Released

# Product Manual 26329
**(Revision AJ, 7/2025)**
**Original Instructions**


# Digital Valve Positioner

## Instruction 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.**<br>**Practice all plant and safety instructions and precautions.**<br>**Failure to follow instructions can cause personal injury and/or property damage.** |

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| **Revisions** | **This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website.**<br>**Woodward Industrial Support: Get Help**<br>**If your publication is not there, please contact your customer service representative to get the latest copy.** |

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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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| **Translated Publications** | **If the cover of this publication states "Translation of the Original Instructions" please note:**<br>**The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Woodward website.**<br>**Woodward Industrial Support: Get Help**<br>**Always compare with the original for technical specifications and for proper and safe installation and operation procedures.**<br>**If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.** |

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

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## Important Definitions

This is the safety alert symbol 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.**

# Electrostatic Discharge Awareness

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| **NOTICE**<br><br>**Electrostatic Precautions** | **Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:**<br>• **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).**<br>• **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**<br>• **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**<br><br>**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, as 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. After removing the old PCB from the control cabinet, immediately place it in the antistatic protective bag.

# Regulatory Compliance

**European Compliance for CE Marking:**
These listings are limited only to those units bearing the CE Marking.

**EMC Directive:** Declared to Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC) and applicable amendments.

**ATEX – Potentially Explosive Atmospheres Directive:** Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.
Standard models: II 3 G, Ex nA IIC T4 Gc
Dual Drive model: II 3 G, Ex nA IIC T3 Gc

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

**RoHS Directive:** Restriction of Hazardous Substances 2011/65/EU:
Woodward Turbomachinery Systems products are intended exclusively for sale and use only as a part of Large Scale Fixed Installations per the meaning of Art.2.4(e) of directive 2011/65/EU. This fulfills the requirements stated in Art.2.4(c) and as such the product is excluded from the scope of RoHS2.

**United Kingdom Compliance for UKCA Marking:**
These listings are limited only to those units bearing the UKCA Marking.
Units bearing the UKCA Mark in addition to the marking indicating Zone 2 are acceptable for use in UKEX Hazardous Locations.

**EMC:** S.I. 2016 No. 1091: Electromagnetic Compatibility Regulations 2016

**UKEX:** S.I. 2016 No. 1107: Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016

**Other International Compliance**

**IECEx:** Certified for use in explosive atmospheres per Certificate:
IECEx CSA 12.0013X
Standard models: II 3 G, Ex nA IIC T4 Gc
Dual Drive model: II 3 G, Ex nA IIC T3 Gc

**North American Compliance:**
These listings are limited only to those units bearing the appropriate marking.
Note: DVP Dual Drive is not CSA certified.

**CSA:** CSA Certified for use in USA and Canada
Class I, Division 2, Groups A, B, C, and D, T4
Certificate 1682018

**Marine Compliance (24 V DVP, IP66, 2-board configuration)**

**LR:** Lloyd's Register Type Approval Certificate. For use in environmental categories ENV1, ENV2, and ENV3 as defined in Lloyd's Register Test Specification No. 1, December 2020

**DNV:** DNV Type Approval Certificate. DNV rules for classification - Ships and offshore units.
Location classes: Temperature D, Humidity B, Vibration B, EMC A,
Enclosure: Required protection according to relevant rules shall be provided upon installation on board.

This product is certified as a component for use in other equipment. The final combination is subject to acceptance by the authority having jurisdiction or local inspection.

Refer to your local authority having jurisdiction for installation wiring codes.

## Special Conditions for Safe Use

Wiring must be in accordance with North American Class I, Division 2 and European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Field wiring must be suitable for at least 95°C (203°F).

Protective Earth Grounding is required to be connected to the input PE Terminal.

Impact testing on DVP with IP66 enclosure was performed per IEC 60079-0, section 26.4.2, Low Impact Group II, 4 Joules on all parts except the external connectors. Product is identified with an "X" and manual specifies product must be installed in an area to protect against high impact, and connectors must be mechanically protected from impact.

DVP models with IP30 enclosure must be installed into a cabinet with an IP54 or higher rating when used in a Zone 2 hazardous location. The end user is responsible for providing a final enclosure that meets the requirements of a suitable protection method defined in IEC 60079 series. The IP54 cabinet shall be suitable for the full ambient temperature rating of the DVP model selected and properly sized, so that after installation the maximum surface temperature is less than 115°C to assure T4 temperature class.

The DVP shall not be installed in areas exceeding Pollution Degree 2, as defined in IEC 60664-1.

The user shall ensure that a minimum clearance of 6.4 mm between live parts and earthed metal is maintained.

Internal batteries located on the Communication Module (models with Ethernet option) are not to be charged and are not customer replaceable.

Transient protection for the DVP is to be provided externally by the end user. The transient protection device is to be set at a level not exceeding 140% of the peak rated voltage (150 Vdc). Transient protection is not required for equipment marked for 18 Vdc to 32 Vdc.

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| ⚠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.**<br><br>**Substitution of components may impair suitability for Class I, Division 2 or Zone 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 situez bien dans une zone non explosive.**

**La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2 et/ou Zone 2.**

**WARNING**

**Do not use any test points on the power supply or control boards unless the area is known to be non-hazardous.**

**AVERTISSEMENT**

**Ne pas utiliser les bornes d'essai du block d'alimentation ou des cartes de commande à moins de se trouver dans un emplacement non dangereux.**

# Chapter 1.
# General Information

## Introduction

The Digital Valve Positioner (DVP) is a digital electronic position driver used to control actuation systems on reciprocating engines and turbines. The DVP is designed to control valves and actuators with either limited angle torque (LAT) or brushless DC (BLDC) motor types. The driver provides position output based on resolver feedback located on the valve or actuator. The DVP uses the latest in Woodward control architecture and a robust controller to provide high-speed precise valve control.

The DVP is designed for plug-and-play installations on many valve types. Woodward has integrated smart technology into the new generation of valves and actuators called an ID (identification) module. Upon connection to a valve or actuator equipped with an ID module, the DVP will automatically read critical valve-specific information to set up the driver. After this auto-detection and customer interface configuration, the DVP is ready for use.

The DVP is designed to accept many different types of input commands, including Single or Dual CAN, Analog Input (4–20 mA or 0–5 V), or Ethernet (if equipped). Woodward also provides a Service Tool that allows users to manipulate, configure, and monitor the DVP operation status.

The Woodward DVP is suitable for +24 VDC or +125 VDC input power supply operation and meets IP30 or IP66 environments. Contact Woodward for more details.

## Purpose and Scope

The purpose of this manual is to provide the necessary background information for installing and operating the Digital Valve Positioner (DVP) appropriately. Topics covered include mechanical installation, electrical wiring, software configuration (Service Tool), as well as troubleshooting information on the DVP.

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| **IMPORTANT** | **Ensure that you have downloaded and are using the latest revision of this manual. Updates are available on the Woodward website at www.woodward.com** |

## Intended Applications

The Woodward DVP is a state-of-the-art driver for electric actuation. It features a rugged and compact design. The DVP provides positioning based on a demand signal from the control systems, and it is designed for use with various Woodward valves and actuators. Multiple input type configurations allow the DVP to be used with many different turbine controllers. The driver supports redundant installations. The new generation DVP provides significant advancements over the earlier generation of the driver, including internal configurability to drive different Woodward products, such as, but not limited to the following:

Table 1-1. Valve Reference Manual

| DVP | Actuators and Valves | Ref. Manual |
|---|---|---|
| 125 Vdc | Electric Gas Metering Valves (EGMV) | 26305 |
| | Electric Liquid Metering Valve (ELMV) | 26306 |
| | Electric Water Metering Valve (EWMV) | 26306 |
| | Electric Liquid Bypass Valve (ELBV) | 26306 |
| | Large Electric Sonic Valve (LESV) | 26419 |
| | GS16DR(Dual Resolver) | 26418 |
| | LQ50 | 26739 |
| | ELA 21 | 35107 |
| 24 Vdc / 125 Vdc | LQ25 | 26475 |
| | LQ25T, LQ25BP | 26476 |
| 24 Vdc | EM35MR/3103 | 26734 |
| | EM100/3151 | 40181 |

# DVP Control Specifications

## General Specifications

| 125 VDC DVP Model | | |
|---|---|---|
| **Description:** | Digital Valve Positioner (DVP) IP30 and IP66 Model, Dual Drive Model | |
| **Power Supply Input:** | 125 VDC +20%, -28% (90–150 VDC) | |
| **Current Draw (Maximum):** | **Standard Models:**<br>2 A steady state, 40 A peak for 200 ms, 240 W max<br>**DVP Dual Drive Model:**<br>8 A transient for 10 s, 40 A peak for 500 ms, with 120 second cooldown<br>3 A steady state (current draw includes output current at maximum listed below) | |
| **Output Current (Maximum)** | **IP30 DVP**<br>40 A peak for up to 500 ms, with 30 second cooldown, 12 A steady state. | **IP66**<br>40 A peak for up to 500 ms and 12 A for up to 10 seconds with 30 sec. cooldown. 11 A steady state. |
| **Package Heat Dissipation:** | **(With Ethernet Option)**<br>40 W nominal; 70 W @ Maximum Heat- Load<br>(This is the heat-load caused by the DVP and occurs when the associated fuel valve is being positioned near the maximum stop of the valve). | |
| | **(Without Ethernet Option)**<br>40 W Nominal; 63 W @ Maximum Heat-Load<br>(This is the heat-load caused by the DVP and occurs when the associated fuel valve is being positioned near the maximum stop of the valve). | |
| **Mechanical Dimensions:** | **IP30 DVP**<br>279 x 272 x 145 mm<br>(11.0 x 10.7 x 5.7 inches) | **IP66 DVP**<br>483 x 311 x 111 mm<br>(19.00 x 12.24 x 4.38 inches) |
| **Weight:** | 7.9 kg (17.5 lb) | 6.94 kg (15.32 lb) |

| 24 Vdc DVP Model | |
|---|---|
| **Description:** | Digital Valve Positioner (DVP) IP30 and IP66 Model |
| **Power Supply Input:** | 24 Vdc +33%, -25% (18–32 Vdc) |
| **Current Draw (Maximum):** | 25 A peak for up to 500 ms, 10 A steady state, 240 W max<br>(Current draw includes output current at maximum listed below) |
| **Output Current (Maximum):** | 25 A peak for up to 500 ms, with 30 sec cooldown, 15 A steady state |

| | | |
|---|---|---|
| **Package Heat Dissipation:** | **(With Ethernet Option)**<br>40 W nominal<br>70 W @ Maximum Heat- Load<br>(This is the heat-load caused by the DVP and occurs when the associated fuel valve is being positioned near the maximum stop of the valve). | |
| | **(Without Ethernet Option)**<br>40 W Nominal<br>63 W @ Maximum Heat-Load<br>(This is the heat-load caused by the DVP and occurs when the associated fuel valve is being positioned near the maximum stop of the valve). | |
| **Mechanical Dimensions:** | **IP30 DVP**<br>279 x 272 x 145 mm<br>(11.0 x 10.7 x 5.7 inches) | **IP66 DVP**<br>483 x 311 x 111 mm<br>(19.00 x 12.24 x 4.38 inches) |
| **Weight:** | 7.9 kg (17.5 lb) | 6.94 kg (15.32 lb) |

## Environmental Specifications

| | |
|---|---|
| **Ambient Operating Temperature:** | -40 to +55°C (-40 to +131°F) with Ethernet option<br>-40 to +70°C (-40 to +158°F) without Ethernet option. DVP Dual Drive |
| **Storage Temperature:** | -40 to +105°C (-40 to +221°F)<br>Component life is adversely affected by high temperature and high humidity environments. Room temperature storage is recommended for long life. If the unit is to be stored for a long period of time, operating power must be applied for a few hours at least once every 18-24 months. |
| **Humidity:** | 0 to 100% non-condensing |
| **Mechanical Vibration:** | Woodward Specification RV5 (0.04 $G^2$/Hz, 10–500 Hz, 2 hours/axis, 1.04 Grms) |
| **Mechanical Shock:** | Woodward Specification MS2 (30 G, 11 ms Half Sine Pulse) |
| **EMI/RFI Specification:** | EN61000-6-2: Immunity for Industrial Environments<br>EN61000-6-4: Emissions for Industrial Environments Woodward imposed requirements: Conducted Low Frequency Immunity, 50 Hz – 10 kHz |
| **Impact Protection** (See Regulatory Compliance section for Special Conditions): | **IP30 DVP**<br>Not provided. A suitable cabinet must be selected for Zone 2 hazardous locations.<br>**IP66 DVP, Dual Drive**<br>Suitable for areas where there is a low risk of mechanical impact (4J per IEC 60079-0 cl. 26.4.2); external connectors must be mechanically protected from impact. |
| **Environmental Protection** (See Regulatory Compliance section for Special Conditions): | **IP30 DVP**<br>IP30 per IEC 60529. A suitable cabinet must be selected for Zone 2 hazardous locations.<br>**IP66 DVP, Dual Drive**<br>IP66 per IEC 60529 and IEC 60079 series for Zone 2 hazardous locations. Door latch covers must remain closed in service for optimum protection. |

# Chapter 2. Installation

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| ⚠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.** |

| | |
|---|---|
| ⚠WARNING | **EXPLOSION HAZARD - For installation in hazardous locations, carefully review all requirements and limitations in the Regulatory Compliance section for Special Conditions of Safe Use.** |

| | |
|---|---|
| ⚠WARNING | **If welding in the area of the DVP, disconnect all cables, and verify the DVP and actuator chassis is grounded prior to conducting the welding.** |

**NOTICE**

**Due to the hazardous location listings associated with this product, proper wire type and wiring practices are critical to operation.**

**If the gland plates are modified to provide input and/or output connections to the DVP, verify that the hardware used for the wiring connections is in accordance with the authority having jurisdiction or local inspection and will not compromise the IP66 rating of the enclosure.**

**The DVP must be grounded for safety and EMC compliance (see Mechanical Installation Requirements).**

**Make all required electrical connections based on the wiring diagrams in Chapter 3.**

## Shielding Requirements

The use of shielded-twisted cabling is required where indicated by the control wiring diagram to ensure EMC compliance. Terminate the cable shield as indicated by control wiring diagram using the installation notes described below.

## Grounding Requirements

IP30 DVP - The chassis is intended to be grounded through the low impedance mechanical mounting interface for proper EMC performance. Additionally, the PE terminal ( ⏚ ) must be connected to PE ground to ensure safety compliance. Note: If the IP30 enclosure is mounted on vibration isolators, the EMC ground must be provided using a short, low-impedance strap or cable (typically >12 AWG/3 mm² and <18”/46 cm in length) connected to the mounting hardware.

IP66 DVP - The chassis is intended to be grounded using a short, low-impedance strap or cable (typically >12 AWG/3 mm² and <18”/46 cm in length) connected to the designated EMC ground terminal ( ⏇ ). Additionally, the PE terminal ( ⏚ ) must be connected to PE ground to ensure safety compliance.

## Wiring Installation Notes

**NOTICE** **Refer to the valve manual for a detailed plant wiring diagram for your wiring installation.**

- Connect all wires as shown in the plant-wiring diagram for the appropriate actuator type (Table 1-1 for valve reference manual).
- Load terminations should be applied accordingly.
- Apply general practice to ensure cables are checked from point to point. Motor and resolver impedance are verified from line power to ground.
- Wires exposed beyond the shield should be as short as possible, not exceeding 2 inches (51 mm).
- The shield termination wire (or drain wire) should be kept as short as possible, not exceeding 2 inches (51 mm), and where possible the diameter should be maximized.
- Installations with severe electromagnetic interference (EMI) may require additional shielding precautions. Contact Woodward 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 ensure satisfactory operation of the product.

Verify details concerning installation mounting requirements, and ground straps, lock washers, etc.

## Mechanical Installation Requirements

This section provides the general information for mounting location selection, installation, and wiring of the Digital Valve Positioner (DVP).

### Unpacking the Shipping Carton

- Before unpacking the control, refer to the inside front cover of this manual and to the Regulatory Compliance page for warnings and cautions. Be careful when unpacking the control. Check for signs of damage such as bent or dented panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.
- The DVP is shipped from the factory in an anti-static foam-lined carton. This carton should always be used for transport of the DVP when it is not installed. Read the Electrostatic Discharge Awareness page before handling the DVP.
- Check for and remove all manuals, connectors, mounting screws, and other items before discarding the shipping box.

## General Installation and Mounting Considerations

When selecting a location for mounting the DVP consider the following:

- Protect the unit from direct exposure to water or a condensation-prone environment.
- The DVP is designed for installation in a low vibration environment. If installed in vibration levels above normal control room levels, the DVP should be vibration isolated from engine and generator vibrations above 50 Hz. See Grounding Requirements above.
- Install the DVP in an area where temperatures will not exceed those listed in Specifications section for the selected options (enclosure, Ethernet).
- The DVP is designed to mount to a metal surface to allow heat from the DVP to be conducted to the metal mounting surface.
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Allow adequate space around the unit for servicing and cable routing (Figure 2-1).
- Do not install near high-voltage or high-current devices.
- Install the DVP in an area where there is a protection from outside contamination.
- Provide a 1 inch (25 mm) clearance from the IP30 DVP to other hardware when selecting a mounting location. The IP30 DVP model can be mounted in any orientation.
- The IP66 DVP enclosure can be mounted in any orientation. However, orientation may be used to limit risk of impact to external connectors when installing in Zone 2 hazardous locations. See Regulatory Compliance section for Special Conditions.
- For maximum thermal performance, the IP30 DVP must be mounted on a vertical surface such that the wires exit out the positioner from an upward and downward direction. See direction indication in Figure 2-1.
- Verify that cable lengths do not exceed lengths specified in the electrical I/O section of this manual.

**NOTICE**

**For maximum thermal performance, the DVP must be mounted vertically with at least 25 mm or 1 inch of clearance on all sides of the DVP to allow free convection air to flow past the enclosure cooling fins. Without proper clearance between adjacent hardware on all sides of the DVP, convection cooling air won't reach the DVP cooling fins, and the DVP may overheat.**

**Do not mount the DVP near sources of excessive radiant heat such as exhaust manifolds or other excessively hot engine components.**

## Wire Preparation and Connector Screw Torque Drive Recommendation

We recommend that you follow wiring preparation and terminal block screw drive torque specifications for all DVP input/output terminal block installations.

Table 2-1. Wire Hookup Guideline

| Specification | I/O Terminal Block | Power Terminal Blocks |
|---|---|---|
| Wire Gauge | 20 – 16 AWG<br>(0.5 – 1.0 mm²) | 8 AWG<br>(8 mm²) |
| Wire Strip Length | 0.25 – 0.300 Inches<br>(6.4–7.6 mm) | 0.45 – 0.55 Inches<br>(11.4–14.0 mm) |
| Recommended Torque drive on the Terminal Block Connector | 2.5 – 3.5 lb-in<br>(0.3 – 0.4 N·m) | 10 – 12 lb-in<br>(1.1 – 1.4 N·m) |

## Connector Kits

The DVP is shipped with mating connectors for all input and output connectors. However, in some applications where an extra set of connectors is needed, Woodward carries a DVP connector kit as shown on Table 2-2.

Table 2-2. Connector Kit Driver Descriptions

| Connector Kits | Generic Driver Description |
|---|---|
| 6995-1063 | DVP, IP66 Conduit in, Circular output |
| 8923-1288 | DVP, 125 VDC IP30, TB input, TB output |
| 8923-1318 | DVP, 125 VDC, IP30, TB input and Circular connector output. |
| 8923-1337 | DVP, 125 VDC, IP66 Conduit in, and Conduit out |
| 8923-1654 | DVP, 24 VDC, IP66 Conduit In and conduit out |
| 8923-1656 | DVP, 24 VDC, IP30, TB in and Circular out |
| 8923-1657 | DVP, 24 VDC, IP30, TB in and TB out |

## Mounting Hardware Kits

The DVP IP-30 is shipped with the mounting hardware kit in Table 2-3. The kit includes the necessary mounting screws and hardware to mount the DVP. In some case where more mounting hardware is needed, we recommend that ¼-20 socket head cap screws be used for the mounting. If metric hardware is required, we recommend that M6 socket head cap screws be used. Make sure to torque the mounting hardware to 80 lb.-in (9.0 N.m).

Table 2-3. Mounting Hardware Kit Information

| Hardware Kit Part Number | Applicable to DVP | Specification |
|---|---|---|
| 8923-1136<br><br>(4 x 1 " (25 mm) long<br>4 x flat washers.) | DVP IP30 box. | User shall apply the following torque specification to ensure screw is securely mounted.<br><br>80 lb-in (9.0 N.m) |
| Not provided (Woodward recommends using a #10 screw for mounting) | DVP IP66 | User will determine the length of the mounting screw and panel. Apply proper torque to suit the application and location. |

## Door Opening and Close (IP66 version)

To open the door, use a large flathead screwdriver to turn the latch insert slot approximately a quarter turn to the proper direction shown on device cover. Opposite motion between latches is required (see Figure 2-1). It may be necessary to push on the door while turning the latch to relieve some of the pressure applied by the door gasket. To fully open device lid, both latch slot lines should point to the UNLOCK or OPEN symbol. When closing the door, make sure both latches are fully turned to the LOCK or CLOSED position for proper device sealing.

**IMPORTANT** — **On the IP66 model, opposite turning motion is required between the latches to open or close the device. See Figure 2-1.**

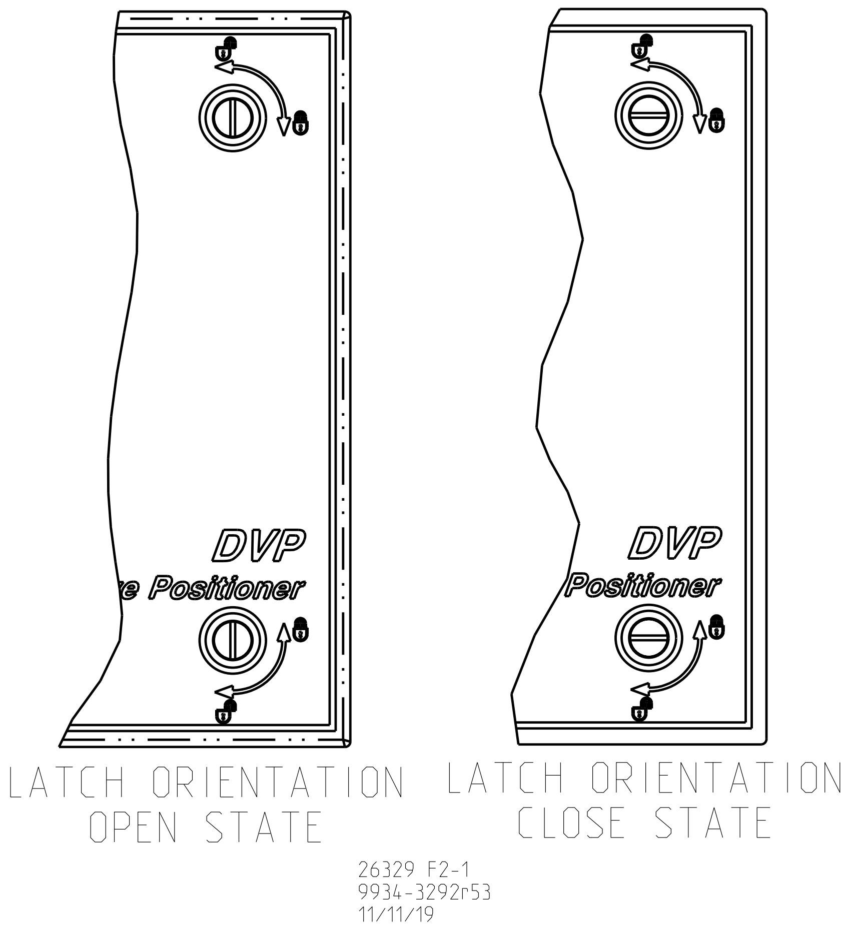



Figure 2-1. Latch Orientation Open/Close State

# Configuration Options

Table 2-4. DVP IP-30 Enclosure Information

## DVP in IP-30 Enclosure


The DVP in IP-30 Enclosure is available in multiple configurations

### Configuration Options

- 125 VDC or 24 VDC Power Input options
- Circular Connector or Terminal Block options
- Dual resolvers or triple resolvers in redundancy option.
- With or without EGD Ethernet Communication Option.

### Mechanical Specification

- Dimension - 279x272x145 mm (11.0x10.7x5.7 inches)
- Weight -7.9 kg (17.5 lb)

### Features

- Analog or Digital Demand Input
- Triple redundant EGD (Ethernet) or dual redundant CANopen with Analog backup option.
- ID Module Compatibility
- Configurable settings available by using Service Tool.
- Configurable Discrete Inputs/outputs.

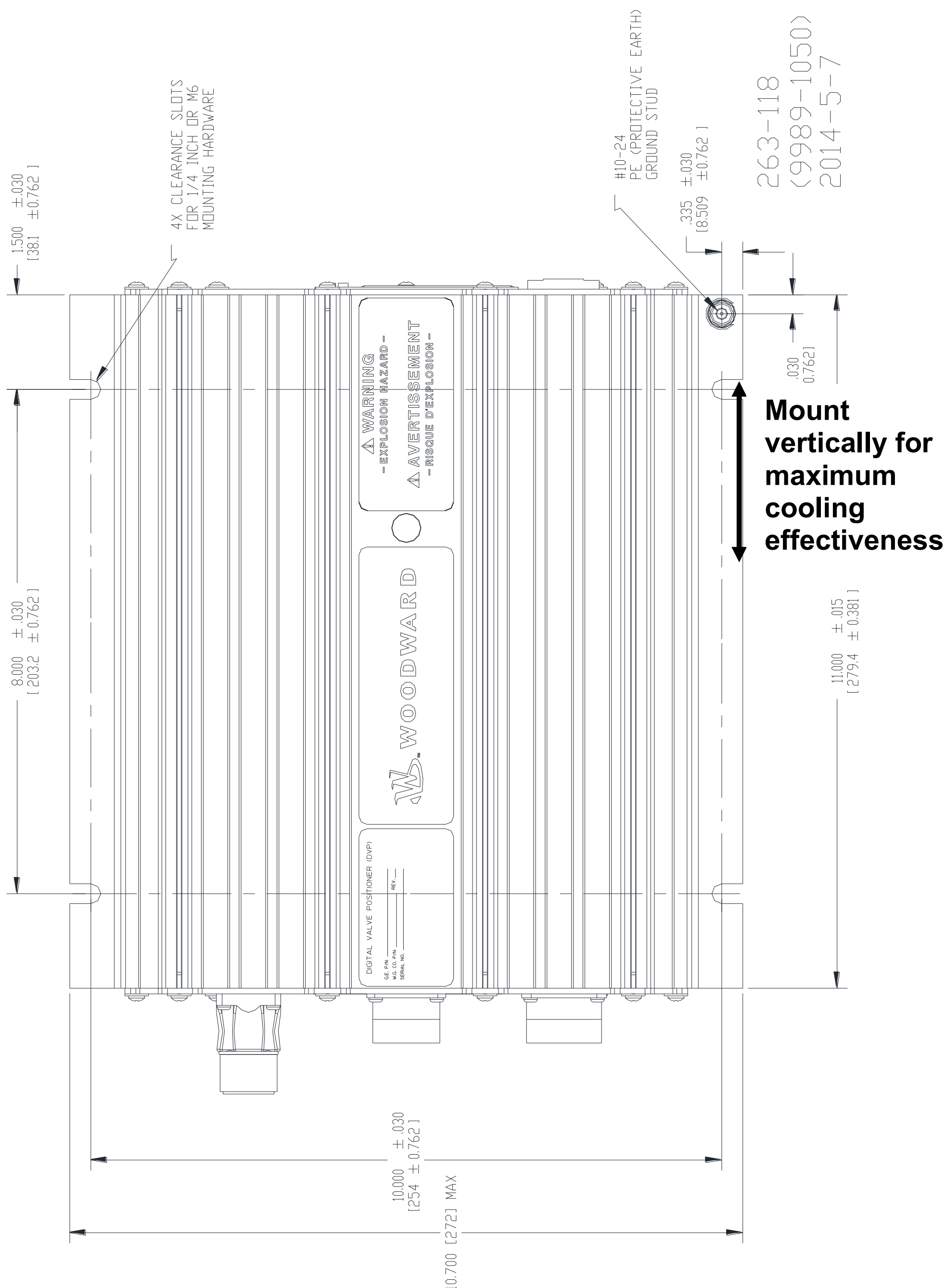
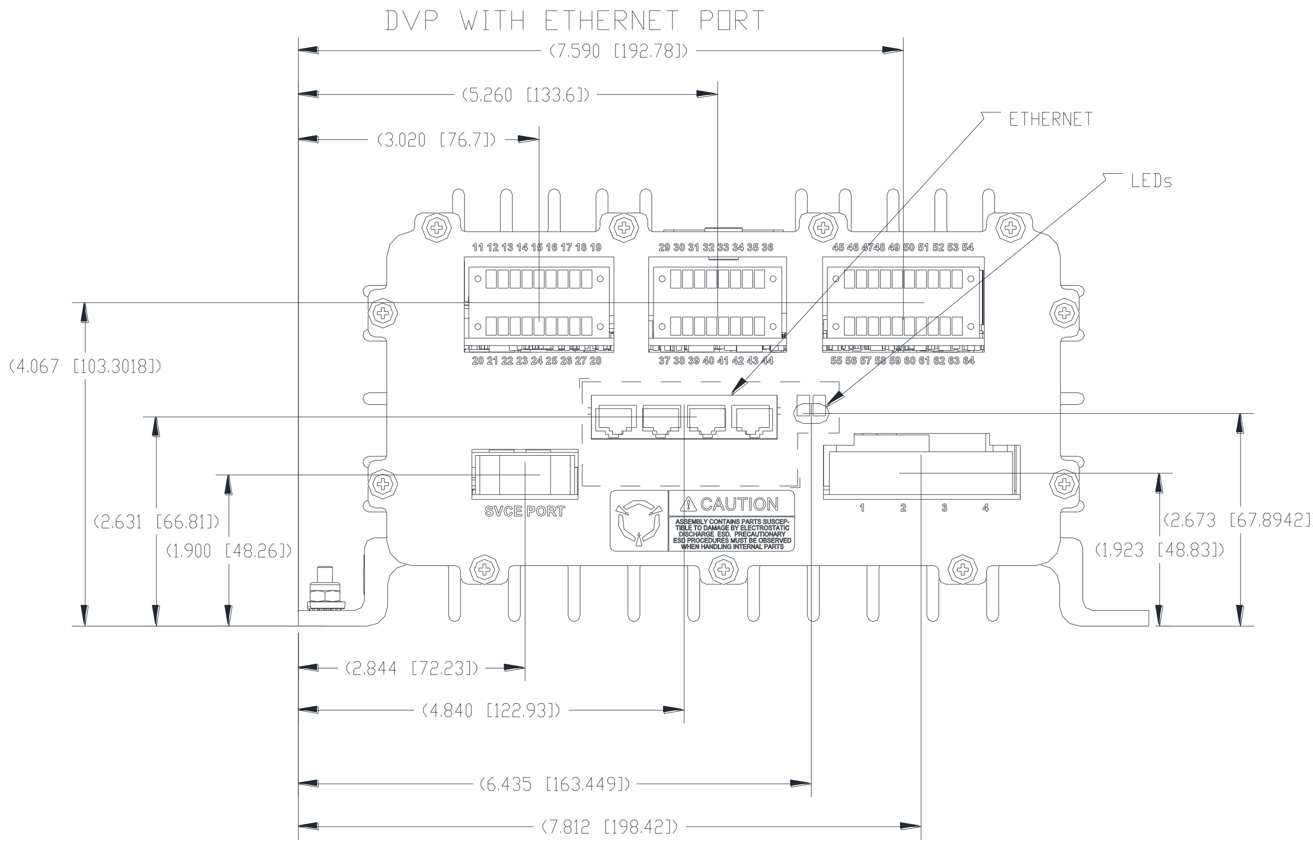



Figure 2-2. DVP Circular Connector Outline Drawing (Top View)

## Terminal Locations

All terminals and connectors are located on the ends of the DVP extruded chassis. Figure 2-2 shows both end views of the Circular Connector DVP to help orient I/O to chassis location. For EMC compliance, the DVP must be mounted with low impedance bond to Earth ground.



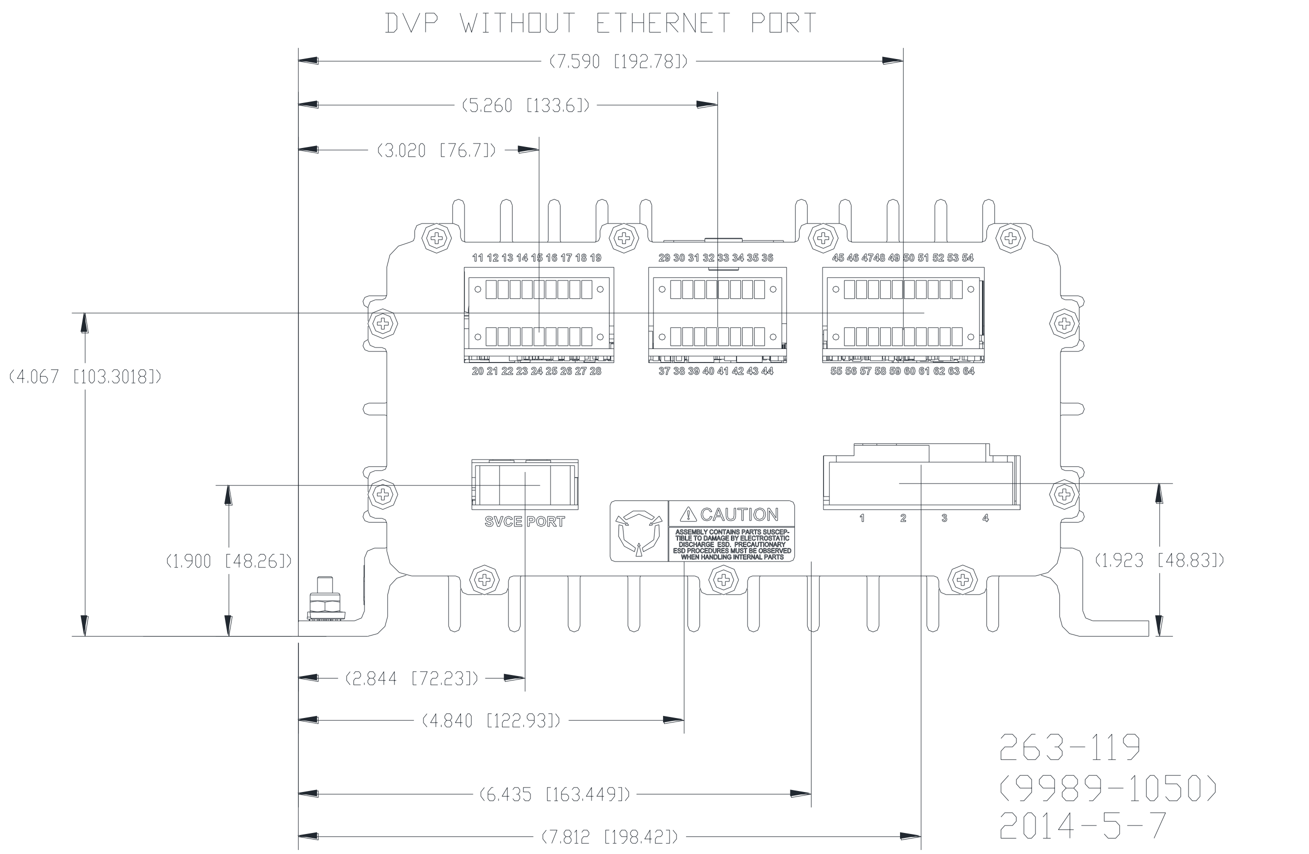




Figure 2-3. DVP IP30 Input Connectors

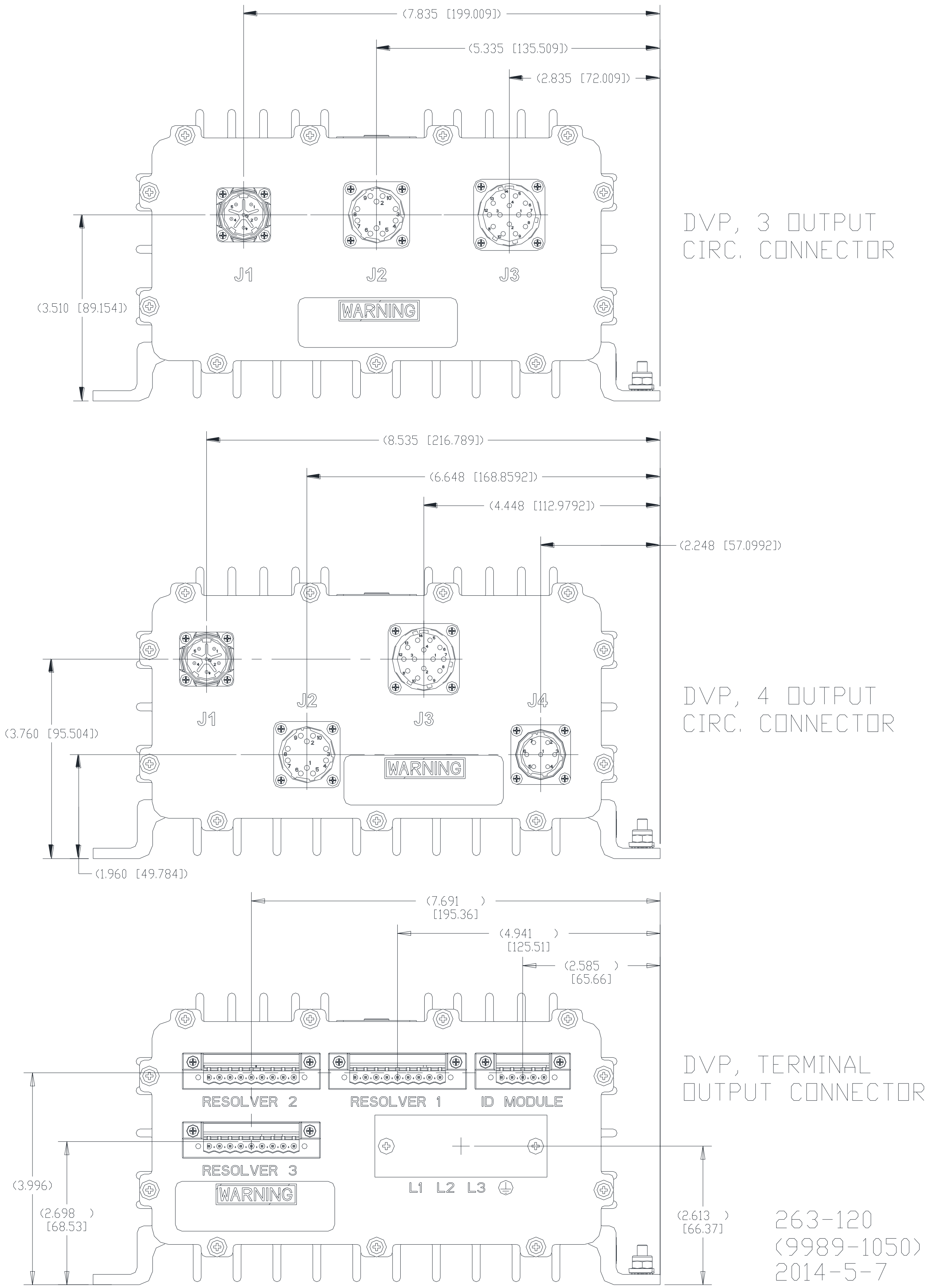
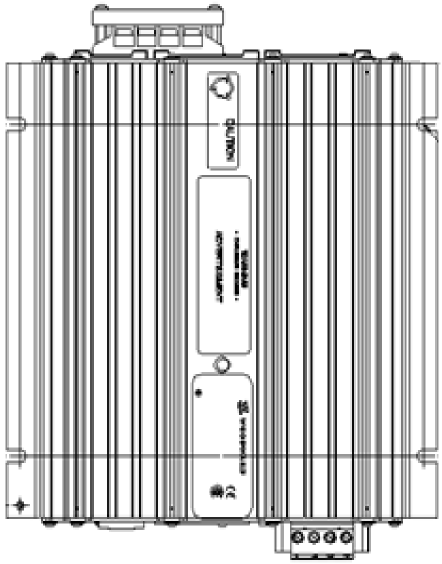
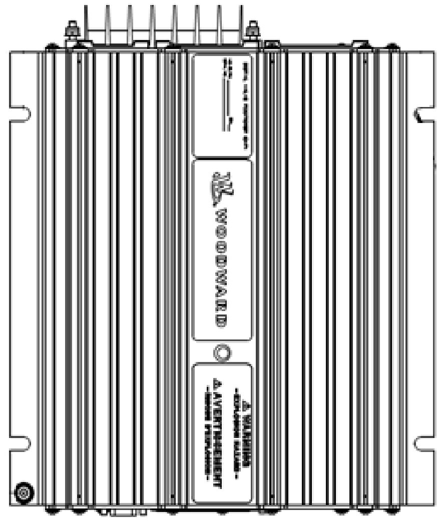


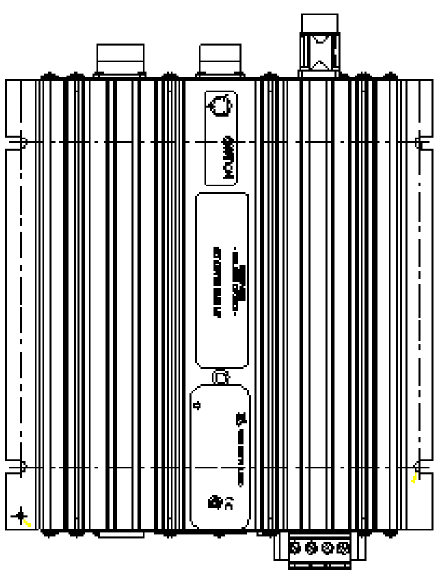

Figure 2-4. DVP IP30 Output Connectors



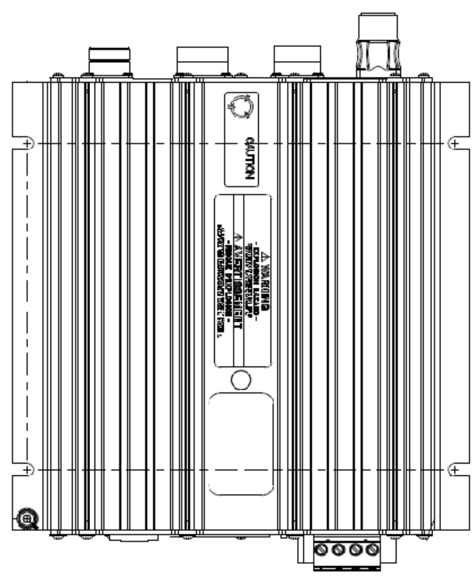
125VDC DVP
TERMINAL BLOCK




24VDC DVP
TERMINAL BLOCK



24V/125VDC DVP
CIRCULAR CONNECTOR
3 RESOLVER




24V/125VDC DVP
CIRCULAR CONNECTOR
4 RESOLVER

Figure 2-5. DVP, IP30, Outline (Top View)

## *INPUT/OUPUT CONNECTORS*

### TB2-POWER

**INPUT POWER**

| | |
|---|---|
| 1 | PWR1+ |
| 2 | PWR1- |
| 3 | PWR2+ |
| 4 | PWR2- |

### DB-9 RS-232

**SERVICE PORT**

| | |
|---|---|
| 1 | NC |
| 2 | DRV TXD/PC RXD |
| 3 | DVR RXD/PC TXD |
| 4 | NC |
| 5 | GND |
| 6 | NC |
| 7 | NC |
| 8 | NC |
| 9 | NC |

### RJ-45, 8 PINS

**ENET #1,2,3**

| | |
|---|---|
| 1 | RXD + |
| 2 | RXD - |
| 3 | TXD + |
| 4 | NC |
| 5 | NC |
| 6 | TXD - |
| 7 | NC |
| 8 | NC |

### TB5 CONNECTOR

**TB5-A (TOP 9 PINS)**

| | |
|---|---|
| 11 | ANALOG IN + |
| 12 | ANALOG IN - |
| 13 | ANALOG IN SHD |
| 14 | NC |
| 15 | NC |
| 16 | NC |
| 17 | PWM MPU + |
| 18 | PWM MPU - |
| 19 | PWM MPU SHD |

**TB5-B (BOTTOM 9 PINS)**

| | |
|---|---|
| 20 | DISCRETE IN1 |
| 21 | DISCRETE IN2 |
| 22 | DISCRETE IN3 |
| 23 | DISCRETE IN4 |
| 24 | DISCRETE IN5 |
| 25 | DISCRETE IN ISO GND |
| 26 | DISCRETE IN ISO GND |
| 27 | DISCRETE IN ISO GND |
| 28 | DISCRETE IN SHD |

### TB6 CONNECTOR

**TB6-A (TOP 8 PINS)**

| | |
|---|---|
| 29 | CAN1 TERMINATION JPR |
| 30 | CAN1 TERMINATION JPR |
| 31 | CAN1 HI IN |
| 32 | CAN1 LOW IN |
| 33 | CAN1 HI OUT |
| 34 | CAN1 LOW OUT |
| 35 | CAN1 ISO GND |
| 36 | CAN1 SHLD |

**TB6-B (BOTTOM 8 PINS)**

| | |
|---|---|
| 37 | CAN2 TERMINATION JPR |
| 38 | CAN2 TERMINATION JPR |
| 39 | CAN2 HI IN |
| 40 | CAN2 LOW IN |
| 41 | CAN2 HI OUT |
| 42 | CAN2 LOW OUT |
| 43 | CAN2 ISO GND |
| 44 | CAN2 SHLD |

### TB7 CONNECTOR

**TB7-A (TOP 10 PINS)**

| | |
|---|---|
| 45 | RS485 HI TERMINATION JPR |
| 46 | RS485 HI TERMINATION JPR |
| 47 | RS485 HI IN |
| 48 | RS485 LO IN |
| 49 | RS485 HI OUT |
| 50 | RS485 LO OUT |
| 51 | RS485 LO TERMINATION JPR |
| 52 | RS485 LO TERMINATION JPR |
| 53 | RS485 ISO GND |
| 54 | RS485 SHLD |

**TB7-B (BOTTOM 10 PINS)**

| | |
|---|---|
| 55 | DISCRETE OUT1 + |
| 56 | DISCRETE OUT1 - |
| 57 | DISCRETE OUT1 SHLD |
| 58 | DISCRETE OUT2 + |
| 59 | DISCRETE OUT2 - |
| 60 | DISCRETE OUT2 SHLD |
| 61 | ANALOG OUT+ |
| 62 | ANALOG OUT- |
| 63 | ANALOG SHLD |
| 64 | N/C |

## *ACTUATOR INTERFACE CONNECTORS*

### J1 CIR. CONNECTOR

**MOTOR CONFIGURATION**

THIS PORT CAN BE CONFIGURED TO DRIVE EITHER BRUSHLESS OR LAT MOTOR

**(BRUSHLESS DC MOTOR)**

| | |
|---|---|
| 1 | L1 |
| 2 | GROUND |
| 6 | NC |
| 4 | L3 |
| 5 | L2 |
| | SHIELD GND |

**LAT MOTOR**

| | |
|---|---|
| 1 | MOTOR (+) |
| 2 | GROUND |
| 6 | NC |
| 4 | NC |
| 5 | MOTOR (-) |
| | SHIELD GND |

### J2 CIR. CONNECTOR

**RESOLVER 1**

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | COS + |
| 4 | COS - |
| 5 | SIN + |
| 6 | SIN - |
| 7 | N/C |
| 8 | N/C |
| 9 | N/C |
| 10 | SHIELD(S) |

### J3 CIR. CONNECTOR

**RESOLVER 2 /ID MODULE**

| | |
|---|---|
| 1 | COS + |
| 2 | COS - |
| 3 | SIN + |
| 4 | SIN - |
| 5 | EXC + |
| 6 | EXC - |
| 7 | ID PWR+ |
| 8 | ID PWR - |
| 9 | ID CAN3 HI |
| 10 | ID CAN3 LO |
| 11 | N/C |
| 12 | N/C |
| 13 | N/C |
| 14 | SHIELD |

### J4 CIR. CONNECTOR

THIS RESOLVER CONNECTOR ONLY USE IN 3 RESOLVER APPL.

**RESOLVER 3**

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | COS + |
| 4 | COS - |
| 5 | SIN + |
| 6 | SIN - |
| 7 | SHIELD |

Figure 2-6. IP30/IP66, DVP Circular Connector Pinout Diagram

## *INPUT/OUPUT CONNECTORS*

**TB2-POWER**
INPUT POWER

| | |
|---|---|
| 1 | PWR1+ |
| 2 | PWR1- |
| 3 | PWR2+ |
| 4 | PWR2- |

**DB-9 RS-232**
SERVICE PORT

| | |
|---|---|
| 1 | NC |
| 2 | DRV TXD/PC RXD |
| 3 | DVR RXD/PC TXD |
| 4 | NC |
| 5 | GND |
| 6 | NC |
| 7 | NC |
| 8 | NC |
| 9 | NC |

**RJ-45, 8 PINS**
ENET #1,2,3

| | |
|---|---|
| 1 | RXD + |
| 2 | RXD - |
| 3 | TXD + |
| 4 | NC |
| 5 | NC |
| 6 | TXD - |
| 7 | NC |
| 8 | NC |

### TB5 CONNECTOR

TB5-A (TOP 9 PINS)

| | |
|---|---|
| 11 | ANALOG IN + |
| 12 | ANALOG IN - |
| 13 | ANALOG IN SHD |
| 14 | NC |
| 15 | NC |
| 16 | NC |
| 17 | PWM MPU + |
| 18 | PWM MPU - |
| 19 | PWM MPU SHD |

TB5-B (BOTTOM 9 PINS)

| | |
|---|---|
| 20 | DISCRETE IN1 |
| 21 | DISCRETE IN2 |
| 22 | DISCRETE IN3 |
| 23 | DISCRETE IN4 |
| 24 | DISCRETE IN5 |
| 25 | DISCRETE IN ISO GND |
| 26 | DISCRETE IN ISO GND |
| 27 | DISCRETE IN ISO GND |
| 28 | DISCRETE IN SHD |

### TB6 CONNECTOR

TB6-A (TOP 8 PINS)

| | |
|---|---|
| 29 | CAN1 TERMINATION JPR |
| 30 | CAN1 TERMINATION JPR |
| 31 | CAN1 HI IN |
| 32 | CAN1 LOW IN |
| 33 | CAN1 HI OUT |
| 34 | CAN1 LOW OUT |
| 35 | CAN1 ISO GND |
| 36 | CAN1 SHLD |

TB6-B (BOTTOM 8 PINS)

| | |
|---|---|
| 37 | CAN2 TERMINATION JPR |
| 38 | CAN2 TERMINATION JPR |
| 39 | CAN2 HI IN |
| 40 | CAN2 LOW IN |
| 41 | CAN2 HI OUT |
| 42 | CAN2 LOW OUT |
| 43 | CAN2 ISO GND |
| 44 | CAN2 SHLD |

### TB7 CONNECTOR

TB7-A (TOP 10 PINS)

| | |
|---|---|
| 45 | RS485 HI TERMINATION JPR |
| 46 | RS485 HI TERMINATION JPR |
| 47 | RS485 HI IN |
| 48 | RS485 LO IN |
| 49 | RS485 HI OUT |
| 50 | RS485 LO OUT |
| 51 | RS485 LO TERMINATION JPR |
| 52 | RS485 LO TERMINATION JPR |
| 53 | RS485 ISO GND |
| 54 | RS485 SHLD |

TB7-B (BOTTOM 10 PINS)

| | |
|---|---|
| 55 | DISCRETE OUT1 + |
| 56 | DISCRETE OUT1 - |
| 57 | DISCRETE OUT1 SHLD |
| 58 | DISCRETE OUT2 + |
| 59 | DISCRETE OUT2 - |
| 60 | DISCRETE OUT2 SHLD |
| 61 | ANALOG OUT+ |
| 62 | ANALOG OUT- |
| 63 | ANALOG SHLD |
| 64 | N/C |

## *ACTUATOR INTERFACE CONNECTORS*

**J2 CIR. CONNECTOR**
RESOLVER 1

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | COS + |
| 4 | COS - |
| 5 | SIN + |
| 6 | SIN - |
| 7 | SHIELD(S) |

**J3 CIR. CONNECTOR**
RESOLVER 2 (LVDT)/ID MODULE

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | COS + |
| 4 | COS - |
| 5 | SIN + |
| 6 | SIN - |
| 7 | N/C |
| 8 | N/C |
| 9 | N/C |
| 10 | SHIELD(S) |

**J4 CIR. CONNECTOR**
THIS RESOLVER CONNECTOR USED IN DUAL MOTOR RESOLVER

| | |
|---|---|
| 1 | COS/B + |
| 2 | COS/B - |
| 3 | SIN/A + |
| 4 | SIN/A - |
| 5 | EXC + |
| 6 | EXC - |
| 7 | ID PWR + |
| 8 | ID PWR - |
| 9 | ID CAN3 HI |
| 10 | ID CAN3 LO |
| 11 | N/C |
| 12 | N/C |
| 13 | N/C |
| 14 | SHIELD(S) |

**J5 CIR CONNECTOR**
THIS RESOLVER CONNECTOR USED IN DUAL DVP APPL

| | |
|---|---|
| 1 | CAN1 HIGH |
| 2 | CAN1 LOW |
| 3 | CAN1 COMMON |
| 4 | RS485 HIGH |
| 5 | RS485 LOW |
| 6 | RS485 COMMON |
| 7 | SHIELD |

Figure 2-7. IP30/IP66, Dual DVP, Circular Connector Pinout Diagram

Released



## ACTUATOR INTERFACE CONNECTORS

### INPUT/OUTPUT CONNECTORS

**TB2-POWER**
**INPUT POWER**

| | |
|---|---|
| 1 | PWR1+ |
| 2 | PWR1- |
| 3 | PWR2+ |
| 4 | PWR2- |

**DB-9 RS-232**
**SERVICE PORT**

| | |
|---|---|
| 1 | NC |
| 2 | DRV TXD/PC RXD |
| 3 | DVR RXD/PC TXD |
| 4 | NC |
| 5 | GND |
| 6 | NC |
| 7 | NC |
| 8 | NC |
| 9 | NC |

**RJ-45, 8 PINS**
**ENET #1,2,3**

| | |
|---|---|
| 1 | RXD + |
| 2 | RXD - |
| 3 | TXD + |
| 4 | NC |
| 5 | NC |
| 6 | TXD - |
| 7 | NC |
| 8 | NC |

**TB5 CONNECTOR**

TB5-A (TOP 9 PINS)

| | |
|---|---|
| 11 | ANALOG IN + |
| 12 | ANALOG IN - |
| 13 | ANALOG IN SHD |
| 14 | NC |
| 15 | NC |
| 16 | NC |
| 17 | PWM MPU + |
| 18 | PWM MPU - |
| 19 | PWM MPU SHD |

TB5-B (BOTTOM 9 PINS)

| | |
|---|---|
| 20 | DISCRETE IN1 |
| 21 | DISCRETE IN2 |
| 22 | DISCRETE IN3 |
| 23 | DISCRETE IN4 |
| 24 | DISCRETE IN5 |
| 25 | DISCRETE IN ISO GND |
| 26 | DISCRETE IN ISO GND |
| 27 | DISCRETE IN ISO GND |
| 28 | DISCRETE IN SHD |

**TB6 CONNECTOR**

TB6-A (TOP 8 PINS)

| | |
|---|---|
| 29 | CAN1 TERMINATION JPR |
| 30 | CAN1 TERMINATION JPR |
| 31 | CAN1 HI IN |
| 32 | CAN1 LOW IN |
| 33 | CAN1 HI OUT |
| 34 | CAN1 LOW OUT |
| 35 | CAN1 ISO GND |
| 36 | CAN1 SHLD |

TB6-B (BOTTOM 8 PINS)

| | |
|---|---|
| 37 | CAN2 TERMINATION JPR |
| 38 | CAN2 TERMINATION JPR |
| 39 | CAN2 HI IN |
| 40 | CAN2 LOW IN |
| 41 | CAN2 HI OUT |
| 42 | CAN2 LOW OUT |
| 43 | CAN2 ISO GND |
| 44 | CAN2 SHLD |

**TB7 CONNECTOR**

TB7-A (TOP 10 PINS)

| | |
|---|---|
| 45 | RS485 HI TERMINATION JPR |
| 46 | RS485 HI TERMINATION JPR |
| 47 | RS485 HI IN |
| 48 | RS485 LO IN |
| 49 | RS485 HI OUT |
| 50 | RS485 LO OUT |
| 51 | RS485 LO TERMINATION JPR |
| 52 | RS485 LO TERMINATION JPR |
| 53 | RS485 ISO GND |
| 54 | RS485 SHLD |

TB7-B (BOTTOM 10 PINS)

| | |
|---|---|
| 55 | DISCRETE OUT1 + |
| 56 | DISCRETE OUT1 - |
| 57 | DISCRETE OUT1 SHLD |
| 58 | DISCRETE OUT2 + |
| 59 | DISCRETE OUT2 - |
| 60 | DISCRETE OUT2 SHLD |
| 61 | ANALOG OUT+ |
| 62 | ANALOG OUT- |
| 63 | ANALOG SHLD |
| 64 | N/C |

### ACTUATOR INTERFACE CONNECTORS

**POWER TERMINAL BLOCK**
**MOTOR CONFIGURATION**

THIS PORT CAN BE CONFIGURED TO DRIVE EITHER THREE PHASES OR LAT MOTOR

DVP IP-30

3 PHASES MOTOR DRV CONFIG.

| | |
|---|---|
| L1 | L1 |
| L2 | L2 |
| L3 | L3 |
| ⏚ | EARTH GND |

LAT MOTOR DRV CONFIG.

| | |
|---|---|
| L1 | L1 |
| L2 | L2 |
| L3 | |
| ⏚ | EARTH GND |

DVP IP-56

3 PHASES MOTOR DRV CONFIG.

| | |
|---|---|
| L1 | L1 |
| L2 | L2 |
| L3 | L3 |

LAT MOTOR DRV CONFIG.

| | |
|---|---|
| L1 | L1 |
| L2 | L2 |
| L3 | |

**ID MODULE ( 5 PINS)**

| | |
|---|---|
| 1 | PWR+ |
| 2 | PWR- |
| 3 | CAN3 HI |
| 4 | CAN3 LO |
| 5 | SHIELD |

**RESOLVER 1 (9 PINS)**

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

**RESOLVER2 (9 PINS)**

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

THIS RESOLVER CONNECTOR ONLY USED IN 3 RESOLVER APPL.

**RESOLVER 3 ( 9 PINS)**

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

Figure 2-8. IP30/IP66, DVP, Terminal Block Pinout

## INPUT/OUTPUT CONNECTORS

### TB2-POWER
**INPUT POWER**

| | |
|---|---|
| 1 | PWR1+ |
| 2 | PWR1- |
| 3 | PWR2+ |
| 4 | PWR2- |

### DB-9 RS-232
**SERVICE PORT**

| | |
|---|---|
| 1 | NC |
| 2 | DRV TXD/PC RXD |
| 3 | DVR RXD/PC TXD |
| 4 | NC |
| 5 | GND |
| 6 | NC |
| 7 | NC |
| 8 | NC |
| 9 | NC |

### RJ-45, 8 PINS
**ENET #1,2,3**

| | |
|---|---|
| 1 | RXD + |
| 2 | RXD - |
| 3 | TXD + |
| 4 | NC |
| 5 | NC |
| 6 | TXD - |
| 7 | NC |
| 8 | NC |

### TB5 CONNECTOR

**TB5-A (TOP 9 PINS)**

| | |
|---|---|
| 11 | ANALOG IN + |
| 12 | ANALOG IN - |
| 13 | ANALOG IN SHD |
| 14 | NC |
| 15 | NC |
| 16 | NC |
| 17 | PWM MPU + |
| 18 | PWM MPU - |
| 19 | PWM MPU SHD |

**TB5-B (BOTTOM 9 PINS)**

| | |
|---|---|
| 20 | DISCRETE IN1 |
| 21 | DISCRETE IN2 |
| 22 | DISCRETE IN3 |
| 23 | DISCRETE IN4 |
| 24 | DISCRETE IN5 |
| 25 | DISCRETE IN ISO GND |
| 26 | DISCRETE IN ISO GND |
| 27 | DISCRETE IN ISO GND |
| 28 | DISCRETE IN SHD |

### TB6 CONNECTOR

**TB6-A (TOP 8 PINS)**

| | |
|---|---|
| 29 | CAN1 TERMINATION JPR |
| 30 | CAN1 TERMINATION JPR |
| 31 | CAN1 HI IN |
| 32 | CAN1 LOW IN |
| 33 | CAN1 HI OUT |
| 34 | CAN1 LOW OUT |
| 35 | CAN1 ISO GND |
| 36 | CAN1 SHLD |

**TB6-B (BOTTOM 8 PINS)**

| | |
|---|---|
| 37 | CAN2 TERMINATION JPR |
| 38 | CAN2 TERMINATION JPR |
| 39 | CAN2 HI IN |
| 40 | CAN2 LOW IN |
| 41 | CAN2 HI OUT |
| 42 | CAN2 LOW OUT |
| 43 | CAN2 ISO GND |
| 44 | CAN2 SHLD |

### TB7 CONNECTOR

**TB7-A (TOP 10 PINS)**

| | |
|---|---|
| 45 | RS485 HI TERMINATION JPR |
| 46 | RS485 HI TERMINATION JPR |
| 47 | RS485 HI IN |
| 48 | RS485 LO IN |
| 49 | RS485 HI OUT |
| 50 | RS485 LO OUT |
| 51 | RS485 LO TERMINATION JPR |
| 52 | RS485 LO TERMINATION JPR |
| 53 | RS485 ISO GND |
| 54 | RS485 SHLD |

**TB7-B (BOTTOM 10 PINS)**

| | |
|---|---|
| 55 | DISCRETE OUT1 + |
| 56 | DISCRETE OUT1 - |
| 57 | DISCRETE OUT1 SHLD |
| 58 | DISCRETE OUT2 + |
| 59 | DISCRETE OUT2 - |
| 60 | DISCRETE OUT2 SHLD |
| 61 | ANALOG OUT+ |
| 62 | ANALOG OUT- |
| 63 | ANALOG SHLD |
| 64 | N/C |

## ACTUATOR INTERFACE CONNECTORS

### POWER TERMINAL BLOCK
**MOTOR CONFIGURATION**

THIS PORT CAN BE CONFIGURED TO DRIVE EITHER THREE PHASES OR LAT MOTOR

**3 PHASES MOTOR DRV CONFIG.**

| | |
|---|---|
| L1 | L1 |
| L1 | |
| L2 | L2 |
| L2 | |
| L3 | L3 |
| L3 | |
| ⏚ | |

**LAT MOTOR DRV CONFIG.**

| | |
|---|---|
| L1 | L1 |
| L1 | |
| L2 | L2 |
| L2 | |
| L3 | |
| L3 | |
| ⏚ | |

24VDC DVP IP-30

### ID MODULE ( 5 PINS)

| | |
|---|---|
| 1 | PWR+ |
| 2 | PWR- |
| 3 | CAN3 HI |
| 4 | CAN3 LO |
| 5 | SHIELD |

### RESOLVER 1 (9 PINS)

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

### RESOLVER2 (9 PINS)

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

THIS RESOLVER CONNECTOR ONLY USED IN 3 RESOLVER APPL.

### RESOLVER 3 ( 9 PINS)

| | |
|---|---|
| 1 | EXC + |
| 2 | EXC - |
| 3 | EXC SHIELD |
| 4 | COS + |
| 5 | COS - |
| 6 | COS SHIELD |
| 7 | SIN + |
| 8 | SIN - |
| 9 | SIN SHIELD |

Figure 2-9. 24 VDC, IP30, DVP, Terminal Block Pin Out

Table 2-5. 24 V/125 VDC, IP66 DVP



DVP Enclosure that meets the IP66 environment is available in multiple configurations:

## Configuration Options

- 125 VDC or 24 VDC Power Input Option
- One-output circular connector gland plate and an input blank gland plate option. This option is recommended for using with pre-made valve interface cable.
- Two blank gland plate configuration options. This option is recommended for conduit entry application.
- With or without EGD Ethernet Communication option.
- Dual Drive Option

## Features

- Demand Input signal
  - Analog
  - Digital
- Redundancy capability
  - CANopen with Analog backup
  - EGD (Ethernet) redundancy
- ID Module Capability
- Configurable and setting through Service Tool
- Software configurable Discrete Inputs and Outputs

## Mechanical Specification

- Dimensions:
  483 X 311 X 111 mm
  (19.0 X 12.24 X 4.38 inches)
- Weight: 6.94 kg (15.32 lb)

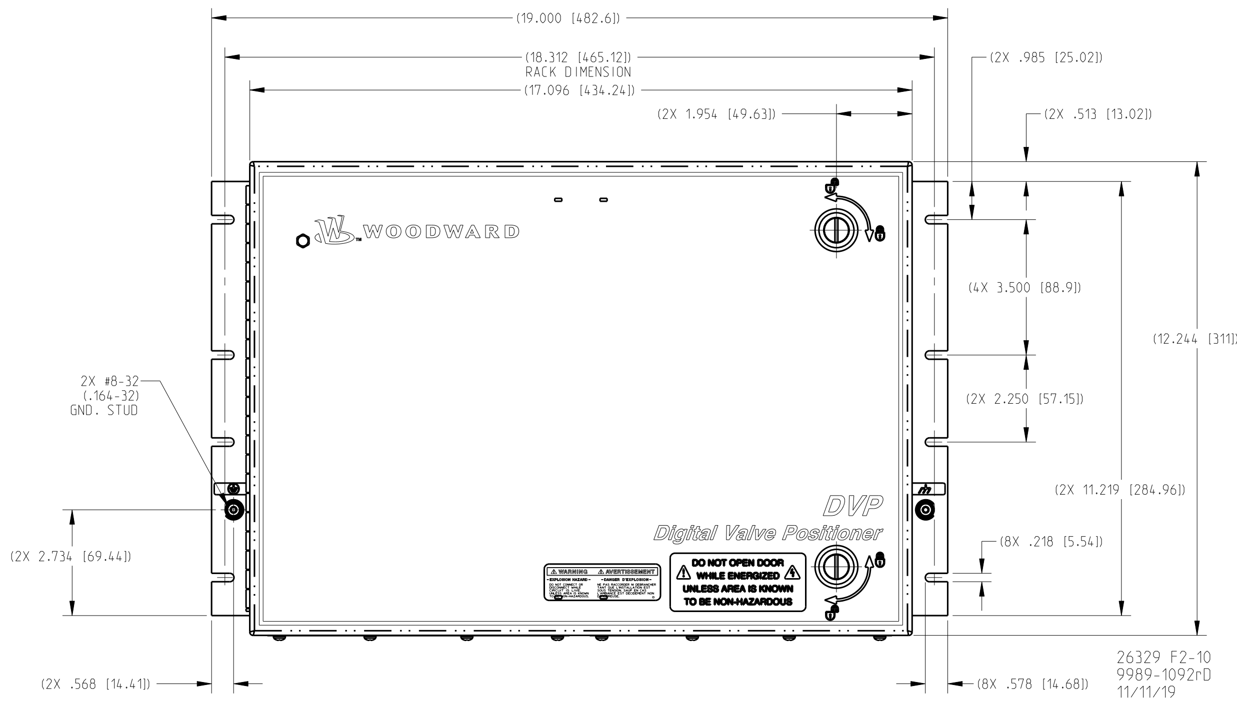



Figure 2-10. 24 V/125 VDC, IP66 DVP, Conduit Entry

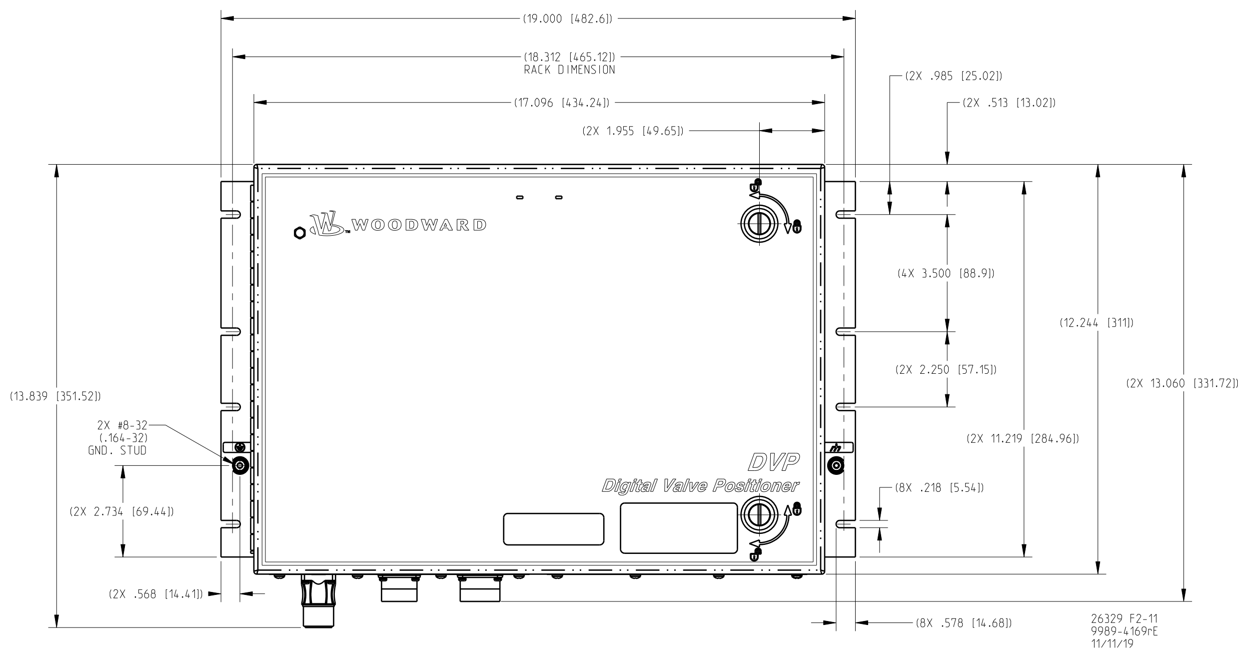



Figure 2-11. DVP IP66, 24 V/125 VDC Circular Connectors

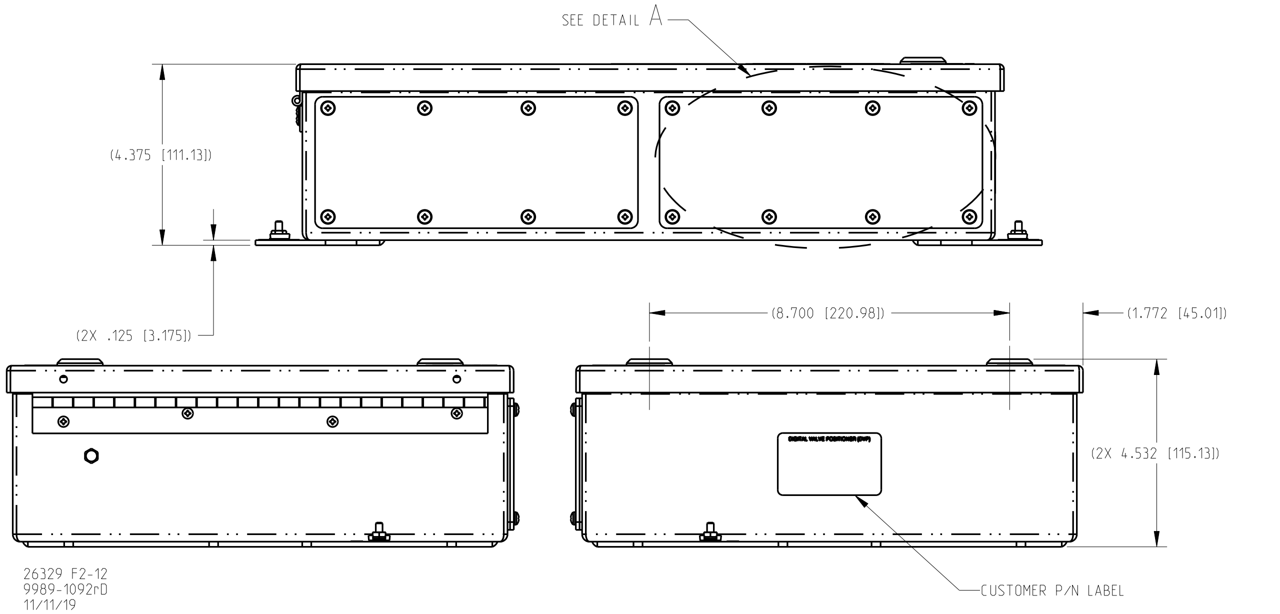



Figure 2-12. DVP IP66 Outline (Side View)

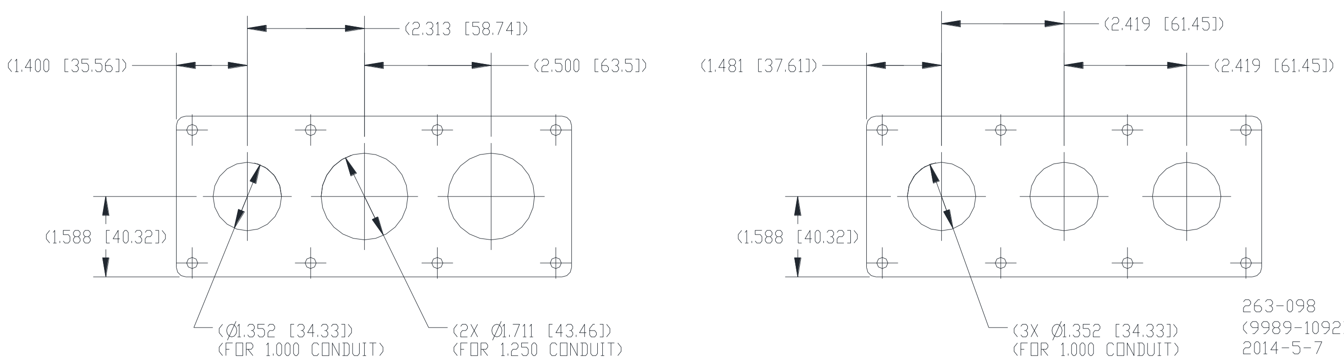



Figure 2-13. DVP IP66 Blank Gland Plate Cutouts Recommendation ("Detail A")

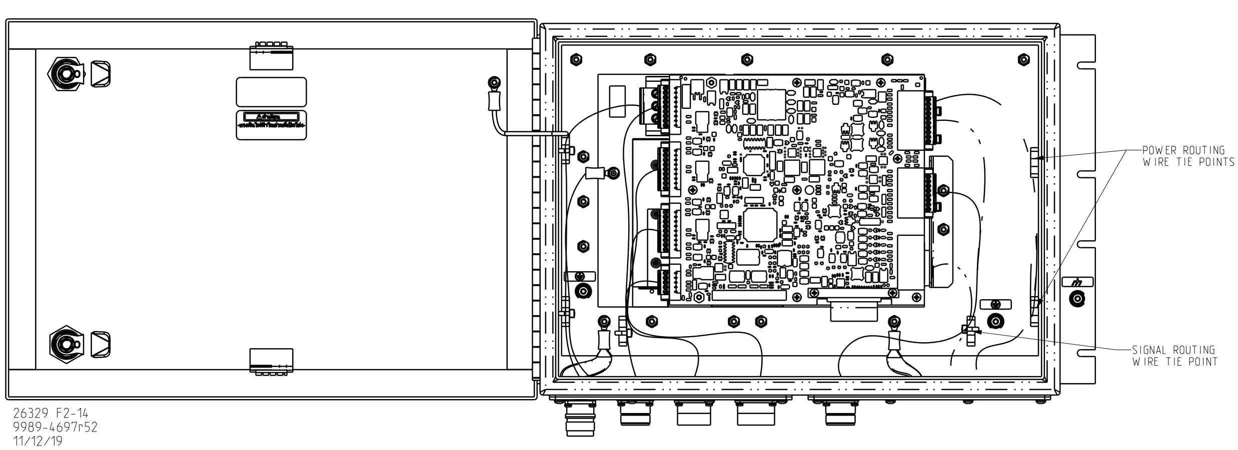



Figure 2-14. DVP IP66 for Dual Drive Applications, 125 VDC with Circular Connectors

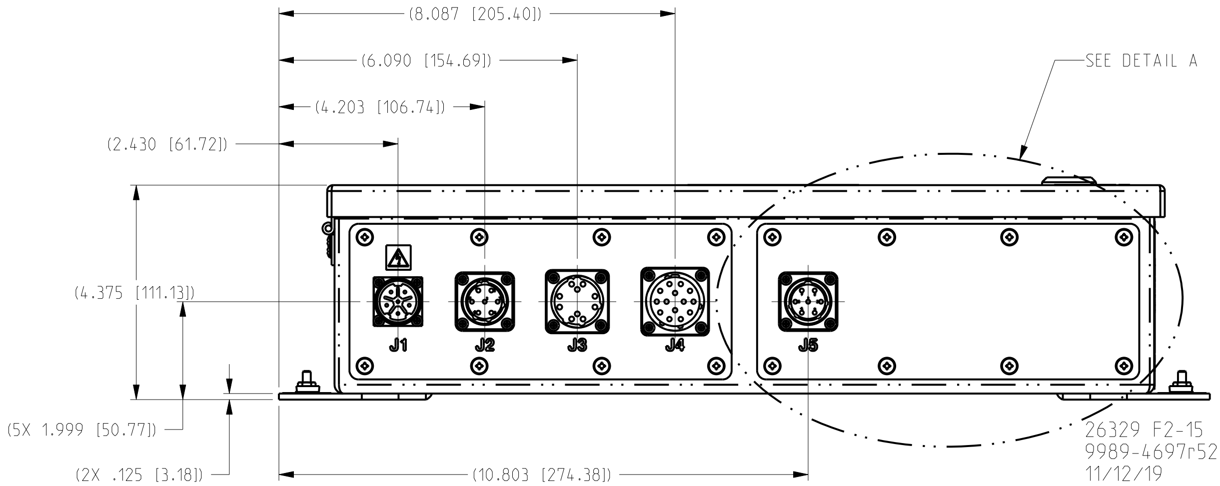



Figure 2-15. DVP IP66 for Dual Drive Applications, 125 VDC with Circular Connectors (Side View)

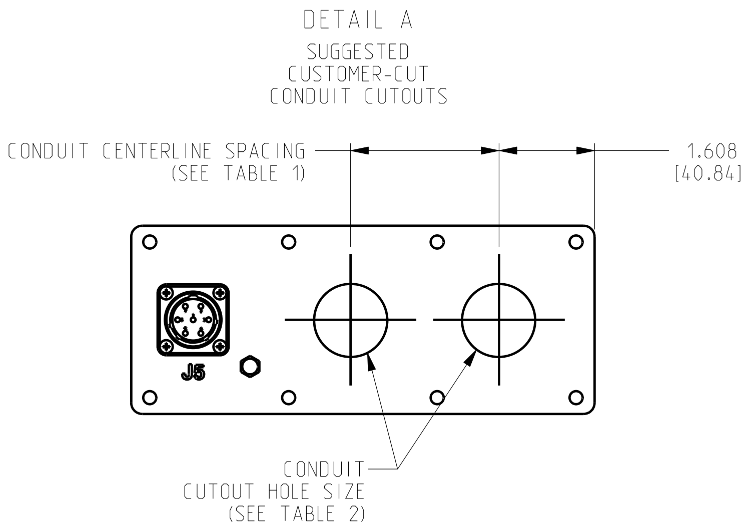



TABLE 1

| CONDUIT TREAD SIZE | 1/2 | 3/4 | 1 | 1 1/4 |
|---|---|---|---|---|
| 1/2 | 1.570 [39.88] | - | - | - |
| 3/4 | 1.680 [42.67] | 1.790 [45.47] | - | - |
| 1 | 1.850 [46.99] | 1.960 [49.78] | 2.130 [54.10] | - |
| 1 1/4 | 2.030 [51.56] | 2.150 [54.61] | 2.320 [58.93] | 2.500 [63.50] |

TABLE 2

| CONDUIT TREAD SIZE | KNOCKOUT DIAMETER | | |
|---|---|---|---|
| | MINIMUM | NOMINAL | MAXIMUM |
| 1/2 | 0.859 [21.82] | 0.875 [22.23] | 0.906 [23.01] |
| 3/4 | 1.094 [27.79] | 1.109 [28.17] | 1.141 [28.98] |
| 1 | 1.359 [34.52] | 1.375 [34.93] | 1.406 [35.71] |
| 1 1/4 | 1.719 [43.66] | 1.734 [44.04] | 1.766 [44.86] |

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Figure 2-16. DVP IP66 for Dual Drive Applications, Gland Plate Cutout Recommendations

To remove the gland plate on the Dual DVP configurations, please use the following procedure to prevent damage to the unit.

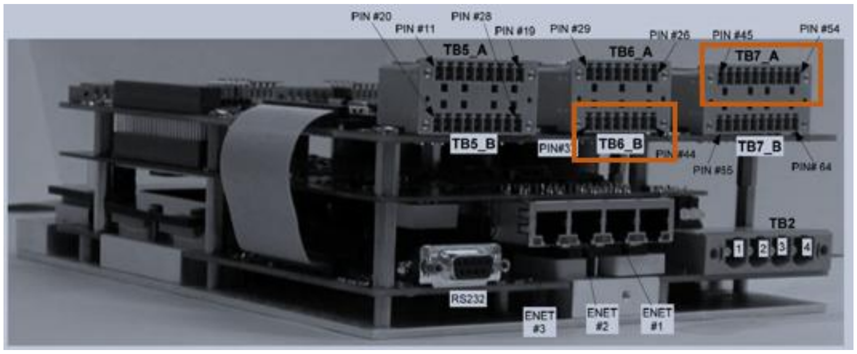



Figure 2-17. Remove Internal Drive Synchronization Harness from Terminal Blocks

Loosen the screws holding the TB6_B and TB7_A terminal blocks in position as shown in Figure 2-16. Remove both terminal blocks leaving the terminal block headers attached to the harness connected to the gland plate. As shown in Figure 2-17, remove the screw attaching the right grounding strap from the DVP Enclosure. Remove the screws attaching the right gland plate of the DVP as shown in Figure 2-18. Remove the gland plate.

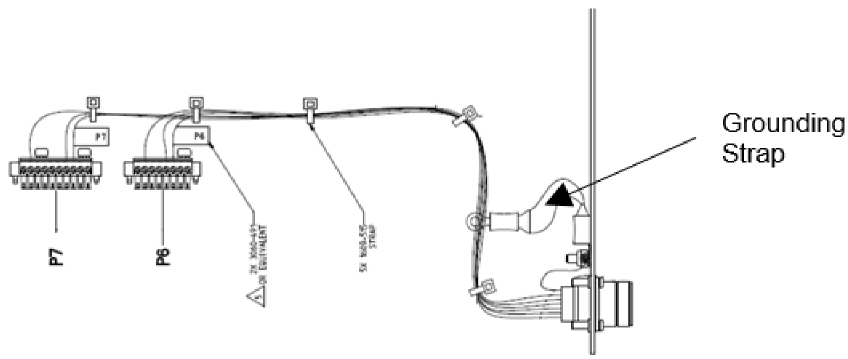



Figure 2-18. Remove Internal Drive Synchronization Harness

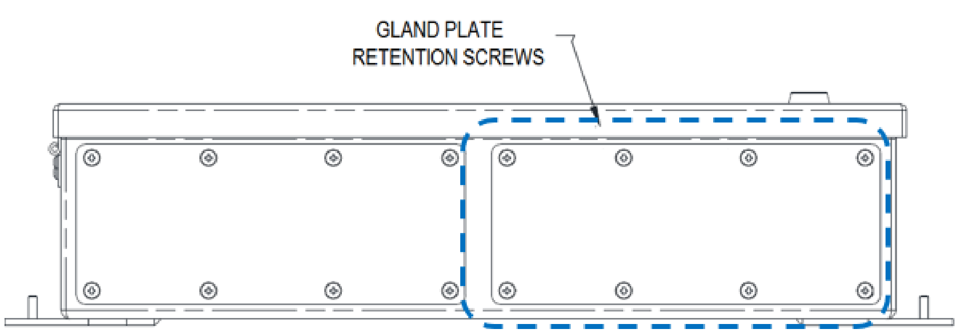



Figure 2-19. Gland Plate Retention Screws

Machine or punch the gland plate for the size necessary to accommodate the power and signal glands or conduit fittings. Install these fittings in accordance with the manufacturer's instructions.
Replace the gland plate in the reverse order. Tighten the fasteners in accordance with the following table.

Table 2-6. Fastener Locations and Recommended Torque

| Fastener Location | Recommended Torque |
|---|---|
| Gland Plate Retention Screws | 13.5 to 16.5 in-lb (1.53 to 1.86 N-m) |
| Grounding Strap Retaining Nut | 13.5 to 16.5 in-lb (1.53 to 1.86 N-m) |
| Terminal Block Retaining Screws | 2.5-3.5 in-lb (0.3-0.4 N-m) |

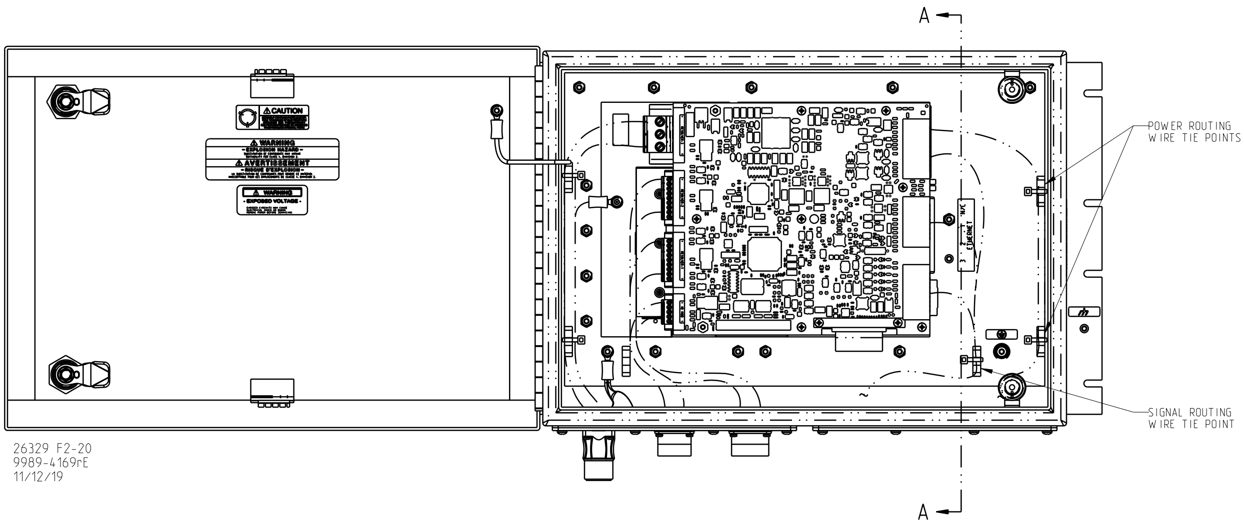



Figure 2-20. DVP IP66 Circular Connector Internal Enclosure Wire Routing

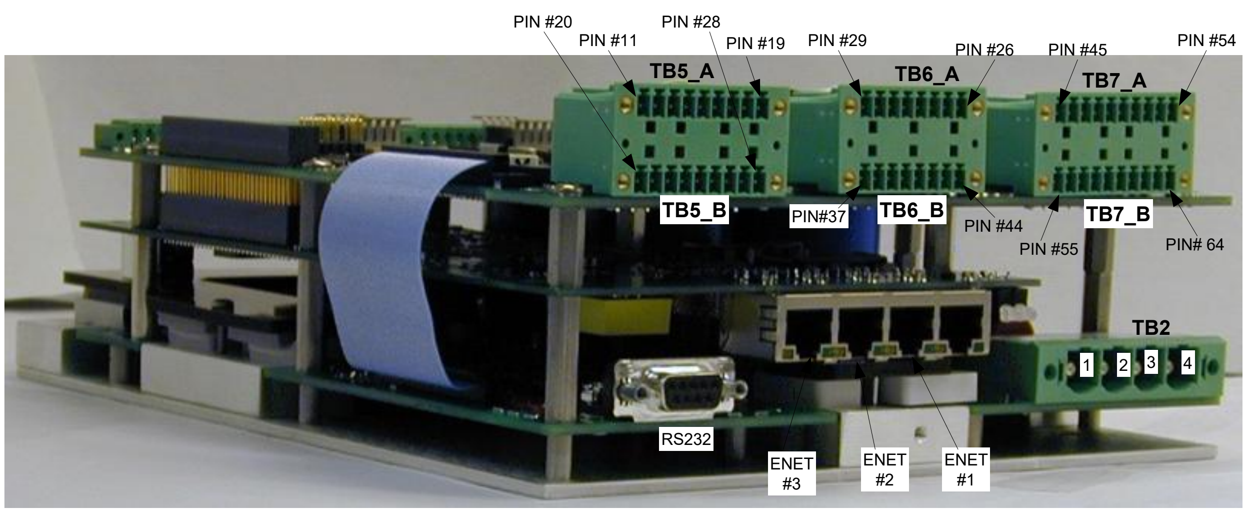



Figure 2-21. DVP IP66 Internal Board Stack—I/O and Power Interface

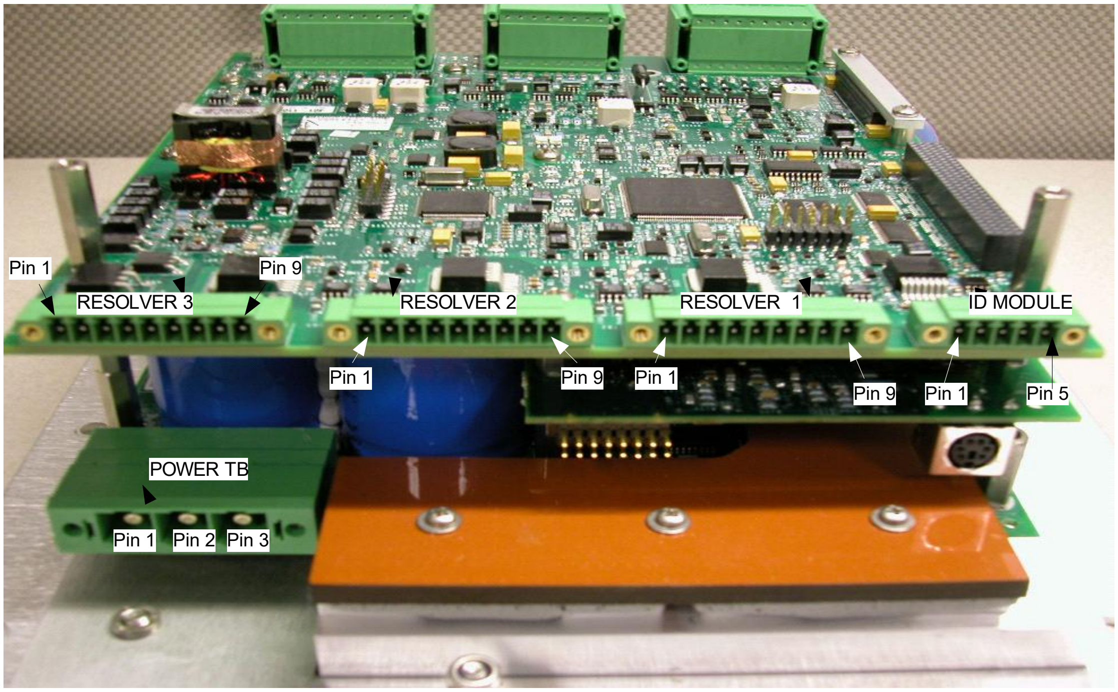



Figure 2-22. DVP IP66 Internal Board Stack—Actuator Interface Side

# Chapter 3.
# Electrical I/O

## Power Supply Inputs

The DVP is designed with redundant power supply inputs. These inputs share a common ground and are isolated from chassis ground. This option allows for redundancy in wiring, connectors, and power sources if the power sources share a common ground. If one of the inputs is lost, drops low, or experiences temporary power loss, the other power input will take over without being affected by the first input. The user is provided with four terminals (each terminal is sized for up to 8 AWG wire), two plus and two minus. The DVP requires a power supply capable of the specified voltages and current levels. Please see Table 3-1 for power and fusing information necessary for safe and reliable operation of the DVP.

**⚠WARNING**

**The DVP is designed to run with a variety of Woodward valves. Power requirement depends on the valve and driver used. See the valve specification for proper power requirements. The valve manual power requirement can be different from the DVP power requirement.**

**NOTICE**

**Overcurrent protection devices recommended in this manual are intended to provide protection against faults which result in increased current flow, and therefore, increased heating and the probability of the start and spread of fire.**

Table 3-1a. DVP Power Requirements (125 VDC)

| **Valve Type** | **LERA (GS150) LELA Based Actuators (LESV, ELMV, EWMV, ELBV, EGMV)** | **ELA21** | **LQ25/LQ25B/ LQ25BP/ GS16DR** | **LQ50** |
|---|---|---|---|---|
| **Input Voltage** | 90 to 150 VDC (120 V nominal) | | | |
| **Steady State Current Continuous** | 2.6 A | 2 A | 3 A | 2A |
| **Transient Current** | 14 A for 250 ms | 8 A for 10 Sec | 5 A for 100 ms | 6A for 50 ms |
| **Fuse** | 15 A, 250 V Slow Blow, minimum $I^2t$ rating 1000 $A^2s$ | | 10 A, 250 V Slow Blow, minimum $I^2t$ rating 500 $A^2s$ | 10 A, 250 V Slow Blow, minimum $I^2t$ rating 500 $A^2s$ |
| **Circuit Breaker** | 20 A, 250 V minimum | | 10 A, 250 V minimum | 10 A, 250 V minimum |

Table 3-1b. DVP Power Requirements (24 VDC)

| Valve Type | EM35 Actuator (EM35MR 3103/3171, EM100/3151) | LQ25/LQ25B/LQ25BP |
|---|---|---|
| Input Voltage Range | 18 V to 32 VDC ( 24 V nominal) | |
| Steady State Current | 2.6 A continuous | 5 A continuous |
| Transient Current | 20 A transient for 200 ms | 15 A transient for 100 ms |
| Fuse | 10 A, 250 V Slow Blow, minimum $I^2t$ rating 500 $A^2s$) | 10 A, 250 V Slow Blow, minimum $I^2t$ rating of 500 $A^2s$ |
| Circuit Breaker | 20 A, 250 V minimum | 10 A, 250 V minimum |

**Note:** Only the DVP 24V will support LQ25 single speed

## Power Wiring

The DVP is not equipped with an input power switch. Input power wiring to the DVP is crucial to its operation; therefore, we recommend that a safety input power switch be provided for installation and servicing. Do not use a fuse as a switch. A circuit breaker meeting the power supply requirement may be used for this purpose. It is important that proper wiring be applied during system installation to avoid an unwanted power trip or ground loop. Figure 3-1 illustrates the correct and incorrect ways to wire the power cable to the DVP.

**⚠CAUTION** **Input power must be steady DC. Do not attach energized wires since intermittent connections may allow transient surges to damage internal circuits.**

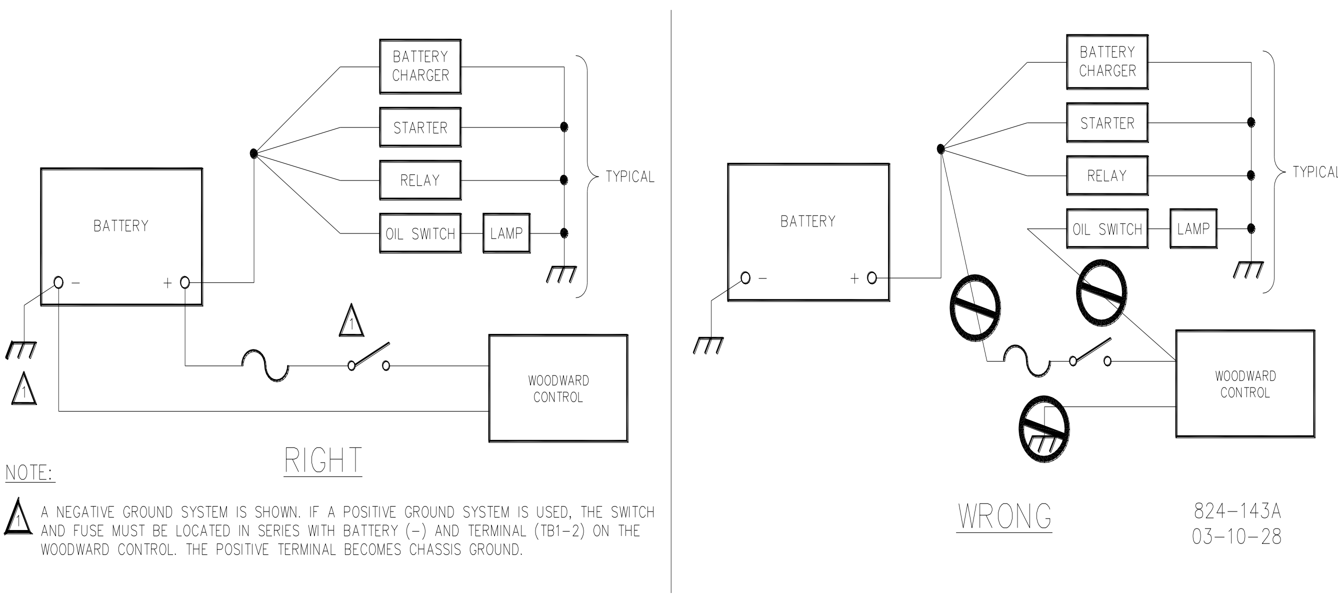



Figure 3-1. Power Wiring Recommendation

| | |
|---|---|
| **⚠CAUTION**<br>**Equipment Damage** | **The power system must be grounded with a low impedance connection. Otherwise, damaging overvoltage transients can be transmitted to the DVP power input terminals resulting in damage. If this cannot be done, external transient protection systems should be employed to avoid damage.** |

| | |
|---|---|
| **⚠WARNING** | **The DVP is designed to run with a variety of Woodward valves. Power requirements depend on the valve and driver used. See the valve specification for proper power requirements. The valve manual power requirements can be different from the DVP power requirements.** |

## Recommendations for Dual and Simplex Power Wiring

The DVP is provided with power terminals suitable for the required voltage and current level. Two positive and two negative pins are each sized for 8 AWG.

Provision for separate redundant power supplies is provided by dual DC inputs. Each of the inputs is diode isolated from the main input bus. If one of the supplies is lost, the other input will take over and the DVP will continue to operate normally. The loss of the input will be annunciated as an alarm.

Woodward recommends that you take advantage of the dual input power wiring configuration; however, the inputs can be tied together for use with a single power supply.

If a single power source is used to supply power to the DVP, jumpers should be used to apply power to both sets of input power terminals. The purpose of these jumpers is to ensure that the power supplied from the source is distributed equally to the two DVP inputs. This minimizes the power dissipated in each of the DVP input diodes for reduced heat load and improved reliability. When using the jumpers, insert the positive (+) power input lead from the power source into either the #1 or #3 positions, and the negative (-) lead into either the #2 or #4 positions as shown in Figure 3-2a.

Some newer versions of the DVP may include power input plugs with jumpers to connect the two positive and two negative terminals.

In installations where separate dual power sources are connected to the DVP, as shown in Figure 3-2b, the jumpers are not required.

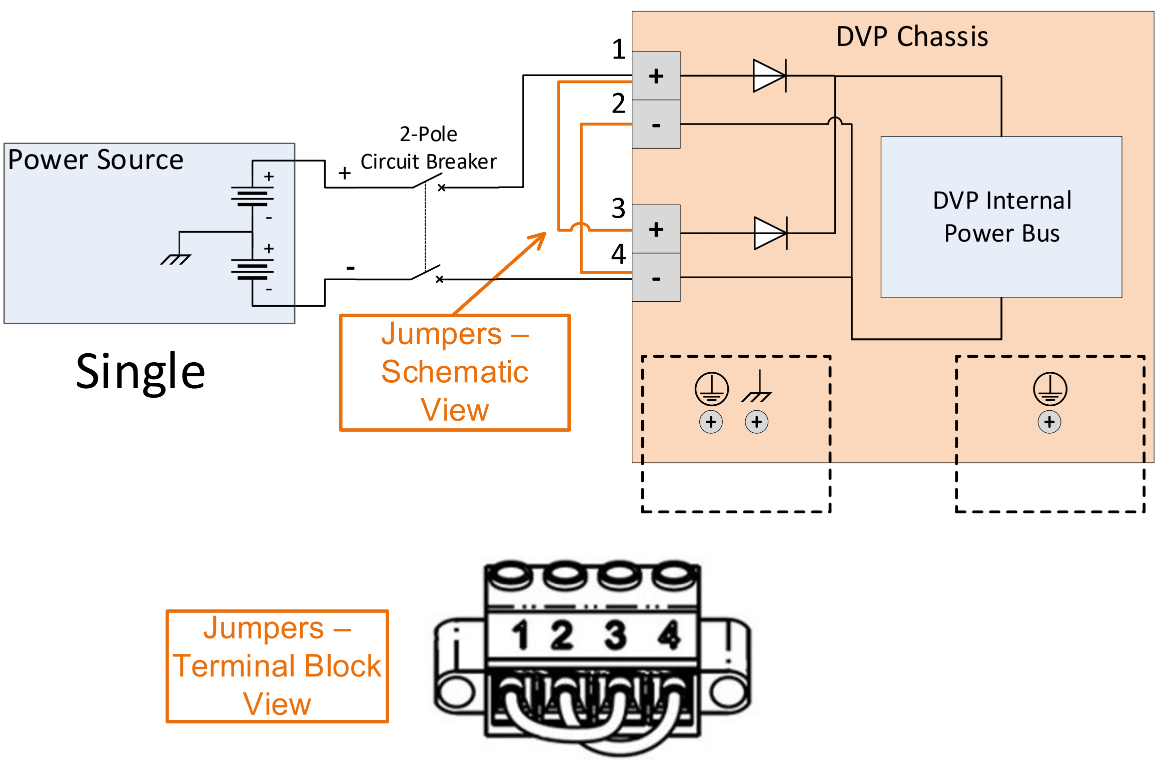



Figure 3-2a. Single Power Source Interface Diagram

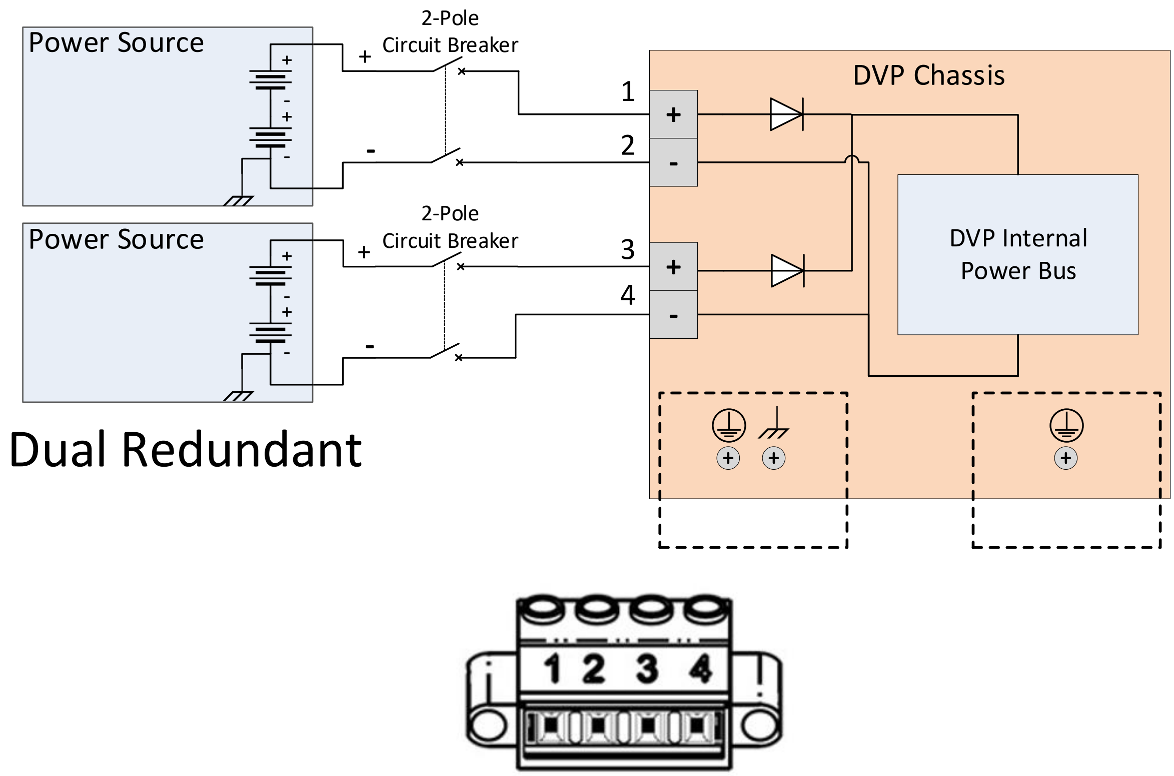



Figure 3-2b. Dual Redundant Power Source Interface Diagram

## Power Input Cable Requirements

Cable selection and sizing are very important to avoid power loss during driver operation**. The power supply input at the driver's input terminal must always provide the required nominal voltage for the driver**.

> **NOTICE**
> **Refer to the valve manual for a detailed plant-wiring diagram for your wiring installation.**

The input power wire must comply with local code requirements and be of sufficient size such that the power supply voltage minus the IR loss in the two lead wires to the DVP driver does not drop below the driver input minimum voltage requirement.

### American Wire Gauge Voltage Drop

A standard wire gauge voltage drop at maximum ambient temperature is provided in Table 3-2 to assist the cable selection.

Table 3-2. Voltage Drop Using American Wire Gauge (AWG)

| Wire Gauge (AWG) | Voltage Drop per Meter @ 20 A Round-Trip (V) | Voltage Drop Per Foot @ 20 A Round-Trip (V) |
|---|---|---|
| 8 | 0.100 | 0.031 |
| 10 | 0.165 | 0.050 |
| 12 | 0.262 | 0.080 |

### Voltage Drop Calculation Using American Wire Gauge

*Example*: 10 AWG wires will drop 0.050 V/ft at 20 A at maximum ambient temperature. Using 100 feet between the DVP driver and the power supply would provide a voltage drop of 100x0.05= 5 V. It is very important to ensure the voltage at the driver's input terminal is within the product power input specification to achieve the maximum performance.

### Wire Area Voltage Drop

A standard wire area voltage drop at maximum ambient temperature is provided in Table 3-3 to assist the cable selection.

Table 3-3. Voltage Drop Using Wire Area ($mm^2$)

| Wire Gauge ($mm^2$) | Voltage Drop Per Meter @ 20 A Round-Trip (V) | Voltage Drop Per Foot @ 20 A Round-Trip (V) |
|---|---|---|
| 10 | 0.087 | 0.026 |
| 6 | 0.144 | 0.044 |
| 4 | 0.216 | 0.066 |

*Example*: 6 $mm^2$ wires will drop 0.144 V/m at 20 A. Using 50 meters between the DVP driver and the power supply would provide a voltage drop of 50x0.144 = 7.2 V. To achieve the maximum DVP performance, we recommend that the applied voltage at the DVP input terminal must within the product nominal specification.

**NOTICE**

**We recommend that the voltage at the DVP input power terminal block always provide the nominal power for the DVP to operate correctly. There is no cable length limitation to the input power of the DVP as long as the voltage at the DVP power input terminal is within the DVP nominal requirement.**

## Resolver Feedback

There are three resolver feedback inputs provided on the DVP for redundancy, or to look at the position of multiple devices, such as the motor and the valve. There is a 5 kHz excitation signal that is sent out to the resolver from the positioner, and a cosine and sine signal are sent back to the DVP. These signals are then translated through a resolver to digital algorithm, and from the output of that block the processor calculates the position of the motor. This information is then fed into the control model at the appropriate intervals. The resolver feedbacks should be appropriately wired and shielded according to instructions and the length of the wires should be limited to 100 m and the lumped capacitance should be limited to 7 nF (Figure 3-3). If approved prefabricated cables are used in conjunction with end plate assembly, then the shielding and length have already been addressed.

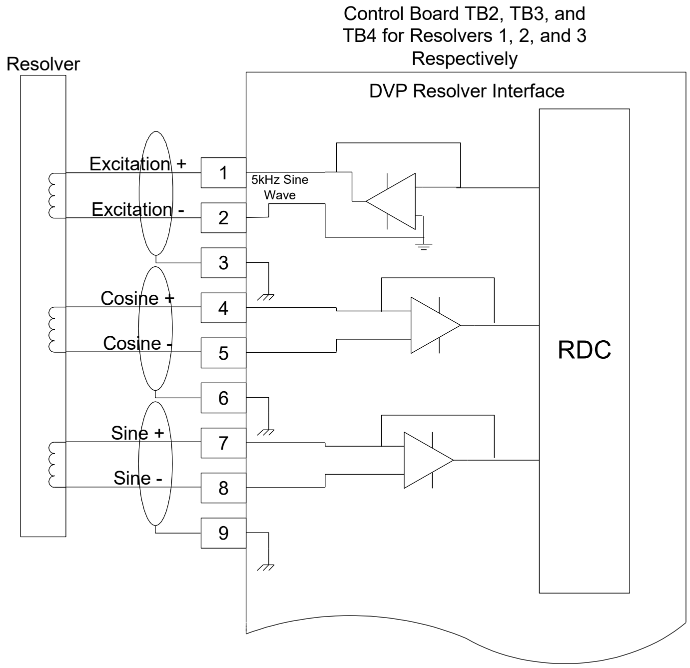



Figure 3-3. Position Feedback Transducer Interface Diagram

## Resolver/LVDT Signal Requirement

Excitation (generated from DVP)
    Frequency: 5 kHz
    Voltage: Controlled by DVP

SIN and COS (signal returned from the position).
    Max Voltage: ±1.5 V

## Position Feedback Transducer Wiring Requirements:

- Shielding: Per drawing above
- The maximum capacitance of the shielded twisted pair position feedback transducer cables should be less than a total of 7 nF (not including internal capacitance) to meet positioning accuracy and performance specifications
- Maximum Run Length: 100 m
- Wire Gauge Range: 16–24 AWG
- All feedback cables must be run separately from the motor cables to avoid coupling between the high voltage switching drive signals and the lower level position feedback transducer feedback signals.

## Motor Driver Outputs

The DVP provides three available motor terminal outputs on the motor drive output, Figures 3-4 and 3-5. Each of the three output terminals is sized for 8 AWG wire. The motor drive output can be software configured to drive a three-phase motor or LAT motor.

In an IP30 circular connector DVP model, an extended cable/connector (J1–6 pin connector) was routed from the internal power driver board to the end plate to allow for motor drive interface (see plant wiring figure for wiring diagram). In an IP30 DVP terminal block version, an extended cable/terminal block (POWER TB–4 pin terminal) is routed to the end plate. Three terminal pins are designated for each of the motor drive outputs, and the one is designated for the EARTH ground.

In an IP30 Terminal Block +24 V DVP model, an extended 6-pin cable/terminal connector is provided allowing 2 cables per one motor output installation. This option is to minimize voltage drop in the wire and ensure the driver meets the slew time.

The safety ground from the motor should be connected to the PE ground post provided on the DVP base plate. If approved prefabricated cables are being used, the appropriate grounding is provided via the cable wiring.

For best noise immunity, the motor power cables should be run in separate cable trays or conduits from the motor resolver cables.

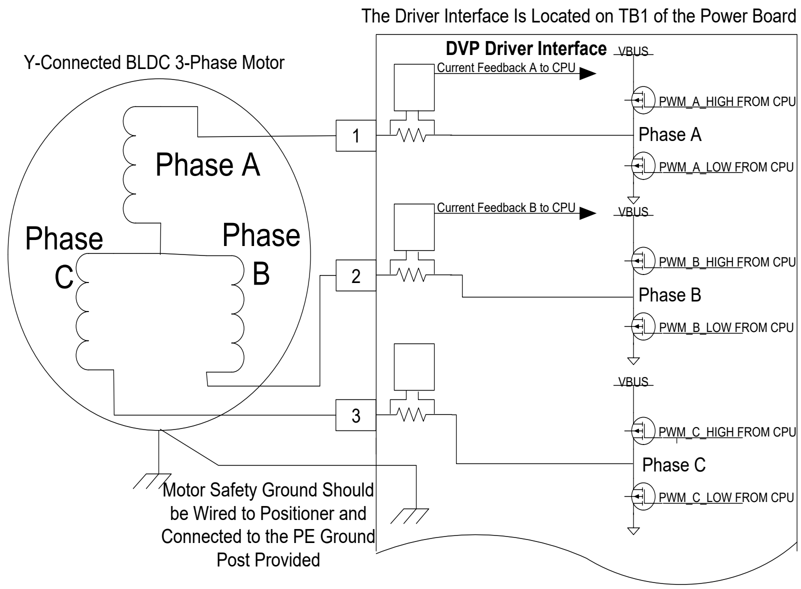



Figure 3-4. 3-Phase Motor Drive Diagram

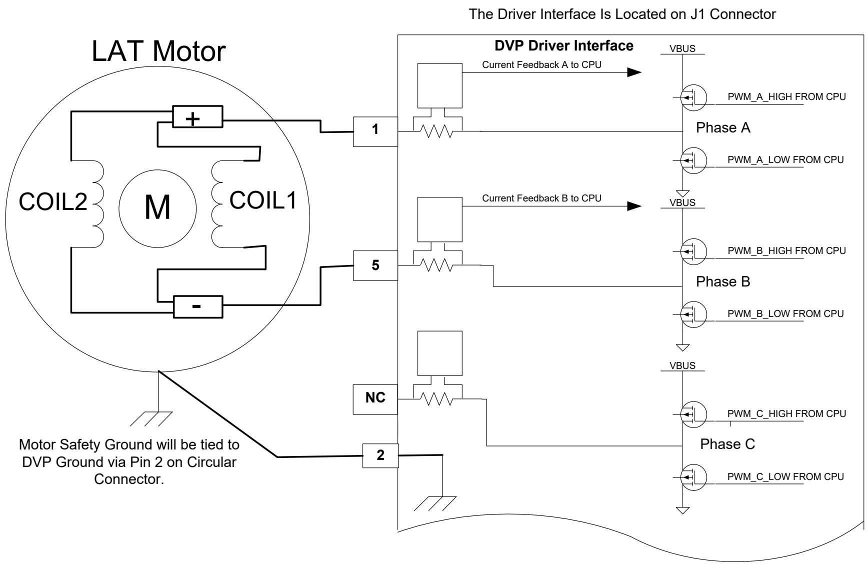



Figure 3-5. LAT Motor Drive Diagram

## Motor Drive Specifications

- **3-Phases Motor or (LAT) Motor Drive**
  - Switching Frequency: 10 kHz
  - Software configurable (depending on the valve application)
- **Maximum Motor Current**
  - Steady State Current: See valve manual
  - Transient Current: See valve manual

## General Motor Wiring Requirements

- The motor wires should be twisted together to avoid excessive loop area that may radiate or be more susceptible to radiation.
- If separate cables are necessary, then the distance between conductors must be minimal to reduce the previously mentioned loops, as shown in Figure 3-6.
- If shielding is used the shield should be terminated at the driver end only through the mating cable connector housing for the circular connector version or to an earth ground connection ⏚ for the conduit entry or terminal block version .
- All motor cables should be run separate from the lower level signals to avoid coupling noise from the high voltage motor drive signals to the lower level feedback signals.

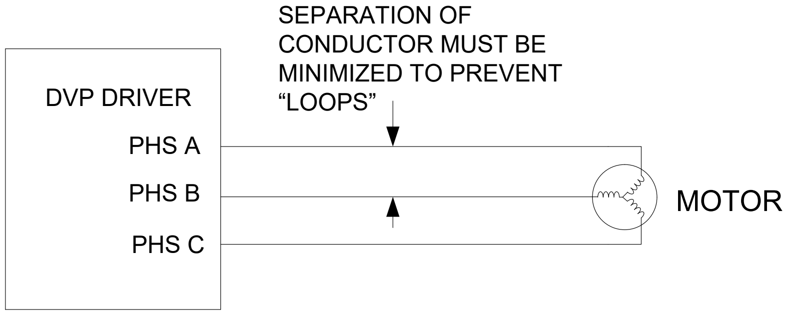



Figure 3-6. Preventing “Loops”

## Motor Cable Length

Follow the indications and recommendations on wire gauge for each desired cable length in Table 3-4. For a motor output drive of the circular DVP model, the cable length is limited due to unavailable connector pins. A long distance beyond the recommended cable length will likely degrade the performance of the DVP.

There are two terminal-pin outputs on both the +24 V DVP and terminal block DVP model, and one motor drive output. A junction box for the inputs is required. This provides the option to install two motor wires into one motor output and permits the long cable distance needed. Tables 3-4 and 3-5 indicate the maximum cable length that can be used.

Table 3-4. 125 VDC DVP Motor Wiring Requirements Table

| Maximum Cable Length | | American Wire Gauge (AWG) | Metric Wire ($mm^2$) |
|---|---|---|---|
| 328 ft | 100 m | 8 | 10 |
| 206 ft | 63 m | 10 | 6 |
| 131 ft | 40 m | 12 | 4 |

Table 3-5. 24 VDC DVP Motor Wiring Requirements Table

| Maximum Cable Length Meters | Feet | Terminal 1, 3, 5 | Terminal 2, 4, 6 | American Wire Gauge (AWG) | Metric Wire ($mm^2$) |
|---|---|---|---|---|---|
| 12 | 40 | X | | 14 | 2.5 |
| 24 | 79 | X | X | 14 | 2.5 |
| 19 | 62 | X | | 12 | 4 |
| 39 | 128 | X | X | 12 | 4 |
| 30 | 98 | X | | 10 | 6 |
| 60 | 197 | X | X | 10 | 6 |
| 50 | 164 | X | | 8 | 10 |
| 100 | 328 | X | X | 8 | 10 |

**NOTICE**

**Woodward offers cable sets that can be used for certain applications, contact Woodward sales for more information.**

## Ethernet Communication Ports

The DVP supports Ethernet communications to the driver from a master controller. The DVP receives command inputs from the master control and will generate a digital response. The wiring requirements and supported protocols are defined below.

When the Ethernet module is present, Ethernet communications provides command input for the DVP. This interface currently utilizes the EGD (Ethernet Global Data) protocol. The three Ethernet channels are voted two out of three to ensure operational reliability if one of the channels fails. See Figure 3-7 and Table 3-6 for the pin-out diagram and required Ethernet / EGD settings.

For information related to cyber-security and the DVP see manual 35124.

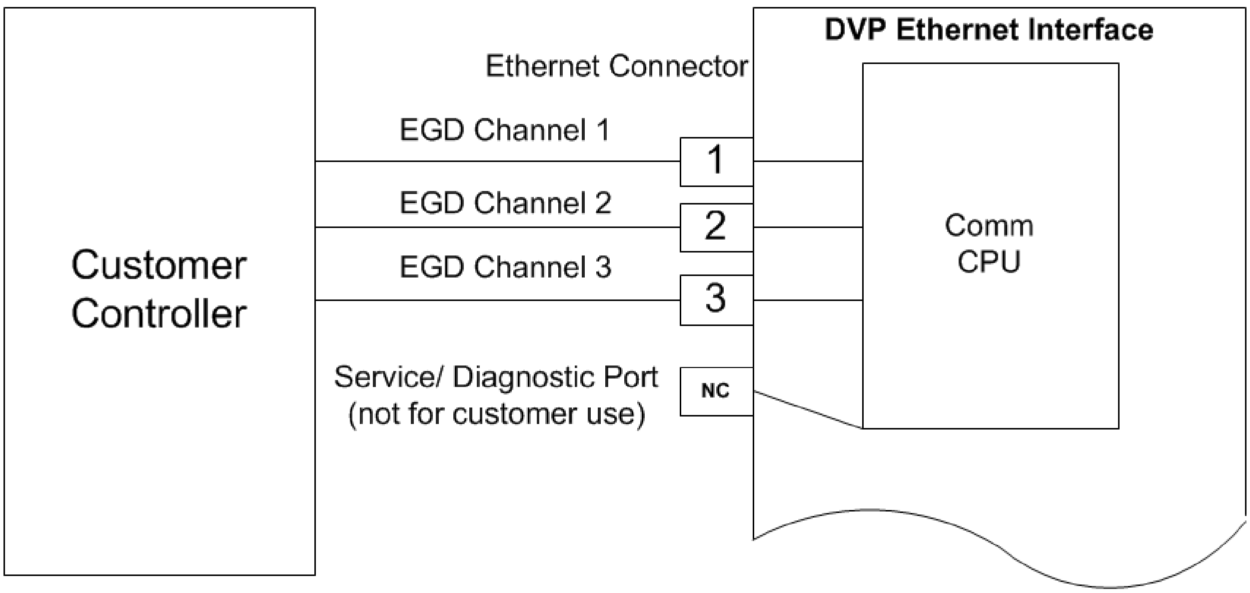



Figure 3-7. Ethernet Interface Diagram

### Wiring Requirements:

- Double shielded (SSTP) cables are required
- CAT-5 Ethernet cable
- Maximum Run Length: 30 m
- For long Ethernet cables where ground loops are a concern, the shield should be capacitive coupled at one end.

### Connection Types (Auto Sensing):

- 10 Base-T
- 10 Base-T Full Duplex
- 100Base-TX
- 100Base-T4
- 100Base-TX Full Duplex

### Ethernet Port Configuration Requirements:

- All ports configured for different subnets.

Table 3-6. EGD Triplex Communication Configurations

| Port | Port Function | DVP Port Configuration<br><br>IP Address<br>Subnet | DVP EGD Producer Configuration<br><br>Producer ID<br>Exchange Num | Customer Controller<br><br>IP Address<br>Subnet | Customer Controller EGD Producer Configuration<br><br>Producer ID<br>Exchange Num |
|---|---|---|---|---|---|
| 1 | EGD Chan 1 | 192.168.128.20<br>255.255.255.0 | 192.168.128.20<br>20 | 192.168.128.1<br>255.255.255.0 | 192.168.128.1<br>1 |
| 2 | EGD Chan 2 | 192.168.129.20<br>255.255.255.0 | 192.168.129.20<br>20 | 192.168.129.1<br>255.255.255.0 | 192.168.129.1<br>1 |
| 3 | EGD Chan 3 | 192.168.130.20<br>255.255.255.0 | 192.168.130.20<br>20 | 192.168.130.1<br>255.255.255.0 | 192.168.130.1<br>1 |
| 4/NC | Service / Test Port | 172.16.100.10<br>255.255.255.0 | No Connection | No Connection | No Connection |

The above table defines the required configuration of both the Ethernet ports and the EGD protocol. The DVP comes preconfigured for the configuration shown in the table. The IP addresses of the EGD ports are not configurable from the DVP service tool. The DVP will not communicate if the IP address / subnet of the customer controller ports are not configured as shown in the DVP configuration table.

EGD producer interface of the DVP is configured to generate an EGD packet with the Producer ID and exchange number set to the values defined in the DVP EGD Producer Configuration column of the table. The DVP EGD consumer interface is configured to accept EGD packets from the customer controller with the producer ID and exchange number set to the values defined in the Customer Controller EGD Producer Configuration column.

## RS-232 Service Port

Use the RS-232 port (Figure 3-8) only during the DVP Configuration or troubleshooting with the Service Tool. See Chapter 5 for initial setup information of this positioner. Perform all normal operation command and monitoring through the Ethernet, CAN, or other command and feedback type depending on the positioner configuration. We recommend that an RS-232 isolator be applied when using the serial port to avoid any possible communication issues. The reason for this is that the port is not isolated, and therefore the isolator will avoid any potential ground loops or unnecessary EMI noise coupling related to PC connections and typical industrial environments. The RS-232 port requires a straight-through cable.

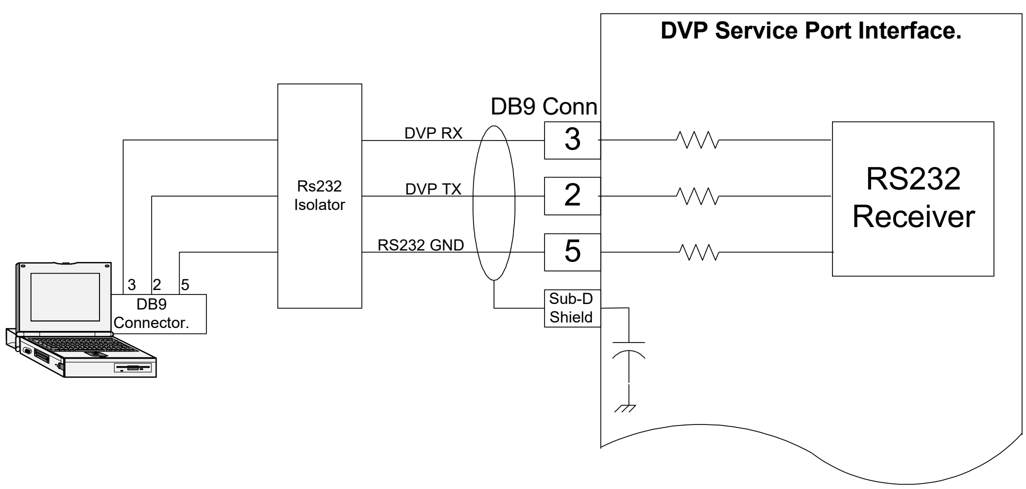



Figure 3-8. RS-232 Interface Diagram

### RS-232 Communication Specification
- Data Rate: fixed baud rate at 38.4 kbps
- Isolation: 1500 VAC from input power

### Wiring Requirements
- External RS-232 isolator is recommended (Phoenix Contact PSM-ME-RS-232/RS-232-P, Woodward P/N 1784-635)
- Straight-through cable type

## Analog Input

The analog input for the DVP is a 4–20 mA or 0–5 V configuration and can be configured through software to be used as the position command input. The input may be used as either a 4–20 mA input or a 0–5 V input, and this configurability is also done through software. See Chapters 5 and 6 to learn more about configuration of the input and how to make changes if necessary.

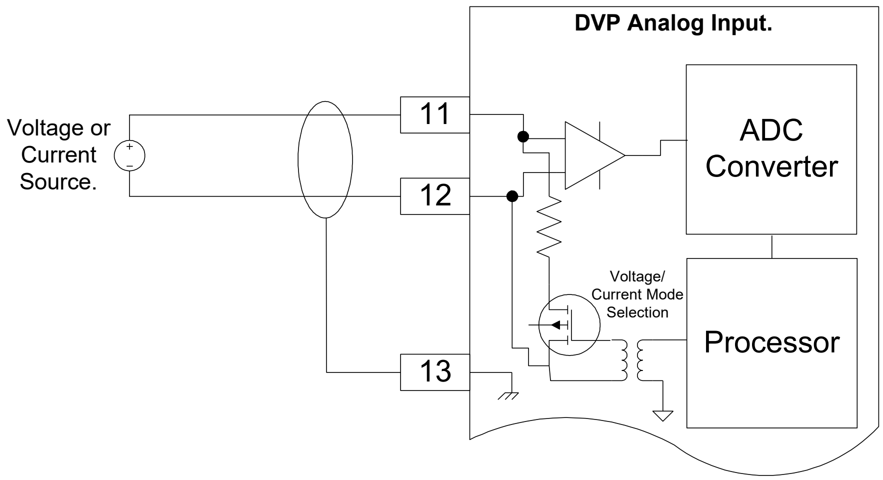



Figure 3-9. Analog Input Interface Diagram

**Analog Input Specification:**
- Analog 4–20 mA: Range is 2 to 22 mA
- Analog 0–5 V selection: Range is 0 to 5 V
- Max. Temperature Drift: 200 ppm/°C
- Calibrated Accuracy: 0.1% of FS
- Common Mode Voltage: ±100 V
- Common Mode Rejection Ratio: –70 dB @ 500 Hz
- Isolation: 400 kΩ from each terminal to Digital Common<br>1500 VAC from Input Power

**Wiring Requirements:**
- Individually shielded twisted pair cable
- Keep this and all other low-level signal cables separated from motor cables and input power cables to avoid unnecessary coupling (noise) between them.
- Maximum Run Length: 100 m
- Wire Gauge Range: 16–20 AWG (0.5 to 1.3 mm³)

## Analog Output

The analog output of the DVP is in the form of a 4–20 mA output and can drive load resistances up to 500Ω. This output can be configured to perform one of many different tasks, such as reporting actual position, set position, or in the case of a speed control, the output can report speed. See Chapters 5 and 6 to learn more about configuration of the input and how to make changes if necessary. This output is designed for monitoring and diagnostic purposes only and is not meant for any type of closed loop feedback.

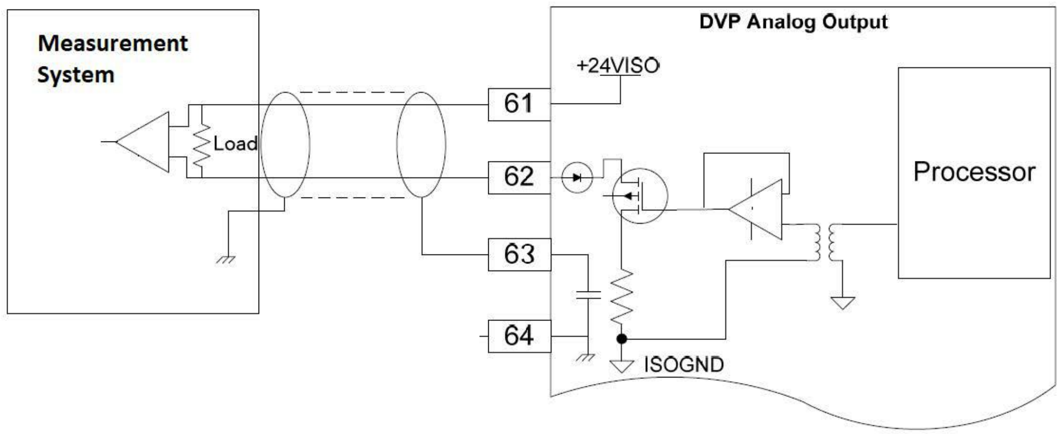



Figure 3-10. Analog Output Interface Diagram

Table 3-7. Analog Output Specification

| | |
|---|---|
| Calibrated Accuracy: | 0.5% of full range |
| Output Range: | 4 to 20 mA |
| Load Range: | 0 Ω up to 500 Ω |
| Maximum Temperature Drift: | 300 ppm/°C |
| Isolation: | 500 VAC from Digital Common, 1500 VAC from Input Power |

Table 3-8. Wiring Requirements

| | |
|---|---|
| Individually shielded twisted pair cable | |
| Keep this and all other low level signal cables separated from motor cables and input power cables to avoid unnecessary coupling (noise) between them. | |
| Maximum Run Length: | 100 m |
| Wire Gauge Range: | 16–20 AWG (0.5 to 1.3 mm³) |

If the measurement system is grounded, then terminate ANALOG OUTPUT SHIELD at pin 63 as shown in Figure 3-10.

Only one end of the ANALOG OUTPUT SHIELD should have a direct connection to ground.

## Discrete Inputs

The DVP has five discrete inputs. These are designed as pull down circuits which create a configurable logic level condition when an external contact is closed. If the external contact is closed, this pulls the sensing signal down to the low state. If the contact is open, the internal 18 VDC source pulls the sensing signal to the high state. Through the software, the user can configure these inputs as active high (open) or active low (ground) depending on the wiring preference. We recommend that the discrete inputs be configured as active low to protect against broken wires. A broken wire will look like an open input, which will be the inactive state. This is especially important in the case of a shutdown input. External power is not necessary for these inputs as the isolation is provided internally.

There are five inputs and only three ground terminals provided, so it may be necessary to use one ground for multiple inputs. This is understood and allowable.

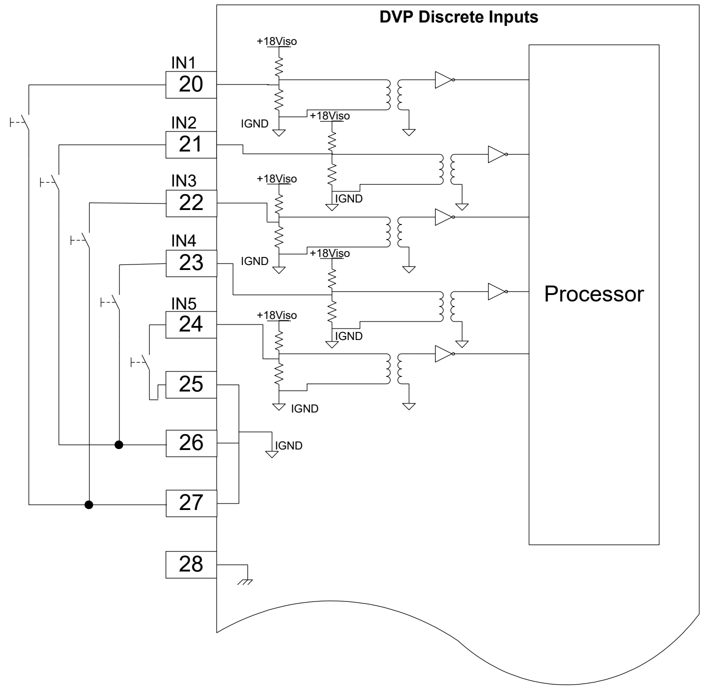



Figure 3-11. Discrete Input Interface Diagram

## Discrete Input Specification

- Trip Points:
  - If the input voltage is less than 3 V the input is guaranteed to detect a low state (input voltage<3 V = LO).
  - If the input voltage is greater than 7 V the input is guaranteed to detect a high state (input voltage >7 V = HI).
  - The open state will look like a high state to the controller, and therefore the two states of the input are open or tied to ground.
  - The hysteresis between the low trip point and the high trip point will be greater than 1 V.
- Contact Types:
  - The inputs will accept either a dry contact from each terminal to ground or an open drain/collector switch to ground.

- Isolation: 500 VAC from Digital Common, 1500 VAC from Input Power

## Wiring Requirements:

- Keep this and all other low-level signal cables separated from motor cables and input power cables to avoid unnecessary coupling (noise) between them.
- Maximum Run Length: 100 m
- Wire Gauge Range: 16–20 AWG

# Discrete Outputs

There are two Discrete Outputs on the DVP. Either output can be configured to react to any or all the Alarms/Shutdowns in the positioner. The outputs can also be configured as active on or active off. See Chapters 5 and 6 to learn more about configuration of the input and how to make changes if necessary. The outputs can be used as high side or low side drivers depending on user preference. We recommend, however, that the output be used as a high side driver as shown in the diagram below. This configuration will make some common wiring faults to ground more detectable.

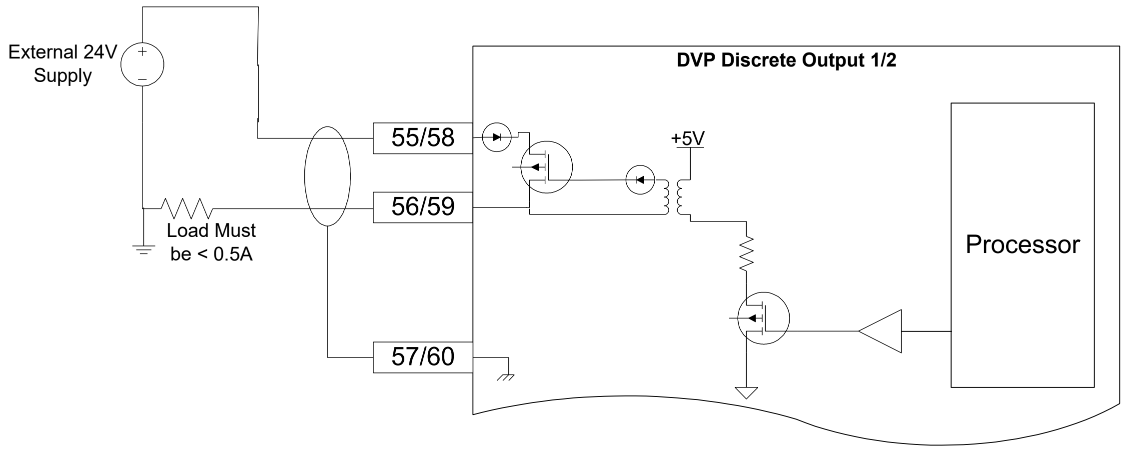



Figure 3-12. Discrete Output Interface Diagram

Table 3-9. Discrete Output Specification

| | |
|---|---|
| External Power Supply Voltage Range: | 18–32 V |
| Maximum Load Current: | 500 mA |
| Protection: | The outputs are short circuit protected<br>The outputs are recoverable after short circuit is removed |
| Response Time: | Less than 2 ms |
| On-state Saturation Voltage: | Less than 1 V @ 500 mA |
| Off-state Leakage Current: | less than 10 µA @ 32 V |
| Hardware Configuration Options: | The outputs can be configured as high-side or low-side drivers, but we recommend that they be used as high side drivers if possible. |
| Isolation: | 500 VAC from Digital Common, 1500 VAC from Input Power |

Table 3-10. Wiring Requirements

| | |
|---|---|
| Individually shielded twisted pair cable | |
| Keep this and all other low level signal cables separated from motor cables and input power cables to avoid unnecessary coupling (noise) between them. | |
| Maximum Run Length: | 100 m |
| Wire Gauge Range: | 16-20 AWG (0.5 to 1.3 mm³) |
| Shielding: | per Figure 3-12 above |

## CAN Communication Ports 1 and 2

The DVP device may be controlled via CAN communication. There are two possible modes:
1. CANopen single with or without analog backup
2. CANopen dual

1. The CANopen single with or without backup: This mode uses CAN port 1 for communication. Optionally it is possible to configure (by CAN communication) the analog input as a backup signal. By default, the analog input is a backup signal. (See analog input section for how to interface and setup an analog input.)

2. CANopen Dual: This mode uses CAN port 1 and CAN port 2. If the two ports are working correctly, information received from CAN port 1 is used. If communication by CAN port 1 is not possible any more (detected by communication time out), CAN port 2 is used for communication.

The CAN communication baud rate can be selected. The possible options are:

- 125 kbps
- 250 kbps
- 500 kbps

Per CiA DS-102 Standard, the following are the recommended maximum cable lengths. Differences in the baud rate and the cable length affect the number of units that can be put onto a network.

Table 3-11. Recommended Cable Length

| Baud Rate | Cable Length | Number of DVP on Link |
|---|---|---|
| 500 Kbps | 100 m | 15 |
| 250 Kbps | 250 m | 7 |
| 125 Kbps | 500 m | 3 |

**IMPORTANT** **The use of controlled impedance (120 ohm) cable is recommended for proper CANbus operation. See ISO 11898 series standards for further information.**

**WARNING** **For communication wiring, use wires with a temperature rating of at least 5°C above surrounding ambient. All other functions use wires with a temperature rating of at least 10°C above surrounding ambient.**

**NOTICE** **Discharge to chassis prior to connecting or disconnecting CAN connector.**

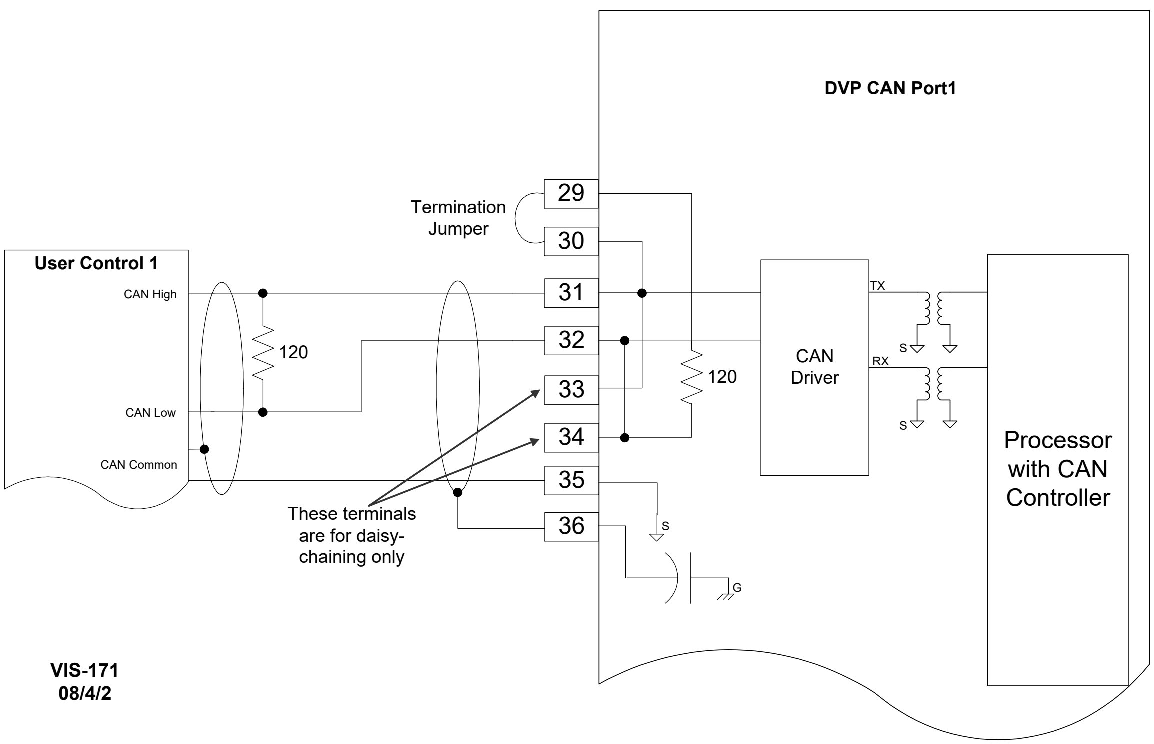



Figure 3-13. CAN Port 1

If CAN port 1 is used, see Figure 3-13 of the CAN port interface. See the Analog Input section above for the analog interface diagram when CAN is used with an Analog Input backup.

Pins 29 and 30 are the termination jumper. Connecting these two pins with a short wire on the connector will enable an internal 120 Ω resistor between CAN high and CAN low wire. This may help with the termination.

**⚠WARNING** **If internal termination is used, disconnecting the terminal block will result in communication disruption of all CAN devices on the network, not just the DVP. If this is not desired, do not use the internal termination—use external termination.**

Pins 31 and Pin 32 are the CAN High and CAN low wires typically found on a CAN system.

Pins 33 and 34 are two additional CAN high and CAN low pins. These can be used to daisy chain the CANbus to the next device, without the need for a junction box.

**⚠WARNING** **If the daisy chain is used, disconnecting the connector will disconnect the complete CANbus. Other devices communicating on the CANbus will not be able to communicate any more. If this is not desired, do not daisy chain the DVP.**

Pin 35 is the CAN ground. The DVP side of the CAN link is galvanically isolated from the DVP, ground, and system common. Therefore, we need to connect the isolated ground to the ground of the user control.

Pin 36 is used to terminate the CAN wiring shield.

**NOTICE** **Discharge to chassis prior to connecting or disconnecting CAN connector.**

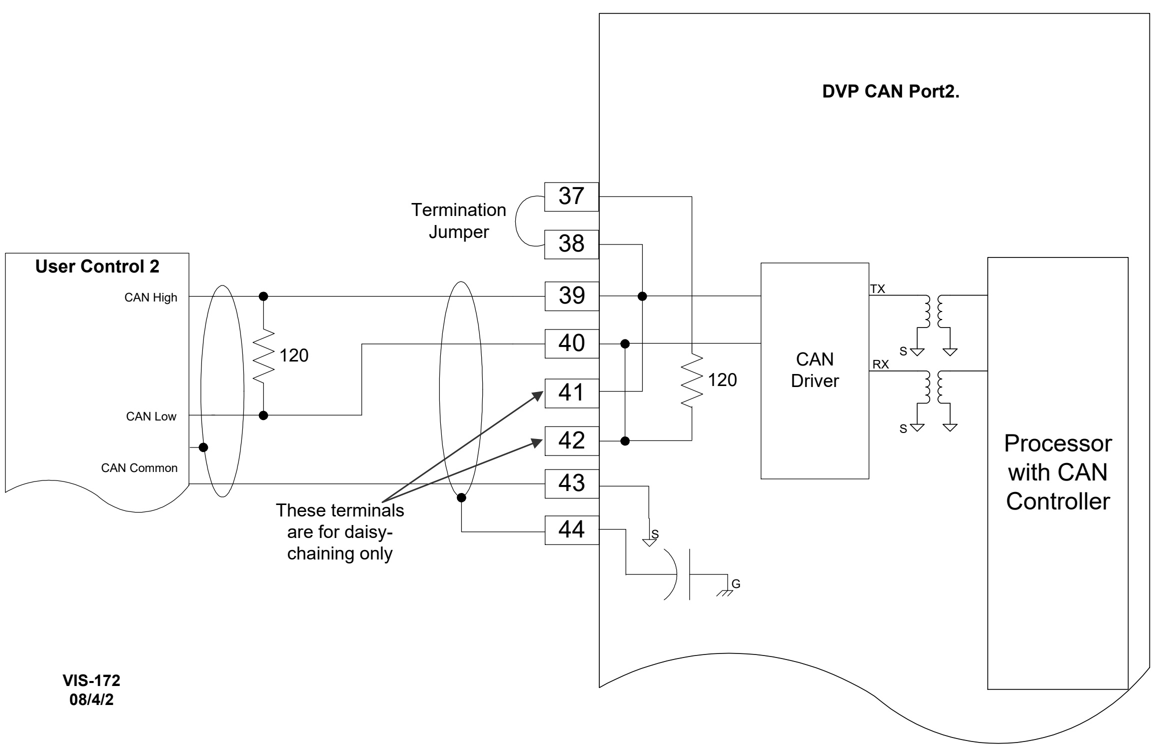



Figure 3-14. CAN Port 2

If you are using dual can communication mode, there are two identical communication ports. Port 1 and Port 2 are wired identically. For description, see Port 1.

Table 3-12. CAN Pin Number and Function

| Pin Number | Function |
|---|---|
| 29 | CAN 1 Termination jumper |
| 30 | CAN 1 Termination jumper |
| 31 | CAN 1 High in |
| 32 | CAN 1 Low in |
| 33 | CAN 1 High out |
| 34 | CAN 1 Low out |
| 35 | CAN 1 ISO GND |
| 36 | CAN 1 Shield |
| | |
| 37 | CAN 2 Termination jumper |
| 38 | CAN 2 Termination jumper |
| 39 | CAN 2 High in |
| 40 | CAN 2 Low in |
| 41 | CAN 2 High out |
| 42 | CAN 2 Low out |
| 43 | CAN 2 ISO GND |
| 44 | CAN 2 Shield |

See Appendix A for more information on CANopen communications.

## CAN Node ID Selection

When using CANopen communications, it is necessary to set the CAN Node ID to a unique value to ensure that the DVP responds to commands intended for the appropriate device. There are two methods for setting this value—software or hardware/wiring. The method is defaulted to a predetermined configuration based on the DVP part number but can be changed using the Service Tool (see manual 26912). With the software option, the node ID setting is a user-defined value set in software. The hardware/wiring (also referred to as harness coding) option uses discrete inputs to select an index which sets the node ID value. The index is determined by the power-up state of the discrete inputs. Note that the discrete input condition is based on open or closed state at power-up, ignoring the active high/low configuration. Changes to any Node ID-related software settings require a power cycle to take effect.

The discrete input CAN ID selection has three different options. The index can be based on two, three, or four discrete inputs, allowing three, seven, or 15 valid preprogrammed settings. This selection method is set using the Service Tool as part of the CAN demand configuration. Tables 3-13, 3-14 and 3-15 identify the selected index based on the configured selection method.

Definitions:

- Discrete Input 5: connection between terminal 24 and GROUND
- Discrete Input 4: connection between terminal 23 and GROUND
- Discrete Input 3: connection between terminal 22 and GROUND
- Discrete Input 2: connection between terminal 21 and GROUND
- Discrete Input 1: connection between terminal 20 and GROUND
- (GROUND can be any terminal 25, 26 or 27)

Table 3-13. Two Input Index Selection

| Index Selected | Discrete Input 5 | Discrete Input 4 |
|---|---|---|
| INVALID | Open | Open |
| 1 | Open | Closed |
| 2 | Closed | Open |
| 3 | Closed | Closed |

Table 3-14. Three Input Index Selection

| Index Selected | Discrete Input 5 | Discrete Input 4 | Discrete Input 3 |
|---|---|---|---|
| INVALID | Open | Open | Open |
| 1 | Open | Open | Closed |
| 2 | Open | Closed | Open |
| 3 | Open | Closed | Closed |
| 4 | Closed | Open | Open |
| 5 | Closed | Open | Closed |
| 6 | Closed | Closed | Open |
| 7 | Closed | Closed | Closed |

Table 3-15. Four Input Index Selection

| Example Device # | Index Selected | Discrete Input 5 | Discrete Input 4 | Discrete Input 2 | Discrete Input 1 |
|---|---|---|---|---|---|
| N/A | INVALID | Open | Open | Open | Open |
| Pressure Control Valve | 1 | Open | Open | Open | Closed |
| Metering Valve #1 | 2 | Open | Open | Closed | Open |
| Metering Valve #2 | 3 | Open | Open | Closed | Closed |
| Metering Valve #3 | 4 | Open | Closed | Open | Open |
| Metering Valve #4 | 5 | Open | Closed | Open | Closed |
| Liquid Metering Valve #1 | 6 | Open | Closed | Closed | Open |
| Liquid Metering Valve #2 | 7 | Open | Closed | Closed | Closed |
| Liquid Metering Valve #3 | 8 | Closed | Open | Open | Open |
| Liquid Metering Valve #4 | 9 | Closed | Open | Open | Closed |
| Dual Actuator #1a | 10 | Closed | Open | Closed | Open |
| Dual Actuator #1b | 11 | Closed | Open | Closed | Closed |
| Dual Actuator #2a | 12 | Closed | Closed | Open | Open |
| Dual Actuator #2b | 13 | Closed | Closed | Open | Closed |
| Dual Actuator #3a | 14 | Closed | Closed | Closed | Open |
| Dual Actuator #3b | 15 | Closed | Closed | Closed | Closed |

## Instructions for Use of CAN ID Terminal Blocks

When using the harness coding method (as described in CAN Node ID Selection Section), it is necessary to install a jumper terminal block within each positioner during initial installation. This terminal block configures each positioner for proper communication with its assigned primary or secondary CAN Open Network. The installation of this terminal block must be performed before attempting power-up or communications across the CAN Open Network. Until this process is complete, the positioners will not communicate with the networks. Install jumpers based on the CAN ID Node Selection and using the information from the appropriate table (3-13, 3-14, and/or 3-15).

Proper installation of the CAN ID Terminal Blocks is performed by the following steps:

1. Ensure that there is no power being applied to the DVPs.

2. Determine which DVP will be connected to the Primary CAN Network, and which will be connected to the Secondary CAN Network.
3. Create the appropriate CAN ID Terminal Block associated with each CAN Network and device index number as shown in table 3-13, 3-14, or 3-15.

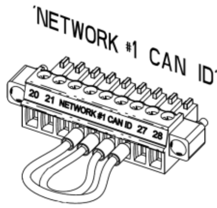



Figure 3-15. Example Index #12
CAN ID Terminal Block

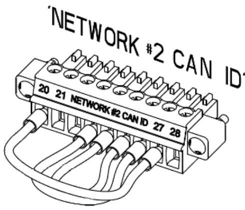



Figure 3-16. Example Index #13
CAN ID Terminal Block

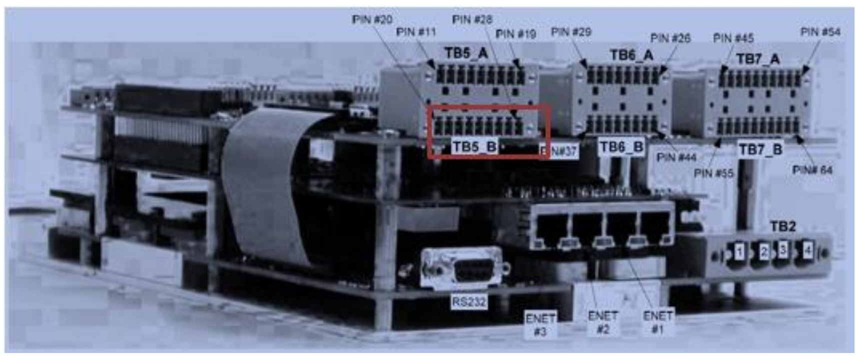



Figure 3-17. Installation Position for CAN ID Jumper

After identifying the appropriate CAN ID Terminal Block, install it into the bottom row of the top printed circuit board of the DVP board stack (TB5-B as shown in Figure 3-17) with the #20 terminal position on the left.

After installation of the jumper terminal blocks, tighten the retaining screws to 2.5 to 3.5 in-lb (0.3 to 0.4 N-m).

## Virtual CAN Networks

When two DVPs are used in a dual actuator configuration, the supporting CAN networks are implemented in a somewhat different fashion as compared to operation of a single device. When used in a dual configuration, each DVP is only connected to one network, but still receives a redundant message in the event of a single network fault. Each drive receives its primary CAN message via the network to which it is directly connected as well as a redundant message which is broadcast via the mating positioner across the dual internal link.

For example, as shown in Figure 3-18 below, the positioner connected to IGV-1 is directly connected to CAN network 1, and IGV-2 is directly connected to CAN Network 2. However, Network 1 is considered primary and used by both positioners unless there is a detected fault on that network. The CAN messages destined for both IGV-1 (Example address 12) and IGV-2 positioner (Example address 14) are normally transmitted across Network 1. The DVP for IGV-1 receives its message directly across Network 1. The DVP for IGV-2 gets its message from DVP-1 across the dual internal link. Conversely, the redundant messages on Network 2 are received directly by the IGV-2 positioner which transmits them across the dual internal link to the IGV-1 positioner. By this method, each drive receives both the primary and redundant message stream. If a fault occurs on the primary network, the system will automatically switch over to the message stream on Network 2. If one of the internal links were to fail, the system will continue transmitting across the second internal link.

By this operation, dual redundant operation and full diagnostics capability is maintained with only two networks. This is critical to maintaining synchronization of the actuators even in the event of a single network fault.

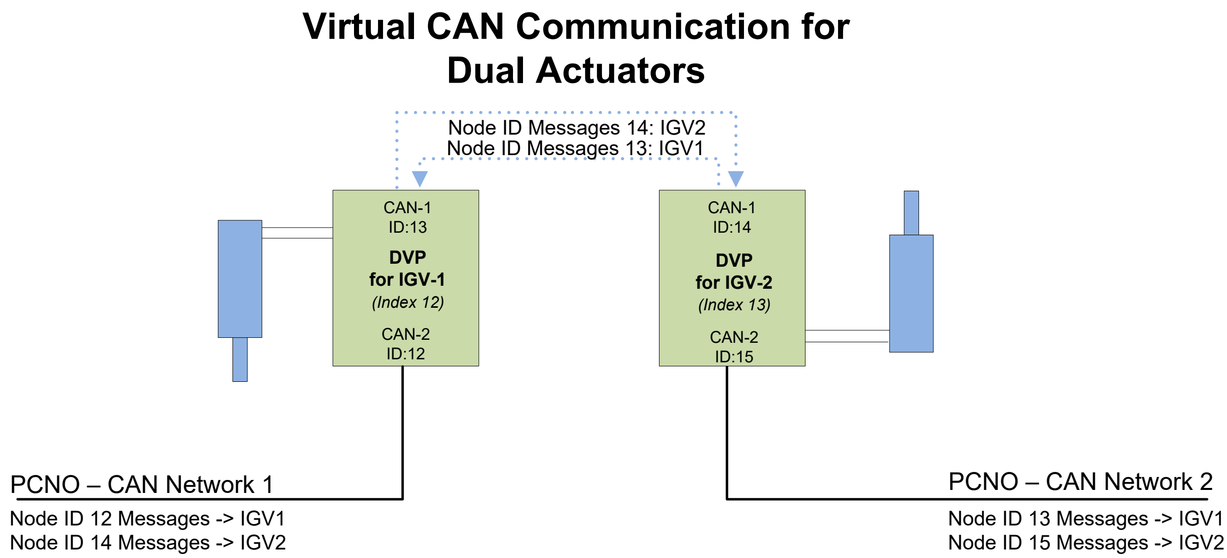



Figure 3-18. Virtual CAN Communication for Dual Actuators

# Dual Redundant Communication Setup

The DVP has an option to operate in a dual redundant or virtual mode where two actuators are controlled by DVPs connected in a dual redundant configuration. Connection to the actuator is shown in the specific actuator manual. Figure 3-19 is the diagram for connection between DVPs. The cable length of the DVP-DVP interlink (CAN 1 and RS485) should be kept to < 3m (< 10ft). For more information, see the sections on RS-485 and CAN.

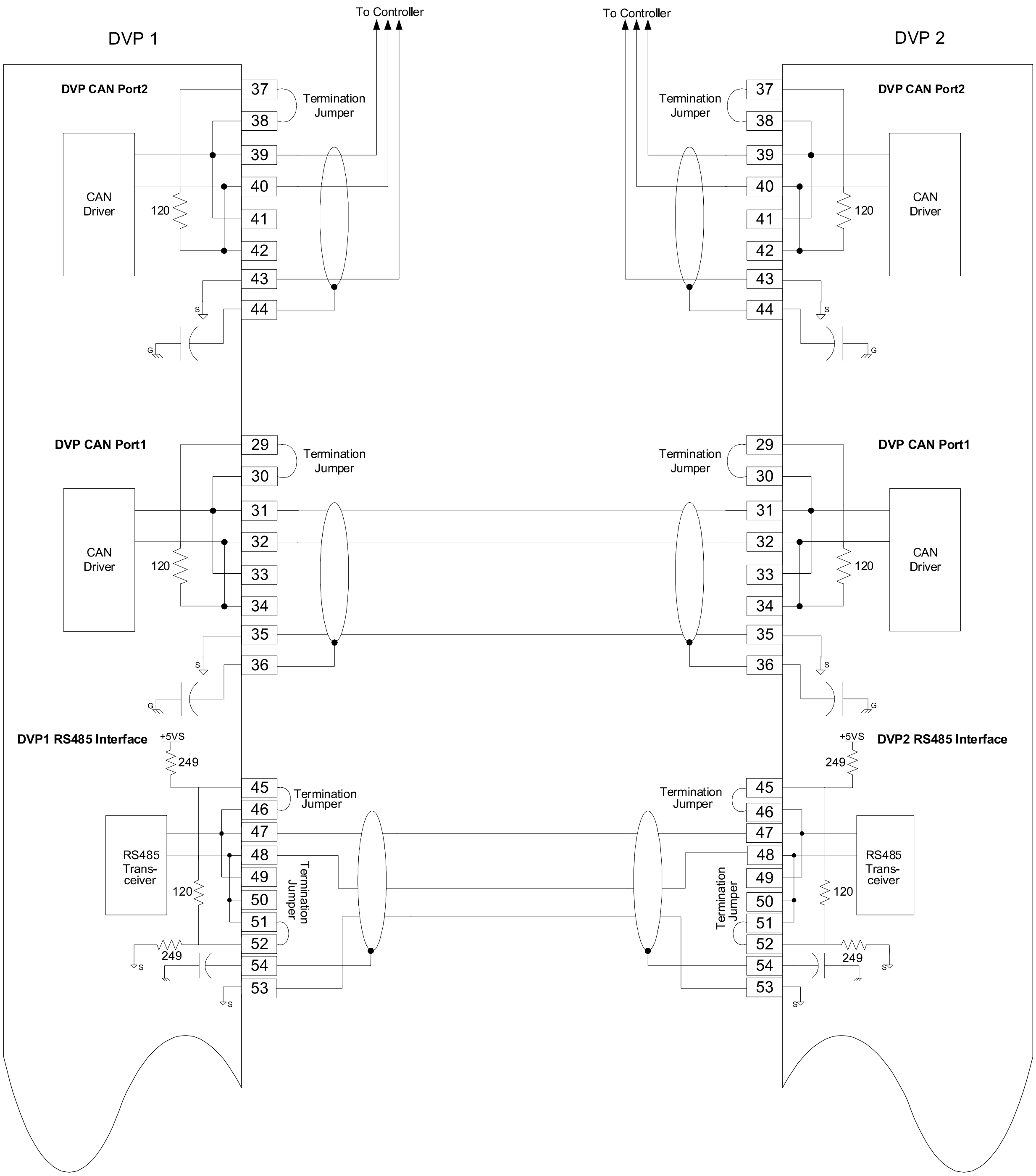



Figure 3-19. Dual Redundant DVP Connection Diagram

# RS-485 Communication Port

The DVP provides an isolated RS-485 communication port (Figure 3-20). This port can be used for a long-distance connection to the control system to utilize the Service Tool or for the dual DVP internal link.

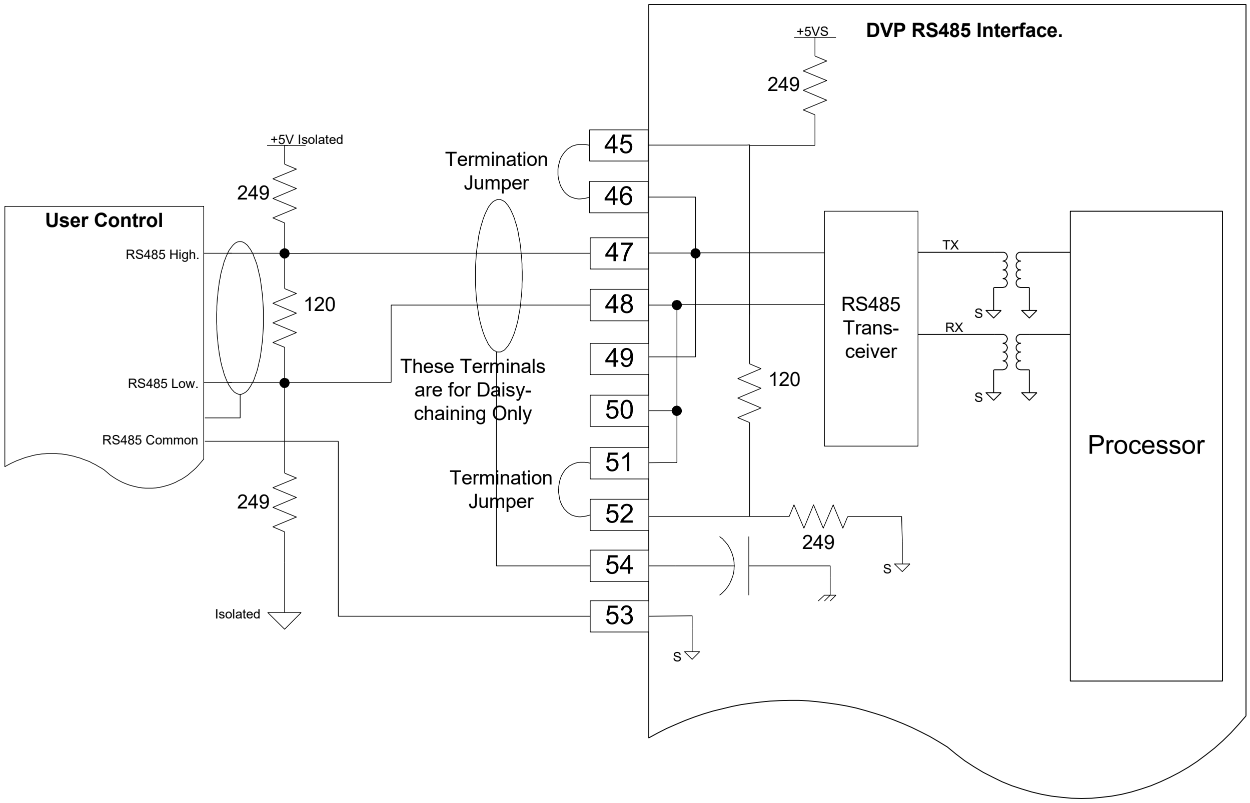



Figure 3-20. RS-485 Interface Diagram

## RS-485 Port Specification (Service Port)

- Baud Rate: Fixed at 38.4 kbps
- Isolation: 500 VAC from Digital Common, 1500 VAC from input power

## Wiring Requirements:

- Individually shielded twisted pair cable
- Keep this and all other low level signal cables separated from motor cables and input power cables to avoid unnecessary coupling (noise) between them.
- Maximum Run Length: 100 m
- Wire Gauge Range: 16–20 AWG
- Shielding: per drawing above

# Chapter 4. Description of Operation

## Functional Description

The DVP is a digital electronic position controller designed for use with many Woodward actuator/valve combinations that are electrically driven. The positioner allows for three different resolver or LVDT combinations and two independent power supply inputs for redundancy in both feedback and power. Normally, resolvers are used for motor commutation and position control, while LVDTs are used for final shaft sensing. The DVP is capable of driving a three-phase brushless DC motor.

The DVP accepts a position demand signal from the user in the form of Ethernet, 4–20 mA, 0–5 V, RS-485, CAN, or PWM depending on the hardware and software configuration of the DVP.

This position setpoint is processed by a digital, model-based control algorithm, which modulates the motor position (indicated by resolver feedback) to track this setpoint. No controller dynamic tuning is needed. Internal bus voltage, current feedback from the inverter phases, and other information is incorporated into this controller to ensure consistent performance as external conditions vary. These conditions, in conjunction with configuration parameters such as number of motor revolutions per full stroke, coil inductance, zero cutoff settings, and valve specific offsets are used to convert the raw signal data to precision measurements appropriate for the actuator/valve system which the DVP is controlling.

The DVP is shipped in a factory set, auto-detect mode. When connected to a valve or actuator equipped with an integrated “ID Module”, the DVP automatically detects the type of valve to which it is connected and performs a self-configuration process. The content of the ID Module is automatically uploaded into the DVP which is then configured with appropriate configuration settings, including the factory set start-up limits. The objective of the startup checks is that all start up limits are passed prior to entering the normal operating mode.

The DVP is protected against I/O, motor, and grounding faults. The motor output will tolerate a fault condition (like a phase short or earth fault) for a predetermined amount of time before turning off the inverter. The controller protects the DVP against actuator overloads by limiting the output and input currents to the driver. In the event that the overload causes current limiting, full output current is maintained if possible and the actuator will move at a slower speed to prevent motor stall.

The DVP incorporates a suite of monitoring diagnostics which continuously monitor the operation and condition of several different sub-systems. Any sensed diagnostic condition is captured and flagged. For devices controlled via digital communications such as CAN or Ethernet, these diagnostics are transmitted back to the main control system.

For devices controlled via analog signals, discrete outputs can be connected to signal an alarm or shutdown condition. A precise determination of the diagnostic condition can be performed using the PC service tool which supports the DVP product family.

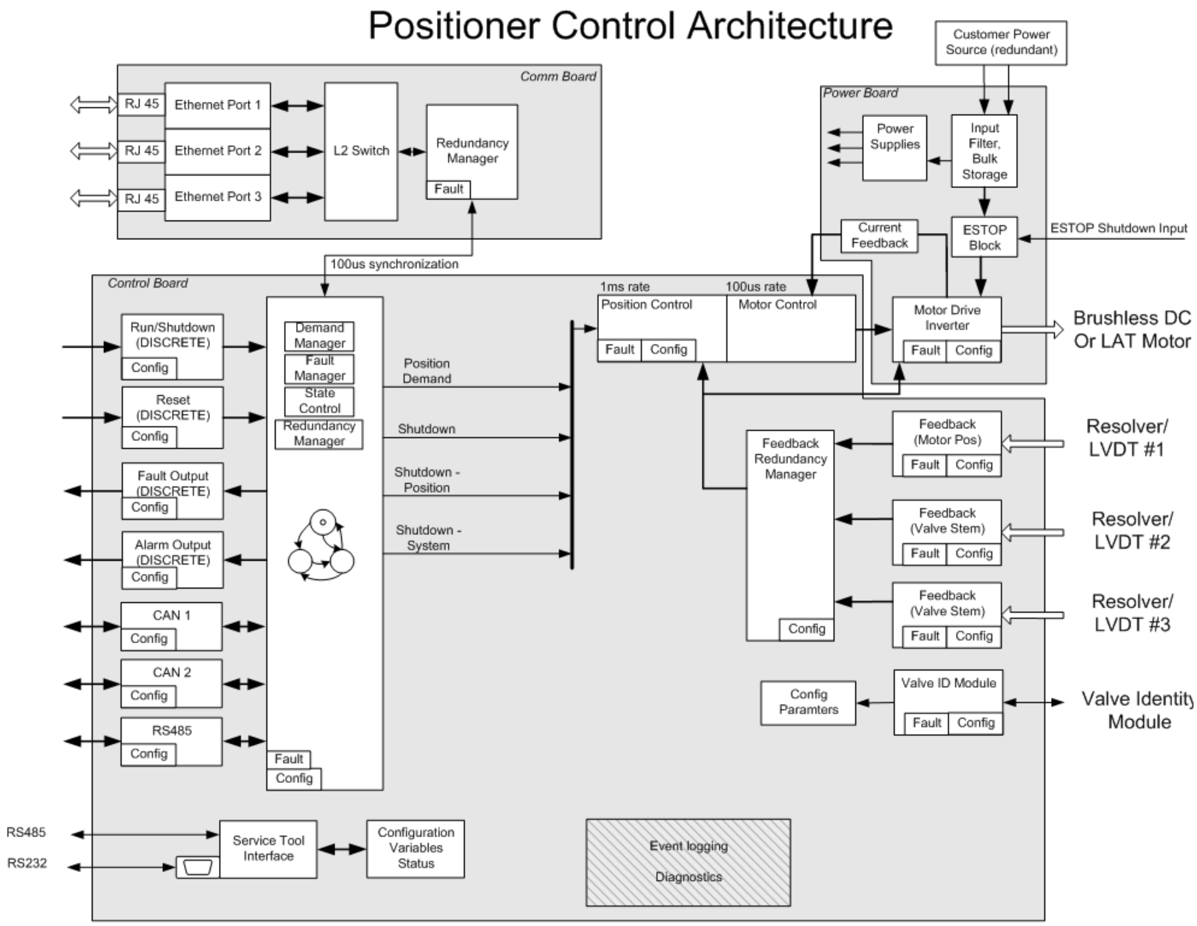



Figure 4-1. Functional Block Diagram

## Startup Checks

Whenever the DVP is reset from a power up or any critical diagnostics shutdown, a series of automatic startup checks is performed and must be successfully completed before the DVP enters the running state. The purpose of the start-up checks is to ensure that correct feedback readings are verified, that the valve or actuator is at the required start-up or “home” position (and confirmed by more than one sensor), and that the actuator moves in the correct direction when commanded before resuming operation. Since many actuators use multi-turn reduction gear trains with multi-turn feedback systems, it is important that the starting point or “zero turn” of the system be confirmed during the startup process. This is particularly important for normally closed control valves, to ensure that the valve is not open at the indicated 0% position, and to prevent a potentially dangerous high flow starting condition. For other actuators controlling externally connected equipment or linkage, verifying the correct zero point during startup can prevent potential collision against the actuator’s internal end-stops, or against a hard stop within the driven linkage. This is important to prevent damage of the actuator, driven equipment, or both.

The startup checks are a critical function designed to help ensure system safety. The DVP Valve/Actuator Startup Check sequence includes a Minimum Direction Startup Check, Maximum Direction Startup Check, and Motor Direction Check. Each of these are explained in further detail in the DVP Service Tool Manual 26912. This manual lists how the startup check indications are displayed. The various fault conditions are also referenced in the troubleshooting chapter for explanation and recommended actions.

# Dual Positioner Systems

The DVP provides capability to synchronously operate dual actuators, for example for control of gas turbine variable geometry systems. This dual positioner, dual actuator system also supports control from dual CAN Open networks for precise digital control and diagnostics of the positioners and actuator system. An important feature of the dual drive system is the ability to synchronize operating states of both positioners, as well as the positions of both actuators. Diagnostic information is exchanged between the two drives to manage certain failure modes. A simplified diagram of the dual actuator and positioner system is shown in Figure 4-2 below.

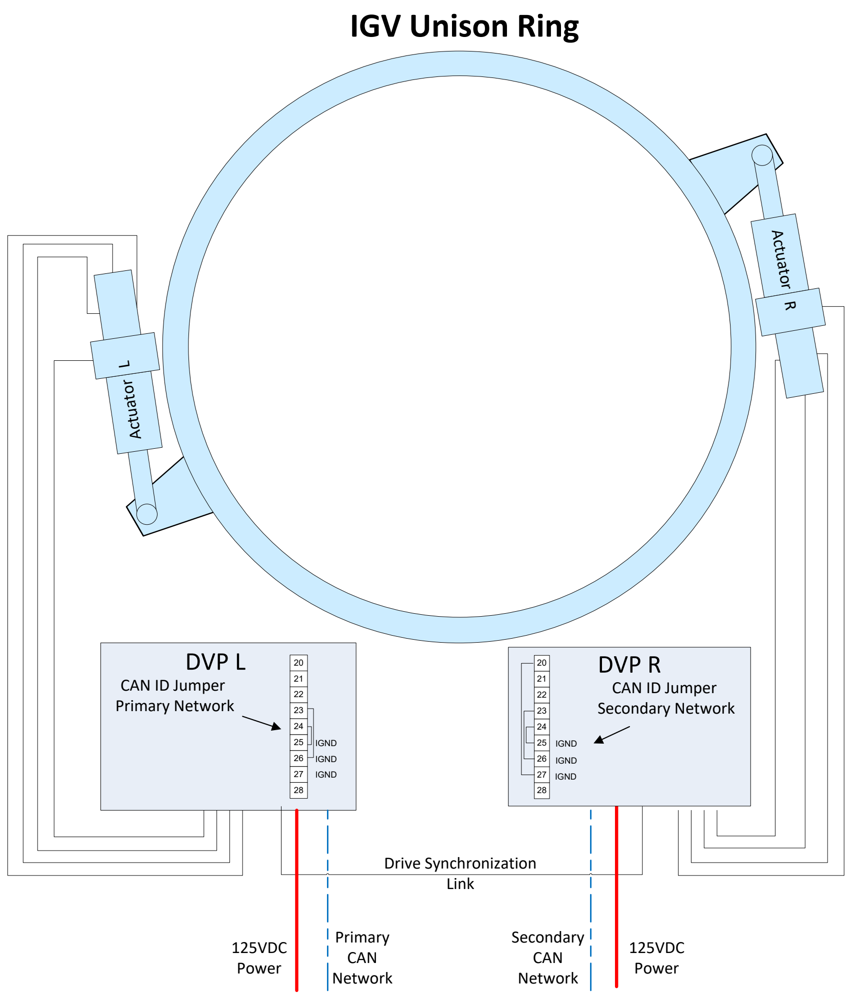



Figure 4-2. Dual Actuator and Positioner System Diagram

## Purpose of the CAN ID Jumper Terminal Blocks

To improve the availability of the system, in the event of a failure one of the CAN Open networks, each of the positioners used in the dual actuator system is connected to a separate CAN Open control network. One network is designated as the “Primary Network”, the other is designated as the “Secondary Network”. Under normal circumstances, the operating states (Run, shutdown, reset) as well as the control messages (position setpoint, position feedback, diagnostics) are transmitted to both positioners via the primary network. The 2nd positioner receives the primary operating states and control messages across the drive synchronization link such that both positioners operate on the exact same message stream. In the event of primary CAN network failure, both positioners revert to the secondary CAN network data stream. In this case also, the drive synchronization link ensures both positioners operate with consistent information from the secondary network.

## Commissioning Checks

After completing all power wiring, actuator wiring, and dual DVP wiring as indicated in Chapter 3, a functional check is recommended to ensure that all aspects of the dual system are performing correctly. The sequence below is provided as a basic set of commissioning checks. Please ensure that all plant level safety procedures are followed in addition to these checks.

1. Continue wiring of the DVP Power, CAN Network Connections, and any discrete I/O as required by the application.

2. Connect all cables between the DVP and the actuator. Ensure that the connector locking rings are snug.

3. Ensure that all personnel are clear from the actuators and driven equipment. Complete any necessary local procedures or checks required by the plant or installation prior to applying power to the DVP's.

4. Power up the DVP. Wait for the status LED to cycle from fast red/green which indicates Device Boot up to a steady red flashing indicator. The steady flashing red indicator signals that boot up is complete. A flashing red indicator is normal as the system is awaiting a reset command prior to enabling operation.

5. Reset the DVP's. Test operation from both primary and secondary CAN Networks. Confirm that both networks are operational. If the status indication does not transition from a steady red flash to a steady green flash, refer to the DVP operating manual for troubleshooting information.

6. Once the status LED flashes a steady green display, the DVP reset has been successful. From the CAN network. Send a setpoint value to the DVP. The actuators should begin tracking the setpoint.

7. Test operation from both the primary and secondary networks. Refer to the control system and plant operating instructions for instructions on how to manually position the valves from the turbine control system.

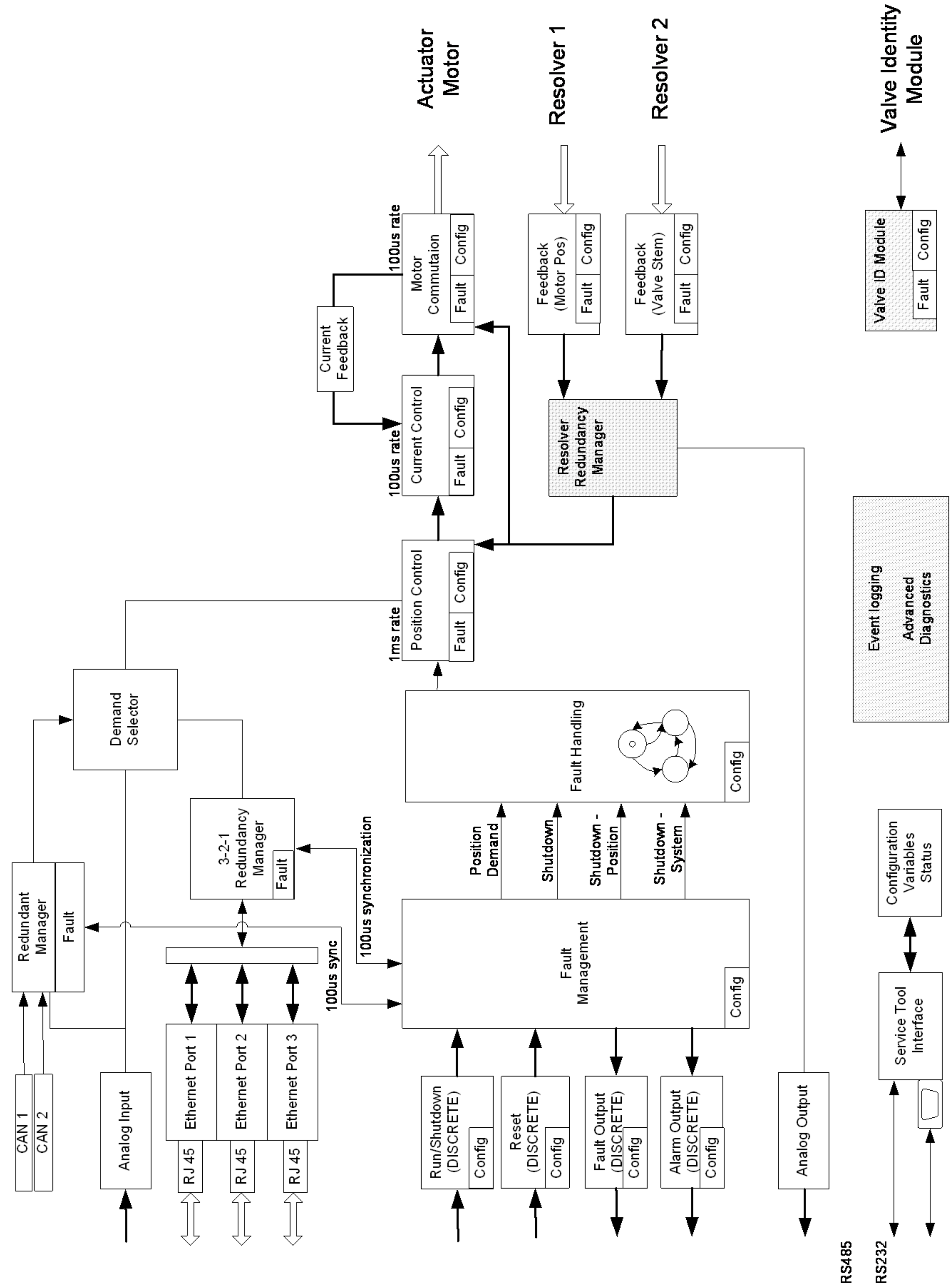



Figure 4-3. Functional Block Diagram

# Duty Cycle Limitations

| NOTICE | The DVP is rated for full capability as stated in the specifications for 30 seconds and a cooling duration of 120 seconds. This cycle can be repeated as long as necessary. Although Woodward sizes the actuation system (valve/actuator/DVP) to ensure there is sufficient margin for the most critical application requirement, the DVP can be over-driven if care is not taken to observe the operational duty cycle limits. |
|---|---|

Active current limits are enforced by the controller software to prevent damage to the DVP. These current limits control the maximum level and duration of the input and output current, to ensure the reliability and compliance ratings of the DVP and the actuator, and to address various failure modes of the DVP and the installed system. These limits have been established to allow an ample motion profile for prime mover control and for test purposes.

However, in the actual application, the system needs to respond to critical control events at any time. Therefore, the DVP does not enforce any restrictions on the duty cycle or frequency of repetitive movements. The frequency or duty cycle of large, full load motions must be controlled by the user or the supervising control system. The following recommendations are provided as a reference for controlling this duty cycle, particularly during testing.

Frequency sweeps, frequency response testing, or large repetitive step responses performed during testing can result in high power dissipation and potential overheating of the DVP. The amount of power dissipation is dependent upon the amplitude of the test signal, the actuator load, as well as the frequency and duration of the tests. To ensure that the system is not overheated during testing, the duration of high power test events such as frequency responses and large amplitude step responses should be limited to a maximum test duration of 30 seconds with a minimum 120 second cool down between tests.

| IMPORTANT | For lab testing, allow 1 minute cool down after frequency testing with demand amplitude > 5% pk-pk. With this test condition, test duration should be limited to 3 minutes. |
|---|---|

# External DVP Diagnostics

## DVP Diagnostic LED Codes

Depending on options, there are up to three diagnostic LEDs located on the DVP. The LED visible through the top of the unit is the main diagnostic LED. There are two LEDs on the end cover near the Ethernet connectors. The right LED (farthest from the RJ45 connections) is the communication board diagnostic LED, and the left LED is the communication board Reset/Run LED. Tables 4-1, 4-2, and 4-3 list the flash codes and operating conditions indicated by each of the LEDs.

## Main Diagnostic LED


Figure 4-4. Main Diagnostic LED Location


Figure 4-5. Main Diagnostic LED on DVP IP66 Enclosure

Table 4-1. Main Diagnostic LED Codes

| Color | On/Off Time (light is on for same time as it is off) | Indicated Condition |
|---|---|---|
| **Red** | 500 ms | Internal DVP shutdown fault detected. |
| **Green** | 500 ms | Normal DVP operation. Indicates Okay, External Shutdown or External Position Shutdown. |
| **Orange (green and red at same time)** | 500 ms | Alert indicating that DVP is not operating in Analog, PWM, EGD or CANopen position demand mode. Indicates either no demand mode is selected, or a test mode is selected (e.g., manual position). |
| **Red and green alternating** | 60 ms | DVP Start-up Sequence (Switches to red, green, or orange after successful start-up) |

## Communication Board Diagnostic LED

The Communication Board Diagnostic LED displays its code through two sequences of blinking. Each sequence shows one digit in the two-digit code. The first digit blinks, and then there is a two second pause. The second digit then blinks and there is a 5 second pause before the pattern repeats. All the diagnostic codes are broadcast in red. The codes are as follows in the table.

Table 4-2. Communication Board Diagnostic LED Codes

| 1st Digit | 2nd Digit | Indicated Condition |
|---|---|---|
| 1 | 4 | RAM Test Failure |
| 2 | 2 | Real Time Clock Test Failure |
| 2 | 3 | Floating Point Unit Test Failure |
| 2 | 4 | Flash Test Failure |
| 2 | 5 | HD1 Flash Test Failure |
| 2 | 6 | I2C Bus Test Failure |

## Communication Board Reset/Run LED

The Communication Board Reset/Run LED shows the user what is happening with the communication board processor. The LED will show red or green depending on what is happening. See the table below for the status of the LED under certain modes.

Table 4-3. Communication Board Reset/Run LED Codes

| Color | Reason |
|---|---|
| Solid Red | Processor held in reset by main CPU or for other diagnostic condition |
| Solid Green | Indicates normal operation, starting operating system (VxWorks*), or functioning between Reset and RAM test where RAM is being prepared. |
| Off After Power Up | RAM test |

*—VxWorks is a trademark of Wind River Systems, Inc.

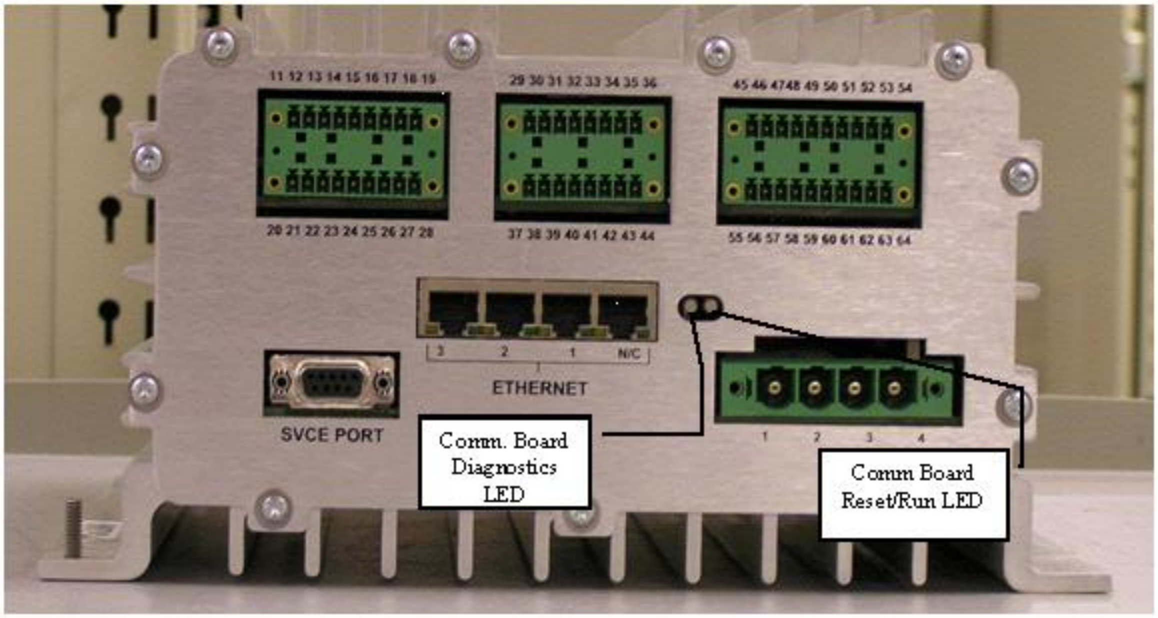



Figure 4-6. Communication Board LED Location

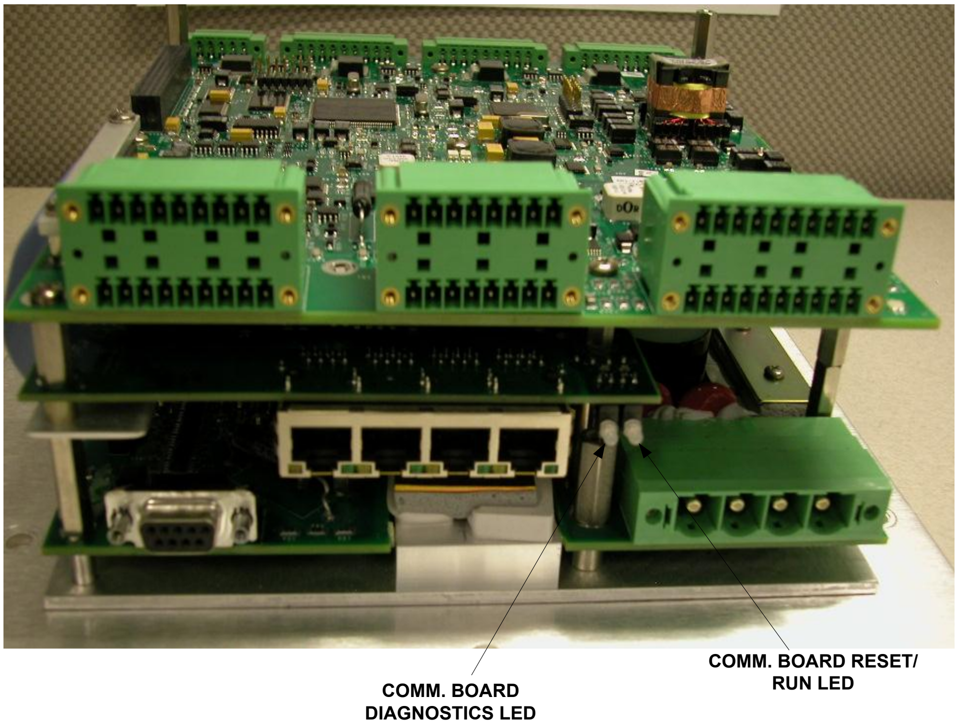



Figure 4-7. Communication Board LED Location DVP IP66

# Chapter 5.
# Initial Setup Guide

## Introduction

| | |
|---|---|
| **WARNING** **Hot Swap Hazard** | **Switch off power before removing covers or connect/disconnect electrical connectors or cable interconnection. Failure to do so may result in permanent damage to the DVP.** |

The Woodward DVP is designed with control and parameter settings which can be configured using the Woodward DVP Service Tool. There are some valve-specific settings that are read by the DVP from the valve's Identity Module on power-up. Additionally, there are certain parameters which are available for configuration of field settings to satisfy the needs of specific applications.

# Chapter 6.
# DVP Configuration

Refer to Manual “26912 DVP Service Tool” for the initial setup of the DVP.

# Chapter 7.
# DVP Operation

## Introduction

| | |
|---|---|
| ⚠WARNING<br>Hot Swap Hazard | **Switch off power before removing covers or connect/disconnect electrical connectors or cable interconnection. Failure to do so may result in permanent damage to the DVP.** |

The Woodward DVP is designed with control and parameter settings which can be configured using the Woodward DVP Service Tool. There are some valve-specific settings that are read by the DVP from the valve's Identity Module on power-up. Additionally, there are certain parameters which are available for configuration of field settings to satisfy the needs of specific applications.

Refer to Manual “26912 DVP Service Tool” for the initial setup of the DVP.

## Service Tool Introduction

Woodward DVP Service Tool software is provided to allow end users to monitor the DVP condition, to reconfigure certain driver parameters and to troubleshoot the DVP operation. Detailed information for configuration and setup of the DVP for customer-specific applications using the DVP Service Tool is provided through the help command.

| | |
|---|---|
| ⚠WARNING<br>Personal Injury | **An unsafe condition could occur with improper use of these software tools. Only qualified personnel should use these tools to modify or monitor the DVP functions.** |

## System Requirements

The minimum system requirements for the DVP Service Tool software are:

- Microsoft Windows® 10, 8.1, 7, Vista (32- & 64-bit) or later
- Microsoft .NET Framework version 4.5.1
- 1 GHz or faster x86 or x64 processor
- 1G of RAM
- Minimum 800 by 600 pixel screen with 256 colors
- Recommended screen resolution 1024 by 768 pixel or higher
- 9 pin sub-D Serial Port (RS-232)
- Woodward ToolKit Software - latest revision

## Cabling Requirements

A straight through serial cable will be required for RS-232 communication. A null modern connector or cable will not work with DVP RS-232 communication. With today’s advanced technology, many new computers are shipped with multiple USB ports but no RS-232 serial ports. In that case, a USB to RS232 converter must be fitted. Some USB-RS232 converters may not work correctly with the DVP. Please contact Woodward for recommendations on which serial converters to use.

## Obtaining the Service Tool

The DVP Service Tool software is based on the Woodward ToolKit software standard version included with the DVP Service Tool installation software package. The DVP Service Tool and the appropriate settings files for your specific application can be obtained from Woodward through Woodward website or via e-mail.

## Tool Installation Procedure

After obtaining the DVP Service Tool software installation package from Woodward, run the included installation program and follow the instructions on the screen to install the Woodward ToolKit software and the DVP Service Tool.

| IMPORTANT | **Check all wirings from point to point, all connections, and terminations to insure having proper installation before applying the power to the DVP.** |
|---|---|

| IMPORTANT | **Verify that fuel pressure is not present to the actuator that may open due to actuator motion before applying power to the DVP.** |
|---|---|

## General Installation Check before Applying Power

1. Verify the power source is set to within the input operating voltage range. Always make sure that the power at the driver is within the input power range to insure the operation of the DVP.
2. Verify all DVP and Valve cable connections are properly installed, including earth and motor ground and I/O cable shield grounding termination.
3. Verify that DVP driver is securely installed, and all cover fasteners are tightened.
4. In the case of using Analog input as demand source, verify that the input command is between 4 to 20 mA.

| WARNING<br>Overspeed | **Failure to follow general installation check prior to applying power to the driver could lead to turbine overspeed if the actuator shuts down in the wrong direction.** |
|---|---|

## Getting Started with the DVP Service Tool

The DVP Service Tool communicates with the DVP via RS-232 connection. The PC (personal computer), running the DVP Service Tool is connected to the DVP using a 9-pin straight-through serial cable. Connect the serial cable to the RS-232 Service Port on the backside of the DVP and an unused RS-232 serial port (COM port) on the PC side.

| IMPORTANT | **The serial cable used to connect the DVP to the PC running the DVP HO (High output) Service Tool must be set up as straight-through configuration. Do NOT use a serial cable with Null-Modem configuration to connect the DVP to the PC!** |
|---|---|

After the DVP and the PC have been connected via the serial cable, the DVP HO (High output) Service Tool can be started from the Windows Start menu or a shortcut on the Desktop (if applicable).

## Connecting and Disconnecting the DVP Service Tool

Connection to the DVP is made by clicking the connect button on the tool bar or by selecting 'Device' and 'Connect' from the main tool bar.


Figure 7-1. Service Tool Connection Options

Disconnecting the Service Tool from the DVP is done by either pressing the disconnect button or selecting 'Device' and 'Disconnect' from the main tool bar.


Figure 7-2. Service Tool Disconnect Options

## Selecting a Communication Port

When trying to connect for the first time, the DVP Service Tool will show a dialog box and query to select a suitable communication (COM) port for communication between the PC and the DVP. In most cases the port of choice will be COM1. Check the checkbox near the bottom of the dialog screen to use the selected port as default in the future.

If a default port is selected the Service Tool will always establish the connection to the DVP immediately after pressing the connect button without asking for a communication port again.

| IMPORTANT | **Before starting the Service Tool, attach the DVP to an available active Serial Port or active USB Serial Port Adapter. The DVP Service Tool will only search for active COM Ports on startup.** |
| --- | --- |

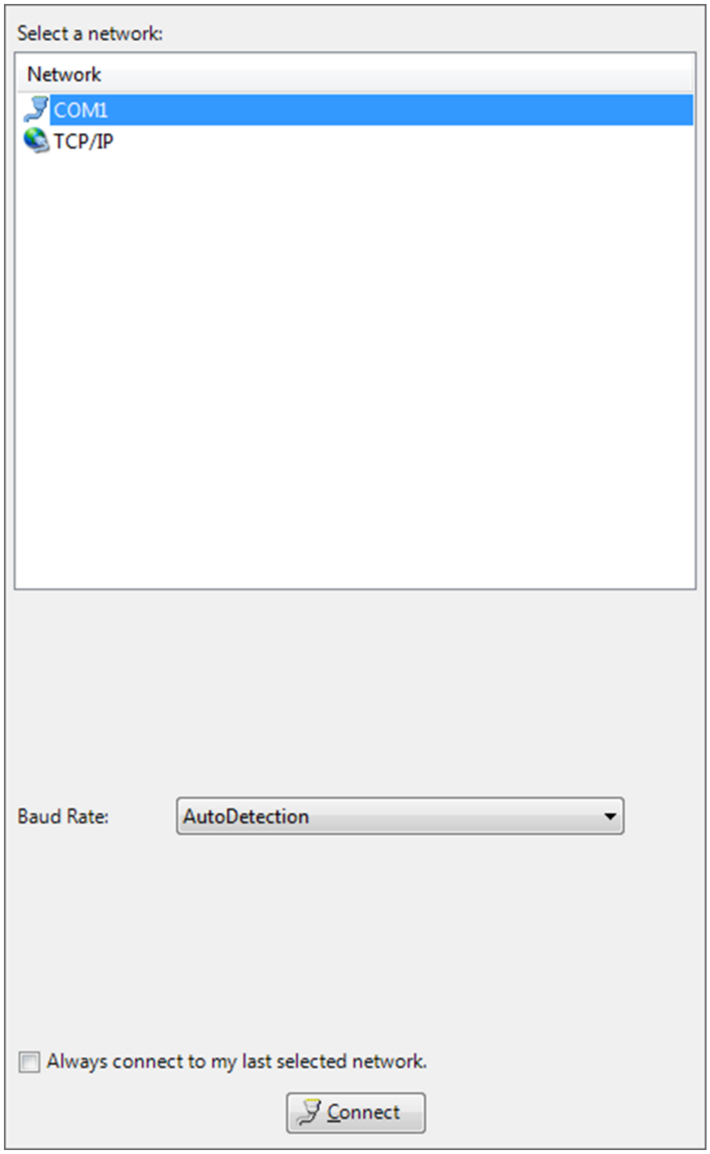



Figure 7-3. Service Tool Communications Port Selection

## Establishing a Connection

After selecting the desired communication port, the Service Tool will try to connect to the DVP.

Following successful connection to the DVP, the screen will populate with current values and the status bar will display the connection status.


Figure 7-4. Service Tool Communication Status

# Chapter 8. Troubleshooting

**⚠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.**

**⚠WARNING**

**Explosion Hazard**

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

**⚠WARNING**

**Electrocution Hazard**

**Follow all local plant and safety instructions/precautions before proceeding with Troubleshooting the DVP Control.**

## Introduction

This chapter addresses several possible causes and recommended actions for many common problems that may be encountered with a system including the DVP, its power source, the actuator/valve assembly, and the wiring interconnect between these components.

**⚠WARNING**

**Personal Injury**

**Incorrect settings may adversely affect the performance, accuracy, behavior, and safety of the valve/actuator/positioner system. Do not make changes to the control per the recommended action without thoroughly reviewing the section of this manual regarding configuration. Injury to personnel or equipment may result.**

***IMPORTANT***

**The following troubleshooting guide contains information on diagnostic indications seen on the service tool. The service tool contains more diagnostics than shown in the troubleshooting guide. The guide will be updated in a later release of the manual.**

# DVP Troubleshooting Guide

## I/O Diagnostics

Table 8-1. DVP Troubleshooting Guide I/O Diagnostics

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **Power–up Reset**<br><br>Detection:<br>CPU reset by a power up event. | It is normal for the Power Up Reset diagnostic to occur upon power up of the DVP. | Issue a reset to the DVP. |
| | If this occurs while the DVP is powered, and the diagnostic is set during a fast position transient, most likely the power infrastructure is not delivering the power needed. | During transient:<br>Check terminal voltage at the DVP during a 0-100% position transient, check wire gauge, fuses, or other resistive components in the power supply system. |
| **Watchdog Reset**<br><br>Detection:<br>CPU reset without a power up event. | It is normal for this to occur after the software is updated. | Issue a reset to the DVP. |
| | A software lockup occurred. | If the cause is not a software update: Contact Woodward Technical Support. |
| **External Shutdown Position**<br><br>Detection:<br>Command sent by Digital communication protocols like: EGD, CANopen. | It is normal for this to occur when a shutdown position has been commanded from an external source. I.E. Service Tool, or Digital Communication. | Take away command and reset DVP for normal operation. |
| | Unexpected command from digital communication. | Take away command and reset DVP for normal operation. |
| **External Shutdown**<br><br>Detection:<br>Command sent by Service Tool or digital communication protocols like: EGD, CANopen or discrete inputs. | It is normal for this to occur when a shutdown has been commanded from an external source. I.E. Service Tool, Digital Communication or Discrete Input. | Take away command and reset DVP for normal operation. |
| | Unexpected command from digital communication. | Take away command and reset DVP for normal operation. |
| | Discrete input wiring problem. | Fix wiring problem. |
| | Discrete input configuration problem. | Ensure the Active/Inactive settings inside the DVP match the Active/Inactive settings of the controller. Settings can be modified using the Service Tool.<br><br>If the Discrete Input is not used, disable this function using the Service Tool. |
| **Aux 3 SD Position**<br><br>Detection:<br>This status flag is set when Discrete Input 3 is set, and the Discrete Input Action Mode is set to Aux3 SD+Reset. When set, indicates the DVP is in Shutdown Position state. | Wiring problem | Check discrete input wiring. Use Service Tool to confirm the selected input status. |
| | DVP settings are incorrect. | Confirm/correct the settings using the Service Tool. |
| **Int. Bus Voltage High**<br><br>Detection:<br>The internal bus voltage sensor is at max. | Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Int. Bus Voltage Low**<br><br>Detection:<br>If the internal bus voltage Sensor is at min. | Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |
| **Driver Current Fault**<br><br>Detection:<br>The Driver fault is detected by monitoring the currents in the driver output stages. | A short exists between phases of the motor or wiring. | Check for phase to phase shorts in the wiring. Check for phase to phase short in the motor. |
| | A short exists between a phase and the ground (wiring or motor). | Check for phase to ground shorts in the wiring. Check for phase to ground (earth ground, motor housing) short in the motor. |
| | A short exists between phase and power supply positive (Wiring problem). | Check for phase to power supply positive short in wiring. |
| | Internal electronics problem. (This is unlikely, the Driver Current Fault is designed to protect the driver from damage). | Contact Woodward Technical Support for further assistance. |
| **Current Phase A High**<br>Detection:<br>The phase A current sensor is at max output. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Current Phase A Low**<br>Detection:<br>The phase A current sensor is at min output. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Current Phase B High**<br>Detection:<br>The phase B current sensor is at max output. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Current Phase B Low**<br>Detection:<br>The phase B current sensor is at min output. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Current Diagnostic 1 or Current Diagnostic 2 or Current Diagnostic 3**<br><br>Detection:<br>When enabled, indicates actual current exceeds configured threshold for longer than the configured delay time. | Electrical or wiring problem | Determine if wiring is correct, see Chapter 3. |
| | The DVP current sense circuit has failed (electronics failure). | Contact Woodward Technical Support for further assistance. |
| | Incorrect settings for the current diagnostic detection. | Verify settings are appropriate for application. |
| **PWM Duty Cycle High**<br><br>Detection:<br>The PWM input duty cycle is above the given setting (User setting). | Incorrect DVP settings. | Correct the duty cycle max setting in the DVP using the Service Tool. |
| | Incorrect duty cycle scaling in control system. | Correct the scaling in the control system using the Service Tool. |
| | Noise interference (Above specified EMI environment). | Verify ground wire between motor and driver is correct and sufficient gauge. Check wiring, grounding of driver and valve, termination of shields, and EMI levels. Verify stability of the control signal using trending capability in the Service Tool. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **PWM Duty Cycle Low**<br><br>Detection:<br>The PWM input duty cycle is below the given setting (User setting). | Incorrect DVP settings. | Correct the duty cycle min setting in the DVP using the Service Tool. |
| | Incorrect duty cycle scaling in control system. | Correct the scaling in the control system using the Service Tool. |
| | Noise interference (Above specified EMI environment). | Verify ground wire between motor and driver is correct and sufficient gauge. Check wiring, grounding of driver and valve, termination of shields, and EMI levels. Verify stability of the control signal using trending capability in the Service Tool. |
| **PWM Frequency High**<br><br>Detection:<br>The PWM frequency is above the given setting (User Setting). | Incorrect frequency max setting in the DVP. | Correct the frequency max setting in the DVP using the Service Tool. |
| | Incorrect frequency setting in the DVP. | Correct the frequency settings in the Control system using the Service Tool. |
| | Noise interference (Above specified EMI environment). | Verify ground wire between motor and driver is correct and sufficient gauge. Check wiring, grounding of driver and valve, termination of shields, and EMI levels. Verify stability of the control signal using trending capability in the Service Tool. |
| **PWM Frequency Low**<br><br>Detection:<br>The PWM frequency is below the given setting (User Setting). | Incorrect frequency min setting in the DVP. | Correct the frequency min setting in the DVP using the Service Tool. |
| | Incorrect frequency setting in the DVP. | Correct the frequency settings in the Control system using the Service Tool. |
| | Noise interference (Above specified EMI environment). | Verify ground wire between motor and driver is correct and sufficient gauge. Check wiring, grounding of driver and valve, termination of shields, and EMI levels. Verify stability of the control signal using trending capability in the Service Tool. |
| **Speed Signal Fault**<br><br>Detection:<br>Only used if speed sensor is active. DVP does not support speed sensor input with present version. | Not Applicable | Not Applicable |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Digital Com Analog Tracking Alarm**<br><br>Detection: When the difference between the demanded position on the CANopen port 1 and the demanded position on the analog backup is larger than the difference parameter and for a greater time span than the time parameter setting allows this flag will be set.<br>In Dual CANopen mode, the difference is calculated between demanded position from port 1 and port 2. | The analog system has an error that has not resulted in a high or low error flag being set. | Correct the analog system. |
| | The control system does not keep the two redundant signals the same. The values are scaled differently, from a different source program, or timing is incorrect. | Debug and correct control system. |
| | If the analog backup is used, the analog system accuracy is worse than the alarm value set. | Make alarm value larger if acceptable for this application or make analog system accuracy better. |
| | The delay is too long between analog and CANopen values which have identical settings. | Determine the delay and if acceptable for the application, correct the difference time delay time in the DVP. |
| **Digital Com Analog Tracking Shutdown**<br><br>Detection:<br>When the difference between the demanded position on the CANopen port 1 and the demanded position on the analog backup is larger than the difference parameter and for a greater time span than the time parameter setting allows this flag will be set.<br>In Dual CANopen mode, the difference is calculated between demanded position from port 1 and port 2. | The analog system has an error that has not resulted in a high or low error flag being set. | Correct the analog system. |
| | The control system does not keep the two redundant signals the same. The values are scaled differently, from a different source program, or timing is incorrect. | Debug and correct control system. |
| | If the analog backup is used, the analog system accuracy is worse than the alarm value set. | Make alarm value larger if acceptable for this application or make analog system accuracy better. |
| | The delay is too long between analog and CANopen values which have identical settings. | Determine the delay and if acceptable for the application, correct the difference time delay time in the DVP. |
| **Digital Com 1 Error**<br>**or**<br>**Digital Com 2 Error**<br><br>Detection:<br>When CANopen demand is used, indicates that the CAN communications (CAN 1 or CAN 2) are not functioning. This can be caused by a communication timeout or a failure to open the CAN port. | CAN wiring or noise problem. | Check CAN wiring. |
| | Incorrect CANopen messaging. | Refer to CANopen communication implementation details in Appendix A. |
| **Digital Com 1 & 2**<br>**and/or**<br>**Analog Backup Error**<br><br>Detection:<br>When CANopen demand is used, indicates the position setpoint is failed.  That the CAN communications (CAN 1 and CAN 2) are not functioning or both analog input and CAN 1 have failed. | Lost signals or wiring problem. | Check wiring. Verify signals in Service Tool. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Analog Input High**<br><br>Detection:<br>The analog input is above the diagnostic threshold. This is a user configurable parameter. Typically, 22 mA. | Short in wiring to external voltage. | Check wiring for shorts to positive voltages. |
| | Control system 4 to 20 mA output has failed high. | Check the current to the analog input of the DVP. Fix control system. |
| | Incorrect user configurable parameter in the driver for the max input diagnostic. | Verify the 4–20 mA Diagnostic Range: High Limit Value using the DVP Service Tool. |
| | DVP internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Analog Input Low**<br><br>Detection:<br>The analog input is below the diagnostic threshold. This is a user configurable parameter. Typically, 2 mA. | Wiring is disconnected or loose. | Check terminals and connections. |
| | Control system is turned off. | Check if the control system is turned on and providing the 4 to 20 mA current to the driver. |
| | Short in wiring to ground or between the plus and minus wires. | Check for short between analog input wiring and any other wiring. |
| | Control system 4 to 20 mA output has failed low. | Check the current in the input to the DVP. Fix control system. |
| | Incorrect user configurable parameter in the driver for the min input diagnostic. | Verify the 4–20 mA Diagnostic Range: Low Limit Value using the DVP Service Tool. |
| | DVP internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **E-Stop 1 Tripped**<br>**E-Stop 2 Tripped**<br><br>Detection:<br>The driver is in a tripped state from the External Shutdown Input. | The External Shutdown Input contact is open. A tripped state is normal when the input is open. To Run, a closed contact must be applied across both SIL inputs. | Check that the External Shutdown Input is wired properly. See wiring and installation section of manual for instructions.<br><br>Check to make sure the signal level at the External Shutdown Input is at the correct level for operation. |
| **CAN Hardware ID Error**<br><br>Detection:<br>This status flag indicates an incorrect CAN Node ID address has been entered through the Discrete Input connector. This is only true if CAN Hardware ID Mode = CAN HW ID DISCRETE IN-DI5,DI4,DI2,DI1 or CAN HW ID DISCRETE IN-DI5,DI4,DI3 or CAN HW ID DISCRETE INDI5, DI4. | Wiring problem. | Check wiring to ensure the discrete input ID selection is correct. Use Service Tool to confirm the selected ID is correct/expected. |
| | DVP settings are incorrect. | Confirm the CAN Hardware ID settings using the Service Tool. |

## Internal Diagnostics

Table 8-2. DVP Troubleshooting Guide Internal Diagnostics

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Input Voltage 1 High**<br>**or**<br>**Input Voltage 2 High**<br><br>Detection:<br>The measured input voltage is higher than the specification limit:<br>33VDC for 24VDC Models<br>150VDC for 125VDC Models<br><br>300VDC for DVP 5000, 10000, and 12000 Models | Power supply and/or setting incorrect for application. | Check input voltage and correct voltage to within specification limits. |
| | Excessive charging voltage and/or battery failure. | |
| | Power supply has problem regulating the voltage at the input terminals during high current transients. | Determine if the power supply is of the correct type to be used with the DVP. See power supply section in this manual. |
| **Input Voltage 1 Low**<br>**or**<br>**Input Voltage 2 Low**<br><br>Detection:<br>The measured input voltage is lower than the specification limit:<br><br>17VDC for 24VDC Models<br>90VDC for 125VDC Models<br><br>90VDC for DVP 5000, 10000, and 12000 Models | Power is not connected to this input. (Dual inputs are provided for redundancy) | If redundancy is not required, jumper power to both inputs. |
| | The power supply is not capable of delivering the transient current. | Determine if the power supply is capable of delivering the transient current. See power supply section in this manual. |
| | The power supply wiring is incorrectly sized for the required transient current. | Determine if the wiring is according to the manual. |
| | Excessive resistance in the wiring due to fuses, connectors, etc. that limits the max transient current to the driver. | Determine if there is excessive resistance in the power supply wiring and correct.<br>Contact Woodward Technical support for appropriate procedure to evaluate the power infrastructure. |
| **Input Current High**<br><br>Detection:<br>The Input current sensor is at max output. | The current sense circuit has failed. | Contact Woodward Technical Support for further assistance. |
| **Input Current Low**<br><br>Detection:<br>The Input current sensor is at min output. | The current sense circuit has failed. | Contact Woodward Technical Support for further assistance. |
| **Electronics Temp. High**<br><br>Detection:<br>The Control Board temperature sensor indicates a temperature above 140°C. | The ambient temperature of the driver is higher than allowed by specification. | Reduce ambient temperature to within specification limits. |
| | The temperature sensor is defective. | Contact Woodward Technical Support for further assistance. |
| **Electronics Temp. Low**<br><br>Detection:<br>The Control Board temperature sensor indicates a temperature below –45°C. | The ambient temperature of the driver is lower than allowed by specification. | Increase ambient temperature to within specification limits. |
| | The temperature sensor is defective. | Contact Woodward Technical Support for further assistance. |
| **Driver Temp. High**<br><br>Detection:<br>The heat sink temperature is above:<br>115°C for 24 and 125 VDC Models<br>70°C for DVP 5000 and 10000<br>55°C for DVP 12000 Models | The ambient temperature of the driver is above specification. | Reduce ambient temperature to within specification limits. |
| | The Temperature sensor is defective. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Driver Temp. High Limit**<br><br>Detection:<br>The heat sink temperature is above:<br>130°C for 24 and 125VDC Models<br>80°C for DVP 5000 and 10000<br>65°C for DVP 12000 Models | The ambient temperature of the driver is far above specification. | Reduce ambient temperature to within specification limits. |
| | | Check if there are other heat sources on the mounting surface heating up the temperature around the DVP. |
| | | Check if the driver is using more current than normal to position the valve. |
| **Driver Temp. Low Limit**<br><br>Detection:<br>The heat sink temperature is below -45°C. | The ambient temperature of the driver is below specification. | Increase ambient temperature to within specification limits. |
| **Driver Temp. Sensor Failed**<br><br>Detection:<br>The temperature sensor is at min or max. | The temperature sensor has failed. | Contact Woodward Technical Support for further assistance. |
| **No Power Board Found**<br><br>Detection:<br>During power up the control board will read the power board. This diagnostic will be set if no Power Board is found. | DVP internal electronics failure or there is no power board connected. | Contact Woodward Technical Support for further assistance. |
| **Power Board Calib. Error**<br><br>Detection:<br>During power up the calibration record in the control is set to “No Power Board” this diagnostic will be set. | The control board has not been calibrated during electrical production. | Contact Woodward Technical Support for further assistance. |
| **Power Board ID Error**<br><br>Detection:<br>During power up, the power board ID and the stored ID in the calibration record do not match. | The power board has been changed to a different type after calibration. | Contact Woodward Technical Support for further assistance. |
| **EEPROM Read Failed**<br><br>Detection:<br>After multiple retries and data comparison the software is not able to read from the non-volatile memory. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **EEPROM Write Failed**<br><br>Detection:<br>After multiple retries and data comparison the software is not able to write to the non-volatile memory. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Invalid Parameters(s)**<br><br>Detection:<br>CRC16 check failures on both parameter sections. | If a new embedded program has been loaded the parameters have not been updated. | Refer to the embedded software update procedure to update the parameters. Cycle power to restart the DVP. |
| | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Invalid Parameter Version**<br><br>Detection:<br>Version information is not correct in the non-volatile memory. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Configuration Process Error**<br><br>Detection: Unexpected settings in ID Module/DVP parameter content. | Valve/actuator configuration content failure. Serious damage or injury may result if run in this condition. Contact Woodward Technical Support for further assistance. | Contact Woodward Technical Support for further assistance. |
| **24V Failed**<br><br>Detection:<br>Internal +24 V is outside acceptable range of 22.1 V to 30.7 V. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **1.8V Failed**<br><br>Detection:<br>Internal 1.8 V is outside acceptable range of 1.818 V to 2.142 V. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **+12V Failed**<br><br>Detection:<br>Internal +12 V is outside acceptable range of 10.6 V to 15.8 V. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **–12V Failed**<br><br>Detection:<br>Internal –12 V is outside acceptable range of –13.7 V to –8.6 V. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **5V Failed**<br><br>Detection:<br>Internal 5 V is outside acceptable range of 4.86 V and 6.14 V. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **5V Reference Failed**<br><br>Detection:<br>Internal 5 V reference is outside acceptable range. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **5V RDC Reference Failed**<br><br>Detection:<br>Internal 5 V RDC reference is outside acceptable range. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **ADC Failed**<br><br>Detection:<br>Internal ADC in processor core has stopped running. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **RDC DSP Failed**<br><br>Detection:<br>DSP that runs the Resolver-to-digital converter has stopped running. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **ADC SPI Failed**<br><br>Detection:<br>External ADC in processor core has stopped running. | Internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **Power Board FPGA Error**<br><br>Detection: An error has occurred on the FPGA located on the power board, either an internal error or with the communication to the control board. | There is a problem in the FPGA chip on the Power board. | Contact Woodward Technical Support for further assistance. |
| **Fan 1 Speed Error**<br><br>Detection: The fan speed on fan 1 or 2 is below the expected fan speed.<br>(Only Applies to DVP 5000, 10000, or 12000 Models) | Fan 1 or Fan 2 (or both) are running slower than expected, possibly from cooling port blockage or a worn out fan. | Check for blockage at the inlet or exhaust of the cooling ports of the DVP.<br><br>Replace Fan assembly, see fan replacement in DVP manual where applicable |
| **Fan 2 Speed Error**<br><br>Detection: The fan speed on fan 1 or 2 is below the expected fan speed.<br>(Only Applies to DVP 5000, 10000, or 12000 Models) | Fan 1 or Fan 2 (or both) are running slower than expected, possibly from cooling port blockage or a worn out fan. | Check for blockage at the inlet or exhaust of the cooling ports of the DVP.<br><br>Replace Fan assembly, see fan replacement in DVP manual where applicable |
| **Position Controller Not Ready**<br><br>Detection:<br>This status flag indicates the DVP is not controlling position. This occurs during power-up initialization and when in a shutdown position state. | DVP is initializing (power-up) or has detected a problem that will not allow the position controller to run. | Using the Service Tool, identify and correct the issues. |
| **Check 100 Percent Error**<br><br>Detection:<br>This status flag indicates the max (100 %) position check has failed. The detected range could be wrong, or a timeout could have occurred during the test. | Unable to reach limit. | Unable to reach max position due to internal or external conditions. Verify that there is no jamming or blockage of the linkage attached to the actuator. |
| | Incorrect min position detection causing an error in the 100% check. | Using the Service Tool, identify and correct the issues. |
| | ID module factory settings are incorrect for max position limit range. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Reduced Torque Error**<br><br>Detection:<br>This status flag indicates the system torque has been reduced due to a reduction in motor current. | User Force Limiter is active. | This could be proper/expected operation or User Force Limiter settings could be incorrect. |
| | Current limiter on motor is active. | Internal protection is active, no action required. If condition persists, contact Woodward Technical Support for further assistance. |
| **Reduced Slew Rate Error**<br><br>Detection:<br>This status flag indicates the system torque has been reduced due to a reduction in motor current. | Input current limiter is active. | Internal protection is active, no action required. If condition persists, contact Woodward Technical Support for further assistance. |
| **Linearization Monotonic Shutdown Error**<br><br>Detection:<br>Linearization Monotonic Shutdown Error | DVP settings are incorrect. | Correct the Linearization settings using the Service Tool. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **CAN Controller Open Error**<br><br>Detection:<br>The CAN Controller peripheral was unable to be opened properly. This may occur if the user is changing the CANopen settings (particularly selecting a lower baud rate) while connected to an active CAN network. | Incorrect CANbus settings | Check CAN settings |

## Position Feedback Transducer Diagnostics

Table 8-3. DVP Troubleshooting Guide Position Feedback Transducer Diagnostics

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Motor 1 Sin Error or Motor 1 Cos Error or Motor 2 Sin Error or Motor 2 Cos Error**<br><br>Detection:<br>The detected signal value is out of range. | The wiring to the position feedback transducer is disconnected or intermittent. | Check wiring and connectors leading to the position feedback transducer. |
| | The position feedback transducer failed open or is intermittent. | See appropriate valve or actuator manual for the appropriate excitation resistance value.<br><br>Check the gain and amplitude values shown on the Position Resolver Diagnostics page of the service tool. The amplitude value must be approximately 80% of max ADC. Gain value should be between 10% and 95% of max output.<br><br>**IMPORTANT**<br>**The gain is continually adjusted by the DVP.** |
| | The DVP position feedback input circuit has failed. | Contact Woodward Technical Support for further assistance. |
| **Motor 1 Exc. Error Or Motor 2 Exc. Error**<br><br>Detection:<br>The Sin and Cos voltage combined are below the diagnostic threshold. | The excitation wiring to the resolver is shorted or intermittent. | Check the resolver excitation coil resistance. See appropriate valve manual for resistance value. |
| | The resolver excitation coil is shorted. | |
| | The resolver gain is too low due to resolver wiring problem. | If the gain is temporarily low, check wiring and resolver. Reset driver for normal operation. Allow the automatic gain control to stabilize. |
| | Excitation circuit failure. | Contact Woodward Technical Support for further assistance. |
| **Motor 1 and 2 Res. Error**<br><br>Detection:<br>This is a summary indication that an error is detected in both motor 1 and motor 2 | A Motor error is true if any of the following errors are detected: Motor Sin Error, Motor Cos Error, Motor Exc. Error, Motor Startup Open Error, Motor Startup Close Error, Motor Startup Direction Error. | If there is a Motor 1 and a Motor 2 error, use the recommended actions for those errors. |
| **Diagnostic Indications** | **Probable Causes** | **Recommended Actions** |
| **Valve Shaft 1 Sin Error or Valve Shaft 1 Cos Error or Valve Shaft 2 Sin Error or Valve Shaft 2 Cos Error**<br><br>Detection:<br>The detected signal value is out of range. | The wiring to the resolver is disconnected or failed. | Check wiring and connectors leading to the resolver. |
| | The resolver is failed open or intermittent. | Check the gain and amplitude values for the resolver on the service tool. Amplitude value must be approximately 80% max ADC. Gain value should be between 10% and 95% max Output.<br><br>**IMPORTANT**<br>**The gain is continually adjusted by the DVP.** |
| | The resolver input circuit has failed. | Contact Woodward Technical Support for further assistance. |
| **Valve Shaft 1 Exc. Error or Valve Shaft 2 Exc. Error** | The excitation wiring to the resolver is shorted or intermittent. | Check the resolver excitation coil resistance. See appropriate valve manual for resistance value. |
| | The resolver excitation coil is shorted. | |

| | | |
|---|---|---|
| Detection:<br>The Sin and Cos voltage combined are too low. | The resolver gain is too low due to resolver wiring problem. | If the gain is temporarily low, check wiring and resolver. Reset driver for normal operation. Allow the automatic gain control to stabilize. |
| | Excitation circuit failure. | Contact Woodward Technical Support for further assistance. |
| **Valve Shaft 1 and 2 Res. Error**<br><br>Detection:<br>The Shaft resolver redundancy manager has detected a Valve shaft 1 and Valve shaft 2 error. | Valve Shaft 1 error is true if any of the following errors are detected:<br>Valve Shaft 1 Sin Error<br>Valve Shaft 1 Cos Error<br>Valve Shaft 1 Exc. Error<br><br>Valve Shaft 2 error is true if any of the following errors are detected:<br>Valve Shaft 2 Sin Error<br>Valve Shaft 2 Cos Error<br>Valve Shaft 2 Exc. Error | If there is a Valve Shaft 1 and 2 error, use the recommended actions for the Valve stem errors. |
| | Range or Setting of the Resolvers is out of tolerance. | If there is a Start-up or Range error, verify the following values:<br>Start-up-Close Valve Shaft 1 Error<br>Start-up-Close Valve Shaft 2 Error<br>Valve Shaft 1 Range Limit Error<br>Valve Shaft 2 Range Limit Error |

## Valve Type Selection

Table 8-4. DVP Troubleshooting Guide Valve Type Selection

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Auto Detect Error**<br><br>Detection:<br>This diagnostic is only enabled when the DVP has been configured for auto detection. (See Auto detection Section).<br><br>This diagnostic is set when:<br>The DVP fails to communicate with the ID module due to write or read problems or the calibration records in the ID module are corrupted (CRC16 failure).<br><br>The DVP fails to write the calibration records into the non-volatile memory. | Failure to read the ID module on the valve/actuator system. | See associated diagnostics on the Valve Type Selection Screen in the Service Tool.<br>If “ID Module Not Detected” is annunciated, check wiring to the ID module. |
| | ID module calibration record corrupted. | See Process Fault & Status Overview Screen in the DVP Service Tool.<br>If “Invalid Parameter(s)” is annunciated the calibration records are corrupt in the ID module. Contact Woodward Technical Support for a copy of the correct parameter file. Valve Serial Number will need to be provided. |
| | DVP non-volatile memory error. | See Process Fault & Status Overview screen in the DVP Service Tool. If “EEPROM Read/Write Failed” or “Invalid Parameter(s)” is annunciated Contact Woodward Technical Support<br><br>**IMPORTANT**<br>**A reset will force the DVP to retry auto detection of the connected valve.** |
| **Control Model Not Running**<br><br>Detection:<br>This status flag indicates the internal DVP Control Model is not Running. The position of the Actuator/valve is not controlled by the DVP. If Actuator/valve has a return spring, the actuator/valve is be positioned by the return spring. | DVP detected a problem that will not allow the position controller to run. | Using the Service Tool, identify and correct the issues. |

<table>
<tr><th>Diagnostic Indications</th><th>Probable Causes</th><th>Recommended Actions</th></tr>
<tr><td rowspan="3">Type / Serial Number Error<br><br>Detection:<br><br>If during power up the DVP detects a valve/actuator system with a different serial number or valve type this diagnostic will be annunciated.</td><td>User has connected a different valve to the DVP.</td><td rowspan="2">See the Valve Type Selection Screen in the Service Tool.<br>Verify the “Valve Type” and “Valve Serial Number” match the valve/actuator system connected to the DVP.<br><br>Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number.<br><br>WARNING<br>Operation of the DVP with incorrect parameter files can cause personal injury and/or property damage.</td></tr>
<tr><td>User has loaded a parameter set to the DVP that does not match this valve/actuator system serial number.</td></tr>
<tr><td>ID module factory calibration incorrect for this valve type / serial number.</td><td>Contact Woodward Technical Support for further assistance.</td></tr>
<tr><td rowspan="2">Type Not Supported<br><br>Detection:<br>This diagnostic is annunciated if the valve type reported by the valve/actuator system in the ID module is not supported by the DVP software.</td><td>Valve type not supported by the DVP</td><td rowspan="2">Contact Woodward Technical Support for potential upgrade to the latest revision of the DVP software.</td></tr>
<tr><td>DVP software is not the required revision for this valve.</td></tr>
</table>

| Diagnostic Indications | Probable Causes | Recommended Actions |
| --- | --- | --- |
| **ID Module Not Detected**<br><br>Detection:<br>During power up the ID Module cannot be read. | Failure to read the ID module on the valve/actuator system. | See associated diagnostics on the Valve Type Selection Screen in the Service Tool.<br>If “ID Module Not Detected” is annunciated, check wiring to the ID module. |
| | ID module calibration record corrupted. | See Process Fault & Status Overview Screen in the DVP Service Tool.<br>If “Invalid Parameter(s)” is annunciated the calibration records are corrupt in the ID module. Contact Woodward Technical Support for a copy of the correct parameter file. Valve Serial Number will need to be provided. |
| | The valve does not have an ID module. | Contact Woodward Technical Support for a copy of the correct parameter file. Valve Serial Number will need to be provided.<br><br>**NOTICE**<br>**The correct parameter file must be uploaded into the DVP. Any reset command via the DVP Service Tool or any other applicable method (e.g., Discrete Input) will force the driver to use the internally stored parameters. This will allow the DVP to function without an ID module.**<br><br>**⚠WARNING**<br>**It is the user’s responsibility to make sure the correct parameters are stored in the DVP! Operation of the DVP with incorrect parameter files can cause personal injury and/or property damage.** |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **ID Module Version Not Supported**<br><br>Detection:<br>This diagnostic is annunciated if the ID module version is not supported by the DVP software.<br><br>**Note**: the Valve Type Auto Detect diagnostic is also set when this condition is detected. | DVP software is not the required revision for this valve. | Contact Woodward Technical Support for potential upgrade to the latest revision of the DVP software. |
| | ID module calibration record corrupted. | See Process Fault & Status Overview Screen in the DVP Service Tool. If “Invalid Parameter(s)” is annunciated the calibration records are corrupt in the ID module. Contact Woodward Technical Support for a copy of the correct parameter file. Valve Serial Number will need to be provided. |
| **Incorrect Power Board**<br><br>Detection:<br>During power up the DVP checks the ID module to determine the power board needed for the valve/actuator system. If the power board ID required and the power board detected do not match, this diagnostic will be annunciated. | Valve/actuator system does not match the DVP power board. | Contact Woodward Technical Support to determine the correct DVP and valve/actuator system for your application. |

## Resolver Diagnostic LAT

Table 8-5. DVP Troubleshooting Guide Resolver Diagnostic LAT

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Valve Shaft 1 Range Limit Error or Valve Shaft 2 Range Limit Error**<br><br>Detection:<br>During calibration at the factory, the resolver range (difference between minimum and maximum stop) is recorded. This diagnostic occurs if the Valve Shaft resolver reading is detected outside the calibrated resolver range. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | There is an electrical problem with the resolver and/or its associated circuits resulting in an incorrect resolver reading. | See Position Resolver Diagnostics screen in the Service Tool. Verify Position, Amplitude and Gain readings. Amplitude should be approximately 80%. Gain should be from 10-90%. Verify appropriate resistance reading on excitation, sine, and cosine after disconnecting leads at the DVP. See associate valve manual for resistance values.<br>Contact Woodward Technical Support for further assistance if readings are out of valve specifications. |
| | The resolver has mechanically moved outside of the range. | Review and record the values shown on the LAT Actuator/Valve Configuration Screen. Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Dual Res. Difference Alarm**<br><br>Detection:<br>The difference between the resolver readings is larger than the permissible alarm limit value. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. This could result in incorrect resolver scaling resulting in a difference error. | Use the auto detection function or download the valve specific calibration file into the DVP for the correct serial number. |
| | One or both resolvers have moved. | Contact Woodward Technical Support for further assistance. |
| | There is an electrical problem with the resolver and/or its associated circuits resulting in an incorrect resolver reading. | See Position Resolver Diagnostics screen in the Service Tool. Verify Position, Amplitude and Gain readings. Amplitude should be approximately 80%. Gain should be from 10-90%.<br>Verify appropriate resistance reading on excitation, sine, and cosine after disconnecting leads at the DVP. See associate valve manual for resistance values.<br>Contact Woodward Technical Support for further assistance if readings are out of valve specifications. |
| **Dual Res. Difference Shutdown**<br><br>Detection:<br>The difference between the resolver readings is larger than the permissible shutdown limit value. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. This could result in incorrect resolver scaling resulting in a difference error. | Use the auto detection function or download the valve specific calibration file into the DVP for the correct serial number. |
| | One or both resolvers have moved. | Contact Woodward Technical Support for further assistance. |
| | There is an electrical problem with the resolver and/or its associated circuits resulting in an incorrect resolver reading. | See Position Resolver Diagnostics screen in the Service Tool. Verify Position, Amplitude and Gain readings. Amplitude should be approximately 80%. Gain should be from 10-90%.<br>Verify appropriate resistance reading on excitation, sine, and cosine after disconnecting leads at the DVP. See associate valve manual for resistance values.<br>Contact Woodward Technical Support for further assistance if readings are out of valve specifications. |

## Resolver Diagnostics 3-Phase

Table 8-6. DVP Troubleshooting Guide Resolver Diagnostics 3-Phase

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Startup Open Motor Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve.<br>During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the motor resolver is not within the calibrated range when checking the open direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The resolvers are not connected or there is a wiring error. See:<br>Motor 2 Sin Error<br>Motor 2 Cos Error<br>Motor 2 Exc Error | Follow motor resolver procedures. |
| | The fusible link on the valve has yielded. | Power down and re-check the min and max mechanical stop for correct operation. Record results from multiple power ups. Contact Woodward Technical Support for further assistance. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Startup Open Motor 2 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve. During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the motor resolver is not within the calibrated range when checking the open direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The resolvers are not connected or there is a wiring error. See:<br>Motor 2 Sin Error<br>Motor 2 Cos Error<br>Motor 2 Exc Error | Follow motor resolver procedures. |
| | The fusible link on the valve has yielded. | Power down and re-check the min and max mechanical stop for correct operation. Record results from multiple power ups. Contact Woodward Technical Support for further assistance. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Startup Close Motor Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve. During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the motor resolver is not within the calibrated range when checking the closed direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The resolvers are not connected or there is a wiring error. See:<br>Motor 1 Sin Error<br>Motor 1 Cos Error<br>Motor 1 Exc Error | Follow motor resolver procedures. |
| | The fusible link on the valve is damaged. | Power down and re-check the min and max mechanical stop for correct operation. Record results from multiple power ups. Contact Woodward Technical Support for further assistance. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |
| **Startup Close Motor 2 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve. During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the motor resolver is not within the calibrated range when checking the closed direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The resolvers are not connected or there is a wiring error. See:<br>Motor 2 Sin Error<br>Motor 2 Cos Error<br>Motor 2 Exc Error | Follow motor resolver procedures. |
| | Motor 2 Sin Error<br>The fusible link on the valve is damaged. | Power down and re-check the min and max mechanical stop for correct operation. Record results from multiple power ups. Contact Woodward Technical Support for further assistance. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Startup Open Valve Shaft 1 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve.<br>During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the valve stem resolver is not within the calibrated range when checking the open direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The fusible link in the valve / actuator is damaged or broken. | Check the fusible link in the valve for any damage. See valve manual. |
| | The resolver is not connected or there is a wiring error. See:<br>Valve Shaft 1 Sin Error<br>Valve Shaft 1 Cos Error<br>Valve Shaft 1 Exc Error | Follow stem resolver procedures. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |
| **Startup Close Valve Shaft 1 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve.<br>During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the valve stem resolver is not within the calibrated range when checking the closed direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The fusible link in the valve / actuator is damaged or broken. | Check the fusible link in the valve for any damage. See valve manual. |
| | The resolver is not connected or there is a wiring error. See:<br>Valve Shaft 1 Sin Error<br>Valve Shaft 1 Cos Error<br>Valve Shaft 1 Exc Error | Follow stem resolver procedures. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Startup Open Valve Shaft 2 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve.<br>During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the valve stem resolver is not within the calibrated range when checking the open direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The fusible link in the valve / actuator is damaged or broken. | Check the fusible link in the valve for any damage. See valve manual. |
| | The resolver is not connected or there is a wiring error. See:<br>Valve Shaft 2 Sin Error<br>Valve Shaft 2 Cos Error<br>Valve Shaft 2 Exc Error | Follow stem resolver procedures. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |
| **Startup Close Valve Shaft 2 Error**<br><br>Detection:<br>During calibration at the factory, the resolver values at the min stop are recorded. The resolver readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve.<br>During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the valve stem resolver is not within the calibrated range when checking the closed direction. | Calibration values specific to the valve/actuator serial number are incorrect as stored in the DVP. | Use the auto detection function or down load the valve specific calibration file into the DVP for the correct serial number. |
| | The valve is not closed, debris or mechanical failure has occurred. | Check the valve according to valve manual. |
| | The fusible link in the valve / actuator is damaged or broken. | Check the fusible link in the valve for any damage. See valve manual. |
| | The resolver is not connected or there is a wiring error. See:<br>Valve Shaft 2 Sin Error<br>Valve Shaft 2 Cos Error<br>Valve Shaft 2 Exc Error | Follow stem resolver procedures. |
| | Insufficient bus voltage. Internal problem with the electronics. | Contact Woodward Technical Support for further assistance. |
| **Startup Motor Direction Error**<br><br>Detection:<br>If the motor did not move into the correct direction, more than the factory calibrated setting, this flag is set. | Motor wiring not connected. | Check wiring connections. |
| | Wiring problem, phases are incorrectly connected. | Check wiring for incorrect phase assignment. |
| | Resolver wiring problem, resolver moving in the incorrect direction. | Check the resolver wiring. See resolver error flags, gain and amplitude. |
| | Motor defect: open phases or shorts. If shorts are present, Driver Current Fault should annunciate. | Check the motor for shorts and open phases. |
| | DVP electronics failure. | Contact Woodward Technical Support for further assistance. |

## Position Error

Table 8-7. DVP Troubleshooting Guide Position Error

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Position Error Motor Alarm**<br><br>Detection:<br>The Motor position is not tracking the set point within limitations set by the tracking error alarm parameters. | Incorrect Parameter Settings | Check parameters settings. See Three Phase Control Operating Summary in the DVP Service Tool. |
| | Contamination in the valve/actuator system. | At earliest opportunity perform check out procedure as described in the Position Error Motor Shutdown. |
| **Position Error Motor Shutdown**<br><br>Detection:<br>The Motor position is not tracking the set point within limitations set by the tracking error shutdown parameters. | Motor wiring not connected. | Check wiring terminations at the DVP, intermediate connections and valve/actuator. Eliminate any intermittent or open circuits. |
| | Wiring problem, phases are connected incorrectly. | Ensure no open phases or shorts in the wiring. (See associated valve wiring diagram) |
| **Position Error Shaft Alarm**<br><br>Detection:<br>The Valve Stem position is not tracking the set point within limitations set by the tracking error alarm parameters. | Resolver wiring problem, resolver moving in the incorrect direction. | Check the resolver wiring/connector. See resolver error flags, gain and amplitude. |
| | Motor defect: open phases or shorts. If shorts are present, Driver Current Fault should annunciate. | Check the motor for shorts and open phases. |
| **Position Error Shaft Shutdown**<br><br>Detection:<br>There is an error bigger than the stem position error parameters between the stem position and the demanded position. | Excessive Valve/Actuator Wear | At earliest opportunity perform check out procedure as described in the Position Error Motor Shutdown. |
| | Incorrect or damaged motor wiring. | Ensure no open phases or shorts in the wiring. Verify the motor phases are wired correctly. (See associated valve wiring diagram) |
| | Motor Failure | Contact Woodward Technical Support for assistance |
| | DVP electronics failure. | Contact Woodward Technical Support for assistance |
| | CAN wiring or noise problem | Check CAN wiring |
| | DVP internal electronics failure | Contact Woodward Technical Support for further assistance. |

## Auxiliary Board Status and Diagnostics

Table 8-8. DVP Troubleshooting Guide Auxiliary Board Status and Diagnostics

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **Aux Board Not Found**<br><br>Detection:<br>The Control board has not detected the Aux Board. | The selected input type requires an Aux board, and no Aux board is present. | Contact Woodward to determine how to upgrade you DVP with an aux board. |
| | | Select an input type that does not need an aux board. |
| **Aux Board Type Error**<br><br>Detection:<br>The Control board has detected an incorrect Aux Board type. | This occurs when the aux board is needed, and the input type selected are not compatible. | Contact Woodward to obtain a DVP with the correct Aux Board configuration. |
| | | Select an input type that is compatible with the Aux Board in your DVP system. |
| **M5200 Starting**<br><br>Detection:<br>The control board is waiting until the M5200 aux board is started. Wait time is approximately 2 minutes. | This is a typical situation during a power up or change of input type that will activate the M5200 aux board. This flag will reset automatically. | Wait until the M5200 aux board is started. |
| **M5200 Detected An Error**<br><br>Detection:<br>One of the five possible errors associated with the M5200 has been set. | DP ram check error:<br>The M5200 has detected a dual ported ram error.<br><br>If the M5200 program is started or stopped this error may occur due to the M5200 and the DVP being out of synch. | Reset DVP, which will resynchronize the states of the M5200.<br><br>If this does not correct the problem, contact Woodward Technical Support for assistance. |
| | MFT Synch error:<br>The DVP has not been able to provide the synch pulse on time to its M5200. | Reset DVP, which will resynchronize the MFT (Minor Frame Timer) of the M5200.<br><br>If this does not correct the problem, contact Woodward Technical Support for assistance. |
| | Version error:<br>DVP and its M5200 do not have compatible software versions. | Load the correct software version on the DVP and/or the M5200 board.<br><br>If this does not correct the problem, contact Woodward Technical Support for assistance. |
| | Block Count error:<br>The DVP and M5200 software have a different number of interface blocks. | Load the correct software on the DVP and/or the M5200 board.<br><br>If this does not correct the problem, contact Woodward Technical Support for assistance. |
| | Heartbeat error:<br>The M5200 has not received a correct heartbeat from the DVP. | Reset DVP, this will reset the M5200 and will synch the two.<br><br>If this does not correct the problem, contact Woodward Technical Support for assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **M5200 DPRAM Error**<br><br>Detection:<br>The DVP has detected a Dual port ram error during the RAM check. | Defective Dual Port Ram or interface. | Contact Woodward Technical Support for assistance. |
| **M5200 Heartbeat Error**<br><br>Detection:<br>The M5200 has not sent the correct heart beat value to its DVP. | The M5200 is not running, or the interface is defective. | Contact Woodward Technical Support for assistance. |
| **M5200 Startup Timeout**<br><br>Detection:<br>After 2 min waiting for a signal from the M5200 aux board the control board will timeout. | There is no M5200 program, or it is not running.<br><br>If the Service/Test Port is configured for DHCP address assignment but cannot get an address (no network connection, no DHCP server). | Contact Woodward Technical Support for assistance.<br><br>Contact Woodward Technical Support for assistance. |
| **Heat Sink Temp. Sensor 1 Error or Heat Sink Temp. Sensor2 Error**<br><br>Detection:<br>This fault status flag indicates power board heat sink sensor (1 or2) has failed. | DVP internal electronics failure or extreme temperature.<br>(Only Applies to DVP 5000, 10000, or 12000 Models) | If DVP temperature is within specified limits, contact Woodward Technical Support for further assistance. |
| **Boost Converter Error**<br><br>Detection:<br>This status flag indicates the Boost Converter board did not reach the proper voltage. | Internal problem with the electronics<br>(Only Applies to DVP 5000, 10000, or 12000 Models) | Contact Woodward Technical Support for further assistance. |

## EGD Diagnostics

Table 8-9. DVP Troubleshooting Guide EGD Diagnostics Status

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **EGD Port 1 Link Error**<br><br>Detection:<br>The EGD messages are received slower than the time out time that is a user setting. | Wiring problem on Ethernet port 1. | Check wiring on Ethernet port 1 |
| | Control system not powered up. | Check if the control system is powered up and running. |
| | IP addresses incorrect. | Check if the correct IP addresses are given to the DVP and control system. |
| **EGD Port 1 Long Message Error**<br><br>Detection: The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |
| **EGD Port 1 Short Message Error**<br><br>Detection:<br>The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |

| Diagnostic Indications | Probable Causes | Recommended Actions |
|---|---|---|
| **EGD Port 2 Link Error**<br><br>Detection:<br>The EGD messages are received slower than the time out time that is a user setting. | Wiring problem on Ethernet port 2. | Check wiring on Ethernet port 2. |
| | Control system not powered up. | Check if the control system is powered up and running. |
| | IP addresses incorrect. | Check if the correct IP addresses are given to the DVP and control system. |
| **EGD Port 2 Long Message Error**<br><br>Detection:<br>The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |
| **EGD Port 2 Short Message Error**<br><br>Detection:<br>The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |
| **EGD Port 2 Stale Data Error**<br><br>Detection:<br>The Application Level Heart Beat variable has not changed in time period greater than the stale data delay time. | Data from the producer is not being updated (stale) in the EGD packet. | Check the Ethernet Port 2 wiring between the DVP and turbine control. Verify the Stale Data Delay setting using the Service Tool. |
| **EGD Port 3 Link Error**<br><br>Detection:<br>The EGD messages are received slower than the time out time that is a user setting. | Wiring problem on Ethernet port 3. | Check wiring on Ethernet port 3. |
| | Control system not powered up. | Check if the control system is powered up and running. |
| | IP addresses incorrect. | Check if the correct IP addresses are given to the DVP and control system. |
| **EGD Port 3 Long Message Error**<br><br>Detection:<br>The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |
| **EGD Port 3 Short Message Error**<br><br>Detection:<br>The EGD message length expected is not the same as the one received. | Incorrect protocol definition. | Contact Woodward Technical Support for further assistance. |
| **EGD Port 3 Stale Data Error**<br><br>Detection:<br>The Application Level Heart Beat variable has not changed in time period greater than the stale data delay time. | Data from the producer is not being updated (stale) in the EGD packet. | Check the Ethernet Port 3 wiring between the DVP and turbine control. Verify the Stale Data Delay setting using the Service Tool. |

## EGD Performance

Table 8-10. DVP Troubleshooting Guide EGD Performance

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **EGD Data Mismatch**<br><br>Detection:<br>Status indication that one or more of the EGD input channels contains different data for longer than the StateDataDelayTime. Triplex mode only. Will not generate an EGD Fault. | Loss of synchronization of master control. | Verify system data and synchronization.<br><br>Verify the Stale Data Delay setting using the Service Tool. |
| **EGD Revision Fault**<br><br>Detection:<br>Revision check of external and internal EGD protocol revision. | The revision of the M5200 and the revision from the control system do not match. | Check EGD protocol revision of control system. |
| **EGD Rate Group Slip**<br><br>Detection:<br>If the M5200 does not have the time to finish the task within the rate group. This will also give a heartbeat error flag. | Internal or processing fault. | Check the M5200 CPU Load percentage using the Service Tool. |
| **EGD Fault**<br><br>Detection:<br>Dependent on the EGD mode: 3 port, 2 port, or 1 port this flag indicates the data required to provide a set position to the DVP is missing. | The EGD mode selection is set to more ports than supported with the control system. | Change the mode or add port(s) from the control system. |
| | There are other error flags active: See associated troubleshooting steps for each error flag. | Correct the EGD individual port errors. |
| **EGD L2 Port 0 Stat Error** | This port is used for internal data logging only. | |
| **EGD L2 Port 1 Stat Error**<br><br>Detection:<br>The Ethernet interface is not communicating status information. | DVP internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **EGD L2 Port 2 Stat Error**<br><br>Detection:<br>The Ethernet interface is not communicating status information. | DVP internal electronics failure. | Contact Woodward Technical Support for further assistance. |
| **EGD L2 Port 3 Stat Error**<br><br>Detection:<br>The Ethernet interface is not communicating status information. | DVP internal electronics failure. | Contact Woodward Technical Support for further assistance. |

# Dual DVP Troubleshooting

Table 8-11. Dual DVP Troubleshooting

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **Dual DVP Waiting to Sync**<br><br>Detection:<br>For dual-DVP applications, this is a status indication that the inter-DVP synchronization process is active. | No communication from Other DVP. | Check that Other DVP has power. Check communication cables between DVP units. |
| | This DVP was in Shutdown Position and then received a Reset, but Other DVP is still operational and controlling its position. | Confirm operational status of Other DVP. Check for any possible causes for this DVP to go into Shutdown Position. |
| **Dual DVP Valve Type Match Error**<br><br>Detection:<br>For dual-DVP applications, indicates the valve types for the two DVPs are not compatible. | Other DVP is incompatible with this DVP. | Check that cabling to Other DVP is connected to correct unit. Confirm the Valve Type Selection Screen in the Service Tool. Verify the "Valve Type" matches the valve/actuator system connected to the DVP. Verify both DVPs, that they match each other or are compatible types. Contact Woodward Technical Support for assistance. |
| | ID module factory calibration incorrect for this valve type. | |
| **Dual DVP Inter Com. CAN Error**<br><br>Detection:<br>Indicates Dual DVP CAN inter-communication error is detected on this DVP, Other DVP, or both.<br><br>**Note:** this status is expected after a unit is powered up and before the first Reset is issued. | If Dual DVP Inter Com. Self CAN Error is not shown, then error condition is detected only on Other DVP. | Perform troubleshooting on Other DVP. |
| | If Dual DVP Inter Com. Self CAN Error is shown, then error condition is detected on this DVP. | See steps for **Dual DVP Inter Com. Self CAN Error** |
| **Dual DVP Inter Com. Self CAN Error**<br><br>Detection:<br>Indicates Dual DVP Inter Com. CAN Error is being detected on this DVP. | Wiring to CAN 1 port is disconnected or loose. | Check terminals and connections. |
| | Connection to CAN 1 port is not connected to Other DVP. | Check that cabling to Other DVP is connected correctly. |
| | Incorrect or missing termination on CAN 1 port. | Confirm that termination is being used on both this DVP and Other DVP. |
| | CAN 1 cable is too long. | Confirm cable is no longer than maximum specified cable length. |
| **Dual DVP Inter Com. RS485 Error**<br><br>Detection:<br>Indicates Dual DVP RS485 inter-communication error is detected on this DVP, Other DVP, or both.<br><br>**Note:** this status is expected after a unit is powered up and before the first Reset is issued. | If Dual DVP Inter Com. Self RS485 Error is not shown, then error condition is detected only on Other DVP. | Perform troubleshooting on Other DVP. |
| | If Dual DVP Inter Com. Self RS485 Error is shown, then error condition is detected on this DVP. | See steps for **Dual DVP Inter Com. Self RS485 Error** |

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **Dual DVP Inter Com. Self RS485 Error**<br><br>Detection:<br>Indicates Dual DVP Inter Com. RS485 Error is being detected on this DVP. | Wiring to RS485 port is disconnected or loose. | Check terminals and connections. |
| | Connection to RS485 port is not connected to Other DVP. | Check that cabling to Other DVP is connected correctly. |
| | Incorrect or missing termination on RS485 port. | Confirm that termination is being used on both this DVP and Other DVP. |
| | RS485 cable is too long. | Confirm cable is no longer than maximum specified cable length. |
| **Dual DVP Inter Com. CAN & RS485 Error**<br><br>Detection:<br>For inter-link communications on dual-DVP applications, indicates both RS485 and CAN are failed. | Dual DVP Inter Com. CAN Error and Dual DVP Inter Com. RS485 Error have both occurred, so all communication to Other DVP has been lost. | Resolve cause for both contributing errors: Dual DVP Inter Com. CAN Error and Dual DVP Inter Com. RS485 Error. |
| **Dual DVP Other Shutdown Position** (status is received from Other DVP)<br><br>Detection:<br>For dual-DVP applications, indicates the other DVP is in a Shutdown Position state. | It is normal for this to occur when a shutdown position has been commanded from an external source. I.E. Service Tool, or Digital Communication. | See entry for **Ext. Shutdown Position** |
| | Other DVP is in Shutdown Position state. | If an unexpected condition, check status of Other DVP and troubleshoot conditions on that unit. |
| **Dual DVP Other Input Shutdown** (status is received from Other DVP)<br><br>Detection:<br>For dual-DVP applications, indicates the other DVP is in a shutdown state. | Set Position input(s) for Other DVP have failed. | If an unexpected condition, check status of Other DVP and troubleshoot conditions on that unit. |
| **Dual DVP All Inputs Lost**<br><br>Detection:<br>For dual-DVP applications, indicates there is not valid position setpoint. The local position setting is failed/lost and either the inter-DVP communications is failed or the other DVP has also lost all its set position (command) inputs.<br><br>**Note:** this status is expected after a unit is powered up and before the first Reset is issued. | All sources of Set Position from both DVP units are invalid. | If an unexpected condition, check status of both DVP units and troubleshoot conditions on each unit if applicable.<br>Check for proper functionality of Set Position sources. |
| **Dual DVP Run Slow** | Actuator is running at reduced speed because Other DVP has gone into Shutdown Position. | If an unexpected condition, check status of Other DVP and troubleshoot conditions on that unit. |
| **Dual DVP Other Reduced Slew Rate** (status is received from Other DVP) | This DVP is running at reduced speed due to status from Other DVP. | If an unexpected condition, check status of Other DVP and troubleshoot conditions on that unit. |
| **Dual DVP Reset Active** | It is normal for Dual DVP Reset Active indicator to sometimes be observed momentarily when unit receives a Reset. | If this indicator stays on continuously contact Woodward Technical Support for assistance. |

## InterDVP RS485 Status

Table 8-12. Dual DVP InterDVP RS485 Status

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **INACTIVE**<br><br>Dual DVP RS485 communication channel is not selected. | This is normal for a unit that is not Dual DVP. | No action needed. |
| **COMM OK**<br><br>Dual DVP RS485 communication channel is working properly. | No issue observed. | No action needed. |
| **SLAVE RX TIMEOUT**<br><br>Dual DVP RS485 communication channel is configured as a Slave, but data is not being received. | Both Dual DVP units are configured as Slaves. | Check CANopen setting of DVP units to make sure one is Master and one is Slave. |
| | Wiring to RS485 port is disconnected or loose. | Check terminals and connections. |
| | Connection to RS485 port is not connected to Other DVP. | Check RS485 connection between paired DVP units. |
| **MASTER RX TIMEOUT**<br><br>Dual DVP RS485 communication channel is configured as a Master, but data is not being received. | Wiring to RS485 port is disconnected or loose. | Check terminals and connections. |
| | Connection to RS485 port is not connected to Other DVP. | Check RS485 connection between paired DVP units. |
| **FRAMING ERROR**<br><br>Dual DVP RS485 communication channel is experiencing data framing errors. | Both Dual DVP units are configured as Masters. | Check CANopen setting of DVP units to make sure one is Master and one is Slave. |
| | Wiring to RS485 port is loose. | Check terminals and connections. |
| | Incorrect or missing termination on RS485 port. | Confirm that termination is being used on both this DVP and Other DVP. |
| | RS485 cable is too long. | Confirm cable is no longer than maximum specified cable length. |

## InterDVP Rx Channel

Table 8-13. Dual DVP InterDVP Rx Channel

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **CAN1 ACTIVE**<br><br>CAN 1 port is being used as active channel for communication between Dual DVP units. | Normal condition for a Dual DVP unit. | No action needed. |
| **RS485 ACTIVE**<br><br>RS485 port is being used as active channel for communication between Dual DVP units due to CAN 1 port communication failure. | CAN 1 port communication between Dual DVP units has previously failed. | See entry for **Dual DVP Inter Com. CAN Error.** |
| **CAN1 STANDBY**<br><br>Neither port is active for control data (such as Set Position), but CAN 1 port has functional integrity and will go to ACTIVE after a Reset.<br><br>**NOTE:** this status is expected after a unit is powered up and before the first Reset is issued. | CAN 1 port and RS485 port communication between Dual DVP units have both previously failed. | See entries for **Dual DVP Inter Com. CAN Error** and **Dual DVP Inter Com. RS485 Error.** |

| Diagnostic Indications | Probable Causes | Recommended Action |
|---|---|---|
| **RS485 STANDBY**<br><br>Neither port is active for control data (such as Set Position), but RS485 port has functional integrity and will go to ACTIVE after a Reset. | CAN 1 port and RS485 port communication between Dual DVP units have both previously failed, and CAN 1 port is still failed. | See entries for **Dual DVP Inter Com. CAN Error** and **Dual DVP Inter Com. RS485 Error.** |
| **NONE**<br><br>No receive channel is currently functional. | Normal condition for a unit that is not Dual DVP. | No action needed. |
| | If a Dual DVP unit, then CAN 1 port and RS485 port communication between Dual DVP units are both currently failed. | See entries for **Dual DVP Inter Com. CAN Error** and **Dual DVP Inter Com. RS485 Error.** |

# Chapter 9.
# 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:

- 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 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 current list of Woodward Business Partners is available at:
https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

## Product Service 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 (Woodward North American Terms and Conditions of Sale 5-09-0690) 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 North American Terms and Conditions of Sale 5-09-0690).

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 North American Terms and Conditions of Sale 5-09-0690) 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 North American Terms and Conditions of Sale 5-09-0690). 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 one of the Full-Service Distributors listed at https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

# Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at https://www.woodward.com/support, which also contains the most current product support and contact information.

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

| Facility | Phone Number |
|---|---|
| Brazil | +55 (19) 3708 4800 |
| China | +86 (512) 8818 5515 |
| Germany | +49 (711) 78954-510 |
| India | +91 (124) 4399500 |
| 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

| Facility | Phone Number |
|---|---|
| Brazil | +55 (19) 3708 4800 |
| China | +86 (512) 8818 5515 |
| Germany | +49 (711) 78954-510 |
| India | +91 (124) 4399500 |
| 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

| Facility | Phone Number |
|---|---|
| Brazil | +55 (19) 3708 4800 |
| China | +86 (512) 8818 5515 |
| India | +91 (124) 4399500 |
| 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 |

# 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

Turbine Model Number

Type of Fuel (gas, steam, 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.*

# Appendix A. CANopen Communication

## Introduction

| IMPORTANT | The CANopen communications described in this manual are a typical Woodward implementation. |
|---|---|

The CAN network that is used for the CANopen communication with the DVP has one NMT Master (Network Master Management Node). This node is responsible for starting communication and the timing of the CAN messages. There can be up to 30 slave devices (depending on network load and timing).

Further detailed information regarding CANopen can be obtained at www.can-cia.org. Information about CAN is available in ISO 11898. Specific information regarding DVP behavior is detailed below. The DVP CANopen Electronic Data Sheet (EDS) can be downloaded from www.woodward.com.

## Network Architecture

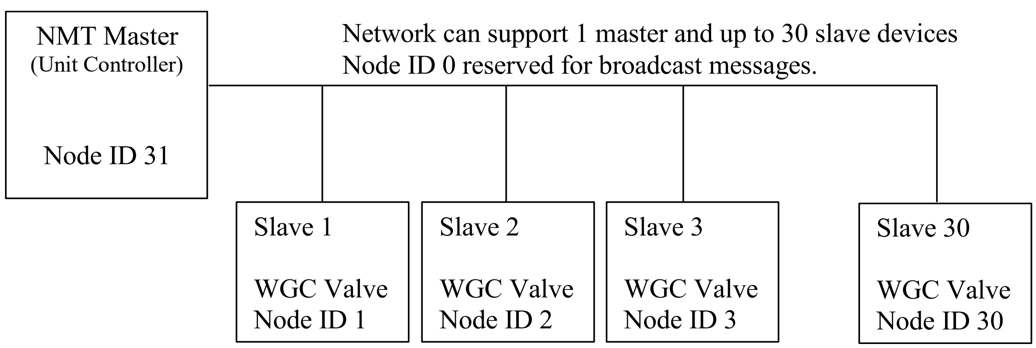



Figure A-1. CANopen Network Architecture

Addressing can support up to 31 devices. To meet the 10 ms timing requirement, only 15 devices can be used at 500 kbaud.

# NMT Master Functions

There are four distinct functions the master can perform. The slave units will respond to these functions.

**NMT Block Diagram (Woodward Implementation)**

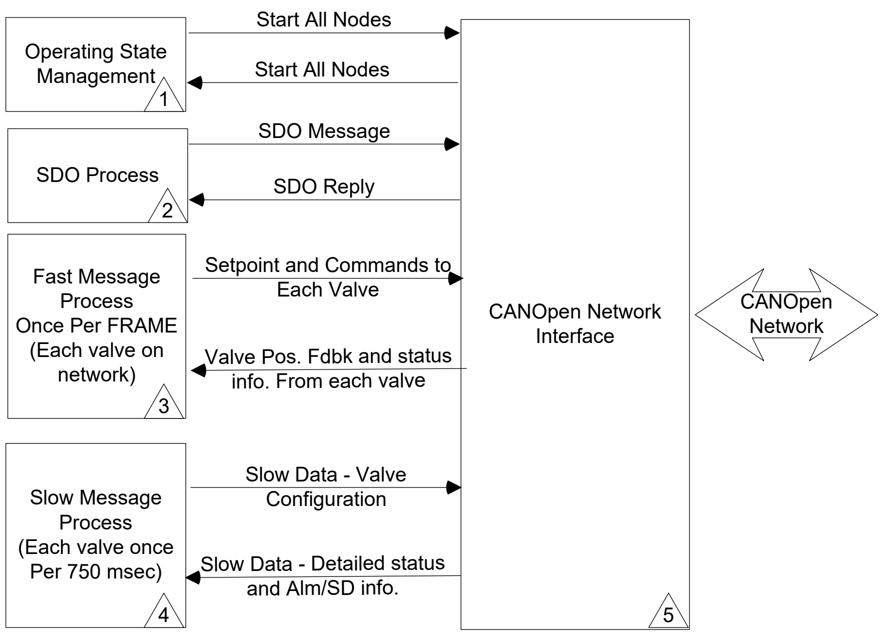



Figure A-2. NMT Master Block Diagram

1) Operating state management: This function is used to change the operational state of the slave devices.

2) SDO process: This function is used to read and or write SDO data into or out of the slave devices. SDO data is typically non-time critical data.

3) Fast Message process: This function will read and write the fast messages (once every frame) to the slave devices. This is time critical data and needs to have priority over the other messages. There is also a synch message supported for timing purposes.

4) Slow Message process: This function will read and write the slow messages to and from the slaves. Typical update rate is 750 ms.

## Operating State Management

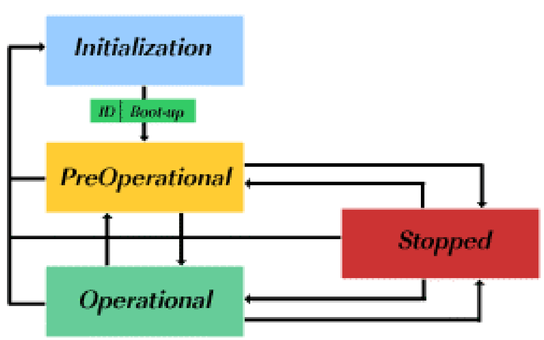



Figure A-3. CANopen Slave State Diagram

The above state diagram is taken from the CANopen specification.

## Initialization:

**NMT and DVP**: The initialization state is used to open the CAN ports and to initialize the CANopen stack. After this is done the DVP or NMT will go to the Pre-Operational state automatically. It will send the Boot up message. The Boot up message is the Heartbeat message. Once the Boot up message is sent, the Heartbeat message is disabled.

## Pre-Operational:

**DVP**: In this state, the DVP is waiting for the "Start All Nodes" message. When the message is received, the DVP will go to the Operational state.

**NMT Master**: In this state, the NMT will transmit a "Start All Nodes" Message. This message will also be received by the NMT Master and will cause the Master to transition to the Operational State.

## Operational:

**DVP**: In this state the DVP is in operational mode and will perform all send and receive functions.

**NMT Master**: In this state NMT will execute all functions.

- Operational state management.
- SDO process.
- Fast messages
- Slow Messages

The NMT master will transmit "Start All Nodes" broadcast message every 1 Sec. By sending this message at a periodical cycle we make sure that nodes that are added or power cycles will go back to the operational state without having to reset the NMT Master.

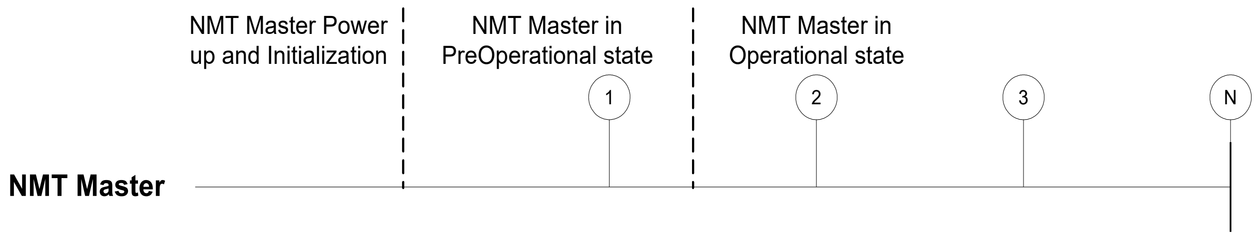
## Stopped:

The Stopped state is not used.

> **Note**: The DVP will respond to an individual “go to operational” NMT command. However, due to the broadcast nature of the NMT command it requires a delay of at least 1.5ms between NMT commands on the CAN bus to ensure the DVP has time to clear the NMT receive buffer. Symptoms of an insufficient delay include the DVP node not advancing to the operational state, or the node not being detected in some CANopen scanner programs.

## Timing:

In a timing diagram the process will look like this:




**1 NMT Master Transmits "Start All Nodes"**

**2 NMT Master Transmits "Start All Nodes" (Time = 0 Sec)**

**3 NMT Master Transmits "Start All Nodes" (Time = 1 Sec)**

**N NMT Master Transmits "Start All Nodes" (Time = N Sec)**

Note: Other messages not shown.

Figure A-4. Sample Operating State Process Timing Diagram

# SDO Process

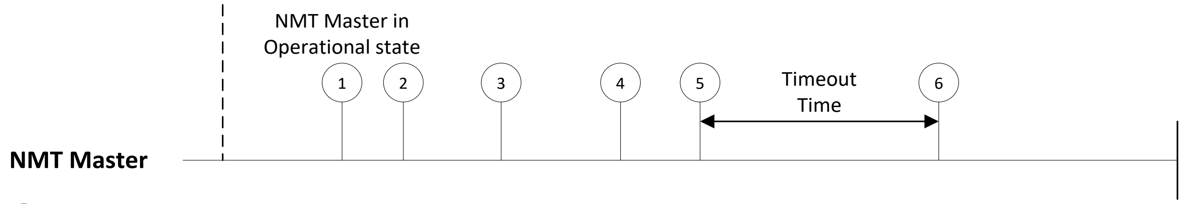
Master will send SDO messages to each valve to retrieve valve specific information such as serial number, part number, etc.

All SDO data will be requested when the NMT master goes from Pre-Operational to Operational. Woodward gives the designed application the option to request all this information under application control. This is to make sure that when the slave devices are powered, cycled, or added, their information gets updated.

The SDO protocol only allows one request message to be sent. The next message will be sent after a response has been received for the previous message. If no response will be received the NMT master must timeout. The typical timeout time used is: 1 second.

## Timing:

In a timing diagram, the process will look like this:




1 NMT Master Transmits SDO Request

2 NMT Master Receives SDO Response

3 NMT Master Transmits SDO Request

4 NMT Master Receives SDO Response

5 NMT Master Transmits SDO Response

6 NMT Master Retransmits SDO Request

Note: Other messages not shown.

Figure A-5. Sample SDP Process Timing Diagram

## Fast Message Process

There are three messages needed to make this process work.

- Fast message to slave
- Fast message from slave
- Synch message to slave

Fast Message to slave: NMT will send a message to the slave within one Frame. This data is processed but not used until the synch message is received. Typical data is the position demand, shutdown flags etc.

Fast message from the slave: Slave will send a message to the NMT. Typical data is the actual position, the shutdown status of the slave etc.

The sent synch message from the master to the slave will do two things.

- If the slave receives the synch, it will update the fast message information and start using this information.
- If the slave receives the synch, it will send back the fast message from slave.

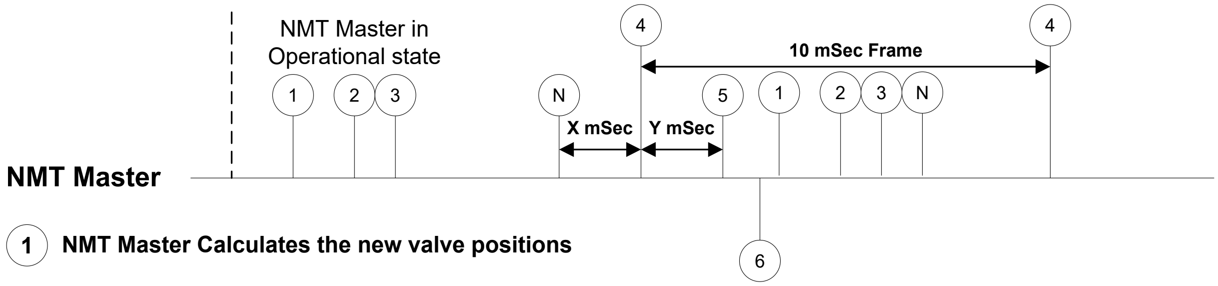
| | |
|---|---|
| ⚠WARNING | **CANopen communication link has a timeout value between 1 ms to 1000 ms and it can be specified through Service tool. It is important to ensure the CANopen timeout is set accordingly and use discrete output as shutdown in case of error detection.** |

## Error Detection:

The slave's error detection is done by checking if the synch message and the fast data message is received within a given timeout time. Typical timeout time is set to 40 ms for a 10 ms rate group and can be changed using the Service tool. This timeout time is variable depending on the turbine performance and application. It is up to the system integrator to determine this timeout number.

The master error detection is the same as the slave error detection with the exception it will look to the fast message from slave to determine if the communication is failed. Again, the system integrator must determine if the timeout time is acceptable for the system/turbine.

## Timing:
In a timing diagram the process will look like this:




**(1) NMT Master Calculates the new valve positions**

**(2) NMT Master Transmits valve data to valve 1**

**(3) NMT Master Transmits valve data to valve 2**

**(N) NMT Master Transmits valve data to valve N**
**Time X referenced to receipt of message by Slave:**
**For <u>Single CANopen</u> or <u>Dual CANopen</u> (single DVP): X ≥ 1 mSec before synch**
**For <u>Dual DVP CANopen</u> (dual DVP): X ≥ 2.5 mSec before synch**

**(4) NMT Master Transmits synch**

**(5) Slaves receive synch and will have new data from the CANopen stack within Y mSec**
**Time Y referenced to receipt of synch message by Slaves:**
**For <u>Single CANopen</u> or <u>Dual CANopen</u> (single DVP): Y ≤ 1 mSec**
**For <u>Dual DVP CANopen</u> (dual DVP): Y ≤ 3 mSec**

**(6) Slaves will send back the fast message triggered by the synch message**

Note: Other messages not shown.

Figure A-6. Sample Fast Message Process Timing Diagram

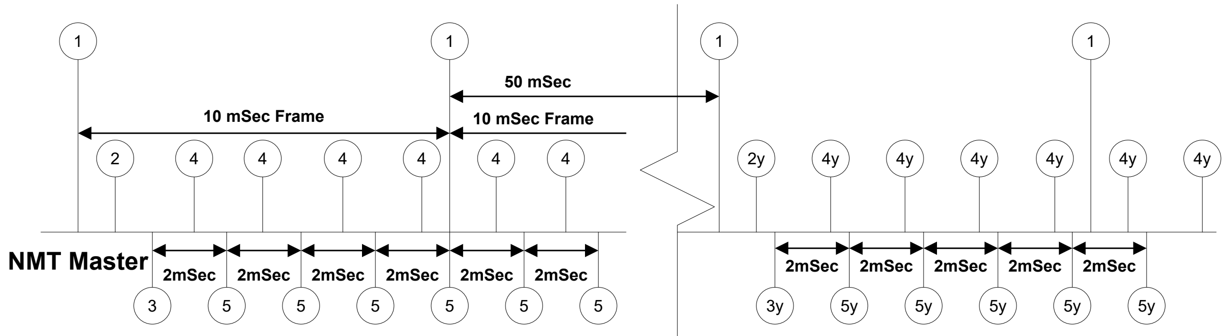
## Slow Message Process
The slow messages are used to get additional status information and set parameters in the slave device. To make sure the CAN bus is not overloaded, the NMT master must send slow messages at a rate that will allow all messages to be sent and received. Woodward spaces the messages so that all slaves are addressed once every 750 ms.

The control will send a slow message every 2 ms, then wait 50 ms after the first slow message is sent before the control starts sending to the next valve. Thus, each valve will receive and transmit slow messages within 50 ms. Max number of valves in the network is 15.

So, the total update time for all valves will be 15 * 50 ms = 750 ms.

The Slave will ***not*** send any slow messages until the first slow message (this is RxPDO2, slow message number 1) is received, at which time the Slave will initiate a slow response sequence which includes all slow PDO messages (PDO 2 to PDO N). This way the NMT master can control the bus loading by determining which slave will reply with its slow messages. The Slave slow message data is sent on a nominal 2 ms tick. The slave will use default data when no slow messages have been received.

## Timing:
In a timing diagram, the process will look like this:




1 **NMT Master Transmits synch**

2 **NMT Master Transmits slow data 1 to valve 1**

3 **Valve 1 sends back Slow data 1 in response to incoming slow data 1 (first message in Slow data response sequence)**

4 **NMT Master Transmits slow data N to valve 1 (not required as part of retrieving Slow data, but can be interleaved if desired)**

5 **Valve 1 continues Slow data response sequence by sending back Slow data N until all messages are sent (nominal interval of 2mSec)**

2y **NMT Master Transmits slow data 1 to valve Y**

3y **Valve Y sends back Slow data 1 in response to incoming slow data 1 (first message in Slow data response sequence)**

4y **NMT Master Transmits slow data N to valve Y (not required as part of retrieving Slow data, but can be interleaved if desired)**

5y **Valve Y continues Slow data response sequence by sending back Slow data N until all messages are sent (nominal interval of 2mSec)**

Note: Other messages not shown.

Figure A-7. Sample Slow Message Process Timing Diagram

## Putting it all Together
Assumptions for calculations:

| | |
|---|---|
| # of bytes in fast Messages to DVP: | 4 |
| # of bytes in fast Messages from DVP: | 5 |
| # of bytes in synch message: | 1 |
| # of slow messages to DVP: | 7 |
| # of slow messages from DVP: | 7 |
| # of data byte in slow message: | 8 |
| # of SDO messages per 10 ms: | 2 |
| # of SDO bytes: | 8 |
| CAN link running at: | 500 KBits = 2 μs per bit |
| Frame Rate: | 10 ms |
| Max number of DVPs: | 15 |
| Message overhead is: | 51 Bits |

## All Messages Sent in a Frame

### Fast Messages:
If 15 valves are connected to a network, the NMT master will send 15 fast messages and receive 15 fast messages. The control also needs to send a synch message.

Total Fast message time = Valve's * (((Overhead + (TxBytes * 8)) * Tperbit) + ((Overhead + (RxBytes * 8)) * Tperbit))
15 * (((51 + (5 * 8)) * 2 µs) + ((51 + (4 * 8)) * 2 µs)) = 5.22 ms

Total Synch message time is = ((Overhead + (SynchDatabytes * 8)) * Tperbit)
((51 + (1 * 8)) * 2 uSec) = 118 uSec

Total time is: 5.22 mSec + 0.118 mSec = 5.338 mSec
Total Load is: (5.338 mSec / 10 mSec) * 100 = 53.38%

### Slow Messages:
Number of slow messages sent and received in one frame is 5 + 5 = 10. Slow messages are sent every 2 ms.
Total Slow message time = Number of messages * ((overhead + (RxTxbytes * 8) * Tperbit)
10 * ((51 + (8 * 8)) * 2 µs) = 2.3 ms
Total peak Load is: (2.3 ms / 10) * 100 = 23.0%

### SDO Messages:
The control can send and receive one SDO message per frame that is two messages.

SDO message time is = 2 * ((Overhead + (SDO bytes * 8)) * Tperbit)
2 * ((51 + (8 * 8)) * 2 uSec) = 460 uSec
Total load = (0.46 mSec / 10 mSec) * 100 = 4.6%

The CAN link loaded is now:
53.38% + 23.0% + 4.6% = 80.98%

## Definitions

### Frame
One frame is defined as the time that it takes to process the input IO, transfer this data to the application level, calculate a new valve setpoint, send a fast message to each valve driver, and finally send a SYNC message out on the CANopen Network.

Example: In Woodward Controllers one FRAME is defined by the rate group that is specified in the CANopen interface block. This is typically 10 ms but can also be 5 ms, 20 ms, 40 ms, or 80 ms.

**IMPORTANT**

**The required FRAME time is a function of the application requirements and is the responsibility of the system integrator to define the requirements for FRAME time. Woodward typical values apply to Woodward systems only. In Woodward systems, all controller timing parameters (latency, jitter, execution times, etc.) are known and are considered in the calculation of FRAME times.**

## Simple Block Diagram to Define Frame Time

Frame time is the time that it takes for the turbine controller to sample the inputs, execute the main application code, and send the SYNC message out on the CANopen network.

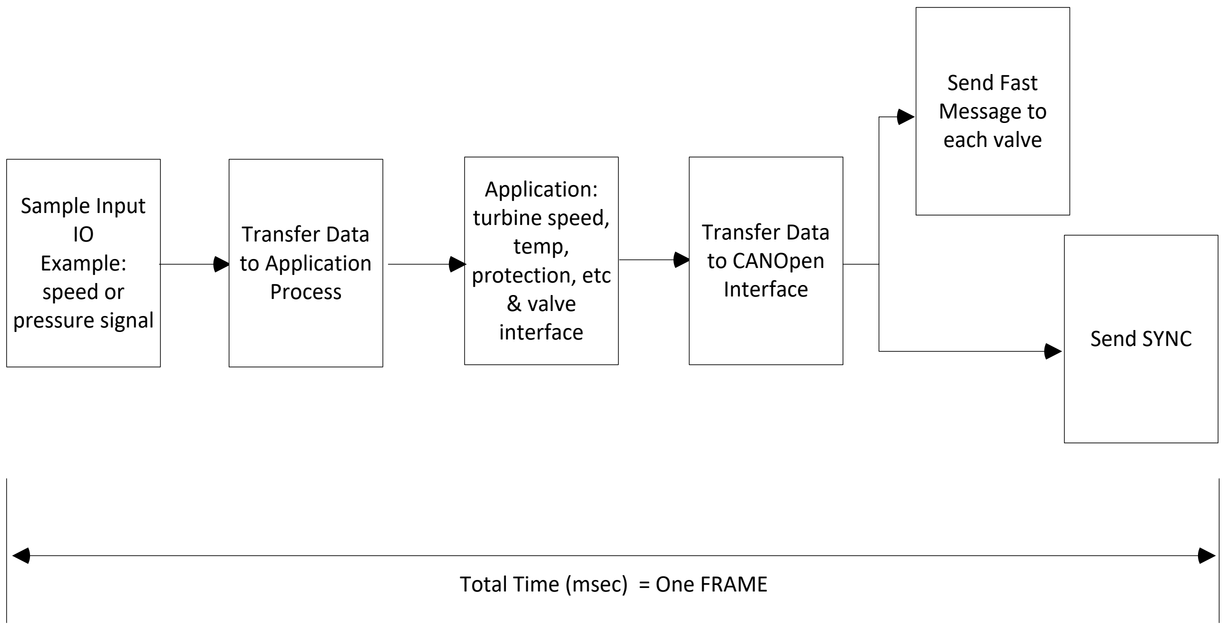



Figure A-8. Frame Time Definition Block Diagram

Table A-1. Transmit PDO Summary

| Id base | Tx PDOs | Name | CAN Byte | Message or Data Type | Mfr # hex |
|---|---|---|---|---|---|
| 0x180 | PDO1 | Fast Message | | Sync | |
| | | Actual position | 0,1 | uint16 | 2034 |
| | | Actual Current | 2,3 | uint16 | 2035 |
| | | Status Bits (0-5 used – 6 &7 unused) | 4 | Array[8] Boolean | 2036 |
| | | Unused | 5-7 | | |
| 0x280 | PDO2 | Temperature/InputCurrent | | Async | |
| | | Driver Temperature | 0-3 | Float | 2037 |
| | | Driver Input Current | 4-7 | Float | 2038 |
| 0x380 | PDO3 | InputVoltage1/InputVoltage2 | | Async | |
| | | InputVoltage1 | 0-3 | Float | 2039 |
| | | InputVoltage2 | 4-7 | Float | 203A |
| 0x480 | PDO4 | ActualPosition1/ActualPosition2 | | Async | |
| | | ActualPosition1 | 0-3 | Float | 203B |
| | | ActualPosition2 | 4-7 | Float | 203C |
| 0x1E0 | PDO5 | ActualCurrentFiltered | | Async | |
| | | ActualCurrentFiltered | 0-3 | Float | 203D |
| | | Unused | 4-7 | | |
| 0x2E0 | PDO6 | Status Error Register Flags 0-3 | | Async | |
| | | Status Error Register Flag 0 | 0,1 | Array[16] Boolean | 203E |
| | | Status Error Register Flag 1 | 2,3 | Array[16] Boolean | 203F |
| | | Status Error Register Flag 2 | 4,5 | Array[16] Boolean | 2040 |
| | | Status Error Register Flag 3 | 6,7 | Array[16] Boolean | 2041 |
| 0x3E0 | PDO7 | Status Error Register Flags 4-7 | | Async | |
| | | Status Error Register Flag 4 | 0,1 | Array[16] Boolean | 2042 |
| | | Status Error Register Flag 5 | 2,3 | Array[16] Boolean | 2043 |
| | | Status Error Register Flag 13 | 4,5 | Array[16] Boolean | 2044 |
| | | Unused | 6,7 | Blank | 2045 |
| 0x4E0 | PDO8 | Status Error Register Flags 8-10 | | Async | |
| | | Status Error Register Flag 8 | 0,1 | Array[16] Boolean | 2046 |
| | | Status Error Register Flag 9 | 2,3 | Array[16] Boolean | 2047 |
| | | Status Error Register Flag 10 | 4,5 | Array[16] Boolean | 2048 |
| | | Unused | 6,7 | Blank | |

Table A-2. Receive PDO Summary

**IMPORTANT** **The manufacturer numbers given here for SDO access are for reference. SDO writes aren't supported, the data must be written with the PDOs.**

| Id base (hex) | Rx PDOs | Name | CAN Byte | Type | Mfr # (hex) |
|---|---|---|---|---|---|
| 0x200 | PDO1 | Fast Message | | | |
| | | Position Demand | 0,1 | uint16 | 2022 |
| | | Command Byte 1 | 2 | Array[8] Boolean | 2023 |
| | | Command Byte2(1 bit used, 7 bits unused) | 3 | Array[8] Boolean | 2024 |
| | | Unused | 4-7 | | |
| 0x300 | PDO2 | Tracking Alarm and Shutdown Difference Errors | | | |
| | | Tracking Alarm Difference Error value | 0-3 | float | 2025 |
| | | Tracking Shutdown Difference Error value | 4-7 | float | 2026 |
| 0x400 | PDO3 | Resolver Alarm and Shutdown Difference Errors | | | |
| | | Resolver Alarm Difference Error value | 0-3 | float | 2027 |
| | | Resolver Shutdown Difference Error value | 4-7 | float | 2028 |
| 0x500 | PDO4 | Difference Alarm and Shutdown Times | | | |
| | | Tracking Alarm Difference Error time value | 0,1 | uint16 | 2029 |
| | | Tracking Shutdown Difference Error time value | 2,3 | uint16 | 202A |
| | | Unused | 4-7 | | |
| 0x260 | PDO5 | Difference Modes | | | |
| | | Resolver Difference Mode | 0,1 | uint16 | 202B |
| | | Unused | 2-7 | | |
| 0x360 | PDO6 | Position Error Motor Alarm and Shutdown Limits | | | |
| | | Position Error Motor Alarm Limit | 0-3 | float | 202C |
| | | Position Error Motor Shutdown Limit | 4-7 | float | 202D |
| 0x460 | PDO7 | Position Error Shaft Alarm and Shutdown Limits | | | |
| | | Position Error Shaft Alarm Limit | 0-3 | float | 202E |
| | | Position Error Shaft Shutdown Limit | 4-7 | float | 202F |
| 0x560 | PDO8 | Position Error Motor and Shaft Times | | | |
| | | Position Error Motor Alarm Time | 0,1 | uint16 | 2030 |
| | | Position Error Motor Shutdown Time | 2,3 | uint16 | 2031 |
| | | Position Error Shaft Alarm Time | 4,5 | uint16 | 2032 |
| | | Position Error Shaft Shutdown Time | 6,7 | uint16 | 2033 |

# Receive (Rx) PDO Definitions

| | |
|---|---|
| **IMPORTANT** | **Data length must be sent as specified.** |

## Receive PDO 1 – Realtime "Fast Message" with Demand and Command Bits

This and a sync message need to be received within the timeout milliseconds.

Message type: "SYNC" (requires SYNC message)
COB Id: 512+Node Id (0x200+NodeId)
Data length: 3 bytes or 4 bytes

## Data:

**Byte 1-2**: Position Demand
Data length: 2 bytes, byte1 is LSB, byte 2 MSB.
Resolution: 16 bits
Units: %
Scaling: 2,500 = 0% to 62,500 = 100%.

**Byte 3**: Command Byte 1
Data length: 1 byte

Bit 0: **Shutdown**. If this bit is "1", the DVP will shut down and set the Shutdown bit.

Bit 1: **Shutdown Position**. If this bit is "1", DVP will perform Shutdown Position by setting the Manual Position Shutdown flag.

Bit 2: **Reset diagnostics bits**. On a "0" to "1" transition (Edge triggered,) the DVP will reset from a shutdown or alarm condition and reset all the diagnostic bits.

Bit 3: **Analog Primary Demand**. If set, the analog input is the primary demand. If analog and CANopen inputs are OK the analog is used. If the bit = "0" the CANopen input is used.

Bit 4: **Use Analog Backup**. Set this to "0" so the analog input will be ignored, and no reading or diagnostics will be triggered.

Bit 5: **Enable Tracking**. If this bit is TRUE (=1), then enable the following to be changeable on the DVP from CANopen:

- Tracking Alarm Difference Error value. (float)
- Tracking Shutdown Difference Error value (float)
- Tracking Alarm Difference Error time value. (uint16)
- Tracking Shutdown Difference Error time value (uint16)

Bit 6: **Enable Resolver**. If this bit is TRUE (=1), then enable the following to be changeable on the DVP from CANopen:

- Resolver Alarm Difference Error value (float)
- Resolver Shutdown Difference Error value (float)
- Resolver Difference Mode (uint16)

Bit 7: **Enable Position Error** -- If this bit is TRUE (=1), then enable the following to be changeable on the DVP from CANopen:

- Position Error Motor Alarm Limit (float)
- Position Error Motor Shutdown Limit (float)
- Position Error Shaft Alarm Limit (float)
- Position Error Shaft Shutdown Limit (float)
- Position Error Motor Alarm Time (uint16)

- Position Error Motor Shutdown Time (uint16)
- Position Error Shaft Alarm Time (uint16)
- Position Error Shaft Shutdown Time (uint16)

**Byte 4**: Command Byte 2
Data length: 1 byte

Bit 0: **Auto Detect Request**. If this bit is "1", it indicates an auto-detection is requested. This is only honored if the valve type state is set to ValveTypeStateSerialValveTypeFailed.

Unused Bits 1 to Bit 7 are reserved, must always be "0". (Spare Bits)

**Bytes 5-8**: These bytes are unused. (Spare Bytes)

## Receive PDOs 2-8 – Parameter Based "Slow Messages"

If slow messages are not received, the DVP uses values that are in RAM. During start-up the RAM will be filled with the EEPROM parameters. The variables in RAM will be used when the parameters are updated from the Service Tool.

If the slow messages are received, the DVP will use these parameters. The exception is if the ENABLE bits are not set, then the DVP will continue using the RAM parameters.

The specified range is enforced with internal DVP value limits.

| **IMPORTANT** | **If the ENABLE bit is toggled from ENABLE true to ENABLE false, the control will use the RAM and the last value received from the CANopen link.** |
|---|---|

## Receive PDO 2 – Slow Message: #1 Tracking Alarm and Shutdown Difference Errors

Message type: "ASYNC"
COB Id: 768+Node Id (0x300+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-4**: **Tracking Alarm Difference Error**
Data length: 4 bytes, Float.
Units: %
Range: 0 to 100%

**Byte 5-8**: **Tracking Shutdown Difference Error value**
Data length: 4 bytes, Float.
Units: %
Range: 0 to 100%

## Receive PDO 3 – Slow Message: #2 Resolver Alarm and Shutdown Difference Errors

Message type: "ASYNC"
COB Id: 1024+Node Id (0x400+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-4**: **Resolver Alarm Difference Error value**
Data length: 4 bytes, Float.
Units: %
Range: 0 to 100%

**Byte 5-8**: **Resolver Shutdown Difference Error value**
Data length: 4 bytes, Float.
Units: %
Range: 0 to 100%

## Receive PDO 4 – Slow Message: #3 Difference Alarm and Shutdown Times

Message type: "ASYNC"
COB Id: 1280+Node Id (0x500+NodeId)
Data length: 4 bytes

| | |
|---|---|
| **IMPORTANT** | **Data length must be sent as 4 bytes.** |

### Data:

**Byte 1-2**: **Tracking Alarm Difference Error time value**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0 to 10000 ms

**Byte 3-4**: **Tracking Shutdown Difference Error time value**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0 to 10000 ms

**Bytes 5-8**: These bytes are not used. (Spare Bytes)

## Receive PDO 5 – Slow Message: #4 Difference Modes

Message type: "ASYNC"
COB Id: 608+Node Id (0x260+NodeId)
Data length: 2 bytes

| | |
|---|---|
| **IMPORTANT** | **Data length must be sent as 2 bytes.** |

### Data:

**Byte 1-2**: **Resolver Difference Mode**
Data length: 2 bytes, unsigned 16
Difference mode used: min = 0, max = 1, avg = 2

**Bytes 3-8**: These bytes are not used. (Spare Bytes)

## Receive PDO 6 – Slow Message: #5 Position Error Motor Alarm and Shutdown Limits

Message type: "ASYNC"
COB Id: 864+Node Id (0x360+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-4**: **Position Error Motor Alarm Limit**
Data length: 4 bytes, Float
Units: %
Range: 0 to 110%

**Byte 5-8**: **Position Error Motor Shutdown Limit**
Data length: 4 bytes, Float
Units: %
Range: 0 to 110%

## Receive PDO 7 – Slow Message: #6 Position Error Shaft Alarm and Shutdown Limits

Message type: "ASYNC"
COB Id: 1120+Node Id (0x460+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-4**: **Position Error Shaft Alarm Limit**
Data length: 4 bytes, Float
Units: %
Range: 0 to 100%

**Byte 5-8**: **Position Error Shaft Shutdown Limit**
Data length: 4 bytes, Float
Units: %
Range: 0 to 100%

## Receive PDO 8 – Slow Message: #7 Position Error Motor and Shaft Times

Message type: "ASYNC"
COB Id: 1376+Node Id (0x560+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-2**: **Position Error Motor Alarm Time**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0-65,535
**Byte 3-4**: **Position Error Motor Shutdown Time**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0-65,535

**Byte 5-6**: **Position Error Shaft Alarm Time**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0-65,535

**Byte 7-8**: **Position Error Shaft Shutdown Time**
Data length: 2 bytes, unsigned 16
Units: milliseconds
Range: 0-65,535

# Transmit (Tx) PDO Definitions

There is only one (1) "Fast Message" sent from the DVP.
There are additional "Slow Message" sent for monitoring purposes.

## Transmit PDO 1 – Actual Position, Current and Status from Valve

### Realtime Fast Message

Message type: Transmitted in Response to NMT Sync Message.
COB Id: 384+Node Id (0x180+NodeId)
Data length: 5 bytes

## Data:

**Byte 1-2**: **Actual Position**
Data length: 2 bytes, byte1 is LSB, byte 2 MSB.
Resolution: 16 bits
Units: %
Scaling: 2,500 = 0% to 62,500 = 100%.

**Byte 3-4**: **Actual Current**
Data length: 2 bytes, byte1 is LSB, byte 2 MSB.
Resolution: 16 bits
Units: Amps
Scaling: –40 A = 2500 counts, 40 A = 62500 counts

**Byte 5**: **Status Bits**
Data length: 1 byte
- Bit 0: **Shutdown**
- Bit 1: **Shutdown Position**
- Bit 2: **Shutdown System**.
- Bit 3: **Shutdown Not External.**
- Bit 4: **Alarm**.
- Bit 5: **Power Up Reset**.
- Bit 6: **Controller Not Ready**
- Bit 7 **are sent as 0.** (Spare Bites)

Bytes 6-8 are unused, not sent. (Spare Bytes)

### Transmit PDO 2 – Slow Message #1: Temperature / Input Current

Message type: Transmitted in Response to Receipt of Receive PDO 2.
COB Id: 640+Node Id (0x280+NodeId)
Data length: 8 bytes

## Data:

**Byte 1-4**: **Driver Temperature**
Data length: 4 bytes, Float.
Units: Kelvin

**Byte 5-8**: **Driver Input Current**
Data length: 4 bytes, Float.
Units: Amps

### Transmit PDO 3 – Slow Message #2: Input Voltage1 / Input Voltage2

Message type: Transmitted 2 ms after receipt of Receive PDO 2.
COB Id: 896+Node Id (0x380+NodeId)
Data length: 8 bytes

## Data:

**Byte 1-4**: **Input Voltage1**
Data length: 4 bytes, Float.
Units: Volts

**Byte 5-8**: **Input Voltage2**
Data length: 4 bytes, Float.
Units: Volts

## Transmit PDO 4 – Slow Message #3: Actual Position 1 / Actual Position 2

Message type: Transmitted 4 ms after receipt of Receive PDO 2.
COB Id: 1152+Node Id (0x480+NodeId)
Data length: 8 bytes

### Data:

**Byte 1-4**: **Actual Position 1**
Data length: 4 bytes, Float.
Units: %

**Byte 5-8**: **Actual Position 2**
Data length: 4 bytes, Float.
Units: %

## Transmit PDO 5 – Slow Message #4: Actual Current Filtered

Message type: Transmitted 6 ms after receipt of Receive PDO 2.
COB Id: 480+Node Id (0x1E0+NodeId)
Data length: 4 bytes

### Data:

**Byte 1-4**: **Actual Current Filtered**
Data length: 4 bytes, Float
Units: Amps

**Bytes 5-8**: These bytes are not used or sent. (Spare Bytes)

## Transmit PDO 6 – Slow Message #5: Status Error Flags 0 through 3

Message type: Transmitted 8 ms after receipt of Receive PDO 2.
COB Id: 736+Node Id (0x2E0+NodeId)
Data length: 8 bytes

**Byte 1-2**: Status Error Register 0 (see table A-3 for bit definition)
**Byte 3-4**: Status Error Register 1 (see table A-4 for bit definition)
**Byte 5-6**: Status Error Register 2 (see table A-5 for bit definition)
**Byte 7-8**: Status Error Register 3 (see table A-6 for bit definition)

Table A-3. PDO6 Byte 1-2 (Status Error Register 0)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 1-2 | Bit 0 | Reserved | Not Used | None |
| Byte 1-2 | Bit 1 | Reading Parameters | Accessing data in internal EEPROM. | None |
| Byte 1-2 | Bit 2 | Discrete Input #1 ON | #1 Discrete input state is True. | The True state can be when the contact is open or when closed, depending on User configuration of the discrete input function.<br><br>See Discrete Inputs Configuration |
| Byte 1-2 | Bit 3 | Discrete Input #2 ON | #2 Discrete input state is True. | |
| Byte 1-2 | Bit 4 | Discrete Input #3 ON | #3 Discrete input state is True. | |
| Byte 1-2 | Bit 5 | Discrete Input #4 ON | #4 Discrete input state is True. | |
| Byte 1-2 | Bit 6 | Discrete Input #5 ON | #5 Discrete input state is True. | |
| Byte 1-2 | Bit 7 | Manual Control Mode | Position demand is controlled via the<br>Service Tool manual operation. The normal control setpoint is ignored. | See Manual Position and Manual Operation |
| Byte 1-2 | Bit 8 | Speed Sensor OK | Not Used | See Speed Signal Fault |
| Byte 1-2 | Bit 9 | Low MPU Voltage Fault | Not Used | None |
| Byte 1-2 | Bit 10 | Shutdown Detected | The Driver is in Shutdown mode and is controlling the actuator/valve position at 0% position.<br><br>This is a summary fault status. Further investigation to the source of the shutdown diagnostic is required. | See Shutdown |
| Byte 1-2 | Bit 11 | Shutdown Position | The Driver is in Shutdown Position mode. All power to the actuator is disabled. If so equipped, the actuator is holding the valve on the seat using force provided from the return spring.<br><br>This is a summary fault status. Further investigation to the source of the shutdown diagnostic is required. | See Shutdown Position |
| Byte 1-2 | Bit 12 | Shutdown System | The Driver is in Shutdown System mode. All power to the actuator is disabled. If so equipped, the actuator is holding the valve on the seat using force provided from the return spring.<br><br>This is a summary fault status. Further investigation to the source of the shutdown diagnostic is required. | See Shutdown System |
| Byte 1-2 | Bit 13 | Alarm Condition Detected | A diagnostic condition has been detected which is configured as alarm.<br><br>This is a summary fault status. Further investigation to the source of the alarm diagnostic is required. | See Alarm |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 1-2 | Bit 14 | Discrete Output #1 Active | Discrete output #1 state is True. | The True state can occur when the detected contact is closed or open. See Discrete Output Configuration. |
| Byte 1-2 | Bit 15 | Discrete Output #2 Active | Discrete output #2 state is True. | |

Table A-4. PDO6 Byte 3-4 (Status Error Register 1)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 3-4 | Bit 0 | Main EEPROM Write Failed | Failure to write to the EPROM has Occurred. | See EEPROM Write Failed |
| Byte 3-4 | Bit 1 | Main EEPROM Read Failed | Failure to read from the EPROM has Occurred. | See EEPROM Read Failed |
| Byte 3-4 | Bit 2 | Parameter Error | Parameters do not match the Embedded Firmware version. | See Invalid Parameter(s) |
| Byte 3-4 | Bit 3 | Parameter Version Error | Parameter version does not match the Embedded Firmware version. | See Invalid Parameter Version |
| Byte 3-4 | Bit 4 | 5V Internal Supply Error | Internal 5 V supply is outside acceptable range. | See 5V Failed |
| Byte 3-4 | Bit 5 | 5V Internal REF Error | Internal 5 V Reference is outside acceptable range. | See 5V Reference Failed |
| Byte 3-4 | Bit 6 | 12V Internal Supply Error | Internal 12 V supply is outside acceptable range. | See 12V Failed |
| Byte 3-4 | Bit 7 | -12V Internal Supply Error | Internal -12 V supply is outside acceptable range. | See -12V Failed |
| Byte 3-4 | Bit 8 | ADC Error | The Analog/Digital Converter in the Core processor has stopped running. | See ADC Failed |
| Byte 3-4 | Bit 9 | SPI ADC Error | The external Analog/Digital Converter has stopped running. | See ADC SPI Failed |
| Byte 3-4 | Bit 10 | 5V Internal RDC Error | The RDC 5 V reference is outside acceptable range. | See 5V RDC Reference Failed |
| Byte 3-4 | Bit 11 | 1.8V Internal Supply Error | Internal 1.8 V supply is outside acceptable range. | See 1.8V Failed |
| Byte 3-4 | Bit 12 | 24V Internal Supply Error | Internal 24 V supply is outside acceptable range. | See 24V Failed |
| Byte 3-4 | Bit 13 | RDC DSP Communication Error | The DSP that computes the feedback positions has stopped running. | See RDC DSP Failed |
| Byte 3-4 | Bit 14 | AUX3 Shutdown Position | Annunciates that a Shutdown Position command has been invoked by an external relay or loss of brake power detected via the Aux 3 input. | See Aux 3 SD Position |
| Byte 3-4 | Bit 15 | Electrical Test Error | Only Used Internally for Production electrical test. | None |

Table A-5. PDO6 Byte 5-6 (Status Error Register 2)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 5-6 | Bit 0 | Power Up Reset | CPU has been reset by a power up event. | See Power-up Reset |
| Byte 5-6 | Bit 1 | Watchdog Reset | CPU has locked up or reset without a power up event. | See Watchdog Reset |
| Byte 5-6 | Bit 2 | Analog Input High Fault | Analog input is above the defined threshold - user configurable. | See Analog Input High Error |
| Byte 5-6 | Bit 3 | Analog Input Low Fault | Analog input is below the defined threshold - user configurable. | See Analog Input Low Error |
| Byte 5-6 | Bit 4 | Control Model Not Running | The start-up sequence of the DVP has been interrupted due to a | See Control Model Not Running |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| | | | detected fault and the final control state has not been reached. | |
| Byte 5-6 | Bit 5 | Manual Shutdown Position | The Shutdown Position mode has been invoked from the service tool. | See Shutdown Position |
| Byte 5-6 | Bit 6 | High Elect. Temperature Detected | The control board temperature has exceeded the maximum threshold. | See Electronics Temp. High |
| Byte 5-6 | Bit 7 | Low Elect. Temperature Detected | The control board temperature is below the maximum threshold. | See Electronics Temp. Low |
| Byte 5-6 | Bit 8 | Speed Sensor Failed | Not Used | See Speed Signal Fault |
| Byte 5-6 | Bit 9 | Low PWM Input Fault | The PWM signal duty cycle is lower than the defined threshold. | See PWM Duty Cycle Low |
| Byte 5-6 | Bit 10 | High PWM Input Fault | The PWM signal duty cycle is higher than the defined threshold. | See PWM Duty Cycle High |
| Byte 5-6 | Bit 11 | Low PWM Frequency Fault | The PWM signal frequency is lower than the defined threshold. | See PWM Frequency Low |
| Byte 5-6 | Bit 12 | High PWM Frequency Fault | The PWM signal frequency is higher than the defined threshold. | See PWM Frequency High |
| Byte 5-6 | Bit 13 | Manual Shutdown | A Shutdown has been invoked from the service tool. | See Shutdown |
| Byte 5-6 | Bit 14 | Position Error Shutdown – Motor Position Induced | Driver is in Shutdown mode due to motor position not tracking the position set point. | See Position Error Motor Shutdown |
| Byte 5-6 | Bit 15 | Position Error Shutdown Shaft (final element) Position Induced | Driver is in Shutdown mode due to the shaft (final element) position not tracking the position set point. | See Position Error Shaft Shutdown |

Table A-6. PDO6 Byte 7-8 (Status Error Register 3)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 7-8 | Bit 0 | DVP Heat Sink Temp Sensor Fault | The driver heatsink temperature sensor has failed. | See Driver Temp. Sensor Failed |
| Byte 7-8 | Bit 1 | High Driver Heat Sink Temp Alarm | The driver heatsink temperature has exceeded the defined warning threshold. | See Driver Temp. High |
| Byte 7-8 | Bit 2 | Low Driver Heat Sink Temp Alarm | The driver heatsink temperature is below the defined warning threshold. | See Driver Temp. Low Limit |
| Byte 7-8 | Bit 3 | Extreme Driver Heat Sink Temp | The driver heatsink temperature has exceeded the defined critical threshold. | See Driver Temp. High Limit |
| Byte 7-8 | Bit 4 | Low Internal Bus Voltage | The internal bus operating voltage sense has failed at low output. | Int. Bus Voltage Low |
| Byte 7-8 | Bit 5 | High Internal Bus Voltage | The internal bus operating voltage sense has failed at high output. | Int. Bus Voltage High |
| Byte 7-8 | Bit 6 | Input Voltage 1 Low | The Driver input voltage # 1 is less than the defined threshold. | See Input Voltage 1 Low |
| Byte 7-8 | Bit 7 | Input Voltage 1 High | The Driver input voltage # 1 is greater than the defined threshold. | See Input Voltage 1 High |
| Byte 7-8 | Bit 8 | Input Voltage 2 Low | The Driver input voltage # 2 is less than the defined threshold. | See Input Voltage 2 Low |
| Byte 7-8 | Bit 9 | Input Voltage 2 High | The Driver input voltage # 2 is greater than the defined threshold. | See Input Voltage 2 High |
| Byte 7-8 | Bit 10 | Low Input Current Sensor Fault | The input current sensor has failed at low output. | See Input Current Low |
| Byte 7-8 | Bit 11 | High Input Current Sensor Fault | The input current sensor has failed at high output. | See Input Current High |
| Byte 7-8 | Bit 12 | Phase A Input Current Sensor Low Fault | Phase A current sensor has failed at low output. | See Current Phase A Low |
| Byte 7-8 | Bit 13 | Phase A Input Current Sensor High Fault | Phase A current sensor has failed at high output. | See Current Phase A High |
| Byte 7-8 | Bit 14 | Phase B Input Current Sensor Low Fault | Phase B current sensor has failed at low output. | See Current Phase B Low |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 7-8 | Bit 15 | Phase B Input Current Sensor High Fault | Phase B current sensor has failed at high output. | See Current Phase B High |

## Transmit PDO 7 – Slow Message #6: Status Error Flags 4, 5, 13

Message type: Transmitted 10 ms after receipt of Receive PDO 2.
COB Id: 992+Node Id (0x3E0+NodeId)
Data length: 8 bytes

**Byte 1-2**: Status Error Register 4 (see table A-7 for bit definition)
**Byte 3-4**: Status Error Register 5 (see table A-8 for bit definition)
**Byte 5-6**: Status Error Register 6 (see table A-9 for bit definition)
**Byte 7-8**: Spare / not used

Table A-7. PDO7 Byte 1-2 (Status Error Register 4)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 1-2 | Bit 0 | No Power Board Found | Control board did not locate a power board after power up. | See No Power Board Found |
| Byte 1-2 | Bit 1 | Power Board ID Error | Power board was changed after Calibration. | See Power Board ID Error |
| Byte 1-2 | Bit 2 | Power Board Calibration Error | The power board was not calibrated correctly. | See Power Board Calib. Error |
| Byte 1-2 | Bit 3 | Driver Current Fault | One of the internal current monitors has detected a fault. | See Driver Current Fault |
| Byte 1-2 | Bit 4 | Startup Closed Fault Detected by Motor Position | The Motor 1 startup checks did not pass in the closing direction. | See Startup Close Motor Error |
| Byte 1-2 | Bit 5 | Startup Closed Fault Detected by Shaft (final element) Position | The Shaft (final element) start up checks did not pass in the closing direction. | See Startup Close Shaft Error |
| Byte 1-2 | Bit 6 | Startup Open Fault Detected by Motor Position | The Motor 1 startup checks did not pass in the opening direction. | See Startup Open Motor Error |
| Byte 1-2 | Bit 7 | Startup Open Fault Detected by Shaft (final element) Position | The Shaft (final element) start up checks did not pass in the opening direction. | See Startup Open Shaft Error |
| Byte 1-2 | Bit 8 | Startup Motor Direction Fault | The motor did not rotate or rotated in the wrong direction. | See Startup Motor Direction Error |
| Byte 1-2 | Bit 9 | Communication CPU Booting | Status indication that the communication processor is booting. | See M5200 Starting |
| Byte 1-2 | Bit 10 | Communication CPU Error Detected | Summary Fault – fault detected by the communication processor. | See M5200 Detected an Error |
| Byte 1-2 | Bit 11 | Communication CPU not found | The communication processor was not detected for a valve type that requires one. | See Aux Board Not Found |
| Byte 1-2 | Bit 12 | Communication CPU Type Fault | The communication processor is not correct for that version of DVP. | See Aux Board Type Error |
| Byte 1-2 | Bit 13 | Communication CPU Memory Fault | A Dual port ram error was detected during the RAM check of the communication processor. | See M5200 DPRAM Error |
| Byte 1-2 | Bit 14 | Communication CPU Timeout Fault | The communication processor did not start in the required time. | See M5200 Startup Timeout |
| Byte 1-2 | Bit 15 | Communication CPU Heartbeat Fault | Loss of the heartbeat signal from the communication processor. | See M5200 Heartbeat Error |

Table A-8. PDO7 Byte 3-4 (Status Error Register 5)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 3-4 | Bit 0 | Motor 1 Sine Error | Detected fault based on the Motor 1 Sine signal value. | See Motor 1 Sin Error |
| Byte 3-4 | Bit 1 | Motor 1 Cosine Error | Detected fault based on the Motor 1 Cosine signal value. | See Motor 1 Cos Error |
| Byte 3-4 | Bit 2 | Motor 1 Excitation Fault | Detected fault based on the combined values of the Motor 1 Sine and Cosine signals. | See Motor 1 Exc. Error |
| Byte 3-4 | Bit 3 | Shaft 1 Sine Error | Detected fault based on the shaft #1(final element) Sine signal value. | See Valve Shaft 1 Sin Error |
| Byte 3-4 | Bit 4 | Shaft 1 Cosine Error | Detected fault based on the shaft #1 (final element) Cosine signal value. | See Valve Shaft 1 Cos Error |
| Byte 3-4 | Bit 5 | Shaft 1 Excitation Fault | Detected fault based on the combined values of the Shaft #1 (final element) Sine and Cosine signals. | See Valve Shaft 1 Exc. Error |
| Byte 3-4 | Bit 6 | Shaft 2 Sine Error | Detected fault based on the shaft #2 (final element) Sine signal value. | See Valve Shaft 2 Sin Error |
| Byte 3-4 | Bit 7 | Shaft 2 Cosine Error | Detected fault based on the shaft #2 (final element) Cosine signal value. | See Valve Shaft 2 Cos Error |
| Byte 3-4 | Bit 8 | Shaft 2 Excitation Fault | Detected fault based on the combined values of the Shaft #2 (final element) Sine and Cosine signals. | See Valve Shaft 2 Exc. Error |
| Byte 3-4 | Bit 9 | Shaft 1 and Shaft 2 Fault | Faults detected in both Shaft 1 and Shaft 2. This is a summary fault, see individual diagnostics. | See Valve Shaft 1 and 2 Res. Error |
| Byte 3-4 | Bit 10 | Motor 2 Sine Error | Detected fault based on the Motor 2 Sine signal value. | See Motor 2 Sin Error |
| Byte 3-4 | Bit 11 | Motor 2 Cosine Error | Detected fault based on the Motor 2 Cosine signal value. | See Motor 2 Cos Error |
| Byte 3-4 | Bit 12 | Motor 2 Excitation Fault | Detected fault based on the combined values of the Motor 2 Sine and Cosine signals. | See Motor 2 Exc. Error |
| Byte 3-4 | Bit 13 | Start up Close Fault Detected by Shaft 1 (final element) Position | The Shaft 1 (final element) start up checks did not pass in the closing direction. | See Startup Close Valve Shaft 1 Error |
| Byte 3-4 | Bit 14 | Start up Close Fault Detected by Shaft 2 (final element) Position | The Shaft 2 (final element) start up checks did not pass in the closing direction. | See Startup Close Valve Shaft 2 Error |
| Byte 3-4 | Bit 15 | Motor 1 and Motor 2 Res Error | Both Motor feedback signals are determined to be faulted. This is a summary fault, see individual diagnostics. | See Position Sensor Diagnostics Motor 1 and 2 Res. Error |

Table A-9. PDO7 Byte 5-6 (Status Error Register 13)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 5-6 | Bit 0 | Heat Sink Temp. Sensor 1 Error (Only Applies to DVP 5000, 10000, or 12000 Models) | The #1 temperature sensor on the Heat Sink is out of range/faulted. | None - Replace DVP<br><br>See Heat Sink Temp. Sensor 1 Error |
| Byte 5-6 | Bit 1 | Heat Sink Temp. Sensor 2 Error (Only Applies to DVP 5000, 10000, or 12000 Models) | The #2 temperature sensor on the Heat Sink is out of range/faulted. | None - Replace DVP<br><br>See Heat Sink Temp. Sensor 2 Error |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 5-6 | Bit 2 | Fan 1 Speed Error | The #1 fan speed is out of range/faulted. | See Fan 1 Speed Error (Only Applies to DVP 5000, 10000, or 12000 Models) |
| Byte 5-6 | Bit 3 | Fan 2 Speed Error | The #2 fan speed is out of range/faulted. | See Fan 2 Speed Error (Only Applies to DVP 5000, 10000, or 12000 Models) |
| Byte 5-6 | Bit 4 | Boost Converter Error (Only Applies to DVP 5000, 10000, or 12000 Models) | A fault is detected within the DVP Boost system indicating the Boost Converter board did not reach the proper voltage. | None - Replace DVP.<br><br>See Boost Converter Error. |
| Byte 5-6 | Bit 5 | E-Stop 1 Tripped | The #1 SIL Shutdown contact input is open – Shutdown. | To Run, a closed contact must be applied across both SIL inputs. Check continuity at the input terminal block. Should be low impedance to run.<br><br>See E-Stop Tripped. |
| Byte 5-6 | Bit 6 | E-Stop 2 Tripped | The #2 SIL Shutdown contact input is open – Shutdown. | |
| Byte 5-6 | Bit 7 | Check 100 Percent Error | The Full Stroke start-up check has failed. | Verify that there is no jamming or blockage of the linkage attached to the actuator.<br><br>See Check 100 Percent Error. |
| Byte 5-6 | Bit 8 | Reduced Torque Error | This Fault status flag indicates the system torque has been reduced due a reduction in motor current. | See Reduced Torque Error. |
| Byte 5-6 | Bit 9 | Reduced Slew Rate Error | This status flag indicates the system slew speed has been reduced; current limiter on motor is activated. | See Reduced Slew Rate Error. |
| Byte 5-6 | Bit 10 | CAN Hardware ID Error | This status flag indicates an incorrect CAN Node ID address has been selected by the Discrete Inputs. | Correct wiring and power cycle the DVP to re-establish a correct CAN ID address.<br><br>See CAN Hardware ID Error |
| Byte 5-6 | Bit 11 | Linearization Monotonic Shutdown Error | The Linearization settings stored in the unit are not monotonically increasing and the unit will not begin operation until this fault is resolved by updating the Linearization settings. The X axis values must be continuously increasing. | Reset the values appropriately.<br><br>See Linearization Monotonic Shutdown Error. |
| Byte 5-6 | Bit 12 | CAN Controller Open Error | The CAN transceivers are not functioning, the CAN Controller peripheral was unable to be opened properly. | Power cycle the DVP. If the problem persists, replace the DVP.<br><br>See CAN Controller Open Error. |
| Byte 5-6 | Bit 13 | RESERVED | Reserved message – never active | None |
| Byte 5-6 | Bit 14 | RESERVED | Reserved message – never active | None |
| Byte 5-6 | Bit 15 | RESERVED | Reserved message – never active | None |

## Transmit PDO 8 – Slow Message #7: Status Error Flags 8, 9, 10

Message type: Transmitted 12 ms after receipt of Receive PDO 2.
COB Id: 1248+Node Id (0x4E0+NodeId)
Data length: **6** bytes

**Byte 1-2**: Status Error Register 8 (see table A-10 for bit definition)
**Byte 3-4**: Status Error Register 9 (see table A-11 for bit definition)
**Byte 5-6**: Status Error Register 10 (see table A-12 for bit definition)

Table A-10. PDO8 Byte 1-2 (Status Error Register 8)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 1-2 | Bit 0 | Auto Detect Error | The DVP failed to communicate with the valve/actuator ID module due to write or read problems or the calibration records in the ID module are corrupted. | Check cables between DVP and actuator.<br>Power Cycle DVP.<br><br>See Auto Detect Error. |
| Byte 1-2 | Bit 1 | Actuator ID Module Not Detected | During power up, indicates a failure to read the ID module on the valve/actuator system.<br><br>ID module calibration data corrupted, or the valve does not have an ID module. | Check cables between DVP and actuator.<br>Power Cycle DVP.<br>This is normal for some valve types.<br><br>See ID Module Not Detected. |
| Byte 1-2 | Bit 2 | Type / Serial Number Error | The detected serial number of the connected device is not consistent with the valve type currently loaded into the DVP.<br><br>User has connected a different valve to the DVP or has loaded a parameter set to the DVP that does not match this valve/actuator system serial number. | If a new unit was intentionally replaced, perform an auto-detect request. Manually verify the correct device is operating after completing a new auto detection.<br><br>See Type / Serial Number Error. |
| Byte 1-2 | Bit 3 | Incorrect Power Board | The actuator connected to the DVP is not compatible with the power board type (i.e., 24VDC actuator connected to 125VDC DVP). | Contact Woodward for compatibility information. A different DVP or actuator is likely required.<br>See Incorrect Power Board. |
| Byte 1-2 | Bit 4 | Valve Type Not Supported | The actuator/valve which is connected to the DVP is newer than the firmware loaded on the DVP. | See instructions for software updates.<br>Contact Woodward for support.<br><br>See Type Not Supported. |
| Byte 1-2 | Bit 5 | Dual Res. Difference Alarm | The readings between the two motor commutation resolvers differs by an amount larger than the alarm threshold for a given valve type. Performance is generally not adversely affected. | Monitor the difference between the two motor resolvers, if the error grows, consider contacting Woodward for a spare actuator/valve.<br><br>See Dual Res. Difference Alarm. |
| Byte 1-2 | Bit 6 | Dual Res. Difference Shutdown | The readings between the two motor commutation resolvers | Contact Woodward for a spare actuator/valve. |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| | | | differs by an amount larger than the shutdown threshold for a given valve type. Performance is adversely affected; the actuator may not operate reliably. | See Dual Res. Difference Shutdown. |
| Byte 1-2 | Bit 7 | Valve Shaft 1 Range Limit Error | The reading of the valve or actuator primary final element position sensor is out of range. | If possible, maintain operation without power cycling the DVP. Contact Woodward for a spare actuator/valve.<br><br>See Valve Shaft 1 Range Limit Error or Valve Shaft 2 Range Limit Error. |
| Byte 1-2 | Bit 8 | Valve Shaft 2 Range Limit Error | The reading of the valve or actuator secondary final element position sensor is out of range. | |
| Byte 1-2 | Bit 9 | Position Error Alarm - Motor | The position of the actuator is not following the demand signal within the control window allowed by the DVP (as measured by the motor position sensors). | Evaluate the impact on the controlled process. Check for other alarms indicated by the DVP and at the system level. This indicates a serious problem with the valve/actuator or driven equipment. Serious damage or injury may result.<br><br>See Position Error Motor Alarm or Position Error Shaft Alarm. |
| Byte 1-2 | Bit 10 | Position Error Alarm - Shaft | The position of the actuator is not following the demand signal within the control window allowed by the DVP (as measured by the final element position sensor(s)).<br><br>There is an error larger than the position error alarm parameters between the shaft position and the demanded position. Excessive Valve/Actuator Wear. | |
| Byte 1-2 | Bit 11 | Digital Comm. Network 1 Error | A communications error is detected on the primary digital communication link (CAN 1). | Check the communication status and operation of the equipment communicating with the DVP.<br>Check thermal conditions at control equipment.<br>See Digital Com 1 Error or Digital Com 2 Error. |
| Byte 1-2 | Bit 12 | Digital Comm. Network 2 Error | A communications error is detected on the secondary digital communication link (CAN 2). | |
| Byte 1-2 | Bit 13 | Digital Comm. Error - All | Both primary and secondary communication links are detected as failed. | See Digital Com 1 & 2 And/Or Analog Backup Error |
| Byte 1-2 | Bit 14 | Digital Comm. Vs Analog Tracking Alarm | The position demand provided via the analog control signal does not match the digital demand signal within the alarm tracking window allowed by the DVP. | Check thermal conditions at control equipment.<br><br>When equipment can be brought down for service, check calibration of the analog source and DVP.<br><br>See Digital Com Analog Tracking Alarm. |
| Byte 1-2 | Bit 15 | Digital Comm. Vs Analog Tracking Shutdown | The position demand provided via the analog control signal does not match the digital demand signal within the shutdown tracking window allowed by the DVP. | See Digital Com Analog Tracking Shutdown. |

Table A-11. PDO8 Byte 3-4 (Status Error Register 9)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 3-4 | Bit 0 | Startup Close Motor 2 Error | This indicates the Motor 2 resolver did not fall within the startup min limit range. | See Startup Close Motor Error |
| Byte 3-4 | Bit 1 | Startup Open Motor 2 Error | This indicates the Motor 2 resolver did not fall within the startup max limit range. | See Startup Open Motor Error |
| Byte 3-4 | Bit 2 | Startup Motor 2 Direction Error | This indicates the Motor 2 resolver did not rotate sufficiently or rotated in the incorrect direction. | See Startup Motor Direction Error |
| Byte 3-4 | Bit 3 | Startup Max Check Shaft 1 Failed | This indicates the primary final element position sensor (shaft 1), or the secondary final element position sensor (shaft 2) did not fall within the startup max limit range. | See Startup Open Valve Shaft 1 Error |
| Byte 3-4 | Bit 4 | Startup Max Check Shaft 2 Failed | | See Startup Open Valve Shaft 2 Error |
| Byte 3-4 | Bit 5 | ID Module Version Not Supported | The version of the ID module is not supported by the DVP to which it is connected. | Contact Woodward for actuator/valve/DVP compatibility.<br><br>See ID Module Version Not Supported |
| Byte 3-4 | Bit 6 | Dual DVP Inter Com CAN Error | In a dual DVP system configuration, the synchronization link over CAN is in-operable | Check the CAN wiring between the DVP's. Ensure that the termination jumper is properly installed.<br><br>See Dual DVP Inter. Com. CAN Error |
| Byte 3-4 | Bit 7 | Dual DVP Inter Com RS485 Error | In a dual DVP system configuration, the synchronization link over RS485 is in-operable. | Check the RS485 wiring between the DVP's.<br><br>See Dual DVP Inter. Com. RS485 Error |
| Byte 3-4 | Bit 8 | Dual DVP Inter Com CAN & RS485 Error | In a dual DVP system configuration, both synchronization link over CAN and RS485 are in-operable. | Check to ensure that both DVP's are powered and there are no other primary electronics faults active.<br>If no other faults are detected, replace DVP.<br><br>See Dual DVP Inter. Com. CAN & RS485 Error |

| | | | | |
|---|---|---|---|---|
| Byte 3-4 | Bit 9 | Dual DVP All Inputs Lost | In a dual DVP system configuration, there are no valid control setpoint signals being received by either device. | Check interface wiring and devices connected to the DVP. Ensure they are operational. This is likely not a DVP problem.<br><br>See Dual DVP All Inputs Lost |
| Byte 3-4 | Bit 10 | Dual DVP Valve Type Match Error | In a dual DVP system configuration, the actuator valve types controlled by the DVP's do not match or are otherwise incompatible. | Check the control wiring between the DVP and the actuator. Ensure that the connected devices match.<br><br>See Dual DVP Valve Type Match Error |
| Byte 3-4 | Bit 11 | RESERVED | Reserved message – never active | None |
| Byte 3-4 | Bit 12 | Power Board FPGA Error | On High Output DVP's, the FPGA interface between the control electronics assembly and power electronics assembly is in-operable.<br><br>This indicates there has been problem in the FPGA chip on the Power board. | None - Replace DVP<br><br>See Power Board FPGA Error |
| Byte 3-4 | Bit 13 | Current Diagnostics 1 Active | The actuator drive current has exceeded the Set 1 alarm level and timeout threshold | Monitor the actuator current as the unit is in operation. At an appropriate service interval, perform a full stroke check. Ensure the driven equipment is not binding.<br><br>Set the 2nd and 3rd level alarms to monitor further degradation.<br><br>Contact Woodward for additional information and monitoring advice.<br><br>See Current Diagnostic 1/2/3 |
| Byte 3-4 | Bit 14 | Current Diagnostics 2 Active | The actuator drive current has exceeded the Set 2 alarm level and timeout threshold | |
| Byte 3-4 | Bit 15 | Current Diagnostics 3 Active | The actuator drive current has exceeded the Set 3 alarm level and timeout threshold | |

Table A-12. PDO8 Byte 5-6 (Status Error Register 10)

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 5-6 | Bit 0 | Zero Cutoff Active | This is a status enunciation only. This bit is active when the actuator is operating in the zero-cutoff mode | Status Only |
| Byte 5-6 | Bit 1 | ID Module Parameter Error | The parameter configuration of the ID module is not consistent with the required DVP definition to which it is connected. | Contact Woodward for compatibility information. A different DVP or actuator is likely required.<br><br>See ID Module Version Not Supported |
| Byte 5-6 | Bit 2 | ID Module Version Not Supported | The parameter version of the ID module is not consistent with the required DVP definition to which it is connected. | |
| Byte 5-6 | Bit 3 | ID Module Read Failed | A memory read failure was detected during communication with the ID module. | Check the wiring between the DVP and the actuator. If the |

| Status Byte | Bit | Status Name | Description | Troubleshooting Guide |
|---|---|---|---|---|
| Byte 5-6 | Bit 4 | ID Module Write Failed | A memory write failure was detected during communication with the ID module. | problem cannot be corrected, contact Woodward for arrangement of a replacement actuator/valve. |
| Byte 5-6 | Bit 5 | Internal Critical Fault (shutdown not external) | An internally generated shutdown has occurred | Summary diagnostic only. Check other DVP diagnostics for shutdown conditions. |
| Byte 5-6 | Bit 6 | Valve Type Auto-detect requested | Status indication that a valve type auto-detect sequence was requested. | Status Only |
| Byte 5-6 | Bit 7 | Analog Primary – Digital backup | The current operating condition is digital communication with analog demand primary | Status Only |
| Byte 5-6 | Bit 8 | Digital primary – Analog Backup | The current operating condition is digital communication with analog demand backup | Status Only |
| Byte 5-6 | Bit 9 | CAN demand tracking settings enabled (delta between position command signals) | DVP using settings from CAN. DVP received a CAN command to enable a CAN setpoint tracking error settings change (see RPDO1 Command Byte 1, RPDO2 and RPDO4). | Status Only |
| Byte 5-6 | Bit 10 | CAN feedback difference error settings enabled (delta between dual feedback signals) | DVP using settings from CAN. DVP received a CAN command to enable a resolver difference error settings change (see RPDO1 Command Byte 1, RPDO3 and RPDO5). | Status Only |
| Byte 5-6 | Bit 11 | CAN position error settings enabled (delta between commanded and actual position) | DVP using settings from CAN. DVP received a CAN command to enable a position error settings change (see RPDO1 Command Byte 1, RPDO6, RPDO7 and RPDO8). | Status Only |
| Byte 5-6 | Bit 12 | Dual feedback signal difference error disabled | Status indication that the resolver difference error is disabled. | This indication is for secondary diagnostics and tracking history only. It is not recommended that the resolver difference error be dis-abled in normal service. |
| Byte 5-6 | Bit 13 | Dual DVP slow mode active | In a dual DVP installation, a single DVP has faulted, or fault condition has been detected requiring a reduced velocity to minimize unbalanced load on the driven system. | This condition is intended to be for short term operation only. At the earliest available opportunity, shutdown the system, troubleshoot the failed DVP/actuator based on the displayed diagnostics and restore normal operation |
| Byte 5-6 | Bit 14 | Reduced slew rate active | Status indication that the slew rate has been reduced due to input current limiting. | Status Only |
| Byte 5-6 | Bit 15 | RESERVED | Reserved message – never active | None |

# CANopen Objects

The following section provides information on the CANopen objects supported by the DVP. The product EDS file (Woodward part number 9927-1518) is available for download on the Woodward website ([www.woodward.com](http://www.woodward.com)).

Table A-13. CANopen Standard Objects supported

| Parameter | Object | Access | Type |
|---|---|---|---|
| NMT | **0** | **WO** | **U16** |
| EMCY | 80+NID | | |
| Device Type | 1000 | RO | uint32 |
| Error Register | 1001 | RO | uint8 |
| COB-ID SYNC | 1005 | RO | uint32 |
| Manufacturer Device Name | 1008 | RO | string |
| Producer Heartbeat (ms) | 1017 | RO | uint16 |
| Identity<br>Vendor ID (1)<br>Product Part Number (2)<br>Product Revision (3)<br>Product Serial Number (4)<br>Valve Part Number (5)<br>Valve Revision (6)<br>Valve Serial Number (7)<br>Valve Type (8) | 1018 | RO | uint32 |

## Object 1000 – Device Type
Requests of the device type always returns a 0, indicating the DVP does not follow a standardized device profile. Access: read-only.

## Object 1001 – Error Register
Error register, part of the Emergency object. Access: read-only.

## Object 1005 – COB-ID SYNC
Requests of this object always returns a constant value of 0x80. Access: read-only.

## Object 1008 – Manufacturer Device Name
String indication of the device name. Returns a constant value of 'DVP1'. Access: read-only.

## Object 1017 – Producer Heartbeat Time
Producer heartbeat time indicates the configured cycle time of the heartbeat. A value of 0 indicates a disabled heartbeat. Access: read-only.

## Object 1018 – Identity Object
Provides the following sub-indexes, all are read-only access and data type uint32:

> SubIndex 0: Number of Entries
> SubIndex 1: Vendor Id (0x0170 for Woodward)
> SubIndex 2: Product Code (Woodward product part number, xxxx-xxxx is represented as xxxxxxxx (no dash)
> SubIndex 3: Product Revision Number

The higher 2 bytes represent the CAN major revision (e.g. 1, 2, 3) and the lower 2 bytes represent the DVP part number revision. The DVP revision level represents the Woodward product part number revision where 1=rev NEW or -, 2=rev A, 3=rev B, etc. Values of 100 or higher indicate a preliminary revision (101=rev 1, 102=rev 2).

> SubIndex 4: Product Serial Number (Woodward DVP product serial number).
> SubIndex 5: Valve Product Code (Woodward valve product part number).

> SubIndex 6: Valve Revision number (Woodward valve product revision number).
Valve revision level represents the Woodward valve part number revision where 1=rev NEW or -, 2=rev A, 3=rev B, etc. Values of 100 or higher indicate a preliminary revision (101=rev 1, 102=rev 2, etc).
> SubIndex 7: Valve Serial number (Woodward valve product serial number).
> SubIndex 8: Valve Type number (Woodward valve type number).

## Manufacturer Objects

The following table lists the available objects that are not mapped to PDOs. Objects 2022 thru 2048 are mapped and are shown in tables A-1 and A-2. These are internal data objects (IDOs) accessible by SDO services.

Table A-14. Unmapped Manufacturer Objects

| Parameter | Object | Access | Type | Units | Scaling |
|---|---|---|---|---|---|
| Valve Product Code (Part Number) | 2049 | RO | uint32 | none | none |
| Valve Revision Number | 204A | RO | uint32 | none | none |
| Valve Serial Number | 204B | RO | uint32 | none | none |

# Appendix B
# Power Down Procedure

This procedure is to power down the Woodward DVP System before performing any maintenance. Follow your local power shutdown procedure to safely turn off the turbine for any maintenance.

| | |
|---|---|
| **⚠WARNING**<br>**Power Down** | **Follow your local power shutdown procedure to safely turn off the power to the turbine for any maintenance.** |

| | |
|---|---|
| **⚠WARNING**<br>**Power Down** | **Follow your plant power lockout/tagout procedures to ensure before any employee performs any servicing or maintenance on the DVP where the unexpected energizing, startup or release of stored energy could occur and cause injury.** |

| | |
|---|---|
| **⚠WARNING**<br>**Power Down** | **The following may occur if you do not observe the danger information given:**<br>• **Damage to material assets**<br>• **Severe personal injury**<br>• **Death** |

## Normal Power Down

The following procedure is to be followed whenever service engineers perform routine maintenance. The procedure is designed to safely power down the Woodward DVP Driver.

## DVP Driver Power Down Procedure

1. Follow your local power shutdown procedure to safely turn off the power to the turbine for any maintenance. Verify that local procedures were completed correctly.
2. Open the main power switch (breaker) to the DVP. In the case of power redundancy, ensure both main switches (breaker) are open.
3. Measure the voltage at the DVP input power terminal to confirm the voltage read approximately 0 volts.
4. Remove the input power terminal from the DVP.
5. Disconnect the actuator cable from the DVP.

# Appendix C. Glossary of Terms

## Numerical Terms

| Term | Definition/Description |
|---|---|
| **+12V Failed** | Internal +12 V is outside acceptable range of 10.6 V to 15.8 V. Internal electronics failure. |
| **–12V Failed** | Internal –12 V is outside acceptable range of –13.7 V to –8.6 V. Internal electronics failure. |
| **1.8V Failed** | Internal 1.8 V is outside acceptable range of 1.818 V to 2.142 V. Internal electronics failure. |
| **24V Failed** | Internal +24 V is outside acceptable range of 22.1 V to 30.7 V. Internal electronics failure. |
| **5V Failed** | Internal 5 V is outside acceptable range of 4.86 V and 6.14 V. Internal electronics failure. |
| **5V RDC Reference Failed** | Internal 5 V RDC reference is outside acceptable range. Internal electronics failure. |
| **5V Reference Failed** | Internal 5 V reference is outside acceptable range. Internal electronics failure. |

## A

| Term | Definition/Description |
|---|---|
| **Actuator Type Selection Diagnostics** | In case of a process fault during the Valve Type Selection Process this group shows the appropriate process fault flags |
| **Actuator Type Selection Diagnostics ID Module Not Detected** | During power up, the control model the ID Module cannot be read. Failure to read the ID module on the valve/actuator system. ID module calibration record corrupted. The valve does not have an ID module. |
| **Actuator Type Selection Diagnostics ID Module Version Not Supported** | During power up, the ID Module version was detected as incompatible with the current version of DVP firmware. |
| **Actuator Type Selection Process** | This indicator group gives an overview of the current status of the Valve Type Selection Process. The progress of the auto-detection process is displayed as a percent value. |
| **ADC Failed** | Internal ADC in processor core has stopped running. Internal electronics failure. |
| **ADC SPI Failed** | External ADC in processor core has stopped running. Internal electronics failure. |
| **Analog Input Configuration** | A section within the Input Configuration and Setpoint Source Configuration screens that contains several readable and user configurable fields including Mode Selection Analog Input Scaling and Diagnostic Ranges. |
| **Analog Input Configuration Mode Selection** | User configurable setting that may be turned off or select voltage input or milliamp input. |
| **Analog Input Demand** | This indicator group gives an overview of the Analog Input signal and valve position information. The analog input demand signal from the control system scaled 0 to 100%. |
| **Analog Input Demand Analog Position Demand** | This displays the position that is being demanded by the Analog Input. |
| **Analog Input Demand Analog Input High** | The analog input is above the diagnostic threshold. This is a user configurable parameter. |
| **Analog Input Demand Analog Input Low** | The analog input is below the diagnostic threshold. This is a user configurable parameter. |

| | |
|---|---|
| **Analog Input Scaling** | This group gives the input scaling information for 4-20 mA or 0-5V analog inputs. |
| **Analog Output** | *Driver Output Data-Demanded Current* |
| **Analog Output Configuration** | A section within the Analog Output Configuration screen that contains several readable and user configurable fields including mode selection and analog output scaling ranges. |
| **Analog Output Configuration Mode** | This displays the current Analog Output Mode; Off, Actual Position (valve position), Echo Setpoint (demanded position) or Motor Current The user may select from any of these configuration modes. |
| **Analog Output Position Scaling Max. Current Value** | This allows setting of the maximum current that will represent the maximum position value (Position at Maximum Current Value) or maximum motor current (Motor Current at Maximum Current Value). |
| **Analog Output Position Scaling Min. Current Value** | This allows setting of the minimum current that will represent the Minimum position value (Position at Max. Current Value) |
| **Analog Output Motor Current, Motor Current at Max. Current Value** | This allows setting of the maximum motor current value that is correlated to the Analog Output Position Scaling Maximum Current Value |
| **Analog Output Motor Current, Motor Current at Min. Current Value** | This allows setting of the minimum motor current value that is correlated to the Analog Output Position Scaling Minimum Current Value |
| **Analog Output Position Scaling Position at Max. Current Value** | This allows setting of the maximum position that is correlated to the Analog Output Position Scaling Maximum Current Value |
| **Analog Output Position Scaling Position at Min. Current Value** | This allows setting of the minimum position that is correlated to the Analog Output Position Scaling Minimum Current Value |
| **Analog Output Status Demanded Current** | This displays the actual analog output current value from the DVP in mA. |
| **Analog Values** | The DVP section of the Status Overview Service Tool screen which displays the real time status of the DVP current, voltages, and temperatures. |
| **Auto Detect Error** | This diagnostic is only enabled when the DVP has been configured for auto detection (See Auto detection Section). This diagnostic is set when: The DVP fails to communicate with the ID module due to write or read problems or the calibration records in the ID module are corrupted (CRC16 failure). The DVP fails to write the calibration records into the non-volatile memory. Failure to read the ID module on the valve/actuator system. ID module calibration record corrupted. DVP non-volatile memory error. |
| **Auto Detection Control** | This indicator group contains Type/Serial Number Error and Type Not Supported status flags and the Auto Detection Request button. |
| **Aux Board Not Found** | The Control board has not detected the Aux Board. The selected input type requires an Aux board, and no Aux board is present. |
| **Aux Board Type Error** | The Control board has detected an incorrect Aux Board type. This occurs when the aux board needed, and the input type selected are not compatible. |
| **AUX 3 SD Position** | This status flag is set when Discrete Input 3 is set and the Discrete Input Action Mode is set to Aux3 SD+Reset. When this Status Flag is set the DVP is in Shutdown Position |

## B

| Term | Definition/Description |
|---|---|
| **Baud Rate** | The number of times per second a signal makes a transition between states and indicates the number of bits per second that are transmitted. |
| **BLDC2 State** | This indicates whether the BLDC2 control model is Running or Not Running. When in Running the DVP is controlling the position of the valve based on the Position Demand |

| | |
|---|---|
| **Boost Converter Error** | This status flag indicates the Boost Converter board did not reach the proper voltage (Only applies to DVP 5000, 10000, and 12000). |

## C

| Term | Definition/Description |
|---|---|
| **CAN Controller Open Error** | The CAN Controller peripheral was unable to be opened properly. This may occur if the user is changing the CANopen settings (particularly selecting a lower baud rate) while connected to an active CAN network. |
| **CAN Hardware ID Error** | This status flag indicates an incorrect CAN Node ID address has been entered through the Discrete Input connector. This is only true if CAN Hardware ID Mode = CAN HW ID DISCRETE IN-DI5,DI4,DI2,DI1 or CAN HW ID DISCRETE IN-DI5,DI4,DI3 or CAN HW ID DISCRETE IN-DI5,DI4 |
| **CAN Hardware ID Mode** | A user configurable menu where Disabled and three combinations of communications settings which may be selected by hardware ID. |
| **CANopen** | A setpoint source which sets the setpoint signal type of CANopen based protocol using 1 or 2 CAN Ports. Optional use Analog back-up (available if using 1 CAN port). |
| **CANopen Dual Configuration** | A section of the Input Configuration screen that is enabled when CAN Open Digital Input is the selected Input Source and CANopen Dual is the communications option. Baud Rate, Port 1 and 2 Node IDs, Timeout interval, and Extended PDO status are displayed. |
| **CANopen Dual Configuration Port 1 Node ID** | This indicates what Node ID is selected for CAN input 1. It is configurable by the user |
| **CANopen Dual Configuration Port 2 Node ID** | This indicates what Node ID is selected for CAN input 2. It is configurable by the user |
| **CANopen Dual Configuration Timeout** | Represents the maximum time allowed between CAN messages. If exceeded the affected port alarm will be activated. |
| **CANopen Redundancy Manager Parameters** | This is a display only section of the CANopen Demand Configuration section of the Input Configuration screen when CAN Open Digital Input is the selected Demand Input source. It shows the parameters that are associated with difference between CAN 1 and CAN 2 demand signals. |
| **Check 100 Percent Error** | This status flag indicates the 100 % position check has failed. |
| **Configuration and Calibration** | Screen within the Service Tool that is used when manual configuration of the DVP to a specific actuator or valve is required. |
| **Control Model Not Running** | This status flag indicates the Control Model is not Running. The position of the Actuator/valve is not controlled by the DVP. If Actuator/valve has a return spring, the actuator/valve is be positioned by the return spring. |
| **Controller Identification** | A section of the Service Tool Identification screen which displays information on the controller including Part Number, Revision, and Serial Number. |
| **Current Diagnostic** | This feature allows the user to turn the mode on or off and when on will display the limits of three sets of diagnostics. |
| **Current Diagnostic Setting** | This shows the operational state of the Current Diagnostic Mode. |
| **Current Phase A High** | The phase A current sensor is at max output. |
| **Current Phase A Low** | The phase A current sensor is at min output. |
| **Current Phase B High** | The phase B current sensor is at max output. |
| **Current Phase B Low** | The phase B current sensor is at min output. |
| **Current Setting** | Displays motor current demand settings for Valve/Actuator startup checks |

# D

| Term | Definition/Description |
|---|---|
| **Demand Input Filter Configuration** | This group contains the settings for the setpoint filter, and the Mode Selection is user configurable. |
| **Demand Input Filter Settings** | These user configurable settings allow selection which input demand filters are enabled; Filter Off, Bandwidth Filter, Noise Filter, Bandwidth and Noise Filter, Slew Rate Filter, Slew Rate Filter and BW Filter, Slew Rate Filter and Noise Filter, Slew Rate Filter, BW and Noise Filter This also displays the break frequency of the Bandwidth filter. The DVP includes a demand signal filter. |
| **Demand Input Filter Settings Bandwidth (Corner Frequency)** | This displays the break frequency of the Bandwidth filter and is user configurable to set the Input Filter Bandwidth Corner Frequency (Hz). |
| **Demand Input Filter Settings Damping Factor** | This displays the damping factor of the Bandwidth filter, which changes the BW filter from under damped response, to a critically damped response or to an over damped response. This is a user configurable Input Filter Damping Factor Setting. |
| **Demand Input Filter Settings Mode Selection** | This displays which input demand filters are enabled; Filter Off, Bandwidth Filter, Noise Filter, Bandwidth and Noise Filter, Slew Rate Filter, Slew Rate Filter and BW Filter, Slew Rate Filter and Noise Filter, Slew Rate Filter, BW and Noise Filter. These are user configurable mode selections. |
| **Demand Input Filter Settings Noise Suppression Threshold** | This displays the threshold above which the Noise Filter does not suppress the Input Demand signal. |
| **Demand Input Filter Settings Noise Supp. Gain (Below Threshold)** | This displays the gain of the noise filter when below the Noise Suppression Threshold. |
| **Demand Input Filter Settings Slew Rate** | This displays the maximum rate the Demand Input will be allowed to change internal to the unit. Demand Input signals exceeding this rate will be internally ramped at the defined rate until achieving the Demand Input. |
| **Demand Input Source** | This displays where the position demand originates; Manual Position, Analog Input, EGD Digital Input, PWM Input, Function Generator, or CAN Open Digital Input. |
| **Demand Position Difference Alarm Delay** | This is the time delay before an alarm will be set (Ratio of 1-to-3). |
| **Demand Position Difference Alarm Limit** | This is the maximum allowed difference between Set Position from “Analog Input and CAN Port 1” or “CAN Port 1 and CAN Port 2” depending on the current mode. Alarm will be activated if difference is exceeded for longer than the Demand Position Difference Alarm Delay. |
| **Demand Position Difference Shutdown Limit** | This is the maximum allowed difference between Set Position from “Analog Input and CAN Port 1” or “CAN Port 1 and CAN Port 2” depending on the current mode. Shutdown will be activated if difference is exceeded for longer than the Demand Position Difference Shutdown Delay. |
| **Demand Position Difference Shutdown Delay** | This is the time delay before a shutdown will be set (Ratio of 1-to-3). |
| **Diagnostic Ranges** | The Diagnostic Ranges are those settings used to detect that a Demand Position from the interface is valid (Position Demand Low Point, Position Demand High Point). |
| **Digital Com 1 Error** | This status Flag indicates when the CAN 1 Input is bad. |
| **Digital Com 2 Error** | This status Flag indicates when the CAN 2 Input is bad. |
| **Digital Com 1 & 2 and/or Analog Backup Error** | This error occurs if both demand input sources have failed (CAN 1 and 2 if Dual CANopen mode or CAN 1 and Analog Input if CANopen with Analog Backup mode). |
| **Digital Com Analog Tracking Alarm** | The CAN demand and Analog Input demand do not match as defined by Demand Position Difference Alarm Limit and Demand Position Difference Alarm Delay. |

| | |
|---|---|
| **Digital Com Analog Tracking Shutdown** | The CAN demand and Analog Input demand do not match as defined by Demand Position Difference Shutdown Limit and Demand Position Difference Shutdown Delay. |
| **Discrete Inputs Action** | This displays the configuration of the Discrete inputs; Off, Shutdown Reset/Reset, Aux 3, Aux3 SD+Reset, Shutdown Reset/Reset FAST. |
| **Discrete Input Functional Status** | These status lights indicate whether a Discrete Input has been set. |
| **Discrete Inputs Configuration** | This tool provides you the ability to select the behavior of the 5 Discrete Inputs (DI1, DI2, DI3, DI4, and/or DI 5). Each of these options are available with each selection on the dropdown menu except for Turned Off. |
| **Discrete Output Configuration** | The main configuration of the discrete outputs is performed on this page. Each of the discrete outputs is configured in the same manner. Each of the two discrete outputs can be configured to activate (or de-activate) upon detection of any of fault conditions monitored by the DVP. |
| **Discrete Output Status** | These status lights indicate whether a Discrete Output has been set. |
| **Driver** | This Service Tool screen displays I/O State Discrete Input and Output status and Driver Input and Output Data in real time. |
| **Driver Current Fault** | The Driver fault status flag is detected by monitoring the currents in the driver output stages. |
| **Driver Temp. High** | The heat sink temperature is above 115° C. |
| **Driver Temp. High Limit** | The heat sink temperature is above 130° C. |
| **Driver Temp. Low Limit** | The heat sink temperature is below –45° C. The ambient temperature of the driver is below specification. |
| **Driver Temp. Sensor Failed** | The temperature sensor is at min or max. The temperature sensor has failed. |
| **Dual Res. Difference Alarm** | The difference between the resolver readings is larger than the permissible alarm limit values specific to the valve/actuator serial number. One or both resolvers have moved. There is an electrical problem with the resolver and/or its associated circuits resulting in an incorrect resolver reading. |
| **Dual Res. Difference Shutdown** | The difference between the resolver readings is larger than the permissible shutdown limit values specific to the valve/actuator serial number. |
| **Dual DVP Status** | The DVP has an option to operate in a dual redundant mode where two actuators are controlled by DVPs connected in a dual redundant configuration. Connection to the actuator is shown in the specific actuator manual. This page displays CANopen Mode, Dual DVP Diagnostics and Dual DVP Configuration. The status information will only display if the connected valve/actuator is a Dual DVP valve type. |
| **Duty Cycle (Function Generator)** | This value defines the ratio of low time to high time when the Wave Pattern is SQUARE WAVE. |
| **DVP Driver Output Information** | This displays the driver output current information; real time. |
| **DVP I/O State** | A section of the Status Overview Service Tool screen which displays five Discrete Input Functional Status indications and two Discrete Output Status indications. |
| **DVP Temperatures** | These real-time measurements display the temperature of DVP Control Board or DVP Power Board in units of Celsius. |

# E

| Term | Definition/Description |
|---|---|
| **EEPROM Read Failed** | After multiple retries and data comparison, the software is not able to read from the non-volatile memory. Internal electronics failure. |
| **EEPROM Write Failed** | After multiple retries and data comparison the software is not able to write to the non-volatile memory. Internal electronics failure. |
| **EGD** | Ethernet Global Data (EGD) is a communications protocol developed by General Electric in 1998. EGD allows a device (the Producer) to transfer data to other devices (the Consumers) on the communications network. |
| **EGD Data Mismatch** | A fault which occurs if the corresponding variables from all nonfaulted input channels do not match. This function is disabled if the EGD Fault is set to TRUE and is monitored for troubleshooting purposes only. |
| **EGD Diagnostics** | Service Tool Screen where up to three EGD ports may be monitored, and error alarms causes may be diagnosed and solutions to extinguish alarms may be determined. |
| **EGD Digital Input** | A setpoint source which sets the setpoint signal type which is UDP based Ethernet signal using the EGD protocol; |
| **EGD Fault** | Dependent on the EGD mode: 3 port, 2 port, or 1 port this flag indicates the data required to provide a set position to the DVP is missing. The EGD mode selection is set to more ports than supported with the control system. There are other error flags active: See associated troubleshooting steps for each error flag. |
| **EGD L2 Port 0 Stat Error** | The Ethernet interface is not communicating status information. DVP internal electronics failure. |
| **EGD L2 Port 1 Stat Error** | The Ethernet interface is not communicating status information. DVP internal electronics failure. |
| **EGD L2 Port 2 Stat Error** | The Ethernet interface is not communicating status information. DVP internal electronics failure. |
| **EGD L2 Port 3 Stat Error** | The Ethernet interface is not communicating status information. DVP internal electronics failure. |
| **EGD Performance** | Service Tool Screen which the user may monitor the performance of up to three EDG channels. The screen also contains buttons to open the EGD Diagnostics and Input Configuration screens directly from the EGD Performance screen. |
| **EGD Port 1 Link Error** | The EGD messages are received slower than the time out time that is a user setting. Wiring problem on Ethernet port 1. Control system not powered up. IP addresses incorrect. |
| **EGD Port 1 Long Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 1 Short Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 1 Stale Data Error** | The Application Level Heart Beat variable has not changed in time period greater than the stale data delay time. Data from the producer is not being updated (stale) in the EGD packet. |
| **EGD Port 2 Link Error** | The EGD messages are received slower than the time out time that is a user setting. Wiring problem on Ethernet port 2. Control system not powered up. IP addresses incorrect. |
| **EGD Port 2 Long Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 2 Short Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 2 Stale Data Error** | The Application Level Heart Beat variable has not changed in time period greater than the stale data delay time. Data from the producer is not being updated (stale) in the EGD packet. |
| **EGD Port 3 Link Error** | The EGD messages are received slower than the time out time that is a user setting. Wiring problem on Ethernet port 3. Control system not powered up. IP addresses incorrect. |

| | |
|---|---|
| **EGD Port 3 Long Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 3 Short Message Error** | The EGD message length expected is not the same as the one received. Incorrect protocol definition. |
| **EGD Port 3 Stale Data Error** | The Application Level Heart Beat variable has not changed in time period greater than the stale data delay time. Data from the producer is not being updated (stale) in the EGD packet. |
| **EGD Rate Group Slip** | If the M5200 does not have the time to finish the task within the rate group. This will also give a heartbeat error flag. |
| **EGD Revision Fault** | Revision check of external and internal EGD protocol revision. The revision of the M5200 and the revision from the control system do not match. |
| **Electronics Temp. High** | The Control Board temperature sensor indicates a temperature above 140° C. |
| **Electronics Temp. Low** | The Control Board temperature sensor indicates a temperature below 45° C. |
| **External Shutdown Position** | Command sent by Digital communication protocols like: EGD, CANopen. |
| **External Shutdown** | Command sent by Service Tool or digital communication protocols like: EGD, CANopen or discrete inputs. |
| **E-Stop 1 Tripped** | This displays the status of the SIL/External Shutdown status. When this is activated the DVP is in Shutdown Position mode. |
| **E-Stop 2 Tripped** | This displays the status of the SIL/External Shutdown status. When this is activated the DVP is in Shutdown Position mode. |
| **Extended PDO** | Enables Transmit and Receive PDO's 5-8 |

# F

| Term | Definition/Description |
|---|---|
| **Fault Status and Configuration Overview** | The Process Fault Status Service Tool screen gives an overview of the entire range of process fault and status flags and their individual status. |
| **Fault Status and Configuration Overview Internals** | This Process Fault Status Service Tool screen gives an overview of the internal process fault and status flags and their individual status. |
| **Final Element Feedback Transducer** | The final element feedback transducer is the position sensor coupled to or most closely to the final output shaft. This is compared to the motor position sensors which are mounted to the motor. |
| **Force Limiter** | This display only mode is used on specially configured valves/actuators to control an applied force limit during operation. This mode is only available with specially configured valves/actuators (and newer DVP firmware). |
| **Function Generator** | A setpoint source which sets the setpoint signal type which is internally generated based on the function generator settings. |
| **Function Generator Configuration** | This is a section on the Input Configuration and Setpoint Source Configuration pages and has two options for modifying the information displayed; the Wave Pattern drop down and the Sweep Mode drop down menus. |
| **Function Generator Configuration Start Frequency** | This displays the start frequency for a sweep function. |
| **Function Generator Configuration Sweep Stop Frequency** | This displays the stop frequency for a sweep function. |
| **Function Generator Configuration Sweep Time** | This displays the time that it will take to go from the start frequency to the stop frequency when is sweep mode. |
| **Function Generator Configuration Synch Logging** | This setting controls whether data logging will also start when a function generator sweep is started. A non-zero value enables this synchronized behavior. |

## G

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## H

| Term | Definition/Description |
|---|---|
| **Home** | Screen within Service Tool that contains contact information for assistance and customer service at a variety of Woodward facilities. |
| **Heat Sink Temp. Sensor 1 Error or Heat Sink Temp. Sensor 2 Error** | This fault status flag indicates power board heat sink sensor (1 or 2) has failed. |

## I

| Term | Definition/Description |
|---|---|
| **ID Module Not Detected** | The DVP is unable to communicate with the ID module or there is no ID module attached to the Actuator or Valve. |
| **ID Module Version Not Supported** | Current version of software does not contain the specifications of the ID Module. |
| **Identification** | Screen within Service Tool that contains Controller and Valve identification in addition to Service Tool and firmware version information. |
| **Incorrect Power Board** | During power up the DVP checks the ID module to determine the power board needed for the valve/actuator system. If the power board ID required and the power board detected do not match, this diagnostic will be annunciated. Valve/actuator system does not match the DVP power board. |
| **Input Configuration** | A Service Tool screen where six different input selections may be made, and the demand configuration may be edited by the user. |
| **Input Current High** | The Input current sensor is at maximum output. |
| **Input Current Low** | The Input current sensor is at minimum output. |
| **Input Power Information** | This displays the input voltage to the DVP (source 1 and source 2), the internal power bus voltage, and the input current to the DVP; real time. |
| **Input Voltage 1 High** | The measured voltage at Input 1 is higher than the DVP specification limit. |
| **Input Voltage 1 Low** | The measured input voltage on input number 1 is lower than the DVP specification limit. |
| **Input Voltage 2 High** | The measured input voltage is higher than the DVP specification limit. |
| **Input Voltage 2 Low** | The measured input voltage on input number 2 is lower than the DVP specification limit. |
| **Int. Bus Voltage High** | The internal bus voltage sensor is at maximum. |
| **Int. Bus Voltage Low** | If the internal bus voltage Sensor is at minimum |
| **Invalid Parameters(s)** | CRC16 check failures on both parameter sections. If a new embedded program has been loaded, the parameters have not been updated. |
| **Invalid Parameter Version** | Version information is not correct in the non-volatile memory. Internal electronics failure. |

## J

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## K

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## L

| Term | Definition/Description |
|---|---|
| **Linearization Monotonic Shutdown Error** | The Linearization settings stored in the unit are not monotonically increasing, and the unit will not begin operation until this fault is resolved by updating the Linearization settings. |

## M

| Term | Definition/Description |
|---|---|
| **M5200** | Refers to the optional aux board in the DVP that provides Ethernet communications. |
| **M5200 CPU Load** | CPU Load of the M5200 in EGD mode. |
| **M5200 Detected An Error** | One of the five possible errors associated with the M5200 has been set. *DP ram check error*: The M5200 has detected a dual ported ram error. If the M5200 program is started or stopped this error may occur due to the M5200 and the DVP being out of synch. *MFT Synch error*: The DVP has not been able to provide the synch pulse on time to its M5200. *Version error*: DVP and its M5200 do not have compatible software versions. *Block Count error*: The DVP and M5200 software have a different number of interface blocks. *Heartbeat error*: The M5200 has not received a correct heartbeat from the DVP. |
| **M5200 DPRAM Error** | The DVP has detected a Dual port ram error during the RAM check. Defective Dual Port Ram or interface. |
| **M5200 Heartbeat Error** | The M5200 has not sent the correct heart beat value to its DVP. The M5200 is not running, or the interface is defective. |
| **M5200 Starting** | The control board is waiting until the M5200 aux board is started. Wait time is approximately 2 minutes. This is a typical situation during a power up or change of input type that will activate the M5200 aux board. This flag will reset automatically. |
| **M5200 Startup Timeout** | After 2 minutes waiting for a signal from the M5200 aux board, the control board will timeout. There is no M5200 program, the M5200 program is not running, or the Service/Test Port is configured for DHCP and cannot get an IP address. |
| **Manual Input Manual Position Demand** | This is the position setpoint provided while in Manual Operation. |
| **Manual Operation** | Service Tool screen where operating the DVP in manual control is monitored. Capabilities include Position Controller information such as Position Demand, Actual Position and Actual Current. |
| **Manual Position** | A setpoint source that sets the setpoint signal type, which is an internally generated setpoint, user-configurable from the Manual Control page. |
| **Mode** | “Mode” is used to describe a parameter which selects one option to the exclusion of the other available options. |
| **Mode Selection** | Allows the user multiple options for input filter configurations. The selected configuration is then displayed in the Mode Selection window of the Position Controller Configuration page. |
| **Motor** | This section displays information related to the Motors resolvers |
| **Motor 1 Cos Error**<br>**Motor 2 Cos Error** | The Cosine input voltage is out of range on the motor resolver. The wiring to the resolver is disconnected or failed. The resolver failed open or is intermittent. |
| **Motor 1 Exc. Error**<br>**Motor 2 Exc. Error** | The Sine and Cosine voltage combined are below the diagnostic threshold. The excitation wiring to the resolver is shorted or intermittent. The resolver excitation coil is shorted. The resolver gain is too low due to resolver wiring problem. Excitation circuit failure. |
| **Motor 1 Sin Error**<br>**Motor 2 Sin Error** | The Sine input voltage is higher than the diagnostic limit on the motor resolver. The wiring to the resolver is disconnected or intermittent. The resolver failed open or is intermittent. |

| | |
|---|---|
| **Motor 1 and 2 Res. Error** | This is a summary indication that an error is detected in both motor 1 and motor 2. |
| **Motor Calibration Point** | This value is the factory calibration point for the motor resolver. |
| **Motor Control Parameters** | A section of the Service Tool Status Overview screen Position Controller which displays parameters of Actual Current and Actual Current (Filtered). |
| **Motor Control Parameters Actual Current** | Real-time current being fed to the actuator; raw current. |
| **Motor Control Parameters Actual Current (Filtered)** | This is the actual current driven into the actuator after filtering. |
| **Motor Current** | The selection will use the actual current which is the current that the driver is applying to the motor. This signal will have a lot of movement such as the current from the current controller continues moving to keep the position of the valve in the same position as the demanded position. |
| **Motor Max. Direction Startup Direction Settings – Direction Limit** | Startup Checks: The maximum allowable motor revolution(s) are displayed during the startup check. |
| **Motor Max. Startup Direction Settings** | This section defines the Startup, max direction, current setting, upper and lower limits, and the startup values from the last startup check. |
| **Motor Maximum Startup Limit Settings Actual Avg. Startup Position Motor 1** | The last maximum direction startup check value for Motor Res 1 is displayed. |
| **Motor Maximum Startup Limit Settings Actual Avg. Startup Position Motor 2** | The last maximum direction startup check value for Motor Res 2 is displayed. |
| **Motor Minimum Startup Limit Settings** | This section defines the Startup, min direction, current setting, upper and lower limits, and the startup values from the last startup check. |
| **Motor Position Error Alarm Limit** | This is the minimum difference between demanded position and measured position (from the motor resolver) that will trigger a Motor Position Error Alarm. |
| **Motor Position Error Alarm Delay Time** | This is the minimum time the Motor Position Error Alarm Limit must be exceeded before an alarm is triggered. |
| **Motor Position Error Shutdown Limit** | This is the minimum difference between demanded position and measured position (from the motor resolver) that will trigger a Motor Position Error Shutdown. |
| **Motor Position Error Shutdown Delay Timer** | This is the minimum time the Motor Position Error Shutdown Limit must be exceeded before a shutdown is triggered. |
| **Motor Resolver Difference Diagnostics** | These diagnostics are for monitoring differences between redundant motor resolvers (Dual Res. Difference Alarm and Dual Res. Difference Shutdown). |
| **MPU/PWM Input** | A setpoint source which sets the setpoint signal type of PWM signal. |

## N

| Term | Definition/Description |
|---|---|
| **No Power Board Found** | During power up the control board will read the power board. This diagnostic will be set if no Power Board is found. DVP internal electronics failure or there is no power board connected. |
| **Number of Cycles** | The number of sweep cycles combined with the number of cycles run. |

## O

| Term | Definition/Description |
|---|---|

| | |
|---|---|
| **Output Configuration** | A Service Toll screen which provides status information on the DVP's analog and digital output section. Three text indicators show the currently active outputs and which mode they have been configured to. |

## P

| Term | Definition/Description |
|---|---|
| **Position Control State** | This displays the controller model that is being used to control the actuator and the state of the controller; Running or Not Running. |
| **Position Controller** | A screen in Service Tool which provides Motor and Actuator/Valve Position Readings, Position Sensor Diagnostics, and Position Error Diagnostics. Additionally, Motor Resolver Difference Diagnostics and Motor Position Control State are provided. |
| **Position Controller Configuration** | A screen in Service Tool which provides the Position Controller Configuration menu indicates the general overview of the actuator operation. User individual configuration edit options are also available on this screen. |
| **Position Controller Not Ready** | This status flag indicates the DVP is not controlling position. This occurs during power-up initialization and when in a shutdown position state. |
| **Position Demand** | Position demand signal currently being used by the DVP. |
| **Position Demand High Point** | This value specifies the threshold above which the Position Demand is considered to have failed. |
| **Position Demand Low Point** | This value specifies the threshold below which the Position Demand is considered to have failed. |
| **Position Error Motor Alarm** | The Motor position is not tracking the set point within limitations set by the tracking error alarm parameters. Incorrect Parameter Settings. Contamination in the valve/actuator system. |
| **Position Error Configuration** | This only displays the group which includes Motor Position and Shaft Position. The errors are displayed in four categories: Alarm Limit, Alarm Delay Time, Shutdown Limit, and Shutdown Delay Time. |
| **Position Error Motor Shutdown** | The Motor position is not tracking the set point within limitations set by the tracking error shutdown parameters. |
| **Position Error Motor Alarm** | The motor position sensor is not tracking the set point within limitations set by the tracking error alarm parameters. Contamination in the valve/actuator system, incorrect or damaged motor wiring, and/or motor failure could be a cause for this diagnostic. |
| **Position Error Shaft Alarm** | There is an error larger than the shaft (final element) position error alarm parameters between the shaft (final element) position and the demanded position. Excessive Valve/Actuator Wear. Incorrect or damaged motor wiring. Motor Failure. DVP electronics failure. |
| **Position Error Shaft Shutdown** | There is an error bigger than the stem position error parameters between the stem position and the demanded position. Excessive Valve/Actuator Wear. Incorrect or damaged motor wiring. Motor Failure. DVP electronics failure. |
| **Position Error Valve Shaft Alarm** | There is an error bigger than the stem position error parameters between the stem position and the demanded position. Excessive Valve/Actuator Wear. Incorrect or damaged motor wiring. Motor Failure. DVP electronics failure. |
| **Position Offset** | Position offset value – configured during valve factory calibration |
| **Position Readings** | A section of the Service Tool Status Overview screen Position Controller which displays readings of Position Demand, Actual Position, and Actual Position Sensors 1 and 2. |
| **Position Readings Actual Position** | A value derived by different sensors represented in percentage that is the reported position (real-time position) of the valve or actuator as seen by the DVP. |
| **Position Readings Actual Position Sensor 1** | This value shows the actual position according to Position Sensor 1. Note that the physical sensor mapped to Position Sensor 1 is dependent on the specific valve or actuator in use. |

| | |
|---|---|
| **Position Readings Actual Position Sensor 2** | This value shows the actual position according to Position Sensor 2. Note that the physical sensor mapped to Position Sensor 2 is dependent on the specific valve or actuator in use. |
| **Position Readings Position Demand** | This represents the Position Demand value currently seen from the selected Position Demand interface, but subject to the following limitations:<br>1) The value will be forced into the range of 0.0% to 100.0%, inclusive.<br>2) When the unit is in the Shutdown state the value will be forced to the defined shutdown position (0.0% or 100.0% dependent on the specific valve or actuator in use). |
| **Position Sensor Diagnostics** | This displays the Fault status flags associated with the Shaft Resolver. Some actuators have one shaft (final element) resolver, and some have two shaft (final element) resolvers. |
| **Position Sensor Diagnostics Motor 1 and 2 Res. Error** | Both the Motor 1 and Motor 2 resolvers have active faults detected. This is a summary fault indicator, and the specific causes can be narrowed by reviewing the other specific resolver fault indicators. |
| **Power Board Calib. Error** | During power up the calibration record in the control is set to "No Power Board" this diagnostic will be set. The control board has not been calibrated during electrical production. |
| **Power Board Diagnostics Fan 1 Speed Error** | This fault status flag indicates Fan 1 is slowing down or has stopped (Only applies to DVP 5000, 10000, and 12000). |
| **Power Board Diagnostics Fan 2 Speed Error** | This fault status flag indicates Fan 2 is slowing down or has stopped (Only applies to DVP 5000, 10000, and 12000). |
| **Power Board Diagnostics Heat Sink Temp. Sensor 1 Error** | This fault status flag indicates power board heat sink sensors # 1 has failed (Only applies to DVP 5000, 10000, and 12000). |
| **Power Board Diagnostics Heat Sink Temp. Sensor 2 Error** | This fault status flag indicates power board heat sink sensors # 2 has failed (Only applies to DVP 5000, 10000, and 12000). |
| **Power Board ID Error** | During power up, the Power board ID and the stored ID in the calibration record do not match. The Power board has been changed to a different type after calibration. |
| **Power–up Reset** | CPU reset by a power up event. |
| **PWM Duty Cycle High** | The PWM input duty cycle is above the given setting (User setting) |
| **PWM Duty Cycle Low** | The PWM input duty cycle is below the given setting (User setting) |
| **PWM Frequency High** | The PWM frequency is above the given setting (User Setting) |
| **PWM Frequency Low** | The PWM frequency is below the given setting (User Setting) |

## Q

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## R

| Term | Definition/Description |
|---|---|
| **Reduced Torque Error** | This Fault status flag indicates the system torque has been reduced due a reduction in motor current |
| **Reduced Slew Rate Error** | This Fault status flag indicates the system slew speed has been reduced; loss of second actuator in a dual system, input current limiter |
| **Relubrication Function Configuration** | This configuration is dependent upon the valve or actuator that is being read by the DVP and the settings are not configurable by the user. This page is a display only and displays relubrication activity which are perturbations (small vibrations) that are introduced into the valve to prevent silt build up. |

| | |
|---|---|
| **Resolver** | This section displays LVDT information, resolver position, signal amplitude, LVDT drive circuit gain |
| **Resolver Diagnostics** | This Service Tool screen displays Resolver, Motor, and Valve diagnostics and displays setting information. There are also Motor and Valve fault indicators that show errors in the diagnostic process. |
| **Resolver Difference** | |
| **RDC DSP Failed** | DSP that runs the Resolver-to-digital converter has stopped running. Internal electronics failure. |

## S

| Term | Definition/Description |
|---|---|
| **Sample Time** | An interval represented in milliseconds which is associated with Sweep Mode of how frequently sample readings are taken. |
| **Servo Position** | This selection sends the 4-20mA equivalent of the ServoPosition to the output using scaling defined in the other parameters in this group/ |
| **Setpoint Source Selection Configuration** | This feature of the Input Configuration screen of Service Tool enables the user to select from six configuration options which include Manual Position, Analog Input, EGD Digital Input, PWM Input, Function Generator, and CANopen Digital Input. These options adjust the settings of the DVP. |
| **Shaft Position Error** | The Shaft position is not tracking the set point within limitations set by the position error parameters. |
| **Shaft Position Error Alarm Limit** | This is the minimum difference between demanded position and measured position (from the shaft resolver) that will trigger a Shaft Position Error Alarm. |
| **Shaft Position Error Alarm Delay Time** | This is the minimum time the Shaft Position Error Shutdown Limit must be exceeded before a shutdown is triggered. |
| **Shaft Position Error Shutdown Limit** | This is the minimum difference between demanded position and measured position (from the shaft resolver) that will trigger a Shaft Position Error Shutdown. |
| **Shaft Position Error Shutdown Delay Time** | This is the minimum time the Shaft Position Error Alarm Limit must be exceeded before a shutdown is triggered. |
| **Shutdown** | This indicates a shutdown condition is detected. The position of the actuator/valve is controlled by the DVP, typically to 0%. On some actuators/valves this may be factory configured to 100% (for example, a special fail open or bypass valve). |
| **Shutdown Position** | This indicates a shutdown condition is detected where correct position control is not possible, so driver output is turned off. The position of the actuator/valve is not controlled by the DVP. If the actuator/valve has a return spring, the actuator/valve is positioned by the return spring. |
| **Shutdown System** | This indicates a shutdown condition is detected where correct position control is not possible due to a detected driver current fault. |
| **Soft Start Variant** | This display-only value identifies the soft stop configuration that is present within the actuator. This setting is only available with specially configured valves/actuators (and newer DVP firmware). |
| **Speed Signal Fault** | Only used if speed sensor is active. DVP does not support speed sensor input with present version. |
| **Start Frequency** | This displays the start frequency for a sweep function. |
| **Startup Checks** | This Service Tool screen shows DVP Diagnostics Valve/Actuator Startup Checks include Position Offset, Motor Calibration Point, Minimum Direction Startup, Maximum Direction Startup and Motor Direction Check. |
| **Startup Close Motor or Startup Close Shaft Error** | During calibration at the factory, the feedback values at the startup position recorded. The readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve. During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the feedback reading is not within the calibrated range when checking the closing direction. |

| | |
|---|---|
| **Startup Close Valve Shaft 2 Error** | This is the same as Startup Close Valve Shaft 1 Error but for the second shaft resolver. Some actuators use 2 shaft resolvers. |
| **Startup Max Check Res 1 Failed**<br>**Or**<br>**Startup Max Check Res 2 Failed** | This indicates the primary final element position sensor (“Res 1”) or the secondary final element position sensor (“Res 2) did not fall within the startup max limit range. This is most common with valve/actuators which do not have the ID module and require manual set-up see Appendix D, E, F in Manual 26912 for set-up instructions. For valve/actuators with ID modules, this can occur due to wiring problems or foreign debris which do not allow the device to close properly. See information on start-up checks in the DVP hardware manual. |
| **Startup Open Motor or Startup Open Shaft Error** | During calibration at the factory, the feedback values during the startup sequence are recorded. The readings corresponding to the fully closed position are recorded in both the opening and closing direction at torques sufficient to overcome the backlash in the gear train, but not to open the valve. During power-up and initialization, the DVP verifies that the valve is at the min stop. This diagnostic occurs if the feedback reading is not within the calibrated range when checking the opening direction. |
| **Startup Motor Direction Error**<br>**Or**<br>**Startup Motor 2 Direction Error** | Most commonly a motor wiring problem. Motor not connected, or phases are connected incorrectly. Can also be caused by a resolver wiring problem; resolver moving in the incorrect direction. Less frequently, a motor defect, open or short circuit. If shorted, it is likely that a Driver Current Fault flag is also detected. Least common: DVP electronics failure. |
| **Startup Open Valve Shaft 2 Error** | This is the same as Startup Open Valve Shaft 1 Error but for the second shaft resolver. Some actuators use 2 shaft resolvers. |
| **Startup Position Lower Limit** | This displays the lower limit of a specific startup check. |
| **Startup Position Upper Limit** | This displays the upper limit of a specific startup check. |
| **Status Overview** | DVP Service Tool screen which contains Position Controller, DVP I/O State, and DVP Analog Value information. A user customizable trend chart is also included to provide a real-time graphical reference to the performance of the DVP. |
| **Stroke Length** | This display-only setting is the programmed stroke length of the actuator. This setting is only for specially configured valves/actuators (and newer DVP firmware). |
| **Sweep Mode** | This dropdown menu within the Function Generator Configuration section is a user configurable, multiple option menu to set different sweep modes such as Linear, Linear Repeat, and Number of Cycles Low/High. |

## T

| Term | Definition/Description |
|---|---|
| **Trend Chart** | A trend chart displays the time varying position set point, actual position, and filtered motor drive current. Trend charts are a feature in several Service Tool screens such as Manual Operation. |
| **Timeout** | A user configurable time interval, typically in milliseconds, which is a buffer. |
| **Type Not Supported** | This diagnostic is annunciated if the valve type reported by the valve/actuator system in the ID module is not supported by the DVP software. Valve type not supported by the DVP. DVP software is not the required revision for this valve. |
| **Type / Serial Number Error** | If during power up the DVP detects a valve/actuator system with a different serial number or valve type this diagnostic will be annunciated. User has connected a different valve to the DVP. User has loaded a parameter set to the DVP that does not match this valve/actuator system serial number. |

## U

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## V

| Term | Definition/Description |
|---|---|
| **Valve Identification** | A section on the Service Tool Identification screen which displays Valve Type, Part Number, Revision, and Serial Number. This information is provided through communications between the valve and the DVP. |
| **Valve Shaft 1 Cos Error** | The Cosine input voltage is out of range on the valve shaft (final element) for Resolver number 1. |
| **Valve Shaft 1 Exc. Error** | The Sine and Cosine voltage combined are too low. |
| **Valve Shaft 1 Sin Error** | The Sine input voltage is out of range on the valve shaft (final element) Resolver number 1 |
| **Valve Shaft 2 Cos Error** | The Cosine input voltage is out of range on the valve shaft (final element) for resolver number 2. |
| **Valve Shaft 2 Exc. Error** | The Sine and Cosine voltage combined are too low. The excitation wiring to the resolver is shorted or intermittent. The resolver excitation coil is shorted. The resolver gain is too low due to resolver wiring problem. Excitation circuit failure. |
| **Valve Shaft 2 Sin Error** | The Sine input voltage is out of range on the valve shaft (final element) resolver number 2. |
| **Valve Shaft 1 and 2 Error** | The shaft (final element) resolver redundancy manager has detected a Valve shaft (final element) 1 and Valve shaft (final element) 2 error. Valve shaft (final element) 1 error is true if any of the following errors are detected:<br>• Valve shaft (final element) 1 Sine Error<br>• Valve shaft (final element) 1 Cosine Error<br>• Valve shaft (final element) 1 Exc. Error<br><br>Valve Stem 2 error is true if any of the following errors are detected:<br>• Valve shaft (final element) 2 Sine Error<br>• Valve shaft (final element) 2 Cosine Error<br>• Valve shaft (final element) 2 Exc. Error |
| **Valve Shaft 1 Range Limit Error or Valve Shaft 2 Range Limit Error** | During calibration at the factory, the final element feedback range (difference between minimum and maximum stop) is recorded.<br>This diagnostic occurs if the final element #1 or #2 resolver reading is detected outside the allowable resolver range. |
| **Valve Shaft Max. Startup Range Settings Actual Avg. Startup Position** | This value shows the average reading obtained for the shaft resolver during the Max portion of the startup checks. This value is used to determine the status of Startup Open Valve Shaft 1 Error or Startup Open Valve Shaft 2 Error. |
| **Valve Shaft Min. Startup Range Settings Actual Avg. Startup Position** | This value shows the average reading obtained for the shaft position feedback transducer during the Min portion of the startup checks. This value is used to determine the status of Startup Close Valve Shaft 1 Error or Startup Close Valve Shaft 2 Error. |
| **Valve Type Selection** | Service Tool screen which contains Actuator Type Selection Process, Auto Detection Control, Actuator Type Selection Diagnostics, Selected Valve Type, Valve Specific and Control Module information. The user may invoke a self-configuration process using data acquired from the valve's Identity (ID module). |

## W

| Term | Definition/Description |
|---|---|
| **Watchdog Reset** | CPU reset without a power up event. |

| | |
|---|---|
| **Wave Pattern** | This dropdown menu within the Function Generator Configuration section is a user configurable, multiple option menu to set wave patterns such as DC, Sine Wave, and Square Wave. |

## X

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## Y

| Term | Definition/Description |
|---|---|
| **None Currently** | |

## Z

| Term | Definition/Description |
|---|---|
| **Zero Cut-off Configuration** | This display-only feature ceases closed-loop position control when the position demand and/or actual position meets certain criteria. The DVP and valve remain active and functional but rely on an open-loop method to achieve the desired position. In this state it prevents high frequency noise from wearing the motor gear teeth. The traditional open-loop method is achieved by removing power to the motor and relying on a return spring. An additional open-loop method is available with specially configured valves/actuators (and newer DVP firmware) to use a constant "seating" current. |
| **Zero Cut-off Current Control Mode** | This display-only setting is when Zero Cut-off is configured to use constant current to push into the valve seat when Zero Cut-off mode is active. This mode is only available with specially configured valves/actuators (and newer DVP firmware). |
| **Zero Cut-off Seating Current** | This display-only setting is the constant current used to push into the valve seat when Zero Cut-off mode is active and is set to Current Control Mode. This mode is only available with specially configured valves/actuators (and newer DVP firmware). |

# Revision History

**Changes in Revision AJ—**
- Added “and applicable amendments” to EMC Directive
- Edited ATEX**,** IECEx, and DNV
- Added content to Storage Temperature in Environmental Specifications
- Added Important box to Chapter 7
- Updated EU DoC
- Updated UKCA DoC

**Changes in Revision AH—**
- Added content to Regulatory Compliance
- Updated Figure 2-7
- Added new Caution boxes to Chapter 3
- New Figure 3-2a and 3-2b
- New Figure 3-10
- Added content to Analog Output section
- Added new content to Table 8-2 and 8-8
- Edited Object 1018
- Revised Appendix B to Power Down Procedure for clarity
- Added new content to Appendix C

**Changes in Revision AG—**
- Corrections to Table 1-1
- Added column for LQ50 to Table 3-1a.

**Changes in Revision AF—**
- Revisions to Regulatory Compliance:
  - Revised ATEX section for standard and dual drive model
  - Removed EAC Customs Union section
  - Revised IECEx section for standard and dual drive model, and certificate number
  - Revised Lloyd’s Register Type Approval Certificate
  - Added United Kingdom Compliance for UKCA Marking
  - Revised DNV section
- Updated capacitance and wire gauge range in Chapter 3
- Replaced EU DoC
- Added UKCA DoC

**Changes in Revision AE—**
- Regulatory and Compliance Section mostly new content
- Updated all references to IP54 to IP66
- Added new content in Chapter 2 immediately above Figure 2-1
- Added new Figure 2-1. Latch Orientation Open/Close State
- Replaced Figures 2-9, 2-10, 2-11, 2-13, 2-14, and 2-19 then renumbered all figures to account for the new Figure 2-1
- New Declaration

**Changes in Revision AD—**
- Regulatory and Compliance Section mostly new content
- Updated figure/table captions with IP54 replacing IP56
- DVP Specification table with many updates moved to Chapter 1
- Updated Warnings and Notice boxes in Chapter 2
- Updated content in General Installation and Mounting Considerations in Chapter 2
- Replaced IP56 with IP54 in Table 2-2 and 2-3
- Reformatted Figure 3-19

- New Declaration

**Changes in Revision AC—**

- Chapter 1, paragraph 3, new content
- Table 1-1. Added ELA21 to 125 VDC section of table
- Table 2-5 new content Ethernet “option” and Dual Drive Option under Configuration Options
- Caption to Figure 2-13, added “125 VDC with Circular Connectors”
- Added Figures 2-14, 2-15, 2-16, 2-17, and Table 2-4
- Added new content on Pgs. 30 and 31
- The following changes have been made to Chapter 3
    - Table 3-1a all rows have content changes
    - Added Recommendations for Dual and Simplex Power Wiring section including replacing Figure 3-2
    - Figure 3-3 caption changed
    - Resolver/LVDT Signal Replacement heading changed
    - Position Feedback Transducer Wiring Requirements heading and bulleted list content changes
    - Ethernet Communication Ports section second paragraph and Figure 3-7 changed
    - Table 3-6 All rows have content changes
    - RS-323 Service Port section first paragraph changed
    - Added Cyber security manual reference to Ethernet Communications Ports section
    - Added two new paragraphs at beginning of Discrete Inputs section
    - Replaced Figures 3-11 and 3-18
    - Added Figure 3-17
    - Figure 3-20 channels have changed
    - Pg. 43, second paragraph from the bottom changed
    - Pg. 44, sentence above NOTICE Box added
    - First sentence and CANNODE ID Selection section below Table 3-12 added including Tables 3-13, 3-14, 3-15, and Figures 3-15, 3-16, and 3-17
    - First sentence in RS-485 Communication Port section added.
- Deleted Positioner Feedback section from Chapter 4
- Chapter 5 replaced with new content
- Chapter 6 replaced with new content
- Edited System Requirements section in Chapter 7
- Appendix A replaced with new content
- Added Appendix C Glossary
- Added Output Current (Maximum) to DVP Control Specifications
- Replaced DOC

**Changes in Revision AB—**

- Added Table 6-1l to the Trouble Shooting section of Chapter

**Changes in Revision AA—**

- Moved Appendices B, C, and D to Service Tool Manual B26912
- Moved all Service Tool Content to Manual B26912
- Replaced message content on pg. 81
- Replaced DOI and updated ATEX/EAC certifications

**Changes in Revision Y—**

- Updated Declaration of Conformity
- Added Warning to Installation section in Chapter 2
- Added Duty Cycle Limitations section to Chapter 4
- Added Notice and Important boxes to Chapter 4
- Added new paragraph on Power Supply in Chapter 3

**Changes in Revision W—**

- Added additional ATEX information to Regulatory Compliance section
- Added ATEX warning to Installation chapter
- Updated percentage values on pages 217 & 218

**Changes in Revision V—**
- Updated Table 1-1 (LQ25/LQ25T/LQ25BP)
- Changed IP30 description to state that any orientation is OK (page 16)
- Updated Table 3-1 to clarify GS16DR transient current and add 3171 valve
- Added 3171 valve to Appendix C

**Changes in Revision U—**
- Updated Regulatory Compliance to add IECEx information

**Changes in Revision T—**
- Chapter 1—Updated Table 1-1
- Chapter 2—Updated Table 2-1 & Figure 2-7 title
- Chapter 3—Updated Table 3-1, added notice above table; updated RS-232 & RS-485 information
- Chapter 7—General update

**Changes in Revision R—**
- Added new screen shot and Zero Cutoff Functionality section to Appendix C

**Changes in Revision P—**
- Added Marine Compliance to Regulatory Compliance page
- Updated Table 3-1 (Power Requirements)
- Updated/expanded Appendixes B, C, D

# Declarations

## EU DECLARATION OF CONFORMITY

| | |
|---|---|
| **EU DoC No.:** | 00319-04-EU-02-01 |
| **Manufacturer's Name:** | WOODWARD POLAND SP. Z O.O. |
| **Manufacturer's Contact Address:** | SKARBOWA 32<br>32-005 NIEPOLOMICE, POLAND |
| **Model Name(s)/Number(s):** | Digital Valve Positioner (DVP) with IP30 or IP66,<br>Digital Valve Positioner (DVP) Dual Drive with IP66,<br>High Output Digital Valve Positioner (HO DVP), DVP5000, DVP10000, DVP12000 with IP20,<br>High Output Digital Valve Positioner (HO DVP) with Servo Interface Module (SIM) DVP5000 with SIM, DVP10000 with SIM. |
| **The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:** | Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres<br>Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC) |
| **Markings in addition to CE marking:** | Standard DVP Version and High Output DVP Version:<br>Ex II 3 G, Ex nA IIC T4 Gc<br>DVP Dual Drive Version:<br>Ex II 3 G, Ex nA IIC T3 Gc<br>HO DVP Version and HO DVP with SIM Version:<br>Ex II 3 G, Ex nA IIC T4 Gc |
| **Applicable Standards:** | |
| **ATEX:** | EN 60079-0:2018 Explosive Atmospheres – Part 0: Equipment – General Requirements<br>EN 60079-15:2010 Explosive Atmospheres – Part 15: Equipment protection by type of protection "n" |
| **EMC:** | **For Digital Valve Positioner (DVP) & Dual Drive version:**<br>EN 61000-6-4:2007 + A1:2011: Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments,<br>EN 61000-6-2:2005 + AC:2005: Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments,<br>**For HO DVP version & HO DVP with SIM version:**<br>EN 61800-3:2004/A1:2012, Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods (DC Powered Category 3, 2nd Environment with deviation) Direct ESD per IEC 61000-4-2 is not claimed due to user precautions from touching the unit inside an IP54 enclosure. DC Power Surge per IEC 61000-4-5 is claimed to a deviation of ±1kV Line to Earth (L-E) and ±0.5kV Line to Line (L-L). |

**This declaration of conformity is issued under the sole responsibility of the manufacturer**
**We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).**

MANUFACTURER

| | |
|---|---|
| **Signature** | Annette Lynch |
| **Full Name** | **Annette Lynch** |
| **Position** | **Engineering Manager** |
| **Place** | **Woodward, Fort Collins, CO, USA** |
| **Date** | 22 April 2025 |

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# UKCA DECLARATION OF CONFORMITY

| | |
|---|---|
| **UKCA DoC No.:** | 00319-04-EU-UKCA-02-01 |
| **Manufacturer's Name:** | WOODWARD POLAND SP. Z O.O. |
| **Manufacturer's Contact Address:** | ul. Skarbowa 32, 32-005 Niepolomice, Poland |
| **Model Name(s)/Number(s):** | Digital Valve Positioner (DVP) with IP30 or IP66,<br>Digital Valve Positioner (DVP) Dual Drive with IP66,<br>High Output Digital Valve Positioner (HO DVP), DVP5000, DVP10000, DVP12000 with IP20,<br>High Output Digital Valve Positioner (HO DVP) with Servo Interface Module (SIM) DVP5000 with SIM, DVP10000 with SIM. |
| **Markings in addition to UKCA marking:** | Standard DVP Version and High Output DVP Version:<br>Ⓔx II 3 G, Ex nA IIC T4 Gc<br>DVP Dual Drive Version:<br>Ⓔx II 3 G, Ex nA IIC T3 Gc<br>HO DVP Version and HO DVP with SIM Version:<br>Ⓔx II 3 G, Ex nA IIC T4 Gc |

**The object of this Declaration is in full conformity with the following UK Statutory Instruments (and their amendments):**

| Appropriate S.I. | Description of S.I. |
|---|---|
| S.I.2016 No. 1107 | Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 |
| S.I.2016 No. 1091 | Electromagnetic Compatibility Regulations 2016 |

**The Object of this Declaration is in conformity with the applicable requirements of the following designated standards and technical specifications.**

| **Appropriate Standard** | **Description of Standard** |
|---|---|
| EN IEC 60079-0:2018 | Explosive Atmospheres – Part 0: Equipment – General requirements |
| EN 60079-15:2010 | Explosive Atmospheres – Part 7: Equipment protection by increased safety "e" |
| **For Digital Valve Positioner (DVP) & Dual Drive version:** | |
| EN 61000-6-4:2007/ A1:2011 | Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments, |
| EN 61000-6-2:2005/ AC:2005 | Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments, |
| **For HO DVP version & HO DVP with SIM version:** | |
| EN 61800-3:2004/ A1:2012 | Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods (DC Powered Category 3, 2nd Environment with deviation) Direct ESD per IEC 61000-4-2 is not claimed due to user precautions from touching the unit inside an IP54 enclosure. DC Power Surge per IEC 61000-4-5 is claimed to a deviation of ±1kV Line to Earth (L-E) and ±0.5kV Line to Line (L-L). |

**This declaration of conformity is issued under the sole responsibility of the manufacturer**
**We, the undersigned, hereby declare that the equipment specified above conforms to the above Regulation(s).**

MANUFACTURER

Annette Lynch

**Signature**

**Annette Lynch**

**Full Name**

**Engineering Manager**

**Position**

**Woodward, Fort Collins, CO, USA**

**Place**

22 April 2025

**Date**

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Released

**We appreciate your comments about the content of our publications.**

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**Please reference publication 26329.**

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