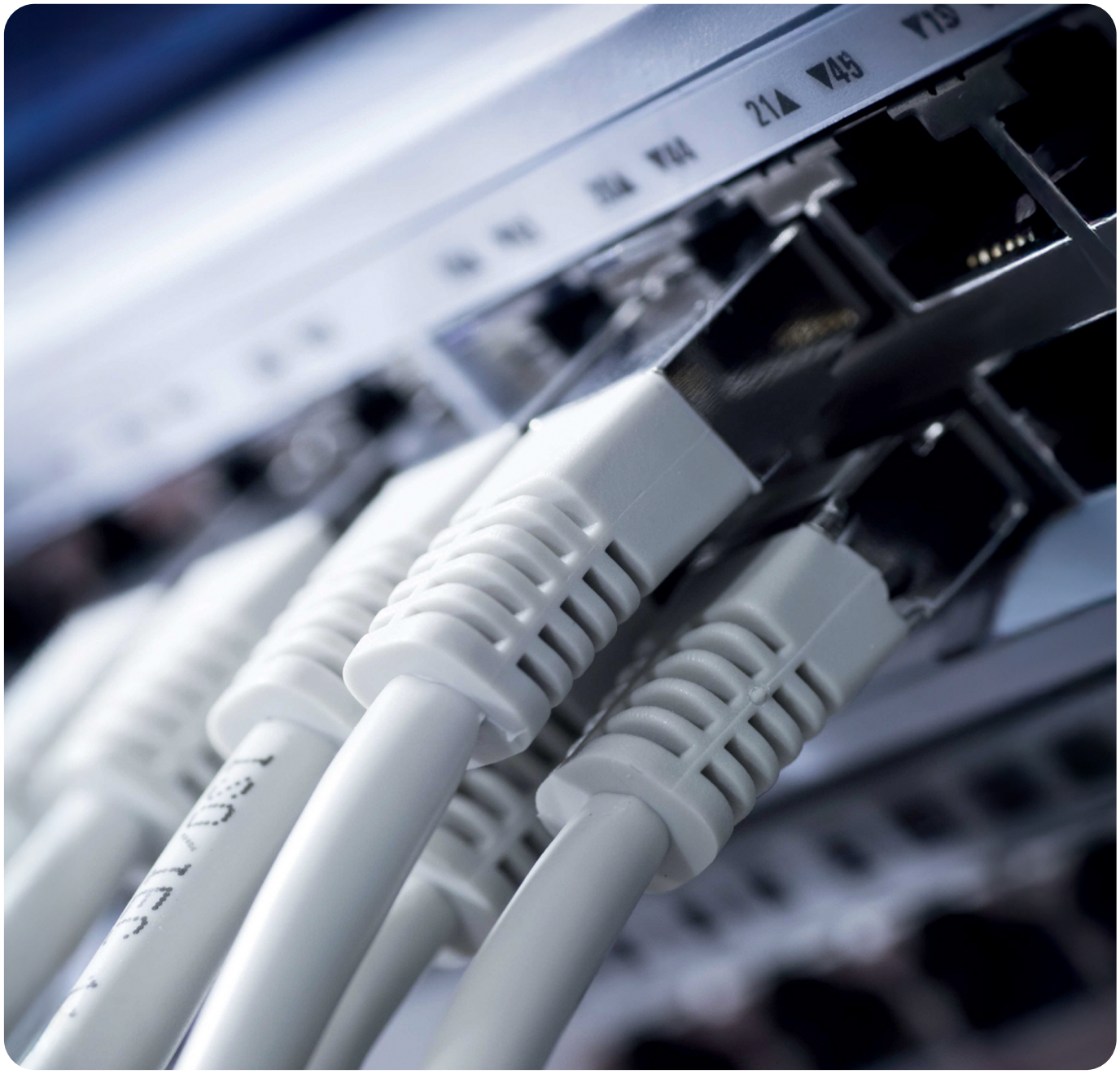
Programming Guide

VLT® EtherNet/IP MCA 121

VLT® HVAC Drive FC 102, VLT® Refrigeration Drive FC 103, VLT® AQUA Drive FC 202, VLT® AutomationDrive FC 301/FC 302, VLT® Decentral Drive FCD 302



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1 Introduction

1.1 Purpose of the Programming Guide

This programming guide provides information about configuring the system, controlling the drive, accessing parameters, programming, and troubleshooting.

The programming guide is intended for use by qualified personnel familiar with VLT® drives, with EtherNet/IP technology, and with the PC or PLC used as a master in the system.

Read the instructions before programming and follow the procedures in this guide.

1.2 Trademarks

VLT® is a registered trademark for Danfoss A/S.

EtherNet/IP™ is a trademark of ODVA, Inc.

1.3 Additional Resources

Resources available for the drives and for optional equipment:

- The drive-specific operating guide provides the necessary information for getting the drive ready for operation.
- The drive-specific design guide provides detailed information about capabilities and functionality to design motor control systems.
- The drive-specific programming guide provides greater details on working with parameters.
- The *VLT® Ethernet Fieldbuses MCA 12X Installation Guide* provides information about installing and troubleshooting the EtherNet/IP interface.
- The *VLT® EtherNet/IP MCA 121 Installation Guide* provides information about network topology, mounting, electrical installation, and a short troubleshooting.
- The *VLT® Motion Control Tool MCT 10 Operating Guide* provides information for installation and use of the software on a PC.

Supplementary publications and guides are available from Danfoss. See www.danfoss.com for listings.

1.4 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome.

The original language of this guide is English.

Table 1: Document and Software Versions

Edition	Remarks	Software version
AU554619617010, version 0101	First release	7.00

1.5 Product Overview

1.5.1 Intended Use

This guide relates to the EtherNet/IP interface.

Code number:

- 130B1119 (uncoated)
- 130B1219 (conformal coated)

The VLT® EtherNet/IP MCA 121 interface is designed to communicate with any system complying with the CIP EtherNet/IP standard. EtherNet/IP provides network tools to deploy standard Ethernet technology for manufacturing applications while enabling internet and enterprise connectivity.

VLT® EtherNet/IP MCA 121 is intended for use with:

- VLT® HVAC Drive FC 102.
- VLT® Refrigeration Drive FC 103.
- VLT® AQUA Drive FC 202.
- VLT® AutomationDrive FC 301/FC 302.
- VLT® Decentral Drive FCD 302.

1.6 Approvals and Certifications

More approvals and certifications are available. For more information, contact a local Danfoss partner.

1.7 Disposal



Do not dispose of equipment containing electrical components together with domestic waste.
Collect it separately in accordance with local and currently valid legislation.

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2 Safety

2.1 Safety Symbols

The following symbols are used in Danfoss documentation and products.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

	ISO warning symbol for general warnings
	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	Symbol for indicating the required discharge time of the capacitors in the product.
	ISO action symbol for referring to the instructions

2.2 Qualified Personnel

To allow trouble-free and safe operation of the unit, only qualified personnel with proven skills are allowed to transport, store, assemble, install, program, commission, maintain, and decommission this equipment.

Persons with proven skills:

- Are qualified electrical engineers, or persons who have received training from qualified electrical engineers and are suitably experienced to operate devices, systems, plants, and machinery in accordance with pertinent laws and regulations.
- Are familiar with the basic regulations concerning health and safety/accident prevention.
- Have read and understood the safety guidelines given in all manuals provided with the unit, especially the instructions given in the operating guide.
- Have a good knowledge of the generic and specialist standards applicable to the specific application.
- Are cleared by the asset owner to have access to the work zone according to the security level in the zone.

2.3 Safety Precautions

⚠ WARNING

LACK OF SAFETY AWARENESS

This guide provides important information on preventing injury and damage to the equipment or the system. Ignoring this information can lead to death, serious injury, or severe damage to the equipment.

- Make sure to fully understand the dangers and safety measures present in the application.
- Before performing any electrical work on the drive, lock out and tag out all power sources to the drive.

⚠ WARNING



HAZARDOUS VOLTAGE

Drives contain hazardous voltage when connected to the AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- Only qualified personnel must perform installation, start-up, and maintenance.

⚠ WARNING

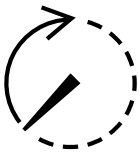
UNINTENDED START

When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time. The motor may start by activation of an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using VLT® Motion Control Tool MCT 10, or after a cleared fault condition. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage.

- Disconnect the drive from the mains.
- Press *[Off/Reset]* on the LCP before programming parameters.
- Ensure that the drive is fully wired and assembled when it is connected to AC mains, DC supply, or load sharing.

⚠ WARNING





DISCHARGE TIME

The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.

Failure to wait the specified time after power has been removed before performing service or repair work could result in death or serious injury.

- Stop the motor.
- Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery backups, UPS, and DC-link connections to other drives.
- Wait for the capacitors to discharge fully before performing any service or repair work. The discharge time is specified on the drive product label.
- Before performing any service or repair work, use a measuring device to make sure that capacitors are fully discharged.

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⚠ WARNING



ELECTRICAL SHOCK HAZARD - HIGH LEAKAGE CURRENT

Leakage currents exceed 3.5 mA. Failure to connect the system properly to protective earth may result in death or serious injury.

- Ensure reinforced protective earthing conductor according to IEC 60364-5-54 cl. 543.7 or according to local safety regulations for high touch current equipment. The reinforced protective earthing of the converter can be done with:
- PE conductor with a cross-section of at least 10 mm^2 Cu or 16 mm^2 Al.
- PE conductor completely enclosed within an enclosure or otherwise protected throughout its length against mechanical damage.

⚠ WARNING



INTERNAL FAILURE HAZARD

An internal failure in the drive can result in serious injury when the drive is not properly closed.

- Ensure that all safety covers are in place and securely fastened before applying power.

3 Configuration

3.1 IP Settings

All IP-related parameters are in parameter group ***12-0* IP Settings***:

- Parameter ***12-00 IP Address Assignment***
- Parameter ***12-01 IP Address***
- Parameter ***12-02 Subnet Mask***
- Parameter ***12-03 Default Gateway***
- Parameter ***12-04 DHCP Server***
- Parameter ***12-05 Lease Expires***
- Parameter ***12-06 Name Servers***
- Parameter ***12-07 Domain Name***
- Parameter ***12-08 Host Name***
- Parameter ***12-09 Physical Address***

There are 2 ways of assigning IP addresses, see 3.2 Assigning IP Addresses Manually and 3.3 Assigning IP Address Automatically.

3.2 Assigning IP Addresses Manually

1. Set parameter ***12-00 IP Address Assignment*** to ***[0] Manual***.
2. Set parameter ***12-01 IP Address*** to 192-168-0.xxx.[1]
3. Set parameter ***12-02 Subnet Mask*** to 255.255.255.0
4. Optionally, set parameter ***12-03 Default Gateway***.
5. Power cycle the drive.

3.3 Assigning IP Address Automatically

When assigning IP addresses automatically, parameters ***12-01 IP Address*** to ***12-03 Default Gateway*** become read-only parameters.

1. Set parameter ***12-00 IP Address Assignment*** to ***[1] DHCP*** or ***[2] BOOTP***.

3.4 DHCP/BOOTP Servers

When the IP address is assigned via DHCP/BOOTP server, the assigned IP address and subnet mask can be read out in parameter ***12-01 IP Address*** and parameter ***12-02 Subnet Mask***.

Parameter ***12-04 DHCP Server*** shows the IP address of the DHCP or BOOTP server found.

For DHCP only: Read out the remaining lease time in parameter ***12-05 Lease Expires***.

Parameter ***12-09 Physical Address*** reads out the MAC address of the option, which is also printed on the label of the option. If using fixed leases with DHCP or BOOTP, the physical MAC address is linked with a fixed IP address.

> NOTE: If no DHCP or BOOTP reply has been received after 4 attempts, for example, if the DHCP/BOOTP server has been powered off, the option falls back to the last good known IP address.

Parameter ***12-03 Default Gateway*** is optional and only used in routed networks.

Parameters ***12-06 Name Servers*** to parameter ***12-08 Host Name*** are used with Domain Name Server systems and are all optional. If DHCP or BOOTP is selected as IP address assignment, the parameters are read only.

1) Class C IP addresses are just examples. Any valid IP address can be entered.

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3.5 Ethernet Link Parameters

The following parameters provide Ethernet link information:

- Parameter ***12-10 Link Status***
- Parameter ***12-11 Link Duration***
- Parameter ***12-12 Auto Negotiation***
- Parameter ***12-13 Link Speed***
- Parameter ***12-14 Link Duplex***

NOTE: The Ethernet link parameters are unique per port.

Parameter ***12-10 Link Status*** and parameter ***12-11 Link Duration*** show information on the link status per port. Parameter ***12-10 Link Status*** shows ***[0] No Link*** or ***[1] Link*** according to the status of the present port.

Parameter ***12-11 Link Duration*** shows the duration of the link on the present port. If the link is broken, the counter resets.

Parameter ***12-12 Auto Negotiation*** is a feature that enables 2 connected Ethernet devices to select a common transmission parameter, such as speed and duplex mode. In this process, the connected devices first share their capabilities for these parameters and then select the fastest transmission mode that they both support. By default, this function is enabled. Incapability between the connected devices may lead to decreased communication performance. To avoid decreased performance, disable auto negotiation.

If parameter ***12-12 Auto Negotiation*** is set to ***[0] Off***, link speed and duplex mode can be configured manually in parameter ***12-13 Link Speed*** and parameter ***12-14 Link Duplex***.

Parameter ***12-13 Link Speed*** shows/sets the link speed per port. If no link is present, none is shown.

Parameter ***12-14 Link Duplex*** shows/sets the duplex mode per port:

- Half duplex provides communication in both directions, but only in 1 direction at a time (not simultaneously).
- Full duplex allows communication in both directions, and unlike half duplex, it allows simultaneous communication in both directions.

3.6 Scanner Configuration

3.6.1 EDS File

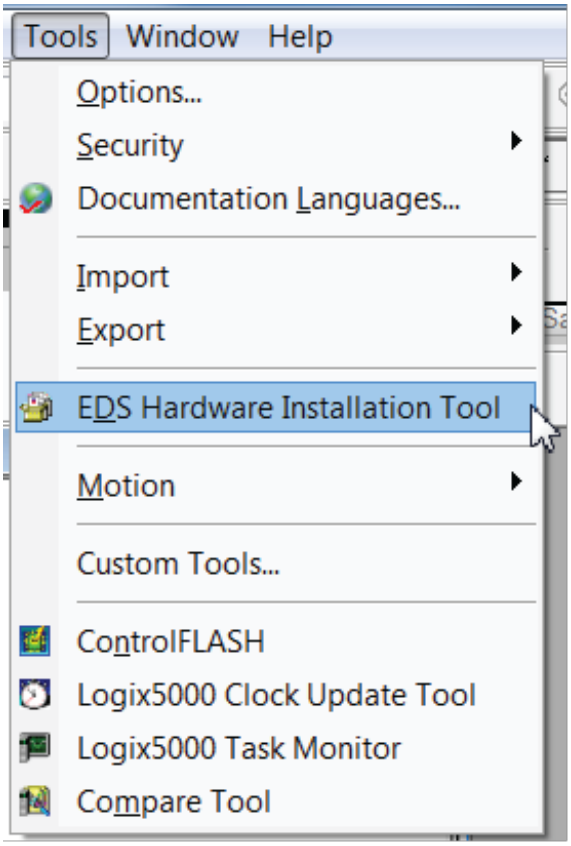
Danfoss provides an English EDS (electronic datasheet) file covering all voltage and power sizes for offline configuration.

The EDS file can be downloaded from: www.danfoss.com.

3.6.2 Configuring a Rockwell Master

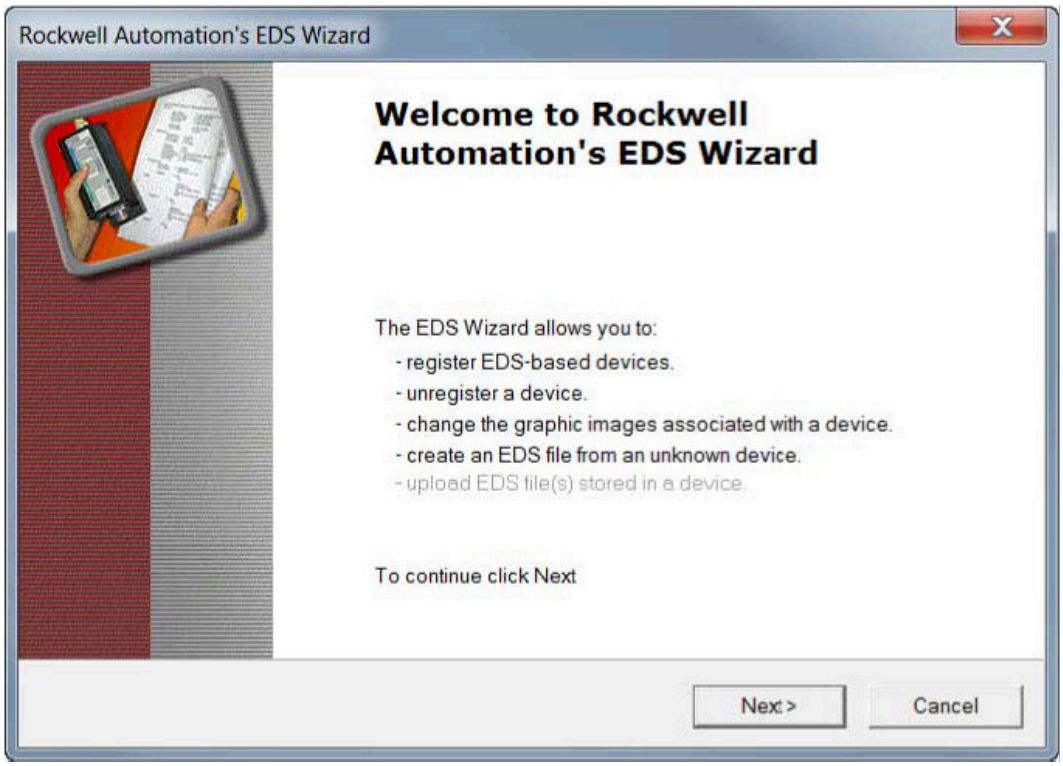
To configure a Rockwell (Allen-Bradley) scanner to operate with an EtherNet/IP device, install the EDS file using the EDS hardware installation tool.

1. In *Rockwell EDS Hardware Installation Tool*, go to *Tools* > *EDS Hardware Installation Tool*.



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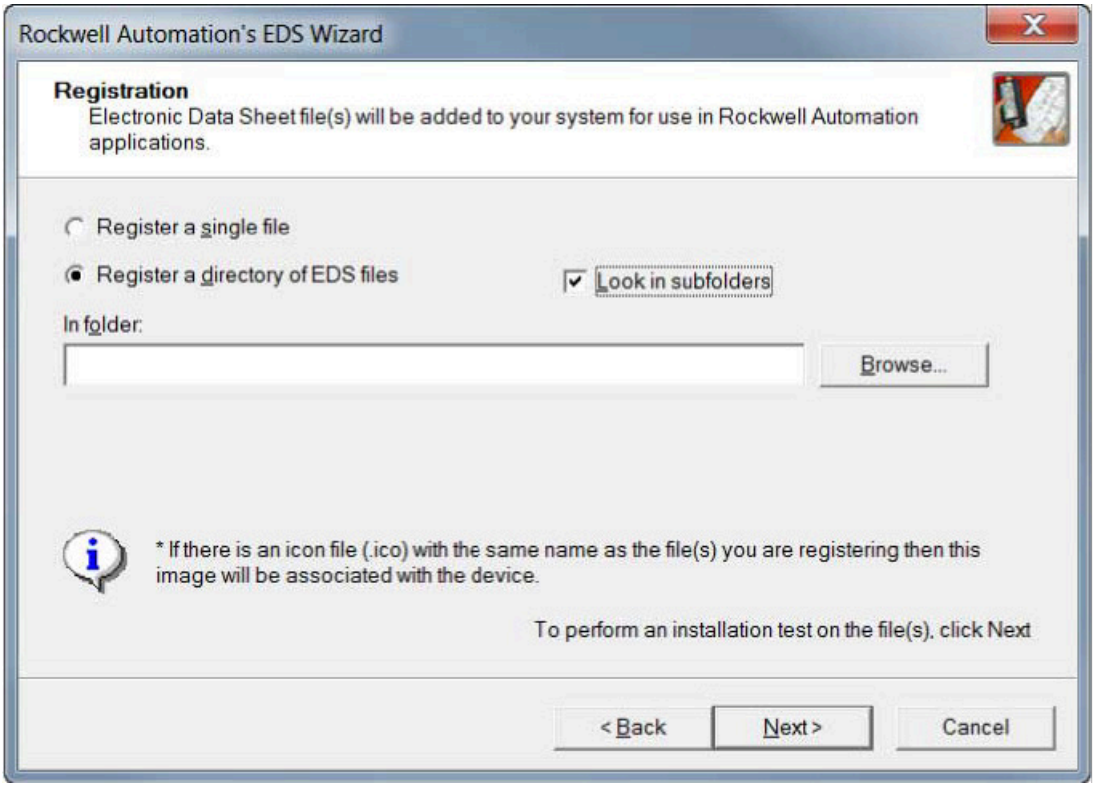
2. Click *Next* to start the EDS wizard tool.



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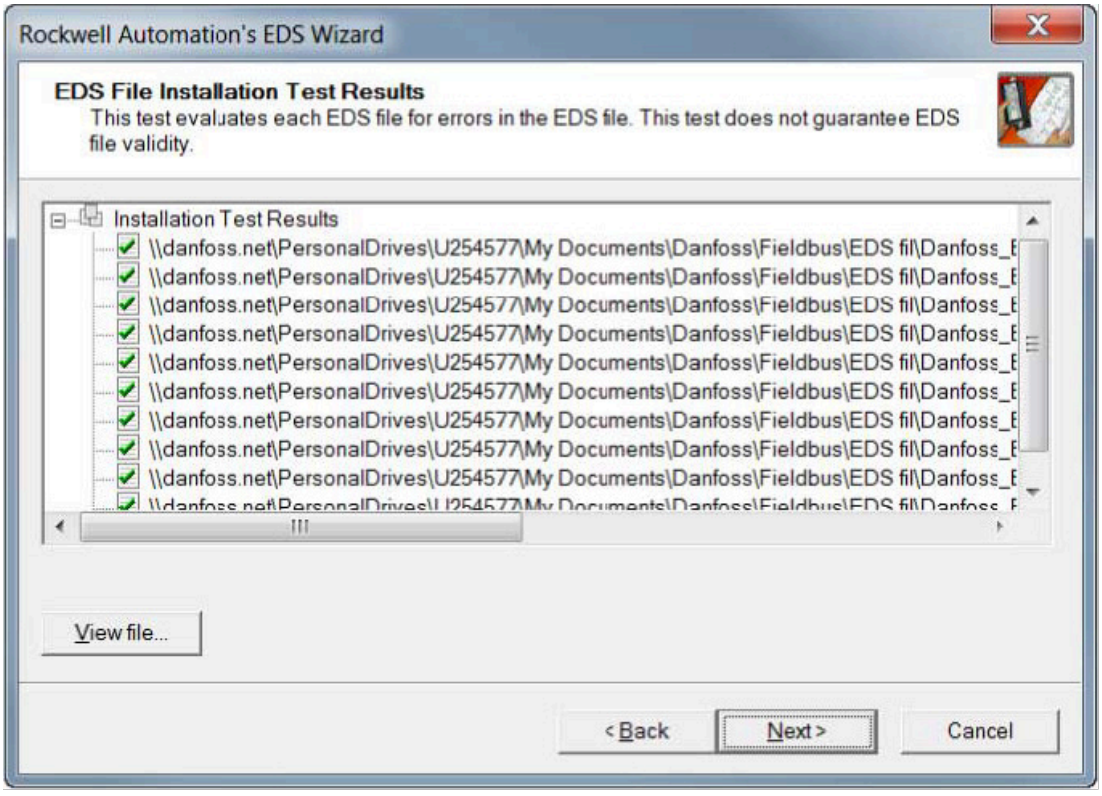
3. Select *Register a directory of EDS files* and click *Next* to register the directory containing the EDS files.

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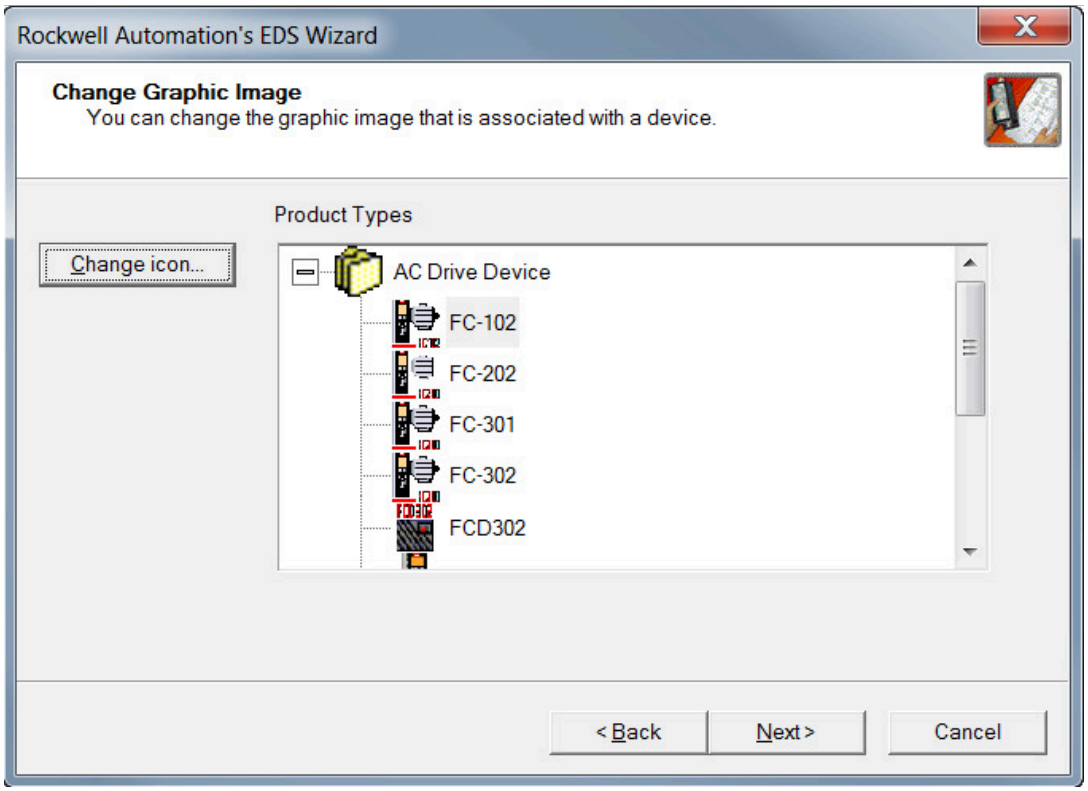
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4. Select the directory containing the EDS files and click *Next* to test for errors in each of the EDS files.



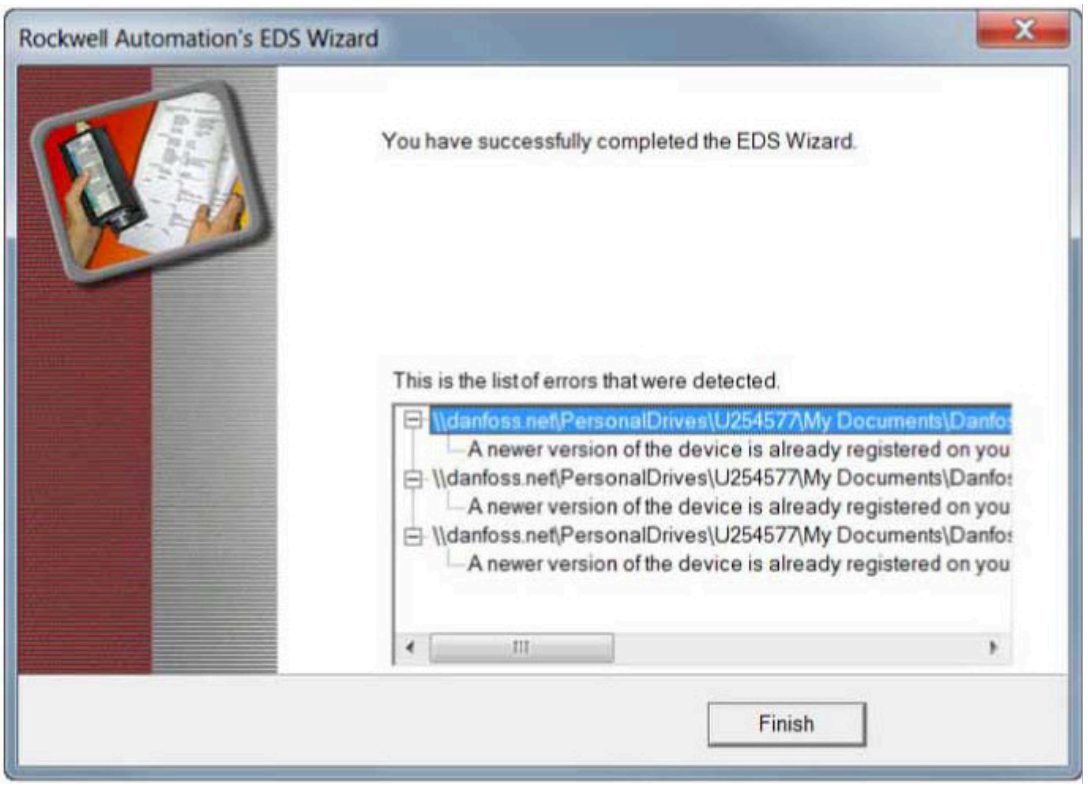
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5. Optional: It is possible to change the icon associated with a device. Click the device, click *Change icon* > *Next*.



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6. Click *Finish* after completion of the EDS wizard.



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3.6.3 Configuration Example with a Rockwell Scanner

The following example sets up the configuration between a Rockwell scanner and a VLT® drive, where the I/O assembly 100/150 is used.

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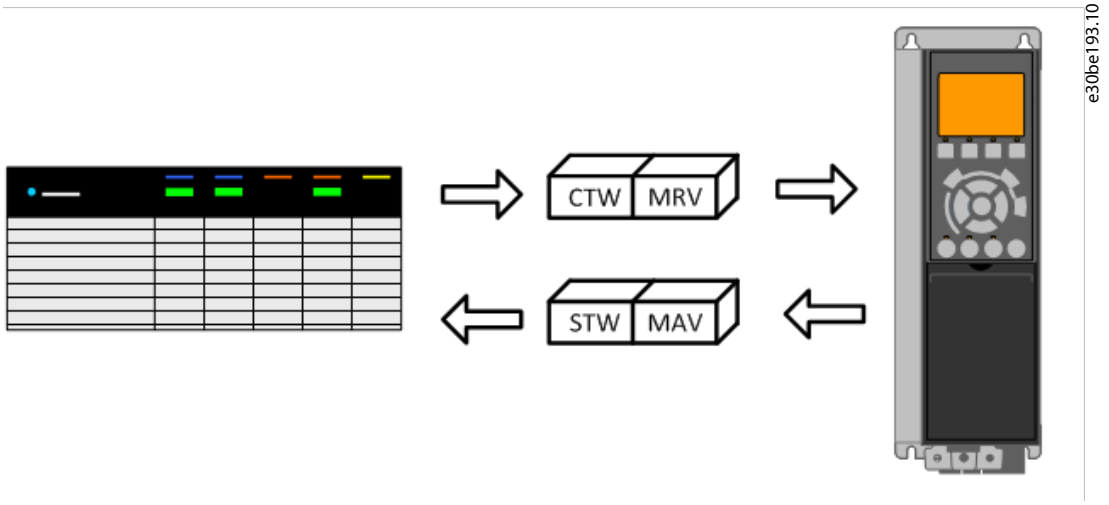


Figure 1: Configuration Example Between a Rockwell Scanner and a VLT® Drive

The scanner sends 2 words. The 1st word is the control word (CTW) of the drive, and the 2nd word is the main reference value (MRV). The drive sends 2 words to the scanner. The 1st word is the status word (STW), and the 2nd word is the main actual value (MAV), which is the actual speed.

The drive has the IP address 192.168.0.121, and the data is updated cyclical every 20 ms in each direction (RPI = 20 ms). To get the best network performance, the data is sent unicast between the scanner and the drive.

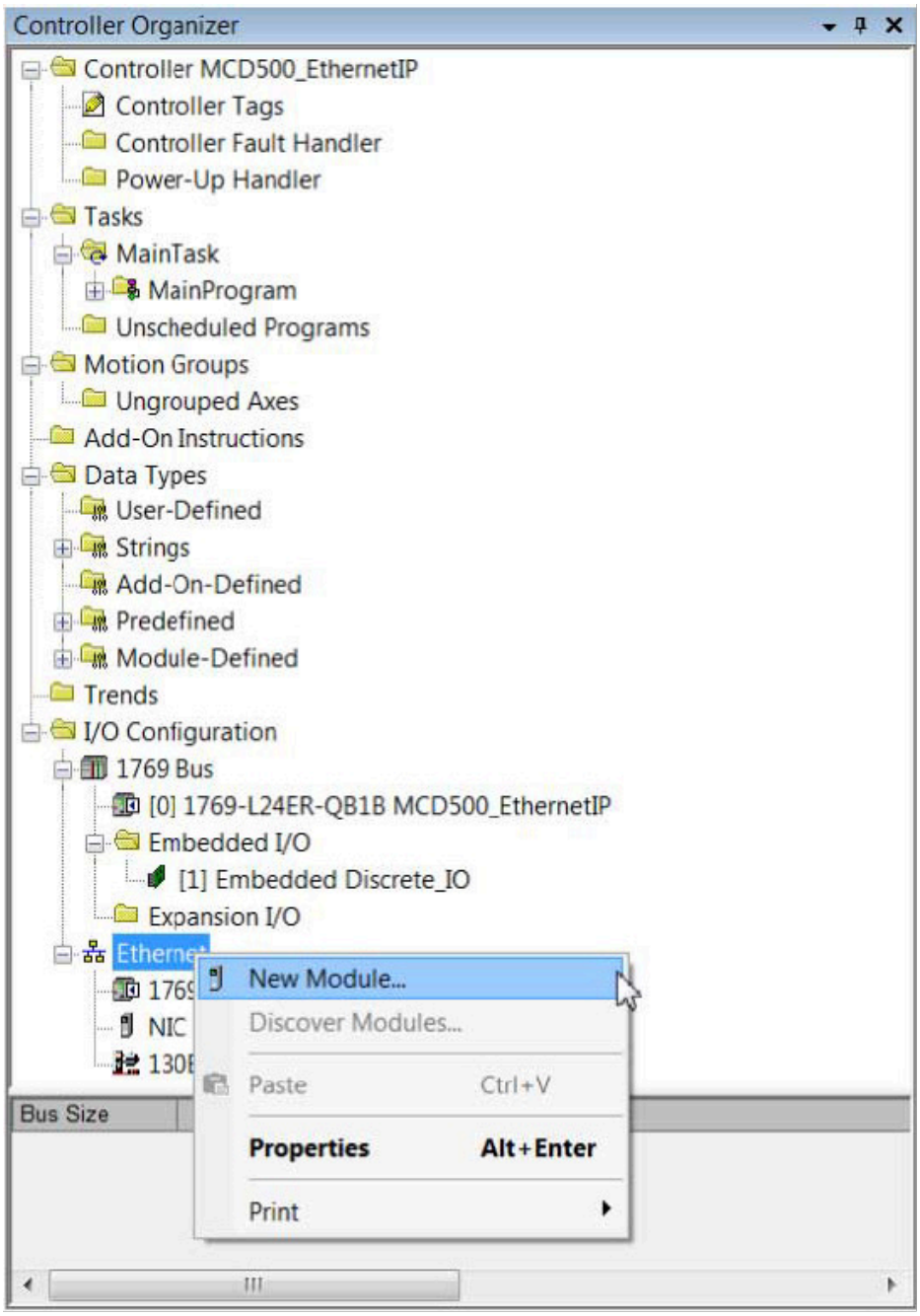
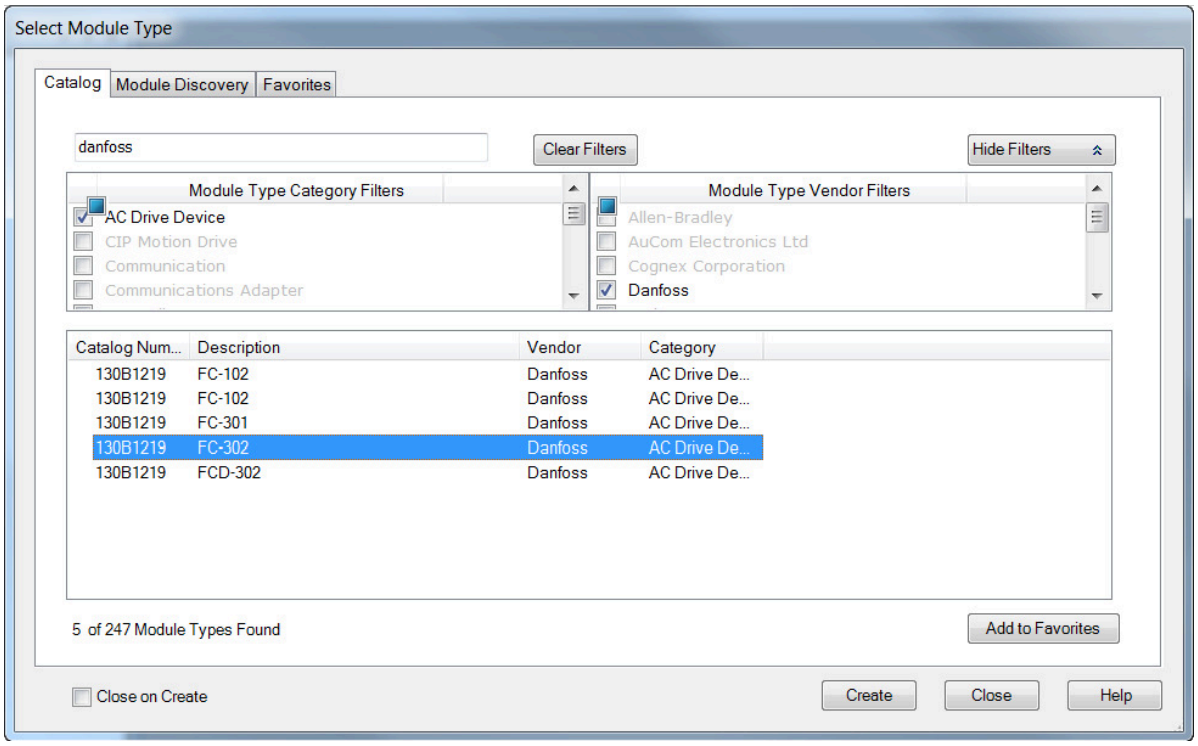


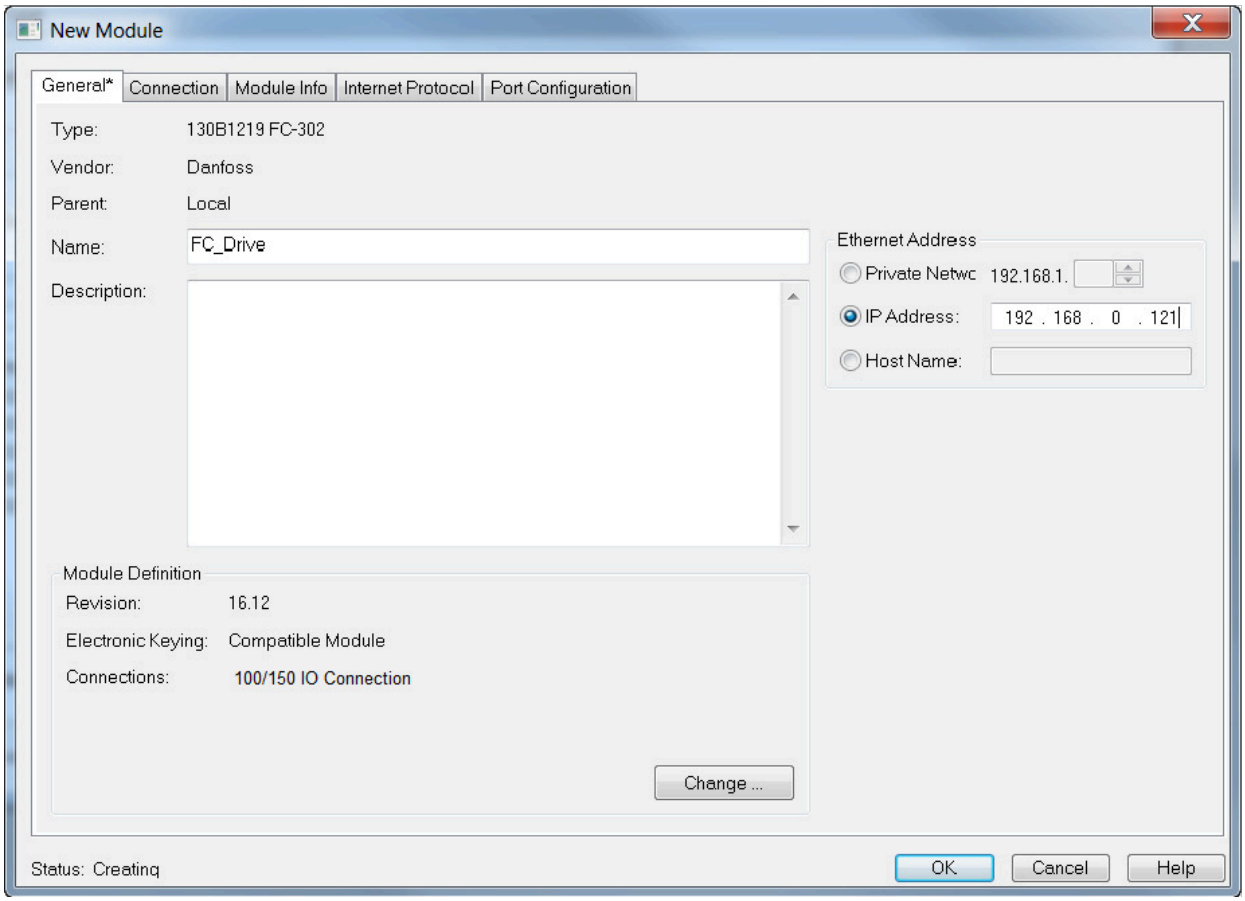
Figure 2: Adding a Drive to the Scanner

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Figure 3: Limiting the Number of Devices in the Catalog View



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Figure 4: Naming the Drive and Assigning the IP Address

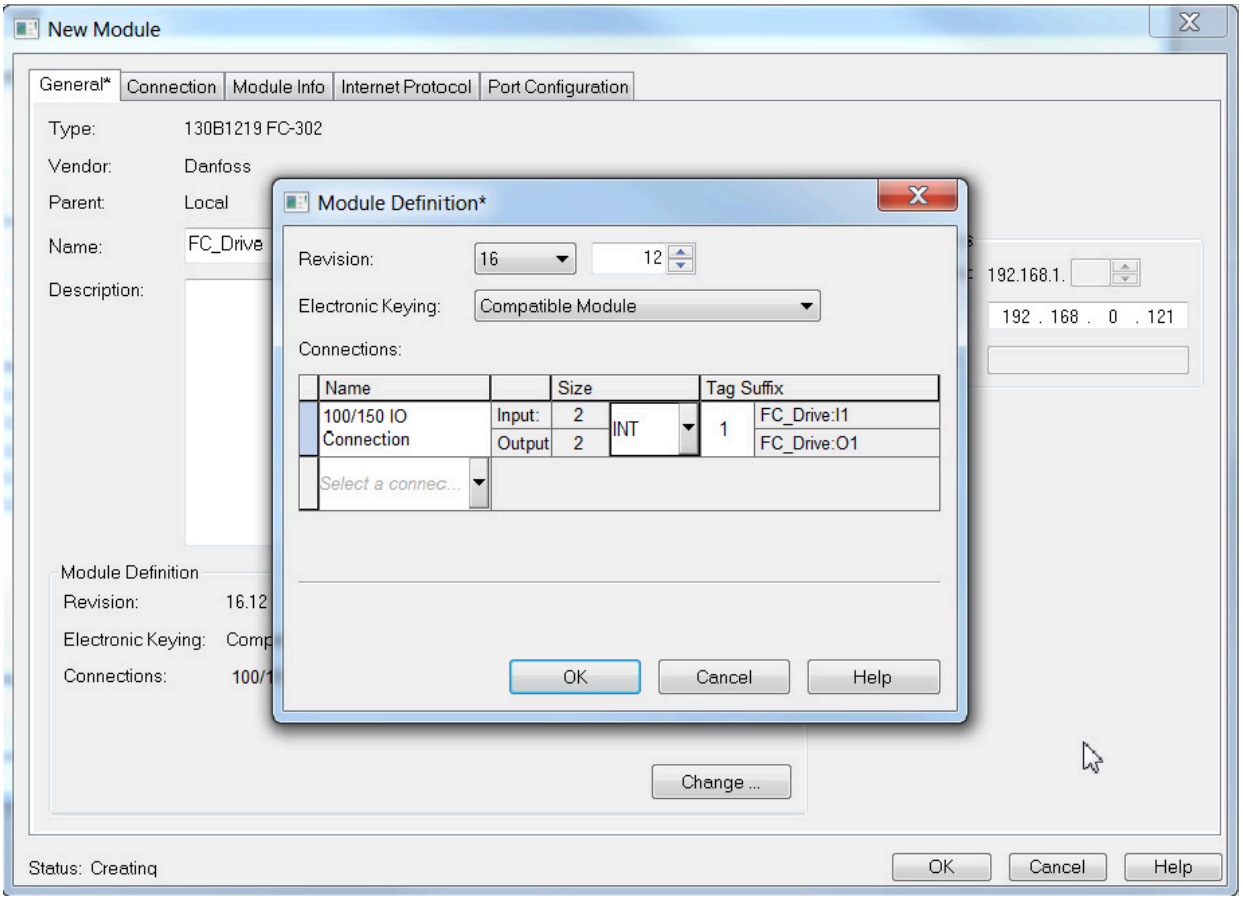


Figure 5: Selecting the Change Option in the Module Definition Part

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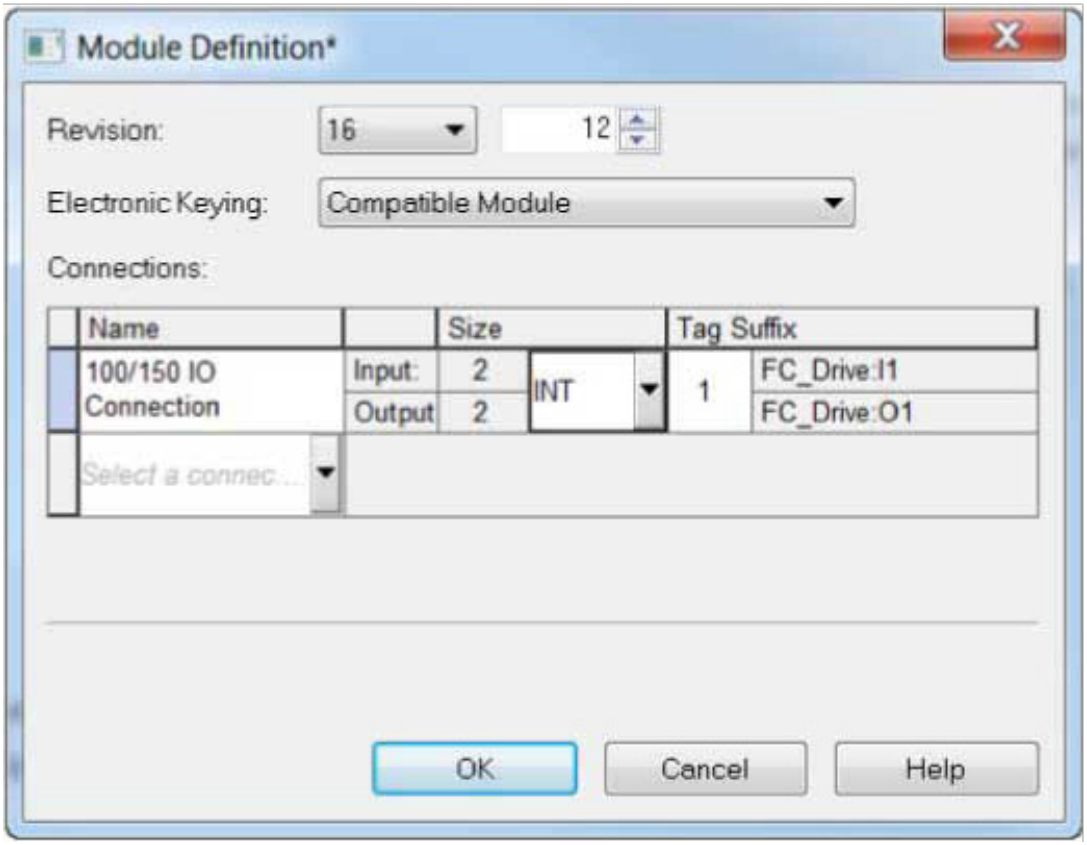


Figure 6: Changing the Settings

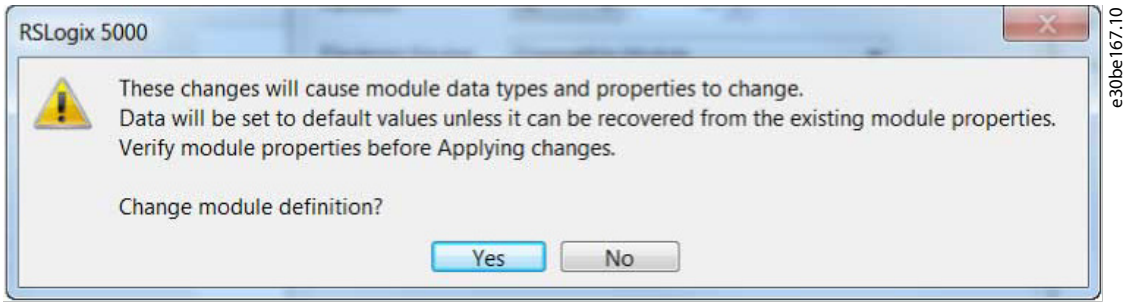


Figure 7: Changing the Connection Properties

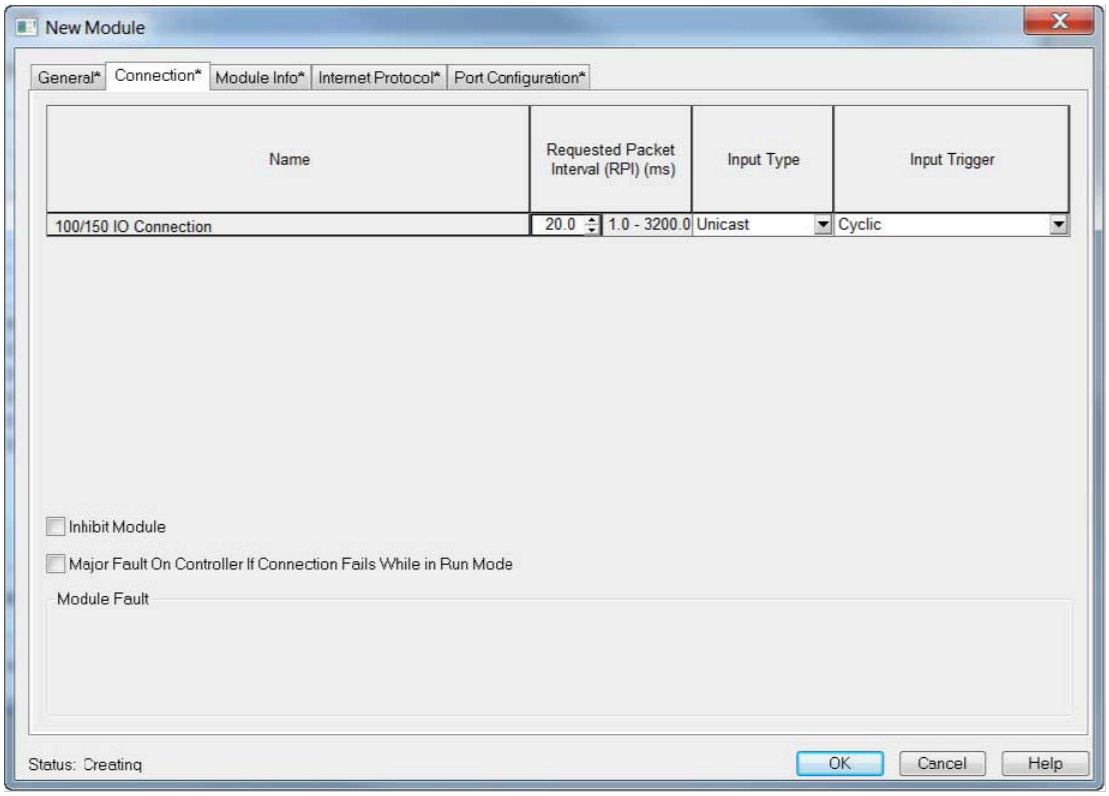


Figure 8: Setting the RPI, Input Type, and Input Trigger

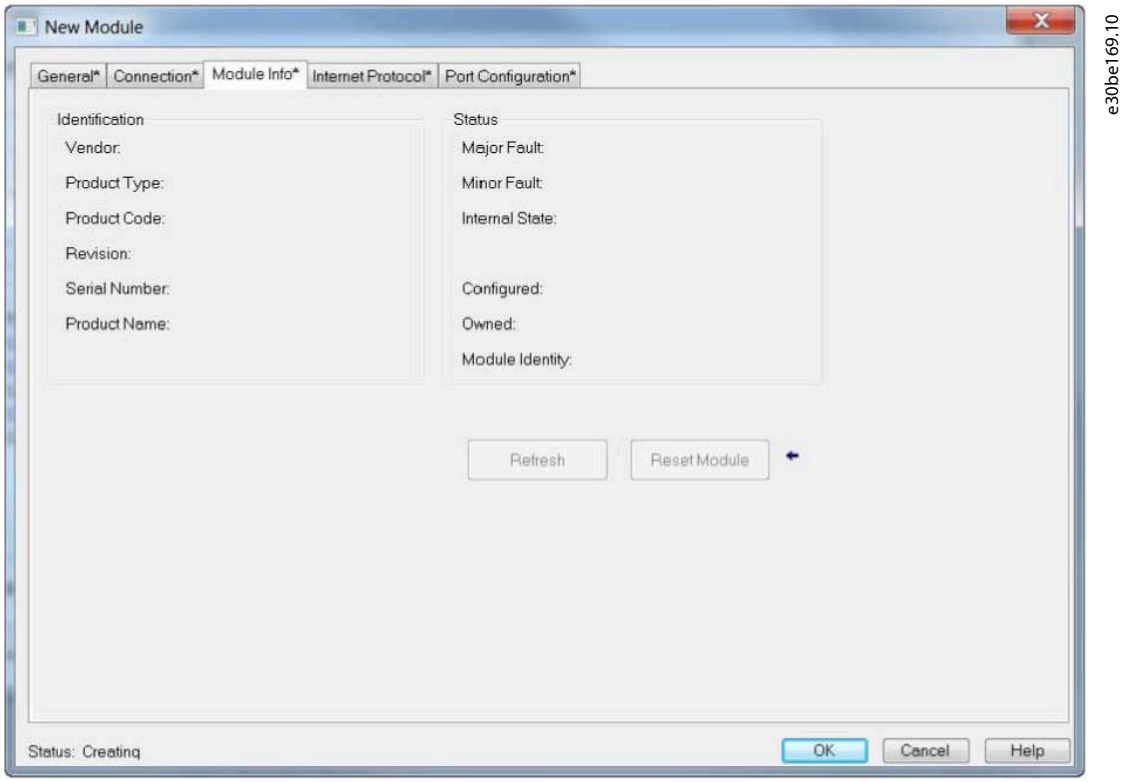
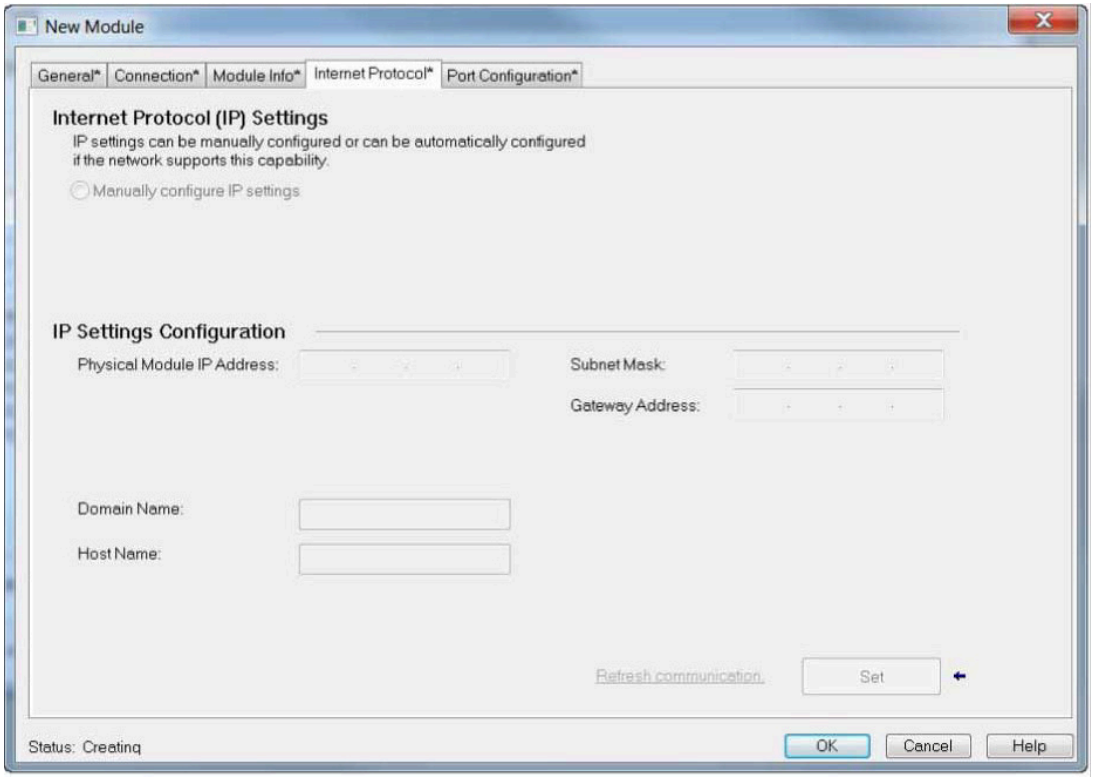


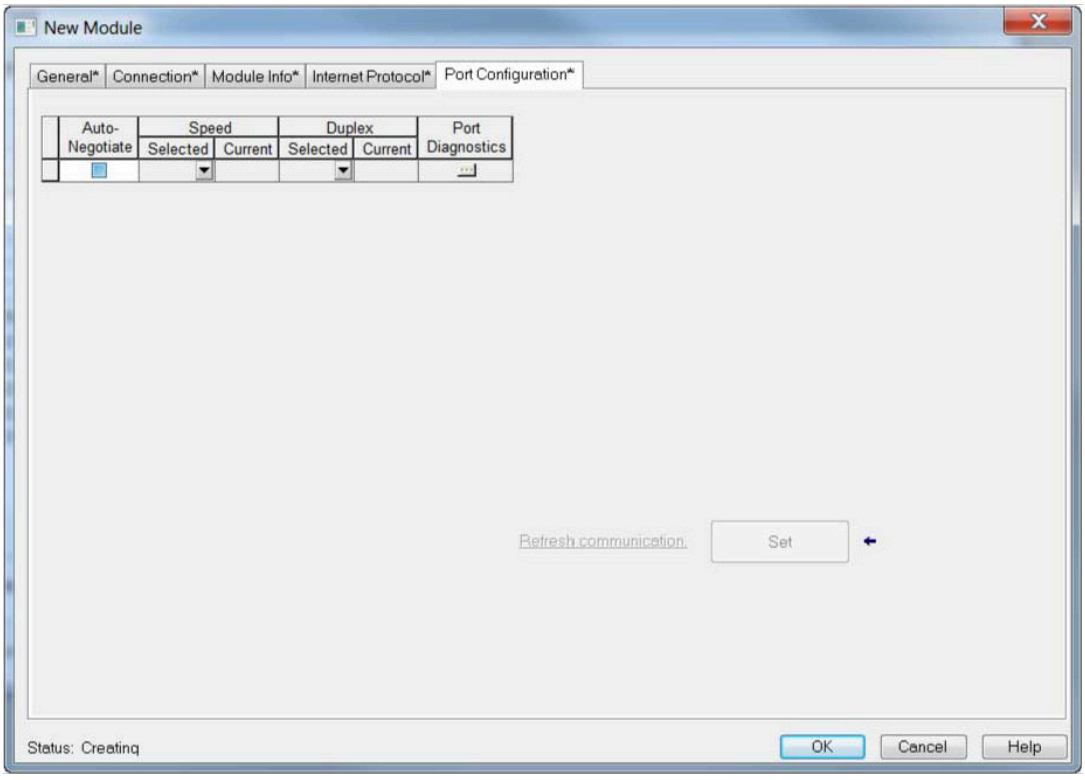
Figure 9: Actual Values of the Drive

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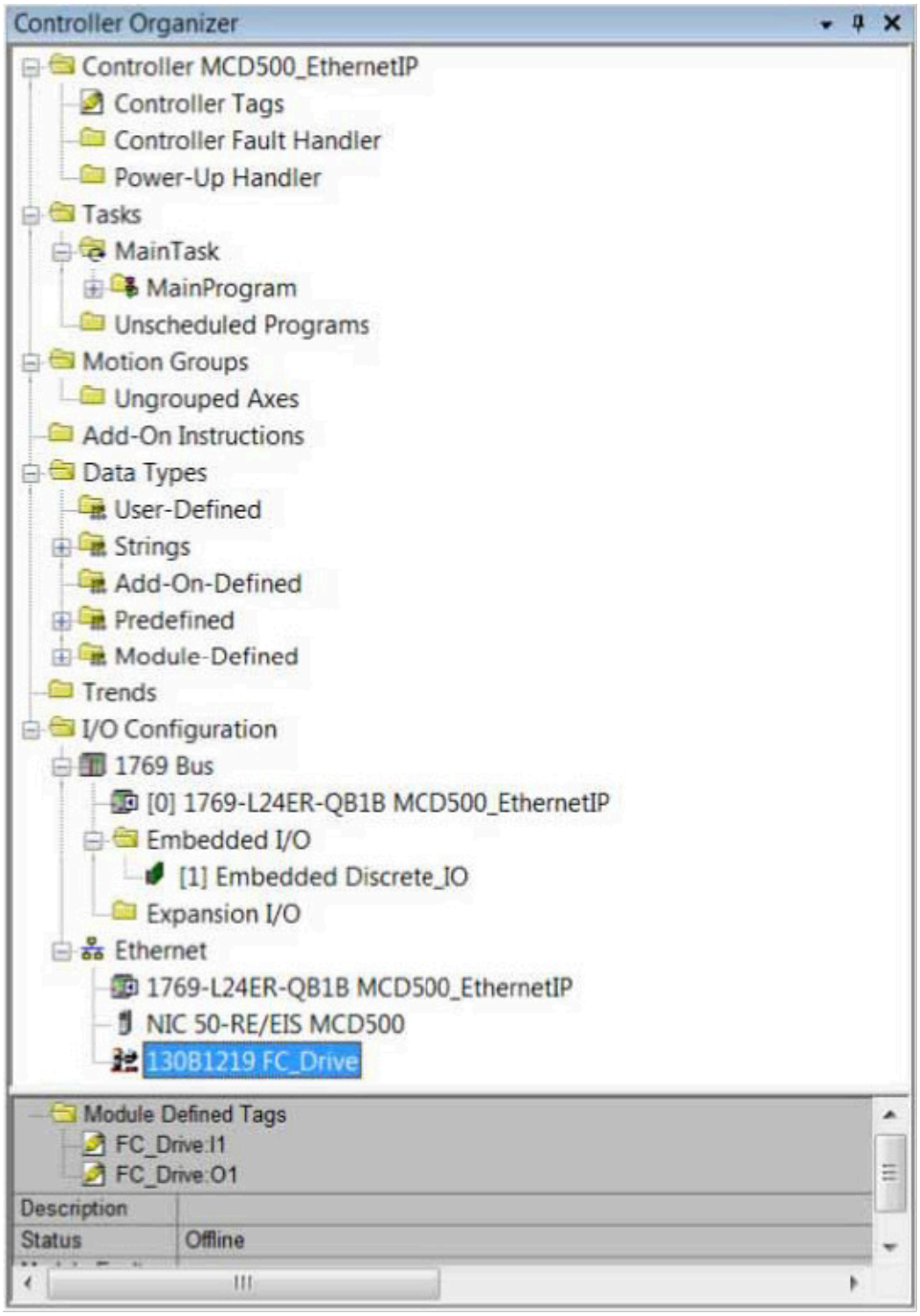
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Figure 10: Online IP Address Settings of the Drive



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Figure 11: Online Port Configuration of the Drive



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Figure 12: Drive Successfully Created in Hardware Configuration

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Name	Value	Force Mask	Style	Data Type	Description
FC_Drive:I1	{...}	{...}		_0061:130B121...	
FC_Drive:I1.ConnectionFaulted	0		Decimal	BOOL	
FC_Drive:I1.Data	{...}	{...}	Decimal	INT[2]	
FC_Drive:I1.Data[0]	0		Decimal	INT	Status Word
FC_Drive:I1.Data[1]	0		Decimal	INT	Main Actual Value
FC_Drive:O1	{...}	{...}		_0061:130B121...	
FC_Drive:O1.Data	{...}	{...}	Decimal	INT[2]	
FC_Drive:O1.Data[0]	0		Decimal	INT	Control Word
FC_Drive:O1.Data[1]	0		Decimal	INT	Main Reference Value

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Figure 13: Tags for the Drive Created in the Controller Tags-window

3.7 IP Traffic

The use of Ethernet-based network for industrial automation purposes requires careful and thorough network design. Especially the use of active network components like switches and routers requires detailed know-how about the behavior of IP traffic.

Multicast/unicast

Multicast traffic is addressed to several recipients. Each host processes the received multicast packet to determine if it is the target for the packet. If not, the IP package is discarded. This causes an excessive network load of each node in the network since they are flooded with multicast packages. The nature of EtherNet/IP traffic is that all originator-to-target is unicast (point-to-point), but target-to-originator traffic is optional multicast. This enables several listen-only connections to a single host. The VLT® EtherNet/IP MCA 121 supports both multicast and unicast traffic.

In switched networks, hosts also have the risk of becoming flooded with multicast traffic. A switch usually forwards traffic by MAC address tables built by looking into the source address field of all the frames that it receives. A multicast MAC address is never used as a source address for a packet. Such addresses do not appear in the MAC address table, and the switch has no method for learning them, so it forwards all multicast traffic to all connected hosts.

IGMP

IGMP (Internet Group Management Protocol) is an integrated part of IP. It allows hosts to join or leave a multicast host group. Group membership information is exchanged between a specific host and the nearest multicast router.

For EtherNet/IP networks, the switches used must support IGMP snooping. IGMP snooping enables the switch to listen in on the IGMP conversation between hosts and routers. The switch then recognizes which hosts are members of which groups, thus being able to forward multicast traffic only to the appropriate hosts.

Redundancy

For an Ethernet network to function properly, only 1 active path can exist between 2 nodes. Spanning-tree protocol is a link management protocol that provides path redundancy while preventing undesirable loops in the network. When loops occur, some switches see stations appearing on both sides. This condition confuses the forwarding algorithm and allows duplicate frames to be forwarded.

4 Control

4.1 I/O Assembly Instances

I/O assembly instances are defined process control objects with defined content comprising control and status information. Unlike DeviceNet, it is possible to run with asymmetrical instances. For example, 101/153 = 8 bytes/20 bytes.

It is not possible to mix instances across profiles, for example, 20/100. Assembly instances must be consistent to the ODVA or drive profile.

Table 2: I/O Assembly Instance Options for Controlling and Monitoring the Drive

Profile (parameter 8-10 Control Word Profile)	Direction	Instances (decimal)	Size (bytes)	Data
ODVA	Originator⇒Target	20	4	CTW (20) | REF
		21	4	CTW (21) | REF
	Target⇒Originator	70	4	STW (70) | MAV
		71	4	STW (71) | MAV
Drive	Originator⇒Target	100	4	CTW (FC) | REF
		101	8	CTW (FC) | REF | PCD [2] | PCD [3]
		103	20	CTW (FC) | REF | PCD [2] | .... | PCD [9]
	Target⇒Originator	150	4	STW (FC) | MAV
		151	8	STW (FC) | MAV | PCD [2] | PCD [9]
		153	20	STW (FC) | MAV | PCD [2] | .... | PCD [9]

NOTE: Use of 32-bit process data: To configure a 2-word (32-bit) parameter read/write, use 2 consecutive arrays in parameter ***12-21 Process Data Config Write*** and parameter ***12-22 Process Data Config Read***, like [2]+[3], [4]+[5], [6]+[7], and so on. Read/write of 2-word values in arrays like [3]+[4], [5]+[6], [7]+[8] is not possible.

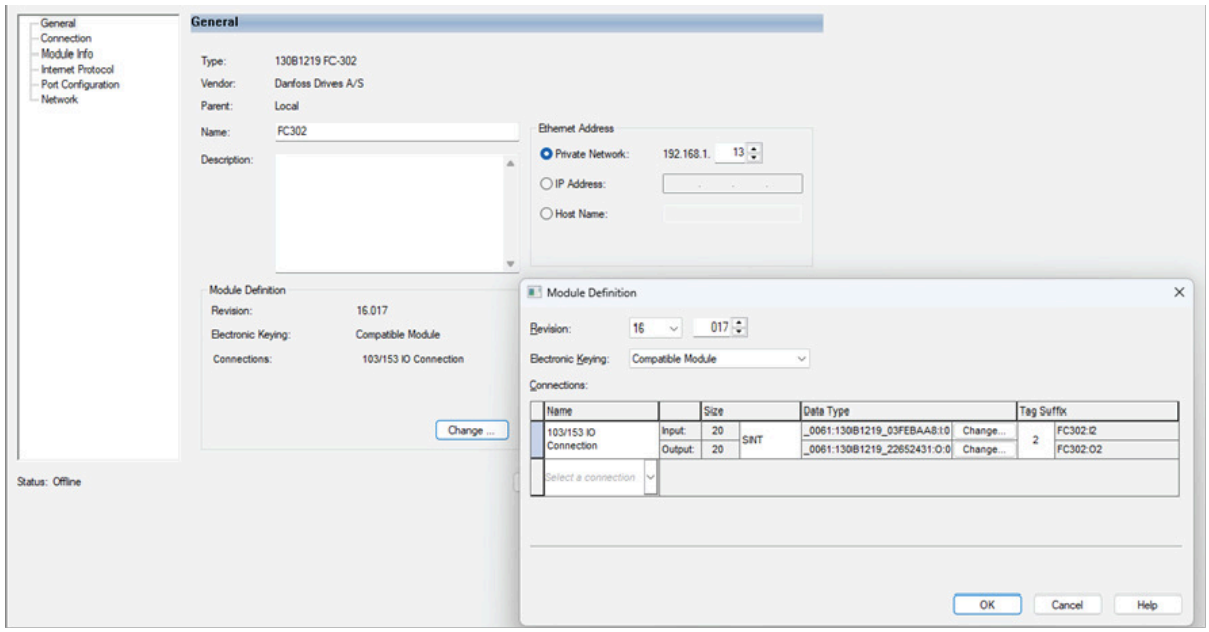
4.2 Auto Configuration Functionality

It is possible to configure all 10 read and write PCDs from the PLC using the drive I/O configuration.

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NOTE: The PCD read and write configuration is only available for the I/O connection 103/153.

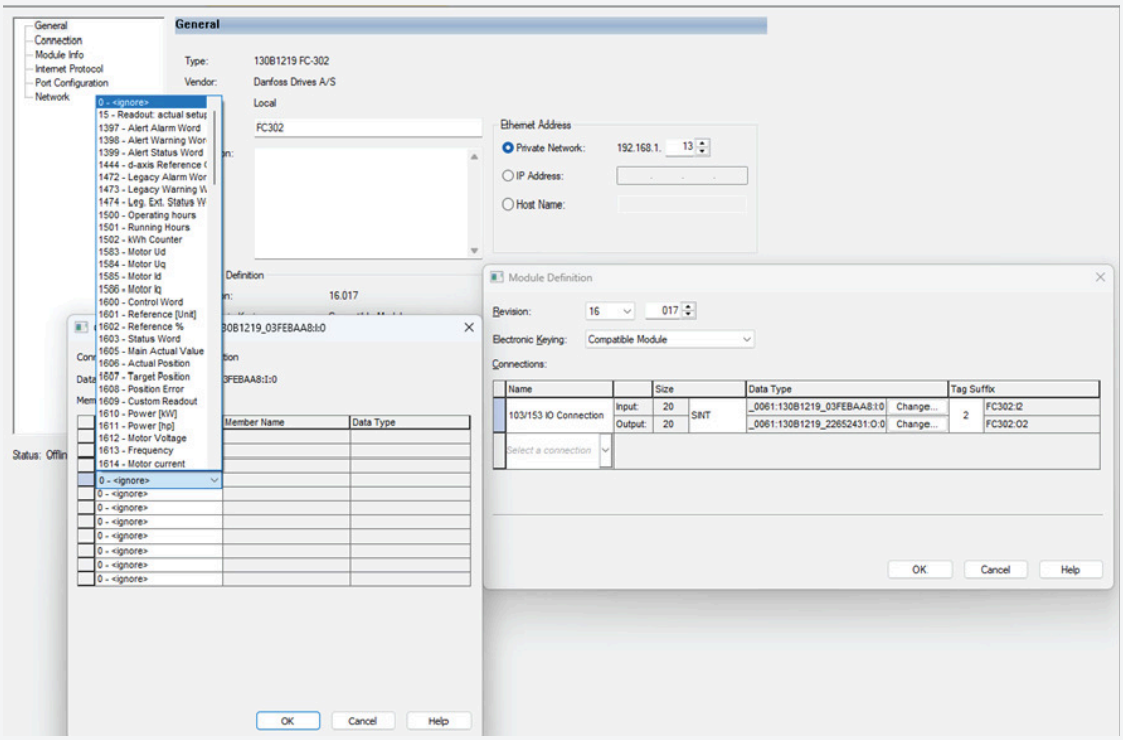
1. Add the drive using the EDS files.
2. Click *Drive properties* > *Go to Module Definition*.
3. Click *Change* and add the 103/153 I/O connection.



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4. In the *Input* row in the dialog box *Module Definition*, click *Change* in the column *Data Type*.

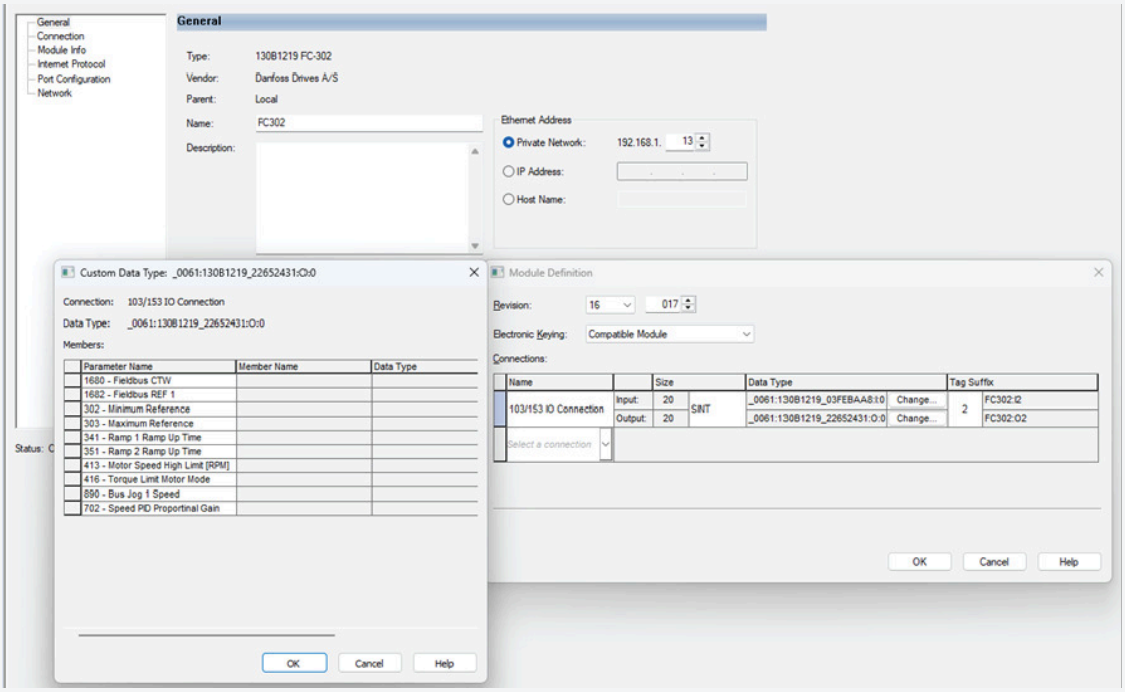
The Read PCD list is now visible.



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5. Add the Read PCDs as required for the 10 PCDs and click *OK*.
6. In the *Output* row in the dialog box *Module Definition*, click *Change* in the column *Data Type*.

The Write PCD list is now visible.



7. Add the Write PCDs as required for the 10 PCDs and click *OK*.
8. Download the configuration to the PLC. The Read and Write PCDs are mapped automatically in parameters ***9-15 PCD Read***, indices [0]–[9] and ***9-16 PCD Write***, indices [0]–[9].

4.3 EtherNet/IP Connections

4.3.1 Class-1 Connection

I/O connection using UDP transport. The EtherNet/IP interface supports maximum 1 class-1 connection, but several listen-only connections can be established if multicast is selected as the transport type. This type of connection is used for cyclic I/O and change-of-state connections. The connection is established with a forward open-command, containing the following information:

- Transport type
- Data size
- Packet rate
- Production inhibit timeout
- Trigger
- Connection points

Transport type

Specified for both directions:

- Originator-to-target/target-to-originator
- Point-to-point
- Multicast (target-to-originator only)

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Data size

Specified in bytes for both directions:

- Originator-to-target
- Target-to-originator

The data size depends on the assembly instance selected in Table 3.

Table 3: Data Size

Instances (decimal)		Data size (bytes)
Originator⇒target	**Target⇒originator**	
20, 21, 100	70, 71, 150	4
101	151	8
103	153	20

Packet rate

Specified (in ms) for both directions: Originator⇒target/Target⇒originator.

Minimum packet rate supported: 1 ms.

Production inhibit timeout

Specifies (in ms) the timeout time for both directions.

Trigger

Selects the transport trigger type:

- Cyclic (data is sent based on API).
- Change-of-state (data is sent on change-of-state only). COS filters are set up in parameter ***12-38 COS Filter***.

Connection points

Specified for both directions: Originator⇒target/Target⇒originator.

Table 4: Connection Points

Profile (parameter 8-10 Control Word Profile	Direction	Connection points (decimal)
ODVA	Originator⇒target	20, 21
	Target⇒originator	70, 71
Drive	Originator⇒target	100, 101, 103
	Target⇒originator	150, 151, 153

4.3.2 Class-3 Connection

Cyclic connection using TCP transport. Maximum 6 class-3 connections are supported. This type of connection is used for explicit messaging. The connection is established with a forward open-command, containing the following information:

- Connection name
- Message parameters

Connection name

The given name for the connection.

Message parameters

- Service code
- Class
- Instance
- Attribute
- Member
- Request data

4.3.3 Control Word Profile

The control profile is selected in parameter ***8-10 Control Word Profile***.

- ODVA gives access to the ODVA-specific profiles and assembly instances:
  - 20
  - 21
  - 70
  - 71
- FC profile enables the Danfoss profile and assembly instances:
  - 100
  - 101
  - 103
  - 150
  - 151
  - 153

For more information on the different profiles, refer to the sections *Danfoss FC Profile* and *ODVA Control Profile*.

NOTE: Change of control profile: Is it only possible to change the control profile while the drive is stopped. Control word and reference are not recalculated to match the selected profile, but are kept at the last good known value.

4.3.4 Change-of-State, COS

The event-controlled operating mode is used to minimize network traffic. Messages are sent only if a defined state or value has changed. Insert COS filters to determine the condition for triggering a COS message (parameter ***12-38 COS Filter***) for each bit in the different PCD words. The filter acts like a logical AND function: if a bit in the filter is set to 1, the COS function triggers when there is a change to the corresponding bit the for PCD word.

To filter out undesired events for COS, use parameter ***12-38 COS Filter***. If a filter bit is set to 0, the corresponding I/O instance bit is unable to produce a COS message. By default, all bits in the COS filters are set to 0.

To signal that the connection has not been interrupted, or that the device is not powered off, a heartbeat message is sent within a specified time interval (heartbeat interval). This interval is defined in attribute heartbeat time of the connection objects, Class 0x01.

To avoid that the device produces heavy network traffic when a value changes frequently, a production inhibit time is defined in parameter ***12-37 COS Inhibit Timer***. This parameter defines the minimum time between 2 COS messages. If parameter ***12-37 COS Inhibit Timer*** is set to 0, the production inhibit timer is disabled.

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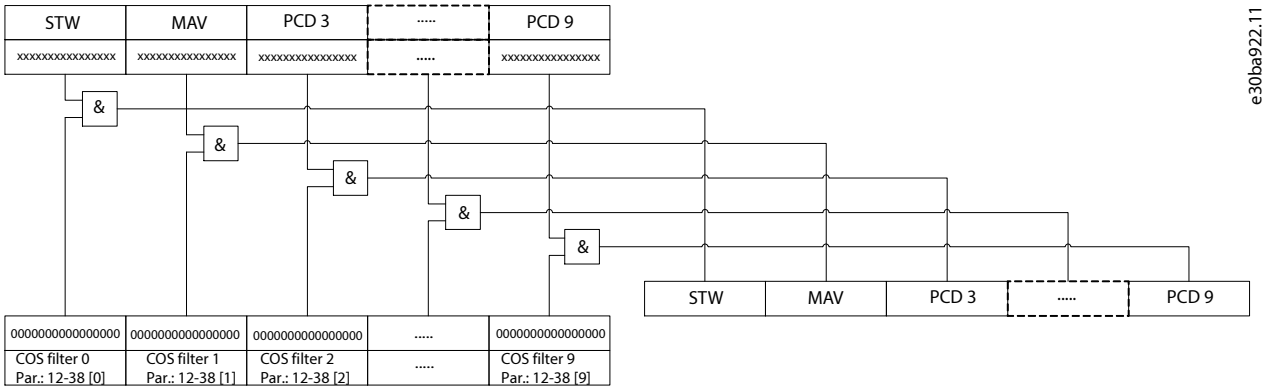


Figure 14: Different PCDs and Corresponding Filter Parameters

4.4 Danfoss FC Profile

4.4.1 Control Word According to Danfoss FC Control Profile

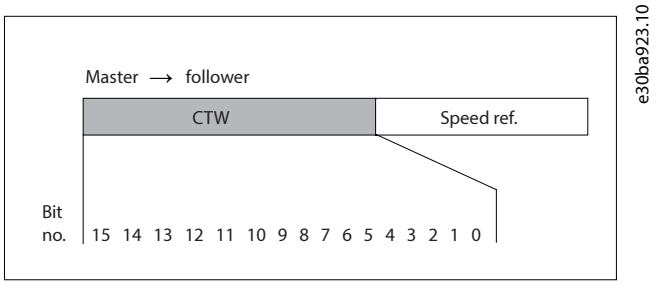


Figure 15: Parameter 8-10 Control Word Profile set to [1] FC Profile

Table 5: Control Word Bits

Bit	Bit value=0	Bit value=1
00	Reference value	External selection lsb
01	Reference value	External selection msb
02	DC brake	Ramp
03	Coasting	No coasting
04	Quick stop	Ramp
05	Hold output frequency	Use ramp
06	Ramp stop	Start
07	No function	Reset
08	No function	Jog
09	Ramp 1	Ramp 2
10	Data invalid	Data valid
11	No function	Relay 01 active
12	No function	Relay 04 active
13	Parameter setup	Selection lsb

Table 5: Control Word Bits - (continued)

Bit	Bit value=0	Bit value=1
14	Parameter setup	Selection msb
15	No function	Reverse

4.4.2 Explanation of the Control Word Bits

Bits 00/01, Reference Value

Bits 00 and 01 are used for selecting between the 4 reference values, which are pre-programmed in parameter ***3-10 Preset Reference*** according to the following table.

Table 6: Reference Values

Programmed reference value	Parameter number	Bit 01	Bit 02
1	3-10 [0]	0	0
2	3-10 [1]	0	1
3	3-10 [2]	1	0
4	3-10 [3]	1	1

NOTE: In parameter ***8-56 Preset Reference Select***, select to define how bits 00/01 are linked with the corresponding function on the digital inputs.

Bit 02, DC Brake/Ramp

- Bit 02 = 0 leads to DC braking and stop. The braking current and duration are set in parameter ***2-01 DC Brake Current*** and parameter ***2-02 DC Braking Time***.
- Bit 02 = 1 leads to ramping according to parameter ***3-41 Ramp 1 Ramp Up Time***.

Bit 03, Coasting/No Coasting

- Bit 03 = 0 leads to a stop.
- Bit 03 = 1 means that the drive can start if the other start conditions are fulfilled.

NOTE: The selection in parameter ***8-50 Coasting Select*** determines how bit 03 is linked with the corresponding function of the digital inputs.

Bit 04, Quick Stop/Ramp

Quick stop using the ramp time of parameter ***3-81 Quick Stop Ramp Time***.

- Bit 04 = 0 leads to a quick stop.
- Bit 04 = 1 means that the drive can start if the other start conditions are fulfilled.

NOTE: The selection in parameter ***8-51 Quick Stop Select*** determines how bit 04 is linked with the corresponding function of the digital inputs.

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Bit 05, Hold Output Frequency/Use Ramp

- Bit 05 = 0 causes the present output frequency (in Hz) to freeze. The frozen frequency can then be changed only with the digital inputs (parameter ***5-10 Terminal 18 Digital Input*** to parameter ***5-15 Terminal 33 Digital Input***) programmed to ***[21] Speed up*** and ***[22] Speed down***.

> NOTE: If freeze output is active, the drive can only be stopped in the following ways:
>
> - Bit 03 Coasting stop
> - Bit 02 DC brake
> - Digital input (parameter ***5-10 Terminal 18 Digital Input*** to parameter ***5-15 Terminal 33 Digital Input***) programmed to ***[5] DC brake inverse***, ***[2] Coast inverse***, or ***[3] Coast and reset inv***.

Bit 06, Ramp Stop/Start

Normal ramp stop using the ramp times of the actual ramp as selected. Additionally, activation of the output relay 1 and 4 if the output frequency is 50 Hz and if [Relay 123] has been selected in parameter ***5-40 Function Relays***.

- Bit 06 = 0 leads to a stop in which the motor speed is ramped down to stop via the selected ramp-down parameter.
- Bit 06 = 1 means that the drive can start if the other start conditions are fulfilled.

> NOTE: The selection in parameter ***8-53 Start Select*** determines how bit 06 is linked with the corresponding functions of the digital inputs.

Bit 07, No Function/Reset

- Bit 07 = 0 means that there is no reset.
- Bit 07 = 1 resets a trip. Reset is activated when the signal changes from logic 0 to logic 1.

Bit 08, No Function/Jog

- Bit 08 = 1 means that the output frequency is as defined in parameter ***3-19 Jog Speed [RPM]***.

Bit 09, Ramp 1/Ramp 2

- Bit 09 = 0 means that ramp 1 is active (parameter ***3-40 Ramp 1 Type*** to parameter ***3-47 Ramp 1 S-ramp Ratio at Decel. Start***).
- Bit 09 = 1 means that ramp 2 is active (parameter ***3-50 Ramp 2 Type*** to parameter ***3-57 Ramp 2 S-ramp Ratio at Decel. Start***).

Bit 10, Data Invalid/Valid

This bit tells the drive whether the control word should be used or ignored.

- Bit 10 = 0 ignores the control word giving the opportunity to turn off the control word when updating/reading parameters.
- Bit 10 = 1 uses the control word. This function is relevant because the control word is always contained in the telegram, regardless of the type of telegram.

Bit 11, No Function/Relay 01 Active

- Bit 11 = 0 means that the relay is not activated.
- Bit 11 = 1 means that relay 01 is activated if ***[36] Control word bit 11*** is selected in parameter ***5-40 Function Relay***.

Bit 12, No Function/Relay 02

- Bit 12 = 0 means that the relay is not activated.
- Bit 12 = 1 means that relay 02 is activated if ***[37] Control Word Bit 12*** is selected in parameter ***5-40 Function Relay***.

Bits 13/14, Setup Selection

Bits 13 and 14 are used for selecting between the 4 parameter setups according to the table below. The function is only possible if ***[9] Multi set-up*** has been selected in parameter ***0-10 Active Set-up***. The selection in parameter ***8-55 Set-up Select*** determines how bits 13 and 14 are linked with the corresponding function of the digital inputs. Changing the setup while the drive is running is only possible if the setups have been linked in parameter ***0-12 This Set-up Linked to***.

Table 7: Parameter Setups

Setup	Bit 13	Bit 13
1	0	0
2	1	0
3	0	1
4	1	1

Bit 15, No Function/Reverse

- Bit 15 = 0 means no reversing.
- Bit 15 = 1 means reversing is active.

NOTE: In the factory setting, reversing is set to ***[0] Digital input*** in parameter ***8-54 Reversing Select***.

NOTE: Bit 15 only activates reversing when ***[1] Bus***, ***[2] Logic AND***, or ***[3] Logic OR*** is selected.

4.4.3 Status Word According to Danfoss FC Profile (STW)

The status word is used to notify a master, for example, a PC, about the status of the drive.

Table 8: Status Word Bits

Bit	Bit=0	Bit=1
00	Control not ready	Control ready
01	Drive not ready	Drive ready
02	Coasting	Enable
03	No error	Trip
04	No error	Error (no trip)
05	Reserved	–
06	No error	Trip lock
07	No warning	Warning
08	Speed ≠ reference	Speed = reference
09	Local operation	Bus control
10	Out of frequency limit	Frequency limit OK
11	No operation	In operation
12	Drive OK	Stopped, autostart
13	Voltage OK	Voltage exceeded

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Table 8: Status Word Bits - (continued)

Bit	Bit=0	Bit=1
14	Torque OK	Torque exceeded
15	Thermal OK	Timer exceeded

4.4.4 Explanation of the Status Word Bits

Bit 00, Control not Ready/Control Ready

- Bit 00 = 0 means that either bit 00, 01, or 02 of the control word is 0, or the drive is switched off (tripped).
- Bit 00 = 1 means that the drive control is ready, but there is not necessarily power supply to the unit present. For example, this situation could occur if 24 V external supply of the control system is used.

Bit 01, Drive not Ready/Drive Ready

Same meaning as bit 00, however, there is a supply of the power unit. The drive is ready when it receives the necessary start signals.

Bit 02, Coasting/Enable

- Bit 02 = 0 means that either bit 00, 01, or 02 of the control word is 0, or the drive is switched off (tripped).
- Bit 02 = 1 means that the drive can start the motor when a start command is given.

Bit 03, No Error/Trip

- Bit 03 = 0 means that there are no error conditions in the drive.
- Bit 03 = 1 means that the drive has tripped and requires a reset signal before it can start.

Bit 04, No Error/Error (no Trip)

- Bit 04 = 0 means that there is no fault in the drive.
- Bit 04 = 1 means that there is a fault in the drive, but it has not tripped.

Bit 05, Reserved

- Bit 05 is not used in the status word.

Bit 06, No Error/Trip Lock

- Bit 06 = 0 means that the drive is not in fault mode.
- Bit 06 = 1 means that the drive is tripped and locked.

Bit 07, No Warning/Warning

- Bit 07 = 0 means that there are no warnings.
- Bit 07 = 1 means that a warning has occurred.

Bit 08, Speed ≠ Reference/Speed = Reference

- Bit 08 = 0 means that the current motor speed deviates from the set speed reference value. This situation may occur, for example, when the speed is changed during start/stop through ramp up/ramp down.
- Bit 08 = 1 means that the current motor speed corresponds to the set speed reference value.

Bit 09, Local Operation/Bus Control

- Bit 09 = 0 indicates that the drive has been stopped via the [*Stop*] key on the LCP, or that ***[0] Linked to hand/auto*** or ***[2] Local*** has been selected in parameter ***3-13 Reference Site***.

- Bit 09 = 1 means that the drive can be controlled via fieldbus/serial communication.

Bit 10, Out of Frequency Limit/Frequency Limit OK

- Bit 10 = 0 indicates that the output frequency is outside the limits set in parameter ***4-52 Warning Speed Low*** and parameter ***4-53 Warning Speed High***.
- Bit 10 = 1 means that the output frequency is within the indicated limits.

Bit 11, No Operation/In Operation

- Bit 11 = 0 means that the motor does not run.
- Bit 11 = 1 means that the drive has a start signal, or the output frequency is > 0 Hz.

Bit 12, Drive OK/Stopped, Autostart

- Bit 12 = 0 means that there is no temporary overloading of the inverter.
- Bit 12 = 1 means that the inverter has stopped due to overloading. However, the drive has not switched off (trip) and will start again after the overloading has ended.

Bit 13, Voltage OK/Voltage Exceeded

- Bit 13 = 0 means that the voltage limits of the drive are not exceeded.
- Bit 13 = 1 means that the direct voltage in the DC link of the drive is too low or too high.

Bit 14, Torque OK/Torque Exceeded

- Bit 14 = 0 means that the motor torque is below the limits set in parameter ***4-16 Torque Limit Motor Mode*** or parameter ***4-17 Torque Limit Generator Mode***.
- Bit 14 = 1 means that the limit selected in parameter ***4-16 Torque Limit Motor Mode*** or parameter ***4-17 Torque Limit Generator Mode*** is exceeded. The nominal torque can be read in parameter ***16-16 Torque [Nm]***.

Bit 15, Thermal OK/Thermal Exceeded

- Bit 15 = 0 indicates that the timers for the motor thermal protection and thermal drive protection have not exceeded 100%.
- Bit 15 = 1 indicates that 1 of the timers has exceeded 100%.

4.5 ODVA Control Profile

4.5.1 Control Word under Instances 20/70 and 21/71

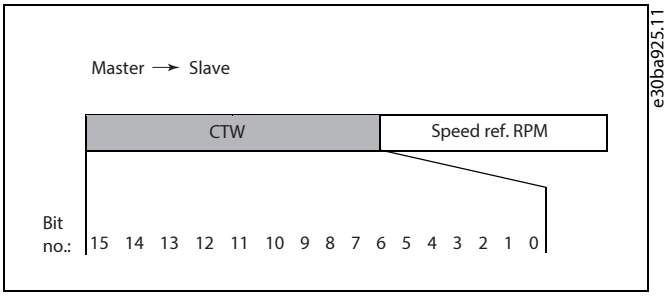


Figure 16: Parameter 8-10 Control Word Profile set to [5] ODVA

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Table 9: Control Word Bits in Instances 20 and 21

Bit	Instance 20		Instance 21	
	Bit value=0	**Bit value=1**	**Bit value=0**	**Bit value=1**
00	Stop	Run	Fwd stop	Run fwd
01	–	–	Stop	Run rev
02	No function	Fault reset	No function	Fault reset
03	–	–	–	–
04	–	–	–	–
05	–	–	–	Net ctrl
06	–	–	–	Net ref
07–15	–	–	–	–

4.5.2 Explanation of the Control Word Bits

Bit 00, Run Fwd

Bit 00 = 0 means that the drive has a stop command.

Bit 00 = 1 means that the drive start the motor in clockwise direction.

Bit 01, Run Rev

Bit 01=0 means that the drive has a stop command.

Bit 01=1 means that the drive starts in motor in counterclockwise direction.

Bit 02, Fault Reset

Bit 02=0 means that there is no trip reset.

Bit 02=1means that a trip is reset.

Bit 03, No Function

Bit 03 has no function.

Bit 04, No Function

Bit 04 has no function.

Bit 05, Net Control

Bit 05=0 means that the drive is controlled from the standard inputs.

Bit 05=1 means that EIP controls the drive.

NOTE: Changes affect parameter ***8-50 Coasting Select*** to parameter ***8-56 Preset Reference Select***.

Bit 06, Net Reference

Bit 06=0 means that the reference comes from the standard inputs.

Bit 06=1 means that the reference comes from EIP.

NOTE: Changes affect parameter ***3-15 Reference Resource 1*** to parameter ***3-17 Reference Resource 3***. For the speed reference, see 4.6.2 Bus Speed Reference Value under Instances 20/70 and 21/71.

4.5.3 Status Word under Instance 20/70 and 21/71

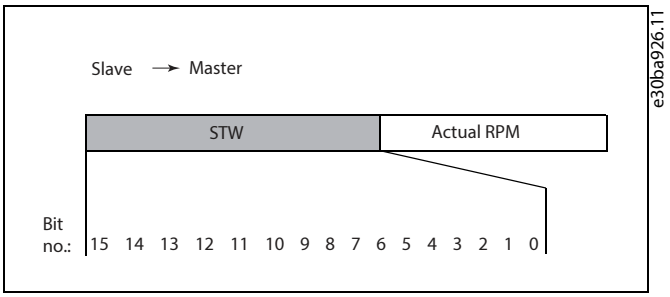


Figure 17: Status Word in Instances 70 and 71

NOTE: Bits 00 and 02 in instance 70 are identical to bits 00 and 02 in the more extensive instance 71.

Table 10: Status Word Bits in Instances 20 and 21

Bit	Instance 70		Instance 71	
	Bit value=0	Bit value=1	Bit value=0	Bit value=1
00	No fault	Fault	No fault	Fault
01	–	–	No warning	Warning
02	–	Running 1 fwd	–	Running 1 fwd
03	–	–	–	Running 2 rev
04	–	–	–	Ready
05	–	–	–	Ctrl from net
06	–	–	–	Ref. from net
07	–	–	–	At reference
08–15	–	–	State attribute	

4.5.4 Explanation of the Status Word Bits

Bit 00, Fault

Bit 00=0 means that there are no faults in the drive.

Bit 00=1 means that there is a fault in the drive.

Bit 01, Warning

Bit 01=0 means there is no unusual situation.

Bit 01=1 means that an abnormal condition has occurred.

Bit 02, Running 1

Bit 02=0 means that the drive is not in 1 of these states, or Run 1 is not set.

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Bit 02=1 means that the drive state attribute is enabled or stopping, or fault-stop and bit 0 (Run 1) of the control word are set at the same time.

Bit 03, Running 2

Bit 03=0 means that the drive is not in 1 of these states, or Run 2 is not set.

Bit 03=1 means that the drive state attribute is enabled or stopping, or fault-stop and bit 0 (Run 2) of the control word are set at the same time.

Bit 04, Ready

Bit 04=0 means that the state attribute is in another state.

Bit 04=1 means that the state attribute is ready, enabled, or stopping.

Bit 05, Control from Net

Bit 05=0 means that the drive is controlled from the standard inputs.

Bit 05=1 means that EIP has control (start, stop, reverse) of the drive.

Bit 06, Ref from Net

Bit 06=0 means that the reference comes from inputs to the drive.

Bit 06=1 means that the reference comes from EIP.

Bit 07, At Reference

Bit 07=0 means that the motor runs, but the present speed is different from the preset speed reference, meaning that the speed is ramped up/down during start/stop.

Bit 07=1 means the drive and reference speeds are equal.

Bits 8–15, State Attribute

NOTE: This only applies to instance 71.

These bits show the state attribute of the drive as indicated in following table.

Table 11: State Attribute of the Drive

Bit	Meaning
8	Not used
9	Start up
10	Not ready
11	Ready
12	Enabled
13	Stopping
14	Fault stop
15	Faulted

For more details of the actual output speed, see 4.6.2 Bus Speed Reference Value under Instances 20/70 and 21/71.

4.6 Reference Handling

4.6.1 Bus Speed Reference Value

In FC profile (parameter ***8-10 Control Word Profile*** = ***[0] FC profile***), the reference is scaled as a normalized relative value in percent. The value is transmitted in hexadecimal:

- 0% = 0 hex
- 100% = 4000 hex
- -100% = C000 hex

Depending on the setting of parameter ***3-00 Reference Range***, the reference is scaled from -maximum to +maximum or from minimum to maximum.

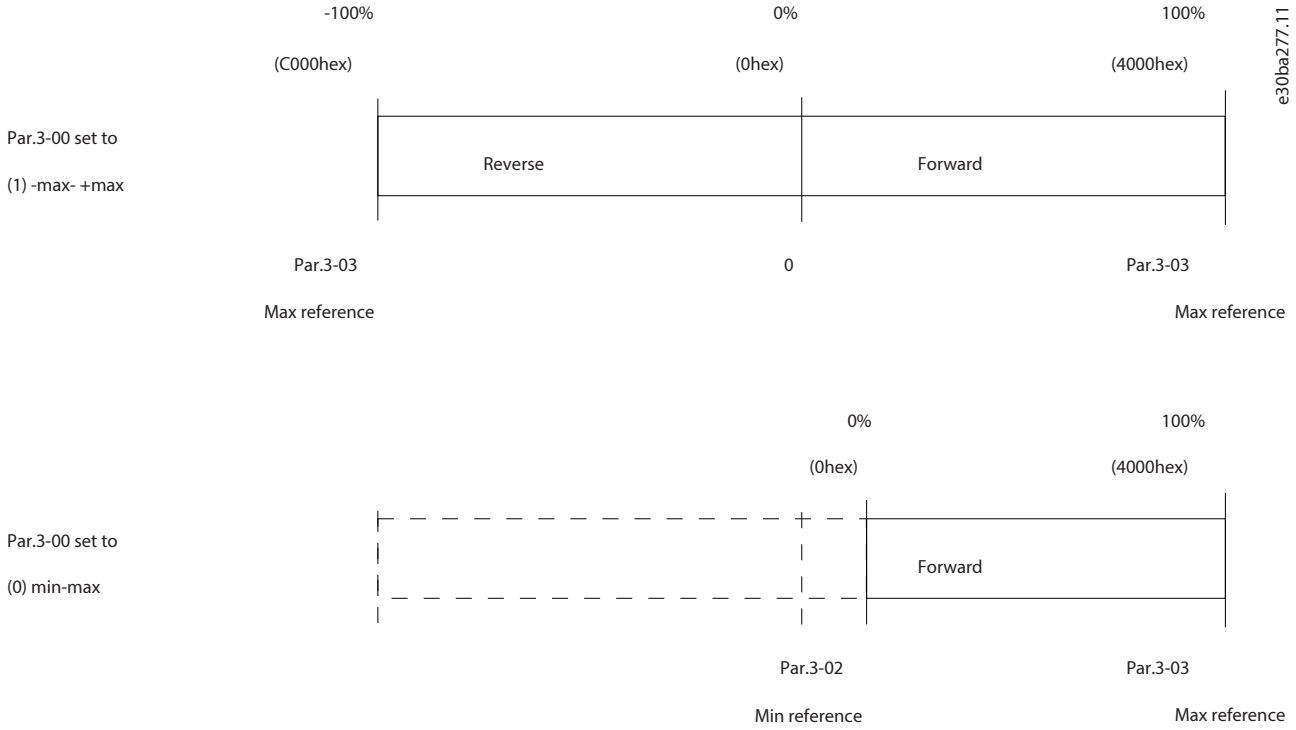


Figure 18: Scaling of Reference Values

The actual reference [Ref.%] in the drive depends on the settings in the following parameters:

- Parameter ***1-23 Motor Frequency***
- Parameter ***1-25 Motor Nominal Speed***
- Parameter ***3-02 Minimum Reference***
- Parameter ***3-03 Maximum Reference***

All references provided to the drive are added to the total reference value. When the fieldbus controls a reference only, ensure that all other reference inputs are 0.

Digital and analog input terminals cannot be used for reference signals. The default setting (0%) can be maintained for preset references in parameter ***3-10 Preset Reference***.

> NOTE: If the bus speed reference is negative, and the control word contains a run reverse signal, the drive runs clockwise (- to - is +).

MAV is scaled in the same way as the reference.

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4.6.2 Bus Speed Reference Value under Instances 20/70 and 21/71



Figure 19: Bus Speed Reference Value under Instances 20/70 and 21/71

The speed reference value is sent to the drive in the form of a 16-bit word. The value is sent directly in RPM.

5 Parameters

5.1 Parameter Group 8-** Communications and Options

5.1.1 8-0* General Settings

8-01 Control Site

Default value:	_[1]	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) The default value for VLT® AQUA Drive FC 202 and VLT® AutomationDrive FC 301/FC 302 is [0] Digital and ctrl. word.

The setting in this parameter overrides the settings in parameter ***8-50 Coasting Select*** to parameter ***8-56 Preset Reference Select***.

Option	Name	Description
[0]	Digital and ctrl.word	Use both digital input and control word.
[1]	Digital only	Use digital inputs only.
[2]	Controlword only	Use control word only.

8-02 Control Word Source

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the source of the control word: 1 of 2 serial interfaces or 4 installed options. During initial power-up, the drive automatically sets this parameter to ***[3] Option A*** if it detects a valid fieldbus option installed in slot A. When the option is removed, the drive detects a configuration change, sets parameter ***8-02 Control Word Source*** to default setting ***[1] FC RS485***, and trips. If an option is installed after initial power-up, the setting of parameter ***8-02 Control Word Source*** does not change, but the drive trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a drive that did not have a bus option installed earlier, change the control to bus-based. This change is required for safety reasons to avoid an unintended change.

Option	Name	Description
[0]	None	Control via serial communication is disabled.
[1]	FC RS485	Control via RS-485 terminals 68/69 on the control card.
[2]	FC USB	Control via USB on the control card.
[3]	Option A	Control via option A.
[4]	Option B	Control via option B.
[5]	Option C0	Control via option C0.
[6]	Option C1	Control via option C1.
[30]	External Can	Internal

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Option	Name	Description
[35]	Option A fast	NOTE: This option is only available in FC 302. Same as option ***[3] Option A***. The reference is transferred faster and without jitter, which ensures more stability and dynamic control. Moreover, all other references are ignored, which means that the drive is controlled by the A-option reference only.
[37]	Option C0 fast	NOTE: This option is only available in FC 302. Same as option ***[5] Option C0***. The reference is transferred faster and without jitter, which ensures more stability and dynamic control. Moreover, all other references are ignored, which means that the drive is controlled by the C-option reference only.

8-03 Control Word Timeout Time

Default value:	Size related	**Parameter type:**	Range, 0.1 - 18000 s[1]
Setup:	1 setup	**Conversion index:**	-1
Data type:	Uint32	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102, the range is 0.5–18000 s. For VLT® AQUA Drive FC 202 the range is 1–18000 s.

Enter the maximum time expected to pass between the reception of 2 consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in parameter ***8-04 Control Word Timeout Function*** is then carried out. A valid control word triggers the timeout counter.

8-04 Control Word Timeout Function

Default value:	_[1]	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202, the default value is [0] Off.

Select the timeout function. The timeout function activates when the control word is not updated within the time period specified in parameter ***8-03 Control Word Timeout Time***.

NOTE:

To change the setup after a timeout, configure as follows:

1. Set parameter ***0-10 Active Set-up*** to ***[9] Multi setup***.
2. Select the relevant link in parameter ***0-12 This Set-up Linked to***.

Option	Name	Description
[0]	Off	Resumes control via fieldbus (fieldbus or standard), using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at jog frequency until communication resumes.

Option	Name	Description
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the drive to restart: • Via the fieldbus. • Via [*Reset*]. • Via a digital input.
[6]	Qstop and trip	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer. Stops the motor with the quick stop ramp (parameter ***3-81 Quick Stop Ramp Time***). Perform a reset to restart the drive.
[7]	Select setup 1	Changes the setup after a control word timeout. If communication resumes after a timeout, parameter ***8-05 End-of-Timeout Function*** either resumes the setup used before the timeout, or retains the setup endorsed by the timeout function.
[8]	Select setup 2	See ***[7] Select set-up 1***.
[9]	Select setup 3	See ***[7] Select set-up 1***.
[10]	Select setup 4	See ***[7] Select set-up 1***.
[16]	Activate emcy mode	This option automatically triggers fire mode/emergency mode on communication loss and returns to normal when communication resumes.
[20]	N2 override release	NOTE: This option is only available in FC 102 and FC 202.
[26]	Trip	NOTE: This option is only available in FC 302 with VLT® Motion Controller Option MCO 302.
[27]	Forced stop and trip	NOTE: This option is only available in FC 102 and FC 202.
[30]	Warning only	NOTE: This option is only available in FC 102 and FC 202.

8-05 End-of-Timeout Function

Default value:	[1] Resume set-up	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the action after receiving a valid control word following a timeout. This parameter is active only when parameter ***8-04 Control Word Timeout Function*** is set to:

- ***[7] Setup 1***
- ***[8] Setup 2***
- ***[9] Setup 3***
- ***[10] Setup 4***

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Option	Name	Description
[0]	Hold set-up	Retains the setup selected in parameter ***8-04 Control Word Timeout Function*** and shows a warning until parameter ***8-06 Reset Control Word Timeout*** toggles. Then the drive resumes its original setup.
[1]*	Resume setup	Resumes the setup that was active before the timeout.

8-06 Reset Control Word Timeout

Default value:	[0] Do not reset	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This parameter is active only when ***[0] Hold set-up*** has been selected in parameter ***8-05 End-of-Timeout Function***.

Option	Name	Description
[0]*	Do not reset	Retains the setup specified in parameter ***8-04 Control Word Timeout Function***, following a control word timeout.
[1]	Do reset	Restores the drive to the original setup following a control word timeout. The drive resets and then immediately reverts to the ***[0] Do not reset*** setting.

8-07 Diagnosis Trigger

Default value:	[0] Disable	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This parameter has no function for DeviceNet.

Option	Name	Description
[0]*	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/warn.	

8-08 Readout Filtering

Default value:	–	**Parameter type:**	Option, Array [1]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Use this function if the speed feedback value readouts on the fieldbus fluctuate. Select ***[1] Motor Data LP-Filter*** if the function is required. A power cycle is required for changes to take effect.

Option	Name	Description
[0]	Motor data Std-Filt.	Normal fieldbus readouts.
[1]	Motor data LP-Filter	Filtered fieldbus readouts of the following parameters: • Parameter ***16-10 Power [kW]*** • Parameter ***16-11 Power [hp]*** • Parameter ***16-12 Motor Voltage*** • Parameter ***16-14 Motor current*** • Parameter ***16-16 Torque [Nm]*** • Parameter ***16-17 Speed [RPM]*** • Parameter ***16-22 Torque [%]*** • Parameter ***16-25 Torque [Nm] High***

8-09 Communication Charset

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: This parameter is only valid for VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

Select the communication character set to be supported.

Option	Name	Description
[0]	ISO 8859-1	
[1]	ANSI X3.4	
[2]	UTF-8	

5.1.2 8-1* Ctrl. Word Settings

8-10 Control Word Profile

Default value:	_[1]	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202, the default value is [0] FC profile.

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. For guidelines in selection of ***[0] FC profile*** and ***[1] PROFIdrive profile***, refer to the product-specific design guide. For more guidelines in the selection of ***[1] PROFIdrive profile***, refer to the installation guide for the installed fieldbus.

Option	Name	Description
[0]	FC profile	
[1]	PROFIdrive profile	

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Option	Name	Description
[3]	FC motion profile	NOTE: This option is only available in FC 302 with IMC software version 48.0X. Assigns motion-specific functions to various control and status word bits. This option is available when ***[9] Positioning*** or ***[10] Synchronization*** is selected in parameter ***1-00 Configuration Mode***.
[5]	ODVA	NOTE: This option is only available with VLT® DeviceNet MCA 104 and VLT® EtherNet/IP MCA 121.
[7]	CANopen DSP 402	
[8]	MCO	NOTE: This option is only available in FC 302 with VLT® Motion Controller Option MCO 302.
[22]	PROFIdrive v4_2 profile	
[23]	Advanced MCO STW	NOTE: This option is only available in FC 302 with VLT® Motion Controller Option MCO 302.
[24]	VIK-NAMUR	NOTE: This option is only available in FC 202 and FC 302.

8-11 Initial Comm. for CTW TO

Default value:	[0] Required	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: This parameter is only available for VLT® AQUA Drive FC 202 and VLT® AutomationDrive FC 301/FC 302.

Specify whether initial communication is required for triggering control word timeout or whether no communication is required.

Option	Name	Description
[0]*	Required	Initial communication is required for triggering a control word timeout.
[1]	Without communication	No initial communication is required for triggering a control word timeout.

8-13 Configurable Status Word STW

Default value:	_[1]	**Parameter type:**	Option, Array [16]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202, the default value is [1] Profile default.

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. For more guidelines in the selection of ***[1] PROFIdrive profile***, refer to the installation guide for the installed fieldbus.

Option	Name	Description
[0]	No function	The input is always low.
[1]	Profile default	Dependent on the profile set in parameter ***8-10 Control Profile***.
[2]	Alarm 68 Only	The input goes high whenever *Alarm 68 Safe Stop Activated* is active and goes low whenever *Alarm 68 Safe Stop Activated* is not active.
[3]	Trip excl Alarm 68	
[4]	Position error	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. The position is outside its limits set in parameter ***3-06 Minimum Position*** and parameter ***3-07 Maximum Position***.
[5]	Position limit	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. The position error exceeds the value in parameter ***4-71 Maximum Position*** for the time set in parameter ***4-72 Position Error Timeout***.
[6]	Touch on target	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Target position is reached in touch probe position mode.
[7]	Touch activated	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Touch probe positioning is active. The drive monitors the touch probe sensor input.
[8]	Touch sensor found	NOTE: This option is only available in FC 302 with IMC software version 48.5X or newer. The touch sensor has been detected.
[9]	Vir. master on ref	NOTE: This option is only available in FC 302 with IMC software version 48.7X or newer. The virtual master is running on the set reference.
[10]	T18DI status	The bit indicates the status of terminal 18. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[11]	T19DI status	The bit indicates the status of terminal 19. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[12]	T27DI status	The bit indicates the status of terminal 27. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[13]	T29DI status	The bit indicates the status of terminal 29. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[14]	T32DI status	The bit indicates the status of terminal 32. 0 indicates that the terminal is low. 1 indicates that the terminal is high.

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Option	Name	Description
[15]	T33DI status	The bit indicates the status of terminal 33. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[16]	T37DI status	The input goes high whenever T37 has 0 V and goes low whenever T37 has 24 V.
[17]	X30/2 DI status	
[18]	X30/3 DI status	
[19]	X30/4 DI status	
[20]	CTW timeout toggle inverse	NOTE: This option is only available in FC 202 and FC 302.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, drive, brake resistor, or thermistor.
[22]	Execution distance extended	NOTE: This option is only available in FC 302 with IMC software version 48.9X or newer. Indicates that the offset execution distance (set in parameter ***17-95 Offset Execution Distance***) has been extended due to speed/ramp limitation.
[29]	Protection mode	NOTE: This option is only available in FC 302.
[30]	Brake fault (IGBT)	Output logic is 1 when the brake IGBT is short-circuited. Use this function to protect the drive if there is a fault on the brake modules. Use the output/relay to cut out the main voltage from the drive.
[40]	Out of ref range	
[49]	Derate active	NOTE: This option is only available in FC 102 and FC 301/FC 302.
[54]	Running	
[59]	On reference	
[60]	Comparator 0	See parameter group ***13-1* Comparators***. If comparator 0 is evaluated as true, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See parameter group ***13-1* Comparators***. If comparator 1 is evaluated as true, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See parameter group ***13-1* Comparators***. If comparator 2 is evaluated as true, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See parameter group ***13-1* Comparators***. If comparator 3 is evaluated as true, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See parameter group ***13-1* Comparators***. If comparator 4 is evaluated as true, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See parameter group ***13-1* Comparators***. If comparator 5 is evaluated as true, the output goes high. Otherwise, it is low.
[66]	Comparator 6	See parameter group ***13-1* Comparators***. If comparator 6 is evaluated as true, the output goes high. Otherwise, it is low.

Option	Name	Description
[67]	Comparator 7	See parameter group ***13-1* Comparators***. If comparator 7 is evaluated as true, the output goes high. Otherwise, it is low.
[68]	Comparator 8	See parameter group ***13-1* Comparators***. If comparator 8 is evaluated as true, the output goes high. Otherwise, it is low.
[69]	Comparator 9	See parameter group ***13-1* Comparators***. If comparator 9 is evaluated as true, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See parameter group ***13-4* Logic Rules***. If logic rule 0 is evaluated as true, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See parameter group ***13-4* Logic Rules***. If logic rule 1 is evaluated as true, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See parameter group ***13-4* Logic Rules***. If logic rule 2 is evaluated as true, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See parameter group ***13-4* Logic Rules***. If logic rule 3 is evaluated as true, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See parameter group ***13-4* Logic Rules***. If logic rule 4 is evaluated as true, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See parameter group ***13-4* Logic Rules***. If logic rule 5 is evaluated as true, the output goes high. Otherwise, it is low.
[76]	Logic rule 6	See parameter group ***13-4* Logic Rules***. If logic rule 6 is evaluated as true, the output goes high. Otherwise, it is low.
[77]	Logic rule 7	See parameter group ***13-4* Logic Rules***. If logic rule 7 is evaluated as true, the output goes high. Otherwise, it is low.
[78]	Logic rule 8	See parameter group ***13-4* Logic Rules***. If logic rule 8 is evaluated as true, the output goes high. Otherwise, it is low.
[79]	Logic rule 9	See parameter group ***13-4* Logic Rules***. If logic rule 9 is evaluated as true, the output goes high. Otherwise, it is low.
[80]	SL digital out A	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[38] Set digital out A high*** is executed. The output goes low whenever the smart logic action ***[32] Set digital out A low*** is executed.
[81]	SL digital out B	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[39] Set digital out B high*** is executed. The output goes low whenever the smart logic action ***[33] Set digital out B low*** is executed.
[82]	SL digital out C	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[40] Set digital out C high*** is executed. The output goes low whenever the smart logic action ***[34] Set digital out C low*** is executed.
[83]	SL digital out D	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[41] Set digital out D high*** is executed. The output goes low whenever the smart logic action ***[35] Set digital out D low*** is executed.

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Option	Name	Description
[84]	SL digital out E	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[42] Set digital out E high*** is executed. The output goes low whenever the smart logic action ***[36] Set digital out E low*** is executed.
[85]	SL digital out F	See parameter ***13-52 SL Controller Action***. The output goes high whenever the smart logic action ***[43] Set digital out F high*** is executed. The output goes low whenever the smart logic action ***[37] Set digital out F low*** is executed.
[86]	ATEX ETR cur. alarm	
[87]	ATEX ETR freq. alarm	
[88]	ATEX ETR cur. warning	
[89]	ATEX ETR freq. warning	
[90]	Safe function active	NOTE: This option is only available in FC 302.
[91]	Safe opt. reset. req.	NOTE: This option is only available in FC 302.
[92]	IGBT-cooling	NOTE: This option is only available in FC 301/FC 302.
[96]	Reverse after ramp	NOTE: This option is only available in FC 302 with IMC software version 48.5X or newer. Indicates if the direction of rotation should be reversed. Depends on whether the speed reference is positive or negative after the ramp specified in parameter ***16-48 Speed Ref. After Ramp [RPM]***.
[121]	Cavitation	
[122]	Cavitation S2	
[123]	Cavitation thld at max/min	
[181]	Prev. maintenance	
[190]	No-flow	NOTE: This option in only available in FC 102 and FC 202.
[191]	Dry pump	NOTE: This option in only available in FC 102 and FC 202.
[192]	End of curve	NOTE: This option in only available in FC 102 and FC 202.
[193]	Sleep mode	NOTE: This option in only available in FC 102 and FC 202.
[194]	Broken belt	NOTE: This option in only available in FC 102 and FC 202.
[196]	Fire mode/Emcy mode is active	The drive is operating in emergency mode. See parameter group ***24-0* Fire Mode/24-0* Emergency Mode***.
[197]	Fire mode/Emcy mode was active	The drive has been operating in fire mode/emergency mode.

Option	Name	Description
[198]	Fire mode/Emcy mode limits	During fire mode/emergency mode operation, 1 of the critical alarms has been activated and suppressed by fire mode/ emergency mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[200]	User defined alerts	
[210]	Pos. set acknowledge	NOTE: This option is only available in FC 302 with IMC software version 48.9X or newer. Acknowledge activation of the set target position.
[231]	In power lim. mot.	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in motor mode only.
[232]	In power lim. gen.	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in generating mode only.
[233]	In power limit	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in both motor and generating modes.
[234]	Fire m./Emcy m. OPR unexpected	Fire mode/emergency mode is not operating as expected, for example, live zero monitoring on an analog input is activated.
[254]	Testing fire mode/emcy mode	Fire mode/emergency mode was activated in a special test mode where the drive stops on all alarms.

8-14 Configurable Control Word CTW

Default value:	[1] Profile default	**Parameter type:**	Option, Array [16]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This is an array parameter with 16 elements, 1 element for each bit in range 0–15. Each of the bits can be configured to any of the following options.

Option	Name	Description
[0]	None	The drive ignores the information in this bit.
[1]*	Profile default	Dependent on the profile set in parameter ***8-10 Control Profile***.
[2]	CTW valid, active low	If set to 1, the drive ignores the remaining bits of the control word.
[3]	Safe option reset	NOTE: This option is only available in FC 302. This function is only available in bits 12–15 of the control word if a safety option is mounted in the drive. The reset is executed on a 0⇒1 transition and resets the safety option as set in parameter ***42-24 Restart behavior***.

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Option	Name	Description
[4]	PID error inverse	NOTE: This option is only available in FC 301/FC 302. Inverts the resulting error from the process PID controller. Available only if parameter ***1-00 Configuration Mode*** is set to ***[6] Surface Winder***, ***[7] Extended PID Speed OL***, or ***[8] Extended PID Speed CL***.
[5]	PID reset I part	NOTE: This option is only available in FC 301/FC 302. Resets the I-part of the process PID controller. Equivalent to parameter ***7-40 Process PID I-part Reset***. Available only if ***parameter 1-00 Configuration Mode*** is set to ***[6] Surface Winder***, ***[7] Extended PID Speed OL***, or ***[8] Extended PID Speed CL***.
[6]	PID enable	NOTE: This option is only available in FC 301/FC 302. Enables the extended process PID controller. Equivalent to parameter ***7-50 Process PID Extended PID***. Available only if parameter ***1-00 Configuration Mode*** is set to ***[6] Surface Winder***, ***[7] Extended PID Speed OL***, or ***[8] Extended PID Speed CL***.
[7]	External interlock	
[10]	Bit 10 = 0>CTW timeout	
[11]	Start homing	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Starts the homing function selected in parameter ***17-80 Homing Function***. Must remain high until homing is done, otherwise homing is aborted.
[12]	Activate touch	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Activates monitoring of the touch sensor input.
[13]	Sync. to pos mode	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Select positioning in synchronization mode.
[14]	Ramp 2	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer. Select between ramp 1 (parameter group ***3-4* Ramp 1***) and ramp 2 (parameter group ***3-5* Ramp 2***).
[15]	Relay 1	Control relay 1.
[16]	Relay 2	Control relay 2.

Option	Name	Description
[17]	Speed mode	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer. Select the speed mode when ***[9] Positioning*** or ***[10] Synchronization*** is selected in parameter ***1-00 Configuration Mode***. Speed reference is set by reference resource 1 or fieldbus REF1 relative to parameter ***3-03 Maximum Reference***.
[18]	Enable vir. master	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer. Enable the signal for the virtual master function. The option is applicable when ***[10] Synchronization*** is selected in parameter ***1-00 Configuration Mode***.
[19]	Enable mast. offset	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer. Activates the master offset selected in parameter ***3-26 Master Offset*** when parameter ***17-93 Master Offset Selection*** has a selection from ***[1] Absolute*** to ***[5] Relative Touch Sensor***.
[20]	Control word toggle command	Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.
[21]	Target inverse	NOTE: This option is only available in FC 302 with IMC software version 48.3X or newer. Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.
[22]	Digital out 27	
[23]	Digital out 29	
[24]	Digital out X30/6	
[25]	Digital out X30/7	
[26]	Home sensor	NOTE: This option is only available in FC 302 with IMC software version 48.3X or newer. NOTE: Accuracy of the home position depends on the delay in transferring the signals. The home sensor is connected via fieldbus master.
[27]	Touch sensor	NOTE: This option is only available in FC 302 with IMC software version 48.3X or newer. NOTE: Accuracy of the home position depends on the delay in transferring the signals. The touch sensor is connected via fieldbus master.

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Option	Name	Description
[28]	Position vir. master	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer. Activates position-controlled virtual master when ***[9] Positioning*** or ***[10] Synchronization*** is selected in parameter ***1-00 Configuration Mode***. When the option is selected, the following occurs: • Target position is set by Fieldbus Pos Ref or preset target is as defined in parameter ***3-20 Preset Target***. • Speed is set relative to parameter ***3-27 Virtual Master Max Ref*** by the source selected in parameter ***3-15 Reference Resource 1*** or fieldbus REF1. • Acceleration and deceleration are set as defined in parameter group ***3-6* Ramp 3***.
[29]	Set master home	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer. Sets the actual master position as defined in parameter ***17-88 Master Home Position***.
[30]	Set vir. mas. pos. to actual	NOTE: This option is only available in FC 302 with IMC software version 48.7X or newer. Bit for setting the virtual master position = the actual follower position. This is needed for setting the correct starting position for position-controlled virtual master ensuring that the virtual master ensuring that the virtual master position is aligned with the physical position of the follower.
[31]	Activate CAM table	NOTE: This option is only available in FC 302 with IMC software version 48.7X or newer. Signal for activating a new CAM table while running with bumpless transfer.
[32]	Halt	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[33]	Bit 10 = 0 > CTW TO always	
[34]	Activate CAM cycles	NOTE: This option is only available with IMC software version 48.96 or newer. Activates the number of CAM cycles set in parameter ***17-97 Number of CAM Cycles***.
[66]	Sleep mode	NOTE: This option is only available in FC 102 and FC 302.
[78]	Reset preventive maintenance word	
[85]	Latched pump derag	NOTE: This option is only available in FC 202.

Option	Name	Description
[86]	Flow confirmation	NOTE: This option is only available in FC 202.
[94]	Light load detection	NOTE: This option is only available in FC 302. Use this option to ensure drive runs in the direction which requires least energy (UPS capacity), during an emergency.
[95]	Evacuation mode	NOTE: This option is only available in FC 302. Use this function to operate the drive at reduced DC voltage for evacuating people in case of power failure.
[189]	Fire mode/emergency mode	
[190]	Fire mode/emcy mode ref bit 0	Enables a choice between 1 of the 8 preset references.
[191]	Fire mode/emcy mode ref bit 1	Enables a choice between 1 of the 8 preset references.
[192]	Fire mode/emcy mode ref bit 2	Enables a choice between 1 of the 8 preset references.
[195]	Test fire mode/emcy mode	Fire mode/emergency mode is activated in a special test mode where the drive stops on all alarms.
[231]	Power limit mot.	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in the motor mode only.
[232]	Power limit gen.	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in the generating mode only.
[233]	Power limit both	NOTE: This option is only available in FC 302. See parameter group ***4-8* Power Limit***. Use this option in both the motor and the generating modes.
[234]	Light load+evacuation	NOTE: This option is only available in FC 302. Use this option to ensure that the drive runs in the direction which requires least energy (UPS capacity), during an emergency and to operate the drive at reduced DC-voltage for evacuating people in case of power failure.
[235]	Setup bit 0	
[236]	Setup bit 1	

8-17 Configurable Alarm and Warning Word

Default value:	–	**Parameter type:**	Option, Array [16]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	True

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NOTE: This parameter is only valid for VLT® AQUA Drive FC 202 and VLT® AuotmationDrive FC 301/FC 302.

This is an array parameter with 16 elements, 1 element for each bit in range 0–15. Each of the bits can be configured to any of the following options.

Option	Name	Description
[0]	Off	
[1]	10 Volts low warning	
[2]	Live zero warning	
[3]	No motor warning	
[4]	Mains phase loss warning	
[5]	DC link voltage high warning	
[6]	DC link voltage low warning	
[7]	DC overvoltage warning	
[8]	DC undervoltage warning	
[9]	Inverter overloaded warning	
[10]	Motor ETR overtemp warning	
[11]	Motor thermistor overtemp warning	
[12]	Torque limit warning	
[13]	Over current warning	
[14]	Earth fault warning	
[17]	Controlword timeout warning	
[19]	Discharge temp high warning	
[22]	Hoist mech brake warning	NOTE: This option is only available in VLT® AutomationDrive FC 301/FC 302.
[23]	Internal fans warning	
[24]	External fans warning	
[25]	Brake resistor short circuit warning	
[26]	Brake powerlimit warning	
[27]	Brake chopper short circuit warning	
[28]	Brake check warning	
[29]	Heatsink temperature warning	
[30]	Motor phase U warning	
[31]	Motor phase V warning	
[32]	Motor phase W warning	
[34]	Fieldbus communication warning	
[36]	Mains failure warning	
[40]	T27 overload warning	

Option	Name	Description
[41]	T29 overload warning	
[45]	Earth fault 2 warning	
[47]	24V supply low warning	
[58]	AMA internal fault warning	
[59]	Current limit warning	
[60]	External interlock warning	
[61]	Feedback error warning	
[62]	Frequency max warning	
[64]	Voltage limit warning	
[65]	Controlboard overtemp warning	
[66]	Heatsink temp low warning	
[68]	Safe stop warning	
[73]	Safe stop autorestart warning	
[76]	Power unit setup warning	
[77]	Reduced powermode warning	
[78]	Tracking error warning	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.
[89]	Mech brake sliding warning	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.
[163]	ATEX ETR cur limit warning	
[165]	ATEX ETR freq limit warning	
[10002]	Live zero error alarm	
[10003]	No motor alarm	
[10004]	Mains phase loss alarm	
[10007]	DC overvoltage alarm	
[10008]	DC undervoltage alarm	
[10009]	Inverter overload alarm	
[10010]	ETR overtemperature alarm	
[10011]	Thermistor overtemp alarm	
[10012]	Torque limit alarm	
[10013]	Overcurrent alarm	
[10014]	Earth fault alarm	
[10016]	Short circuit alarm	
[10017]	CTW timeout alarm	

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Option	Name	Description
[100222]	Hoist brake alarm	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.
[10026]	Brake powerlimit alarm	
[10027]	Brakechopper shortcircuit alarm	
[10028]	Brake check alarm	
[10029]	Heatsink temp alarm	
[10030]	Phase U missing alarm	
[10031]	Phase V missing alarm	
[10032]	Phase W missing alarm	
[10033]	Inrush fault alarm	
[10034]	Fieldbus com faul alarm	
[10035]	Option fault alarm	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.
[10036]	Mains failure alarm	
[10037]	Phase imbalance alarm	
[10038]	Internal fault	
[10039]	Heatsink sensor alarm	
[10045]	Earth fault 2 alarm	
[10046]	Powercard supply alarm	
[10047]	24V supply low alarm	
[10048]	1.8V supply low alarm	
[10049]	Speed limit alarm	
[10060]	Ext interlock alarm	
[10061]	Feedback error alarm	
[10063]	Mech brake low alarm	
[10065]	Controlboard overtemp alarm	
[10067]	Option config changed alarm	
[10068]	Safe stop alarm	
[10069]	Power card temp alarm	
[10073]	Safestop auto restart alarm	
[10074]	PTC thermistor alarm	
[10075]	Illegal profile alarm	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.
[10078]	Tracking error alarm	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.

Option	Name	Description
[10079]	Illegal PS config alarm	
[10081]	CSIV corrupt alarm	
[10082]	CSIV param error alarm	
[10084]	No safety option alarm	
[10090]	Feedback monitor alarm	
[10091]	AI54 settings alarm	
[10164]	ATEX ETR current lim alarm	
[10166]	ATEX ETR freq limit alarm	
[10201]	Misc. alarm	NOTE: This option is only available in VLT® AutomationDrive FC 301/ FC 302.

8-18 Add Fieldbus ref. to Reference

Default value:	[1] Yes	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	Yes

This parameter specifies whether to use the fieldbus reference in reference calculations.

Option	Name	Description
[0]	No	The fieldbus reference is ignored, and only the fieldbus control word is used for reference calculations.
[1]*	Yes	The fieldbus reference is used for reference calculations.

8-19 Product Code

Default value:	Size related	**Parameter type:**	Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Select 0 to read out the actual fieldbus product code according to the mounted fieldbus option. Select 1 to read out the actual vendor ID.

5.1.3 8-3* FC Port Settings

8-30 Protocol

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the protocol to be used. Changing protocol is not effective until after powering off the drive.

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Option	Name	Description
[0]	FC	Communication according to the FC Protocol.
[1]	FC MC	Same as ***[0] FC*** but to be used when downloading SW to the drive or uploading a DLL file (covering information regarding parameters available in the drive and their inter-dependencies) to MCT 10 Setup software.
[2]	Modbus RTU	Communication according to the Modbus RTU protocol.
[3]	Metasys N2	NOTE: This option is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202. Communication protocol. The N2 software protocol is general in nature to accommodate the unique properties each device may have. See *VLT® HVAC Drive Metasys Operating Instructions*.
[4]	FLN	NOTE: This option is only available in VLT® HVAC Drive FC 102. Communication according to the Apogee FLN P1 protocol.
[5]	BACnet	NOTE: This option is only available in VLT® HVAC Drive FC 102. Communication according to an open data communications protocol (building automation and control network), American National Standard (ANSI/ASHRAE 135-1995).
[9]	FC option	NOTE: This option is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202. To be used when a gateway is connected to the integrated RS-485 port, for example the BACnet gateway. The following changes take place: • Address for the FC port is set to 1, and parameter ***8-31 Address*** is now used to set the address for the gateway on the network, for example BACnet. See *VLT® HVAC Drive BACnet Operating Instruction*. • Baud rate for the FC port is set to a fixed value (115.200 Baud), and parameter ***8-32 Baud Rate*** is now used to set the baud rate for the network port (for example, BACnet) on the gateway.
[20]	LEN	NOTE: This option is only available in VLT® HVAC Drive FC 102.
[23]	Modbus Multi Master	NOTE: This option is only available in VLT® AQUA Drive FC 202.
[25]	Modbus RTU master	NOTE: This option is only available in VLT® HVAC Drive FC 102.

8-31 Address

Default value:	Size related[1]	**Parameter type:**	Range, 1 - 255[2]
Setup:	1 setup	**Conversion index:**	0

Data type:	Uint8	**Change during operation:**	True

1) For VLT® AutomationDrive FC 301/FC 302, the default value is 1.

2) For VLT® AutomationDrive FC 301/FC 302, the range is 1–247.

Enter the address for the drive (standard) port. Valid range: Depends on the selected protocol.

8-32 FC Port Baud Rate

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]	2400 Baud	Baud rate selection for the FC (standard) port.
[1]	4800 Baud	
[2]	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

8-33 Parity/Stop Bits

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]	Even parity, 1 stop bit	
[1]	Odd parity, 1 stop bit	
[2]	No parity, 1 stop bit	
[3]	No parity, 2 stop bits	

8-34 Estimated Cycle Time

Default value:	0 ms	**Parameter type:**	Range, 0 - 1000000 ms
Setup:	2 setups	**Conversion:**	-3
Data type:	Uint32	**Change during operation:**	True

In noisy environments, the interface may be blocked due to overload or bad frames. This parameter specifies the time between 2 consecutive frames on the network. If the interface does not detect valid frames in that time, it flushes the receive buffer.

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8-35 Minimum Response Delay

Default value:	10 ms[1]	**Parameter type:**	Range, 1 - 10000 ms[2]
Setup:	1 setup	**Conversion index:**	-3
Data type:	Unt16	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102, the default value is size related.

2) For VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202, the range is 5–10000 ms.

Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

8-36 Max Response Delay

Default value:	Size related	**Parameter type:**	Range, 11 - 10001 ms
Setup:	1 setup	**Conversion index:**	-3
Data type:	Uint16	**Change during operation:**	True

Specify the maximum allowed delay time between transmitting a request and receiving a response. If a response from the drive exceeds the time setting, it is discarded.

8-37 Max Inter-Char Delay

Default value:	Size related	**Parameter type:**	Range, 0.00 - 35.00 ms
Setup:	1 setup	**Conversion index:**	-5
Data type:	Uint16	**Change during operation:**	True

Specify the maximum allowed time interval between receipt of 2 bytes. This parameter activates timeout if transmission is interrupted. This parameter is active only when parameter ***8-30 Protocol*** is set to ***[1] FC MC protocol***.

8-39 Protocol/Profile Firmware Version

Default value:	0	**Parameter type:**	Readout, Array [8]
Setup:	All setups	**Conversion index:**	0
Data type:	VisStr [10]	**Change during operation:**	False

This parameter shows the firmware revision as follows:

Index	Name
[0]	FC
[1]	Modbus
[2]	Metasys N2
[3]	FLN
[4]	BACnet
[5]	Future native protocol
[6]	PROFIdrive profile
[7]	DS402 profile

5.1.4 8-4* FC MC Protocol Set

8-40 Telegram Selection

Default value:	[1] Standard telegram 1	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enables use of freely configurable telegrams or standard telegrams for the FC port.

Option	Name	Description
[1]*	Standard telegram 1	
[20]	Standard telegram 20	NOTE: This option is only available in VLT® AQUA Drive FC 202 and VLT® AutomationDrive FC 301/FC 302.
[100]	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	
[109]	PPO 9	
[200]	Custom telegram 1	
[202]	Custom telegram 3	NOTE: This option is only available in VLT® AQUA Drive FC 202 and VLT® AutomationDrive FC 301/FC 302.

8-41 Parameters for Signals

Default value:	[0] None	**Parameter type:**	Readout, Array [1000]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	False

NOTE: This parameter is only available in VLT® AutomationDrive FC 301/FC 302.

Option	Name	Description
[0]*	None	
[15]	Readout: actual setup	

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Option	Name	Description
[109]	Mode of operation	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[321]	Touch target	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer.
[322]	Master scale numerator	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer.
[323]	Master scale denominator	NOTE: This option is only available in FC 302 with IMC software version 48.1X or newer.
[326]	Master offset	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer.
[328]	Master offset speed ref	NOTE: This option is only available in FC 302 with IMC software version 48.2X or newer.
[330]	Min. speed ramp time	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[361]	Ramp 3 ramp up time	NOTE: This option is only available in FC 302 with IMC software version 48.7X or newer.
[362]	Ramp 3 ramp down time	NOTE: This option is only available in FC 302 with IMC software version 48.7X or newer.
[380]	Jog/homing ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	

Option	Name	Description
[417]	Torque limit generator mode	
[482]	Power limit motor mode	
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #X30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X54/1 bus control	
[683]	Terminal X54/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1444]	d-axis reference gain	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	

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Option	Name	Description
[1583]	Motor Ud	View the motor voltage on the d-axis. The value is a calculated value used for controlling the motor.
[1584]	Motor Uq	View the motor voltage on the q-axis. The value is a calculated value used for controlling the motor.
[1585]	Motor Id	View the motor d-axis current measured as a mean value, I_{RMS}.
[1586]	Motor Iq	View the motor q-axis current measured as a mean value, I_{RMS}.
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	

Option	Name	Description
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback [Unit]	
[1653]	Digi pot reference	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	

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Option	Name	Description
[1683]	Fieldbus pos. REF	NOTE: This option is only available in FC 302 with IMC software version 48.0X or newer.
[1684]	Comm. option STW	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1687]	Bus readout alarm/warning	
[1688]	Fieldbus torque FF	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1699]	Ext. status word 3	
[1728]	SSI status bits	
[1740]	Fieldbus sync. delta	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[1741]	Fieldbus profile velocity	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[1742]	Fieldbus velocity FF.	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[1743]	Fieldbus acceleration FF.	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[1744]	Fieldbus target velocity	NOTE: This option is only available in FC 302 with IMC software version 48.8X or newer.
[1766]	SSI status	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	

Option	Name	Description
[1782]	Home position	NOTE: This option is only available in FC 302 with IMC software version 48.3X or newer.
[1783]	Homing speed	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer.
[1788]	Master home position	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer.
[1797]	Number of CAM cycles	NOTE: This option is only available in FC 302 with IMC software version 48.96 or newer.
[1804]	Mech brake count	
[1820]	Commanded position	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer.
[1821]	Master position	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer.
[1823]	Virtual master pos.	NOTE: This option is only available in FC 302 with IMC software version 48.4X or newer.
[1824]	Marker pos. offset	NOTE: This option is only available in FC 302 with IMC software version 48.5X or newer.
[1825]	Latched actual pos	NOTE: This option is only available in FC 302 with IMC software version 48.5X or newer.
[1826]	Fieldbus sync. delta REF	NOTE: This option is only available in FC 302 with IMC software version 48.5X or newer.
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2 [mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog out X49/7	

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Option	Name	Description
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1847]	X9 digital output [bin]	
[1848]	Last warning count	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[1864]	Power based speed limit	
[1866]	Actual switching frequency	
[1867]	Alarm word 4	
[1868]	Warning word 4	
[1889]	Mode of operation display	
[1898]	Expected time to ramp down	
[1899]	Speed PID torque FF. [Nm]	
[2470]	Min. ref. change	NOTE: This option is only available in FC 302 with IMC software version 48.96 or newer.
[2471]	Rope length	NOTE: This option is only available in FC 302 with IMC software version 48.96 or newer.
[2472]	Period of swing	NOTE: This option is only available in FC 302 with IMC software version 48.96 or newer.
[2473]	Max speed change per swing	NOTE: This option is only available in FC 302 with IMC software version 48.96 or newer.
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3421]	PCD 1 read from MCO	

Option	Name	Description
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4027]	Back EMF voltage	
[4029]	B-EMF protection log readout	
[4030]	Acc. delta speed	
[4031]	Acc. delta time	
[4032]	Dec. delta speed	

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Option	Name	Description
[4033]	Dec. delta time	
[4034]	Error code	
[4035]	DS402 Qstop	
[4036]	DS402 current actual	
[4037]	Motor current	
[4038]	Motor power	
[4039]	Motor torque	
[4280]	Safe option status	
[4281]	Safe option status 2	
[4282]	Safe control word	
[4283]	Safe status word	
[4285]	Active safe func.	
[4287]	Time until manual test	
[4520]	Type	
[4521]	Status	
[4523]	Baseline result info	
[4589]	Cavitation [%]	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	
[4901]	Autonomous status	
[4902]	Autonomous capacitance value	
[4911]	Baseline status	

8-42 PCD Write Configuration

Default value:	Size related	**Parameter type:**	Array [64]
Setup:	2 setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Select the parameters to be assigned to the telegrams of the PCD. The number of available PCDs depends on the telegram type. The values in the PCDs are then written to the selected parameters as data values.

8-43 PCD Read Configuration

Default value:	Size related	**Parameter type:**	Array [64]
Setup:	2 setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Select the parameters to be assigned to the PCDs of the telegrams. The number of available PCDs depends on the telegram type. PCDs contain the actual data values of the selected parameters.

8-45 BTM Transaction Command

Default value.	[0] Off	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	Off	
[1]	Write to active setup	
[2]	Commit transaction	Commit all parameters that have been sent during BTM mode.
[3]	Clear error	When parameter ***8-46 BTM Transaction Status*** shows an error (3–8), the parameter must be cleared by setting this value.
[4]	Write to setup 1	
[5]	Write to setup 2	
[6]	Write to setup 3	
[7]	Write to setup 4	
[8]	Cancel BTM transaction	Abort any BTM activity. Parameters are not committed.

8-46 BTM Transaction Status

Default value:	[0] Off	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]*	Off	
[1]	Transaction started	
[2]	Commit transaction	
[3]	Transaction timeout	
[4]	Err. non-existing par.	
[5]	Err. par. out of range	

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Option	Name	Description
[6]	Transaction failed	
[7]	SO config check	NOTE: This option is only available in VLT® AutomationDrive FC 302.
[8]	SO config check done	NOTE: This option is only available in VLT® AutomationDrive FC 302.

8-47 BTM Timeout

Default value:	60 s	**Parameter type:**	Range, 1 - 360 s
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

Select the BTM timeout after a BTM transaction has been started. Timeout is between each acyclic write of parameters.

8-48 BTM Maximum Errors

Default value:	21	**Parameter type:**	Range, 0 - 21
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

Select the maximum allowed number of bulk transfer mode errors before aborting. If it is set to maximum, there is no abort.

8-49 BTM Error Log

Defaul value:	Size related	**Parameter type:**	Array [22]
Setup:	1 setup	**Conversion index:**	-3
Data type:	Uint32	**Change during operation:**	True

List of parameters that failed during bulk transfer mode. The value after the decimal break is the fault code (255 stands for no error).

5.1.5 8-5* Digital/Bus

NOTE: The parameters in this group are only active when parameter ***8-01 Control Site*** is set to ***[0] Digital and control word***.

8-50 Coasting Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the trigger for the coasting function.

Option	Name	Description
[0]	Digital input	A digital input triggers the coasting function.
[1]	Bus	A serial communication port or the fieldbus triggers the coasting function.

Option	Name	Description
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the coasting function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the coasting function.

8-51 Quick Stop Select

Default value:	_[1]	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102 and VLT® AutomationDrive FC 301/FC 302, the default value is [3] Logic OR.

Select the control of the quick stop function via the terminals and/or via the bus.

Option	Name	Description
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]	Logic OR	
[4]	Disabled	NOTE: This option is only available in FC 202. The quick stop function is disabled.

8-52 DC Brake Select

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.

NOTE: When parameter ***1-10 Motor Construction*** is set to ***[1] PM non-salient SPM***, only selection ***[0] Digital input*** is available.

Option	Name	Description
[0]	Digital input	Activate a start command via a digital input.
[1]	Bus	Activate a start command via a serial communication port or fieldbus option.
[2]	Logic AND	Activate a start command via the fieldbus/serial communication port and also via 1 of the digital inputs.
[3]	Logic OR	Activate a start command via the fieldbus/serial communication port or via 1 of the digital inputs.

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8-53 Start Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the trigger for the start function.

Option	Name	Description
[0]	Digital input	A digital input triggers the start function.
[1]	Bus	A serial communication port or the fieldbus triggers the start function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the start function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the start function.

8-54 Reversing Select

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the trigger for the reversing function.

Option	Name	Description
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

8-55 Set-up Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the trigger for the setup selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the setup selection.
[1]	Bus	A serial communication port or the fieldbus triggers the setup selection.

Option	Name	Description
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the setup selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the setup selection.

8-56 Preset Reference Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the trigger for the preset reference selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the preset reference selection.
[1]	Bus	A serial communication port or the fieldbus triggers the preset reference selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the preset reference selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the preset reference selection.

8-57 PROFIdrive OFF2 Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: This parameter is only valid for VLT® AutomationDrive FC 301/FC 302

Select control of the drive OFF2 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when parameter ***8-01 Control Site*** is set to ***[0] Digital and ctrl. word*** and parameter ***8-10 Control Word Profile*** is set to ***[1] PROFIdrive profile***.

Option	Name	Description
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]*	Logic OR	

8-58 PROFIdrive OFF3 Select

Default value:	[3] Logic OR	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

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NOTE: This parameter is only valid for VLT® AutomationDrive FC 302/FC 302.

Select control of the drive OFF3 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when parameter ***8-01 Control Site*** is set to ***[0] Digital and ctrl. word*** and parameter ***8-10 Control Word Profile*** is set to ***[1] PROFIdrive profile***.

Option	Name	Description
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]*	Logic OR	

5.1.6 8-8* FC Port Diagnostics

Use the parameters in this group for monitoring the bus communication via the drive port.

8-80 Bus Message Count

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter shows the number of valid telegrams detected on the bus.

8-81 Bus Error Count

Default value:	0	**Parameter type:**	Readout, Array [6]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter shows the number of telegrams with faults (for example, CRC fault) detected on the bus.

8-82 Slave Messages Rcvd

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter shows the number of valid telegrams addressed to the slave sent by the drive.

8-83 Slave Error Count

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter shows the number of error telegrams which are not executed by the drive.

8-84 Slave Messages Sent

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102.

This parameter shows the number of messages sent from this drive.

8-85 Slave Timeout Errors

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102.

This parameter shows the number of messages suppressed due to timeout.

8-89 Diagnostics Count

Default value:	0	**Parameter type:**	Array [10]
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102.

This parameter shows the number of messages detected on the bus.

5.1.7 8-9* Bus Jog/Feedback

8-90 Bus Jog 1 Speed

Default value:	100 RPM(1)	**Parameter type:**	Range, 0 - Par. 4-13 RPM
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

1) VLT® AutomationDrive FC 301/FC 302 has not default value.

Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed

Default value:	Size related(1)	**Parameter type:**	Range, 0 - par. 4-13 RPM
Setup:	All setups	**Conversion index:**	67

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Data type:	Uint16	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102, the default value is 200 RPM.

Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

8-94 Bus Feedback 1

Default value:	0	**Parameter type:**	Range, -200 - 200
Setup:	1 setup	**Conversion index:**	0
Data type:	N2	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

8-95 Bus Feedback 2

Default value:	0	**Parameter type:**	Range, -200 - 200
Setup:	1 setup	**Conversion index:**	0
Data type:	N2	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

8-96 Bus Feedback 3

Default value:	0	**Parameter type:**	Range, -200 - 200
Setup:	1 setup	**Conversion index:**	0
Data type:	N2	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

8-97 Response Error Codes

Default value:	0	**Parameter type:**	Readout, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

NOTE: This parameter is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

This parameter is a 40-bytes buffer that contains the error words.

5.2 Parameter Group 12-** Ethernet

5.2.1 12-0* IP Settings

12-00 IP Address Assignment

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type: Uint8	Change during operation: True		

Select the method for assigning the IP address.

Option	Name	Description
[0]	Manual	Set the IP address in parameter ***12-01 IP Address***.
[1]	DHCP	Assign the IP address via DHCP server.
[2]	BOOTP	Assign the IP address via BOOTP server.
[3]	Disable	NOTE: This option is only available in FC 102 and FC 202.

12-01 IP Address

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

Configure the IP address of the option. Read-only if parameter ***12-00 IP Address Assignment*** is set to ***[1] DHCP***, ***[2] BOOTP***, or via DIP switches.

12-02 Subnet Mask

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

Configure the IP subnet mask of the option. Read-only if parameter ***12-00 IP Address Assignment*** is set to ***[1] DHCP*** or ***[2] BOOTP***.

12-03 Default Gateway

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup[1]	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

1) VLT® AQUA Drive FC 202 has 2 setups.

Configure the IP default gateway of the option. Read-only if parameter ***12-00 IP Address Assignment*** set to ***[1] DHCP*** or ***[2] BOOTP***. In a non-routed network, this address is set to the IP address of the I/O device.

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12-04 DHCP Server

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	2 setups	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

NOTE: This parameter is only available for VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

NOTE: A power cycle is necessary after setting the IP parameters manually.

This parameter is read-only. It shows the IP address of the found DHCP or BOOTP server.

12-05 Lease Expires

Default value:	Size related	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type:	TimeDifferenceWithDateIndication	**Change during operation:**	True

NOTE: This parameter is only available for VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.

This parameter is read-only. It shows the lease time for the current DHCP-assigned IP address.

12-06 Name Servers

Default value:	0	**Parameter type:**	Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

IP addresses of the domain name servers. Can be automatically assigned when using DHCP.

12-07 Domain Name

Default value:	0	**Parameter type:**	Range, 0 - 48
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[48]	**Change during operation:**	True

Domain name of the attached network. Can be automatically assigned when using DHCP network.

12-08 Host Name

Default value:	0	**Parameter type:**	Range, 0 - 48
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[48]	**Change during operation:**	True

NOTE: The display of the drive only shows the 1st 19 characters, but the remaining characters are stored in the drive.

Logical (given) name of the option.

12-09 Physical Address

Default value:	0	**Parameter type:**	Range, 0 - 17
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[17]	**Change during operation:**	True

This parameter is read-only. It shows the physical (MAC) address of the option.

5.2.2 12-1* Ethernet Link Parameters

The following applies for the whole parameter group:

- Index [0] is used for port 1, and index [1] is used for port 2.
- For EtherCat, index [0] is for the in-port, and index [1] is for the out-port.

12-10 Link Status

Default value:	[0] No link	**Parameter type:**	Readout, Array [2]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This parameter is read-only. It shows the link status of the Ethernet ports. Index [0] is used for port 1, and index [1] is used for port 2. For EtherCAT, index [0] is for the in-port, and index [1] is for the out-port.

Index	Description
[0]*	No link
[1]	Link

12-11 Link Duration

Default value:	Size related	**Parameter type:**	Readout, Array [2]
Setup:	All setups	**Conversion index:**	0
Data type:	TimeDifferenceWithDateIndication	**Change during operation:**	True

Shows the duration of the present link on each port in dd:hh:mm:ss.

12-12 Auto Negotiation

Default value:	[1] On[1]	**Parameter type:**	Option, Array [2]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) VLT® AutomationDrive FC 301/FC 302 has no default value.

Configures auto negotiation of Ethernet link parameters, for each port: ON or OFF. Link Speed and Link Duplex can be configured in parameter ***12-13 Link Speed*** and parameter ***12-14 Link Duplex***.

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Option	Name	Description
[0]	Off	
[1]*	On	

12-13 Link Speed

Default value:	[0] None[1]	**Parameter type:**	Option, Array [2]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) VLT® AutomationDrive F 301/FC 302 has not default value.

Forces the link speed for each port in 10 Mbps or 100 Mbps. If parameter ***12-12 Auto Negotiation*** is set to ***[0] On***, this parameter is read-only and shows the actual link speed. If no link is present, ***[0] None*** is shown.

Option	Name	Description
[0]*	None	
[1]	10 Mbps	
[2]	100 Mbps	

12-14 Link Duplex

Default value:	[1] Full duplex[1]	**Parameter type:**	Option, Array [2]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) VLT® AutomationDrive FC 301/FC 302 does not have a default value.

Forces the duplex for each port to full or half duplex. If parameter ***12-12 Auto Negotiation*** is set to ***[1] On***, this parameter is read-only.

Option	Name	Description
[0]	Half duplex	
[1]*	Full duplex	

12-18 Supervisor MAC

Default value:	0	**Parameter type:**	Array [2]
Setup:	2 setups	**Conversion index:**	0
Data type:	OctStr[6]	**Change during operation:**	True

MAC addresses of currently active supervisors.

12-19 Supervisor IP Addr.

Default value:	0	**Parameter type:**	Array [2]
Setup:	2 setups	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

IP addresses of currently active supervisors.

5.2.3 12-2* Process Data

12-20 Control Instance

Default value:	Size related	**Parameter type:**	Range, 0 - 255
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

This parameter is read-only. It shows the connection to the master.

- In Ethernet/IP: If no CIP connection is present, None is shown.
- In EtherCAT: If no connection is active, None is shown, otherwise it shows the active PDO.

12-21 Process Data Config Write

Default value:	–	**Parameter type:**	Option, Array [20]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	True

Option	Name	Description
[0]	None	
[177]	Compressor start max speed [RPM]	NOTE: This option is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.
[178]	Compressor start max speed [Hz]	NOTE: This option is only available in VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202.
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[319]	Jog speed [RPM]	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[380]	Jog/homing ramp time jog ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[553]	Term. 29 high ref./feedb. value	

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Option	Name	Description
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	NOTE: This option is only available in FC 302.
[703]	Speed PID integral time	NOTE: This option is only available in FC 302.
[704]	Speed PID feed forward factor	NOTE: This option is only available in FC 302.
[748]	PCD feed forward	NOTE: This option is only available in FC 302.
[890]	Bus jog 1speed	
[891]	Bus jog 2 speed	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1444]	d-axis reference gain	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1728]	SSI status bits	NOTE: This option is only available in FC 302.

12-22 Process Data Config Read

Default value:	–	**Parameter type:**	Option, Array [20]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	True

Option	Name	Description
[0]	None	
[15]	Readout: actual setup	
[177]	Compressor start max speed [RPM]	NOTE: This option is only available in FC 102 and FC 202.
[178]	Compressor start max speed [Hz]	NOTE: This option is only available in FC 102 and FC 202.
[894]	Bus feedback 1	NOTE: This option is only available in FC 102 and FC 202.
[895]	Bus feedback 2	NOTE: This option is only available in FC 102 and FC 202.
[896]	Bus feedback 3	NOTE: This option is only available in FC 102 and FC 202.
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1444]	d-axis reference gain	
[1472]	Legacy alarm word	NOTE: This option is only available in FC 302.
[1473]	Legacy warning word	NOTE: This option is only available in FC 302.
[1474]	Leg. ext. status word	NOTE: This option is only available in FC 302.
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1583]	Motor U_d	NOTE: This option is only available in FC 302.
[1584]	Motor U_q	NOTE: This option is only available in FC 302.
[1585]	Motor I_d	NOTE: This option is only available in FC 302.
[1586]	Motor I_q	NOTE: This option is only available in FC 302.
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	

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Option	Name	Description
[1606]	Actual position	NOTE: This option is only available in FC 302.
[1608]	Position error	NOTE: This option is only available in FC 302.
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm]	NOTE: This option is only available in FC 302.
[1626]	Power filtered [kW]	NOTE: This option is only available in FC 102 and FC 202.
[1627]	Power filtered [hp]	NOTE: This option is only available in FC 102 and FC 202.
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	

Option	Name	Description
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	NOTE: This option is only available in FC 302.
[1652]	Feedback[unit]	
[1653]	Digi pot reference	
[1654]	Feedback 1 [unit]	NOTE: This option is only available in FC 102 and FC 202.
[1655]	Feedback 2 [unit]	NOTE: This option is only available in FC 102 and FC 202.
[1656]	Feedback 3 [unit]	NOTE: This option is only available in FC 102 and FC 202.
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	NOTE: This option is only available in FC 302.
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1684]	Comm. option STW	
[1685]	FC port CTW 1	NOTE: This option is only available in FC 102.
[1687]	Bus readout alarm/warning	

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Option	Name	Description
[1689]	Configurable alarm/warning word	NOTE: This option is only available in FC 202 and FC 302.
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Alarm word	
[1693]	Alarm word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1699]	Ext. status word 3	NOTE: This option is only available in FC 202 and FC 302.
[1728]	SSI status bits	NOTE: This option is only available in FC 302.
[1766]	SSI status	NOTE: This option is only available in FC 302.
[1767]	Raw inc. quad counter	NOTE: This option is only available in FC 302.
[1768]	Raw abs. pos. low	NOTE: This option is only available in FC 302.
[1769]	Raw abs. pos. high	NOTE: This option is only available in FC 302.
[1804]	Mech brake count	NOTE: This option is only available in FC 302.
[1827]	Safe opt. est. speed	NOTE: This option is only available in FC 302.
[1828]	Safe opt. meas. speed	NOTE: This option is only available in FC 302.
[1829]	Safe opt. speed error	NOTE: This option is only available in FC 302.
[1830]	Analog input X42/1	NOTE: This option is only available in FC 102 and FC 202.
[1831]	Analog input X42/3	NOTE: This option is only available in FC 102 and FC 202.
[1832]	Analog input X42/5	NOTE: This option is only available in FC 102 and FC 202.
[1833]	Analog out X42/7 [V]	NOTE: This option is only available in FC 102 and FC 202.

Option	Name	Description
[1834]	Analog out X42/9 [V]	NOTE: This option is only available in FC 102 and FC 202.
[1835]	Analog out X42/11 [V]	NOTE: This option is only available in FC 102 and FC 202.
[1836]	Analog input X48/2[mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 Digital output [bin]	
[1847]	Last warning	
[1848]	Last warning count	
[1850]	Sensorless readout [unit]	NOTE: This option is only available in FC 102 and FC 202.
[1860]	Digital input 2	
[1861]	Temp. input X48 max	NOTE: This option is only available in FC 302.
[1864]	Power based speed limit	NOTE: This option is only available in FC 302.
[1866]	Actual switching frequency	
[1867]	Alarm word 4	
[1868]	Warning word 4	
[1899]	Speed PID torque FF [Nm]	NOTE: This option is only available in FC 302.

12-27 Primary Master

NOTE: In VLT® AutomationDrive FC 301/FC 302, this parameter is called ***Master Address***.

Default value:	0	**Parameter type:**	Range, Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True[1]

1) In VLT® Aqua Drive FC 202 and VLT® AutomationDrive FC 301/FC 302, change during operation=false.

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Holds the valid ip addresses for masters that are allowed to control this slave. If both indexes are set to 0.0.0.0 all masters have access.

12-28 Store Data Values

Default value:	[0] Off	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This parameter activates a function that stores all parameter values in the non-volatile memory (EEPROM) thus retaining parameter values at power-down. The parameter returns to ***[0] Off***.

Option	Name	Description
[0]*	Off	
[1]	Store all setups[1]	
[2]	Store all setups	

1) In VLT® AQUA Drive FC 202, this option is called Store edit setup.

12-29 Store Always

Default value:	[0] Off	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Activates a function that always stores received parameter data in the non-volatile memory (EEPROM).

Option	Name	Description
[0]*	Off	
[1]	On	

5.2.4 12-3* EtherNet/IP

12-30 Warning Parameter

Default value:	0	**Parameter type:**	Readout
Setup:	All setups	**Conversion index:**	0
Data type	Uint32	**Change during operation:**	True

This parameter is read-only. It shows the EtherNet/IP-specific 16-bit status word.

Table 12: 16-Bit Status Word, EtherNet/IP

Bit	Description
0	Owned
1	Not used
2	Configured
3	Not used
4	Not used
5	Not used

Table 12: 16-Bit Status Word, EtherNet/IP - (continued)

Bit	Description
6	Not used
7	Not used
8	Minor recoverable fault
9	Minor unrecoverable fault
10	Major recoverable fault
11	Major unrecoverable fault
12	Not used
13	Not used
14	Not used
15	Not used

12-31 Net Reference

Default value:	[0] Off	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Shows the reference source in instance 21/71.

Option	Name	Description
[0]*	Off	Reference from the network is not active.
[1]	On	Reference from the network is active.

12-32 Net Control

Default value:	[0] Off	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uin8	**Change during operation:**	True

Shows the control source in instance 21/71.

Option	Name	Description
[0]*	Off	Control via the network is not active.
[1]	On	Control via the network is active.

12-33 CIP Revision

Default value:	Size related	**Parameter type:**	Readout, Array [2]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

This parameter is read-only. It shows the CIP version of the option software.

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12-34 CIP Product Code

Default value:	Size related	**Parameter type:**	Range, 0 - 65535
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

This parameter is read-only. It shows the CIP product code.

12-37 COS Inhibit Timer

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Read-only change-of-state inhibit timer. If the option is configured for COS operation, this inhibit timer can be configured in the forward open telegram to prevent the continuously changing PCD data from generating extensive network traffic. The inhibit time is in ms. 0 = disabled.

12-38 COS Filter

Default value:	0	**Parameter type:**	Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Change-of-state PCD filters. Sets up a filter mask for each word of process data when operating in COS mode. Single bits in the PCDs can be filtered in/out.

5.2.5 12-8* Other Ethernet Services

12-80 FTP Server

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enables/disables the built-in FTP server.

Option	Name	Description
[0]*	Disabled	Disable the built-in FTP server.
[1]	Enabled	Enable the built-in FTP server.
[2]	Enabled with TLS	NOTE: This option is only available in FC 102 and FC 202.

12-81 HTTP Server

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enables/disables the built-in HTTP (web) server.

Option	Name	Description
[0]*	Disabled	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) server.

12-82 SMTP Service

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enables/disables the built-in SMTP (e-mail) service on the option.

Option	Name	Description
[0]*	Disabled	Disable the SMTP (e-mail) service on the option.
[1]	Enabled	Enable the SMTP (e-mail) service on the option.

12-83 SNMP Agent

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Use this parameter to either enable or disable the SNMP agent.

Option	Name	Description
[0]	Disabled	Disable the SNMP agent.
[1]*	Enabled	Enable the SNMP agent.

12-84 Address Conflict Detection

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Use this parameter to detect and resolve IP address conflict.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

12-85 ACD Last Conflict

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	2 setups	**Comversion index:**	0
Data type:	OctStr[35]	**Change during operation:**	True

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The name of the IP address causing the most recent address conflict.

12-86 NTP Host Server

Default value:	0	**Parameter type:**	Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[48]	**Change during operation:**	True

Enter the IPv4/IPv6 address, the FQDN, or the hostname of the NTP server.

12-87 SNTP Time Sync

Default value:	60 min	**Parameter type:**	Range, 1 - 65535 min
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Synchronize the clock via NTP at a defined interval.

12-89 Transparent Socket Channel Port

Default value:	Size related	**Parameter type:**	Range, 0 - 65535
Setup:	2 setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Configures the TCP port number for the transient socket channel. This enables FC telegrams to be sent transiently on Ethernet via TCP. 0 indicates that the function is disabled.

5.2.6 12-9* Advanced Ethernet Services

12-90 Cable Diagnostics

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enables/disables the advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in parameter ***12-93 Cable Error Length***. The parameter resumes to the default setting ***[0] Disable*** after the diagnostics have finished.

NOTE: The cable diagnostics function is only issued on ports where there is no link (see parameter ***12-10 Link Status***).

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

12-91 Auto Cross Over

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–

Data type:	Uint8	**Change during operation:**	True

NOTE: Disabling of the auto-crossover function requires crossed Ethernet cables for daisy-chaining the options.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

12-92 IGMP Snooping

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enabling the IGMP snooping function prevents flooding of the Ethernet protocol stack. Multicast packets are only forwarded to ports that are a member of the multicast group.

Option	Name	Description
[0]	Disabled	The IGMP snooping function is disabled.
[1]*	Enabled	The IGMP snooping function is enabled.

12-93 Cable Error Length

Default value:	0	**Parameter type:**	Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

If cable diagnostics is enabled in parameter ***12-90 Cable Diagnostic***, the built-in switch is possible via time domain reflectometry (TDR). This is a measurement technique which detects common cabling problems such as open circuits, short circuits, and impedance mismatches or breaks in transmission cables. The distance from the option to the error is shown in meters with an accuracy of ±2 m (6.6 ft). The value 0 means no errors detected.

12-94 Broadcast Storm Protection

Default value:	-1%	**Parameter type:**	Range, -1 - 20%
Setup:	2 setups	**Conversion index:**	0
Data type:	Int8	**Change during operation:**	True

The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: OFF means that the filter is disabled - all broadcast messages are passed through. The value 0% means that no broadcast messages are passed through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages exceeds the 10% threshold, they are blocked.

12-95 Inactivity Timeout

Default value:	120	**Parameter type:**	Range, 0 - 3600

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Setup:	2 setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Applies to parameter ***12-94 Broadcast Storm Protection***, if the broadcast storm protection also includes multicast telegrams.

12-96 Port Config

Default value:	_(1)	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

1) In VLT® HVAC Drive FC 102, the default value is [0] Normal.

Enable or disable the port-mirroring function. The function is used for troubleshooting with a network analyzer tool.

Option	Name	Description
[0]	Normal/Disable	
[1]	Mirror port 1 to 2	
[2]	Mirror port 2 to 1	
[10]	Port 1 disabled	
[11]	Port 2 disabled	
[254]	Mirror int. port to 1	NOTE: This option is only available in FC 202.
[255]	Mirror int. port to 2	NOTE: This option is only available in FC 202.

12-97 QoS Priority

Default value:	Size related	**Parameter type:**	Array [7]
Setup:	2 setups	**Conversion index:**	0
Data type:	Int8	**Change during operation:**	True

Each index sets the DSCP value of different types of QoS prioritized messages.

Table 13: Parameter Index

Index	Value
[0]	59
[1]	47
[2]	55
[3]	47
[4]	43
[5]	31
[6]	27

12-98 Interface Counters

Default value:	4000[1]	**Parameter type:**	Readout, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

1) For VLT® HVAC Drive FC 102, the default value is 0.

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

Table 14: Parameter Indices

Index	Description
[0]	Octet received on the interface.
[1]	Unicast packets received on the interface.
[2]	Non-unicast packets received on the interface
[3]	Inbound packets received on the interface, but discarded.
[4]	Inbound packets that contain errors.
[5]	Incound packets with unknown protocol.
[6]	Octet sent on the interface.
[7]	Unicast packets sent on the interface.
[8]	Non-unicast packets sent on the interface.
[9]	Outbound packets discarded.
[10]	Outbound packets that contain errors.

12-99 Media Counters

Default value:	0	**Parameter type:**	Readout, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

Table 15: Parameter Indices

Index	Description
[0]	Alignment errors
[1]	FCS errors
[2]	Single collisions
[3]	Multiple collisions
[4]	SQE test errors
[5]	Deferred transmissions
[6]	Late collisions
[7]	Excessive collisions

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Table 15: Parameter Indices - (continued)

Index	Description
[8]	MAC transmit errors
[9]	Carrier sense errors

6 Troubleshooting

6.1 LED Status

The EtherNet/IP interface has 3 bicolored LEDs that allow a fast and detailed diagnosis. Each LED is linked to its unique part of the EtherNet/IP interface, see Table 16.

Table 16: LED Label

LED label	Description
MS	Module status, reflects the activity on the EtherNet/IP stack.
NS1	Network status 1, reflects the activity on port 1.
NS2	Network status 2, reflects the activity on port 2.

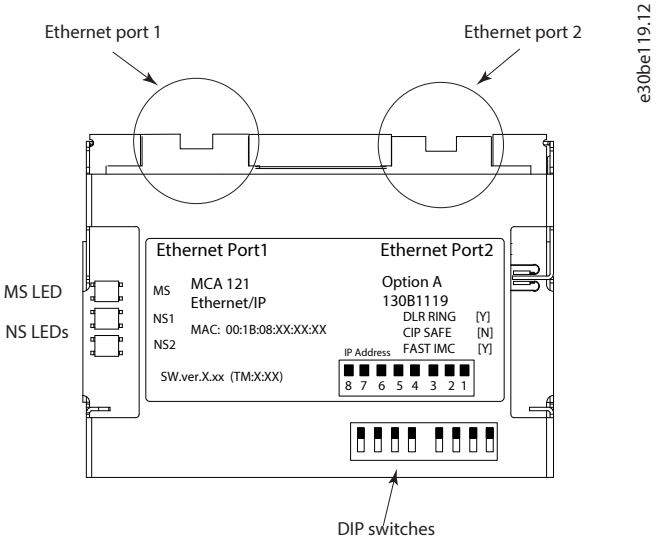


Figure 20: Overview of the EtherNet/IP Module

Table 17: MS: Module Status

State	LED		Description
Standby		Flashing green	The device needs commissioning.
Device operational		Solid green	The device is operational.
Major recoverable fault		Flashing red	The device has detected a recoverable fault (MAR).
Major unrecoverable fault		Solid red	The device has detected an unrecoverable fault (MAU).
Self-test		Flashing red/green	The EIP option is in self-test mode.

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Table 18: NS1 + NS2: Network Status (1 per Port)

State	LED		Description
No connections		Flashing green	There are no established CIP connections to the device.
Connected		Solid green	There is at least 1 established CIP connection to the device.
Connection timeout		Flashing red	1 or more CIP connections have timed out.
Duplicate IP		Solid red	The IP address assigned to the device is already in use.
Self-test	 	Flashing red/green	The EIP option is in self-test mode.

6.2 No Communication with the Drive

If there is no communication with the drive, proceed with the following checks:

Check the link status

If CIP connection is not established, the status of the Ethernet link cannot be directly identified using the LEDs. Verify presence of the link in parameter ***12-10 Link Status***.

Verify that the link is steadily present in parameter ***12-11 Link Duration***. The parameter shows the duration of the present link and is preset to 00:00:00:00 when the link is broken.

Check the cabling

In rare cases of cabling misconfiguration, the option may show the presence of a link even if no communication is running. Exchange the cable if in doubt.

Check the IP address

Verify that the option has a valid IP address in parameter ***12-01 IP Address***. If the option has identified a duplicate IP address, the NS LEDs are solid red. If the option is set up for BOOTP or DHCP, verify that a BOOTP or DHCP server is connected in parameter ***12-04 DHCP Server***. If no server is connected, the parameter shows 000.000.000.000.

6.3 Warnings and Alarms

NOTE: Refer to the drive-specific operating guide for an overview of warning and alarm types, and for the full list of warnings and alarms.

Alarm words and warning words are shown in the display in hex format. When there is more than 1 warning or alarm, the sum of all warnings and alarms is shown. Warning words and alarm words are shown in parameter ***16-90 Alarm Word*** to parameter ***16-99 Ext. Status Word 3*** and in parameter ***18-67 Alarm Word 4*** to parameter ***18-68 Warning Word 4***.

Table 19: Parameter 16-90 Alarm Word

Bit (hex)	Alarm word (parameter 16-90 Alarm Word)	CIP classification
00000001	Brake check	–
00000002	Power card overtemperature	MAR
00000004	Ground fault	MAU

Table 19: Parameter 16-90 Alarm Word - (continued)

Bit (hex)	Alarm word (parameter 16-90 Alarm Word)	CIP classification
00000008	Control card overtemperature	–
00000010	Control word timeout	MAR
00000020	Torque limit	MAU
00000040	Overcurrent	MAR
00000080	Motor thermistor overtemperature	MAR
00000100	Motor ETR overtemperature	MAR
00000200	Inverter overloaded	MAR
00000400	DC-link undervoltage	MAR
00000800	DC-link overvoltage	MAR
00001000	Short circuit	MAU
00002000	Inrush fault	MAR
00004000	Mains phase loss	MAU
00008000	AMA not OK	MAR
00010000	Live zero error	MAR
00020000	Internal fault	MAU
00040000	Brake overload	MAU
00080000	Motor phase U is missing	MAU
00100000	Motor phase V is missing	MAU
00200000	Motor phase W is missing	MAU
00400000	Fieldbus fault	MAR
00800000	24 V supply fault	MAU
01000000	Mains failure	MAR
02000000	1.8 V supply fault	MAU
04000000	Brake resistor short circuit	MAR
08000000	Brake chopper fault	MAR
10000000	Option change	–
20000000	Drive initialized	–
40000000	Safe stop	MAR
80000000	Mech. brake low	–

Table 20: Parameter 16-91 Alarm Word 2

Bit (hex)	Alarm word (parameter 16-91 Alarm Word 2)
00000001	Service trip, read/write
00000002	Gate drive voltage fault
00000004	Service trip, type code/spare part
00000008	Service trip (reserved)

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Table 20: Parameter 16-91 Alarm Word 2 - (continued)

Bit (hex)	Alarm word (parameter 16-91 Alarm Word 2)
00000010	Service trip (reserved)
00000020	No flow
00000040	Dry pump
00000080	End-of-curve
00000100	Broken belt
00000200	Discharge high
00000400	Start failed
00000800	Speed limit
00001000	External interlock
00002000	Illegal option combi.
00004000	No safety option
00008000	Flow/pressure infor missing
00010000	Earth fault DESAT/Hoist mech. brake
00020000	KTY error
00040000	Fans error
00080000	ECB error
00100000	Option detection
00200000	Option fault
00400000	Locked rotor
00800000	Position ctrl. fault
01000000	Tension limit/Overspeed
02000000	Current limit
04000000	Motor not at standstill
08000000	AIC fault
10000000	Feedback fault
20000000	Feedback error/monitor, locked rotor
40000000	PTC thermistor
80000000	Dangerous failure

Table 21: Parameter 16-92 Warning Word

Bit (hex)	Alarm word (parameter 16-92 Warning Word)
00000001	Brake check
00000002	Power card overtemperature
00000004	Ground fault
00000008	Control card overtemperature
00000010	Control word timeout
00000020	Overcurrent

Table 21: Parameter 16-92 Warning Word - (continued)

Bit (hex)	Alarm word (parameter 16-92 Warning Word)
00000040	Torque limit
00000080	Motor thermistor overtemperature
00000100	Motor ETR overtemperature
00000200	Inverter overloaded
00000400	DC-link undervoltage
00000800	DC-link overvoltage
00001000	DC-link voltage low
00002000	DC-link voltage high
00004000	Mains phase loss
00008000	No motor
00010000	Live zero error
00020000	10 V low
00040000	Brake resistor power limit
00080000	Brake resistor short circuit
00100000	Brake chopper fault
00200000	Speed limit
00400000	Fieldbus communication fault
00800000	24 V supply fault
01000000	Mains failure
02000000	Current limit
04000000	Low temperature
08000000	Voltage limit
10000000	Encoder loss
20000000	Output frequency limit
40000000	Safe stop
80000000	Extended status word

Table 22: Parameter 16-93 Warning Word 2

Bit (hex)	Alarm word (parameter 16-93 Warning Word 2)
00000001	Start delayed
00000002	Stop delayed
00000004	Clock failure
00000008	Fire mode/emergency mode was active
00000010	Check valve failure
00000020	No flow
00000040	Dry pump
00000080	End-of-curve

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Table 22: Parameter 16-93 Warning Word 2 - (continued)

Bit (hex)	Alarm word (parameter 16-93 Warning Word 2)
00000100	Broken belt
00000200	Discharge high
00000400	Multi-monitor underload
00000800	Multi-monitor overload
00001000	Compressor interlock
00002000	Mechanical brake sliding
00004000	Safe option warning
00008000	Auto DC braking
00010000	Hoist mech. brake
00020000	KTY warning
00040000	Fans warning
00080000	ECB warning
00100000	Terminal 27 overload
00200000	Terminal 29 overload
00400000	Memory module
00800000	Reserved
01000000	Overspeed
02000000	Power limit motor
04000000	Power limit generator
08000000	AIC fault
10000000	Feedback fault
20000000	Back EMF too high
40000000	PTC thermistor
80000000	Production mode

Table 23: Parameter 16-94 Extended Status Word

Bit (hex)	Alarm word (parameter 16-94 Extended Status Word)
00000001	Ramping
00000002	AMA running
00000004	Start CW/CCW
00000008	Slow down
00000010	Catch up
00000020	Feedback high
00000040	Feedback low
00000080	Output current high
00000100	Output current low
00000200	Output frequency high

Table 23: Parameter 16-94 Extended Status Word - (continued)

Bit (hex)	Alarm word (parameter 16-94 Extended Status Word)
00000400	Output frequency low
00000800	Brake check OK
00001000	Braking maximum
00002000	Braking
00004000	Out of speed range
00008000	OVC active
00010000	AC brake
00020000	Password timelock
00040000	Password protection
00080000	Reference high
00100000	Reference low
00200000	Local reference/Remote reference
00400000	Production mode notification
00800000	Derag
01000000	Oil boost
02000000	Derating
04000000	AIC sleeping
08000000	Reactive current = ref ±10%
10000000	DC-link voltage = ref ±10%
20000000	Regenerating
40000000	Regen current limit
80000000	Production

Table 24: Parameter 16-95 Extended Status Word 2

Bit (hex)	Alarm word (parameter 16-95 Extended Status Word 2)
00000001	Off
00000002	Hand/Auto
00000004	PROFIBUS OFF1 active
00000008	PROFIBUS OFF2 active
00000010	PROFIBUS OFF3 active
00000020	Relay 123 active
00000040	Start prevented
00000080	Control ready
00000100	Drive ready
00000200	Quick stop
00000400	DC brake
00000800	Stop

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Table 24: Parameter 16-95 Extended Status Word 2 - (continued)

Bit (hex)	Alarm word (parameter 16-95 Extended Status Word 2)
00001000	Stand by
00002000	Freeze output request
00004000	Freeze output
00008000	Jog request
00010000	Jog
00020000	Start request
00040000	Start
00080000	Start applied
00100000	Start delay
00200000	Sleep
00400000	Sleep boost
00800000	Running
01000000	Bypass
02000000	Fire mode/Emergency mode
04000000	External interlock
08000000	Fire mode/Emergency mode limit exceed
10000000	Fly start active
20000000	Heat sink clean warning
40000000	Check value ramping
80000000	Running (VLT® AQUA Drive FC 202 only)

7 Appendix

7.1 Supported CIP Objects

As in all implementations of CIP, EtherNet/IP shares the common object model. Objects are a common way of describing the specific application implemented in a device.

Data is structured in classes, instances, and attributes. A class is a group of objects with the same structure. These groups of objects within a class are called instances. Every instance provides the same data elements called attributes. Each class provides services to access data or to change the state of an object.

Table 25: Instance Attributes - Class ID 0x01 Identity Object

Attribute	Access	Name	Data type	Description
1	Get	Vendor	Uint (97)	Danfoss Drives vendor code
2	Get	Device type	Uint (2)	Drive
3	Get	Product code	Uint	Value of parameter ***12-34 CIP Product Code***
4	Get	Revision	Struct	Value of parameter ***12-33 CIP Revision***
5	Get	Status	WORD	EIP status word (parameter ***12-30 Warning Parameter***)
6	Get	Serial number	UDINT	Serial number
7	Get	Product name	String	Value of parameter ***15-40 FC Type***
8	Get	State	Uint	0 = Non-existing 1 = Device self-testing 2 = Standby 3 = Operational 4 = Major recoverable fault 5 = Major unrecoverable fault 6–254 = Reserved 255 = Default for get attribute all
9	Get	Conf. consistency value	Uint	–
10	Get	Heartbeat interval	Uint	–

Table 26: Instance Attributes - Class ID 0x04 Assembly Objects

Instance	Access	Name	Size	Description
20	Set	ODVA basic speed control output	2 words	–
21	Set	ODVA extended speed control output	2 words	–
70	Get	ODVA basic speed control input	2 words	–
71	Get	ODVA extended speed control input	2 words	–
100	Set	Danfoss basic control output	2 words	–

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Table 26: Instance Attributes - Class ID 0x04 Assembly Objects - (continued)

Instance	Access	Name	Size	Description
101	Set	Danfoss extended control output	4 words	–
103	Set	Danfoss extended control output	10 words	–
150	Get	Danfoss basic control input	2 words	–
151	Get	Danfoss extended control input	4 words	–
153	Get	Danfoss extended control input	10 words	–

Table 27: Instance Attributes - Class ID 0x06 Connection Manager

Attributes	Access	Name	Data type	Description
1	Get	Open requests	Uint	Number of forward open requests received.
2	Get	Open format rejects	Uint	Number of forward open requests rejected due to bad format.
3	Get	Open resource rejects	Uint	Number of forward open requests rejected due to lack of resources.
4	Get	Other open rejects	Uint	Number of forward open requests rejected due to other reasons.
5	Get	Close requests	Uint	Number of forward close requests received.
6	Get	Close format requests	Uint	Number of forward close requests rejected due to bad format.
7	Get	Close other requests	Uint	Number of forward close requests rejected due to other reasons.
8	Get	Connection timeouts	Uint	Number of connection timeouts.
9	Get	Connection entry list	INT	Number of connection entries ConnOpenBits ARRAY of BOOL List of connection data.

Table 28: Instance Attribute - Class ID 0x28 Motor Data Object

Attribute	Access	Name	Data type	Parameter	Description
1	Get	Number of attributes supported	USINT	–	7
2	Get	List of attributes supported	Array of USINT	–	3,6,7,8,9,12,15

Table 28: Instance Attribute - Class ID 0x28 Motor Data Object - (continued)

Attribute	Access	Name	Data type	Parameter	Description
3	Get/Set	Motor type	USINT	***1-10 Motor Construction***	3: PM sync. motor 7: Squirrel cage induction motor
6	Get/Set	Rated current	Uint	***1-24 Motor Current***	Unit: 100 mA
7	Get/Set	Rated voltage	Uint	***1-22 Motor Voltage***	Unit: V
8	Get/Set	Rated power	UDINT	***1-20 Motor Power [kW]***	Unit: W
9	Get/Set	Rated frequency	Uint	***1-23 Motor Frequency***	Unit: Hz
12	Get/Set	Pole count	Uint	***1-39 Motor Poles***	Number of poles in the motor
15	Get/Set	Base speed	Uint	***1-25 Nominal Motor Speed***	Unit: RPM

NOTE: Class ID 0x28 is only available when ***[5] ODVA*** is selected in parameter ***8-10 Control Word Profile***.

Table 29: Instance Attributes - Class ID 0x29 Control Supervisor Object

Attributes	Access	Name	Data type	Description
1	Get	Number of attributes supported	USINT	12
2	Get	List of supported attributes	Array of USINT	3,4,5,6,7,8,9,10,11,12,13,15
3	Get/Set	Run 1 (forward)	Boolean	Drive CTW bit 6=Run 1 XOR Run 2 Drive CTW bit 15=0
4	Get/Set	Run 2 (reverse)	Boolean	Drive CTW bit 6=Run 1 XOR Run 2 Drive CTW bit 15=1
5	Get/Set	Network control	Boolean	Parameter ***12-32 Net Control*** value written from option
6	Get	State	USINT	The state of the CIP state machine
7	Get	Running 1	Boolean	Run 1 AND bit 11 in drive STW
8	Get	Running 2	Boolean	Run 2 AND bit 11 in drive STW
9	Get	Ready	Boolean	STATE_ENABLED or STATE_STOPPING or STATE_FAULT_STOP from state machine
10	Get	Faulted	Boolean	Bit 3 in drive STW
11	Get	Warning	Boolean	Bit 7 in drive STW
12	Get/Set	Fault reset	Boolean	Bit 7 in drive CTW

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Table 29: Instance Attributes - Class ID 0x29 Control Supervisor Object - (continued)

Attributes	Access	Name	Data type	Description
13	Get	Fault code	Uint	Mapping of parameter ***16-90 Alarm Word*** to CIP-specific fault codes.
15	Get	Control from net	Boolean	Parameter ***12-31 Net Reference*** value written from option

NOTE: Class ID 0x29 is only available when ***[5] ODVA*** is selected in parameter ***8-10 Control Word Profile***.

Table 30: Attribute 13 Fault Code

CIP malfunction code	Meaning	Drive code alarm word	CIP malfunction meaning	CIP classification
0	No alarm	0000 0000	No fault	–
0	Unused	0000 0001	No fault	–
4210	Drive overtemperature	0000 0002	Excessive device temperature	MAR
2240	Ground fault	0000 0004	Short to ground	MAU
0	Unused	0000 0008	No fault	–
8100	Control word timeout	0000 0010	Communication	MIR
2310	Overcurrent	0000 0020	Continuous overcurrent	MAU
8302	Torque limit	0000 0040	Torque limiting	MAR
4310	Motor thermistor	0000 0080	Excess drive temperature	MAR
4310	Motor ETR overtemperature	0000 0100	Excess drive temperature	MAR
2311	Inverted overloaded	0000 0200	Current inside the device, No. 1	MAR
3220	DC-link undervoltage	0000 0400	Undervoltage inside the device	MAR
3210	DC-link overvoltage	0000 0800	Overvoltage inside the device	MAR
2130	Short circuiting	0000 1000	Short circuit	MAU
2213	Inrush fault	0000 2000	Overcurr. during start-up	MAR
3130	Mains phase loss	0000 4000	Phase failure	MAU
5210	AMT fail	0000 8000	Measurement circuit	MIR
1000	Live zero fault	0001 0000	General fault	MAR
6100	Internal fault	0002 0000	Internal software fault	MAU
7110	Brake resistor power limit	0004 0000	Brake chopper	MAU
3300	Motor phase U missing	0008 0000	Output voltage	MAU
3300	Motor phase V missing	0010 0000	Output voltage	MAU
3300	Motor phase W missing	0020 0000	Output voltage	MAU

Table 30: Attribute 13 Fault Code - (continued)

CIP malfunction code	Meaning	Drive code alarm word	CIP malfunction meaning	CIP classification
8100	Fieldbus fault	0040 0000	Communication	MIR
5112	24 V supply fault	0080 0000	+24 V power supply	MAU
3100	Mains failure	0100 0000	Mains voltage	MAR
5110	1.8 V supply fault	0200 0000	Low-voltage power supply	MAU
7110	Brake resist. short circ.	0400 0000	Brake chopper	MAR
7110	Brake chopper fault	0800 0000	Brake chopper	MAR
0	Unused	1000 0000	No fault	–
0	Unused	2000 0000	No fault	–
0	Unused	4000 0000	No fault	–
0	Unused	8000 0000	No fault	–

Table 31: Services Supported

Service code	Service name	Service description
0Eh	Get_attribute_single	Returns contents of the specified attribute.
10h	Set_attribute_single	Sets the contents of the specified attribute.
05h	Reset	Resets the drive to its start-up state.

Table 32: Instance Attributes - Class ID 0x2A AC/DC Drive Object

Attribute	Access rule	Information	Data type	Content
1	Get	Number of attributes supported	USINT	12.
2	Get	List of attributes supported	USINT	3,4,6,7,8,18,19,20,21,22,28,29.
3	Get	At reference	Boolean	Bit 8 of drive STW.
4	Get/Set	Network reference	Boolean	Value written to parameter ***10-14 Net Reference***.
6	Get/Set	Drive mode	USINT	Mapping of values from parameter ***1-00 Configuration Mode***.
7	Get	Actual speed	INT	See attribute 22.
8	Get/Set	Reference speed	INT	See attribute 22.
18	Get/Set	Acceleration time	Uint	Scaled with attribute 28 and written to parameter ***3-41 Ramp 1 Ramp Up Time***.
19	Get/Set	Deceleration time	Uint	Scaled with attribute 28 and written to parameter ***3-42 Ramp 1 Ramp Down Time***.

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Table 32: Instance Attributes - Class ID 0x2A AC/DC Drive Object - (continued)

Attribute	Access rule	Information	Data type	Content
20	Get/Set	Low speed limit	Uint	Scaled with attribute 22 and written to parameter ***4-11 Motor Speed High Limit [RPM]***.
21	Get/Set	High speed limit	Uint	Scaled with attribute 22 and written to parameter ***4-13 Motor Speed Low Limit [RPM]***.
22	Get/Set	Speed scale	SINT	Forms the speed reference and main actual value for the drive together with attributes 7 and 8.
28	Get/Set	Time scale	SINT	Scaling factor for all time attributes.
29	Get	Ref from net	Boolean	Value of parameter ***10-14 Net Reference***.

NOTE: Class ID 0x2A is only available when ***[5] ODVA*** is selected in parameter ***8-10 Control Word Profile***.

Table 33: Attribute 6 Drive Mode

Value of attribute 6	ODVA text	Value of parameter *1-00 Configuration Mode*	Drive text
0	Vendor specific	Remaining values not listed below.	N/A
1	Open-loop speed ctr.	0	Speed open loop
2	Closed-loop speed ctr.	1	Speed closed loop
3	Torque control	N/A	N/A
4	Process control	N/A	N/A
5	Position control	N/A	N/A

Table 34: Instance Attributes - Class ID 0xF5 Interface Object

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
1	Get	Status	DWORD	Interface status	–
2	Get	Configuration capability	DWORD	Interface capability flags	–
3	Get/Set	Configuration control	DWORD	Interface control flags	–
4	Get	Physical link object	STRUCT of:	Path to physical link object	–
		Path size	Uint	Size of path	–
		Path	Padded EPATH	Logical segments identifying the physical link object	–

Table 34: Instance Attributes - Class ID 0xF5 Interface Object - (continued)

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
5	Get/Set	Interface configuration	STRUCT of:	TCP/IP network interface configuration	–
		IP address	UDINT	The device IP address	***12-01 IP Address***
		Network mask	UDINT	The device network mask	***12-02 Subnet Mask***
		Gateway address	UDINT	Default gateway address	***12-03 Default Gateway***
		Name server	UDINT	Primary name server	***12-06 Name Servers***, index [0]
		Name server 2	UDINT	Secondary name server	***12-06 Name Servers***, index [1]
		Domain name	STRING	Default domain name	***12-07 Domain Name***
6	Get/Set	Host name	STRING	Host name	***12-08 Host Name***
7	Get	–	UDINT	Safety network	–
8	Get	–	UDINT	TTL value	–
9	Get	–	UDINT	Multicast configuration	–
10	Get/Set	–	BOOL	Select ACD	–
11	Get	–	USINT	Last conflict detected	–
12	Get	–	BOOL	EtherNet/IP quick connect	–
13	Get/Set	–	UINT	Encapsulation inactivity timeout	–

Three instances of the link object are implemented:

- Instances 1 and 2 relate to the physical ports 1 and 2 of the option.
- Instance 3 relates to the internal interface of the option, after the built-in switch.

Table 35: Instance Attribute - Class ID 0xF6 Link Object

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
1	Get	Interface speed	UDINT	Interface speed in Mbps, that is, 0, 10, 100, 1000, and so on.	***12-13 Link Speed***
2	Get	Interface flags	DWORD	Interface status flags.	–
3	Get	Physical address	ARRAY of 6 USINTs	MAC layer address.	***12-09 Physical Address***

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Table 35: Instance Attribute - Class ID 0xF6 Link Object - (continued)

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
4	Get	Interface counters	STRUCT of:	–	–
		In octets	UDINT	Octets received on the interface.	***12-98 Interface Counters***, index [0]
		In Ucast packets	UDINT	Unicast packets received on the interface.	***12-98 Interface Counters***, Index [1]
		In NUcast packets	UDINT	Non-unicast packets received on the interface.	***12-98 Interface Counters***, Index [2]
		In discards	UDINT	Inbound packets received on the interface but discarded.	***12-98 Interface Counters***, Index [3]
		In errors	UDINT	Inbound packets that contain errors (does not include *In discards*).	***12-98 Interface Counters***, Index [4]
		In unknown protos	UDINT	Inbound packets with unknown protocol.	***12-98 Interface Counters***, Index [5]
		Out octets	UDINT	Octets sent on the interface.	***12-98 Interface Counters***, Index [6]
		Out Ucast packets	UDINT	Unicast packets sent on the interface.	***12-98 Interface Counters***, Index [7]
		Out NUcast packets	UDINT	Non-unicast packets sent on the interface.	***12-98 Interface Counters***, Index [8]
		Out discards	UDINT	Outbound packets discarded.	***12-98 Interface Counters***, Index [9]
		Out errors	UDINT	Outbound packets that contain errors.	***12-98 Interface Counters***, Index [10]

Table 35: Instance Attribute - Class ID 0xF6 Link Object - (continued)

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
5	Get	Media counters	STRUCT:	Media-specific	–
		Alignment errors	UDINT	Frames received that are not an integral number of octets in length.	***12-99 Media Counters***, index [0]
		FCS errors	UDINT	Frames received that do not pass the FCS check.	***12-99 Media Counters***, index [1]
		Single collision	UDINT	Successfully sent frames which experienced exactly 1 collision.	***12-99 Media Counters***, index [2]
		Multiple collisions	UDINT	Successfully sent frames which experienced more than 1 collision.	***12-99 Media Counters***, index [3]
		SQE test errors	UDINT	Number of times the SQE test error message is generated.	***12-99 Media Counters***, index [4]
		Deferred transmissions	UDINT	Frame for which the 1st transmission attempt is delayed because the medium is busy.	***12-99 Media Counters12-99 Media Counters***, index [5]
		Late collisions	UDINT	Number of times a collision is detected later than 512 bit times into the transmission of a packet.	***12-99 Media Counters***, index [6]
		Excessive collisions	UDINT	Frames for which transmission fails due to excessive collisions.	***12-99 Media Counters***, index [7]
		MAC transmit errors	UDINT	Frames for which transmission fails due to an internal MAC sub layer transmit error.	***12-99 Media Counters***, index [8]
		Carrier sense errors	UDINT	Times that the carrier sense condition was lost or never asserted when attempting to send a frame.	***12-99 Media Counters***, index [9]
		Frame too long	UDINT	Frames received that exceed the maximum allowed frame.	***12-99 Media Counters***, index [10]
		MAC receive errors	UDINT	Frame for which reception on an interface fails due to an internal MAC sub layer receive error.	***12-99 Media Counters***, index [11]

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Table 35: Instance Attribute - Class ID 0xF6 Link Object - (continued)

Attribute	Access rule	Name	Data type	Description of attribute	Parameter
6	Set	Interface control	STRUCT of:	Configuration for physical interface.	–
		Control bits	WORD	Interface control bits.	–
		Forced interface speed	Uint	Speed at which the interface shall be forced to operate speed in Mbps (10, 100, 1000, and so on).	–
7	Get	Interface type	SHORT_STRING	Human-readable identification.	–
8	Get	Interface state	USINT	Number of member in the link list.	–
9	Get	Admin state	ARRAY OF Uint	Link list between internal and all corresponding external interfaces.	–
10	Get	Interface label	STRING	–	–
11	Get	Interface capability	UINT	–	–

Table 36: Services Supported

Service code	Supported		Service name	Description of service
	Class	Instance		
01h	Yes	Yes	Get_attribute_all	Returns a predefined listing of the object attributes.
0Eh	Yes	Yes	Get_attribute_single	Returns the contents of the specified attribute.
10h	–	Yes	Set_attribute_single	Modifies a single attribute.
43h	–	Yes	Get_and_clear	Gets, then clears the specified attribute (interface counters or media counters).

Table 37: Class Attribute - Class ID 0x0F Parameter Object

Attribute	Access rule	Name	Data type	Description of attribute	Content
1	Get	Revision	Uint	Revision of object	01
2	Get	Maximum instance	Uint	Maximum instance number	Variable
3	Get	Number of instances	Uint	Number of instances	Variable
8	Get	Parameter class descriptor	WORD	Parameter description	0x03
9	Get	Configuration assembly instance	Uint	Instance number of the configuration assembly	0
10	Get/Set	Native language	USINT	Language ID for all character array accesses	Variable

Table 38: Instance Attributes - Class ID 0x0F Parameter Object

Attribute	Access rule	Name	Data type	Description	Value
1	Set/Get	Parameter value	Data type described in attribute 5	Actual value of parameter.	Value of parameter from drive.
2	Get	Link path size	USINT	Size of link path.	Variable.
3	Get	Link path	ARRAY:	CIP path of the origin of the parameter.	Variable.
		Segment type/port	BYTE	–	–
		Segment address	Path	–	–
4	Get	Descriptor	WORD	Description of parameter.	See standard.
5	Get	Data type	EPATH	Data type code.	–
6	Get	Data size	USINT	Number of bytes in parameter value.	Variable.
7	Get	Parameter name string	SHORT STRING	Human-readable text string showing the parameter name.	Parameter attribute from the drive.
8	Get	Unit string	SHORT STRING	Human-readable text string showing the parameter unit.	Parameter attribute from the drive.
9	Get	Help string	SHORT STRING	Human-readable text string showing short online help.	Parameter attribute from the drive.
10	Get	Minimum value	Data type described in attribute 5	Generic minimum valid value.	Parameter attribute from the drive.
11	Get	Maximum value	Data type described in attribute 5	Generic maximum valid value.	Parameter attribute from the drive.
12	Get	Default value	Data type described in attribute 5	Default value of generic parameter.	Parameter attribute from the drive.
13	Get	Scaling multiplier	Uint	Multiplier form scaling factor.	1
14	Get	Scaling divisor	Uint	Divisor for scaling factor.	1
15	Get	Scaling base	Uint	Base for scaling formula.	0
16	Get	Scaling offset	INT	Offset for scaling formula.	0
17	Get	Multiplier link	Uint	Parameter instance of multiplier source.	0
18	Get	Divisor link	Uint	Parameter instance of divisor source.	0
19	Get	Base link	Uint	Parameter instance of base source.	0
20	Get	Offset link	Uint	Parameter instance of offset source.	0
21	Get	Decimal precision	USINT	Specifies the parameter value format.	Variable.

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Table 39: Services Supported

Service code	Supported		Service name	Description of service
	Class	Instance		
0Eh	Yes	Yes	Get_attribute_single	Returns contents of specified attribute.
01h	Yes	Yes	Get_attribute_all	Returns predefined listing of object attributes.
10h	No	Yes	Set_attriute_single	Modifies attribute.
4Bh	No	Yes	Get_Enum_string	Read enumerated string from the parameter instance.

Table 40: Instance Attributes - Class ID 0x10 Parameter Group Object

Attribute	Access rule	Name	Data type	Description	Contents
1	Get	Group name string	SHORT_STRING	Shows group name.	Name of group from the drive.
2	Get	Number of group members	Uint	Number of parameters in the group.	Value of n.
3	Get	First group parameter (000–099)	Uint	Instance number of parameter object.	Variable.
4	Get	Second group parameter (100–199)	Uint	Instance number of parameter object.	Variable.
...	Get	...	Uint	...	Variable.
n+2	Get	n^{th} group parameter	Uint	Instance number of parameter object.	Variable.

The CIP class ID 100–199 (0x64 to 0xC7) gives access to all parameters.

Table 41: Class ID 0x64 to 0xC7 Objects

Class (decimal)	Parameter range
100	0-01 to 0-99
101	1-00 to 1-99
102	2-00 to 2-99
103	3-00 to 3-99
104	4-00 to 4-99
105	5-00 to 5-99
106	6-00 to 6-99
107	7-00 to 7-99
108	8-00 to 8-99
109	9-00 to 9-99
110	10-00 to 10-99
111	11-00 to 11-99
...	...
199	99-00 to 99-99

The class instance and attribute act in the following way:

- 100 added to the parameter group = the value for the class.
- 100 added to the remaining parameter number = the value for the instance.
- 100 added to the array index of the parameter = the value for the attribute.

Examples:

- Parameter 0-01, index [0] = class 100, instance 101, attribute 100.
- Parameter 1-00, index [0] = class 101, instance 100, attribute 100.
- Parameter 2-59, index [0] = class 102, instance 159, attribute 100.
- Parameter 5-34, index [3] = class 105, instance 134, attribute 103.
- Parameter 6-54, index [9] = class 106, instance 154, attribute 109.
- Parameter 10-01, index [0] = class 110, instance 101, attribute 100.

All values are in decimal.

All parameters are accessed in the active setup (parameter ***0-10 Active Set-up***).

Table 42: Services Supported

Service code	Supported		Service name	Description of service
	Class	Instance		
0Eh	Yes	Yes	Get_attribute_single	Returns content of the specified attribute.
10h	No	Yes	Set_attribute_single	Modifies attribute.
4Bh	No	Yes	Get_att_scattered	Returns specified parameter values.
4Ch	No	Yes	Set_att_scattered	Set specified parameter values.

7.2 Abbreviations

Table 43: Definitions of Abbreviations

Abbreviation	Definition
API	Actual packet interval
CC	Control card
CIP™	Common industrial protocol
COS	Change of state
CTW	Control word
DHCP	Dynamic host configuration protocol
EIP	EtherNet/IP
EMC	Electromagnetic compatibility
FC	Frequency converter
I/O	Input/output
IP	Internet protocol
LCP	Local control panel
LED	Light-emitting diode
LSB	Least significant bit

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Table 43: Definitions of Abbreviations - (continued)

Abbreviation	Definition
MAR	Major recoverable fault
MAU	Major unrecoverable fault
MAV	Main actual value (actual output)
MIR	Minor recoverable fault
MRV	Main reference value
MSB	Most significant bit
Msg	Message
N/A	Not applicable
ODVA	Open DeviceNet Vendors Association
PC	Personal computer
PLC	Programmable logic controller
PNU	Parameter numbre
REF	Reference (=MRV)
RTC	Real-time clock
STP	Spanning tree control
STW	Status word

7.3 Conventions

- Numbered lists indicate procedures.
- Bulleted and dashed lists indicate listings of other information where the order of the information is not relevant.
- Bolded text indicates important information and section headings.
- Italicized text indicates the following:
  - Cross-reference.
  - Link.
  - Footnote.
  - Alarms/warnings
- Bolded and italicized text indicates the following:
  - Parameter name.
  - Parameter option.
  - Parameter group name.
- All dimensions in drawings are in metric values (imperial values in brackets).
- An asterisk (*) indicates the default setting of a parameter.

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