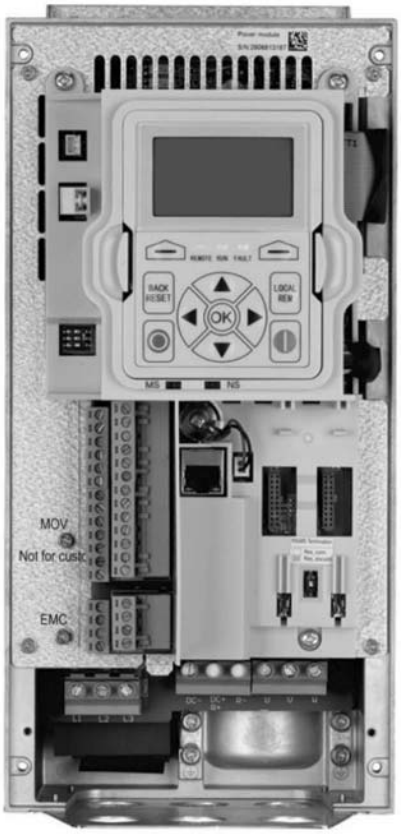
PowerXL DG1 Series VFD
Effective September 2016
Supersedes May 2014

Communication manual



EATON
Powering Business Worldwide

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

The information, recommendations, descriptions, and safety notations in this document are based on Eaton's experience and judgment and may not cover all contingencies. If further information is required, an Eaton sales office should be consulted. Sale of the product shown in this literature is subject to the terms and conditions outlined in appropriate Eaton selling policies or other contractual agreement between Eaton and the purchaser.

THERE ARE NO UNDERSTANDINGS, AGREEMENTS, WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OTHER THAN THOSE SPECIFICALLY SET OUT IN ANY EXISTING CONTRACT BETWEEN THE PARTIES. ANY SUCH CONTRACT STATES THE ENTIRE OBLIGATION OF EATON. THE CONTENTS OF THIS DOCUMENT SHALL NOT BECOME PART OF OR MODIFY ANY CONTRACT BETWEEN THE PARTIES.

In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability, or otherwise for any special, indirect, incidental, or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations, and descriptions contained herein. The information contained in this manual is subject to change without notice.

Cover Photo: Eaton PowerXL® HVAC Drives

Support services

Support services

The goal of Eaton is to ensure your greatest possible satisfaction with the operation of our products. We are dedicated to providing fast, friendly, and accurate assistance. That is why we offer you so many ways to get the support you need. Whether it is by phone, fax, or email, you can access Eaton's support information 24 hours a day, seven days a week.

Our wide range of services is listed below.

You should contact your local distributor for product pricing, availability, ordering, expediting, and repairs.

Website

Use the Eaton Website to find product information. You can also find information on local distributors or Eaton's sales offices.

Website address

www.eaton.com/drives

EatonCare customer support center

Call the EatonCare Support Center if you need assistance with placing an order, stock availability or proof of shipment, expediting an existing order, emergency shipments, product price information, returns other than warranty returns, and information on local distributors or sales offices.

Voice: 877-ETN-CARE (386-2273) (8:00 a.m.–6:00 p.m. EST)
After-Hours Emergency: 800-543-7038
(6:00 p.m.–8:00 a.m. EST)

Drives technical resource center

Voice: 877-ETN-CARE (386-2273) option 2, option 6
(8:00 a.m.–5:00 p.m. Central Time U.S. [UTC –6])
email: TRCDrives@Eaton.com

For customers in europe, contact

Phone: +49 (0) 228 6 02-3640
Hotline: +49 (0) 180 5 223822
email: AfterSalesEGBonn@Eaton.com
www.eaton.com/moeller/aftersales

Contents

List of Figures

List of Tables

Safety

WARNING!
DANGEROUS ELECTRICAL VOLTAGE!

Before commencing the installation

- Disconnect the power supply of the device
- Ensure that devices cannot be accidentally restarted
- Verify isolation from the supply
- Earth and short circuit the device
- Cover or enclose any adjacent live components
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system
- Before installation and before touching the device ensure that you are free of electrostatic charge
- The functional earth (FE, PES) must be connected to the protective earth (PE) or the potential equalization. The system installer is responsible for implementing this connection
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation
- Suitable safety hardware and software measures should be implemented for the I/O interface so that an open circuit on the signal side does not result in undefined states in the automation devices
- Ensure a reliable electrical isolation of the extra-low voltage of the 24V supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD384.4.41 S2
- Deviations of the input voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause a restart
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed and with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage DIP or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented
- Wherever faults in the automation system may cause injury or material damage, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks, and so on)
- Depending on their degree of protection, adjustable frequency drives may contain live bright metal parts, moving or rotating components, or hot surfaces during and immediately after operation
- Removal of the required covers, improper installation, or incorrect operation of motor or adjustable frequency drive may cause the failure of the device and may lead to serious injury or damage
- The applicable national accident prevention and safety regulations apply to all work carried out on live adjustable frequency drives
- The electrical installation must be carried out in accordance with the relevant regulations (for example, with regard to cable cross sections, fuses, PE)
- Transport, installation, commissioning, and maintenance work must be carried out only by qualified personnel (IEC 60364, HD 384 and national occupational safety regulations)
- Installations containing adjustable frequency drives must be provided with additional monitoring and protective devices in accordance with the applicable safety regulations. Modifications to the adjustable frequency drives using the operating software are permitted
- All covers and doors must be kept closed during operation
- To reduce hazards for people or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety-related variables (speed, travel, end positions, and so on)
  - Electrical or non-electrical system-wide measures (electrical or mechanical interlocks)
  - Never touch live parts or cable connections of the adjustable frequency drive after it has been disconnected from the power supply. Due to the charge in the capacitors, these parts may still be live after disconnection. Fit appropriate warning signs

Read this manual thoroughly and make sure you understand the procedures before you attempt to install, set up, operate or carry out any maintenance work on this DG1 Adjustable Frequency Drive.

Definitions and symbols

WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous high voltage

WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

- **Stand on an insulating pad and make it a habit to use only one hand when checking components**
- **Always work with another person in case an emergency occurs**
- **Disconnect power before checking controllers or performing maintenance**
- **Be sure equipment is properly earthed**
- **Wear safety glasses whenever working on electronic controllers or rotating machinery**

WARNING

The components in the drive's power section remain energized after the supply voltage has been switched off. After disconnecting the supply, wait at least five minutes before removing the cover to allow the intermediate circuit capacitors to discharge.

Pay attention to hazard warnings!

DANGER
5 MIN

WARNING

Electric shock hazard—risk of injuries! Carry out wiring work only if the unit is de-energized.

WARNING

Do not perform any modifications on the AC drive when it is connected to mains.

Warnings and cautions

WARNING

Be sure to ground the unit following the instructions in this manual. Ungrounded units may cause electric shock and/or fire.

WARNING

This equipment should only be installed, adjusted, and serviced by qualified electrical maintenance personnel familiar with the construction and operation of this type of equipment and the hazards involved. Failure to observe this precaution could result in death or severe injury.

WARNING

Components within the drive are live when it is connected to power. Contact with this voltage is extremely dangerous and may cause death or severe injury.

WARNING

Line terminals (L1, L2, L3), motor terminals (U, V, W) and the DC link/brake resistor terminals (DC–, DC+/R+, R–) are live when the drive is connected to power, even if the motor is not running. Contact with this voltage is extremely dangerous and may cause death or severe injury.

⚠ WARNING

Even though the control I/O-terminals are isolated from line voltage, the relay outputs and other I/O-terminals may have dangerous voltage present even when the drive is disconnected from power. Contact with this voltage is extremely dangerous and may cause death or severe injury.

⚠ WARNING

This equipment has a large capacitive leakage current during operation, which can cause enclosure parts to be above ground potential. Proper grounding, as described in this manual, is required. Failure to observe this precaution could result in death or severe injury.

⚠ WARNING

Before applying power to this drive, make sure that the front and cable covers are closed and fastened to prevent exposure to potential electrical fault conditions. Failure to observe this precaution could result in death or severe injury.

⚠ WARNING

An upstream disconnect/protective device must be provided as required by the National Electric Code® (NEC®). Failure to follow this precaution may result in death or severe injury.

⚠ WARNING

This drive can cause a DC current in the protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.

⚠ WARNING

Carry out wiring work only after the drive has been correctly mounted and secured.

⚠ WARNING

Before opening the drive covers:

- **Disconnect all power to the drive, including external control power that may be present**
- **Wait a minimum of five minutes after all the lights on the keypad are off. This allows time for the DC bus capacitors to discharge**
- **A hazard voltage may still remain in the DC bus capacitors even if the power has been turned off. Confirm that the capacitors have fully discharged by measuring their voltage using a multimeter set to measure the DC voltage**

Failure to follow these precautions may cause death or severe injury.

⚠ WARNING

The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

⚠ WARNING

Operation of this equipment requires detailed installation and operation instructions provided in the Installation/Operation manual intended for use with this product. This information is provided on the CD-ROM, floppy diskette(s) or other storage device included in the container this device was packaged in. it should be retained with this device at all times. A hard copy of this information may be ordered from Eaton literature fulfillment.

⚠ WARNING

Before servicing the drive:

- **Disconnect all power to the drive, including external control power that may be present**
- **Place a "DO NOT TURN ON" label on the disconnect device**
- **Lock the disconnect device in the open position**

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

The drive outputs (U, V, W) must not be connected to the input voltage or the utility line power as severe damage to the device may occur and there may be a risk of fire.

⚠ WARNING

The heat sink and/or outer enclosure may reach a high temperature.

Pay attention to hazard warnings!

Hot Surface—Risk of Burn. DO NOT TOUCH!

⚠ CAUTION

Any electrical or mechanical modification to this drive without prior written consent of Eaton will void all warranties and may result in a safety hazard in addition and voiding of the UL® listing.

CAUTION

Install this drive on flame-resistant material such as a steel plate to reduce the risk of fire.

CAUTION

Install this drive on a perpendicular surface that is able to support the weight of the drive and is not subject to vibration, to lessen the risk of the drive falling and being damaged and/or causing personal injury.

CAUTION

Prevent foreign material such as wire clippings or metal shavings from entering the drive enclosure, as this may cause arcing damage and fire.

CAUTION

Install this drive in a well-ventilated room that is not subject to temperature extremes, high humidity, or condensation, and avoid locations that are directly exposed to sunlight, or have high concentrations of dust, corrosive gas, explosive gas, inflammable gas, grinding fluid mist, etc. Improper installation may result in a fire hazard.

CAUTION

When selecting the cable cross-section, take the voltage drop under load conditions into account. The consideration of other standards is the responsibility of the user.

The user is responsible for compliance with all international and national electrical standards in force concerning protective grounding of all equipment.

CAUTION

The specified minimum PE conductor cross-sections in this manual must be maintained.

Touch current in this equipment exceeds 3.5 mA (AC). The minimum size of the protective earthing conductor shall comply with the requirements of EN 61800-5-1 and/or the local safety regulations.

CAUTION

Touch currents in this frequency inverter are greater than 3.5 mA (AC). According to product standard IEC/EN 61800-5-1, an additional equipment grounding conductor of the same cross-sectional area as the original protective earthing conductor must be connected, or the cross-section of the equipment grounding conductor must be at least 10 mm2 Cu. Drive requires that only copper conductor should be used.

CAUTION

Debounced inputs may not be used in the safety circuit diagram. Residual current circuit breakers (RCD) are only to be installed between the AC power supply network and the drive.

CAUTION

Debounced inputs may not be used in the safety circuit diagram. If you are connecting multiple motors on one drive, you must design the contactors for the individual motors according to utilization category AC-3.

Selecting the motor contactor is done according to the rated operational current of the motor to be connected.

CAUTION

Debounced inputs may not be used in the safety circuit diagram. A changeover between the drive and the input supply must take place in a voltage-free state.

CAUTION

Debounced inputs may not be used in the safety circuit diagram. Fire hazard!

Only use cables, protective switches, and contactors that feature the indicated permissible nominal current value.

CAUTION

Before connecting the drive to AC mains make sure that the EMC protection class settings of the drive are appropriately made according to instructions in this manual.

- If the drive is to be used in a floating distribution network, remove screws at MOV and EMC. See Installation Manual MN040002EN
- Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system), otherwise the system will be connected to ground potential through the EMC filter capacitors. This may cause danger, or damage the drive
- Disconnect the internal EMC filter when installing the drive on a corner grounded TN system, otherwise the drive will be damaged

Note: When the internal EMC filter is disconnected, the drive might be not EMC compatible.

- Do not attempt to install or remove the MOV or EMC screws while power is applied to the drive's input terminals.

Motor and equipment safety

⚠ CAUTION

Do not perform any meggar or voltage withstand tests on any part of the drive or its components. Improper testing may result in damage.

⚠ CAUTION

Prior to any tests or measurements of the motor or the motor cable, disconnect the motor cable at the drive output terminals (U, V, W) to avoid damaging the drive during motor or cable testing.

⚠ CAUTION

Do not touch any components on the circuit boards. Static voltage discharge may damage the components.

⚠ CAUTION

Before starting the motor, check that the motor is mounted properly and aligned with the driven equipment. Ensure that starting the motor will not cause personal injury or damage equipment connected to the motor.

⚠ CAUTION

Set the maximum motor speed (frequency) in the drive according to the requirements of the motor and the equipment connected to it. Incorrect maximum frequency settings can cause motor or equipment damage and personal injury.

⚠ CAUTION

Before reversing the motor rotation direction, ensure that this will not cause personal injury or equipment damage.

⚠ CAUTION

Make sure that no power correction capacitors are connected to the drive output or the motor terminals to prevent drive malfunction and potential damage.

⚠ CAUTION

Make sure that the drive output terminals (U, V, W) are not connected to the utility line power as severe damage to the drive may occur.

⚠ CAUTION

When the control terminals of two or more drive units are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the units or an external supply.

⚠ CAUTION

The drive will start up automatically after an input voltage interruption if the external run command is on.

⚠ CAUTION

Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel start and stop keys and, or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

⚠ CAUTION

Improper drive operation:

- If the drive is not turned on for a long period, the performance of its electrolytic capacitors will be reduced
- If it is stopped for a prolonged period, turn the drive on at least every six months for at least 5 hours to restore the performance of the capacitors, and then check its operation. It is recommended that the drive is not connected directly to the line voltage. The voltage should be increased gradually using an adjustable AC source

Failure to follow these instructions can result in injury and/or equipment damage.

For more technical information, contact the factory or your local Eaton sales representative.

Sécurité

AVERTISSEMENT !
TENSION ÉLECTRIQUE DANGEREUSE !

Avant de commencer l'installation

- Débrancher l'alimentation de l'appareil
- S'assurer que les dispositifs ne peuvent pas être accidentellement redémarrés
- Vérifier l'isolement de l'alimentation
- Mettre l'appareil à la terre et le protéger contre les courts-circuits
- Couvrir ou enfermer tout composant sous tension adjacent
- Seul le personnel qualifié conformément à la norme EN 50110-1/-2 (VDE 0105 Partie 100) peut travailler sur cet appareil/ce système
- Avant l'installation et avant de toucher l'appareil, s'assurer de ne porter aucune charge électrostatique
- La terre fonctionnelle (FE, PSE) doit être raccordée à la terre de protection (PE) ou la compensation de potentiel. L'installateur du système a la responsabilité d'assurer cette connexion
- Les câbles de connexion et les lignes de signal doivent être installés de façon à ce que les interférences capacitives ou inductives ne compromettent pas les fonctions d'automatisation
- Installer les appareils d'automatisation et les éléments de fonctionnement associés de manière à ce qu'ils soient bien protégés contre tout fonctionnement accidentel
- Des dispositifs de sécurité matériels et logiciels appropriés doivent être utilisés en rapport avec l'interface des E/S afin qu'un circuit ouvert sur le côté signal ne résulte pas en états indéfinis dans les dispositifs d'automatisation
- Assurer une isolation électrique fiable sur le côté tension extra basse de l'alimentation 24 V. Utiliser uniquement des blocs d'alimentation conformes à la norme CEI 60364-4-41 (VDE 0100, partie 410) ou HD384.4.41 S2
- Les écarts entre la tension d'entrée et la tension nominale ne doivent pas dépasser les limites de tolérance indiquées dans les spécifications, au risque de provoquer un mauvais fonctionnement et une utilisation dangereuse du système
- Les dispositifs d'arrêt d'urgence conformes à la norme CEI/EN 60204-1 doivent être efficace dans tous les modes de fonctionnement des dispositifs d'automatisation. Le déverrouillage des dispositifs d'arrêt d'urgence ne doit pas entraîner un redémarrage
- Les dispositifs conçus pour un montage dans des boîtiers ou armoires de commande ne doivent être utilisés et contrôlés qu'après avoir été installés et avec le boîtier fermé. Les unités de bureau ou portatives ne doivent être utilisées et contrôlées que dans leurs boîtiers fermés
- Des mesures doivent être prises pour assurer un bon redémarrage des programmes interrompus après une chute ou une panne de tension. Ceci ne doit pas causer des états de fonctionnement dangereux, même pour un court laps de temps. Si nécessaire, des dispositifs d'arrêt d'urgence doivent être utilisés
- Quand des défaillances du système d'automatisation peuvent entraîner des blessures ou des dommages matériels, des mesures externes doivent être appliquées pour assurer un état de fonctionnement sans danger en cas de panne ou de mauvais fonctionnement (par exemple au moyen de disjoncteurs séparés, de verrouillages mécaniques, etc.)
- En fonction de leur degré de protection, les entraînements à fréquence variable peuvent contenir des pièces métalliques sous tension, des composants rotatifs ou en mouvement et des surfaces brûlantes, pendant le fonctionnement et immédiatement après l'arrêt
- Le retrait des protections requises, une installation incorrecte ou un mauvais fonctionnement du moteur ou de l'entraînement à fréquence variable peuvent causer la défaillance de l'appareil et entraîner des blessures graves et des dommages importants
- La réglementation nationale applicable en matière de sécurité et de prévention des accidents s'applique à tous les travaux effectués sur les entraînements à fréquence variable sous tension
- L'installation électrique doit être effectuée conformément aux réglementations applicables (par exemple, en ce qui concerne les sections transversales des câbles, les fusibles, la mise à la terre de protection)
- Le transport, l'installation, la mise en service et les travaux de maintenance doivent être effectués uniquement par un personnel qualifié (IEC 60364, HD 384 et règles de sécurité du travail)
- Les installations contenant des entraînements à fréquence variable doivent être équipées de dispositifs de surveillance et de protection, conformément aux réglementations applicables en matière de sécurité. Les modifications des entraînements à fréquence variable réalisées à l'aide du logiciel d'exploitation sont autorisées
- Toutes les protections et les portes doivent être maintenues fermées pendant le fonctionnement

- Pour réduire les risques d'accidents et de dommages matériels, l'utilisateur doit inclure dans la conception de la machine des mesures limitant les conséquences de panne ou de mauvais fonctionnement de l'entraînement (augmentation de la vitesse ou arrêt soudain du moteur). Ces mesures comprennent :
  - Autres dispositifs indépendants de surveillance des variables en rapport avec la sécurité (vitesse, voyages, positions d'extrémité, etc.)
  - Mesures électriques ou non électriques appliquées à l'ensemble du système (verrouillages électriques ou mécaniques)
  - Ne jamais toucher les pièces sous tension ni les connexions des câbles de l'entraînement à fréquence variable après leur déconnexion de l'alimentation. En raison de la charge dans les condensateurs, ces pièces peuvent être encore sous tension après la déconnexion. Installer les panneaux d'avertissement appropriés

Lire ce manuel en entier et s'assurer de bien comprendre les procédures avant de tenter d'installer, de configurer, d'utiliser et d'effectuer tout travail d'entretien sur cet entraînement à fréquence variable DG1.

Définitions et symboles

AVERTISSEMENT

Ce symbole indique une haute tension. Il attire l'attention sur les éléments ou les opérations qui pourraient être dangereux pour les personnes utilisant cet équipement. Lire attentivement le message et suivre attentivement les instructions.

Ce symbole est le « symbole d'alerte de sécurité ». Il accompagne les deux termes d'avertissement suivants: MISE EN GARDE ou AVERTISSEMENT, comme décrit ci-dessous.

AVERTISSEMENT

Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures graves ou la mort.

MISE EN GARDE

Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures légères à modérées et d'importants dégâts matériels. La situation décrite dans la MISE EN GARDE peut, si elle n'est pas évitée, entraîner des conséquences graves. Des mesures de sécurité importantes sont décrites dans les MISES EN GARDE (ainsi que dans les AVERTISSEMENTS).

Haute tension dangereuse

AVERTISSEMENT

L'équipement de contrôle du moteur et les contrôleurs électroniques sont branchés sur des tensions secteur dangereuses. Lors de l'entretien des entraînements et des contrôleurs électroniques, il peut y avoir des composants exposés avec des boîtiers ou des protubérances au niveau du potentiel du réseau ou au-dessus. Toutes les précautions doivent être prises pour se protéger contre les chocs électriques.

- **Se tenir sur un tapis isolant et prendre l'habitude de n'utiliser qu'une seule main pour vérifier les composants**
- **Toujours travailler avec une autre personne lorsqu'une situation d'urgence se produit**
- **Débrancher l'alimentation avant de vérifier les contrôleurs ou d'effectuer des travaux d'entretien**
- **S'assurer que l'équipement est correctement relié à la terre**
- **Porter des lunettes de sécurité lors des travaux sur les contrôleurs électroniques ou les machines rotatives**

AVERTISSEMENT

Les composants de la section d'alimentation de l'entraînement restent sous tension après la coupure de la tension d'alimentation. Après la déconnexion de l'alimentation, attendre au moins cinq minutes avant de retirer le couvercle pour permettre la décharge des condensateurs du circuit intermédiaire.

Prêter attention aux avertissements signalant des dangers !

DANGER
5 MIN

AVERTISSEMENT

Risque de choc électrique - risque de blessures ! Effectuer le câblage uniquement si l'unité n'est plus sous tension.

AVERTISSEMENT

Ne pas effectuer de modifications sur l'entraînement CA lorsqu'il est connecté à l'alimentation secteur.

Avertissements et mises en garde

⚠ AVERTISSEMENT

S'assurer de mettre l'appareil à la terre en suivant les instructions de ce manuel. Les unités non mises à la terre peuvent causer des chocs électriques et des incendies.

⚠ AVERTISSEMENT

Cet équipement ne doit être installé, réglé et entretenu que par un personnel d'entretien électrique qualifié connaissant la construction et le fonctionnement de ce type d'équipement, ainsi que les risques encourus. Le non-respect de cette précaution peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

Les composants à l'intérieur de l'entraînement sont sous tension lorsque l'entraînement est branché à l'alimentation. Le contact avec cette tension est extrêmement dangereux et peut causer la mort ou des blessures graves.

⚠ AVERTISSEMENT

Les bornes de phase (L1, L2, L3), les bornes du moteur (U, V, W) et les bornes de résistance de liaison CC/ frein (DC-, DC+ /R+, R-) sont sous tension lorsque l'entraînement est branché à l'alimentation, même si le moteur ne tourne pas. Le contact avec cette tension est extrêmement dangereux et peut causer la mort ou des blessures graves.

⚠ AVERTISSEMENT

Même si les bornes E/S de commande sont isolées de la tension secteur, les sorties de relais et les autres bornes E/S peuvent présenter une tension dangereuse même lorsque l'entraînement est débranché. Le contact avec cette tension est extrêmement dangereux et peut causer la mort ou des blessures graves.

⚠ AVERTISSEMENT

Cet équipement a un grand courant de fuite capacitif pendant le fonctionnement, ce qui peut mettre les pièces du boîtier à un niveau supérieur au potentiel de terre. Une mise à la terre appropriée, telle que décrite dans ce manuel, est nécessaire. Le non-respect de cette précaution peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

Avant de mettre l'entraînement sous tension, s'assurer que les protections avant et des câbles sont fermées et attachées pour empêcher l'exposition à d'éventuelles défaillances électriques. Le non-respect de cette précaution peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

Un dispositif de protection/déconnexion en amont doit être fourni, tel que requis par le code électrique national (NEC®). Le non-respect de cette précaution peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

Cet entraînement peut causer un courant CC dans le conducteur de mise à la terre de protection. Lorsqu'un dispositif de protection ou de surveillance à courant résiduel est utilisé pour la protection en cas de contact direct ou indirect, seul un dispositif de type B est autorisé sur le côté alimentation de ce produit.

⚠ AVERTISSEMENT

Ne travailler sur le câblage qu'après que l'entraînement a été correctement monté et attaché.

⚠ AVERTISSEMENT

Avant d'ouvrir les couvercles de l'entraînement :

- **Débrancher toute l'alimentation allant à l'entraînement, y compris l'alimentation de commande externe pouvant être présente**
- **Attendre un minimum de cinq minutes après l'extinction de tous les voyants du clavier. Cela permet aux condensateurs de bus CC de se décharger**
- **Une tension dangereuse peut rester dans les condensateurs de bus CC même si l'alimentation a été coupée. Confirmer que les condensateurs sont entièrement déchargés en mesurant la tension à l'aide d'un multimètre réglé pour mesurer la tension CC**

Le non-respect de cette précaution peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

L'ouverture du dispositif de protection du circuit de dérivation peut indiquer que le courant de défaut a été interrompu. Pour réduire le risque d'incendie ou de choc électrique, les pièces porteuses de courant et les autres composants du contrôleur doivent être examinés et remplacés s'ils sont endommagés. Si l'élément de courant d'un relais de surcharge a grillé, le relais de surcharge doit être intégralement remplacé.

⚠ AVERTISSEMENT

Le fonctionnement de cet équipement nécessite le respect des instructions d'installation et de fonctionnement détaillées fournies dans le manuel d'installation/de fonctionnement destiné à être utilisé avec ce produit. Ces informations sont fournies sur le CD-ROM, la disquette ou tout autre périphérique de stockage inclus dans l'emballage contenant ce dispositif. Ce support doit être conservé avec cet appareil à tout moment. Une copie papier de ces informations peut être commandée auprès du service de documentation Eaton.

⚠ AVERTISSEMENT

Avant de procéder à l'entretien de l'entraînement :

- **Débrancher toute l'alimentation allant à l'entraînement, y compris l'alimentation de commande externe pouvant être présente**
- **Placer une étiquette « NE PAS UTILISER » sur le dispositif de déconnexion**
- **Verrouiller le dispositif de déconnexion en position ouverte**

Le non-respect de ces instructions peut entraîner la mort ou des blessures graves.

⚠ AVERTISSEMENT

Les sorties de l'entraînement (U, V, W) ne doivent pas être connectées à la tension d'entrée ni à l'alimentation secteur, car ceci pourrait gravement endommager l'appareil et causer un incendie.

⚠ AVERTISSEMENT

Le dissipateur de chaleur et/ou le boîtier externe peuvent atteindre une température élevée.

Prêter attention aux avertissements signalant des dangers !

Surface brûlante - Risque de brûlure. NE PAS TOUCHER !

⚠ MISE EN GARDE

Toute modification électrique ou mécanique de cet entraînement sans consentement écrit préalable d'Eaton annule toutes les garanties, peut entraîner un danger pour la sécurité et annuler l'homologation UL®.

⚠ MISE EN GARDE

Installer cet entraînement sur une matière résistante aux flammes, telle qu'une plaque d'acier, pour réduire les risques d'incendie.

⚠ MISE EN GARDE

Installer cet entraînement sur une surface perpendiculaire capable de supporter le poids de l'entraînement et non soumise à des vibrations afin de diminuer les risques de chute et de dommage de l'entraînement, ainsi que les risques de blessures.

⚠ MISE EN GARDE

Empêcher la pénétration de corps étrangers, tels que morceaux de fils et copeaux métalliques, dans le boîtier de l'entraînement, car ceci pourrait provoquer la formation d'un arc électrique et un incendie.

⚠ MISE EN GARDE

Installer cet entraînement dans une pièce bien aérée non soumise à des températures extrêmes, à une forte humidité ou à la condensation. Éviter les endroits directement exposés au soleil ou présentant de fortes concentrations de poussières, des gaz corrosifs, des gaz explosifs, des gaz inflammables, ou des vapeurs de liquide de meulage, etc. Une installation inadéquate peut entraîner un risque d'incendie.

⚠ MISE EN GARDE

Lors de la sélection de la section transversale des câbles, prendre en compte la chute de tension dans des conditions de charge. La prise en compte d'autres paramètres relève de la responsabilité de l'utilisateur.

Il relève de la responsabilité de l'utilisateur de respecter toutes les normes électriques nationales et internationales en vigueur concernant la mise à la terre de protection de l'ensemble de l'équipement.

⚠ MISE EN GARDE

Les spécifications minimum relatives aux sections transversales des conducteurs de terre de protection indiquées dans ce manuel doivent être respectées.

Le courant de fuite de cet équipement dépasse 3,5 mA (CA). La taille minimum du conducteur de la mise à la terre de protection doit être conforme aux exigences de la norme EN 61800-5-1 et/ou aux réglementations de sécurité locales.

⚠ MISE EN GARDE

Les courants de fuite de ce convertisseur de fréquence sont supérieures à 3,5 mA (CA). Conformément à la norme CEI/EN 61800-5-1, un conducteur de mise à la terre de l'équipement supplémentaire possédant la même superficie de coupe transversale que le conducteur de mise à la terre de protection d'origine doit être branché, ou la section transversale du conducteur de mise à la terre de l'équipement doit être d'au moins 10 mm2 Cu. Seul un conducteur en cuivre doit être utilisé avec cet entraînement.

⚠ MISE EN GARDE

Les entrées anti-rebond ne sont pas permises dans le schéma du circuit de sécurité. Des disjoncteurs de courant résiduel (RCD) ne peuvent être installés qu'entre le réseau de courant alternatif et l'entraînement.

⚠ MISE EN GARDE

Les entrées anti-rebond ne sont pas permises dans le schéma du circuit de sécurité. Si plusieurs moteurs sont connectés à un entraînement, des contacteurs doivent être conçus pour les moteurs individuels conformément à la catégorie d'utilisation AC-3.

Sélectionner du contacteur du moteur en fonction du courant de fonctionnement nominal du moteur à connecter.

⚠ MISE EN GARDE

Les entrées anti-rebond ne sont pas permises dans le schéma du circuit de sécurité. Une commutation entre l'entraînement et l'alimentation d'entrée doit avoir lieu dans un état sans tension.

⚠ MISE EN GARDE

Les entrées anti-rebond ne sont pas permises dans le schéma du circuit de sécurité. Risque d'incendie !

Utiliser uniquement des câbles, des interrupteurs de protection et des contacteurs indiquant le courant nominal permis.

⚠ MISE EN GARDE

Avant de connecter l'entraînement à l'alimentation secteur CA, s'assurer que les réglages de la classe de protection CEM sont correctement effectués selon les instructions de ce manuel.

- Si l'entraînement doit être utilisé dans un réseau de distribution flottant, retirer les vis au niveau des VOM et CEM. Voir « Installation dans un réseau à une phase connectée à la terre (corner-grounded) » à la **Page [?]** et « Installation dans un réseau IT» à la **Page [?]** respectivement
- Débrancher le filtre CEM interne lors de l'installation de l'entraînement sur un réseau IT (système d'alimentation non mis à la terre ou système d'alimentation électrique mis à la terre haute résistance [plus de 30 ohms]) pour ne pas que le système soit connecté au potentiel de terre via les condensateurs du filtre CEM. Ceci peut être une cause de dangers ou endommager l'entraînement
- Débrancher le filtre CEM interne lors de l'installation de l'entraînement sur un système TN à une phase connectée à la terre pour ne pas endommager l'entraînement

Note: Lorsque le filtre CEM interne est débranché, l'entraînement peut ne pas être conforme aux normes de compatibilité électromagnétique.

- Ne pas tenter d'installer ou de retirer les vis des VOM et CEM lorsque l'alimentation est appliquée aux bornes d'entrée de l'entraînement

Sécurité du moteur et de l'équipement

⚠ MISE EN GARDE

N'effectuer aucun test de résistance de tension ou au mégohmmètre sur toute partie de l'entraînement ou de ses composants. Un test inadéquat peut entraîner des dommages.

⚠ MISE EN GARDE

Avant tout test ou mesure du moteur ou du câble du moteur, débrancher le câble du moteur au niveau des bornes de sortie de l'entraînement (U, V, W) pour éviter d'endommager ce dernier lors des tests.

⚠ MISE EN GARDE

Ne toucher aucun composant sur les cartes de circuit. Les décharges d'électricité statique peuvent endommager les composants.

⚠ MISE EN GARDE

Avant de mettre le moteur en marche, vérifier qu'il est correctement monté et aligné avec l'équipement entraîné. S'assurer que le démarrage du moteur ne risque pas de provoquer des blessures ou d'endommager l'équipement connecté au moteur.

⚠ MISE EN GARDE

Régler la vitesse maximale du moteur (fréquence) dans l'entraînement conformément aux exigences du moteur et de l'équipement qui lui est connecté. Des réglages de fréquence maximum incorrects peuvent endommager le moteur ou l'équipement et causer des blessures.

⚠ MISE EN GARDE

Avant d'inverser le sens de rotation du moteur, veiller à ce que cela ne risque pas de provoquer des blessures ou des dommages matériels.

⚠ MISE EN GARDE

S'assurer qu'aucun condensateur de correction de puissance n'est connecté à la sortie de l'entraînement ou aux bornes du moteur pour éviter un mauvais fonctionnement de l'entraînement et des dommages potentiels.

⚠ MISE EN GARDE

S'assurer que les bornes de sortie de l'entraînement (U, V, W) ne sont pas connectées à l'alimentation secteur, ce qui pourrait causer de graves dommages à l'entraînement.

⚠ MISE EN GARDE

Lorsque les bornes de commande de deux ou plusieurs unités d'entraînement sont raccordées en parallèle, la tension auxiliaire de ces connexions de commande doit être fournie par une source unique, qui peut être soit l'une des unités, soit une alimentation externe.

⚠ MISE EN GARDE

L'entraînement démarre automatiquement après une interruption de la tension d'entrée si la commande de démarrage externe est active.

⚠ MISE EN GARDE

Ne pas commander le moteur avec le dispositif de déconnexion ; à la place, utiliser les touches de marche et d'arrêt du tableau de contrôle ou les commandes du tableau des E/S de l'entraînement. Le nombre de cycles de charge maximum permis des condensateurs CC (c'est-à-dire les mises sous tension par application de puissance) est de cinq en dix minutes.

⚠ MISE EN GARDE

Fonctionnement incorrect de l'entraînement :

- Si l'entraînement n'est pas mis en marche pendant une longue période, la performance de ses condensateurs électrolytiques sera réduite
- S'il est arrêté pour une période prolongée, le mettre en marche au moins tous les six mois pendant au moins 5 heures pour restaurer la performance des condensateurs, puis vérifier son fonctionnement. Il est recommandé de ne pas brancher l'entraînement directement sur la tension secteur. La tension doit être augmentée progressivement en utilisant une source CA réglable

Le non-respect de ces instructions peut entraîner des blessures ou des dégâts matériels.

Pour plus d'informations techniques, contacter l'usine ou le représentant commercial Eaton local.

PowerXL series overview

This series overview describes the purpose and contents of this manual, the receiving inspection recommendations and the DG1 Series Open Drive catalog numbering system.

How to use this manual

The purpose of this manual is to provide you with information necessary to install, set and customize parameters, start up, troubleshoot and maintain the Eaton DG1 Series Variable Frequency Drive (VFD). To provide for safe installation and operation of the equipment, read the safety guidelines at the beginning of this manual and follow the procedures outlined in the following chapters before connecting power to the DG1 Series VFD. Keep this operating manual handy and distribute to all users, technicians and maintenance personnel for reference.

Receiving and inspection

The DG1 Series VFD has met a stringent series of factory quality requirements before shipment. It is possible that packaging or equipment damage may have occurred during shipment. After receiving your DG1 Series VFD, please check for the following:

Check to make sure that the package includes the Instruction Leaflet (IL040016EN), Quick Start Guide (MN040006EN), User Manual CD (CD040002EN) and accessory packet. The accessory packet includes:

- Rubber grommets
- Control cable grounding clamps
- Additional grounding screw

Inspect the unit to ensure it was not damaged during shipment.

Make sure that the part number indicated on the nameplate corresponds with the catalog number on your order.

If shipping damage has occurred, please contact and file a claim with the carrier involved immediately.

If the delivery does not correspond to your order, please contact your Eaton Electrical representative.

Note: Do not destroy the packing. The template printed on the protective cardboard can be used for marking the mounting points of the DG1 VFD on the wall or in a cabinet.

Real time clock battery activation

To activate the real time clock (RTC) functionality in the PowerXL DG1 Series VFD, the RTC battery (already mounted in the drive) must be connected to the control board.

Simply remove the primary drive cover, locate the RTC battery directly below the keypad, and connect the white 2-wire connector to the receptacle on the control board.

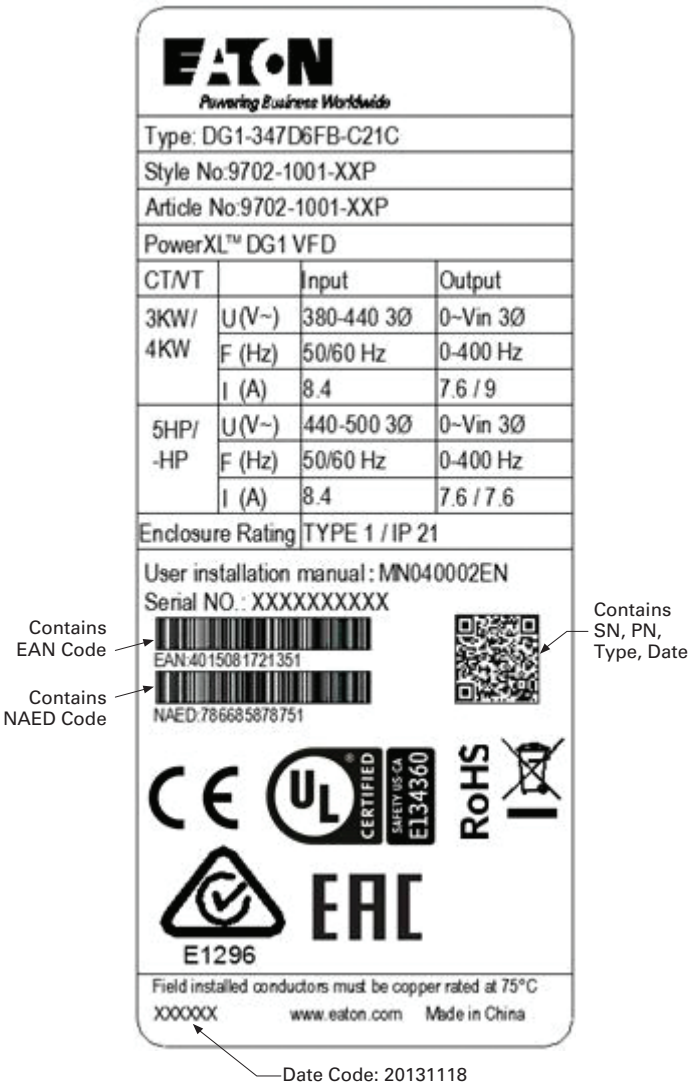
Figure 1. RTC battery connection

Table 1. Common abbreviations

Abbreviation	Definition
CT	Constant torque with high overload rating (150%)
VT	Variable torque with low overload rating (110%)
I_H	High Overload (150%)
I_L	Low Overload (110%)
RTC	Real Time Clock
VFD	Variable Frequency Drive

Rating label

Figure 2. Rating label



Carton labels (U.S. and Europe)

Same as rating label shown above.

General information

The DGI Series Drives from Eaton's electrical business provides a wide selection of option boards to increase the number and type of control inputs and outputs (I/O) and communication interfaces to provide the versatility required for today's demanding motor control applications.

The input and output capability is designed with modularity in mind, comprised of option boards, each having its own input and output configuration. The control unit is designed to accept a total of two boards, the boards provide standard analog and digital inputs and outputs, fieldbus capability, and application specific hardware.

The basic, expander and adapter boards are installed in board slots, which are parts of the control board. The I/O boards are interchangeable between different members of the PowerXL DG1 Series of drives.

Option card slots

The control board is located inside the control unit of the DG1 Series Drive. There are two slots, labeled A and B, on the control board. The different option boards can be added to any slots. For more information see "PowerXL DG1 Option Board Summary." When the DG1 Series Drive is assembled at the factory, no option boards are installed in slots A and B. If an incorrect board is plugged into either slot, the board will not work, but there is no danger to personal or for equipment damage.

Figure 3. DG1 series control board location

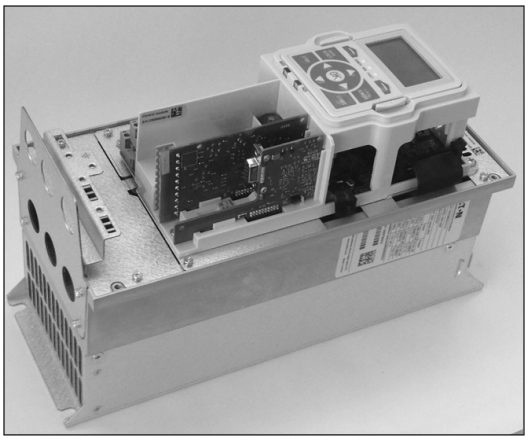
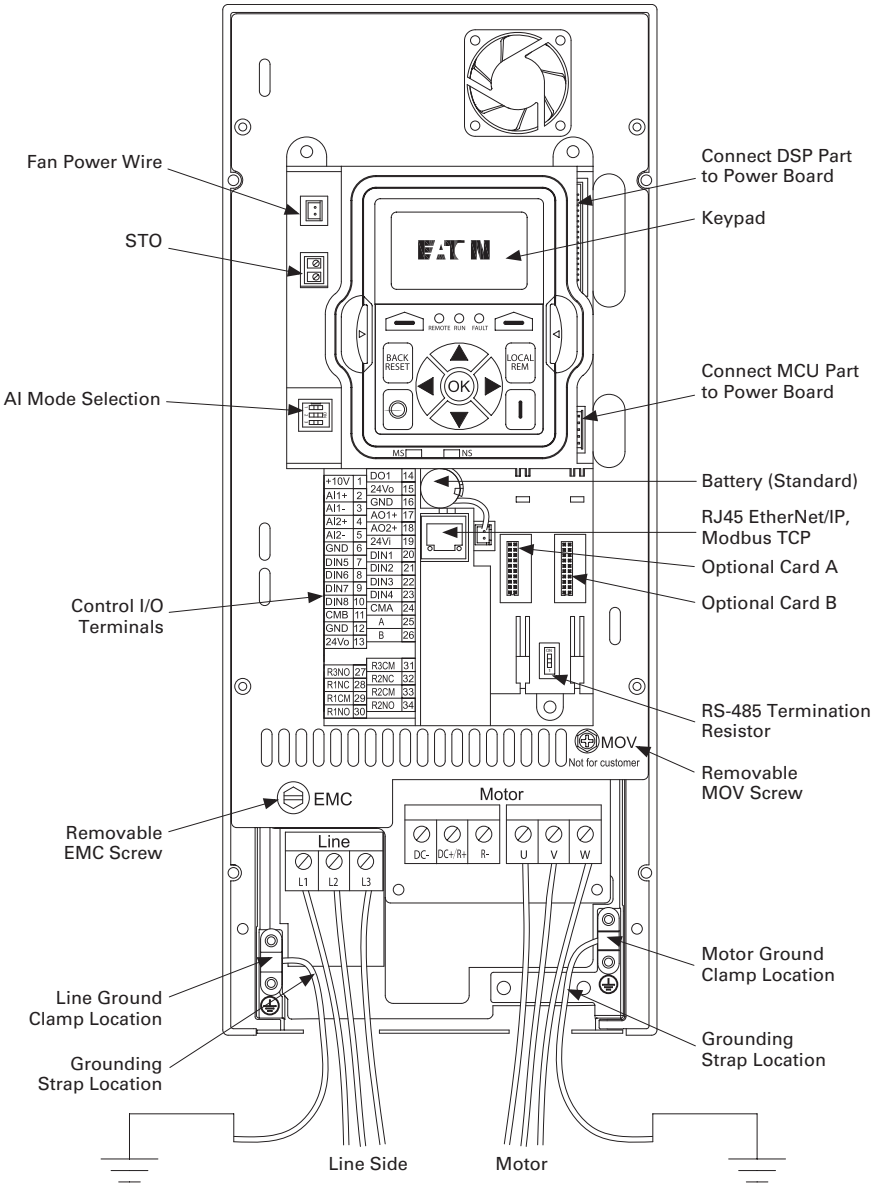


Figure 4. Drive control board layout showing option card slots

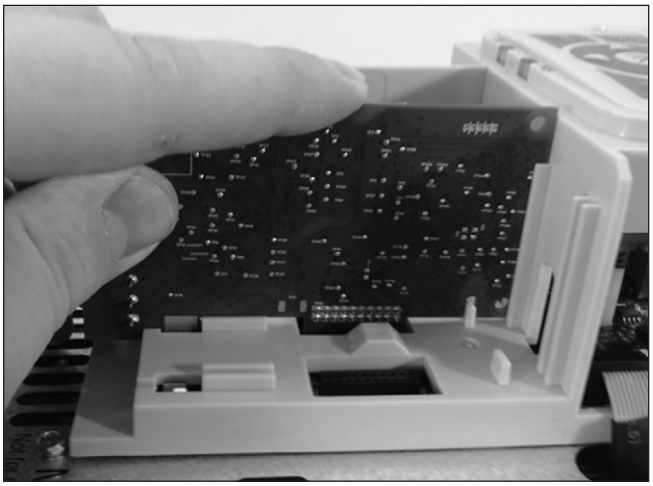


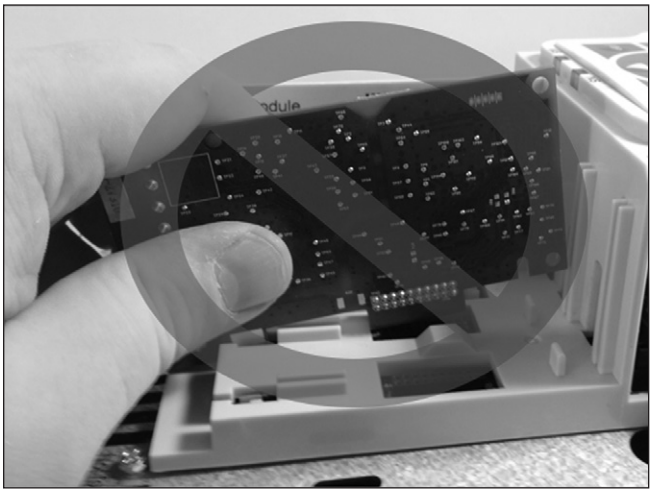
Installing DG1 option board

Remove Utility line and control power from the PowerXL DG1 series drive. Install the option board in one of the slots available on the control board. To insert and remove the board, hold it in a horizontally straight position to avoid twisting the connector pins.

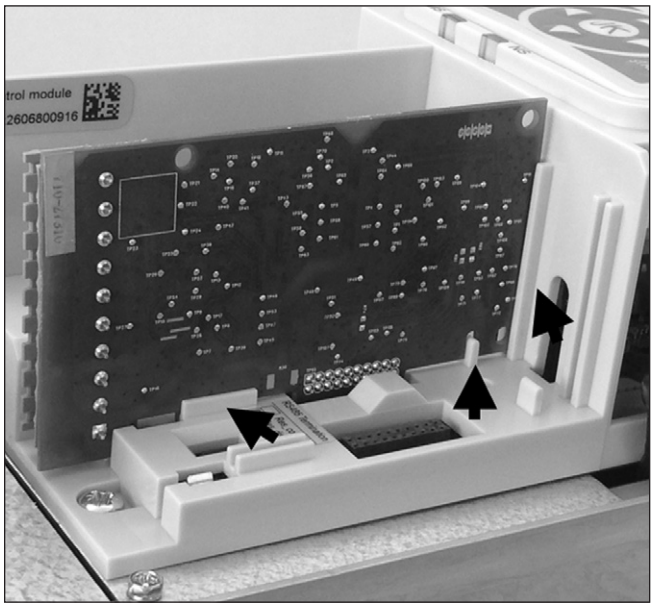
⚠ CAUTION

To prevent board damage, option cards and fieldbus boards must not be installed, removed or replaced while utility line or control power is applied to the PowerXL Drive.





Verify the board fits tightly in the metal clamp and plastic groove. If the board seems to be difficult to install in the slot, you should confirm that you are using one of the allowed slots for the option board.



Note: Check that the DIP switch settings on the board correspond to your need.

Control wiring

Digital I/O and 24 Vdc can use Stranded Cu or Solid Cu wire as specified below. Analog signal PT100 must use shielded cables. **Table 2** shows the wire sizes available. I/O terminals allow for 5.00 mm connectors.

Table 2. Wire sizes

Wire type	Wire size	Terminal torque
Solid Cu –90 °C	12–28 AWG (0.2–2.5 mm^2)	4.5 in-lb (0.5 Nm)
Stranded Cu –90 °C	12–30 AWG (0.2–2.5 mm^2)	4.5 in-lb (0.5 Nm)

EMC directive

For the electrical equipment installed in the EMC, directive states that the equipment must not disturb the environment and must be immune to other electromagnetic disturbances in the environment. **Table 3** indicates the requirements for the control wiring to meet this directive.

Table 3. Control wiring requirements

Item	Directive
Product	IEC 61800-2
Safety	UL 508C, IEC / EN 61800-5-1
EMC (at default settings)	Immunity: EN / IEC 61800-3, 2nd environment
	Radiated emissions: EN / IEC 61800-3 (Transient Testing included), 1st environment
	Conducted emissions: EN / IEC 61800-3
	Category C1: is possible with external filter connected to drive. Please consult factory
	Category C2: with internal filter maximum of 10m motor cable length
	Category C3: with internal filter maximum of 50m motor cable length

Control cable grounding

It is recommended that the shielded cables be grounded as shown in **Figure 5**. Strip the cable insulation required allowing attachment to the frame with the grounding clamp.

Figure 5. Control cable grounding

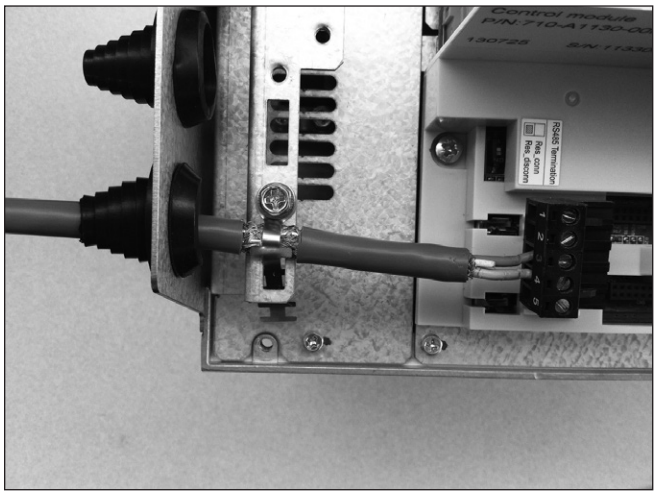


Table 4. PowerXL series—DG1 general purpose drive option boards

DX G – NET – PROFB

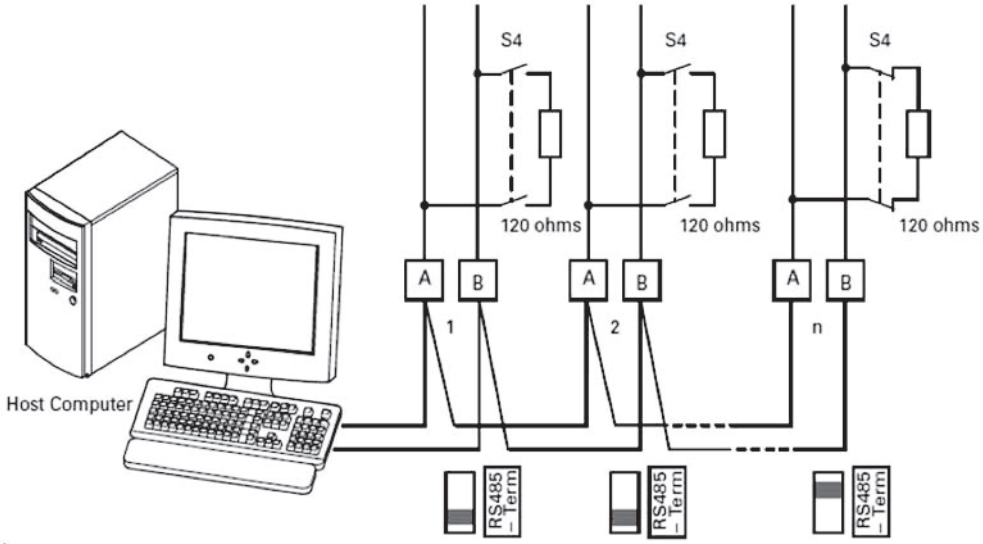
Basic naming	Series	Type	Function
DX = PowerXL Drive	**G** = General purpose	**NET** = Communication card **EXT** = I/O card **ACC** = Accessory **SPR** = Spare part **KEY** = Keypad **CBL** = Cable	**PROFIBUS** = PROFIBUS **DEVICENET** = DeviceNet **CANopen** = CANopen **SWD** = SmartWire [1] See Volume 6, **CA08100007E**, Tab 2, PowerXL DG1 Accessories for full offering

Note:
① Will be available 2017.

Modbus RTU On-Board communications

The PowerXL DG1 product can be controlled via Modbus® RTU through the on-board RS-485 terminals.

Figure 6. Connection diagram



The figure shows a typical arrangement with a host computer (master) and any number maximum 31 slaves of frequency inverters. Each frequency inverter has a unique address in the network. This addressing is executed individually for each AFD via the communication parameters.

The electrical connection between master and the slaves connected in parallel are implemented via the serial interface A-B (A = negative, B = positive) with a shielded RS-485 twisted pair cable.

Modbus RTU specifications

Communication board connections

Table 5. Connections

Item	Description
Interface	
Data Transfer Method	RS-485, half-duplex
Transfer Cable	Twisted pair (1 pair and shield)
Electrical Isolation	

Communications

Table 6. Communications

Item	Description
Modbus RTU	As described in "Modicon Modbus Protocol Reference Guide" found at. http.//public.modicon.com/
Baud Rate	9600,19200,38400,57600,115200
Addresses	1 to 247

Connections

The RS-485 communication port is connected via the A and B terminals on the drives control board.

Figure 7. Terminal wiring

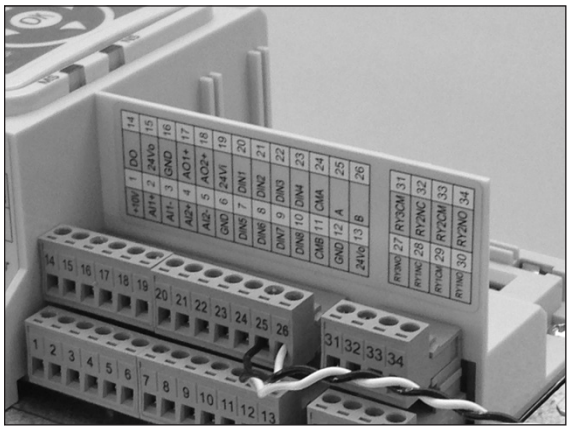
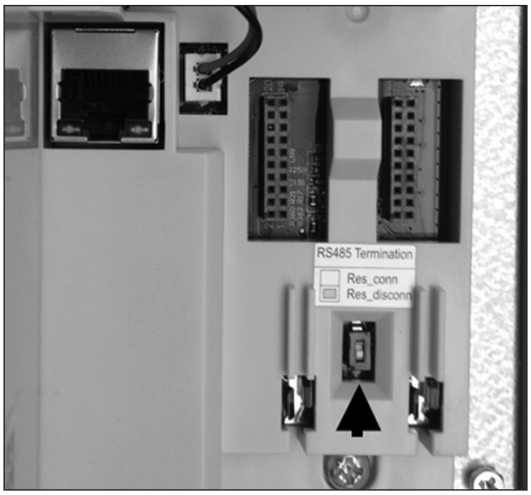
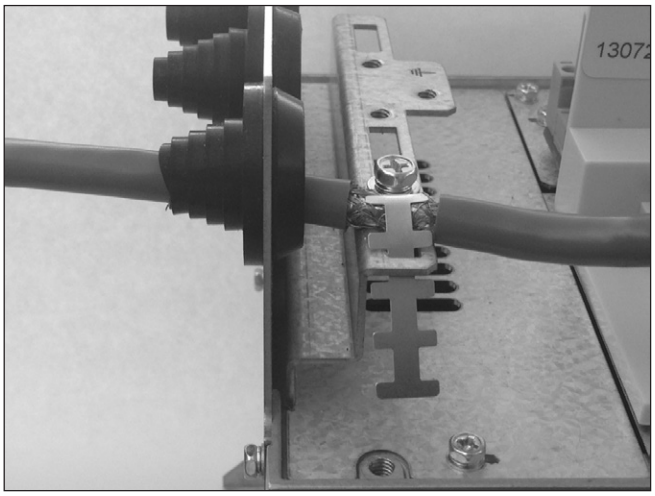


Figure 8. Termination resistor and shielding





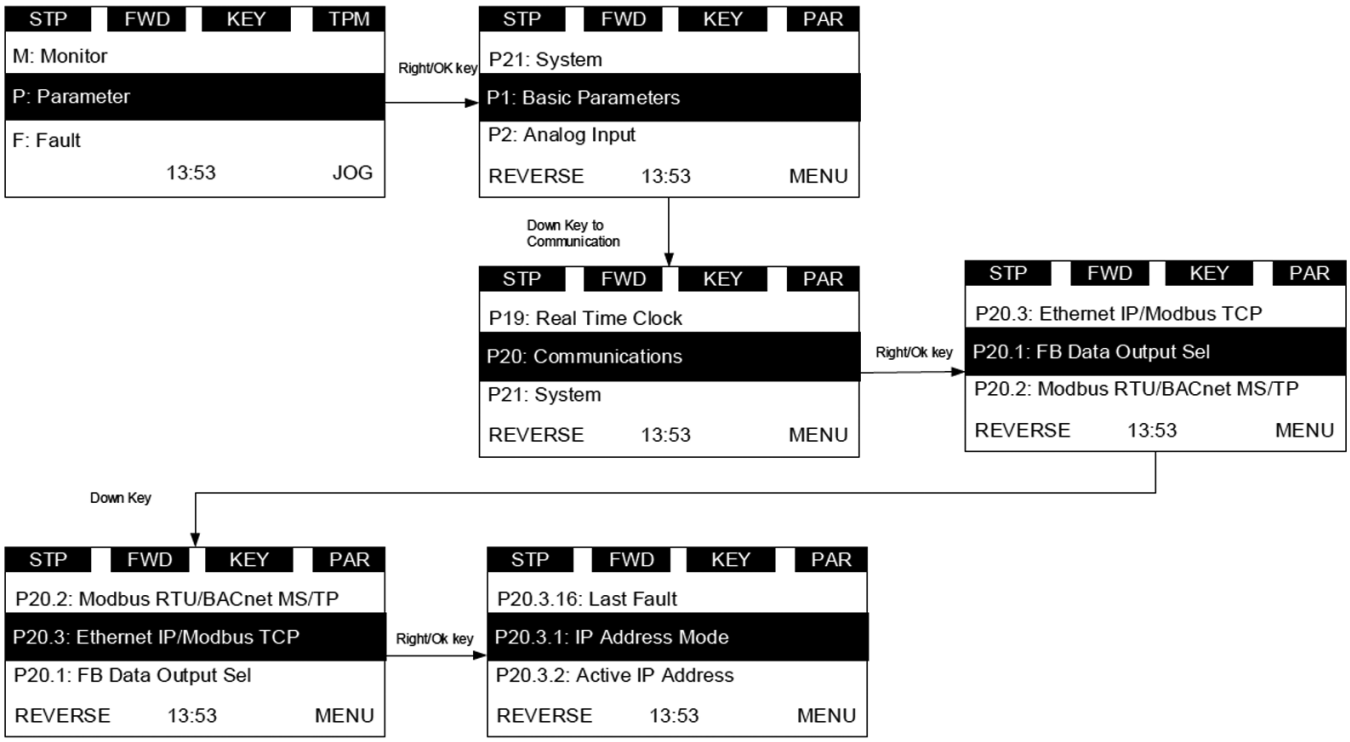
Commissioning

RS-485 communication parameters

To commission the RS-485 communication board, enter the Keypad menu as described below.

Change the Modbus RTU commissioning parameter values.

Figure 9. Keypad navigation to RS-485 menu



In this menu you will be able to scroll through the below settings to setup the communication protocol.

Table 7. Modbus RTU/BACnet MS/TP—P20.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.2.1	RS485 comm set				0	586	0 = Modbus RTU 1 = BACnet® MS/TP 2 = SmartWire-DT®
P20.2.2	Slave address	1	247		1	587	
P20.2.3	Baud rate				1	584	0 = 9600 1 = 19200 2 = 38400 3 = 57600 4 = 115200
P20.2.4	Parity type				2	585	0 = None, 2 Stop Bits 1 = Odd, 1 Stop Bit 2 = Even, 1 Stop Bit
P20.2.5	Protocol status				0	588	0 = Initial 1 = Stopped 2 = Operational 3 = Faulted

Table 7. Modbus RTU/BACnet MS/TP—P20.2, continued

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.2.6	Slave busy				0	589	0 = Not Busy 1 = Busy
P20.2.7	Parity error				0	590	
P20.2.8	Slave fault				0	591	
P20.2.9	Last fault response				0	592	
P20.2.10	Comm timeout modbus RTU			ms	10000	593	
P20.2.17	Modbus RTU/BACNet Fault Response	0	1		0	2516	0 = In Fieldbus Control 1 = in all Control

The parameters of every device must be set before connecting to the bus. Each parameter must be the same as the master configuration.

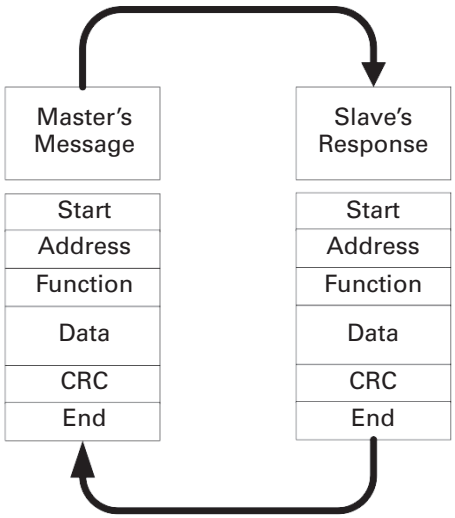
Modbus communication standards

The Modbus protocol is an industrial communications and distributed control system to integrate PLCs, computers, terminals, and other monitoring, sensing and control devices. Modbus is a Master-Slave communications protocol. The Master controls all serial activity by selectively polling one or more slave devices. The protocol provides for one master device and up to 247 slave devices on a common line. Each device is assigned an address to distinguish it from all other connected devices.

The Modbus protocol uses the master-slave technique, in which only one device (the master) can initiate a transaction. The other devices (the slaves) respond by supplying the requested data to the master, or by taking the action requested in the query. The master can address individual slaves or initiate a broadcast message to all slaves. Slaves return a message ("response") to queries that are addressed to them individually. Responses are not returned to broadcast queries from the master.

A transaction comprises a single query and single response frame or a single broadcast frame. The transaction frames are defined below.

Figure 10. The basic structure of a modbus frame



Valid slave device addresses are in the range of 0–247 decimal. The individual slave devices are assigned addresses in the range of 1–247. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

The function code field of a message frame contains two characters (ASCII) or eight bits (RTU). Valid codes are in the range of 1–255 decimal. When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform.

Examples are to read the ON/OFF states of a group of discrete coils or inputs; to read the data contents of a group of registers; to read the diagnostic status of the slave; to write to designated coils or registers; or to allow loading, recording or verifying the program within the slave.

When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most significant bit set to a logic state of 1.

The data field is constructed using sets of two hexadecimal digits, in the range of 00 to FF hexadecimal. These can be made from a pair of ASCII characters, or from one RTU character, according to the network's serial transmission mode.

The data field of messages sent from a master to slave devices contains additional information that the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken.

Two kinds of checksum are used for standard Modbus networks. The error checking field contents depend upon the transmission method that is being used.

Supported functions

Table 8. Functions

Function code	Description
0x01	Read coils
0x02	Read discrete inputs
0x03	Read holding registers
0x04	Read input registers
0x05	Write single coil
0x06	Write single register
0x07	Read exception status
0x08	Read diagnostics (Only support 0x00 return query data)
0x0F	Write multiple coils
0x10	Write multiple registers
0x17	Read/write multiple registers
0x2B/0x0E	Read device identity

Note: Note: Broadcasting can be used with codes 0x05, 0x06, 0x0F and 0x10.

Example of the request to read coils 2000–2003 from Slave device 18.

Table 9. Request to read coils

Item	Code	Description
Slave address	0x12	
Function code	0x01	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of coils High	0x00	Number of coils 0x0003 hex (= 3)
Number of coils Low	0x03	
CRC High	0x7E	
CRC Low	0x25	

Example of the request to read Discrete Inputs 2000–2003 from Slave device 18.

Table 10. Request to read discrete inputs

Item	Code	Description
Slave address	0x12	
Function code	0x02	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Discrete Inputs High	0x00	Number of Discrete Inputs 0x0003 hex (= 3)
Number of Discrete Inputs Low	0x03	
CRC High	0x3A	
CRC Low	0x25	

Example of the request to read Holding Registers 2000–2003 from Slave device 18.

Table 11. Request to read holding registers

Item	Code	Description
Slave address	0x12	
Function code	0x03	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Holding Registers High	0x00	Number of Holding Registers 0x0003 hex (= 3)
Number of Holding Registers Low	0x03	
CRC High	0x07	
CRC Low	0xE5	

Example of the request to read Input Registers 2000–2003 from Slave device 18.

Table 12. Request to read input registers

Item	Code	Description
Slave address	0x12	
Function code	0x04	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Input Registers High	0x00	Number of Input Registers 0x0003 hex (= 3)
Number of Input Registers Low	0x03	
CRC High	0xB2	
CRC Low	0x25	

Example of the request to read exception status from Slave device 18.

Table 13. Request to read exception status

Item	Code	Description
Slave address	0x12	
Function code	0x07	
CRC High	4C	
CRC Low	D2	

Example of Read Diagnostics from Slave address 18.

Table 14. Read diagnostics

Item	Code	Description
Slave address	0x12	
Function code	0x08	
Sub function High	0x00	Sub function code 0x0000 (= 0)
Sub function Low	0x00	Note. Only support sub function code 0x0000
Data High	0xA5	Data 0xA5A5 (= 42405)
Data Low	0xA5	
CRC High	0x59	
CRC Low	0x83	

Example of the request to write single coil 2000 from slave device 18, the output value is 65280.

Table 15. Request to write single coil

Item	Code	Description
Slave address	0x12	
Function code	0x05	
Output address High	0x07	Starting address 0x07D0 hex (= 2000)
Output address Low	0xD0	
Output value High	0xFF	Output value 0xFF00 hex (= 65280)
Output value Low	0x00	Note. Output value is 0x0000 or 0xFF00
CRC High	0x8E	
CRC Low	0x14	

Example of the request to write single register 2000 from Slave device 18, the output value is 5.

Table 16. Request to write single register

Item	Code	Description
Slave address	0x12	
Function code	0x06	
Output address High	0x07	Starting address 0x07D0 hex (= 2000)
Output address Low	0xD0	
Output value High	0x00	Output value 0x0005 hex (= 5)
Output value Low	0x05	
CRC High	0x4B	
CRC Low	0xE7	

Example of Write coils 19–28 from Slave device 18.

Table 17. Write coils 19–28

Item	Code	Description
Slave Address	0x12	
Function code	0x0F	
Starting Address High	0x00	Starting Address 0x0013 (= 19)
Starting Address Low	0x13	
Quantity of Outputs High	0x00	Quantity of Outputs 0x000A (= 10)
Quantity of Outputs Low	0x0A	
Bye Count	0x02	
Outputs Value High	0xCD	
Outputs Value Low	0x01	
CRC High	0xAB	
CRC Low	0xFB	

Note: The binary outputs in the previous example correspond to the outputs in the following way.

Table 18. Binary bits and corresponding outputs

Bit	1	1	0	0	1	1	0	1	0	0	0	0	0	0	1
Output	26	25	24	23	22	21	20	19	—	—	—	—	—	28	27

Example of write Holding registers 2000-2001 from Slave device 18.

Table 19. Request to write holding registers

Item	Code	Description
Slave Address	0x12	
Function code	0x10	
Starting Address High	0x07	Starting Address 0x07D0 (= 2000)
Starting Address Low	0xD0	
Quantity of Outputs High	0x00	Quantity of Outputs 0x0002 (= 2)
Quantity of Outputs Low	0x02	
Bye Count	0x04	
Outputs Value High	0x00	
Outputs Value Low	0x01	
Outputs Value High	0x00	
Outputs Value Low	0x02	
CRC High	0x53	
CRC Low	0x46	

Modbus registers

The variables and fault codes as well as the parameters can be read and written from Modbus. The parameter addresses are determined in the application. Every parameter and actual value have been given an ID number in the application. The ID numbering of the parameter as well as the parameter ranges and steps can be found in the application manual in question. The parameter value shall be given without decimals.

All values can be read with function codes 3 and 4 (all registers are 3X and 4X reference). Modbus registers are mapped to drive IDs as follows.

Table 20. Index table

ID	Modbus register	Group	R/W
1–98	40001–40098 (30001–30098)	Actual Values	1/1
100	40099 (30099)	Fault Code	1/1
101–1999	40101–41999 (30101–31999)	Parameters	1/1
2004–2011	42004–42011 (32004–32011)	Process Data In	1/1
2104–2111	42104–42111 (32104–32111)	Process Data Out	1/1

Process data

The process data fields are used to control the drive (e.g., Run, Stop, Reference, Fault Reset) and to quickly read actual values (e.g., Output frequency, Output current, Fault code). The fields are structured as follows.

Table 21. Process data slave → master (max. 22 bytes)

ID	Modbus register	Group	Range/Type
2101	32101, 42101	FB Status Word	Binary coded
2102	32102, 42102	FB General Status Word	Binary coded
2103	32103, 42103	FB Actual Speed	0–100.00%
2104	32104, 42104	FB Process Data Out 1	
2105	32105, 42105	FB Process Data Out 2	
2106	32106, 42106	FB Process Data Out 3	
2107	32107, 42107	FB Process Data Out 4	
2108	32108, 42108	FB Process Data Out 5	
2109	32109, 42109	FB Process Data Out 6	
2110	32110, 42110	FB Process Data Out 7	
2111	32111, 42111	FB Process Data Out 8	

Table 22. Process data master → slave (max. 22 bytes)

ID	Modbus register	Group	Range/Type
2001	32001, 42001	FB Control Word	Binary coded
2002	32002, 42002	FB General Control Word	Binary coded
2003	32003, 42003	FB Speed Reference	0–100.00% Hz
2004	32004, 42004	FB Process Data In 1	Integer 16
2005	32005, 42005	FB Process Data In 2	Integer 16
2006	32006, 42006	FB Process Data In 3	Integer 16
2007	32007, 42007	FB Process Data In 4	Integer 16
2008	32008, 42008	FB Process Data In 5	Integer 16
2009	32009, 42009	FB Process Data In 6	Integer 16
2010	32010, 42010	FB Process Data In 7	Integer 16
2011	32011, 42011	FB Process Data In 8	Integer 16

The use of process data depends on the application. In a typical situation, the device is started and stopped with the Control Word (CW) written by the Master and the Rotating speed is set with Reference (REF). With PD1–PD8 the device can be given other reference values (e.g., Torque reference). With the Status Word (SW) read by the Master, the status of the device can be seen. Actual Value (ACT) and PD1–PD8 show the other actual values.

Process data in

This register range is reserved for the control of the VFD. Process Data In is located in range ID 2001–2099. The registers are updated every 10 ms. See table below.

Table 23. Fieldbus basic input table

ID	Modbus register	Group	Range/Type
2001	32001, 42001	FB Control Word	Binary coded
2002	32002, 42002	FB General Control Word	Binary coded
2003	32003, 42003	FB Speed Reference	0–100.00%
2004	32004, 42004	FB Process Data In 1	Integer 16
2005	32005, 42005	FB Process Data In 2	Integer 16
2006	32006, 42006	FB Process Data In 3	Integer 16
2007	32007, 42007	FB Process Data In 4	Integer 16
2008	32008, 42008	FB Process Data In 5	Integer 16
2009	32009, 42009	FB Process Data In 6	Integer 16
2010	32010, 42010	FB Process Data In 7	Integer 16
2011	32011, 42011	FB Process Data In 8	Integer 16

Note: For FB Process Data In, see section below on Process Data IN.

Control word

PowerXL DG1 drive uses 16 bits as shown below. These bits are application specific.

Table 24. Binary bits and corresponding outputs

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
①	①	①	①	①	①	FB Ref	FB Ctrl	Bypass	FB DI 4	FB DI 3	FB DI 2	FB DI 1	Fault Reset	Reverse	RUN

Note:
① The bit is not used.

Table 25. FB control word

Bit	Description Value = 0	Value = 1
0	Drive Output Off	Drive Output On
1	Clockwise Rotation	Counter Clockwise
2	No Reset	Fault Reset
3	FB INDATA1 Off	FB INDATA1 On
4	FB INDATA2 Off	FB INDATA2 On
5	FB INDATA3 Off	FB INDATA3 On
6	FB INDATA4 Off	FB INDATA4 On
7	Bypass Relay Disable	Bypass Relay Enable
8	FB Control Off	FB Control On
9	FB Reference Off	FB Reference On
10–15	Not in use	Not in use

Fb general control word

The DG1 does not use the FB General Control Word. The main control word is used to provide commands to the drive.

Table 26. Speed reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Reference 1 to the VFD. Used normally as Speed reference.

The scaling on this value is 0–100.00% of the Maximum Frequency (P1.2). The 0 to 100.00% is represented by 0 to 10,000 value indicating 0 or 0% as Minimum Frequency (P1.1) and 10,000 or %100.00 as Maximum Frequency (P1.2). This value has 2 decimal places in it.

Process data in 1 to 8

Process Data In values 1 to 8 can be used in applications for various purposes. See Process Data IN section for setup.

Process data out

This register range is normally used to fast monitoring of the VFD. Process Data Out is located in range ID 2101–2199. See table below.

Table 27. Fieldbus basic output table

ID	Modbus Register	Group	Range/Type
2101	32101, 42101	FB Status Word	Binary coded
2102	32102, 42102	FB General Status Word	Binary coded
2103	32103, 42103	FB Actual Speed	%
2104	32104, 42104	FB Process Data Out 1	
2105	32105, 42105	FB Process Data Out 2	
2106	32106, 42106	FB Process Data Out 3	
2107	32107, 42107	FB Process Data Out 4	
2108	32108, 42108	FB Process Data Out 5	
2109	32109, 42109	FB Process Data Out 6	
2110	32110, 42110	FB Process Data Out 7	
2111	32111, 42111	FB Process Data Out 8	

Table 28. FB status word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
—	—	—	—	—	—	—	—	—	—	—	Direction	Fault	Direction	Running	Ready

Information about the status of the device and messages is indicated in the FB Status Word. The FB Status Word is composed of 16 bits that have the following meanings.

Table 29. FB status word bit descriptions

Bit	Description Value = 0	Value = 1
0	Not Ready	Ready
1	STOP	RUN
2	Clockwise	Counterclockwise
3	—	Faulted
4	—	Warning
5	Ref. frequency not reached	Ref. frequency reached
6	Bypass not activated	Bypass activated
7	Run disable	Run Enable
8	Not in use	Not in use
9–15	Not in use	Not In use

Table 30. FB general status word

Bit	Description Value = 0	Value = 1
0	Not Ready	Ready
1	Stop	Run
2	Clockwise	Counter Clockwise
3	No Fault	Fault
4	No Warning	Warning
5	Ref. Frequency Not Reached	Ref. Frequency Reached
6	Ref > 0 Speed	Ref = 0 speed
7	Motor Flux Off	Motor Flux On①
8	Motor Speed Limit On	Motor Speed Limit Off①
9	Encoder Direction Off	Encoder Direction On①
10	Under Voltage Fast Stop Off	Under Voltage Fast Stop On①
11	DC Brake Off	DC Brake On
12	FB Ref Not Enable	FB Ref Enabled
13	Motor Start Delay Off	Motor Start Delay On
14	Remote Not Enable	Remote Enable
15	FB WD Pulse Not Enabled	FB WD Pulse Enable①

Note:
① The bit is not used.

Table 31. Speed reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Actual Speed of the motor. This value comes back in the form of %.

Process data out 1 to 8

Process Data Out values 1 to 8 can be used in application for various purposes.
See below tables for additional information.

Process data OUT (slave → master)

The fieldbus master can read the AFD's actual values using process data variables. Standard, Pump and Fan Control, PID control and Multi-Purpose applications use process data as follows. These values are selectable via the Fieldbus Process Data parameter group. These values would correspond to the Modbus ID value. See **Appendix A** for Parameter ID table showing values can be set.

Table 32. Process data OUT

Id	Data	Value	Default value	Default para	Unit	Scale
2104	Process Data OUT 1	-32768–32767	1	Output Frequency	Hz	
2105	Process Data OUT 2	-32768–32767	2	Motor Speed	RPM	
2106	Process Data OUT 3	-32768–32767	3	Motor Current	A	
2107	Process Data OUT 4	-32768–32767	4	Motor Torque	%	
2108	Process Data OUT 5	-32768–32767	5	Motor Power	%	
2109	Process Data OUT 6	-32768–32767	6	Motor Voltage	V	
2110	Process Data OUT 7	-32768–32767	7	DC Link Voltage	V	
2111	Process Data OUT 8	-32768–32767	28	Latest Fault Code	—	

Process data IN (master → slave)

Control Word, Reference and Process Data are used with All-in-One applications as follows.

Table 33. Process data IN

ID	Data	Value	Unit	Scale
2003	Reference	Speed Reference	Hz	0.01
2001	Control Word	—	—	—
2004	Process Data IN1	①	%	0.01%
2005	Process Data IN2	①	%	0.01%
2006	Process Data IN3	①	%	0.01%
2007	Process Data IN4	①	%	0.01%
2008	Process Data IN5	①	%	0.01%
2009	Process Data IN6	①	%	0.01%
2010	Process Data IN7	①	%	0.01%
2011	Process Data IN8	①	%	0.01%

Note:
① Process Data IN1 through Process Data IN8 change based off the selected application. See **Appendix B** for layout.

Startup test

Select Fieldbus (Bus/Comm) as the active control and reference place.

1. Set FB control word (Modbus Address 42000) value to 1hex
2. DG1 status is RUN
3. Set FB Speed reference (Modbus Address 42002) value to 5000 (= 50.00%)
4. The Actual value is 5000 and the DG1 output frequency is 50.00%
5. Set FB control word (Modbus Address 42000) value to 0hex
6. DG1 status is STOP

Modbus TCP On-Board communications

Modbus/TCP specifications

Table 34. Modbus/TCP technical data

General	Description	Specification
Ethernet connections	Interface	RJ-45 connector
Communications	Transfer cable	Shielded twisted pair
	Speed	10/100 Mb
	Duplex	Half/full
	Default IP–address Mode	DHCP with Auto-IP
Default static IP configurations	Default static IP address	192.168.1.254
	Default Network Mask	255.255.255.0
	Default Gateway Address	192.168.1.1

Modbus/TCP protocol

Modbus/TCP is a variant of the Modbus family. It is a manufacturer-independent protocol for monitoring and controlling automatic devices. Modbus/TCP is a client-server protocol. The client makes queries to the server by sending "request" messages to the server's TCP port 502. The server answers client queries with "response" messages. The term "client" can refer to a master device that runs queries. Correspondingly, the term "server" refers to a slave device that serves the master device by answering its queries. Both the request and the response messages are composed as follows.

Byte 0. Transaction ID High

Byte 1. Transaction ID Low

Byte 2. Protocol ID High

Byte 3. Protocol ID Low

Byte 4. Length field High

Byte 5. Length field Low

Byte 6. Unit identifier

Byte 7. Modbus function code

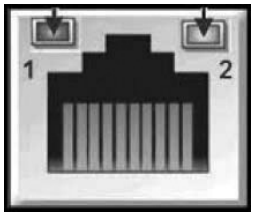
Byte 8. Data (of variable length)

Modbus/TCP vs. modbus RTU

Compared to the Modbus RTU protocol, the Modbus/TCP differs mostly in error checking and slave addresses. As the TCP already includes an efficient error checking function, the Modbus/TCP protocol does not include a separate CRC field. In addition to the error checking functionality, the TCP is responsible for resending packets and for splitting long messages so that they fit the TCP frames. The slave address field of the Modbus/RTU is named as the unit identifier field in Modbus/TCP, and it is only used when one IP address stands for several endpoints.

Hardware specifications

Ethernet port LED indications



Ethernet LED

1. Ethernet Link Status
2. Ethernet Link Speed

Table 35. Ethernet LED description

LED	Meaning
Ethernet link status	Flashes with Ethernet message activity.
Ethernet link speed	Displays the link speed. Yellow LED on the Ethernet Jack is ON when link speed is 100 mbps Yellow LED on the Ethernet Jack is OFF when link speed is 10 mbps

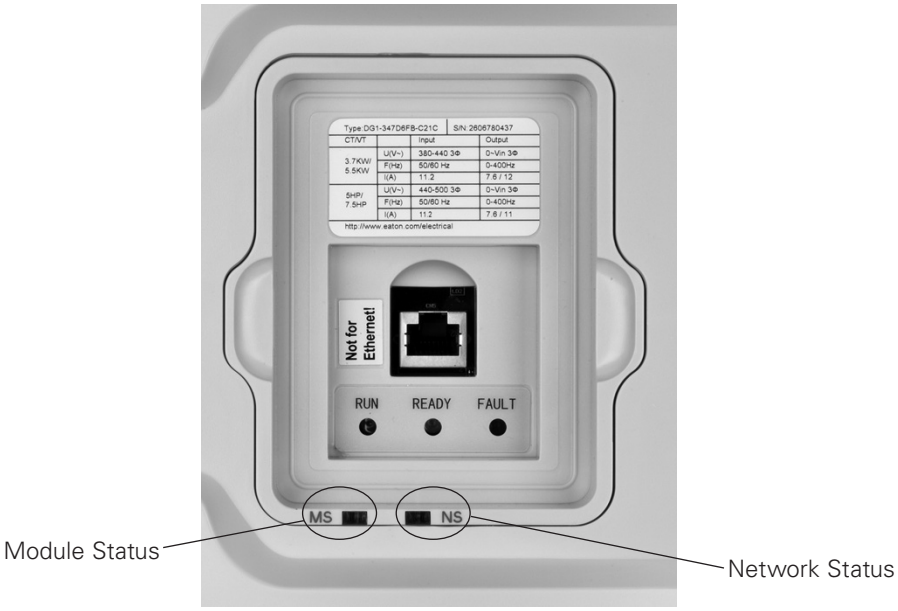
Ethernet LED indications at power up

When PowerXL is powered up, an indicator test will be performed. To allow a visual inspection, the following sequence will be performed.

1. Turn first indicator Green, all other indicators off
2. Leave first indicator on Green for approximately 0.25 second
3. Turn first indicator on Red for approximately 0.25 second
4. Turn first indicator on Green
5. Turn second indicator (if present) on Green for approximately 0.25 second
6. Turn second indicator (if present) on Red for approximately 0.25 second
7. Turn second indicator (if present) Off

If other indicators are present, test each indicator in sequence as prescribed by the second indicator above. If a Module Status indicator is present, it will be the first indicator in the sequence, followed by any Network Status indicators present. After completion of this power up test, the indicator(s) will turn to a normal operational state.

Figure 11. Module and network status



Module status indications

Represents the state of the drive.

Table 36. Module status LED description

Indicator state	Summary	Meaning
Steady Off	No power	No power is supplied to the PowerXL.
Steady Green	Device operational	PowerXL is operating correctly.
Flashing Green①	Standby	PowerXL has not been configured.
Flashing Red①	Minor fault	PowerXL has detected a recoverable minor fault. Note. An incorrect or inconsistent configuration would be considered a minor fault. Also check that on clearing the fault, it turns off.
Steady Red	Major fault	PowerXL has detected a non-recoverable major fault.
Flashing Green/Red①	Self-test	PowerXL is performing its power up testing.

① Flash rate is 1 flash per second.

Network status indications

Represents the state of the Ethernet port network interface.

Table 37. Network status LED description

Indicator state	Summary	Meaning
Steady Off	Not powered, no IP address	PowerXL is powered off, or is powered on but with no IP address configured (Interface Configuration attribute of the TCP/IP Interface Object).
Flashing Green①	No connections	An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out.
Steady Green	Connected	At least one CIP connection (any transport class) is established, and an Exclusive Owner connection has not timed out.
Flashing Red①	Connection timeout	PowerXL is powered on and an exclusive Owner connection has timed out. It returns to steady green only when all timed out Exclusive Owner connections are established.
Steady Red	Major fault	PowerXL has detected a non-recoverable major fault.
Flashing Green/Red①	Self-test	PowerXL is performing its power up testing.

① Flash rate is 1 flash per second.

Commissioning

Connections and wiring

The Ethernet port supports 10/100 Mb speeds in both full and half-duplex modes. The boards must be connected to the Ethernet network with a shielded CAT-5e cable. A crossover cable (at least CAT-5e cable with STP, shielded twisted pair) may be needed if you want to connect the EtherNet/IP board directly to the master appliance.

Use only industrial standard components in the network and avoid complex structures to minimize the length of response time and the amount of incorrect dispatches. It is often a good practice to use a subnet that is different from other devices not related to the drive control.

Figure 12. CAT-5e cable

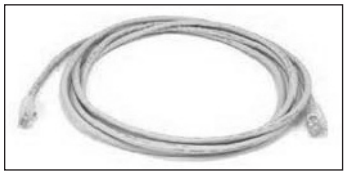
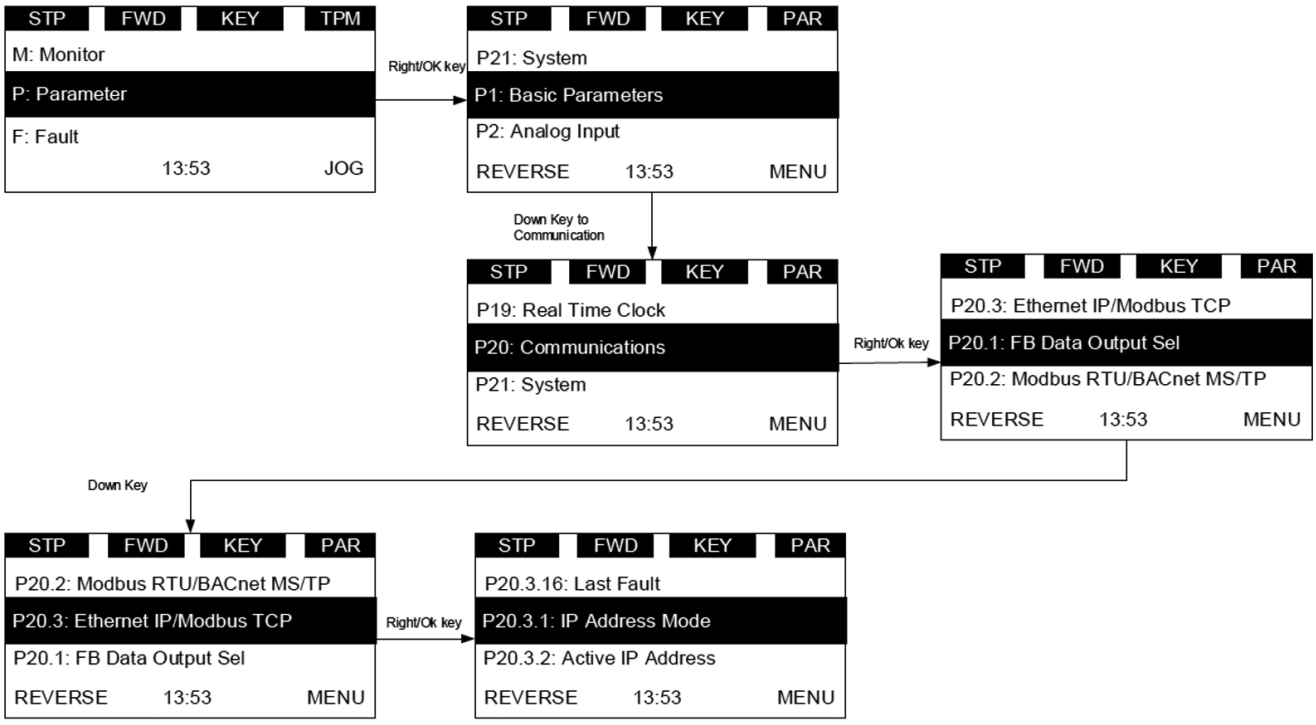


Figure 13. Keypad navigation to ethernet comm settings



In this menu you will be able to scroll through the below settings to setup the communication protocol.

Table 38. EtherNet/IP / Modbus TCP—P20.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.3.1	IP Address Mode				1	1500	0 = Static IP 1 = DHCP with AutoIP
P20.3.2	Active IP Address					1507	
P20.3.3	Active Subnet Mask					1509	
P20.3.4	Active Default Gateway					1511	
P20.3.5	MAC Address					1513	

Table 38. EtherNet/IP / Modbus TCP—P20.3, continued

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.3.6	Static IP Address				192.168.1.254	1501	
P20.3.7	Static Subnet Mask				255.255.255.0	1503	
P20.3.8	Static Default Gateway				192.168.1.1	1505	
P20.3.10	Connection Limit	0	5		5	609	
P20.3.11	Modbus TCP Unit ID				1	610	
P20.3.12	Comm Timeout Modbus TCP			ms	10000	611	
P20.3.13	Protocol Status				0	612	0 = Stopped 1 = Operational 2 = Faulted
P20.3.14	Slave Busy				0	613	0 = Not Busy 1 = Busy
P20.3.15	Parity Error				0	614	
P20.3.16	Slave Failure				0	615	
P20.3.17	Last Fault Response				0	616	
P20.3.18	Modbus TCP Fault Response	0	1		0	2517	0 = In Fieldbus Control 1 = in all Control

DHCP

PowerXL EtherNet/IP communication supports DHCP for easier network configuration. Dynamic Host Configuration Protocol (DHCP) is a network protocol that is used to configure network devices so that they can communicate on an IP network. As a DHCP client, PowerXL EtherNet/IP negotiates with the DHCP server to determine its IP address and obtain any other initial configuration details it needs for network operation.

IP address

IP is divided into four parts. (Part = Octet) Default Static IP Address is 192.168.1.254

Communication timeout

Defines how much time can pass from the last received message from the client device before fieldbus fault is generated. Default communication timeout is 10 seconds.

Note: If the network cable is broken from PowerXL EtherNet/IP port, a fieldbus error is generated immediately.

Static IP address

In most cases the user may want to establish a Static IP Address for the PowerXL EtherNet/IP based on their network configuration.

Static IP address default configurations are as defined in "PowerXL EtherNet/IP network settings" table, provided in "Connections and Wiring" section.

The user can manually define the network address for the PowerXL EtherNet/IP as long as all units connected to the network are given the same network portion of the address. In these situations the user will need to manually set the IP Address in the PowerXL by using PowerXL drive keypad. Be aware that overlapping IP addresses can cause conflicts between devices on the network. For more information about selecting IP addresses, contact your network administrator.

Unit identifier

The Unit Identifier used in Modbus TCP is used for the Modbus protocol in place of the slave address used in Modbus RTU. This Unit Identifier is used to communicate via devices such as bridges, routers and gateways that use a single IP address to support multiple independent Modbus end units.

Manual IP address configuration

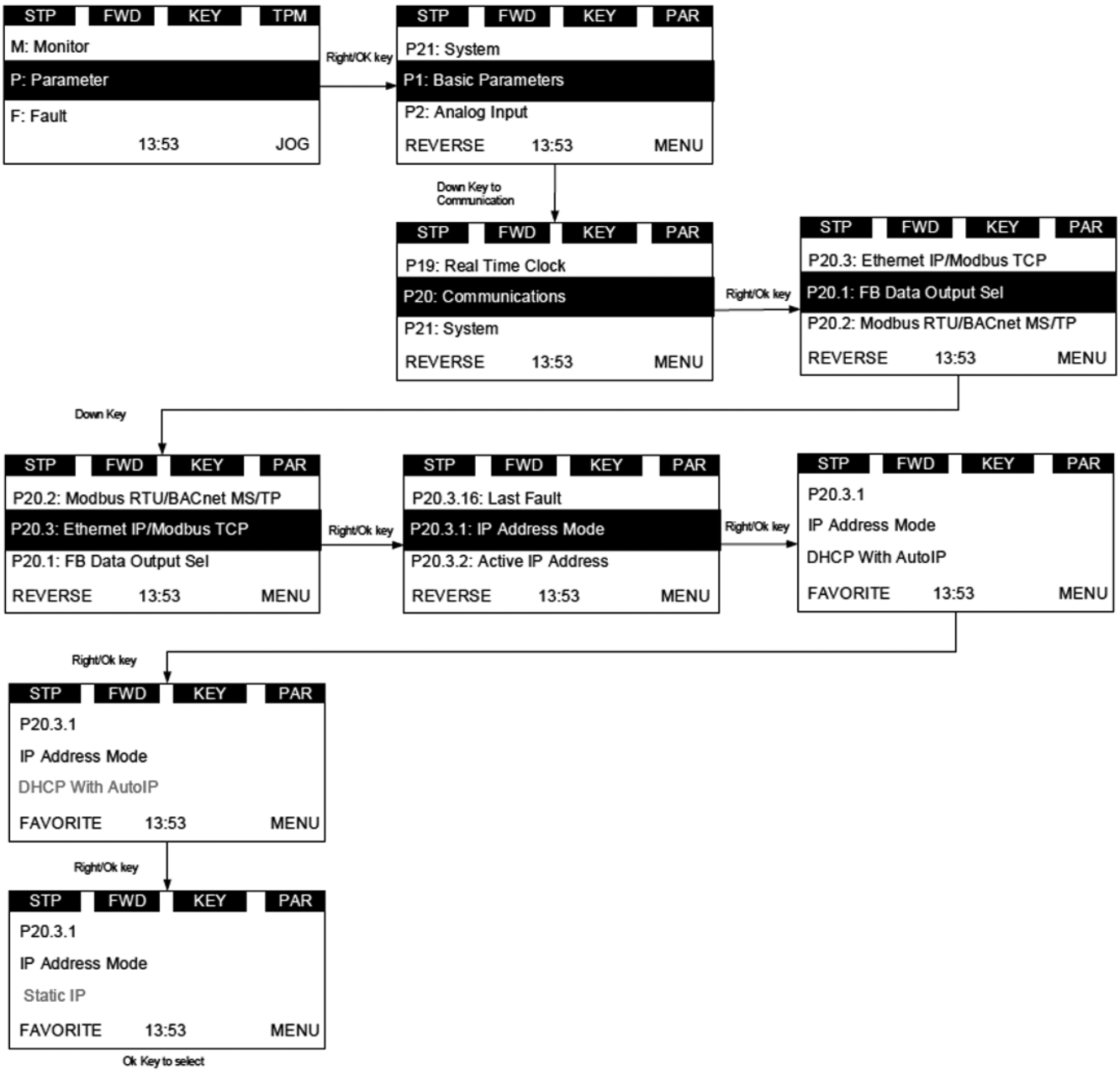
Using the PowerXL drive keypad

Using the PowerXL Drive Keypad to set the IP Address manually in the PowerXL EtherNet/IP.

1. Select IP addressing mode as Static IP. Static IP mode configurations will be loaded.

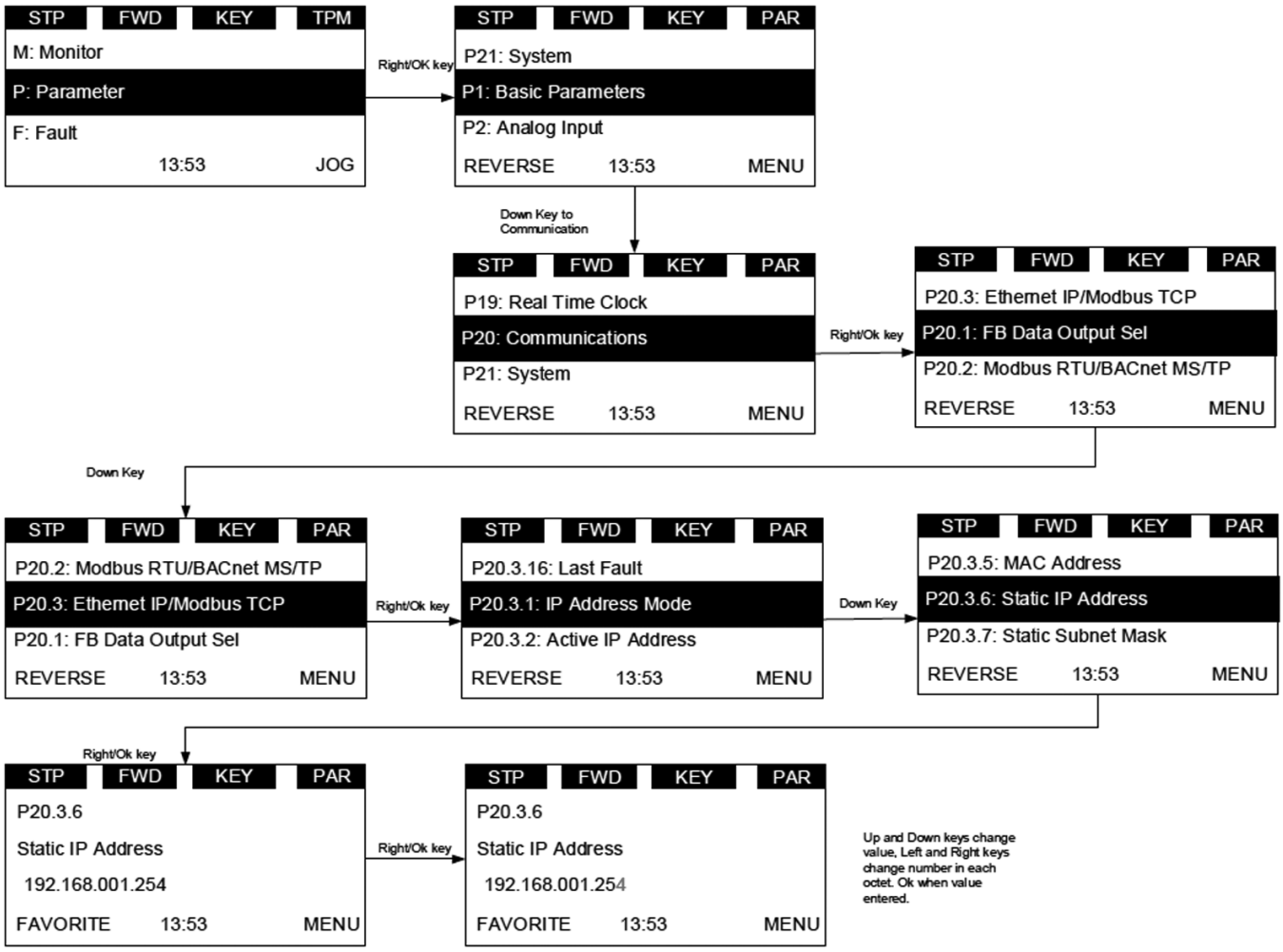
Note: Change in IP address mode will require PowerXL to power cycle to get this change effective. Also ensure device MAC address (Keypad menu. P20.3.5)

Figure 14. Static IP mode



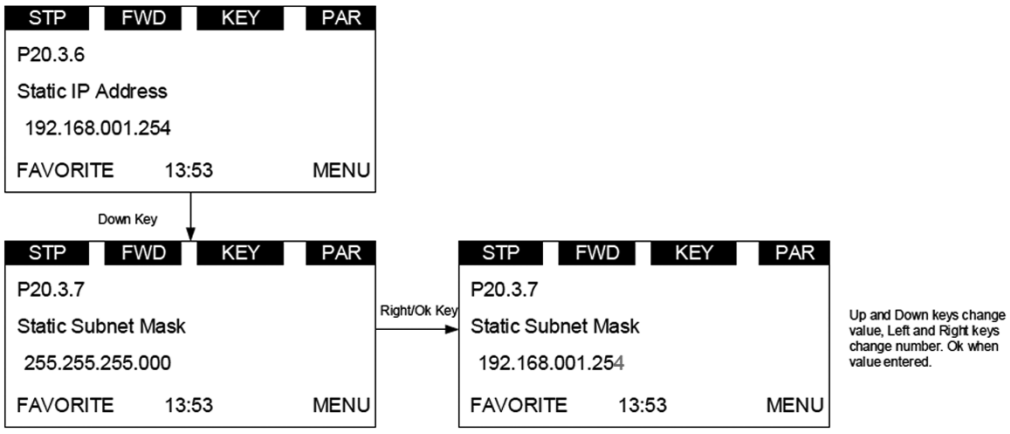
2. Using PowerXL drive keypad, set the IP address in the PowerXL EIP to the desired address setting by.
   a. Setting Static IP Address

Figure 15. Static IP address



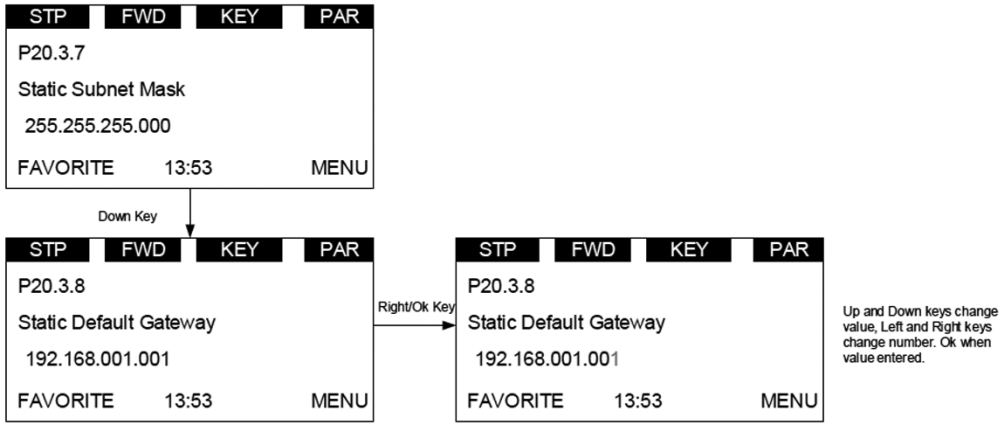
b. Setting Static Subnet Mask

Figure 16. Static subnet mask



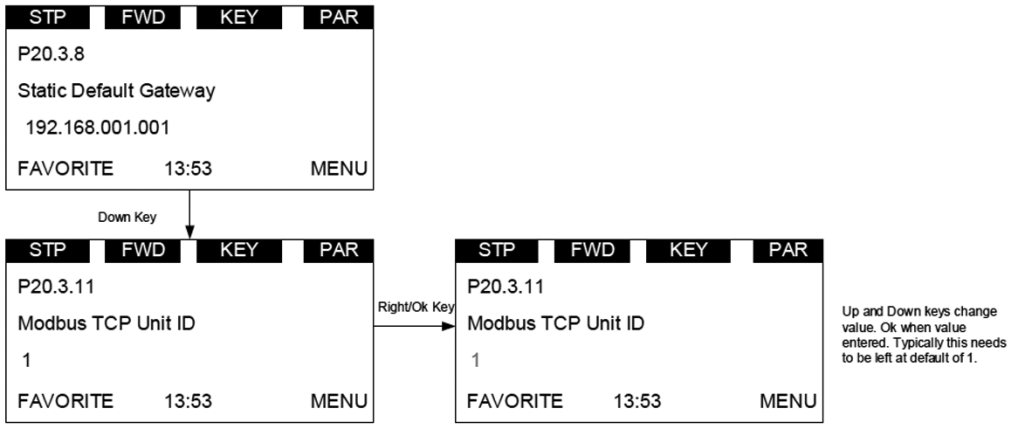
c. Setting Static Default Gateway

Figure 17. Static default gateway



d. Setting Modbus TCP Unit ID

Figure 18. Modbus TCP unit ID



3. Make note of the changed IP Address.
4. Using PowerXL drive keypad, read “Active IP Address” (Keypad menu. P20.3.2), “Active Subnet Mask” (Keypad menu. P20.3.3), “Active Default Gateway” (Keypad menu. P20.3.4) parameters to ensure that IP address has been set to desired IP address.

Modbus communication standards

Example of the request to read coils 2000–2003 from Slave device 18.

Table 39. Request to read coils

Item	Code	Description
Slave address	0x12	
Function code	0x01	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of coils High	0x00	Number of coils 0x0003 hex (= 3)
Number of coils Low	0x03	
CRC High	0x7E	
CRC Low	0x25	

Example of the request to read Discrete Inputs 2000–2003 from Slave device 18.

Table 40. Request to read discrete inputs

Item	Code	Description
Slave address	0x12	
Function code	0x02	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Discrete Inputs High	0x00	Number of Discrete Inputs 0x0003 hex (= 3)
Number of Discrete Inputs Low	0x03	
CRC High	0x3A	
CRC Low	0x25	

Example of the request to read Holding Registers 2000–2003 from Slave device 18.

Table 41. Request to read holding registers

Item	Code	Description
Slave address	0x12	
Function code	0x03	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Holding Registers High	0x00	Number of Holding Registers 0x0003 hex (= 3)
Number of Holding Registers Low	0x03	
CRC High	0x07	
CRC Low	0xE5	

Example of the request to read Input Registers 2000–2003 from Slave device 18.

Table 42. Request to read input registers

Item	Code	Description
Slave address	0x12	
Function code	0x04	
Start address High	0x07	Starting address 0x07D0 hex (= 2000)
Start address Low	0xD0	
Number of Input Registers High	0x00	Number of Input Registers 0x0003 hex (= 3)
Number of Input Registers Low	0x03	
CRC High	0xB2	
CRC Low	0x25	

Example of the request to read exception status from Slave device 18.

Table 43. Request to read exception status

Item	Code	Description
Slave address	0x12	
Function code	0x07	
CRC High	4C	
CRC Low	D2	

Example of Read Diagnostics from Slave address 18.

Table 44. Read diagnostics

Item	Code	Description
Slave address	0x12	
Function code	0x08	
Sub function High	0x00	Sub function code 0x0000 (= 0)
Sub function Low	0x00	Note. Only support sub function code 0x0000
Data High	0xA5	Data 0xA5A5 (= 42405)
Data Low	0xA5	
CRC High	0x59	
CRC Low	0x83	

Example of the request to write single coil 2000 from Slave device 18, the output value is 1.

Table 45. Request to write single coil

Item	Code	Description
Slave address	0x12	
Function code	0x05	
Output address High	0x07	Starting address 0x07D0 hex (= 2000)
Output address Low	0xD0	
Output value High	0xFF	Output value 0xFF00 hex (= 65280)
Output value Low	0x00	Note. Output value is 0x0000 or 0xFF00
CRC High	0x8E	
CRC Low	0x14	

Example of the request to write single register 2000 from Slave device 18, the output value is 5.

Table 46. Request to write single register

Item	Code	Description
Slave address	0x12	
Function code	0x06	
Output address High	0x07	Starting address 0x07D0 hex (= 2000)
Output address Low	0xD0	
Output value High	0x00	Output value 0x0005 hex (= 5)
Output value Low	0x05	
CRC High	0x4B	
CRC Low	0xE7	

Example of Write coils 19–28 from Slave device 18.

Table 47. Write coils 19–28

Item	Code	Description
Slave Address	0x12	
Function code	0x0F	
Starting Address High	0x00	Starting Address 0x0013 (= 19)
Starting Address Low	0x13	
Quantity of Outputs High	0x00	Quantity of Outputs 0x000A (= 10)
Quantity of Outputs Low	0x0A	
Bye Count	0x02	
Outputs Value High	0xCD	
Outputs Value Low	0x01	
CRC High	0xAB	
CRC Low	0xFB	

Note: The binary outputs in the previous example correspond to the outputs in the following way.

Table 48. Binary bits and corresponding outputs

Bit	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1
Output	26	25	24	23	22	21	20	19	—	—	—	—	—	—	28	27

Example of write Holding registers 2000–2001 from Slave device 18.

Table 49. Write holding registers

Item	Code	Description
Slave Address	0x12	
Function code	0x10	
Starting Address High	0x07	Starting Address 0x07D0 (= 2000)
Starting Address Low	0xD0	
Quantity of Outputs High	0x00	Quantity of Outputs 0x0002 (= 2)
Quantity of Outputs Low	0x02	
Bye Count	0x04	
Outputs Value High	0x00	
Outputs Value Low	0x01	
Outputs Value High	0x00	
Outputs Value Low	0x02	
CRC High	0x53	
CRC Low	0x46	

Modbus registers

The variables and fault codes as well as the parameters can be read and written from Modbus. The parameter addresses are determined in the application. Every parameter and actual value have been given an ID number in the application. The ID numbering of the parameter as well as the parameter ranges and steps can be found in the application manual in question. The parameter value shall be given without decimals.

All values can be read with function codes 3 and 4 (all registers are 3X and 4X reference). Modbus registers are mapped to drive IDs as follows.

Table 50. Index table

ID	Modbus register	Group	R/W
1–98	40001–40098 (30001–30098)	Actual Values	1/1
100	40099 (30099)	Fault Code	1/1
101–1999	40101–41999 (30101–31999)	Parameters	1/1
2004–2011	42004–42011 (32004–32011)	Process Data In	1/1
2104–2111	42104–42111 (32104–32111)	Process Data Out	1/1

Process data

The process data fields are used to control the drive (e.g., Run, Stop, Reference, Fault Reset) and to quickly read actual values (e.g., Output frequency, Output current, Fault code). The fields are structured as follows.

Table 51. Process data slave → master (max. 22 bytes)

ID	Modbus register	Group	Range/Type
2101	32101, 42101	FB Status Word	Binary coded
2102	32102, 42102	FB General Status Word	Binary coded
2103	32103, 42103	FB Actual Speed	0–100.00%
2104	32104, 42104	FB Process Data Out 1	
2105	32105, 42105	FB Process Data Out 2	
2106	32106, 42106	FB Process Data Out 3	
2107	32107, 42107	FB Process Data Out 4	
2108	32108, 42108	FB Process Data Out 5	
2109	32109, 42109	FB Process Data Out 6	
2110	32110, 42110	FB Process Data Out 7	
2111	32111, 42111	FB Process Data Out 8	

Table 52. Process data master → slave (max. 22 bytes)

ID	Modbus register	Group	Range/Type
2001	32001, 42001	FB Control Word	Binary coded
2002	32002, 42002	FB General Control Word	Binary coded
2003	32003, 42003	FB Speed Reference	0–100.00%
2004	32004, 42004	FB Process Data In 1	Integer 16
2005	32005, 42005	FB Process Data In 2	Integer 16
2006	32006, 42006	FB Process Data In 3	Integer 16
2007	32007, 42007	FB Process Data In 4	Integer 16
2008	32008, 42008	FB Process Data In 5	Integer 16
2009	32009, 42009	FB Process Data In 6	Integer 16
2010	32010, 42010	FB Process Data In 7	Integer 16
2011	32011, 42011	FB Process Data In 8	Integer 16

The use of process data depends on the application. In a typical situation, the device is started and stopped with the ControlWord (CW) written by the Master and the Rotating speed is set with Reference (REF). With PD1–PD8 the device can be given other reference values (e.g., Torque reference). With the StatusWord (SW) read by the Master, the status of the device can be seen. Actual Value (ACT) and PD1–PD8 show the other actual values.

Process data in

This register range is reserved for the control of the VFD. Process Data In is located in range ID 2001–2099. The registers are updated every 10 ms. See table below.

Table 53. Fieldbus basic input table

ID	Modbus register	Group	Range/Type
2001	32001, 42001	FB Control Word	Binary coded
2002	32002, 42002	FB General Control Word	Binary coded
2003	32003, 42003	FB Speed Reference	0–100.00%
2004	32004, 42004	FB Process Data In 1	Integer 16
2005	32005, 42005	FB Process Data In 2	Integer 16
2006	32006, 42006	FB Process Data In 3	Integer 16
2007	32007, 42007	FB Process Data In 4	Integer 16
2008	32008, 42008	FB Process Data In 5	Integer 16
2009	32009, 42009	FB Process Data In 6	Integer 16
2010	32010, 42010	FB Process Data In 7	Integer 16
2011	32011, 42011	FB Process Data In 8	Integer 16

FB control word

PowerXL DG1 drive uses 16 bits as shown below. These bits are application specific.

Table 54. Binary bits and corresponding outputs

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
①	①	①	①	①	①	FB Ref	FB Ctrl	BYS	FB DIN 4	FB DIN 3	FB DIN 2	FB DIN 1	F_RST	DIR	RUN

Note:
① The bit is not used.

FB general control word

The DG1 does not use the FB General Control Word. The main control word is used to provide commands to the drive.

Table 55. FB control word

Bit	Description value = 0	Value = 1
0	Drive Output Off	Drive Output On
1	Clockwise Rotation	Counter Clockwise
2	No Reset	Fault Reset
3	FB INDATA1 Off	FB INDATA1 On
4	FB INDATA2 Off	FB INDATA2 On
5	FB INDATA3 Off	FB INDATA3 On
6	FB INDATA4 Off	FB INDATA4 On
7	Bypass Relay Disable	Bypass Relay Enable
8	FB Control Off	FB Control On
9	FB Reference Off	FB Reference On
10–15	Not in use	Not in use

Table 56. Speed reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Reference 1 to the VFD. Used normally as Speed reference.

The scaling on this value is 0–100.00% of the Maximum Frequency (P1.2). The 0 to 100.00% is represented by 0 to 10,000 value indicating 0 or 0% as Minimum Frequency (P1.1) and 10,000 or %100.00 as Maximum Frequency (P1.2). This value has 2 decimal places in it.

Process data in 1 to 8

Process Data In values 1 to 8 can be used in applications for various purposes. See below Process Data IN section for setup.

Process data out

This register range is normally used to fast monitoring of the VFD. Process Data Out is located in range ID 2101–2199. See table below.

Table 57. Fieldbus basic output table

ID	Modbus register	Group	Range/Type
2101	32101, 42101	FB Status Word	Binary coded
2102	32102, 42102	FB General Status Word	Binary coded
2103	32103, 42103	FB Actual Speed	%
2104	32104, 42104	FB Process Data Out 1	
2105	32105, 42105	FB Process Data Out 2	
2106	32106, 42106	FB Process Data Out 3	
2107	32107, 42107	FB Process Data Out 4	
2108	32108, 42108	FB Process Data Out 5	
2109	32109, 42109	FB Process Data Out 6	
2110	32110, 42110	FB Process Data Out 7	
2111	32111, 42111	FB Process Data Out 8	

Table 58. FB status word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
—	—	—	—	—	—	—	—	RUNEN	BYS	AREF	WARN	FLT	DIR	RUN	RDY

Information about the status of the device and messages is indicated in the Status Word. The Status Word is composed of 16 bits that have the following meanings.

Table 59. FB status word bit descriptions

Bit	Description Value = 0	Value = 1
0	Not Ready	Ready
1	STOP	RUN
2	Clockwise	Counterclockwise
3	—	Faulted
4	—	Warning
5	Ref. frequency not reached	Ref. frequency reached
6	Bypass not activated	Bypass activated
7	Run disable	Run Enable
8	Not in use	Not in use
9–15	Not in use	Not In use

Table 60. FB general status word

Bit	Description value = 0	Value = 1
0	Not Ready	Ready
1	Stop	Run
2	Clockwise	Counter Clockwise
3	No Fault	Fault
4	No Warning	Warning
5	Ref. Frequency Not Reached	Ref. Frequency Reached
6	Ref > 0 Speed	Ref = 0 speed
7	Motor Flux Off	Motor Flux On ①
8	Motor Speed Limit On	Motor Speed Limit Off ①
9	Encoder Direction Off	Encoder Direction On ①
10	Under Voltage Fast Stop Off	Under Voltage Fast Stop On ①
11	DC Brake Off	DC Brake On
12	FB Ref Not Enable	FB Ref Enabled
13	Motor Start Delay Off	Motor Start Delay On
14	Remote Not Enable	Remote Enable
15	FB WD Pulse Not Enabled	FB WD Pulse Enable ①

Note:
① Indicates the bit is not used.

Table 61. Actual speed

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Actual Speed of the motor.This value comes back in the form of %

Process data out 1 to 8

Process Data Out values 1 to 8 can be used in application for various purposes. See below tables for additional information.

Process data OUT (slave → master)

The fieldbus master can read the AFD's actual values using process data variables. Standard, Pump and Fan Control, PID control and Multi-Purpose applications use process data as follows. These values are selectable via the Fieldbus Process Data parameter group. These values would correspond to the Modbus ID value. See **Appendix A** for Parameter ID table showing values can be set.

Table 62. Process data OUT

ID	Data	Value	Default value	Default para	Unit	Scale
2104	Process Data OUT 1	-32768–32767	1	Output Frequency	Hz	
2105	Process Data OUT 2	-32768–32767	2	Motor Speed	RPM	
2106	Process Data OUT 3	-32768–32767	3	Motor Current	A	
2107	Process Data OUT 4	-32768–32767	4	Motor Torque	%	
2108	Process Data OUT 5	-32768–32767	5	Motor Power	%	
2109	Process Data OUT 6	-32768–32767	6	Motor Voltage	V	
2110	Process Data OUT 7	-32768–32767	7	DC Link Voltage	V	
2111	Process Data OUT 8	-32768–32767	28	Latest Fault Code	—	

Process data IN (master → slave)

Control Word, Reference and Process Data are used with All-in-One applications as follows.

Table 63. Process data IN

ID	Data	Value	Unit	Scale
2003	Reference	Speed Reference	%	0.01
2001	Control Word	—	—	—
2004	Process Data IN1	①	%	0.01%
2005	Process Data IN2	①	%	0.01%
2006	Process Data IN3	①	%	0.01%
2007	Process Data IN4	①	%	0.01%
2008	Process Data IN5	①	%	0.01%
2009	Process Data IN6	①	%	0.01%
2010	Process Data IN7	①	%	0.01%
2011	Process Data IN8	①	%	0.01%

Note:
① Process Data IN1 through Process Data IN8 change based off the selected application. See **Appendix B** for layout.

EtherNet/IP On-Board communications

The PowerXL EtherNet/IP communication interface features standard EtherNet/IP communication, allowing you to easily manage drive control and data over EtherNet/IP networks.

EtherNet/IP communication interface features:

- Provides a means to control, configure and collect data over an Ethernet network
- 10/100 Mbps, full duplex operation
- Explicit messaging (for example, parameter read/write)
- Diagnostics, device items and events

Every device connected to an Ethernet network has two identifiers. a MAC address and an IP address. The MAC address (address format. 00.D0.AF.xx.yy.zz) is unique to the appliance and cannot be changed. The EtherNet/IP board's MAC address can be found on the sticker attached to the board. Please find the software installation at www.Eaton.com/drives.

In a local network, IP addresses are determined by the network server using DHCP protocol. The user can also manually define the network address for the PowerXL as long as all units connected to the network are given the same network portion of the address. For more information about IP addresses, contact your network administrator.

Overlapping IP addresses can cause conflicts between appliances. For more information about setting IP addresses, see "Manual IP Address Configuration" on **Page 21.**

Note: EtherNet/IP is a trademark of the Open DeviceNet Vendor Association (ODVA).

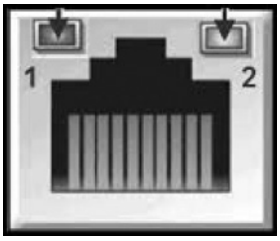
EtherNet/IP specifications

Table 64. EtherNet/IP technical data

General	Description	Specification
Ethernet connections	Interface	RJ-45 connector
Communications	Transfer cable	Shielded twisted pair
	Speed	10/100 Mb
	Duplex	Half/full
	Default IP–address Mode	DHCP with Auto-IP
Default static IP Configurations.	Default static IP address	192.168.1.254
	Default network mask	255.255.255.0
	Default gateway address	192.168.1.1

Hardware specifications

Ethernet port LED indications



Ethernet LED

1. Ethernet Link Status
2. Ethernet Link Speed

Table 65. Ethernet LED description

LED	Meaning
Ethernet Link status	Flashes with ethernet message activity.
Ethernet Link Speed	Displays the link speed.
	Yellow LED on the ethernet jack is ON when link speed is 100 mbps
	Yellow LED on the ethernet jack is OFF when link speed is 10 mbps

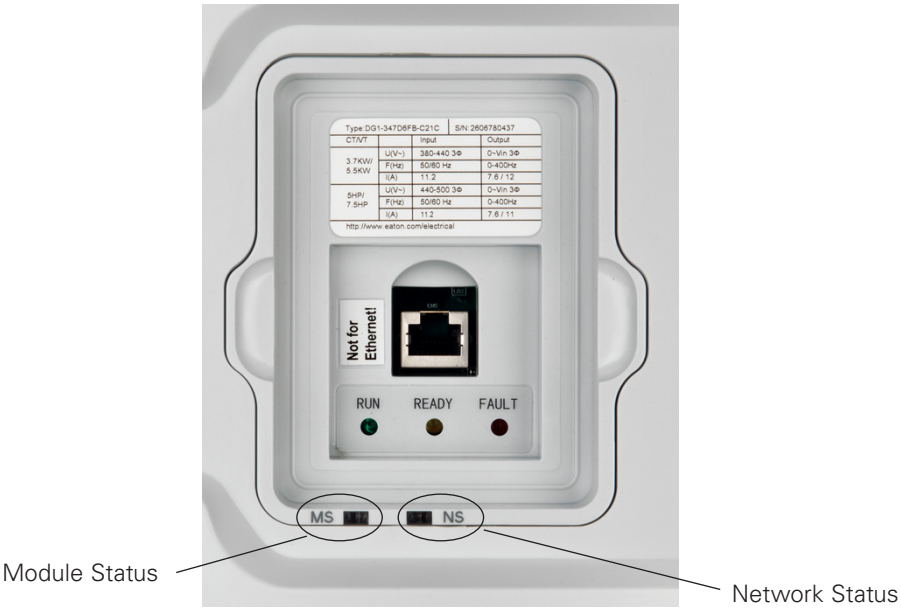
Ethernet LED indications at power up

When PowerXL is powered up, an indicator test will be performed. To allow a visual inspection, the following sequence will be performed.

1. Turn first indicator Green, all other indicators off.
2. Leave first indicator on Green for approximately 0.25 second.
3. Turn first indicator on Red for approximately 0.25 second.
4. Turn first indicator on Green.
5. Turn second indicator (if present) on Green for approximately 0.25 second.
6. Turn second indicator (if present) on Red for approximately 0.25 second.
7. Turn second indicator (if present) Off.

If other indicators are present, test each indicator in sequence as prescribed by the second indicator above. If a Module Status indicator is present, it will be the first indicator in the sequence, followed by any Network Status indicators present. After completion of this power up test, the indicator (s) will turn to a normal operational state.

Figure 19. Module and network status



Module status indications

Represents the state of the drive.

Table 66. Module status LED description

Indicator state	Summary	Meaning
Steady off	No power	No power is supplied to the PowerXL.
Steady green	Device operational	PowerXL is operating correctly.
Flashing green ①	Standby	PowerXL has not been configured.
Flashing red ①	Minor fault	PowerXL has detected a recoverable minor fault. Note. An incorrect or inconsistent configuration would be considered a minor fault. Also check that on clearing the fault, it turns off.
Steady red	Major fault	PowerXL has detected a non-recoverable major fault.
Flashing green/red	Self-test	PowerXL is performing its power on self test.

Network status indications

Represents the state of the Ethernet port network interface.

Table 67. Network status LED description

Indicator State	Summary	Meaning
Steady off	Not powered, no IP address	PowerXL is powered off, or is powered on but with no IP address configured (Interface Configuration attribute of the TCP/IP Interface Object).
Flashing green ①	No connections	An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out.
Steady green	Connected	At least one CIP connection (any transport class) is established, and an Exclusive Owner connection has not timed out.
Flashing red ①	Connection timeout	PowerXL is powered on and an exclusive Owner connection has timed out. It returns to steady green only when all timed out Exclusive Owner connections are established.
Steady red	Duplicate IP address	PowerXL has detected a Duplicate IP.
Flashing green/red	Self-test	PowerXL is performing its power on self test.

①Flash rate is 1 flash per second.

EtherNet/IP overview

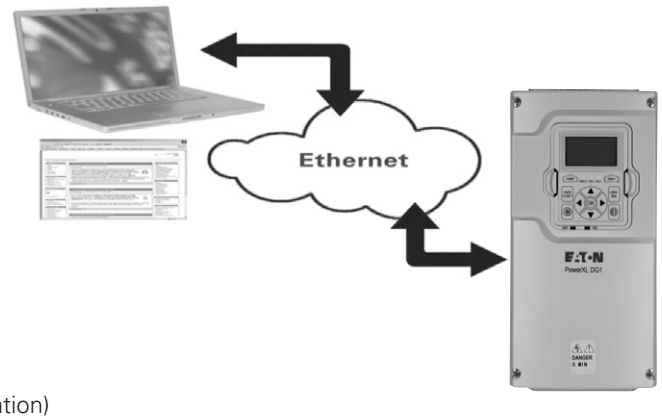
EtherNet/IP was introduced in 2001 and today is the most developed, proven and complete industrial Ethernet network solution available for manufacturing automation. EtherNet/IP is a member of a family of networks that implements the Common Industrial Protocol (CIP.) at its upper layers. CIP encompasses a comprehensive suite of messages and services for a variety of manufacturing automation applications, including control, safety, synchronization, motion, configuration and information. As a truly media-independent protocol that is supported by hundreds of vendors around the world, CIP provides users with unified communication architecture throughout the manufacturing enterprise.

There are two common use cases of Ethernet—devices are "human to machine" and "machine to machine." Basic features are presented in the pictures below.

1. Human to machine (graphical user interface, relatively slow communication)

   User Interface

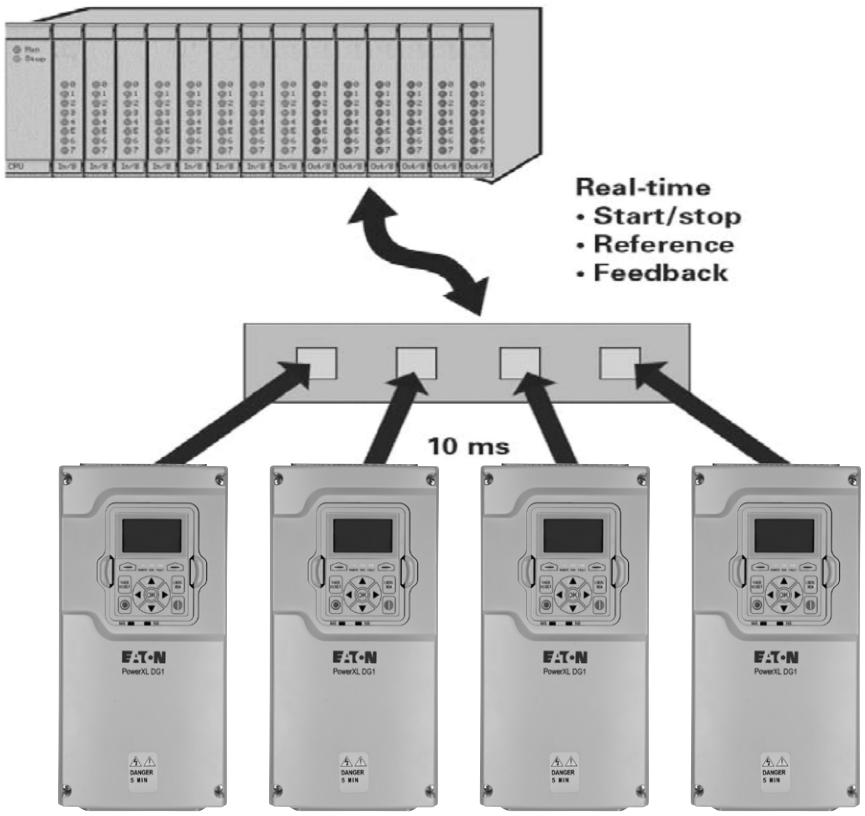
Figure 20. Human to machine user interface



2. Machine to machine (industrial environment, fast communication)

   Industrial Environment

Figure 21. Machine to machine (industrial environment, fast communication)



Connections and wiring

The EtherNet/IP board supports 10/100 Mb speeds in both full and half-duplex modes. The boards must be connected to the Ethernet network with a shielded CAT-5e cable. A crossover cable (at least CAT-5e cable with STP, shielded twisted pair) may be needed if you want to connect the EtherNet/IP board directly to the master appliance.

Use only industrial standard components in the network and avoid complex structures to minimize the length of response time and the amount of incorrect dispatches. It is often a good practice to use a subnet that is different from other devices not related to the drive control.

Figure 22. CAT-5e cable

Table 68. PowerXL EtherNet/IP network settings

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.3.1	IP Address Mode				1	1500	0 = Static IP 1 = DHCP with AutoIP
P20.3.2	Active IP Address					1507	
P20.3.3	Active Subnet Mask					1509	
P20.3.4	Active Default Gateway					1511	
P20.3.5	MAC Address					1513	
P20.3.6	Static IP Address				192.168.1.254	1501	
P20.3.7	Static Subnet Mask				255.255.255.0	1503	
P20.3.8	Static Default Gateway				192.168.1.1	1505	
P20.3.9	EtherNet/IP Protocol Status				0	608	0 = Off 1 = Operational 2 = Faulted
P20.3.10	Connection Limit	0	5		5	609	
P20.3.19	EIP Fault Response	0	1		0	2518	0 = In Fieldbus Control 1 = in all Control

Commissioning

Keypad EtherNet/IP communication menu

DHCP

PowerXL EtherNet/IP communication supports DHCP for easier network configuration. Dynamic Host Configuration Protocol (DHCP) is a network protocol that is used to configure network devices so that they can communicate on an IP network. As a DHCP client, PowerXL EtherNet/IP negotiates with the DHCP server to determine its IP address and obtain any other initial configuration details it needs for network operation.

IP address

IP is divided into four parts. (Part = Octet) Default Static IP Address is 192.168.1.254

Communication timeout

Defines how much time can pass from the last received message from the client device before fieldbus fault is generated. Default communication timeout is 10seconds.

Note: If the network cable is broken from PowerXL EtherNet/IP slot, a fieldbus error is generated immediately.

Static IP address

In most cases the user may want to establish a Static IP Address for the PowerXL EtherNet/IP based on their network configuration. Static IP address default configurations are as defined in "PowerXL EtherNet/IP network settings" table, provided in "Connections and Wiring" section. The user can manually define the network address for the PowerXL EtherNet/IP as long as all units connected to the network are given the same network portion of the address. In these situations the user will need to manually set the IP Address in the PowerXL by using PowerXL drive keypad. Be aware that overlapping IP addresses can cause conflicts between devices on the network. For more information about selecting IP addresses, contact your network administrator.

Manual IP address configuration

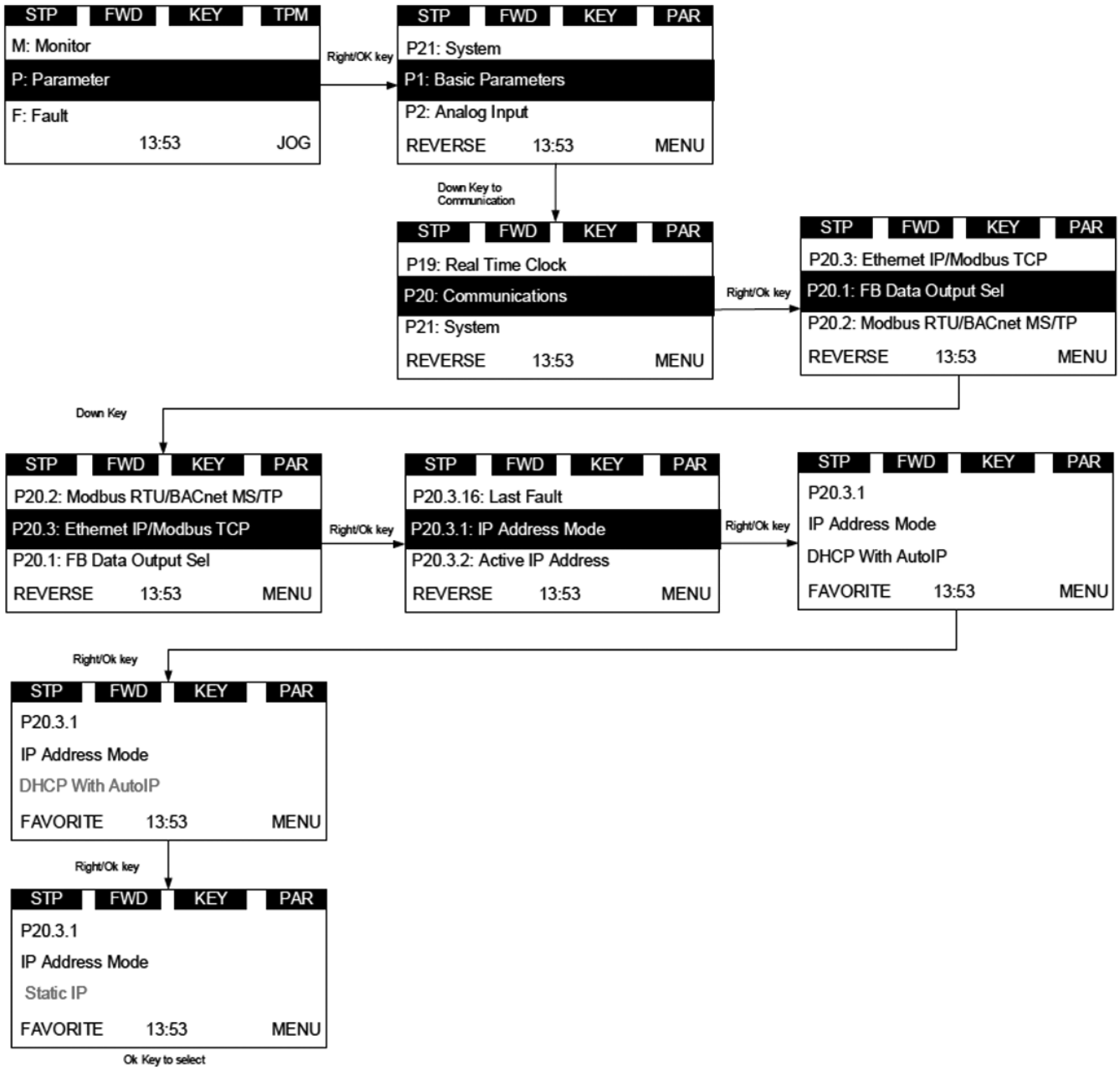
Using the PowerXL drive keypad

Using the PowerXL Drive Keypad to set the IP Address manually in the PowerXL EtherNet/IP.

1. Select IP addressing mode as Static IP. Static IP mode configurations will be loaded.

Note: Change in IP address mode will require PowerXL to power cycle to get this change effective. Also ensure device MAC address (Keypad menu. P20.3.5)

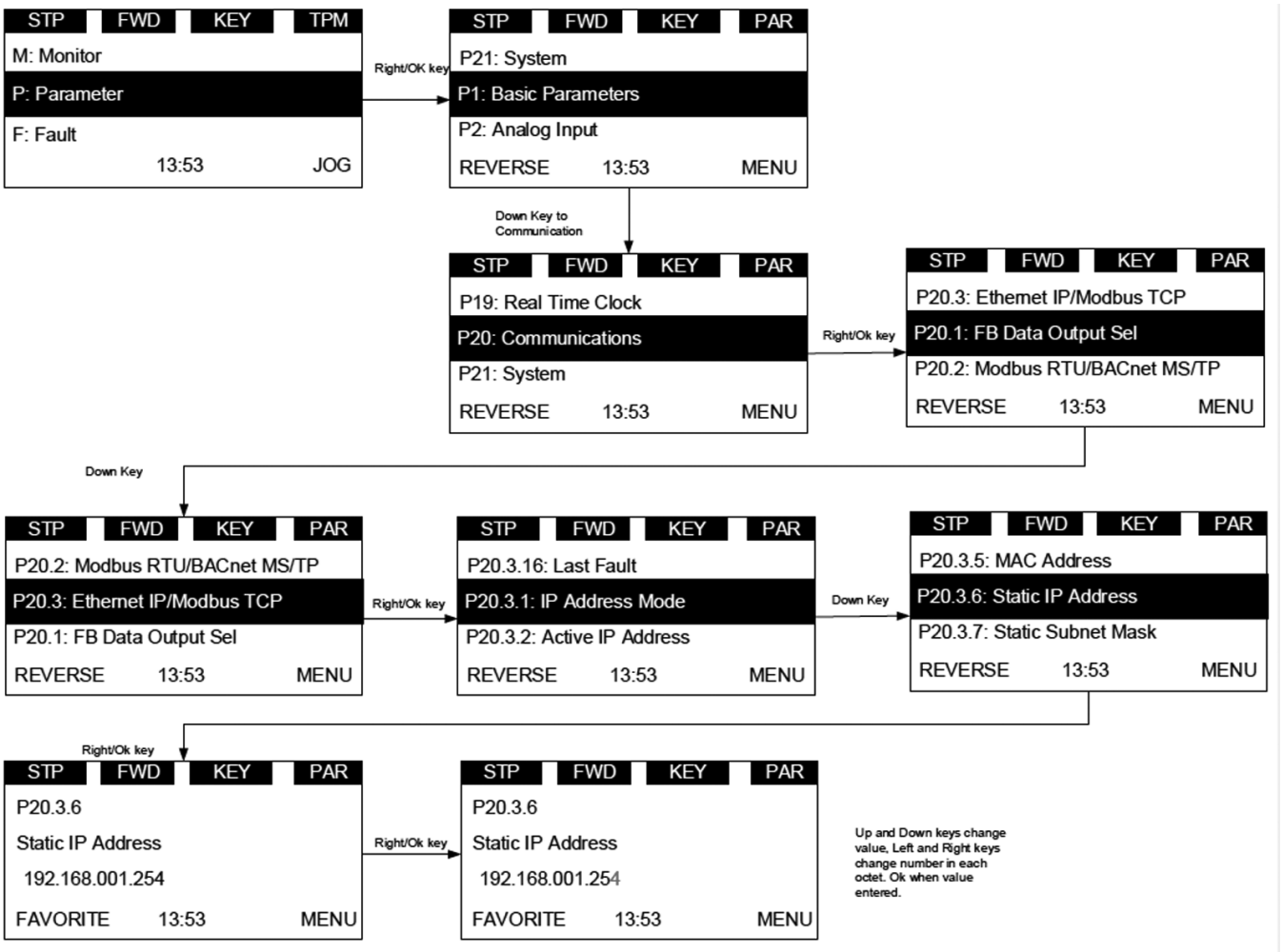
Figure 23. Static IP mode



2. Using PowerXL drive keypad, set the IP address in the PowerXL EIP to the desired address setting by:

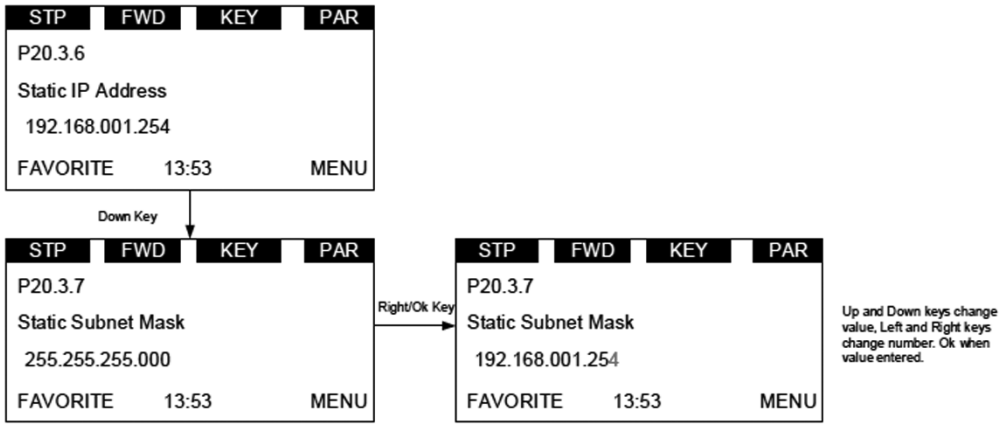
   a. Setting Static IP Address

Figure 24. Static IP address



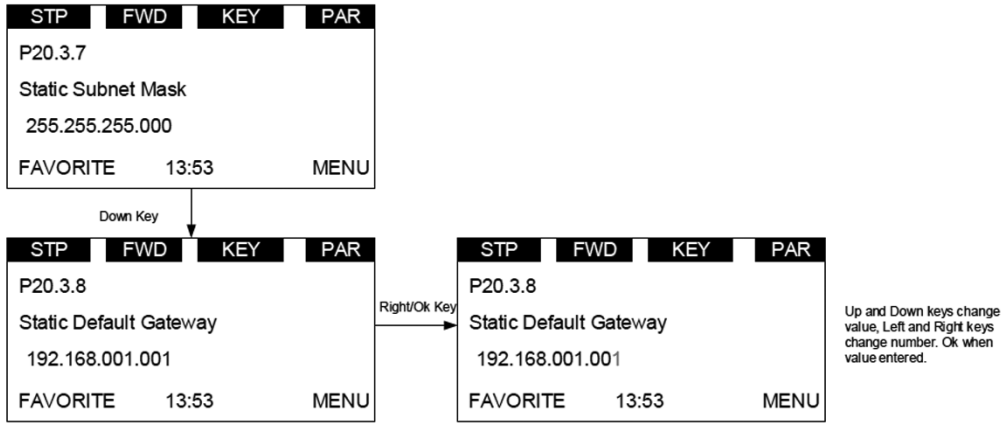
b. Setting Static Subnet Mask

Figure 25. Static subnet mask



c. Setting Static Default Gateway

Figure 26. Static default gateway



3. Make note of the changed IP Address.
4. Using PowerXL drive keypad, read "Active IP Address" (Keypad menu. P20.3.2), "Active Subnet Mask" (Keypad menu. P20.3.3), "Active Default Gateway" (Keypad menu. P20.3.4) parameters to ensure that IP address has been set to desired IP address.

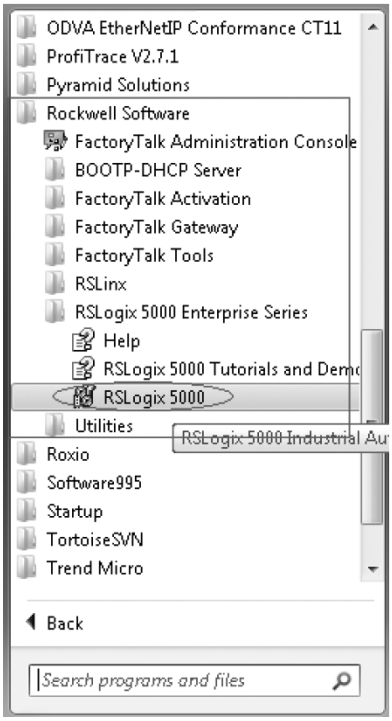
PLC programming

ControlLogix 5000

When using a ControlLogix PLC as a PowerXL EIP master, you must first configure a compatible EtherNet/IP scanner, and then map ladder logic variables to the scanner. The following example is for an RSLogix5000 with a CompactLogix-L23E-QB1 PLC controller.

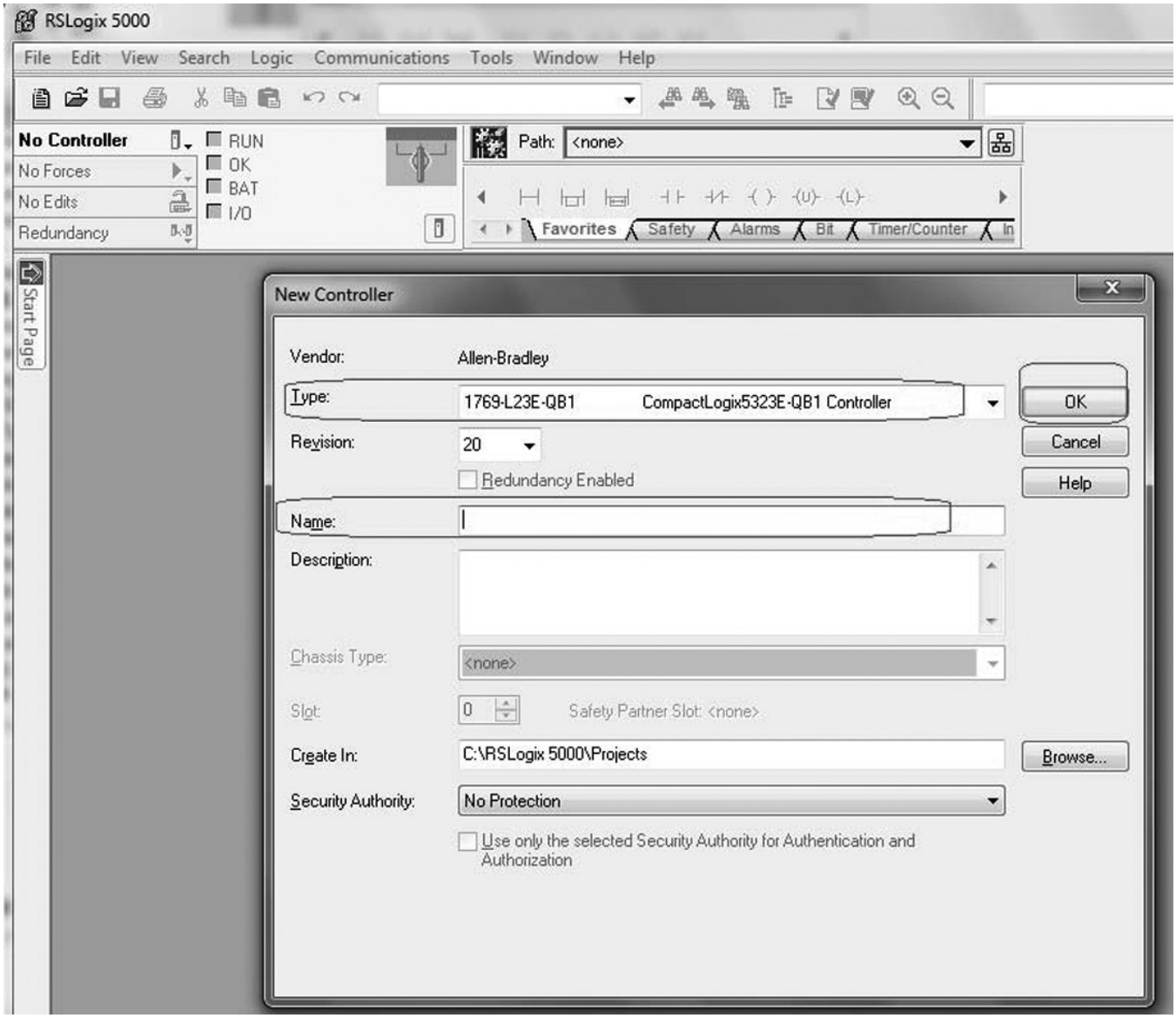
Note: Some PLCs do not support polled messaging for EtherNet/IP. For example, the SLC500 only supports explicit messaging.

Select windows Start → All Programs. Open RSLogix 5000.



From the Tools drop-down menu, select EDS Hardware Installation Tool to install the PowerXL Drive EtherNet/IP EDS file. This file can be downloaded from the Eaton website.

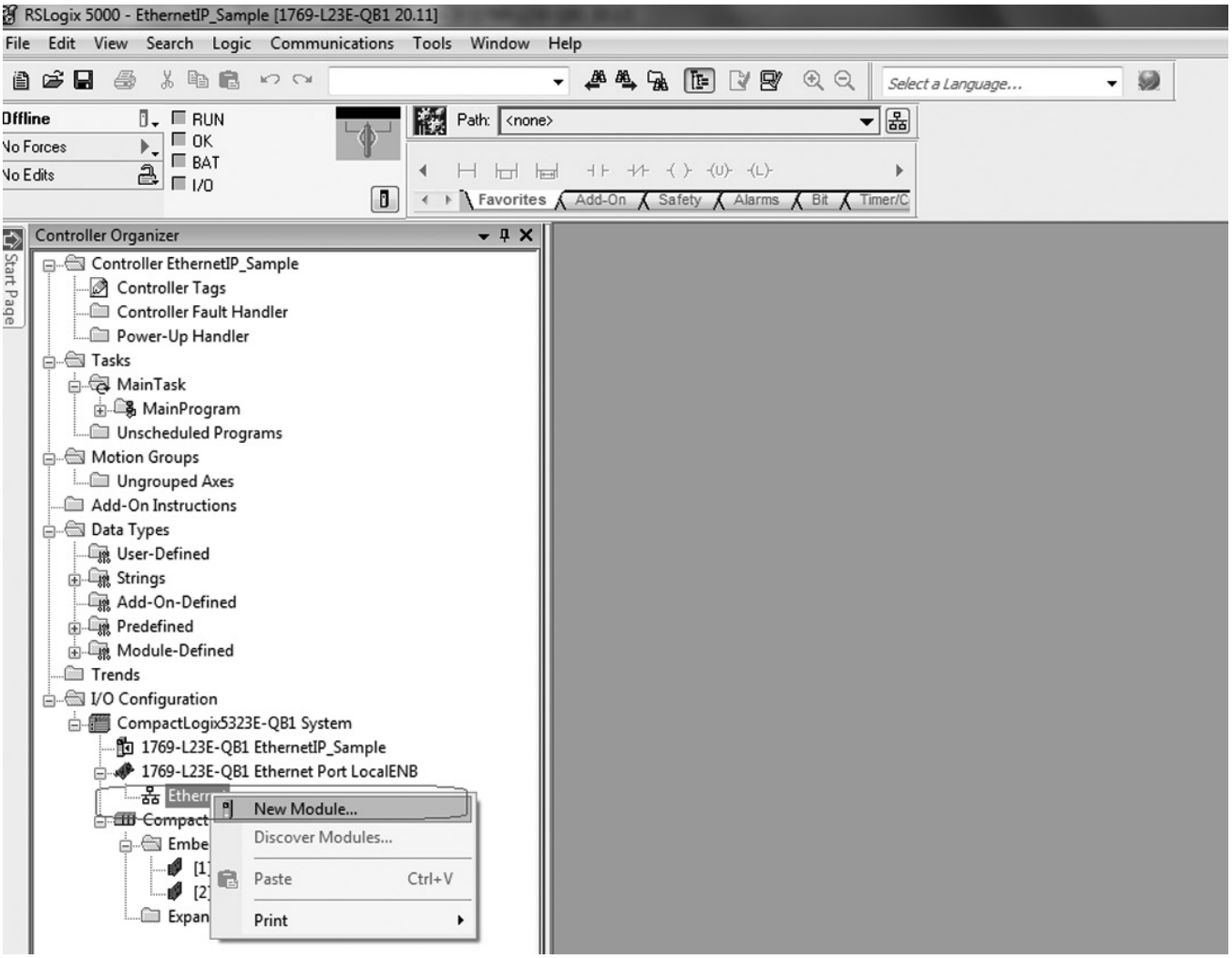
Select "New" from "File" menu. New controller window will pop-up. Select the controller and assign unique name.



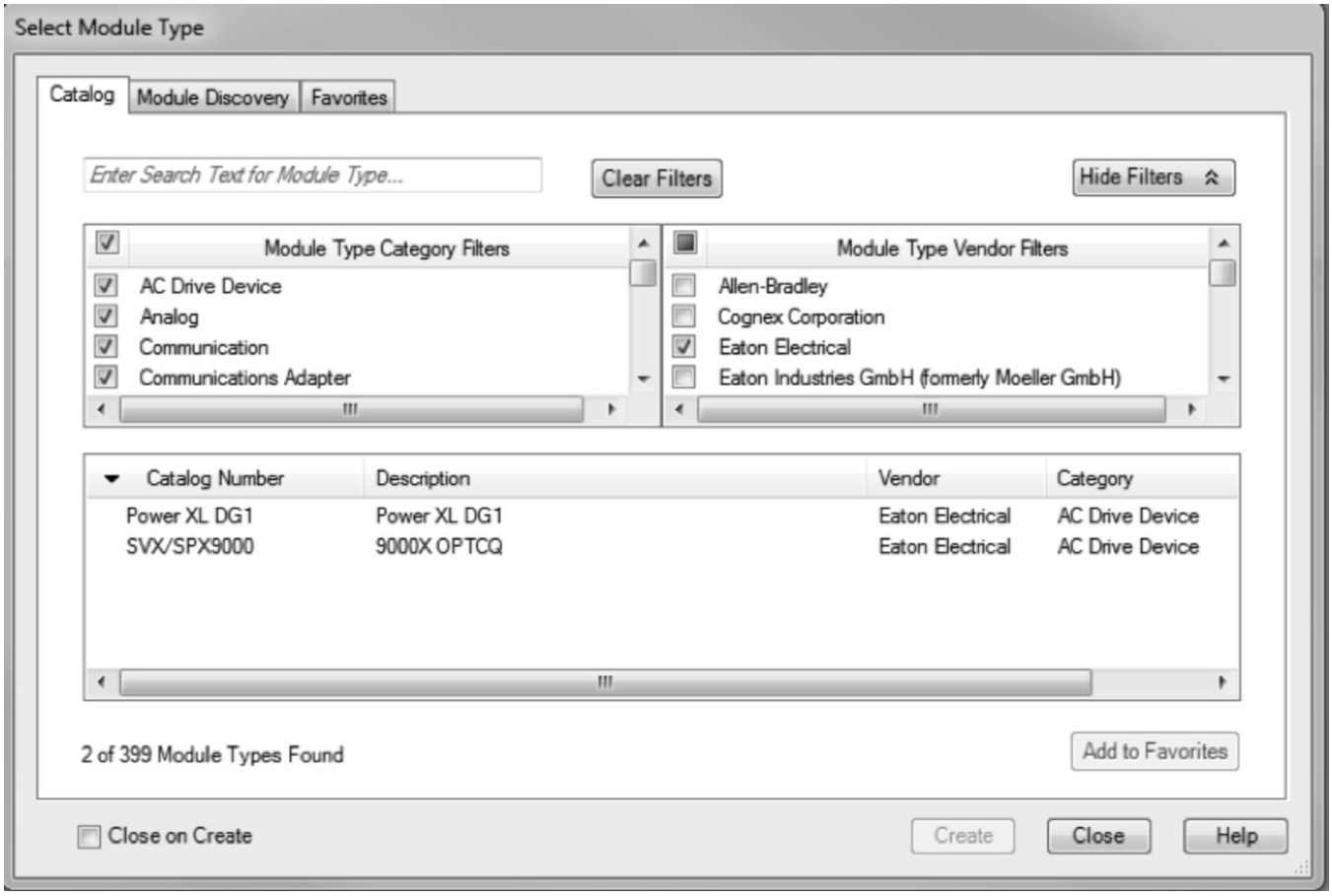
Press OK.

Right-click on Ethernet. Select "New Module."

Note: PC on which RSLogix (master) is running and PowerXL device (slave) should be connected in same network.

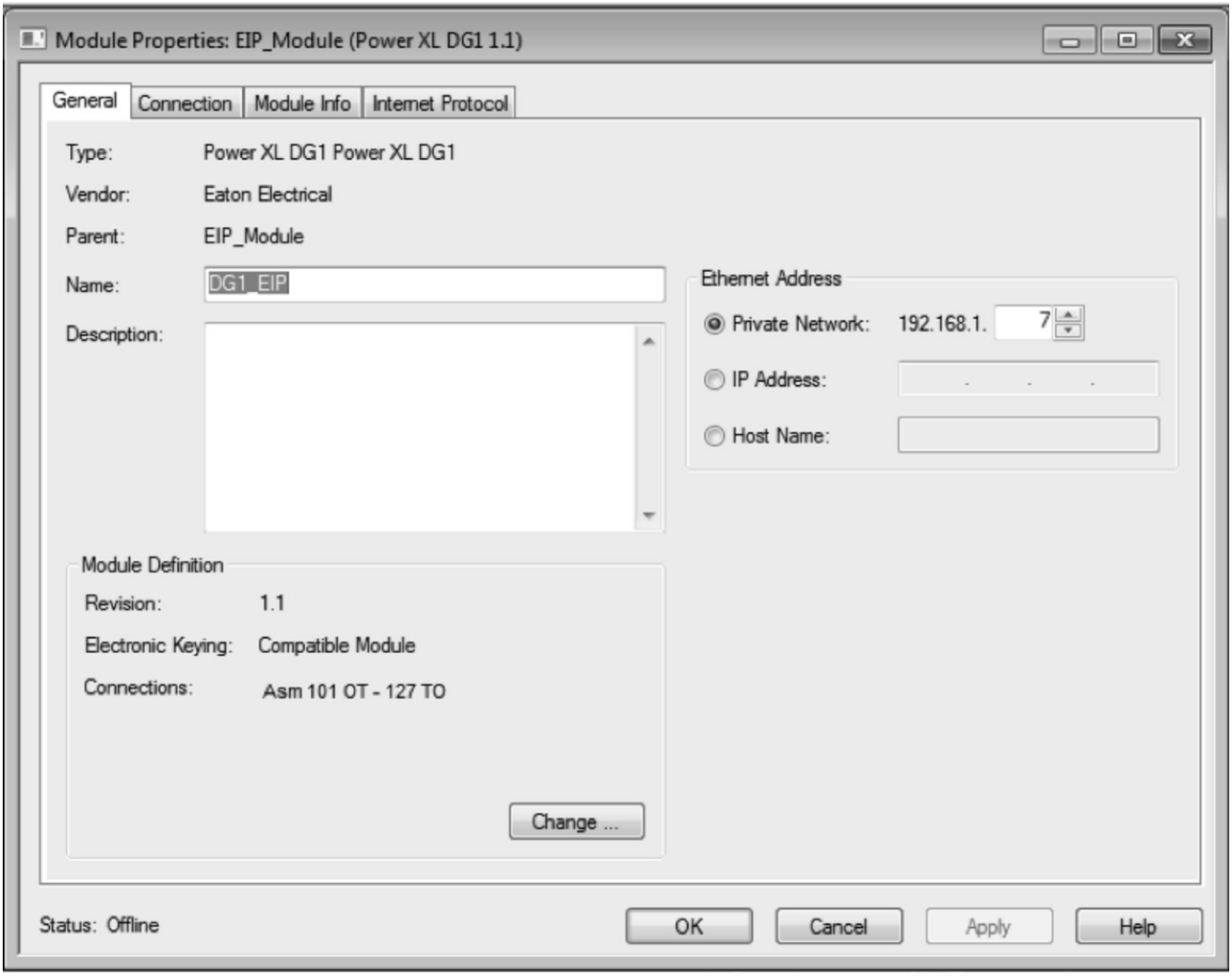


"Select Module Type" window will pop-up. Select "PowerXL DG1" (use filter to search PowerXL from catalog).

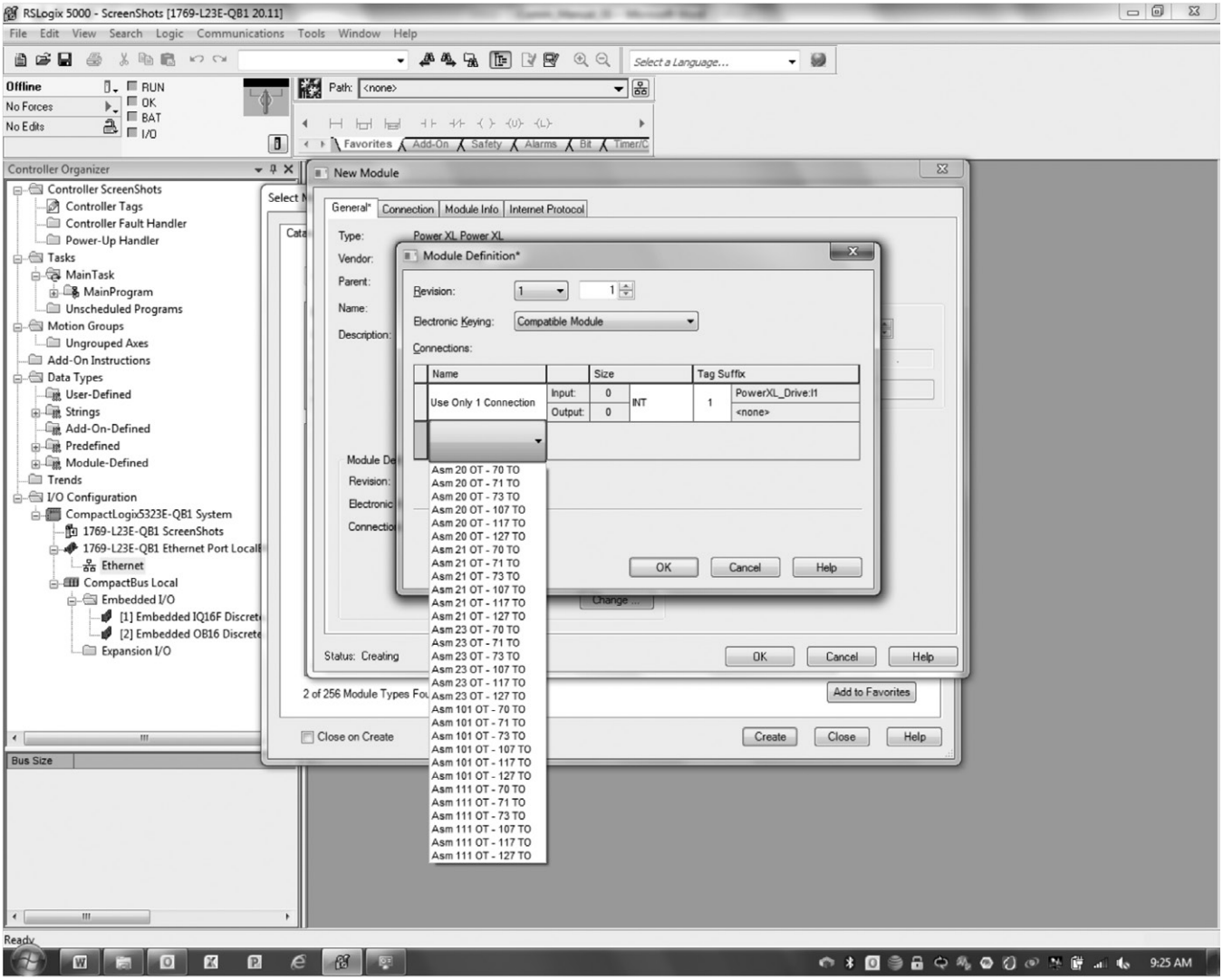


After selecting "PowerXL," "New Module" window will pop-up (as shown below). Fill in unique name and appropriate IP address for PowerXL. Press OK. The device will get added under "Ethernet" module.

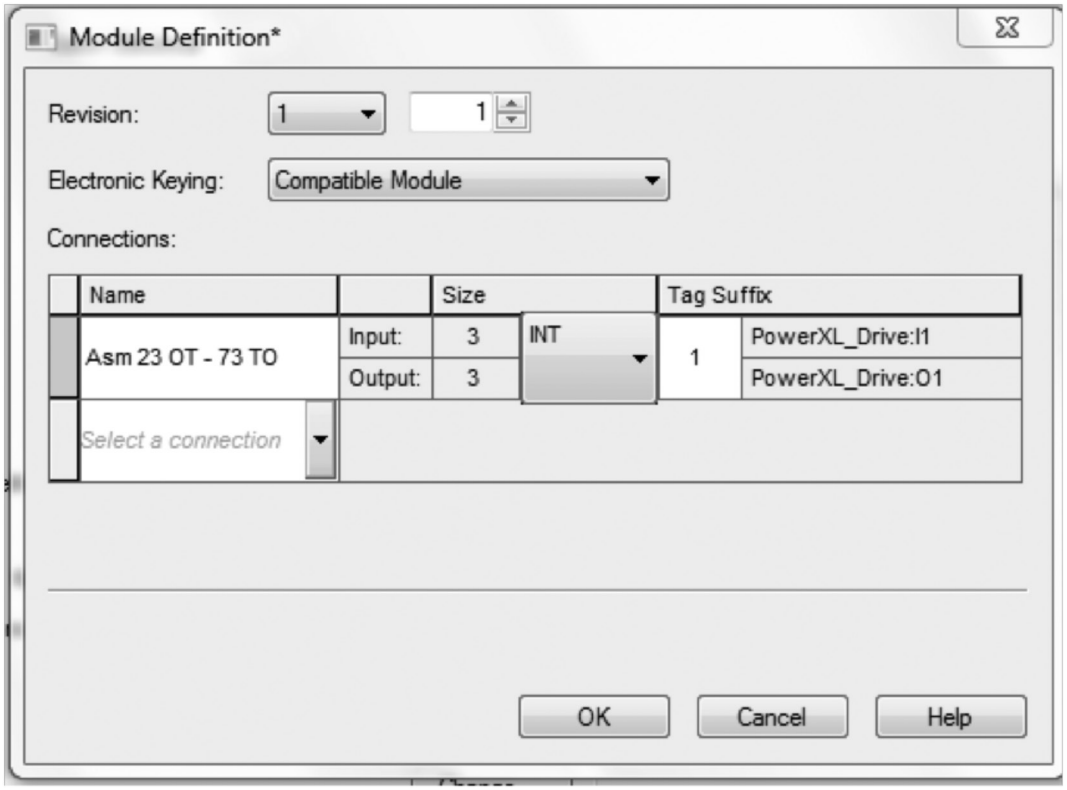
Note: You must change the class1 connection from provided default option by using "Change" button available on "New Module" window. This can also be done after adding the device under Ethernet by double-clicking on it.



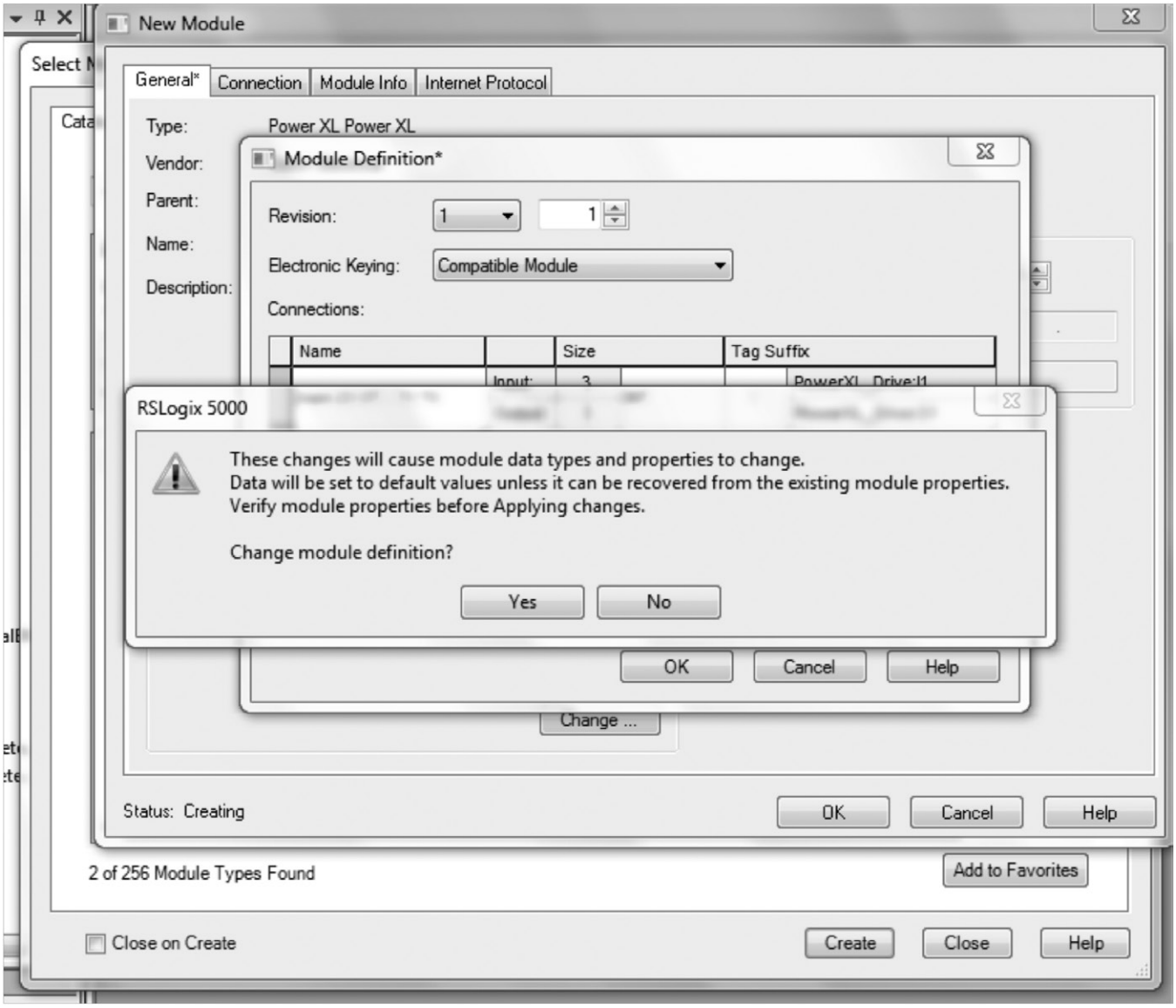
Choose the INT data type then select /IO connection from the provided list. After selecting desired I/O assembly instance connection, information related to it will appear.



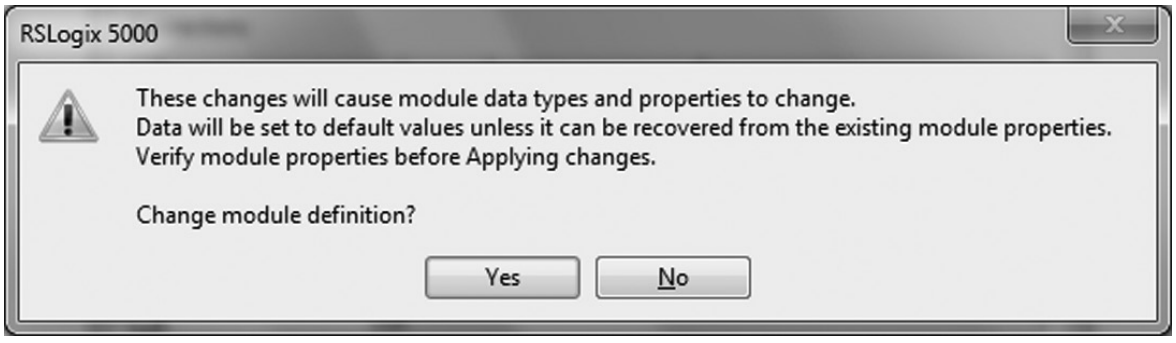
After selecting the I/O connection, click "OK." For this example, I/O connection ASM23OT-73TO will be used. The module definition window will then look as follows.



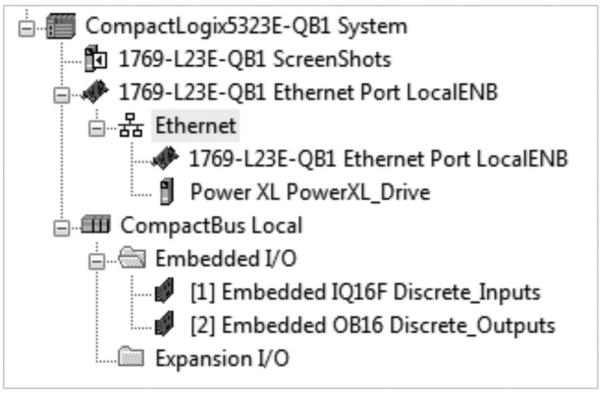
After pressing "OK," the following warning will pop-up. Press "Yes."



Warning snapshot.



Then select “OK” on the New Module Window and the PowerXL drive will be added to the EtherNet/IP Network on the left, in this case under the CompactLogix EtherNet/IP master port as shown.



Close the Select Module Type window or add more devices to the Network.

Select the controller tags to view the three INT input and output tags for the drive. The layout for the three input and output INTs for input assembly 73 and output assembly 23 are shown later in this section.

Name	Value	Force Mask	Style	Data Type
Local:1:C	{...}	{...}		AB:Embedded_IQ16F:C:0
Local:1:I	{...}	{...}		AB:Embedded_IQ16F:I:0
Local:2:C	{...}	{...}		AB:Embedded_OB16:C:0
Local:2:I	{...}	{...}		AB:Embedded_OB16:I:0
Local:2:O	{...}	{...}		AB:Embedded_OB16:O:0
PowerXL_Drive:I1	{...}	{...}		_0044:PowerXL_BD7BDD2...
PowerXL_Drive:I1.ConnectionFaulted	0		Decimal	BOOL
PowerXL_Drive:I1.Data	{...}	{...}	Decimal	INT[3]
PowerXL_Drive:I1.Data[0]	0		Decimal	INT
PowerXL_Drive:I1.Data[1]	0		Decimal	INT
PowerXL_Drive:I1.Data[2]	0		Decimal	INT
PowerXL_Drive:O1	{...}	{...}		_0044:PowerXL_B82B6E11:...
PowerXL_Drive:O1.Data	{...}	{...}	Decimal	INT[3]
PowerXL_Drive:O1.Data[0]	0		Decimal	INT
PowerXL_Drive:O1.Data[1]	0		Decimal	INT
PowerXL_Drive:O1.Data[2]	0		Decimal	INT

Eaton also provides a tag generation tool that generates I/O tags for your Eaton EtherNet/IP slave devices. This software tool generates a CSV file containing all the I/O tags that can then be imported into RSLogix5000. These tags are automatically aliased to the generic I/O tags created by RSLogix5000. The generic tags shown above for the PowerXL drive are an example.

This means you will not have to type any data into the Controller tags area for your Eaton EtherNet/IP products. The imported tags will match the layouts for the I/O assemblies chosen and displayed later in this section and can be used directly in your programs. This tool and a user manual can be downloaded from the Eaton website at the following link:

www.eaton.com/software

Note: The drive auto senses when a master polls it for valid I/O assemblies. There is no configuration necessary in the drive with regard to I/O assemblies or data lengths.

EtherNet/IP

Overview

EtherNet/IP (Ethernet/Industrial Protocol) is a communication system suitable for use in industrial environments. EtherNet/IP allows industrial devices to exchange time-critical application information. These devices include simple I/O devices such as sensors/actuators, as well as complex control devices such as robots, programmable logic controllers, welders, and process controllers. EtherNet/IP uses CIP (Control and Information Protocol), the common network, transport, and application layers also shared by ControlNet and EtherNet/IP. EtherNet/IP then makes use of standard Ethernet and TCP/IP technology to transport CIP communications packets. The result is a common, open application layer on top of open and highly popular Ethernet and TCP/IP protocols.

EtherNet/IP messaging forms.

- Unconnected messaging is used for connection establishment and for infrequent, low-priority messages
- Connected messaging uses resources that are dedicated in advance to a particular purpose such as real-time I/O data transfer

EtherNet/IP messaging connections.

- Explicit messaging connections are general purpose point-to-point connections. Messages are sent through TCP protocol
- Implicit (I/O data) connections are established to move application-specific I/O data at regular intervals. They are often set up as one-to-many relationships in order to take full advantage of the producer-consumer multicast model. Implicit messages are sent through UDP protocol

AC/DC drive profile

In order to provide compatibility between similar devices from different manufacturers, there a defined "standard" in which those devices.

- Exhibit the same behavior
- Produce and/or consume the same basic set of I/O data
- Contain the same basic set of configurable attributes. The formal definition of this information is known as a device profile.

EDS File

EDS—Is the abbreviation for Electronic Data Sheet, a file on disk that contains configuration data for specific device types. You can provide configuration support for your device by using a specially formatted ASCII file, referred to as the EDS.

The information in an EDS allows configuration tools to provide informative screens that guide a user through the steps necessary to configure a device. An EDS provides all of the information necessary to access and alter the configurable parameters of a device. This information matches the information provided by instances of the parameter object class. The CIP object library describes the parameter object class in detail.

Explicit messaging

Explicit Messaging is used in commissioning and parameterizing of the EtherNet/IP board. Explicit messages provide multipurpose, point-to-point communication paths between two devices. They provide the typical request/response-oriented network communication used to perform node configuration and problem diagnosis. Explicit messages typically use low priority identifiers and contain the specific meaning of the message right in the data field. This includes the service to be performed and the specific object attribute address.

Note: If Class 1 connection (cyclic data) has been established, then explicit messages cannot be used to control output data. However, this restriction doesn't apply for IO Data reading.

List of object classes

The communication interface supports the following object classes.

Table 69. List of object classes

Class	Object	Remark
0x01	Identity objects	CIP required object
0x04	Assembly object	CIP object for drive device
0x06	Connection manager object	Communication object
0x28	Motor data object	CIP object for drive device
0x29	Control supervisor object	CIP object for drive device
0x2A	Ac/dc drive object	CIP object for drive device
0xA0	Vendor parameters object	CIP object for drive device—vendor specific
0xA1	Vendor parameter object	Please refer to **Appendix A**
0xA2	Vendor parameter object	Please refer to **Appendix A**
0xA3	Vendor parameter object	Please refer to **Appendix A**
0xA4	Vendor parameter object	Please refer to **Appendix A**
0xA5	MPFC parameter object	Please refer to **Appendix A**
0xF5	TCP/IP Interface Object	CIP required object
0x02	Message router object	Communication object
0xF4	Port object	Communication object
0xF6	Ethernet link object	CIP required object

List of services

The services supported by these object classes are shown below.

Table 70. Services supported by object classes

		Identity object		Connection manager		TCP/IP Interface		Ethernet link		Assembly		Motor data		Control supervisor		AC/DC drive		Vendor parameter	
Service Code (in hex)	Service Name	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst
01	Get_attributes_All	Y	Y	Y	Y	Y	Y	Y	Y										
05	Reset (Type 0 & 1)		Y												Y①				
0E	Get_attribute_single	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		Y		Y		Y
10	Set_attribute_single						Y				Y		Y		Y		Y		Y
4E	Forward close				Y														
52	Unconnected_send				Y														
54	Forward_open				Y														

Note

① Control supervisor supports only reset-type 0 instance service.

List of data types

The attribute list that follows includes information on the data type of each attribute. The following tables explain the data, structure, and array type codes used in the data type column.

Following data types are supported.

Table 71. Elementary data types

Data type name	Data type code (in hex)	Data type description
BOOL	C1	Logical Boolean with values TRUE and FALSE
SINT	C2	Signed 8-bit integer value
INT	C3	Signed 16-bit integer value
USINT	C6	Unsigned 8-bit integer value
UINT	C7	Unsigned 16-bit integer value
UDINT	C8	Unsigned 32-bit integer value
BYTE	D1	Bit string–8-bit
WORD	D2	Bit string–16-bit
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)
REAL	CA	32-bit floating point value
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)

Table 72. Constructed data types

Type Code	Description
A1	Abbreviated array type encoding
A2	Formal structure type encoding

Reset service

The following table lists the different types of resets supported by the identity object.

Resetting the PowerXL interface to its out-of-box configuration will change the response of the drive to a loss of communications with the PowerXL. The device will have to be re-configured for your application before resuming normal operation. Reset Time 1 sec.

Table 73. Different types of resets supported by the identity object

Value	Type of reset
0	Initializes drive to the Power-up state.
1	Writes default values to all instance attributes AND then saves all non-volatile attributes to FLASH memory AND then performs the equivalent of a Reset (0).

Common industrial objects implemented by the PowerXL EIP

Cip common required objects

Identity object, class 0x01

This object provides identification of and general information about the PowerXL.

Table 74. Identity object

ID	Description	Data type	Access rule	Remarks/Default values
Class attributes				
01h	Revision	UINT	Get	1
02h	Max Instances	UINT	Get	1
03h	Number of instances	UINT	Get	1
06h	Maximum ID class attribute	UINT	Get	7
07h	Maximum ID instance attribute	UINT	Get	7
Class services				
0Eh	Get_attribute_single			
01h	Get_attribute_all			
Instance attributes				
01h	Vendor ID	UINT	Get	68 (Eaton Vendor ID)
02h	Device type	UINT	Get	CIP specified–lined to motor (AC Drive)–2
03h	Product code	UINT	Get	0x3000
04h	Revision	STRUCT of	Get	
	Major revision	USINT		
	Minor revision	USINT		
05h	Status	WORD	Get	0x34–Default
06h	Serial number	UDINT	Get	
07h	Product name	SHORT_STRING	Get	PowerXL DG1
Instance services				
01h	Get_attributes_all			
05h	Reset			Reset type 0 & 1
0Eh	Get_attribute_single			

Connection manager object, class 0x06

The connection manager class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Manager Class is referred to as a Connection Instance or a Connection Object.

Table 75. Connection manager object

ID	Description	Data type	Access rule	Remarks/Default values
Class attributes				
01h	Revision	UINT	Get	
02h	Max instances	UINT	Get	
03h	Number of instances	UINT		
04h	Optional attribute list	STRUCT of	Get	
	Number of optional attributes	UINT		
06h	Maximum ID	UINT	Get	
	Number class			
	Attributes			
07h	Maximum ID number	UINT	Get	
	Instance attribute			
Class services				
0Eh	Get_attribute_single			
01h	Get_attribute_all			
Instance attributes				
01h	Open requests	UINT	Get	
02h	Open format rejects	UINT	Get	
03h	Open resource rejects	UINT	Get	
04h	Open other rejects	UINT	Get	
05h	Close requests	UINT	Get	
06h	Close format requests	UINT	Get	
07h	Close other requests	UINT	Get	
08h	Connection timeouts	UINT	Get	
Instance services				
01h	Get_attributes_all			
0Eh	Get_attribute_single			
4Eh	Forward_close			
52h	Unconnected_send			
54h	Forward_open			

TCP/IP interface object, class 0XF5

The TCP/IP interface object provides the mechanism to configure a device's TCP/IP network interface. Examples of configurable items include the device's IP Address, Network Mask, and Gateway Address.

Table 76. TCP/IP interface object

ID	Description	Data type	Access rule	Remarks/Default values
Class attributes				
01h	Revision	UINT	Get	3
02h	Max instance	UINT	Get	1
03h	Number of instances	UINT	Get	1
04h	Optional attribute list	Array of UINT	Get	0x04 0x00 0x08 0x00 0x09 0x00 0x0A 0x00 0x0B 0x00
06h	Maximum ID class attribute	UINT	Get	7
07h	Maximum ID instance attribute	UINT	Get	0x0B
Class services				
01h	Get_attributes_all			
0Eh	Get_attribute_single			
Instance attributes				
01h	Status	DWORD	Get	01
02h	Configuration capability	DWORD	Get	0xD4
03h	Configuration control	DWORD	Get/Set ①	02-dhcp, 0- static
04h	Physical link	STRUCT of	Get	
	Path size	UINT		00
	Path	Padded EPATH		00
05h	Interface configuration	Struct of:-NV	Get/Set ①	
	Ip address	UDINT		192.168.1.254
	Network mask	UDINT		255.255.255.0
	Gateway address	UDINT		192.168.1.1
	Name server	UDINT		00
	Name server 2	UDINT		00
	Domain name	STRING		00
06h	Host name	STRING	Get/Set ①	00
08h	TTL value	USINT	Get	01
09h	Multicast configuration	Struct of	Get	
	Alloc control	USINT		00
	Reserved	USINT		00
	Number of mcast	UINT		0x20
	Starting multicast address	DWORD		0xA0 0x20 0xC0 0xEF
0Ah	Selectacd	BOOL	Get/Set ①	1
0Bh	Last conflict detected	Struct of	Get/Set ①	
	ACD activity	USINT		0
	Remote MAC	Array of 6 USINT		00
	ARP PDU	Array of28 USINT		00
Instance services				
01h	Get_attributes_all			
0Eh	Get_attribute_single			
10h	Set_attribute_single			

① Set service is applicable only in Static IP addressing Mode.

Note: Attribute configuration control supports only value 0 (device is using configuration values that are stored in non-volatile memory). Attribute host name is used just for information purposes.

Ethernet link object class 0XF6

The Ethernet link object maintains link-specific counters and status information for an IEEE® 802.3 communications interface.

Table 77. Ethernet link object

ID	Description	Data type	Access rule	Remarks/Default values
Class attributes				
01h	Revision	UINT	Get	3
02h	Max instance	UINT	Get	1
03h	Number of instances	UINT	Get	1
04h	Optional attribute list	Struct of:	Get	
	Number of attributes	UINT		0x04 0x00
	Array of attributes	Array of UINT		0x07 0x00 0x08 0x00 0x09 0x00 0x0A 0x00
06h	Maximum ID class attribute	UINT	Get	0x07
07h	Maximum ID instance attribute	UINT	Get	0x0A
Class services				
01h	Get_attributes_all			
0Eh	Get_attribute_single			
Instance attributes				
01h	Interface speed	UDINT	Get	0x64 0x00 0x00 0x00
02h	Interface flags	DWORD	Get	0x2D
03h	Physical	ARRAY of	Get	
	Address	6 USINTs		
06h	Interface control	Struct of:	Get	
	Control bits	WORD		01
	Forced interface speed	UINT		00
07h	Interface type	USINT	Get	02
08h	Interface state	USINT	Get	01
09h	Admin state	USINT	Get/Set	01 (Other value write is invalid)
0Ah	Interface label	Short String	Get	ASCII code of "PowerXL DG1"
Instance services				
01h	Get_attribute_all			
10h	Set_attribute_single			
0Eh	Get_attribute_single			

Objects present in an AC/DC drive.

Assembly object class 0X04

Table 78. Assembly Object

ID	Description	Data type	Access rule	Remarks/Default values
Class attributes				
01h	Revision	UINT	Get	2
02h	Max instance	UINT	Get	0x7F
03h	Number of instances	UINT	Get	0x0E
04h	Optional attribute list	Struct of:	Get	
	Number of attributes	UINT		01
	Array of attributes	Array of UINT		04 00
06h	Maximum ID class attribute	USINT	Get	07 00
07h	Maximum ID instance attribute	USINT	Get	04 00
Class services				
0Eh	Get_attribute_single			
Instance attributes				
03	Data	ARRAY of BYTES	Get/Set	
Instance services				
10h	Set_attribute_single			
0Eh	Get_attribute_single			

Motor data object, class 0x28

Table 79. Motor data object

ID	Description	Data type	Access rule	Remarks/Default Values/Min./Max.
Class attributes				
01	Revision	UINT	Get	1
02	Max instance	UINT	Get	3
03	Number of instances	UINT	Get	3
Class services				
0Eh	Get_attribute_single			
Instance 1 attributes				
03h	Motor type	USINT-V	Get	Squirrel cage induction motor (7)
06h	Rated current	UINT	Get	126,1,5000
07h	Rated voltage	UINT	Get	380,180,690
09h	Rated frequency	UINT	Get	50,30,400
0Ch	Pole count	UINT	Get	4,1,8
0Fh	Base speed	UINT	Get	1440,300,20000
Instance 2 attributes				
03h	Motor type	USINT-V	Get	Squirrel cage induction motor (7)
06h	First rated current	UINT-NV	Get/Set	126,1,5000
07h	First rated voltage	UINT-NV	Get/Set	380,180,690
09h	First rated frequency	UINT-NV	Get/Set	50,30,400
0Ch	Pole count	UINT	Get	4,1,8
0Fh	First base speed	UINT-NV	Get/Set	1440,300,20000
Instance 3 attributes				
03h	Motor type	USINT-V	Get	Squirrel cage induction motor (7)
06h	Second rated current	UINT-NV	Get/Set	120,1,5000
07h	Second rated voltage	UINT-NV	Get/Set	380,180,690
09h	Second rated frequency	UINT-NV	Get/Set	50,30,400
0Ch	Pole count	UINT	Get	4,1,8
0Fh	Second base speed	UINT-NV	Get/Set	1440,300,20000
Instance services				
0Eh	Get_attribute_single			
10h	Set_attribute_single			

Control supervisor object, class 0x29

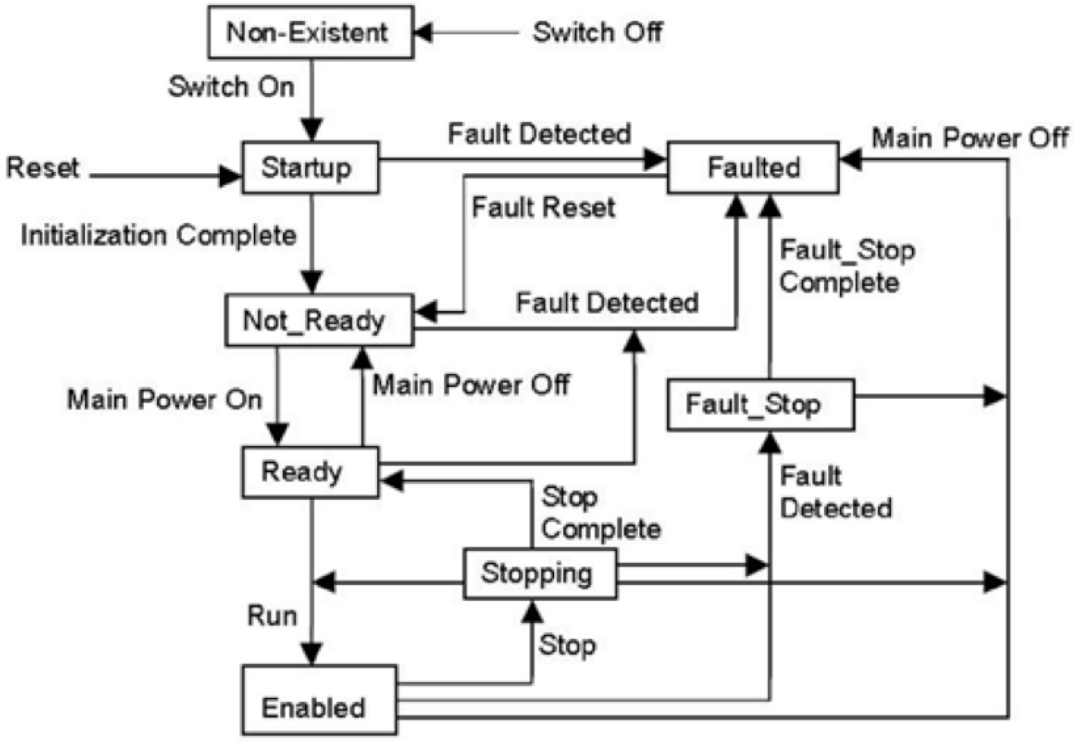
Table 80. Control supervisor object

ID	Description	Data type	Access rule	Default	Range
Class Attributes					
01h	Revision	UINT	Get	1	—
02h	Max instance	UINT	Get	1	—
03h	Number of instances	UINT	Get	1	—
Class Services					
0Eh	Get_attribute_single				
Instance Attributes					
03h	Run1 (RunForward)	BOOL	Get/Set	0	0–1
04h	Run2 (RunReverse)	BOOL	Get/Set	0	0–1
05h	NetCtrl	BOOL	Get/Set	0	0–1
06h	State	USINT	Get	0	0–7
07h	Running1	BOOL	Get	0	0–1
08h	Running2	BOOL	Get	0	0–1
09h	Ready	BOOL	Get	0	0–1
0Ah	Faulted0	BOOL	Get	0	0–1
0Bh	Warning	BOOL	Get	0	0–1
0Ch	FaultRst	BOOL	Get/Set	0	0–1
0Fh	CtrlFromNet	BOOL	Get	0	0–1
0Dh	Active fault code ①	UINT	Get	0	0–65535
6Ch	Comm idle action value	BOOL	Get/Set	2	0–2
6Dh	Comm timeout	UINT	Get/Set	10 sec	0-60sec
Instance Services					
0Eh	Get_attribute_single				
10h	Set_attribute_single				
05h	Reset (Type 0)			Type 0	

① See **Appendix C** for list of Fault Codes.

Note: When both Run (Run1 & Run2) attributes set, then no action.

Figure 27. State transition diagram



AC/DC drive object, class 0x2a

This object models the functions specific to an AC or DC Drive, e.g., speed ramp, torque control, and so on.

Table 81. Motor data object

ID	Description	Data type	Access rule	Default
Class attributes				
01h	Revision	UINT	Get	1
02h	Max instance	UINT	Get	1
03h	Number of instances	UINT	Get	1
Class services				
0Eh	Get_attribute_single			
Instance attributes				**Default, Min./Max.**
03h	Atreference	BOOL	Get	0
04h	Netref	BOOL	Get/Set	0
06h	Drivemode	USINT	Get	0
07h	Speedactual	INT	Get	0
08h	Speedref	INT	Get/Set	0
0Bh	Torqueactual	INT	Get	0
0Ch	Torqueref	INT	Get/Set	0
1Dh	Reffromnet	BOOL	Get	0
12h	Accel time	UINT	Get	468,1,46875
13h	Decel time	UINT	Get	468,1,46875
0Ah	Currentlimit	INT-NV	Get/Set	345
64h	Accel time 1	UINT-NV	Get/Set	468,1,46875
65h	Accel time 2	UINT-NV	Get/Set	468,1,46875
66h	Decel time 1	UINT-NV	Get/Set	468,1,46875
67h	Decel time 2	UINT-NV	Get/Set	468,1,46875
1Ch	Time scale	SINT-NV	Get/Set	6,0,127
Instance services				**Default**
0Eh	Get_attribute_single			
10h	Set_attribute_single			

Note: Final Accel Time = Accel Time 1 x (2 to power Time Scale).

Vendor parameters object, class 0xA0, 0xA1, 0xA2, 0xA3, 0xA4 and 0xA5

PowerXL DG1 shall support Vendor Parameters Object, Class 0xA0, 0xA1, 0xA2, 0xA3, 0xA4 and 0xA5 as given in table below.

Vendor parameter object is used in order to get access to drive parameters.

Please refer to **Appendix A** for Class, Instance, and Attribute values for each parameter.

Table 82. Vendor specific objects

ID	Description	Data type	Access rule	Remarks/default
Class attributes				
01h	Revision	UINT	Get	1
02h	Max instance	UINT	Get	1
03h	Number of instances	UINT	Get	Varies for different objects
Class services				
0Eh	Get_attribute_single			
Instance attributes				
	Varies for different objects			
Instance services				
0Eh	Get_attribute_single			
10h	Set_attribute_single			

Note: All the drive parameters given in the application manual are accessible using the vendor parameter object. See **Appendix A** for instance values.

Assembly instances implemented by PowerXL EtherNet/IP

Assemblies 20–23 ODVA AC/DC profile; assemblies 71–73 ODVA AC/DC profile; assemblies >100, Eaton profile.

Output instances

Assembly instance 20

Table 83. Instance 20 (Output) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset		RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							

Assembly instance 21

Table 84. Instance 21 (Output) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							

Assembly instance 23

Table 85. Instance 23 (Output) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl			FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							
4	Torque reference (Low Byte), Nm ①							
5	Torque reference (High Byte), Nm ①							

① Torque Reference is sent to the Drive only if Motor Control Mode is set to "Torque Control".

Note: Torque Reference is send to the Drive as a Process Data 1.

Assembly instance 25

Table 86. Instance 25 (Output) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl			FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							
4	Process reference (Low Byte) ①							
5	Process reference (High Byte)							

① In Speed control Mode—Process Ref is Process Data IN8 (Analog Input 1).
In Freq. control—Process Ref is Process Data IN8 (Analog Output 1, reading the actual output current.).
In Torque control—Process Ref is Process Data IN1 (Torque Reference)
Based on selection of A0, process reference value will be sent on A0 out.

Assembly instance 101

Table 87. Instance 101 (Output) length = 8 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl	FB DATAIN 2	FB DATAIN 1	FaultReset	RunRev	RunFwd
1	PDSELB3	PDSELB2	PDSELB1	PDSELB0	PDSELA3	PDSELA2	PDSELA1	PDSELA0
2	FBSpeed reference (Low Byte), rpm							
3	FBSpeed reference (High Byte), rpm							
4	FBProcessDataIn1 (Low Byte)							
5	FBProcessDataIn1 (High Byte)							
6	FBProcessDataIn2 (Low Byte)							
7	FBProcessDataIn2 (High Byte)							

Note: Process data is sent to the drive independently from the NetRef and NetCtrl bits settings.

This allocates 4 input data words and 4 output data words. Byte 1 of the 101 Output assembly selects which Process Data out selection is read back to the EIP scanner. Bytes 4 through 7 of the 101 Output assembly are application specific.

Select the Multi-purpose application to read data other than what is set as default Process Data.

Default Fieldbus Process data out selections 1 through 8 are:

1 = Output frequency (hertz)
2 = Motor Speed (rpms)
3 = Motor Current (amps)
4 = Motor Torque (% of nominal motor torque)
5 = Motor Power (% of nominal motor power)
6 = Motor Voltage (Calculated motor voltage)
7 = DC Bus Voltage
8 = Active Fault Code

Multipurpose has a "Fieldbus" group where you reference the FBProcessDataOUT1 through FBProcessDataOUT8 selections. Referring to the 101/107 I/O assembly sheet, bits PDSELx0–PDSELx3 in each "nibble" of Byte 1 of Output Assembly 101 are used to select which FBProcessDataOUT (1–8) you "read" back to your PLC. That is integer 1 through 8 converted to binary Bit 0 through Bit 3. Any parameter or monitored value can be read using the Multi-purpose application, as long as it references a specific ID number. Whichever ProcessDataOutput selector used from 1 through 8 dictates what bits are used in Byte 1 of the output assembly 101. Values are then sent via Input Assembly 107 in Bytes 4 and 5 and Bytes 6 and 7 respectively. If all PDSELxx values are zero, the "Drive state" will be selected at Byte1 location of 107 assembly.

Speed Reference commands for Instances 20, 21, 23, and 101 are set up to send the RPM value. This value is sent based off the Motor Nameplate setting provided in the drive. This would be the direct RPM value written.

Assembly instance 111

Table 88. Instance 111 (Output) length = 20 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl	FB DATAIN 2	FB DATAIN 1	FaultReset	Direction	Run
1	NA							
2	FBSpeedReference (Low Byte) ①							
3	FBSpeedReference (High Byte) ①							
4	ProcessDataIn1 (LowByte)							
5	ProcessDataIn1 (HighByte)							
6	ProcessDataIn2 (LowByte)							
7	ProcessDataIn2 (HighByte)							
8	ProcessDataIn3 (LowByte)							
9	ProcessDataIn3 (HighByte)							
10	ProcessDataIn4 (LowByte)							
11	ProcessDataIn4 (HighByte)							
12	ProcessDataIn5 (LowByte)							
13	ProcessDataIn5 (HighByte)							
14	ProcessDataIn6 (LowByte)							
15	ProcessDataIn6 (HighByte)							
16	ProcessDataIn7 (LowByte)							
17	ProcessDataIn7 (HighByte)							
18	ProcessDataIn8 (LowByte)							
19	ProcessDataIn8 (HighByte)							

① This is the reference1 to the frequency converter. Used normally as Speed reference. The allowed scaling is 0 to 10000. In the application, the value is scaled in percentage of the frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Input instances

Assembly instance 70

Table 89. Instance 70 (Input) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						Running1		Faulted
1								
2	Speed Actual (Low Byte), rpm							
3	Speed Actual (High Byte), rpm							

Assembly instance 71

Table 90. Instance 71 (Input) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive State ①							
2	Speed Actual (Low Byte), rpm							
3	Speed Actual (High Byte), rpm							

① Refer "State transition diagram," provided under "Control Supervisor Object" and "Drive State" table specified at end of "Input Instances" section.

Drive State

0x00	DN_NON_EXISTANT
0x01	DN_STARTUP
0x02	DN_NOT_READY
0x03	DN_READY
0x04	DN_ENABLED
0x05	DN_STOPPING
0x06	DN_FAULT_STOP
0x07	DN_FAULTED

Assembly instance 73

Table 91. Instance 73 (Input) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive state ①							
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							
4	Torque actual (Low Byte), Nm							
5	Torque actual (High Byte), Nm							

① See note 1 from **Table 90** on **Page 65**.

Assembly instance 75

Table 92. Instance 75 (Input) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive state ①							
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							
4	Process actual (Low Byte), Nm ②							
5	Process actual (High Byte), Nm							

① See note 1 from **Table 90** on **Page 65**.

② Process actual value is same as process reference. This value will be a 0 to 10000 (100.00%) for use with Analog outputs writing, 0 = 0 or 4 mA and 10000 being 20 mA.

Assembly instance 107

Table 93. Instance 107 (Input) length = 8 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive State/Processdata Selector Value (if pdselector is used) ①							
2	% Speed actual (Low Byte) ②							
3	% Speed actual (High Byte) ②							
4	Process DataOut1 (Low Byte)							
5	Process DataOut1 (High Byte)							
6	Process DataOut2 (Low Byte)							
7	Process DataOut2 (High Byte)							

① See note 1 from **Table 90** on **Page 65**.

② Speed Actual. This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Note: See info on Assembly 101 for varying values in the Process Data Out 1 and Process Data Out 2 Bytes. See **Appendix B** on default Process Data info.

Assembly instance 117

Table 94. Instance 117 (input). EIP drive status length = 34 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CtrlFromNet	At zero speed	AtReference	Alarm/Warning	Faulted	Direction	Running	Ready
1	NA							
2	% Speed actual (Low Byte) ①							
3	% Speed actual (High Byte) ①							
4	RPM speed actual (Low Byte) ②							
5	RPM speed actual (High Byte) ②							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved							
12	Reserved							
13	Reserved							
14	Reserved							
15	Reserved							
16	Reserved							
17	Reserved							
18	ProcessDataOut1 (LowByte)							
19	ProcessDataOut1 (HighByte)							
20	ProcessDataOut2 (LowByte)							
21	ProcessDataOut2 (HighByte)							
22	ProcessDataOut3 (LowByte)							
23	ProcessDataOut3 (HighByte)							
24	ProcessDataOut4 (LowByte)							
25	ProcessDataOut4 (HighByte)							
26	ProcessDataOut5 (LowByte)							
27	ProcessDataOut5 (HighByte)							
28	ProcessDataOut6 (LowByte)							
29	ProcessDataOut6 (HighByte)							
30	ProcessDataOut7 (LowByte)							
31	ProcessDataOut7 (HighByte)							
32	ProcessDataOut8 (LowByte)							
33	ProcessDataOut8 (HighByte)							

① This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–0000 = 100.00%).
② The RPM Speed Actual is the actual speed of the motor. The unit is RPM.

Note: See **Appendix B** for Process Data Value defaults.

Assembly instance 127

Table 95. Instance 127 (Input). EIP drive status length = 20 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CtrlFromNet	At zero speed	AtReference	Alarm/Warning	Faulted	Direction	Running	Ready
1	Drive state ①							
2	% Speed actual (Low Byte) ②							
3	% Speed actual (High Byte) ②							
4	ProcessDataOut1 (LowByte)							
5	ProcessDataOut1 (HighByte)							
6	ProcessDataOut2 (LowByte)							
7	ProcessDataOut2 (HighByte)							
8	ProcessDataOut3 (LowByte)							
9	ProcessDataOut3 (HighByte)							
10	ProcessDataOut4 (LowByte)							
11	ProcessDataOut4 (HighByte)							
12	ProcessDataOut5 (LowByte)							
13	ProcessDataOut5 (HighByte)							
14	ProcessDataOut6 (LowByte)							
15	ProcessDataOut6 (HighByte)							
16	ProcessDataOut7 (LowByte)							
17	ProcessDataOut7 (HighByte)							
18	ProcessDataOut8 (LowByte)							
19	ProcessDataOut8 (HighByte)							

① See note 1 from **Table 90** on **Page 65**.

② This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Note: See **Appendix B** for Process Data Value defaults.

Table 96. Instance 128 (Input). EIP drive status length = 20 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive state							
2	% Speed actual (Low Byte) ①							
3	% Speed actual (High Byte) ①							
4	ProcessDataOut1 (LowByte)							
5	ProcessDataOut1 (HighByte)							
6	ProcessDataOut2 (LowByte)							
7	ProcessDataOut2 (HighByte)							
8	ProcessDataOut3 (LowByte)							
9	ProcessDataOut3 (HighByte)							
10	ProcessDataOut4 (LowByte)							
11	ProcessDataOut4 (HighByte)							
12	ProcessDataOut5 (LowByte)							
13	ProcessDataOut5 (HighByte)							
14	ProcessDataOut6 (LowByte)							
15	ProcessDataOut6 (HighByte)							
16	ProcessDataOut7 (LowByte)							
17	ProcessDataOut7 (HighByte)							
18	ProcessDataOut8 (LowByte)							
19	ProcessDataOut8 (HighByte)							

① This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

BACnet MS/TP—On-Board communication

BACnet stands for Building Automation and Control Networks. It is the common name for the communication standard ISO 16484-5 which defines the methods and the protocol for cooperating building automation devices to communicate. Devices can be designed to operate using BACnet communication protocol as well as utilizing BACnet protocol to communicate between systems. BACnet is an internationally accepted protocol for building automation (such as lightning control, air conditioning and heating automation) and control over a communications network. BACnet provides a method by which computer-based control equipment, from different manufacturers can work together, or "interoperate." For this to be achieved, components must be able to exchange and understand BACnet data messages. Your G-Max HVAC drive is equipped with BACnet support as standard.

BACnet MS/TP specifications

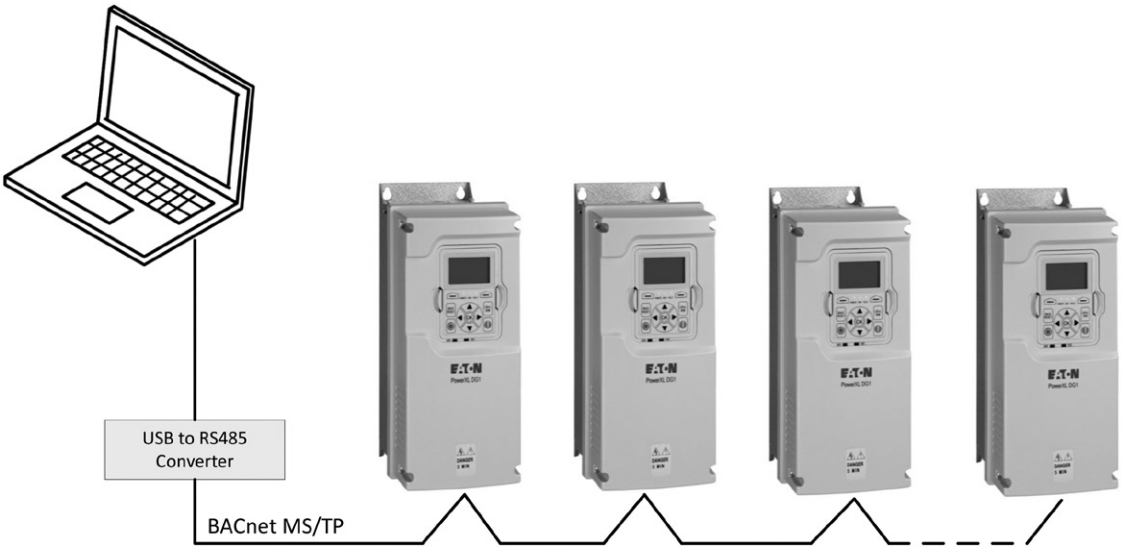
Table 96. BACnet MS/TP technical data

Item	Description
Interface	RS-485
Data transfer method	RS-485, half-duplex
Transfer cable	STP (Shielded Twisted Pair), type Belden or similar
Connection: Electrical isolation	Communication: Functional
Connection: BACnet MS/TP	Communication: As described in ANSI/ ASHRAE Standards 135-2004
Connection: Baud rate	Communication: 9600, 19200, 38400, 76800, 115200

BACnet MS/TP connections

The control board is located inside the control unit of the DG1 Series Drive.

Figure 28. Principal example diagram



Prepare for use through MS/TP

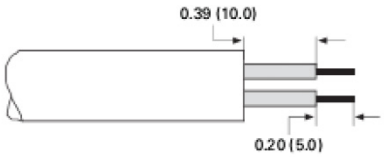
1. Open the cover of the AC drive.

⚠ WARNING

The relay outputs and other I/O-terminals may have a dangerous control voltage present even when G-Max is disconnected from mains.

2. Locate the components that you will need on the drive to connect and run the BACnet cables.
3. Strip about 0.59 in (15 mm) of the RS-485 cable and cut off the grey cable shield. Remember to do this for both bus cables (except for the last device). Leave no more than 0.39 in (10 mm) of the cable outside the terminal block and strip the cables at about 0.20 in (5 mm) to fit in the terminals. See illustration below.

Figure 29. Stripping the cable

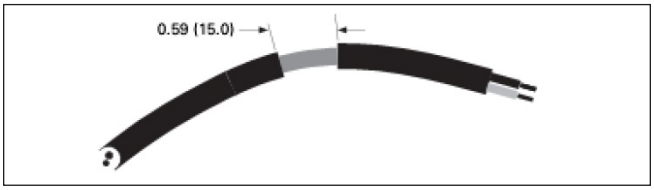


Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 0.59 in (15 mm).

⚠ IMPORTANT

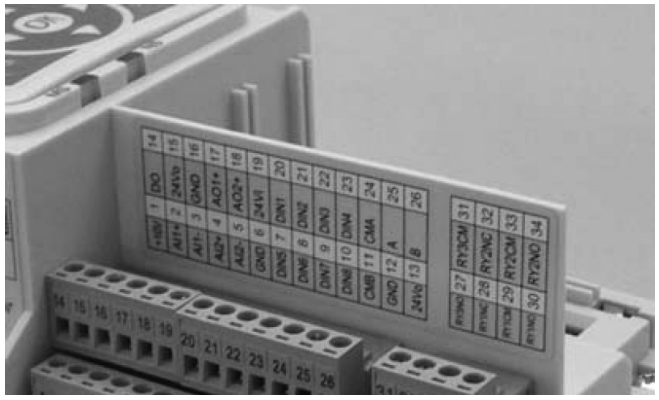
Do not strip the aluminum cable shield!

Figure 30. RS-485 Cable strip (Aluminum Shield)



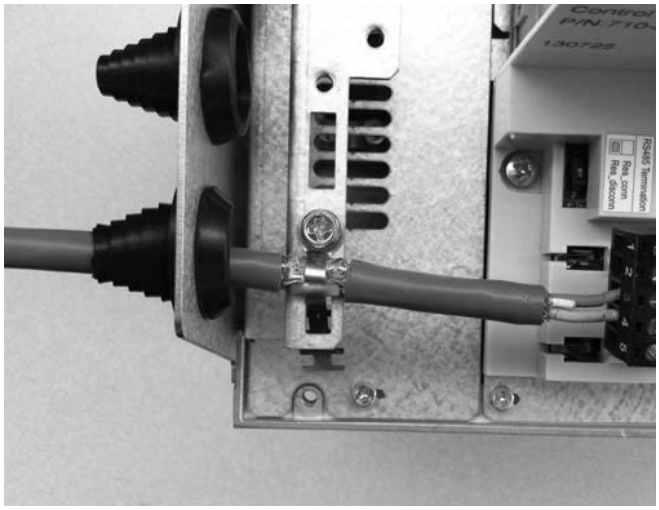
4. Then connect the cable to its appropriate terminals on G-Max drive standard terminal block, terminals A and B (A = negative, B = positive). See illustration below.

Figure 31. G-Max drive terminals (BACnet)



5. Using the cable clamp included in the delivery of the drive, ground the shield of the RS-485 cable to the frame of the AC drive.

Figure 32. RS-485 ground



6. If the PowerXL DG1 is the last device on the bus, the bus termination must be set. Locate the DIP switches to the right of the control keypad of the drive and turn the switch for the RS-485 bus termination resistor to position ON. Biasing is built in the termination resistor. See also step 8 below.

Figure 33. RS-485 Bus termination setup

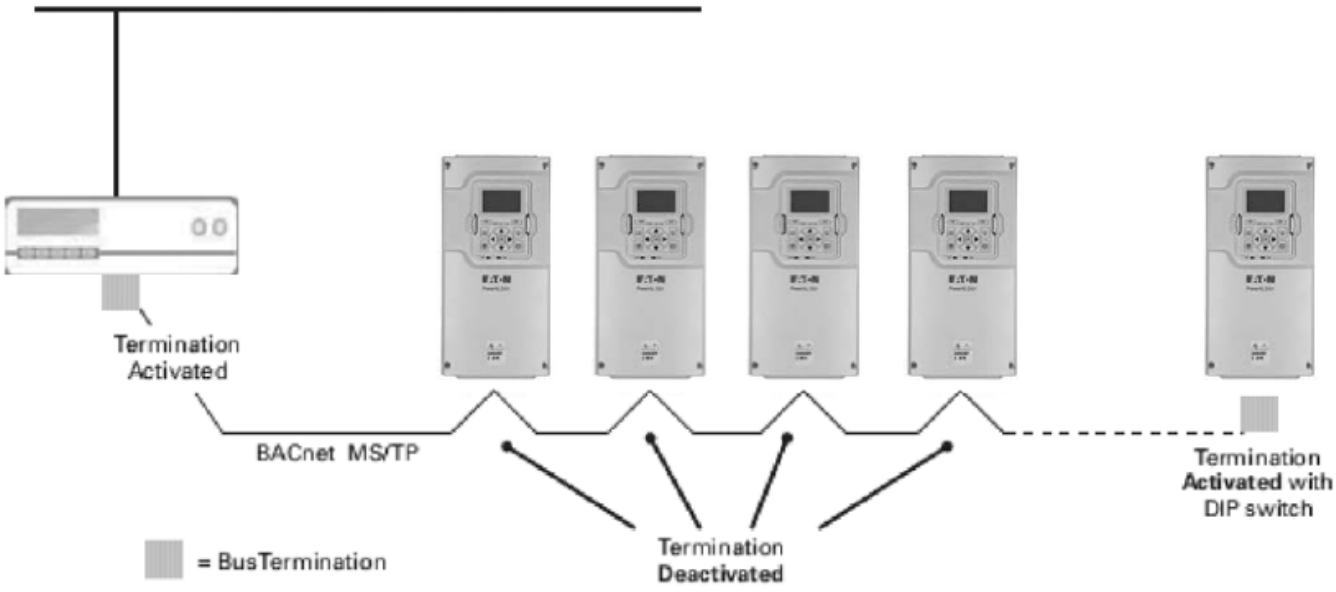
7. Remount the AC drive cover.

Note: When planning the cable runs, remember to keep the distance between the fieldbus cable and the motor cable at a minimum of 11.81 in (30 cm).

8. The bus termination must be set for the first and last device of the fieldbus line. See illustration below. See also step 6 above. We recommend that the first device on the bus terminated is the Master device.

BACnet MS/TP bus termination

Figure 34. BACnet bus termination

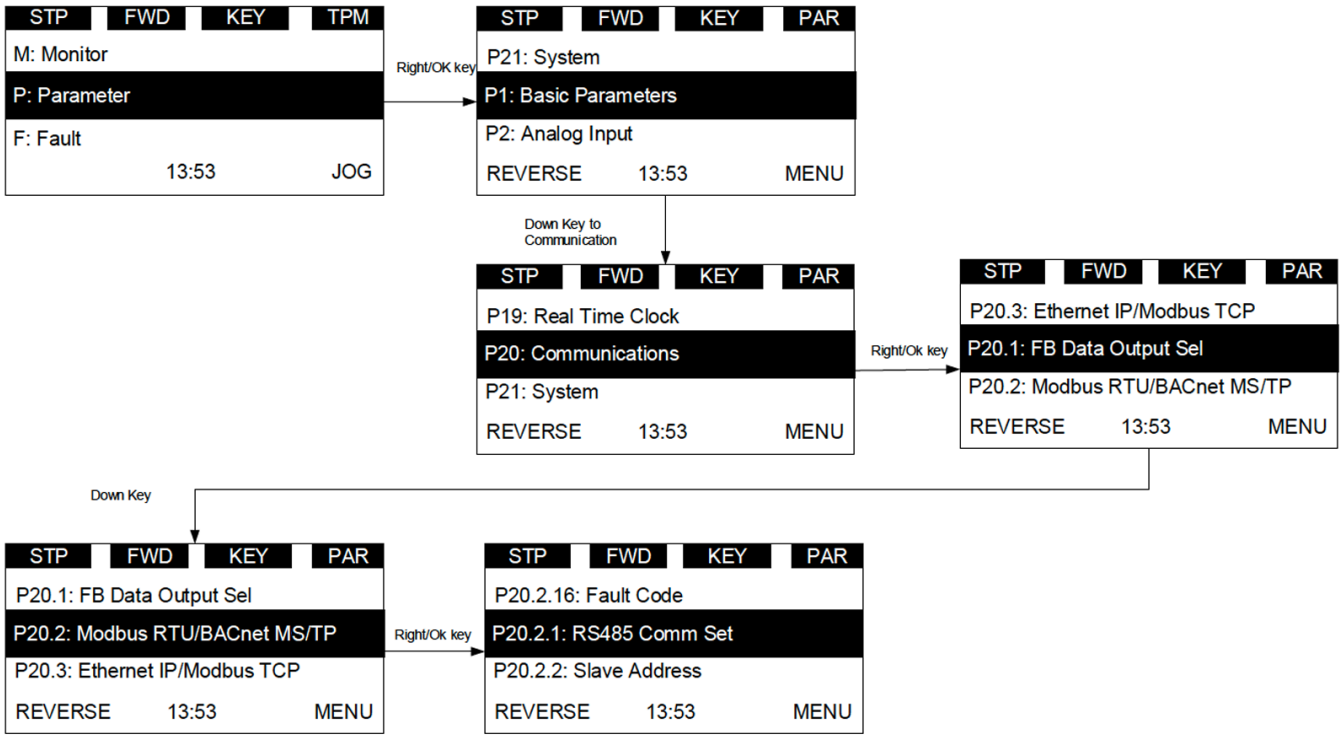


Commissioning

BACnet programming

The navigation path to the fieldbus parameters may differ from application to application. The exemplary paths below apply to the G-Max HVAC drive.

Figure 35. BACnet parameter navigation



1. First ensure that the right fieldbus protocol is selected.

Navigate:

Main Menu → Parameter → Communication → Modbus RTU/BACnet MS/TP → RS-485 Comm Set → Edit → (Choose Protocol as BACnet MS/TP)

BACnet MS/TP Parameters and monitoring values

Table 97. Modbus RTU/BACnet MS/TP—P20.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P20.2.1	RS485 Comm Set				0	586	0 = Modbus RTU 1 = BACnet MS/TP
P20.2.11	BACnet Baud Rate				2	594	0 = 9600 1 = 19200 2 = 38400 3 = 768000 4 = 115200
P20.2.12	MAC Address	0	127		1	595	
P20.2.13	Instance Number	0	4194302		varies	596	
P20.2.14	Comm Timeout BACnet			ms	10000	598	
P20.2.15	Protocol Status				0	599	0 = Stopped 1 = Operational 2 = Faulted
P20.2.16	Fault Code				0	600	0 = None 1 = Sole Master
P20.2.17	Modbus RTU/BACNet Fault Response	0	1		0	2516	0 = In Fieldbus Control 1 = in all Control

BACnet MS/TP parameters

Baud Rate

Select the communication speed for the network. The default value is 38400 baud.

MAC address

The parameters of every device must be set before connecting to the bus. Especially the parameters MAC Address and baud rate must be the same as in the master's configuration. The first parameter, MAC (Medium Access Control) address, must be unique on the network to which it is connected. The same MAC address may be used on a device on another network within the internetwork. Addresses 128–254 are reserved for slaves. Addresses 1–127 are valid for both masters and slaves. The portion of the address space that is actually used for masters in a particular installation is determined by the value of the Max_Master property of the device object. It is recommended that MAC address 0 be reserved for the MS/TP router and MAC address 255 is used for broadcasts.

Instance number

The Device Object's Instance number is used in conjunction with the MAC address to assign the devices on the network. The instance number can have up to 127 nodes on it before a different instance number is required.

Communication time-out

BACnet board initiates a communication error if the board is a "sole master" in the network for a time defined with this parameter.

BACnet overview

BACnet technical data

Protocol Implementation Conformance Statement (PICS)

Controller Profile

- B-ASC

Segmentation Capability

- Not supported

Data Link Layer and Routing Options

- MS/TP Master Baud rates (9600,19200,38400, 76800, 115200)

Character Sets Supported

- UTF8

BIBBS Supported

- Data Sharing
  - ReadProperty-B
  - WriteProperty-B
- Device Management
  - Dynamic Device Binding–B
  - Dynamic Object Binding–B
  - DeviceCommunicationControl–B
  - ReinitializeDevice–B
- Alarms and Events: Not supported
- Schedules: Not supported
- Trends: Not supported
- Network Management: Not supported

Table 98. Supported object types and properties summery

Property	Device object type	Analog value object type	Binary value object type
Object_identifier	■	■	■
Object_name	■	■	■
Object_type	■	■	■
System_status	■	—	—
Vendor_name	■	—	—
Vendor_identifier	■	—	—
Model_name	■	—	—
Firmware_revision	■	—	—
Application_software_version	■	—	—
Location	—	—	—
Description	■	■	■
Protocol_version	■	—	—
Protocol_revision	■	—	—
Protocol_services_supported	■	—	—
Protocol_object_types_supported	■	—	—
Object_list	■	—	—
Structured_object_list	—	—	—
Max_apdu_length_accepted	■	—	—
Segmentation_supported	■	—	—
Vt_classes_supported	—	—	—
Active_vt_sessions	—	—	—
Local_time	—	—	—
Local_date	—	—	—
Utc_offset	—	—	—
Daylight_savings_status	—	—	—
Apdu_segment_timeout	—	—	—

Table 98. Supported object types and properties summery, continued

Property	Device object type	Analog value object type	Binary value object type
Apdu_timeout	■	—	—
Number_of_apdu_retries	■	—	—
List_of_session_keys	—	—	—
Time_synchronization_recipients	—	—	—
Max_master	■	—	—
Max_info_frames	■	—	—
Device_address_binding	■	—	—
Database_revision	■	—	—
Configuration_files	—	—	—
Last_restore_time	—	—	—
Backup_failure_timeout	—	—	—
Active_cov_subscriptions	—	—	—
Max_segments_accepted	—	—	—
Slave_proxy_enable	—	—	—
Auto_slave_discovery	—	—	—
Slave_address_binding	—	—	—
Manual_slave_address_binding	—	—	—
Profile_name	■	—	—
Last_restart_session	—	—	—
Time_of_device_restart	—	—	—
Restart_notification_recipients	—	—	—
Utc_time_synchronization_recipients	—	—	—
Time_synchronization_interval	—	—	—
Align_intervals	—	—	—
Interval_offset	—	—	—
Present_value	—	■	■
Status_flags	—	■	■
Event_state	—	■	■
Out_of_service	—	■	■
Inactive_text	—	—	■
Active_text	—	—	■
Units	—	■	—
Password ①	■	—	—

① Password is a vendor specific property added to device object with property identifier as 600. Default value of password is empty string; this is a writable property with max length of 20, it always returns ***** on read. Same password will be used for Reinitialize Device Service and Device communication Control service.

Object instance summary

Binary Value Object Instance Summary

The following table summarizes the Binary Value Objects supported.

Table 99. Binary value object instance summary

Instance ID	Object name (related To drive parameter)	Description	Inactive/Active text	Preset value access
BV0	Ready state	Indicates whether the drive is ready or not	Not Ready/Ready	R
BV1	Run/stop state	Indicates whether the drive is running or stopped	Stop/Run	R
BV2	Fwd/rev state	Indicates the rotation direction of motor	Fwd/Rev	R
BV3	Fault state	Indicates if a fault is active	OK/Fault	R
BV4	Warning state	Indicates if a warning is active	OK/Warning	R
BV5	At set point	Ref. Frequency reached	False/True	R
BV6	At zero speed	Motor running at zero speed	False/True	R
BV7	Motor ctrl source	Command to change active source for controlling motor	LocalMotorCtrl/FBMotorCtrl	C
BV8	Speed reference source	Command to change source of motor speed reference	LocalSpeedRef/FBSpeedRef	C
BV9	Run/stop cmd	Command to start drive	Stop/Run	C
BV10	Fwd/rev cmd	Command to change rotational direction	Fwd/Rev	C
BV11	Reset fault	Command to reset active fault from drive	0/Reset	C
BV12	Digital input 1	Digital input 1	OFF/ON	R
BV13	Digital input 2	Digital input 2	OFF/ON	R
BV14	Digital input 3	Digital input 3	OFF/ON	R
BV15	Digital input 4	Digital input 4	OFF/ON	R
BV16	Digital input 5	Digital input 5	OFF/ON	R
BV17	Digital input 6	Digital input 6	OFF/ON	R
BV18	Digital input 7	Digital input 7	OFF/ON	R
BV 19	Digital input 8	Digital input 8	OFF/ON	R
BV 20	Digital output 1	Digital output 1	OFF/ON	R
BV 21	Digital output 2	Relay 1 output	OFF/ON	R
BV 22	Digital output 3	Relay 2 output	OFF/ON	R
BV 23	Digital output 4	Relay 3 output	OFF/ON	R

Note: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable.

Commandable values support priority arrays and relinquish defaults.

Analog value object instance summary

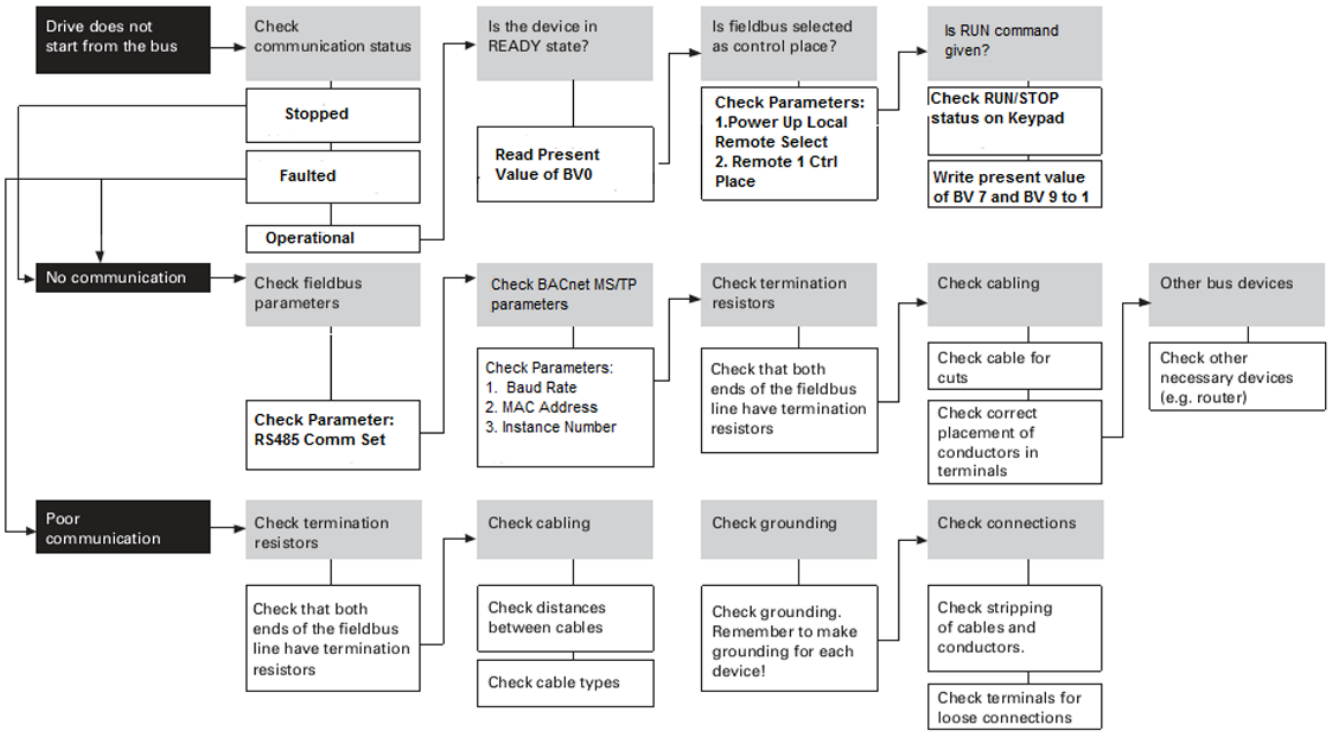
The following table summarizes the Analog Value Objects supported.

Table 100. Analog value object instance summary

Instance ID	Object name	Description	Units	Preset value access
AV0	Frequency set point	Frequency set point	Hz	R
AV1	Output frequency	Output frequency	Hz	R
AV2	Motor speed	Motor speed	Rpm	R
AV3	Motor load	Motor shaft power	Percent	R
AV4	Megawatt hours total	Megawatt hour counter (total)	MWh	R
AV5	Motor current	Motor current	Amps	R
AV6	Dc link voltage	Dc link voltage	Volts	R
AV7	Motor voltage	Motor voltage	Volts	R
AV8	Unit temperature	Heatsink temperature	°C	R
AV9	Motor torque	Motor torque	Percent	R
AV10	Operating days	Operating days (resettable)	Day	R
AV11	Operating hours	Operating hours (resettable)	Hour	R
AV12	Torque reference	Torque reference	Percent	R
AV13	Motor temperature	Motor temperature	Percent	R
AV14	Active fault code	Latest active fault code	No Units	R
AV15	Speed reference	Motor speed reference from network	%	C
AV16	Current limit	Current limit	Amps	W
AV17	Min frequency	Minimum frequency	Hz	W
AV18	Maximum frequency	Maximum frequency	Hz	W
AV19	Accel time 1	Acceleration time	seconds	W
AV20	Decel time 1	Deceleration time	seconds	W
AV21	Anyparam id	Parameter id number to be accessed	No Units	W
AV22	Anyparam value	Value of parameter defined by av21	No Units	W
AV23	Analog input 1	Analog input 1	Volts	R
AV24	Analog input 2	Analog input 2	Volts	R
AV25	Analog output 1	Analog output 1	Volts	R
AV26	Analog output 2	Analog output 2	Volts	R

Note: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays and relinquish defaults.

Fault tracing



PROFIBUS-DP external communication cards

PowerXL DG1 can be connected to the PROFIBUS® DP using an optional PROFIBUS communication card. PowerXL DG1 can be controlled, monitored and programmed from the Host system. The devices are connected in a bus structure. There is a max of 32 stations (master or slave) can be connected to one segment bus. The bus is terminated at beginning and end of each segment. To ensure error-free operation, both bus terminations must always be powered, if more than 32 stations are used, repeaters are required.

PROFIBUS specifications

Table 101. PROFIBUS technical data

Items	Value
Terminal	DB9 connector (Female) or 5.00 mm connector (male)
Data transfer method	RS-485 half-duplex
Cable	Twisted pair (1 pair and shield)
Isolation	500 Vdc
Protocol	PROFIBUS-DP-V1
DOIO type	ST1 Telegram
Baud rate	9.6K~12M
Addresses	2~125
Environment	
Ambient operating temperature	–10°C to +55°C
Storing temperature	–40°C to +60°C
Humidity	<95%, no condensation allowed
Altitude	Max. 1000m
Vibration	0.5G at 9–200 Hz
Safety	Fulfills EN 50178 standard

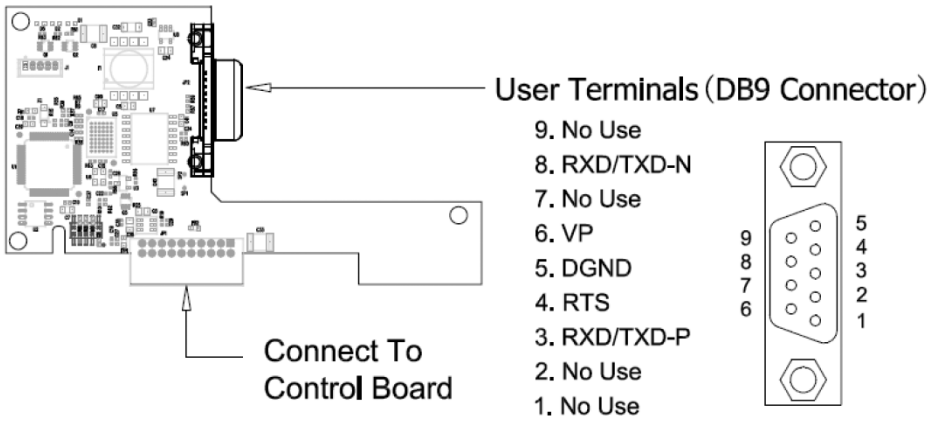
Line length depends on different transmission speeds.

Table 102. Line length

Baud rate (kbit/s)	9.6	19.2	93.75	187.5	500	1500	3000–12000
Length line A [m]	1200	1200	1200	1000	400	200	100
Length line B [m]	1200	1200	1200	600	200	—	—

Hardware specifications

Figure 36. Com1 PROFIBUS card layout



LEDs

PROFIBUS LEDs are as stated below.

Table 103. PROFIBUS LEDs

ON (GREEN, the left one)	BF (RED, the middle one)	SF (RED, the right one)	Fault condition
Blinking	Blinking	Blinking	Board Initialization
ON	OFF	OFF	Everything OK
ON	ON	OFF	No communication
ON	blinking	OFF	Communication, but not in data exchange
ON	ON	ON	No communication and system fault
ON	OFF	ON	Communication and system fault

Connector On-Board

Use DB-9 connector, pin assignment as below.

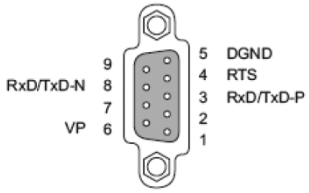


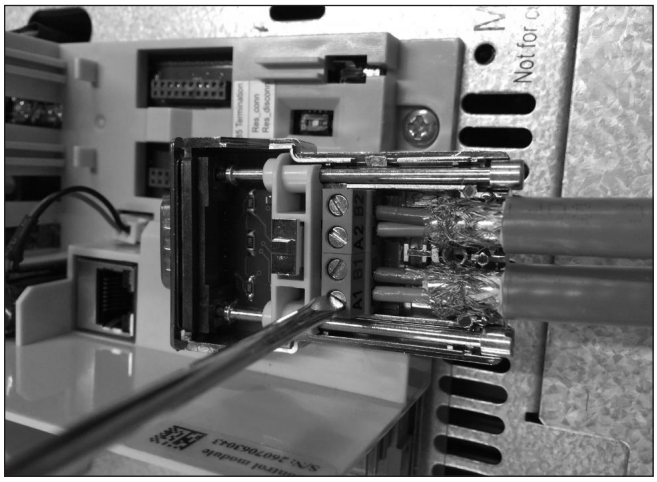
Table 104. Connector and pin assignment

Pin number	Purpose
Housing	Shield, Connected to PE
1	No use (or Shield, shield or protect GND)
2	No use (or M24, Minus 24V output Voltage)
3	RXD/TXD-P, Positive of Receive or Transmit signal
4	RTS, Request To Send
5	DGND, GND of signal (Isolated GND from RS-485 side)
6	VP, +5V, (Voltage- Plus, Isolated 5V from RS-485 side)
7	No use (or P24, Plus 24V Output Voltage)
8	RXD/TXD-N, Negative of Receive or Transmit signal
9	No use (or CNTR_N, Control-N)

Use 5.0 mm connector and pin assignment.

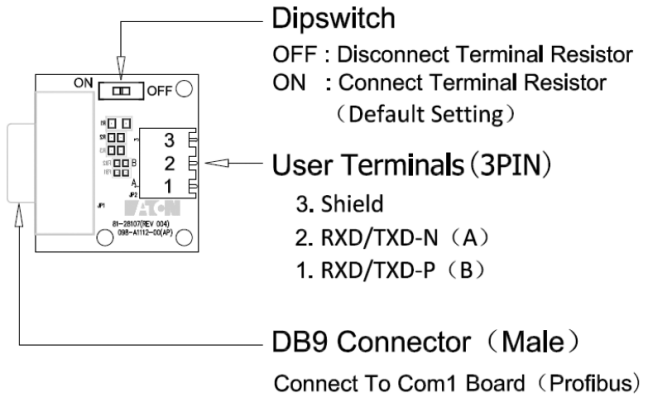
Connector on customer side

Customer side connector for DB9.



Customer side connector for 5.0 mm.

Figure 37. Com1 PROFIBUS DB9 adapter



PROFIBUS cable

Two types of cables can be used for PROFIBUS connection.

Table 105. PROFIBUS cable connections

Parameter	Line A	Line B
Impedance	135–165 Ω (3–20 MHz)	100–130 Ω (f >100 kHz)
Capacity	<30 pF/m	<60 pf/m
Resistance	<100 Ω/km	—
Wire gauge	>0.64 mm	>0.53 mm
Conductor area	>0.34 mm^2	>0.22 mm^2

Table 106. Recommended cable

Cable	Description	Part Number
Belden	PROFIBUS Data Cable	**3079A**
Olflex	PROFIBUS Cable	**21702xx**
Siemens	SINEC L2 LAN cable for PROFIBUS	**6XV1830 = 0AH0**

Commissioning

The PROFIBUS board is commissioned by inserting it into the Slot A or Slot B on the DG1 control board. Once the card is inserted to the slot, the device will recognize it and will show a warning for "Device Added." This warning will be shown for 5 seconds and will be cleared. Once the card is detected, the keypad will show the menu for this card in Optional Card Menu.

Optional comm cards parameters

Once the card is detected, following parameters can be set on keypad for the PROFIBUS.

Figure 38. PROFIBUS parameter menu

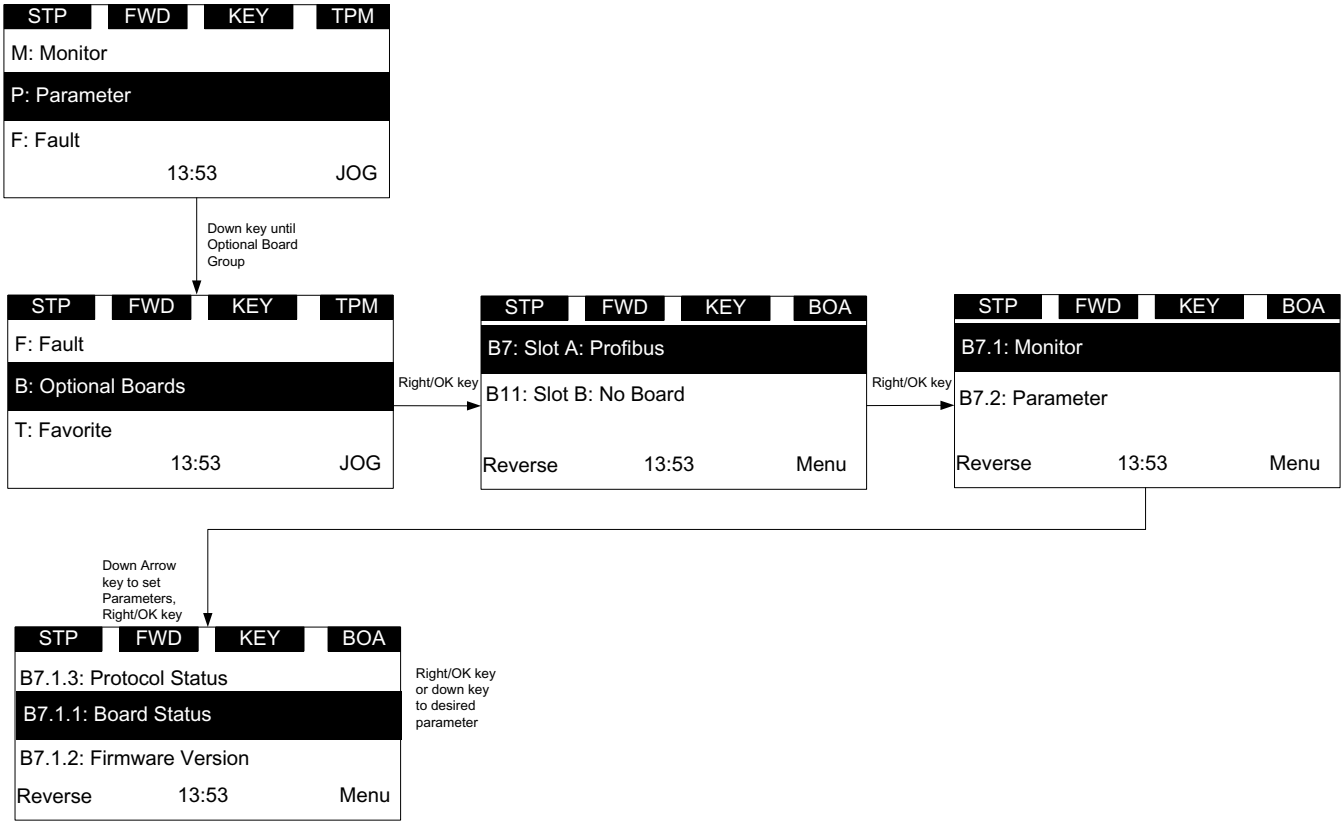


Table 107. PROFIBUS parameters

Code		Parameter	Min.	Max.	Unit	Default	ID (Slot A/Slot B)	Note
BX.1.1		Board Status				0	883/910	B0 = Optional Comm. Card Fault B1 = Board HW Fault B2 = Reserved B3 = Fieldbus Fault B4 = Reserved
BX.1.2		Firmware Version					1064/1066	
BX.1.3		Protocol Status				0	2131/2142	0 = Waiting for Parameterization 1 = Parameterization Fault 2 = Waiting for Configuration 3 = Configuration Fault 4 = Data Exchange
BX.2.1	2	Slave Address	2	125		118	1242/1250	Address of the PROFIBUS Slave
BX.2.2	2	Baud Rate	1	10		10	1243/1251	Baud Rate for PROFIBUS 1 = 9.6 kBaud 2 = 19.2 kBaud 3 = 93.75 kBaud 4 = 187.5 kBaud 5 = 500 kBaud 6 = 1.5 MBaud 7 = 3 MBaud 8 = 6 MBaud 9 = 12 MBaud 10 = Automatic
BX.2.3	2	DO I/O Data	1	1		1	1244/1252	Drive Profile 1 = Standard Telegram
BX.2.4	2	Operation Mode	0	2		1	1245/1253	Operation Mode 0 = PROFIdrive 1 = Echo 2 = Bypass
BX.2.5		Comm Card FB Fault Response	0	1		0	2519/2520	0 = In Fieldbus Control 1 = in all Control

Note: X will depend on the slot the drive is in, Slot A = 7, Slot B = 14.

The parameters of every device must be set before connecting to the bus. Especially the parameters "Slave Address" must be same as set in Master.

PROFIBUS—PowerXL DG1

General

Data transfer between PROFIBUS-DP master and slave takes place via the input/output data field. The master writes to slave's output data and the slave answers by sending the contents of its inputs data to master. The content of the input/output data is defined in the device profile. The device profile for drives is PROFIdrive.

PowerXL drive can be controlled by PROFIBUS-DP Master using ST1 telegram of the PROFIdrive profile using the ST1 standard telegram in Drive profile mode, or using other modules in Bypass Mode. The Modules where Process Data values are returned can be used via the Bypass Operation mode. When Fieldbus has been selected as the active control place, the drive operation is controlled from PROFIBUS-DP Master as long as PNU927 = 1 and PNU928 = 1 by default. When these bits are disabled, it only allows monitoring values cyclic via acyclic commands.

Operation mode

The parameter Operation Mode BX.2.4 above defines how the input/output data is handled on the option board.

PROFIdrive

Data transfer follows the document PROFIBUS Profile for variable speed drives, PROFIdrive following the Standard Telegram 1.

Echo

The OUTPUT data written by the Master is echoed back to the Master in the INPUT field.

The data is not shown in the drive, but echoing is carried out on the option board.

This mode can be used when the function of the bus connection is tested.

Bypass

The information of the Process data field is transferred to the application interface without handling.

The desired PPO Modules define the amount of data that is transferred. Once drive is set in Bypass mode, it will give the ability to set the desired PPO module.

PowerXL PROFIdrive interface

PowerXL has PROFIdrive profile 4.1, which allows—

- Direct control of the drive using PROFIBUS Master
- Full access to all drive parameters

Control word and status word

The Control Word and Status Word used when in Bypass mode using one of the 4 modules will follow the layout used in Modbus for the CW, SW, Ref Speed, ACT Speed, and FB Data points.

Control word

PowerXL DG1 drive uses 16 bits as shown below. These bits are application specific.

Table 108. Binary bits and corresponding outputs

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
①	①	①	①	①	①	FB Ref	FB Ctrl	BYS	FB DIN 4	FB DIN 3	FB DIN 2	FB DIN 1	F_RST	DIR	RUN

Note:

① The bit is not used.

FB general control word

The DG1 does not use the FB General Control Word. The main control word is used to provide commands to the drive.

Table 109. FB control word

Bit	Description value = 0	Value = 1
0	Drive Output Off	Drive Output On
1	Clockwise Rotation	Counter Clockwise
2	No Reset	Fault Reset
3	FB INDATA1 Off	FB INDATA1 On
4	FB INDATA2 Off	FB INDATA2 On
5	FB INDATA3 Off	FB INDATA3 On
6	FB INDATA4 Off	FB INDATA4 On
7	Bypass Relay Disable	Bypass Relay Enable
8	FB Control Off	FB Control On
9	FB Reference Off	FB Reference On
10–15	Not in use	Not in use

Table 110. Speed reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Reference 1 to the VFD. Used normally as Speed reference.

The scaling on this value is 0–100.00% of the Maximum Frequency (P1.2). The 0 to 100.00% is represented by 0 to 10,000 value indicating 0 or 0% as Minimum Frequency (P1.1) and 10,000 or %100.00 as Maximum Frequency (P1.2). This value has 2 decimal places in it.

Process data in 1 to 8

Process Data In values 1 to 8 can be used in applications for various purposes.

Table 111. Bypass mode process data modules

Module	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Module 1	CW	REF	FBData_In_1	FBData_In_2						
	SW	ACT	FBData_Out_1	FBData_Out_2						
Module 2	CW	REF	FBData_In_1	FBData_In_2	FBData_In_3	FBData_In_4				
	SW	ACT	FBData_Out_1	FBData_Out_2	FBData_Out_3	FBData_Out_4				
Module 3	CW	REF	FBData_In_1	FBData_In_2	FBData_In_3	FBData_In_4	FBData_In_5	FBData_In_6		
	SW	ACT	FBData_Out_1	FBData_Out_2	FBData_Out_3	FBData_Out_4	FBData_Out_5	FBData_Out_6		
Module 4	CW	REF	FBData_In_1	FBData_In_2	FBData_In_3	FBData_In_4	FBData_In_5	FBData_In_6	FBData_In_7	FBData_In_8
	SW	ACT	FBData_Out_1	FBData_Out_2	FBData_Out_3	FBData_Out_4	FBData_Out_5	FBData_Out_6	FBData_Out_7	FBData_Out_8

Note:

① Only available in bypass mode.

Process data out

This register range is normally used to fast monitoring of the VFD. Process Data Out is located in range ID 2104–2111. See table below.

Table 112. Fieldbus basic output table

ID	Modbus register	Group	Range/Type
2101	32101, 42101	FB Status Word	Binary coded
2102	32102, 42102	FB General Status Word	Binary coded
2103	32103, 42103	FB Actual Speed	%
2104	32104, 42104	FB Process Data Out 1	
2105	32105, 42105	FB Process Data Out 2	
2106	32106, 42106	FB Process Data Out 3	
2107	32107, 42107	FB Process Data Out 4	
2108	32108, 42108	FB Process Data Out 5	
2109	32109, 42109	FB Process Data Out 6	
2110	32110, 42110	FB Process Data Out 7	
2111	32111, 42111	FB Process Data Out 8	

Note: FB Process data is defined in **Appendix B.**

Table 113. Status word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
—	—	—	—	—	—	—	—	RUNEN	BYS	AREF	WARN	FLT	DIR	RUN	RDY

Information about the status of the device and messages is indicated in the Status Word. The Status Word is composed of 16 bits that have the following meanings.

Table 114. Status word bit descriptions

Bit	Description value = 0	Value = 1
0	Not Ready	Ready
1	STOP	RUN
2	Clockwise	Counterclockwise
3	—	Faulted
4	—	Warning
5	Ref. frequency not reached	Ref. frequency reached
6	Bypass not activated	Bypass activated
7	Run disable	Run Enable
8	Not in use	Not in use
9–15	Not in use	Not In use

Table 115. Actual speed

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LSB

This is the Actual Speed of the motor.This value comes back in the form of %.

PROFIBUS overview

PROFIBUS is a vendor independent, open fieldbus standard for a wide range of applications in manufacturing, process and building automation. Vendor independence and openness are guaranteed by the PROFIBUS standard EN 50 170. With PROFIBUS, devices of different manufactures can communicate without special interfaces adjustment. PROFIBUS can be used for both high-speed time critical data transmission and extensive complex communication tasks.

PROFIBUS-DP—Optimized for high speed and inexpensive hookup, this PROFIBUS version is designed especially for communication between automation and control systems and distributed I/O at the device level. PROFIBUS-DP can be used to replace parallel signal transmission with 24V or 0 to 20 mA.

The PROFIBUS Family—PROFIBUS specifies the technical and functional characteristics of a serial fieldbus system with decentralized digital controllers can be networked together from the field level to the cell level. PROFIBUS distinguishes between master and slave devices.

Master Devices—Determines the data communication on the bus. A master can send messages without an external request when it holds access rights (the token). Master are also called "active stations" in the PROFIBUS protocol.

Slave Devices are peripheral devices. Typical devices include input/output devices, valves, drives and measuring transmitters. They do not have bus access rights and they can only acknowledge received messages or send messages to the master when requested to do so. Slaves are also called 'passive stations".

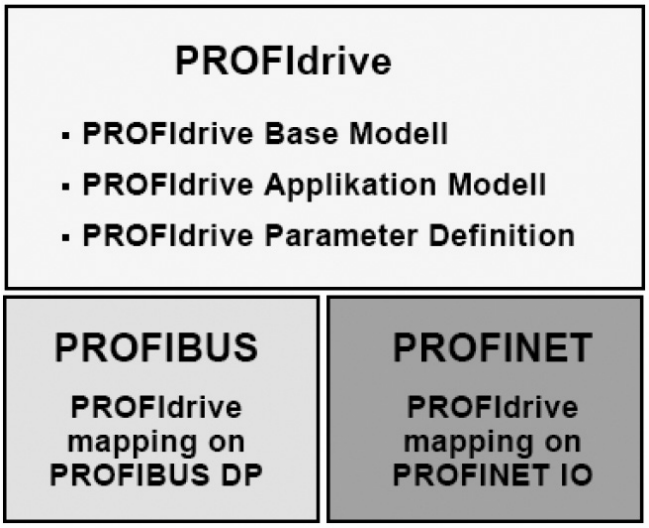
Profiles—The PROFIBUS-DP protocol defines how user data to be transmitted between stations over the bus. User data are not evaluated by the PROFIBUS transmission protocol. The meaning is specified in the profiles. In addition, the profiles specify how PROFIBUS-DP is to be used in the "PowerXL" PROFIBUS Fieldbus board.

Leading manufacturers of drive technology have jointly defined the PROFIdrive profile. The profile specifies how the drives are to be parameterized and how the set points and actual values are to be transmitted. This enables drives from different vendors to be exchanged. The profile contains necessary specifications for speed control and positioning. It specifies the basic drive functions while leaving sufficient freedom for application-specific expansions and further developments. The profile describes the mapping of the application functions for DP.

PROFIdrive consists of a general part and a bus specific part. The following properties are defined in the general part.

- Base Model
- Parameter model
- Application Model

Figure 39. PROFIdrive



The PROFIdrive base model describes an automation system in terms of a number of devices and their interrelationships (application interfaces, parameter access). The base model distinguishes between following device classes.

Communication Services—Two communication services are defined in the PROFIdrive profile; namely, cyclic data exchange and acyclic data exchange.

Cyclic data exchange via a cyclic data channel

Motion control system need cyclically updated data during operation for open and closed loop control purposes. This data must be sent to the drive units in the form of set points or transmitted from the drive units in the form of actual values, via the communication systems.

Acyclic data exchange via an acyclic data channel

In addition to cyclic data exchange, there is an acyclic parameter channel for exchanging parameters between control/supervisor and drive units. Access to this data is not time critical.

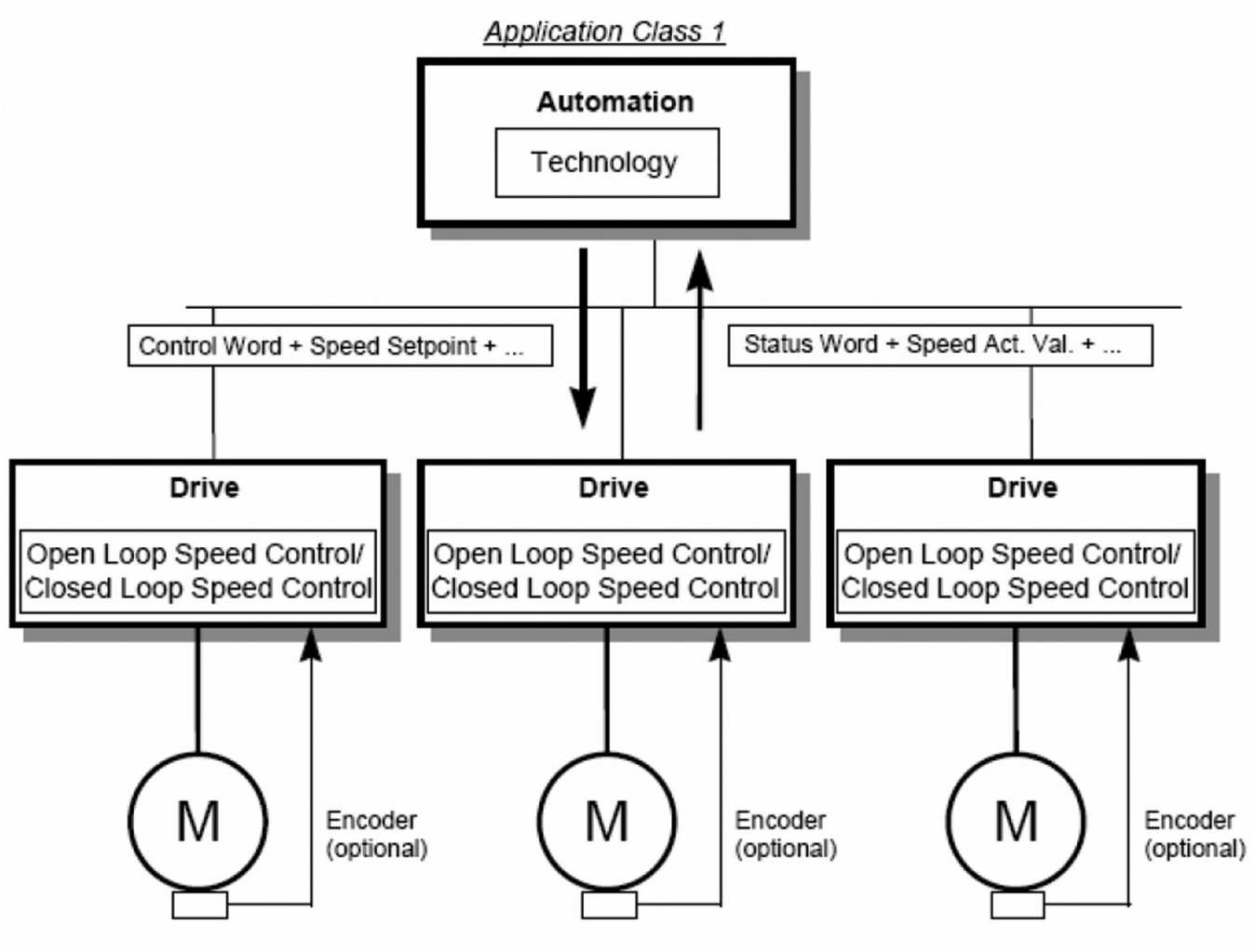
Application classes

The integration of drives into automation solutions depend strongly upon the drive task. To cover the extensive range of drive application from the most simple frequency convertor up to highly dynamic synchronized multi axis systems with a single profile. PROFIdrive defines six application categories but PowerXL PROFIBUS optional card support below application class 1.

Table 116. Application class

SN	Application class	Interface	Function
1	Standard Drive (e.g., pumps, fans, agitators)	n-set point	Cyclic I/O data interface

Figure 40. Application class



Startup test

Set up the communication with Master and follow below steps.

1. Complete Parameterization of the device. Below parameters are important to control device on PROFIBUS.
   a. Parameterization Enable/Disable = 1 (Enabled)
   b. Local / remote selection = 1 (Remote control)
   c. Remote 1 control place = 1 (Fieldbus)
   d. Remote 1 reference = 7 (Fieldbus Ref)
   e. PNU927-Opern priority of param = 1
   f. PNU928 Ctrl priority DOIO Data = 1
   g. ProfiBus Operation Mode = 0 (ProfiDrive)
2. Select the "Standard Telegram 1" in the Configuration step in the PLC
3. Set control word value to 0x0406 to enter ProfiDrive State S2
4. Set control word value to 0x0407 to enter ProfiDrive State S3
5. Set control word value to 0x047F and Set Frequency reference t0 0x4000 to enter ProfiDrive State S4
6. Check drive is running on output frequency 100%.
7. Set control word value to 0x047E to drive stop and ProfiDrive State S2
8. Check drive is in stop mode and output frequency 0%

Control and status words

The Control Word (PROFIBUS Parameter number (PNU) = 967) is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master station to the drive, the adapter module acting as a gateway.

The drive switches between its states according to the bit-coded instructions on the Control Word, and returns status information to the master in the Status Word (PROFIBUS Parameter number (PNO) = 968).

Control word 1 (STW1)

To improve the exchange of devices of different manufacturers in a control application, we strongly recommend using the device-specific bits only for the control of manufacturer specific functions. The device-specific bits shall not be necessary for the operation of a device in the speed control mode and in the positioning mode (default of the device-specific bits = 0).

Table 117. PROFIdrive control word 1—STW1 message examples

Bit	Value	Significance	Comments
0	1	ON	"Switched on" condition; voltage at the power converter, i.e. the main contact is closed (if present).
	0	OFF (OFF 1)	Power-down (the drive returns to the "ready for switching on "condition); the drive is ramped-down along the ramp (RFG) or along the current limit or along the voltage limit of the d.c. link; if standstill is detected, the voltage is isolated; the main contact is opened (if present). During deceleration bit 1 of ZSW1 is still set. An OFF command is interruptible.
1	1	No Coast Stop (no OFF 2)	All "Coast Stop (OFF2)" commands are withdrawn.
	0	Coast Stop (OFF 2)	Voltage is isolated. The main contact is then opened (if present) and the drive goes into the "Switching On Inhibited" condition; the motor coasts down to a standstill.
2	1	No Quick Stop (no OFF 3)	All "Quick Stop (OFF3)" commands are withdrawn.
	0	Quick Stop (OFF 3)	Quick stop; if required, withdraw the operating enable, the drive is decelerated as fast as possible, e.g., along the current limit or at the voltage limit of the d.c. link, at n / f = 0; if the rectifier pulses are disabled, the voltage is isolated (the contact is opened) and the drive goes into the "Switching On Inhibited" condition. A Quick Stop command is not interruptible.
3	1	Enable Operation (Start)	Enable electronics and pulses. The drive then runs-up to the set point.
	0	Disable Operation (Stop)	The drive coasts down to a standstill (ramp-function generator to 0 or tracking) and goes into the "Switched on" condition (refer to control word 1, bit 0).

Table 117. PROFIdrive control word 1—STW1 message examples, continued

Bit	Value	Significance	Comments
4	1	Enable Ramp Generator	
	0	Reset Ramp Generator	Output of the RFG is set to 0. The main contact remains closed, the converter is not isolated from the line, the drive decelerates along the current limit or along the voltage limit of the d.c. link.
5	1	Unfreeze Ramp Generator	
	0	Freeze Ramp Generator	Freeze the actual set point entered by the ramp-function generator. If Application Class 4 is used Bit 5 is not relevant.
6	1	Enable Set point	The value selected at the input of the RFG is switched-in.
	0	Disable Set point	The value selected at the input of the RFG is set to 0.
7	1	Fault Acknowledge (0 → 1)	The group signal is acknowledged with a positive edge; the drive reaction to a fault depends on the type of fault. If the fault reaction has isolated the voltage, the drive then goes into the "Switching On Inhibited" condition.
	0	No significance	
8	1	Jog 1 Ona	Prerequisite. Operation is enabled, drive is in standstill and STW1 bit 4, 5, 6 = 0. The drive runs up along the ramp of RFG to jogging set point 1.
	0	Jog 1 OFFa	Drive brakes along the ramp of RFG, if "Jog 1" was previously ON, and goes into "Operation Enabled" when drive comes to a standstill.
9	1	Jog 2 Ona	N/A
	0	Jog 2 OFFa	N/A
10	1	Control By PLC	Control via interface, DO I/O Data valid (refer to 6.3.11).
	0	No Control By PLC	DO I/O Data not valid; expect Sign-Of-Life. If loosing the control priority bit the reaction is device-specific. Possible reactions. 1) speed control. "old" process data is kept, 2) positioning. DO I/O Data are set to 0.
11	1	Device Specific	N/A
	0	Device Specific	N/A
12	1	Device Specific	N/A
	0	Device Specific	N/A
13	1	Device Specific	N/A
	0	Device Specific	N/A
14	1	Device Specific	N/A
	0	Device Specific	N/A
15	1	Device Specific	N/A
	0	Device Specific	N/A

Below is various defined control word (STW1) command.

Table 118. Control word (STW1) message examples

SN	Control word (STW1)	Control word description (STW1)	Comment
1	0x0400	Set PLC Control	PLC Control should be set in MCU
2	0x0000	Clear PLC Control	PLC Control should be reset in MCU
3	0x040F	Run Command without RFG	Motor Off as no RAMP Generator
4	0x0407	Clear Run Command	Motor Off as earlier
5	0x041F	Run Command with RFG and without Set point	Motor Off as no Set point Generator
6	0x0407	Clear Run Command	Motor Off as earlier
7	0x047F	Run Command with RFG and with Set point	Motor ON with RFG
8	0x0407	Clear Run Command	Motor Off as earlier
9	0x047F	Run Command with RFG and with Set point	Motor ON with RFG
10	0x045F	Set Freeze of Ramp	Motor ON with Ramp Freeze
11	0x047F	Clear Freeze of Ramp	Motor ON with Following Ramp Timing
12	0x047E	OFF 1 Command	Motor Off with RFG
13	0x047F	Run Command with RFG and with Set point	Motor ON with RFG
14	0x047D	OFF 2 Command (Coast Stop)	Motor Off with Coast
15	0x047F	Run Command with RFG and with Set point	Motor ON with RFG
16	0x047B	OFF 3 Command (Quick Stop)	Motor Off with 0 DECEL Time
17	0x047F	Run Command with RFG and with Set point	Motor ON with RFG
18	0x0477	Disable Operation	Motor Off with Coast
19	0x057F	Run Command with RFG and with Set point At Jog Speed	Motor ON at Jog Speed
20	0x0477	Disable Operation	Motor Off with Coast
21	0x0480	Fault Reset bit	Fault should get reset

Status word 1 (ZSW1)

Table 119. Application status word PROFIdrive

Bit	Value	Significance	Comments
0	1	Ready To Switch On	Power supply is switched on, electronics initialized, main contact, if available, has dropped out, pulses are inhibited.
	0	Not Ready To Switch On	
1	1	Ready To Operate	Refer to control word 1, bit 0.
	0	Not Ready To Operate	
2	1	Operation Enabled	Drive follows set point. This means, that the electronic and pulses are enabled (Refer to control word 1, bit 3), the closed loop control is active and controls the motor and the output of the set point channel is the input for the closed loop control.
	0	Operation Disabled	Either the pulses are disabled or the drive doesn't follow the output value of the set point channel.
3	1	Fault Present	Unacknowledged faults or currently not acknowledgeable faults (fault messages) are present (in the fault buffer). The fault reaction is fault-specific and device-specific. The acknowledging of a fault may only be successful, if the fault cause has disappeared or has been removed before. If the fault has isolated the voltage, the drive goes into the "Switching On Inhibited" condition, otherwise the drive returns to operation. The related fault numbers are in the fault buffer.
	0	No Fault	
4	1	Coast Stop Not Activated (No OFF 2)	
	0	Coast Stop Activated (OFF 2)	"Coast Stop (OFF 2)" command is present.
5	1	Quick Stop Not Activated (No OFF 3)	
	0	Quick Stop Activated (OFF 3)	"Quick Stop (OFF 3)" command is present.
6	1	Switching On Inhibited	The drive goes only again in the "Switched On" condition with "No Coast Stop AND No Quick Stop" followed by "ON." This means that the "Switching On Inhibited" bit is only set back to zero if the OFF command is set after "No Coast Stop AND No Quick Stop."
	0	Switching On Not Inhibit	
7	1	Warning Present	Warning information present in the service/maintenance parameter; no acknowledgement.
	0	No Warning	There is no warning or the warning has disappeared again.
8	1	Speed Error Within Tolerance Range	Actual value is within a tolerance band; dynamic violations are permissible for t < tmax, e.g., n = nset±, f = fset±, etc., tmax may be parameterised
	0	Speed Error Out Of Tolerance Range	
9	1	Control Requested	The automation system is requested to assume control (refer to 6.3.11.
	0	No Control Requested	Control by the automation system is not possible, only possible at the device or by another interface.
10	1	f Or n Reached Or Exceeded	Actual value ≥ comparison value (set point) which may be set via the parameter number.
	0	f Or n Not Reached	
11	1	Device Specific	N/A
	0	Device Specific	N/A
12	1	Device Specific	N/A
	0	Device Specific	N/A
13	1	Device Specific	N/A
	0	Device Specific	N/A
14	1	Device Specific	N/A
	0	Device Specific	N/A
15	1	Device Specific	N/A
	0	Device Specific	N/A

References

References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference is formed by calculating the 2's complement from the corresponding positive reference.

Table 120. References

SN	N2 data type hex	N2 data type decimal	N2 data type percentage	Frequency in decimal
1	4000	16384	100	50
2	3000	12288	74	37
3	2000	8192	50	25
4	1000	4096	24	12
5	0	0	0	0
6	F000	61440	–25	12
7	E000	57344	–50	25
8	D000	53248	–75	37
9	C000	49152	–100	50

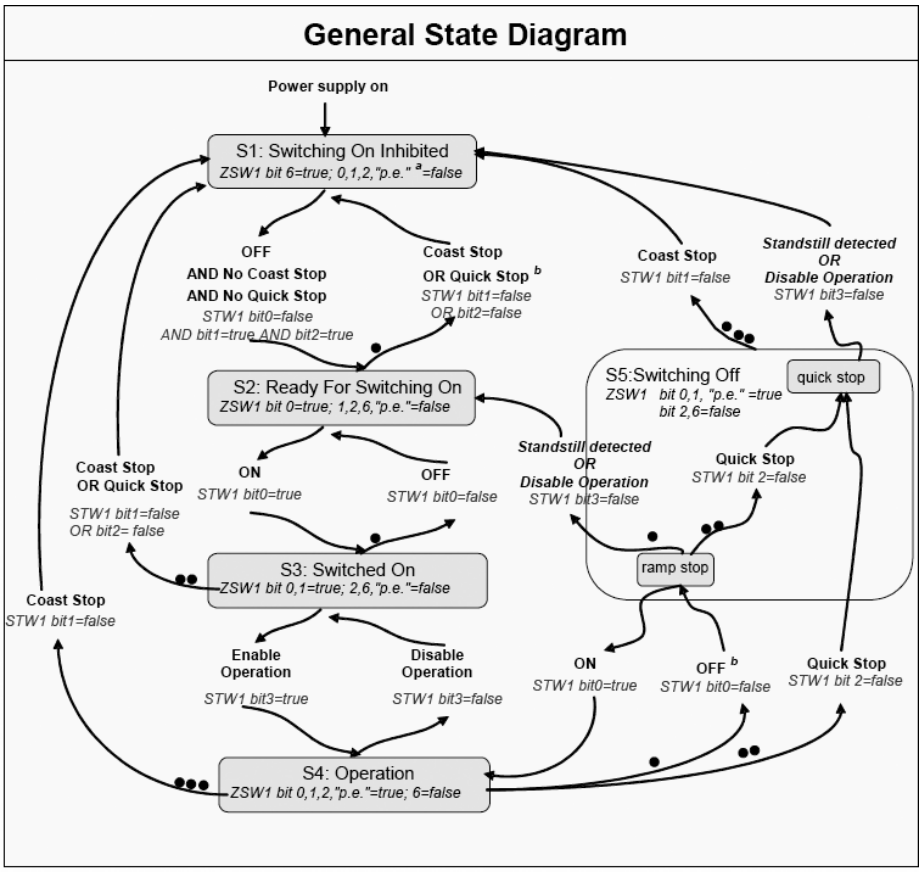
Actual values

Actual values are 16-bit words containing information on the operation of the drive. The function to be monitored are selected by a drive parameter. The scaling of the integers sent to the master as Actual Values depends on the selected function.

General state machine

State diagrams are defined for the operating modes. In the PROFIdrive control profile, the controls bits 0 to 3 perform the basic start-up / power down functions whereas the control bits 4 to 15 perform application-oriented control.

Figure 41. General state diagram



Notes:

STW1 bit x, y = These control word bits shall be set by the control.

ZSW1 bit x, y = These status word bits indicate the actual state.

Standstill detected is an internal result of a stop operation.

a Abbr.: "p.e." = "Pulses enabled" optional.

b The internal condition "fault with ramp stop" also activates this transition.

Information on the general state diagram

- The green blocks represent states, the arrows represent transitions
- From several states, several transitions are possible
- The more points that a transition has, the higher is its priority. A transition without points has the lowest priority
- The PROFIBUS interfaces between this controller and the DO has the control priority (PNO 928)
- ZSW1 Bit 9 is set by the DO
- STW1 Bit 10 is set by the controller
- The bits defined for positioning mode are only relevant, if the drive is in the state "S4" operation
- All stop-reactions caused by faults (Fault with Ramp stop, Fault with Quick stop, Fault with Coast stop) for the general state machine to switch to state S1 (Switching on Inhibited) or S2 (Ready For switching)

DO I/O data

The set points to the Axis and also the actual from the Axis are transferred as DO I/O data. The DO I/O data is transferred using the cyclic data exchange. The representation of data shall be in big endian format.

The following advantages are obtained due to the telegram configuring and normalization.

- Interoperability and interchangeability of PROFIdrive Controllers and Drive Objects
- Standard components may be simply commissioned
- Automation mechanisms in the controller application

Signals

A series of signals with appropriate signal numbers is defined to configure the DO I/O Data (set points, actual values).

The following values are permissible for the signal numbers.

- 0 = not assigned
- 1-99 = standard signal numbers (profile-specific signal numbers)
- 100-65535 = signal numbers (device-specific)

The PowerXL PROFIBUS optional card, the defined signal numbers are listed in the following.

Table 121. PROFIBUS option Card

Signal no.	Significance	Abbreviation	Length
1	Control word 1	STW1	16
2	Status word 1	ZSW1	16
5	Speed set point A	NSOLL_A	16
6	Speed actual value A	NIST_A	16

Standard telegram 1

Standard telegrams 1 is defined for speed set point interface operations application class (AC1). The standard telegrams are selected when configuring the DO I/O Data.

The standard telegram 1 has the following structure.

- n set interface, 16 bit

Table 122. Standard telegram 1

I/O Data Number	Set point	Actual value
1	STW1	ZSW1
2	NSOLL_A	NIST_A

PROFIdrive Profile

The PROFIdrive profile PNU numbers are listed in **Appendix A** of this manual.

DPV1 acyclic communication

Base model parameter access, whose structure is defined in the PROFIdrive profile 4.1, is always used for communicating the writing/reading parameters for PROFIdrive drives such as PowerXL.

Under this arrangement, parameters access always consists of two elements. Under this arrangement, parameter access always consists of two elements.

Write request (“Write data set “)
Read request (“Read data set”)

Write request or Request can be send via DPV1 master class 1 or master class 2.

The DP V1 command/response part is used for the standard DP V1 read/Write on the Slot 0, Index47 data block.

Parameter requests and parameter responses

A parameter consists of three segments.

Request header

ID for the request and number of parameters which are accessed. Multi-Axis and Modular drives, Addressing of one DO.

Parameter address

Addressing of a parameter. If parameters are accessed, there are correspondingly many parameter addresses but can only be accessed on a single case. The parameter address appears only in the request, not in the response.

Parameter value. Per addressed parameter, there is a segment for the parameter values. Depending on the request ID, parameter values appear only either in the request or in the reply.

Words and double words

The following telegram contents are displayed in words (a word or 2 bytes per line). Words or double words will have the most significant byte being transmitted first (big endian).

Table 123. Words and Double Words

Word	Byte 1	Byte 2
Double Word	Byte 1	Byte 2
	Byte 3	Byte 4

According to the Base Model Parameter access the structure of the parameter request and parameter response as shown in **Table 124** and **Table 125**.

Table 124. Base mode parameter request

Block definition	Byte n+1	Byte n	n
Request Header	Request reference	Request ID 0	0
	Axis-No. / DO-ID	Axis-No. / DO-ID	2
1st Parameter address	Attribute	No. of elements	4
	Parameter number (PNU)		
	Subindex		
1st Parameter Value (s) (only for request “Change parameter”)	Format values	No. of values	4 + 6 × n

Table 125. Base model response

Block definition	Byte n+1	Byte n	n
Response header	Request Ref. mirrored	Response ID	0
	Axis-No. / DO-ID mirrored	No. of parameters = n	2
1st Parameter Value (s) (only after request “Request”)	Format values or error values	No.of values	4
nth Parameter values			4 +... + (Format_n × Qty_n)

Coding

Coding of the fields in parameter request/parameter response of base model parameter access.

The Eaton PowerXL Profibus board support only single parameter and single element.

Max No. of Parameters = 1

Max No. of Elements = 1

Max No. of Values = 1

Table 126. Field coding

Field	Data Type	Value		Comment
Request Reference	Unsigned 8	0x00	Reserved	
		0x01…0xFF		
Response ID	Unsigned 8	0x00	Reserved	
		0x01	Request parameter (+)	
		0x02	Change parameter(+)	
		0x03…0x3F	Reserved	
		0x40	INCORRECT Request Ref	
		0x41	INCORRECT Request ID	
		0x42	INVALID NOS PARAM	
		0x43	INVALID_Axis_DO_DI	
		0x44…0x7F	Manufacturer-specific	
		0x80	Reserved	
		0x81	Request parameter (–)	
		0x82	Change parameter (–)	
		0x83…0xBF	Reserved	
		0xC0…0xFF	Manufacturer-specific	
Axis/DO-ID	Unsigned 8	0x00	Device-Representative	Zero is not a DO but representative of the access to the drive unit.
		0x01…0xFE	DO-ID-Number 1–254	
		0xFF	Reserved	
No. of Parameters	Unsigned 8	0x00	Reserved	There may be an additional limitation through the communication system (telegram length) or optional scalability.
		0x01…0x27	Quantity 1–39	
		0x28…0xFF	Reserved	
Attribute	Unsigned 8	0x00	Reserved	The four less significant bits are reserved for (future) expansion of “No. of Elements” to 12 bits.
		0x10	Value	
		0x20	Description	
		0x30	Text	
		0x40…0x70	Reserved	
		0x80…0xF0	Manufacturer-specific	
No. of Elements	Unsigned 8	0x00	Special Function	Limitation through compatibility with PROFIBUS process data ASE telegram length.
		0x01…0xEA	Quality 1–234	
		0xEB…0xFF	Reserved	
Parameter Number	Unsigned 16	0x0000	Reserved	
		0x0001	Number 1–65535	
		0xFFFF		
Subindex	Unsigned 16	0x0000…	Number 0–65534	
		0xFFFF		

Table 126. Field coding, continued

Field	Data type	Value		Comment
Format	Unsigned 8	0x00	Reserved	Every slave shall at least support the data types Byte, Word and Double Word (mandatory). Write requests by the master preferable use the "correct" data types. As substitute, Byte, Word, or Double Word are also possible. The master shall be able to interpret all values/data types.
		0x01…0x36	Data types	
		0x37…0x3F	Reserved	
		0x40	Zero	
		0x41	Byte	
		0x42	Word	
		0x43	Double word	
		0x44	Error	
		0x45…0xFF	Reserved	
No. of Values	Unsigned 8	0x00…0xEA	Quantity 0–234	Limitation because of 240 Bytes Data block size (compatible with former PROFIdrive version 3.1.2).
		0xEB…0xFF	Reserved	
Error Number	Unsigned 16	0x0000…	Error numbers	The more significant byte is reserved.
		0x00FF		

Generic station description (GSD) file

Please refer GSD file "EATN0EF5.gsd"

CANopen external communication cards

The Eaton PowerXL DG1 series can be connected to the CANopen system using a fieldbus board. Through this board the drive can be controlled, monitored and programmed from the Host system. The CANopen fieldbus board can be installed in either slot A or slot B on the control board of the drive. The devices are connected in a bus structure. There is a maximum of 127 devices that can be connected to a single master. The bus termination should be made on the end of the bus segment.

CANopen technical data

Table 127. CANopen connections

Item	Value
Interface	Open style connector (Pluggable connector)
Data Transfer method	CAN (ISO 11898)
Transfer Cable	2 wire Twisted shielded cable
Electrical Isolation	500 Vdc

Table 128. Communications

Item	Value
CANopen	CiA DS-301, CiA DSP-402
Baud rate	1000 kBaud
	800 kBaud
	500 kBaud
	250 kBaud
	125 kBaud
	50 kBaud
	20 kBaud
Addresses	1–127

Table 129. Environment

Description	Specification
Ambient Operation Temperature	–10 °C to +55 °C
Storing Temperature	–40 °C to +60 °C
Humidity	<95%, no condensation allowed
Altitude	Max. 1000 M
Vibration	0.5G at 9–200 Hz
Safety	Fulfills EN 50178 Standard

CANopen cable

To meet the ISO 11898 standard, cables to be used with CANbus lines should have a nominal impedance of 120 ohms, a line delay of 5 ns/m. Line termination has to be provided through termination resistors of 120 ohms on both ends of the transmission lines. The length should be related to resistance at 70 mohm/m. There is a terminating resistor bank on all boards and can be set via the DIP switch setting.

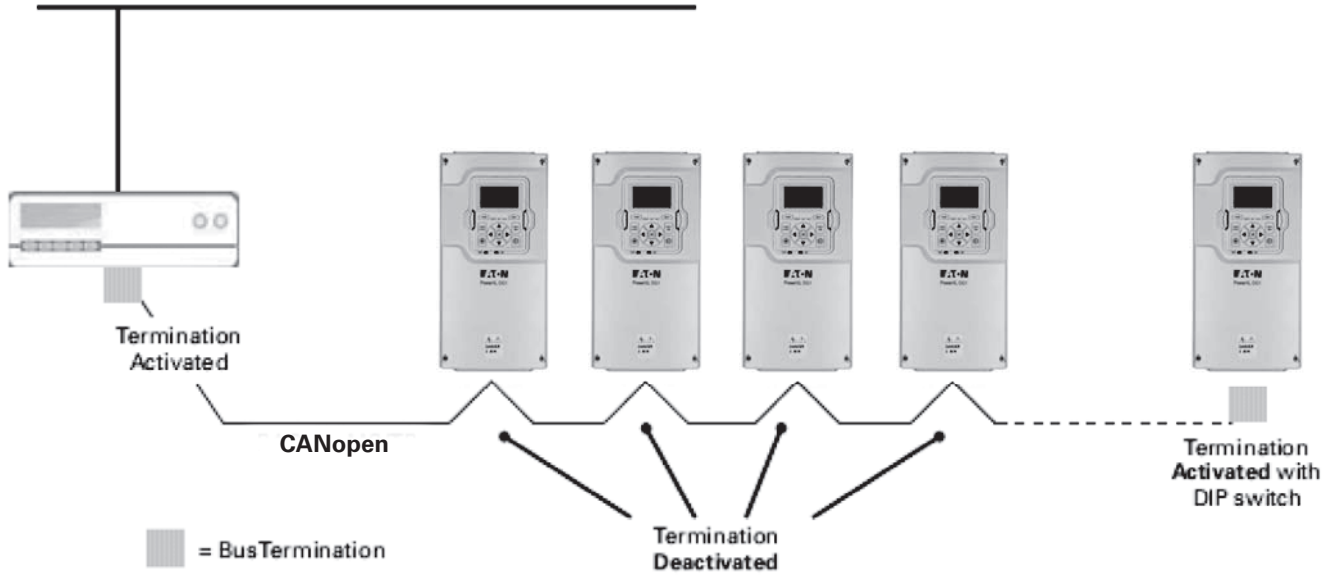
Below are the practical bus length for CANopen networks with less than 64 nodes.

Table 130. Practical bus length

Item	Value						
Baud Rate (kbits/s)	1000	800	500	250	125	50	20
Max. Bus Length in m	30	50	100	250	500	1000	2500

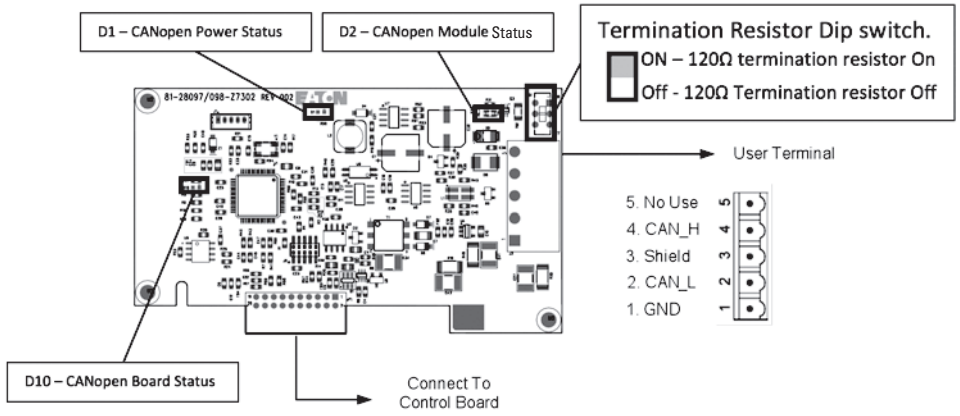
CANopen bus termination

Figure 42. CANopen bus termination



Hardware specification

Figure 43. CANopen hardware



LED status

CANopen LEDs are as stated below.

Table 131. Power LED (D1) Red LED

Illumination Pattern	Meaning
OFF	Power to Option board is not activated
ON	Power to Option board is activated

Table 132. CANopen board status LED (D10) (Red LED)

Illumination Pattern	Meaning
OFF	Option board not activated
ON	Option board in Normal condition, i.e., no fault is occurred
Blinking at 40 Hz	Optional Card Communication Fault
Blinking at 20 Hz	Option card Hardware fault occurs
Blinking at 10 Hz	CAN communication fault occurs

Table 133. CANopen module status—Error LED (D2-Red LED)

Illumination Pattern	Meaning	Description
OFF	No error	The device is in working condition
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
Double flash	Error control event	A guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer) has occurred
ON	Bus Off	The CAN controller is bus off

Note: An LSS master shall flicker its ERROR and RUN LED whilst executing LSS services.

Table 134. CANopen module status—Run LED (D2-Green LED)

Illumination Pattern	Meaning	Description
Blinking	PREOPERATIONAL	The device is in state PREOPERATIONAL
Single flash	STOPPED	The device is in state STOPPED
On	OPERATIONAL	The device is in state OPERATIONAL

Commissioning

The CANopen board is commissioned by inserting it into Slot A and Slot B ports on the control board. Once the card is inserted to the slot, the device will recognize it and will show a warning for "Device Added." This warning will be shown for 5 seconds and will clear. Once the card is detected, the keypad will show the menu for the card in the Optional Card Menu.

Option card parameters

Once the card is detected, the following parameters can be set on keypad for CANopen.

Figure 44. CANopen parameters

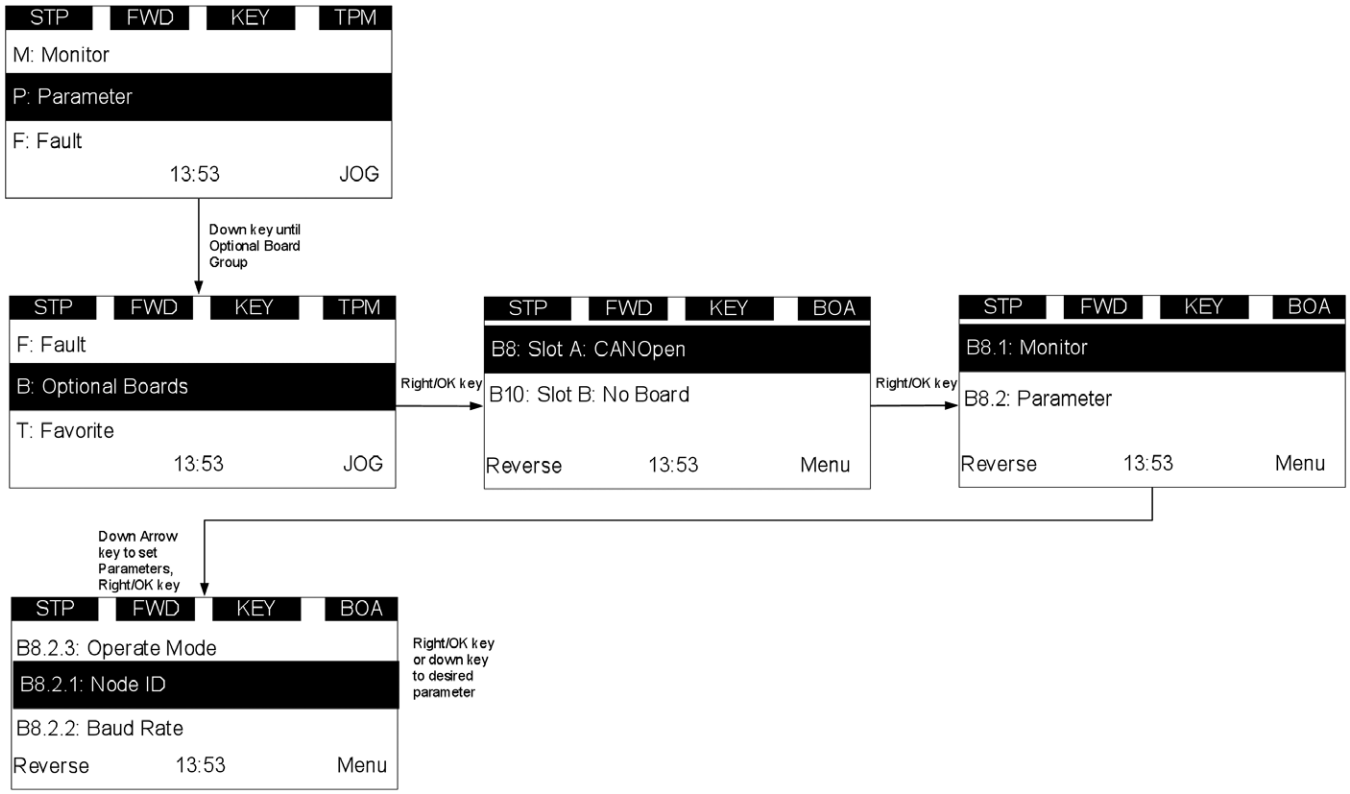


Table 135. CANopen parameters

Code	Parameter	Min.	Max.	Unit	Default	ID (Slot A/Slot B)	Note
BX.1.1	Board Status				0	883/910	B0 = DCOM Comm. Fault B1 = Board HW Fault B2 = Reserved B3 = Fieldbus Fault B4 = Reserved
BX.1.2	Firmware Version					1064/1066	
BX.1.3	Protocol Status				0	2132/2143	0 = Initialization 4 = Stopped 5 = Operational 6 = Pre-Operational
BX.2.1	Node ID	1	127		1	2133/2144	Address of device
BX.2.2	Baud Rate	0	7		0	2134/2145	0 = 1000 kBaud 1 = 800 kBaud 2 = 500 kBaud 3 = 250 kBaud 4 = 125 kBaud 5 = 50 kBaud 6 = 20 kBaud
BX.2.3	Operate Mode	0	1		0	2135/2146	0 = Drive Profile 1 = Bypass Profile
BX.2.4	Comm Card FB Fault Response	0	1		0	2519/2520	0 = In Fieldbus Control 1 = in all Control

Note: PDO1 and PDO2 should be used when in "Drive Mode" and PDO3 and PDO4 used in "Bypass Mode".

By default, the CANopen option board is configured to be used in the Drive Profile mode but can be changed to a Bypass mode, which is a manufacturer specified mode.

Drive profile

The CIA 402 Drive Profile mode where the control of the drive is done using a control word and speed reference value as specified in the drive profile specification.

Bypass profile

In this mode, the drive control can be done using the process data that is defined by the Drive application. The Drive Profile state machine and other objects are not valid in this mode.

Electronic data source file

The usage of devices in a communication network requires configuration of the device parameters and communication facilities. CANopen defines the required standard way to access these parameters via the object directory.

Please refer to the EDS file "PowerXL_CANopen_vx.x.eds."

CANopen overview

CANopen is a network system based on the serial bus network Controller Area Network (CAN). The CANopen communication profile (CiA-301) supports both direct access to device parameters and critical process data communications. CANopen device profiles (CiA DS-40X) define standards for device functionality while providing ample ability for additional vendor-specific device features. CANopen is used in direct peer-to-peer data exchange between nodes and the host machine. CANopen supports cyclic and event driven communications, allowing for reduced bus load and better performance with minimal cable loss.

Device Profile Drives and Motion Control (CiA-402) document represents the standardized CANopen Device Profile for digital controlled motion products like servo, drives or stepper motors. All these types of devices use the same communication techniques that conform to those described in the CANopen Application Layer and Communication Profile. The starting and stopping of the drive and several mode specific commands are executed by the state machine.

CANopen communication objects transmitted via the CAN network are described by services and protocols. They are set up as follows:

- The real-time data transfer is performed by the Process Data Objects (PDOs) protocol
- Service Data Object (SD) protocols provide the read and write access to entries of a device dictionary
- The Network Management (NMT) protocols provide services for network initialization, error control and device status control

CANopen message frame

Table 136. Message Frame

SOF	COB-ID	RTR	CTRL	Data Segment	CRC	ACK	EOF
1 bit	11 bits	1 bit	5 bit	0–8 bytes	16 bits	2 bits	7 bits

SOF	Start of Frame	CRC	Cyclic Redundancy Check
RTR	Remote Transmission Request	ACK	Acknowledge
CTRL	Control Field (i.e., Data Length)	EOF	End of Frame

COB-ID

The identification field of the CANopen-message is 11 bits.

D-Bit	10	9	8	7	6	5	4	3	2	1	0
COB-ID	Function Code				Node ID						

The default identification field consists of a functional part and a module-ID part.
The functional part determines the object priority. This kind of identification field allows communication between a master and 127 slaves. Broadcasting is indicated by a module-ID of zero. Function codes are determined with object dictionaries in device profiles.

Predefined connection set

CANopen pre-defines some communication objects and their connection set (DS301).

Table 137. Predefined connection set

Object	Function Code	COB-ID	Comm. Parameter Index
NMT	0000	0x0000	
Emergency	0010	0x0080+Node	
TPDO1	0011	0x0180+Node	0x1800
RPDO1	0100	0x0200+Node	0x1400
TPDO2	0101	0x0280+Node	0x1801
RPDO2	0110	0x0300+Node	0x1401
TPDO3	0111	0x0380+Node	0x1802
RPDO3	1000	0x0400+Node	0x1402
TPDO4	1001	0x0480+Node	0x1803
RPDO 4	1010	0x0500+Node	0x1403
SDO-TX	1011	0x0580+Node	0x1200-01
SDO-RX	1100	0x0600+Node	0x1200-02
Node Guarding	1110	0x0700+Node	0x100E

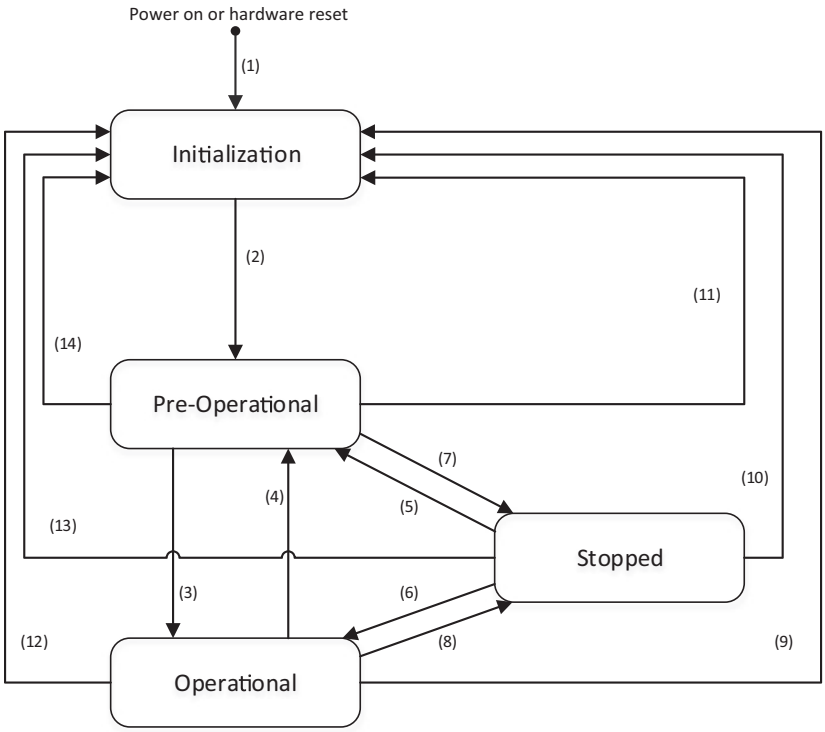
Network management (NMT)

The CANopen network management is node-oriented and follows a master/slave structure. It requires one device to function as the NMT Master, the others are slaves.

The CANopen NMT slave devices implement state machine tasks shown below. After power-up of a node, it will initialize and transmit to the "Pre-Operational State." In this state, communication across SDO channels is possible for node configuration, but not yet across PDOs. With the NMT message "Start Remote Node," a selected node or all nodes on the network can be set into the "Operational State." When the device is in this state, data exchange can be done via PDOs.

NMT network management manages CANopen, and is a mandatory, common feature for all devices. The protocol describes several node control services and the state machine.

Figure 45. NMT state machine



1 = When the power is on, the NMT state is entered autonomously.

2 = The NMT state initialization is finished, the NMT pre-operational state is entered automatically.

3 = NMT service starts with remote node indication or by local control.

4 and 5 = NMT service enters pre-operational indication.

6 = NMT service starts remote node indication.

7 and 8 = NMT service stops remote node indication.

9, 10 and 11 = NMT resets node indication.

12, 13 and 14 = Indication of NMT service reset communication.

To set the connected node into the "Operational State," the following message is required.

Table 138. Start remote node message

CAN ID	LENGTH	DATA 0	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	DATA 7
0x0	0x2	0x1	NODE ID						

The stop remote message sets the node into a "Stopped State" indicated in the NMT state machine. When the node ID in the message is set to "0," the message broadcasts to all nodes on the network.

Table 139. Stop remote node message

CAN ID	LENGTH	DATA 0	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	DATA 7
0x0	0x2	0x2	NODE ID						

The pre-operation message sets the node into the "Pre-Operational state" indicated in the NMT state machine. If the node ID in the message is set to "0," it will broadcast to all nodes.

Table 140. Enter pre-operational message

CAN ID	LENGTH	DATA 0	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	DATA 7
0x0	0x2	0x80	NODE ID						

The reset node message makes the nodes apply application reset. The application reset sets the whole object dictionary back to the default or previously stored values. If the node ID in the message is set to "0," it will broadcast to all nodes. Upon a reset, the node will enter into the "Pre-Operational state."

Table 141. Reset node message

CAN ID	LENGTH	DATA 0	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	DATA 7
0x0	0x2	0x81	NODE ID						

The reset communication message when sent to the node causes the communication reset. This does not affect the object dictionary values. If the node ID in the message is set to "0," it will broadcast to all nodes. After the node has received the communication reset, it will enter into the "Pre-Operational" state.

Table 142. Reset communication message

CAN ID	LENGTH	DATA 0	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	DATA 7
0x0	0x2	0x82	NODE ID						

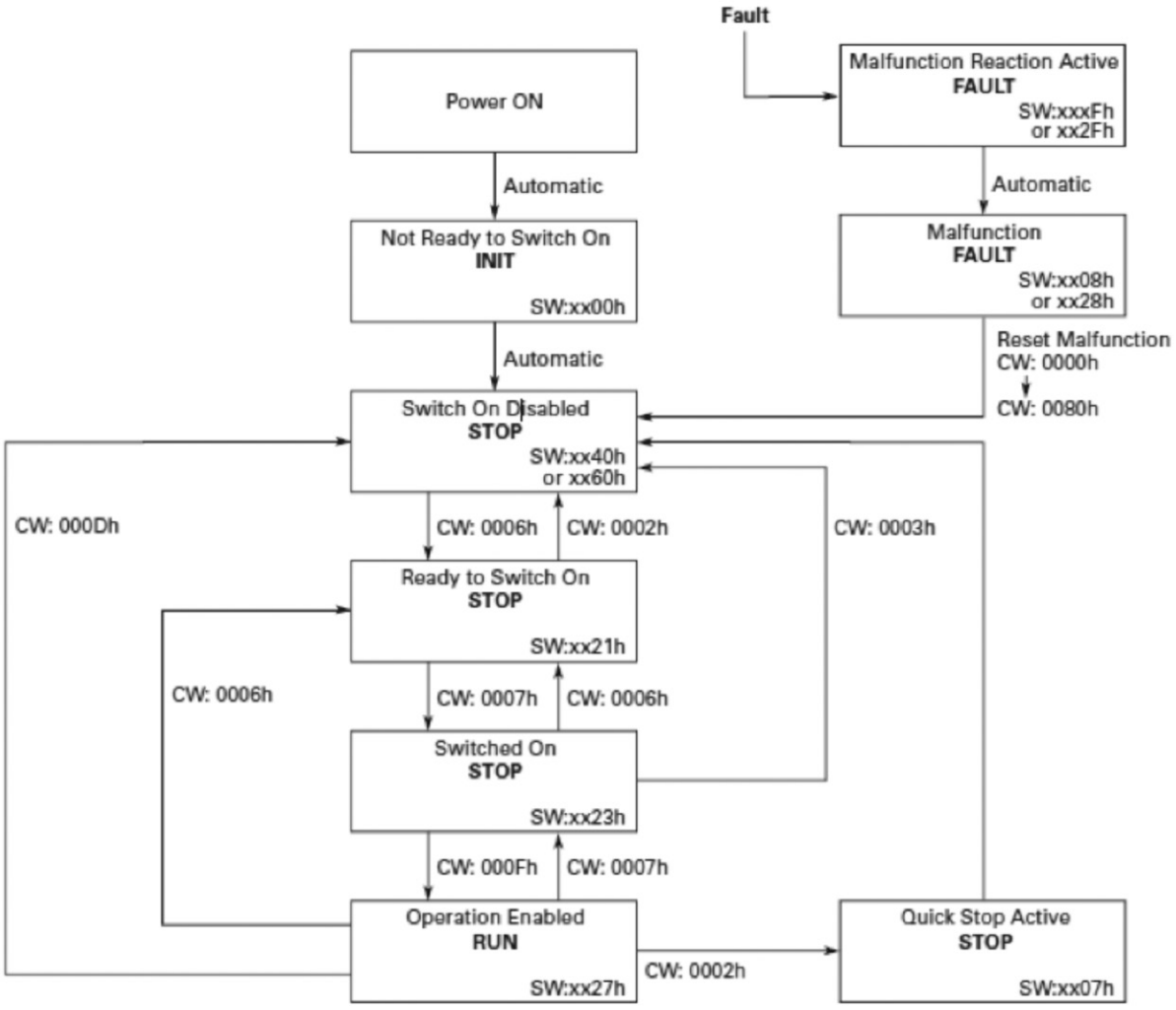
Drive profile state machine

State machine

The state machine describes the device status and the possible control sequence of the drive. The state transitions can be generated by using "controlword." The "statusword" parameter indicates the current status of the state machine. The modes ***INIT, STOP, RUN*** and ***FAULT*** correspond to the actual mode of the drive.

SW = StatusWord
CW = ControlWord

Figure 46. Internal state machine



Device profile parameters

Table 143. Device profile parameters

Index

Hex	Dec	Sub-Index	Name	Type	Attr.
6040	24640		control word	Unsigned16	RW
6041	24641		status word	Unsigned16	RO
6042	24642		vl target velocity	Integer16	RW
6043	24643		vl velocity demand	Integer16	RO
6044	24644		vl control effort	Integer16	RO
6046	24646		vl velocity min max amount		
		0	Number of entries	Unsigned8	RO
		1	Minimum speed	Unsigned16	RW
		2	Maximum speed	Unsigned16	RW
6048	24648		vl velocity acceleration		
		0	Number of entries	Unsigned8	RO
		1	delta speed	Unsigned32	RW
		2	delta time	Integer16	RW
6049	24649		vl velocity deceleration		
		0	Number of entries	Unsigned8	RO
		1	delta speed	Unsigned32	RW
		2	delta time	Integer16	RW
604A	24650		vl velocity quick stop		
		0	Number of entries	Unsigned8	RO
		1	delta speed	Unsigned32	RW
		2	delta time	Integer16	RW
604E	24654		vl velocity reference	Unsigned32	RW
6052	24658		vl nominal percentage	Integer16	RW
6053	24659		vl percentage demand	Integer16	RO
6054	24660		vl actual percentage	Integer16	RO
6060	24672		modes of operation	Unsigned8	RW
6061	24673		modes of operation display	Unsigned8	RO

Control word

The control word is used to control the drive operation according to the Internal State Machine. This is mapped into the first 2 bytes of rxPDO1.

Table 144. 0x6040 control word

Bit	Name	Description
0	Switch ON	Enables drive start command
1	Disable Voltage	Enable/Disable DG1 Motor output voltage
2	Quick Stop	Stops drive with a 0.1 sec ramp when value is changed to 0.
3	Enable Operation	Enable drive start
4	Operation Mode Specific	Not Used
5	Operation Mode Specific	Not Used
6	Operation Mode Specific	Not Used
7	Reset Fault	Rising Edge resets active faults.
8	Reserved	Not Used
9	Reserved	Not Used
10	Reserved	Not Used
11	Manufacturer Specific	Not Used
12	Manufacturer Specific	Not Used
13	Manufacturer Specific	Not Used
14	Manufacturer Specific	Not Used
15	Manufacturer Specific	Not Used

Status word

The Status Word provides drive status for the current control. By default this is mapped into the first 2 bytes of txPDO1

Table 145. 0x6041 status word

Bit	Name	Description
0	Ready to Switch ON	Device is in the ready state, ready to switch on
1	Switched ON	Device switch is enabled
2	Operation Enabled	Device drive is enabled and running
3	Fault Present	Device Fault is present
4	voltage disable	Drive output voltage is enabled
5	Quick Stop	Device Quick Stop is enabled
6	Switching On Disable	Device switch is disabled
7	Warning Present	Indicates if drive is in Warning state
8	Manufacturer Specific	Not Used
9	Remote	Indicates if the drive is in the Remote control state
10	Target Reached Or Exceeded	Target velocity is reached
11	Manufacturer Specific	Not Used
12	Manufacturer Specific	Not Used
13	Manufacturer Specific	Not Used
14	Manufacturer Specific	Not Used
15	Manufacturer Specific	Not Used

VL Target velocity

The signed value of the requested motor rpm speed. When the value is reading negative, it indicates the motor spinning in the counterclockwise direction. By default, this is mapped into the bytes of RxPDO1.

Range: –32768 to 32767

VL Velocity demand

The signed value is of the ramp generator output scaled into rpm and is a read only value. A negative value will indicate the motor is running in the clockwise direction.

Range: –32768 to 32767

VL Velocity control effort

This signed value is the motor actual rpm speed. A negative value will indicate that the motor is running in the clockwise rotation. By default, this is mapped into the TxPDO1.

Range: –32678 to 32767

Process data (PDO)

The real time data transfer is performed by means of using the "Process Data Objects." The transfer of PDOs is performed with no protocol overhead. The Process Data is time-critical data used for control of the drive and monitor status.

Table 146. Process data (PDO)

RxPDO1										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x201	0	4	Control Word		Target Velocity					
TxPDO1										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x181	0	4	Status Word		Control effort					
RxPDO2										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x301	0	8	Motor Nominal Percentage		Velocity deceleration delta speed				Velocity deceleration delta time	
TxPDO2										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x281	0	8	Motor Actual Percentage		Torque %		Current %		Fault Code	
RxPDO3										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x401	0	8	Fixed control word		Speed reference Percentage		FB_Process_data_in1		FB_Process_data_in2	
TxPDO3										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x381	0	8	Fixed status word		Actual speed Percentage		FB_Process_data_out1		FB_Process_data_out2	
RxPDO4										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x501	0	8	FB_Process_data_in3		FB_Process_data_in4		FB_Process_data_in5		FB_Process_data_in6	
TxPDO4										
Header			**Data**							
ID	**RTR**	**LEN**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0x481	0	8	FB_Process_data_out3		FB_Process_data_out4		FB_Process_data_out5		FB_Process_data_out6	

Some drive actual values can be monitored by using a Process Data Object 2 (rx).

Note: PDO1 and PDO2 should be used when in "Drive Mode" and PDO3 and PDO4 used in "Bypass Mode".

vl_actual percentage Motor Speed. Scaled with percentage function

_torque_percentage Calculated torque. Scaled in 0.0%–100% (0–1000)

_current_percentage Measured motor current. (1 = 0.01 A)

fault_code Shows the drive fault code (= 0, if no fault active)

Fixed control word

Table 147. Fixed control word

Bit	Name
0	Run
1	Counterclockwise
2	Rising edge of this bit will reset active fault
3	FB Input data 1
4	FB Input data 2
5	FB Input data 3
6	FB Input data 4
7	Bypass
8	FB_Ctrl
9	FB_Ref
10	Not in use
11	Not in use
12	Not in use
13	Not in use
14	Not in use
15	Not in use

Bit	Description Value = 0	Value = 1
0	Stop	RUN
1	Clockwise	Counterclockwise
2	Rising edge of this bit will reset active fault	Rising edge of this bit will reset active fault
3	FB Input data 1 off	FB Input data 1 On
4	FB Input data 2 off	FB Input data 2 On
5	FB Input data 3 off	FB Input data 3 On
6	FB Input data 4 off	FB Input data 4 On
7	Switch to drive	Switch to bypass
8	Control of drive is not selected from fieldbus	Control of drive is selected from fieldbus
9	Reference is not selected from fieldbus	Reference is selected from fieldbus
10–15	Not in use	Not in use

Speed ref percentage

The Speed Reference Percentage is based off a 0 to 100.00 %(10000) scale with 0 being 0 rpm and 10000 indicating 100.00% speed value. A negative value will indicate the inverted direction.

Process data in

The Process Data In values are based off the application selected. See **Appendix B** to reference the current Process Data In values assigned.

Fixed Status Word

Table 148. Fixed status word

Bit	Name
0	Ready
1	RUN
2	Counterclockwise
3	Faulted
4	Warning
5	Ref. Frequency reached
6	Bypass
7	Run enable
8	Not in use
9	Not in use
10	Not in use
11	Not in use
12	Not in use
13	Not in use
14	Not in use
15	Not in use

Bit	Description Value = 0	Value = 1
0	Not Ready	Ready
1	STOP	RUN
2	Clockwise	Counterclockwise
3	—	Faulted
4	—	Warning
5	Ref. frequency not reached	Ref. Frequency reached
6	—	Motor is running in bypass
7	Disable motor run	Enable motor run
8–15	Not in use	Not in use

Actual speed percentage

The Actual Speed Percentage indicates the actual speed value of the motor. This value will be read as a 0 to 10000 value, which indicates 0 to 100.00% speed actual.

FB process data out

The Process Data Out value is assigned by the Fieldbus Parameter group in the application parameters. These 8 values can be set to any available Modbus ID value listed. See **Appendix B** to reference the default Process Data Out values assigned.

Object directory

Table 149. Object directory

Index

Hex	Dec	Sub-Index	Name	Type	Attr.
1000	4096		Device type	Unsigned32	RO
1001	4097		Error register	Unsigned8	RO
1003	4099		Predefined error field		
		0	Highest index	Unsigned8	RW
		1	Standard error field 1	Unsigned32	RO
100C	4108		Guard time	Unsigned16	RW
100D	4109		Life time factor	Unsigned8	RW
1014	4116		COB ID EMCY	Unsigned 32	RO
1018	4120		Identity object		
		0	Highest index	Unsigned8	RW
		1	Vendor ID	Unsigned32	RO
		2	Product Code	Unsigned32	RO
		3	Revision number	Unsigned32	RO
		4	Serial number	Unsigned32	RO
1200	4608		Server SDO parameter		
		0	Highest index	Unsigned8	RW
		1	COB-ID Client→Server (RX)	Unsigned32	RO
		2	COB-ID Server→Client (TX)	Unsigned32	RO
1400	5120		Receive PDO communication parameter 1		RO
		0	Number of entries	Unsigned8	RW
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
1401	5121		Receive PDO communication parameter 2		
		0	Number of entries	Unsigned8	RW
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
1402	5122		Receive PDO communication parameter 3		RO
		0	Number of entries	Unsigned8	RW
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
1403	5123		Receive PDO communication parameter 4		
		0	Number of entries	Unsigned8	RW
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
1600	5632		Receive PDO 1 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	60400020-controlword	Unsigned32	RO
		2	60420010-vl target velocity	Integer16	RO
1601	5633		Receive PDO 2 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	60520010-vl nominal percentage	Integer16	RO
		2	60490120-vl velocity deceleration-delta speed	Unsigned32	RO
		3	60490210-vl velocity deceleration-delta time	Integer16	RO

Table 149. Object directory, continued

Index

Hex	Dec	Sub-Index	Name	Type	Attr.
1602	5634		Receive PDO 3 Mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	20100010-Fixed control word	Unsigned16	RW
		2	20110010-Speed reference in percentage	Unsigned16	RW
		3	20120010-FB process data In 1	Integer16	RW
		4	20130010-FB process data In 2	Integer16	RW
1603	5635		Receive PDO 4 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	20140010-FB process data In 3	Integer16	RW
		2	20150010-FB process data In 4	Integer16	RW
		3	20160010-FB process data In 5	Integer16	RW
		4	20170010-FB process data In 6	Integer16	RW
1800	6144		Transmit PDO 1 communication parameters		
		0	Highest sub index	Unsigned8	RO
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
		3	Inhibit time	Unsigned16	RW
		4	Event timer	Unsigned16	RW
1801	6145		Transmit PDO 2 communication parameters		
		0	Highest Sub index	Unsigned8	RO
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
		3	Inhibit Time	Unsigned16	RW
		4	Event timer	Unsigned16	RW
1802	6146		Transmit PDO 3 communication parameters		
		0	Highest Sub index	Unsigned8	RO
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
		3	Inhibit time	Unsigned16	RW
		4	Event timer	Unsigned16	RW
1803	6147		Transmit PDO 4 communication parameters		
		0	Highest sub index	Unsigned8	RO
		1	COB ID	Unsigned32	RW
		2	Transmission type	Unsigned8	RO
		3	Inhibit Time	Unsigned16	RW
		4	Event timer	Unsigned16	RW
1A00	6656		Transmit PDO 1 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	60410010-statusword	Unsigned16	RO
		2	60440010-vl control effort	Unsigned16	RO

Table 149. Object directory, continued

Index

Hex	Dec	Sub-Index	Name	Type	Attr.
1A01	6657		Transmit PDO 2 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	60540020-vl velocity reference	Unsigned32	RO
		2	20040010- torque percentage	Unsigned16	RO
		3	20030010- Current percentage	Unsigned16	RO
		4	20630010-fault code	Unsigned16	RO
1A02	6658		Transmit PDO 3 mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	20180010-Fixed status word	Unsigned16	RO
		2	20190010-Actual speed in percentage	Unsigned16	RO
		3	20200010-FB process data Out 1	Integer16	RO
		4	20210010-FB process data Out 2	Integer16	RO
1A03	6659		Transmit PDO 4 Mappings		
		0	Number of mapped objects	Unsigned8	RW
		1	20220010-FB process data Out 3	Integer16	RO
		2	20230010-FB process data Out 4	Integer16	RO
		3	20240010-FB process data Out 5	Integer16	RO
		4	20250010-FB process data Out 6	Integer16	RO

Service data (SDO)

With Service Data Objects (SDOs), the access to entries of a device Object Dictionary is provided. Via SDO, all items from object dictionary can be read/write. These are mainly used for device configuration such as setting device parameters. They are also used to define the types and formats of the information in the Process Data Objects. CANopen Configuration tools with EDS files can be used for this purpose.

SDO protocol can be used to read any parameter or actual value and write any parameter from the drive. These parameters are read from the drive with its ID number specified in the user manual. There are three indexes in the object dictionary as follows for Any Parameter service.

Table 150. Service data (SDO)

Index	Description	Size	Access Type	Hi 16 b	Low 16 b
2000	AnyparameterReadID	UINT16	RW	-	Read ID
2001	AnyparameterReadValue	UINT32	RO	Status	Value
2002	AnyparameterWrite	UINT32	RW	ID	Write Value

Reading any parameter

Writing new value to index 2000 will trigger read event, while read in process index 2001 is zero. Read event will return value to index 2001. If read is success, status will get value of ID and Value is value of ID. If read fails, the Status will get value 0xFFFF (Dec 65535).

Writing any parameter

When new ID and value is written to index 2002, a write event will be triggered. Index 2002 value will remain as long as writing is processed (normal SDO/PDO operation during this time). If write is success, index 2002 ID and value will be cleared and new write is possible. If write fails, ID will clamp to 0xFFFF and value zero.

Process data application mapping

Table 151. Process data application mapping

Index

Hex	Dec	Sub-Index	Name	Type	Attr.
2000	8192		Any parameter read ID	Unsigned16	RW
2001	8193		Any parameter read value	Unsigned32	RO
2002	8194		Any parameter write	Unsigned32	RW
2003	8196		Current percentage	Unsigned16	RO
2004	8195		Torque percentage	Unsigned16	RO
2005	8197		Motor nom current	Unsigned16	RW
2006	8198		Motor nom speed	Unsigned16	RW
2007	8199		Motor PF	Unsigned16	RW
2008	8200		Motor nom voltage	Unsigned16	RW
2009	8201		Motor nom frequency	Unsigned16	RW
200A	8202		Power up local remote select	Unsigned8	RW
200B	8203		Remote 1 control place	Unsigned8	RW
200C	8204		Local control place	Unsigned8	RW
200D	8205		Local reference	Unsigned8	RW
200E	8206		Remote 1 ref	Unsigned8	RW
200F	8207		Reverse enable	Unsigned8	RW
2010	8208		Fixed control word	Unsigned16	RW
2011	8209		Speed reference in percentage	Unsigned16	RW
2012	8210		FB process data in 1	Integer16	RW
2013	8211		FB process data in 2	Integer16	RW
2014	8212		FB process data in 3	Integer16	RW
2015	8213		FB process data in 4	Integer16	RW
2016	8214		FB process data in 5	Integer16	RW
2017	8215		FB process data in 6	Integer16	RW
2018	8216		Fixed status word	Unsigned16	RO
2019	8217		Actual speed in percentage	Unsigned16	RO
201A	8218		FB process data out 1	Integer16	RO
201B	8219		FB process data out 2	Integer16	RO
201C	8220		FB process data out 3	Integer16	RO
201D	8221		FB process data out 4	Integer16	RO
201E	8222		FB process data out 5	Integer16	RO
201F	8223		FB process data out 6	Integer16	RO
2063	8291		Fault code	Integer16	RO

Fixed control word

Refer to **Table 147** on **Page 37**.

Speed ref percentage

The Speed Reference Percentage is based off a 0 to 100.00 % (10000) scale with 0 being 0 rpm and 10000 indicating 100.00% speed value.

Process data in

The Process Data In values are based off the application selected. See **Appendix B** to reference the current Process Data In values assigned.

Fixed status word

Refer to **Table 147** on **Page 38**.

Actual speed percentage

The Actual Speed Percentage indicates the actual speed value of the motor. This value will be read as a 0 to 10000 value, which indicates 0 to 100.00% speed actual.

FB process data out

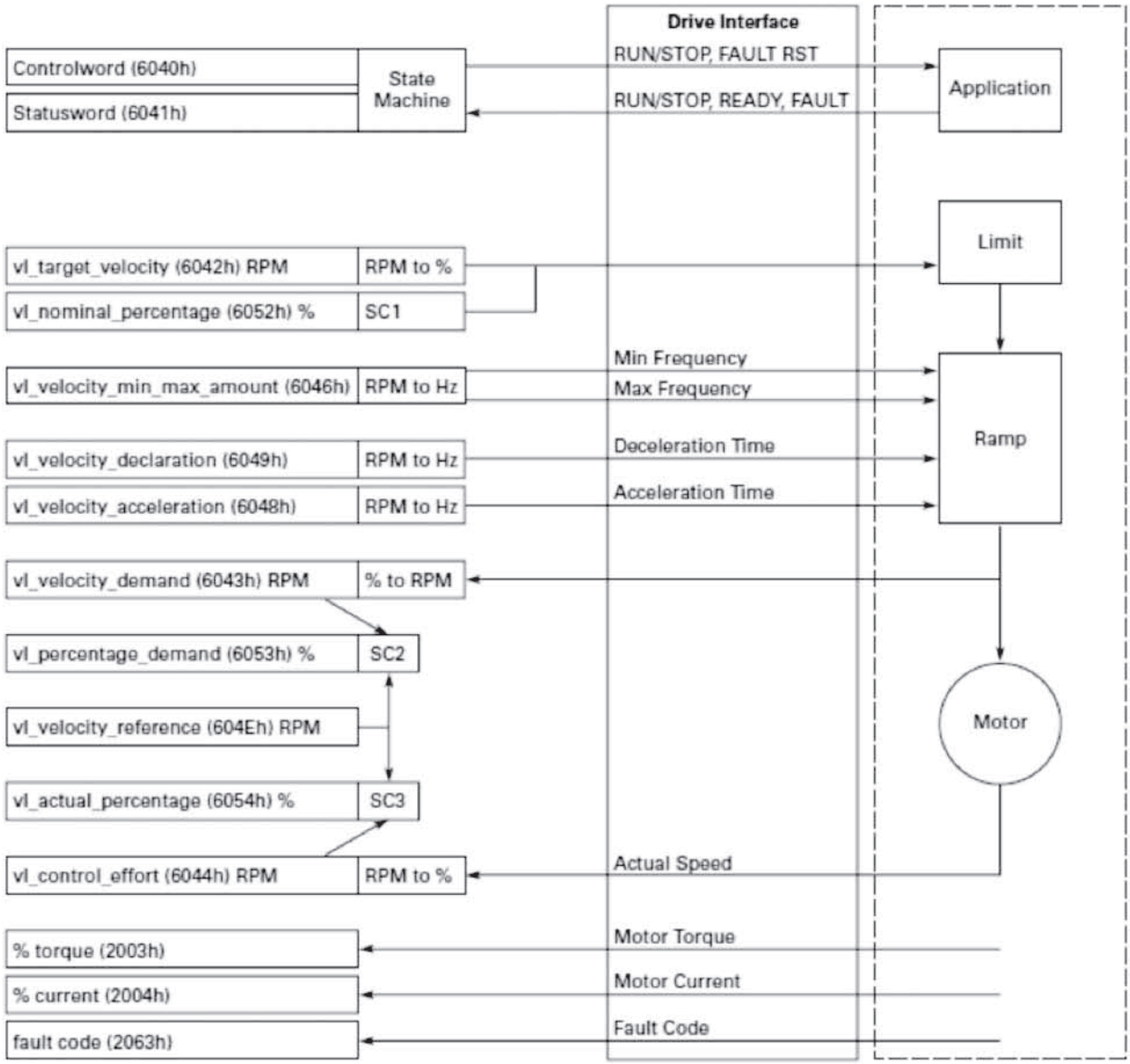
The Process Data Out value is assigned by the Fieldbus Parameter group in the application parameters. These 8 values can be set to any available Modbus ID value listed. See **Appendix B** to reference the default Process Data Out values assigned.

Fault code

The Fault Code is an indication of the current fault code; the default value will be 0.

Bypass profile

Figure 47. Device profile



SC2: Percentage Function 2

$$vl\_percentage\_demand = \frac{vl\_velocity\_demand * 0x3FFF}{vl\_velocity\_reference}$$

SC3: Percentage Function 3

$$vl\_actual\_percent = \frac{vl\_control\_effort * 0x3FFF}{vl\_velocity\_reference}$$

DeviceNet external communication cards

DeviceNet is an open protocol network based on the CAN stack protocol. It is designed to connect industrial control devices to a network without expensive hardwiring. With direct connectivity, DeviceNet provides improved communications between devices as well as important device diagnostic information that is typically not as easily accessed with hardwired I/O interfaces.

The DeviceNet model is referred to as an application independent. It provides communication services needed by various types of applications. It uses a predefined Master/ Slave connection set that is used between the devices on the network with the master controller. This being said it is based on the CIP (Common Industrial Protocol).

DeviceNet technical data

Table 152. DeviceNet connection

Item	Value
Interface	Open style connector (Pluggable connector)
Data Transfer method	CAN
Transfer Cable	2 wire Twisted shielded cable with 2 wire but power cable and drain
Electrical Isolation	500 Vdc

Table 153. Communications

Item	Value
ODVA CT26 Compliant	
Baud rate	500 kBaud 250 kBaud 125 kBaud
Addresses	0-63
Product Code	0x3019
Product Type	0x02
Vendor ID	68
DeviceNet	Network supply voltage: 11 to 25 Vdc network input current: 28 mA typical, 125 mA inrush (24 Vdc)

Table 154. Environment

Description	Specification
Ambient Operation Temperature	–10 °C to +55 °C
Storing Temperature	–40 °C to +60 °C
Humidity	<95%, no condensation allowed
Altitude	Max. 1000 M
Vibration	0.5G at 9–200 Hz
Safety	Fulfills EN 50178 standard

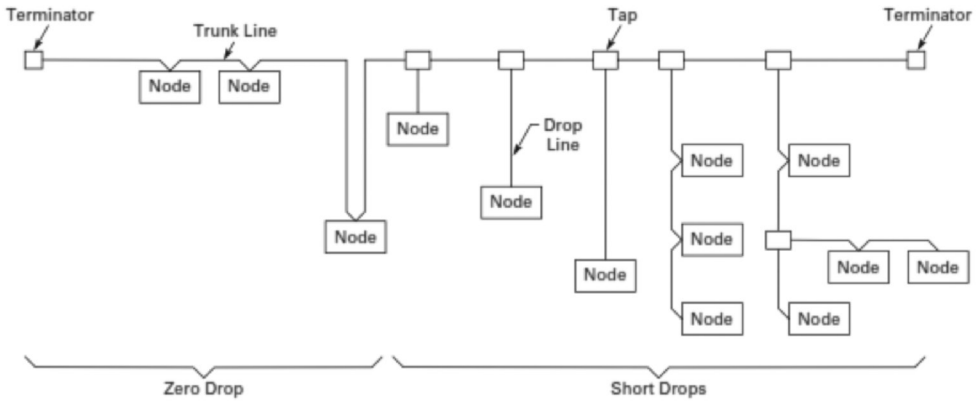
Table 155. Environment

Description	Specification	
Baud Rate	125 Kbps, 250 Kbps and 500 Kbps	
Network Size	Up to 64 nodes including master	
Network Length	Selectable end to end distance varies with speed	
	Baud rate	Distance
	125 Kbps	500 m
	250 Kbps	250 m
	500 Kbps	100 m

DeviceNet cabling

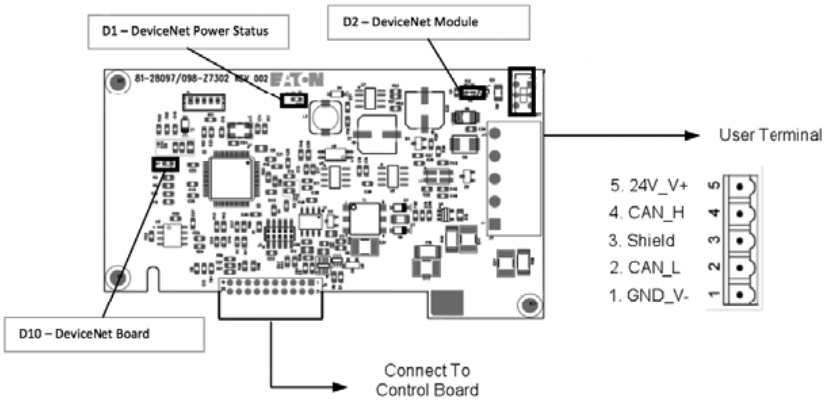
When using DeviceNet, it uses a basic trunk-line/drop-line topology with separate twisted pair busses for both signal and power distribution. Wire diameter for the trunk and drop lines may vary, and the distance will be determined by baud rate and cable size. In this topology, devices are powered directly from the bus and communicate with each other using the same cable. Nodes can also be removed or inserted into the network without powering it down.

Figure 48. Trunk lines or drop lines



Hardware specification

Figure 49. DeviceNet hardware



DeviceNet board LED status

Table 156. DeviceNet power LED (D1)

Illumination Pattern	Meaning
OFF	Power to controller of Option board is not activated
ON	Power to controller of Option board is activated

Table 157. DeviceNet Board status LED (D10)

Illumination Pattern	Meaning
OFF	Option board not activated
ON	Option board in Normal condition i.e. no fault is occurred
Blinking at 40 Hz	DCOM communication fault occurs
Blinking at 20 Hz	Option card Hardware fault occurs
Blinking at 10 Hz	DeviceNet communication fault occurs

Table 158. The MS and NS LED (D2)

For this state ...	LED is ...	To indicate ...
Device not powered/ not on–line	Off	Device is not on–line. • The device has not completed the Dup_MAC_ID test yet. • The device may not be powered.
Device operational AND On–line, connected	Green	The device is operating in a normal condition and the device is on–line with connections in the established state. • For a Group 2 Only device it means that the device is allocated to a Master. • For a UCMM capable device it means that the device has one or more established connections.
Device operational AND On–line, not connected or Device On–line AND Device needs commissioning	Flashing Green	The device is operating in a normal condition and the device is on–line with no connections in the established state. • The device has passed the Dup_MAC_ID test, is on–line, but has no established connections to other nodes. • For a Group 2 Only device it means that this device is not allocated to a master. • For a UCMM capable device it means that the device has no established connections. • Configuration missing, incomplete or incorrect.
Minor Fault and/or Connection Time–Out and/or No Network Power	Flashing Red	Any one or more of the following conditions: • Recoverable fault • One or more I/O Connections are in the Timed-Out state • No network power present
Critical Fault or Critical Link Failure	Red	The device has an unrecoverable fault; may need replacing. Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus–off).
Communication Faulted and Received an Identify Comm Fault Request—Long Protocol	Flashing Red and Green	A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request—Long Protocol message.

Commissioning

The DeviceNet board is commissioned by inserting it into Slot A and Slot B ports on the control board. Once the card is inserted into the slot, the device will recognize it and will show a warning for "Device Added." This warning will be shown for 5 seconds and will clear. Once the card is detected, the keypad will show the menu for the card in the Optional Card Menu.

Option card parameters

Once the card is detected, the following parameters can be set on keypad for DeviceNet.

Figure 50. DeviceNet parameters

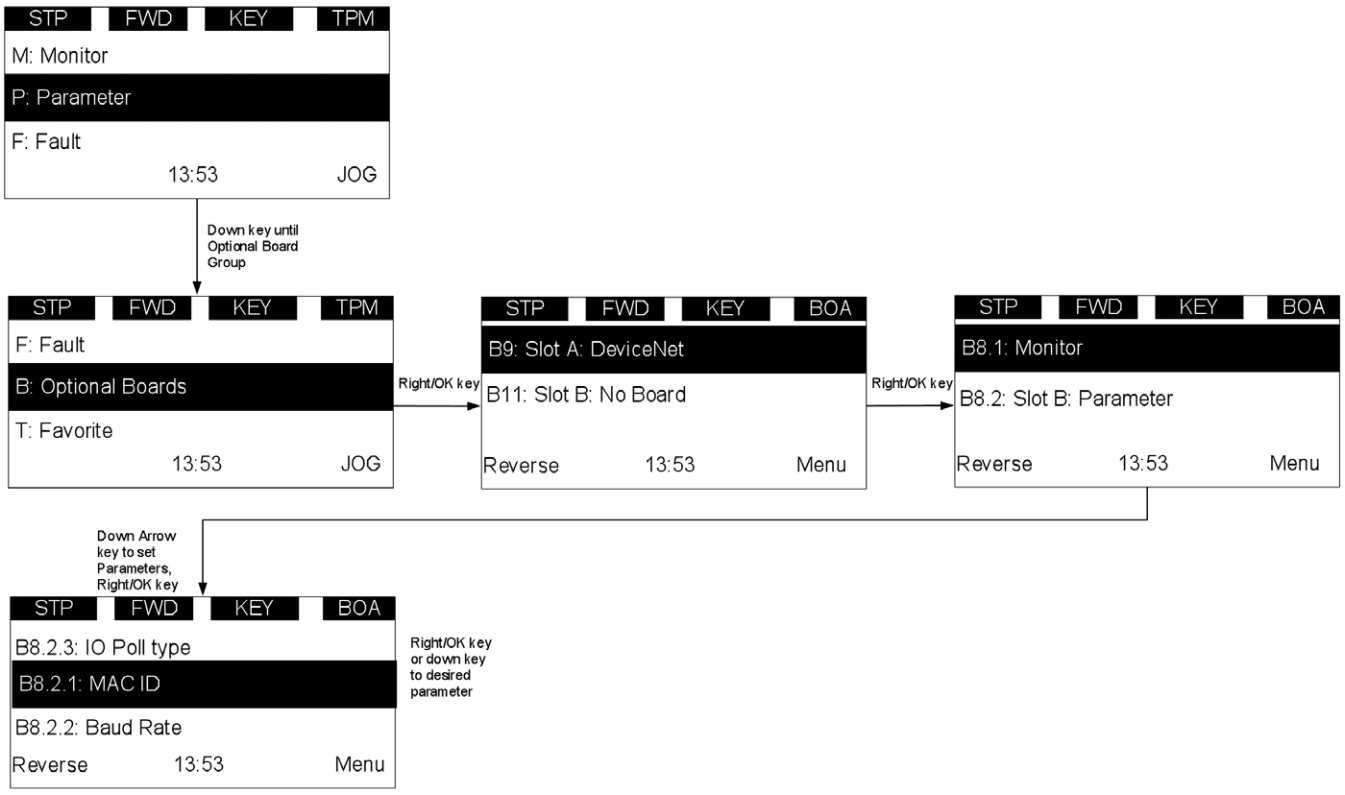


Table 159. DeviceNet parameters

Code	Parameter	Min.	Max.	Unit	Default	ID (Slot A/Slot B)	Note
BX.1.1	Board status				0	883/910	B0 = DCOM Comm. Fault B1 = Board HW fault B2 = Reserved B3 = Fieldbus fault B4 = DNET 24 V fault
BX.1.2	Protocol status				0	2136/2147	0 = Non existent bus power 1 = Configuring state 2 = Established 3 = Timeout
BX.2.1	MAC ID	0	63		63	2137/2148	Address of device.
BX.2.2	Baud rate	0	2		0	2138/2149	0 = 125 kBaud 1 = 250 kbaud 2 = 500 kBaud
BX.2.3	IO Poll type	0	7		0	2187/2188	0 = Assembly 21/71 1 = Assembly 20/70 2 = Assembly 21/71 3 = Assembly 23/73 4 = Assembly 25/75 5 = Assembly 101/107 6 = Assembly 111/117 7 = Assembly 111/127
BX.2.4	Comm Card FB Fault Response	0	1		0	2519/2520	0 = In Fieldbus Control 1 = in all Control

DeviceNet Overview

DeviceNet is designed to provide two different types of messaging: I/O Messaging and Explicit Messaging.

I/O Messaging

I/O polling messages are set up for time-critical data that is oriented for control sequences. These messages are transferred between the devices and the master at all times and used for continuous control of the devices. It is a dedicated communication path between the producing application or master device and the one or more consuming devices or slaves. These messages are not in the 8-byte data protocol. Before messages are sent, the master and slave need to be configured. In the configuration, it contains the source and destination object attribute addresses for the master and slave.

Assembly instances implemented by PowerXL DeviceNet

Assemblies 20–23 ODVA AC/DC profile; assemblies 71–73 ODVA AC/DC profile; assemblies >100, Eaton profile.

Output instances

Assembly instance 20

Table 160. Instance 20 (Output) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset		RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							

Assembly instance 21

Table 161. Instance 21 (Output) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl			FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							

Assembly instance 23

Table 162. Instance 23 (Output) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl			FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							
4	Torque reference (Low Byte), Nm ①							
5	Torque reference (High Byte), Nm ①							

① Torque Reference is sent to the Drive only if Motor Control Mode is set to "Torque Control".

Note: Torque Reference is send to the Drive as a Process Data 1.

Assembly instance 25

Table 163. Instance 25 (Output) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl			FaultReset	RunRev	RunFwd
1								
2	Speed reference (Low Byte), rpm							
3	Speed reference (High Byte), rpm							
4	Process reference (Low Byte) ①							
5	Process reference (High Byte)							

① In Speed control Mode—Process Ref is Process Data IN8 (Analog Output).
In Freq. control—Process Ref is Process Data IN8 (Analog Output, reading the actual output current.).
In Torque control—Process Ref is Process Data IN1 (Torque Reference)
Based on selection of A0, process reference value will be sent on A0 out.

Assembly instance 101

Table 164. Instance 101 (Output) length = 8 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl	FB DATAIN 2	FB DATAIN 1	FaultReset	RunRev	RunFwd
1	PDSELB3	PDSELB2	PDSELB1	PDSELB0	PDSELA3	PDSELA2	PDSELA1	PDSELA0
2	FBSpeed Reference (Low Byte), rpm							
3	FBSpeed Reference (High Byte), rpm							
4	FBProcessDataIn1 (Low Byte)							
5	FBProcessDataIn1 (High Byte)							
6	FBProcessDataIn2 (Low Byte)							
7	FBProcessDataIn2 (High Byte)							

Note: Process data is sent to the drive independently from the NetRef and NetCtrl bits settings.

This allocates 4 input data words and 4 output data words. Byte 1 of the 101 Output assembly selects which Process Data out selection is read back to the EIP scanner. Bytes 4 through 7 of the 101 Output assembly are application specific.

Select the Multi-purpose application to read data other than what is set as default Process Data.

Default Fieldbus data out selections 1 through 8 are:

1 = Output frequency (hertz)

2 = Motor Speed (rpms)

3 = Motor Current (amps)

4 = Motor Torque (% of nominal motor torque)

5 = Motor Power (% of nominal motor power)

6 = Motor Voltage (Calculated motor voltage)

7 = DC Bus Voltage

8 = Active Fault Code

Multipurpose has a "Fieldbus" group where you reference the FBProcessDataOUT1 through FBProcessDataOUT8 selections. Referring to the 101/107 I/O assembly sheet, bits PDSELx0–PDSELx3 in each "nibble" of Byte 1 of Output Assembly 101 are used to select which FBProcessDataOUT (1–8) you "read" back to your PLC. That is integer 1 through 8 converted to binary Bit 0 through Bit 3. Any parameter or monitored value can be read using the Multi-purpose application, as long as it references a specific ID number. Whichever ProcessDataOutput selector used from 1 through 8 dictates what bits are used in Byte 1 of the output assembly 101. Values are then sent via Input Assembly 107 in Bytes 4 and 5 and Bytes 6 and 7 respectively. If all PDSELxx values are zero, the "Drive state" will be selected at Byte1 location of 107 assembly.

Speed Reference commands for Instances 20, 21, 23, and 101 are set up to send the RPM value. This value is sent based off the Motor Nameplate setting provided in the drive. This would be the direct RPM value written.

Assembly instance 111

Table 165. Instance 111 (Output) length = 20 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0		NetRef	NetCtrl	FB Input Data 2	FB Input Data 1	FaultReset	Direction	Run
1	NA							
2	FBSpeedReference (Low Byte) ①							
3	FBSpeedReference (High Byte) ①							
4	ProcessDataIn1 (LowByte)							
5	ProcessDataIn1 (HighByte)							
6	ProcessDataIn2 (LowByte)							
7	ProcessDataIn2 (HighByte)							
8	ProcessDataIn3 (LowByte)							
9	ProcessDataIn3 (HighByte)							
10	ProcessDataIn4 (LowByte)							
11	ProcessDataIn4 (HighByte)							
12	ProcessDataIn5 (LowByte)							
13	ProcessDataIn5 (HighByte)							
14	ProcessDataIn6 (LowByte)							
15	ProcessDataIn6 (HighByte)							
16	ProcessDataIn7 (LowByte)							
17	ProcessDataIn7 (HighByte)							
18	ProcessDataIn8 (LowByte)							
19	ProcessDataIn8 (HighByte)							

① This is the reference1 to the frequency converter. Used normally as Speed reference. The allowed scaling is 0 to 10000.
In the application, the value is scaled in percentage of the frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Input instances

Assembly instance 70

Table 166. Instance 70 (Input) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						Running1		Faulted
1								
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							

Assembly Instance 71

Table 167. Instance 71 (Input) length = 4 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive state ①							
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							

① Refer "State transition diagram," provided under "Control Supervisor Object" and "Drive State" table specified at end of "Input Instances" section.

Drive State

0x00	DN_NON_EXISTANT
0x01	DN_STARTUP
0x02	DN_NOT_READY
0x03	DN_READY
0x04	DN_ENABLED
0x05	DN_STOPPING
0x06	DN_FAULT_STOP
0x07	DN_FAULTED

Assembly instance 73

Table 168. Instance 73 (Input) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive State ①							
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							
4	Torque actual (Low Byte), Nm							
5	Torque actual (High Byte), Nm							

① Refer "State transition diagram," provided under "Control Supervisor Object" and "Drive State" table specified at end of "Input Instances" section.

Drive State	
0x00	DN_NON_EXISTANT
0x01	DN_STARTUP
0x02	DN_NOT_READY
0x03	DN_READY
0x04	DN_ENABLED
0x05	DN_STOPPING
0x06	DN_FAULT_STOP
0x07	DN_FAULTED

Assembly instance 75

Table 169. Instance 75 (Input) length = 6 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive State ①							
2	Speed actual (Low Byte), rpm							
3	Speed actual (High Byte), rpm							
4	Process actual (Low Byte), Nm ②							
5	Process actual (High Byte), Nm							

① Process actual value is same as process reference. This value will be a 0 to 10000 (100.00%) for use with Analog outputs writing, 0 = 0 or 4 mA and 10000 being 20 mA.
② Refer "State transition diagram," provided under "Control Supervisor Object" and "Drive State" table specified at end of "Input Instances" section.

Drive State	
0x00	DN_NON_EXISTANT
0x01	DN_STARTUP
0x02	DN_NOT_READY
0x03	DN_READY
0x04	DN_ENABLED
0x05	DN_STOPPING
0x06	DN_FAULT_STOP
0x07	DN_FAULTED

Assembly instance 107

Table 170. Instance 107 (Input) length = 8 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Drive State ①							
2	% Speed Actual (Low Byte) ②							
3	% Speed Actual (High Byte) ②							
4	Process DataOut1 (Low Byte)							
5	Process DataOut1 (High Byte)							
6	Process DataOut2 (Low Byte)							
7	Process DataOut2 (High Byte)							

① Refer "State transition diagram," provided under "Control Supervisor Object" and "Drive State" table specified at end of "Input Instances" section.

Drive State	
0x00	DN_NON_EXISTANT
0x01	DN_STARTUP
0x02	DN_NOT_READY
0x03	DN_READY
0x04	DN_ENABLED
0x05	DN_STOPPING
0x06	DN_FAULT_STOP
0x07	DN_FAULTED

② Speed Actual. This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Note: See info on Assembly 101 for varying values in the Process Data Out 1 and Process Data Out 2 Bytes. See **Appendix B** on default Process Data info.

Assembly instance 117

Table 171. Instance 117 (Input). EIP drive status length = 34 bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CtrlFromNet	At Zero Speed	At Reference	Alarm/Warning	Faulted	Direction	Running	Ready
1	NA							
2	% Speed Actual (Low Byte) ①							
3	% Speed Actual (High Byte) ①							
4	RPM Speed Actual (Low Byte) ②							
5	RPM Speed Actual (High Byte) ②							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved							
12	Reserved							
13	Reserved							
14	Reserved							
15	Reserved							
16	Reserved							
17	Reserved							
18	ProcessDataOut1 (LowByte)							
19	ProcessDataOut1 (HighByte)							
20	ProcessDataOut2 (LowByte)							
21	ProcessDataOut2 (HighByte)							
22	ProcessDataOut3 (LowByte)							
23	ProcessDataOut3 (HighByte)							
24	ProcessDataOut4 (LowByte)							
25	ProcessDataOut4 (HighByte)							
26	ProcessDataOut5 (LowByte)							
27	ProcessDataOut5 (HighByte)							
28	ProcessDataOut6 (LowByte)							
29	ProcessDataOut6 (HighByte)							
30	ProcessDataOut7 (LowByte)							
31	ProcessDataOut7 (HighByte)							
32	ProcessDataOut8 (LowByte)							
33	ProcessDataOut8 (HighByte)							

① This is the actual value from the frequency converter. The value is between 0 and 10000.
In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–0000 = 100.00%).
② The RPM Speed Actual is the actual speed of the motor. The unit is RPM.

Note: See Appendix B for Process Data Value defaults.

Assembly instance 127

Table 172. Instance 127 (Input). EIP Drive status length = 20 bytes

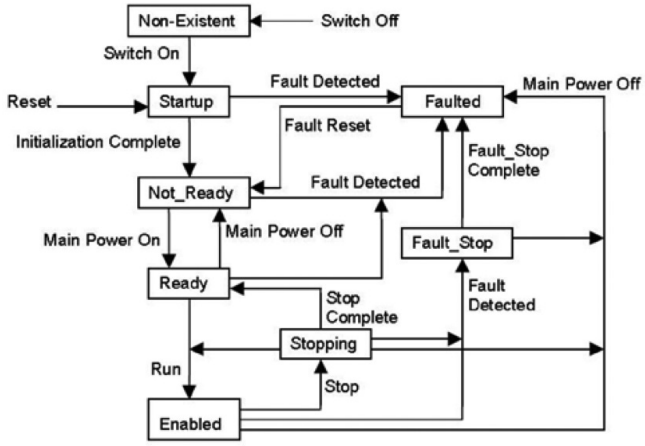
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CtrlFromNet	At Zero Speed	At Reference	Alarm/Warning	Faulted	Direction	Running	Ready
1	NA							
2	% Speed Actual (Low Byte) ①							
3	% Speed Actual (High Byte) ①							
4	ProcessDataOut1 (LowByte)							
5	ProcessDataOut1 (HighByte)							
6	ProcessDataOut2 (LowByte)							
7	ProcessDataOut2 (HighByte)							
8	ProcessDataOut3 (LowByte)							
9	ProcessDataOut3 (HighByte)							
10	ProcessDataOut4 (LowByte)							
11	ProcessDataOut4 (HighByte)							
12	ProcessDataOut5 (LowByte)							
13	ProcessDataOut5 (HighByte)							
14	ProcessDataOut6 (LowByte)							
15	ProcessDataOut6 (HighByte)							
16	ProcessDataOut7 (LowByte)							
17	ProcessDataOut7 (HighByte)							
18	ProcessDataOut8 (LowByte)							
19	ProcessDataOut8 (HighByte)							

① This is the actual value from the frequency converter. The value is between 0 and 10000. In the application, the value is scaled in percentage of frequency area between set minimum and maximum frequency. (0 = 0.00%–10000 = 100.00%).

Note: See **Appendix B** for Process Data Value defaults.

Network state machine

Figure 51. Network state machine



Start Forward, Start Reverse, Change to Forward, Change to Reverse, and stop is static outputs of the Control Supervisor state machine.

EDS file

EDS is the abbreviation for Electronic Data Sheet, a file on disk that contains configuration data for specific device types. You can provide configuration support for your device by using a specially formatted ASCII file, referred to as the EDS.

The information in an EDS allows configuration tools to provide informative screens that guide a user through the steps necessary to configure a device. An EDS provides all of the information necessary to access and alter the configurable parameters of a device. This information matches the information provided by instances of the parameter object class. The CIP object library describes the parameter object class in detail.

Explicit messaging

Explicit messaging is used in commissioning and parameterizing the DeviceNet board and device. It is a tool used to provide multi-purpose, point-to-point communication paths between two devices. They provide the typical request/response-oriented network communication used to perform node configuration and problem diagnosis. Explicit messages are low priority identifiers and contain the specific meaning of the message right in the data field.

List of object classes

The communication interface supports the following object class.

Table 173. List of object classes

Class	Object	Remark
0x01	Identity objects	Cip required object
0x03	DeviceNet object	Cip required object
0x04	Assembly object	CIP object for drive device
0x05	Connection object	Communication object
0x28	Motor Data object	CIP object for drive device
0x29	Control supervisor object	CIP object for drive device
0x2A	AC/DC drive object	CIP object for drive device
0xA0~0xBB	Vendor parameters object	Vendor specific
0x96	Base device information object	Vendor specific

List of services

The Service supported by these object classes are shown below.

Table 174. List of services

		Identity object		Message router		DeviceNet		Assembly		Connection		Motor data		Control supervisory		AC/DC Drive		Other objects	
Service Code (in hex)	Service Name	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Class	Inst	Inst	Inst	Class	Inst	Class	Inst	Class	Inst
05	Reset (Type 0, 1)	—	Y	—	—	—	—	—	—	—	—	—	—	—	Y*	—	—	—	—
0E	Get_attribute_single	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	Set_attribute_single	—	—	—	Y	—	Y	—	Y	—	Y	Y	Y	—	Y	—	Y	—	Y
14	Error Response	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4B	Allocate_Master/ Slave_Connection_Set	—	—	—	—	—	Y	—	—	—	—	—	—	—	—	—	—	—	—
4C	Release_Master/ Slave_Connection_Set	—	—	—	—	—	Y	—	—	—	—	—	—	—	—	—	—	—	—

* Control Supervisory has only Type 0 service.

List of data types

The attribute list that follows includes information on the Data Type of each attribute. The following tables explain the Data, Structure, and Array Type codes used in the Data Type column.

Following data types are supported.

Table 175. List of data types

Data type name	Data type code object	Data type description
BOOL	C1	Logical Boolean with values TRUE and FALSE
SINT	C2	Signed 8-bit integer value
INT	C3	Signed 16-bit integer value
USINT	C6	Unsigned 8-bit integer value
UINT	C7	Unsigned 16-bit integer value
UDINT	C8	Unsigned 32-bit integer value
BYTE	D1	Bit string = 8-bits
WORD	D2	Bit string = 16-bits
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)
REAL	CA	32-bit floating point value
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)

Reset service

The following table lists the different types of resets supported by the identity object.

Resetting the PowerXL interface to its out-of-box configuration will change the response of the drive to a loss of communications with the PowerXL. The devices will have to be re-configured for your application before resuming normal operation.

Table 176. Reset service

Value	Reset description
0	Initializes drive to the Power-up state. (Soft reset)
1	Writes default values to all instance attributes then saves all non-volatile attributes to FLASH memory and then performs the equivalent of a Reset (0). (Factory Reset)

Common industrial objects implemented by PowerXL DeviceNet

CIP common required objects

Identity object, class 0x01

This object provides identification of and general information about the PowerXL.

Table 177. Identity Object, Class 0x01

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
01h	Revision	NV	UINT	Get	1
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**	**NV**	**Data type**	**Access rule**	
01h	Vendor ID	NV	UINT	Get	68 (Eaton Vendor ID)
02h	Device Type	NV	UINT	Get	2 (AC Drive)
03h	Product Code	NV	UINT	Get	0x3019
04h	Revision	NV	Struct of:	Get	
	Major Revision		USINT		
	Minor Revision		USINT		As Device Version
05h	Status	V	WORD	Get	Refer **Table 168**
06h	Serial Number	NV	UDINT	Get	Runtime = 0
07h	Product Name	NV	SHORT_STRING	Get	PowerXL VFD DeviceNET Comm. Card
Instance services					
ID	**Service**				
Id	Service				
0Eh	Get_attribute_single				
05h	Reset				

Table 178. Bit definitions for status instance attribute of identity object

Bits	Called	Definitions
0	Owned	TRUE indicates the device (or an object within the device) has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/Slave Connection Set has been allocated to a master.
1	Reserved	Reserved, shall be 0
2	Configured	TRUE indicates the application of the device has been configured to do something different than the "out-of-box" default. This shall not include configuration of the communications.
3	Reserved	Reserved, shall be 0
4–7	Extended device status	Vendor-specific or as defined by **Table 179**.
8		Not used
9		Not used
10		Not used
11		Not used
12–15	Extended device status 2	Reserved—(shall be 0)

Table 179. Values for extended device status field (Bits 4–7) in status instance attribute

Value	Description
0	Self-Testing or Unknown
2	At least one faulted I/O connection
3	No I/O connections established
6	At least one I/O connection in run mode
7	At least one I/O connection established, all in idle mode

Connection object, class 0x05

Table 180. Connection object, class 0x05

Object descriptions						
Class attributes						
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default**	**Range**
1	Revision	NV	UINT	Get	1①	1
Class services						
ID	**Service**			**Requirements**		
0Eh	Get_attribute_single					
Instance attribute						
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default**	**Range**
1	State		USINT	Get		
2	Instance type		USINT	Get		
3	Transport class trigger		BYTE	Get		
4	Produced connection id		UINT	Get		
5	Consumed connection id		UINT	Get		
6	Initial comm characteristics		BYTE	Get		
7	Produced connection size		UINT	Get		
8	Consumed connection size		UINT	Get		
9	Expected packet rate		UINT	Get/Set		
12	Watchdog timeout action		USINT	Get/Set		
13	Produced connection path length		UINT	Get		
14	Produced connection path		Packed EPATH	Get		
15	Consumed connection path length		UINT	Get		
16	Consumed connection path		Packed EPATH	Get		
Instance services						
ID	**Service**					
0Eh	Get_attribute_single					
10h	Set_attribute_single					

Note

① Default values as per stack.

DeviceNet object, class 0x03

Table 181. DeviceNet object, class 0x03

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
01h	Revision	NV	UINT	Get	02h
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
1	MAC ID	NV	USINT	Get/Set	63, (0–63)
2	Baud rate	NV	USINT	Get/Set	0 (0–125,1–250, 2–500 K)
5	Allocation information	V	STRUCT of:	Get	
	Allocation choice byte		BYTE		Bit 0 = Explicit Bit 1 = Poll
	Master's MAC ID		USINT		1 Range 0–63, 255 Modified via Allocate only
Instance services					
ID	**Service**				
0Eh	Get_attribute_single				
10h	Set_attribute_single				

Objects present in an AC/DC drive

Assembly object, class 0x04

Table 182. Assembly object, class 0x04

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
01h	Revision	V	UINT	Get	2
02h	Max instance	V	UINT	Get	0x7F
03h	Number of instances	V	UINT	Get	0x0D
04h	Optional attribute list	V	Struct of:	Get	
	Number of attributes	V	UINT		1
	Array of attributes	V	Array of UINT		04 00
06h	Maximum ID class attribute	V	USINT	Get	07 00
07h	Maximum ID instance attribute	V	USINT	Get	04 00
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**		**Data type**	**Access rule**	
3	Data	V	Array of BYTES	Get/Set	
Instance services					
ID	**Service**				
10h	Set_attribute_single				
0Eh	Get_attribute_single				

Motor data object, class 0x28

Table 183. Motor data object, class 0x28

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
1	Revision	NV	UINT	Get	1
2	Max instance	NV	UINT	Get	3
3	Number of instances	NV	UINT	Get	3
Class services					
ID	**Service**				
0Eh	Get attribute single				
Instance 1 attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default Min. Max.**
03h	Motor type ①	NV	USINT	Get	Squirrel cage Induction Motor (7)
06h	Rated current	NV	UINT	Get	②
07h	Rated voltage	NV	UINT	Get	②
09h	Rated frequency	NV	UINT	Get	②
0Ch	Pole count ①	NV	UINT	Get	②
0Fh	Base speed	NV	UINT	Get	②
Instance 2 attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
06h	First rated current	NV	UINT	Get/Set	②
07h	First rated voltage	NV	UINT	Get/Set	②
09h	First rated frequency	NV	UINT	Get/Set	②
0Ch	First pole count	NV	UINT	Get	②
0Fh	First base speed	NV	UINT	Get/Set	②
Instance 3 attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
06h	Second rated current	NV	UINT	Get/Set	②
07h	Second rated voltage	NV	UINT	Get/Set	②
09h	Second rated frequency	NV	UINT	Get/Set	②
0Ch	Second pole count	NV	UINT	Get	②
0Fh	Second base speed	NV	UINT	Get/Set	②
Instance services					
ID	**Service**				
0Eh	Get_attribute_single				
10h	Set_attribute_single				

Notes

① Instance 1 Motor type and Pole count are also part of instance 2 and instance 3.
② Refer the application manual for the default values of the motor data attribute parameters.

Control supervisor object, class 0x29

This object models all the management functions for devices within the "Hierarchy of Motor Control Devices." The behavior of motor control devices is described by the State Transition Diagram.

Table 184. Control supervisor object, class 0x29

Object descriptions						
Class attributes						
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default**	**Range**
01h	Revision	NV	UINT	Get	1	—
02h	Max instance	NV	UINT	Get	1	—
03h	Number of instances	NV	UINT	Get	1	—
Class services						
ID	**Service**			**Requirements**		
0Eh	Get attribute single					
Instance attribute						
ID	**Description**	**NV**	**Data type**	**Access rule**		
03h	Run1	V	BOOL	Get/Set	0	0–1
04h	Run2	V	BOOL	Get/Set	0	0–1
05h	NetCtrl	V	BOOL	Get/Set	0	0–1
06h	State	V	USINT	Get	0	0–7
07h	Running1	V	BOOL	Get	0	0–1
08h	Running2	V	BOOL	Get	0	0–1
09h	Ready	V	BOOL	Get	0	0–1
0Ah	Faulted	V	BOOL	Get	0	0–1
0Bh	Warning	V	BOOL	Get	0	0–1
0Ch	FaultRst	V	BOOL	Get/Set	0	0–1
0Fh	CtrlFromNet	V	BOOL	Get	0	0–1
0Dh	Active fault code ①	V	UINT	Get	0	0–65535
6Ch	Comm idle action value ②	NV	USINT	Get/Set	2	0–2
6Dh	Comm timeout	NV	UINT	Get /Set	10 sec	0-60 sec
Instance services						
ID	**Service**					
0Eh	Get_attribute_single					
10h	Set_attribute_single					
05h	Reset					Type 0

Notes

① See **Appendix C** for Active list of fault codes.
② Modification of Attribute 0x6C of Supervisory

- Default value for this attribute to be Fault on idle Communication mode
- This attribute to have 3 values as
  - 0 = No Action (Hold Last State) in Idle Communication mode
  - 1 = Stop Motor in Idle Communication mode
  - 2 = Fault Motor in Idle Communication mode

AC/DC Drive Object, Class 0x2A

This object models the functions specific to an AC or DC drive, e.g., speed ramp, torque control and so on.

Table 185. AC/DC drive object, class 0x2A

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default**
01h	Revision	NV	UINT	Get	1
02h	Max Instance	NV	UINT	Get	1
03h	Number of instances	NV	UINT	Get	1
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default Min. Max.**
03h	AtReference	V	BOOL	Get	0
04h	NetRef	V	BOOL	Get/Set	0
06h	DriveMode	V	USINT	Get	0
07h	SpeedActual	V	INT	Get	0
08h	SpeedRef	V	INT	Get/Set	0
0Bh	TorqueActual	V	INT	Get	0
0Ch	TorqueRef	V	INT	Get/Set	0
1Dh	RefFromNet	V	BOOL	Get	0
12h	Accel time	V	UINT	Get	①
13h	Decel time	V	UINT	Get	①
0Ah	Current limit	NV	INT	Get/Set	①
64h	Accel time 1	NV	UINT	Get/Set	①
65h	Accel time 2	NV	UINT	Get/Set	①
66h	Decel time 1	NV	UINT	Get/Set	①
67h	Decel time 2	NV	UINT	Get/Set	①
1Ch	Time scale	NV	SINT	Get/Set	①
Instance services					
ID	**Service**				
0Eh	Get_attribute_single				
10h	Set_attribute_single				

Note

① Varies based off drive parameter settings.

AC/DC drive object

Note: Refer to the PowerXL Application manual for the default values of the parameters.

Vendor parameters object, class 0xA0~0xBB

PowerXL DG1 shall support Vendor Parameters Object, Class 0xA0 through 0xBB as given in table below. Vendor Parameter object is used in order to get access to drive parameters. Please refer to **Appendix A** for Class, Instance and Attribute values for each parameter.

Table 186. Vendor parameters object, class 0xA0, 0xA1, 0xA2, 0xA3, 0xA3, 0xA4, 0xA5

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Remarks/Default**
01h	Revision	NV	UINT	Get	1
02h	Max Instance	NV	UINT	Get	1
03h	Number of Instances	NV	UINT	Get	Varies for different objects
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**			**Access rule**	
Varies for different objects					
Instance services					
ID	**Service**				
0Eh	Get_attribute_single				
10h	Set_attribute_single				

Base device information object, class 0x96

Base device Information Object is used in order to get information about the Base Device to which this option card is connected.

Table 187. Base device information object

Object descriptions					
Class attributes					
ID	**Description**	**NV**	**Data type**	**Access rule**	**Default/Remark**
01h	Revision	NV	UINT	Get	1
02h	Max instance	NV	UINT	Get	1
03h	Number of instances	NV	UINT	Get	1
Class services					
ID	**Service**				
0Eh	Get_attribute_single				
Instance attribute					
ID	**Description**	**NV**	**Data type**	**Access rule**	
01h	Product name	NV	SHORT_STRING	Get	"PowerXL DG1"
02h	Firmware revision	NV	Struct of:	Get	
	Major revision		USINT		
	Minor revision		USINT		
03h	Hardware version	NV	USINT	Get	0xXX
04h	Product code	NV	UINT	Get	0x3000
05h	Serial number	NV	UDINT	Get	Runtime = Read from the board
Instance services					
ID	**Service**				
0Eh	Get_attribute_single				

Appendix A—Parameter ID list

Parameter descriptions

Table 188. Parameter ID list

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
M1	1	502	0	160	1	1	160	1	1	Output Frequency
M2	24	1	0	160	1	2	160	1	2	Freq Reference
M3	2	503	0	4	70	3	4	70	3	Motor Speed
M4	3	504	0	160	1	4	160	1	4	Motor Current
M5	4	507	0	160	1	5	160	1	5	Motor Torque
M6	5	513	1	160	1	6	160	1	6	Motor Power
M7	6	501	0	160	1	7	160	1	7	Motor Voltage
M8	7	501	1	160	1	8	160	1	8	DC-link Voltage
M9	8	822	6	160	1	9	160	1	9	Unit Temperature
M10	9	822	4	160	1	10	160	1	10	Motor Temperature
M11	15	2	1	160	1	11	160	1	11	Torque Reference
M12	10	560	0	160	1	12	160	1	12	Analog Input 1
M13	11	560	1	160	1	13	160	1	13	Analog Input 2
M14	25	570	0	4	75	3	4	75	3	Analog Output 1
M15	575	570	1	160	1	15	160	1	15	Analog Output 2
M16	12	760	0	160	1	16	160	1	16	DI1, DI2, DI3
M17	13	760	1	160	1	17	160	1	17	DI4, DI5, DI6
M18	576	760	2	160	1	18	160	1	18	DI7, DI8
M19	14	754	0	160	1	19	160	1	19	DO1,Virtual RO1,Virtual RO2
M20	557	762	0	160	1	20	160	1	20	RO1, RO2, RO3
M21	558	763	0	160	1	22	160	1	21	TC1, TC2, TC3
M22	559	3125	0	160	1	23	160	1	22	Interval 1
M23	560	3125	1	160	1	24	160	1	23	Interval 2
M24	561	3125	2	160	1	25	160	1	24	Interval 3
M25	562	3125	3	160	1	26	160	1	25	Interval 4
M26	563	3125	4	160	1	27	160	1	26	Interval 5
M27	569	3101	0	160	1	28	160	1	27	Timer 1
M28	571	3101	1	160	1	29	160	1	28	Timer 2
M29	573	3101	2	160	1	30	160	1	29	Timer 3
M30	16	2150	0	160	1	31	160	1	30	PID1 Set Point
M31	18	2864	0	160	1	32	160	1	31	PID1 Feedback
M32	20	2167	0	160	1	33	160	1	32	PID1 Error Value
M33	22	2124	0	160	1	34	160	1	33	PID1 Output
M34	23	2133	0	160	1	35	160	1	34	PID1 Status
M35	32	2150	1	160	1	36	160	1	35	PID2 Set Point
M36	34	2864	1	160	1	37	160	1	36	PID2 Feedback
M37	36	2167	1	160	1	38	160	1	37	PID2 Error Value
M38	38	2124	1	160	1	39	160	1	38	PID2 Output
M39	39	2133	1	160	1	40	160	1	39	PID2 Status
M40	26	1911	0	160	1	41	NA	NA	NA	Running Motors
M41	27	580	0	160	1	42	160	1	41	PT100 Temperture
M42	28	NA	NA	160	1	44	160	1	42	Latest Fault Code
M43	583	790	0	162	1	11	160	1	43	RTC Battery Status

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
M44	1686	NA	NA	164	1	57	160	1	44	Instant Motor Power
M45	2120	NA	NA	164	1	77	160	1	45	Energy Savings
M46	2209	NA	NA	NA	NA	NA	NA	NA	NA	Control Board DIDO Status
M47	2210	NA	NA	NA	NA	NA	NA	NA	NA	SlotA DIDO Status
M48	2211	NA	NA	NA	NA	NA	NA	NA	NA	SlotB DIDO Status
M49	29	NA	NA	160	1	43	NA	NA	NA	Application Status Word
M50	2414	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word
M51	2445	NA	NA	NA	NA	NA	NA	NA	NA	Output
M52	2447	NA	NA	NA	NA	NA	NA	NA	NA	Reference
M53	601	520	2	162	1	13	185	1	3	Total MWh Count
M54	603	522	0	162	1	14	185	1	4	Total Power Day Count
M55	606	821	1	162	1	15	185	1	5	Total Power Hr Count
M56	604	806	0	162	1	16	185	1	6	Trip MWh Count
M57	636	870	0	162	1	18	185	1	8	Trip Power Day Count
M58	637	871	0	162	1	19	185	1	9	Trip Power Hr Count
M59	30	329	0	160	1	45	160	1	46	Multi-Monitoring
P1.1	101	20	0	160	1	162	162	1	1	Min Frequency
P1.2	102	20	1	160	1	163	162	1	2	Max Frequency
P1.3	103	130	0	160	1	164	162	1	3	Accel Time 1
P1.4	104	134	0	160	1	165	162	1	4	Decel Time 1
P1.5	486	210	0	40	2	6	40	2	6	Motor Nom Current
P1.6	489	217	0	40	2	15	40	2	15	Motor Nom Speed
P1.7	490	215	0	161	1	116	162	1	7	Motor PF
P1.8	487	211	0	40	2	7	40	2	7	Motor Nom Voltage
P1.9	488	216	0	161	1	118	162	1	9	Motor Nom Frequency
P1.10	1685	NA	NA	164	1	56	162	1	10	Power Up Local Remote Select
P1.11	135	408	0	160	1	150	162	1	11	Remote 1 Control Place
P1.12	1695	NA	NA	164	1	63	162	1	12	Local Control Place
P1.13	2462	NA	NA	NA	NA	NA	NA	NA	NA	Bumpless Enable
P1.14	136	436	0	160	1	152	162	1	13	Local Reference
P1.15	137	437	0	160	1	153	162	1	14	Remote 1 Reference
P1.16	1679	622	3	164	1	53	162	1	15	Reverse Enable
P1.17	2423	NA	NA	NA	NA	NA	NA	NA	NA	Run Delay Time
P1.18	2465	NA	NA	NA	NA	NA	NA	NA	NA	HOA Source
P2.1.1	144	35	1	160	1	50	163	1	21	AI Ref Scale Min Value
P2.1.2	145	34	1	160	1	51	163	1	22	AI Ref Scale Max Value
P2.2.1	222	263	0	160	1	52	163	1	1	AI1 Mode
P2.2.2	175	260	0	160	1	54	163	1	2	AI1 Signal Range
P2.2.3	176	264	0	160	1	55	163	1	3	AI1 Custom Min
P2.2.4	177	265	0	160	1	56	163	1	4	AI1 Custom Max
P2.2.5	174	266	0	160	1	57	163	1	5	AI1 Filter Time
P2.2.6	181	267	0	160	1	62	163	1	6	AI1 Signal Invert
P2.2.7	178	1711	0	160	1	63	163	1	7	AI1 Joystick Hyst
P2.2.8	179	1720	0	160	1	64	163	1	8	AI1 Sleep Limit
P2.2.9	180	1721	0	160	1	65	163	1	9	AI1 Sleep Delay
P2.2.10	133	1712	0	160	1	66	163	1	10	AI1 Joystick Offset
P2.3.1	223	263	1	160	1	53	163	1	11	AI2 Mode
P2.3.2	183	260	1	160	1	58	163	1	12	AI2 Signal Range

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P2.3.3	184	264	1	160	1	59	163	1	13	AI2 Custom Min
P2.3.4	185	265	1	160	1	60	163	1	14	AI2 Custom Max
P2.3.5	182	266	1	160	1	61	163	1	15	AI2 Filter Time
P2.3.6	189	267	1	160	1	67	163	1	16	AI2 Signal Invert
P2.3.7	186	1711	1	160	1	68	163	1	17	AI2 Joystick Hyst
P2.3.8	187	1720	1	160	1	69	163	1	18	AI2 Sleep Limit
P2.3.9	188	1721	1	160	1	70	163	1	19	AI2 Sleep Delay
P2.3.10	134	1712	1	160	1	71	163	1	20	AI2 Joystick Offset
P2.4.1	2484	NA	NA	NA	NA	NA	NA	NA	NA	Fine Tuning Input
P2.4.2	2485	NA	NA	NA	NA	NA	NA	NA	NA	Fine Tuning Min
P2.4.3	2486	NA	NA	NA	NA	NA	NA	NA	NA	Fine Tuning Max
P3.1	143	425	0	160	1	169	164	1	1	IO Terminal 1 Start Stop Logic
P3.2	190	414	0	160	1	72	164	1	2	IO Terminal 1 Start Signal 1
P3.3	191	414	1	160	1	73	164	1	3	IO Terminal 1 Start Signal 2
P3.4	881	409	0	160	1	200	164	1	4	Thermistor Input Select
P3.5	198	421	2	160	1	74	164	1	5	Reverse
P3.6	192	446	0	160	1	75	164	1	6	Ext. Fault 1 NO
P3.7	193	447	0	160	1	76	164	1	7	Ext. Fault 1 NC
P3.8	200	400	7	160	1	77	164	1	8	Fault Reset
P3.9	194	400	16	160	1	78	164	1	9	Run Enable
P3.10	205	432	0	160	1	79	164	1	10	Preset Speed B0
P3.11	206	432	1	160	1	80	164	1	11	Preset Speed B1
P3.12	207	432	2	160	1	81	164	1	12	Preset Speed B2
P3.13	550	2134	0	160	1	82	164	1	13	PID1 Control Enable
P3.14	553	2134	1	160	1	83	164	1	14	PID2 Control Enable
P3.15	195	435	0	160	1	84	164	1	15	Accel/Decel Time Set
P3.16	201	400	5	160	1	85	164	1	16	Accel/Decel Prohibit
P3.17	215	402	5	160	1	86	164	1	17	No Access To Param
P3.18	203	421	4	160	1	87	164	1	18	Accel Pot Value
P3.19	204	421	5	160	1	88	164	1	19	Decel Pot Value
P3.20	216	405	0	160	1	89	164	1	20	Reset Pot Zero
P3.21	196	406	0	160	1	90	164	1	21	Remote Control
P3.22	197	406	1	160	1	91	164	1	22	Local Control
P3.23	209	407	0	160	1	92	164	1	23	Remote 1/2 Select
P3.24	217	417	0	160	1	93	164	1	24	Second Motor Para Select
P3.25	218	NA	NA	160	1	94	164	1	25	Bypass Start
P3.26	202	402	4	160	1	95	164	1	26	DC Brake Active
P3.27	219	402	2	160	1	96	164	1	27	Smoke Mode
P3.28	220	402	3	160	1	97	164	1	28	Fire Mode
P3.29	221	439	0	160	1	98	164	1	29	Fire Mode Ref 1/2 Select
P3.30	351	410	0	160	1	99	164	1	30	PID1 Set Point Select
P3.31	352	410	1	160	1	100	164	1	31	PID2 Set Point Select
P3.32	199	400	8	160	1	101	164	1	32	Jog Enable
P3.33	224	3104	0	160	1	102	164	1	33	Start Timer 1
P3.34	225	3104	1	160	1	103	164	1	34	Start Timer 2
P3.35	226	3104	2	160	1	104	164	1	35	Start Timer 3
P3.36	208	415	0	160	1	105	164	1	36	AI Ref Source Select
P3.37	210	1910	0	160	1	106	164	1	37	Motor Interlock 1
P3.38	211	1910	1	160	1	107	164	1	38	Motor Interlock 2

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P3.39	212	1910	2	160	1	108	164	1	39	Motor Interlock 3
P3.40	213	1910	3	160	1	109	164	1	40	Motor Interlock 4
P3.41	214	1910	4	160	1	110	164	1	41	Motor Interlock 5
P3.42	747	400	2	160	1	111	164	1	42	Emergency Stop
P3.43	1246	1804	0	160	1	113	164	1	43	Bypass Overload
P3.44	2119	NA	NA	164	1	76	164	1	44	Fire Mode Reverse
P3.45	2206	NA	NA	NA	NA	NA	NA	NA	NA	IO Terminal 2 Start Stop Logic
P3.46	2207	NA	NA	NA	NA	NA	NA	NA	NA	IO Terminal 2 Start Signal 1
P3.47	2208	NA	NA	NA	NA	NA	NA	NA	NA	IO Terminal 2 Start Signal 2
P3.48	2293	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 2 NO
P3.49	2294	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 2 NC
P3.50	2295	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 3 NO
P3.51	2296	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 3 NC
P3.52	2297	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 1 Text
P3.53	2298	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 2 Text
P3.54	2299	NA	NA	NA	NA	NA	NA	NA	NA	Ext. Fault 3 Text
P3.55	2312	NA	NA	NA	NA	NA	NA	NA	NA	Parameter Set1/2 Sel
P3.56	2394	NA	NA	NA	NA	NA	NA	NA	NA	Deragging Enable
P3.57	2395	NA	NA	NA	NA	NA	NA	NA	NA	HOA On/Off
P4.1	227	276	0	160	1	114	165	1	1	AO1 Mode
P4.2	146	460	0	160	1	116	165	1	2	AO1 Function
P4.3	149	279	0	160	1	117	165	1	3	AO1 Minimum
P4.4	147	277	0	160	1	118	165	1	4	AO1 Filter Time
P4.5	150	274	0	160	1	119	165	1	5	AO1 Scale
P4.6	148	278	0	160	1	120	165	1	6	AO1 Inversion
P4.7	173	275	0	160	1	121	165	1	7	AO1 Offset
P4.8	228	276	1	160	1	115	165	1	8	AO2 Mode
P4.9	229	460	1	160	1	122	165	1	9	AO2 Function
P4.10	232	279	1	160	1	123	165	1	10	AO2 Minimum
P4.11	230	277	1	160	1	124	165	1	11	AO2 Filter Time
P4.12	233	274	1	160	1	125	165	1	12	AO2 Scale
P4.13	231	278	1	160	1	126	165	1	13	AO2 Inversion
P4.14	234	275	1	160	1	127	165	1	14	AO2 Offset
P5.1	151	461	0	160	1	128	166	1	1	DO1 Function
P5.2	152	451	0	160	1	129	166	1	2	RO1 Function
P5.3	153	451	1	160	1	130	166	1	3	RO2 Function
P5.4	538	451	2	160	1	131	166	1	4	RO3 Function
P5.5	2463	NA	NA	NA	NA	NA	NA	NA	NA	Virtual RO1 Function
P5.6	2464	NA	NA	NA	NA	NA	NA	NA	NA	Virtual RO2 Function
P5.7	154	1201	0	160	1	132	166	1	5	Freq Limit 1 Supv
P5.8	155	1101	0	160	1	133	166	1	6	Freq Limit 1 Supv Val
P5.9	157	1201	1	160	1	134	166	1	7	Freq Limit 2 Supv
P5.10	158	1101	1	160	1	135	166	1	8	Freq Limit 2 Supv Val
P5.11	159	1202	0	160	1	136	166	1	9	Torque Limit Supv
P5.12	160	1102	0	160	1	137	166	1	10	Torque Limit Supv Val
P5.13	161	1200	0	160	1	138	166	1	11	Ref Limit Supv
P5.14	162	1100	0	160	1	139	166	1	12	Ref Limit Supv Val
P5.15	163	2205	1	160	1	140	166	1	13	Ext Brake Off Delay
P5.16	164	2205	0	160	1	141	166	1	14	Ext Brake On Delay

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P5.17	165	1222	1	160	1	142	166	1	15	Temp Limit Supv
P5.18	166	822	0	160	1	143	166	1	16	Temp Limit Supv Val
P5.19	167	1203	0	160	1	144	166	1	17	Power Limit Supv
P5.20	168	1103	0	160	1	145	166	1	18	Power Limit Supv Val
P5.21	170	1504	0	160	1	146	166	1	19	AI Supv Select
P5.22	171	1204	0	160	1	147	166	1	20	AI Limit Supv
P5.23	172	1404	0	160	1	148	166	1	21	AI Limit Supv Val
P5.24	1346	2860	0	161	1	6	166	1	22	PID1 Superv Enable
P5.25	1347	2861	0	161	1	7	166	1	23	PID1 Superv Upper Limit
P5.26	1349	2862	0	161	1	8	166	1	24	PID1 Superv Lower Limit
P5.27	1351	2863	0	161	1	9	166	1	25	PID1 Superv Delay
P5.28	1408	2860	1	161	1	59	166	1	26	PID2 Superv Enable
P5.29	1409	2861	1	161	1	60	166	1	27	PID2 Superv Upper Limit
P5.30	1411	2862	1	161	1	61	166	1	28	PID2 Superv Lower Limit
P5.31	1413	2863	1	161	1	62	166	1	29	PID2 Superv Delay
P5.32	2112	NA	NA	164	1	69	166	1	30	RO1 On Delay
P5.33	2113	NA	NA	164	1	70	166	1	31	RO1 Off Delay
P5.34	2114	NA	NA	164	1	71	166	1	32	RO2 On Delay
P5.35	2115	NA	NA	164	1	72	166	1	33	RO2 Off Delay
P5.36	2116	NA	NA	164	1	73	166	1	34	RO3 On Delay
P5.37	2117	NA	NA	164	1	74	166	1	35	RO3 Off Delay
P5.38	2118	NA	NA	164	1	75	166	1	36	RO3 Reverse
P5.39	2189	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 1 Supv
P5.40	2190	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 1 Supv Value
P5.41	2191	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 2 Supv
P5.42	2192	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 2 Supv Value
P5.43	2193	NA	NA	NA	NA	NA	NA	NA	NA	Second AI Supv Select
P5.44	2194	NA	NA	NA	NA	NA	NA	NA	NA	Second AI Limit Supv
P5.45	2195	NA	NA	NA	NA	NA	NA	NA	NA	Second AI Limit Supv Val
P5.46	2196	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 1 Supv Hyst
P5.47	2197	NA	NA	NA	NA	NA	NA	NA	NA	Motor Current 2 Supv Hyst
P5.48	2198	NA	NA	NA	NA	NA	NA	NA	NA	AI Supv Hyst
P5.49	2199	NA	NA	NA	NA	NA	NA	NA	NA	Second AI Supv Hyst
P5.50	2200	NA	NA	NA	NA	NA	NA	NA	NA	Freq Limit 1 Supv Hyst
P5.51	2201	NA	NA	NA	NA	NA	NA	NA	NA	Freq Limit 2 Supv Hyst
P5.52	2202	NA	NA	NA	NA	NA	NA	NA	NA	Torque Limit Supv Hyst
P5.53	2203	NA	NA	NA	NA	NA	NA	NA	NA	Ref Limit Supv Hyst
P5.54	2204	NA	NA	NA	NA	NA	NA	NA	NA	Temp Limit Supv Hyst
P5.55	2205	NA	NA	NA	NA	NA	NA	NA	NA	Power Limit Supv Hyst
P6.1	751	2002	0	162	1	84	167	1	1	Logic Function Select
P6.2	752	2000	0	162	1	85	167	1	2	Logic Operation Input A
P6.3	753	2001	0	162	1	86	167	1	3	Logic Operation Input B
P7.1	138	408	1	160	1	151	168	1	1	Remote 2 Control Place
P7.2	139	437	1	160	1	154	168	1	2	Remote 2 Reference
P7.3	141	1	8	160	1	155	161	1	12	Keypad Reference
P7.4	116	621	1	160	1	156	168	1	4	Keypad Direction
P7.5	114	622	1	160	1	157	168	1	5	Keypad Stop
P7.6	117	1	9	160	1	159	168	1	6	Jog Reference
P7.7	156	111	4	160	1	160	168	1	7	Motor Pot Ramp Time

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P7.8	169	426	0	160	1	161	168	1	8	Motor Pot Ref Reset
P7.9	252	620	0	160	1	167	168	1	9	Start Mode
P7.10	253	620	1	160	1	168	168	1	10	Stop Mode
P7.11	247	117	0	160	1	166	168	1	11	Ramp 1 Shape
P7.12	248	117	1	160	1	172	168	1	12	Ramp 2 Shape
P7.13	249	130	1	160	1	170	168	1	13	Accel Time 2
P7.14	250	134	1	160	1	171	168	1	14	Decel Time 2
P7.15	256	41	0	160	1	173	168	1	15	Skip F1 Low Limit
P7.16	257	42	0	160	1	174	168	1	16	Skip F1 High Limit
P7.17	258	41	1	160	1	175	168	1	17	Skip F2 Low Limit
P7.18	259	42	1	160	1	176	168	1	18	Skip F2 High Limit
P7.19	260	41	2	160	1	177	168	1	19	Skip F3 Low Limit
P7.20	261	42	2	160	1	178	168	1	20	Skip F3 High Limit
P7.21	264	43	0	160	1	179	168	1	21	Skip Range Ramp Factor
P7.22	267	639	0	160	1	180	168	1	22	Power Loss Function
P7.23	268	151	0	160	1	181	168	1	23	Power Loss Time
P7.24	2122	NA	NA	164	1	78	168	1	24	Currency
P7.25	2123	NA	NA	164	1	79	168	1	25	Energy Cost
P7.26	2124	NA	NA	164	1	80	168	1	26	Data Type
P7.27	2125	NA	NA	164	1	81	168	1	27	Energy Savings Reset
P7.28	2444	NA	NA	NA	NA	NA	NA	NA	NA	2th Stage Ramp Frequency
P7.29	2515	NA	NA	NA	NA	NA	NA	NA	NA	Change PhaseSequence Motor
P8.1	287	255	0	161	1	81	168	1	28	Motor Control Mode
P8.2	107	281	0	42	1	10	42	1	10	Current Limit
P8.3	109	60	0	161	1	82	168	1	30	V/Hz Optimization
P8.4	108	61	0	161	1	74	168	1	31	V/Hz Ratio
P8.5	289	23	0	161	1	75	168	1	32	Field Weakening Point
P8.6	290	24	0	161	1	76	168	1	33	Voltage at FWP
P8.7	291	23	1	161	1	77	168	1	34	V/Hz Mid Frequency
P8.8	292	24	1	161	1	78	168	1	35	V/Hz Mid Voltage
P8.9	293	27	0	161	1	79	168	1	36	Zero Frequency Voltage
P8.10	2522	NA	NA	NA	NA	NA	NA	NA	NA	Switching Frequency
P8.11	1665	341	0	164	1	22	168	1	38	Sine Filter Enable
P8.12	294	626	3	161	1	83	168	1	39	OverVoltage Control
P8.13	298	2901	0	161	1	84	168	1	40	Load Drooping
P8.14	299	340	0	161	1	85	168	1	41	Identification
P8.15	1574	20	7	163	1	193	168	1	42	Neg Frequency Limit
P8.16	1576	20	6	163	1	194	168	1	43	Pos Frequency Limit
P8.17	1585	140	0	163	1	199	168	1	44	Frequency Ramp Out FilterTime Constant
P8.18	1591	2406	1	163	1	203	168	1	45	Speed Error Filter Time Constant
P8.19	1592	2405	0	163	1	204	168	1	46	Speed Error Band Stop Frequency
P8.20	1593	2400	0	163	1	205	168	1	47	Speed Control Kp
P8.21	1594	2401	0	163	1	206	168	1	48	Speed Control Ti
P8.22	1595	2400	3	163	1	207	168	1	49	Speed Control Kp At Field Weakening
P8.23	1596	2400	1	163	1	208	168	1	50	Speed Control Kp Below F0

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P8.24	1597	2403	0	163	1	209	168	1	51	Speed Control F0
P8.25	1598	2403	1	163	1	210	168	1	52	Speed Control F1
P8.26	1599	2410	0	163	1	211	168	1	53	Speed Control Kp Below T0
P8.27	1600	2404	0	163	1	212	168	1	54	Speed Control T0
P8.28	1601	2406	0	163	1	213	168	1	55	Speed Control Kp Filter Time Constant
P8.29	1602	30	1	163	1	214	168	1	56	Motoring Torque Limit
P8.30	1603	31	1	163	1	215	168	1	57	Generator Torque Limit
P8.31	1604	36	1	163	1	216	168	1	58	Torque Limit Forward
P8.32	1605	37	1	163	1	217	168	1	59	Torque Limit Reverse
P8.33	1607	282	0	163	1	219	168	1	60	Motoring Power Limit
P8.34	1608	282	1	163	1	220	168	1	61	Generator Power Limit
P8.35	1611	2420	0	163	1	223	168	1	62	Acc Compensation Time Constant
P8.36	1612	2421	0	163	1	224	168	1	63	Acc Compensation Filter Time Constant
P8.37	1620	254	0	163	1	232	168	1	64	Flux Reference
P8.38	1621	237	0	163	1	233	168	1	65	Stop State Magnetisation
P8.39	1622	132	0	163	1	234	168	1	66	Start Boost Rise Time
P8.40	1623	105	0	163	1	235	168	1	67	Flux Current Ramp Time
P8.41	1624	118	2	163	1	236	168	1	68	Zero Speed Start Time
P8.42	1625	118	3	163	1	237	168	1	69	Zero Speed Stop Time
P8.43	1630	2902	0	163	1	241	168	1	70	Droop Control Filter Time Constant
P8.44	1631	420	4	163	1	242	168	1	71	Startup Torque Selection
P8.45	1632	2	3	163	1	243	168	1	72	Torque Memory Start
P8.46	1633	36	0	163	1	244	168	1	73	Startup Torque Forward
P8.47	1634	37	0	163	1	245	168	1	74	Startup Torque Reverse
P8.48	1635	506	1	163	1	246	168	1	75	Startup Torque Actual
P8.49	1667	133	0	164	1	21	168	1	76	Startup Torque Time
P8.50	771	218	0	162	1	123	168	1	77	Stator Resistor
P8.51	772	221	0	162	1	124	168	1	78	Rotor Resistor
P8.52	773	224	0	162	1	125	168	1	79	Leak Inductance
P8.53	774	225	0	162	1	126	168	1	80	Mutual Inductance
P8.54	775	223	0	162	1	127	168	1	81	Excitation Current
P9.1	306	840	29520	160	1	182	169	1	1	4mA Input Fault
P9.2	331	1	7	160	1	183	169	1	2	4mA Fault Frequency
P9.3	307	840	36864	160	1	197	169	1	3	External Fault
P9.4	332	840	12592	160	1	198	169	1	4	Input Phase Fault
P9.5	330	840	12576	160	1	202	169	1	5	Uvolt Fault Response
P9.6	308	840	9040	160	1	199	169	1	6	Output Phase Fault
P9.7	309	840	9008	160	1	203	169	1	7	Ground Fault
P9.8	310	840	17168	160	1	192	169	1	8	Motor Thermal Protection
P9.9	311	1012	0	160	1	193	169	1	9	Motor Thermal F0 Current
P9.10	312	1011	0	160	1	194	169	1	10	Motor Thermal Time
P9.11	313	840	28963	160	1	184	169	1	11	Stall Protection
P9.12	314	1010	0	160	1	185	169	1	12	Stall Current Limit
P9.13	315	1010	1	160	1	186	169	1	13	Stall Time Limit
P9.14	316	1010	2	160	1	187	169	1	14	Stall Frequency Limit
P9.15	317	840	28979	160	1	188	169	1	15	Underload Protection

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P9.16	318	1013	0	160	1	189	169	1	16	Underload Fnom Torque
P9.17	319	1013	1	160	1	190	169	1	17	Underload F0 Torque
P9.18	320	1011	1	160	1	191	169	1	18	Underload Time Limit
P9.19	333	840	28978	160	1	201	169	1	19	Thermistor Fault Response
P9.20	750	861	0	162	1	83	169	1	20	Line Start Lockout
P9.21	334	840	29953	160	1	195	169	1	21	Fieldbus Fault Response
P9.22	335	840	35088	160	1	196	169	1	22	OPTCard Fault Response
P9.23	1564	840	16912	163	1	188	169	1	23	Unit Under Temp Prot
P9.24	321	846	0	160	1	206	169	1	24	AR Wait Time
P9.25	322	846	1	160	1	207	169	1	25	AR Trail Time
P9.26	323	847	0	160	1	208	169	1	26	AR Start Function
P9.27	324	845	12832	160	1	209	169	1	27	Undervoltage Attempts
P9.28	325	845	12816	160	1	210	169	1	28	OverVoltage Attempts
P9.29	326	845	8736	160	1	211	169	1	29	OverCurrent Attempts
P9.30	327	845	29520	160	1	212	169	1	30	4mA Fault Attempts
P9.31	329	845	28978	160	1	213	169	1	31	Motor Temp Fault Attempts
P9.32	328	845	36864	160	1	214	169	1	32	External Fault Attempts
P9.33	336	845	28979	160	1	215	169	1	33	Underload Attempts
P9.34	955	840	35344	160	1	204	169	1	34	RTC Fault
P9.35	337	840	29536	160	1	205	169	1	35	PT100 Fault Response
P9.36	1256	840	35345	163	1	127	169	1	36	Replace Battery Fault Response
P9.37	1257	840	28688	163	1	128	169	1	37	Replace Fan Fault Response
P9.38	1678	840	30070	163	1	187	169	1	38	IP Address Confliction Resp
P9.39	2126	NA	NA	164	1	82	169	1	39	Cold Weather Mode
P9.40	2127	NA	NA	164	1	83	169	1	40	Cold Weather Volt. Level
P9.41	2128	NA	NA	164	1	84	169	1	41	Cold Weather Time Out
P9.42	2129	NA	NA	164	1	85	169	1	42	Cold Weather Password
P9.43	2130	NA	NA	164	1	86	169	1	43	Under Temp Fault Override
P9.44	2158	NA	NA	164	1	113	169	1	44	Ground Fault Limit
P9.45	2157	NA	NA	164	1	112	169	1	45	Keypad Comm Fault Response
P9.46	2159	NA	NA	164	1	114	169	1	46	Preheat Mode
P9.47	2160	NA	NA	164	1	115	169	1	47	Preheat Control Source
P9.48	2161	NA	NA	164	1	116	169	1	48	Preheat Enter Temp
P9.49	2162	NA	NA	164	1	117	169	1	49	Preheat Quit Temp
P9.50	2163	NA	NA	164	1	118	169	1	50	Preheat Output Volt
P9.51	2401	NA	NA	NA	NA	NA	NA	NA	NA	PID Feedback AI Loss Response
P9.52	2402	NA	NA	NA	NA	NA	NA	NA	NA	PID Feedback AI Loss Pre Freq
P9.53	2403	NA	NA	NA	NA	NA	NA	NA	NA	PID Feedback AI Loss Pipe Fill Loss Level
P9.54	2404	NA	NA	NA	NA	NA	NA	NA	NA	PID Feedback AI Loss PreFreq Timeout
P9.55	2405	NA	NA	NA	NA	NA	NA	NA	NA	PID Feedback AI Loss Attempts
P9.56	2427	NA	NA	NA	NA	NA	NA	NA	NA	STO Fault Response
P9.57	2483	NA	NA	NA	NA	NA	NA	NA	NA	Fault Reset Start
P10.1	1294	2100	0	160	1	216	170	1	1	PID1 Control Gain
P10.2	1295	2101	0	160	1	217	170	1	2	PID1 Control ITime
P10.3	1296	2102	0	160	1	218	170	1	3	PID1 Control DTime

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P10.4	1297	2870	0	160	1	219	170	1	4	PID1 Process Unit
P10.5	1298	2871	0	160	1	221	170	1	5	PID1 Process Unit Min
P10.6	1300	2872	0	160	1	222	170	1	6	PID1 Process Unit Max
P10.7	1302	2873	0	160	1	220	170	1	7	PID1 Process Unit Decimal
P10.8	1303	2850	0	160	1	223	170	1	8	PID1 Error Inversion
P10.9	1304	2851	0	160	1	224	170	1	9	PID1 Dead Band
P10.10	1306	2852	0	160	1	225	170	1	10	PID1 Dead Band Delay
P10.11	1307	2170	0	160	1	226	170	1	11	PID1 Keypad Set Point 1
P10.12	1309	2179	0	160	1	227	170	1	12	PID1 Keypad Set Point 2
P10.13	1311	2151	0	160	1	228	170	1	13	PID1 Ramp Time
P10.14	1312	2110	0	160	1	229	170	1	14	PID1 Set Point 1 Source
P10.15	1313	2168	0	160	1	230	170	1	15	PID1 Set Point 1 Min
P10.16	1314	2169	0	160	1	231	170	1	16	PID1 Set Point 1 Max
P10.17	1315	2136	0	160	1	232	170	1	17	PID1 Set Point 1 Sleep Enable
P10.18	2396	NA	NA	NA	NA	NA	NA	NA	NA	PID1 Set Point 1 Sleep Unit Sel
P10.19	2450	NA	NA	NA	NA	NA	NA	NA	NA	PID1 Set Point 1 Sleep Level
P10.20	1317	2138	0	160	1	234	170	1	19	PID1 Set Point 1 Sleep Delay
P10.21	1318	2139	0	160	1	235	170	1	20	PID1 Set Point 1 Wake Up Level
P10.22	1320	2154	0	160	1	236	170	1	21	PID1 Set Point 1 Boost
P10.23	1321	2116	0	160	1	237	170	1	22	PID1 Set Point 2 Source
P10.24	1322	2177	0	160	1	238	170	1	23	PID1 Set Point 2 Min
P10.25	1323	2178	0	160	1	239	170	1	24	PID1 Set Point 2 Max
P10.26	1324	2140	0	160	1	240	170	1	25	PID1 Set Point 2 Sleep Enable
P10.27	2397	NA	NA	NA	NA	NA	NA	NA	NA	PID1 Set Point 2 Sleep Unit Sel
P10.28	2452	NA	NA	NA	NA	NA	NA	NA	NA	PID1 Set Point 2 Sleep Level
P10.29	1326	2142	0	160	1	242	170	1	27	PID1 Set Point 2 Sleep Delay
P10.30	1327	2143	0	160	1	243	170	1	28	PID1 Set Point 2 Wake Up Level
P10.31	1329	2157	0	160	1	244	170	1	29	PID1 Set Point 2 Boost
P10.32	1330	2171	0	160	1	245	170	1	30	PID1 Feedback Function
P10.33	1331	2153	0	160	1	246	170	1	31	PID1 Feedback Gain
P10.34	1332	2112	0	160	1	247	170	1	32	PID1 Feedback 1 Source
P10.35	1333	2172	0	160	1	248	170	1	33	PID1 Feedback 1 Min
P10.36	1334	2173	0	160	1	249	170	1	34	PID1 Feedback 1 Max
P10.37	1335	2117	0	160	1	250	170	1	35	PID1 Feedback 2 Source
P10.38	1336	2181	0	160	1	251	170	1	36	PID1 Feedback 2 Min
P10.39	1337	2182	0	160	1	252	170	1	37	PID1 Feedback 2 Max
P10.40	1338	2800	0	160	1	253	170	1	38	PID1 Feedforward Func
P10.41	1339	2801	0	160	1	254	170	1	39	PID1 Feedforward Gain
P10.42	1340	2810	0	160	1	255	170	1	40	PID1 Feedforward 1 Source
P10.43	1341	2811	0	161	1	1	170	1	41	PID1 Feedforward 1 Min
P10.44	1342	2812	0	161	1	2	170	1	42	PID1 Feedforward 1 Max
P10.45	1343	2815	0	161	1	3	170	1	43	PID1 Feedforward 2 Source
P10.46	1344	2816	0	161	1	4	170	1	44	PID1 Feedforward 2 Min
P10.47	1345	2817	0	161	1	5	170	1	45	PID1 Feedforward 2 Max
P10.48	1352	2830	0	161	1	10	170	1	46	PID1 Set Point 1 Comp Enable
P10.49	1353	2831	0	161	1	11	170	1	47	PID1 Set Point 1 Comp Max

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P10.50	1354	2835	0	161	1	12	170	1	48	PID1 Set Point 2 Comp Enable
P10.51	1355	2836	0	161	1	13	170	1	49	PID1 Set Point 2 Comp Max
P10.52	2466	NA	NA	NA	NA	NA	NA	NA	NA	PID1 Wake Up Action
P11.1	1356	2100	1	161	1	14	171	1	1	PID2 Control Gain
P11.2	1357	2101	1	161	1	15	171	1	2	PID2 Control I Time
P11.3	1358	2102	1	161	1	16	171	1	3	PID2 Control D Time
P11.4	1359	2870	1	161	1	17	171	1	4	PID2 Process Unit
P11.5	1360	2871	1	161	1	19	171	1	5	PID2 Process Unit Min
P11.6	1362	2872	1	161	1	20	171	1	6	PID2 Process Unit Max
P11.7	1364	2873	1	161	1	18	171	1	7	PID2 Process Unit Decimal
P11.8	1365	2850	1	161	1	21	171	1	8	PID2 Error Inversion
P11.9	1366	2851	1	161	1	22	171	1	9	PID2 Dead Band
P11.10	1368	2852	1	161	1	23	171	1	10	PID2 Dead Band Delay
P11.11	1369	2170	1	161	1	24	171	1	11	PID2 Keypad Set Point 1
P11.12	1371	2179	1	161	1	25	171	1	12	PID2 Keypad Set Point 2
P11.13	1373	2151	1	161	1	26	171	1	13	PID2 Ramp Time
P11.14	1374	2110	1	161	1	27	171	1	14	PID2 Set Point 1 Source
P11.15	1375	2168	1	161	1	28	171	1	15	PID2 Set Point 1 Min
P11.16	1376	2169	1	161	1	29	171	1	16	PID2 Set Point 1 Max
P11.17	1377	2136	1	161	1	30	171	1	17	PID2 Set Point 1 Sleep Enable
P11.18	2398	NA	NA	NA	NA	NA	NA	NA	NA	PID2 Set Point 1 Sleep Unit Sel
P11.19	2454	NA	NA	NA	NA	NA	NA	NA	NA	PID2 Set Point 1 Sleep Level
P11.20	1379	2138	1	161	1	32	171	1	19	PID2 Set Point 1 Sleep Delay
P11.21	1380	2139	1	161	1	33	171	1	20	PID2 Set Point 1 WakeUp Level
P11.22	1382	2154	1	161	1	34	171	1	21	PID2 Set Point 1 Boost
P11.23	1383	2116	1	161	1	35	171	1	22	PID2 Set Point 2 Source
P11.24	1384	2177	1	161	1	36	171	1	23	PID2 Set Point 2 Min
P11.25	1385	2178	1	161	1	37	171	1	24	PID2 Set Point 2 Max
P11.26	1386	2140	1	161	1	38	171	1	25	PID2 Set Point 2 Sleep Enable
P11.27	2399	NA	NA	NA	NA	NA	NA	NA	NA	PID2 Set Point 2 Sleep Unit Sel
P11.28	2456	NA	NA	NA	NA	NA	NA	NA	NA	PID2 Set Point 2 Sleep Level
P11.29	1388	2142	1	161	1	40	171	1	27	PID2 Set Point 2 Sleep Delay
P11.30	1389	2143	1	161	1	41	171	1	28	PID2 Set Point 2 WakeUp Level
P11.31	1391	2157	1	161	1	42	171	1	29	PID2 Set Point 2 Boost
P11.32	1392	2171	1	161	1	43	171	1	30	PID2 Feedback Func
P11.33	1393	2153	1	161	1	44	171	1	31	PID2 Feedback Gain
P11.34	1394	2112	1	161	1	45	171	1	32	PID2 Feedback 1 Source
P11.35	1395	2172	1	161	1	46	171	1	33	PID2 Feedback 1 Min
P11.36	1396	2173	1	161	1	47	171	1	34	PID2 Feedback 1 Max
P11.37	1397	2117	1	161	1	48	171	1	35	PID2 Feedback 2 Source
P11.38	1398	2181	1	161	1	49	171	1	36	PID2 Feedback 2 Min
P11.39	1399	2182	1	161	1	50	171	1	37	PID2 Feedback 2 Max
P11.40	1400	2800	1	161	1	51	171	1	38	PID2 Feedforward Func
P11.41	1401	2801	1	161	1	52	171	1	39	PID2 Feedforward Gain
P11.42	1402	2810	1	161	1	53	171	1	40	PID2 Feedforward 1 Source
P11.43	1403	2811	1	161	1	54	171	1	41	PID2 Feedforward 1 Min

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P11.44	1404	2812	1	161	1	55	171	1	42	PID2 Feedforward 1 Max
P11.45	1405	2815	1	161	1	56	171	1	43	PID2 Feedforward 2 Source
P11.46	1406	2816	1	161	1	57	171	1	44	PID2 Feedforward 2 Min
P11.47	1407	2817	1	161	1	58	171	1	45	PID2 Feedforward 2 Max
P11.48	1414	2830	1	161	1	63	171	1	46	PID2 Set Point1 Comp Enable
P11.49	1415	2831	1	161	1	64	171	1	47	PID2 Set Point1 Comp Max
P11.50	1416	2835	1	161	1	65	171	1	48	PID2 Set Point 2 Comp Enable
P11.51	1417	2836	1	161	1	66	171	1	49	PID2 Set Point 2 Comp Max
P11.52	2467	NA	NA	NA	NA	NA	NA	NA	NA	PID2 Wake Up Action
P12.1	105	5	1	161	1	67	172	1	1	Preset Speed 1
P12.2	106	5	2	161	1	68	172	1	2	Preset Speed 2
P12.3	118	5	3	161	1	69	172	1	3	Preset Speed 3
P12.4	119	5	4	161	1	70	172	1	4	Preset Speed 4
P12.5	120	5	5	161	1	71	172	1	5	Preset Speed 5
P12.6	121	5	6	161	1	72	172	1	6	Preset Speed 6
P12.7	122	5	7	161	1	73	172	1	7	Preset Speed 7
P13.1	295	53	0	161	1	86	173	1	1	Torque Limit
P13.2	303	420	2	161	1	89	173	1	2	Torque Ref Select
P13.3	782	2	2	162	1	138	161	1	11	Keypad Torque Ref
P13.4	304	50	1	161	1	90	173	1	4	Torque Ref Max
P13.5	305	50	0	161	1	91	173	1	5	Torque Ref Min
P13.6	1666	NA	NA	164	1	23	173	1	6	Speed Limiter Mode
P13.7	1636	3401	0	163	1	247	173	1	7	Window Pos Width
P13.8	1637	3401	1	163	1	248	173	1	8	Window Neg Width
P13.9	1638	3401	2	163	1	249	173	1	9	Window Pos Off Limit
P13.10	1639	3401	3	163	1	250	173	1	10	Window Neg Off Limit
P13.11	1640	140	1	163	1	251	173	1	11	Torque Reference Filter TC
P13.12	1606	NA	NA	163	1	218	173	1	12	Pull Out Torque
P13.13	1684	NA	NA	164	1	55	173	1	14	Stop State Magnetisation Time
P14.1	254	2227	0	161	1	95	174	1	1	DC-Brake Current
P14.2	263	2222	0	161	1	96	174	1	2	Start DC-Brake Time
P14.3	262	2223	0	161	1	97	174	1	3	Stop DC-Brake Frequency
P14.4	255	2222	1	161	1	98	174	1	4	Stop DC-Brake Time
P14.5	251	2204	0	161	1	99	174	1	5	Brake Chopper Define
P14.6	266	2214	0	161	1	100	174	1	6	Flux Brake
P14.7	265	2217	0	161	1	101	174	1	7	Flux Brake Current
P15.1	535	640	0	161	1	102	175	1	1	Fire Mode Function
P15.2	536	438	0	161	1	103	175	1	2	Fire Mode Ref Select Function
P15.3	537	28	2	161	1	104	175	1	3	Fire Mode Min Frequency
P15.4	565	1	5	161	1	105	175	1	4	Fire Mode Freq Ref 1
P15.5	564	1	6	161	1	106	175	1	5	Fire Mode Freq Ref 2
P15.6	554	1	11	161	1	107	175	1	6	Smoke Purge Frequency
P15.7	2443	NA	NA	NA	NA	NA	NA	NA	NA	Fire Mode Test Enable
P16.1	577	210	1	40	3	6	40	3	6	Motor Nom Current 2
P16.2	578	217	1	40	3	15	40	3	15	Motor Nom Speed 2
P16.3	579	215	1	161	1	124	176	1	3	Motor PF 2
P16.4	580	211	1	40	3	7	40	3	7	Motor Nom Volt 2
P16.5	581	216	1	161	1	126	176	1	5	Motor Nom Freq 2

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P16.6	1419	218	1	162	1	128	176	1	6	Stator Resistor 2
P16.7	1420	221	1	162	1	129	176	1	7	Rotor Resistor 2
P16.8	1421	224	1	162	1	130	176	1	8	Leak Inductance 2
P16.9	1422	225	1	162	1	131	176	1	9	Mutual Inductance 2
P16.10	1423	223	1	162	1	132	176	1	10	Excitation Current 2
P17.1.1	1418	1801	0	163	1	141	177	1	1	Bypass Enable
P17.1.2	544	1802	0	161	1	129	177	1	2	Bypass Start Delay
P17.1.3	542	1800	1	161	1	130	177	1	3	Auto Bypass
P17.1.4	543	1802	1	161	1	131	177	1	4	Auto Bypass Delay
P17.1.5	547	1803	0	161	1	132	177	1	5	OverCurrent Bypass Enable
P17.1.6	546	1803	1	161	1	133	177	1	6	IGBT Fault Bypas Enable
P17.1.7	548	1803	2	161	1	134	177	1	7	4mA Fault Bypass Enable
P17.1.8	545	1803	3	161	1	135	177	1	8	UnderVoltage Bypass Enable
P17.1.9	549	1803	4	161	1	136	177	1	9	OverVoltage Bypass Enable
P17.2.1	2476	NA	NA	NA	NA	NA	NA	NA	NA	Redundant Drive Enable
P17.2.2	2278	NA	NA	165	1	56	NA	NA	NA	Drive ID
P17.2.3	2477	NA	NA	NA	NA	NA	NA	NA	NA	Redundant Run Time Enable
P17.2.4	2478	NA	NA	NA	NA	NA	NA	NA	NA	Redundant Run Time Reset
P17.2.5	2479	NA	NA	NA	NA	NA	NA	NA	NA	Redundant RunTime Limit
P18.1.1	2279	NA	NA	165	1	57	NA	NA	NA	Multi-pump Mode
P18.1.2	2278	NA	NA	165	1	56	NA	NA	NA	Drive ID
P18.1.3	2458	NA	NA	NA	NA	NA	NA	NA	NA	PID Bandwidth
P18.1.4	2315	NA	NA	165	1	81	NA	NA	NA	Staging Frequency
P18.1.5	2316	NA	NA	165	1	82	NA	NA	NA	De-Staging Frequency
P18.1.6	344	1923	0	161	1	139	178	1	3	Add/Remove Delay
P18.1.7	350	1909	0	161	1	140	178	1	4	Interlock Enable
P18.1.8	483	636	0	160	1	47	178	1	10	Damper Start
P18.1.9	484	118	0	160	1	48	178	1	11	Damper Time Out
P18.1.10	485	118	1	160	1	49	178	1	12	Damper Delay
P18.1.11	2468	NA	NA	NA	NA	NA	NA	NA	NA	Derag Cycles
P18.1.12	2469	NA	NA	NA	NA	NA	NA	NA	NA	Derag at Start/Stop
P18.1.13	2470	NA	NA	NA	NA	NA	NA	NA	NA	Deragging Run Time
P18.1.14	2471	NA	NA	NA	NA	NA	NA	NA	NA	Derag Speed
P18.1.15	2472	NA	NA	NA	NA	NA	NA	NA	NA	Derag Off Delay
P18.2.1.1	2218	NA	NA	165	1	1	NA	NA	NA	Drive 1
P18.2.1.2	2230	NA	NA	165	1	12	NA	NA	NA	Drive 2
P18.2.1.3	2242	NA	NA	165	1	23	NA	NA	NA	Drive 3
P18.2.1.4	2254	NA	NA	165	1	34	NA	NA	NA	Drive 4
P18.2.1.5	2266	NA	NA	165	1	45	NA	NA	NA	Drive 5
P18.2.2.1	2219	NA	NA	165	1	2	NA	NA	NA	Drive 1
P18.2.2.2	2231	NA	NA	165	1	13	NA	NA	NA	Drive 2
P18.2.2.3	2243	NA	NA	165	1	24	NA	NA	NA	Drive 3
P18.2.2.4	2255	NA	NA	165	1	35	NA	NA	NA	Drive 4
P18.2.2.5	2267	NA	NA	165	1	46	NA	NA	NA	Drive 5
P18.2.3.1	2220	NA	NA	165	1	3	NA	NA	NA	Drive 1
P18.2.3.2	2232	NA	NA	165	1	14	NA	NA	NA	Drive 2
P18.2.3.3	2244	NA	NA	165	1	25	NA	NA	NA	Drive 3
P18.2.3.4	2256	NA	NA	165	1	36	NA	NA	NA	Drive 4
P18.2.3.5	2268	NA	NA	165	1	47	NA	NA	NA	Drive 5

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P18.3.1.1	2221	NA	NA	165	1	4	NA	NA	NA	Drive 1
P18.3.1.2	2233	NA	NA	165	1	15	NA	NA	NA	Drive 2
P18.3.1.3	2245	NA	NA	165	1	26	NA	NA	NA	Drive 3
P18.3.1.4	2257	NA	NA	165	1	37	NA	NA	NA	Drive 4
P18.3.1.5	2269	NA	NA	165	1	48	NA	NA	NA	Drive 5
P18.3.2.1	2222	NA	NA	165	1	5	NA	NA	NA	Drive 1
P18.3.2.2	2234	NA	NA	165	1	16	NA	NA	NA	Drive 2
P18.3.2.3	2246	NA	NA	165	1	27	NA	NA	NA	Drive 3
P18.3.2.4	2258	NA	NA	165	1	38	NA	NA	NA	Drive 4
P18.3.2.5	2270	NA	NA	165	1	49	NA	NA	NA	Drive 5
P18.3.3.1	2223	NA	NA	165	1	6	NA	NA	NA	Drive 1
P18.3.3.2	2235	NA	NA	165	1	17	NA	NA	NA	Drive 2
P18.3.3.3	2247	NA	NA	165	1	28	NA	NA	NA	Drive 3
P18.3.3.4	2259	NA	NA	165	1	39	NA	NA	NA	Drive 4
P18.3.3.5	2271	NA	NA	165	1	50	NA	NA	NA	Drive 5
P18.3.4.1	2224	NA	NA	165	1	7	NA	NA	NA	Drive 1
P18.3.4.2	2236	NA	NA	165	1	18	NA	NA	NA	Drive 2
P18.3.4.3	2248	NA	NA	165	1	29	NA	NA	NA	Drive 3
P18.3.4.4	2260	NA	NA	165	1	40	NA	NA	NA	Drive 4
P18.3.4.5	2272	NA	NA	165	1	51	NA	NA	NA	Drive 5
P18.3.5.1	2225	NA	NA	165	1	8	NA	NA	NA	Drive 1
P18.3.5.2	2237	NA	NA	165	1	19	NA	NA	NA	Drive 2
P18.3.5.3	2249	NA	NA	165	1	30	NA	NA	NA	Drive 3
P18.3.5.4	2261	NA	NA	165	1	41	NA	NA	NA	Drive 4
P18.3.5.5	2273	NA	NA	165	1	52	NA	NA	NA	Drive 5
P18.3.6.1	2226	NA	NA	165	1	9	NA	NA	NA	Drive 1
P18.3.6.2	2238	NA	NA	165	1	20	NA	NA	NA	Drive 2
P18.3.6.3	2250	NA	NA	165	1	31	NA	NA	NA	Drive 3
P18.3.6.4	2262	NA	NA	165	1	42	NA	NA	NA	Drive 4
P18.3.6.5	2274	NA	NA	165	1	53	NA	NA	NA	Drive 5
P18.3.7.1	2227	NA	NA	165	1	10	NA	NA	NA	Drive 1
P18.3.7.2	2239	NA	NA	165	1	21	NA	NA	NA	Drive 2
P18.3.7.3	2251	NA	NA	165	1	32	NA	NA	NA	Drive 3
P18.3.7.4	2263	NA	NA	165	1	43	NA	NA	NA	Drive 4
P18.3.7.5	2275	NA	NA	165	1	54	NA	NA	NA	Drive 5
P18.3.8.1	2228	NA	NA	165	1	11	NA	NA	NA	Drive 1
P18.3.8.2	2240	NA	NA	165	1	22	NA	NA	NA	Drive 2
P18.3.8.3	2252	NA	NA	165	1	33	NA	NA	NA	Drive 3
P18.3.8.4	2264	NA	NA	165	1	44	NA	NA	NA	Drive 4
P18.3.8.5	2276	NA	NA	165	1	55	NA	NA	NA	Drive 5
P18.4.1	342	1906	0	161	1	137	178	1	1	Number of Pumps
P18.4.2	346	1904	0	161	1	141	178	1	5	Include Freq Converter
P18.4.3	345	1900	0	161	1	142	178	1	6	Auto-Change Enable
P18.4.4	347	1901	0	161	1	143	178	1	7	Auto-Change Interval
P18.4.5	349	1902	0	161	1	144	178	1	8	Auto-Change Freq Limit
P18.4.6	348	1903	0	161	1	145	178	1	9	Auto-Change Pump Limit
P18.4.7	2439	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Aux Pump Select
P18.4.8	2440	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Aux Pump Run Time
P18.4.9	2441	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Aux Pump Operation

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P18.4.10	2442	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Aux Pump Delay
P18.5.1	2449	NA	NA	NA	NA	NA	NA	NA	NA	Number of Drives
P18.5.2	2284	NA	NA	165	1	61	NA	NA	NA	Regulation Source
P18.5.3	2285	NA	NA	165	1	62	NA	NA	NA	Recovery Method
P18.5.4	2286	NA	NA	165	1	63	NA	NA	NA	Callback Source
P18.5.5	2311	NA	NA	165	1	80	NA	NA	NA	Add/Remove Drive Selection
P18.5.6	2280	NA	NA	165	1	58	NA	NA	NA	Run Time Enable
P18.5.7	2281	NA	NA	165	1	59	NA	NA	NA	Run Time Limit
P18.5.8	2283	NA	NA	165	1	60	NA	NA	NA	Run Time Reset
P18.5.9	2473	NA	NA	NA	NA	NA	NA	NA	NA	Master Drive Mode
P18.5.10	2474	NA	NA	NA	NA	NA	NA	NA	NA	Master Fixed Speed
P18.5.11	2475	NA	NA	NA	NA	NA	NA	NA	NA	Master Fixed Speed Delay
P18.6.1	2406	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Detection Method
P18.6.2	2407	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Level
P18.6.3	2408	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Time
P18.6.4	2409	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Frequency
P18.6.5	2410	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Response
P18.6.6	2411	NA	NA	NA	NA	NA	NA	NA	NA	Pipe Fill Loss Attempts
P18.6.7	2428	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Enable
P18.6.8	2429	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Level
P18.6.9	2431	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Frequency
P18.6.10	2432	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Delay Time
P18.6.11	2433	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Loss of Prime Level
P18.6.12	2434	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Level 2
P18.6.13	2436	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Frequency 2
P18.6.14	2437	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Delay Time 2
P18.6.15	2438	NA	NA	NA	NA	NA	NA	NA	NA	Prime Pump Loss of Prime Level 2
P19.1	491	NA	NA	161	1	146	179	1	1	Interval 1 On Time
P19.2	493	NA	NA	161	1	147	179	1	2	Interval 1 Off Time
P19.3	517	3122	0	161	1	148	179	1	3	Interval 1 From Day
P19.4	518	3123	0	161	1	149	179	1	4	Interval 1 To Day
P19.5	519	3124	0	161	1	150	179	1	5	Interval 1 Channel
P19.6	495	NA	NA	161	1	151	179	1	6	Interval 2 On Time
P19.7	497	NA	NA	161	1	152	179	1	7	Interval 2 Off Time
P19.8	520	3122	1	161	1	153	179	1	8	Interval 2 From Day
P19.9	521	3123	1	161	1	154	179	1	9	Interval 2 To Day
P19.10	522	3124	1	161	1	155	179	1	10	Interval 2 Channel
P19.11	499	NA	NA	161	1	156	179	1	11	Interval 3 On Time
P19.12	501	NA	NA	161	1	157	179	1	12	Interval 3 Off Time
P19.13	523	3122	2	161	1	158	179	1	13	Interval 3 From Day
P19.14	524	3123	2	161	1	159	179	1	14	Interval 3 To Day
P19.15	525	3124	2	161	1	160	179	1	15	Interval 3 Channel
P19.16	503	NA	NA	161	1	161	179	1	16	Interval 4 On Time
P19.17	505	NA	NA	161	1	162	179	1	17	Interval 4 Off Time
P19.18	526	3122	3	161	1	163	179	1	18	Interval 4 From Day
P19.19	527	3123	3	161	1	164	179	1	19	Interval 4 To Day
P19.20	528	3124	3	161	1	165	179	1	20	Interval 4 Channel

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P19.21	507	NA	NA	161	1	166	179	1	21	Interval 5 On Time
P19.22	509	NA	NA	161	1	167	179	1	22	Interval 5 Off Time
P19.23	529	3122	4	161	1	168	179	1	23	Interval 5 From Day
P19.24	530	3123	4	161	1	169	179	1	24	Interval 5 To Day
P19.25	531	3124	4	161	1	170	179	1	25	Interval 5 Channel
P19.26	511	3100	0	161	1	171	179	1	26	Timer 1 Duration
P19.27	532	3102	0	161	1	172	179	1	27	Timer 1 Channel
P19.28	513	3100	1	161	1	173	179	1	28	Timer 2 Duration
P19.29	533	3102	1	161	1	174	179	1	29	Timer 2 Channel
P19.30	515	3100	2	161	1	175	179	1	30	Timer 3 Duration
P19.31	534	3102	2	161	1	176	179	1	31	Timer 3 Channel
P19.32	2487	NA	NA	NA	NA	NA	NA	NA	NA	Interval 1 Setting
P19.33	2488	NA	NA	NA	NA	NA	NA	NA	NA	Interval 2 Setting
P19.34	2489	NA	NA	NA	NA	NA	NA	NA	NA	Interval 3 Setting
P19.35	2490	NA	NA	NA	NA	NA	NA	NA	NA	Interval 4 Setting
P19.36	2491	NA	NA	NA	NA	NA	NA	NA	NA	Interval 5 Setting
P20.1.1	1556	442	0	163	1	179	180	1	1	FB Process Data Output 1 Sel
P20.1.2	1557	442	1	163	1	180	180	1	2	FB Process Data Output 2 Sel
P20.1.3	1558	442	2	163	1	181	180	1	3	FB Process Data Output 3 Sel
P20.1.4	1559	442	3	163	1	182	180	1	4	FB Process Data Output 4 Sel
P20.1.5	1560	442	4	163	1	183	180	1	5	FB Process Data Output 5 Sel
P20.1.6	1561	442	5	163	1	184	180	1	6	FB Process Data Output 6 Sel
P20.1.7	1562	442	6	163	1	185	180	1	7	FB Process Data Output 7 Sel
P20.1.8	1563	442	7	163	1	186	180	1	8	FB Process Data Output 8 Sel
P20.1.9	2415	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit0 Function Select
P20.1.10	2416	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit1 Function Select
P20.1.11	2417	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit2 Function Select
P20.1.12	2418	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit3 Function Select
P20.1.13	2419	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit4 Function Select
P20.1.14	2420	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit5 Function Select
P20.1.15	2421	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit6 Function Select
P20.1.16	2422	NA	NA	NA	NA	NA	NA	NA	NA	Standard Status Word Bit7 Function Select
P20.2.1	586	3220	0	161	1	192	181	1	1	RS485 Comm Set
P20.2.2	587	3221	0	161	1	193	181	1	2	Slave Address
P20.2.3	584	3222	0	161	1	194	181	1	3	Baud Rate
P20.2.4	585	3224	0	161	1	195	181	1	4	Parity Type
P20.2.5	588	3225	0	161	1	196	181	1	5	Modbus RTU Protocol Status
P20.2.6	589	3226	0	161	1	197	181	1	6	Slave Busy
P20.2.7	590	3227	0	161	1	198	181	1	7	Parity Error
P20.2.8	591	3228	0	161	1	199	181	1	8	Slave Fault
P20.2.9	592	3229	0	161	1	200	181	1	9	Last Fault Response
P20.2.10	593	3290	0	161	1	201	181	1	10	Comm Timeout Modbus RTU
P20.2.11	594	3232	0	161	1	202	181	1	11	BACnet Baud Rate

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P20.2.12	595	3272	0	161	1	203	181	1	12	BACnet MS/TP Device Address
P20.2.13	596	3270	0	161	1	204	181	1	13	BACNet Instance Number
P20.2.14	598	3273	0	161	1	205	181	1	14	BACNet Comm Timeout BACnet
P20.2.15	599	3265	0	161	1	206	181	1	15	BACnet Protocol Status
P20.2.16	600	3274	0	161	1	207	181	1	16	BACNet Fault Code
P20.2.17	2516	NA	NA	NA	NA	NA	NA	NA	NA	Modbus RTU/BACNet Fault Response
P20.3.1	1500	3249	0	161	1	208	182	1	1	IP Address Mode
P20.3.2	1507	3246	0	161	1	209	182	1	2	Active IP Address
P20.3.3	1509	3247	0	161	1	210	182	1	3	Active Subnet Mask
P20.3.4	1511	3248	0	161	1	211	182	1	4	Active Default Gateway
P20.3.5	1513	3333	0	161	1	212	182	1	5	MAC Address
P20.3.6	1501	3243	0	162	1	139	182	1	6	Static IP Address
P20.3.7	1503	3244	0	162	1	140	182	1	7	Static Subnet Mask
P20.3.8	1505	3245	0	162	1	141	182	1	8	Static Default Gateway
P20.3.9	608	NA	NA	164	1	54	182	1	9	Ethernet IP Protocol Status
P20.3.10	609	NA	NA	161	1	213	182	1	10	Connection Limit
P20.3.11	610	NA	NA	161	1	214	182	1	11	Modbus TCP Unit ID
P20.3.12	611	NA	NA	41	1	109	182	1	12	Comm Timeout Modbus TCP
P20.3.13	612	3235	0	161	1	216	182	1	13	Modbus TCP Protocol Status
P20.3.14	613	3236	0	161	1	217	182	1	14	Slave Busy
P20.3.15	614	3237	0	161	1	218	182	1	15	Parity Error
P20.3.16	615	3238	0	161	1	219	182	1	16	Slave Failure
P20.3.17	616	3239	0	161	1	220	182	1	17	Last Fault Response
P20.3.18	2517	NA	NA	NA	NA	NA	NA	NA	NA	Modbus TCP Fault Response
P20.3.19	2518	NA	NA	NA	NA	NA	NA	NA	NA	EIP Fault Response
P21.1.1	340	323	0	162	1	21	183	1	1	Language
P21.1.2	142	256	0	160	1	46	183	1	2	Application
P21.1.3	619	970	0	162	1	22	183	1	3	Parameter Sets
P21.1.4	620	302	0	162	1	23	183	1	4	Up To Keypad
P21.1.5	621	302	1	162	1	24	183	1	5	Down From Keypad
P21.1.6	623	305	0	162	1	26	183	1	6	Parameter Comparison
P21.1.7	624	320	0	162	1	27	183	1	7	Password
P21.1.8	625	625	0	162	1	28	183	1	8	Parameter Lock
P21.1.9	627	328	0	162	1	30	183	1	9	Multimonitor Set
P21.1.10	628	326	0	162	1	31	183	1	10	Default Page
P21.1.11	629	330	0	162	1	32	183	1	11	Timeout Time
P21.1.12	630	324	0	162	1	33	183	1	12	Contrast Adjust
P21.1.13	631	330	1	162	1	34	183	1	13	Backlight Time
P21.1.14	632	627	0	162	1	35	183	1	14	Fan Control
P21.1.15	633	362	0	162	1	36	183	1	15	Keypad ACK Timeout
P21.1.16	634	3291	0	162	1	37	183	1	16	Keypad Retry Number
P21.1.17	626	NA	NA	162	1	29	NA	NA	NA	Startup Wizard
P21.1.18	2412	NA	NA	NA	NA	NA	NA	NA	NA	Jog Softkey Hidden
P21.1.19	2413	NA	NA	NA	NA	NA	NA	NA	NA	Reverse Softkey Hidden
P21.1.20	2424	NA	NA	NA	NA	NA	NA	NA	NA	Output Display Unit
P21.1.21	2460	NA	NA	NA	NA	NA	NA	NA	NA	Output Display Unit Min
P21.1.22	2425	NA	NA	NA	NA	NA	NA	NA	NA	Output Display Unit Max

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
P21.2.1	640	207	2	161	1	255	184	1	1	Keypad Software Version
P21.2.2	642	206	0	162	1	1	184	1	2	Motor Control Software Version
P21.2.3	644	207	1	1	1	4	184	1	3	Application Software Version
P21.3.1	646	2206	0	162	1	9	184	1	4	Brake Chopper
P21.3.2	647	2200	0	162	1	10	184	1	5	Brake Resistor Status
P21.3.3	648	209	0	162	1	8	184	1	6	Serial Number
P21.4.1	566	3000	0	160	1	21	185	1	1	Real Time Clock
P21.4.2	582	3001	0	162	1	12	185	1	2	Daylight Saving
P21.4.3	601	520	2	162	1	13	185	1	3	Total MWh Count
P21.4.4	603	522	0	162	1	14	185	1	4	Total Power Day Count
P21.4.5	606	821	1	162	1	15	185	1	5	Total Power Hr Count
P21.4.6	604	806	0	162	1	16	185	1	6	Trip MWh Count
P21.4.7	635	322	3	162	1	17	185	1	7	Clear Trip MWh Count
P21.4.8	636	870	0	162	1	18	185	1	8	Trip Power Day Count
P21.4.9	637	871	0	162	1	19	185	1	9	Trip Power Hr Count
P21.4.10	639	322	4	162	1	20	185	1	10	Clear Trip Power Count
B2.1.1	883	710	1	162	1	151	186	1	1	Board Status
B2.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B2.1.3	889	760	3	162	1	160	186	1	2	DI1, DI2, DI3
B2.1.4	888	761	3	162	1	159	186	1	3	DO1, DO2, DO3
B2.1.5	891	593	100	162	1	162	186	1	4	Thermistor Resistor
B2.1.6	887	753	100	162	1	158	186	1	5	Thermistor State
B2.2.1	241	461	100	162	1	155	186	1	6	DO1 Function
B2.2.2	242	461	101	162	1	156	186	1	7	DO2 Function
B2.2.3	243	461	102	162	1	157	186	1	8	DO3 Function
B2.2.4	890	343	100	162	1	161	186	1	9	Thermistor Config
B3.1.1	883	710	1	162	1	151	186	1	1	Board Status
B3.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B3.1.3	894	560	100	162	1	181	186	1	11	AI1 Value
B3.1.4	897	570	100	162	1	184	186	1	12	AO1 Value
B3.1.5	899	570	101	162	1	186	186	1	13	AO2 Value
B3.2.1	893	263	100	162	1	180	186	1	14	AI1 Mode
B3.2.2	124	260	100	162	1	164	186	1	15	AI1 Signal Range
B3.2.3	125	264	100	162	1	165	186	1	16	AI1 Custom Min
B3.2.4	126	265	100	162	1	166	186	1	17	AI1 Custom Max
B3.2.5	123	266	100	162	1	179	186	1	18	AI1 Filter Time
B3.2.6	127	267	100	162	1	163	186	1	19	AI1 Signal Invert
B3.2.7	896	276	100	162	1	183	186	1	20	AO1 Mode
B3.2.8	235	460	100	162	1	167	186	1	21	AO1 Function
B3.2.9	238	279	100	162	1	168	186	1	22	AO1 Minimum
B3.2.10	236	277	100	162	1	169	186	1	23	AO1 Filter Time
B3.2.11	239	274	100	162	1	170	186	1	24	AO1 Scale
B3.2.12	237	278	100	162	1	171	186	1	25	AO1 Inversion
B3.2.13	240	275	100	162	1	172	186	1	26	AO1 Offset
B3.2.14	898	276	101	162	1	185	186	1	27	AO2 Mode
B3.2.15	269	460	101	162	1	173	186	1	28	AO2 Function
B3.2.16	270	279	101	162	1	174	186	1	29	AO2 Minimum
B3.2.17	271	277	101	162	1	175	186	1	30	AO2 Filter Time

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
B3.2.18	272	274	101	162	1	176	186	1	31	AO2 Scale
B3.2.19	273	278	101	162	1	177	186	1	32	AO2 Inversion
B3.2.20	274	275	101	162	1	178	186	1	33	AO2 Offset
B4.1.1	883	710	1	162	1	151	186	1	1	Board Status
B4.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B4.1.3	900	455	100	162	1	190	186	1	35	RO1, RO2, RO3
B4.2.1	540	451	100	162	1	187	186	1	36	RO1 Function
B4.2.2	541	451	101	162	1	188	186	1	37	RO2 Function
B4.2.3	551	451	102	162	1	189	186	1	38	RO3 Function
B5.1.1	883	710	1	162	1	151	186	1	1	Board Status
B5.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B5.1.3	905	756	100	162	1	195	186	1	40	PT100 State
B5.1.4	902	NA	NA	162	1	194	186	1	41	PT100 Values
B5.2.1	901	342	100	162	1	191	186	1	42	PT100-3,2,1
B5.2.2	338	581	100	162	1	192	186	1	43	PT100 Warning Limit
B5.2.3	339	582	100	162	1	193	186	1	44	PT100 Fault Limit
B6.1.1	883	710	1	162	1	151	186	1	1	Board Status
B6.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B6.1.3	908	760	3	162	1	196	186	1	46	AC1, AC2, AC3
B6.1.4	1696	760	7	162	1	197	186	1	47	AC4, AC5, AC6
B7.1.1	883	710	1	162	1	151	186	1	1	Board Status
B7.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B7.1.3	2131	NA	NA	164	1	90	NA	NA	NA	Protocol Status
B7.2.1	1242	3201	100	163	1	116	NA	NA	NA	Slave Address
B7.2.2	1243	3202	100	163	1	117	NA	NA	NA	Baud Rate
B7.2.3	1244	3204	0	163	1	118	NA	NA	NA	DO IO Data
B7.2.4	1245	3200	100	163	1	119	NA	NA	NA	Operate Mode
B7.2.5	2519	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
B8.1.1	883	710	1	162	1	151	186	1	1	Board Status
B8.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B8.1.3	2132	NA	NA	164	1	91	NA	NA	NA	Protocol Status
B8.2.1	2133	NA	NA	164	1	92	NA	NA	NA	Node ID
B8.2.2	2134	NA	NA	164	1	93	NA	NA	NA	Baud Rate
B8.2.3	2135	NA	NA	164	1	94	NA	NA	NA	Operate Mode
B8.2.4	2519	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
B9.1.1	883	710	1	162	1	151	186	1	1	Board Status
B9.1.2	1064	NA	NA	162	1	154	NA	NA	NA	Firmware Version
B9.1.3	2136	NA	NA	164	1	95	187	1	2	Protocol Status
B9.2.1	2137	NA	NA	164	1	96	187	1	3	MAC ID
B9.2.2	2138	NA	NA	164	1	97	187	1	4	Baud Rate
B9.2.3	2187	NA	NA	NA	NA	NA	NA	NA	NA	IO Poll Type
B9.2.4	2212	NA	NA	NA	NA	NA	41	1	109	Dnet Comm Timeout
B9.2.5	2519	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
B11.1.1	910	710	2	162	1	199	187	1	10	Board Status
B11.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B11.1.3	915	550	200	162	1	208	187	1	11	DI1, DI2, DI3
B11.1.4	914	761	2	162	1	207	187	1	12	DO1, DO2, DO3

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
B11.1.5	917	593	200	162	1	210	187	1	13	Thermistor Resistor
B11.1.6	913	753	200	162	1	206	187	1	14	Thermistor State
B11.2.1	244	461	200	162	1	203	187	1	15	DO1 Function
B11.2.2	245	461	201	162	1	204	187	1	16	DO2 Function
B11.2.3	246	461	202	162	1	205	187	1	17	DO3 Function
B11.2.4	916	343	200	162	1	209	187	1	18	Thermistor Config
B12.1.1	910	710	2	162	1	199	187	1	10	Board Status
B12.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B12.1.3	920	560	200	162	1	229	187	1	20	AI1 Value
B12.1.4	923	570	200	162	1	232	187	1	21	AO1 Value
B12.1.5	925	570	201	162	1	234	187	1	22	AO2 Value
B12.2.1	919	NA	NA	162	1	228	187	1	23	AI1 Mode
B12.2.2	129	260	200	162	1	212	187	1	24	AI1 Signal Range
B12.2.3	130	264	200	162	1	213	187	1	25	AI1 Custom Min
B12.2.4	131	265	200	162	1	214	187	1	26	AI1 Custom Max
B12.2.5	128	266	200	162	1	227	187	1	27	AI1 Filter Time
B12.2.6	132	267	200	162	1	211	187	1	28	AI1 Signal Invert
B12.2.7	922	276	200	162	1	231	187	1	29	AO1 Mode
B12.2.8	275	460	200	162	1	215	187	1	30	AO1 Function
B12.2.9	276	279	200	162	1	216	187	1	31	AO1 Minimum
B12.2.10	277	277	200	162	1	217	187	1	32	AO1 Filter Time
B12.2.11	278	274	200	162	1	218	187	1	33	AO1 Scale
B12.2.12	279	278	200	162	1	219	187	1	34	AO1 Inversion
B12.2.13	280	275	200	162	1	220	187	1	35	AO1 Offset
B12.2.14	924	276	201	162	1	233	187	1	36	AO2 Mode
B12.2.15	281	460	201	162	1	221	187	1	37	AO2 Function
B12.2.16	282	279	201	162	1	222	187	1	38	AO2 Minimum
B12.2.17	283	277	201	162	1	223	187	1	39	AO2 Filter Time
B12.2.18	284	274	201	162	1	224	187	1	40	AO2 Scale
B12.2.19	285	278	201	162	1	225	187	1	41	AO2 Inversion
B12.2.20	286	275	201	162	1	226	187	1	42	AO2 Offset
B13.1.1	910	710	2	162	1	199	187	1	10	Board Status
B13.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B13.1.3	926	762	2	162	1	238	187	1	44	RO1, RO2, RO3
B13.2.1	552	451	200	162	1	235	187	1	45	RO1 Function
B13.2.2	555	451	201	162	1	236	187	1	46	RO2 Function
B13.2.3	556	451	202	162	1	237	187	1	47	RO3 Function
B14.1.1	910	710	2	162	1	199	187	1	10	Board Status
B14.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B14.1.3	931	757	2	162	1	243	187	1	49	PT100 State
B14.1.4	928	NA	NA	162	1	242	187	1	50	PT100 Values
B14.2.1	927	342	200	162	1	239	187	1	51	PT100-3,2,1
B14.2.2	937	581	200	162	1	240	187	1	52	PT100 Warning Limit
B14.2.3	938	582	200	162	1	241	187	1	53	PT100 Fault Limit
B15.1.1	910	710	2	162	1	199	187	1	10	Board Status
B15.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B15.1.3	934	760	4	162	1	244	187	1	55	AC1, AC2, AC3
B15.1.4	1697	760	8	162	1	245	187	1	56	AC4, AC5, AC6
B16.1.1	910	710	2	162	1	199	187	1	10	Board Status

Table 188. Parameter ID list, continued

Menu Item No.	Modbus Register	Profibus PNU	Profibus PNU SubIndex	EtherNet/ IP Class	EtherNet/ IP Instance	EtherNet/ IP Attribute	DeviceNET Class	DeviceNET Instance	DeviceNET Attribute	Parameter Description
B16.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B16.1.3	2142	NA	NA	164	1	101	NA	NA	NA	Protocol Status
B16.2.1	1250	3201	200	163	1	120	NA	NA	NA	Slave Address
B16.2.2	1251	3202	200	163	1	121	NA	NA	NA	Baud Rate
B16.2.3	1252	3204	200	163	1	122	NA	NA	NA	DO IO Data
B16.2.4	1253	3200	200	163	1	123	NA	NA	NA	Operate Mode
B16.2.5	2520	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
B17.1.1	910	710	2	162	1	199	187	1	10	Board Status
B17.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B17.1.3	2143	NA	NA	164	1	102	NA	NA	NA	Protocol Status
B17.2.1	2144	NA	NA	164	1	103	NA	NA	NA	Node ID
B17.2.2	2145	NA	NA	164	1	104	NA	NA	NA	Baud Rate
B17.2.3	2146	NA	NA	164	1	105	NA	NA	NA	Operate Mode
B17.2.4	2520	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
B18.1.1	910	710	2	162	1	199	187	1	10	Board Status
B18.1.2	1067	NA	NA	162	1	202	NA	NA	NA	Firmware Version
B18.1.3	2147	NA	NA	164	1	106	187	1	69	Protocol Status
B18.2.1	2148	NA	NA	164	1	107	187	1	70	MAC ID
B18.2.2	2149	NA	NA	164	1	108	187	1	71	Baud Rate
B18.2.3	2188	NA	NA	NA	NA	NA	NA	NA	NA	IO Poll Type
B18.2.4	2212	NA	NA	NA	NA	NA	41	1	109	Dnet Comm Timeout
B18.2.5	2520	NA	NA	NA	NA	NA	NA	NA	NA	Comm Card FB Fault Response
O1	1	502	0	160	1	1	160	1	1	Output Frequency
O2	24	1	0	160	1	2	160	1	2	Freq Reference
O3	2	503	0	4	70	3	4	70	3	Motor Speed
O4	3	504	0	160	1	4	160	1	4	Motor Current
O5	4	507	0	160	1	5	160	1	5	Motor Torque
O6	5	513	1	160	1	6	160	1	6	Motor Power
O7	6	501	0	160	1	7	160	1	7	Motor Voltage
O8	7	501	1	160	1	8	160	1	8	DC-link Voltage
O9	8	822	6	160	1	9	160	1	9	Unit Temperature
O10	9	822	4	160	1	10	160	1	10	Motor Temperature
R11	782	2	2	162	1	138	161	1	11	Keypad Torque Ref
R12	141	1	8	160	1	155	161	1	12	Keypad Reference
R13	1307	2170	0	160	1	226	170	1	11	PID1 Keypad Set Point 1
R14	1309	2179	0	160	1	227	170	1	12	PID1 Keypad Set Point 2

Appendix B—Process data values

Process data OUT (slave → master)

The fieldbus master can read the frequency converter's actual values using process data variables. All software applications use process data as follows:

Table 189. Process data OUT (slave → master)

Data	Value	Unit	Scale	Default, Min., Max.
Process data out 1	Output frequency	Hz	0.01 Hz	
Process data out 2	Motor dpeed	rpm	1 rpm	
Process data out 3	Motor current	A	0.1 A	
Process data out 4	Motor torque	%	0.10%	
Process data out 5	Motor power	%	0.10%	
Process data out 6	Motor voltage	V	0.1 V	
Process data out 7	DC link voltage	V	1 V	
Process data out 8	Latest fault code			

Note: The communication parameter group in any application has a selector parameter for every process data. The monitoring values and drive parameters can be selected using the ID number. Default selections are shown in the table above. Reference **Appendix A** for Modbus IDs that can be set via the keypad P20.1 FB Process Data Out group.

Process data IN (master → slave)

Control word, Reference and Process Data are used with All-in-One applications as follows:

Table 190. Process data IN (master → slave)

Application data	Standard and multi-pump palue	Data type	Unit	Scale	Default
Reference	Speed reference	UINT	%	0.01%	0
FBFixedControlWord	Start/Stop/Fault reset command	UINT	—	—	—
PD1 – PD7	Not used	UINT	—	—	—
PD8	Analog output	UINT	—	—	—

Application Data	Multi-purpose control value	Data type	Unit	Scale	Default
Reference	Speed reference	UINT	%	0.01%	0
FBFixedControlWord	Start/Stop/Fault reset command	UINT	—	—	—
Process data IN1	Torque reference	UINT	%	0.10%	0
Process data IN2	Reference for PID1 controller	UINT	%	0.01%	0
Process data IN3	Actual value 1 to PID1 controller	UINT	%	0.01%	0
Process data IN4	Actual value 2 to PID1 controller	UINT	%	0.01%	0
Process data IN5	Reference for PID2 controller	UINT	%	0.01%	0
Process data IN6	Actual value 1 to PID2 controller	UINT	%	0.01%	0
Process data IN7	Actual value 2 to PID2 controller	UINT	%	0.01%	0
Process data IN8	Analog output	UINT	%	0.01%	0

Application data	PID Control value	Data type	Unit	Scale	Default
Reference	Speed reference	UINT	%	0.01%	0
FBFixedControlWord	Start/stop/fault reset command	UINT	—	—	—
Process data IN1	Not used	UINT	—	—	—
Process data IN2	Reference for PID1 controller	UINT	%	0.01%	0
Process data IN3	Actual value 1 to PID1 controller	UINT	%	0.01%	0
Process data IN4	Actual value 2 to PID1 controller	UINT	%	0.01%	0
Process data IN5	Reference for PID2 controller	UINT	%	0.01%	0
Process data IN6	Actual value 1 to PID2 controller	UINT	%	0.01%	0
Process data IN7	Actual value 2 to PID2 controller	UINT	%	0.01%	0
Process data IN8	Analog output	UINT	%	0.01%	—

To change the Application, go into the P21.1.2 Application to adjust the desired All-in-One application.

DG1 Process data definition

When configuring the Process Data parameters for the DG1 drive there are many parameters which can monitored over the fieldbus and selected using the P20.1.1 to P20.1.8 menu items.

Menu Item	Parameter	Parameter Number	Default Monitored Parameter
P20.1.1	FB Data Out 1 Sel	1	Output Frequency
P20.1.2	FB Data Out 2 Sel	2	Motor Speed
P20.1.3	FB Data Out 3 Sel	3	Motor Current
P20.1.4	FB Data Out 4 Sel	4	Motor Torque
P20.1.5	FB Data Out 5 Sel	5	Motor Power
P20.1.6	FB Data Out 6 Sel	6	Motor Voltage
P20.1.7	FB Data Out 7 Sel	7	DC-link Voltage
P20.1.8	FB Data Out 8 Sel	8	Unit Temperature

However, since these **P20.1.1** to **P20.1.8** Menu Items are read write items, these monitored parameters can be modified to any parameter in the DG1 by simply changing the value for the **P20.1** menu item. For example, if in **FB Data Out 8** one wanted to monitor the state of the Digital Inputs D1 to D3 they would change **P20.1.8** from an 8 to a 12. For a complete list of parameters please refer to Communication Application Guide **MN040010EN** which can be found on the www.eaton.com/drives web site.

Typically the parameters which are monitored over fieldbus are the same types of parameters monitored on the Monitoring menu of the drive, a list of those parameters and IDs are provided below.

Parameter ID	Description	Parameter ID	Description
1	Output Frequency	16	PID1 Set Point
2	Motor Speed	18	PID1 Feedback
3	Motor Current	20	PID1 Error Value
4	Motor Torque	22	PID1 Output
5	Motor Power	23	PID1 Status
6	Motor Voltage	24	Freq Reference
7	DC-link Voltage	25	Analog Output 1
8	Unit Temperature	26	Running Motors
9	Motor Temperature	27	PT100 Temperature
10	Analog Input 1	28	Last Active Fault
11	Analog Input 2	30	Multi-Monitoring
12	DI1, DI2, DI3	32	PID2 Set Point
13	DI4, DI5, DI6	34	PID2 Feedback
14	DO1	36	PID2 Error Value
15	Torque Reference	38	PID2 Output
		39	PID2 Status

Appendix C—Fault codes

Fault codes

Table 191. Fault code list

Fault Code	Fault Name	Fault type	Default	Realization	CIP Fault code	PROFIdrive fault code
1	Over current	Fault		DSP	0x2310h	8976
2	Over voltage	Fault		DSP	0x3210h	12816
3	Earth vault	Configurable	Fault	DSP	0x2330h	9008
5	Charging switch	Fault		DSP	0xA000h	12849
6	Emergency stop	Fault		MCU	0xA001h	21121
7	Saturation trip	Fault		DSP	0xA002h	29040
9	UnderVoltage	Configurable	Fault	DSP/MCU	0x3220h	12576
10	Input Phase Spv	Configurable	Fault	DSP	0xA004h	8528
11	Output Phase Spv	Configurable	Fault	DSP	0xA005h	9040
12	BrakeChopperSpv	Fault		DSP	0x7110h	28944
13	Drive underTemp	Configurable	Warning	DSP	0x4320h	16928
14	Drive overTemp	Fault		DSP	0x4310h	16912
15	Motor stalled	Configurable	No Action	DSP	0x7121h	28963
16	Motor overTemp	Configurable	No Action	DSP	0x4210h	17168
17	Motor underLoad	Configurable	No Action	DSP	29d	28979
18	IP address conflict	Configurable	Warning	MCU	0xA006h	30070
19	Power board EEPROM fault	Fault		MCU	0xA007h	21795
20	FRAM fault	Fault		MCU	0xA008h	21777
21	Serial flash fault	warning		MCU	0xA009h	21796
25	MCU WatchDog fault	Fault		MCU	0x6010h	24848
26	Start-up prevent	Fault		MCU	0xA00Ah	35585
29	Thermistor fault	Configurable	Fault	MCU	0x7300h	28978
32	Fan cooling	Fault		DSP	0xA00Bh	28689
36	Compatibility fault	Fault		MCU	0x5200h	24849
37	Device change	Warning		MCU	0xA00Ch	35360
38	Device added	Warning		MCU	0xA00Dh	35361
39	Device removed	Fault		MCU	0xA00Eh	35362
40	Device Unknown	Fault		MCU	0xA00Fh	35363
41	IGBT temperature	Fault		DSP	66d	16913
50	AIN<4mA(4to20mA)	Configurable	No Action	MCU	0xA011h	29520
51	External fault	Configurable	Fault	MCU	0x9000h	36864
52	Keypad communication fault	Configurable	Fault	MCU	0xA012h	21264
54	OPT card fault	Configurable	Fault	MCU	0xA013h	35073
55	Real time clock fault	Configurable	Warning	MCU	0xA015h	35344
56	PT100 fault	Configurable	Fault	MCU	0xA016h	29536
57	Motor ID fault	Fault		DSP	0xA017h	29072
59	Possible power wiring error detected	Fault		DSP	0x5400h	37121
58	Current measure fault	Fault		DSP	0x2100h	9217
60	Control board overtemp	Fault		DSP	0x4300h	16914
61	Internal-ctrl supply	Fault		MCU	0x5112h	20737
62	Too many speed search restarts	Fault		DSP	0xA018h	33809

Table 191. Fault Code List, continued

Fault Code	Fault Name	Fault type	Default	Realization	CIP Fault code	PROFIdrive fault code
63	Current unbalance	Fault		DSP	26d	9056
64	Replace battery	Configurable	Warning	MCU	0xA019h	35345
65	Replace fan	Configurable	Warning	MCU	0xA01Ah	28688
66	Safety torque off	Fault		DSP	0xA01Bh	21665
67	Current limit control	Warning		DSP	0x2200h	8977
68	Over voltage control	Warning		DSP	0x3310h	12817
69	System Fault - Thermistor SPI	Fault		MCU	0xA01Ch	21009
70	System Fault - DSP Parameter	Fault		MCU	0xA01Dh	22018
71	System Fault - Intercom	Fault		MCU	0xA01Eh	22019
72	Power board EEPROM fault	Fault		MCU	0xA01Fh	22305
73	Internal FRAM	Fault		MCU	0xA020h	22033
74	FRAM data error	Fault		MCU	0xA021h	21809
75	Internal power board EEPROM fault	Fault		MCU	0xA022h	22035
76	EEPROM Data error	Fault		MCU	0xA023h	21808
77	Internal serial flash	Fault		MCU	0xA024h	22051
82	Bypass overload	Fault		MCU	0xA025h	28980
83	FieldBus fault	Configurable	Fault	MCU	0xA026h	30064
84	FieldBus fault	Configurable	Fault	MCU	0xA027h	30065
85	FieldBus fault	Configurable	Fault	MCU	0xA028h	30066
86	FieldBus fault	Configurable	Fault	MCU	0x8100h	30067
87	FieldBus fault	Configurable	Fault	MCU	0xA029h	30068
88	FieldBus fault	Configurable	Fault	MCU	0xA02Ah	30069
89	Under voltage	Fault		DSP	0xA02Bh	30070
90	Drive UnderTemp	Warning/Fault		DSP	0x3221h	30071
91	Option card fault	Fault		MCU	0xA02Ch	30072
92	External fault 2	Configurable	Fault	MCU	0xA02Dh	NA
93	External fault 3	Configurable	Fault	MCU	0xA02Eh	NA
94	Pump lost	Warning		MCU	0xA02Fh	58881
95	Need alternation	Warning		MCU	0xA030	58882
96	Parameter error	Warning		MCU	0x6320	33072
97	Prime loss	Configurable	No Action	MCU	0xA031	35587
98	PID1 feedback AI loss	Configurable	No Action	MCU	0xA032	33283
99	PID2 feedback AI loss	Configurable	No Action	MCU	0xA033	33284

Note: Configurable—Faults that are specified as "Configurable" have "Fault configuration parameter" associated with them. This configuration parameter can be configured as using keypad (menu P9. Protections) or using PowerXL EIP vendor specific object.

Eaton is dedicated to ensuring that reliable, efficient and safe power is available when it's needed most. With unparalleled knowledge of electrical power management across industries, experts at Eaton deliver customized, integrated solutions to solve our customers' most critical challenges.

Our focus is on delivering the right solution for the application. But, decision makers demand more than just innovative products. They turn to Eaton for an unwavering commitment to personal support that makes customer success a top priority. For more information, **visit www.eaton.com/electrical.**

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Printed in USA
Publication No. MN040010EN / Z16334
September 2016

Powering Business Worldwide