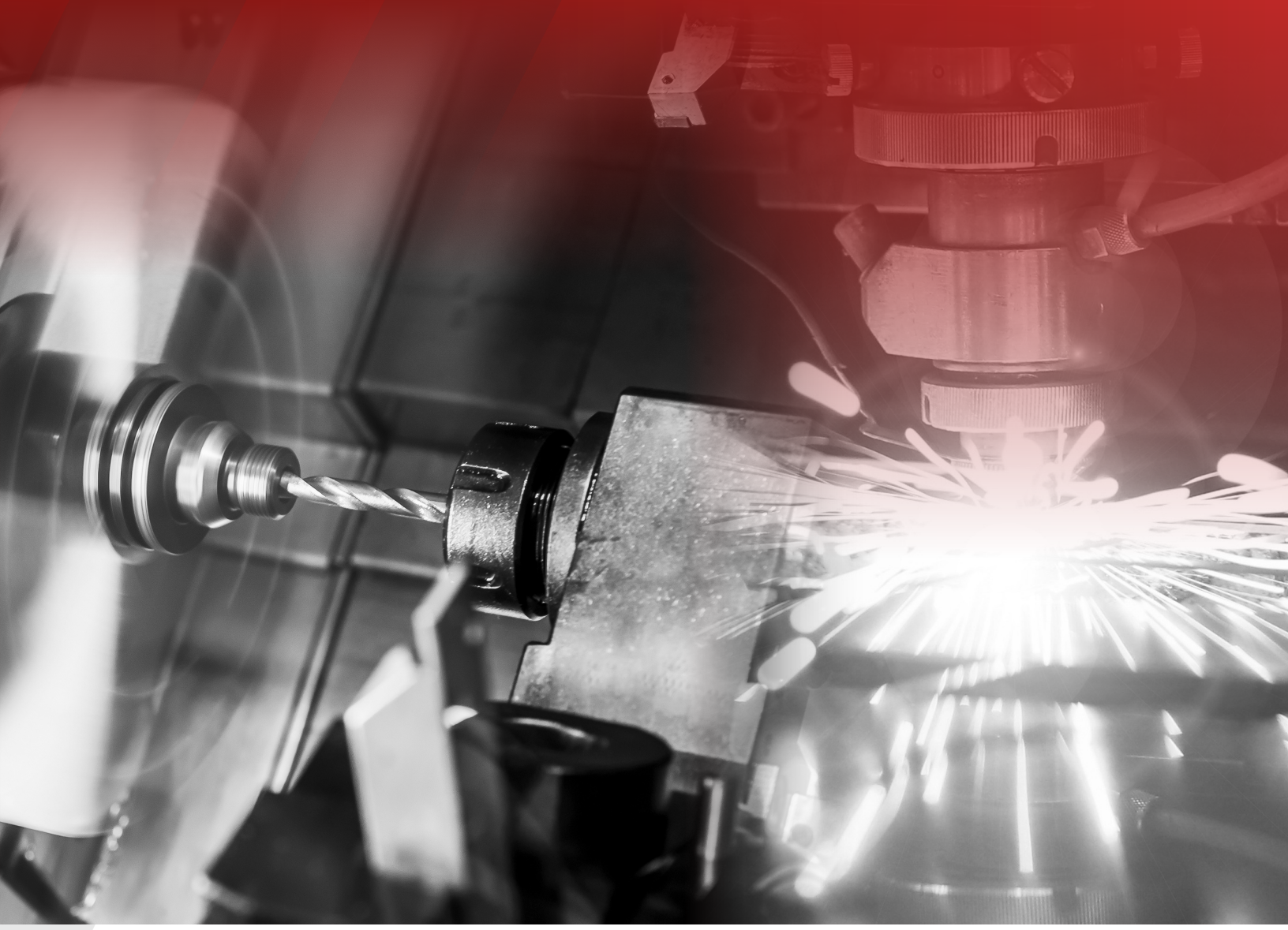
PHASE TECHNOLOGIES

PHASE ETHERNET/IP®

USER MANUAL



SAFETY MESSAGES AND WARNINGS

To ensure safe and reliable operation of the Phase EtherNet/IP®, it is important to carefully read this manual and to observe all warning labels attached to the unit before installing. Please follow all instructions exactly and keep this manual with the unit for quick and easy reference.

Definitions of Warning Signs and Symbols

⚠ **CAUTION:** Indicates a potentially hazardous situation that could result in injury or damage to the product.

⚠ **WARNING:** Indicates a potentially hazardous situation that could result in serious injury or death.

⚠ **HIGH VOLTAGE:** The voltage associated with the procedures referenced could result in serious injury or death. Use caution and follow instructions carefully.

READ THESE WARNINGS BEFORE INSTALLING

OR OPERATING EQUIPMENT

⚠ **WARNING:** Risk of electric shock. More than one disconnect switch may be required to de-energize the equipment before servicing.

⚠ **WARNING:** Risk of electric shock. De-energize the unit by disconnecting all incoming sources of power, then wait 30 minutes for internal charges to dissipate before servicing the equipment.

⚠ **HIGH VOLTAGE:** This equipment is connected to line voltages that can create a potentially hazardous situation. Electric shock could result in serious injury or death. This device should be installed and serviced only by trained, licensed, and qualified personnel. Follow instructions carefully and observe all warnings.

⚠ **WARNING:** Installation of this equipment must comply with the National Electrical Code (NEC) and all applicable local codes. Failure to observe and comply with these codes could result in risk of electric shock, fire, or damage to the equipment.

⚠ **WARNING:** Grounding electrodes must be installed such that earth resistance is 25 Ohms or less, as specified by the NEC section 250-56. If surge protection is installed, earth resistance must be 3 Ohms or less for full effect. Failure to meet these requirements could result in serious injury or death and will void the manufacturer's warranty.

⚠ **CAUTION:** Circuit breakers, fuses, proper ground circuits, and other safety equipment and their proper installation are not provided by Phase Technologies, LLC, and are the responsibility of the end user.

⚠ **CAUTION:** Failure to maintain adequate clearance may lead to overheating of the unit and cause damage or fire.

⚠ **WARNING:** Input power connections should be made by a qualified electrician into circuit with adequate voltage and current carrying capacity for the model. Branch circuit protection to the unit should be provided by appropriately sized fuses or a 2-pole circuit breaker.

⚠ **CAUTION:** Use 600 V vinyl-sheathed wire or equivalent. The voltage drop of the leads needs to be considered in determining wire size. Voltage drop is dependent on wire length and gauge. Use only copper conductors.

⚠ **CAUTION:** Wires fastened to the terminal blocks shall be secured by tightening the terminal screws to a torque value listed in Error! Reference source not found. - Error! Reference source not found.

⚠ **CAUTION:** The input wire gauge must be sized for the single-phase input current, which will be significantly larger than the three-phase output current to the load. The minimum wire gauge for the input terminals is listed in Table 7.

⚠ **CAUTION:** Never allow bare wire to contact metal surfaces.

⚠ **CAUTION:** Never connect AC main power to the output terminals T1, T2, and T3.

⚠ **WARNING:** Under certain conditions, the motor load may automatically restart after a fault occurs. Make sure power to the converter has been disconnected before servicing the equipment, or serious injury may occur.

Contents

1.BASIC ETHERNET/IP INFORMATION

Phase LHX/DXL drives implement the EtherNet/IP protocol as an AC/DC Drive (Device Type 0x02) paired with a custom Modbus interface.

To use the EtherNet/IP protocol:

LHX INTF firmware version must be at least 5.1.53.

1.3.45 CUSTOMER COMM PROTOCOL must be set to EtherNet/IP.

1.3.46.9 PROGRAM MY IP, 1.3.46.11 PROGRAM GATEWAY, and **1.3.46.12 PROGRAM SUBNET** must be set to appropriate values for the network.

Modbus interface details can be found in 3.1.3 and 3.2. Section 2 and the introductory part of 3 are also relevant. The remaining sections describe the AC/DC Drive (Device Type 0x02) implementation and other fundamental EtherNet/IP implementation details if you need/prefer a “native” EtherNet/IP interface.

EDS files can be found at https://www.phasetechnologies.com/downloads/ethernetip-supporting-files.zip

2. ALLOWED CONNECTIONS

Up to six Class 3 and two Class 1 connections can be opened. Class 3 connections can only be made with Message Router (0x02). Class 1 connections may use a combination of appropriate Assembly (0x04) instances and/or the standard heartbeat connection points. No connection configuration objects exist.

3.FULL ETHERNET/IP IMPLEMENTATION DESCRIPTION

The available classes, instances, services, and attributes are listed in the following tables. Modbus addresses can be found in a separate Phase Modbus Manual.

3-1 Supported Objects

Object Name	Class Code	Object Description
Identity	0x01	Provides information about the drive
Message Router	0x02	Services addressed to classes or instances are passed through this object
Assembly	0x04	Binds attributes of multiple classes and/or instances
Connection Manager	0x06	Forward open service is addressed to this object
Motor Data	0x28	Provides motor information
Control Supervisor	0x29	Models drive management functions
AC/DC Drive	0x2A	Models some additional drive management functions
TCP/IP Interface	0xF5	Provides TCP/IP interface information
Ethernet Link	0xF6	Provides Ethernet hardware interface information
LLDP Management	0x109	Provides LLDP interface information

3-2 Supported Assembly (0x04) Instances

Instance Name	Instance Code	Instance Description
Basic Speed Control Output	0x14	Models drive controls
Basic Speed Control Input	0x46	Models drive response
Modbus Output	0x64	Modbus request
Modbus Input	0x65	Modbus response

3-3 Supported Data Types

Data Type Name	Interpretation
BOOL	1-bit string (stored in a BYTE)
BYTE 8-bit string	8-bit string
WORD	16-bit string
DWORD	32-bit string
USINT	8-bit unsigned integer
UINT	16-bit unsigned integer
UDINT	32-bit unsigned integer
INT	16-bit signed integer
SHORT_STRING	String of characters
STRING	String of characters
PATH	Class/instance/attribute identifying byte sequence

Note: Most EtherNet/IP data is passed in little endian format. Please ensure that you are using little endian format when passing data, including when using the Modbus Assembly (0x04) instances.

3.1. Supported Services and Attributes

3.1.1. Identity (0x01)

3-4 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attributes All	0x01	Get all attributes	X	X
Reset	0x05	Reset drive		X
Get Attribute Single	0x0E	Get a single attribute	X	X

3-5 Supported Class Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Revision	0x01	UINT	0x03	X

3-6 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Vendor ID	0x01	UINT	Phase Technologies - 0x72A	X
Device Type	0x02	UINT	AC Drive Device - 0x02	X
Product Code	0x03	UINT	0x01	X
Revision	0x04	Struct	See table 3-7	X
Status	0x05	WORD	Device status flags	X
Serial Number	0x06	UDINT	Device serial number	X
Product Name	0x07	SHORT_STRING	LHX/DXL	X
Application Profiles	0x19	Struct	See table 3-8	X

3-7 Instance Revision (0x04) Structure

Struct Item Name	Data Type	Description
Major Revision	USINT	0x01
Minor Revision	USINT	0x01

3-8 Application Profiles (0x19) Structure

Struct Item Name	Data Type	Description
Number of Application Profiles	UINT	0x02
Application Profile Array	Array of struct	See table 3-9

3-9 Application Profile Array Item Structure

Struct Item Name	Data Type	Description
Profile Number	UINT	EtherNet/IP Transports - 0x02, EtherNet/IP Usage - 0x03
Features Supported	DWORD	Feature support flags

3.1.2. Message Router (0x02)

This section is blank.

3.1.3. Assembly (0x04)

3-10 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute	X	X
Set Attribute Single	0x10	Set a single attribute		X

3-11 Supported Class Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Revision	0x01	UINT	0x02	X

3-12 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
Data	0x03	Struct	See table 3-13	X	See table 3-14

3-13 Data (0x03) Structure

Instance Code	Data Type
0x14	See table 3-15
0x46	See table 3-16
0x64	See table 3-17
0x65	See table 3-19

3-14 Data (0x03) Set Attribute Single (0x10) Support

Instance Code	Set
0x14	X
0x46	
0x64	X
0x65	

3-15 Basic Speed Control Output (0x14) Data (0x03) Structure

Struct Item Name	Data Type	Description
Control Flags	WORD	Bit 2 = Control Supervisor's (0x29) Fault Reset (0x0C), Bit 0 = Control Supervisor's (0x29) Run (0x03)
Speed Reference	INT	AC/DC Drive's (0x2A) Speed Actual (0x07)

3-16 Basic Speed Control Input (0x46) Data (0x03) Structure

Struct Item Name	Data Type	Description
Status Flags	WORD	Bit 2 = Control Supervisor's (0x29) Running (0x07), Bit 0 = Control Supervisor's (0x29) Faulted (0x0A)
Speed Actual	INT	AC/DC Drive's (0x2A) Speed Reference (0x08)

3-17 Modbus Output (0x64) Data (0x03) Structure

Struct Item Name	Data Type	Description
Context Number	USINT	Number placed in the first byte of corresponding Modbus responses
Modbus Function Array	Array of struct, 8 items max, 63 bytes max	See table 3-18

3-18 Modbus Output (0x64) Modbus Function Array Item Structure

Struct Item Name	Data Type	Description
Function Code	USINT	Get - 0x01, Set - 0x02
Initial Modbus Address	UINT	Address from Phase Modbus Manual
Count	USINT	Number of values to get/set
Values	Array of INT	Array of values ONLY for Set (0x02) functions

3-19 Modbus Input (0x65) Data (0x03) Structure

Struct Item Name	Data Type	Description
Context Number	USINT	Number received from corresponding Modbus request
Modbus Function Array	Array of struct, 8 items max, 63 bytes max	See table 3-20

3-20 Modbus Input (0x65) Modbus Function Array Item Structure

Struct Item Name	Data Type	Description
Status Code	USINT	Success - 0x01, Invalid Read/Write - 0x02, Parsing Error - 0x04
Values	Array of INT	Array of values ONLY for Get (0x01) functions

Example usage of Modbus Output (0x64) and Modbus Input (0x65) instances can be found in 3.2.

3.1.4.Connection Manager (0x06)

3-21 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Forward Close	0x4E	Close a connection		X
Forward Open	0x54	Open a connection		X
Large Forward Open	0x5B	Open a connection		X

3.1.5.Motor Data (0x28)

3-22 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute		X
Set Attribute Single	0x10	Set a single attribute		X

3-23 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
Motor Type	0x03	USINT	Motor type, does not affect functionality	X	X
Rated Current	0x06	UINT	Overcurrent Limit	X	X
Rated Voltage	0x07	UINT	Output Voltage	X	X

3.1.6.Control Supervisor (0x29)

3-24 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Reset	0x05	Reset drive		X
Get Attribute Single	0x0E	Get a single attribute		X
Set Attribute Single	0x10	Set a single attribute		X

3-25 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
Run	0x03	BOOL	Drive run control	X	X
Running	0x07	BOOL	Drive run status	X	
Faulted	0x0A	BOOL	Fault status	X	
Fault Reset	0x0C	BOOL	Fault reset control	X	X

3.1.7.AC/DC Drive (0x2A)

3-26 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute		X
Set Attribute Single	0x10	Set a single attribute		X

3-27 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
Net Reference	0x04	BOOL	Local or net control	X	X
Drive Mode	0x06	USINT	Drive operating mode	X	X
Speed Actual	0x07	INT	Actual speed in RPM (frequency * 60)	X	X
Speed Reference	0x08	INT	Desired speed in RPM (frequency * 60)	X	X

3.1.8.TCP/IP Interface (0xF5)

3-28 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute	X	X
Set Attribute Single	0x10	Set a single attribute		X

3-29 Supported Class Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Revision	0x01	UINT	0x04	X

3-30 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
Status	0x01	DWORD	Status flags	X	
Config Capability	0x02	DWORD	Capability flags	X	
Config Control	0x03	DWORD	Control flags	X	X
Physical Link Object	0x04	Struct	See table 3-31	X	
Interface Config	0x05	Struct	See table 3-32	X	
Host Name	0x06	STRING	Host name, non-functional	X	
Encapsulation Inactivity Timeout	0x0D	UINT	TCP connections are closed after this many seconds of inactivity	X	X

3-31 Physical Link Object (0x04) Structure

Struct Item Name	Data Type	Description
Path Size	UINT	0x02
Path	PATH	Ethernet Link (0xF6) Instance (0x01)

3-32 Interface Config (0x05) Structure

Struct Item Name	Data Type	Description
IP Address	UDINT	IP address
Subnet Mask	UDINT	Subnet mask
Gateway	UDINT	Gateway address
Name Server	UDINT	Name server, non-functional
Name Server 2	UDINT	Name server, non-functional
Domain Name	STRING	Domain name, non-functional

3.1.9.Ethernet Link (0xF6)

3-33 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute	X	X

3-34 Supported Class Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Revision	0x01	UINT	0x04	X

3-35 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get
Interface Speed	0x01	UDINT	Speed in Mbps	X
Interface Flags	0x02	DWORD	Status flags	X
Physical Address	0x03	Array of 6 USINT	MAC address	X
Interface Capability	0x0B	Struct	See table 3-36	X

3-36 Interface Capability (0x0B) Structure

Struct Item Name	Data Type	Description
Capability Bits	DWORD	Capability flags
Speed/Duplex Array Count	USINT	0X00

3.1.10.LLDP Management (0x109)

3-37 Supported Services

Service Name	Service Code	Service Description	Class	Instance
Get Attribute Single	0x0E	Get a single attribute		X
Set Attribute Single	0x10	Set a single attribute		X

3-38 Supported Instance Attributes

Attribute Name	Attribute Code	Data Type	Description	Get	Set
LLDP Enable	0x01	Struct	See table 3-39	X	X
Message TX Interval	0x02	UINT	LLDP transmission interval in seconds	X	X
Message TX Hold	0x03	USINT	TTL multiplier of transmission interval	X	X

3-39 LLDP Enable (0x01) Structure

Struct Item Name	Data Type	Description
LLDP Enable Array Length	UINT	0x02
LLDP Enable Bits	BYTE	Bit 1 = Port TX Enable, Bit 0 = Global TX Enable

3.2.Example Modbus Request, Response, and Resulting Behavior

Modbus addresses in the following examples are from a separate Phase Modbus Manual.

3-40 Example Modbus Request

Message Number		Data Type	Data
	Context Number	USINT	0XAB
1	Function Code	USINT	Get - 0x01
	Initial Modbus Address	UNIT	4001
	Count	USINT	2
2	Function Code	USINT	Set - 0x02
	Initial Modbus Address	UNIT	40001
	Count	USINT	2
	First Value in Values	INT	310
	Second Value in Values	INT	610

NOTE: Remaining bytes are all zeros.

3-41 Example Modbus Response

Message Number	Item Name	Data Type	Data
	Context Number	USINT	0xAB
1	Status Code	USINT	Success - 0x1
	First Value in Values	INT	310
	Second Value in Values	INT	610
2	Status CodeUSINT	USINT	Success - 0x1

NOTE: Remaining bytes are all zeros (the first of the remaining bytes may be Status Code Parsing Error (0x04), which can be ignored).

Resulting behavior in this example:

Min Frequency is set to 31.0 Hz

Max Frequency is set to 61.0 Hz.

All Modbus Set (0x02) requests are handled before Get (0x01) requests, which is demonstrated in this example.

When using the Modbus Assembly (0x04) instances, it is recommended to limit Set (0x02) requests for permanently stored parameters as much as possible or to use Set Attribute Single (0x10) and Get Attribute Single (0x0E) as appropriate to change values and verify message acceptance instead of using a Class 1 connection.

EDS page: https://www.phasetechnologies.com/downloads/ethernetip-supporting-files.zip

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