

PowerXL DG1 Series VFD

Communication Manual

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New Information



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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.

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 adjustable frequency drive (AFD). 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 AFD. Keep this operating manual handy and distribute to all users, technicians and maintenance personnel for reference.

Receiving and Inspection

The DG1 Series AFD 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 AFD, 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 AFD 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 AFD, 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%)
AFD	Adjustable Frequency Drive
VFD	Variable Frequency Drive

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

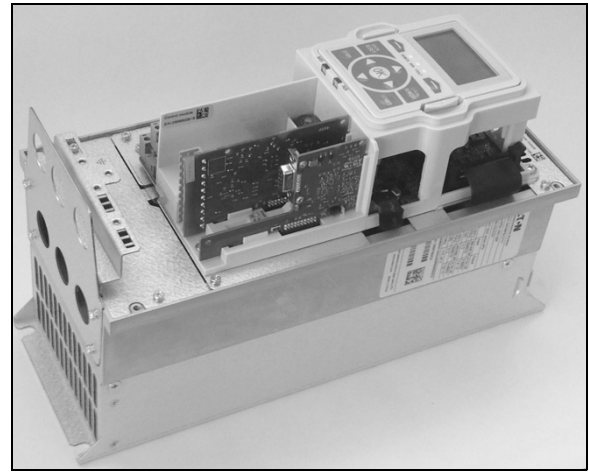
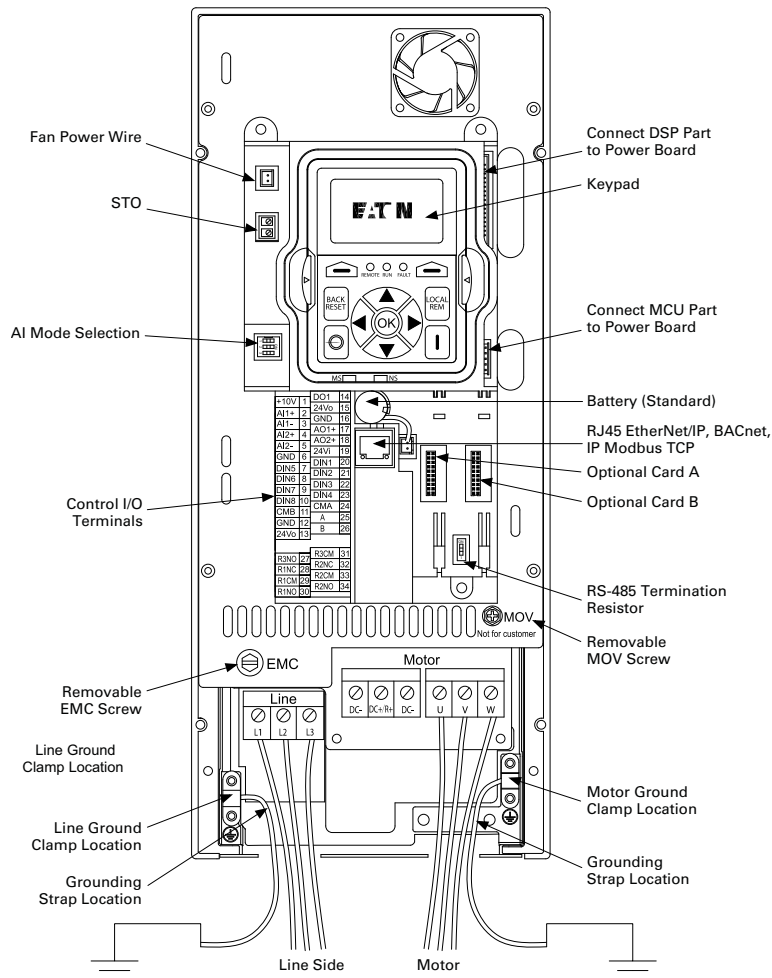


Figure 4. Drive Control Board Layout Showing Option Card Slots

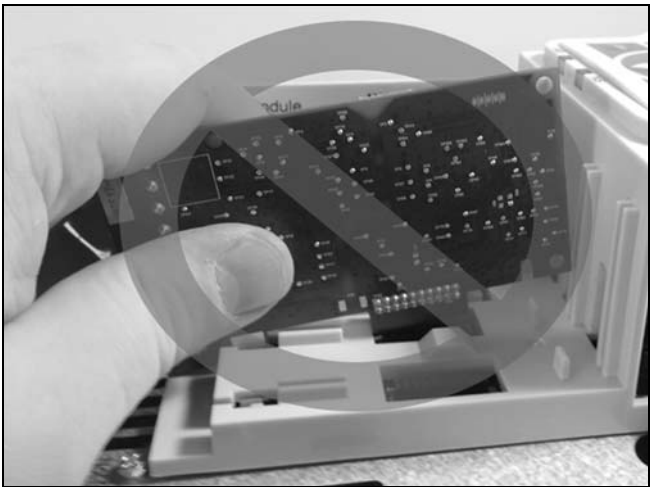
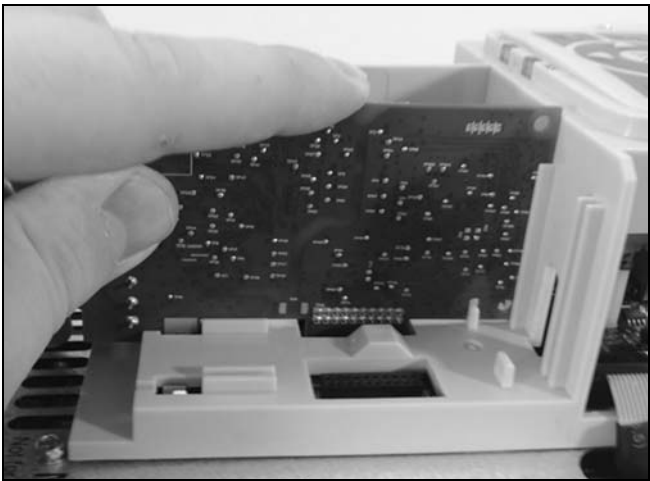


Installing DG1 Option Board

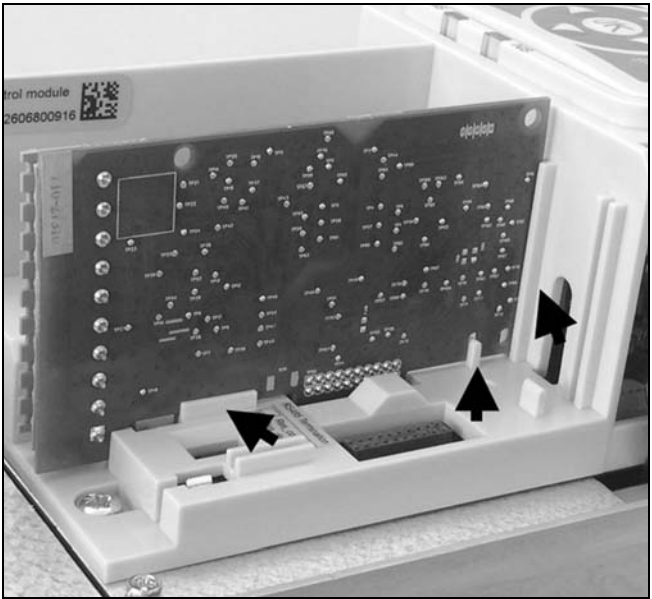
Remove Utility line and control power from the PowerXL DG1 series drive. Install the option board in one of the slots available on the control board. To insert and remove the board, hold it in a horizontally straight position to avoid twisting the connector pins.

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

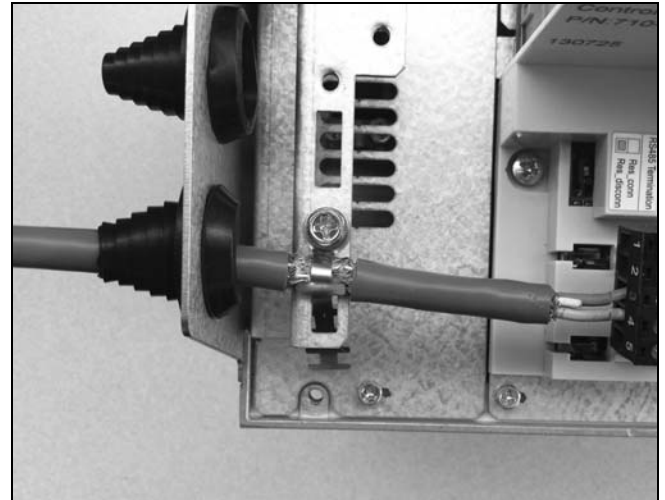
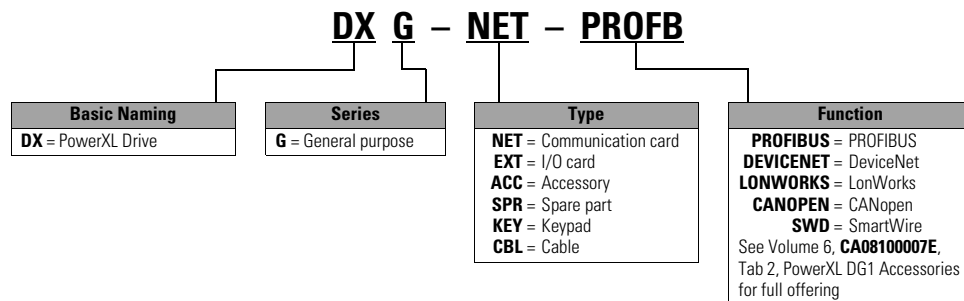


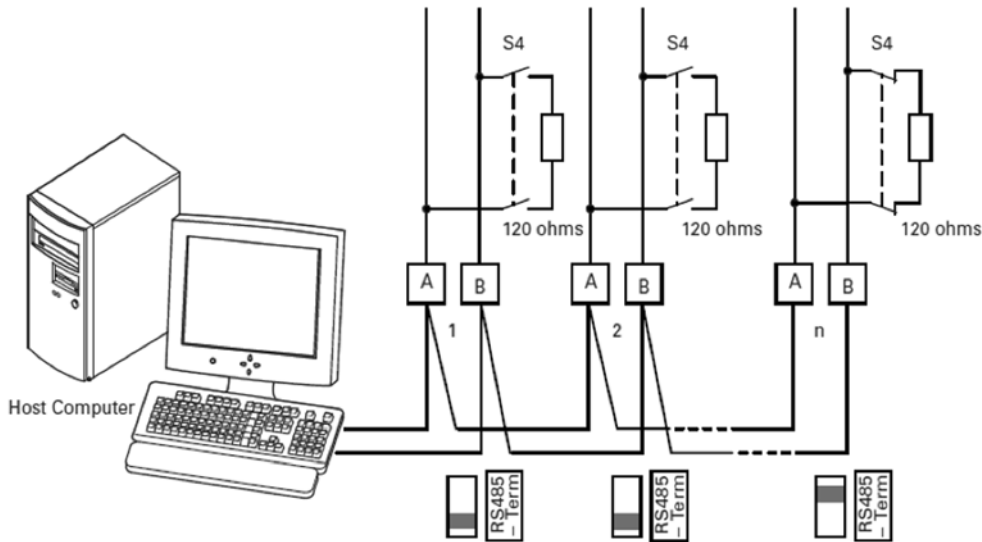
Table 4. PowerXL Series—DG1 General Purpose Drive Option Boards



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

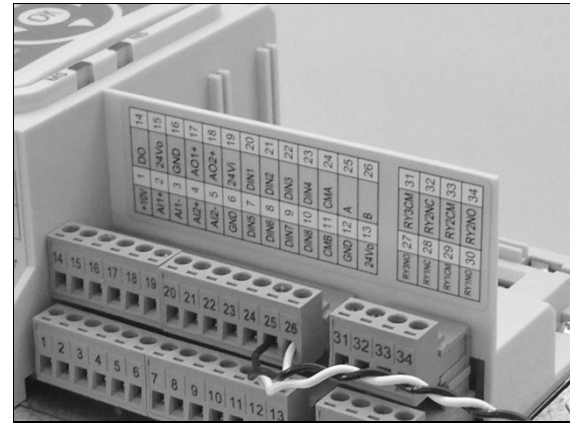
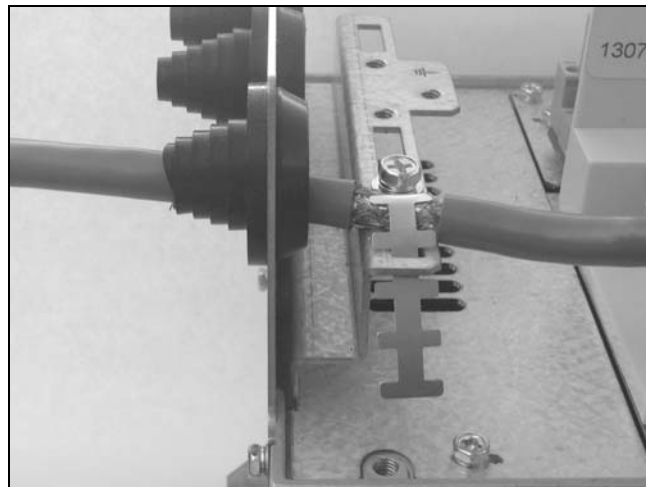
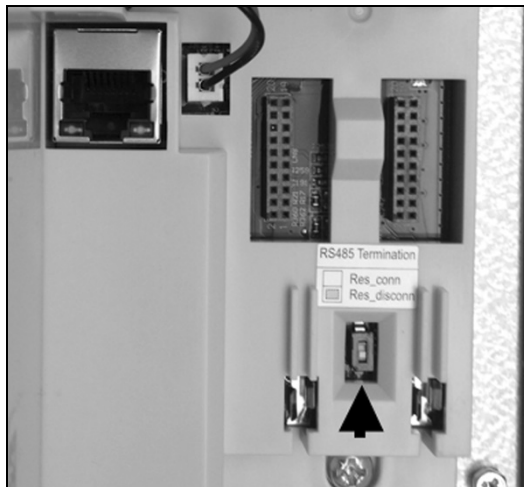


Figure 8. Termination Resistor and Shielding



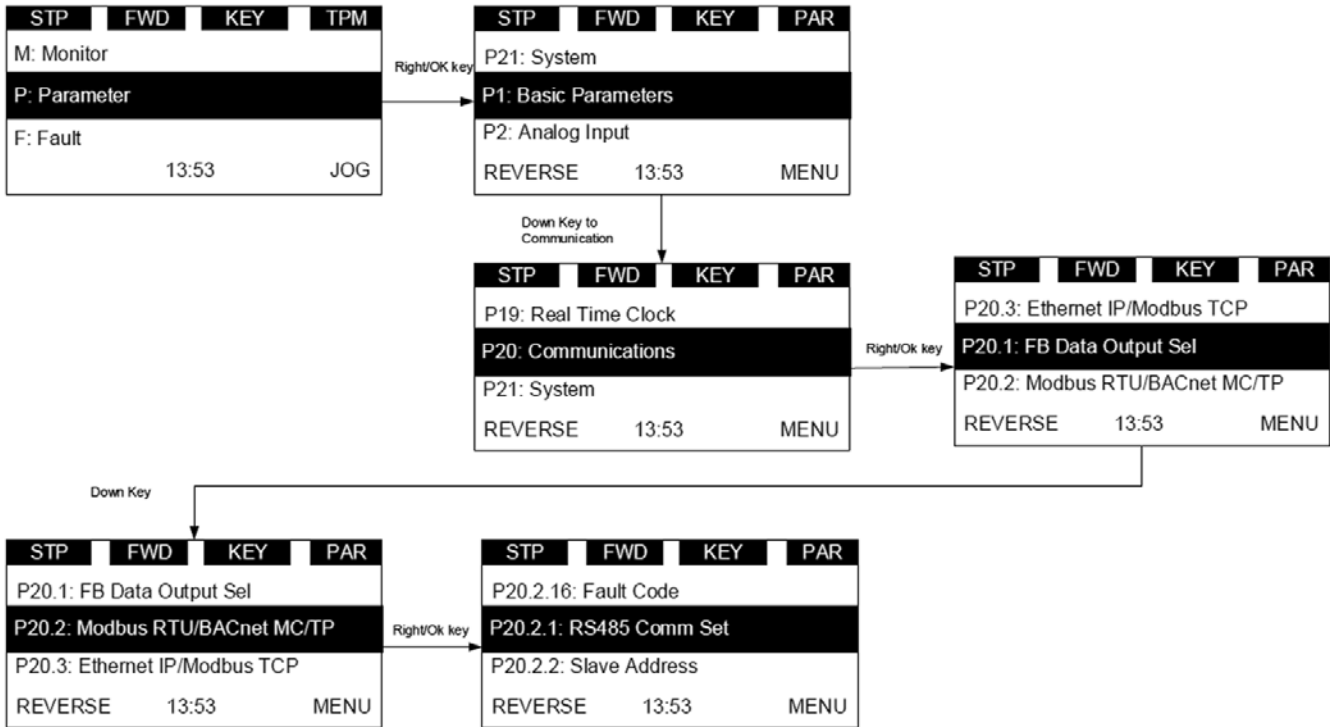
Commissioning

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
P20.2.2	Slave Address	1	247		18	587	
P20.2.3	Baud Rate				2	584	0 = 9600 1 = 19200 2 = 38400 3 = 57600 4 = 115200
P20.2.4	Parity Type				2	585	0 = None 1 = Odd 2 = Even
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	2000	593	

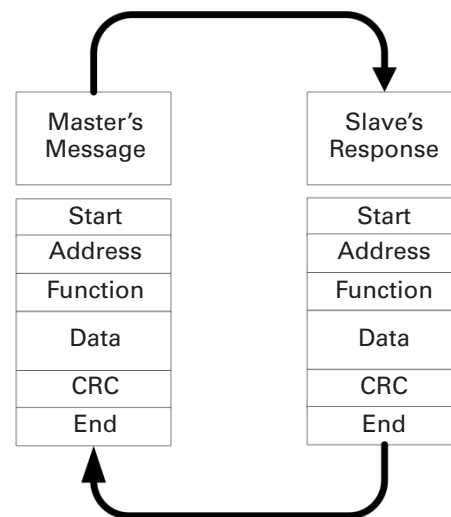
The parameters of every device must be set before connecting to the bus. Each parameter must be the same as the master configuration.

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: 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) Note. Only support sub function code 0x0000
Sub function Low	0x00	
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 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) Note. Output value is 0x0000 or 0xFF00
Output value Low	0x00	
CRC High	0x8E	
CRC Low	0x14	

Modbus RTU On-Board Communications

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 bits 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
99	40099 (30099)	Fault Code	1/1
101–1999	40101–41999 (30101–31999)	Parameters	1/1
2001–2099	42001–42099 (32001–32099)	Process Data In	20/20
2101–2199	42101–42199 (32101–32199)	Process Data Out	20/20

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

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	②	②	BYS	①	①	①	①	F_RST	DIR	RUN

Notes

- ① Not for use.
- ② Net Cntrl.

Table 25. 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.

Process Data In 1 to 8

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

For Older Firmwares (eg V.14, Note that the FB Speed Reference is NOT in %... but rather in HZ. eg. 5000 = 50HZ, NOT 50%.

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 26. 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	Hz
2104	32104, 42104	FB Process Data Out 1	Speed % (1)
2105	32105, 42105	FB Process Data Out 2	Power % (15)
2106	32106, 42106	FB Process Data Out 3	FaultCode (28)
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 27. 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 28. 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 29. 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.

Process Data Out 1 to 8

Process Data Out values 1 to 8 can be used in application for various purposes. See DG1 application manual for what these values can be set to.

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.

Table 30. Process Data OUT

ID	Data	Value	Unit	Scale
2104	Process Data OUT 1	–32768–32767	—	—
2105	Process Data OUT 2	–32768–32767	—	—
2106	Process Data OUT 3	–32768–32767	—	—
2107	Process Data OUT 4	–32768–32767	—	—
2108	Process Data OUT 5	–32768–32767	—	—
2109	Process Data OUT 6	–32768–32767	—	—
2110	Process Data OUT 7	–32768–32767	—	—
2111	Process Data OUT 8	–32768–32767	—	—

Process Data IN (Master → Slave)

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

Table 31. Process Data IN

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

Startup Test

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

- Set FB control word (Modbus Address 42000) value to 1hex. **NOT 0x01... SHOULD BE 0x31**
- DG1 status is RUN.
- Set FB Speed reference (Modbus Address 42002) value to 5000 (=50.00%).
- The Actual value is 5000 and the DG1 output frequency is 50.00%.
- Set FB control word (Modbus Address 42000) value to 0hex. **NOT 0x00... SHOULD BE 0x30**
- DG1 status is STOP.

Modbus TCP On-Board Communications

Modbus/TCP Specifications

Table 32. 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.

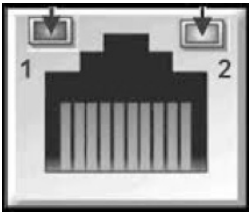
- Byte 0. Transaction ID High
- Byte 1. Transaction ID Low
- Byte 2. Protocol ID High
- Byte3. Protocol ID Low
- Byte 4. Length field High
- Byte 5. Length field Low
- Byte 6. Unit identifier
- Byte 7. Modbus function code
- Byte 8. Data (of variable length)

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 33. Ethernet LED Description

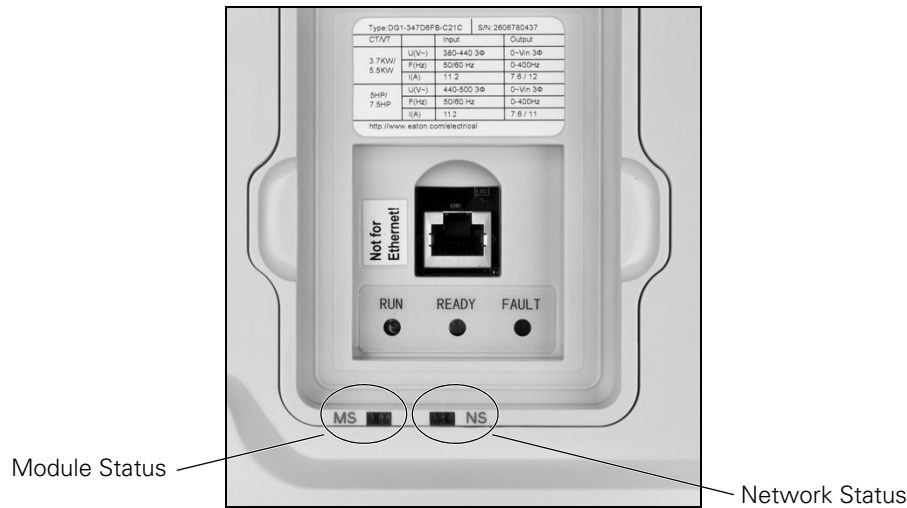
LED	Meaning
Ethernet link status	Flashes with Ethernet message activity.
Ethernet link speed	Displays the link speed. Yellow LED on the Ethernet Jack is ON when link speed is 100 mbps Yellow LED on the Ethernet Jack is OFF when link speed is 10 mbps

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 34. 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 ①	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 35. 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	Major fault	PowerXL has detected a non-recoverable major fault.
Flashing Green/Red ①	Self-test	PowerXL is performing its power up testing.

① Flash rate is 1 flash per second.

Commissioning

Connections and Wiring

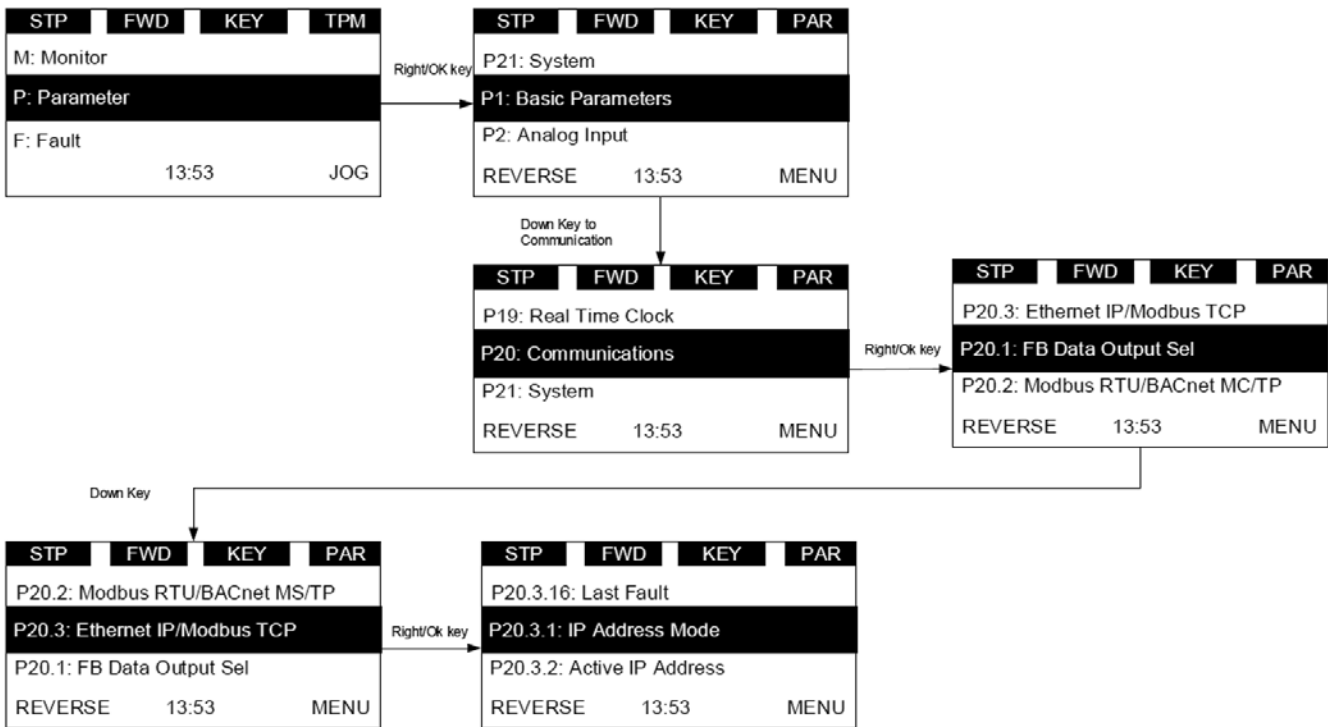
The Ethernet port supports 10/100 Mb speeds in both full and half-duplex modes. The boards must be connected to the Ethernet network with a shielded CAT-5e cable. A crossover cable (at least CAT-5e cable with STP, shielded twisted pair) may be needed if you want to connect the EtherNet/IP board directly 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 36. 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 36. 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	
P20.3.9	Connection Limit	0	2		2	609	
P20.3.10	Modbus TCP Unit ID				1	610	
P20.3.11	Comm Timeout Modbus TCP			ms	2000	611	
P20.3.12	Protocol Status				0	612	0 = Stopped 1 = Operational 2 = Faulted
P20.3.13	Slave Busy				0	613	0 = Not Busy 1 = Busy
P20.3.14	Parity Error				0	614	
P20.3.15	Slave Failure				0	615	
P20.3.16	Last Fault Response				0	616	

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 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.

Manual IP Address Configuration

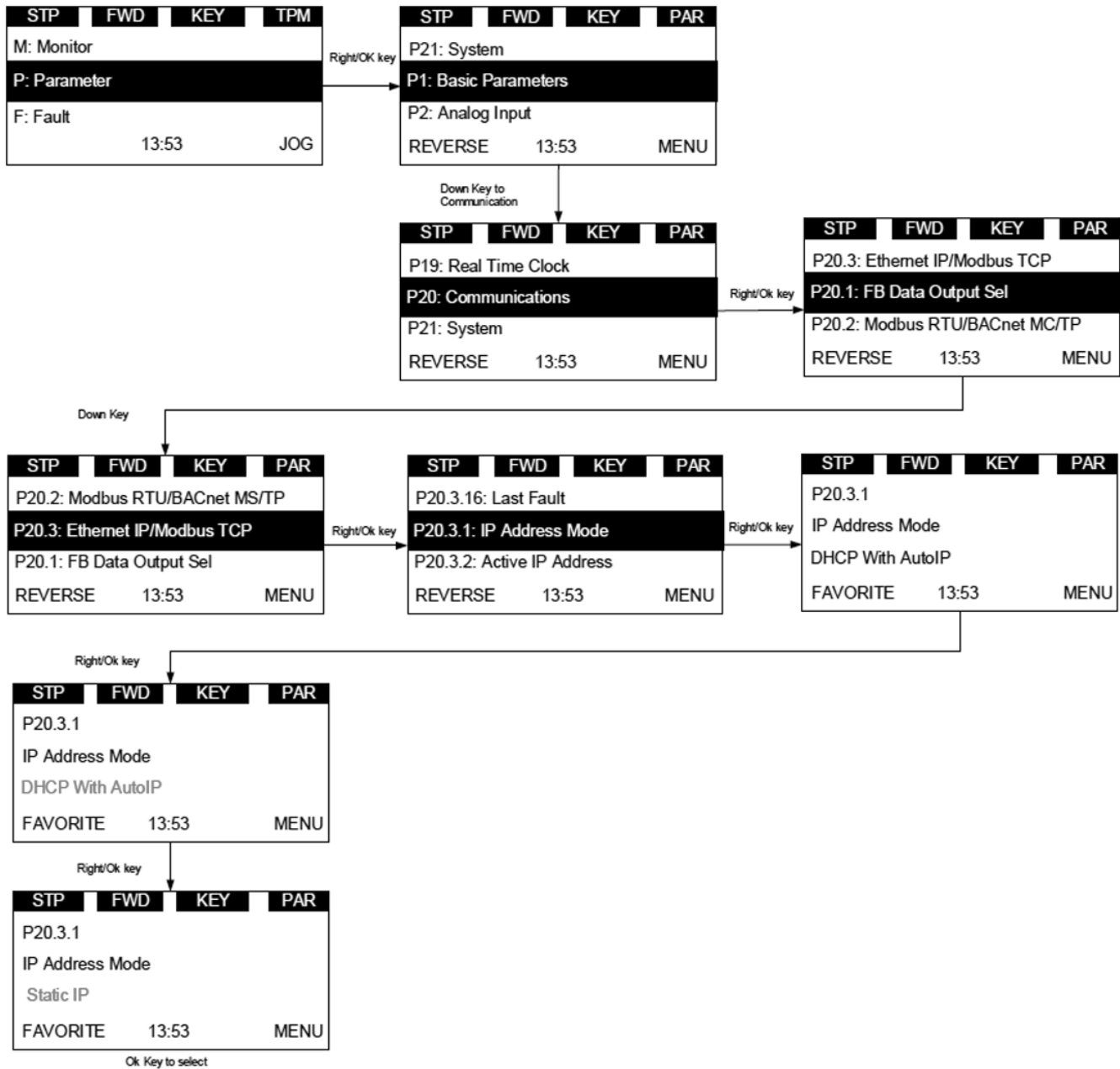
Using the PowerXL Drive Keypad

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

- 1. Select IP addressing mode as Default static IP configurations will be loaded.

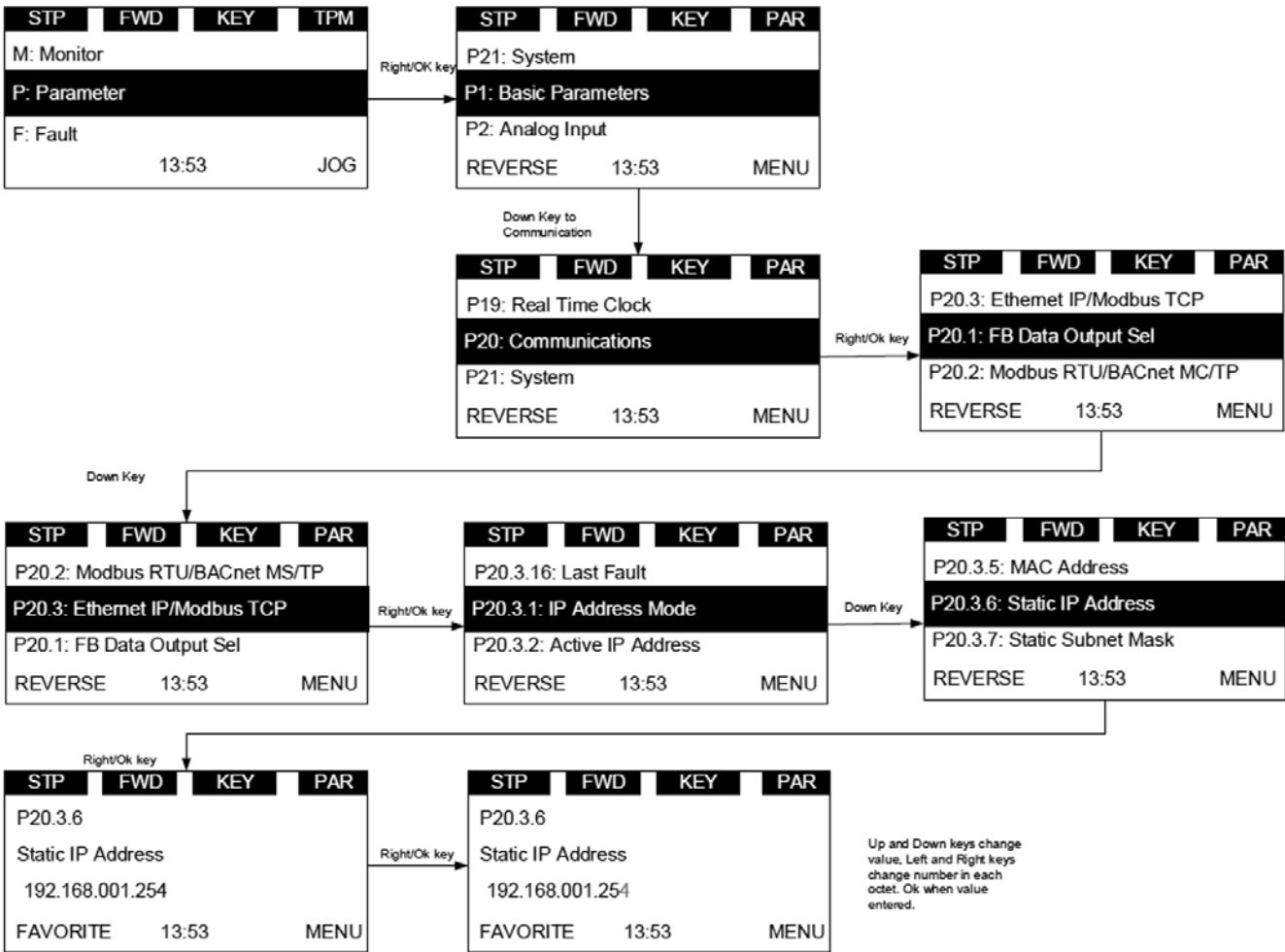
Note: Change in IP address mode will require PowerXL to power cycle to get this change effective. Also ensure device MAC address (Keypad menu. P20.3.5)

Figure 14. Static IP Mode



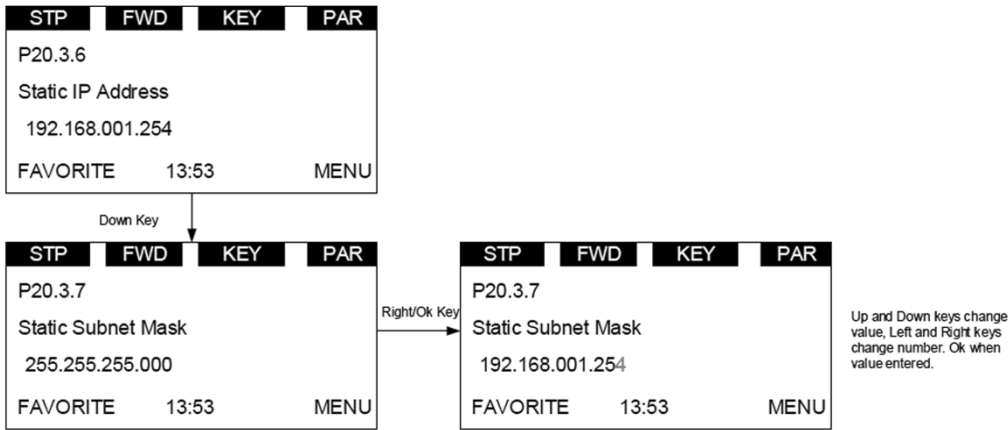
- 2. Using PowerXL drive keypad, set the IP address in the PowerXL EIP to the desired address setting by.
 - a. Setting Static IP Address

Figure 15. Static IP Address



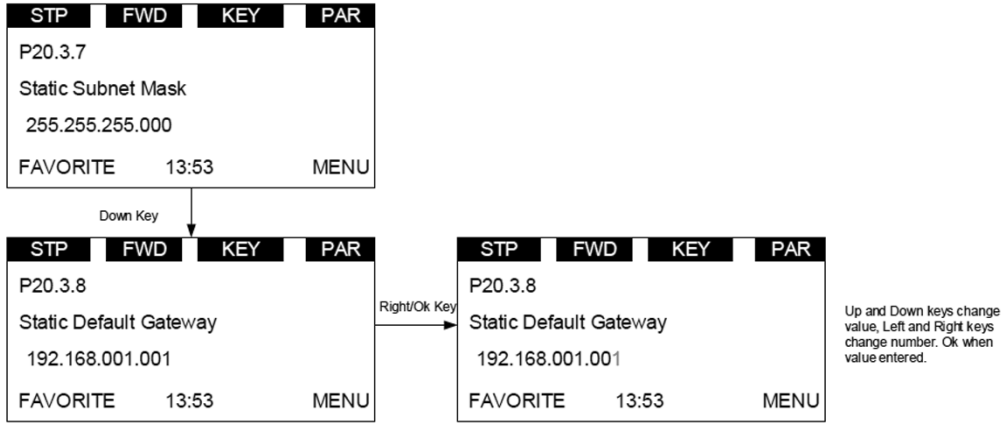
b. Setting Static Subnet Mask

Figure 16. Static Subnet Mask

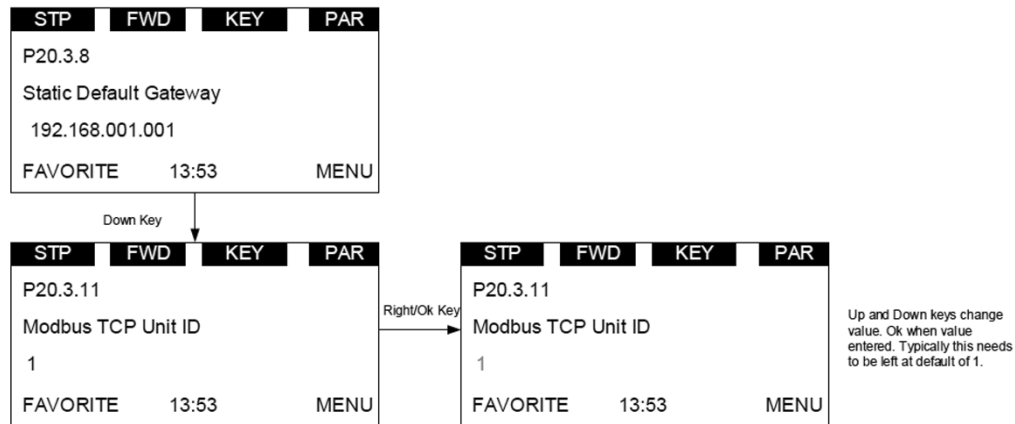


c. Setting Static Default Gateway

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. Power off the drive control and wait three minutes for the internal voltages to dissipate.
5. 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 37. 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 38. 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 39. 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 40. 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 41. 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 42. 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 43. 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) Note. Output value is 0x0000 or 0xFF00
Output value Low	0x00	
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 44. 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 45. 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 bits correspond to the outputs in the following way.

Table 46. 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 47. 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 48. Index Table

ID	Modbus Register	Group	R/W
1–98	40001–40098 (30001–30098)	Actual Values	1/1
99	40099 (30099)	Fault Code	1/1
101–1999	40101–41999 (30101–31999)	Parameters	1/1
2001–2099	42001–42099 (32001–32099)	Process Data In	20/20
2101–2199	42101–42199 (32101–32199)	Process Data Out	20/20

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 49. 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 50. 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 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 51. 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

Control Word

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

Table 52. PowerXL DG1 Drive 16 Bits

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

Notes

- ① Not for use.
- ② Net Ref.
- ③ Net Cntrl.

Table 53. 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.

Process Data In 1 to 8

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

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 54. 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	Hz
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 55. 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 56. 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 57. 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.

Process Data Out 1 to 8

Process Data Out values 1 to 8 can be used in application for various purposes. See DG1 application manual for what these values can be set to.

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.

Table 58. Process Data OUT

ID	Data	Value	Unit	Scale
2104	Process Data OUT 1	–32768–32767	—	—
2105	Process Data OUT 2	–32768–32767	—	—
2106	Process Data OUT 3	–32768–32767	—	—
2107	Process Data OUT 4	–32768–32767	—	—
2108	Process Data OUT 5	–32768–32767	—	—
2109	Process Data OUT 6	–32768–32767	—	—
2110	Process Data OUT 7	–32768–32767	—	—
2111	Process Data OUT 8	–32768–32767	—	—

Process Data IN (Master → Slave)

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

Table 59. Process Data IN

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

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: 00.21.99.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 20**.

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

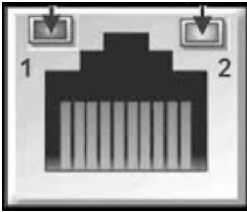
EtherNet/IP Specifications

Table 60. 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 61. Ethernet LED Description

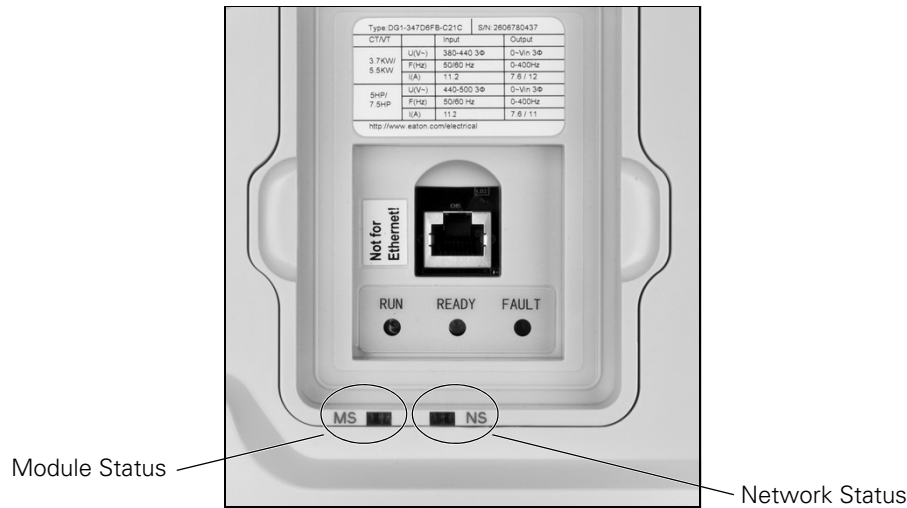
LED	Meaning
Ethernet Link status	Flashes with Ethernet message activity.
Ethernet Link Speed	Displays the link speed. Yellow LED on the Ethernet Jack is ON when link speed is 100 mbps Yellow LED on the Ethernet Jack is OFF when link speed is 10 mbps

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 62. 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 ①	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 63. 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	Major fault	PowerXL has detected a non-recoverable major fault.
Flashing Green/Red ①	Self-test	PowerXL is performing its power up testing.

① Flash rate is 1 flash per second.

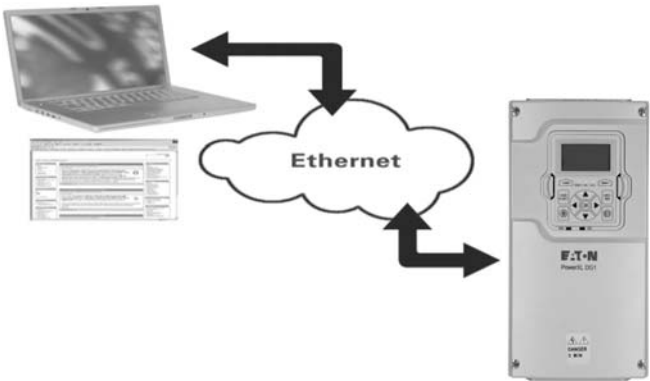
EtherNet/IP Overview

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.

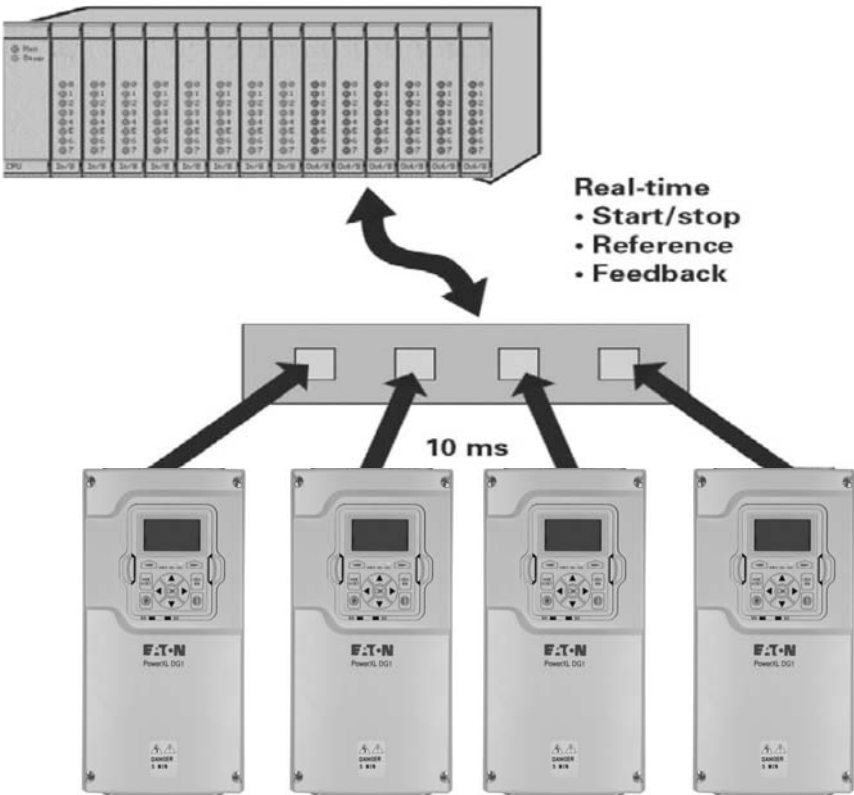
- 1. Human to machine (graphical user interface, relatively slow communication)
User Interface

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 64. 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	2		2	609	

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

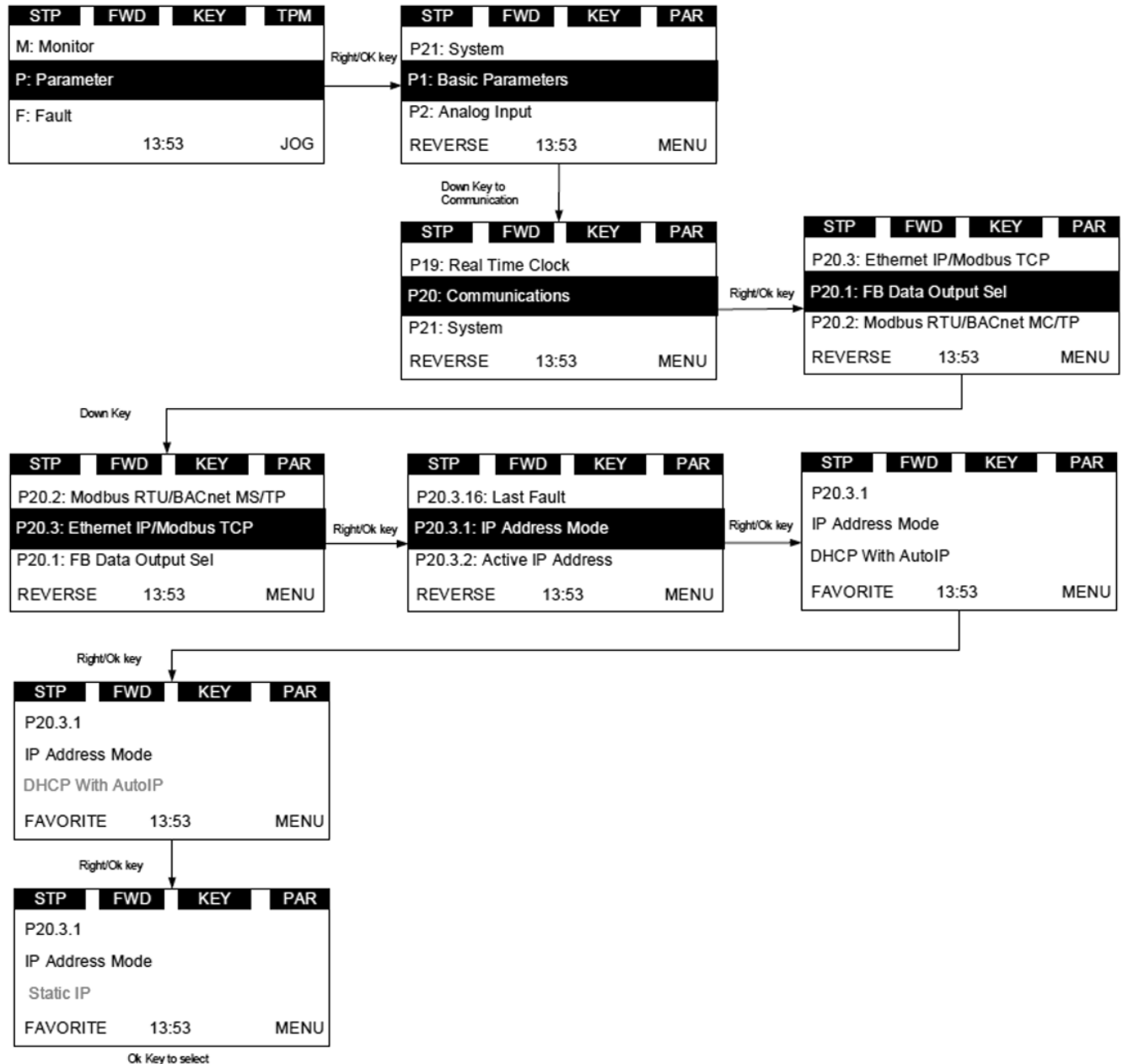
Using the PowerXL Drive Keypad

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

1. Select IP addressing mode as Default static IP configurations will be loaded.

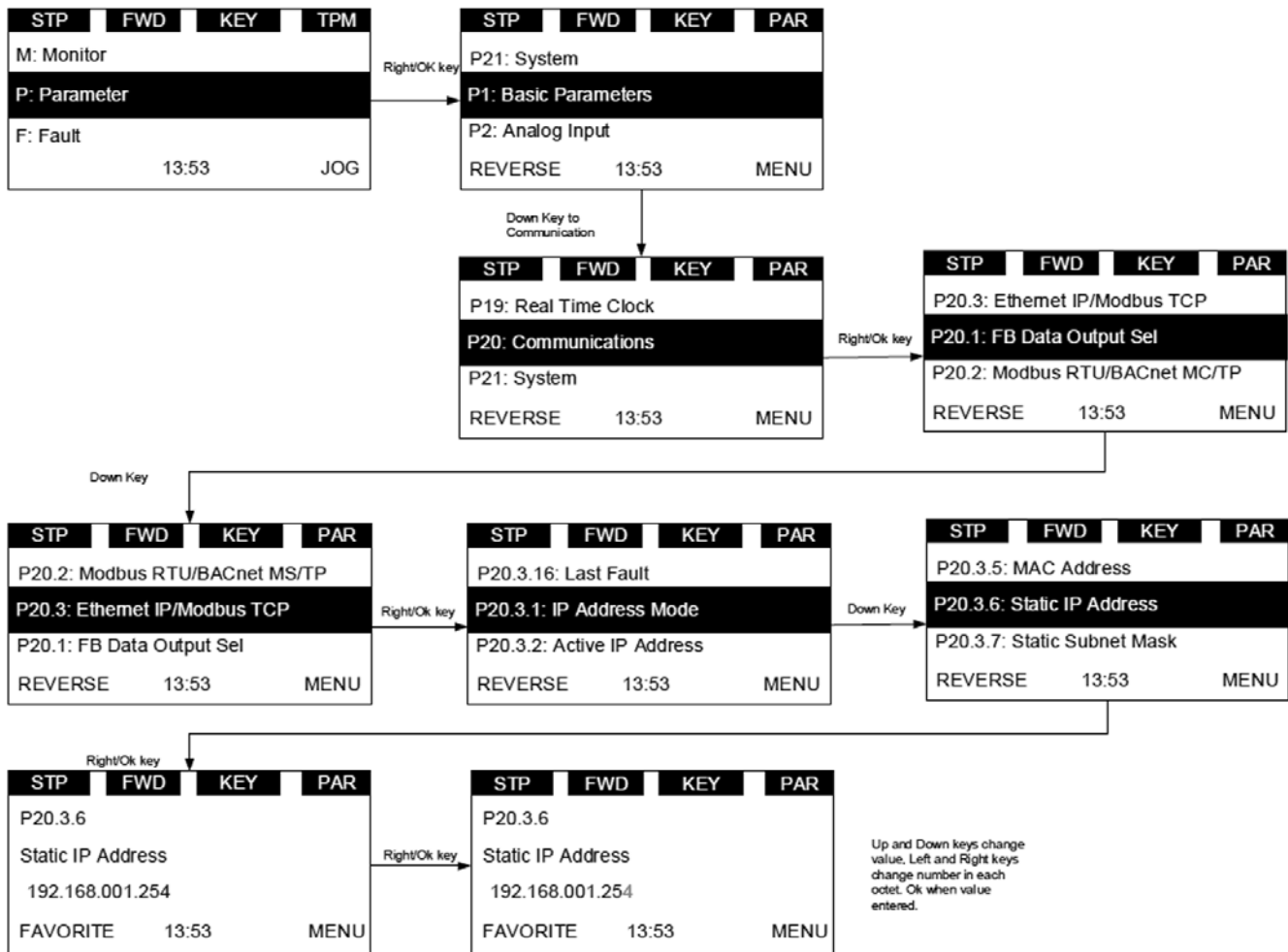
Note: Change in IP address mode will require PowerXL to power cycle to get this change effective. Also ensure device MAC address (Keypad menu. P20.3.5)

Figure 23. Static IP Mode

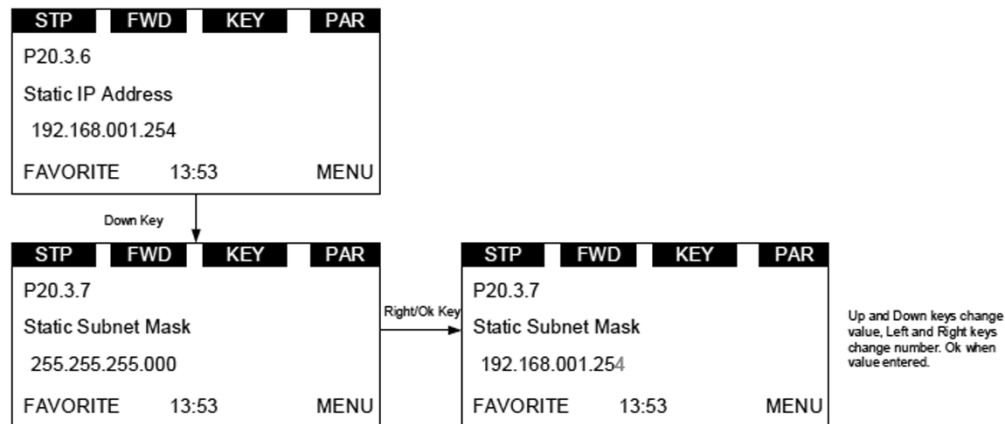


- 2. Using PowerXL drive keypad, set the IP address in the PowerXL EIP to the desired address setting by:
 - a. Setting Static IP Address

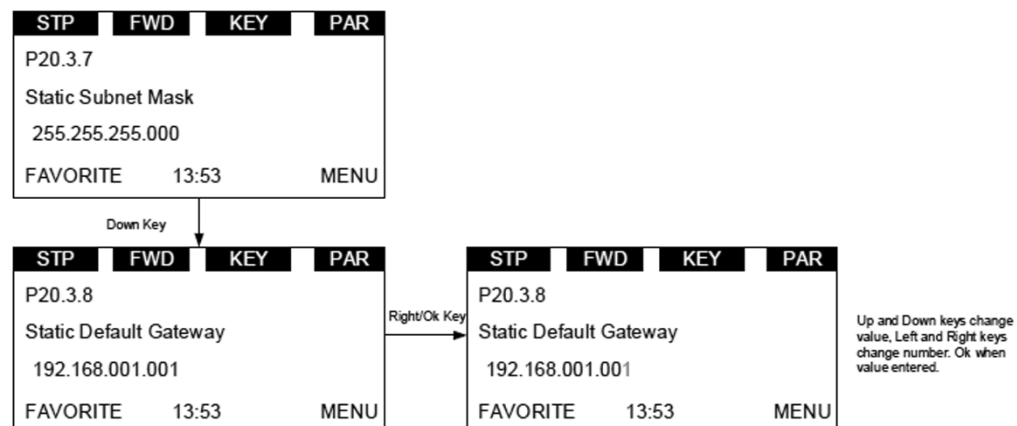
Figure 24. Static IP Address



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. Power off the drive control and wait three minutes for the internal voltages to dissipate.
5. 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

Process Data Out (Slave to Master)

The fieldbus master can read the frequency converter’s actual values using process data variables. All PowerXL applications use process data as follows.

Table 65. Process Data Out (Slave to Master)

Data	Value	Unit	Scale
Process data OUT 1	Output Frequency	Hz	0.01 Hz
Process data OUT 2	Motor Speed	rpm	1 rpm
Process data OUT 3	Motor Current	A	0.1A
Process data OUT 4	Motor Torque	%	0.1%
Process data OUT 5	Motor Power	%	0.1%
Process data OUT 6	Motor Voltage	V	0.1V
Process data OUT 7	DC link voltage	V	1V
Process data OUT 8	Active Fault code	—	—

The multipurpose control 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 as in the table above.

Process Data In (Master to Slave)

Control word, Reference and Process Data are used with different PowerXL applications as follows.

Table 66. Standard and Multi-Pump

Data	Value	Data Type	Unit	Scale	Default
FBFixedControlWord	Start/Stop/Fault reset Command	UINT	—	—	—
Reference	Speed Reference	UINT	%	0.01%	0
PD1–PD8	Not used	—	—	—	—

Table 67. Multipurpose Control

Data	Value	Data Type	Unit	Scale	Default
FBFixedControlWord	Start/Stop/Fault reset Command	UINT	—	—	—
Reference	Speed Reference	UINT	%	0.01%	0
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	Not used	—	—	—	—

Table 68. PID Control

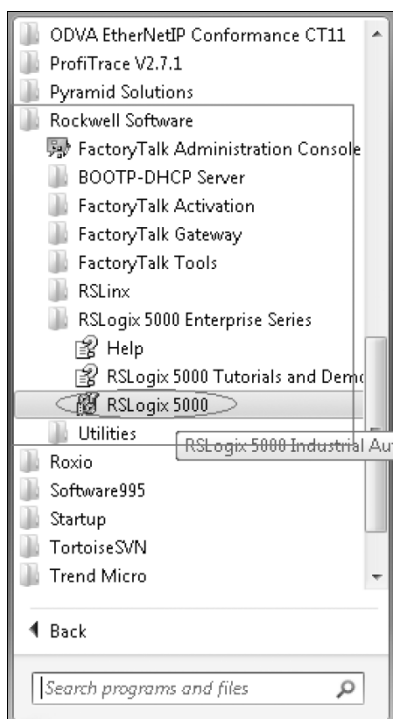
Data	Value	Data Type	Unit	Scale	Default
FBFixedControlWord	Start/Stop/Fault reset Command	UINT	—	—	—
Reference	Speed Reference	UINT	%	0.01%	0
Process Data IN1	Not used	—	—	—	—
Process Data IN2	Reference for PID1 controller	UINT	%	0.01%	0
Process Data IN3	Actual Value 1 to PID1 controller	UINT	%	0.01%	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	Not Used	—	—	—	—

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.

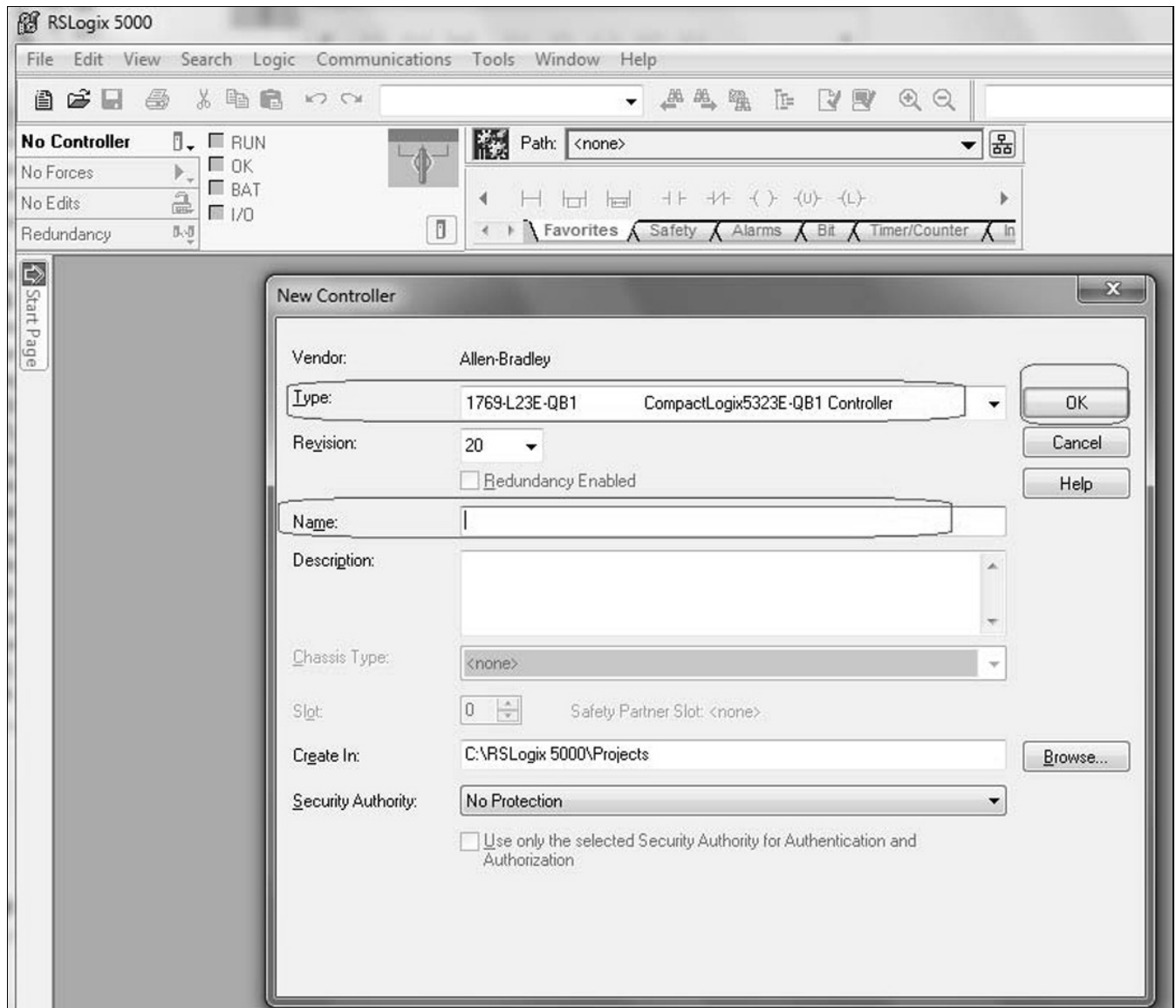
Note: Some PLCs do not support polled messaging for EtherNet/IP. For example, the SLC500 only supports explicit messaging.

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.

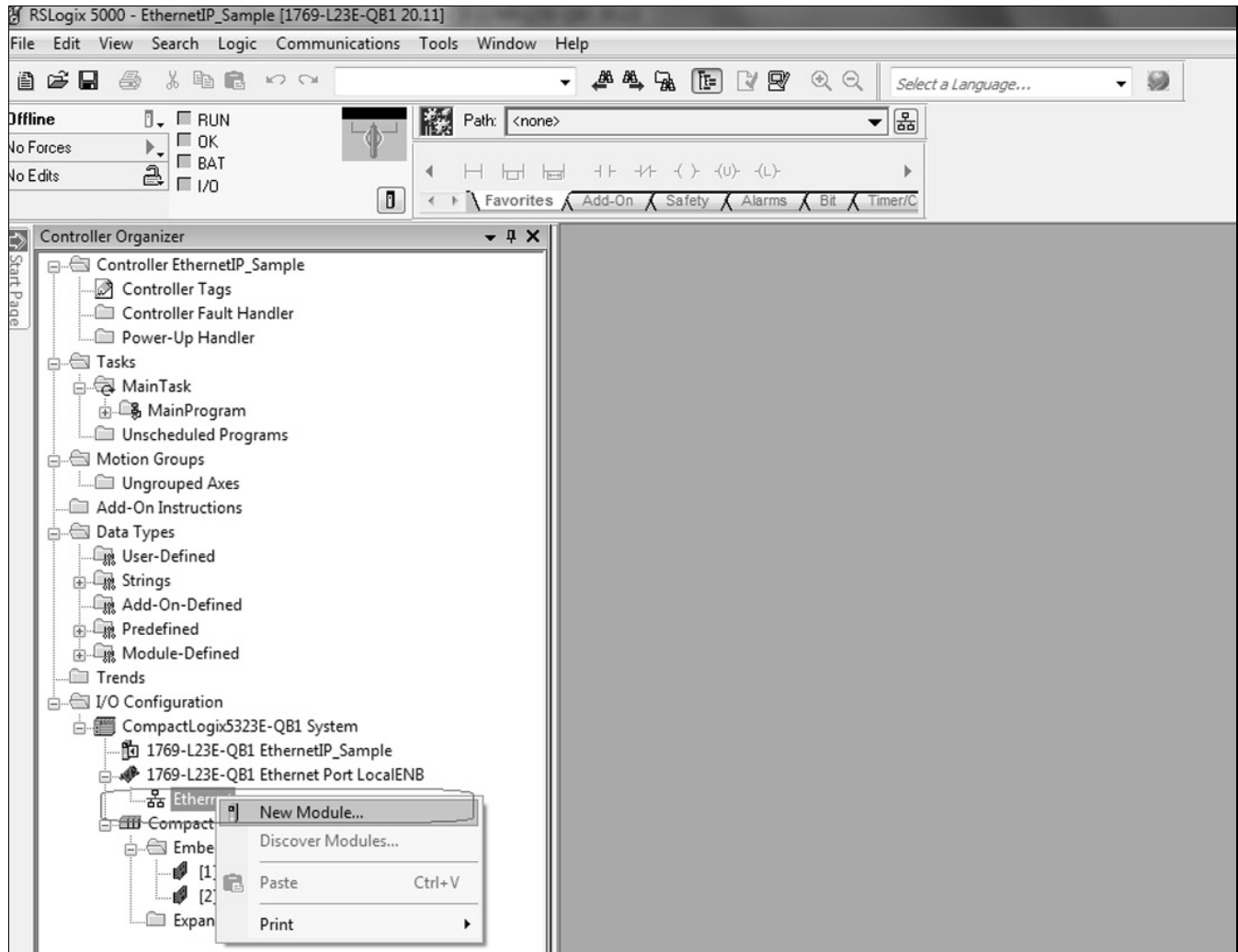


EtherNet/IP On-Board Communications

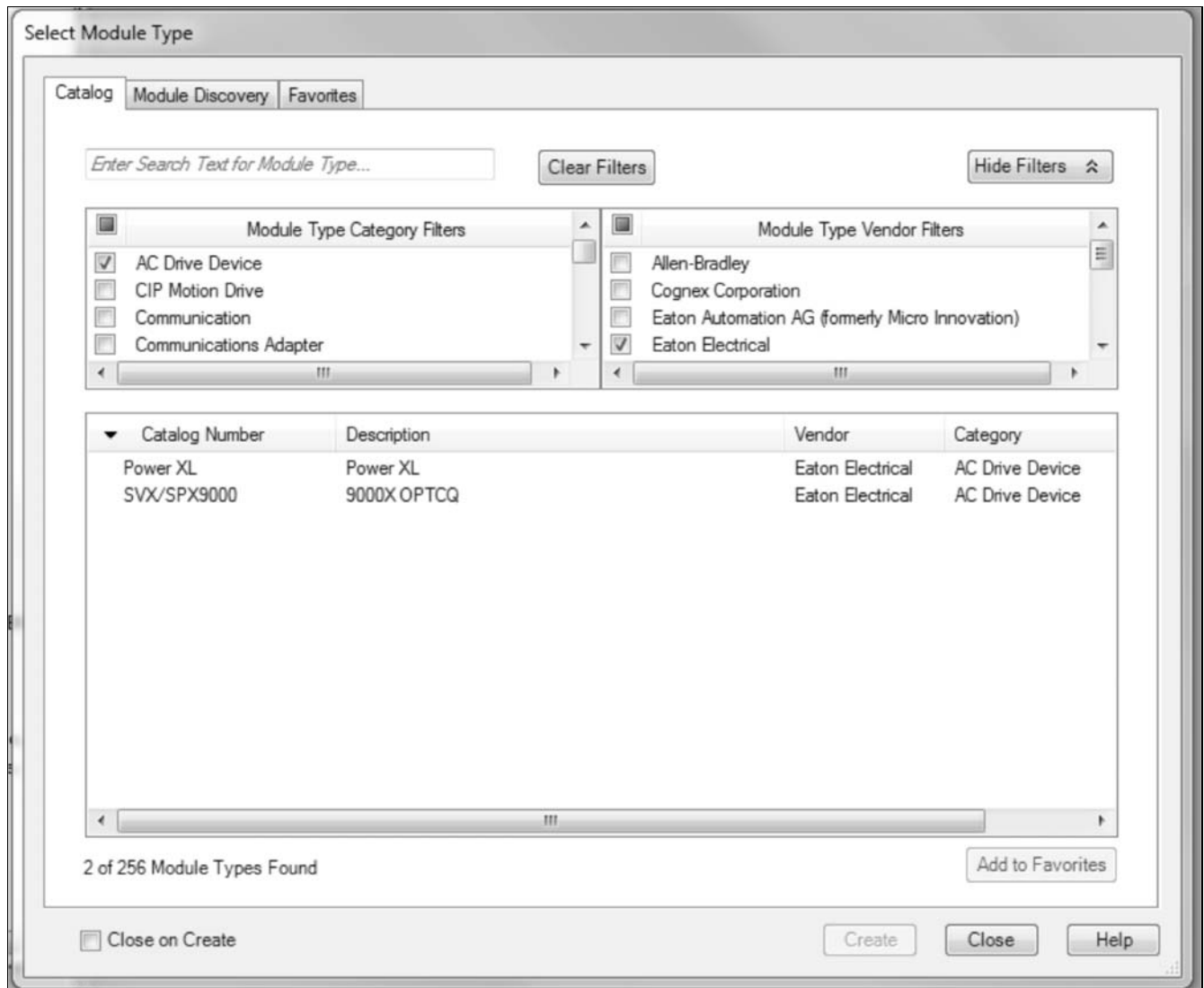
Press OK.

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" (use filter to search PowerXL from catalog).



EtherNet/IP On-Board Communications

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.

New Module

General

Connection

Module Info

Internet Protocol

Type:Power XL Power XL

Vendor:Eaton Electrical

Parent:LocalENB

Name:PowerXL_Drive

Description:

Ethernet Address

☒ Private Network:192.168.1.2

☐ IP Address:

☐ Host Name:

Module Definition

Revision:1.1

Electronic Keying:Compatible Module

Connections:Use Only 1 Connection

Change ...

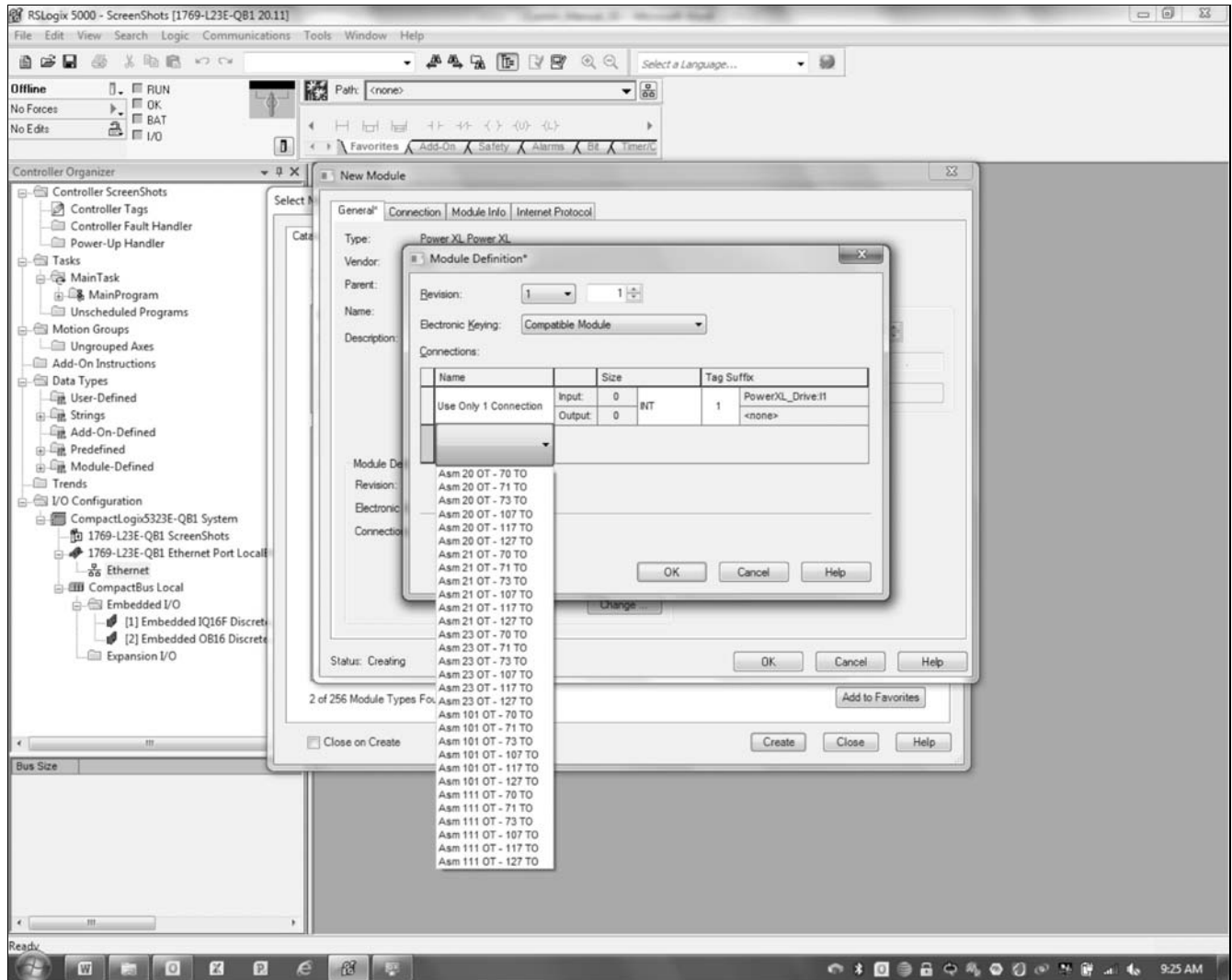
Status: Creating

OK

Cancel

Help

Choose the INT data type then select I/O 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.

Module Definition*

Revision:

1

1

Electronic Keying:

Compatible Module

Connections:

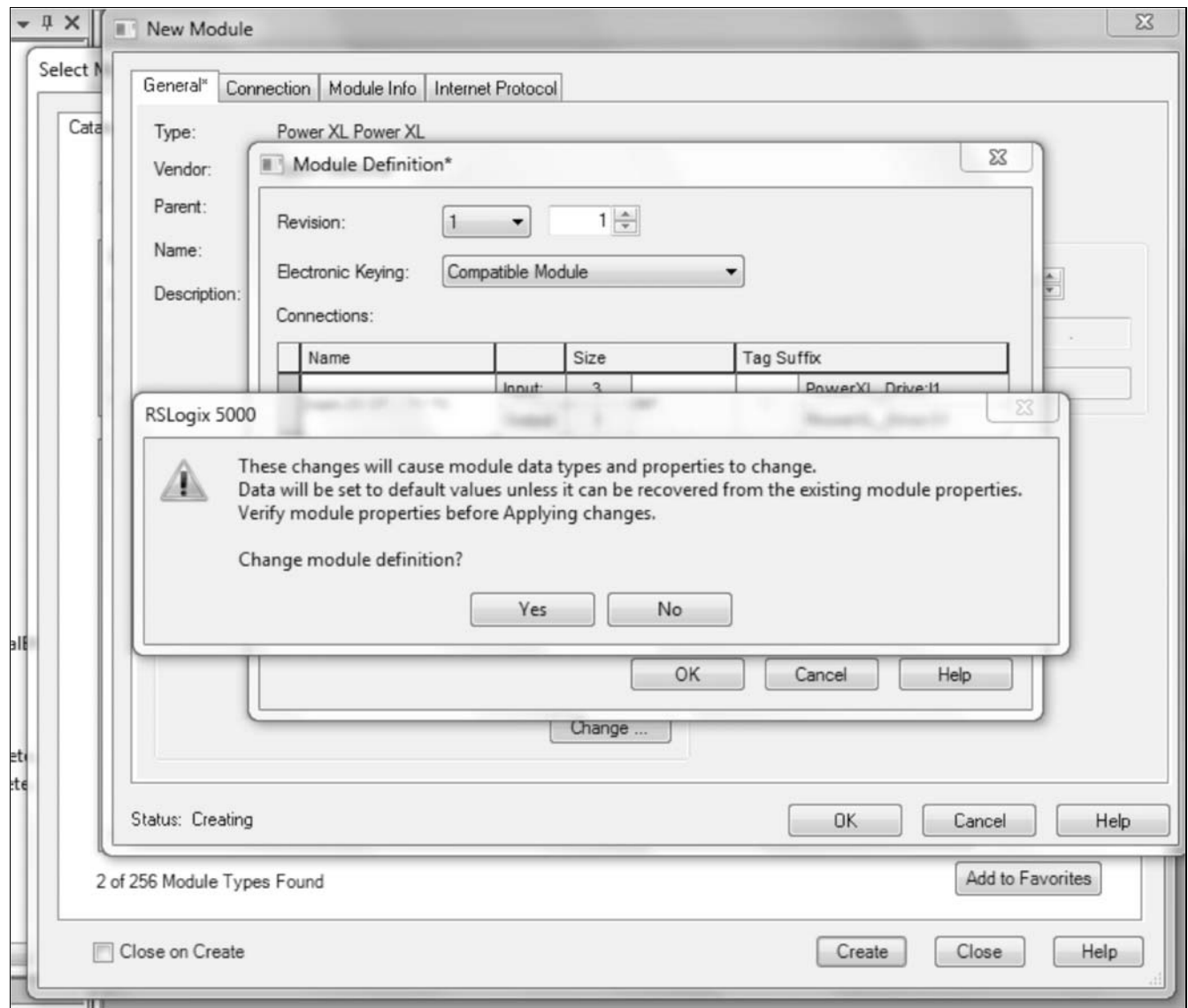
Name		Size		Tag Suffix
Asm 23 OT - 73 TO	Input:	3	INT	1
	Output:	3		
Select a connection				

OK

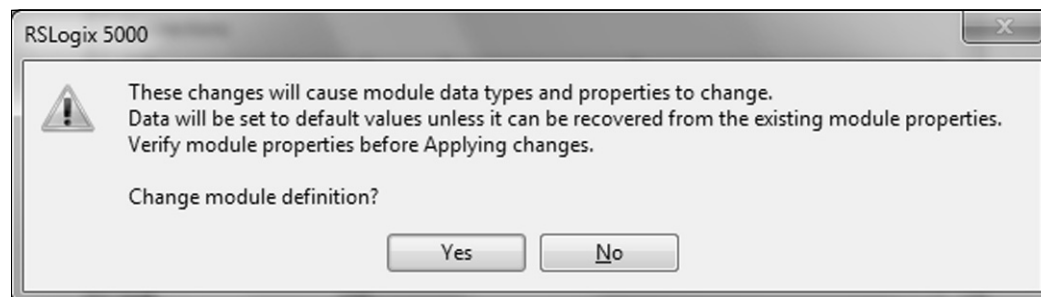
Cancel

Help

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

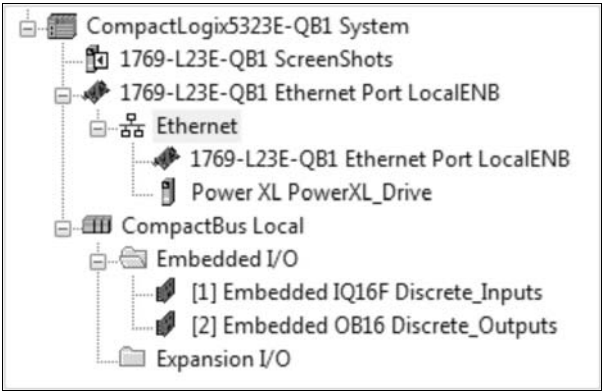


Warning snapshot.



EtherNet/IP On-Board Communications

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_B82B8E11:...
	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		
0xA2		
0xA3		
0xA4		
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

Service Code (in hex)	Service Name	Identity Object		Connection Manager		TCP/IP Interface		Ethernet Link		Assembly		Motor Data		Control Supervisor		AC/DC Drive		Vendor Parameter	
		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											
05	Reset (Type 0 & 1)		Y											Y					
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														

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		4
	Minor Revision	USINT		3
05h	Status	WORD	Get	0x34—Default
06h	Serial Number	UDINT	Get	
07h	Product Name	SHORT_STRING	Get	PowerXL
Instance Services				
01h	Get_Attributes_All			
05h	Reset			
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 Number Class Attributes	UINT	Get	
07h	Maximum ID Number Instance Attribute	UINT	Get	
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	04 00 08 00 09 00 0A 00 0B 00
06h	Maximum ID Class Attribute	UINT	Get	7
07h	Maximum ID Instance Attribute	UINT	Get	0Bh
Class Services				
01h	Get_Attributes_All			
0Eh	Get_Attribute_Single			
Instance Attributes				
01h	Status	DWORD	Get	01
02h	Configuration Capability	DWORD	Get	D4
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		A0 20 C0 EF
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 of 28 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		04 00
	Array of Attributes	Array of UINT		07 00 08 00 09 00 0A 00
06h	Maximum ID Class Attribute	UINT	Get	07
07h	Maximum ID Instance Attribute	UINT	Get	0A
Class Services				
01h	Get_Attributes_All			
0Eh	Get_Attribute_Single			
Instance Attributes				
01h	Interface Speed	UDINT	Get	0x64 00 00 00
02h	Interface Flags	DWORD	Get	0X2D
03h	Physical Address	ARRAY of 6 USINTs	Get	
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"
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	0X0B
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
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	0	0–1
Instance Services					
0Eh	Get_Attribute_Single				
10h	Set_Attribute_Single				
05h	Reset (Type 0)				

^① For Active Fault code, refer “CIP Fault Code” mentioned in “List of Fault Codes Supported by PowerXL EtherNet/IP”

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

Figure 27. State Transition Diagram

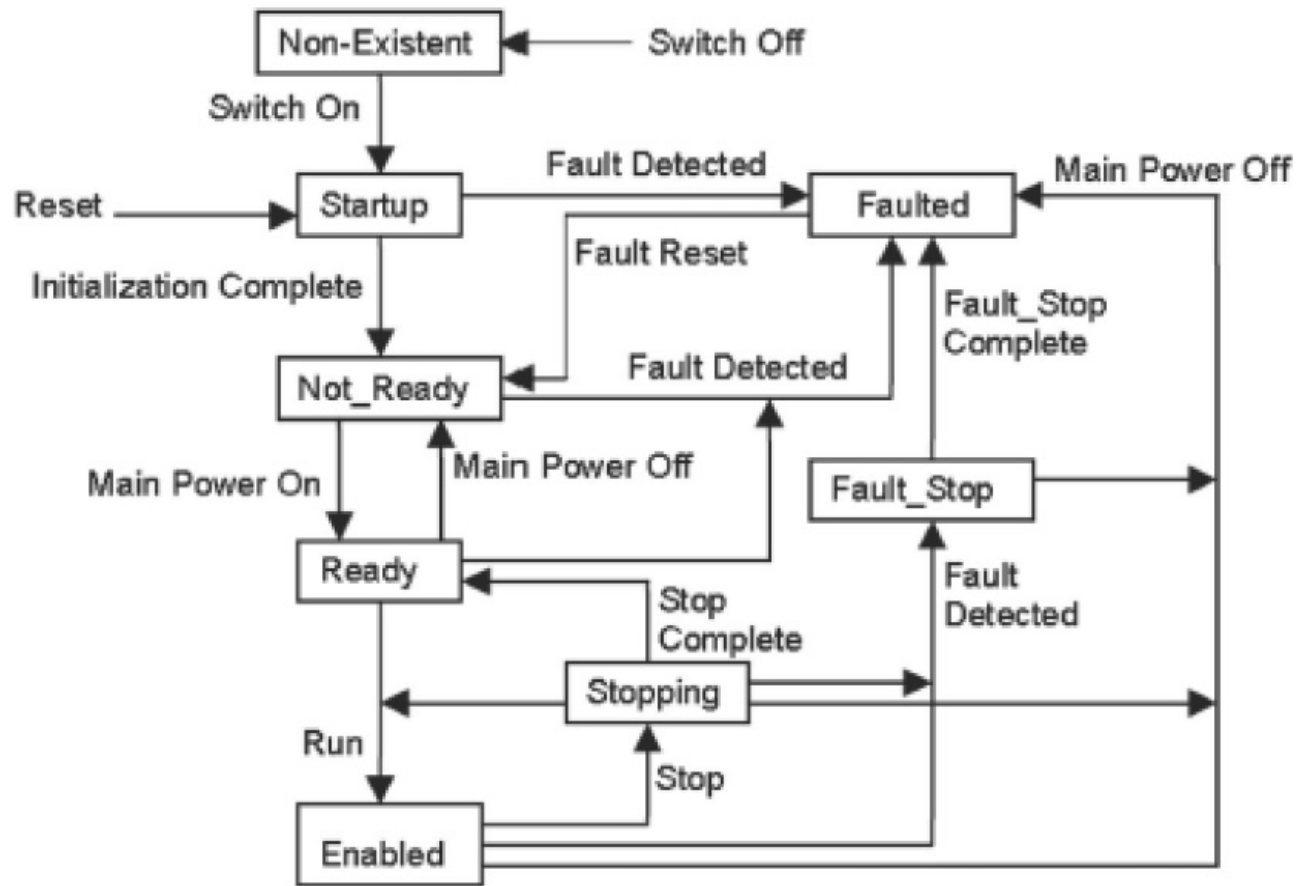


Table 81. List of Fault Codes Supported By PowerXL EtherNet/IP

Fault Code	Fault Description	Fault/Warning	Default	Realization	CIP Fault code
1	OverCurrent	Fault		DSP	2310h
2	OverVoltage	Fault		DSP	3210h
3	Earth Fault	Configurable	Fault	DSP	2330h
4	Charging Switch	Fault		DSP	A000h
5	Emergency Stop	Fault		MCU	A001h
6	Saturation Trip	Fault		DSP	A002h
7	System Fault	Fault		DSP/MCU	A003h
8	UnderVoltage	Configurable	Fault	DSP	3220h
9	Input Phase Spv	Configurable	No Action	DSP	A004h
10	Output Phase Spv	Configurable	Fault	DSP	A005h
11	BrakeChopperSpv	Fault		DSP	7110h
12	Drive UnderTemp	Configurable	warning	DSP	4320h
13	Drive OverTemp	Fault		DSP	4310h
14	Motor Stalled	Configurable	No Action	DSP	7121h
15	Motor OverTemp	Configurable	No Action	DSP	4210h
16	Motor UnderLoad	Configurable	No Action	DSP	29d

Table 81. List of Fault Codes Supported By PowerXL EtherNet/IP, continued

Fault Code	Fault Description	Fault/Warning	Default	Realization	CIP Fault code
17	IP conflict	Configurable	Warning	MCU	A006h
18	Power board EEPROM Fault	Fault		MCU	A007h
19	FRAM Fault	Fault		MCU	A008h
20	Serial Flash Fault	Warning		MCU	A009h
21	MCU WatchDog Fault	Fault		MCU	6010h
22	Start-up Prevent	Fault		MCU	A00Ah
23	Thermistor Fault	Configurable	Fault	MCU	7300h
24	Fan Cooling	Fault		DSP	A00Bh
25	Compatibility Fault	Fault		MCU	5200h
26	Device Change	Warning		MCU	A00Ch
27	Device Added	Warning		MCU	A00Dh
28	Device Removed	Fault		MCU	A00Eh
29	Device Unknown	Fault		MCU	A00Fh
30	IGBT Temperature	Fault		DSP	66d
31	Encoder Fault	Fault		MCU	7305h
32	AIN<4mA(4to20mA)	Configurable	No Action	MCU	A011h
33	External Fault	Configurable	Fault	MCU	9000h
34	Keypad Communication Fault	Fault		MCU	A012h
35	FieldBus communication Fault	Configurable	No Action	MCU	8100h
36	OPT Card Fault	Configurable	Fault	MCU	A013h
37	BypassOverLoad	Fault		MCU	A014h
38	Real time clock fault	Configurable	Warning	MCU	A015h
39	PT100 Fault	Configurable	Fault	MCU	A016h
40	Motor ID fault	Fault		DSP	A017h
41	Current Measure Fault	Fault		DSP	2100h
42	Possible power wiring error detected	Fault		DSP	5400h
43	Control Board OverTemp	Fault		DSP	4300h
44	Internal-ctrl Supply	Fault		MCU	5112h
45	Too Many Speed Search Restarts	Fault		DSP	A018h
46	Current Unbalance	Fault		DSP	26d
47	Replace Battery	Configurable	Warning	MCU	A019h
48	Replace Fan	Configurable	Warning	MCU	A01Ah
49	Safety Torque Off	Fault		DSP	A01Bh
50	Current Limit Control	Warning		DSP	0x2200
51	Over Voltage Control	Warning		DSP	0x3310

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.

1. No action
2. Warning
3. Fault
4. Fault, Coast

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 82. 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

Vendor parameter object is used in order to get access to drive parameters. Because drive parameters are identified by the 16-bit length ID number, it is impossible to use only attribute ID, which is 8-bit in length. To overcome this issue, we are using the following method to calculate requested drive parameter ID.

Drive parameter ID = instance ID (higher byte) + attribute ID (lower byte).

Table 83. Vendor Specific Objects

ID	Description	Data Type	Access Rule	Remarks/Default
Class Attributes				
01h	Revision	UINT	Get	1
02h	Max Instance	UINT	Get	0X05
03h	Number of Instances	UINT	Get	0X05
Class Services				
0Eh	Get_Attribute_Single			
Instance Attributes				
LOWER BYTE OF THE PARAMETER ID				
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.

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 84. 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 85. 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 86. 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 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			FaultReset	RunRev	RunFwd
1								
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.

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	FBFixedControlWord (Low Byte) ①							
1	FBFixedControlWord (High Byte) ①							
2	FBSpeedReference (Low Byte) ②							
3	FBSpeedReference (High Byte) ②							
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 FBFixedControlWord.

Bit	Description (Value = 0)	Description (Value = 1)	Default	Range
0	STOP	RUN	0	0–1
1	Clockwise	Counter-clockwise	0	0–1
2	Rising edge of this bit will reset active fault	Rising edge of this bit will reset active fault	0	0–1
3–15	Not in use	Not in use	0	0

② This is the reference1 to the frequency converter. Used normally as Speed reference. The allowed scaling is 0...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.

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

Assembly Instance 107

Table 92. 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%).

Assembly Instance 117**Table 93. 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	FBStatusWord (Low Byte)							
1	FBStatusWord (High Byte)							
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.

Assembly Instance 127

Table 94. 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	FBStatusWord (Low Byte) ①							
1	FBStatusWord (High Byte) 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 FBStatusWord.

Bit	Description (Value = 0)	Description (Value = 1)
0	Not ready	Ready
1	Stop	Run
2	Clockwise	Counter-clockwise
3	No fault	Faulted
4	No alarm	Alarm
5	Ref. Freq. not reached	Ref. Freq. reached
6	Motor not running at zero speed	Motor running at zero speed
7–15	Not in use	

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%).

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

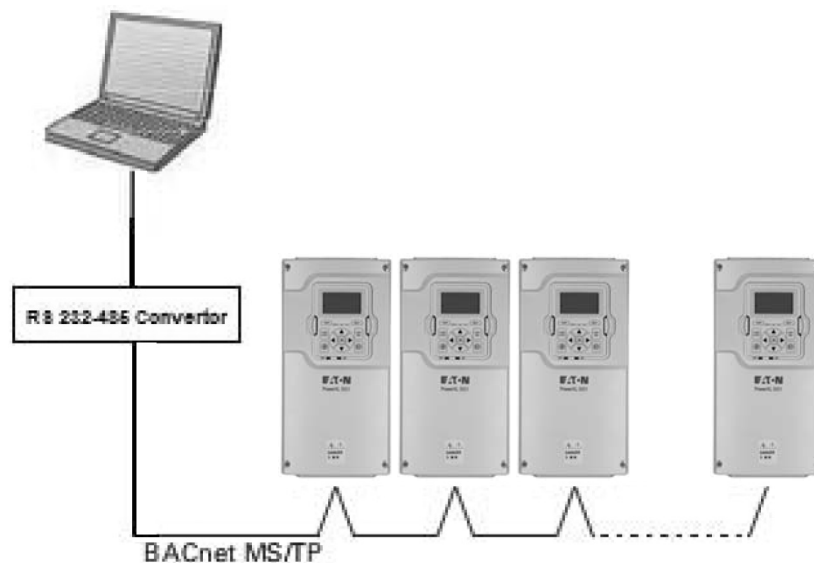
Table 95. BACnet MS/TP Technical Data

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 (supports autobaud detection)

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

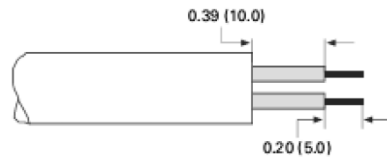
1. Open the cover of the AC drive.

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

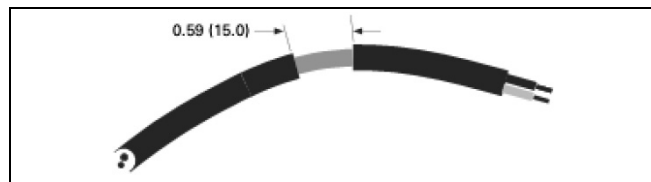


Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 0.59 in (15 mm).

IMPORTANT

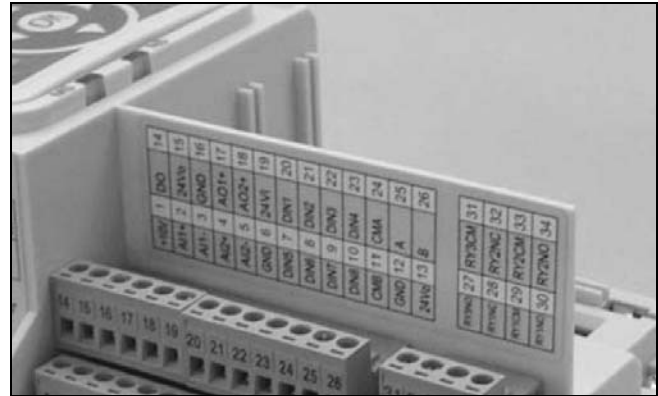
Do not strip the aluminum cable shield!

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



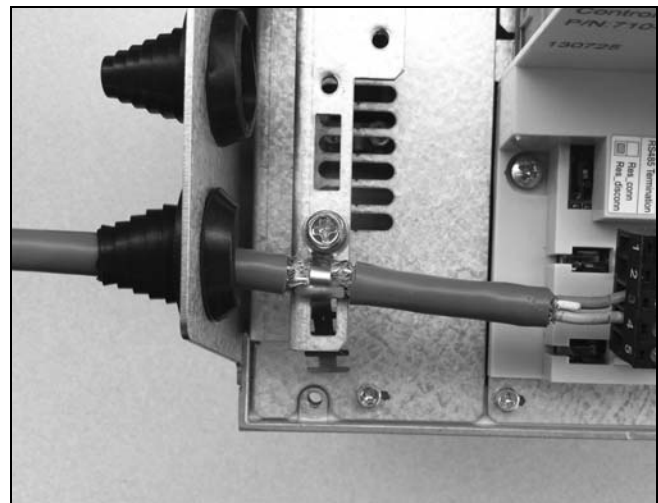
4. Then connect the cable to its appropriate terminals on G-Max drive standard terminal block, terminals A and B (A = negative, B = positive). See illustration below.

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 G-Max 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.

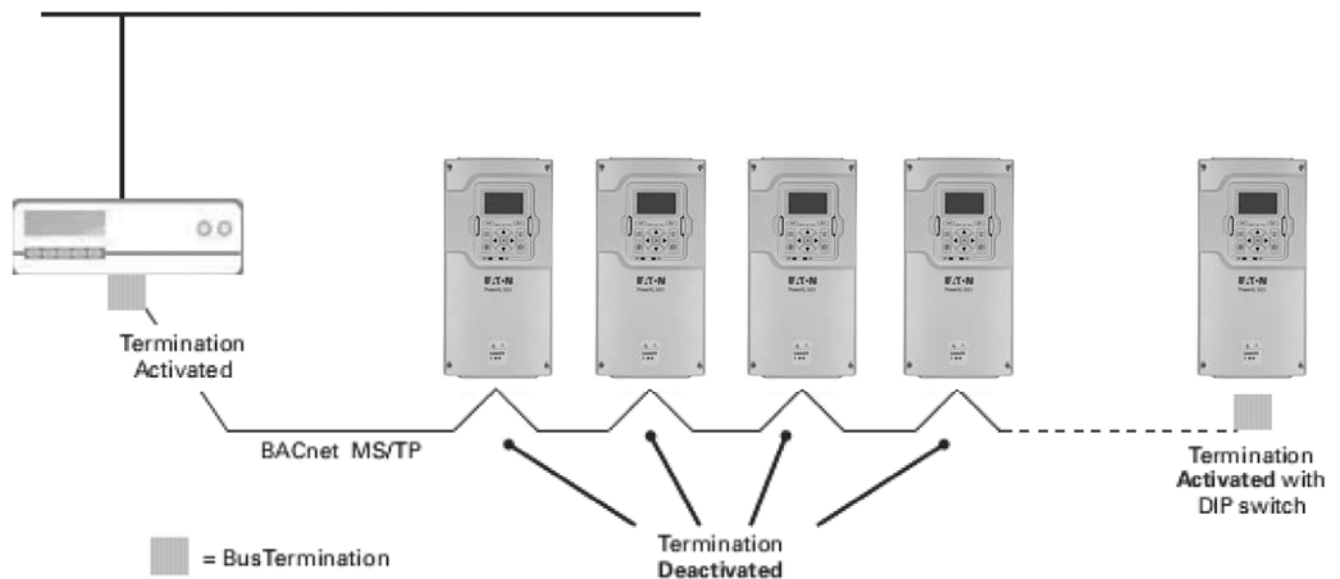
Figure 33. RS-485 Bus Termination Setup

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

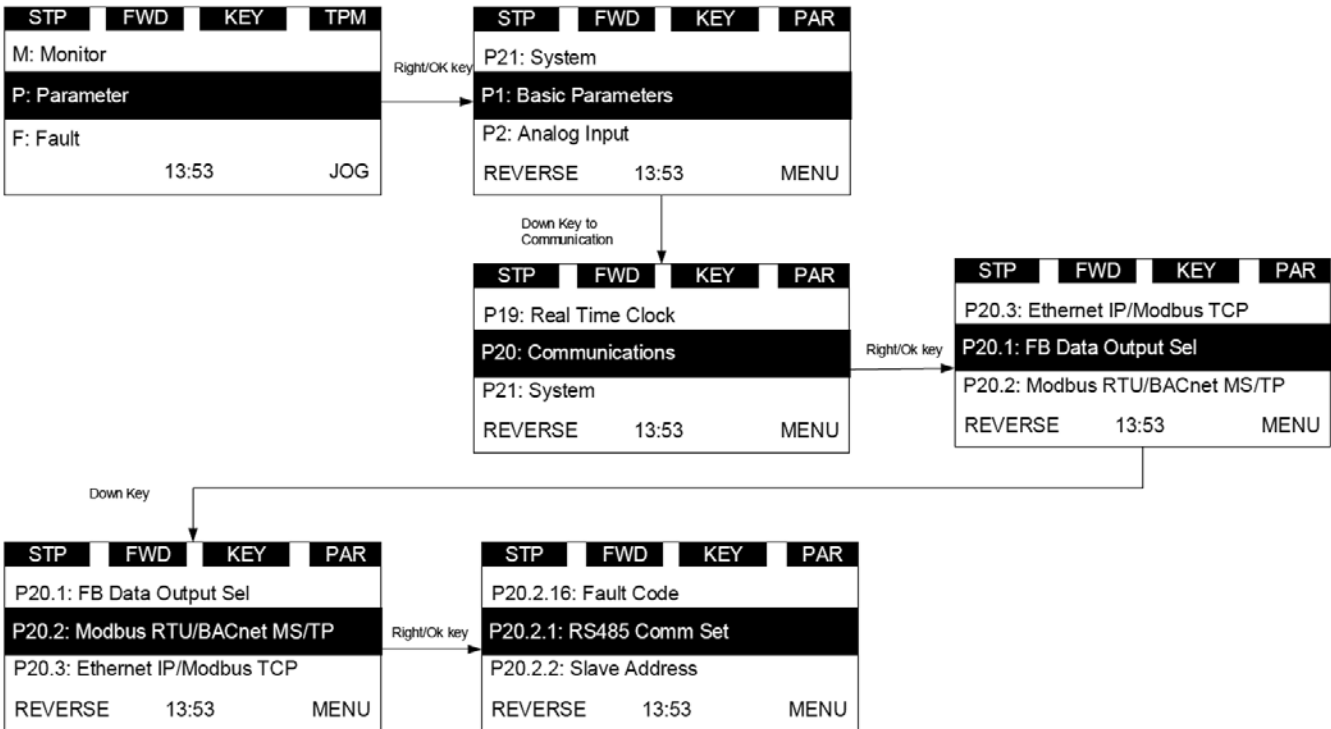
Figure 34. BACnet Bus Termination

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 96. 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		0	596	
P20.2.14	Comm Timeout BACnet			ms	6000	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

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 must be unique across the entire BACnet internetwork because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation.

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 97. Supported Object Types and Properties Summary

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 97. Supported Object Types and Properties Summary, 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 98. 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

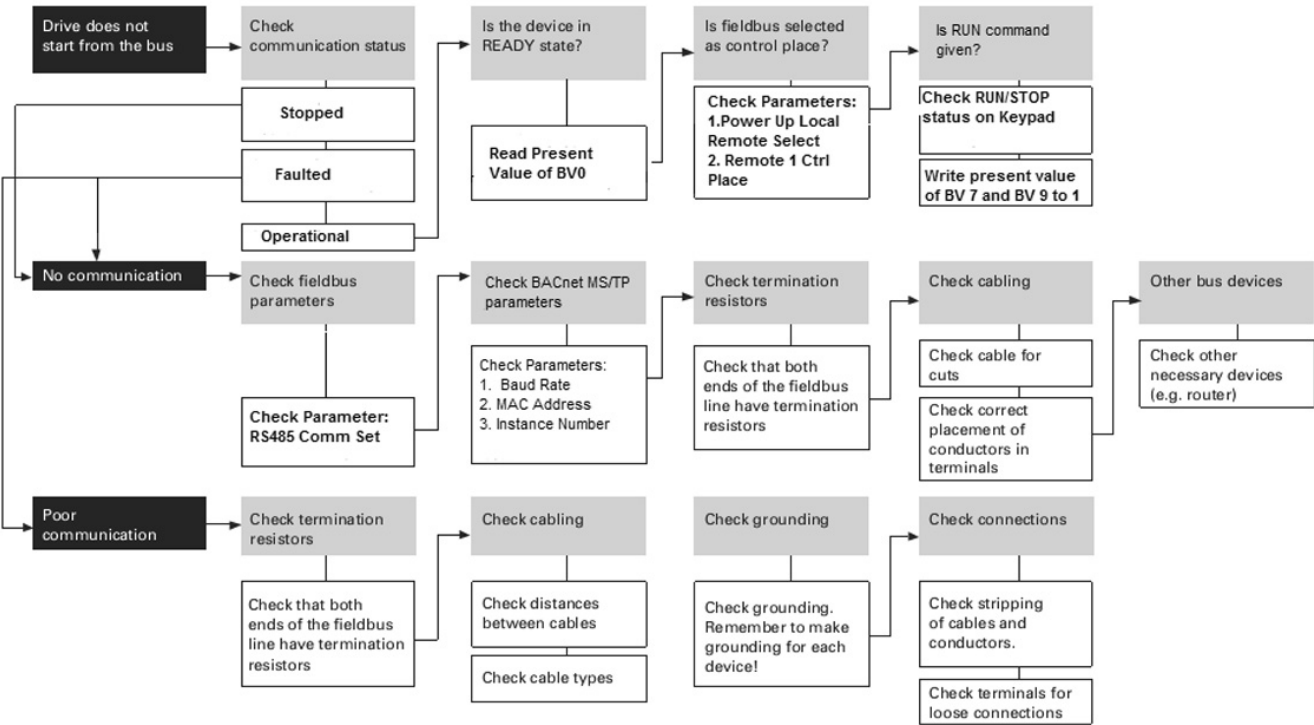
The following table summarizes the Analog Value Objects supported.

Table 99. 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 Load	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	In% of motor nominal 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	Hz	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 a field bus board. 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 100. 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	2~126
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

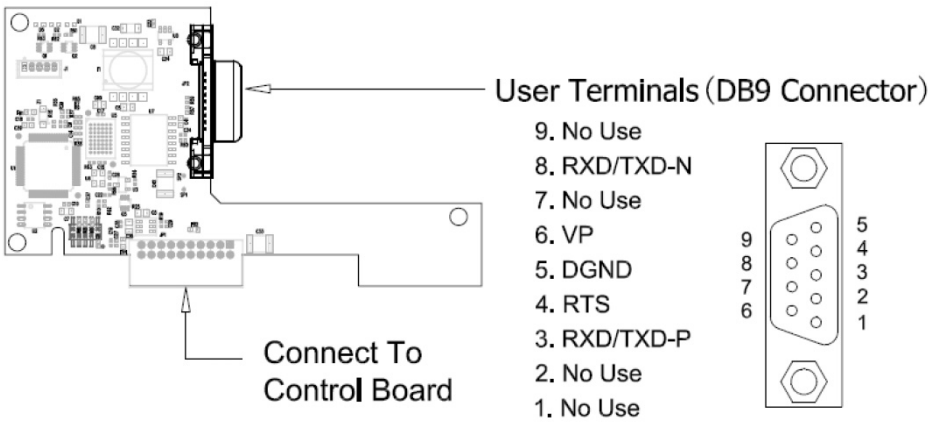
Line length depends on different transmission speeds.

Table 101. 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 102. PROFIBUS LEDs

ON (GREEN, the left one)	BF (RED, the middle one)	SF (RED, the right one)	Fault condition
ON	OFF	OFF	Everything OK
ON	ON	OFF	No communication
ON	blinking	OFF	Communication, but not in data exchange
ON	ON	ON	Configuration not OK (System Fault)

Connector On-Board

Use DB-9 connector, pin assignment as below.

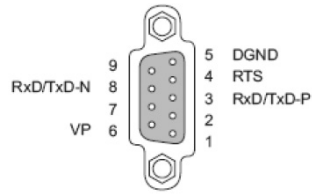


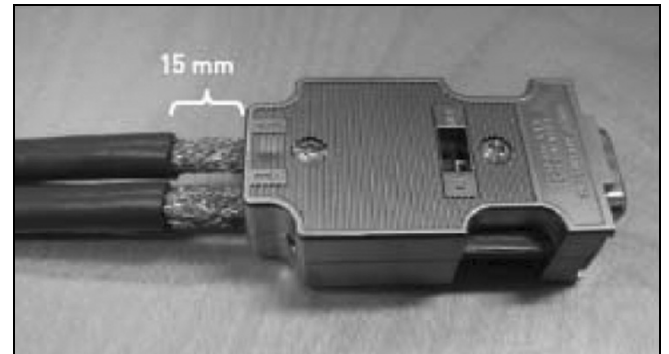
Table 103. Connector and Pin Assignment

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.

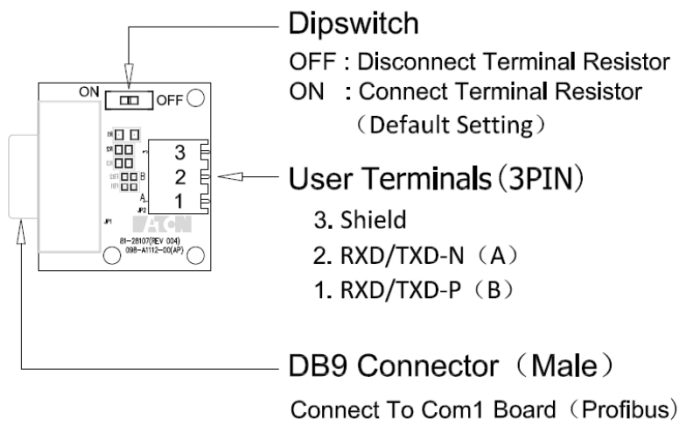
Connector on Customer Side

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 104. 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 105. 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 to the Slot A or Slot B. 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 go away. 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

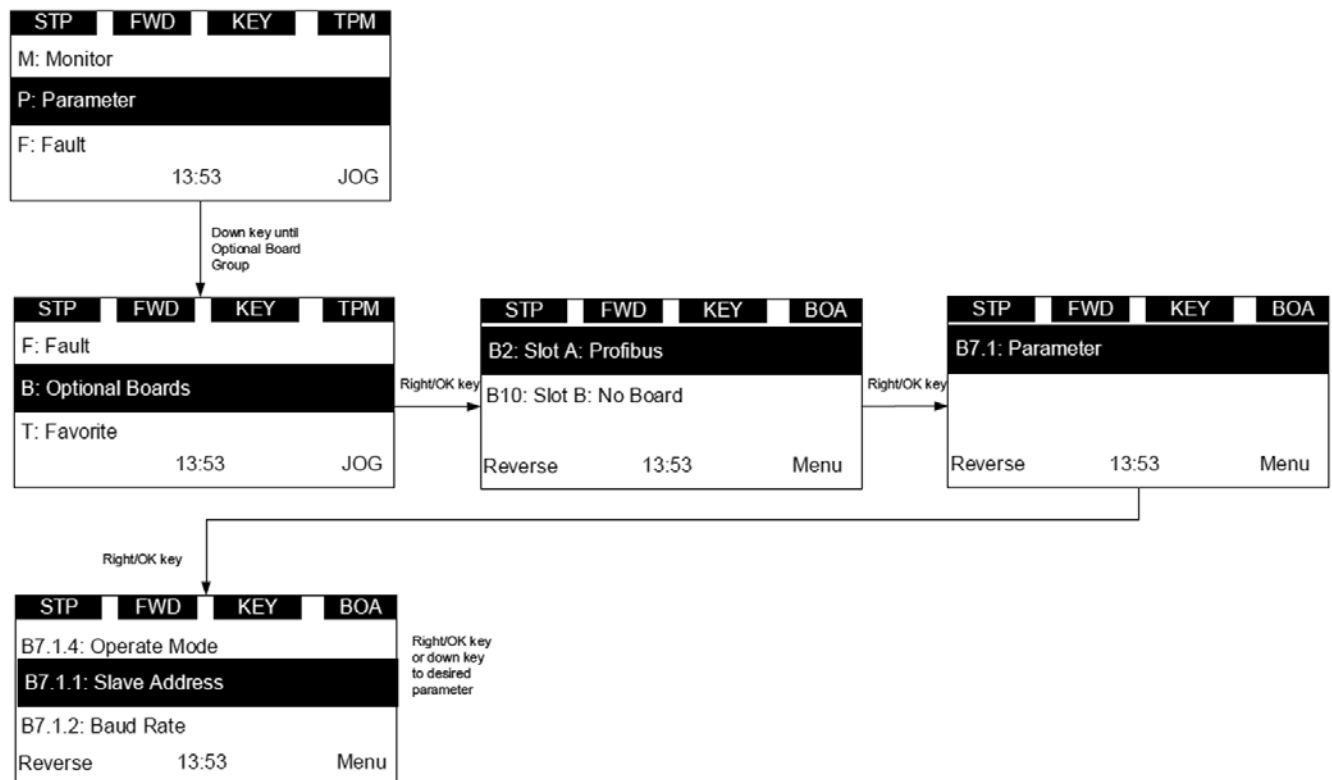


Table 106. PROFIBUS Parameters

Code		Parameter	Min.	Max.	Unit	Default	ID (Slot A/Slot B)	Note
BX.1.1		Board Status				0	883/910	
BX.2.1	2	Slave Address	2	126		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 Mod	1	2		1	1245/1253	Operation Mode 1=PROFIdrive 2= Echo

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.

Startup Test

Set up the communication with Master and follow below steps.

1. Set control word value to 0x0400 to get control from PLC.
2. Set control word value to 0x047F to give run command from PLC.
3. Drive is in Run mode.
4. Set Frequency reference to xx.
5. Drive follows frequency reference.
6. Set control word value to 0x047E to give off command from PLC.
7. Drive is in Off mode.

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’.

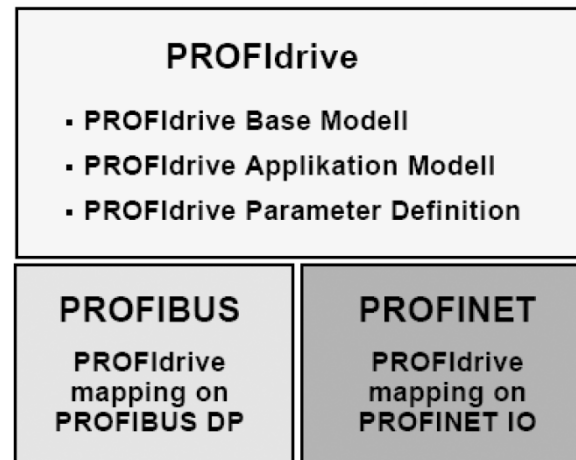
Profiles—The PROFIBUS DP protocol defines how user data to be transmitted between stations over the bus. User data are not evaluated by the PROFIBUS transmission protocol. The meaning is specified in the profiles. In addition, the profiles specify how PROFIBUS DP is to be used in the “PowerXL” PROFIBUS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

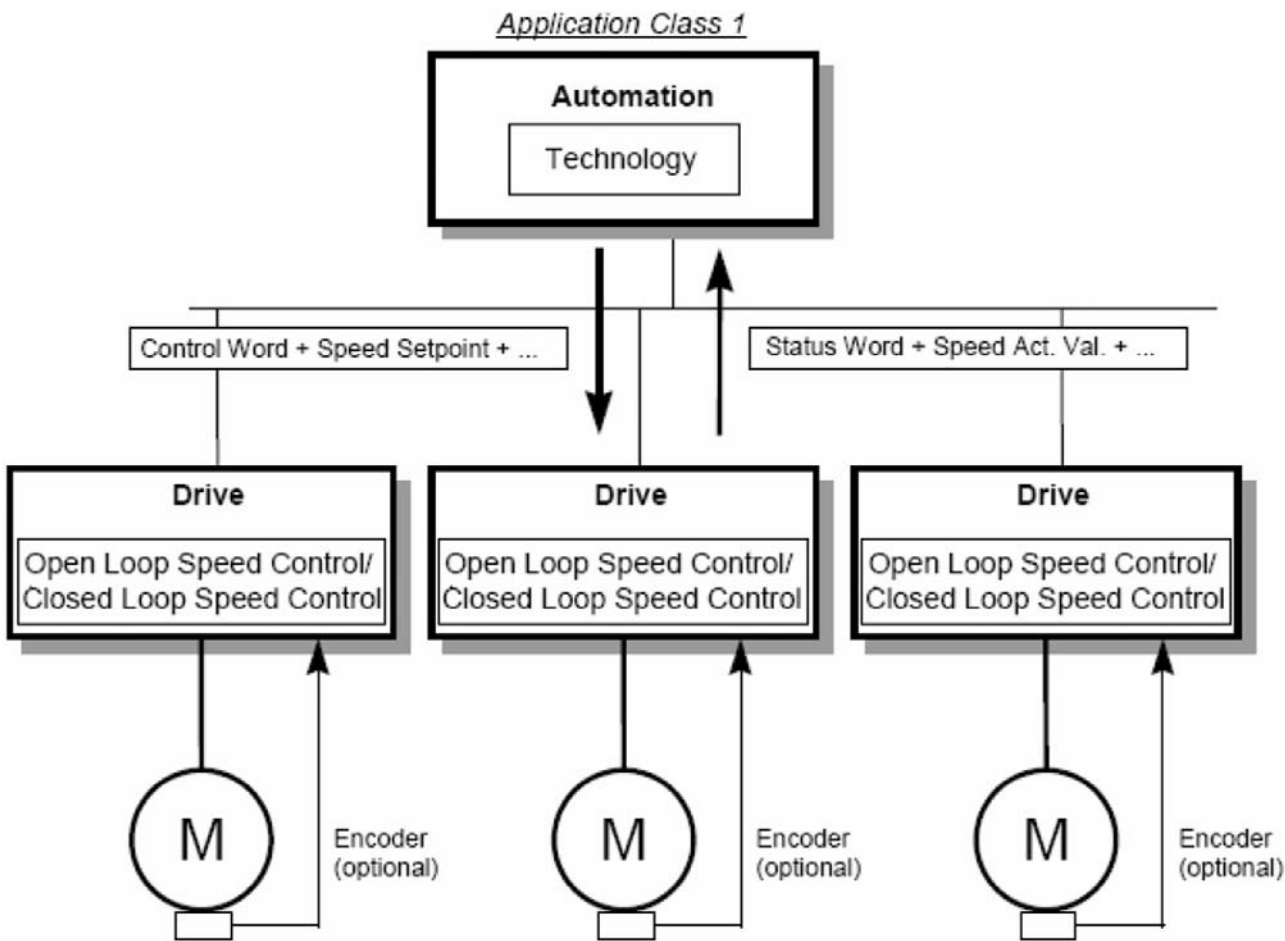
Application Classes

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 107. 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



Control and Status Words

The Control Word (PROFIBUS Parameter number (PNO) = 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 108. PROFIdrive Control Word 1—STW1

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).
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

Table 108. PROFIdrive Control Word 1—STW1, continued

Bit	Value	Significance	Comments
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 109. Control Word (STW1)

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 110. 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 $t < t_{max}$, e.g., $n=n_{set}\pm$, $f=f_{set}\pm$, etc., t_{max} 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 $\geq$ 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

Table 110. Application Status Word PROFIdrive, continued

Bit	Value	Significance	Comments
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 111. 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

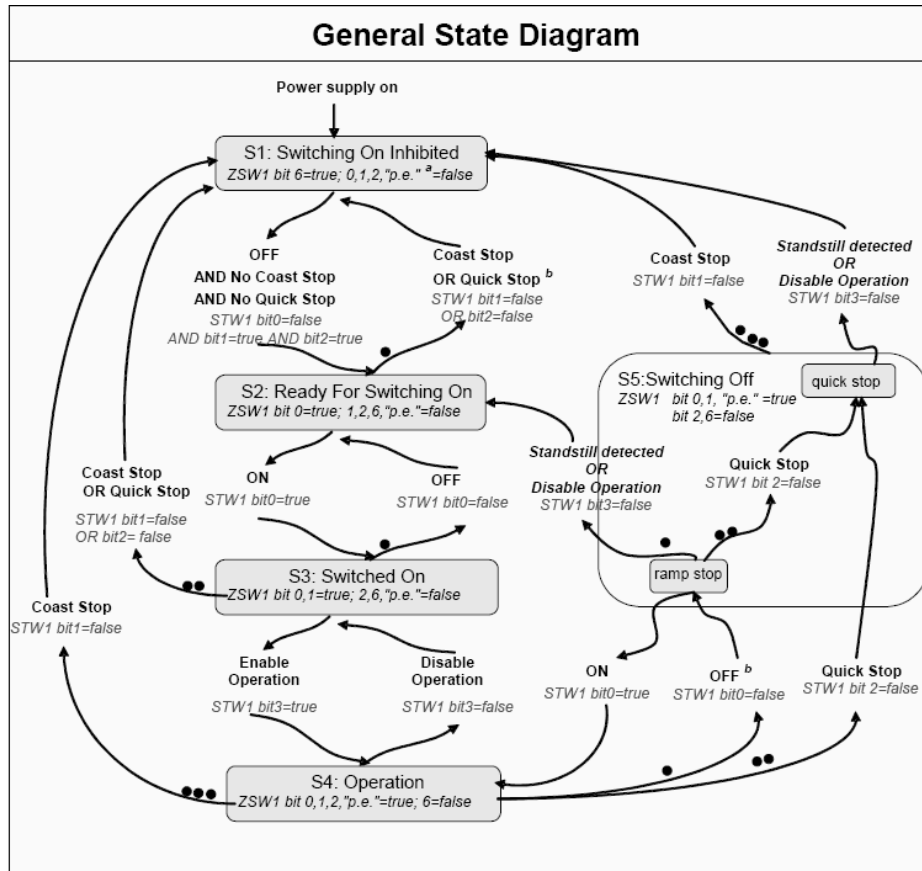
Actual Values

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 112. 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 113. 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, 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 several parameters are accessed, there are correspondingly many parameter addresses. 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 114. 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 115** and **Table 116**.

Table 115. 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		
nth Parameter Address			... 4 + 6 × (n-1)
1st Parameter Value (s) (only for request "Change parameter")	Format Values	No. of Values	4 + 6 × n
nth Parameter Values			4 + 6 × n + ... + (Format_n × Qty_n)

Table 116. 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.

Table 117. Field Coding

Field	Data Type	Values	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...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 117. Field Coding, continued

Field	Data Type	Values	Comment
Format	Unsigned 8	0x00	Reserved
		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
		0xEB...0xFF	Reserved
Error Number	Unsigned 16	0x0000...	Error Numbers
		0x00FF	

Fault Code Tracking

Table 118. Fault Codes

SN	Fault Code	Fault	Possible Cause	Correction measures
1	26	Device Change	Option Board Changed	Reset
2	27	Device Added	Option Board Added	
3	28	Device Removed	Option Board Removed	Reset
4	29	Device Unknown	Unknown Option Board	
5	35	Comm Bus Fault	The data connection between the PROFIBUS master and	Check the installation is correct.
6	56	OPT Card Fault	Device option board or slot. The PROFIBUS option board is broken.	Check the board and slot.

Generic Station Description (GSD) File

Please refer GSD file “019D0CFF.gsd”

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

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.

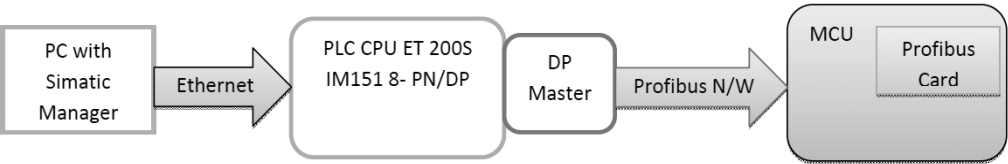
PowerXL drive can be controlled by PROFIBUS DP master using ST1 telegram of the PROFIdrive profile.

Siemens Configuration

PLC Configuration Instructions Document

Siemens PLC Setup

Figure 42. PLC Configuration



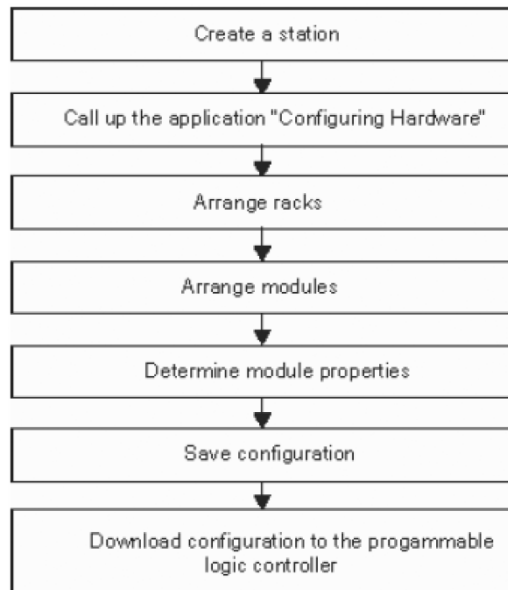
Configuring Hardware and Communication Connection Step 7

Before using PowerXL DG1 PROFIBUS Slave on PROFIBUS network, PROFIBUS Master is needed which can communicate with PowerXL DG1 PROFIBUS Slave.

The term “configuring” refers to the arranging of racks, modules, distributed I/O (DP) racks, and interface sub modules in a station window.

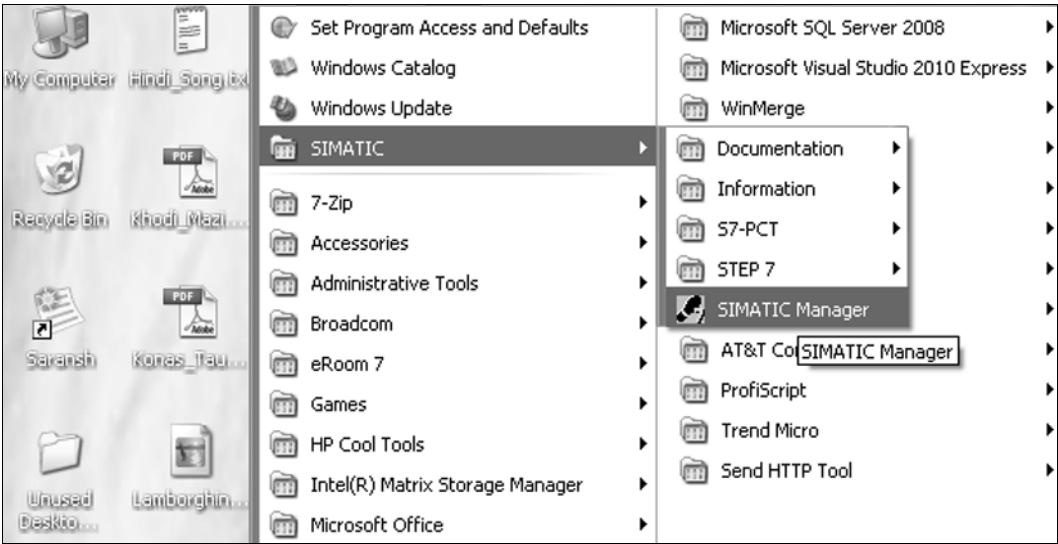
Basic Procedure to configure and assign parameters to a structure, proceed as shown below.

Figure 43. Basic Procedure



IM151-8 PN/DP CPU Configuration Process

Step 1. Open Simatic manager from start menu.



Step 2. Step_2. It will open “New Project” in STEP 7 wizard.



Step 3. Select default “next” option.

STEP 7 Wizard: "New Project"

1 Which CPU are you using in your project? 2(4)

CPU:

CPU Type	Order No
CPU312	6ES7 312-1AE14-0AB0
CPU312 C	6ES7 312-5BE03-0AB0
CPU312 IFM	6ES7 312-5AC02-0AB0
CPU313	6ES7 313-1AD03-0AB0
CPU313 C	6ES7 313-5BF03-0AB0
CPU313 C-2 DP	6ES7 313-6CG03-0AB0

CPU name: CPU312(1)

MPI address: 2

Work memory 32 KB; 0.1 ms/1000 instructions; MPI connection; single-tier

Preview<<

S7_Pro15

- SIMATIC 300 Station
 - CPU312(1)
 - S7 Program(1)
 - Blocks

Block Name	Symbolic Name
OB1	Cycle Execution

< Back Next > Finish Cancel Help

Step 4. Select language from available option.

STEP 7 Wizard: "New Project"

2 Which blocks do you want to add? 3(4)

Blocks:

Block Name	Symbolic Name
☒ OB1	Cycle Execution
☐ OB10	Time of Day Interrupt 0
☐ OB11	Time of Day Interrupt 1
☐ OB12	Time of Day Interrupt 2
☐ OB13	Time of Day Interrupt 3

☐ Select All Help on OB

Language for Selected Blocks

☐ STL ☐ LAD ☒ FBD

☐ Create with source files Preview<<

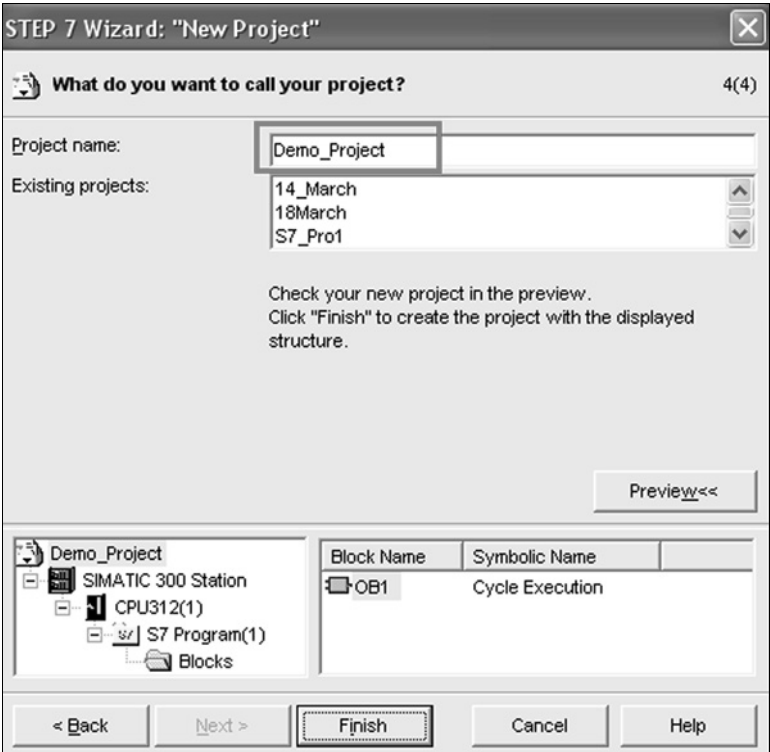
Demo_Project

- SIMATIC 300 Station
 - CPU312(1)
 - S7 Program(1)
 - Blocks

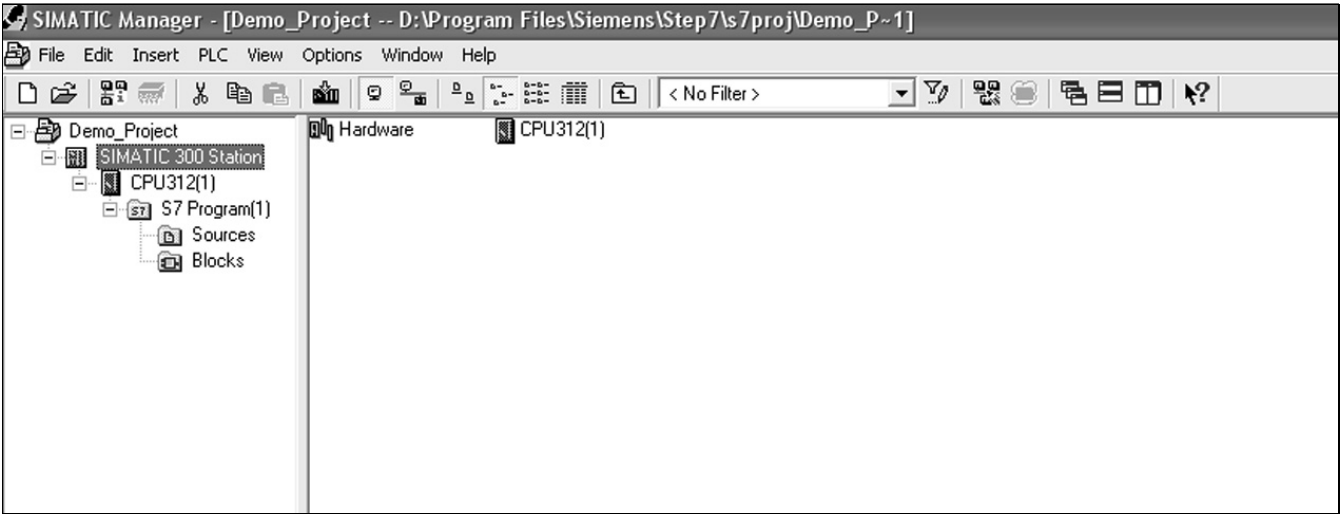
Block Name	Symbolic Name
OB1	Cycle Execution

< Back Next > Finish Cancel Help

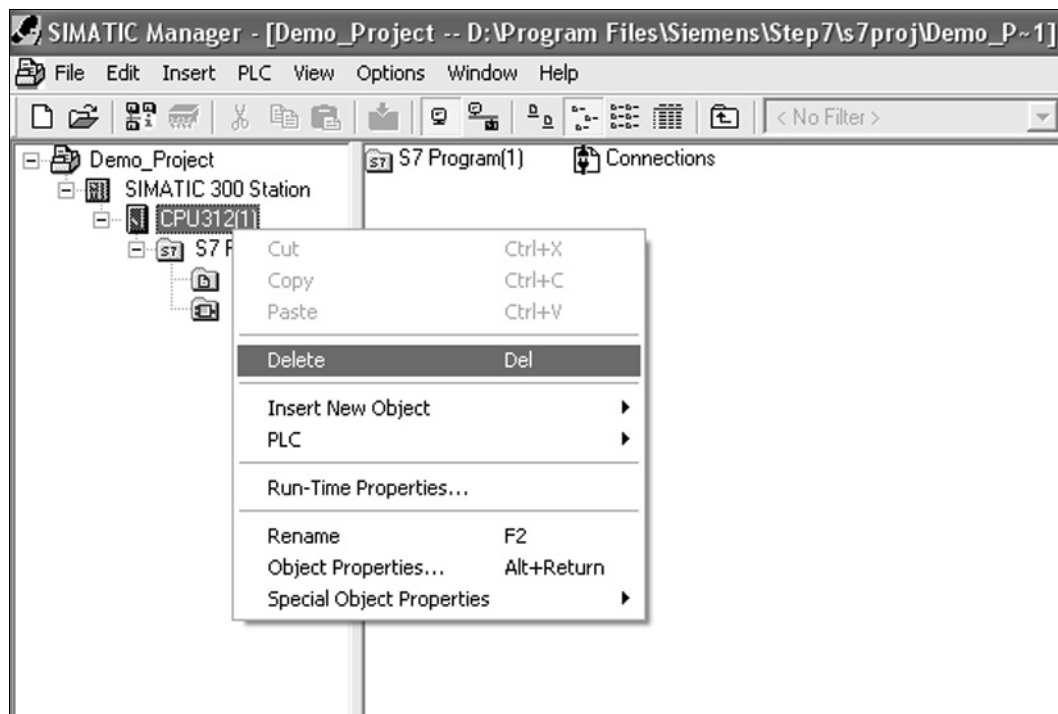
Step 5. Give a new name to default project and click on to finish option.



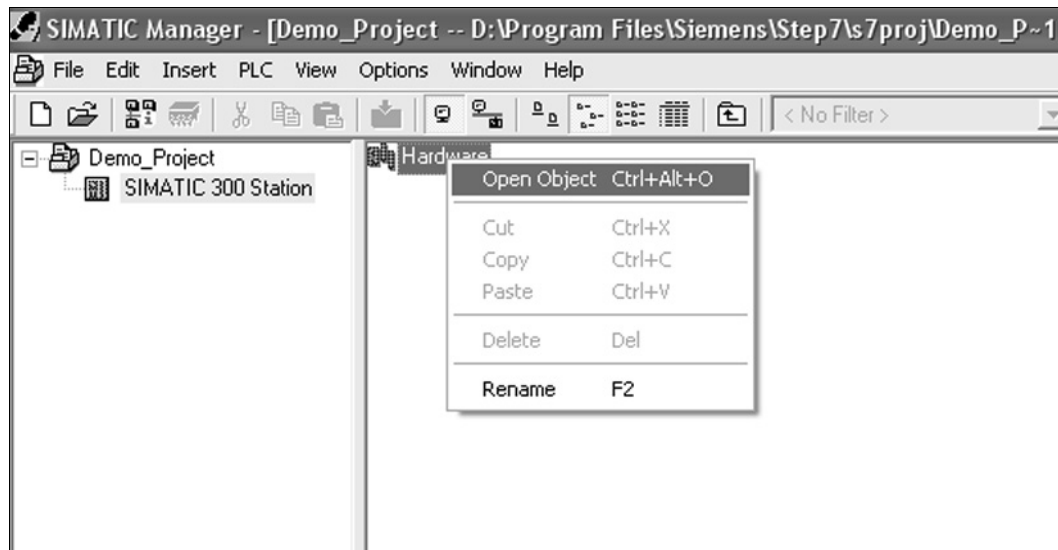
Step 6. Simatic Manager will open with new "Demo Project"



Step 7. Delete CPU312 (1) from SIMATIC 300 Station which gets added by default.

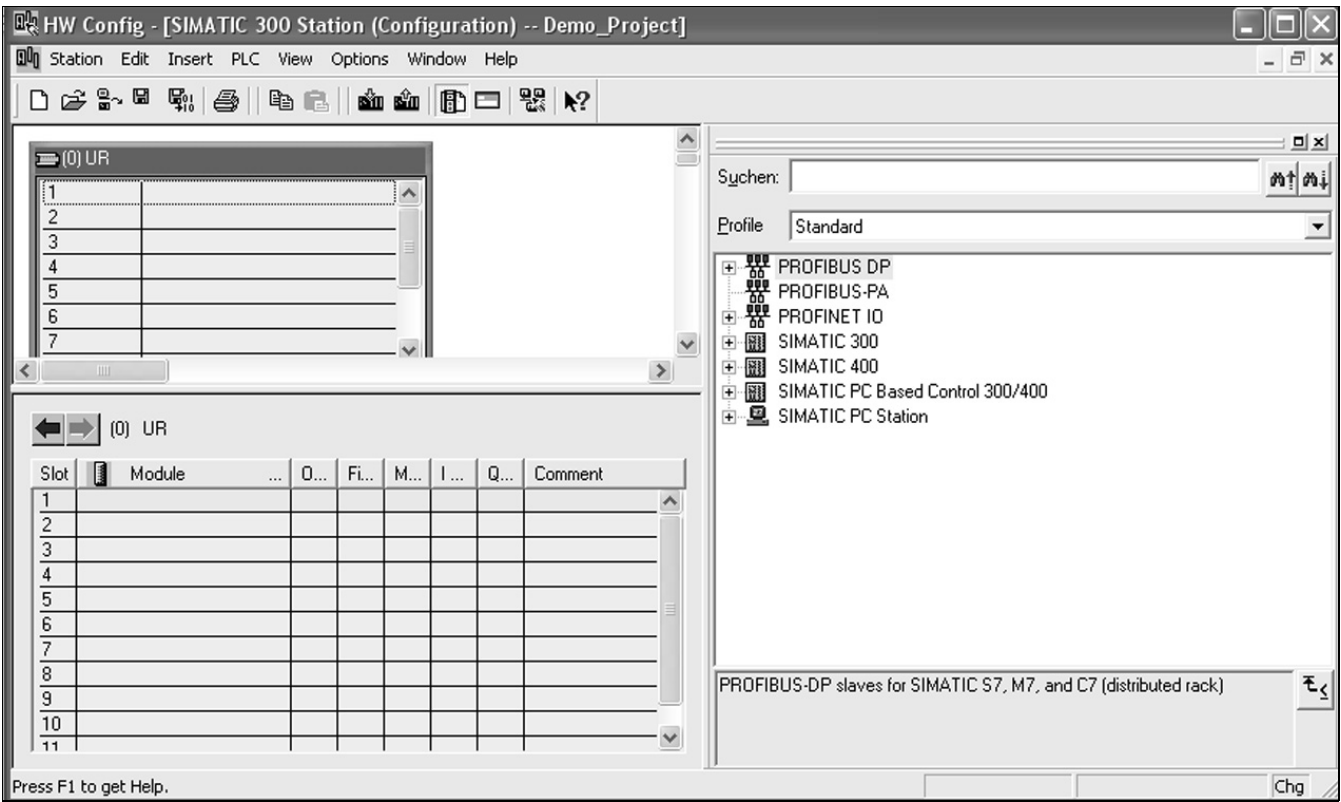


Step 8. Select SIMATIC 300 station and right click on “Hardware” option.

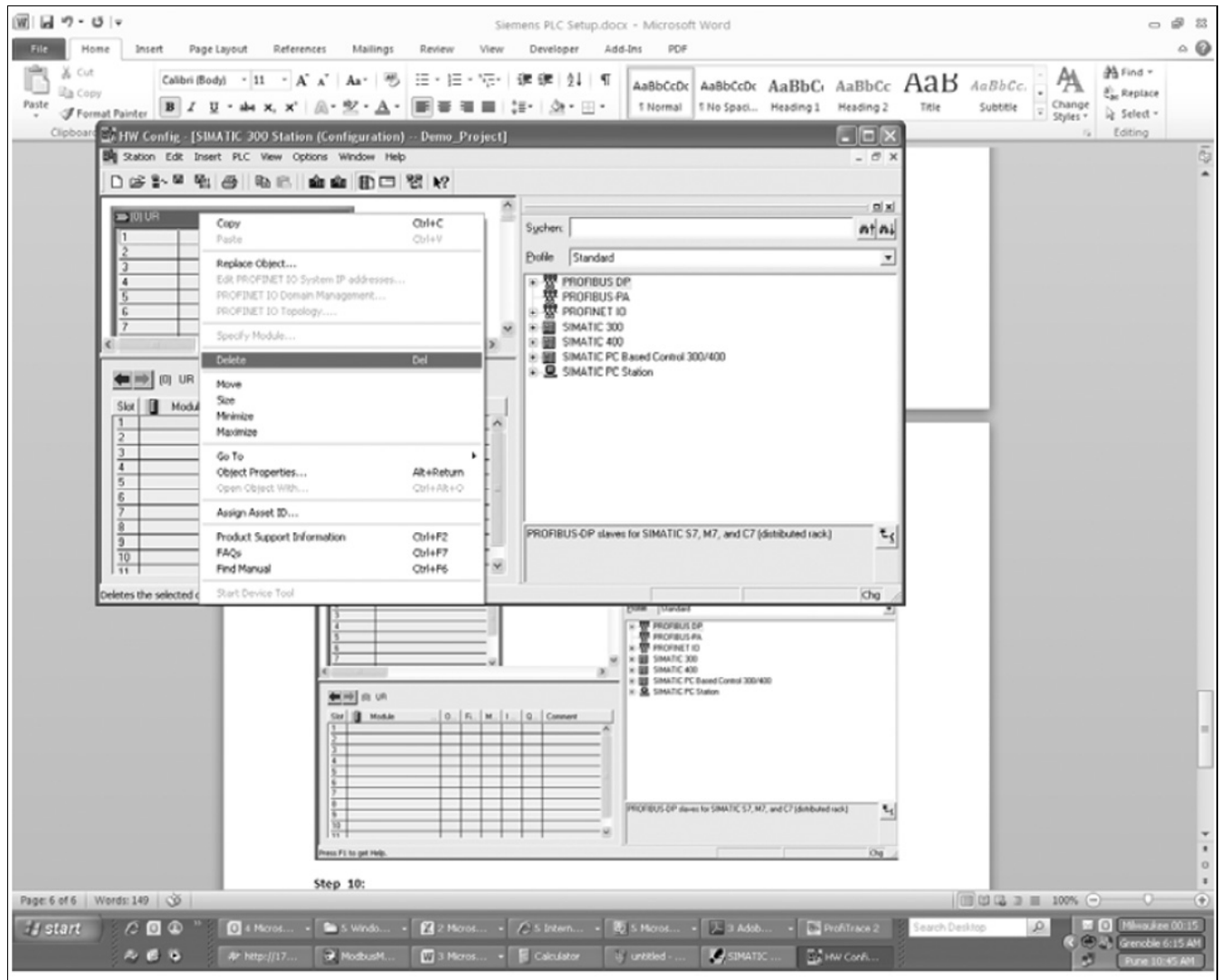


PROFIBUS-DP External Communication Cards

Step 9. Hardware configuration wizard will open for “Demo Project”.

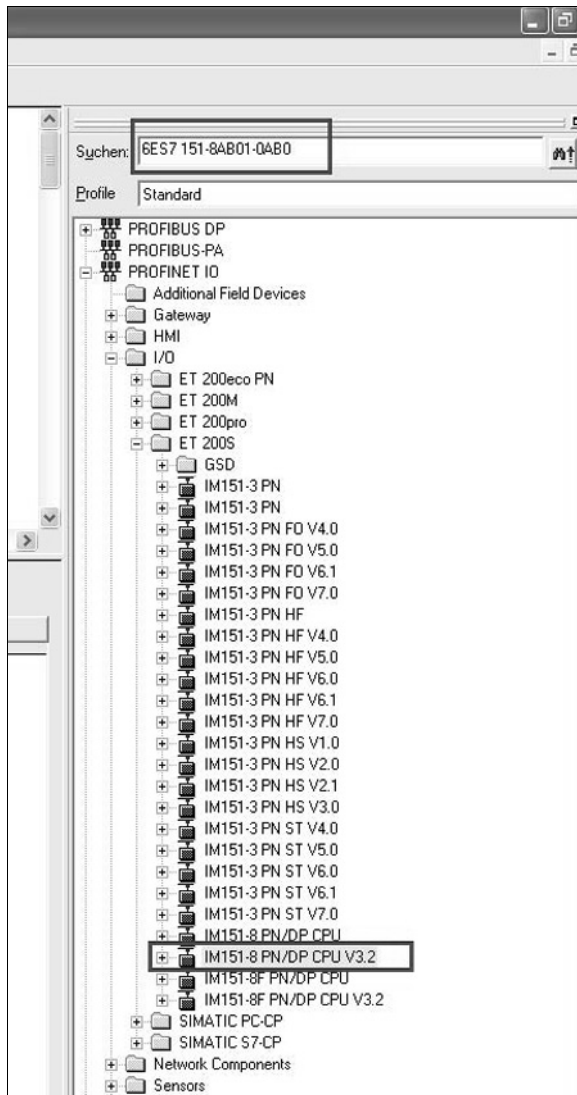


Step 10. Delete "(0) UR" (Universal Rack) as showed which was added by default.



PROFIBUS-DP External Communication Cards

Step 11. Now search part no device in hardware catalog as shown below.



Note: If required CPU is unavailable in hardware category, download hardware software package (HSP) for respective CPU (e.g., IM 151-8 PN/DP CPU or part no. 6ES7 151-8AB01-0AB0) from Siemens website.

Step 12. Drop and drag selecting respective device in rack section. Configure Ethernet interface PN-IO with your local network configuration.

Properties - Ethernet interface PN-IO (R0/S2.1)

General Parameters

If a subnet is selected, the next available addresses are suggested.

IP address: 166.99.170.103
Subnet mask: 255.255.255.0

☐ Use different method to obtain IP address

Gateway
☐ Do not use router
☒ Use router
Address: 166.99.170.253

Subnet:
not networked ---
Galaxy

New...
Properties...
Delete

OK Cancel Help

Properties - IM151-8 PN/DP CPU - Rack 0

General

Short Description: IM151-8 PN/DP CPU

Order No.: 6ES7 151-8AB01-0AB0

Name: IM151-8 PN/DP CPU

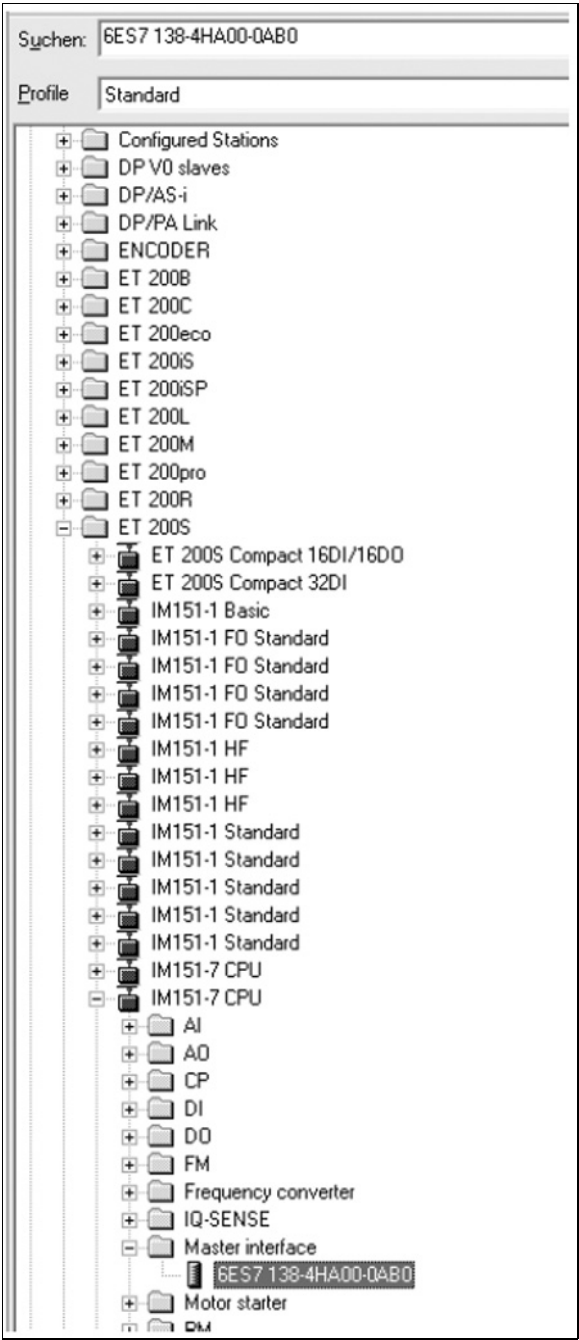
Rack No.: 0

Comment:

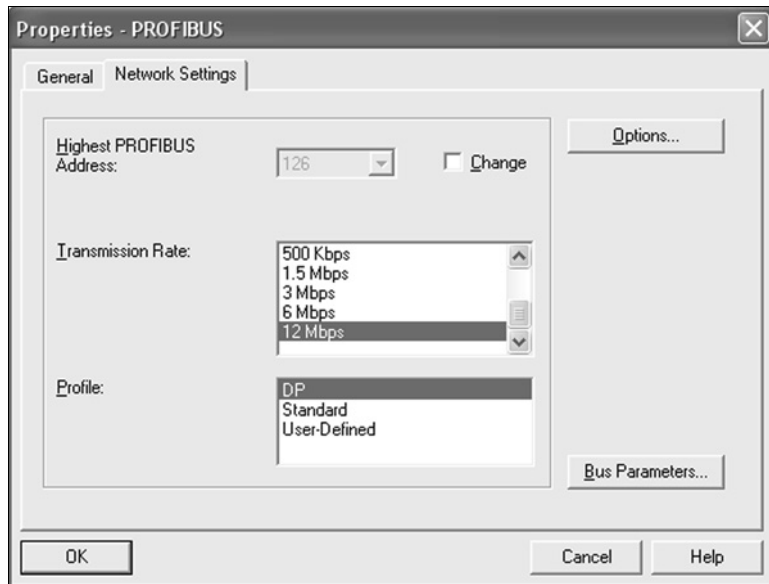
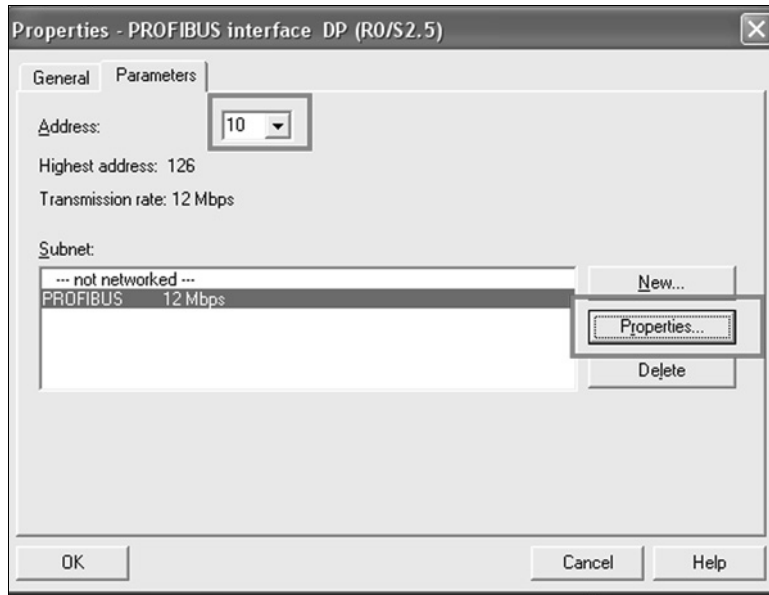
OK Cancel Help

PROFIBUS-DP External Communication Cards

Step 13. Now search for DP master with part number to attach it with CPU.



Step 14. Drop and drag in module of IM 151 8 PN/DP CPU and set station address "10"; transmission rate baud rate "12Mbps" and profile "DP".



PROFIBUS-DP External Communication Cards

HW Config - [SIMATIC 300 Station (Configuration) -- Demo_Project]

Station Edit Insert PLC View Options Window Help

Galaxy: PROFINET-IO-System (100)

(0) IM151-8 PN/DP CPU

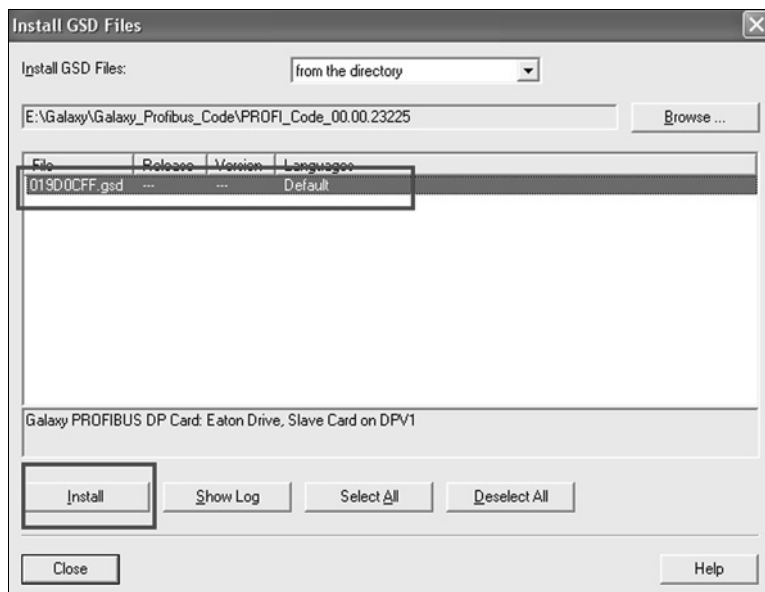
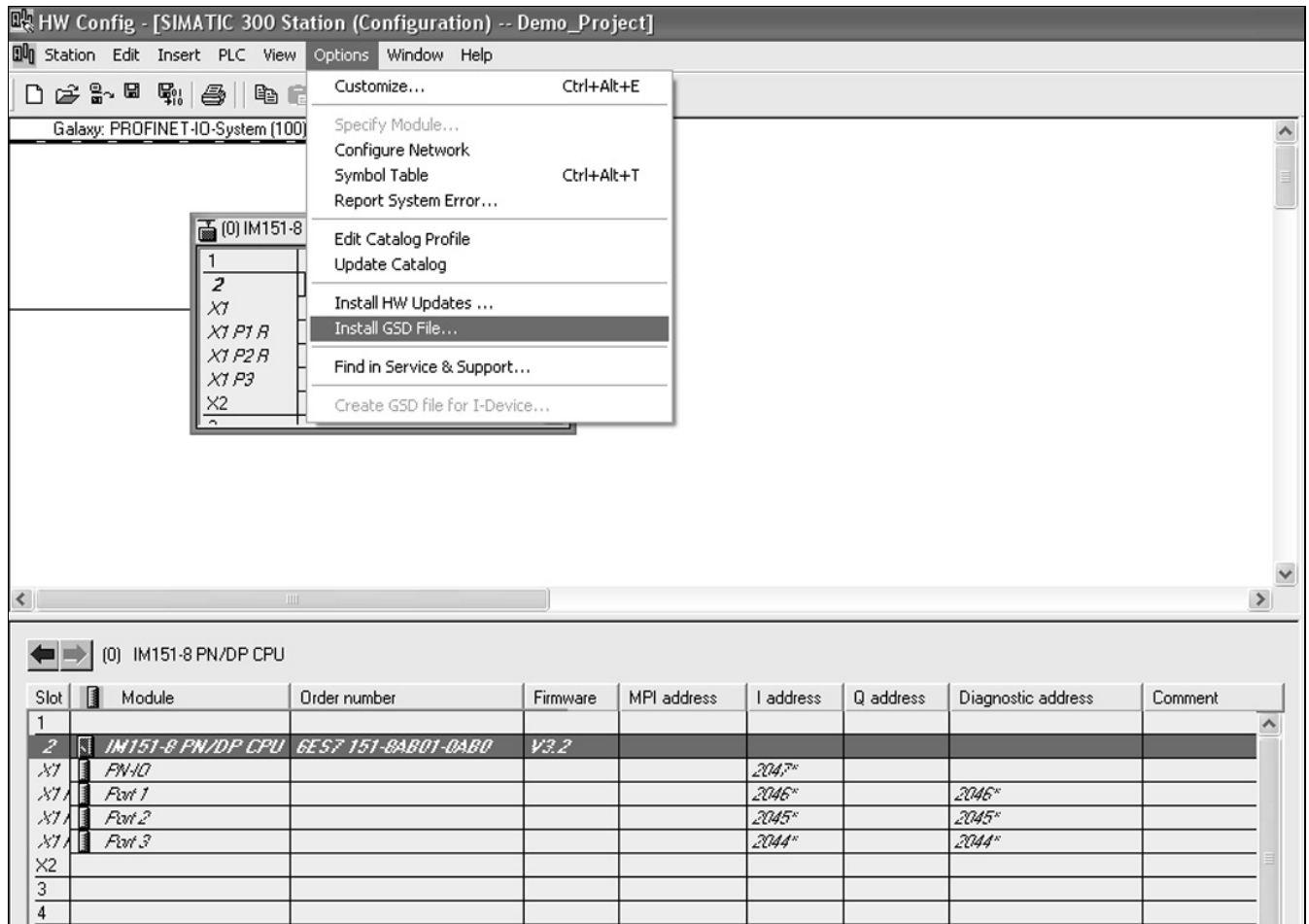
1	
2	IM151-8 PN/DP CPU
X1	PN-IO
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP

PROFIBUS: DP master system (1)

PROFIBUS: DP master system (1)

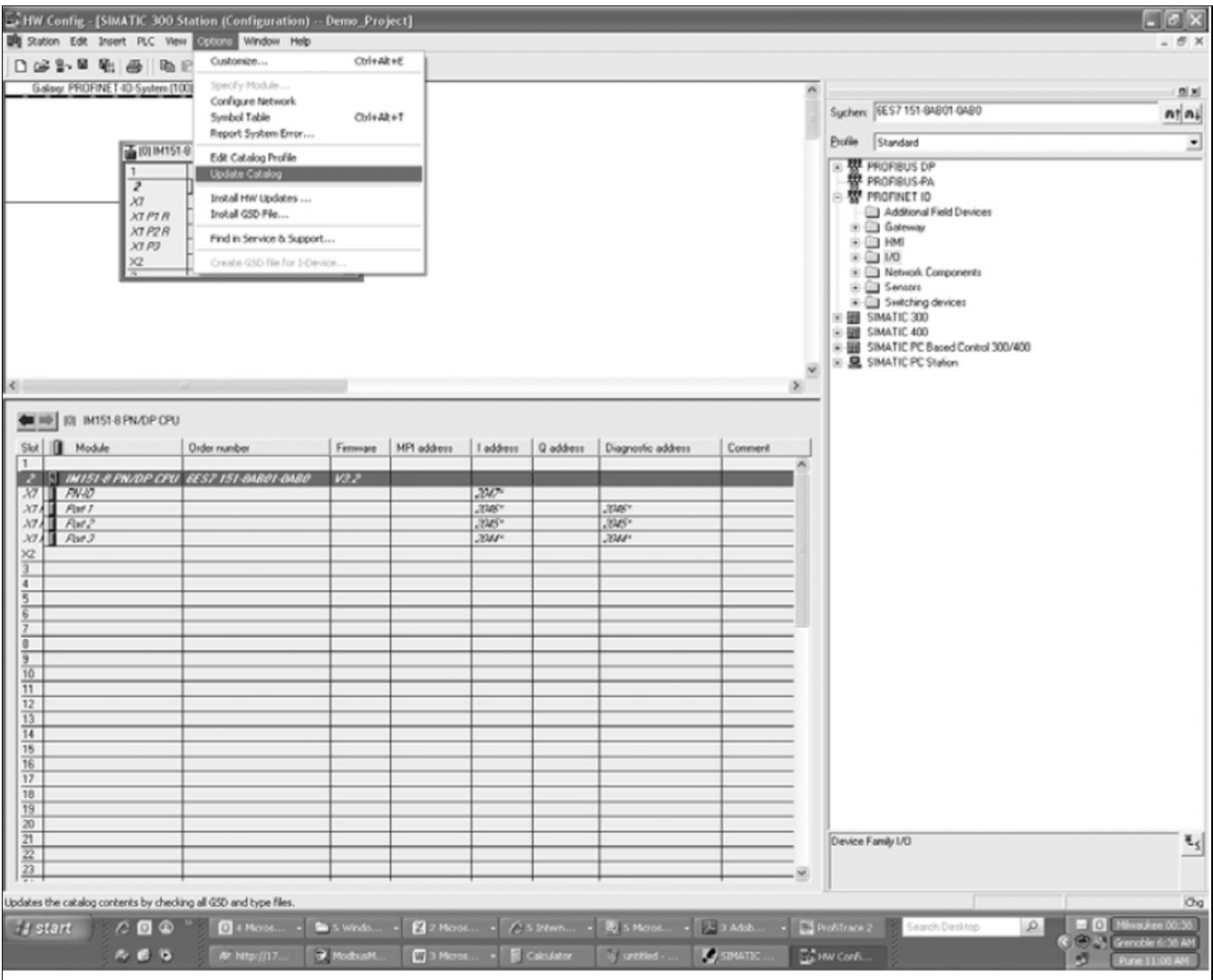
PROFIBUS address	Module	Order number	Firmware	Diagnostic address	Comment
------------------	--------	--------------	----------	--------------------	---------

Step 15. Now install GSD files for “PowerXL DG1 PROFIBUS Card”

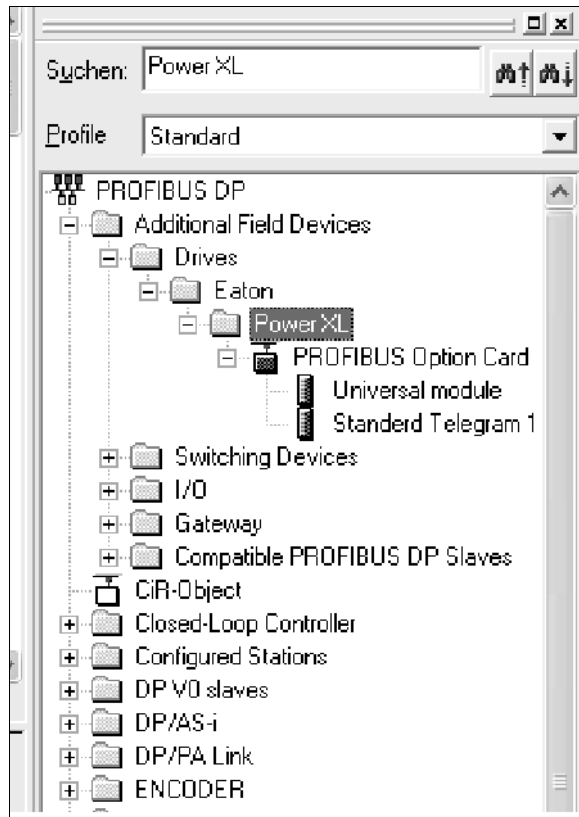


PROFIBUS-DP External Communication Cards

Step 16. After successful installation “update catalog”.

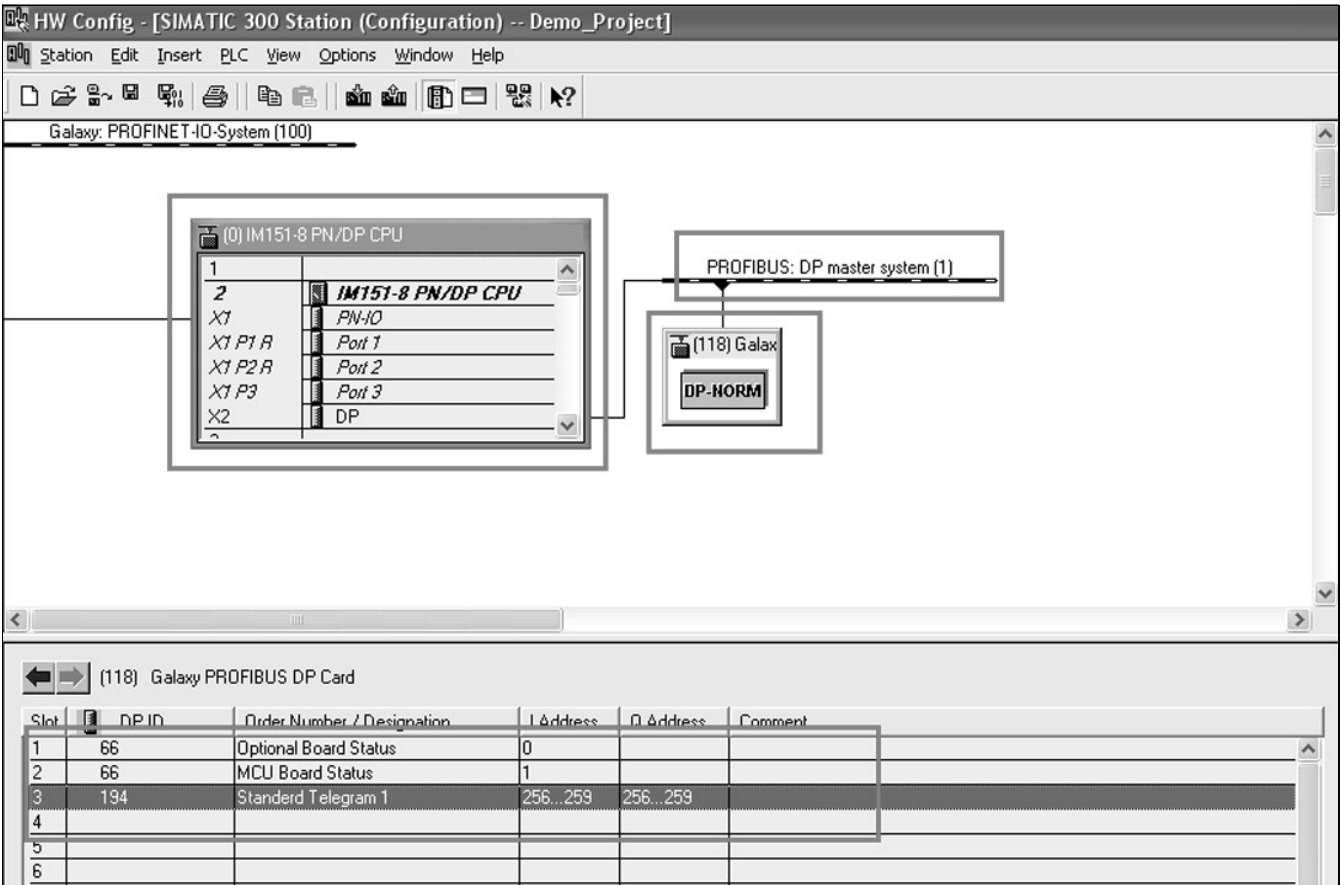
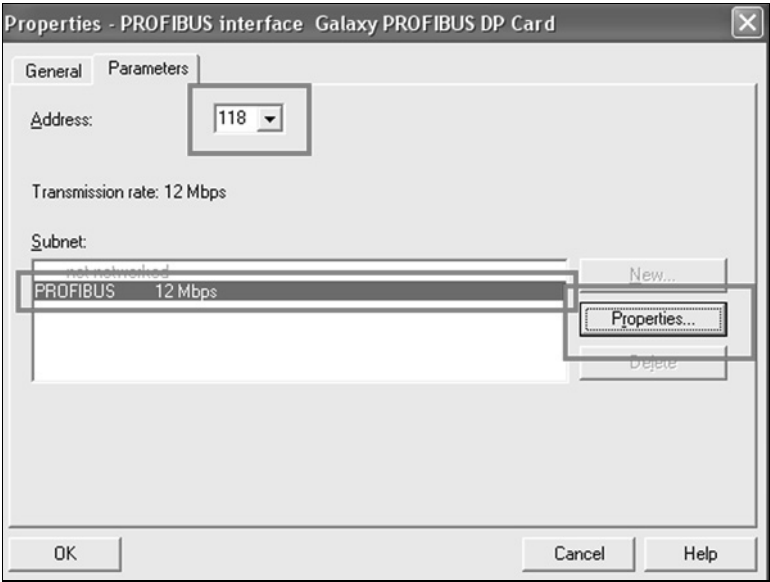


Step 17. Now search in PROFIBUS DP added GSD file “PowerXL”



PROFIBUS-DP External Communication Cards

Step 18. Double click on “PowerXL DG1 PROFIBUS DP Card” and set card station address and transmission rate. Click “OK”.



Step 19. Select standard telegram 1 from available PowerXL DG1 PROFIBUS Card. Set output address and input address.

Properties - DP slave

Address / ID:

I/O type:

Output

Address: Length: Unit: Consistent over:

Start: End:

Process image:

Input

Address: Length: Unit: Consistent over:

Start: End:

Process image:

Manufacturer-specific data:
(Maximum 14 bytes hexadecimal, separated by comma or blank space)

(118) Galaxy PROFIBUS DP Card

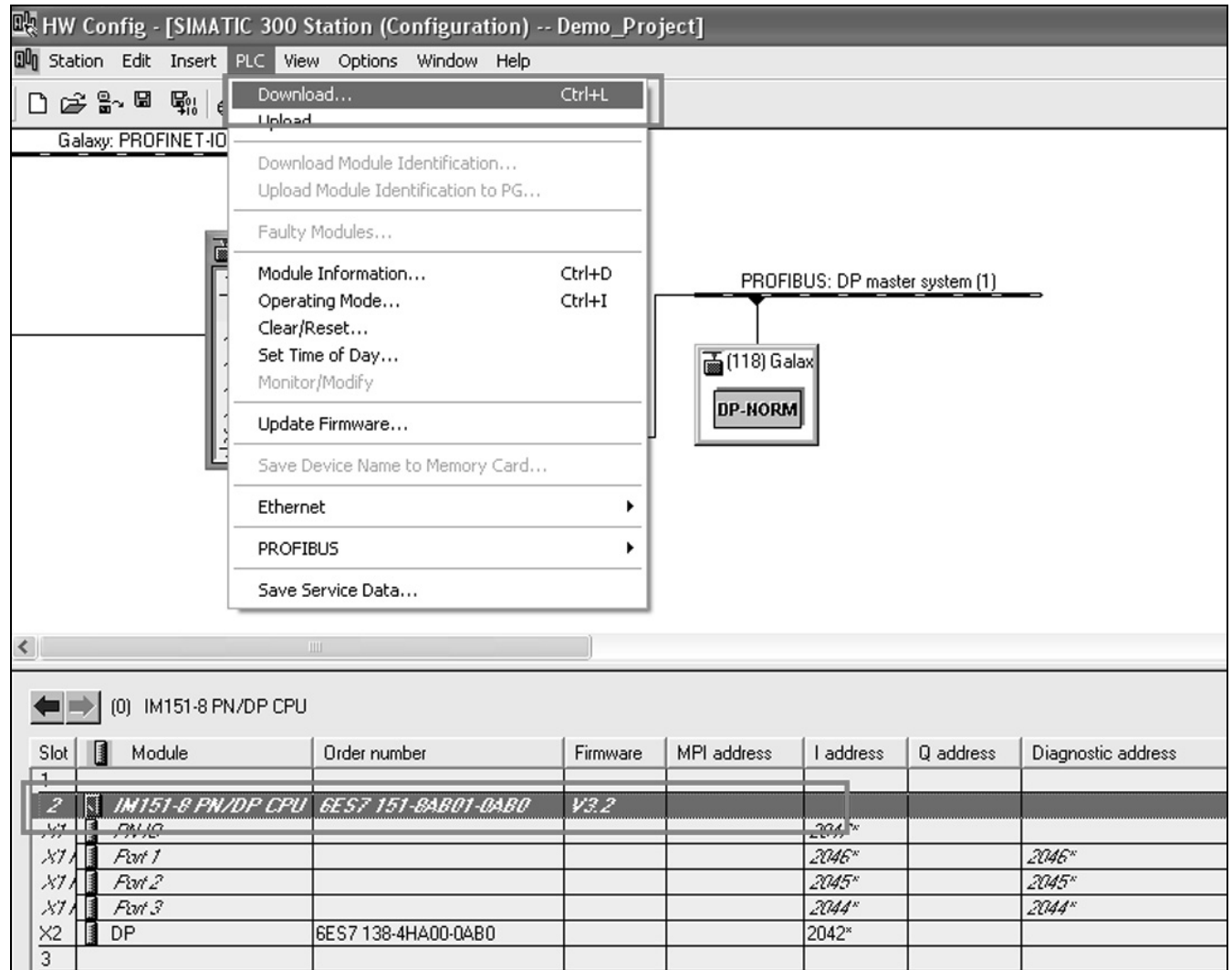
Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	66		Optional Board Status	0		
2	66		MCU Board Status	1		
3	194		Standard Telegram 1	2..5	8..11	
4						
5						

Step 20. Now save and compile.

The screenshot shows the 'HW Config' window for a SIMATIC 300 Station. The 'Station' menu is open, and 'Save and Compile' is highlighted. The background diagram shows a CPU connected to a PROFIBUS DP master system (1), which includes a (118) Galax DP-NORM card. Below the diagram is a table listing slot configurations.

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	66	Optional Board Status	0		
2	66	MCU Board Status	1		
3	194	Standard Telegram 1	2...5	8...11	
4					
5					

Step 21. Now select module “IM 151-8 PN/DP CPU” and go to “PLC” option and click on download option.



The screenshot shows the SIMATIC Manager HW Config interface. The top menu bar includes Station, Edit, Insert, PLC, View, Options, Window, and Help. The 'PLC' menu is open, displaying options such as Download... (Ctrl+L), Upload, Download Module Identification..., Upload Module Identification to PG..., Faulty Modules..., Module Information... (Ctrl+D), Operating Mode... (Ctrl+I), Clear/Reset..., Set Time of Day..., Monitor/Modify, Update Firmware..., Save Device Name to Memory Card..., Ethernet, PROFIBUS, and Save Service Data....

The main workspace shows a rack configuration for a SIMATIC 300 Station. The rack is labeled 'Galaxy: PROFINET-IO'. The rack contains the following modules:

- Slot 1: IM151-8 PN/DP CPU (Order number: 6ES7 151-8AB01-0AB0, Firmware: V3.2)
- Slot 2: DP (Order number: 6ES7 138-4HA00-0AB0)

The rack is connected to a PROFIBUS-DP master system (1). The master system is labeled '(118) Galaxy' and 'DP-MORM'.

Slot	Module	Order number	Firmware	MPI address	I address	Q address	Diagnostic address
1	IM151-8 PN/DP CPU	6ES7 151-8AB01-0AB0	V3.2				
2	DP	6ES7 138-4HA00-0AB0			2042*		
X1	Port 1				2046*		2046*
X1	Port 2				2045*		2045*
X1	Port 3				2044*		2044*

Select Node Address

Over which station address is the programming device connected to the module IM151-8 PN/DP CPU?

Rack:

Slot:

Target Station:

Local

Can be reached by means of gateway

Enter connection to target station:

IP address	MAC address	Module type	Station name	Module name	P
166.99.170.103					

Accessible Nodes

View

OK

Cancel

Help

Click on "YES" to restart the module.

Download (13:4363)



The module IM151-8 PN/DP CPU [R 0/S 2] is in the STOP mode.

Do you want to start the module now (complete restart)?

Yes

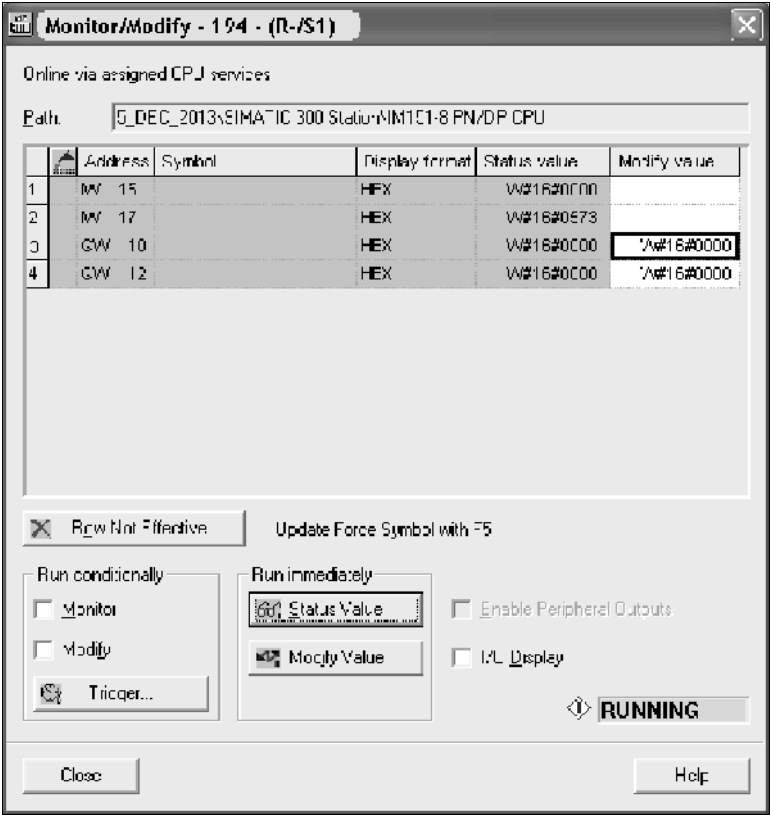
No

LED of (IM 1518-PN/DP CPU) is turned into "RUN" mode.

Step 22. Click on PowerXL DG1 PROFIBUS Card and select “Standard Telegram 1.”
Monitor / Modify wizard will open.

The screenshot shows the SIMATIC Manager HW Config interface. The title bar indicates the project is 'HW Config - [SIMATIC 300 Station (Configuration) -- 5_DEC_2013]'. The 'PLC' menu is open, and the 'Monitor/Modify' option is selected. The main workspace shows a 'Profibus Master 5 Dec: DP master system (1)' connected to a 'DP-NORM' card. The bottom status bar shows '(118) PROFIBUS Option Card'.

Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	194		Standard Telegram 1	15..18	10..13	
2						
3						
4						



Appendix A—Parameter ID List

Parameter Descriptions

Table 119. Parameter ID List

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
B10.1.1 ①	910	710	200	Board Status
B10.1.2 ①	920	560	200	AI1 Value
B10.1.3 ①	923	570	2	AO1 Value
B10.1.4 ①	925	570	201	AO2 Value
B10.2.1 ①	893	263	200	AI1 Mode
B10.2.10 ①	277	277	2	AO1 Filter Time
B10.2.11 ①	278	274	200	AO1 Scale
B10.2.12 ①	279	278	2	AO1 Inversion
B10.2.13 ①	280	275	2	AO1 Offset
B10.2.14 ①	924	276	201	AO2 Mode
B10.2.15 ①	281	460	201	AO2 Function
B10.2.16 ①	282	279	201	AO2 Minimum
B10.2.17 ①	283	277	201	AO2 Filter Time
B10.2.18 ①	284	274	201	AO2 Scale
B10.2.19 ①	285	278	201	AO2 Inversion
B10.2.2 ①	129	260	2	AI1 Signal Range
B10.2.20 ①	286	275	201	AO2 Offset
B10.2.3 ①	130	264	2	AI1 Custom Min
B10.2.4 ①	131	265	2	AI1 Custom Max
B10.2.5 ①	128	266	2	AI1 Filter Time
B10.2.6 ①	132	267	2	AI1 Signal Invert
B10.2.7 ①	922	276	2	AO1 Mode
B10.2.8 ①	275	460	2	AO1 Function
B10.2.9 ①	276	279	2	AO1 Minimum
B11.1.1 ①	910	710	200	Board Status
B11.1.2 ①	926	455	2	RO1, RO2, RO3
B11.2.1 ①	552	451	200	RO1 Function
B11.2.2 ①	555	451	201	RO2 Function
B11.2.3 ①	556	451	202	RO3 Function
B12.1.1 ①	910	710	200	Board Status
B12.1.2 ①	931	756	2	PT100 State
B12.1.3 ①	928	583	2	PT100 Values
B12.2.1 ①	927	342	2	PT100-3,2,1
B12.2.2 ①	937	581	2	PT100 Warning Limit
B12.2.3 ①	938	582	2	PT100 Fault Limit
B13.1.1 ①	910	710	200	Board Status
B13.1.2 ①	934	550	2	AC1, AC2, AC3
B13.1.3 ①	1697	550	203	AC4, AC5, AC6
B14.1.1 ①	910	710	200	Board Status

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
B14.2.1 ①	1250	3201	2	Slave Address
B14.2.2 ①	1251	3202	2	Baud Rate
B14.2.3 ①	1252	3203	2	DO IO Data
B14.2.4 ①	1253	3200	2	Operate Mode
B2.1.1 ①	883	710	100	Board Status
B2.1.2 ①	889	550	1	DI1, DI2, DI3
B2.1.3 ①	888	754	1	DO1, DO2, DO3
B2.1.4 ①	891	593	1	Thermistor Resistor
B2.1.5 ①	887	753	1	Thermistor State
B2.2.1 ①	241	461	100	DO1 Function
B2.2.2 ①	242	461	101	DO2 Function
B2.2.3 ①	243	461	102	DO3 Function
B2.2.4 ①	890	343	1	Thermistor Config
B3.1.1 ①	883	710	100	Board Status
B3.1.2 ①	894	560	100	AI1 Value
B3.1.3 ①	897	570	100	AO1 Value
B3.1.4 ①	899	570	101	AO2 Value
B3.2.1 ①	919	263	100	AI1 Mode
B3.2.10 ①	236	277	100	AO1 Filter Time
B3.2.11 ①	239	274	100	AO1 Scale
B3.2.12 ①	237	278	100	AO1 Inversion
B3.2.13 ①	240	275	100	AO1 Offset
B3.2.14 ①	898	276	101	AO2 Mode
B3.2.15 ①	269	460	101	AO2 Function
B3.2.16 ①	270	279	101	AO2 Minimum
B3.2.17 ①	271	277	101	AO2 Filter Time
B3.2.18 ①	272	274	101	AO2 Scale
B3.2.19 ①	273	278	101	AO2 Inversion
B3.2.2 ①	124	260	1	AI1 Signal Range
B3.2.20 ①	274	275	101	AO2 Offset
B3.2.3 ①	125	264	100	AI1 Custom Min
B3.2.4 ①	126	265	100	AI1 Custom Max
B3.2.5 ①	123	266	100	AI1 Filter Time
B3.2.6 ①	127	267	100	AI1 Signal Invert
B3.2.7 ①	896	276	100	AO1 Mode
B3.2.8 ①	235	460	100	AO1 Function
B3.2.9 ①	238	279	100	AO1 Minimum
B4.1.1 ①	883	710	100	Board Status
B4.1.2 ①	900	455	100	RO1, RO2, RO3
B4.2.1 ①	540	451	100	RO1 Function
B4.2.2 ①	541	451	101	RO2 Function
B4.2.3 ①	551	451	102	RO3 Function
B5.1.1 ①	883	710	100	Board Status
B5.2.1 ①	901	342	1	PT100-3,2,1

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
B5.2.2 ①	338	581	1	PT100 Warning Limit
B5.2.3 ①	339	582	1	PT100 Fault Limit
B6.1.1 ①	883	710	100	Board Status
B6.1.2 ①	908	550	1	AC1, AC2, AC3
B6.1.3 ①	1696	550	103	AC4, AC5, AC6
B7.1.1 ①	883	710	100	Board Status
B7.2.1 ①	1242	3201	100	Slave Address
B7.2.2 ①	1243	3202	100	Baud Rate
B7.2.3 ①	1244	3203	100	DO IO Data
B7.2.4 ①	1245	3200	100	Operate Mode
B9.1.1 ①	910	710	200	Board Status
B9.1.2 ①	915	550	2	DI1, DI2, DI3
B9.1.3 ①	914	550	203	DO1, DO2, DO3
B9.1.4 ①	917	593	0	Thermistor Resistor
B9.1.5 ①	913	753	200	Thermistor State
B9.2.1 ①	244	461	200	DO1 Function
B9.2.2 ①	245	461	201	DO2 Function
B9.2.3 ①	246	461	202	DO3 Function
B9.2.4 ①	916	343	2	Thermistor Config
M1	1	502	0	Output Frequency
M10	9	822	4	Motor Temperature
M11	15	2	1	Torque Reference
M12	10	560	0	Analog Input 1
M13	11	560	1	Analog Input 2
M14	25	570	0	Analog Output 1
M15	575	570	1	Analog Output 2
M16	12	550	0	DI1, DI2, DI3
M17	13	550	3	DI4, DI5, DI6
M18	576	550	6	DI7, DI8
M19	14	754	0	DO1
M2	24	1	0	Freq Reference
M20	557	455	0	RO1, RO2, RO3
M21	558	3103	0	TC1, TC2, TC3
M22	559	3125	0	Interval 1
M23	560	3125	1	Interval 2
M24	561	3125	2	Interval 3
M25	562	3125	3	Interval 4
M26	563	3125	4	Interval 5
M27	569	3101	0	Timer 1
M28	571	3101	1	Timer 2
M29	573	3101	2	Timer 3
M3	2	503	0	Motor Speed
M30	16	2150	0	PID1 Set Point
M31	18	2864	0	PID1 Feedback

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
M32	20	2167	0	PID1 Error Value
M33	22	2166	0	PID1 Output
M34	23	2133	0	PID1 Status
M35	32	2150	1	PID2 Set Point
M36	34	2864	1	PID2 Feedback
M37	36	2167	1	PID2 Error Value
M38	38	2166	1	PID2 Output
M39	39	2133	1	PID2 Status
M4	3	504	0	Motor Current
M40	26	1911	0	Running Motors
M41	27	580	0	PT100 Temperature
M42	28	947	0	Last Active Fault
M43	30	327	0	Multi-Monitoring
M5	4	507	0	Motor Torque
M6	5	513	0	Motor Power
M7	6	501	0	Motor Voltage
M8	7	501	1	DC-link Voltage
M9	8	822	6	Unit Temperature
P1.1	101	20	0	Min Frequency
P1.10	140	416	0	Local/Remote Select
P1.11	135	408	0	Remote 1 Control Place
P1.12	136	436	0	Local Reference
P1.13	137	437	0	Remote 1 Reference
P1.14	1679	622	3	Reverse Enable
P1.2	102	20	1	Max Frequency
P1.3	103	130	0	Accel Time 1
P1.4	104	134	0	Decel Time 1
P1.5	113	210	0	Motor Nom Current
P1.6	112	217	0	Motor Nom Speed
P1.7	115	215	0	Motor PF
P1.8	110	211	0	Motor Nom Voltage
P1.9	111	216	0	Motor Nom Frequency
P10.1 ①	1294	2100	0	PID1 Control Gain
P10.10 ①	1306	2852	0	PID1 Dead Band Delay
P10.11 ①	1307	2170	0	PID1 Keypad Set Point 1
P10.12 ①	1309	2179	0	PID1 Keypad Set Point 2
P10.13 ①	1311	2151	0	PID1 Ramp Time
P10.14 ①	1312	2110	0	PID1 Set Point 1 Source
P10.15 ①	1313	2168	0	PID1 Set Point 1 Min
P10.16 ①	1314	2169	0	PID1 Set Point 1 Max
P10.17 ①	1315	2136	0	PID1 Set Point 1 Sleep Enable
P10.18 ①	1316	2137	0	PID1 Set Point 1 Sleep Freq
P10.19 ①	1317	2138	0	PID1 Set Point 1 Sleep Delay
P10.2 ①	1295	2101	0	PID1 Control ITime

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P10.20 ①	1318	2139	0	PID1 Set Point 1 Wake Up Level
P10.21 ①	1320	2154	0	PID1 Set Point 1 Boost
P10.22 ①	1321	2116	0	PID1 Set Point 2 Source
P10.23 ①	1322	2177	0	PID1 Set Point 2 Min
P10.24 ①	1323	2178	0	PID1 Set Point 2 Max
P10.25 ①	1324	2140	0	PID1 Set Point 2 Sleep Enable
P10.26 ①	1325	2141	0	PID1 Set Point 2 Sleep Freq
P10.27 ①	1326	2142	0	PID1 Set Point 2 Sleep Delay
P10.28 ①	1327	2143	0	PID1 Set Point 2 Wake Up Level
P10.29 ①	1329	2157	0	PID1 Set Point 2 Boost
P10.3 ①	1296	2102	0	PID1 Control DTime
P10.30 ①	1330	2171	0	PID1 Feedback Function
P10.31 ①	1331	2153	0	PID1 Feedback Gain
P10.32 ①	1332	2112	0	PID1 Feedback 1 Source
P10.33 ①	1333	2172	0	PID1 Feedback 1 Min
P10.34 ①	1334	2173	0	PID1 Feedback 1 Max
P10.35 ①	1335	2117	0	PID1 Feedback 2 Source
P10.36 ①	1336	2181	0	PID1 Feedback 2 Min
P10.37 ①	1337	2182	0	PID1 Feedback 2 Max
P10.38 ①	1338	2800	0	PID1 Feedforward Func
P10.39 ①	1339	2801	0	PID1 Feedforward Gain
P10.4 ①	1297	2870	0	PID1 Process Unit
P10.40 ①	1340	2810	0	PID1 Feedforward 1 Source
P10.41 ①	1341	2811	0	PID1 Feedforward 1 Min
P10.42 ①	1342	2812	0	PID1 Feedforward 1 Max
P10.43 ①	1343	2815	0	PID1 Feedforward 2 Source
P10.44 ①	1344	2816	0	PID1 Feedforward 2 Min
P10.45 ①	1345	2817	0	PID1 Feedforward 2 Max
P10.46 ①	1352	2830	0	PID1 Set Point 1 Comp Enable
P10.47 ①	1353	2831	0	PID1 Set Point 1 Comp Max
P10.48 ①	1354	2835	0	PID1 Set Point 2 Comp Enable
P10.49 ①	1355	2836	0	PID1 Set Point 2 Comp Max
P10.5 ①	1298	2871	0	PID1 Process Unit Min
P10.6 ①	1300	2872	0	PID1 Process Unit Max
P10.7 ①	1302	2873	0	PID1 Process Unit Decimal
P10.8 ①	1303	2850	0	PID1 Error Inversion
P10.9 ①	1304	2851	0	PID1 Dead Band
P11.1 ①	1356	2100	1	PID2 Control Gain
P11.10 ①	1368	2852	1	PID2 Dead Band Delay
P11.11 ①	1369	2170	1	PID2 Keypad Set Point 1
P11.12 ①	1371	2179	1	PID2 Keypad Set Point 2
P11.13 ①	1373	2151	1	PID2 Ramp Time
P11.14 ①	1374	2110	1	PID2 Set Point 1 Source
P11.15 ①	1375	2168	1	PID2 Set Point 1 Min

Note

① Available on PROFIBUS in October 2014.

Appendix A—Parameter ID List

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P11.16 ①	1376	2169	1	PID2 Set Point 1 Max
P11.17 ①	1377	2136	1	PID2 Set Point 1 Sleep Enable
P11.18 ①	1378	2137	1	PID2 Set Point 1 Sleep Freq
P11.19 ①	1379	2138	1	PID2 Set Point 1 Sleep Delay
P11.2 ①	1357	2101	1	PID2 Control I Time
P11.20 ①	1380	2139	1	PID2 Set Point 1 WakeUp Level
P11.21 ①	1382	2154	1	PID2 Set Point 1 Boost
P11.22 ①	1383	2116	1	PID2 Set Point 2 Source
P11.23 ①	1384	2177	1	PID2 Set Point 2 Min
P11.24 ①	1385	2178	1	PID2 Set Point 2 Max
P11.25 ①	1386	2140	1	PID2 Set Point 2 Sleep Enable
P11.26 ①	1387	2141	1	PID2 Set Point 2 Sleep Freq
P11.27 ①	1388	2142	1	PID2 Set Point 2 Sleep Delay
P11.28 ①	1389	2143	1	PID2 Set Point 2 WakeUp Level
P11.29 ①	1391	2157	1	PID2 Set Point 2 Boost
P11.3 ①	1358	2102	1	PID2 Control D Time
P11.30 ①	1392	2171	1	PID2 Feedback Func
P11.31 ①	1393	2153	1	PID2 Feedback Gain
P11.32 ①	1394	2112	1	PID2 Feedback 1 Source
P11.33 ①	1395	2172	1	PID2 Feedback 1 Min
P11.34 ①	1396	2173	1	PID2 Feedback 1 Max
P11.35 ①	1397	2117	1	PID2 Feedback 2 Source
P11.36 ①	1398	2181	1	PID2 Feedback 2 Min
P11.37 ①	1399	2182	1	PID2 Feedback 2 Max
P11.38 ①	1400	2800	1	PID2 Feedforward Func
P11.39 ①	1401	2801	1	PID2 Feedforward Gain
P11.4 ①	1359	2870	1	PID2 Process Unit
P11.40 ①	1402	2810	1	PID2 Feedforward 1 Source
P11.41 ①	1403	2811	1	PID2 Feedforward 1 Min
P11.42 ①	1404	2812	1	PID2 Feedforward 1 Max
P11.43 ①	1405	2815	1	PID2 Feedforward 2 Source
P11.44 ①	1406	2816	1	PID2 Feedforward 2 Min
P11.45 ①	1407	2817	1	PID2 Feedforward 2 Max
P11.46 ①	1414	2830	1	PID2 Set Point1 Comp Enable
P11.47 ①	1415	2831	1	PID2 Set Point1 Comp Max
P11.48 ①	1416	2835	1	PID2 Set Point 2 Comp Enable
P11.49 ①	1417	2836	1	PID2 Set Point 2 Comp Max
P11.5 ①	1360	2871	1	PID2 Process Unit Min
P11.6 ①	1362	2872	1	PID2 Process Unit Max
P11.7 ①	1364	2873	1	PID2 Process Unit Decimal
P11.8 ①	1365	2850	1	PID2 Error Inversion
P11.9 ①	1366	2851	1	PID2 Dead Band
P12.1 ①	105	5	1	Preset Speed 1
P12.2 ①	106	5	2	Preset Speed 2

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P12.3 ①	118	5	3	Preset Speed 3
P12.4 ①	119	5	4	Preset Speed 4
P12.5 ①	120	5	5	Preset Speed 5
P12.6 ①	121	5	6	Preset Speed 6
P12.7 ①	122	5	7	Preset Speed 7
P13.1 ①	295	53	0	Torque Limit
P13.12 ①	1636	3401	0	Window Pos Width
P13.13 ①	1637	3401	1	Window Neg Width
P13.14 ①	1638	3401	2	Window Pos Off Limit
P13.15 ①	1639	3401	3	Window Neg Off Limit
P13.16 ①	1640	140	1	Torque Reference Filter TC
P13.2 ①	296	3400	0	Torque Limit Control P
P13.3 ①	297	3400	1	Torque Limit Control I
P13.4 ①	303	420	2	Torque Ref Select
P13.6 ①	304	50	1	Torque Ref Max
P13.7 ①	305	50	0	Torque Ref Min
P13.8 ①	300	28	3	Torque Control Freq Min
P14.1 ①	254	2227	0	DC-Brake Current
P14.2 ①	263	2222	0	Start DC-Brake Time
P14.3 ①	262	2223	0	Stop DC-Brake Frequency
P14.4 ①	255	2222	1	Stop DC-Brake Time
P14.5 ①	251	2204	0	Brake Chopper
P14.6 ①	266	2214	0	Flux Brake
P14.7 ①	265	2217	0	Flux Brake Current
P15.1 ①	535	538	0	Fire Mode Function
P15.2 ①	221	638	0	Fire Mode Ref Select Function
P15.3 ①	537	28	2	Fire Mode Min Frequency
P15.4 ①	564	1	5	Fire Mode Freq Ref 1
P15.5 ①	565	1	6	Fire Mode Freq Ref 2
P15.6 ①	554	1	11	Smoke Purge Frequency
P16.1 ①	577	8402	0	Motor Nom Current 2
P16.10 ①	1423	8415	0	Excitation Current 2
P16.2 ①	578	8409	0	Motor Nom Speed 2
P16.3 ①	579	8407	0	Motor PF 2
P16.4 ①	580	8403	0	Motor Nom Volt 2
P16.5 ①	581	8408	0	Motor Nom Freq 2
P16.6 ①	1419	8410	0	Stator Resistor 2
P16.7 ①	1420	8413	0	Rotor Resistor 2
P16.8 ①	1421	8416	0	Leak Inductance 2
P16.9 ①	1422	8417	0	Mutual Inductance 2
P17.1 ①	1418	1801	0	Bypass Enable
P17.2 ①	544	1802	0	Bypass Start Delay
P17.3 ①	542	1800	1	Auto Bypass
P17.4 ①	543	1802	1	Auto Bypass Delay

Note

① Available on PROFIBUS in October 2014.

Appendix A—Parameter ID List

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P17.5 ①	547	1803	0	Overcurrent Bypass Enable
P17.6 ①	546	1803	1	IGBT Fault Bypass Enable
P17.7 ①	548	1803	2	4mA Fault Bypass Enable
P17.8 ①	545	1803	3	Undervoltage Bypass Enable
P17.9 ①	549	1803	4	Overvoltage Bypass Enable
P18.1 ①	342	1911	0	Number of Motors
P18.10 ①	483	636	0	Damper Start
P18.11 ①	484	118	0	Damper Time Out
P18.12 ①	485	118	1	Damper Delay
P18.2 ①	343	1922	0	Bandwidth
P18.3 ①	344	1923	0	Bandwidth Delay
P18.4 ①	350	1909	0	Interlock Enable
P18.5 ①	346	1904	0	Include Freq Converter
P18.6 ①	345	1900	0	Auto-Change Enable
P18.7 ①	347	1901	0	Auto-Change Interval
P18.8 ①	349	1902	0	Auto-Change Freq Limit
P18.9 ①	348	1903	0	Auto-Change Motor Limit
P19.1 ①	491	3120	0	Interval 1 On Time
P19.10 ①	522	3124	1	Interval 2 Channel
P19.11 ①	499	3120	2	Interval 3 On Time
P19.12 ①	501	3121	2	Interval 3 Off Time
P19.13 ①	523	3122	2	Interval 3 From Day
P19.14 ①	524	3123	2	Interval 3 To Day
P19.15 ①	525	3124	2	Interval 3 Channel
P19.16 ①	503	3120	3	Interval 4 On Time
P19.17 ①	505	3121	3	Interval 4 Off Time
P19.18 ①	526	3122	3	Interval 4 From Day
P19.19 ①	527	3123	3	Interval 4 To Day
P19.2 ①	493	3121	0	Interval 1 Off Time
P19.20 ①	528	3124	3	Interval 4 Channel
P19.21 ①	507	3120	4	Interval 5 On Time
P19.22 ①	509	3121	4	Interval 5 Off Time
P19.23 ①	529	3122	4	Interval 5 From Day
P19.24 ①	530	3123	4	Interval 5 To Day
P19.25 ①	531	3124	4	Interval 5 Channel
P19.26 ①	511	3100	0	Timer 1 Duration
P19.27 ①	532	3102	0	Timer 1 Channel
P19.28 ①	513	3100	1	Timer 2 Duration
P19.29 ①	533	3102	1	Timer 2 Channel
P19.3 ①	517	3122	0	Interval 1 From Day
P19.30 ①	515	3100	2	Timer 3 Duration
P19.31 ①	534	3102	2	Timer 3 Channel
P19.4 ①	518	3123	0	Interval 1 To Day
P19.5 ①	519	3124	0	Interval 1 Channel

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P19.6 ①	495	3120	1	Interval 2 On Time
P19.7 ①	497	3121	1	Interval 2 Off Time
P19.8 ①	520	3122	1	Interval 2 From Day
P19.9 ①	521	3123	1	Interval 2 To Day
P2.1 ①	222	263	0	AI1 Mode
P2.10 ①	133	262	0	AI1 Joystick Offset
P2.11 ①	223	263	1	AI2 Mode
P2.12 ①	183	260	1	AI2 Signal Range
P2.13 ①	184	264	1	AI2 Custom Min
P2.14 ①	185	265	1	AI2 Custom Max
P2.15 ①	182	266	1	AI2 Filter Time
P2.16 ①	189	267	1	AI2 Signal Invert
P2.17 ①	186	268	1	AI2 Joystick Hyst
P2.18 ①	187	271	1	AI2 Sleep Limit
P2.19 ①	188	272	1	AI2 Sleep Delay
P2.2 ①	175	260	0	AI1 Signal Range
P2.20 ①	134	262	1	AI2 Joystick Offset
P2.21 ①	144	35	1	AI Ref Scale Min Value
P2.22 ①	145	34	1	AI Ref Scale Max Value
P2.3 ①	176	264	0	AI1 Custom Min
P2.4 ①	177	265	0	AI1 Custom Max
P2.5 ①	174	266	0	AI1 Filter Time
P2.6 ①	181	267	0	AI1 Signal Invert
P2.7 ①	178	268	0	AI1 Joystick Hyst
P2.8 ①	179	271	0	AI1 Sleep Limit
P2.9 ①	180	272	0	AI1 Sleep Delay
P20.1.1 ①	1556	442	0	FB Data Output 1 Sel
P20.1.2 ①	1557	442	1	FB Data Output 2 Sel
P20.1.3 ①	1558	442	2	FB Data Output 3 Sel
P20.1.4 ①	1559	442	3	FB Data Output 4 Sel
P20.1.5 ①	1560	442	4	FB Data Output 5 Sel
P20.1.6 ①	1561	442	5	FB Data Output 6 Sel
P20.1.7 ①	1562	442	6	FB Data Output 7 Sel
P20.1.8 ①	1563	442	7	FB Data Output 8 Sel
P20.2.1 ①	586	3220	0	RS485 Comm Set
P20.2.10 ①	593	3290	0	Comm Timeout Modbus RTU
P20.2.11 ①	594	3232	0	BACnet Baud Rate
P20.2.12 ①	595	3272	0	MAC Address
P20.2.13 ①	596	3270	0	Instance Number
P20.2.14 ①	598	3273	0	Comm Timeout BACnet
P20.2.15 ①	599	3265	0	Protocol Status
P20.2.16 ①	100	3274	0	Fault Code
P20.2.2 ①	587	3221	0	Slave Address
P20.2.3 ①	584	3222	0	Baud Rate

Note

① Available on PROFIBUS in October 2014.

Appendix A—Parameter ID List

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P20.2.4 ①	585	3224	0	Parity Type
P20.2.5 ①	588	3225	0	Protocol Status
P20.2.6 ①	589	3226	0	Slave Busy
P20.2.7 ①	590	3227	0	Parity Error
P20.2.8 ①	591	3228	0	Slave Fault
P20.2.9 ①	592	3229	0	Last Fault Response
P20.3.1 ①	1500	3249	0	IP Address Mode
P20.3.12 ①	612	3235	0	Protocol Status
P20.3.13 ①	613	3236	0	Slave Busy
P20.3.14 ①	614	3237	0	Parity Error
P20.3.15 ①	615	3238	0	Slave Failure
P20.3.16 ①	616	3239	0	Last Fault Response
P20.3.2 ①	1507	3246	0	Active IP Address
P20.3.3 ①	1509	3247	0	Active Subnet Mask
P20.3.4 ①	1511	3248	0	Active Default Gateway
P20.3.5 ①	1513	3242	0	MAC Address
P20.3.6 ①	1501	3243	0	Static IP Address
P20.3.7 ①	1503	3244	0	Static Subnet Mask
P20.3.8 ①	1505	3245	0	Static Default Gateway
P21.1.1	340	323	0	Language
P21.1.10	628	326	0	Default Page
P21.1.11	629	330	0	Timeout Time
P21.1.12	630	324	0	Contrast Adjust
P21.1.13	631	330	1	Backlight Time
P21.1.14	632	627	0	Fan Control
P21.1.15	633	362	0	HMI ACK Timeout
P21.1.16	634	366	0	HMI Retry Number
P21.1.2 ①	142	256	0	Application
P21.1.3	619	976	0	Parameter Sets
P21.1.4	620	302	0	Up To Keypad
P21.1.5	621	302	1	Down From Keypad
P21.1.6	623	305	0	Parameter Comparison
P21.1.7	624	320	0	Password
P21.1.8	625	304	0	Parameter Lock
P21.1.9	627	328	0	Multimonitor Set
P21.2.1	640	207	2	Keypad Software Version
P21.2.2	642	206	0	Motor Control Software Version
P21.2.3	644	207	1	Application Software Version
P21.3.1	646	2206	0	Brake Chopper Stat
P21.3.2	647	2200	0	Brake Resistor
P21.3.3	648	209	0	Serial Number
P21.4.1 ①	566	3000	0	Real Time Clock
P21.4.10	637	871	0	Trip Power Hr Count
P21.4.11	639	322	4	Clear Trip Power Count

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P21.4.2	583	790	0	RTC Battery Status
P21.4.3	582	3001	0	Daylight Saving
P21.4.4	601	520	1	Total MWh Count
P21.4.5	603	522	0	Total Power Day Count
P21.4.6	606	521	2	Total Power Hr Count
P21.4.7	604	806	0	Trip MWh Count
P21.4.8	635	322	3	Clear Trip MWh Count
P21.4.9	636	870	0	Trip Power Day Count
P3.1	143	423	1	Start/Stop Logic
P3.10 ①	205	432	0	Preset Speed B0
P3.11 ①	206	432	1	Preset Speed B1
P3.12 ①	207	432	2	Preset Speed B2
P3.13 ①	550	2134	0	PID1 Control Enable
P3.14 ①	553	2134	1	PID2 Control Enable
P3.15	195	435	0	Accel/Decel Time Set
P3.16	201	400	5	Accel/Decel Prohibit
P3.17 ①	215	402	5	No Access To Param
P3.18 ①	203	421	4	Accel Pot Value
P3.19 ①	204	421	5	Decel Pot Value
P3.2	190	414	0	Start Signal 1
P3.20 ①	216	405	0	Reset Pot Zero
P3.21	196	406	0	Remote Control
P3.22	197	406	1	Local Control
P3.23	209	407	0	Remote 1/2 Select
P3.24 ①	217	403	0	Second Motor Para Select
P3.25 ①	539	1800	3	Bypass Start
P3.26 ①	202	402	4	DC Brake Enable
P3.27 ①	219	402	2	Smoke Mode
P3.28 ①	220	402	3	Fire Mode
P3.29 ①	536	438	0	Fire Mode Ref Select
P3.3 ①	191	414	1	Start Signal 2
P3.30 ①	351	410	0	PID1 Set Point Select
P3.31 ①	352	410	1	PID2 Set Point Select
P3.32 ①	199	400	8	Jog Enable
P3.33 ①	224	3104	0	Start Timer 1
P3.34 ①	225	3104	1	Start Timer 2
P3.35 ①	226	3104	2	Start Timer 3
P3.36 ①	208	415	0	AI Ref Source Select
P3.37 ①	210	1910	0	Motor Interlock 1
P3.38 ①	211	1910	1	Motor Interlock 2
P3.39 ①	212	1910	2	Motor Interlock 3
P3.4	881	409	0	Thermistor Input Select
P3.40 ①	213	1910	3	Motor Interlock 4
P3.41 ①	214	1910	4	Motor Interlock 5

Note

① Available on PROFIBUS in October 2014.

Appendix A—Parameter ID List

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P3.42	747	400	3	Emergency Stop
P3.43 ①	1246	1804	0	Bypass Overload
P3.5	198	421	2	Reverse
P3.6	192	402	0	Ext. Fault Close
P3.7	193	402	1	Ext. Fault Open
P3.8	200	400	7	Fault Reset
P3.9	194	400	16	Run Enable
P4.1 ①	227	276	0	A01 Mode
P4.10 ①	232	279	1	A02 Minimum
P4.11 ①	230	277	1	A02 Filter Time
P4.12 ①	233	274	1	A02 Scale
P4.13 ①	231	278	1	A02 Inversion
P4.14 ①	234	275	1	A02 Offset
P4.2 ①	146	460	0	A01 Function
P4.3 ①	149	279	0	A01 Minimum
P4.4 ①	147	277	0	A01 Filter Time
P4.5 ①	150	274	0	A01 Scale
P4.6 ①	148	278	0	A01 Inversion
P4.7 ①	173	275	0	A01 Offset
P4.8 ①	228	276	1	A02 Mode
P4.9 ①	229	460	1	A02 Function
P5.1	151	461	0	DO1 Function
P5.10 ①	160	1102	0	Torque Limit Supv Val
P5.11 ①	161	1200	0	Ref Limit Supv
P5.12 ①	162	1100	0	Ref Limit Supv Val
P5.13 ①	163	2205	1	Ext Brake Off Delay
P5.14 ①	164	2205	0	Ext Brake On Delay
P5.15 ①	165	1222	1	Temp Limit Supv
P5.16 ①	166	822	0	Temp Limit Supv Val
P5.17 ①	167	1203	0	Power Limit Supv
P5.18 ①	168	1103	0	Power Limit Supv Val
P5.19 ①	170	1504	0	AI Supv Select
P5.2	152	451	0	RO1 Function
P5.20 ①	171	1204	0	AI Limit Supv
P5.21 ①	172	1404	0	AI Limit Supv Val
P5.22 ①	1346	2860	0	PID1 Superv Enable
P5.23 ①	1347	2861	0	PID1 Superv Upper Limit
P5.24 ①	1349	2862	0	PID1 Superv Lower Limit
P5.25 ①	1351	2863	0	PID1 Superv Delay
P5.26 ①	1408	2860	1	PID2 Superv Enable
P5.27 ①	1409	2861	1	PID2 Superv Upper Limit
P5.28 ①	1411	2862	1	PID2 Superv Lower Limit
P5.29 ①	1413	2863	1	PID2 Superv Delay
P5.3	153	451	1	RO2 Function

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P5.4	538	451	2	RO3 Function
P5.5 ①	154	1201	0	Freq Limit 1 Supv
P5.6 ①	155	1101	0	Freq Limit 1 Supv Val
P5.7 ①	157	1201	1	Freq Limit 2 Supv
P5.8 ①	158	1101	1	Freq Limit 2 Supv Val
P5.9 ①	159	1202	0	Torque Limit Supv
P6.1	751	2002	0	Logic Function Select
P6.2	752	2000	0	Logic Operation Input A
P6.3	753	2001	0	Logic Operation Input B
P7.1	138	408	1	Remote 2 Control Place
P7.10	253	620	1	Stop Mode
P7.11	247	117	0	Ramp 1 Shape
P7.12	248	117	1	Ramp 2 Shape
P7.13	249	130	1	Accel Time 2
P7.14	250	134	1	Decel Time 2
P7.15	256	41	0	Skip F1 Low Limit
P7.16	257	42	0	Skip F1 High Limit
P7.17	258	41	1	Skip F2 Low Limit
P7.18	259	42	1	Skip F2 High Limit
P7.19	260	41	2	Skip F3 Low Limit
P7.2	139	437	1	Remote 2 Reference
P7.20	261	42	2	Skip F3 High Limit
P7.21	264	43	0	Prohibit Accel/Decel Ramp
P7.22	267	639	0	Power Loss Function
P7.23	268	151	0	Power Loss Time
P7.4	116	621	1	Keypad Direction
P7.5	114	622	1	Keypad Stop
P7.6	117	1	9	Jog Reference
P7.7	156	111	4	Motor Pot Ramp Time
P7.8	169	423	2	Motor Pot Ref Reset
P7.9	252	620	0	Start Mode
P8.1	287	255	0	Motor Control Mode
P8.10	288	390	0	Switching Frequency
P8.11	1665	341	0	Sine Filter Enable
P8.12	294	626	3	Overvoltage Control
P8.13	298	2901	0	Load Drooping
P8.14	299	340	0	Identification
P8.15	1574	20	7	Neg Frequency Limit
P8.16	1576	20	6	Pos Frequency Limit
P8.17	1585	140	0	Frequency Ramp Out FilterTime Constant
P8.18	1591	2406	1	Speed Error Filter Time Constant
P8.19	1592	2405	0	Speed Error Band Stop Frequency
P8.2	107	281	0	Current Limit
P8.20	1593	2400	0	Speed Control Kp

Note

① Available on PROFIBUS in October 2014.

Appendix A—Parameter ID List

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P8.21	1594	2401	0	Speed Control Ti
P8.22	1595	2400	3	Speed Control Kp At Field Weakening
P8.23	1596	2400	1	Speed Control Kp Below F0
P8.24	1597	2403	0	Speed Control F0
P8.25	1598	2403	1	Speed Control F1
P8.26	1599	2410	0	Speed Control Kp Below T0
P8.27	1600	2404	0	Speed Control T0
P8.28	1601	2406	0	Speed Control Kp Filter Time Constant
P8.29	1602	30	1	Motoring Torque Limit
P8.3	109	60	0	V/Hz Optimization
P8.30	1603	31	1	Generator Torque Limit
P8.31	1604	36	1	Torque Limit Forward
P8.32	1605	37	1	Torque Limit Reverse
P8.33	1607	282	0	Motoring Power Limit
P8.34	1608	282	1	Generator Power Limit
P8.35	1611	2420	0	Acc Compensation Time Constant
P8.36	1612	2421	0	Acc Compensation Filter Time Constant
P8.37	1614	283	0	Positive Iq Current Limit
P8.38	1615	283	1	Negative Iq Current Limit
P8.39	1620	254	0	Flux Reference
P8.4	108	61	0	V/Hz Ratio
P8.40	1621	223	1	Stop State Magnetization
P8.41	1622	132	0	Start Boost Rise Time
P8.42	1623	105	0	Flux Current Ramp Time
P8.43	1624	118	2	Zero Speed Start Time
P8.44	1625	118	3	Zero Speed Stop Time
P8.45	1628	1	13	Droop Frequency
P8.46	1630	2902	0	Droop Control Filter Time Constant
P8.47	1631	420	4	Startup Torque Selection
P8.48	1632	2	3	Torque Memory Start
P8.49	1633	36	0	Startup Torque Forward
P8.5	289	23	0	Field Weakening Point
P8.50	1634	37	0	Startup Torque Reverse
P8.51	1635	506	0	Startup Torque Actual
P8.52	1667	133	0	Startup Torque Time
P8.53	1424	218	0	Stator Resistor
P8.54	1425	221	0	Rotor Resistor
P8.55	1426	224	0	Leak Inductance
P8.56	1427	225	0	Mutual Inductance
P8.57	775	223	0	Excitation Current
P8.6	290	24	0	Voltage at FWP
P8.7	291	23	1	V/Hz Mid Frequency
P8.8	292	24	1	V/Hz Mid Voltage
P8.9	293	27	0	Zero Frequency Voltage

Note

① Available on PROFIBUS in October 2014.

Table 119. Parameter ID List, continued

Menu Item No.	Modbus Register	PROFIBUS PNU	PROFIBUS PNU Subindex	Parameter
P9.1	306	840	29520	4mA Input Fault
P9.10	312	1011	0	Motor Thermal Time
P9.11	313	840	28963	Stall Protection
P9.12	314	1010	0	Stall Current Limit
P9.13	315	1010	1	Stall Time Limit
P9.14	316	1010	2	Stall Frequency Limit
P9.15	317	840	28979	Underload Protection
P9.16	318	1013	0	Underload Fnom Torque
P9.17	319	1013	1	Underload F0 Torque
P9.18	320	1011	1	Underload Time Limit
P9.19 ①	333	840	28978	Thermistor Fault Response
P9.2	331	1	7	4mA Fault Frequency
P9.20	750	861	0	Line Start Lockout
P9.21	334	840	29953	Fieldbus Fault Response
P9.22	335	840	35088	OPTCard Fault Response
P9.23	1564	840	16912	Unit Under Temp Prot
P9.24	321	846	0	Wait Time
P9.25	322	846	1	Trail Time
P9.26	323	847	0	Start Function
P9.27	324	845	0	Undervoltage Attempts
P9.28	325	845	1	Overvoltage Attempts
P9.29	326	845	2	Overcurrent Attempts
P9.3	307	840	36864	External Fault
P9.30	327	845	3	4mA Fault Attempts
P9.31	329	845	4	Motor Temp Fault Attempts
P9.32	328	845	5	External Fault Attempts
P9.33	336	845	6	Underload Attempts
P9.34	955	840	35344	RTC Fault
P9.35	337	840	29536	PT100 Fault Response
P9.36	1256	840	35345	Replace Battery Fault Response
P9.37	1257	840	28688	Replace Fan Fault Response
P9.4	332	840	12592	Input Phase Fault
P9.5	330	840	12576	Uvoltage Fault Response
P9.6	308	840	13080	Output Phase Fault
P9.7	309	840	9008	Ground Fault
P9.8	310	840	17168	Motor Thermal Protection
P9.9	311	1012	0	Motor Thermal F0 Current
R11	782	2	2	Keypad Torque Ref
R12	141	1	8	Keypad Reference

Note

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