specifications:

Shock—US Mil Std 810C, M516.2, PL 40G, 11 ms sawtooth

Vibration—Random Vibration 0.04 G²/Hz WGC RV2

If the application has a higher vibration level than specified (0.04 G²/Hz), vibration isolators must be used to keep the levels below the given levels.

Mount the driver in a location with space for adjustment and wiring access. Do not expose the driver to sources of radiant heat such as exhaust manifolds or turbochargers. Mount the driver close enough to the actuator and battery to meet the wire length requirements (see wiring requirements in Chapter 5).

The driver will generate some heat, so surfaces must be open to normal air movement. No special ventilation is required.

Ideally, the driver should be mounted flush to the metal side of a control cabinet, protected from the weather and high humidity, and close to the engine being controlled. Do not install the driver directly on the engine. The location should provide protection from high-voltage or high-current devices, or devices which produce electromagnetic interference. After initial adjustments are completed, access to the driver will not be required for normal engine operation.

Actuator Installation

Thermal

The actuators are designed for installation on the engine. The actuators will generate heat, especially when stalled or during other conditions requiring maximum torque output. Maximum operating temperature for the ProAct II actuator is 100 °C (212 °F).

The installer must consider the heat conductivity of the installation bracket, and the operating temperature of the ultimate heat sink to which the bracket will be attached. Generally the heat transfer abilities of aluminum and low-carbon steel are better than those of high-carbon steel or stainless steel.

Uninhibited air flow over the heat-exchanger fins on the side of the actuators will help control possible heat problems. Keep the fins as clean as possible to improve heat transfer. Do NOT paint the fins, since this will reduce the heat transfer efficiency.

If operating temperature is a concern, contact Woodward for more information.

Fuel Position Stops

Diesel Stops. Diesel installations will generally use the fuel system minimum and maximum position stops. Diesel engine racks are normally designed to provide the minimum and maximum stops without binding.

The actuator's stops must not prevent the actuator from driving the fuel linkage to the minimum and maximum positions. The linkage should be designed to use as much actuator travel as possible, without preventing minimum and maximum fuel positions (see Figure 2-1).

Gas Engine Stops. Butterfly valves in carburetors will often bind if rotated too far toward minimum or maximum. For this reason, the stops in the actuator should be used at both minimum and maximum positions. Note that the stops will allow up to 3 degrees of additional rotation in both directions during impact (see Figure 2-2).

The engine must always shut down when the actuator is at the minimum stop.

NOTICE

The actuator's maximum slew rate can place stress on fuel system stops and on the linkage between the actuator and the fuel system. Maximum actuator speed is 900 degrees per second in both the increase and decrease fuel directions. The ProAct II actuator's Mass Moment of Inertia (MMOI, with inertia disc applied) is $3.67 \cdot 10^{-3}$ in-lb-sec².

ProAct II actuator stops are designed to absorb 1.1 J (10 in-lbs) of kinetic energy with 3 degrees overtravel. If the actuator travel stops are used, the linkage must be designed to allow this 3 degree overrun.

Use good rod-end connectors with as little free play as possible. Select rod ends which will not become loose and which will wear well during the nearly constant movement associated with precise speed control. Low-friction, long-wearing rod ends are available from Woodward.

The link connecting the actuator lever to the fuel-control lever must be short or stiff enough to prevent flexing when the engine is running.

Actuator levers are available from Woodward which allow adjustment of the rod-end location with respect to the center of the actuator shaft. The lever used must have the correct interface for the actuator used.

Adjust the location of the rod end on the lever to achieve the desired rotation of the actuator shaft between minimum and maximum positions. (Use as much of the 75-degree rotation as possible—at least 60 degrees.) To increase the amount of rotation, move the rod end closer to the actuator shaft or farther away from the shaft controlling fuel flow. To decrease the amount of rotation used, move the rod end farther from the actuator shaft or closer to the shaft controlling fuel flow.

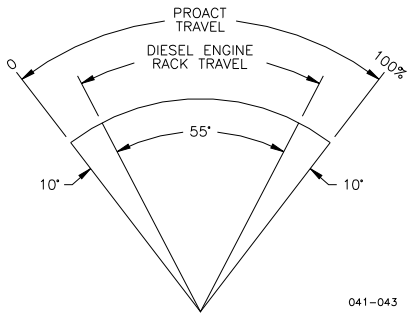


Figure 2-1. Diesel Engine Travel Stops

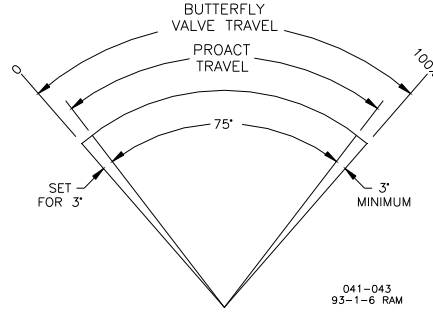


Figure 2-2. Carburetor Travel Stops

Actuator Bracket

The actuator may be installed on a bracket which attaches to the base with four M8x1.25 (0.312-18) screws with a minimum engagement of 16 mm (0.625 inch). The actuator may be mounted in any attitude. The actuator is weatherproof and resistant to the corrosive effects of water and salt water. Avoid pressure washing near the shaft seals.

The ProAct II actuator weighs 6.9 kg (15.23 lbs). The bracket and attaching hardware must be designed to hold the weight and to withstand the vibration associated with engine mounting. The bracket must also be designed to provide a heat sink (heat transfer) from the actuator to the engine block. Figure 2-3 provides an illustration of the mounting bracket.

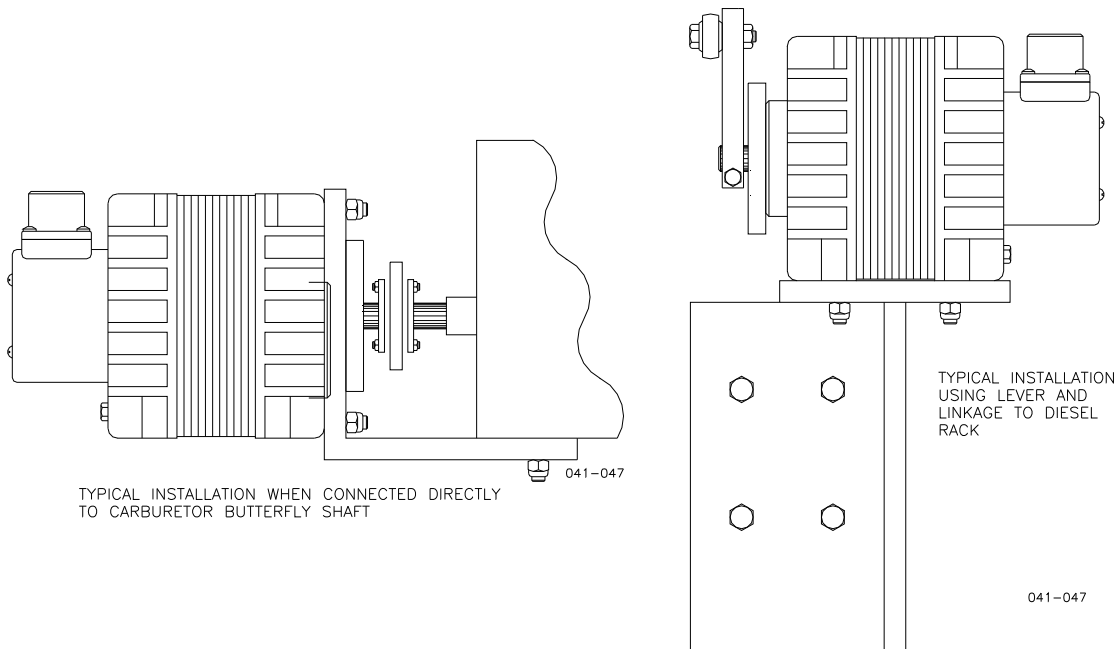


Figure 2-3. ProAct II Mounting Bracket

Electrical Connections

External wiring connections and shielding requirements for a typical control installation are shown in the plant wiring diagram (Figure 1-4).

The type and gauge of the wiring used should follow the wire length and type shown in the System Wiring section of Chapter 5.

Shielded Wiring

All shielded cable must be twisted conductor pairs or triples. Do not attempt to tin the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields to the correct pins on the driver connector or wiring. Do not connect shields to the actuator ground. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor. **DO NOT** run shielded signal wires along with other wires carrying large currents. See Woodward application note 50532, *Interference Control in Electronic Governing Systems*, for more information.

Where shielded cable is required, cut the cable to the desired length and prepare the cable as instructed below (Figure 2-4).

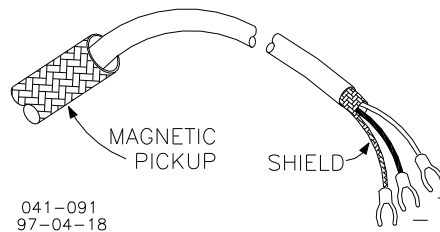


Figure 2-4. Preparing Shielded Wiring

1. Strip outer insulation from **BOTH ENDS**, exposing the braided or spiral wrapped shield. **DO NOT CUT THE SHIELD.**
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.

The shield must be considered as a separate circuit when wiring the system. The shield must be carried through connectors without interruption.

Installations with severe electromagnetic interference (EMI) may require additional shielding precautions. Contact Woodward Governor Company for more information.

Failure to provide shielding can produce future conditions which are difficult to diagnose. Proper shielding at the time of installation is required to assure satisfactory operation of the ProAct control system.

Power Supply

Power supply output must be low impedance (for example, directly from batteries).

Run an insulated wire directly from the positive (+) battery terminal to the fuse and the switch as shown in Figure 2-5, then from the switch to the correct connection on the driver (see Figure 1-4). Run a second insulated wire directly from the negative (-) terminal of the battery to the driver. Neither of these connections needs to be shielded (see Figure 2-5 for correct installation).

Run the power leads directly from the power source to the control. **DO NOT POWER OTHER DEVICES WITH LEADS COMMON TO THE CONTROL.** If the power source is a battery, be sure the system includes an alternator or other battery-charging device (see Figure 2-6 for *incorrect* installation).

When the engine is shut down, the driver powers the actuator to the minimum stop. If the battery charging system is off when the engine is shut down, this will cause the battery to be drained. In this case, the power to the ProAct must be turned off with a switch or relay. Any such switch or relay must be interlocking to prevent starting the engine when power to the actuator is shut off.

Do not use the driver for normal shutdown procedures. All actuator position commands should come from the control unit, through the driver, to the actuator.

NOTICE

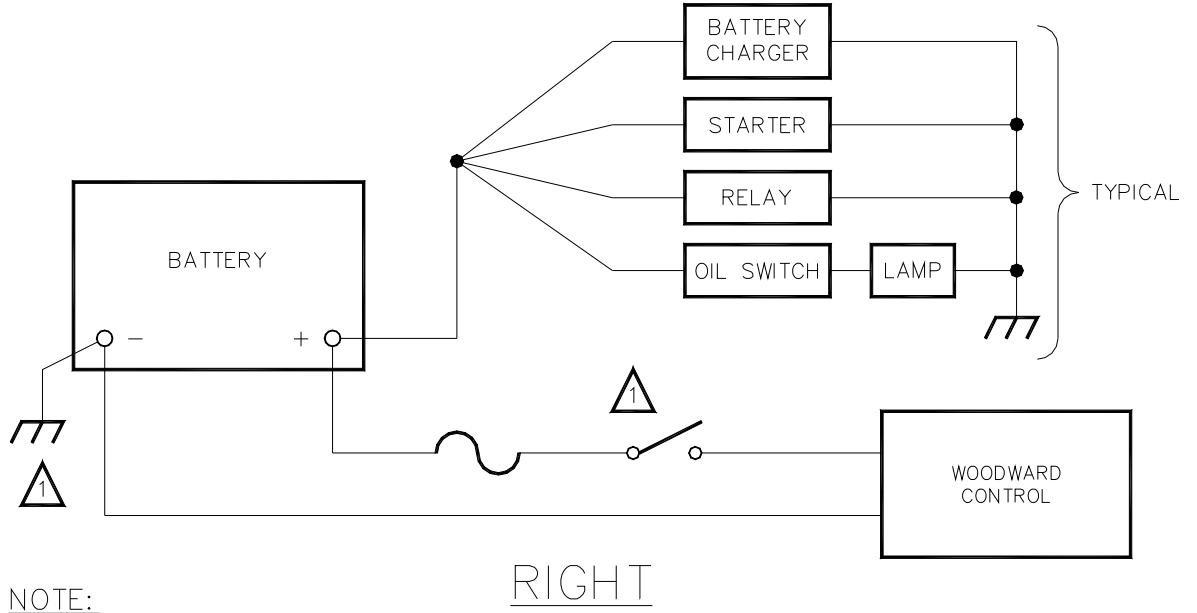
To prevent possible damage to the control, or poor control performance resulting from ground loop problems, follow these instructions.

It is important to set up the ProAct driver in the order that follows. See Figure 2-7 for the location of potentiometers on the driver box.

NOTICE

Always hold onto the side of the control box with one hand while making an adjustment with the other hand. This prevents possible static damage to parts.

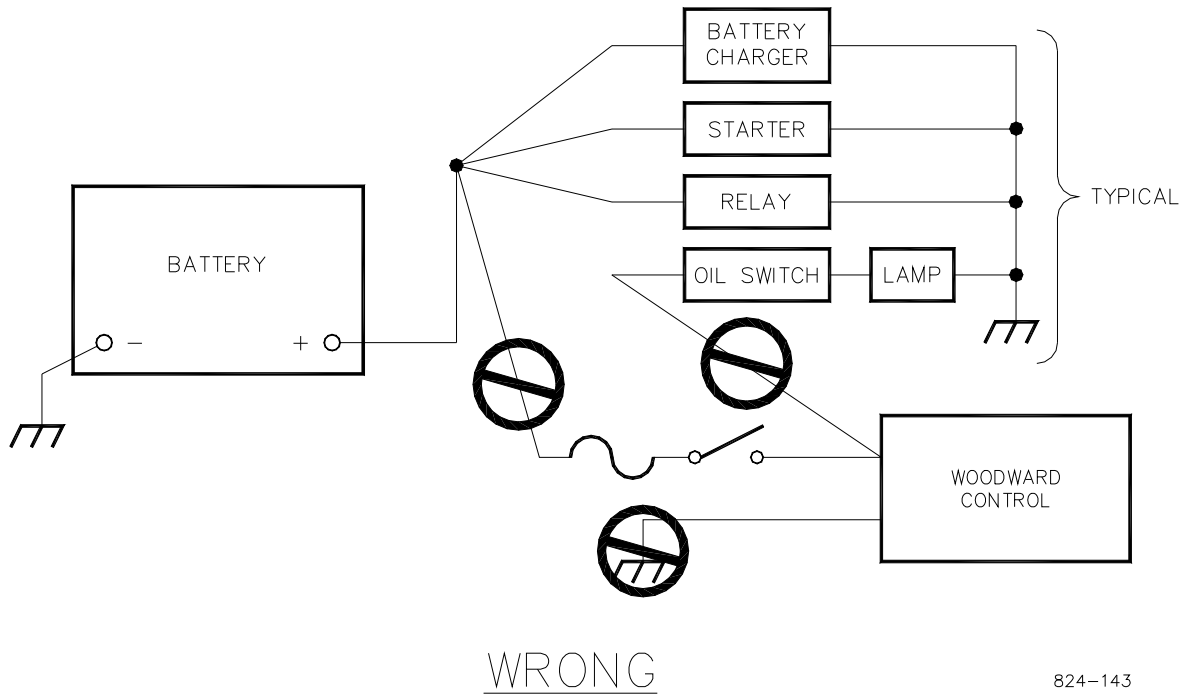
Use an insulated screwdriver to make adjustments. Extensive damage is possible should the high voltages present inside the box be shorted to elements on the board.



NOTE:

⚠ A NEGATIVE GROUND SYSTEM IS SHOWN. IF A POSITIVE GROUND SYSTEM IS USED, THE SWITCH AND FUSE MUST BE LOCATED IN SERIES WITH BATTERY (-) AND TERMINAL (TB1-2) ON THE WOODWARD CONTROL. THE POSITIVE TERMINAL BECOMES CHASSIS GROUND.

Figure 2-5. Correct Wiring to Power Supply



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Figure 2-6. Incorrect Power Supply Wiring

RP1 – POSITION COMMAND OFFSET
 RP2 – UNUSED
 RP3 – POSITION COMMAND GAIN
 RP4 – SYSTEM POSITION FB GAIN
 RP5 – SYSTEM POSITION FB OFFSET

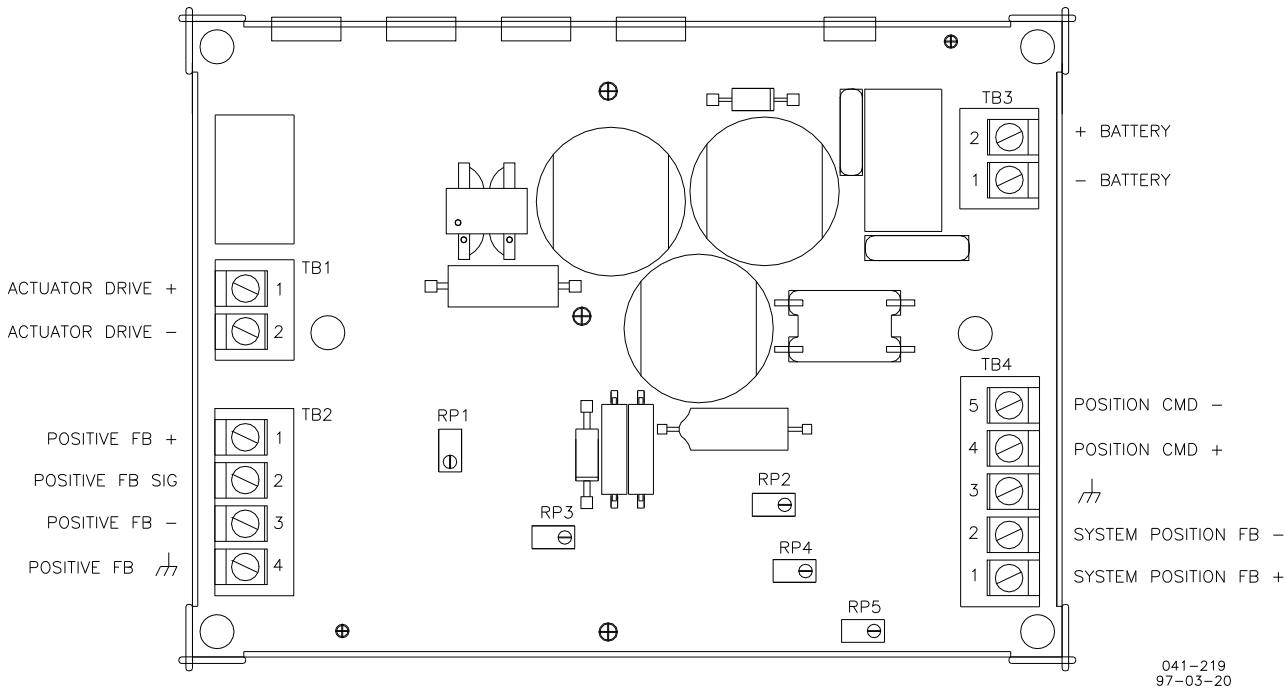


Figure 2-7. ProAct Driver Adjustment Locations

Position Feedback Adjustment

The driver's position feedback Gain and Offset adjustments normally don't need to be changed unless you experience feedback values outside the normal operating parameters of the driver. If the characteristic falls outside the tolerance limits, adjust System Position FB Gain and Offset as required to get the characteristic midway between the tolerance limits (see Figure 2-7 for adjustment locations).

The procedure for adjusting the system position feedback is as follows.

To set up the driver system feedback, first disconnect the actuator drive wires at the control (DO NOT disconnect the actuator position feedback wires). Power up the system with the actuator disconnected from the linkage but with the inertia disk in place. DO NOT START THE ENGINE AT THIS TIME.

The actuator can be manually moved between minimum and maximum fuel, based on actuator stops. Adjust the System Position FB (feedback) Gain and Offset potentiometers until the output at the terminals is within the desired specification. The nominal voltages are 0.5 V at minimum fuel and 4.5 V at maximum fuel.

IMPORTANT

The adjustment of the system position feedback potentiometers does not affect the positioning of the actuator relative to the position input signal, or the response of the actuator to the position input signal.

Reconnect the actuator drive wires.

Actuator Travel

The driver's Gain and Offset adjustments normally don't need to be changed unless you experience difficulty getting the actuator to travel full stroke. If the characteristic falls outside the tolerance limits, adjust Position Command Gain and Offset as required to get the characteristic midway between the tolerance limits (see Figure 2-7 for adjustment locations).

To set up the driver and actuator, power up the system with the actuator disconnected from the linkage but with the inertia disk in place. **DO NOT START THE ENGINE AT THIS TIME.**

Vary the signal into the position input to the driver and observe actuator angle. Adjust the Position Command Gain and Offset potentiometers to achieve the desired relationship (see Figure 2-7). Failure to make this adjustment correctly may result in the inability to shut off fuel or the inability to reach full-fuel position. After this adjustment is made, re-install linkage, coupling, etc., to the engine.

This procedure must be repeated whenever the actuator or driver is changed. The Gain and Offset pots are both located on the printed circuit board inside the driver box.

The actuator position feedback sensor is factory set and should not be adjusted.

Chapter 3. Description of Operation

The ProAct control system functions by receiving a position command signal from a Woodward electronic governor. The system then sends a pulse width modulated current (-12 A to +12 A) signal to the actuator, modified by signals from a position feedback, velocity, and current sensor from the actuator (Figure 3-1).

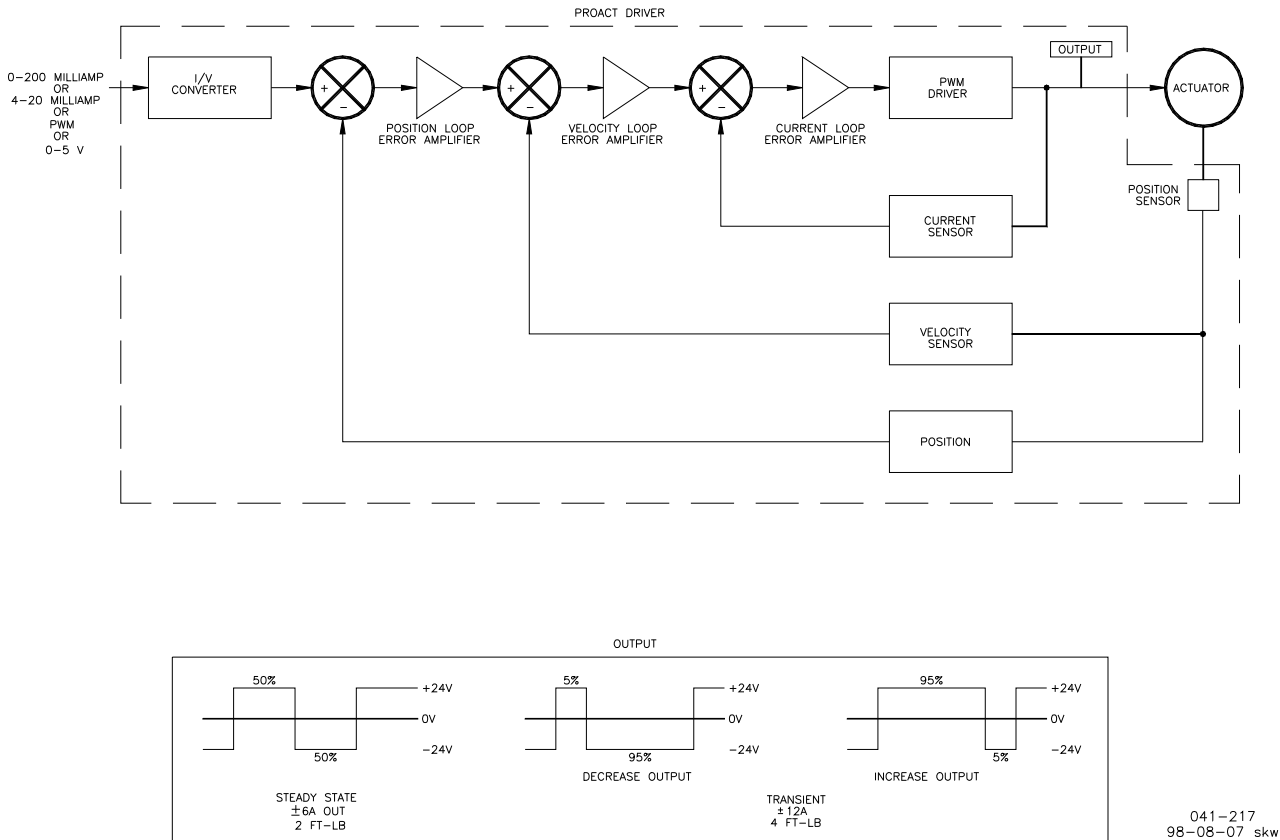


Figure 3-1. ProAct II Functional Block Diagram

Electronic Circuits

All circuits in the ProAct driver are solid state and are not serviceable in the field. The printed circuit board is manufactured by Woodward to provide maximum tolerance to temperature and vibration.

Four potentiometers, accessible when the cover of the driver box is removed, provide all adjustments to the driver system.

A 25-turn pot (Position Command Gain) adjusts how far the actuator travels when the speed control signal varies from minimum to maximum.

A 25-turn pot (Position Command Offset) adjusts the offset of the actuator travel when the speed control signal varies from minimum to maximum.

A 25-turn pot (System Position Feedback Gain) adjusts the system position feedback gain as the actuator varies from minimum to maximum.

A 25-turn pot (System Position Feedback Offset) adjusts the system position feedback offset as the actuator varies from minimum to maximum.

Actuator Position Signal

The feedback device is located on the closed shaft of the actuator. The older actuators use a rotary transducer which changes resistance proportional to the actuator shaft angle. The new replacement actuators use a rotary Hall Effect position sensor which changes output voltage proportional to the actuator shaft angle. The device is a non-contacting unit, thereby eliminating most wear problems.

Actuator

The rotary design of the ProAct actuators gives 75 degrees of shaft rotation to position fuel controls. The actuators apply torque in both directions. Torque is proportional to the current supplied to the actuator by the driver.

The actuator uses sealed bearings, eliminating the need for maintenance. The feedback mechanism attaches to the end of the rotor not being used to control the engine. The device is enclosed in a Ryton housing and is sealed against the elements. Avoid pressure washing the actuator.

An inertia disc is installed on the actuator output shaft. The disc is necessary for stable actuator operation with light, low-friction linkages. Do not remove the disc (see Figure 1-3).

Chapter 4. Troubleshooting

Improper engine operation is often the result of factors other than governor operation. This chapter gives 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 make problems worse.

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 faults are usually caused by installation problems or the linkage between the actuator and the engine. Carefully review all the wiring connections, the power supply, and the linkage before making any adjustments to the actuator or driver. Always check the fuel-control linkage from stop to stop as if the actuator were moving it. The linkage must move freely without friction and without backlash. Some fuel controls will present problems at particular fuel or rack position because of a hesitation or binding in the linkage.

Fuel supply and injector conditions can also present problems which resemble governor problems.

On spark-ignited engines, distributor, coil, points, and timing problems can all cause improper operations which may resemble faulty governor control.

Linkage and Actuator Stroke

Use as much of the 75 degrees of actuator stroke as possible. Carefully follow the guidelines in the Actuator Installation section of Chapter 2 in making linkage arrangements. Using less than optimum actuator movement will make stability more difficult, and will make the actuator more sensitive to external loading forces and friction.

Possible problems with driver-actuator system include:

Symptom	Possible Cause	Possible Fix 1	Possible Fix 2
Actuator drives opposite direction than the command signal directs.	Actuator drive and position feedback signals are connected incorrectly.	Actuator drive wires and position feedback (both) may be connected in the reverse polarity. Check wiring for proper polarity.	
Actuator drives into max stop with a command to min fuel applied.	Actuator drive or position feedback signals are connected incorrectly.	Actuator drive wires may be connected in the reverse polarity. Check wiring for proper polarity.	Actuator position feedback input may be connected in the reverse polarity. Check wiring for proper polarity.
Actuator drives into min stop with a command to mid fuel (or some other non-stop command) applied.	Position command signal is not being received correctly.	Position command input leads may be connected in wrong polarity. Check wiring for proper polarity.	Position command input may have poor connection to input signal. Check wiring for good connection.
Actuator and control system do not respond—all voltage outputs are 0 V.	Actuator and driver is not receiving power.	Input power leads may be connected in wrong polarity. Check wiring for proper polarity.	Input power leads may have poor connection to battery + or battery -. Check wiring for good connection.

Chapter 5.

Technical Specifications

Power Supply

The power supply for the ProAct II driver is configured to operate from 20 to 32 Vdc. The minimum current level to be provided by the system will be 6 A dc and 12 A dc for up to two seconds.

Actuator Position Feedback

The actuator position feedback output provides a nominal 0.5 to 4.5 Vdc corresponding to 0% to 100% actuator travel. The actuator position feedback will filter the position output signal using a low-pass filter with a cut-off frequency of 40 Hz. The actuator position output has gain and offset adjustments to trim the voltage output for the proper voltages at the correct positions.

System Wiring

The actuator driver is capable of driving the actuator through wiring harnesses of the following configurations:

The maximum length of the line distance between the battery summed with twice the distance between the control and the actuator must be less than the distance in the following chart.

Line Length	Driver Wire Gauge	Actuator Position Feedback Wire Gauge	Actuator Position Feedback Wire Type
0–3 m (0–10 ft)	1.5 mm ² (16 AWG) or larger stranded	0.5 mm ² (20 AWG) or larger stranded	twisted shielded triple
3–6 m (10–20 ft)	2 mm ² (14 AWG) or larger stranded	0.5 mm ² (20 AWG) or larger stranded	twisted shielded triple
6–10.5 m (20–35 ft)	4 mm ² (12 AWG) or larger stranded	0.5 mm ² (20 AWG) or larger stranded	twisted shielded triple
10.5–16.8 m (35–55 ft)	6 mm ² (10 AWG) or larger stranded	0.5 mm ² (20 AWG) or larger stranded	twisted shielded triple

Under no circumstances should the maximum length calculated using the formula above be greater than 16.8 m (55 ft).

In applications where these maximum line lengths are followed, the worst case transient current level at elevated actuator temps (100 °C ambient) will be 57.5% of the transient limit. This only affects the transient current limits, the steady state limits will still be 6 A.

Input Configurations

The following input configurations are available for the position command input.

PWM

The PWM input will accept a 1000 ± 100 Hz input signal of 5 to 32 V peak voltage (referenced to unit battery ground). The nominal input of 10% to 90% duty cycle will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

0–200 mA

The 0–200 mA input will accept a 0 to 200 mA dc input. The nominal input of 20 to 160 mA will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

4–20 mA

The 4–20 mA input will accept a 0 to 20 mA dc input. The nominal input of 4 to 20 mA will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

■ The following items are no longer available:

■ 11–20 mA – No longer available

The 11–20 mA input will accept a 0 to 20 mA dc input. The nominal input of 12 to 20 mA will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

■ 4–13 mA – No longer available

The 4–13 mA input will accept a 0 to 20 mA dc input. The nominal input of 4 to 12 mA will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

■ 0–5 Volt – No longer available

The 0–5 V input will accept a 0 to 5 Vdc input. The nominal input of 0.5 to 4.5 V will correspond to 0% to 100% actuator travel (at system calibration temperature). The position command input will be capable of providing a common mode input voltage range (unit battery ground referenced) of 0 to 4 V for all inputs.

System Performance

The performance of the driver when mated to a ProAct II actuator will be as follows:

Inertia level

The driver mated to a ProAct II actuator can drive inertial loads not to exceed 5.9×10^{-3} in-lb-sec². This is specified as un-damped direct inertia.

Actuator compliance

The actuator compliance will be to reach peak steady-state torque in less than 5% of actuator full travel, external deflection of the actuator from commanded position for all supply voltages and current levels within the specified power supply ranges.

Actuator slew rate

The actuator slew rate will be between 80 ms and 100 ms for a 10% to 90% or 90% to 10% actuator slew, commanded with the appropriate input square wave for all supply voltages, current levels and inertial loads within the specified ranges.

Small signal bandwidth

The small signal (1% of full stroke actuator travel sine wave actuator drive) bandwidth of the driver for command to position will be between 6 and 8 Hz for the -3 dB point and 3 and 4 Hz for -45 degree phase loss point, for all supply voltages, current levels, and actuator load inertias within the specified ranges.

Large signal bandwidth

The large signal (10% of full stroke actuator travel sine wave actuator drive) bandwidth of the driver for command to position will be between 10 and 15 Hz for the -3 dB point and between 4 and 5 Hz for the -45 degree phase loss point, for all supply voltages, current levels, and actuator load inertias within the specified ranges.

Position accuracy

The position accuracy for command to position will be better than 1% of actuator full travel after the unit has been calibrated to the actuator for gain and offset. This accuracy is valid at the calibration temperature of the actuator assembly. If the actuator assembly temperature is different from the calibration temperature, the position error will be less than 20% over the entire temperature range. The temperature deviation is a negative tolerance. This means that the unit will drift such that minimum fuel and maximum fuel is always reachable using the standard input range. However, the unit may reach minimum or maximum fuel at input percentages 20% less than (in the case of maximum fuel) or greater than (in the case of minimum fuel) the nominal range.

Unit-to-unit position accuracy

The unit-to-unit position accuracy for two units that have been calibrated and are mounted on the same engine, operating from the same command signal and at the same temperature, will be less than 5% for all actuator temperatures within the specified operating range.

System protection

The system contains protection circuitry to prevent damage if the power supply circuits are connected in reverse polarity. The unit also contains circuitry to prevent driver and actuator damage if one of the actuator wires is short-circuited to battery positive or ground, or if one actuator wire is shorted to the other. The result will be an actuator shutdown during the period of the short circuit. The unit also contains circuitry to prevent driver and actuator damage if the driver steady-state current rises above 6 A continuously. The result will be an actuator shutdown.

Chapter 6.

Product Support and Service Options

Product Support Options

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

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (EngineHelpDesk@Woodward.com) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or 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 current list of Woodward Business Partners is available at www.woodward.com/directory.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 one of the Full-Service Distributors listed at www.woodward.com/directory.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at www.woodward.com/directory.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

<u>Facility</u> -----	<u>Phone Number</u>
Brazil -----	+55 (19) 3708 4800
China -----	+86 (512) 6762 6727
Germany:	
Kempen----	+49 (0) 21 52 14 51
Stuttgart--	+49 (711) 78954-510
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

Products Used In Engine Systems

<u>Facility</u> -----	<u>Phone Number</u>
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

Products Used In Industrial Turbomachinery Systems

<u>Facility</u> -----	<u>Phone Number</u>
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

For the most current product support and contact information, please visit our website directory at www.woodward.com/directory.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

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 _____

Symptoms

Description _____

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.

ProAct II Actuator/Driver Specifications

Driver Box:

Operating Temperature Range	-40 to +70 °C (-40 to +158 °F)
Storage Temperature Range	-55 to +105 °C (-67 to +221 °F)
Humidity	MS810D, M507.3, P3, 95% RH@60 °C 10 cycles, NC
Shock	MS810C, M516.2, PL 40 G, 11mS Saw tooth
Vibration	Random Vibration 0.04G ² /Hz WGC RV2
Salt Fog	MS810D, M509.2, PL 48 hrs (for IP56 version)
Power Supply	20 to 32 Vdc (24 Vdc nominal)
Current Requirements	6 A sustained; 12 A available for two seconds

Actuator:

Operating Temperature Range	-40 to +100 °C (-40 to +212 °F)
Storage Temperature Range	-55 to +125 °C (-67 to +257 °F)
Shock	MS810C, M516.2, Procedure IV, 100 g
Vibration	MS810C, M514.2, Proc. VIII, 20 g (10 g in axial direct.)
Mass Moment of Inertia (with inertia disc applied)	ProAct II Actuator is 3.67*10 ⁻³ in-lb-sec ²

Revision History

Changes in Revision G—

- Deleted items in Input Configuration table, page 5.
- Marked Input Configurations 11–20, 4–13 mA, and 0–5 Volt, as no longer available. Page 22.

Changes in Revision F—

- Revision advanced to coordinate with new installation sheet.

Changes in Revision E—

- Updated Actuator Position Signal description (page 15) for new replacement actuators

Declarations

Declaration of Incorporation

Woodward Governor Company
1000 E. Drake Road
Fort Collins, Colorado 80525
United States of America

Product: ProAct II Electric Powered Actuators and Drivers
Part Number: 8400-702 Driver and similar
8405-024 Actuator and similar

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 the following EU Directives as they apply to a component:

- 98/37/EC (Machinery)
- 89/336/EEC and ammendments (EMC)
Tested to EN50081-2 and EN50082-2

This product is intended to be put into service only upon incorporation into an apparatus/system that itself will meet the requirements of the above Directives and bears the CE mark.

Manufacturer


Signature

Jennifer R. Williams

Full Name

Engineering Project/Process Manager

Position

WGC, Fort Collins, CO, USA

Location

2-08-01

Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication **04176G**.



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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.