Altivar Process 900
Ethernet manual - Embedded

12/2015

Schneider Electric

The information provided in this documentation contains general descriptions and/or technical character-istics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

ⓘ

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification Of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used. All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

Intended Use

This product is a drive for three-phase synchronous and asynchronous motors and intended for industrial use according to this manual.The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design). Any use other than the use explicitly permitted is prohibited and can result in hazards. Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

Product Related Information

Read and understand these instructions before performing any procedure with this drive.

⚡ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Many components of the product, including the printed circuit boards, operate with mains voltage. Do not touch. Use only electrically insulated tools.
- Do not touch unshielded components or terminals with voltage present.
- Motors can generate voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors of the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors or the braking resistor terminals.
- Before performing work on the drive system:
  - ○ Disconnect all power, including external control power that may be present.
  - ○ Place a **Do Not Turn On** label on all power switches.
  - ○ Lock all power switches in the open position.
  - ○ Wait 15 minutes to allow the DC bus capacitors to discharge. The DC bus LED is not an indicator of the absence of DC bus voltage that can exceed 800 Vdc.
    Measure the voltage on the DC bus between the DC bus terminals (PA/+, PC/-) using a properly rated voltmeter to verify that the voltage is <42 Vdc
  - ○ If the DC bus capacitors do not discharge properly, contact your local Schneider Electric representative. Do not repair or operate the product.
- Install and close all covers before applying voltage.

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

⚠ WARNING

UNEXPECTED MOVEMENT

Drive systems may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data or other errors.
- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with unknown or unsuitable settings or data.
- Perform a comprehensive commissioning test.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Damaged products or accessories may cause electric shock or unanticipated equipment operation.

⚡ ⚠ DANGER

ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION

Do not use damaged products or accessories.

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

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

⚠ WARNING

LOSS OF CONTROL

● The designer of any control scheme must consider the potential failure modes of control paths and, for critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage and restart.
● Separate or redundant control paths must be provided for critical control functions.
● System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
● Observe all accident prevention regulations and local safety guidelines (1).
● Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

(1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

NOTICE

DESTRUCTION DUE TO INCORRECT MAINS VOLTAGE

Before switching on and configuring the product, verify that it is approved for the mains voltage

Failure to follow these instructions can result in equipment damage.

About the Book

At a Glance

Document Scope

The purpose of this document is to:
- Show you how to connect the Ethernet fieldbus on your drive.
- Show you how to set up the drive to use Ethernet for display, monitoring, and control.
- Provide examples of setup using the commissioning software

NOTE: Read and understand this document and all related documents (see below) before installing,operating, or maintaining your drive.

Validity Note

This documentation is valid for the Altivar Process drives.

The technical characteristics of the devices described in this document also appear online. To access this information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the model number/product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in this manual should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the manual and online information, use the online information as your reference.

Related Documents

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on www.schneider-electric.com

The internet site provides the information you need for products and solutions
- The whole catalog for detailed characteristics and selection guides
- The CAD files to help design your installation, available in over 20 different file formats
- All software and firmware to maintain your installation up to date
- A large quantity of White Papers, Environment documents, Application solutions, Specifications... to gain a better understanding of our electrical systems and equipment or automation
- And finally all the User Guides related to your drive, listed below:

Title of Documentation	Reference Number
Altivar Process ATV900 Getting Started	NHA61578 (English), NHA61579 (French), NHA61580 (German), NHA61581 (Spanish), EAV61724 (Italian), NHA61583 (Chinese)
Altivar Process ATV900 Getting Started Annex (SCCR)	NHA61584 (English)
Altivar Process ATV930, ATV950 Installation Manual	NHA80932 (English), NHA80933 (French), NHA80934 (German), NHA80935 (Spanish), NHA80936 (Italian), NHA80937 (Chinese)
Altivar Process ATV930, ATV950, ATV960, ATV980 Programming Manual	NHA80757 (English), NHA80758 (French), NHA80759 (German), NHA80760 (Spanish), NHA80761 (Italian), NHA80762 (Chinese)
Altivar Process ATV900 Modbus SL manual (Embedded)	NHA80939 (English)
Altivar Process ATV900 Ethernet manual (Embedded)	NHA80940 (English)
Altivar Process ATV900 PROFIBUS DP manual (VW3A3607)	NHA80941 (English)
Altivar Process ATV900 DeviceNet manual (VW3A3609)	NHA80942 (English)
Altivar Process ATV900 PROFINET manual (VW3A3627)	NHA80943 (English)
Altivar Process ATV900 CANopen manual (VW3A3608, 618, 628)	NHA80945 (English)
Altivar Process ATV900 EtherCAT manual - (VW3A3601)	NHA80946 (English)
Altivar Process ATV900 Communication Parameters	NHA80944 (English)
Altivar Process ATV900 Service Instructions	NHA80954 (English)
Altivar Process ATV900 Safety Functions manual	NHA80947 (English), NHA80948 (French), NHA80949 (German), NHA80950 (Spanish), NHA80951 (Italian), NHA80953 (Chinese)
Altivar Process Drive Systems – Installation manual	NHA37118 (German), NHA37119 (English), NHA37121 (French), NHA37122 (Spanish), NHA37123 (Italian), NHA37124 (Dutch), NHA37126 (Polish), NHA37127 (Portuguese), NHA37128 (Russian), NHA37129 (Turkish), NHA37130 (Chinese)
Altivar Process ATV960 Configuration guide	NHA37115 (English), NHA37114 (German)
Altivar Process ATV980 Configuration guide	NHA37117 (English), NHA37116 (German)

You can download these technical publications and other technical information from our website at http://download.schneider-electric.com

Terminology

The technical terms, terminology, and the corresponding descriptions in this manual normally use the terms or definitions in the relevant standards.

In the area of drive systems this includes, but is not limited to, terms such as **error, error message, failure, fault, fault reset, protection, safe state, safety function, warning, warning message**, and so on.

Among others, these standards include:
- IEC 61800 series: Adjustable speed electrical power drive systems
- IEC 61508 Ed.2 series: Functional safety of electrical/electronic/programmable electronic safety-related
- EN 954-1 Safety of machinery - Safety related parts of control systems
- EN ISO 13849-1 & 2 Safety of machinery - Safety related parts of control systems.
- IEC 61158 series: Industrial communication networks - Fieldbus specifications
- IEC 61784 series: Industrial communication networks - Profiles
- IEC 60204-1: Safety of machinery - Electrical equipment of machines – Part 1: General requirements

Inaddition, the term **zone of operation** is used in conjunction with the description of specific hazards, and is defined as it is for a **hazard zone** or **danger zone** in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.

Also see the glossary at the end of this manual.

Chapter 1
Presentation

Hardware Overview

General

The drive embeds an Ethernet dual port adapter that can be used in the following two industrial communication protocols:
● Modbus TCP
● EtherNet/IP

In addition of the communication services provided by each protocol, the adapter provides a set of services at the Ethernet and TCP/IP level. The embedded adapter offers an embedded Web server (in 6 langages) which offers comfortable displaying and commissioning functions directly from a standard web browser.

The figure shows the location of the Ethernet dual port adapter.
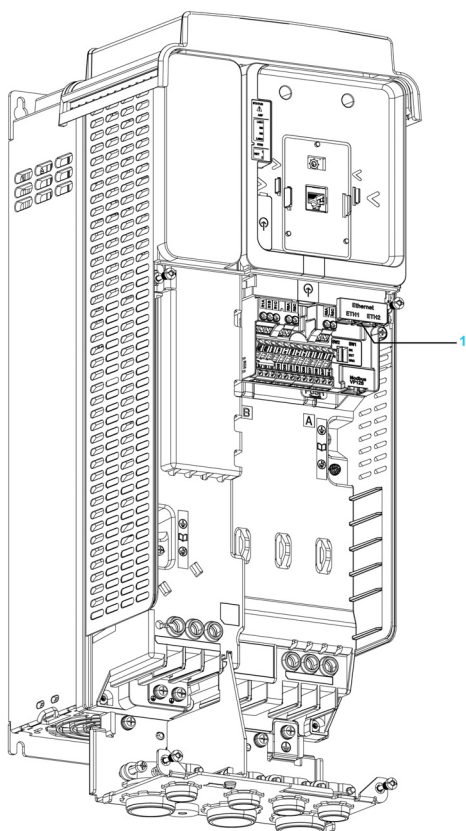
1   Ethernet dual port adapter

Software Overview

Simplified TCP/IP Model

The table provides the basic overview to the simplified TCP/IP model

Application	Modbus TCP-EtherNet/IP
Transport	TCP / UDP
Network	IP
Link	Ethernet

Modbus TCP-EtherNet/IP Features Overview
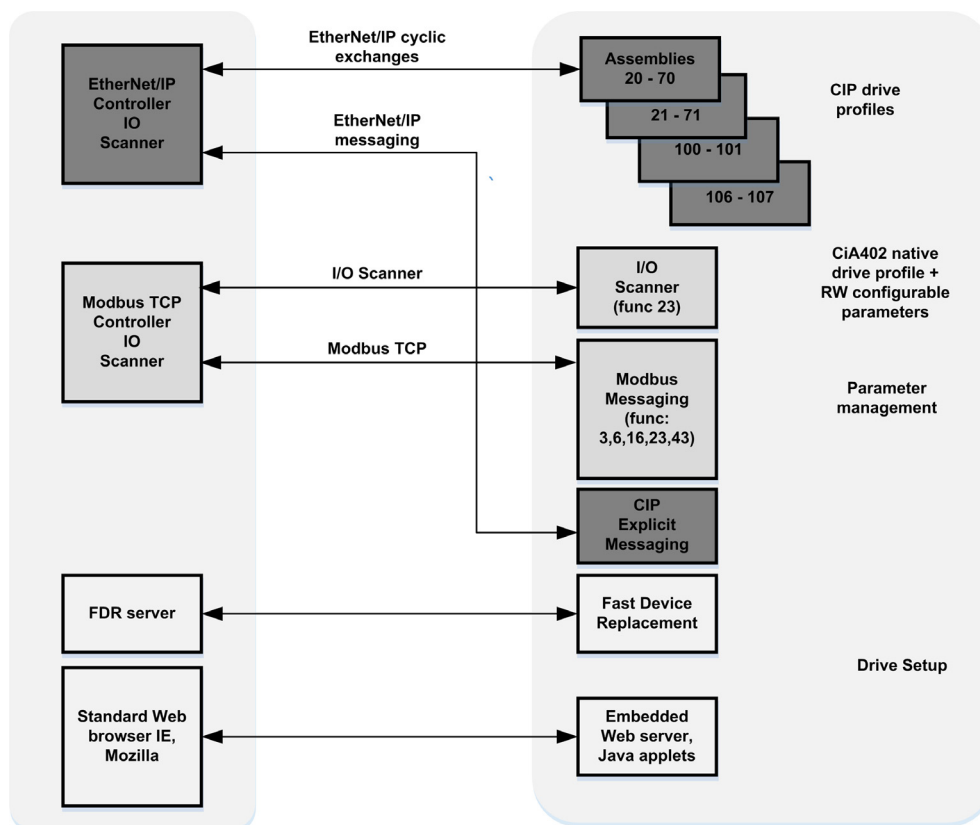
Chapter 2
Basics

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Introduction

What Is in This Section?

This section contains the following topics:

Introduction

Modbus TCP

The Modbus application layer is standard. Many of the manufacturers are already implementing this protocol. Many have already developed a Modbus TCP/IP connection and numerous products are currently available. With the simplicity of its protocol and the fast Ethernet throughput data rate of 100 Mbit/s, Modbus TCP/IP achieves excellent performance.

EtherNet/IP

EtherNet/IP is a fieldbus based on TCP and UDP. EtherNet/IP extends Ethernet by an advanced industrial protocol (CIP, Common Industrial Protocol) as an application layer for automation applications in this way, Ethernet suites for industrial control. Products from different manufacturers can be networked without the need for special interface adaptation.

TCP/IP and Ethernet Features

The product supports the following functions via:
- Manual IP address assignment
- Automatic IP address assignment via BOOTP or DHCP
- Automatic configuration data via FDR
- Commissioning via DTM-based commissioning software
- Diagnostics and configuration via integrated Web server
- Support of LLDP (Link Layer Discovery Protocol)
- Support of RSTP (Rapid Spanning Tree Protocol)
- Support of SNMP (Simple Network Management Protocol)
- Support of SMTP (Simple Mail Transfer Protocol)
- Support of DNS (Domain Name System)
- Support of IPV6 for DPWS (Devices Profile for Web Services)
- Handling of QoS (Quality of Service)

Web Server

The standard webserver (in six languages) provides access to pages such as:
- My dashboard
- Display
- Diagnostics
- Drive
- Setup

Network Layer Supported Functions/Protocols

ARP Protocol

The ARP (Address resolution protocol) is a protocol used to map network addresses (IP) to hardware addresses (MAC).

The protocol operates below the network layer as a part of the OSI link layer, and is used when IP is used over Ethernet. A host, wishing to obtain a physical address, broadcasts an ARP request onto the TCP/IP network. A unique IP address is assigned to the host, and is sent to its hardware address.

ICPM Protocol

The embedded adapter manages the ICMP protocol.
- ICMP client: not supported
- ICMP server: the managed requests are the following:

Type	Description
0	Echo reply (ping)
3	Destination unreachable
4	Sources quench
5	Redirect
6	Alternate host address
8	Echo request (ping)
9	Router advertisement
10	Router solicitation
11	Time exceeded
12	Parameter problem
13	Time stamp request
14	Time stamp reply
15	Information request
16	Information reply
17	Address mask request
18	Address mask reply

IP Protocol

The Ethernet adapter implements the IPV4 and IPV6 (for DPWS) protocols.

SNMP Services

The Ethernet adapter accepts the community name "private" for writing and the community name "public" for Reading.

MIB

Objects	Description	Access	Default Value
SysDescr	Text description of the product	Read only	Schneider Electric Altivar Ethernet TCP/IP
SysObjectID	Points in the private MIB on the product part number	Read only	1.3.6.1.4.1.3833.1.100.4.1
SysUpTime	Time elapsed since the last power-up	Read only	Managed by the option
SysContact	Information allowing to contact the node manager	Read/write	" "
SysName	Node administrative name	Read/write	"" or FDR device name if configured
SysLocation	Physical location of the product	Read/write	" "
SysService	Indicates the service type offered by the product.	Read only	72

TCP and UDP Protocol

Connections

The Ethernet adapter supports up to 32 concurrent TCP/IP and/or TCP/UDP connection.

BOOTP and DHCP Protocol

The Ethernet adapter can use BOOTP and DHCP protocols.

The BOOTP frame is the same: only the OP field is different.

The following table describes the DHCP frame format:

OP (1 byte)	HTYPE (1 byte)	HLEN (1 byte)	HOPS (1 byte)
XID (4 bytes)			
SECS (2 bytes)		FLAGS (2 bytes)	
CIADDR (4 bytes)			
YIADDR (4 bytes)			
SIADDR (4 bytes)			
GIADDR (4 bytes)			
CHADDR (16 bytes)			
SNAME (64 bytes)			
FILE (128 bytes)			
OPTIONS (312 bytes)			

DHCP frame fields are described as follows:

Field	Description
op	Message type DHCP request / DHCP reply
htype	Address hardware type
hlen	Hardware address length
hops	Used by relay agent
xid	Transaction identifier, random number chosen by the client allowing to associate the request and the response
secs	Time in seconds since the beginning of the transaction
flags	First bit used for the broadcast reply flag
ciaddr	Client IP address, only used if the client can respond to ARP request
yiaddr	Client IP address, "your" IP address proposed by the server
siaddr	IP address of the server
giaddr	Gateway IP address, used when a relay agent needs to be crossed
sname	Server name
file	Location of boot file
options	Optional parameters with DHCP extensions

DHCP Message

The DHCP protocol uses 8 different types of message during the IP assigning process.

The following table describes the 8 messages:

Message	Description
DISCOVER	The client tries to discover the DHCP server using a broadcast
OFFER	The server proposes a configuration
REQUEST	The client chooses a DHCP server and declines other offers
ACK	The chosen server assigns the IP configuration
NAK	The server rejects the client request
DECLINE	The client declines the assigned IP configuration
RELEASE	The client releases Its IP address before the end of the lease
INFORM	The client asks for network information (it already has an IP address)

Operating Modes

The choice between DHCP, BOOTP, and fixed configuration is made through one parameter:
- Fixed: the Ethernet adapter uses the address stored in parameter.
- BOOTP: the Ethernet adapter receives the addresses from BOOTP server.
- DHCP: if the device name [XXX] is valid, the Ethernet adapter receives the addresses from the DHCP server.

Section 2.2
Modbus TCP Features

What Is in This Section?

This section contains the following topics:

Modbus TCP Frames

TCP Telegrams

Modbus TCP telegrams are not only Modbus standard requests and responses encapsulated in TCP frames.

TCP ADU

Modbus TCP/IP ADU

1	2	3	4

PDU
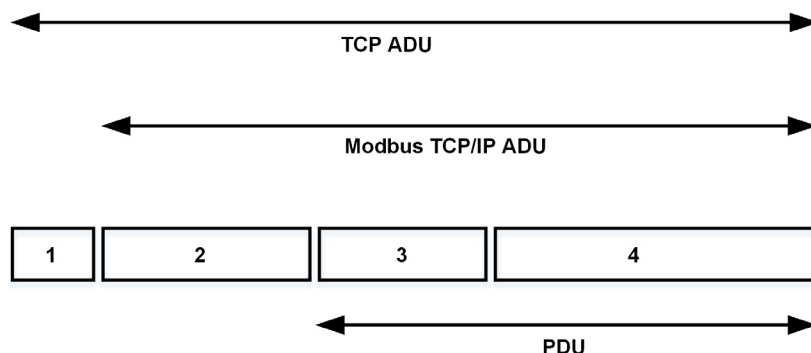
1 TCP header
2 MBPA: Modbus application protocol header
3 ADU: Application data unit
4 PDU: Protocol data unit (The Modbus message itself)

MBAP Header Structure

Fields	Length	Description	Client	Server
Transaction identifier	2 bytes	Identification of a Modbus request / response transaction	Initialized by the client	Recopied by the server from the received request
Protocol identifier	2 bytes	0= Modbus protocol	Initialized by the client	Recopied by the server from the received request
Length	2 bytes	Number of following bytes	Initialized by the client (request)	Initialized by the server (response)
Unit identifier	1 byte	Identification of a remote slave connected on a serial line or on other buses	Initialized by the client	Recopied by the server from the received request

Modbus TCP Servers

Overview

Unit ID	Modbus TCP server	Accessible parameters
0/248	Variable speed drive	See the file related to drive communication parameters.
255	Drive I/O scanner	See I/O scanner setting *(see page 28)*

Supported Modbus TCP Functions

Modbus TCP Services

The Modbus TCP option supports the following services:

Function Name	Code		Description	Remarks
	Dec	Hex		
Read holding registers	03	03 hex	Read N output words	Max PDU length: 63 words
Write 1 output word (Unit ID 0-248 only)	06	06 hex	Write 1 output word	
Write multiple registers	16	10 hex	Write N output word	Max PDU length: 63 words
Read/write multiple registers (Uint ID 0-248 and 255)	23	17 hex	Read/write multiple registers	Max PDU length: 32 words (W), 32 words (R)
(Subfunction) Read device identification	43/14	2B hex 0E hex	Encapsulated interface transport / read device identification	See the table below

Identification

Id	Value	Comment
00 hex	Schneider electric	Device manufacturer
01 hex	ATVXXX	Drive commercial part number
02 hex	0101	Drive version
04 hex	–	–
05 hex	–	–
06 hex	Customized Name	Device name

I/O Scanning Service

The I/O scanning service is used to exchange periodic I/O data between:
- A controller or PLC (I/O scanner).
- Devices (I/O scanning servers).

This exchange is performed by implicit requests, thus avoiding the need to program the controller (PLC).

The I/O scanner periodically generates the read/write multiple registers (23 = 17 hex) request. The I/O scanning service operates if it has been enabled in the PLC and in the drive. The drive parameters assigned to I/O scanning have been selected by default. This assignment can be modified by configuration.

When the I/O scanning service has been enabled in the drive:
- A TCP connection is assigned to it.
- The parameters assigned in the periodic variables are exchanged cyclically between the Ethernet adapter and the drive.
- The parameters assigned to the periodic output variables are reserved for I/O scanning. They cannot be written by other Modbus services, even if the I/O scanner is not sending its periodic output variables.

I/O Scanner Setting

The communication scanner is managed through the DTM-based PC software.

Channel	Factory Setting
Output 1	C M d
Output 2	L F r d
Output 3	0
Up to output 32	0
Input 1	E t A
Input 2	r F r d
Input 3	0
Up to Input 32	0

Application Profile with Modbus TCP

Description

The profiles managed with the drive when it is controlled through Modbus TCP are:
● Native profile (CiA402 - IEC 61800-7),
● I/O profile.

For details, refer to CiA®402 - IEC61800-7 functional profile

Section 2.3
Ethernet IP Features

What Is in This Section?

This section contains the following topics:

Topic	Page
EtherNet/IP	31
Cyclical Exchanges (Implicit Exchanges)	32
Messaging (Explicit Exchanges)	35
Timeout Monitoring	36

EtherNet/IP

EtherNet/IP Fieldbus Adapter Features Overview
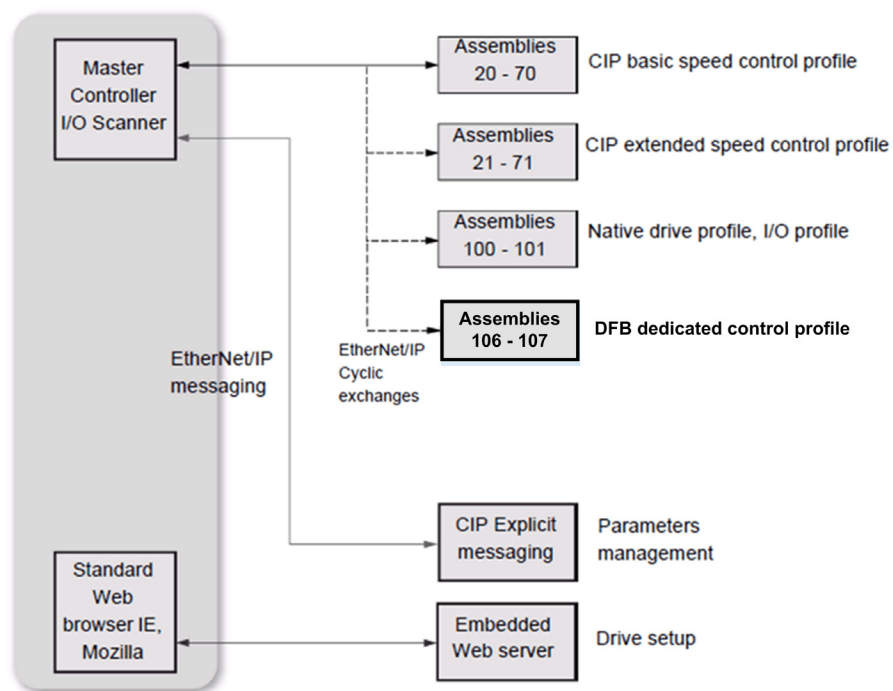
The Ethernet adapter, is compliant with the ODVA drive profile. It supports the following profiles:
● CIP basic speed control
● CIP extended speed control
● Drive native profile (IEC 61800-7 CiA402) and I/O profile only for assembly 100, 101, 106, and 107. In addition to these cyclic exchanges, the adapter also supports explicit messaging.
● CIP energy objects

Cyclical Exchanges (Implicit Exchanges)

Overview

This part gives a description of the assembly sets and how to configure them.

Principle of Control Configuration

By the configuration of the control, it is possible to decide from which channel the drive receives its commands and reference frequency, either permanently or depending on a switching command. Numerous configurations are possible. For more information, refer to the programming manual and communication parameters manual.The following configurations are some of the available possibilities.

The selection of the assembly set is made with the Ethernet adapter.

Control with Communication Scanner

If the default assemblies selected are 100 and 101, the drive is controlled according to its native profile CiA402.-IEC-61800-7.

By configuring the communication scanner, it is possible to assign any relevant parameter of the drive to the 32 input and 32 output variables of the assemblies. This is available through the DTM interface.

Control According to ODVA AC Drive Profile

The ODVA AC drive profile is activated when one of the following assemblies is selected:
- 20: Basic speed control output, size 2 words / 8 bytes
- 21: Extended speed control output, size 2 words / 8 bytes
- 70: Basic speed control input, size 2 words / 8 bytes
- 71: Extended speed control input, size 2 words / 8 bytes

The Ethernet adapter translates the commands, behavior, and display information from of ODVA profile (on the network) to the CiA402 profile (in the drive).

CIP Basic Speed Control (Assemblies 20 and 70)

- Assembly 20: CIP basic speed control output

The following table describes the assembly mapping:

Word Number	Definition
0	CIP basic command word
1	Speed reference (rpm)

The following table describes the CIP basic command word:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not used	Not used	Not used	Not used	Not used	Fault reset [1] 0: No command 1: Fault reset	Not used	Run forward [2] 0: Stop 1: Run
[1] Active on rising edge [2] Active on level							

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used

- Assembly 70: CIP basic speed control input

The following table describes the assembly mapping:

Word Number	Definition
0	CIP basic status word
1	Actual speed (rpm)

The following table describes the CIP basic command word:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not used	Not used	Not used	Not used	Not used	Running 0: Stopped 1: Running	Not used	Operating state fault 0: Inactive 1: Active

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used

CIP Extended Speed Control (Assemblies 21 and 71)

NOTE: `NetRef` and `NetCtrl` objects must be set by explicit messaging to control the drive by network.

- Assembly 21: CIP extended speed control output

The following table describes the assembly mapping:

Word Number	Definition
0	CIP extended command word
1	Speed reference (rpm)

The following table describes the CIP extended command word:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not used	Network setpoint 0: Setpoint by terminal 1: Setpoint by network	Network command 0: Setpoint by terminal 1: Setpoint by network	Not used	Not used	Fault reset [1] 0: No command 1: Fault reset	Run forward / reverse 00: Quick stop 01: Run forward 10: Run reverse 11: Freewheel stop	
[1] Active on rising edge							

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used

Network Setpoint and Network Address Management

The assembly 21 uses the command and reference frequency switching functions of the drive. The Ethernet adapter, when configured with the assembly 21, links the bit 5 and the bit 6 to C512 and C513 respectively.

To operate correctly, command settings of the drive must be as follows or an **[External Error]** $E P F$ I is triggered.

Menu	Parameter	Settings
[Complete settings] $C 5 t -$/**[Command and Reference]** $C r P -$	**[Control Mode]** $C H C F$ **[Ref Freq 1 Config]** $F r I$ **[Ref Freq 2 Config]** $F r 2$ **[Cmd Channel 1]** $C d I$ **[Cmd Channel 2]** $C d 2$ **[Command Switching]** $C C 5$ **[Ref Freq 2 switching]** $r F C$	**[Separate]** $5 E P$ **[Embedded Ethernet]** $E t H$ **[AI1]** $A i I$ or **[AI2]** $A i 2$ **[Ethernet]** $E t H$ **[Terminals]** $t E r$ **[C512]** $C 5 I 2$ **[C513]** $C 5 I 3$

- Assembly 71: CIP extended speed control input

The following table describes the assembly mapping:

Word Number	Definition
0	CIP extended status word
1	Actual speed (rpm)

The following table describes the CIP extended status word:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
At reference 0: Reference not reached 1: Reference reached	Setpoint from network 0: Setpoint from terminal 1: Setpoint from network	Command from network 0: Setpoint from terminal 1: Setpoint from network	Ready 0: Not ready 1: Ready	Run forward / reverse 00: Stopped 01: Running forward 10: Running reverse 11: Not used		Warning 0: No Warning 1: Warning	Operating state fault 0: Inactive 1: Active

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Not used	Not used	Not used	Not used	Not used	Bit 8 to 10 are used for the drive state 000: Not used 001: Startup 010: Not ready 011: Ready 100: Enabled 101: Stopping 110: Fault stop 111: Operating state fault		

Messaging (Explicit Exchanges)

Introduction

Parameters of the drive can be accessed by R/W as CIP objects.

Altivar Parameters Path

The drive parameters are grouped in classes:
- Each application class has only one instance.
- Each instance groups 200 parameter.
- Each attribute in an instance relates to a parameter.

The first parameter registered in the first application class (class code: 70 hex = 112) has the logical address 3000.

Example

The following table describes the examples of logical addresses:

Logical Address	Hexadecimal	Decimal
3000	70 hex / 01 hex / 01 hex	112/1/1
3100	70 hex / 01 hex / 65 hex	112/1/101
3200	71 hex / 01 hex / 01 hex	113/1/1
64318	A2 hex / 01 hex / 77 hex	418/1/119

For details, refer to the communication parameters manual.

Timeout Monitoring

Description

An EtherNet/IP time-out is triggered if the adapter does not receive any cyclic messages within a predefined time period. This period is managed by the EtherNet/IP controller (not by the drive) and is configured in its module properties box. The duration of the time-out is defined by the RPI (Request packet intervals) and a multiplier.

Section 2.4
CIP Object

What Is in This Section?

This section contains the following topics:

Supported Object Classes

Introduction

Three categories of object classes can be defined:
- CIP device on EtherNet/IP
- AC/DC drive
- VSD specific

These objects are detailed in the following table:

Object class	Class ID	Cat.	No. of instances	Effect on behavior interface
Identity	01 hex	1	1	Supports the reset service.
Message router	02 hex	1	1	Explicit message connection.
Ethernet link	F6 hex	1	1	Counter and status information.
TCP/IP interface	F5 hex	1	1	TCP/IP configuration.
Connection manager	05 hex	1	1	–
Motor data	28 hex	2	1	Defines data for the motor connected to the device.
Control supervisor	29 hex	2	1	Manages drive functions, operational states, and control.
AC/DC drive	2A hex	2	1	Provides drive configuration.
Assembly	04 hex	2	12	Defines I/O data format.
Application	–	3	1	Vendor-specific object - drive parameters.

Identity Object (01 hex)

Overview

The identity object provides identification and status information about the drive.

Class Code

Hexadecimal	Decimal
01 hex	1

Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Revision`	UNIT	X	Revision index of the class
2	Get	`Max instances`	UNIT	1	1 defined instance
3	Get	`Number of instances`	UNIT	1	–
4	Get	`Optional attribute list`	UNIT	1	–
6	Get	`Max ID of class attributes`	UNIT	7	–
7	Get	`Max ID of instance attribute`	UNIT	7	–

Instance Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Vendor ID`	UNIT	243	–
2	Get	Device type	UNIT	00h 02h	AC/DC drive profile (02h)
3	Get	`Product code`	UNIT	6152	1830 hex
4	Get	`Revision`	Struct of: USINT USINT	x	Major = high byte of ($C\ I5\omega$) Minor = low byte of ($C\ I5\omega$)
5	Get	`Status`	WORD	–	See definition in the following table
6	Get	`Serial number`	UDINT	–	First byte: 18 hex Second…Fourth byte: last 3 bytes of MAC-ID
7	Get	`Product name`	Struct of: USINT STRING	–	ATVxxx

Attribute 5–Status

Bit	Definition	How
0	Owned by master (predefined master/slave connection)	No interface
2	Configured	If any of the product (option + drive) NVS attributes has changed from their default (out of box values).
4 - 7	Extended device status: See below	–
8	Minor recoverable Fault	No minor recoverable fault.
9	Minor unrecoverable Fault	No minor unrecoverable fault.
10	Major recoverable Fault	**[Embd Eth Com Interrupt]** $E\,t\,H\,F$ detected error or CIP connection timeout or Ethernet network overload.
11	Major unrecoverable Fault	$_iL\,F$ detected error, EEPROM failed, OB hardware detected error.
Others	Reserved 0	–

Bit 4-7 Definition

Bit 4-7	Definition	How
0 0 0 0	Self-testing or unknown	Not used
0 0 0 1	Firmware update in progress	Not used
0 0 1 0	At least on faulted I/O connection	–
0 0 1 1	No I/O connections established	–
0 1 0 0	Non-volatile configuration bad	Non-volatile memory detected error in OB
0 1 0 1	Major fault - either bit 10 or 11 is true	Bit 10 or 11 is true
0 1 1 0	At least one I/O connection in run mode	–
0 1 1 1	At least one I/O connection established, all in idle mode	–
1 0 0 0 1 0 0 1	Reserved, shall be 0	–
1 0 1 0 to 1 1 1 1	Vendor specific	–

Supported Class Services

Service code	Service name	Description
01 hex	Get_Attribute_All	Read all attributes
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
01 hex	Get_Attribute_All	Read all attributes
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute
05 hex	Reset	Perform the reset of the drive

State Diagram for the Identity Object

Nonexistent

Off

Power loss
(from any state)

Power
Applied

Identity object reset service

(from any state except Major
unrecoverable fault)

Device self testing

Flashing red/green

Failed
tests

Passed
tests

Fault corrected

Standby

Flashing green

Activated

Desactivated

Minor
fault

Operational

Solid green

Major
recoverable
fault

Major
unrecoverable
fault

**Major
recoverable
fault**

Flashing red

**Major
unrecoverable
fault**

Solid red

Message Router Object (02 hex)

Overview

The message router object is the element through which all the `Explicit messages` objects pass in order to be directed towards the truly destined objects.

Class Code

Hexadecimal	Decimal
02 hex	2

Class Attributes

Attribute ID	Access	Name	Need	Data type	Value	Details
1	Get	`Revision`	Opt.	UINT	X	Revision index of the class
2	Get	`Max instances`	Opt.	UINT	1	1 defined instance

TCP/IP Interface Object (F5 hex)

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Detail
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max instances	UINT	1	1 defined instance
3	Get	Number of instances	UINT	1	–
4	Get	Optional attribute list	UINT	1	–
5	Get	Optional service list	UINT	1	–
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attribute	UINT	6	–

Supported Instance Attributes

Attribute ID	Access	Name	Data type	Detail
1	Get	Status	DWORD	0 = The interface configuration attribute has not been configured 1 = The interface configuration attribute contains valid configuration
2	Get	Configuration capability	DWORD	Bit 0 = 1 (TRUE) shall indicate that the device is capable of obtaining its network configuration via BOOTP Bit 1 = 1 (TRUE) shall indicate that the device is capable of resolving host names by querying a DNS server Bit 2 = 1 (TRUE) shall indicate that the device is capable of obtaining its network configuration via DHCP Bit 3 = 1 (TRUE) shall indicate that the device is capable of sending its host name in the DHCP request Bit 4 = 1 (TRUE) shall indicate that the Interface Configuration attribute is settable. Bit 5-31: reserved
3	Get/Set	Configuration control	DWORD	Bits 0-3 start-up configuration 0 = The device shall use the interface configuration values previously stored 1 = The device shall obtain its interface configuration values via BOOTP 2 = The device shall obtain its interface configuration values via DHCP upon start-up [1] 3-15 = Reserved for future use Bit 4 = 1 (TRUE), the device shall resolve host names by querying a DNS server Bit 5-31: reserved
4	Get	Physical link object	STRUCT of UINT EPATH	Path size Path: Logical segments identifying the physical link object Example [20][F6][24][01]: [20] = 8-bit class segment type; [F6] = Ethernet link object class; [24] = 8-bit instance segment type; [01] = instance 1

[1] If set option board parameter OBP:FDRU=0 is also set to implicitly disable the FDR mechanism on the DHCP protocol. This to be compatible with CIP tools that has configured the device to operate in a non-FDR specific environment. You have to manually enable the feature if you wish to use it.

Attribute ID	Access	Name	Data type	Detail
5	Get/Set	`Interface configuration`	STRUCT of UDINT UDINT UDINT UDINT UDINT String	IP address (0: no address configured) Network mask (0: no network mask configured) Gateway address (0: no address configured) Name server address (0: no address configured) Name server address 2 (0: no address configured) Domain name
6	Get/Set	`Host name`	String	Read/write name of the drive
8	Get/Set	`TTL value`	USINT	TTL value for EtherNet/IP multicast packets
9	Get/Set	`Mcast config`	Struct Of.	IP multicast address configuration
		`Alloc control`	USINT	0 - Use default allocation algorithm to generate multicast addresses 1 - Multicast addresses shall be allocated according to the values in Num Mcast and Mcast Start Addr
		`Reserved`	USINT	Shall be 0
		`Num Mcast`	UINT	Number of multicast addresses to allocate for EtherNet/IP
		`Mcast Start Addr`	UDINT	Starting multicast address from which to begin allocation
[1] If set option board parameter OBP:FDRU=0 is also set to implicitly disable the FDR mechanism on the DHCP protocol. This to be compatible with CIP tools that has configured the device to operate in a non-FDR specific environment. You have to manually enable the feature if you wish to use it.				

Supported Class Services

Service code	Service name	Description
01 hex	`Get_Attribute_All`	Read all attributes
0E hex	`Get_Attribute_Single`	Read one attribute
10 hex	`Set_Attribute_Single`	Write one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	`Get_Attribute_Single`	Read one attribute
10 hex	`Set_Attribute_Single`	Write one attribute
01 hex	`Get_Attribute_All`	–

TCP/IP Interface Behavior
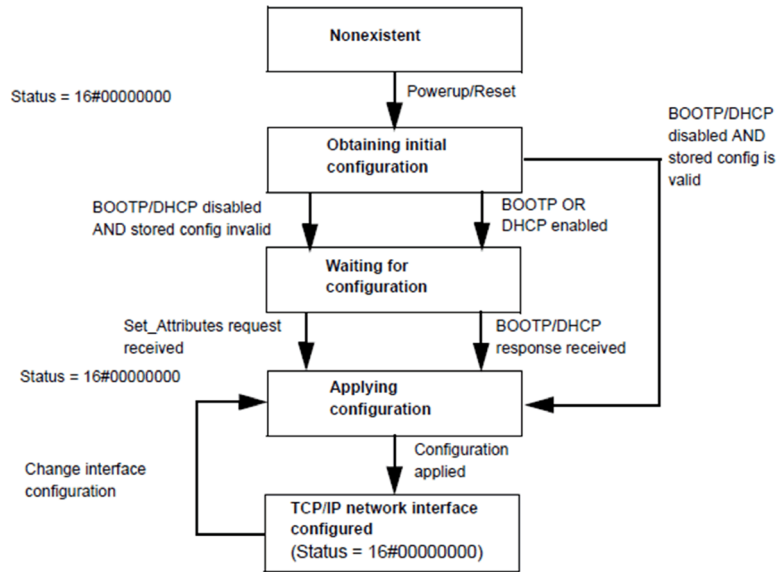
Ethernet Link Object (F6 hex)

Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Revision`	UINT	X	Revision index of the class
2	Get	`Max instances`	UINT	1	One defined instance
3	Get	`Number of instances`	UINT	1	–
6	Get	`Max ID of class attributes`	UINT	7	–
7	Get	`Max ID of instance attribute`	UINT	6	–

Supported Instance Attributes

Attribute ID	Access	Name	Data type	Detail
1	Get	`Interface speed`	UDINT	Interface speed currently in use
2	Get	`Interface flags`	DWORD	Bit 0: Link status indicates whether the Ethernet 802.3 communications interface is connected to an active network. 0 indicates an inactive link; 1 indicates an active link Bit 1: Half/Full duplex indicates the duplex mode currently in use. 0 indicates that the interface is running half duplex; 1 indicates full duplex Bit 2-4: Negotiation status ● 0: Auto-negotiation in progress ● 1: Auto-negotiation and speed detection not successful ● 2: Auto negotiation not successful but detected speedduplex was defaulted ● 3: Successfully negotiated speed and duplex ● 4: Auto-negotiation not attempted. Forced speedand duplex Bit 5: Manual setting require reset ● 0: Indicates that the interface can activate changes to link parameters (autonegotiate, duplex mode, interface speed) automatically ● 1: Indicates that the device requires a reset service be issued to its identity object in order for the changes to take effect. Bit 6: Local hardware error ● 0: Indicates that the interface detects no local hardware error ● 1: Indicates that a local hardware error is detected. The meaning of this is product-specific Bit 7-31: Reserved shall be set to zero
3	Get	`Physical address`	USINT [6]	MAC layer address
4	Get	`Interface counters`	–	–
5	Get	`Media counters`	–	–
6	Get/Set	`Interface control`	–	Force auto negotiate, half full and speed
7	Get	`Interface type`	USINT	2
10	Get	`Interface label`	SHORT_STRING	RS3: Instance 1: "Left" RS3: Instance 2: "Right" SERVO3: Instance 1: "Top" SERVO3: Instance 2: "Bottom" Service code

Supported Class Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
01 hex	Get_Attribute_All	–

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute
01 hex	Get_Attribute_All	–
4C hex	Get_And_Clear	Same than Get_Attribute_Single

Assembly Object (04 hex)

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Detail
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max instances	UINT	1	One defined instance
3	Get	Number of instances	UINT	1	–
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attribute	UINT	3	–

Supported Instances

Attribute ID	Access	Name	Data type	Value	Details
3	Get/Set	Data	ARRAY OF BYTE		
4	Get	Size	UINT		

Supported Instances for Altivar Process

Instance	Type	Name
20	AC drive output	CIP Basic Speed Control Output
21	AC drive output	CIP Extended Speed Control Output
70	AC drive input	CIP Basic Speed Control Input
71	AC drive input	CIP Extended Speed Control Input
100	AC drive output	Native Drive Output
101	AC drive input	Native Drive Input

Supported Class Services

Service code	Service Name	Description
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service Code	Service Name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute

Output Instance Data Description

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0	X	X	X	X	X	Fault Reset 0 = No command 1= Fault Reset	X	Run Forward 0 = Stop 1 = Run
	1	X	X	X	X	X	X	X	X
	2-3	Speed Actual (rpm)							
21	0	X	Net Reference 0 = Local, by terminal 1= Network	NetCommand 0 = Local 1 = Network	X	X	Fault Reset 0 = No command 1= Fault Reset	Run Fwd / Reverse: 00: Quick stop 01: Run forward 10: Run reverse 11: No action (no freewheel stop as in legacy becauseasked by CIP)	
	1	X	X	X	X	X	X	X	X
	2-3	Speed Actual (rpm)							
100	0-1	I/O Scanning word 1							
	2-3	I/O Scanning word 2							
	4-5	I/O Scanning word 3							
	6-7	I/O Scanning word 4							
	8-9	I/O Scanning word 5							
	10-11	I/O Scanning word 6							
70	0	X	X	X	X	X	0 = Stopped 1 = Running	X	0 = No error 1 = Error
	1	X	X	X	X	X	X	X	X
	2-3	Speed Actual (rpm)							
71	0	At reference 0 = Not reached 1 = Reached	Ref From Net 0 = From terminal 1 = From network	Cmd From Net 0 = From terminal 1 = From network	Ready 0 = Not ready 1 =Ready	Running Fwd / reverse 00: Stopped 01: Running Forward 10: Running reverse 11: Not used		Warning 0 = No warning 1 = Warning	Not used
	1	X	X	X	X	X	000: Not used 001: Startup 010: Not ready 011: Ready 100: Enabled 101: Stopping 110: Fault stop 111: Operating state fault		
	2-3	Speed Actual (rpm)							
101	0-1	Scanner Read word 1							
	2-3	Scanner Read word 2							
	4-5	Scanner Read word 3							
	6-7	Scanner Read word 4							
	8-9	Scanner Read word 5							
	10-11	Scanner Read word 6							

Connection Manager Object (06 hex)

Class Code

Hexadecimal	Decimal
06 hex	6

Class Attributes

Attribute ID	Access	Name	Need	Data type	Value	Details
1	Get	`Revision`	Opt.	UINT	X	Revision index of the class
2	Get	`Max instances`	Opt.	UINT	4	3 defined instance

Attributes of Instance 1 - Explicit Message Instance

Attribute	Access	Name	Need	Data type	Value	Details
1	Get	`State`	Req.	USINT	–	0: Non-existent 3: Established 5: Deferred Delete
2	Get	`Instance_type`	Req.	USINT	0	Explicit Message
3	Get	`TransportClass_trigger`	Req.	BYTE	83 hex	Class 3 server
4	Get	`Produced_connection_id`	Req.	UINT	10xxxxxx011	xxxxxx = Node address
5	Get	`Consumed_connection_id`	Req.	UINT	10xxxxxx100	xxxxxx = Node address
6	Get	`Initial_comm_characteristics`	Req.	BYTE	21 hex	Explicit messaging via Group 2
7	Get	`Produced_connection_size`	Req.	UINT	36	Produced data maximum size (in bytes)
8	Get	`Consumed_connection_size`	Req.	UINT	36	Consumed data maximum size (in bytes)
9	Get/Set	`Expected_packet_rate`	Req.	UINT	2500	2.5 sec. (TimeOut)
12	Get/Set	`Watchdog_timeout_action`	Req.	USINT	1 or 3	1: Auto-Delete 3: Deferred Delete (Default)
13	Get	`Produced connection path length`	Req.	UINT	0	Length of attribute 14 data
14	Get	`Produced connection path`	Req.	Array of UINT	Null	Not used
15	Get	`Consumed connection path length`	Req.	UINT	0	Length of attribute 16 data
16	Get	`Consumed connection path`	Req.	Array of UINT	Null	Not used
For details, refer to Ethernet/ specification for more information.						

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max Instances	UINT	1	1 defined instance
3	Get	Number of Instances	UINT	1	–
4	Get	Optional attribute list	STRUCT of	–	List of optional attribute numbers
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attributes	UINT	–	Attribute ID number of last class attribute

Supported Instance1 (Explicit) Attributes

Attribute ID	Access	Name	Data type	Details
1	Get	Open Requests	UINT	Number of forward open service requests received.
2	Get	Open Format Rejects	UINT	Number of forward open service requests which were rejected due to bad format.
3	Get	Open Resources Rejects	UINT	Number of forward open service requests which were rejected due to lack of resources.
4	Get	Open Other Rejects	UINT	Number of forward open service requests which were rejected for reasons other than bad format or lack of resources.
5	Get	Close Requests	UINT	Number of forward close service requests received.
6	Get	Close Format Requests	UINT	Number of forward close service requests which were rejected due to bad format.
7	Get	Close Other Requests	UINT	Number of forward close service requests which were rejected for reasons other than bad format.
8	Get	Connection Timeouts	UINT	Total number of connection timeouts that have occurred in connections controlled by this connection manager.

Supported Class Services

Service code	Service name	Description
01 hex	Get_Attribute_All	Read all attributes
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute
4E hex	Forward_Close	Closes a connection
54 hex	Forward_Open	Opens a connection, maximum data size is 511 bytes

Motor Data Object (28 hex)

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max Instances	UINT	1	One defined instance
3	Get	Number of Instances	UINT	1	–
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attribute	UINT	15	–

Supported Instance Attributes

Attribute ID	Access	Name	Need	Data type	ATV	Details
1	Get	NumAttr	Opt.	USINT	No	–
2	Get	Attributes List	Opt.	USINT (ARRAY)	No	–
3	Get	MotorType	Req.	USINT	Yes	7
6	Get/Set	RatedCurrent	Req.	UINT	Yes	Motor nominal current Linked to NCR drive parameter. NCR unit is 0,1 A as attribute 6
7	Get/Set	RatedVoltage	Req.	UINT	Yes	Motor nominal voltage Linked to UNS drive parameter UNS unit is 1V as attribute 7
8	Get/Set	RatedPower	Opt.	UINT	No	–
9	Get/Set	RatedFreq	Opt.	UINT	Yes	Motor nominal frequency linked to FRS drive parameter FRS unit is 0,1 Hz. The parameter value has to be divided by 10 to be in the unit of attribute 9
12	Get/Set	PoleCount	Opt.	UINT	No	–
15	Get/Set	BaseSpeed	Opt.	UINT	Yes	Motor nominal speed Linked to NSP drive parameter NSP unit is 1 rpm as attribute 15

Supported Class Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute

Control Supervisor Object (29 hex)

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max Instances	UINT	1	One defined instance
3	Get	Number of Instances	UINT	1	–
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attribute	UINT	17	–

Supported Instance Attributes for Schneider Electric

Attribute ID	Access	Name	Data type	Details
3	Get/Set	Run Fwd	BOOL	On edge (0 --> 1)
4	Get/Set	Run Rev	BOOL	On edge (0 --> 1)
5	Get/Set	Net Ctrl	BOOL	0: Local control 1: Network control (default)
6	Get	State	USINT	See machine status: 0: 1: Startup 2: Not_Ready 3: Ready 4: Enabled 5: Stopping 6: Fault_stop 7: Operating state fault
7	Get	Running Fwd	BOOL	ETA.15 = 0
8	Get	Running Rev	BOOL	ETA.15 = 1
9	Get	Ready	BOOL	ETA.1 = 1
10	Get	Error detected	BOOL	ETA.3 = 1
12	Get/Set	Fault Reset	BOOL	CMD.7 = 1.
13	Get	Error Code	USINT	Parameter $E\,r\,r\,d$
15	Get	Ctrl From Net	BOOL	0: Local Control 1: Network Control
16	Get/Set	DN Error Mode	USINT	Action on loss of CIP network. 0: Stop + **[Embd Eth Com Interrupt]** $E\,t\,H\,F$ detected error 1: Ignored
17	Get/Set	Force error	BOOL	Force **[Embd Eth Com Interrupt]** $E\,t\,H\,F$ detected error (On edge)

Supported Class Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute
05 hex	Reset	Reset drive

Control Supervisor States
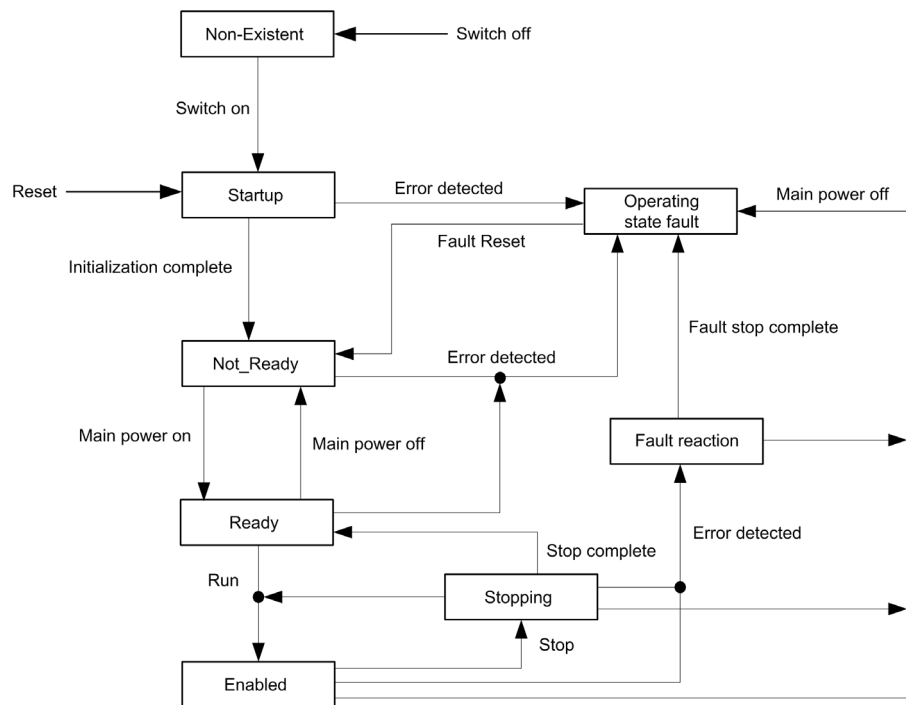
AC/DC Drive Object (2A hex)

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Revision`	UINT	X	Revision index of the class
2	Get	`Max Instances`	UINT	1	1 defined instance
3	Get	`Number of Instances`	UINT	1	–
6	Get	`Max ID of class attributes`	UINT	7	–
7	Get	`Max ID of instance attribute`	UINT	21	–

Supported Instance

Attribute ID	Access	Name	Need	Data type	ATV	Comments
1	Get	`NumAttr`	Opt.	USINT	No	–
2	Get	`Attributes List`	Opt.	USINT (ARRAY)	No	–
3	Get	`At Reference`	Opt.	BOOL	Yes	Use the result of the "reference reached" function of the device. No more, no less specific adjustment than what is in the drive function.
4	Get/Set	`NetRef`	Req.	BOOL	Yes	Image of the NetRef signal received from the network. 'Get' order returns the value written by 'Set' order. Used to manage the reference channel.
6	Get	`Drive mode`	Req.	USINT	Yes	Used to get the drive mode. In the standard, the attribute can also be used to set the drive mode, but it is not possible on our products. Value is fixed at 1. **NOTE:** On other drives this value main depends on the Motor control law set in the device.
7	Get	`Speed Actual`	Req.	INT	Yes	Used to get the value of the motor Speed. Unit: rpm
8	Get/Set	`SpeedRef`	Req.	INT	Yes	Image of the speed reference signal received from the network. Unit: rpm 'Get' order returns the value written by 'Set' order Used to set the speed reference in the drive.
9	Get	`Current Actual`	Opt.	INT	Yes	Used to get the value of the current in the motor. Unit: 0.1 Amps
10	Get/Set	`Current Limit`	Opt.	INT	Yes	Used to set or get the current value used for the motor thermal protection. Unit: 0,1 Amps.
11	Get	`Torque Actual`	Opt.	INT	Yes	Used to get the value of the motor torque. Unit: 1 N.m
15	Get	`Power Actual`	Opt.	INT	No	Used to get the value of the output power. Unit 1 <--> 1/2PowerScale.

[1] For the standard, the acceleration, and deceleration time are given to go from 0 to **[HighSpdLimit]** (attribute 21 of AC/DC drive object). For the drive, the acceleration and deceleration time are given to go from 0 to the motor nominal frequency (($F r 5$) parameter).

[2] In the drive, the unit of acceleration and deceleration time depends on INR parameter.
($i n r$) = 0: acceleration and deceleration time are in 0,01 s
($i n r$) = 1 (factory setting): acceleration and deceleration time are in 0,1 s
($i n r$) = 2: acceleration and deceleration time are in 1 s
The minimal requirement is to have this attribute in ms when ($i n r$) parameter is in factory setting.

Attribute ID	Access	Name	Need	Data type	ATV	Comments
18	Get/Set	AccelTime	Opt.	UINT	Yes	Used to get and set the acceleration time[1] Units ms [2]
19	Get/Set	DecelTime	Opt.	UINT	Yes	Used to get and set the deceleration time[1] Units ms [2]
20	Get/Set	LowSpdLimit	Opt.	UINT	Yes	Used to get and set the low speed limit. Units: rpm
21	Get/Set	HighSpdLimit	Opt.	UINT	Yes	Used to get and set the high speed limit. Units: rpm
26	Get/Set	PowerScale	Opt.	SINT	No	–
28	Get/Set	TimeScale	Opt.	SINT	No	Default value = 0
29	Get	RefFromNet	Opt.	BOOL	No	Used to know if the drive is processing the reference sent by the network that asks the attribute 29 value
46	Get	Cumulative Run Time	Brand	UINT	No	Cumulative run time

[1] For the standard, the acceleration, and deceleration time are given to go from 0 to **[HighSpdLimit]** (attribute 21 of AC/DC drive object). For the drive, the acceleration and deceleration time are given to go from 0 to the motor nominal frequency ((*F r 5*) parameter).

[2] In the drive, the unit of acceleration and deceleration time depends on INR parameter.
(*i n r*) = 0: acceleration and deceleration time are in 0,01 s
(*i n r*) = 1 (factory setting): acceleration and deceleration time are in 0,1 s
(*i n r*) = 2: acceleration and deceleration time are in 1 s
The minimal requirement is to have this attribute in ms when (*i n r*) parameter is in factory setting.

Attribute ID	Details
3	Attribute value = value of bit 10 of ETA drive parameter (TBC)
7	Motor speed. Linked to (*r F r d*) drive parameter (TBC). (*r F r d* is in 1 rpm as attribute 7
8	Speed reference. Linked to (*L F r d* drive parameter (TBC). (*L F r d*) is in 1 rpm as attribute 8
9	Actual current in the motor. Linked to (*L C r*) drive parameter.(*L C r*) is in 0,1 A as attribute 9
10	Current value used for the motor thermal protection. Linked to (*i t H*) drive parameter. (*i t H*) is in 0,1 A as attribute 10
11	Actual torque in the motor. Linked to (*o t r n*) drive parameter (TBC). (*o t r n*) is in 0,1 N.m. The value has to be multiplied by 10 to be in the unit of attribute 11
18	Acceleration time. Linked to (*A C C*) drive parameter. See note (2) of the specification above
19	Deceleration time. Linked to (*d E C*) drive parameter. See note (2) of the specification above
20	Low speed. Linked to (*S M i L*) drive parameter. (*S M i L*) is in 1 rpm as attribute 20
21	High speed. Linked to (*S M A L*) drive parameter. (*S M A L*) is in 1 rpm as attribute 21

Supported Class Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute

Application Object (70 hex to C7 hex) / Explicit Messaging

Application Object Behavior

Class = ((AdL - 3000) / 200) + 70 hex

Instance = 1

Attribute = (AdL % 200) + 1

AdL = (class - 70h) * 200 + attribute - 1 + 3000

This rule allows the access to address under 20599. The other addresses are not accessible.

The drive parameters are grouped into classes.
- Each application class has only one instance.
- Each instance groups 200 parameters.
- Each attribute in an instance relates to a parameter.

Supported Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	Revision	UINT	X	Revision index of the class
2	Get	Max Instances	UINT	1	One defined instance
3	Get	Number of Instances	UINT	1	–
6	Get	Max ID of class attributes	UINT	7	–
7	Get	Max ID of instance attribute	UINT	X	–

Supported Instance Attributes

Attribute ID	Access	Name	Data type	Details
1	Get/Set	1st parameter of the block	UINT	Value returned by the drive at address xx
–	–	–	–	Value returned by the drive at address xx
X	Get/Set	Last parameter of the block	UINT	Value returned by the drive at address xx

Supported Class Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute

Supported Instance Services

Service code	Service name	Description
0E hex	Get_Attribute_Single	Read one attribute
10 hex	Set_Attribute_Single	Write one attribute

Base Energy Object (4E hex)

Overview

The base energy object acts as an **Energy Supervisor** for CIP Energy implementations. It is responsible for providing a time base for energy values, provides energy mode services, and can provide aggregation services for aggregating energy values up through the various levels of an industrial facility. It also provides a standard format for reporting energy metering results.

Class Code

Hexadecimal	Decimal
4E hex	78

Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Revision`	UINT	X	Revision index of the class
2	Get	`Max instances`	UINT	1	1 defined instance
3	Get	`Number of instances`	UINT	1	–

Instance Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Energy/Resource Type`	UINT	1	1 = Electrical
2	Get	`Base Energy Object Capabilities`	UINT	–	See definition in the following table
3	Get	`Energy Accuracy`	UINT	–	See definition in the following table
4	Get	`Energy Accuracy Basis`	UINT	–	See definition in the following table
7	Get	`Consumed Energy Odometer`	ODOMETER	–	The consumed energy value in kWh
8	Get	`Generated Energy Odometer`	ODOMETER	–	The generated energy value in kWh
9	Get	`Net Energy Odometer`	SIGNED_ODOMETER	–	The generated energy value in kWh

The following table provides the Odometer and Signed_Odometer structure principle:

Data Type Structure		Description of Data Type Element	Semantics of Value
ODOMETER STRUCT of:	SIGNED_ODOMETER STRUCT of:	–	–
UINT	INT	$x10^n$	$\pm Unit1 \times 10^n$
UINT	INT	$x10^{n+3}$	$\pm Unit1 \times 10^{n+3}$
UINT	INT	$x10^{n+6}$	$\pm Unit1 \times 10^{n+6}$
UINT	INT	$x10^{n+9}$	$\pm Unit1 \times 10^{n+9}$
UINT	INT	$x10^{n+12}$	$\pm Unit1 \times 10^{n+12}$
The valid range of n shall be a SINT between 0 and -15.			

The following table provides the Odometer type in Kilowatt-hours units and n = -3:

$x10^{n+12}$	$x10^{n+9}$	$x10^{n+6}$	$x10^{n+3}$	$x10^n$
Terawatt-hours (kWh x 10^9)	Gigawatt-hours (kWh x 10^6)	Megawatt-hours (kWh x 10^3)	Kilowatt-hours (kWh)	Watt-hours (kWh x 10^{-3})

Attribute 1-Energy/Resource Type

This attribute specifies the type of energy managed by this Base Energy Object instance. If this attribute value = 1 Electrical, then this instance of the Base Energy Object is associated with a corresponding instance of the Electrical Energy Object pointed to by attribute 12.

Attribute 2-Base Energy Object Capabilities

The value indicates how **Energy Odometer** values are generated and/or how **Energy Transfer Rates** are generated or specified.

Value	Name	Definition
0	Energy Measured	Indicates that the instance reports energy values that are directly measured by the device

Attribute 3-Energy Accuracy

This attribute specifies the accuracy of metering energy results. By default, it specifies the accuracy of energy metering results as 100 times the percentage of reading. A value of 500 indicates a device accuracy of 5% of reading.

Attribute 4-Energy Accuracy Basis

This optional attribute defines the basis of the Energy Accuracy attribute.

Value	Name	Definition
0	Per cent of reading	Error = (Energy Accuracy value / 100) * Delta Energy

Attribute 7-Consumed Energy Odometer

The Consumed Energy Odometer represents a range of 0 kWh to 999,999,999,999.999 kWh.

Section	Description
Consumed energy value in kWh	Odometer structure: 5x16 bits parameters give a value of consumed energy value in kWh.

Attribute 8-Generated Energy Odometer

The generated energy odometer represents a range of 0 kWh to 999,999,999,999.999 kWh.

Section	Description
Generated energy value in kWh	Odometer structure: 5x16 bits parameters give a value of generated energy value in kWh.

Attribute 9-Net Energy Odometer

The net energy odometer represents a range of -999,999,999,999.999 kWh to 999,999,999,999.999 kWh.

Section	Description
Total energy value in kWh	Signed odometer structure: 5x16 bits parameters give a value of total energy value in kWh.

Electrical Energy Object (4F hex)

Overview

This object is used to provide unified electrical energy reporting capability for CIP enabled devices and processes. Energy reporting is typically related to the measurement of various metering results. This object provides for the consistent reporting of electrical energy data. Electrical energy is assigned a separate object to accommodate its alternating and polyphase characteristics, which result in a collection of attributes that are unique among energy sources.

Each instance of the Electrical Energy Object shall be associated with an instance of the Base Energy Object (class code 0x4E). Instance attribute 41, **Associated Base Energy Object Path** is used to define this association.

Class Code

Hexadecimal	Decimal
4F hex	79

Class Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Revision`	UINT	X	Revision index of the class
2	Get	`Max instances`	UINT	1	1 defined instance
3	Get	`Number of instances`	UINT	1	–

Instance Attributes

Attribute ID	Access	Name	Data type	Value	Details
1	Get	`Real Energy Consumed Odometer`	ODOMETER	–	The total real energy consumed in kWh
2	Get	`Real Energy Generated Odometer`	ODOMETER	–	The total real energy generated in kWh
3	Get	`Real Energy Net Odometer`	SIGNED_ ODOMETER	–	The running total of Real Energy Consumed minus Real Energy Generated in kWh
9	Get	`Line Frequency`	REAL	–	Line Frequency (0.1 Hertz) Available on Low harmonic drives
13	Get	`Average Current`	REAL	–	RMS line current of three-phase average (0.1 Amps) Available on Low harmonic drives
19	Get	`L1-L2 Voltage`	REAL	–	RMS L1 to L2 voltage (0.1 Volts)
20	Get	`L2-L3 Voltage`	REAL	–	RMS L2 to L3 voltage (0.1 Volts)
21	Get	`L3-L1 Voltage`	REAL	–	RMS L3 to L1 voltage (0.1 Volts)
22	Get	`Average L-L Voltage`	REAL	–	RMS line to line voltage three-phase average (0.1 Volts)
27	Get	`Total Real Power`	REAL	–	Total real power, signed to show direction (Watts)
41	Get	`Associated Base Energy Object Path`	SRUCT of:	–	Path to associated Base Energy Object instance
		`Path Size`	UNIT	–	Size of path (in words)
		`Path`	Padded EPATH	–	This is an array of bytes whose contents convey the application path and other information of the request for this transaction

Attribute 1-Real Energy Consumed Odometer

The Real Energy Consumed Odometer represents a range of 0 kWh to 999,999,999,999.999 kWh.

Section	Description
Total real energy consumed value in kWh	Odometer structure: 5x16 bits parameters give a value of consumed energy value in kWh.

Attribute 2-Real Energy Generated Odometer

The Real Energy Generated Odometer represents a range of 0 kWh to 999,999,999,999.999 kWh.

Section	Description
Total real energy generated value in kWh	Odometer structure: parameters give a value of generated energy value in kWh.

Attribute 3-Real Energy Net Odometer

The Real Energy Net Odometer represents a range of -999,999,999,999.999 kWh to 999,999,999,999.999 kWh.

Section	Description
Total real energy net value in kWh	Signed odometer structure: 5x16 bits parameters give a value of total real energy net value in kWh.

Attribute 27- Total Real Power

This attribute expresses the time rate of energy transfer as a REAL value, expressed in engineering units of kilowatts (kW). A positive value indicates consumption of energy, while a negative value indicates generation of energy.

Attribute 41- Associated Base Energy Object Path

The Base Energy Object (class code 0x4E) acts as an **energy supervisor** for CIP Energy implementations.

Chapter 3
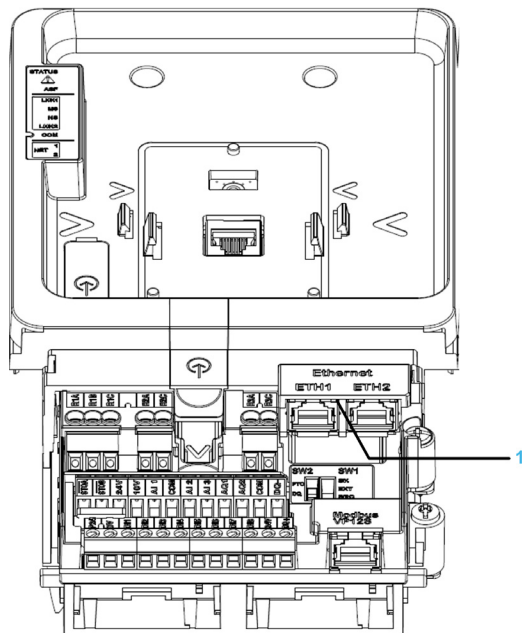## Hardware Setup

What Is in This Chapter?

This chapter contains the following topics:

Hardware Presentation

Ethernet Dual Port

The figure shows EtherNet/IP Adapter equipped with 2 RJ45 connectors:
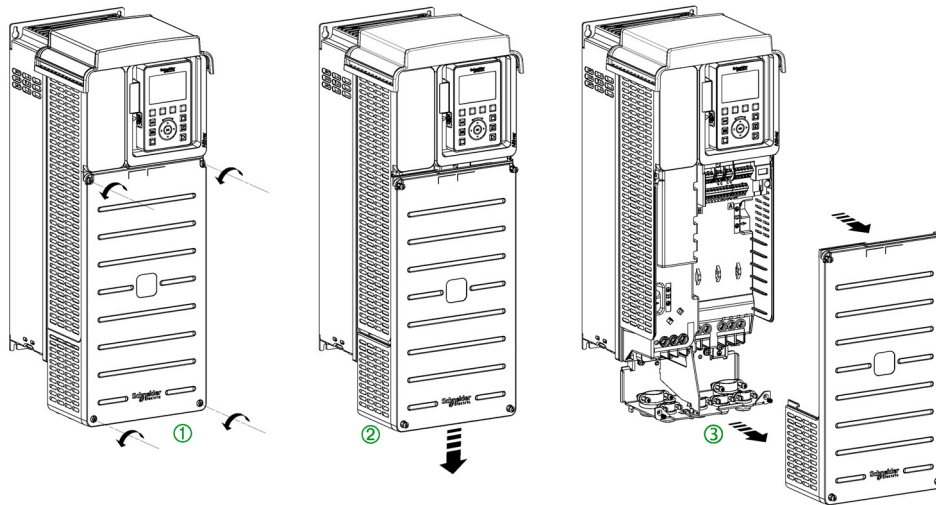

1 Ethernet dual port adapter

Firmware Version

Compatibility

There is no specific firmware for the Ethernet adapter. The drive firmware embeds the Ethernet adapter firmware.

Firmware Version

Compatibility

Connection to the Adapter

## Procedure to Remove the Front Cover of the Drive

Apply the following instructions to remove the front cover of the drive:

Step	Action
1	Unscrew the four screws attaching the front cover
2	Slide down the front cover
3	Remove the front cover
4	Plug the cable in the port

Electrical Installation

Pin Layout

The drive is equipped with 2 RJ45 female sockets for the Ethernet connection.
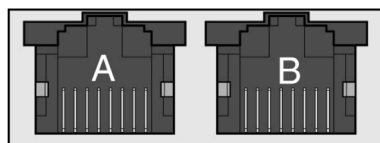
The table provides the pin out details of each RJ45 connector:

Pin	Signal	Meaning
1	Tx+	Ethernet transmit line +
2	Tx-	Ethernet transmit line –
3	Rx+	Ethernet receive line +
4	–	–
5	–	–
6	Rx-	Ethernet receive line –
7	–	–
8	–	–

Cable Specification

Cable specifications are as follows:
- Minimum Cat 5e,
- Use equipotential bonding conductors (100 BASE-TX, category 5e or industrial Ethernet fast connect)
- Connector RJ45, no crossover cable
- Shield: both ends grounded
- Twisted-pair cable
- Verify that wiring, cables, and connected interfaces meet the PELV requirements.
- Maximum cable length per segment = 100 m (328 ft) / 6 plugs

NOTE: RSTP function is not compatible with half duplex configuration. All devices involved in the RSTP topology shall be RSTP capable and configured.

Cable Routing Practice

Installation Topology

The Ethernet adapter enables several wiring solutions:
- Daisy chain and/or Star topology

NOTE: In daisy chain topology, if one drive is turned off, an **[Embd Eth Com Interrupt]** $E \, t \, H \, F$ error is trigged in the other drives connected to the same topology. To keep the integrity of Ethernet daisy chain network when one or more drives are powered off, add an external permanent 24VDc supply to the control block of the drive.
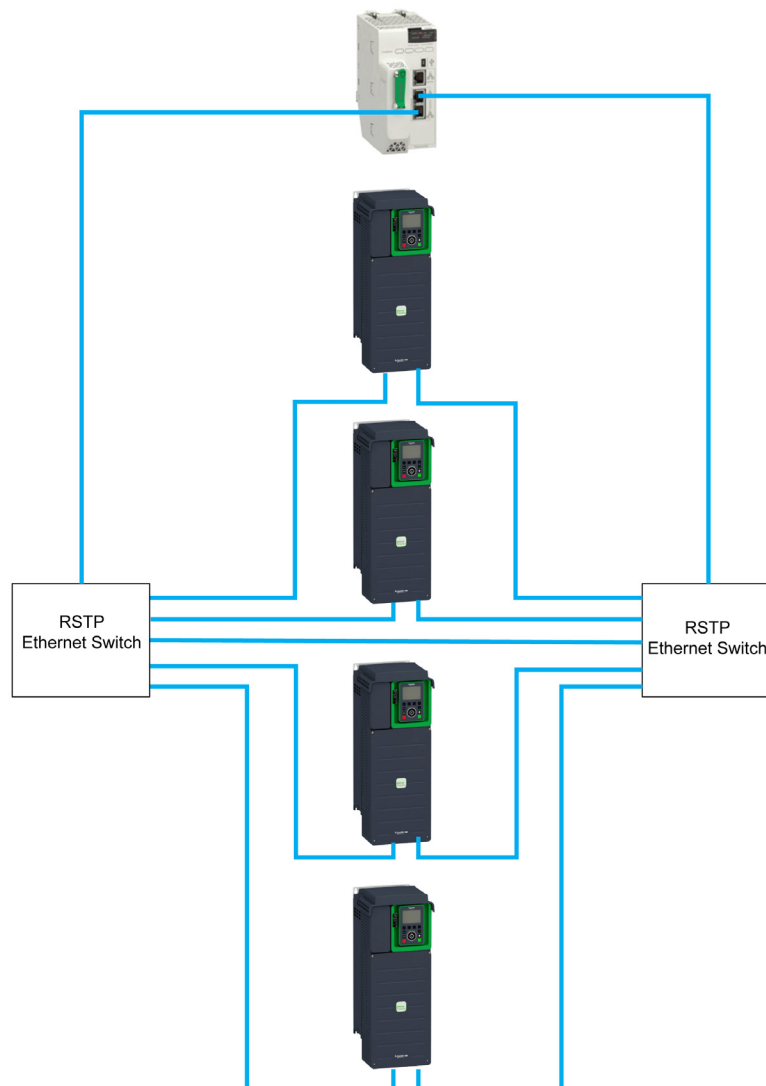
- Redundant ring topology with RSTP (with an RSTP switch)
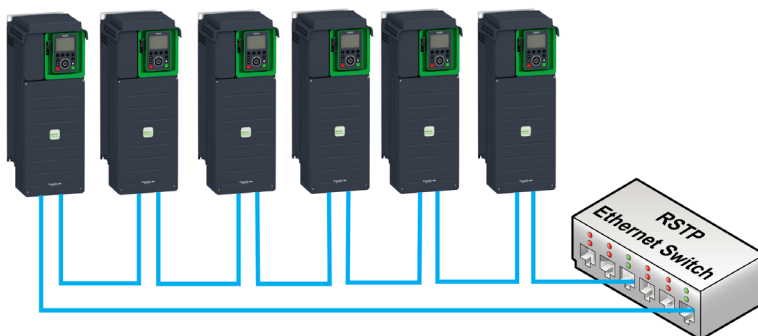
● Redundant ring topology with RSTP (with a RSTP PLC)
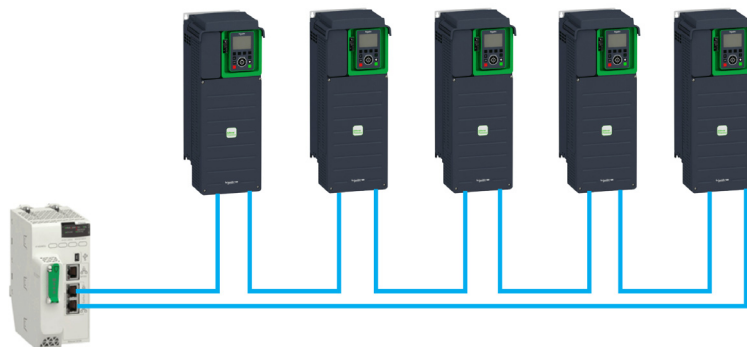
● Redundant star topology with RSTP

The following figure shows the direct connection between the drive and PC.

Chapter 4
Software Setup

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Basic Settings

What Is in This Section?

This section contains the following topics:

IP Parameter Settings

Assigning IP Parameters

If not using IPV6 functionalities for DWPS, following parameters shall be configured:
● The drive IP address.
● The subnet mask.
● The gateway IP address.

These IP addresses can be entered using the display terminal, the embedded webserver, or the DTM-based PC software.

They can be also provided by:
● A BOOTP server (correspondence between the MAC address and the IP addresses).
● Or a DHCP server (correspondence between device name **[DEVICE NAME]** *PAn* and the IP addresses).

If an IP address other than 0.0.0.0 has been entered manually, assignment using a server is disabled. Regardless of the type of IP address assignment, if the address is modified, then the IP address is effective the next time the drive is turned on (control voltage if a separate power supply is being used).

Entering IP Parameters in the Display Terminal

In the **[Communication]** *Con-*, **[Comm parameters]** *CMP-* menu and **[Embd Eth Config]** *EtE-* submenu, enter the following IP addresses:
● **[IP address]** *iC01, iC02, iC03, iC04*
● **[Mask]** *iM01, iM02, iM03, iM04*,
● **[Gateway]** *iG01, iG02, iG03, iG04*.

If this address is modified, the new IP address entered is displayed.

Configuring BOOTP

The BOOTP service is used to assign IP addresses based on the MAC address. The MAC address consisting of 6 hexadecimal digits (MM-MM-MM-XX-XX-XX) must be entered in the BOOTP server. The MAC address appears on the fieldbus adapter dedicated menu on the display terminal.

In the **[Communication]** *Con-*, **[Comm parameters]** *CMP-* menu and **[Embd Eth Config]** *EtE-* submenu:
● Leave the IP address **[IP address]** *iC01?, iC02?, iC03?, iC04* at the value **[0.0.0.0]** *0?0?0?0*.
● Do not enable the FDR service.

Configuring DHCP

The DHCP service is used to assign IP addresses and FDR configuration file path based on the device name **[DEVICE NAME]** *PAn*.

The device name consisting of an alphanumeric string must be entered in both the DHCP server and the drive.

In the **[Communication]** *Con-*, **[Comm parameters]** *CMP-* menu and **[Embd Eth Config]** *EtE-* submenu, enter the **[DEVICE NAME]** *PAn*

[Device Name] *PAn*

About This Parameter

This parameter is used set the device name.

Access

This parameter is accessible via **[Communication]** *CoM-*, **[Comm parameters]** *CMP-* menu and **[Embd Eth Config]** *EtE-* submenu.

This is a read/write parameter

Possible Settings

The FDR (Fast Device Replacement) service is based on identification of the device by a **Device Name**. In the case of the Altivar drive, this is represented by the **[Device Name]** *PAn* parameter. Verify that all the network devices have different **Device Name**.

[IP mode Ether. Embd] ﬠ ⊓ ⊓ ⊓

About This Parameter

This parameter is used to select the IP address assignment method.

Access

This parameter is accessible via **[Communication]** ⊂ ⊙ ⊓ - , **[Comm parameters]** ⊂ ⊓ ⊓ - menu and **[Embd Eth Config]** ⋿ ⵝ ⋿ - submenu.

This is a read/write parameter

The parameter number is 64400.

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[Fixed]	⊓ ⴷ ⊓ ⛌	0	Manually set the IP address.
[BOOTP]	ⴷ ⊙ ⊙ ⵝ	1	Automatically gets the IP address from the Bootp or DHCP server using the MAC address.
[DHCP]	ⴷ ⵝ ⵛ ⵔ	2	Automatically gets the IP address from the DHCP server using the device name. **Factory setting**: DHCP

[IP address] *ıС0 1,С02 ,С0 3 ,С0 4*

About This Parameter

This parameter is used to set the IP address and can be edited only when the IP mode is set to fixed address.

Access

This parameter is accessible via **[Communication]** *СоП-* , **[Comm parameters]** *СПР-* menu and **[Embd Eth Config]** *ЕЕЕ-* submenu.

This is a read/write parameter

The parameter number for IC01 is 64401

The parameter number for IC02 is 64402

The parameter number for IC03 is 64403

The parameter number for IC04 is 64404

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[139.160.069.241]	*139*	0...255	First byte of IP address.
	160	0...255	Second byte of IP address.
	069	0...255	Third byte of IP address.
	241	0...255	Fourth byte of IP address.

[Mask] *ın0ı,ın02,ın03,ın04*

About This Parameter

This parameter is used to set the IP subnet mask and can be edited only when IP mode is set to fixed address.

Access

This parameter is accessible via **[Communication]** *Com-*, **[Comm parameters]** *CmP-* menu and **[Embd Eth Config]** *EtE-* submenu.

This is a read/write parameter

The parameter number for IM01 is 64405

The parameter number for IM02 is 64406

The parameter number for IM03 is 64407

The parameter number for IM04 is 64408

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[255.255.254.0]	*255* *255* *254* *0*	0...255 0...255 0...255 0...255	First byte of IP Mask . Second byte of IP Mask . Third byte of IP Mask . Fourth byte of IP Mask

[Gateway] *ıG0 1,G02,G03,G04*

About This Parameter

This parameter is used to set the default gateway address and can be edited only IP mode is set to fixed address.

Access

This parameter is accessible via **[Communication]** *Cоⁿ-*, **[Comm parameters]** *CⁿP-* menu and **[Embd Eth Config]** *EtE-* submenu.

This is a read/write parameter

The parameter number for is 64409

The parameter number for is 64410

The parameter number for is 64411

The parameter number for is 64412

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[0.0.0.0]	*0*	0...255	First byte of IP gateway.
	0	0...255	Second byte of IP gateway
	0	0...255	Third byte of IP gateway
	0	0...255	Fourth byte of IP gateway

[Enable FDR] ϝ d Ʋ Ɵ

About This Parameter

This parameter is used to enable or disable the FDR service.

Access

This parameter is accessible via **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu and **[Fast Device Replacement]** *F d r -* submenu.

This is a read/write parameter.

The parameter number is 64435

This parameter can be accessed if **[IP mode Ether. Embd]** *ı M Ɵ Ɵ* is set to **[DHCP]** *d H C P*

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[No] **[Yes]**	*n o* * Y E S*	0 1	No: FDR service disabled Yes: FDR service enabled **Factory setting**: No

[FDR Action] *F d A O*

About This Parameter

This parameter is used to select the FDR action that needs to be performed.

Access

This parameter is accessible via **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu and **[Fast Device Replacement]** *F d r -* submenu.

This is a read/write parameter.

The parameter number is 64434

This parameter can be accessed if **[IP mode Ether. Embd]** *i M O O* is set to **[DHCP]** *d H C P*

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[NOT ACTIVE]	*i d L E*	0	Not active: No FDR action
[SAVE]	*S A V E*	1	Save: FDR save command
[REST]	*r E S t*	2	Restore: FDR restore command

[FDR Operating State] F d S O

About This Parameter

This parameter is used to display the FDR operating state.

Access

This parameter is accessible via **[Communication]** C o M - , **[Comm parameters]** C M P - menu, **[Embd Eth Config]** E t E - submenu and **[Fast Device Replacement]** F d r - submenu.

This is a read-only parameter.

The parameter number is 64433

This parameter can be accessed if **[IP mode Ether. Embd]** i M O O is set to **[DHCP]** d H C P

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[Initialization]	i n i t	0	INIT: Initialization
[Not Active]	i d L E	1	IDLE: Function not active
[Operational]	o P E	2	OPE: Operational
[Ready]	r d Y	4	RDY: Ready
[IP Configuration]	i P C	5	IPC: IP configuration
[Not Configured]	u n C F	7	UNCF: Function not configured
[Reading Configuration]	G E t	8	GET: Download the current configuration
[Writing Configuration]	S E t	9	SET: Save the current configuration
[Applying Configuration]	A P P	10	APP: Applying the configuration to the drive

[FDR Error Status] *F d r O*

About This Parameter

This parameter is used to display the FDR error status.

Access

This parameter is accessible via **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu and **[Fast Device Replacement]** *F d r -* submenu.

This is a read-only parameter.

The parameter number is 64432

This parameter can be accessed if **[IP mode Ether. Embd]** *i M O O* is set to **[DHCP]** *d H C P*

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[No Error]	*n o*	0	NO: No error
[Service Timeout]	*t o u t*	1	TOUT: Server timeout
[Server No File]	*S n F*	2	SNF: No file on server
[Server Corrupt File]	*C r P t*	3	CRPT: Corrupted file on server
[Server Empty File]	*E P t y*	4	EPTY: Empty file on server
[Drive Invalid File]	*H i n V*	5	HINV: Invalid file on drive
[CRC Error]	*C r C*	6	CRC: CRC error
[Version Incompatibility]	*V r M*	7	VRM: Version incompatibility between drive and file
[Drive No File]	*H n F*	9	HNF: No file on drive
[Server Reading Size]	*S i Z E*	10	SIZE: File size reading error on server
[Drive Opening File]	*o P E n*	11	OPEN: Drive cannot open the file
[Drive Reading File]	*r E A d*	12	READ: Drive cannot read the file
[Incompatibility]	*S C n t*	13	SCNT: File incompatibility
[Drive Invalid Name]	*n i n V*	14	NINV: Drive name is invalid
[Server Incorrect File Size]	*F S i Z*	15	FSIZ: Incorrect file size on server
[Drive Writing File]	*H W F*	16	HWF: Drive cannot write the file
[Server Writing File]	*S W F*	17	SWF: Server cannot write the file

[MAC @] *ΠΗΓ□*

About This Parameter

This parameter displays the MAC address of the device.

Access

This parameter is accessible via **[Display]** *Π□η⁻* , **[Communication map]** *ΓΠΠ⁻* menu and submenu.**[Ethernet Emb Diag]** *ΠΡΕ⁻*

This is a read-only parameter

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[MM-MM-MM-XX-XX-XX]	*ΠΠ - ΠΠ - ΠΠ - XX - XX - XX*	MM-MM-MM-XX-XX-XX	MAC address

[ETH emb Rx frames] *E r X E*

About This Parameter

This parameter displays the Ethernet adapter received frames counter

Access

This parameter is accessible via **[Display]** *N o n -* , **[Communication map]** *C N N -* menu and **[Ethernet Emb Diag]** *N P E -* submenu.

This is a read-only parameter

The parameter numbers is 64416

[ETH emb Tx frames] *E t X E*

About This Parameter

This parameter displays the Ethernet adapter transmitted frames counter

Access

This parameter is accessible via **[Display]** *Π o n -* , **[Communication map]** *C Π Π -* menu and **[Ethernet Emb Diag]** *Π P E -* submenu.

This is a read-only parameter

The parameter numbers is 64418

[ETH emb error frames] $E\,E\,\mathsf{r}\,E$

About This Parameter

This parameter displays the Ethernet adapter error frames counter

Access

This parameter is accessible via [Display] $\mathit{\Pi}\,\mathit{o}\,\mathit{n}\,$- , [Communication map] $\mathit{C}\,\mathit{\Pi}\,\mathit{\Pi}\,$- menu and [Ethernet Emb Diag] $\mathit{\Pi}\,\mathit{P}\,\mathit{E}\,$- submenu.

This is a read-only parameter

The parameter numbers is 64420

[Ethernet Rate Data] *ArdE*

About This Parameter

This parameter displays the Ethernet adapter actual rate.

Access

This parameter is accessible via **[Display]** *Mon-* , **[Communication map]** *CMM-* menu and **[Ethernet Emb Diag]** *MPE-* submenu.

This is a read-only parameter

The parameter numbers is 64413

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[Auto]	*Auto*	Auto	Data rate is auto detected depending on the first data packet received.
[10M. full]	*10F*	10 F	Data rate is set to10 Mbit/s full
[10M. half]	*10H*	10 H	Data rate is set to10 Mbit/s half
[100M. full]	*100F*	100 F	Data rate is set to100 Mbit/s full
[100M. half]	*100H*	100 H	Data rate is set to100 Mbit/s half
			Factory setting: Auto

[Enable Webserver] *EWEE*

About This Parameter

This parameter is used to manage the fieldbus adapter Web services.

Access

This parameter is accessible via **[My preferences]** *MYP-* menu and **[Webserver]** *WbS-* submenu.

This is a read/write parameter

The parameter numbers is 64264

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[No] **[Yes]**	*no* *YES*	0 1	Web services disabled Web services enabled **Factory setting**: Yes

[Reset EmbWeb] $r \, W \, P \, E$

About This Parameter

This parameter is used to manage the set to factory value the Ethernet webserver settings, including the password.

Access

This parameter is accessible via **[My preferences]** $\Pi \, Y \, P \, -$ menu and **[Webserver]** $W \, b \, S \, -$ submenu.

This is a read/write parameter

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[No] [Yes]	$n \, o$ $Y \, E \, S$	0 1	Reset of the adapter webserver password not requested Reset of the adapter webserver password requested **NOTE:** The parameter is set to **[No]** when the operation is done

[Ethernet Embd cmd.] *C П d S*

About This Parameter

This parameter displays the command word built with Ethernet embedded source (same as CMD).

Access

This parameter is accessible via **[Display]** *П o n -* , **[Communication map]** *C П П -* menu and **[Command word image]** *C W ı -* submenu.

This is a read-only parameter

The parameter numbers is 8515

[Ethernet Embd Ref Freq] L F r S

About This Parameter

This parameter displays the reference frequency built with Ethernet embedded source (same as LFr).

Access

This parameter is accessible via **[Display]** ⊓ o ⊓ - , **[Communication map]** C ⊓ ⊓ - menu and **[Command word image]** C W ı - submenu.

This is a read-only parameter

The parameter numbers is 8525

[Ethernet Timeout] *t t o b*

About This Parameter

This parameter is used to set the Ethernet timeout.

Access

This parameter is accessible via fieldbus using the Modbus address.

This is a read/write parameter

The parameter number is 64415.

Possible Settings

The table presents the parameter settings:

Settings	Description
0.1...30 sec	**Factory setting**: 10 sec

Section 4.2
Additional Settings

What Is in This Section?

This section contains the following topics:

Topic	Page
FDR Settings	94
RSTP Settings	95
Configuring I/O Scanning	97

FDR Settings

Access

The parameters are accessible via the webserver or the DTM-based PC software

FDR Configuration

The following figure shows FDR settings via webserver:

The table presents the **FDR Configuration** settings:

Parameter	Description	Settings
FDR Activation	This parameter is used to enable or disable the FDR service **NOTE:** You can enable FDR only if the **IP assignment mode** selected is DHCP.	**Enabled**: FDR service enabled **Disabled**: FDR service disabled. **Factory setting**: Disabled
Control Configuration	This parameter is used to select the server or local configuration.	**Served**: Transfers the configuration file from server to drive at power-up. **Stored**: uses the configuration stored in the drive at power-up. **Factory setting:** served
Automatic Syncho Cycle (Sec)	Allows you to select the interval for periodic synchronization of the drive with the FDR server. **NOTE:** You can configure automatic Synchro cycle only if **Synchronization mode** check box is selected.	10...655350 sec **Factory setting**: 2560 sec

RSTP Settings

Access

The parameters are accessible via the DTM-based PC software.

Bridge Settings

The following figure shows the bridge settings using the DTM:

The table presents the **Bridge** configuration

Parameters	Description	Settings	
Enable RSTP	Allows you to enable or disable the RSTP	To enable RSTP, select the **Enable RSTP** check box.	
Status	Allows you to enable or disable the RSTP bridge.	**Enabled**: Enables the use of Rapid Spanning-Tree Protocol (RSTP). **Disabled**:Disables the use of Rapid Spanning-Tree Protocol (RSTP)	
Bridge Priority	The bridge priority is used to control which bridge is elected as the root bridge. Bridge with the smallest (lowest) bridge ID is elected as the root bridge. Bridge ID consists of the configurable priority and the MAC address of the bridge. To compare 2 bridge ids, bridge priorities are compared first. If the bridge priorities are equal, then the MAC addresses are compared. The bridge priority can be set only in increments of 4096	0 4096 8192 12288 16384 20480 24576 28672 32768 36864 40960 45056 49152 53248 57344 61440	0 hex 1000 hex 2000 hex 3000 hex 4000 hex 5000 hex 6000 hex 7000 hex 8000 hex 9000 hex A000 hex B000 hex C000 hex D000 hex E000 hex F000 hex
Hello Time(S)	The hello time parameter corresponds to the time interval at which the root bridge transmits configuration Bridge Protocol Data Units (BPDU)s.	1...10 sec	
Max age time (6-40 s	The maximum age time correspond to the maximum expected arrival time of hello BPDUs. If the timer expires, the bridge detects acommunication interruption to the root bridge and initiates a topology convergence.The maximum age timer should be longer than the configured hello time.	6...40 sec	

Ports Configuration

The following figure shows the port settings:

The table provides the **Ports** settings

Parameters	Description	Settings
Port Priority	Allows you to define the priority of the interface to the other going to same subnet.	0...240 **NOTE:** - The port priority can be set only in increments of 16 - Drive takes the value in account after a product restart.
Port Path Cost	Allows you to define the cost of sending spanning tree traffic through the interface. RSTP uses path cost to determine the topology with the smallest total path cost between each point of the tree and the root bridge.	0...1,569,325,055 **NOTE:** If the port path cost is set to 0 (auto), the path cost is based on the port link speed maximum, for details see the following table.
Port Select	Allows you to select the type of ports. With the port types defined, RSTP can quickly reconfigure a network when a change in network topology is detected.	**RSTP Port** **Edge Port**

Table provides the value of the path cost based on the port link maximum speed

Port Link Maximum Speed	Automatic Path Cost
10 Gb/s (Not supported by the adapter)	2000
1 Gb/S (Not supported by the adapter)	20000
100 Mb/s	200000
10 Mb/s	2000000

Configuring I/O Scanning

Description

The drive I/O scanning service can be enabled or disabled with the DTM-based PC software.

It is not possible to modify the assignment of the I/O scanning periodic variables using the display terminal. To configure I/O scanning, use the DTM-based PC software.

Section 4.3
Fast Device Replacement

What Is in This Section?

This section contains the following topics:

Presentation

FDR Service

The FDR (Fast Device Replacement) service is used to simplify the maintenance of drives connected to an Ethernet network. In the event of a drive not working correctly, this service automatically reconfigures its replacement.

The new drive (FDR client) retrieves:
- Its IP addresses and the FDR file path from a DHCP server
- The FDR file from an FTP server if the drive is not configured in local configuration

In practice, the DHCP server and the FTP server are the same device (PAC M580, M340 PLC, or dedicated PCs).

The FDR file contains:
- The Ethernet parameters (configuration of I/O scanning, FDR, and so on)
- The drive parameters (drive, functions, application, and so on)

The FDR service is based on identification of the device by a **Device Name**. In the case of the drive, this is represented by the **[DEVICE NAME]** $P \, H \, n$ parameter.

The configuration of the FDR service is accessible via embedded webserver or DTM-based software or Graphic Display Terminal.

NOTE: Check that all the network devices have different **Device Name**.
The FDR server controls duplication of **Device Name** (it does not assign an IP address that has already been assigned and is active).

If the same IP address is supplied on 2 devices, the second should trigger an IP address duplication (network management detected error which triggers an **[External Error]** $E \, P \, F \, 1$ by default).

If the FDR service has been enabled, the Ethernet adapter attempts to restore its IP addresses on each power-up. Each time the procedure has detected error, the Ethernet adapter reiterates its FDR requests (DHCP).
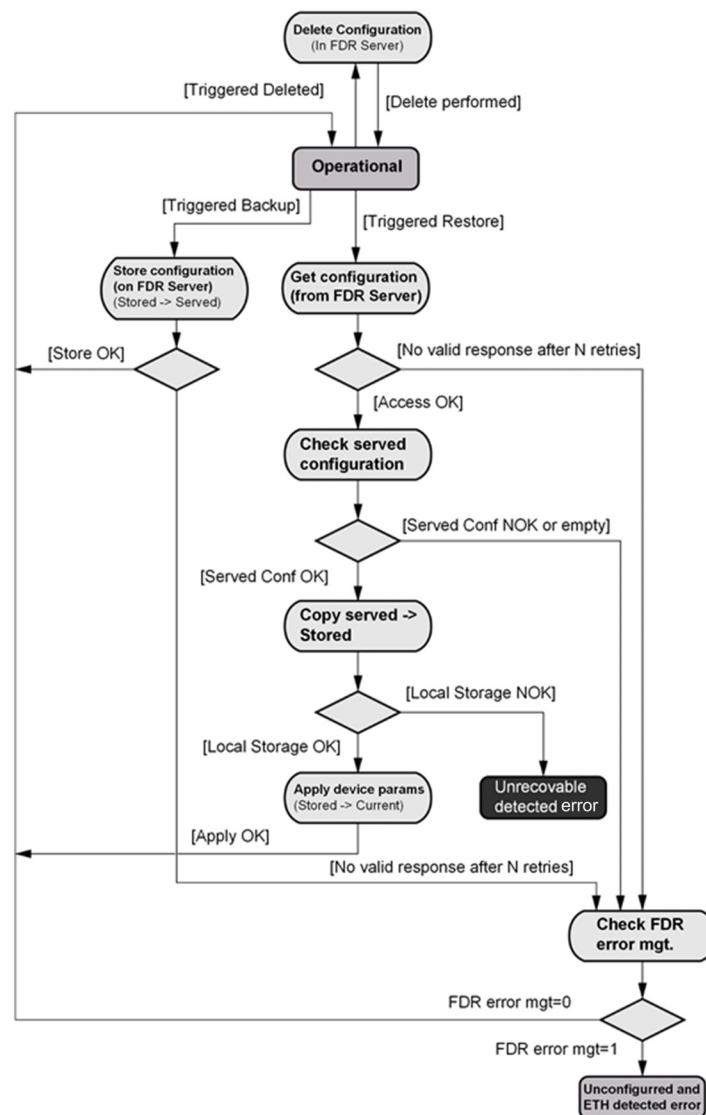
After assigning the Ethernet adapter IP addresses, if the configuration is not downloaded successfully, the Ethernet adapter triggers a **[FDR1 Error]** $F \, d \, r \, 1$.

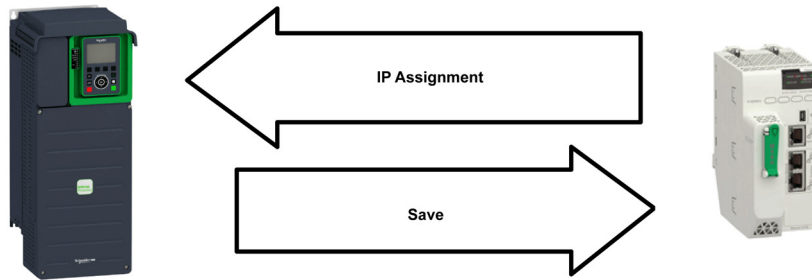## Startup Detailed Behavior

Presentation
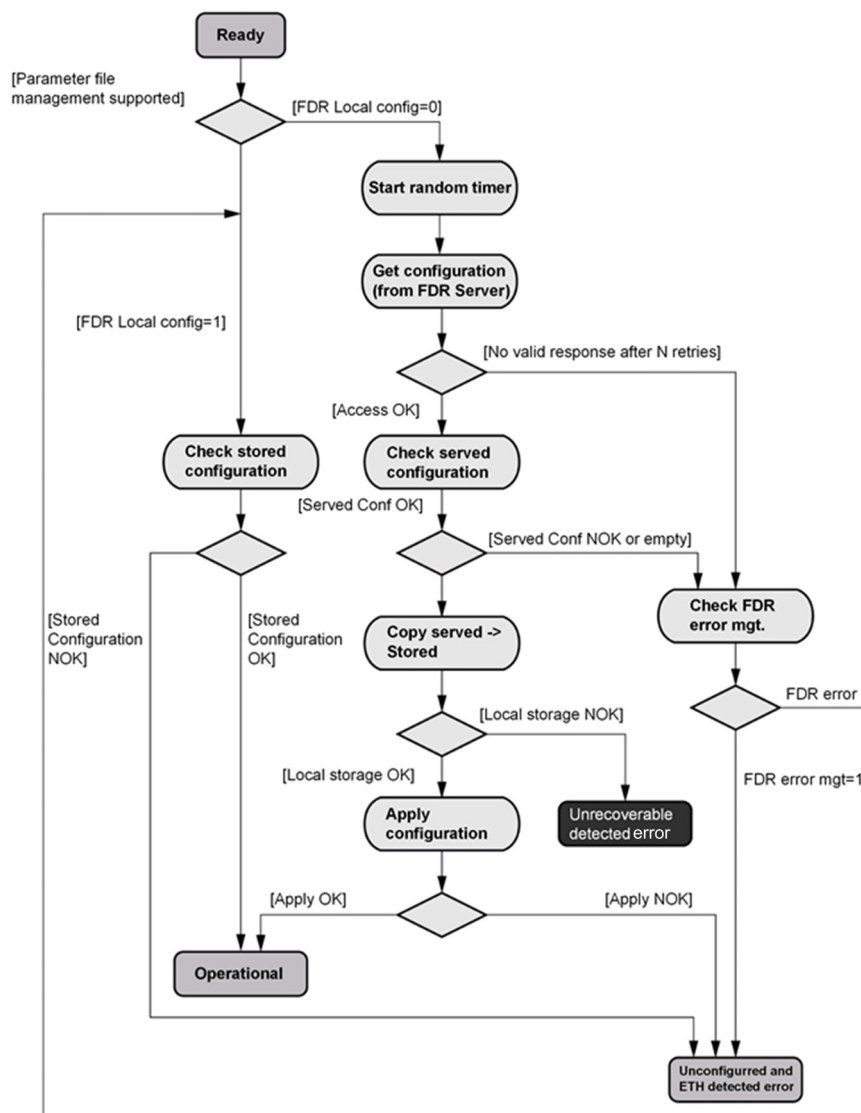
FDR Operation Behavior

Local Configuration

Presentation

IP Assignment Save

If the drive parameter configuration is local, the FDR server only assigns the following IP addresses:
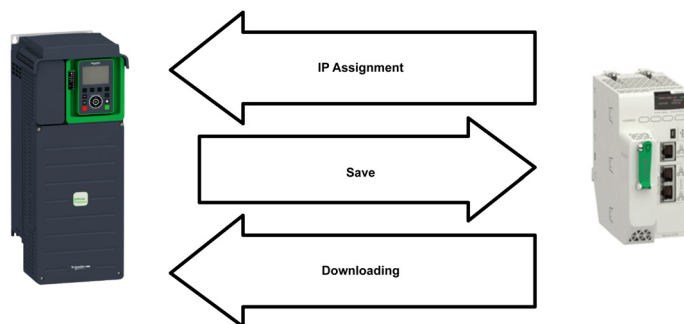- IP address,
- Subnet mask,
- Gateway IP address.

On connection to the network, the drive automatically saves its parameters in the FDR server.

Drive Connection Procedure

Step	Action	Description
1	Configure the FDR server	See the PLC manual or the section on software setup using Unity
2	Configure the drive	In the **[Communication]** *C o M -*, **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* Configure **[IP Mode Ether. Embd]** *i M O 1*= **[DHCP]** *d H C P* Enable the FDR service via webserver or DTM-based software or Graphic Display Terminal. Select local drive configuration with webserver or DTM-based software. Enter the device name, **DEVICE NAME**, in the **[Communication]** *C o M -*, **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu.
3	Turn off the drive	Turn off the drive and then back on again (control voltage supply if a separate power supply is being used), otherwise the device name is not taken into account
4	Connect the drive to the network	Connect the drive and the FDR server (PLC) to the Ethernet network

Downloaded Configuration

Presentation

IP Assignment Save

If the drive parameter configuration has been downloaded, the FDR server assigns the following addresses:
- IP address,
- Subnet mask,
- Gateway IP address,
- FDR server IP address.

Periodic Saving

Periodic saving of the drive configuration can be configured on the FDR server in either local configuration or downloaded configuration mode

Using the embedded webserver or the DTM-based software:
- Set FDR synchronization to automatic mode
- Set the synchronization cycle time

NOTE: Saving too often overburden the fieldbus and adversely affects its performance (factory setting: 2.560 s.).

Limitations

The FDR service is able to store the current configuration of the drive, but does not provide the possibility to store multi-parameters configurations.

Drive Parameters (Configuration)

In the procedure described below, the configuration file is transferred to the FDR server, via the Ethernet network, using a manual save command.

Step	Action	Description
1	Configure the drive	In the **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu: ● Leave the IP address **[IP address]** *i C 0 1?* *i C 0 2?* *i C 0 3?* *i C 0 4* at the value **[0.0.0.0]** *0?0?0?0* Using the embedded webserver or the DTM-based software: ● Set FDR synchronization to manual mode. ● Before the first connection, select local drive configuration. The drive needs first to push the configuration to the server. Enter the device name, **DEVICE NAME**, in the **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Ethernet Eth Config]** *E t E -* submenu.
2	Turn off the drive	Turn off the drive and then back on again (control voltage if a separate power supply is being used), otherwise the device name is not taken into account
3	Connect the drive to the fieldbus	Connect the drive and the FDR server (PLC) to the Ethernet fieldbus.
4	Configure the FDR server (see the PLC manual)	The server downloads the IP addresses to the Ethernet adapter . Check that the operation has proceeded correctly: you can also check, in the **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu. Whether the **[IP address]** *i C 0 1?* *i C 0 2?* *i C 0 3?* *i C 0 4* , **[Mask]** *i M 0 1?* *i M 0 2?* *i M 0 3?* *i M 0 4* and **[Gateway]** *i G 0 1?* *i G 0 2?* *i G 0 3?* *i G 0 4?* parameters have values other than **[0.0.0.0]** *0?0?0?0*
5	Supply the FDR server with the configuration file	Using the embedded webserver or the DTM-based software ● Specify that the drive configuration is downloaded from the FDR server on each power-up ● Send a save command to the FDR server.
6	Check that the system is operational	If the save operation has not been successful, the adapter detects a communication error which, in factory settings mode, triggers a **[FDR1 Error]** *F d r 1*

Replacing a Drive

For replacing a drive, it is necessary to follow the procedure below:

Step	Action	Action
1	Configure the drive	In the **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu: ● Leave the IP address **[IP address]** *i C 0 1?* *i C 0 2?* *i C 0 3?* *i C 0 4* at the value **[0.0.0.0]** *0?0?0?0* Using the embedded webserver or the DTM-based software: ● Set FDR synchronization to manual mode. ● Before the first connection, select served drive configuration. The drive needs first to transfer the configuration from the server. Enter the device name, **DEVICE NAME**, in the **[Communication]** *C o M -* , **[Comm parameters]** *C M P -* menu, **[Embd Eth Config]** *E t E -* submenu.
2	Turn off the drive	Turn off the drive and then back on again (control voltage if a separate power supply is being used), otherwise the device name is not taken into account
3	Connect the drive to the fieldbus	Connect the drive and the FDR server (PLC) to the Ethernet fieldbus
4	Check that the drive is operational	Check that the operation has proceeded correctly. If downloading has not been possible after a period of 2 min following assignment of the IP addresses, the adapter detects a communication error which, in factory settings mode, triggers an **[FDR1 Error]** *F d r 1*

Section 4.4
Communication Profile

What Is in This Section?

This section contains the following topics:

Definition of a Profile

Types of Profiles

There are 3 types of profile:
- Communication profiles
- Functional profiles
- Application profiles

Communication Profile

A communication profile describes the characteristics of a bus or network:
- Cables
- Connectors
- Electrical characteristics
- Access protocol
- Addressing system
- Periodic exchange service
- Messaging service
- ...

A communication profile is unique to a type of fieldbus (such as Modbus, PROFIBUS DP, and so on) and is used by different types of devices.

Functional Profile

A functional profile describes the behavior of a type of device:
- Functions
- Parameters (such as name, format, unit, type, and so on.)
- Periodic I/O variables
- State chart
- ...

A functional profile is common to all members of a device family (such as variable speed drives, encoders, I/O modules, displays, and so on).

They can feature common or similar parts. The standardized (IEC 61800-7) functional profiles of variable speed drives are:
- CiA402
- PROFIDRIVE
- CIP AC Drive

CiA402 device profile for drives and motion control represents the next stage of this standard development and is now part of the IEC 61800-7 standard.

Application Profile

Application profile defines the services to be provided by the devices on a machine. For example, CiA DSP 417-2 V 1.01 part 2: CANopen application profile for lift control systems - virtual device definitions.

Interchangeability

The aim of communication and functional profiles is to achieve interchangeability of the devices connected via the fieldbus.

Functional Profiles Supported by the Drive

I/O Profile

Using the I/O profile simplifies PLC programming.

The I/O profile mirrors the use of the terminal strip for control by utilizing 1 bit to control a function.

The I/O profile for the drive can also be used when controlling via a fieldbus.The drive starts up as soon as the `run` command is sent.15 bits of the control word (bits 1...15) can be assigned to a specific function.

This profile can be developed for simultaneous control of the drive via:
● The terminals
● The Modbus control word
● The CANopen control word
● EtherNet embedded
● The fieldbus module control word

The I/O profile is supported by the drive itself and therefore in turn by all the communication ports (integrated Modbus, and fieldbus modules).

CiA402 Profile

The drive only starts up following a command sequence.

The control word is standardized.

5 bits of the control word (bits 11...15) can be assigned to a function.

The CiA402 profile is supported by the drive itself and therefore by all the communication ports (integrated Modbus, CANopen, and fieldbus modules).

The drive supports the `velocity` mode of CiA402 profile.

In the CiA402 profile, there are two modes that are specific to the drive and characterize commands and references value management:
● `Separate` **[Separate]** $5\,E\,P$
● `Not separate` **[Not separ.]** $5\,\iota\,\varPi$,

Functional Description

Introduction

Drive operation involves two main functions, which are illustrated in the diagrams below.

CiA402

The main parameters are shown with their CiA402 name and their CiA402/Drivecom index (the values in brackets are the CANopen addresses of the parameter).
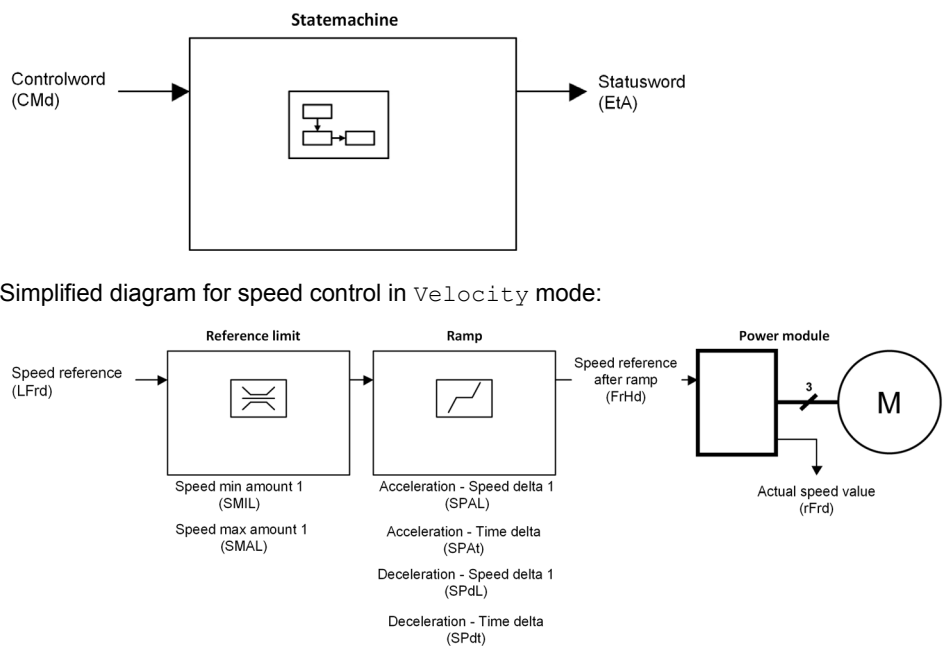
The following figure shows the control diagram for drive operation:

Simplified diagram for speed control in `Velocity` mode:
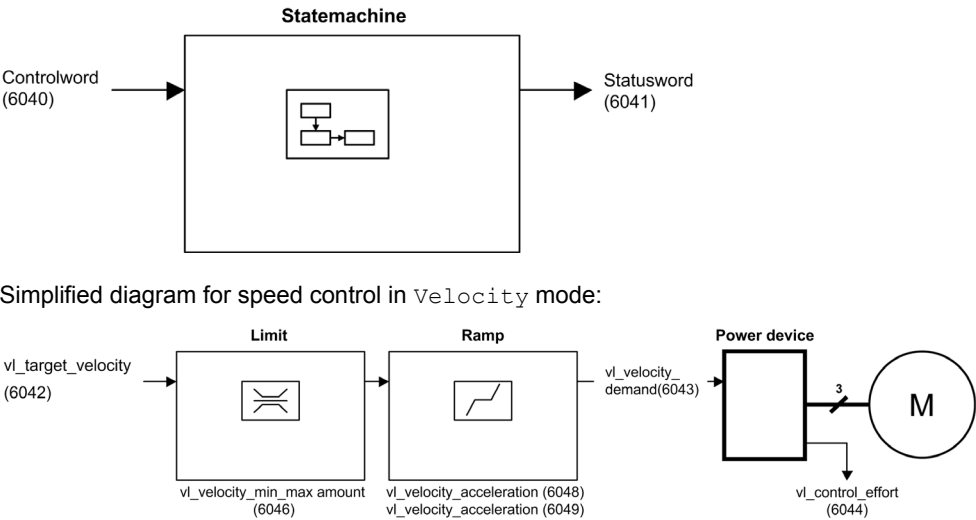
Altivar Drive

These diagrams translate as follows for the Altivar drive.

The following figure shows the control diagram for drive operation:

Simplified diagram for speed control in `Velocity` mode:

CIA402 Operating State Diagram

State Diagram

After switching on and when an operating mode is started, the product goes through a number of operating states.

The state diagram (state machine) shows the relationships between the operating states and the state transitions. The operating states are internally monitored and influenced by monitoring functions.

The following figure shows the CIA402 state diagram:
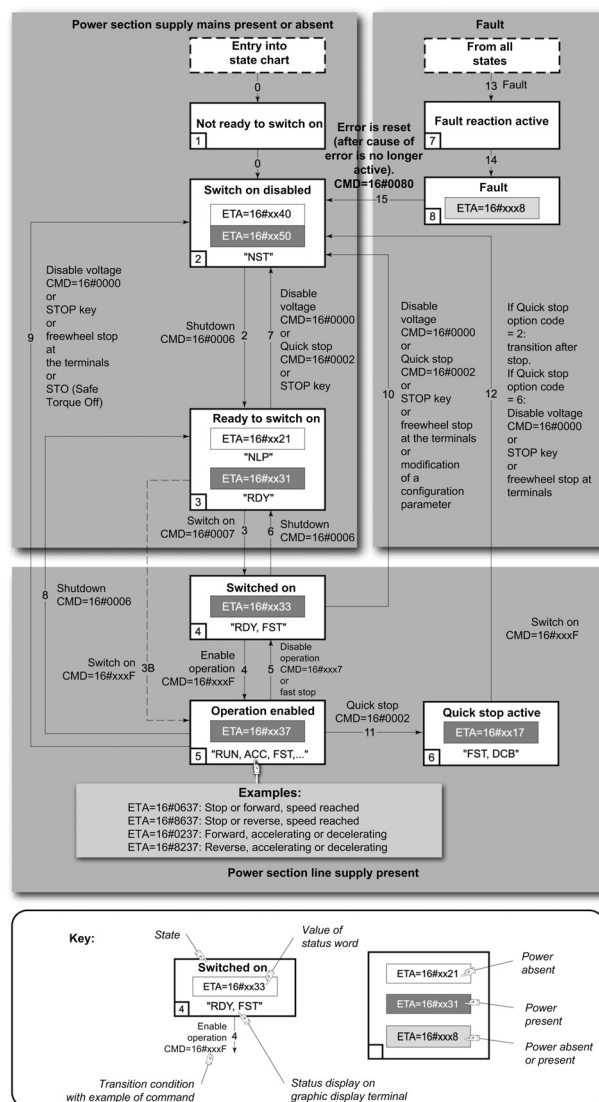
Description of Operating States

Drive Operating State

The operating state of the drive changes depending on whether the control word **[Cmd Register]** `?C П d`, is sent or an event occurs (an error detection, for example).

The drive operating state can be identified by the value of the status word **[CIA402 State Reg]** `E t A`.

Operating State	Description
1 - Not ready to switch on	Initialization starts. This is a transient state invisible to the communication network.
2 - Switch on disabled	The power stage is not ready to switch on. The drive is locked, no power is supplied to the motor. For a separate control stage, it is not necessary to supply the power. For a separate control stage with mains contactor, the contactor is not closed. The configuration and adjustment parameters can be modified.
3 - Ready to switch on	The power stage is ready to switch on and awaiting power stage supply mains. For a separate control stage, it is not necessary to supply the power stage, but the system expects it in order to change to state 4 - Switched on. For a separate control stage with mains contactor, the contactor is not closed. The drive is locked, no power is supplied to the motor. The configuration and adjustment parameters can be modified.
4 - Switched on	Power stage is switched on. For a separate control stage, the power stage must be supplied. For a separate control stage with mains contactor, the contactor is closed. The drive is locked, no power is supplied to the motor. The power stage of the drive is ready to operate, but voltage has not yet been applied to the output. The adjustment parameters can be modified. If a configuration parameter is modified, the drive returns to the state 2 - Switch on disable.
5 - Operation enabled	Power stage is enabled. The drive is in running state For a separate control stage, the power stage must be supplied. For a separate control stage with mains contactor, the contactor is closed. The drive is unlocked, power is supplied to the motor. The drive functions are activated and voltage is applied to the motor terminals. If the reference value is zero or the `Halt` command is applied, no power is supplied to the motor and no torque is applied. To perform **[Auto tuning]** `t u n`, the drive must be in state 5 - Operation enabled. The adjustment parameters can be modified. The configuration parameters cannot be modified. **NOTE:** The command 4 - Enable operation must be taken into consideration only if the channel is valid. In particular, if the channel is involved in the command and the reference value, transition 4 is possible only after the reference value has been received once. The reaction of the drive to a `Disable operation` command depends on the value of the **[SwitchOnDisable Stp]** `d o t d` parameter: ● If the **[SwitchOnDisable Stp]** `d o t d` parameter is set to 0, the drive changes to operating state 4 - Switched on and stops in freewheel stop. ● If the **[SwitchOnDisable Stp]** `d o t d` parameter is set to 1, the drive stops on ramp and then changes to operating state 4 - Switched on.

Operating State	Description
6 - Quick stop active	The drive performs a fast stop and remains locked in the operating state `6-Quick stop active.` Before restarting the motor, it is required to go to the operating state `2-switch on disabled.` During fast stop, the drive is unlocked and power is supplied to the motor. The configuration parameters cannot be modified. The condition for transition 12 to state `2 - Switch on disabled` depends on the value of the parameter Quick stop mode (QStd): If the `Quick stop` mode parameter has the value FST2, the drive stops according to the fast stop ramp and then changes to state `2 - Switch on disabled.` If the `Quick stop` mode parameter has the value FST6, the drive stops according to the fast stop ramp and then remains in state `6 - Quick stop active` until: • A `Disable voltage` command is received or • The **STOP** key is pressed or • A freewheel stop command via the digital input of the terminal.
7 - Fault reaction active	Transient state during which the drive performs an action corresponding to the selected error response.
8 - Fault	Error response terminated. Power stage is disabled. The drive is locked, no power is supplied to the motor.

Summary

Device Status Summary

Operating State	Power Stage Supply for Separate Control Stage	Power Supplied to Motor	Modification of Configuration Parameters
`1 - Not ready to switch on`	Not required	No	Yes
`2 - Switch on disabled`	Not required	No	Yes
`3 - Ready to switch on`	Not required	No	Yes
`4 - Switched on`	Required	No	Yes, return to `2 - Switch on disabled` operating state
`5 - Operation enabled`	Required	Yes	No
`6 - Quick stop active`	Required	Yes, during fast stop	No
`7 - Fault reaction active`	Depends on error response configuration	Depends on error response configuration	–
`8 - Fault`	Not required	No	Yes

Cmd Register `C П d`

Bit Mapping of the Control Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Fault reset	Reserved (=0)	Reserved (=0)	Reserved (=0)	Enable operation	Quick stop	Enable voltage	Switch on
0 to 1 transition = Error is reset (after cause of error is no longer active)				1 = Run command	0 = Quick stop active	Authorization to supply AC power	Mains contactor control

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Manufacturer specific assignable	Manufacturer specific assignable	Manufacturer specific assignable	Manufacturer specific assignable	Manufacturer specific	Reserved (=0)	Reserved (=0)	Halt
				0 = Forward direction asked 1= Reverse direction asked			Halt

Command	State Transition	Final Operating State	Bit 4 Fault Reset	Bit 3 Enable Operation	Bit 2 Quick Stop	Bit 1 Enable Voltage	Bit 0 Switch On	Example Value
Shutdown	2, 6, 8	3 – Ready to switch on	X	X	1	1	0	0006 hex
Switch on	3	4 – Switched on	X	X	1	1	1	0007 hex
Enable operation	4	5 – Operation enabled	X	1	1	1	1	000F hex
Disable operation	5	4 – Switched on	X	0	1	1	1	0007 hex
Disable voltage	7, 9, 10, 12	2 – Switch on disabled	X	X	X	0	X	0000 hex
Quick stop	11	6 – Quick stop active	X	X	0	1	X	0002 hex
	7, 10	2 – Switch on disabled						
Fault reset	15	2 – Switch on disabled	0 → 1	X	X	X	X	0080 hex
X: Value is of no significance for this command. 0→1: Command on rising edge.								

Stop Commands

Halt Command

The `Halt` command enables movement to be interrupted without having to leave the `5 - Operation enabled` state. The stop is performed in accordance with the **[Type of stop]** `5 ʈ ʈ` parameter.

If the `Halt` command is active, no power is supplied to the motor and no torque is applied.

Regardless of the assignment of the **[Type of stop]** `5 ʈ ʈ` parameter **[Fast stop Assign]** `F 5 ʈ`, **[Ramp stop]** `r ⲛ P`, **[Freewheel Stop]** `n 5 ʈ`, or **[DC Injection Assign]** `d C ı`, the drive remains in the `5 - Operation enabled` state.

Fast Stop Command

A `Fast Stop` command at the terminals or using a bit of the control word assigned to `Fast Stop` causes a change to the `4 - Switched on`

Freewheel Command

A `Freewheel Stop` command using a digital input of the terminal or a bit of the control word assigned to `Freewheel Stop` causes a change to operating state `2 - Switch on disabled`.

Assigning Control Word Bits

Function Codes

In the CiA402 profile, fixed assignment of a function input is possible using the following codes:

Bit	Ethernet Embedded
Bit 11	C511
Bit 12	C512
Bit 13	C513
Bit 14	C514
Bit 15	C515

For example, to assign the DC injection braking to bit13 of the fieldbus adapter, simply configure the **[DC Injection Assign]** d C ı parameter with the **[C513]** C 5 ı 3?value.

Bit 11 is assigned by default to the operating direction command **[Reverse Assign]**?r r 5.

[CIA402 State Reg] $E \, t \, \overline{H}$

Bit Mapping of the Status Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to switch on
A warning is active	Power stage supply disabled	0 = Quick stop is active	Power stage supply present	Error detected	Running	Ready	1 = Awaiting power Stage supply

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Manufacturer-specific Direction of rotation	Manufacturer-specific Stop via STOP key	Reserved (=0)	Reserved (=0)	Internal limit active	Target reached	Remote	Reserved (=0)
				Reference value outside limits	Reference value reached	Command or reference value via fieldbus	

Operating State	Bit 6 Switch On Disabled	Bit 5 Quick Stop	Bit 4 Voltage Enabled	Bit 3 Fault	Bit 2 Operation Enabled	Bit 1 Switched On	Bit 0 Ready to Switch On	ETA Masked by 006F H [1]
1 -Not ready to switch on	0	X	X	0	0	0	0	–
2 -Switch on disabled	1	X	X	0	0	0	0	0040 hex
3 -Ready to switch on	0	1	X	0	0	0	1	0021 hex
4 - Switched on	0	1	1	0	0	1	1	0023 hex
5 - Operation enabled	0	1	11	0	1	1	1	0027 hex
6 -Quick stop active	0	0		0	1	1	1	0007 hex
7 -Fault reaction active	0	X	X	1	1	1	1	–
8 -Fault	0	X	X	1	0	0	0	0008 hex[2]...0028 hex
[1] This mask can be used by the PLC program to test the diagram state.								
[2] detected error following operating state 6 – Quick stop active. X: In this state, the value of the bit can be 0 or 1.								
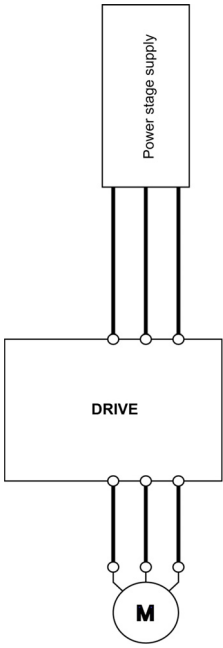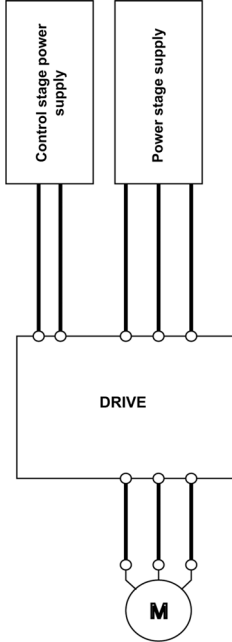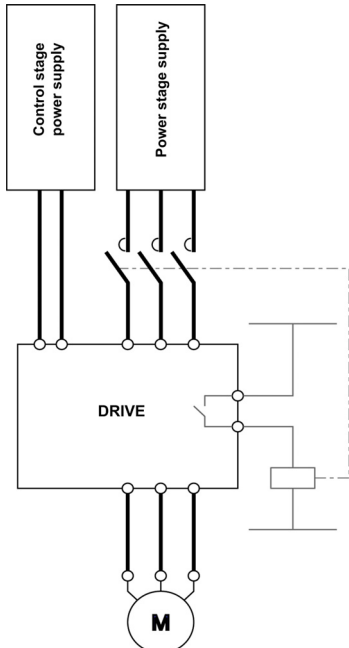
Starting Sequence

Description

The command sequence in the state diagram depends on how power is being supplied to the drive.

There are 3 possible scenarios:

Power stage supply	Direct	Direct	Mains contactor controlled by the drive
Control stage supply	Not separate [1]	Separate	Separate
[1] The power stage supplies the control stage.			

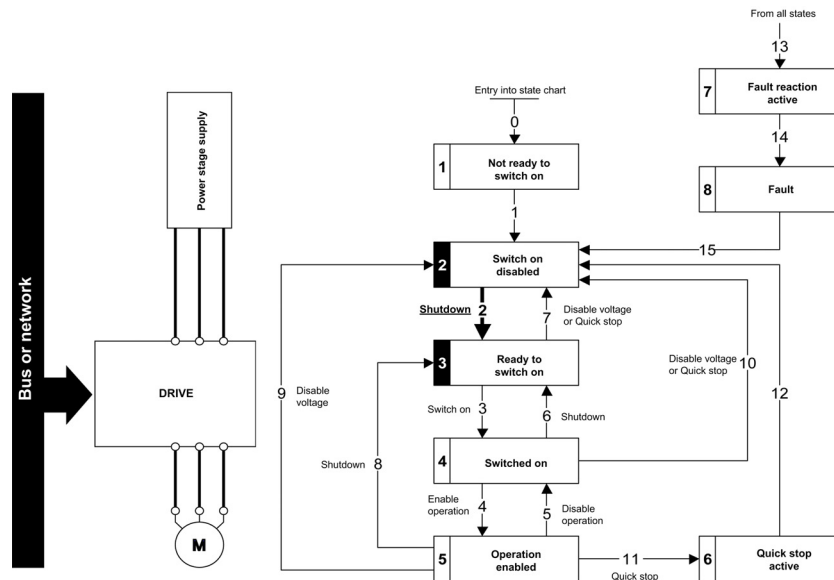## Sequence for a Drive Powered by the Power Stage Supply

Description

Both the power and control stages are powered by the power stage supply.

If power is supplied to the control stage, it has to be supplied to the power stage as well.
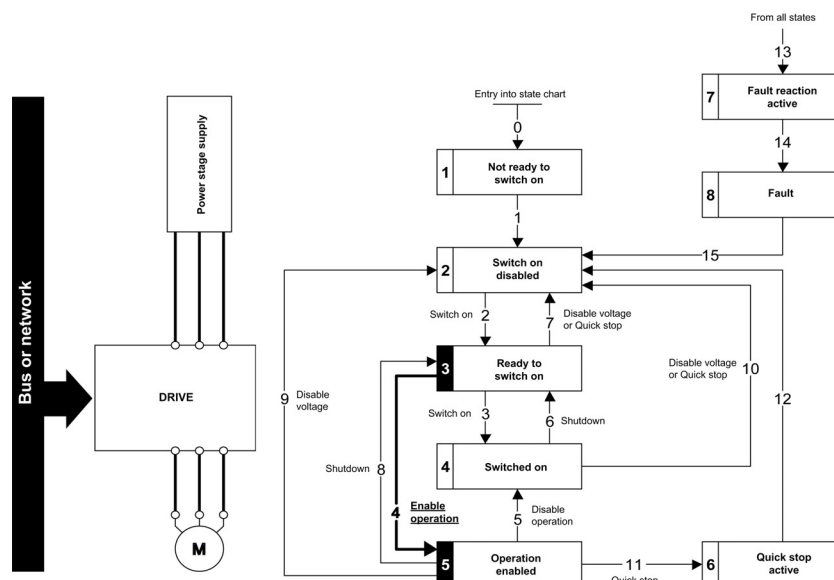
The following sequence must be applied:

Step 1

Apply the `2 - Shut down` command

Step 2

- Check that the drive is in the operating state `3 - Ready to switch on`.
- Then apply the `4 - Enable operation` command.
- The motor can be controlled (send a reference value not equal to zero).

NOTE: It is possible, but not necessary to apply the `3 - Switch on` command followed by the `4 - Enable Operation` command to switch successively into the operating states `3 - Ready to Switch on`, `4 - Switched on` and then `5 - Operation Enabled`. The `4 - Enable operation` command is sufficient.

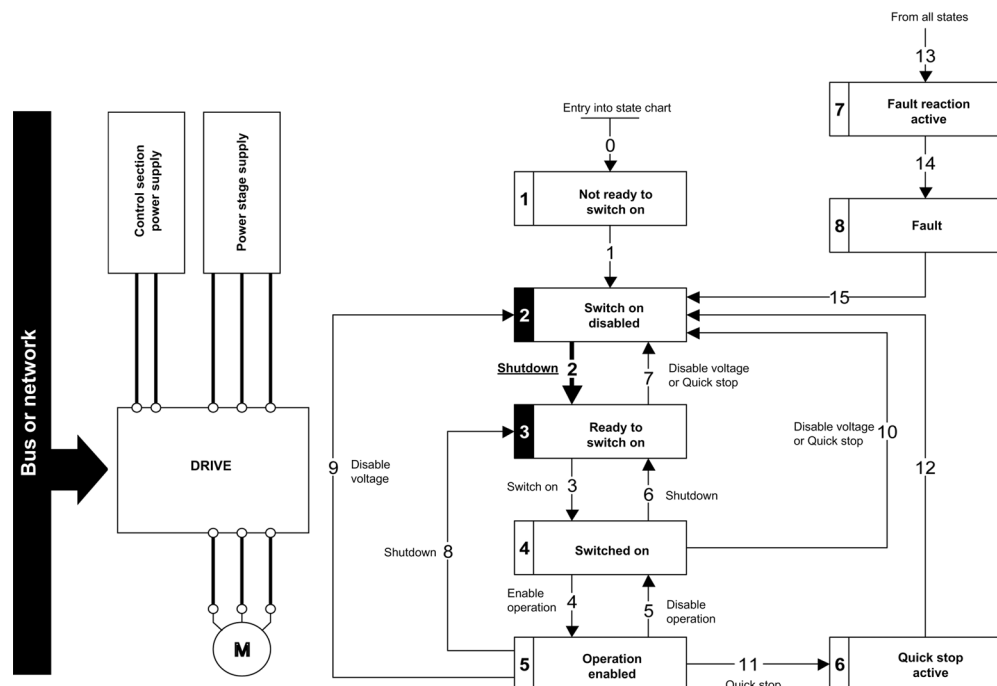## Sequence for a Drive with Separate Control Stage

Description

Power is supplied separately to the power and control stages.

If power is supplied to the control stage, it does not have to be supplied to the power stage as well.

The following sequence must be applied:

Step 1

- The power stage supply is not necessarily present.
- Apply the `2 - Shut down` command

Step 2

- Check that the drive is in the operating state `3 - Ready to switch on`.
- Check that the power stage supply is present (`Voltage enabled` of the status word).

Power Stage Supply	Terminal Display	Status Word
Absent	`nLP`	21 hex
Present	`rdY`	31 hex

- Apply the `3 - Switch on` command

Step 3

- Check that the drive is in the operating state `4 - Switched on`.
- Then apply the `4 - Enable operation` command.
- The motor can be controlled (send a reference value not equal to zero).
- If the power stage supply is still not present in the operating state `4 - Switched on` after a time delay **[Mains V. time out]** `LCt`, the drive triggers an error **[Input Contactor]** `LCF`.

Sequence for a Drive with Mains Contactor Control

Description

Power is supplied separately to the power and control stages.

If power is supplied to the control stage, it does not have to be supplied to the power stage as well. The drive controls the mains contactor.
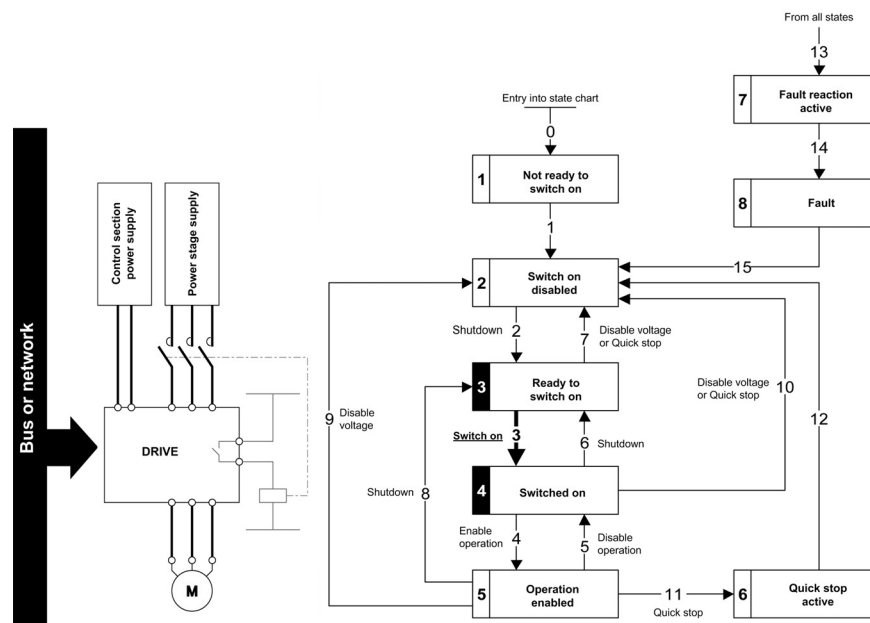
The following sequence must be applied:

Step 1

- The power stage supply is not present as the mains contactor is not being controlled.
- Apply the `2 - Shutdown` command.
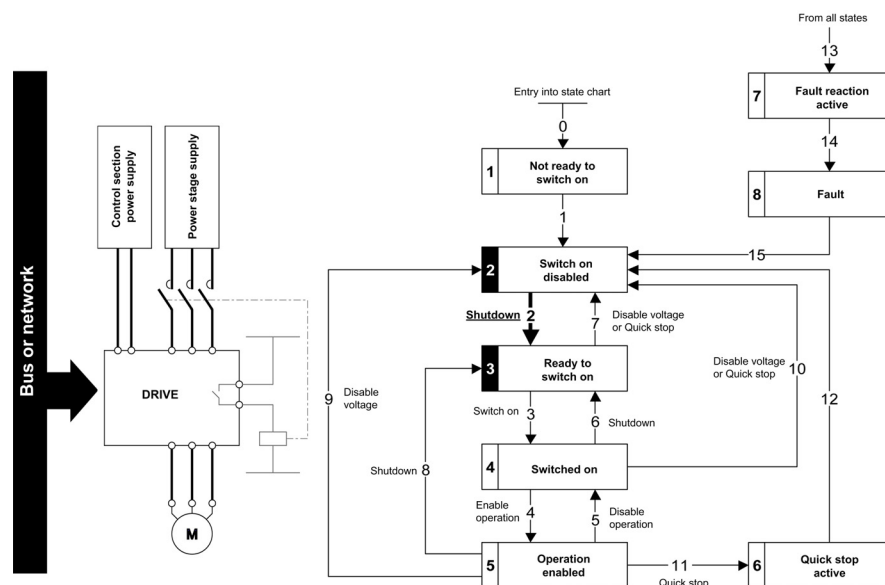
Step 2

- Check that the drive is in the operating state `3 - Ready to switch on`.
- Apply the `3 - Switch on` command, which closes the mains contactor and switch on the power stage supply.

Section 4.5
Embedded Webserver

What Is in This Section?

This section contains the following topics:

Overview

Webserver

The Ethernet adapter provides an integrated Web server (in six languages) which allows several functions like: display, parameter settings, and diagnostics. This chapter describes the services provided by this webserver.

The webserver can be accessed from standard browsers like Internet Explorer, chrome, safari, or Firefox.

Connection to the Webserver

Access

The webserver can be accessed from standard browsers.

In the following example, the drive has received the IP address 10.0.0.5:

First connect the computer to the drive by typing http:// followed by the drive IP address.

You are asked to first enter a **User Name** and a **Password**.

By default the user name is ADMIN. If you are connecting to the webserver for the first time, the password is available from the Graphic Display Terminal of the drive in the **[Main Menu]** / **[My preference]** ⊓ ⅄ ℙ /**[Webserver]** Ⴍ ᵬ Ƽ - /**[Webserver default password]** Ⴍ ᑯ ℙ menu. Once logged in you are asked to change the default connection ID (User Name and Password), according to the default security access rule. Access rules can be modified in the Setup/Access Management web page.

Once connected, the webserver home page is displayed.

Using IPV6 network discovery service, there is no need to set IP parameters. The drive appears automatically in the network explorer of the PC while physically connected.

The drive is identified as ATV9•••••••-MMMM where MMMM is the two last bytes of the MAC address.

Right-click and select **Display device web page** to open the webserver.

Web Server Site Map

The descriptions of the Web server pages are shown in the following table

Page	Menu	Description
My Dashboard		This page can be customized, adding or removing Widgets that are designed for a quick overview of the drive data.
Display	Drive	Drive parameters are displayed in data tables. Customized tables can be created.
	Energy Dashboard	Trends show information about the energy consumption of the drive.
	Chart Viewer	Drive parameters are displayed in charts. Customized charts can be created.
Diagnostics	Drive	Drive diagnostics are displayed.
	Fieldbus	Communication diagnostics are displayed.
Drive	Drive Parameter	Drives settings can be modified.
	Drive Communication	Communication settings can be modified.
Setup	Fieldbus	Drive Ethernet settings can be modified.
	File Transfer	Drive configuration and reports can be downloaded or loaded between a computer and the drive.
	My Preferences	Webserver access and appearance can be handled.

My Dashboard

Overview

The following table provides the procedure to add the widget to this page:

Step	Action
1	Click the **add a widget** button.
2	Drag a widget to the desired location.

The following figure shows the widgets that can be added. Various widgets of a same category are available.

Display - Drive

Data Table

The following table provides the procedure to create data tables of drive parameters.

Step	Action
1	Type the name of the table. Spaces are not allowed in this field.
2	Select a parameter by clicking the top of the parameter or typing the code and clicking the ⊕ button. To delete a parameter while creating the table click the parameter.
3	Click the **Add Table** button.To remove a table click the ⊠ button, only visible when the table is selected.

Chart Viewer

The following table provides the procedure to create a chart viewer.

Step	Action
1	Type the name of the chart. Spaces are not allowed in this field.
2	Select the plot frequency.
3	Select the plot frequency unit.
4	Select the number of plot points.
5	Select a parameter by clicking the top of the parameter or typing the code and clicking the ⊕ button. To delete a parameter while creating the chart click the parameter. Maximum of five parameters can be selected.
6	Click the **Create Chart** button, To remove a chart click the ⊠ button, only visible when chart is selected.

Setup - My Preference

User Access

In this menu, the access to the Web server can be managed by users with administrator rights. These users can add, remove, block, unblock, and modify the access rights of other users.

The following table shows the description of the buttons located in this menu:

Button	Description
⊕	Add a new user, typing the name of the user; the password and the access rights.
🔒 🔓	Block and unblock the access of a user to the webserver
🔃	Change the password. The administrator can change the password of other users.

Themes

In this menu, the aspect of the Web server can be changed. Predefined themes are available, which can be customized.

The following table provides the procedure for creating new themes

Step	Action
1	Click the ⊕ button.
2	Type the name of the theme. Spaces are not allowed in this field.
3	Type the description of the theme.
4	Upload a logo by clicking the 🔼 button.
5	Type name of the website.
6	Click the **Save** button.

Access Management

Select if login credentials are required or not to access to the web server. The password policy can be changed.

The following table describes the different actions that can be set to enforce the password policy.

Action	Description
Enforce Password Policy	Enable or disable the password enforcement
Password History	Limits the number of failed attempts to access before locking the user account, it can be set to disable or three and even five attempts.
Special Character Required	If enabled, a special character is mandatory when creating a password for a user account.
Numeric Character	If enabled, a numeric character is mandatory when creating a password for a user account.
Alphabetic Character	If enabled, an alphabetical character is mandatory when creating a password for a user account.
Minimum Password Length	If enabled, a preset number of characters is mandatory when creating a password for a user account.

Section 4.6
Fieldbus Integration Using Unity Pro (M580)

What Is in This Section?

This section contains the following topics:

Introduction

Overview

The following figure shows the basic configuration to control the drive with a M580 PLC. The version of Unity used here is Unity Pro XL.

EtherNet/IP Configuration

Ethernet Port Configuration

From the project browser, open the EtherNet/IP port configuration by double-clicking the Ethernet port.
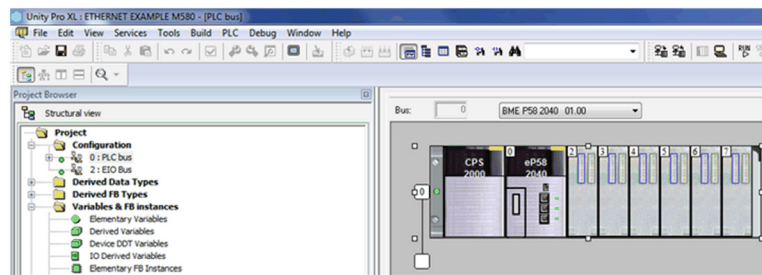
Configuration of the Master

PLC Configuration

The configuration of the memory area of the PLC is set by default and can be modified.

The IP address can be managed in the **IPCongif** tab.

DTM Library

Configuring the Drive Using Unity Pro

Before configuring the drive using Unity Pro, verify that the DTM and the drive firmware are compatible.

The DTM libraries are available on www.schneider-electric.com.

DTM Browser

Launch the DTM Using Unity Pro

After installing the DTM library on your PC, restart the Unity Pro to add the DTM to the Unity Pro libraries.

Open the DTM browser to add the drive to the configuration, as shown in the following figure:
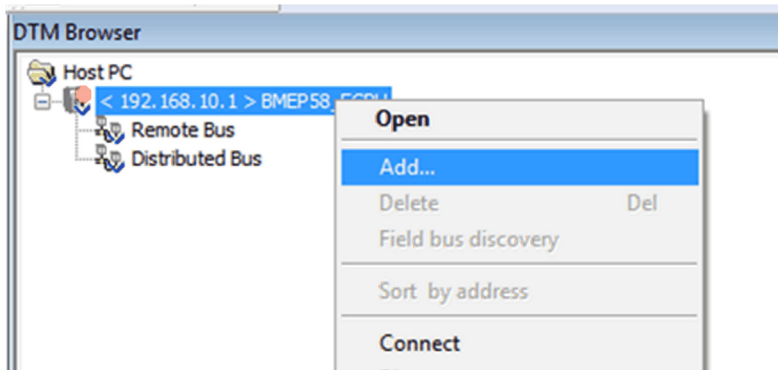
Select the drive from the list and click the **Add DTM** button to add the DTM.
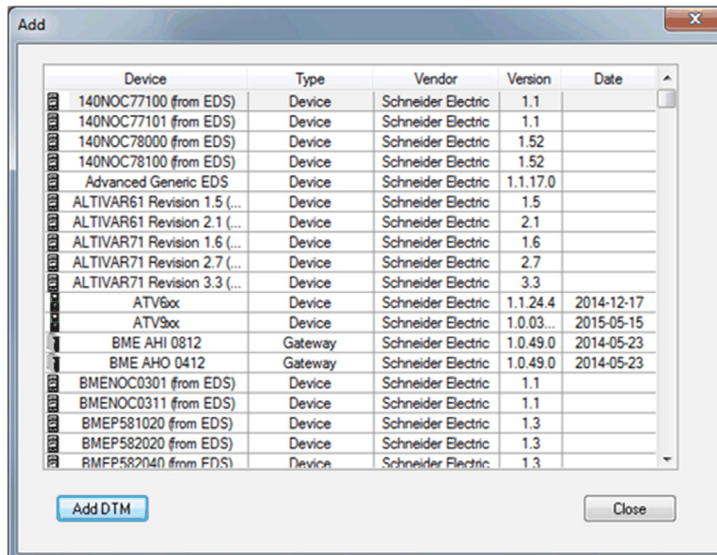
You can select even Modbus or EtherNet/IP communication with this configuration.

Finally the drive used in the configuration can be named with an alias in order to differentiate it in the case of using other drives. The alias name is used by default as device name for FDR service. The DTM online help is available in this window.
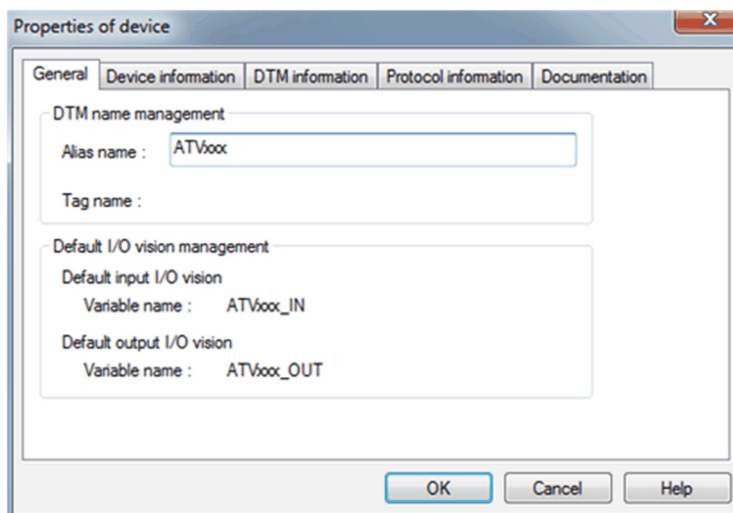
Chapter 5
Operations

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Operating States

Configuring Communication Error Response

Description

The response of the drive in the event of an Ethernet communication interruption can be configured. Configuration can be performed using the display terminal from the **[Complete settings]** *C S t -* , **[Error/Warning handling]** *C S W M -* menu, **[Embedded modbus TCP]** *E M t C -* submenu, via the **[Eth Error Response]** *E t H L* parameter.

The values of the **[Eth Error Response]** *E t H L* parameter, which triggers a transition to the operating state fault **[Embd Eth Com Interrupt]** *E t H F* are:

Value	Meaning
[Freewheel Stop] *Y E S*	Freewheel stop (factory setting)
[Ramp stop] *r M P*	Stop on ramp
[Fast stop] *?F S t*	Fast stop
[DC injection] *d C i*	DC injection stop

The values of the **[Embd Eth Com Interrupt]** *E t H F* parameter, which does not trigger a transition to the operating state fault are:

Value	Meaning
[Ignore] *n o*	Detected error ignored
[Per STT] *S t t*	Stop according to configuration of **[Type of stop]** *S t t*
[Fallback Speed] *L F F*	Change to fallback speed, maintained as long as the detected error persists and the run command has not been removed
[Speed maintained] *r L S*	The drive maintains the speed at the time the detected error occurred, as long as the detected error persists, and the run command has not been removed

The fallback speed can be configured in the **[Complete settings]** *C S t -* , **[Error/Warning handling]** *C S W M -* menu, **[Fallback speed]** *L F F -* submenu, using the **[FallbackSpeed]** *L F F* parameter.

⚠ WARNING

LOSS OF CONTROL

If this parameter is set to *n o*, Ethernet communication monitoring is disabled.
● Only use this setting after a thorough risk assessment in compliance with all regulations and standards that apply to the device and to the application.
● Only use this setting for tests during commissioning.
● Verify that communication monitoring has been re-enabled before completing the commissioning procedure and performing the final commissioning test.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Detected Errors

Parameter	Description	Possible Values	Terminal Display
[Embd Eth Com Interrupt] *E t H F* Written to the device	This parameter is used to indicate that fieldbus error has been detected. When the detected error is active, the value corresponds to the cause of the error. When the cause of the error is no longer active, the value is reset to 0.	1: Modbus TCP timeout	**[1]** *I*
[Internal Error 22] *i n F П*	This parameter is used to indicate that an internal error has been detected. The error can only be reset by switching off the product.	–	–
[External Error] *E P F I*	–	1: Invalid IP address 2: Duplicate IP address	**[1]** *I* **[2]** *2*
[FDR1Error] *F d r I*	This parameter is used to indicate that an error has been detected during FDR procedure. Details about this error are provided using FDR0 parameter.	0: No error 1: Server timeout 2: No file on server 3: Corrupted file on server 4: Empty file on server 5: Invalid file on drive 6: CRC error 7: Version incompatibility between drive and file. 9: No file on drive 10: File size reading error on server 11: Drive cannot open the file 12: Drive cannot read the file 13: File incompatibility 14: Drive name is invalid 15: Incorrect file size on server 16: Drive cannot write the file 17: Server cannot write the file	**[No error]** **[Server Timeout]** **[Server No File]** **[Server Corrupt File]** **[Server Empty File]** **[Drive Invalid File]** **[CRC Error]** **[Version Incompatibility]** **[Drive No File]** **[Server Reading Size]** **[Drive Opening File]** **[Drive Reading File]** **[Incompatibility]** **[Drive Invalid Name]** **[Server Incorrect File Size]** **[Drive Writing File]** **[Server Writing File]**

Section 5.2
Operating Modes

What Is in This Section?

This section contains the following topics:

Configuring the Control Channel

Overview

This chapter explains how to configure the drive for operation from communication network through three following examples.

- I/O mode - a simple command word (based on forward, reverse, and reset binary commands).
- Combined mode (with native profile CiA 402) - Both reference value and command word come from the communication network.
- Separate (with native profile CiA 402) - reference value and command come from separate sources: for example, the command (in CiA 402) comes from the communication network and the reference value from the HMI.

Configuration of the Drive for Operation in I/O Profile

Description

For the I/O profile, here is a simple example, which can be extended with additional features. The command word is made of run forward (bit 0 of CMd), run reverse (bit 1 of CMd), and the function fault reset (bit 7 of CMd).

[Forward] is assigned to *C Π d* bit 0

[Complete settings] (*C S t -*),
[Cmd and Reference] (*C r P -*),
[Reverse Assign] (*r r S*)
is assigned to *C Π d* bit 1

[Complete settings] (*C S t -*),
[Error/Warning handling] (*C S W Π*),
[Fault Reset] (*r S t -*)
[Fault Reset Assign] (*r S F*) is assigned to
C Π d bit 7

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

Error Reset

Run reverse

Run forward
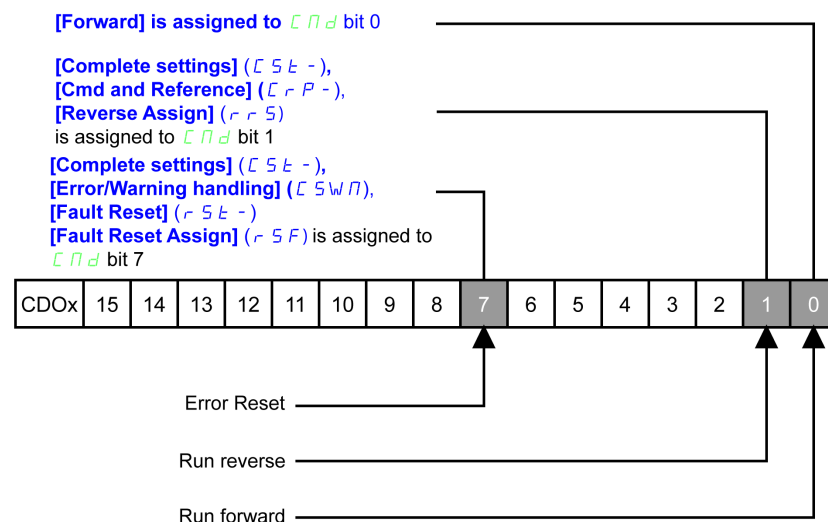
The settings are the following:

[Ref Freq 1 Config] *F r 1*	**[HMI]** *H Π i*
[Control Mode] *C H C F*	**[I/O profile]** *i o*
[Command switching] *C C S*	Default
[Cmd channel 1] *C d 1*	**[Ethernet]** *E t H*

The bits of the command word can now be configured.

In the **[Command and Reference]** *C r P -* menu configure:

[Reverse Assign] *r r S*	**[CD01]** *C d O 1*

In the **[Error/Warning handling]** *C S W Π -* menu, **[Fault reset]** *r S t -?*submenu, configure:

[Fault Reset Assign] *r S F*	**[CD07]** *C d O 7*

Configuration of the Drive for Operation with CiA 402 Profile in Combined Mode

Description

This section describes how to configure the settings of the drive if it is controlled in CiA 402 mode. The example focuses on the not separate mode. Additional modes are detailed in the drive programming manual.

In the **[Complete settings]** $C \, 5 \, E \, - \, ?$ menu, **[Command and reference]** $C \, r \, P \, -$ submenu:
- **[Ref Freq Channel 1]** $F \, r \, I$: is set on according to the communication source you can choose in the following table:

Origin of the Control	Ref1 Channel Setting
Ethernet embedded	**[Embedded Ethernet]** $E \, E \, H$

- **[Freq Switch Assign]** $r \, F \, C$ is set to default value (**[Ref Freq 1 Config]** $F \, r \, I$).
- **[Control Mode]** $C \, H \, C \, F$: defines if the drive operates in combined mode (reference and command from the same channel).

For the current example, **[Control Mode]** $C \, H \, C \, F$ is adjusted to **[Not separ.]** $5 \, i \, \Pi$ as reference and control are originated from the communication network:

Profile	Ref1 Channel setting
CiA 402 combined mode	**[Not separ.]** $5 \, i \, \Pi$
CiA 402 separate mode	**[Separate]** $5 \, E \, P$
I/O profile	**[I/O profile]** $i \, o$

Configuration of the Drive for Operation with CiA 402 Profile in Separate Mode

Description

Alternate combinations are possible, see the drive programming manual for the list of possible settings.

For example:
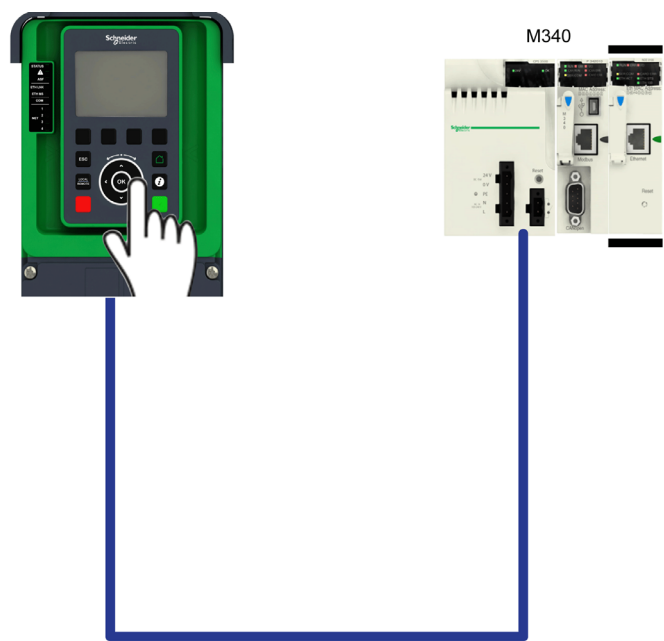
The drive is controlled from the communication but the reference value is adjusted on the display terminal. The control word comes from the controller and is written according to CiA 402 profile.

The settings are as shown in the table:

[Ref Freq 1 Config] *F r 1*	[AI1] *A ı 1*
[Control Mode] *C H C F*	[Separate] *S E P*
[Cmd channel 1] *C d 1*	[Ethernet] *E t H*
[Freq Switch Assign] *r F C*	Factory setting

Chapter 6
Diagnostic and Troubleshooting

What Is in This Chapter?
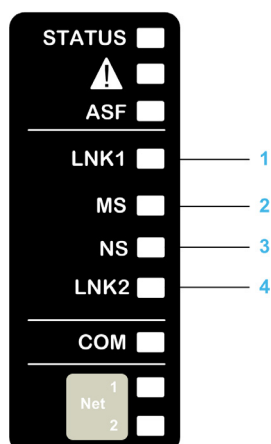
This chapter contains the following topics:

Fieldbus Status LEDs

LED Indicators

The following figure describes the LEDs status for fieldbus monitoring:

LED Description

Item	LED	Description
1	**LNK1**	Indicates port A activity.
2	**MS**	Indicates adapter status.
3	**NS**	Indicates network status.
4	**LNK2**	Indicates port B activity.

LNK1 and LNK2

These LEDs indicate the status of the Ethernet adapter ports:

Color & status	Description
OFF	No link
Blinking Green/Yellow	Power on testing
Green ON	Link established at 100 Mbit/s
Yellow ON	Link established at 10 Mbit/s
Blinking Green	Fieldbus activity at 100 Mbit/s
Blinking Yellow	Fieldbus activity at 10 Mbit/s

NS: Network Status

This LED indicates the status of the fieldbus

Color & status	Description
OFF	The device does not have an IP address or powered off
Blinking Green/Red	Power on testing
Green ON	A connection is established to control the command word.
Blinking Green	Device has a valid IP, but no command word connection.
Red ON	Duplicated IP
Blinking Red	An established connection to control the command word is closed or timed out

MS: Module Status

This LED indicates the status of the adapter

Color & status	Description
OFF	No power is supplied to the device
Blinking Green/Red	Power on testing
Green ON	The device is operating correctly.
Blinking Green	Device has not been configured.
Blinking red	The device has detected a recoverable minor detected error.
Red ON	The device has detected a non-recoverable major detected error.

MS: Module Status

This LED indicates the status of the adapter

Connection for Fieldbus Mode

Description

If the product cannot be addressed via the fieldbus, first check the connections. The product manuals contains the technical data of the device and information on fieldbus and device installation.

Verify the following:
● Power connections to the device
● Fieldbus cable and fieldbus wiring
● Fieldbus connection to the device

Fieldbus Functions Test

Channels for Commands and Reference Values

All the drive commands and reference value parameters are managed on a channel-by-channel basis.

Parameter Name	Parameter Code				
	Taken Into Account by the Drive	Modbus Serial	CANopen	Fieldbus Module	Ethernet Embedded
Control word	*CMd*	*CMd1*	*CMd2*	*CMd3*	*CMd5*
Extended control word	*CMi*	*CMi1*	*CMi2*	*CMi3*	*CMi5*
Reference speed (rpm)	*LFd*	*LFd1*	*LFd2*	*LFd3*	*LFd5*
Reference frequency (0.1 Hz)	*LFr*	*LFr1*	*LFr2*	*LFr3*	*LFr5*
Reference value for torque control mode (0.1% of the nominal torque)[1]	*Ltr*	*Ltr1*	*Ltr2*	*Ltr3*	*Ltr5*
Reference value supplied by PI controller	*PiSP*	*Pir1*	*Pir2*	*Pir3*	*Pir5*
Reference value supplied by analog multiplier function	*MFr*	*MFr1*	*MFr2*	*MFr3*	*MFr5*
[1]: If available					

Fieldbus Monitoring Criteria

The fieldbus is monitored according to the protocol-specific criteria.

Protocol	Criteria	Related Detected Error
Embedded Ethernet	FDR detected error IP address duplication detected error Adjustable time-out for received control word (I/O scanning or messaging) Fieldbus overload	[External Error] *EPF1* [FDR 1 Error] *Fdr1* [Embd Eth Com Interrupt] *EtHF*

Monitoring of Communication Channels

Communication channels are monitored if they are involved in one of the following parameters:

- The control word (**[Cmd Register]** $\mathit{C\,\Pi\,d}$) from the active command channel
- The control word containing the command switch (bit configured on **[Cmd switching]** $\mathit{C\,C\,5}$)
- The control word containing the switch for reference value 1'1B (bit configured on **[Ref 1B switching]** $\mathit{r\,C\,b}$)
- The control word containing the switch for reference value 1'2 (bit configured on **[Freq Switch Assign]** $\mathit{r\,F\,C}$)
- The reference frequency or reference speed (**[Ref Frequency]** $\mathit{L\,F\,r}$ or LFRD: Nominal speed value) from the active channel for reference value
- Summing reference frequency or reference speed (**[Ref Frequency]** $\mathit{L\,F\,r}$ or LFRD: Nominal speed value) 2 (assigned to **[Summing Input 2]** $\mathit{5\,R\,2}$)
- Summing reference frequency or reference speed (**[Ref Frequency]** $\mathit{L\,F\,r}$ or LFRD: Nominal speed value) 3 (assigned to **[Summing Input 3]** $\mathit{5\,R\,3}$?)
- Subtracting reference frequency or reference speed (**[Ref Frequency]** $\mathit{L\,F\,r}$ or LFRD: Nominal speed value) 2 (assigned to **[Subtract Ref Freq 2]** $\mathit{d\,R\,2}$)
- Subtracting reference frequency or reference speed (**[Ref Frequency]** $\mathit{L\,F\,r}$ or LFRD: Nominal speed value) 3 (assigned to **[Subtract Ref Freq 3]** $\mathit{d\,R\,3}$)
- The reference value given by the PID controller (PISP)
- The PID controller feedback (**[AI Virtual 1]** $\mathit{R\,i\,u\,1}$)
- The multiplication coefficient of the reference values (**[Multiplying coeff.]** $\mathit{\Pi\,F\,r}$) 2 (assigned to **[Ref Freq 2 Multiply]** $\mathit{\Pi\,R\,2}$)
- The multiplication coefficient of the reference values (**[Multiplying coeff.]** $\mathit{\Pi\,F\,r}$) 3 (assigned to **[Ref Freq 3 Multiply]** $\mathit{\Pi\,R\,3}$)

As soon as one of these parameters has been written once to a communication channel, it activates monitoring for that channel.

If a communication warning is sent (in accordance with the protocol criteria) by a monitored port or fieldbus module, the drive triggers a communication interruption.

The drive reacts according to the communication interruption configuration (operating state Fault, maintenance, fallback, and so on)

If a communication warning occurs on a channel that is not being monitored, the drive does not trigger a communication interruption.

Enabling of Communication Channels

A communication channel is enabled once all the parameters involved have been written at least one time.The drive is only able to start if all channels involved in command and reference value are enabled.

For example:

A drive in DSP402 profile is connected to an active communication channel.

It is mandatory to write at least 1 time the reference value and the command in order to switch from `4-Switched on` to `5-Operation enabled` state.

A communication channel is disabled:

- In the event of a communication warning.
- In `forced local` mode.
  NOTE: On exiting `forced local` mode:

- The drive copies the `run` commands, the direction, and the forced local reference value to the active channel (maintained).
- Monitoring of the active channels for the command and reference value resumes following a time delay **[Time-out forc. local]** $\mathit{F\,L\,o\,t}$.
- Drive control only takes effect once the d rive has received the reference and the command from the active channels.

Control-Signal Diagnostics

Introduction

On the display terminal, the **[Display]** *Пол -*, **[Communication map]** *СПП -* submenu can be used to display control-signal diagnostic information between the drive and the controller:

- Active command channel **[Command Channel]** *СПдС*
- Value of the control word **[Cmd Register]** *СПд* from the active command channel **[Command Channel]** *СПдС*
- Active reference frequency channel **[Ref Freq Channel]** *гFСС*
- Value of the reference frequency **[Pre-Ramp Ref Freq]** *FгН* from the active target channel **[Ref Freq Channel]** *гFСС*
- Value of the operating state word **[CIA402 State Reg]** *ЕЕН*
- Specific data for all available fieldbusses are in dedicated submenus.
- In the **[Command word image]** *СW ι -* submenu: control words from all channels
- In the **[Freq. ref. word map]** *гW ι -* submenu: reference frequency values produced by all channels

Control Word Display

The **[Command Channel]** *СПдС* parameter indicates the active command channel.

The **[Cmd Register]** *СПд* parameter indicates the hexadecimal value of the control word (CMD) used to control the drive.

The **[Command word image]** *СW ι -* submenu (**[Ethernet Embd cmd.]** *СПд 5*) parameter is used to display the hexadecimal value of the control word from the fieldbus .

Reference Frequency Display

The **[Ref Freq Channel]** *гFСС* parameter indicates the active channel for reference frequency.

The **[Ref Frequency]** *LFг* parameter indicates the value (in 0.1 Hz units) of the reference frequency used to control the drive.

The **[Freq. ref. word map]** *гW ι -* submenu (**[Ethernet Embd Ref Freq]** *LFг 5*) parameter is used to display the value (in 0.1 Hz units) of the reference frequency from the fieldbus.

Operating State Word Display

The **[CIA402 State Reg]** *ЕЕН* parameter gives the value of the operating state word (ETA).

The table provides the bit details of *ЕЕН* parameter:

Bit	Description
DRIVECOM	Status word
Bit0 = 1	Ready to switch on
Bit1 = 1	Switched on
Bit2 = 1	Operation enabled
Bit3 = 1	Operating state fault
Bit4 = 1	Power stage is switched on
Bit5 = 0	Quick stop
Bit6 = 1	Switch on disabled
Bit7 = 1	Warning
Bit8 = 1	Drivecom reserved
Bit9 = 0	Forced local mode in progress
Bit10 = 1	Reference value reached (steady state)
Bit11 = 1	Reference value exceeded (< LSP or > HSP)
Bit12	Reserved
Bit13	Reserved
Bit14 = 1	Stop imposed via **STOP** key
Bit15 = 0	Motor rotation in forward direction (or stopped)

Glossary

A

Abbreviations

Req. = Required

Opt. = Optional

C

CAN

Controller Area Network is an internally standardized serial bus system

COB

Communication Object. A unit of transportation in a CAN network. Data must be sent across a CAN Network inside a COB. There are 2048 different COB's in a CAN network. A COB can contain at most 8 bytes of data.

COB ID

Each COB is uniquely identified in a CAN network by a number called the COB Identifier (COB-ID).

D

Display terminal

The display terminal menus are shown in square brackets.

For example: **[Communication]**

The codes are shown in round brackets.

For example: $C \, o \, \Pi \, -$

Parameter names are displayed on the display terminal in square brackets.

For example: **[Fallback Speed]**

Parameter codes are displayed in round brackets.

For example: $L \, F \, F$

DP

Decentralized Periphery

DPWS

Device Profile for Web Service

E

Error

Discrepancy between a detected (computed, measured, or signaled) value or condition and the specified or theoretically correct value or condition.

F

Factory setting

Factory settings when the product is shipped

Fault

Fault is an operating state. If the monitoring functions detect an error, a transition to this operating state is triggered, depending on the error class. A "Fault reset" is required to exit this operating state after the cause of the detected error has been removed. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).

Fault Reset

A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.

L

LSB

Least Significant Byte

M

Monitoring function

Monitoring functions acquire a value continuously or cyclically (for example, by measuring) in order to check whether it is within permissible limits. Monitoring functions are used for error detection.

MS0, MS1

Number of a master in the network.

MSB

Most Significant Byte

N

NMT

Network Management. One of the service elements of the application layer in the CAN Reference Model. The NMT serves to configure, initialize, and handle detected errors in a CAN network.

P

Parameter

Device data and values that can be read and set (to a certain extent) by the user.

PDO

Process Data Object

PELV

Protective Extra Low Voltage, low voltage with isolation. For more information: IEC 60364-4-41

PLC

Programmable logic controller

PNO

PROFIBUS Nutzerorganisation e.V. (PROFIBUS User organization).

Power stage

The power stage controls the motor. The power stage generates current for controlling the motor.

Q

QoS

Quality of Service

Quick Stop

The quick Stop function can be used for fast deceleration of a movement as a response to a detected error or via a command.

R

RPDO

Receive PDO

S

SNMP

Simple Network Management Protocol

SNTP

Simple Network Time Protocol

SYNC

Synchronization Object

T

TPDO

Transmit PDO

W

Warning

If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning does not cause a transition of the operating state.

Z

Zone of operation

This term is used in conjunction with the description of specific hazards, and is defined as it is for a **hazard zone** or **danger zone** in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.