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X5EIP01 Ethernet IP Option Board with 115 VAC Encoder Interface

Installation Manual

DPD00111

Need Help?

This manual answers most installation and startup questions
that may arise. However, if you have any problems,
please let your first call be to us.

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Installing the X5EIP01 Ethernet IP Option Board with 115 VAC Encoder Interface

Introduction

The X5 frequency converters can be connected to Ethernet using an Ethernet IP option board, the X5EIP01.

Every device connected to an Ethernet network has two identifiers: a MAC address and an IP address. The MAC address (formatted as xx:xx:xx:xx:xx:xx, where xx is a hexadecimal byte) is unique to the device and cannot be changed. The Ethernet board's MAC address can be found on the sticker attached to the board or by using various network configuration tools.

In a local network, IP addresses can be defined by a user 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 cause conflicts between devices.

The X5EIP01 also provides the option of controlling the X5 AC drive from 115 VAC control signals, or of connecting a shaft-mounted encoder to the drive to improve speed regulation. Up to five channels of 115 VAC control are available for use in selecting direction, preset speeds, or other drive functions.

With this option, an encoder with a nominal rating of up to 2048 pulses per revolution can be connected to the X5 unit to improve speed load regulation of the drive. Overall encoder frequency at maximum process speed must be limited to 100kHz.

This option also provides two additional control relays, each rated for 115 VAC, 1 amp, or for 230 VAC, 0.5 amp.

NOTE: This network communication interface included with the X5 option is warranted to meet the core specifications for Modbus TCP. Many existing software applications are custom-engineered and may contain "brand-specific" communication that will not be supported by the X5 without modification. No guarantee of compatibility with any specific system is made. The user is responsible for any interface software and hardware needed to make an application function.

Applicable Documents

This manual is supplied as a supplement to the X5 AC Drive User's Manual (DPD 00089, previously Form 1434).

Option Kit Contents

The option kit includes the following materials:

Part Number	Description
25100067C	Ethernet IP Option Board
32100391	Flexible cable assembly

Installation Procedures

⚠ WARNING

SENSITIVE EQUIPMENT

This assembly contains static-sensitive components. It should be handled only by a static-safe installer, using a grounded wrist strap.

Failure to observe this precaution may cause premature equipment failure.

⚠ DANGER

HAZARDOUS VOLTAGE

- Disconnect all power before servicing a drive unit or its components. **WAIT 5 MINUTES** until the DC bus capacitors discharge.
- Ensure that any other power sources that may feed control logic have been disconnected.
- **DO NOT** short across DC bus capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers before applying power or starting and stopping the drive.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in a drive, including printed circuit boards, operate at line voltage. **DO NOT TOUCH.** Use only electrically-insulated tools.

Before servicing any drive.

- Disconnect all power.
- Place a “DO NOT TURN ON” label on the drive disconnect.
- Lock the disconnect in the open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death.

Figure 1 shows the option board and the location of the terminals and the power supply selector.

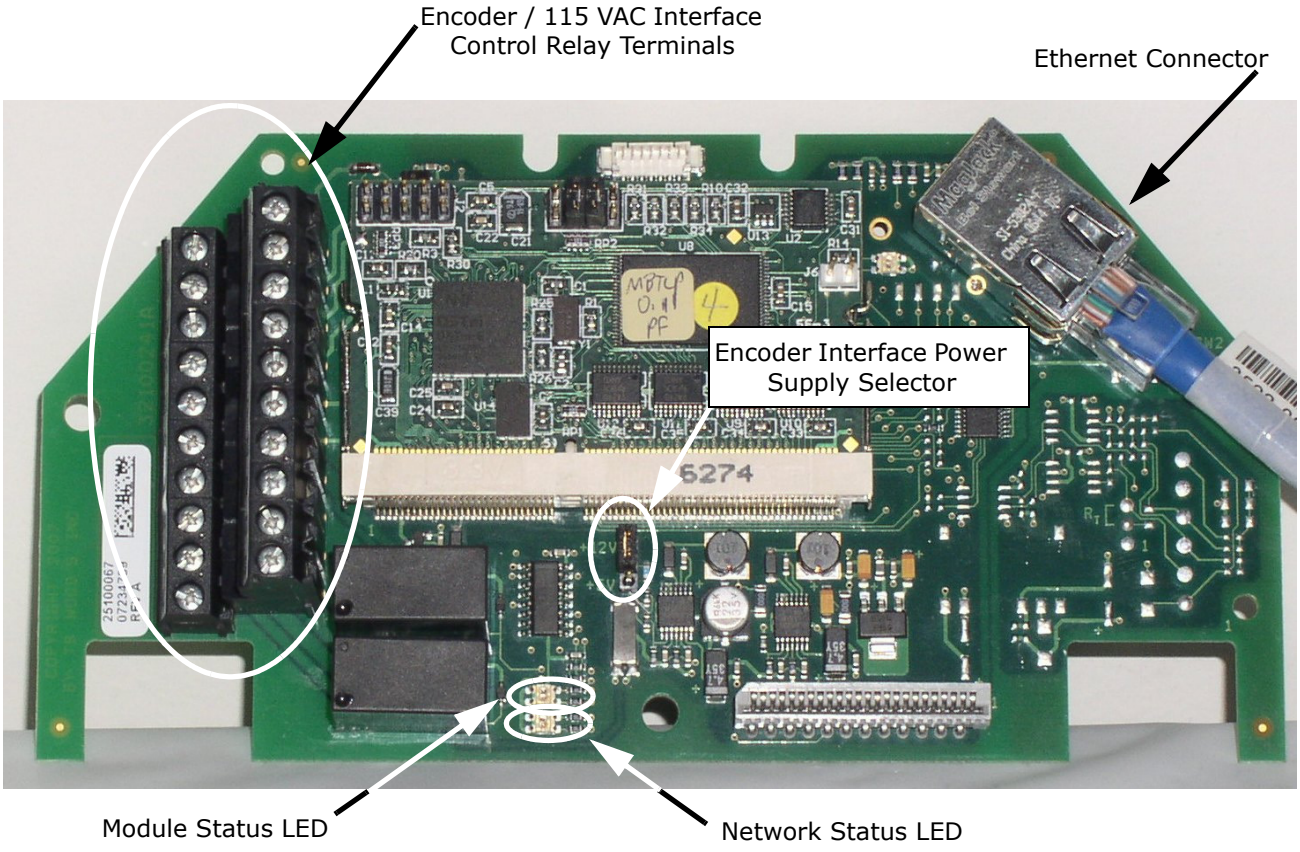

Figure 1: Option Board Layout

Before you can install the option board, you must first remove the drive cover.

Figure 2 shows the locations of the cover screws. The torque range for the X5 Size 1 cover is 18-26 in/lbs.

Figure 2: Cover Assembly and Screw Locations

The option board is installed just above the control board in all configurations (a Size 1 unit is shown in Figure 3 for reference). The screws labeled "A" must be removed from the X5; those labeled "B" need only to be loosened to accept the board slot.

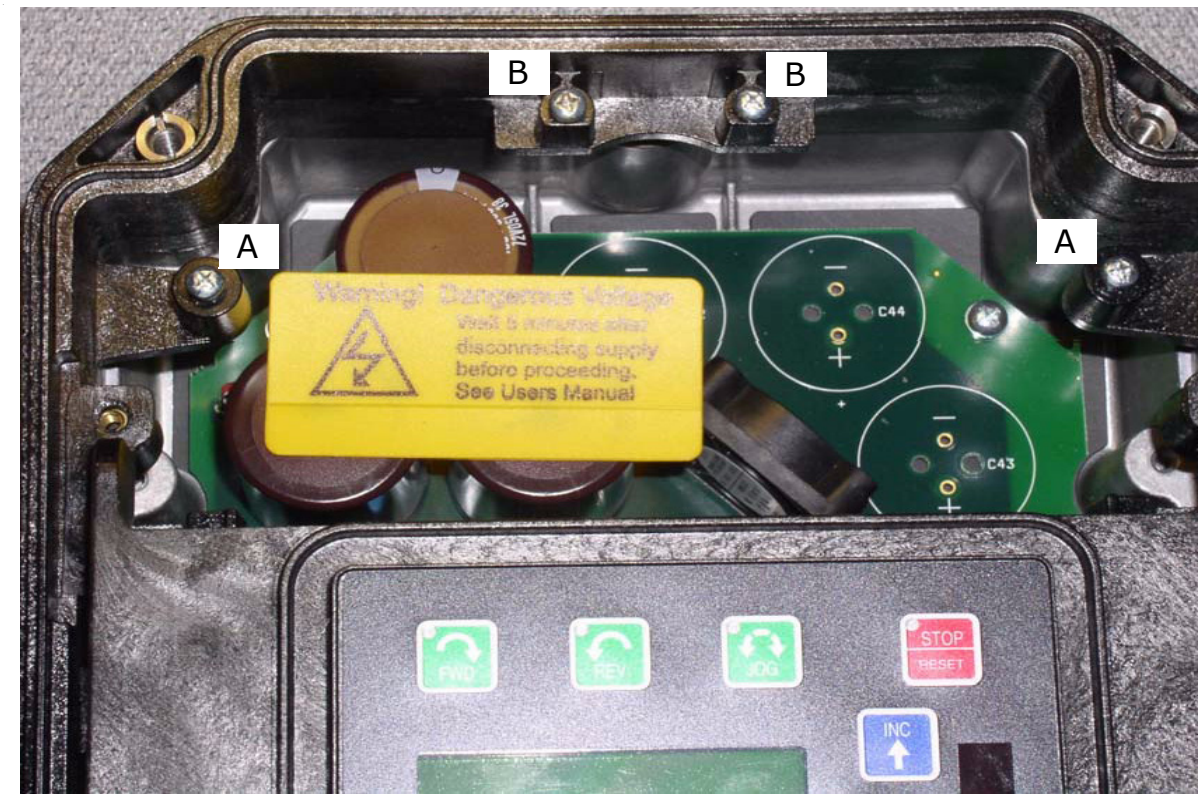

Figure 3: Option Mounting Locations

Once the board is in place, tighten the screws to a maximum of 26 in-lbs.

Next, install the flexible circuit to finish the interface to the control board. (Refer to Figure 4.) To install the flexible circuit, first remove the keypad frame (necessary in this size unit). The frame is attached with two screws in opposite corners; the screws thread into fasteners in the plastic assembly. After the flexible circuit is installed, replace these screws, limiting the installation torque to 12 in-lbs..

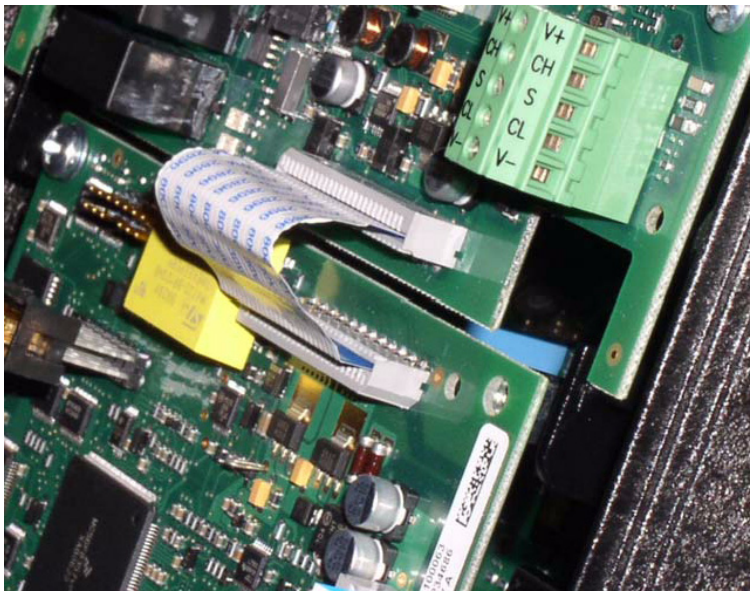

Figure 4: Flexible Circuit Interface to Control Board

115 VAC Interface / Relay / Encoder Interface Terminals

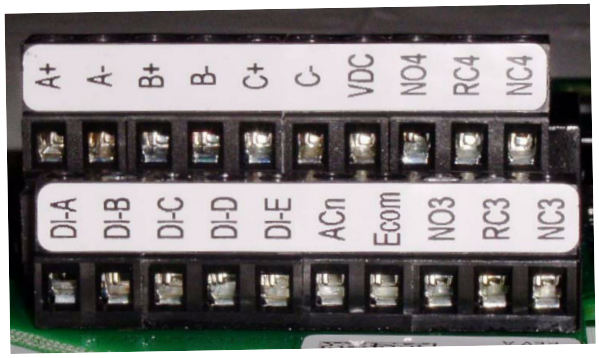

Figure 5: 115 VAC Interface / Encoder Terminals

The X5OPT01 option kit includes five 115 VAC inputs, two additional programmable relays, and an encoder interface. The details of the terminals on the board related to the 115 VAC interface and the encoder are shown in Table 1 on page 7:

Table 1: Encoder Interface Terminals

Terminal	Description
DI-A **DI-B** **DI-C** **DI-D** **DI-E**	115 VAC logic input; connect input to 115 VAC to activate. The programmable functionality of these inputs is controlled by parameters 728, 729, 730, 731, and 732. Each of these inputs can be disabled or configured to emulate the function of the FWD, REV, R/J, EN, MOL, DI1, DI2, DI3, DI4, or DI5 input terminals on the X5 control board. Refer to the X5 User's Manual for more information (DPD 00089).
ACn	The neutral connection for the 115 VAC control inputs
NO3 **RC3** **NC3**	The third auxiliary relay. The function of this relay is set by parameter 709. Functionally, it is capable of each of the features outlined in the X5 user manual under parameters 705-708. Terminal NO3 is a normally-open contact; it closes when the relay activates. NC3 is a normally-closed contact; it opens when the relay activates. RC3 is the common terminal associated with both contacts. The ratings of these contacts are 115 VAC, 1 amp; and 230 VAC, 0.5 amp.
NO4 **RC4** **NC4**	The fourth auxiliary relay. The function of this relay is set by parameter 710. Functionally, it is capable of each of the features outlined in the X5 user manual under parameters 705-708. Terminal NO4 is a normally-open contact; it closes when the relay activates. NC4 is a normally-closed contact; it opens when the relay activates. RC4 is the common terminal associated with both contacts. The ratings of these contacts are 115 VAC, 1 amp; and 230 VAC, 0.5 amp.
A+ **A-**	Channel A input from the encoder. Compatible with line driver, open collector, or totem pole outputs from an encoder. If it is an open collector or totem pole-type, encoder outputs are used; connect the A- terminal to Ecom.
B+ **B-**	Channel B input from the encoder. Compatible with line driver, open collector, or totem pole outputs from an encoder. If it is an open collector or totem pole-type, encoder outputs are used; connect the B- terminal to Ecom.
C+ **C-**	Channel C input from the encoder, the home pulse. Compatible with line driver, open collector, or totem pole outputs from an encoder. If it is an open collector or totem pole-type, encoder outputs are used; connect the C- terminal to Ecom.
VDC	Power supply terminal for use with a customer-supplied encoder. It can be either +12 VDC or +5 VDC based on the position of the encoder interface power supply selector shown in Figure 1. Voltage regulation: +/- 5%; maximum current available is 100 mA.
Ecom	Signal common for the encoder interface

Note that the connections described in Table 1 work only when the encoder has an internal pull-up resistor on the open collector. Alternatively, it might be preferable to pull the + channel high, and attach the open collector to the - channel. For example, if using Channel A, A+ on the option board would be tied to VDC, and A- would be connected to the open collector coming from the encoder. The advantage in this method is that no pull-up/down resistors are needed; if the encoder has an internal pull-up, this does not affect anything.

Specifications for Encoder / 115 VAC Interface

Encoder Interface			115 VAC Interface	
Speed regulation	< 0.1 Hz **(1)**		**On state**	90-140 VAC
Input frequency (max.)	100 kHz		**Off state**	< 10 VAC
Input voltage	10-24 VDC +/- 5%		**Input frequency**	58-62 Hz
Suggested pull-up resistor	5 VDC	500 ohms	**On/off delay**	30 ms maximum
	12 VDC	1k ohms		
	24 VDC	3.3k ohms		
Terminal block wire limitations	12-24 AWG		**Terminal block wire limitations**	12-24 AWG
(1) PID feedback plus optimal motor turning in SLV mode employed				

Setup and Use

The encoder interface is most effective if used in conjunction with the vector mode of operation. Refer to the X5 User's Manual (Chapter 6) for information about using the vector mode. Three additional parameters are provided to calibrate the encoder:

Parameter #	Parameter Name	Range	Default Value
219	Encoder Pulses per Revolution	0-16383	1024
220	Encoder Filter Time	10-1000 ms	20 ms
221	Encoder Speed Protection	0-20.0%	0%

Parameter 219, Encoder Pulses per Revolution, can either be extracted from the encoder nameplate or the data sheet supplied with it. Parameter 220, Encoder Filter Time, is used to filter the encoder signal in the event of noise. Parameter 221 is for limiting the response of the drive, in the event of the loss of encoder signal.

Two other parameters are provided to allow more flexibility in encoder selection, and to improve PID application usage:

Parameter #	Parameter Name	Range	Default Value
223	EncoderType	Quadrature or Single Channel	Quadrature
224	Encoder Range	0-24000 rpm	0 rpm

Parameter 223, Encoder Type, allows the use of either quadrature or single-channel types of encoders.

Parameter 224, Encoder Range, improves PID application flexibility. This parameter should be used in situations where the encoder feedback signal is not always directly proportional to the motor speed, for example, a winder using an encoder mounted on an idler pulley feeding a winding spool. The PID may be attempting to maintain a constant linear speed on the wound media, but as the diameter of the media on the spool changes, the motor turning the spool needs to vary its speed to maintain the linear speed at the idler pulley.

When parameter 224 is set to 0, it is ignored, and the PID calculates the feedback percentage based on parameter 301, Maximum Frequency. When this parameter is set to a non-zero value, the PID uses instead Parameter 224's setting to calculate the feedback percentage.

Encoder feedback works similarly to an analog input as configured in parameters 850 (PID Configure), 851 (PID Feedback), 852 (PID Prop Gain), 853 (PID Int Gain), and 859 (PID Derivative Gain). The "feed forward" options are suggested for setting parameter 850. More specific details on each of the listed parameters can be found in the X5 User's Manual (DPD 00089).

The encoder interface can easily serve as one of the inputs to the X5's Keeper Function (data logging). See the X5 User's Manual for more information.

Both the Vmet and Imet output from the drive can be configured to indicate the status of the encoder. Parameters 700 (Vmet) and 702 (Imet) that relate to the setup and calibration of the Vmet and Imet outputs, both have selections related to the status of the encoder input.

The Program Sequencer function can also key off the encoder's home pulse. To make use of this function, the encoder's home pulse (1 pulse per revolution) must be connected to the C- input of the encoder board.

Encoder Interface Troubleshooting

Any problem with the encoder interface will result in an F37 fault. Four advanced fault codes are available to help you determine whether you have an encoder calibration problem, or a defect. For more information on troubleshooting, refer to the Troubleshooting chapter in the X5 User's Manual.

Using Ethernet Connections

Following are the specifications for Modbus / TCP connections:

Table 2: Ethernet Connection Specifications

Connections	Interface	RJ-45 Connector
Communications	Transfer cable	Foiled CAT5e
	Speed	10 / 100 Mb
	Duplex	half/full
	Default IP address	0.0.0.0

To communicate with the drive over Ethernet, the drive's IP address must be set. This is done with parameters 922-925. After setting the IP address, be sure to cycle power off and back on for the new address to take effect.

LED Indications

The Ethernet / IP Option Board includes two LED status indicators: Network Status and Module Status. See Figure 1 on page 4 for the location of these LEDs on the board. Network status provides information on the network connection status and Module status provides information on the Ethernet / IP module itself. The following tables explain the meaning of the status LEDs:

Table 3: Network Status LED

	If the LED is...	This means...
Network Status LED	**OFF**	There is no power applied to the option board.
	Red	The option board cannot communicate on the network.

Table 4: Module Status LED

	If the LED is...	This means...
Module Status LED	**OFF**	There is no power applied to the option board.
	Green	The option board is operating normally.
	Green (flashing)	The option board is in Standby state or the device needs commissioning because of a missing, incomplete, or incorrect configuration.
	Red (flashing)	The option board has detected a recoverable fault.
	Red	The option board has detected an unrecoverable fault.

Getting Started

To begin communicating with the drive over Modbus / TCP, the drive's IP address must be set (use parameters 922-925). After setting the IP address, cycle power off and on for the new address to take effect.

For information on setting parameters, see the X5 User's Manual.

I/O Messaging

Input / Output (I/O) polling messages are for time-critical, control-oriented data. The messages are transferred between the devices all the time and are used for continuous control of the frequency converter. They provide a dedicated, special-purpose communication path between a producing application (master) and one or more consuming applications (slaves). They are exchanged across single- or multi-cast connections and typically use high-priority identifiers.

The polling message flow is shown in Figure 6.

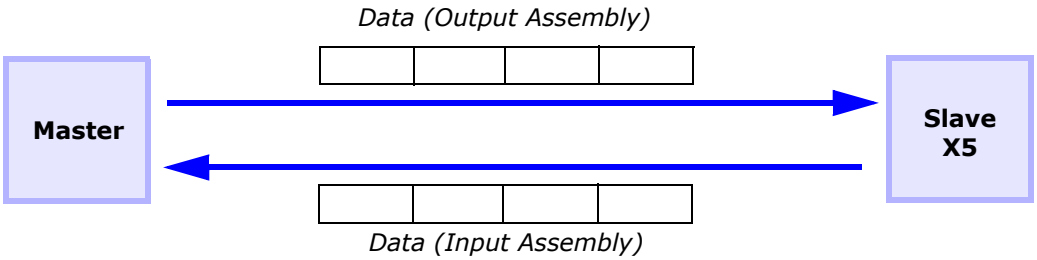

Figure 6: Polling Message Diagram

I/O messages 20, 21, 70, and 71 are standard Common Industrial Protocol (CIP) assemblies.

I/O messages 121, 122, 131, 132, 171, 172, 181, and 182 are vendor-specific messages that allow for customized assemblies.

The values of the following parameters indicate which drive parameters are read or written to by the I/O assembly:

Table 5: Parameter Assignments (Parameters 880-894)

Parameter #	Parameter Name	Range	Default
880	FBus Read 1	0-65535	103 (Output Voltage)
881	FBus Read 2		104 (Output Current)
882	FBus Read 3		105 (Drive Load)
883	FBus Read 4		107 (Drive Temp)
884	FBus Read 5		909 (DI Status)
890	FBus Write 1	0-65535	103 (Output Voltage)
891	FBus Write 2		104 (Output Current)
892	FBus Write 3		105 (Drive Load)
893	FBus Write 4		107 (Drive Temp)
894	FBus Write 5		909 (DI Status)

Examples 1 and 2 on the following pages show how using the FBus Write 2 = Parameter 402 would allow the I/O assembly to set the drive's acceleration rate.

Example 1: Output Assemblies

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0						Fault Reset		Run Fwd
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
21	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
121	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
	4	FBus Write1 (low byte)							
	5	FBus Write1 (high byte)							
	6	FBus Write2 (low byte)							
	7	FBus Write2 (high byte)							
122	0	FBus Write1 (low byte)							
	1	FBus Write1 (high byte)							
	2	FBus Write2 (low byte)							
	3	FBus Write2 (high byte)							
131	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
	4	FBus Write1 (low byte)							
	5	FBus Write1 (high byte)							
	6	FBus Write2 (low byte)							
	7	FBus Write2 (high byte)							
	8	FBus Write3 (low byte)							
	9	FBus Write3 (high byte)							
	10	FBus Write4 (low byte)							
	11	FBus Write4 (high byte)							
	12	FBus Write5 (low byte)							
	13	FBus Write5 (high byte)							
132	0	FBus Write1 (low byte)							
	1	FBus Write1 (high byte)							
	2	FBus Write2 (low byte)							
	3	FBus Write2 (high byte)							
	4	FBus Write3 (low byte)							
	5	FBus Write3 (high byte)							
	6	FBus Write4 (low byte)							
	7	FBus Write4 (high byte)							
	8	FBus Write5 (low byte)							
	9	FBus Write5 (high byte)							

Example 2: Input Assemblies

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0						Running 1 (Fwd)		Faulted
	1								
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
71	0	At Ref	Ref from Net	Ctrl from Net	Ready	Running 2 (Rev)	Running 1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
171	0	At Ref	Ref from Net	Ctrl from Net	Ready	Running 2 (Rev)	Running 1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
	4	FBus Read1 (low byte)							
	5	FBus Read1 (high byte)							
	6	FBus Read2 (low byte)							
	7	FBus Read2 (high byte)							
172	0	FBus Read1 (low byte)							
	1	FBus Read1 (high byte)							
	2	FBus Read2 (low byte)							
	3	FBus Read2 (high byte)							
181	0	At Ref	Ref from Net	Ctrl from Net	Ready	Running 2 (Rev)	Running 1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
	4	FBus Read1 (low byte)							
	5	FBus Read1 (high byte)							
	6	FBus Read2 (low byte)							
	7	FBus Read2 (high byte)							
	8	FBus Read3 (low byte)							
	9	FBus Read3 (high byte)							
	10	FBus Read4 (low byte)							
	11	FBus Read4 (high byte)							
	12	FBus Read5 (low byte)							
	13	FBus Read5 (high byte)							
182	0	FBus Read1 (low byte)							
	1	FBus Read1 (high byte)							
	2	FBus Read2 (low byte)							
	3	FBus Read2 (high byte)							
	4	FBus Read3 (low byte)							
	5	FBus Read3 (high byte)							
	6	FBus Read4 (low byte)							
	7	FBus Read4 (high byte)							
	8	FBus Read5 (low byte)							
	9	FBus Read5 (high byte)							

Control Supervisor Behavior

The State Transition diagram in Figure 7 provides a graphical description of the states and corresponding state transitions for the control supervisor.

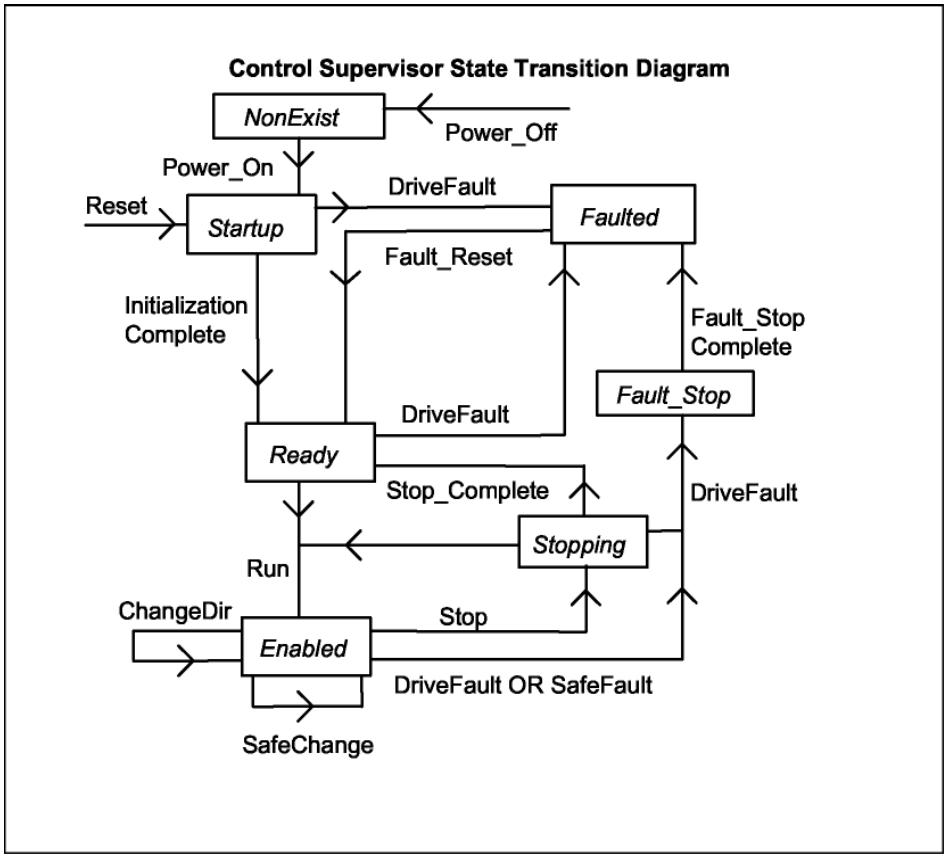

Figure 7: Control Supervisor State Transition Diagram

Table 6 on page 14 explains the state transitions pictured in the flow diagram in Figure 7.

Start Forward, Start Reverse, Change to Forward, Change to Reverse, and Stop (Not Faulted Stop) are static outputs of the control supervisor state machine. They are commands to the drive when CtrlFromNet = 1. When CtrlFromNet = 0, control commands are from another source.

When performing changes to achieve programmed Safe State:

- Run / Stop / Direction can be changed because CtrlFromNet must equal 1 when in the Enabled state.
- Reference in the drive can be changed to Preset Speed only if RefFromNet = 1.

Table 6: Explanation of State Transitions *(Page 1 of 2)*

Input Conditions								Results	
Old State	**CtrlFromNet**	**Run1 (Fwd)**	**Run 2 (Rev)**	**Idle Mode**	**Fwd Mode**	**Rev Mode**	**Event**	**New State**	**Action**
x	x	x	x	x	x	x	Power_Off	NonExist	
x	x	x	x	x	x	x	Reset	Startup	Faulted = 0 Ready = 0
(except NonExist)									FwdMode = 0 RevMode = 0
									Run1 Var = 0 Run2 Var = 0
NonExist	x	x	x	x	x	x	Power_On	Startup	Faulted = 0 Ready = 0
									FwdMode = 0 RevMode = 0
									Run1 Var = 0 Run2 Var = 0
Startup	x	x	x	x	x	x	Drive Fault	Faulted	Faulted = 1 FaultCode = x
Startup	x	x	x	x	x	x	Initialization Complete	Ready	Ready = 1
Ready	x	x	x	x	x	x	Drive Fault	Faulted	Faulted = 1 FaultCode = x Ready = 0
Ready	1	1	0	0	x	x	Run (Fwd)	Enabled	FwdMode = 1 (Start Forward)
Ready	1	0	1	0	x	x	Run (Rev)	Enabled	RevMode = 1 (Start Reverse)
Enabled	x	x	x	x	x	x	Drive Fault	Fault_Stop	Faulted = 1 FaultCode = x (Initiate Faulted Stop)
									FwdMode = 0 RevMode = 0 Ready = 0
Enabled	1	0	0	x	x	x	Stop	Stopping	(Initiate Stop)
Enabled	1	1	0	0	0	1	ChangeDir (Fwd)	Enabled	FwdMode = 1 RevMode = 0 (Change to Forward)
Enabled	1	0	1	0	1	0	ChangeDir (Rev)	Enabled	FwdMode = 0 RevMode = 1 (Change to Reverse)

Table 6: Explanation of State Transitions *(Page 2 of 2)*

Input Conditions								Results	
Old State	**CtrlFromNet**	**Run1 (Fwd)**	**Run 2 (Rev)**	**Idle Mode**	**Fwd Mode**	**Rev Mode**	**Event**	**New State**	**Action**
Enabled	1	x	x	x	x	x	SafeFault	Fault_Stop	Faulted = 1 FaultCode = x (Initiate Faulted Stop)
									FwdMode = 0 RevMode = 0 Ready = 0
									Run1 Var = 0 Run2 Var = 0
Enabled	1	x	x	x	x	x	SafeChange	Enabled	FwdMode = Run1 Var = NOT PresetDir
									RevMode = 0 Run2 Var = PresetDir
									SpeedRef = Preset Speed
									TorqueRef = Preset Torque
Stopping	x	x	x	x	x	x	Drive Fault	Fault_Stop	Faulted = 1 FaultCode = x (Initiate Faulted Stop)
									Ready = 0
Stopping	1	1	0	0	x	x	Run (Fwd)	Enabled	FwdMode = 1 (Start Forward)
Stopping	1	0	1	0	x	x	Run (Rev)	Enabled	RevMode = 1 (Start Reverse)
Stopping	x	0	0	x	x	x	Stop_Complete	Ready	
Fault_Stopped	x	x	x	x	x	x	Fault_Stop_ Complete	Faulted	
Faulted	x	x	x	x	x	x	Fault_Reset	Ready	Faulted = 0 Ready = 1

Explicit Messaging

Explicit Messaging is used in commissioning and configuring 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.

LIST OF OBJECT CLASSES

The Communication Interface supports the following object classes:

Table 7: Object Classes

Class	Object
0x28	Motor Data
0x29	Control Supervisor
0x2A	AC/DC Drive
0x2B	Acknowledge Handler
0x65	Parameter

LIST OF DATA TYPES

The attribute list in Table 8 includes information on the data type of each attribute. See Table 10 on page 18 through Table 13 on page 21 for more detailed explanations of the Data, Structure, and Array Type codes used in the Data Type column.

Table 8: Data Types

Data Type Name	Data Type Code	Data Type Description
WORD	1	16-bit word
UINT	2	16-bit unsigned integer
INT	3	16-bitsigned integer
BOOL	4	Boolean
SINT	5	Short integer
DINT	6	Double integer
LINT	7	Long integer
USINT	8	Unsigned short integer
UDINT	9	Unsigned double integer
ULINT	10	Unsigned long integer
REAL	11	Single floating-point format (IEEE 754)
LREAL	12	Double floating-point format (IEEE 754)
ITIME	13	Duration (short)
TIME	14	Duration
FTIME	15	Duration (high resolution)
LTIME	16	Duration (long)
DATE	17	Date (see Ethernet/IP spec)
TIME_OF_DAY	18	Time of day
DATE_AND_TIME	19	Date and time
STRING	20	8-bit-per-character string
STRING2	21	16-bit-per-character string
STRINGN	22	N-bytes-per-character string
SHORT_STRING	23	Short N-byte character string
BYTE	24	8-bit string
DWORD	25	32-bit string
LWORD	26	64-bit string

Ethernet Troubleshooting

Following are the advanced fault codes for the drive fault (F38) related to the option board. For more information, see the X5 User's Manual (Chapter 8). The option board status LEDs are described on page 9 of this manual.

Table 9: Advanced Fault Codes

Advanced Fault Code	Fault	Possible Cause	Corrective Measures
1	Option board loss	Option board is disconnected or damaged	Check option board status LEDs, ribbon cable connection, and cycle power. Replace option board if necessary.
2	Unstable ID during power-up	Option board hardware issues	Cycle power. If problem persists, contact Vacon technical support.
3	Option board changed	Option board was changed during last power-down	If the change was intentional, cycle power.
4	Invalid ID	Option board hardware issues	Cycle power. If problem persists, contact Vacon technical support.
5	Wrong or no daughter card installed	Option DIMM module issues	Cycle power. If problem persists, contact Vacon technical support.
6	Option board software error	Option board software issues	Cycle power. If problem persists, contact Vacon technical support.
7	Option board removed	Option board was removed during last power-down sequence	If the change was intentional, cycle power. Otherwise, follow corrective measures for fault code 1.

Appendix: X5 Communication Interface Object Profiles

In the following tables, attributes shown in bold face are stored in the non-volatile part of the drive and maintain their values after a power loss. All other settable attributes will power up at their default values.

Table 10: Motor Data Object
(Class Code 0x28, Motor Data Class (40) - Instance Attributes (1)

#	Attribute Name	Services	Default, Minimum, Maximum (1)	Data Type	Description
6 0x06	**RatedCurrent[100mA]**	Get_Attribute_Single Set_Attribute_Single	360 0 65535	2	Rated Stator Current Units: [100mA]
7 0x07	**RatedVoltage[V]**	Get_Attribute_Single Set_Attribute_Single	230 100 690	2	Rated Base Voltage Units: [V]
9 0x09	**RatedFrequency[Hz]**	Get_Attribute_Single Set_Attribute_Single	60 0 400	2	Rated Electrical Frequency Units: [Hz}
12 0x0C	PoleCount	Get_Attribute_Single	2 2 16	2	Number of poles in the motor
15 0x0F	**BaseSpeed[RPM]**	Get_Attribute_Single Set_Attribute_Single	1760 1 24000	2	Nominal speed at rated frequency from nameplate Units: [RPM]

(1) The default value shown in this column is model-dependent.

Table 11: Control Supervisor Object
(Class Code 0x29, Control Supervisor Class (41) - Instance Attributes (1)

#	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Description
3 0x03	Run1	Get_Attribute_Single Set_Attribute_Single	0 0 1	4	Run Forward Request
4 0x04	Run2	Get_Attribute_Single Set_Attribute_Single	0 0 1	4	Run Reverse Request
5 0x05	NetCtrl	Get_Attribute_Single Set_Attribute_Single	0 0 1	4	Requests Run/Stop control to be local or from network
6 0x06	State	Get_Attribute_Single	N/A 0 7	8	State of Control Supervisor Instance: 1 = Startup 2 = Not_Ready 3 = Ready 4 = Enabled 5 = Stopping 6 = Fault_Stop 7 = Faulted
7 0x07	Running1	Get_Attribute_Single	N/A 0 1	4	Running Forward Status: 0 = Other state 1 = Running Forward
8 0x08	Running2	Get_Attribute_Single	N/A 0 1	4	Running Reverse Status: 0 = Other state 1 = Running Reverse
9 0x09	Ready	Get_Attribute_Single	N/A 0 1	4	Ready to Accept a Run Event: 0 = Other state 1 = Ready to accept a Run event
10 0x0A	Faulted	Get_Attribute_Single	N/A 0 1	4	Fault Occurred: 0 = No faults present 1 = Fault occurred (latched)
12 0x0C	FaultRst	Get_Attribute_Single Set_Attribute_Single	0 0 1	4	Fault Reset Request: 0 = No action 0 -> 1 = Fault reset request 1 = No action
13 0x0D	FaultCode	Get_Attribute_Single	N/A 0 65535	2	If in faulted state, FaultCode indicates the fault that caused the transition to be in a faulted state. The fault codes are listed in the Ethernet/ IP specifications
15 0x0F	CtrlFromNet	Get_Attribute_Single	N/A 0 1	4	Status of Run / Stop control source: 0 = Control is local 1 = Control is from the network

Table 12: AC/DC Drive Object
(Class Code 0x2A, AC/DC Drive Class (42) - Instance Attributes (1)

#	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Description
3 0x03	AtReference	Get_Attribute_Single	N/A 0 1	4	1 = Drive actual at speed reference
4 0x04	NetRef	Get_Attribute_Single Set_Attribute_Single	0 0 1	4	Requests speed reference to be local or from the network: 0 = Set Reference to local control 1 = Set Reference to DN control Note that the actual status of torque or speed reference is reflected in attribute 29, RefFromNet.
6 0x06	DriveMode	Get_Attribute_Single	1 1 1	8	1 = Open loop speed (Frequency)
7 0x07	SpeedActual(RPM)	Get_Attribute_Single	N/A 0 10000	3	Actual drive speed (best approximation) Units: RPM
8 0x08	SpeedRef[RPM}	Get_Attribute_Single Set_Attribute_Single	1800 0 12000	3	Speed reference Units: RPM
9 0x09	CurrentActual[100mA)	Get_Attribute_Single	N/A 0 1000	3	Actual motor phase current Units: 100mA
17 0x11	OutputVoltage[V]	Get_Attribute_Single	N/A 0 690	3	Output Voltage Units: Volts
18 0x12	AccelTime[100ms]	Get_Attribute_Single Set_Attribute_Single	30 1 32000	2	Acceleration time Time from 0 to HighSpdLimit Units: 100ms
19 0x13	DecelTime[100 ms]	Get_Attribute_Single Set_Attribute_Single	30 1 32000	2	Deceleration time Time from HighSpdLimit to 0 Units: 100ms
20 0x14	LowSpdLimit[RPM]	Get_Attribute_Single Set_Attribute_Single	0 0 12000	2	Minimum speed limit Units: RPM
21 0x15	HighSpdLimit[RPM]	Get_Attribute_Single Set_Attribute_Single	1800 0 12000	2	Maximum speed limit Units: RPM
29 0x1D	RefFromNet	Get_Attribute_Single	N/A 0 1	4	Status of speed reference: 0 = Local speed reference 1 = Ethernet / IP speed reference

Table 13: Parameter Object
(Class Code 0x65, Parameter Class (101) - Class Attributes (1-999)

#	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Description
1 0x01	N/A	Get_Attribute_Single Set_Attribute_Single	N/A N/A N/A	2	These instances give direct access to all drive parameters where the instance number corresponds to the parameter number. See the X5 User's Manual (Ch. 7) for more information on specific drive parameters.

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