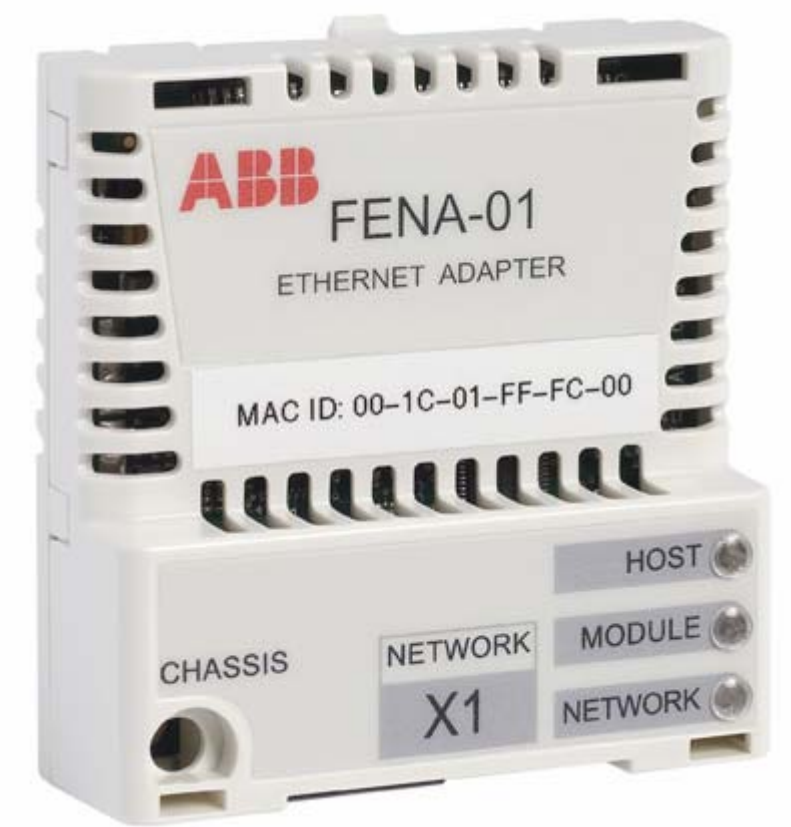
ABB Drives

Protocol Manual - Modbus/TCP
Ethernet Adapter Module
FENA-01



Ethernet Adapter Module - Modbus/TCP
FENA-01

Protocol Manual

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Safety instructions

Overview

This chapter states the general safety instructions that must be followed when installing and operating the FENA-01 Ethernet Adapter module.

The material in this chapter must be studied before attempting any work on, or with, the unit.

In addition to the safety instructions given below, read the complete safety instructions of the specific drive you are working on.

General safety instructions

WARNING! All electrical installation and maintenance work on the drive should be carried out by qualified electricians.

The drive and adjoining equipment must be properly earthed.

Do not attempt any work on a powered drive. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the frequency converter, the motor or the motor cable. It is good practice to check (with a voltage indicating instrument) that the drive is in fact discharged before beginning work.

The motor cable terminals of the drive are at a dangerously high voltage when mains power is applied, regardless of motor operation.

There can be dangerous voltages inside the drive from external control circuits even when the drive mains power is shut off. Exercise appropriate care when working on the unit. Neglecting these instructions can cause physical injury or death.

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Introduction

Intended audience

The manual is intended for people responsible for installing, commissioning and using an FENA-01 Ethernet Adapter module for Modbus/TCP communication. The reader is expected to have a basic knowledge of electrical fundamentals, electrical wiring practices and how to operate the drive.

Before you start

It is assumed that the drive is installed and ready to operate before starting the installation of the extension module.

In addition to conventional installation tools, have the drive manuals available during the installation as they contain important information not included in this manual. The drive manuals are referred to at various points of this document.

What this manual contains

This manual contains information on the configuration and use of the FENA-01 Ethernet Adapter module with the Modbus/TCP protocol.

Safety instructions are featured in the first few pages of this manual.

Overview contains short descriptions of the Modbus/TCP protocol and the FENA-01 Ethernet Adapter module and a delivery checklist.

Drive configuration explains how to program the drive before the communication through the adapter module can be started.

Client configuration explains how to program the Modbus/TCP client before communication through the adapter module can be started.

Communication profiles describes the communication profiles used in the communication between the Modbus/TCP client, the FENA-01 module and the drive.

Communication contains a description of the Modbus/TCP functionality supported by the FENA-01.

Diagnostics explains how to trace faults with the status LEDs on the FENA-01 module.

Definitions and abbreviations explains definitions and abbreviations concerning Modbus/TCP on the FENA-01.

Overview

Overview

The FENA-01 Ethernet Adapter module supports the Modbus/TCP network protocol. This chapter contains a short description of Modbus/TCP and the FENA-01 Ethernet Adapter module.

For information on Ethernet standards, including media and topologies, see *FENA-01 Ethernet Adapter Module Hardware Manual* (3AUA0000022986 [English]).

Modbus/TCP

Modbus/TCP is a variant of the Modbus family of simple, vendor-neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of Modbus messaging over TCP connection on an IP network.

The implementation of the Modbus/TCP server in the FENA-01 module is done according to

- Modbus Application Protocol Specification v1.1a
- Modbus Messaging on TCP/IP Implementation Guide v1.0a

The supported Modbus commands are listed in chapter *Communication*. Two simultaneous Modbus/TCP connections are supported.

Further information on the Modbus/TCP protocol is available on the world wide web from www.modbus.org.

Modbus/TCP on FENA-01 Ethernet Adapter Module

The FENA-01 Ethernet Adapter module is an optional device for ABB drives which enables the connection of the drive to an Ethernet network. The module supports a variety of higher-level communications protocols, including Modbus/TCP. Through the FENA-01 Ethernet Adapter module it is possible to:

- give control commands to the drive (Start, Stop, Run enable, etc.)
- feed a motor speed or torque reference to the drive
- give a process actual value or a process reference to the PID controller of the drive
- read status information and actual values from the drive
- change drive parameter values
- reset a drive fault.

The FENA-01 acts as a Modbus/TCP server with support for ABB Drives and Transparent profiles. The Modbus commands supported by the FENA-01 Ethernet Adapter module are discussed in chapter *Communication*.

The adapter module is mounted into an option slot on the motor control board of the drive. See the drive documentation for module placement options.

Compatibility

The FENA-01 is compatible with all Modbus/TCP clients that support:

- Modbus Application Protocol Specification v1.1a
- Modbus Messaging on TCP/IP Implementation Guide v1.0a

Drive configuration

Overview

This chapter gives information on configuring the FENA-01 Ethernet Adapter module for use with Modbus/TCP.

Ethernet connection configuration

After the FENA-01 Ethernet Adapter module has been mechanically and electrically installed according to the FENA-01 Hardware Manual, the drive must be prepared for communication with the module.

The detailed procedure of activating the module for Ethernet communication with the drive is dependent on the drive type. Normally, a parameter must be adjusted to activate the communication (see the drive documentation).

As communication between the drive and the FENA-01 is established, several configuration parameters are copied to the drive. These parameters (*Table 1.*, *Table 2.* and *Table 3.*) must be checked first and adjusted where necessary. The alternative selections for these parameters are discussed in more detail below the tables.

Note: The new settings take effect only when the module is powered up the next time or when a ‘Fieldbus Adapter parameter refresh’ is given (see the drive documentation).

*Table 1. FENA-01 Configuration Parameters - Group A (Group 1)**

Par. no.	Parameter name	Alternative settings	Default setting
1	FBA TYPE	(Read-only)	ETHERNET
2	PROTOCOL/ PROFILE	Modbus/TCP: **0** ABB Drives Classic **1** ABB Drives Enhanced **2** Transparent 16-bit **3** Transparent 32-bit EtherNet/IP: **100** ODVA AC/DC Drive **101** ABB Drives Profile **102** Transparent 16-bit **103** Transparent 32-bit	**0** Modbus/TCP
3	COMMRATE	**0** Auto-negotiate; **1** 100 Mbps, Full Duplex **2** 100 Mbps, Half Duplex **3** 10 Mbps, Full Duplex **4** 10 Mbps, Half Duplex	**0** Auto-negotiate
4	IP CONFIGURATION	**0** Static IP **1** Dynamic IP (DHCP)	**1** Dynamic IP (DHCP)
5	IP ADDRESS 1	0…255	0
6	IP ADDRESS 2	0…255	0
7	IP ADDRESS 3	0…255	0
8	IP ADDRESS 4	0…255	0
9	SUBNET CIDR	1…31	1
10	GW ADDRESS 1	0…255	0
11	GW ADDRESS 2	0…255	0
12	GW ADDRESS 3	0…255	0
13	GW ADDRESS 4	0…255	0

14 - 19	Reserved	N/A	N/A
20	MODBUS/TCP TIMEOUT	0…65535	0
21	TIMEOUT MODE	**0** NONE **1** ANY MESSAGE **2** CONTROL WRITE	**2** CONTROL WRITE
22	WORD ORDER	**0** HILO **1** LOHI	**1** LOHI
23 - 26	Reserved	N/A	N/A

*Actual parameter group number depends on the drive type. Eg, group A (group 1) equals to parameter group 51 in ACS350, ACS355, ACSM1, ACS850 and ACQ810.

1 FBA TYPE

This parameter shows the fieldbus adapter type as detected by the drive. The value should not be adjusted by the user.

If this parameter is undefined, the communication between the drive and the module has not been established.

2 PROTOCOL/PROFILE

Selects the application protocol and communication profile for the network connection.

0 = Modbus/TCP protocol with ABB Drives Profile - Classic.

1 = Modbus/TCP protocol with ABB Drives Profile - Enhanced.

2 = Modbus/TCP protocol with Transparent 16-bit profile.

3 = Modbus/TCP protocol with Transparent 32-bit profile.

100 = EtherNet/IP protocol with ODVA AC/DC Drive profile.

101 = EtherNet/IP protocol with ABB Drives Profile.

102 = EtherNet/IP protocol with Transparent 16-bit profile.

103 = EtherNet/IP protocol with ODVA AC/DC Drive profile.

3 COMMRATE

Sets the bit rate for the Ethernet interface.

0 = Auto-negotiate

1 = 100 Mbits/s, full duplex

2 = 100 Mbits/s, half duplex

3 = 10 Mbits/s, full duplex

4 = 10 Mbits/s, half duplex

4 IP CONFIGURATION

Sets the method for configuring the IP address, subnet mask and gateway address for the module.

0 = Static IP: Configuration will be obtained from configuration parameters 5-13.

1 = Dynamic IP: Configuration will be obtained via DHCP.

DHCP, Dynamic Host Configuration Protocol, is a protocol for automating the configuration of IP devices. DHCP can be used to automatically assign IP addresses and related network information.

5 IP ADDRESS 1

6 IP ADDRESS 2

7 IP ADDRESS 3

8 IP ADDRESS 4

An IP address is assigned to each IP node on a network. An IP address is a 32-bit number that is typically represented in “dotted decimal” notation consisting of four decimal integers, on the range 0..255, separated by periods. Each integer represents the value of one octet (8-bits) in the IP address. These parameters define the four octets of the IP address.

9 SUBNET CIDR

Subnet masks are used for splitting networks into smaller networks called subnets. A subnet mask is a 32-bit binary number that is used to split the IP Address into a network address and host address. Subnet masks are typically represented in either dotted-decimal notation or the more compact CIDR notation.

Dotted Decimal	CIDR	Dotted Decimal	CIDR
255.255.255.254	31	255.254.0.0	15
255.255.255.252	30	255.252.0.0	14
255.255.255.248	29	255.248.0.0	13
255.255.255.240	28	255.240.0.0	12
255.255.255.224	27	255.224.0.0	11
255.255.255.192	26	255.224.0.0	10
255.255.255.128	25	255.128.0.0	9
255.255.255.0	24	255.0.0.0	8
255.255.254.0	23	254.0.0.0	7
255.255.252.0	22	252.0.0.0	6
255.255.248.0	21	248.0.0.0	5
255.255.240.0	20	240.0.0.0	4
255.255.224.0	19	224.0.0.0	3
255.255.192.0	18	192.0.0.0	2
255.255.128.0	17	128.0.0.0	1
255.255.0.0	16		

10 GW ADDRESS 1

11 GW ADDRESS 2

12 GW ADDRESS 3

13 GW ADDRESS 4

IP gateways connect individual physical IP subnets into a unified IP network. When an IP node needs to communicate with an IP node on another subnet, the IP node sends the data to the IP gateway for forwarding. These parameters define the four octets of the gateway address.

14-19 Reserved

These parameters are unused by the FENA-01 when configured for Modbus/TCP.

20 MODBUS/TCP TIMEOUT

The Modbus protocol does not specify a timeout mechanism for the application layer. A timeout mechanism may be desired when controlling a drive, so a method is provided for this purpose.

If the parameter value is zero, then this feature is disabled.

If the parameter value is non-zero, then the timeout is

(Modbus/TCP Timeout Value) * 100 milliseconds.

For example, a Modbus/TCP timeout value of 22 would result in a timeout of

22 * 100 milliseconds = 2.2 seconds

In the event of a Modbus/TCP timeout, the FENA-01 will signal the drive that communication with the client has been lost. The drive configuration will determine how it will respond. For example, if the Modbus/TCP timeout is configured for 250 ms and the drive is configured to fault on a communication failure with a delay of 500ms, then the drive will fault 750ms after communications is lost.

21 TIMEOUT MODE

Selects which Modbus/TCP register accesses reset the timeout counter.

0 = NONE: The Modbus/TCP timeout feature is disabled.

1 = ANY MESSAGE: The timeout counter is reset when any Modbus register of the drive is accessed.

2 = CONTROL WRITE: The timeout counter is reset when the drive receives either a new control word or new reference value (REF1 or REF2) from the Modbus/TCP master.

22 WORD ORDER

Selects in which order 16-bit registers of 32-bit parameters are transferred.

0 = HILO: The first register contains the low order word and the second register contains the high order word.

1 = LOHI: The first register contains the high order word and the second register contains the low order word.

For each register (16-bit), the first byte contains the high order byte and the second byte contains the low order byte.

23-26 Reserved

These parameters are unused by the FENA-01 when configured for Modbus/TCP.

*Table 2. FENA-01 Configuration Parameters - Group B (Group 2)**

Par. no. **	Parameter name	Alternative settings	Default setting
1	DATA OUT 1 (client to drive)	0 to 9999 Format: **xxyy**, where **xx** = parameter group and **yy** = parameter index.	0
2	DATA OUT 2	See DATA OUT 1 above.	0
3	DATA OUT 3	See DATA OUT 1 above.	0
4	DATA OUT 4	See DATA OUT 1 above.	0
5	DATA OUT 5	See DATA OUT 1 above.	0
6	DATA OUT 6	See DATA OUT 1 above.	0
7	DATA OUT 7	See DATA OUT 1 above.	0
8	DATA OUT 8	See DATA OUT 1 above.	0
9	DATA OUT 9	See DATA OUT 1 above.	0
10	DATA OUT 10	See DATA OUT 1 above.	0
11	DATA OUT 11	See DATA OUT 1 above.	0
12	DATA OUT 12	See DATA OUT 1 above.	0

*Actual parameter group number depends on the drive type. Eg, group B (group 2) equals to parameter group 55 in ACS350 and ACS355, and group 53 in ACSM1, ACS850 and ACQ810.

** Number of parameters in this group may vary by drive.

1 DATA OUT 1

For Modbus register maps that include drive parameters, this parameter specifies which parameter's value will be written to when the register corresponding to DATA OUT 1 is written by the Modbus client. Content is specified by a decimal number as follows.

0	Not Used
1 - 99	Virtual Address Area of Drive. Not used when the Modbus/TCP protocol is used.
101 - 9999	Parameter Area of Drive

Parameter numbers are formatted as xxyy, where xx is the parameter group number (1 to 99) and yy is the parameter index within that group (01 to 99). For example, parameter 99.02 would be entered as 9902.

2-12 DATA OUT 2 to DATA OUT 12

See DATA OUT 1 above.

*Table 3. FENA-01 Configuration Parameters - Group C (Group 3)**

Par. no. **	Parameter name	Alternative settings	Default setting
1	DATA IN 1 (drive to client)	0 to 9999 Format: **xxyy**, where **xx** = parameter group and **yy** = parameter index.	0
2	DATA IN 2	See DATA IN 1 above.	0
3	DATA IN 3	See DATA IN 1 above.	0
4	DATA IN 4	See DATA IN 1 above.	0
5	DATA IN 5	See DATA IN 1 above.	0
6	DATA IN 6	See DATA IN 1 above.	0
7	DATA IN 7	See DATA IN 1 above.	0
8	DATA IN 8	See DATA IN 1 above.	0
9	DATA IN 9	See DATA IN 1 above.	0
10	DATA IN 10	See DATA IN 1 above.	0
11	DATA IN 11	See DATA IN 1 above.	0
12	DATA IN 12	See DATA IN 2 above.	0

*Actual parameter group number depends on the drive type. Eg, group C (group 3) equals to parameter group 54 in ACS350 and ACS355, and group 52 in ACSM1, ACS850 and ACQ810.

** Number of parameters in this group may vary by drive.

1 DATA IN 1

For Modbus register maps that include drive parameters, this parameter specifies which parameter's value will be read from when the register corresponding to DATA IN 1 is read by the Modbus client. Content is specified by a decimal number as follows.

0	Not used
1 - 99	Virtual Address Area of Drive. Not used when the Modbus/TCP protocol is used.
101 - 9999	Parameter Area of Drive

Parameter numbers are formatted as xxyy, where xx is the parameter group number (1 to 99) and yy is the parameter index within that group (01 to 99). For example, parameter 99.02 would be entered as 9902.

2-12 DATA IN 2 to DATA IN 12

See DATA IN 1 above.

Control locations

ABB drives can receive control information from multiple sources including digital inputs, analogue inputs, the drive control panel and a communication module (eg, FENA-01). ABB drives allow the user to separately determine the source for each type of control information (Start, Stop, Direction, Reference, Fault Reset, etc.). In order to give the fieldbus client the most complete control over the drive, the communication module must be selected as the source of this information. See the user documentation of the drive for information on the selection parameters.

Client configuration

Overview

This chapter gives information on configuring the Modbus/TCP client for communication through the FENA-01 Ethernet Adapter module.

Configuring the system

After the FENA-01 Ethernet Adapter module has been mechanically and electrically installed according to the instructions in the FENA-01 Hardware Manual and has been initialized by the drive, the client must be prepared for communication with the module.

Please refer to the client documentation for information on configuring the system for communication with the FENA-01.

Modbus Register Maps

The Modbus register map presented by the FENA-01 to the Modbus client is selected by the PROFILE configuration parameter. For details, see chapter *Drive configuration*.

For Modbus register map definitions, see chapter *Communication*.

For definitions of Control, Status, References and Actuals for a given communication profile, see chapter *Communication profiles*.

Communication profiles

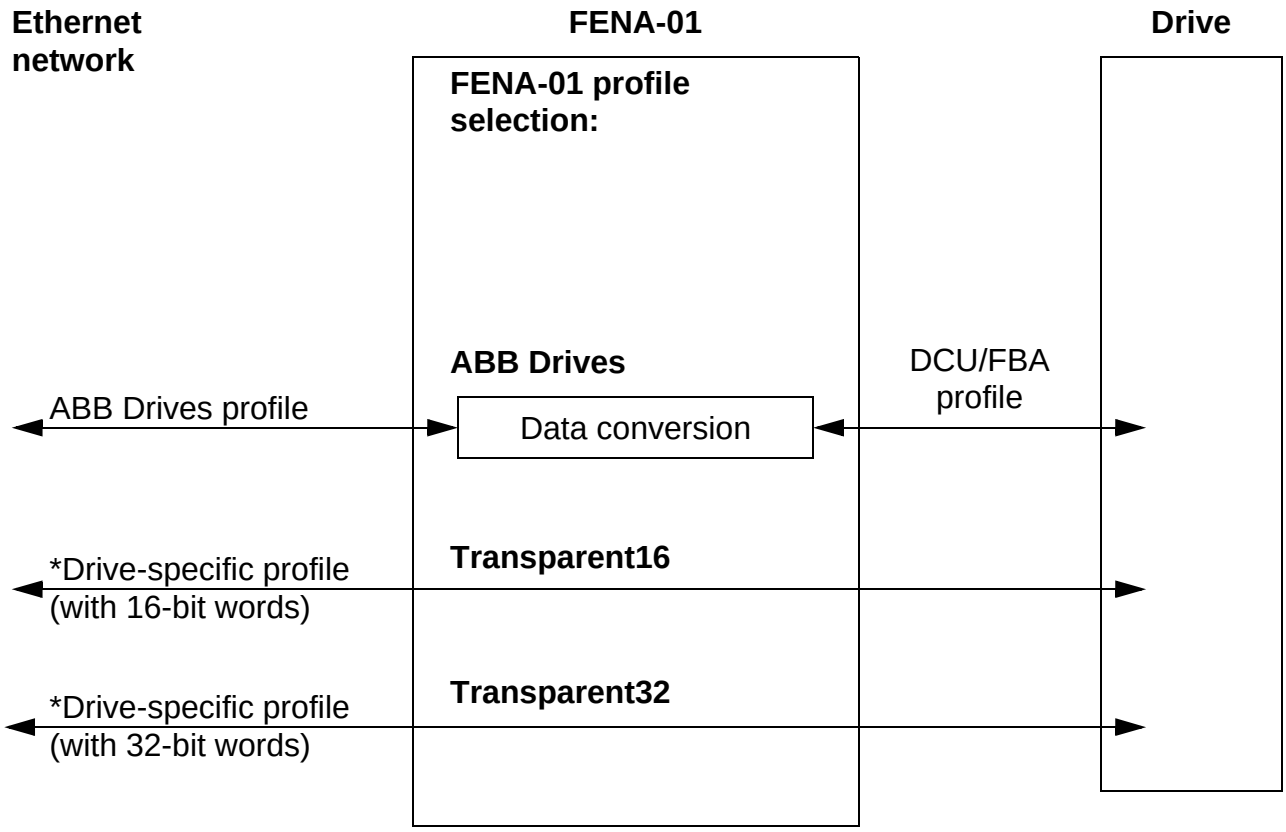
Overview

This chapter describes the communication profiles used in the communication between the Modbus/TCP client, the FENA-01 module and the drive.

Communication profiles

Communication profiles are ways of conveying control commands (Control word, Status word, references and actual values) between the Modbus client and the drive.

The FENA-01 module may be configured to provide either the ABB Drives Profile or one of two Transparent modes for 16 and 32 bit words respectively. For the ABB Drives Profile, data is converted by the FENA-01 into the DCU/FBA profile (detailed in the drive documentation). For the Transparent modes, no data conversion takes place.



*To be used if the drive does not support the DCU/FBA communication profile.

The ABB Drives communication profile

The Control Word and the Status Word

The Control Word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus client station to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions on the Control Word and returns status information to the client in the Status Word.

The contents of the Control Word and the Status Word are detailed in Tables *4* and *5* respectively. The drive states are presented in the ABB Drives Profile state machine (*Figure 1.*).

References

References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two’s complement from the corresponding positive reference.

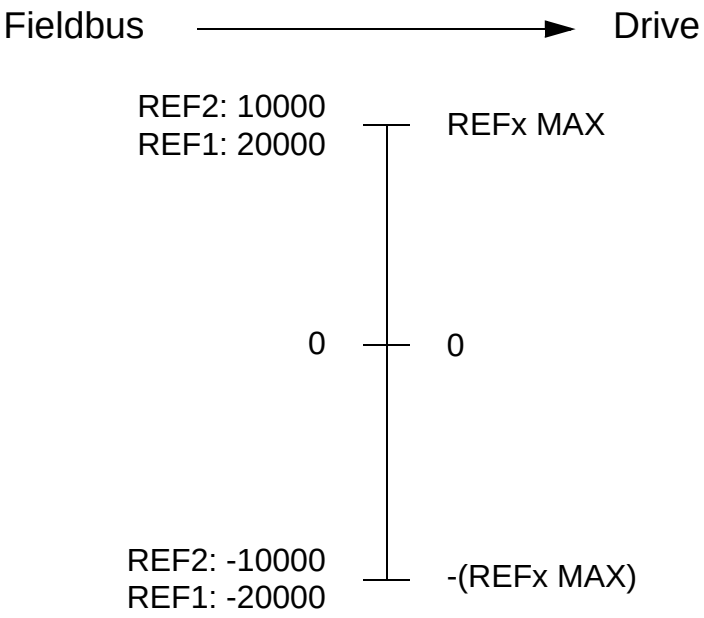
ABB drives can receive control information from multiple sources including analogue and digital inputs, the drive control panel and a communication module (eg, FENA-01). In order to have the drive controlled through the fieldbus, the module must be defined as the source for control information, eg, Reference.

Scaling

References are scaled as shown below.

Note: The values of REF1 MAX and REF2 MAX are set by drive parameters. See the drive documentation for further information.

Note: Drive parameter REFx MIN may limit the actual minimum reference.



Actual values

Actual values are 16-bit words containing information on the operation of the drive. The functions to be monitored are selected by a drive parameter.

Scaling

Actual values are scaled as shown below.

Note: The values of REF1 MAX and REF2 MAX are set by drive parameters. See the drive documentation for further information.

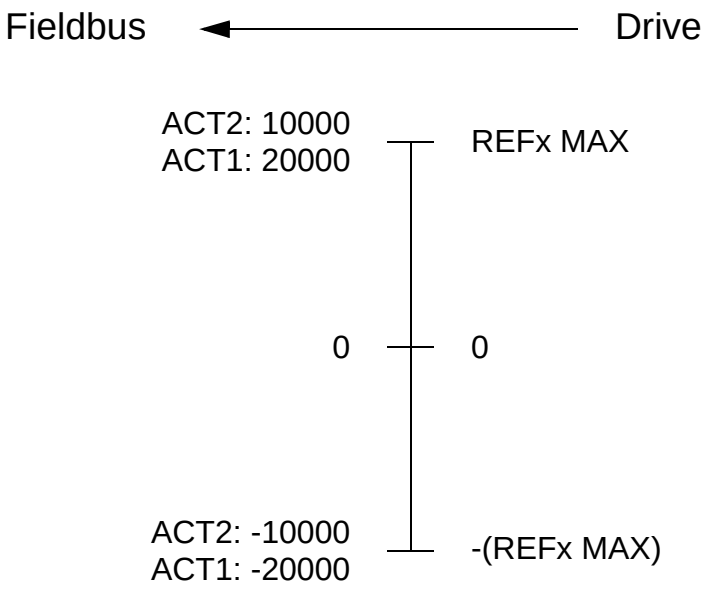


Table 4. The Control Word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 1.

Bit	Name	Value	STATE/Description
0	OFF1_ CONTROL	1	Proceed to **READY TO OPERATE**.
		0	Stop along currently active deceleration ramp. Proceed to **OFF1 ACTIVE**; proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active.
1	OFF2_ CONTROL	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to stop. Proceed to **OFF2 ACTIVE**, proceed to **SWITCH-ON INHIBITED**.
2	OFF3_ CONTROL	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**. **Warning:** Ensure motor and driven machine can be stopped using this stop mode.
3	INHIBIT_ OPERATION	1	Proceed to **OPERATION ENABLED**. **Note:** Run enable signal must be active; see drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal.
		0	Inhibit operation. Proceed to **OPERATION INHIBITED**.
4	RAMP_OUT_ ZERO	1	Normal operation. Proceed to **RAMP FUNCTION GENERATOR: OUTPUT ENABLED**.
		0	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).

Bit	Name	Value	STATE/Description
5	RAMP_HOLD	1	Enable ramp function. Proceed to **RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED**.
		0	Halt ramping (Ramp Function Generator output held).
6	RAMP_IN_ ZERO	1	Normal operation. Proceed to **OPERATING**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Force Ramp Function Generator input to zero.
7	RESET	0=>1	Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Continue normal operation.
8 to 9	Reserved.		
10	REMOTE_ CMD	1	Fieldbus control enabled.
		0	Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference. Control Word = 0 and Reference = 0: Fieldbus control enabled. Reference and deceleration/ acceleration ramp are locked.
11	EXT_CTRL_ LOC	1	Select External Control Location EXT2. Effective if control location parameterised to be selected from fieldbus.
		0	Select External Control Location EXT1. Effective if control location parameterised to be selected from fieldbus.
12 to 15	Reserved or freely programmable control bits*		

*Not supported with ACS350/355

Table 5. The Status Word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 1.

Bit	Name	Value	STATE/Description
0	RDY_ON	1	**READY TO SWITCH ON**.
		0	**NOT READY TO SWITCH ON**.
1	RDY_RUN	1	**READY TO OPERATE**.
		0	**OFF1 ACTIVE**.
2	RDY_REF	1	**OPERATION ENABLED**.
		0	**OPERATION INHIBITED**.
3	TRIPPED	1	**FAULT**.
		0	No fault.
4	OFF_2_STA	1	OFF2 inactive.
		0	**OFF2 ACTIVE**.
5	OFF_3_STA	1	OFF3 inactive.
		0	**OFF3 ACTIVE**.
6	SWC_ON_ INHIB	1	**SWITCH-ON INHIBITED**.
		0	–
7	ALARM	1	Warning/Alarm.
		0	No warning/alarm.
8	AT_ SETPOINT	1	**OPERATING**. Actual value equals reference = is within tolerance limits, i.e. in speed control, speed error is 10% max. of nominal motor speed.
		0	Actual value differs from reference = is outside tolerance limits.
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2).
		0	Drive control location: LOCAL.

Bit	Name	Value	STATE/Description
10	ABOVE_ LIMIT	1	Actual frequency or speed equals or exceeds supervision limit (set by drive parameter). Valid in both directions of rotation.
		0	Actual frequency or speed within supervision limit.
11	EXT_CTRL_ LOC	1	External Control Location EXT2 selected.
		0	External Control Location EXT1 selected.
13 to 14	Reserved or freely programmable status bits*		
15		1	Communication error detected by fieldbus adapter module.
		0	Fieldbus adapter communication OK.

*Not supported with ACS350/355

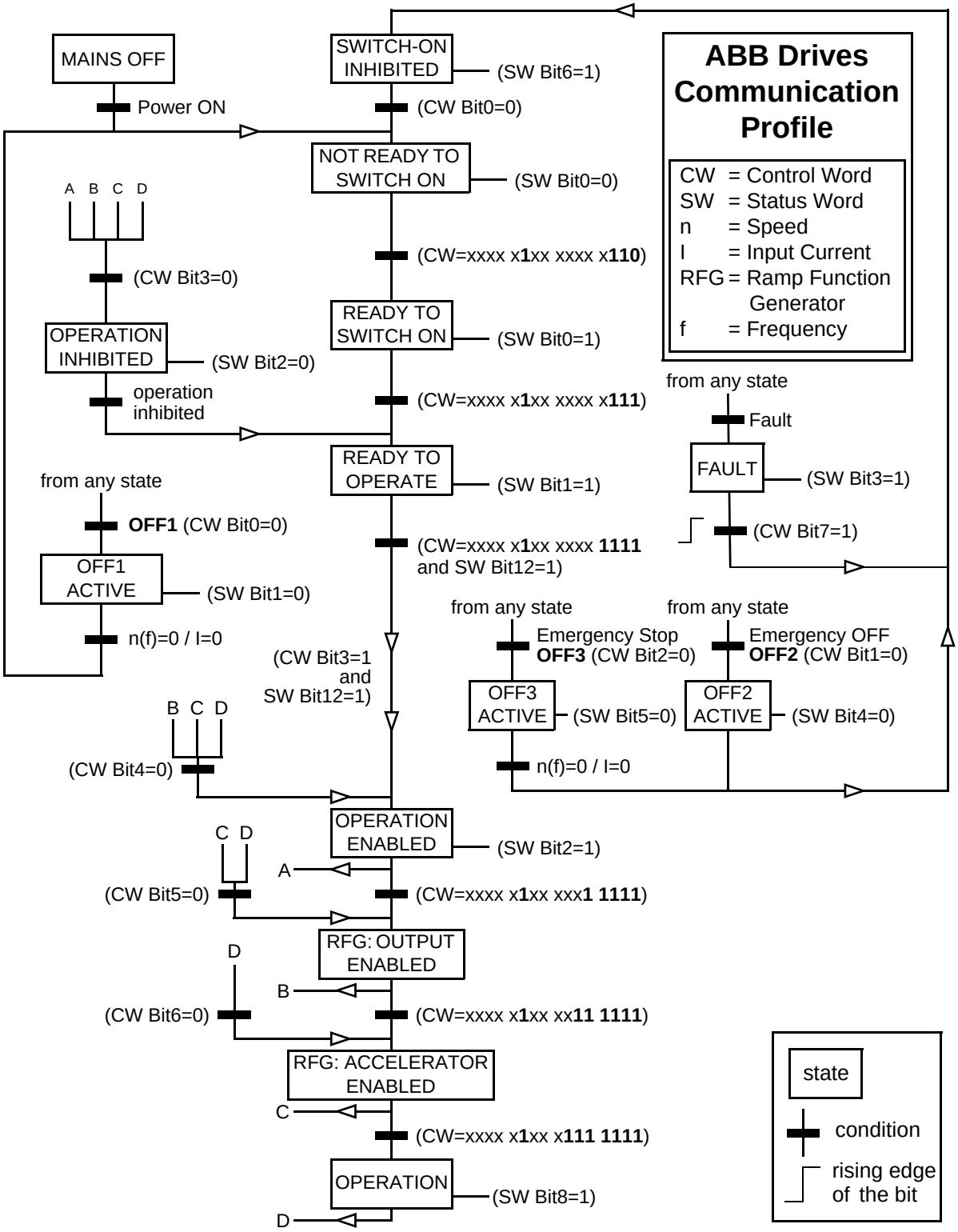


Figure 1. ABB Drives Profile state machine

Communication

Overview

This chapter describes the Modbus/TCP communication protocol for the FENA-01. For detailed information on Modbus/TCP communication, refer to

- Modbus Application Protocol Specification v1.1a
- Modbus Messaging on TCP/IP Implementation Guide v1.0a

Register Addressing

The address field of Modbus Requests for accessing Holding Registers is 16 bits. This allows the Modbus protocol to support addressing of 65536 Holding Registers.

Historically, Modbus client devices used 5-digit decimal addresses from 40001 to 49999 to represent Holding Register addresses. 5-digit decimal addressing limited to 9999 the number of holding registers that could be addressed.

Modern Modbus client devices typically provide a means to access the full range of 65536 Modbus Holding Registers. One of these methods is to use 6-digit decimal addresses from 400001 to 465536. This manual uses 6-digit decimal addressing to represent Modbus Holding Register addresses.

Modbus client devices that are limited to 5-digit decimal addressing may still access registers 400001 to 409999 by using 5-digit decimal addresses 40001 to 49999. Registers 410000-465536 are inaccessible to these clients.

Function Codes

The FENA-01 supports the Modbus function codes shown below.

Function Code	Name	Description
03h	Read Holding Registers	Reads the contents of a contiguous block of holding registers in a server device.
06h	Write Single Register	Writes a single holding register in a server device.
10h	Write Multiple Registers	Writes the contents of a contiguous block of holding registers in a server device.
17h	Read/Write Multiple Registers	Writes the contents of a contiguous block of holding registers in a server device, then reads the contents of of a contiguous block of holding registers (same or different than those written) in a server device.
2Bh/0Eh	Encapsulated Interface Transport / Read Device Identification	Allows reading identification and other information of the server. Parameter "Read Device ID code" allows to define three access types: 01: Request to get the basic device identification (stream access) 02: Request to get the regular device identification (stream access) 04: Request to get one specific identification object (individual access)

Encapsulated Interface Transport / Read Device Identification

The FENA-01 supports the Modbus EIT/RDI objects shown below.

Object ID	Name
00h	Vendor Name
01h	Product Code
02h	Major/Minor Revision
03h	Vendor URL
04h	Product Name

Exception Codes

The FENA-01 supports the Modbus exception codes shown below.

Exception Code	Name	Description
01h	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server.
02h	ILLEGAL DATA ADDRESSS	The data address received in the query is to an allowable address for the server.
03h	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the server.
04h	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action.
06h	SLAVE DEVICE BUSY	The server is engaged in processing a long-duration command. The client should retransmit the message later when the server is free.

Communication Profiles

Modbus is an application layer messaging protocol. It describes how data is transferred between client and server, but not the meaning of that data. Communication profiles are used to define the meaning of the data.

ABB Drives Profile - Classic

The ABB Drives Profile - Classic communication profile provides register mapped access to the control, status, reference and actual values of the ABB Drives Profile in the classic format for backward compatibility.

Register Address*	Register Data (16-bit)
400001	ABB Drives Profile Control
400002	ABB Drives Profile Reference 1
400003	ABB Drives Profile Reference 2
400004	ABB Drives Profile Status
400005	ABB Drive Profile Actual 1
400006	ABB Drive Profile Actual 2
400101-409999	Drive Parameter Access (16-bit) Register Address = 400000 + 100 x Group + Index Example for Drive Parameter 3.18 400000 + 100 x 3 + 18 = 400318

* 6-digit register addressing (400001) is used instead of 5-digit register addressing (40001) to describe register map. See section *Register Addressing* on page *37* for additional information.

ABB Drives Profile - Enhanced

The ABB Drives Profile - Enhanced communication profile provides register mapped access to the control, status, reference and actual values of the ABB Drives Profile. The mapping of the registers has been enhanced to allow writing of control and reading of status in a single Read/Write Multiple Register request.

Register Address*, **	Register Data (16-bit)
400001	ABB Drives Profile Control
400002	ABB Drives Profile Reference 1
400003	ABB Drives Profile Reference 2
400004	DATA OUT 1
400005	DATA OUT 2
400006	DATA OUT 3
400007	DATA OUT 4
400008	DATA OUT 5
400009	DATA OUT 6
400010	DATA OUT 7
400011	DATA OUT 8
400012	DATA OUT 9
400013	DATA OUT 10
400014	DATA OUT 11
400015	DATA OUT 12
400051	ABB Drives Profile Status
400052	ABB Drive Profile Actual 1
400053	ABB Drive Profile Actual 2
400054	DATA IN 1
400055	DATA IN 2
400056	DATA IN 3
400057	DATA IN 4
400058	DATA IN 5
400059	DATA IN 6
400060	DATA IN 7
400061	DATA IN 8
400062	DATA IN 9
400063	DATA IN 10
400064	DATA IN 11
400065	DATA IN 12

Register Address*, **	Register Data (16-bit)
400101-409999	Drive Parameter Access (16-bit) Register Address = 400000 + 100 x Group + Index Example for Drive Parameter 3.18 400000 + 100 x 3 + 18 = 400318 Register addressing of the 32-bit parameters (not supported with ACS350 and ACS355): 420000 + 200 x Group + 2 x Index Example for Drive Parameter 1.27 420000 + 200 x 1 + 2 x 27 = 420254

* 6-digit register addressing (400001) is used instead of 5-digit register addressing (40001) to describe register map. See section *Register Addressing* on page *37* for additional information.

** Register addresses of the 32-bit parameters cannot be accessed by using 5-digit register numbers.

Transparent 16-bit

The Transparent 16-bit communication profile provides unaltered 16-bit access to the configured drive profile.

Register Address*, **	Register Data (16-bit)
400001	Native Drive Profile Control
400002	Native Drive Profile Reference 1
400003	Native Drive Profile Reference 2
400004	DATA OUT 1
400005	DATA OUT 2
400006	DATA OUT 3
400007	DATA OUT 4
400008	DATA OUT 5
400009	DATA OUT 6
400010	DATA OUT 7
400011	DATA OUT 8
400012	DATA OUT 9
400013	DATA OUT 10
400014	DATA OUT 11
400015	DATA OUT 12
400051	Native Drive Profile Status

Register Address*, **	Register Data (16-bit)
400052	Native Drive Profile Actual 1
400053	Native Drive Profile Actual 2
400054	DATA IN 1
400055	DATA IN 2
400056	DATA IN 3
400057	DATA IN 4
400058	DATA IN 5
400059	DATA IN 6
400060	DATA IN 7
400061	DATA IN 8
400062	DATA IN 9
400063	DATA IN 10
400064	DATA IN 11
400065	DATA IN 12
400101-409999	Drive Parameter Access (16-bit) Register Address = 400000 + 100 x Group + Index Example for Drive Parameter 3.18 400000 + 100 x 3 + 18 = 400318 Register addressing of the 32-bit parameters (not supported with ACS350 and ACS355): 420000 + 200 x Group + 2 x Index Example for Drive Parameter 1.27 420000 + 200 x 1 + 2 x 27 = 420254

* 6-digit register addressing (400001) is used instead of 5-digit register addressing (40001) to describe register map. See section *Register Addressing* on page *37* for additional information.

** Register addresses of the 32-bit parameters cannot be accessed by using 5-digit register numbers.

Transparent 32-bit

The Transparent 32-bit communication profile provides unaltered 32-bit access to the configured drive profile.

Register Address*, **	Register Data (16-bit)
400001	Native Drive Profile Control - Least Significant 16-bits
400002	Native Drive Profile Control - Most Significant 16-bits

Register Address*, **	Register Data (16-bit)
400003	Native Drive Profile Reference 1 - Least Significant 16-bits
400004	Native Drive Profile Reference 1 - Most Significant 16-bits
400005	Native Drive Profile Reference 2 - Least Significant 16-bits
400006	Native Drive Profile Reference 2 - Most Significant 16-bits
400007	DATA OUT 1
400008	DATA OUT 2
400009	DATA OUT 3
400010	DATA OUT 4
400011	DATA OUT 5
400012	DATA OUT 6
400013	DATA OUT 7
400014	DATA OUT 8
400015	DATA OUT 9
400016	DATA OUT 10
400017	DATA OUT 11
400018	DATA OUT 12
400051	Native Drive Profile Status - Least Significant 16-bits
400052	Native Drive Profile Status - Most Significant 16-bits
400053	Native Drive Profile Actual 1 - Least Significant 16-bits
400054	Native Drive Profile Actual 1 - Most Significant 16-bits
400055	Native Drive Profile Actual 2 - Least Significant 16-bits
400056	Native Drive Profile Actual 2 - Most Significant 16-bits
400057	DATA IN 1
400058	DATA IN 2
400059	DATA IN 3
400060	DATA IN 4
400061	DATA IN 5
400062	DATA IN 6
400063	DATA IN 7
400064	DATA IN 8
400065	DATA IN 9
400066	DATA IN 10
400067	DATA IN 11
400068	DATA IN 12

Register Address*, **	Register Data (16-bit)
400101-409999	Drive Parameter Access (16-bit) Register Address = 400000 + 100 x Group + Index Example for Drive Parameter 3.18 400000 + 100 x 3 + 18 = 400318 Register addressing of the 32-bit parameters (not supported with ACS350 and ACS355): 420000 + 200 x Group + 2 x Index Example for Drive Parameter 1.27 420000 + 200 x 1 + 2 x 27 = 420254

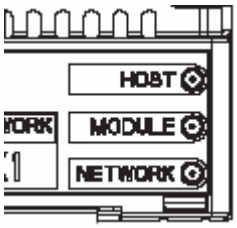
* 6-digit register addressing (400001) is used instead of 5-digit register addressing (40001) to describe register map. See section *Register Addressing* on page *37* for additional information.

** Register addresses of the 32-bit parameters cannot be accessed by using 5-digit register numbers.

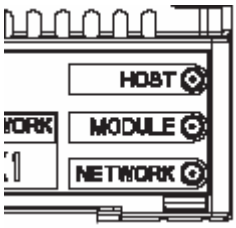
Diagnostics

LED indications

The FENA-01 module is equipped with three bicolor diagnostic LEDs. The LEDs are described below.



Name	Color	Function/State
HOST	Blinking green	Establishing communication to host.
	Green	Connection to host OK.
	Blinking red	Communication to host lost temporarily.



Name	Color	Function/State
MODULE	Off	There is no power applied to the device.
	Flashing Yellow	Device is attempting to obtain IP configuration from DHCP Server.
	Yellow	Device is executing Duplicate Address Detection.
	Flashing Green	Device is waiting for a Modbus request.
	Green	Device has received a Modbus request within the Modbus/TCP Timeout period.
	Flashing Red	Ethernet link is down.
	Red	Ethernet interface is disabled. Duplicate Address Detection may have detected a duplicate address. Check IP configuration and either initiate a Fieldbus Adapter Parameter refresh or cycle power to the drive.
NETWORK	Off	Ethernet link is down.
	Flashing Green	Ethernet link is up at 100 Mbps. Flashing indicates activity on interface.
	Flashing Yellow	Ethernet link is up at 10 Mbps. Flashing indicates activity on interface.

Definitions and abbreviations

Communication Module

Communication Module is a name for a device (eg, a fieldbus adapter) through which the drive is connected to an external serial communication network (eg, a fieldbus). The communication with the communication module is activated by a drive parameter.

Parameter

A parameter is an operating instruction for the drive. Parameters can be read and programmed using the drive control panel, or through the FENA-01 module.

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library*. You can browse the library or enter selection criteria, for example a document code, in the search field.

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