Altivar Process ATV600
Variable Speed Drive for Asynchronous and Synchronous Motors

CANopen Manual - VW3A3608, 618, 628

04/2017

Schneider Electric

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Safety Information

ⓘ

Important Information

NOTICE

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

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

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

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

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

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

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

PLEASE NOTE

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

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

Qualification Of Personnel

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

Intended Use

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

Product Related Information

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

⚡ ⚠ DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH
- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.   - The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.   - Many components of the product, including the printed circuit boards, operate with mains voltage. Do not touch.   - Only use properly rated, electrically insulated tools and measuring equipment.   - Do not touch unshielded components or terminals with voltage present.   - Motors can generate voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.   - AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors of the motor cable.   - Do not short across the DC bus terminals or the DC bus capacitors or the braking resistor terminals.   - Before performing work on the drive system: - Disconnect all power, including external control power that may be present.   - Place a **Do Not Turn On** label on all power switches related to the drive system.   - Lock all power switches in the open position.   - Wait 15 minutes to allow the DC bus capacitors to discharge.   - Follow the instructions given in the chapter "Verifying the Absence of Voltage" in the installation manual of the product.   - Before applying voltage to the drive system: - Verify that the work has been completed and that the entire installation cannot cause hazards.   - If the mains input terminals and the motor output terminals have been grounded and short-circuited, remove the ground and the short circuits on the mains input terminals and the motor output terminals.   - Verify proper grounding of all equipment.   - Verify that all protective equipment such as covers, doors, grids is installed and/or closed.
Failure to follow these instructions will result in death or serious injury.

Drive systems may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data or other errors.

⚠ WARNING
UNANTICIPATED EQUIPMENT OPERATION
- Carefully install the wiring in accordance with the EMC requirements.   - Do not operate the product with unknown or unsuitable settings or data.   - Perform a comprehensive commissioning test.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

⚡ ⚠ DANGER
ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION
Do not use damaged products or accessories.
Failure to follow these instructions will result in death or serious injury.

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

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

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

NOTICE
DESTRUCTION DUE TO INCORRECT MAINS VOLTAGE
Before switching on and configuring the product, verify that it is approved for the mains voltage
Failure to follow these instructions can result in equipment damage.

The temperature of the products described in this manual may exceed 80 °C (176 °F) during operation.

⚠ WARNING
HOT SURFACES
● Ensure that any contact with hot surfaces is avoided. ● Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces. ● Verify that the product has sufficiently cooled down before handling it. ● Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER
POTENTIAL FOR EXPLOSION
Install and use this equipment in non-hazardous locations only.
Failure to follow these instructions will result in death or serious injury.

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

⚠ WARNING
UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS
● In your hazard and risk analysis, consider all hazards that result from access to and operation on the network/fieldbus and develop an appropriate cyber security concept. ● Verify that the hardware infrastructure and the software infrastructure into which the machine is integrated as well as all organizational measures and rules covering access to this infrastructure consider the results of the hazard and risk analysis and are implemented according to best practices and standards covering IT security and cyber security (such as: ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/ IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security). ● Verify the effectiveness of your IT security and cyber security systems using appropriate, proven methods.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

About the Book

At a Glance

Document Scope

The purpose of this document is to:
- Show you how to install the CANopen fieldbus on your drive.
- Show you how to configure drive to use CANopen for monitoring and control.
- Provide examples of setup using Unity

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

Validity Note

This documentation is valid for the drive Altivar Process drives.

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

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

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

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

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

Title of Documentation	Reference Number
ATV600 Getting Started	EAV63253 (English), EAV63254 (French), EAV63255 (German), EAV63256 (Spanish), EAV64310 (Italian), EAV64298 (Chinese)
ATV600 Getting Started Annex (SCCR)	EAV64300 (English)
ATV630, ATV650 Installation Manual	EAV64301 (English), EAV64302 (French), EAV64306 (German), EAV64307 (Spanish), EAV63257 (Italian), EAV64317 (Chinese)
ATV600 Programming Manual	EAV64318) (English), EAV64320 (French), EAV64321 (German), EAV64322 (Spanish), EAV64323 (Italian), EAV64324 (Chinese)
ATV600 Modbus Serial Link Manual (Embedded)	EAV64325) (English)
ATV600 Ethernet Manual (Embedded)	EAV64327) (English),
ATV600 Ethernet IP - Modbus TCP Manual (VW3A3720, 721)	EAV64328 (English),
ATV600 PROFIBUS DP manual (VW3A3607)	EAV64329) (English),
ATV600 DeviceNet manual (VW3A3609)	EAV64330 (English),
ATV600 PROFINET manual (VW3A3627)	EAV64331 (English),
ATV600 CANopen Manual (VW3A3608, 618, 628)	EAV64333) (English),
ATV600 Communication Parameters	EAV64332 (English),
ATV600 Safety Function manual	EAV64334 (English),
Altivar Process Drive Systems – Installation manual	NHA37119 (English), NHA37121 (French), NHA37118 (German), NHA37122 (Spanish), NHA37123 (Italian), NHA37130 (Chinese), NHA37124 (Dutch), NHA37126 (Polish), NHA37127 (Portuguese), NHA37128 (Russian), NHA37129 (Turkish)
ATV660 Handbook	NHA37111 (English), NHA37110 (German)
ATV680 Handbook	NHA37113 (English), NHA37112 (German)
ATV600F, ATV900F Installation Instruction sheet	NVE57369 (English),
ATV600, ATV900 ATEX manual	NVE42416 (English),
SoMove: FDT	SoMove_FDT (English, French, German, Spanish, Italian, Chinese)
Altivar Process ATV600: DTM	ATV6xx_DTM_Library_EN (English), ATV6xx_DTM_Library_FR (French), ATV6xx_DTM_Language_DE (German), ATV6xx_DTM_Library_SP (Spanish), ATV6xx_DTM_Library_IT (Italian), ATV6xx_DTM_Library_CN (Chinese)

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

Terminology

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

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

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

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

Also see the glossary at the end of this manual.

Chapter 1
Presentation

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Hardware Overview	14
Software Overview	15

Hardware Overview

General

The VW3A3608, VW3A3618, VW3A3628 are CANopen modules that can be used in a CANopen industrial fieldbus.

The following figure shows the hardware presentation of these three CANopen modules.

Software Overview

General

CANopen manages communication between the network devices with object dictionaries and objects. A network device can use process data objects (PDO) and service data objects (SDO) to request the object data from the object dictionary of another device and, if permissible, write back modified values.
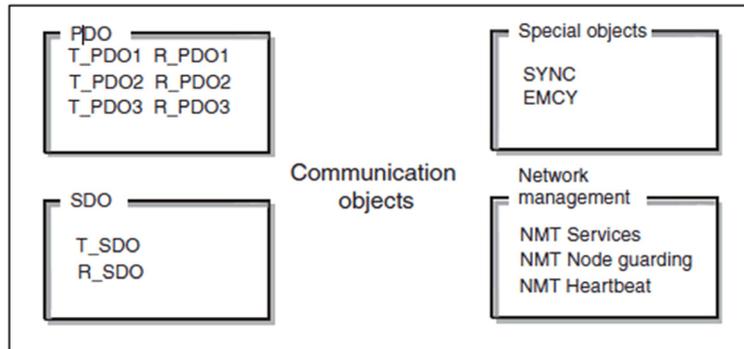
- PDOs (process data objects) for real-time transmission of process data.
- SDOs (service data object) for read and write access to the object dictionary.
- Objects for controlling CAN messages:
  - SYNC object (synchronization object) for synchronization of network devices.
  - EMCY object (emergency object), for signaling errors of a device or its peripherals.
- Network management services:
  - NMT services for initialization and network control (NMT: network management).
  - NMT node guarding for monitoring the network devices.
  - NMT heartbeat for monitoring the network devices.

Chapter 2
Basics

What Is in This Chapter?

This chapter contains the following topics:

Object Dictionary

Description

Each CANopen device manages an object dictionary which contains the objects for communication.

Index and Subindex

The objects are addressed in the object dictionary via a 16 bit index.

One or more 8 bit subindex entries for each object specify individual data fields in the object. Index and subindex are shown in hexadecimal notation.

The following table provides the index and subindex entries using the example of the object ramps (203C hex):

Index	Subindex	Name	Meaning
203C hex	00 hex	–	Number of entries
203C hex	01 hex	`ACC`	Acceleration time
203C hex	02 hex	`DEC`	Deceleration time

Description Object Dictionary

The description object dictionary is made of separate chapters:
- Communication profile area
- RPDO
- TPDO
- Manufacturer specific
- Application profile (CiA402)

Index (hex)	Object
0000	Unused
0001...001F	Static data types
0020...003F	Complex data types
0040...005F	Unused (Manufacturer-specific complex data types)
0060...007F	Device profile-specific static data types
0080...009F	Device profile-specific complex data types
00A0...0FFF	Reserved for further use
1000...1FFF	Communication profile area
2000...5FFF	ATV6xx specific profile area
6000...9FFF	Standardized device profile area
A000...FFFF	Reserved for further use
NOTE: For more details on object dictionary, refer Appendix A *(see page 81)*	

Communication Object Identifier

Description

The COB ID (communication object identifier) has 2 tasks as far as controlling communication object is concerned:
- Bus arbitration: Specification of transmission priorities
- Identification of communication objects

An 11-bit COB identifier as per the CAN 3.0 A specification is defined for CAN communication; it comprises two parts:
- Function code, 4 bits
- Node address (node ID), 7 bits
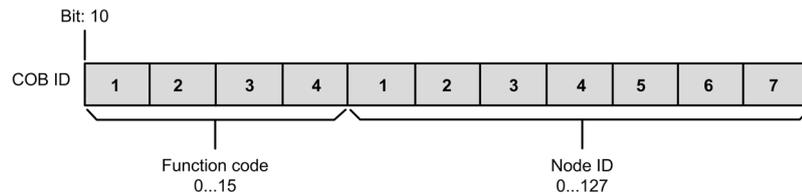
Function Code

The function code classifies the communication objects. Since the bits of the function code if the COB ID is more significant, the function code also controls the transmission priorities: Objects with a lower function code are transmitted with higher priority. For example, an object with function code **A** is transmitted prior to an object with function code **3** in the case of simultaneous bus access.

Node Address

Each network device is configured before it can be operated on the network. The device is assigned a unique 7-bit node address (node ID) between 1 (01 hex) and 127 (7F hex). The device address **0** is reserved for broadcast transmissions which are used to send messages to all reachable devices simultaneously.

COB IDs of the Communication Objects

The following table provides the COB IDs of the communication objects with the factory settings.

Communication object	Function code	Node address, node ID [1...127]	COB ID decimal (hexadecimal)
Service Network Management (NMT)	0 0 0 0	0 0 0 0 0 0 0	0 (0 hex)
Synchronization service (SYNC)	0 0 0 1	0 0 0 0 0 0 0	128 (80 hex)
Emergency service (EMCY)	0 0 0 1	x x x x x x x	128 (80 hex) + node ID
Transmit PDO1 (TPDO1)	0 0 1 1	x x x x x x x	384 (180 hex) + node ID
Receive PDO1 (RPDO1)	0 1 0 0	x x x x x x x	512 (200 hex) + node ID
Transmit PDO2 (TPDO2)	0 1 0 1	x x x x x x x	640 (280 hex) + node ID
Receive PDO2 (RPDO2)	0 1 1 0	x x x x x x x	768 (300 hex) + node ID
Transmit PDO3 (TPDO3)	0 1 1 1	x x x x x x x	896 (380 hex) + node ID
Receive PDO3 (RPDO3)	1 0 0 0	x x x x x x x	1024 (400 hex) + node ID
Transmit SDO (TSDO)	1 0 1 1	x x x x x x x	1408 (580 hex) + node ID
Receive SDO (RSDO)	1 1 0 0	x x x x x x x	1536 (600 hex) + node ID
NMT error control (Node Guarding, Heartbeat)	1 1 1 0	x x x x x x x	1792 (700 hex) + node ID

Service Data Communication

Description

Service Data Objects (SDO) can be used to access the entries of an object dictionary using index and subindex. The values of the objects can be read and, if permissible, also written.

Every network device has at least one SDO server to be able to respond to read and write requests from a different device.

The TSDO of a SDO client is used to send the request for data exchange; the RSDO is used to receive.

The data frame of a SDO consists of 8 bytes.

SDOs have a higher COB ID than PDOS, therefore they are transmitted over the can bus at a low priority.

Example of Read Request

This example explains how to read the acceleration (ACC) parameter on an Altivar located at CANopen address 4 (COB ID = 580 hex + Node ID or 600 hex + Node ID). The index / subindex value of this parameter is 203C/02 hex. Values are given in hexadecimal.

Read request: **Master → Drive**

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
COB ID	Request code	Object index		Subindex	Request data			
604	40	3C	20	02	00	00	00	00

Read response: **Master ← Drive**

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
COB ID	Request code	Object index		Subindex	Request data			
584	4B	3C	20	02	E8	03	00	00

The value of parameter read is equal to 1000 (03E8 hex), equivalent to an acceleration (ACC) of 100 s, as the unit of this parameter is 0.1 s.

Example of Write Request

This example explains how to write the value 100 s to the acceleration (ACC) parameter on an Altivar located at CANopen address 4 (COB ID = 580 hex + NodeID or 600 hex + Node ID). The index / subindex value of this parameter is 203C/02 hex. Values are give in hexadecimal.

The request code is 2B hex for an item of 2 bytes data length.

Write request: **Master → Drive**

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
COB ID	Request code	Object index		Subindex	Request data			
604	2B	3C	20	02	E8	03	00	00

The request data field indicates the value 03E8 hex as value written is 1000, equivalent to an acceleration (ACC) of 100 s, as the unit of this parameter is 0.1 s.

Write response: **Master ← Drive**

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
COB ID	Request code	Object index		Subindex	Request data			
584	60	3C	20	02	00	00	00	00

Request Codes and Response Codes

The SDO request code differs depending on the scenarios detailed in the following table:

Request code	Description of the command	Byte 4	Byte 5	Byte 6	Byte 7
23 hex	Write 4 bytes data length (ex: UNSIGNED32)	Bits 7 - 0	Bits 15 - 8	Bits 23 - 16	Bits 31 - 24
2B hex	Write 2 bytes data length (ex: UNSIGNED16)	Bits 7 - 0	Bits 15 - 8	00 hex	00 hex
2F hex	Write 1 byte data length (ex: UNSIGNED8)	Bits 7 - 0	00 hex	00 hex	00 hex
40 hex	Read 1, 2 bytes or 4 bytes data length	00 hex	00 hex	00 hex	00 hex
80 hex	Cancel current SDO command	00 hex	00 hex	00 hex	00 hex

The SDO response codes correspond to the request codes and are detailed in the following table:

Request code	Description of the command	Byte 4	Byte 5	Byte 6	Byte 7
43 hex	Read 4 bytes data length (response to 40 hex request code)	Bits 7 - 0	Bits 15 - 8	Bits 23 - 16	Bits 31 - 24
4B hex	Read 2 bytes data length (response to 40 hex request code)	Bits 7 - 0	Bits 15 - 8	00 hex	00 hex
4F hex	Read 1 byte data length (response to 40 hex request code)	Bits 7 - 0	00 hex	00 hex	00 hex
60 hex	Write data 1, 2 bytes or 4 bytes data length (response to 23 hex, 2B hex, or 2F hex request codes)	00 hex	00 hex	00 hex	00 hex
80 hex	Error : sending abort code[1].	00 hex	00 hex	00 hex	00 hex
[1]: The response data (bytes 4 to 7) correspond to a 32 bit abort code detailed below.					

Abort Codes

The following table describes the possible abort code that may occur during data exchange with the product:

Abort Code	Description
0503 0000 hex	Segmented transfer: the toggle bit is not toggled
0504 0001 hex	Command Specifier (CS) incorrect or unknown
0601 0000 hex	Access to object not possible
0601 0002 hex	Attempt to execute a write request on a read-only parameter
0602 0000 hex	Object does not exist in object dictionnary
0604 0041 hex	PDO object assignment: the object cannot be assigned to the PDO, this error is triggered when writing to parameters 1600 hex, 1602 hex, 1A00 hex, 1A01 hex, and 1A02 hex (assignments of PDO1, PDO2, and PDO3)
0604 0042 hex	PDO object assignment : the number and/or length of the parameters to be assigned exceeds the maximum PDO length
0609 0011 hex	The subindex of the object sent in the request does not exist in object dictionnary
0609 0030 hex	Outside parameter value limits (for a write request only)
0609 0031 hex	Value of parameter written too high
0800 0000 hex	General error triggered
NOTE: The abort codes listed in this table have been written in accordance with general convention and must, therefore, be inverted in the case of byte-by-byte representation for " bytes 4 to 7 " (example: 0609 0030 hex becomes byte 4: 30 hex, byte 5: 00 hex, byte 6: 09 hex, byte 7: 06 hex)	

Process Data Communication

Description

Process Data Objects (PDO) are used for real-time data exchange of process data such as actual and reference values or the operating state of the device. Transmission is fast because the data is sent without administration data and data transmission acknowledgment from the recipient is not required. Each PDO can be enabled or disabled independently using the bit 31 (valid bit) in subindex 01 hex of the respective communication object.

PDO1 Details

The first PDO is by default compliant with the PDO1 of the Velocity mode of the CiA402. It is asynchronous and contains two data: the control word (6040 hex, CMD) and the target velocity (6042 hex, LFRD) for the output (from Master to Device) and the status word (6041 hex, ETA) and the control effort (6044 hex, RFRD) for the input (from Device to Master).

PDO2 Details

The second PDO set (PDO2) is deactivated by default and can be fully configurable (1 to 4 words of the user choice). It is reserved for adjustments and for additional control and monitoring functions.

PDO3 Details

The third PDO set (PDO3) is reserved. Deactivated by default, it cannot be configured and comprises:
- RPDO3 (receive), containing four output (from Master to Device) words of the communication scanner NC1 to NC4
- TPDO3 (transmit), containing four input (from Device to Master) words of the communication scanner NM1 to NM4

Transmission Mode

By default, the three PDOs are asynchronous, although the transmission mode of each PDO can be reconfigured by the user in accordance with requirements:
- Asynchronous mode (255): The transmit PDO is only sent when the value of its data changes. In this mode, the `inhibit time` and `event timer` can be modified in order to adjust the PDO transmission frequency on the bus.
- Cyclic synchronous mode (1…240): The transmit PDO is sent each time a synchronization object (SYNC) is received or when a preconfigured number of synchronization objects (from 1 to 240) is received.
- Acyclic synchronous mode (0): The transmit PDO is sent each time the value of its data changes, but only during the synchronous window authorized by the next synchronization object (SYNC).

Synchronization Object

The synchronization object (SYNC) is sent cyclically by the CANopen master. It does not contain data and its frame is limited to its unique COB ID identifier (080 hex). The purpose of this object is essentially to authorize synchronous communication modes for CANopen slaves.

Network Management Services

Description

Network management (NMT) is part of the CANopen communication profile; it is used to initialize the network and the network devices and to start, stop, and monitor the network devices during operation on the network.

NMT services can be divided into two groups:
- Services for device control, to initialize devices for CANopen communication and to control the behavior of devices during operation on the network.
- Services for connection monitoring to check the status of network devices.

Network Management State Machine

The CANopen NMT slave device implements a state machine, which brings automatically after power-on and internal initialization every device in pre-Operational state. In this state the node may be configured and parameterized using SDO, no PDO communication is allowed.

The NMT master device may switch all nodes or a single node to operational state and conversely. In operational state PDO transfer is allowed. By switching a device into the stopped state, it is forced to stop PDO and SDO communication. Furthermore, this state can be used to achieve certain application behavior.

In the operational state, all communication objects are active. Object Dictionary access through SDO is possible.

NMT Message Description

The NMT services for device control are transmitted as unconfirmed messages with COB ID 0. By default, they have the highest priority on the CAN bus.

COB ID	Byte 0	Byte 1
0 (000 hex)	Command specifier (CS)	Node ID[1]
[1] If Node ID is 0, the command specifier is broadcast to all CANopen slaves.		

The following table provides the of command specifier used to manage the NMT state machine.

Command specifier (CS)	Meaning
1 (01 hex)	Start_Remote_Node
2 (02 hex)	Stop_Remote_Node
128 (80 hex)	Enter_Pre-Operational_State
129 (81 hex)	Reset_Node
130 (82 hex)	Reset_Communication

NMT State Chart
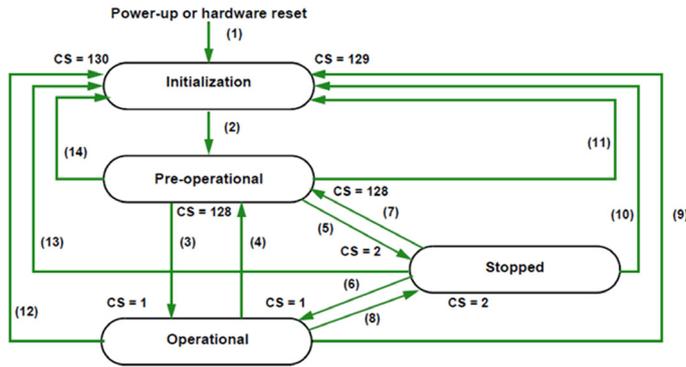
Transition	Description
(1)	On power-up, the node automatically changes to the initialization state
(2)	Once initialization is complete, the pre-operational state is activated automatically
(3), (6)	`Start_Remote_Node`
(4), (7)	`Enter_Pre-Operational_State`
(5), (8)	`Stop_Remote_Node`
(9), (10), (11)	`Reset_Node`
(12), (13), (14)	`Reset_Communication`

Depending on the communication status of the drive, the following services are available:

	Initialization	Pre-Operational	Operational	Stopped
PDO			X	
SDO		X	X	
Synchronization (SYNC)		X	X	
Emergency (EMCY)		X	X	
Bootup Service	X		X	
Network Management (NMT)		X	X	X

In Pre-Operational mode, the master can only perform SDO.

In operation mode, the master can perform SDO and PDO. The device can be controlled only if the user has selected CANopen as the command channel.

In Stop mode, the master cannot perform SDO and PDO.

In the event of a resettable detected error, the drive must be in the Operational NMT state in order that the PDO carrying the control word CMD can reset the drive using the CMD `Fault reset` bit.

Node Guarding Service

Either the Node Guarding service described here of the Heartbeat service described below can be used for communication monitoring. Only one these two services can be active at any one time. The Node guarding service is deactivated by default on the Altivar.

The master scans the drive at regular intervals (`Life Time`) by sending "Remote Transmit Requests" (RTR). The "Life Time" is calculated by multiplying the `Guard Time` by the `Life Time Factor`.

If, once the `Life Time` has expired, the drive has not received the RTR:
- It triggers a `Life Guarding` error
- Sends an emergency telegram (`EMCY`)

Node Guarding Frame Description

COB ID	Byte 0	Byte 1
1792 (700 hex) + Node ID	Bit 7	Bit 6 - 0
	Toggle bit	Node State

The drive indicates its NMT state via the "NMT information field, described here:

Bit 6-0 (node state): Current NMT state of the drive:
- Initialization (00 hex)
- Stopped (04 hex)
- Operational (05 hex)
- Pre-Operational (7 F hex)

Bit 7 (toggle bit): The value of this bit must alternate from one drive response to the other. The value of the toggle bit for the first response following activation of the node Guarding service is 0. This bit can only be reset by sending the `Reset_Communication` command to the drive. If a response is received with the same toggle bit value as the previous one, the new response is treated as if it had not been received.

Heartbeat Service

If you do not activate the node Guarding service described above, you can use the Heartbeat service to monitor communication with another node that supports this service.

The Heartbeat service is deactivated by default on the Altivar.

Each `Heartbeat Producer` sends Heartbeat messages at regular intervals (`Producer Heartbeat Time`).

All `Heartbeat Consumer` check that they receive these messages in a time less that the `Consumer Heartbeat Time`.

The `Producer Heartbeat Time` must be less that the `Consumer Heartbeat Time`. If the drive has been configured as a consumer and a period equal to the `Consumer Heartbeat Time` elapses without a `Heartbeat message` being received, the drive triggers a `Heartbeat event` and send an emergency telegram (`EMCY`).

Heartbeat Frame Description

COB ID	Byte 0	
1792 (700 hex) + Node ID	Bit 7	Bit 6 - 0
	Reserved	Heartbeat Producer State

The `Heartbeat message` sent from the drive contains a `Heartbeat Producer state` field (byte 0), described here:

Bit 6-0: Heartbeat Producer state: Current NMT state of the drive:
- Initialization (00 hex)
- Stopped (04 hex)
- Operational (05 hex)
- Pre-Operational (7F hex)

Bit 7 (toggle bit): Reserved: This bit is equal to 0.

Emergency Object

An Emergency object (`EMCY`) is sent by the drive to other CANopen devices, with a high priority, each time an error is detected or cleared. This is the case in particular for `Heartbeat` of `Life Guard` type detected errors. An Emergency object is never repeated.

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
128 (80 hex) + NodeID	Error code *Err d*		Error register	0	0	0	0	0
	LSB	MSB	Bit 0 = 0 (no error) or 1 (error)	–	–	–	–	–

The error code *Err d*, and its possible values, is described in the communication parameter file available on *www.schneider-electric.com*

Chapter 3
Hardware Setup

What Is in This Chapter?

This chapter contains the following topics:

Hardware Presentation

CANopen Fieldbus Modules

The following figure shows the VW3A3608 CANopen module with 2 RJ45 connectors:
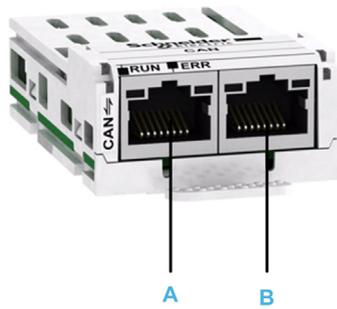
Item	Description	Comment
A	Port A	RJ45 connector
B	Port B	RJ45 connector

The following figure shows the VW3A3618 CANopen module with a SubD9 connector:

Item	Description	Comment
–	–	SubD9 connector

The following figure shows the VW3A3628 CANopen module with an open style connector:

Item	Description	Comment
–	–	Open style connector

Firmware and Description File

Compatibility

The associated EDS file is named as the following example:

SEATV6x0_010103E.eds

The files are available on www.schneider-electric.com.

Installation of the Module

Before Starting

Check that the module catalog number marked on the label is the same as that on the delivery note corresponding to the purchase order.

Remove the fieldbus module from its packaging and check that it has not been damaged in transit.

Insertion of the Fieldbus Module

The table provides the procedure for insertion of the CANopen option module in the drive:

Step	Action
1	Ensure that the power is off.
2	Locate the fieldbus module slot (A) on the bottom of the control part.
3	Add the corresponding sticker on the LED front panel of the drive.
4	Insert the module.
5	Check that the module is correctly inserted and locked mechanically in the drive.
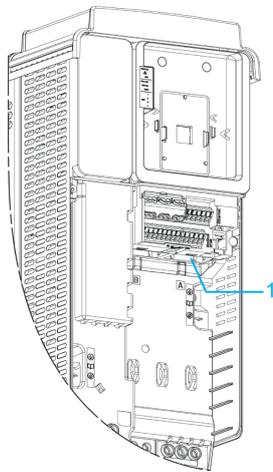
1 Slot A

Removal of the Fieldbus Module

The table provides the procedure for removal of the CANopen option module from the drive:

Step	Action
1	Ensure that the power is off.
2	Press the strip.
3	Remove the module while maintaining the strip pressed,

Electrical Installation

Pin Layout of VW3A3608

The VW3A3608 option module is equipped with 2 RJ45 female sockets for the CANopen connection.
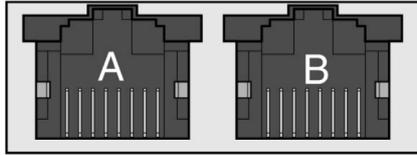
The table provides the pin out details of each RJ45 connector:

Pin	RJ45 signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	Not connected
5	Not connected
6	Not connected
7	Not connected
8	Not connected

NOTE: Both RJ45 are interconnected internally as on the diagram below:
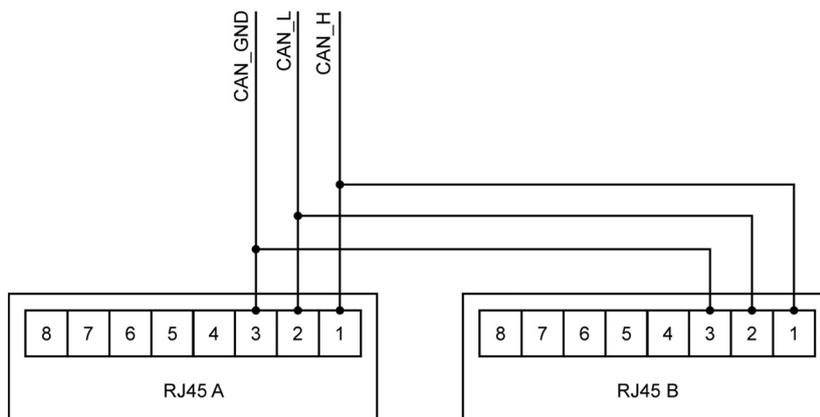
Pin Layout of VW3A3618

The VW3A3618 option module is equipped with 1 SubD9 male connector for the CANopen connection.
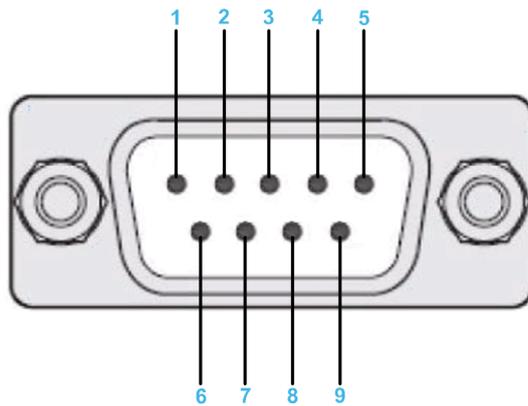
The table provides the pin out details of the SUB-D 9 connector:

Pin	SubD signal
1	Reserved
2	CAN_L
3	CAN_GND
4	Reserved
5	CAN_SHLD
6	CAN_GND
7	CAN_H
8	Reserved
9	Reserved

Pin Layout of VW3A3628

The VW3A3628 option module is equipped with 1 open style male connector for the CANopen connection.
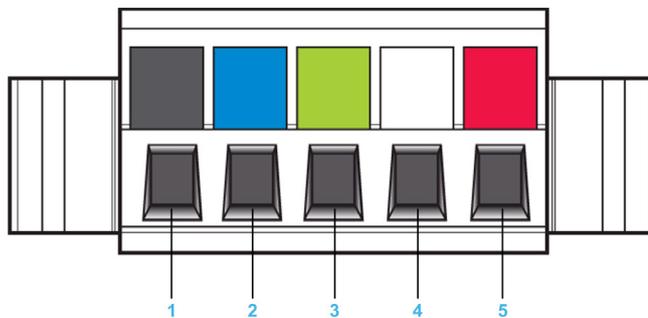
The table provides the pin out of the open style connector:

Pin	Signal
1	CAN_GND
2	CAN_L
3	CAN_SHLD
4	CAN_H
5	Reserved

Cable Specification and Maximum Bus Length

The following table describes the maximum length:

Baud rate KBit/s	Maximum bus length m (ft)
50	1000 (3280)
125	500 (1640)
250	250 (820)
500	100 (328)
1000	20 (65)

The reference potential CAN_GND and the shield connection (connector housing) are galvanically isolated.
- Keep the galvanic isolation in order to avoid ground loops via the CAN bus.
- Use equipotential bonding conductors.
- Use pre-assembled cables to reduce wiring errors.
- Verify that wiring, cables, and connected interfaces meet the PELV requirements.

Terminating Resistor

Terminating resistors must be placed on both ends of a CAN bus line. A 120 Ohms terminating resistor between CAN_L and CAN_H is used for this purpose.

Cable Routing Practices

Installation Topology

The following image shows the connection of multiple drives equipped with VW3A3608 CANopen modules.

Accessories Presentation

Introduction

Both ends of a CAN bus line must be terminated. A 120 ohm terminating resistor between CAN_L and CAN_H is used for this purpose. According to the CANopen several solutions are available (See accessories and wear parts).

The following table describes the CANopen accessories for the different bus termination:

Bus termination	Accessories	
CANopen RJ45 module VW3A3608	CANopen terminating resistor, 120 Ohm, integrated in RJ45 connector	TCSCAR013M120
CANopen open style module VW3A3628	CANopen terminating resistor, 120 ohm, for terminal screw terminal	TCSCAR01NM120
CANopen SubD9 module VW3A3618	CANopen connector, SubD9 (female), with switchable terminating resistor, straight	TSXCANKCDF180T
	CANopen cable, 1 m, SubD9 (female) with integrated terminating resistor to RJ45	VW3M3805R01
	CANopen cable, 3 m, SubD9 (female) with integrated terminating resistor to RJ45	VW3M3805R030

Chapter 4
Software Setup

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
4.1	Basic Settings	36
4.2	Profile	39
4.3	Software Setup with Unity (M340)	58

Section 4.1
Basic Settings

What Is in This Section?

This section contains the following topics:

Configuring the Communication Parameters

Overview

The parameters are described according to the graphic display terminal. These settings are also possible from commissioning software.

Access

The parameters are accessible in the **[Communication]** $\Box \Box \Pi$, **[CANopen]** $\Box \Box \Box$ - menu.

[CANopen Address] $\mathcal{R} \Box \Box \Box$

About This Parameter

This parameter defines the address of the drive on the network. This parameter is taken into account after a power cycle.

Access

This is a read/write parameter.

The parameter number is 6051 via Modbus access

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[OFF] [1 to 127]	$\Box F F$ $I...$ $I \overline{c} \overline{1}$	0 1...127	CANopen address is not assigned. CANopen address is assigned. **Factory setting**: OFF

[CANopen Baudrate] $b \Box \Box \Box$

About This Parameter

This parameter defines the baud rate at which data is transferred. This parameter is taken into account after a power cycle.

Access

This is a read/write parameter.

The parameter number is 6053 via Modbus access.

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[50 kbps] [125 kbps] [250 kbps] [500 kbps] [1 Mbps]	$5 \Box$ $I \overline{c} 5$ $\overline{c} 5 \Box$ $5 \Box \Box$ $I \Pi$	38 52 60 68 76	Baud rate is set to 50 Kbps. Baud rate is set to 125 Kbps. Baud rate is set to 250 Kbps. Baud rate is set to 500 Kbps. Baud rate is set to 1 Mbps. **Factory setting**: 250 Kbps

[CANopen Error] $E\ r\ C\ o$

About This Parameter

This parameter indicates the last active CANopen detected error.

Access

This is a read-only Parameter.

The parameter number is 6056 via Modbus access..

Possible Settings

The table presents the parameter settings:

Settings	Code	Value	Description
[0]	0	0	No errors detected since the last start of CANopen communication.
[1]	1	1	Bus off or CAN overrun.
[2]	2	2	Node guarding error requiring a return to the NMT initialization state.
[3]	3	3	CAN overrun (possible alternative values: 32, 64 or 128)
[4]	4	4	Heartbeat error requiring a return to the NMT initialization state.
[5]	5	5	NMT states chart error.
NOTE: If the motor is running, a **[CANopen Error]** $C\ o\ F$ is triggered in case of change of NMT state.			

Section 4.2
Profile

What Is in This Section?

This section contains the following topics:

Definition of a Profile

Types of Profiles

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

Communication Profile

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

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

Functional Profile

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

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

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

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

Application Profile

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

Interchangeability

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

Functional Profiles Supported by the Drive

I/O Profile

Using the I/O profile simplifies PLC programming.

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

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

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

The I/O profile is supported by the drive itself and therefore in turn by all the communication ports.

CiA402 Profile

The drive only starts up following a command sequence.

The control word is standardized.

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

The CiA402 profile is supported by the drive itself and therefore by all the communication ports.

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

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

Functional Description

Introduction

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

CiA402

The main parameters are shown with their CiA402 name and their CiA402/Drivecom index (the values in brackets are the CANopen addresses of the parameter).

The following figure shows the control diagram for drive operation:
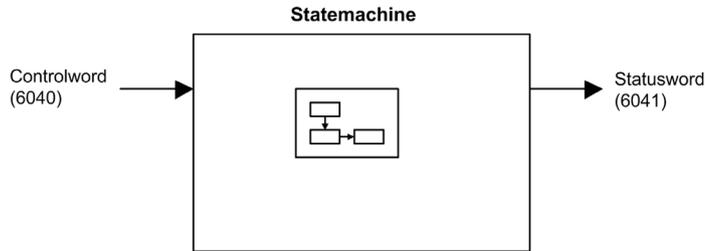
Simplified diagram for speed control in `Velocity` mode:
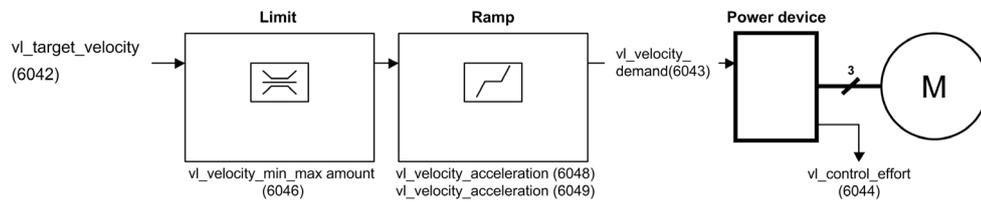
Altivar Drive

These diagrams translate as follows for the Altivar drive.

The following figure shows the control diagram for drive operation:
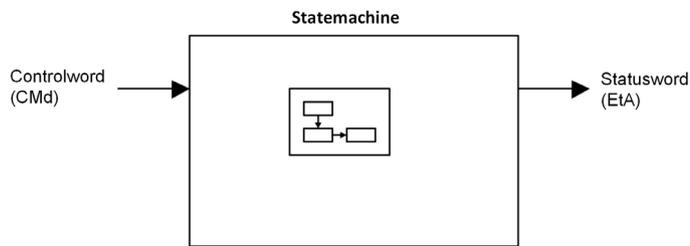
Simplified diagram for speed control in `Velocity` mode:
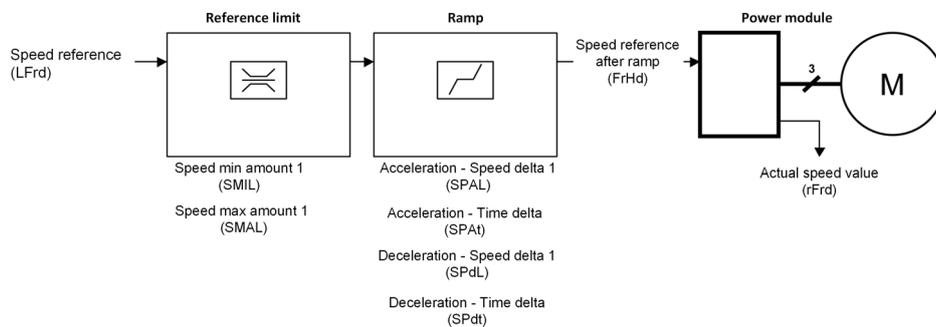
CIA402 Operating State Diagram

State Diagram

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

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

The following figure shows the CIA402 state diagram:

Description of Operating States

Drive Operating State

The operating state of the drive changes depending on whether the control word **[Cmd Register]** $\mathit{C\,\Pi\,d}$, is sent or an event occurs (an error detection, for example).

The drive operating state can be identified by the value of the status word **[CIA402 State Reg]** $\mathit{E\,t\,A}$.

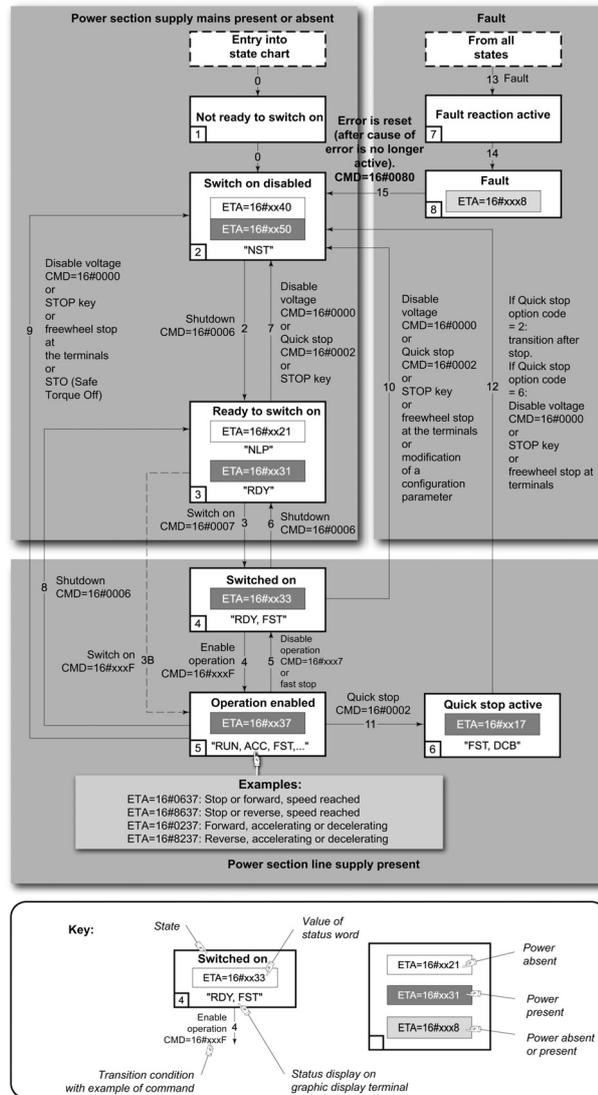| Operating State	Description
`1 – Not ready to switch on`	Initialization starts. This is a transient state invisible to the communication network.
`2 – Switch on disabled`	The power stage is not ready to switch on. The drive is locked, no power is supplied to the motor. For a separate control stage,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

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

Summary

Device Status Summary

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

NOTE:
- Configuration parameters are described in communication parameter file as R/WS access type parameters. Other parameters can be accessed whatever the operating state.
- A Setting parameter can be accessed in all operating state of the drive.

Cmd Register *C П d*

Bit Mapping of the Control Word

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

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

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

Stop Commands

Halt Command

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

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

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

Fast Stop Command

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

Freewheel Command

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

Assigning Control Word Bits

Function Codes

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

Bit	CANopen
Bit 11	C211
Bit 12	C212
Bit 13	C213
Bit 14	C214
Bit 15	C215

For example, to assign the DC injection braking to bit13 of CANopen, simply configure the **[DC Injection Assign]** *dCi* parameter with the **[C213]** *C213* value.

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

[CIA402 State Reg] *E t A*

Bit Mapping of the Status Word

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

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

Operating State	Bit 6 Switch On Disabled	Bit 5 Quick Stop	Bit 4 Voltage Enabled	Bit 3 Fault	Bit 2 Operation Enabled	Bit 1 Switched On	Bit 0 Ready to Switch On	ETA Masked by 006F H [1]
1 –Not ready to switch on	0	X	X	0	0	0	0	–
2 –Switch on disabled	1	X	X	0	0	0	0	0040 hex
3 –Ready to switch on	0	1	X	0	0	0	1	0021 hex
4 – Switched on	0	1	1	0	0	1	1	0023 hex
5 – Operation enabled	0	1	1	0	1	1	1	0027 hex
6 –Quick stop active	0	0	1	0	1	1	1	0007 hex
7 –Fault reaction active	0	X	X	1	1	1	1	002F
8 –Fault	0	X	X	1	0	0	0	0008 hex[2]...0028 hex

[1] This mask can be used by the PLC program to test the diagram state.
[2] detected error following operating state `6 – Quick stop active`.
X: In this state, the value of the bit can be 0 or 1.

Starting Sequence

Description

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

There are 3 possible scenarios:

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

Sequence for a Drive Powered by the Power Stage Supply

Description

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

If power is supplied to the control stage, it has to be supplied to the power stage as well.

The following sequence must be applied:

Step 1

Apply the `2 - Shut down` command
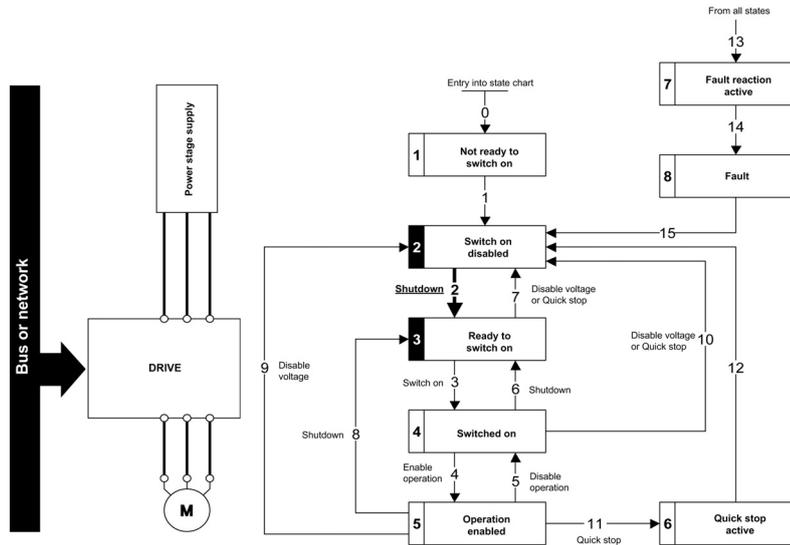
Step 2

- Check that the drive is in the operating state `3 - Ready to switch on`.
- Then apply the `4 - Enable operation` command.
- The motor can be controlled (send a reference value not equal to zero).
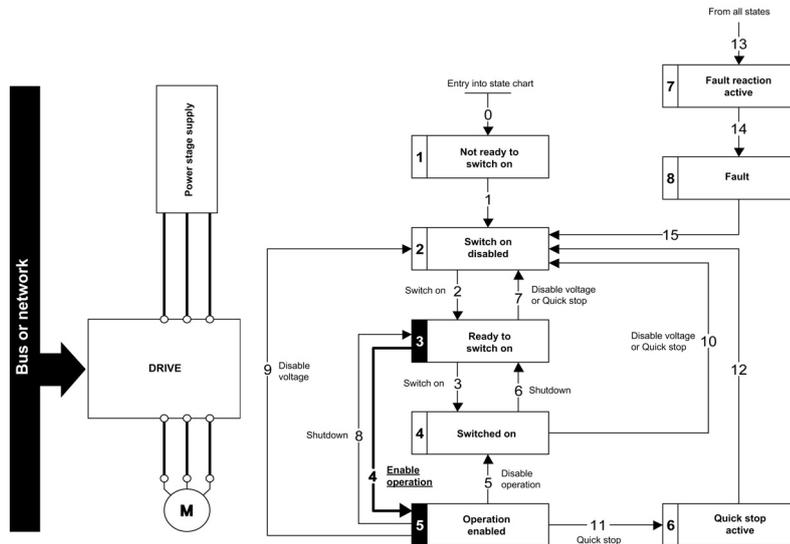
NOTE: It is possible, but not necessary to apply the `3 - Switch on` command followed by the `4 - Enable Operation` command to switch successively into the operating states `3 - Ready to Switch on`, `4 - Switched on` and then `5 - Operation Enabled`. The `4 - Enable operation` command is sufficient.

Sequence for a Drive with Separate Control Stage

Description

Power is supplied separately to the power and control stages.

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

The following sequence must be applied:

Step 1

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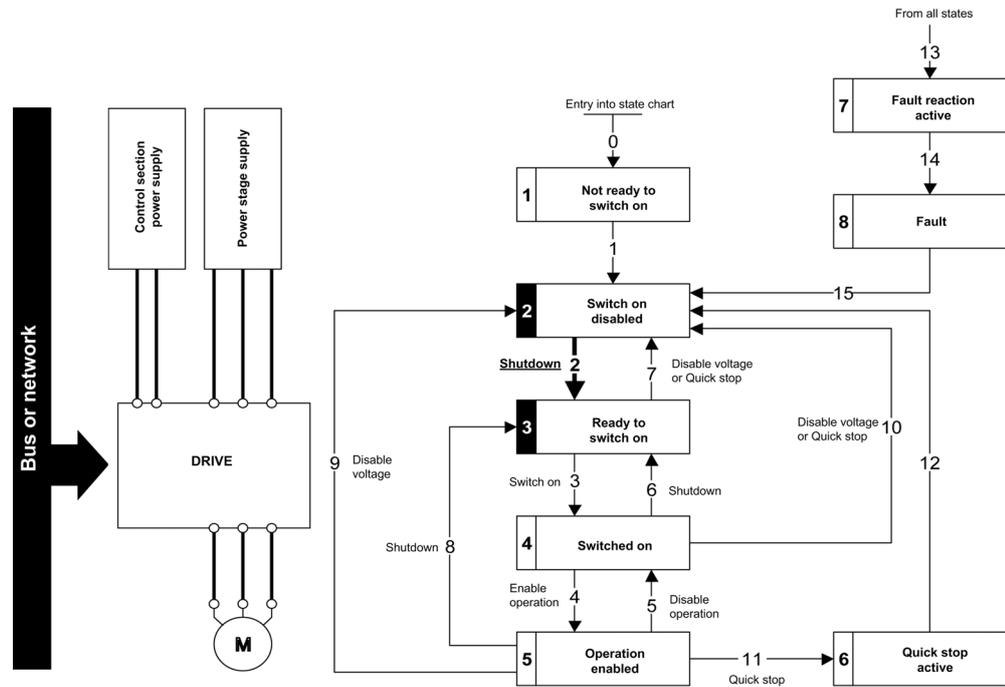
Step 2

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

Power Stage Supply	Terminal Display	Status Word
Absent	*n L P*	21 hex
Present	*r d Y*	31 hex

- Apply the `3 - Switch on` command
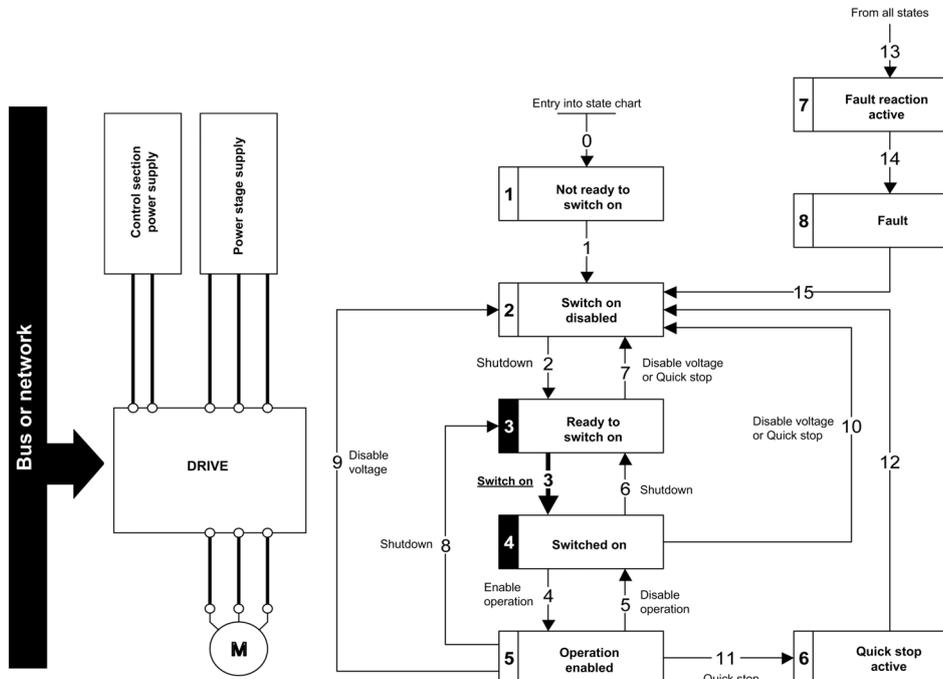
Step 3

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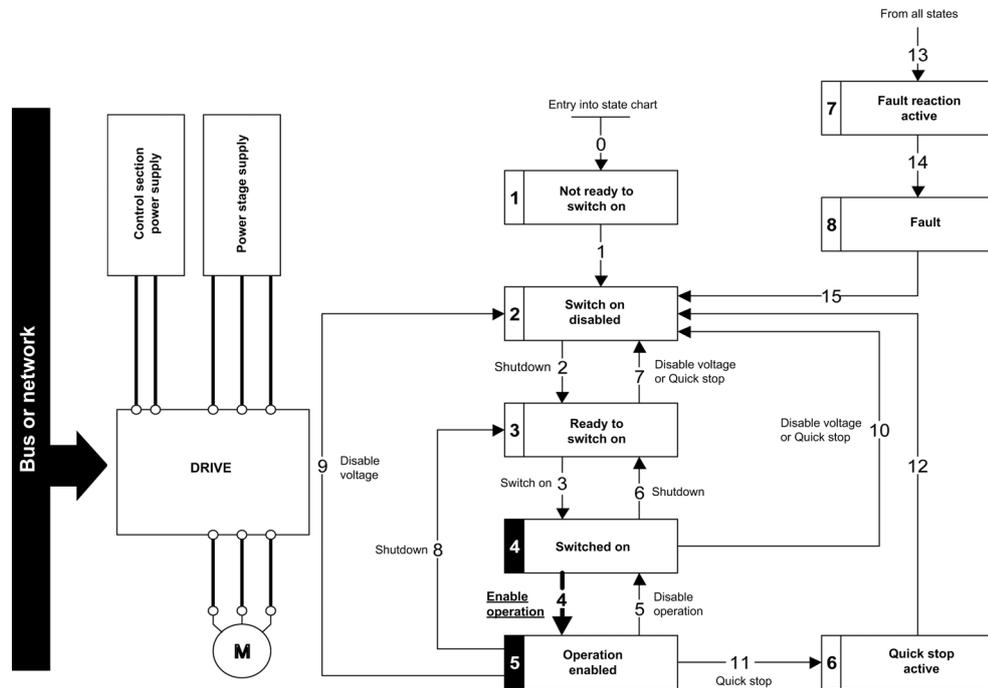
Sequence for a Drive with Mains Contactor Control

Description

Power is supplied separately to the power and control stages.

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

The following sequence must be applied:

Step 1

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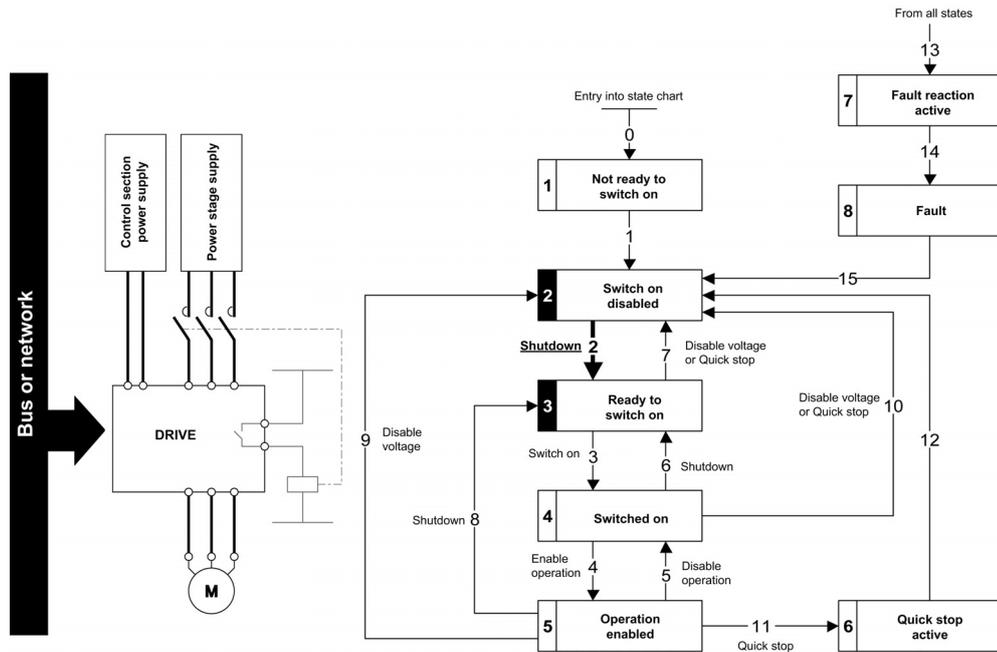
Step 2

- Check that the drive is in the operating state `3 - Ready to switch on`.
- Apply the `3 - Switch on` command, which closes the mains contactor and switch on the power stage supply.
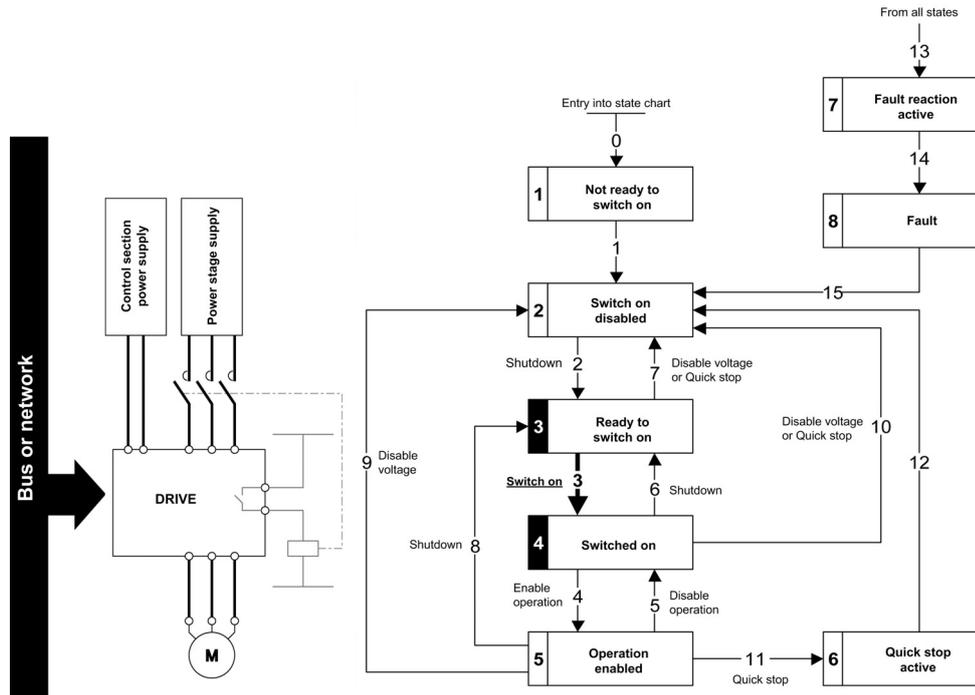
Section 4.3
Software Setup with Unity (M340)

What Is in This Section?

This section contains the following topics:

Topic	Page
Introduction	59
Drive Configuration	60

Introduction

Overview

Here is an example of an application that shows how to control a drive with a M340 PLC equipped with a CANopen port. The operator can control the drive directly from Unity. The version of Unity used here is Unity Pro XL
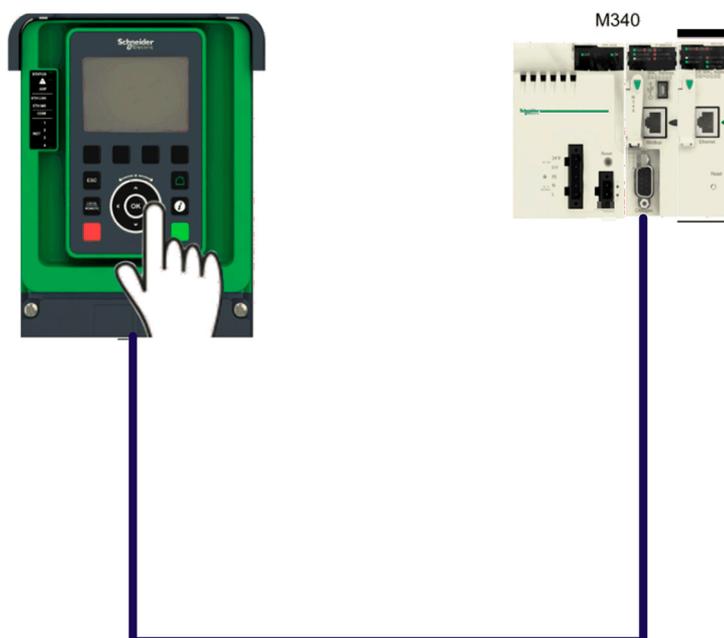
Drive Configuration

Factory Setting

Before configuring the drive, it is advised to make a factory setting. Go to:
● **[File management]** *F ⊓ Ł -* menu
● **[Factory settings]** *F C 5 -* submenu

Then configure **[Go to Factory Settings]** *G F 5* parameter to **OK**

Command Configuration

To control the drive with a CANopen fieldbus, it is necessary to select CANopen as command channel active.

Go to:
● **[Complete Settings]** *C 5 Ł -*
● **[Command and Reference]** *C ┌ P -* menu

Then configure **[Ref.1 channel]** *F ┌ 1* parameter to **[Ref. Freq-CANopen]** *C A ⊓* value

Communication Configuration

Select the CANopen address and the Baud rate in the menu:
● **[Communication]** *C ₒ ⊓ -*
● **[Comm parameters]** *C ⊓ P -*
● **[CANopen]** *C ⊓ ₒ -*

Then configure
● **[CANopen Address]** *A d C ₒ* parameter to **[2]** *2*.
● **[CANopen Baudrate]** *b d C ₒ* parameter to **[500 kbps]** *5 ₀ ₀*

The drive must be restarted in order to take into account the CANopen address

EDS Integration

If your Unity software does not contain the drive in the CANopen catalog. You must add the EDS file to the hardware catalog manager installed with Unity.
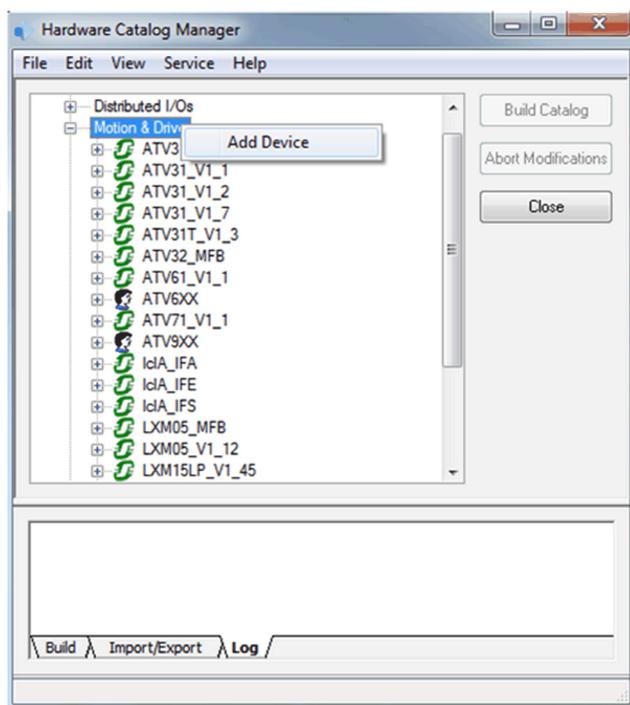
Once imported, you should see the drive in the **Motion & Drive** section. The two topics **default** and **PDOsonly** are used in the CANopen device configuration screen of Unity to select which objects are mapped and linked to an application variable.

● Default: all the objects described in the EDS have reserved memory in the PLC application.
● PDOs only: Only the TPDO and RPDO objects are mapped in PLC memory. (The current example uses this function).

Your hardware catalog manager is now updated and contains the drive. If you import only the EDS file you have only the default choice. You must create new functions in the hardware catalog manager if you need several choices.

NOTE: You cannot reopen the project, if the device which is used in an existing unity project is removed from the hardware catalog manager.

Configuring the Drive in the CANopen Master Project

From the project browser opens the CANopen configuration tool by double-clicking the CANopen drop:
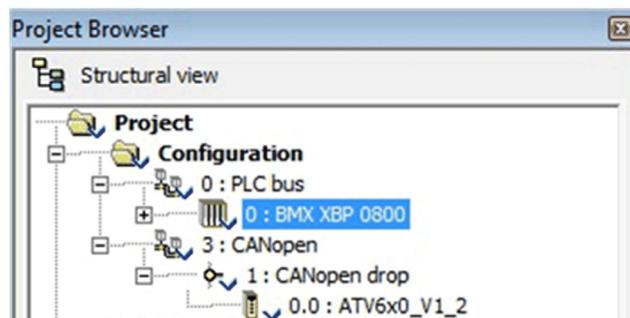
Configuration of the Master

The master configuration consists of:
- Setting the baud rate
- Setting the SYNC message period
- Configuring the memory area which is the image of the whole PDOs handled by the PLC.
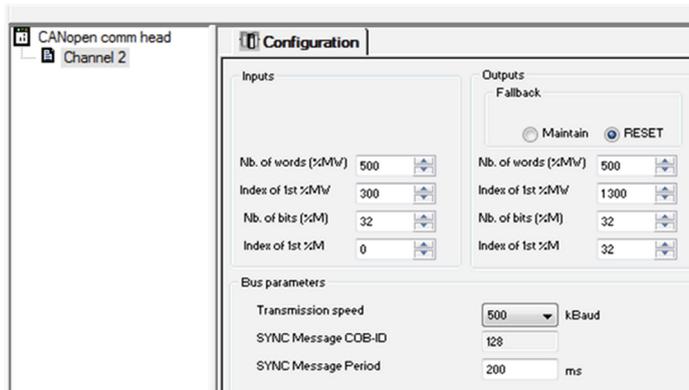
Configuration of the Slave

Add a new device and select the drive in the catalog. The drive was previously added to the catalog by importing the EDS file of the drive.
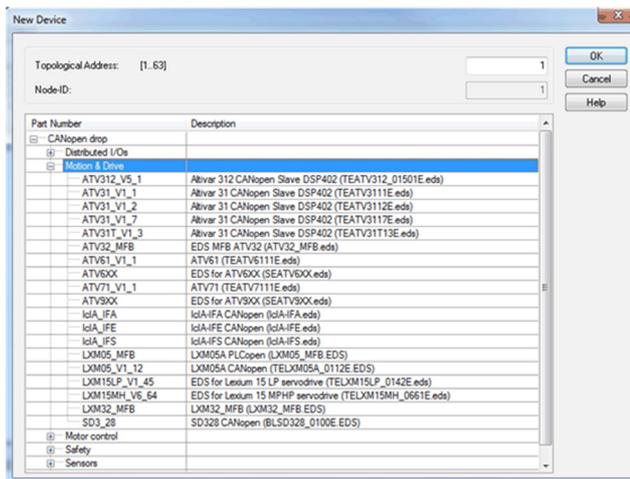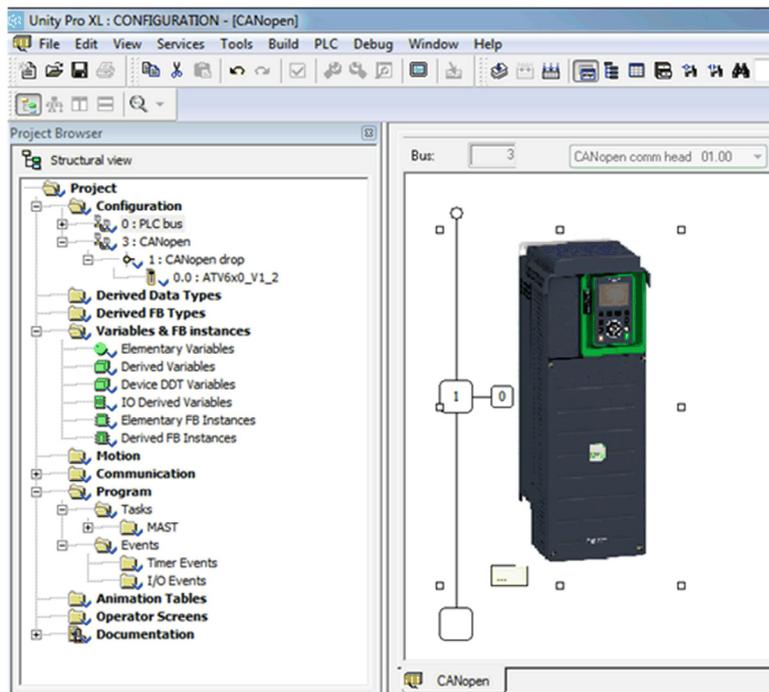
In the example below, TPDO1 and RPDO1 are selected which provides the basic control command of the drive with the CiA402 velocity mode profile.
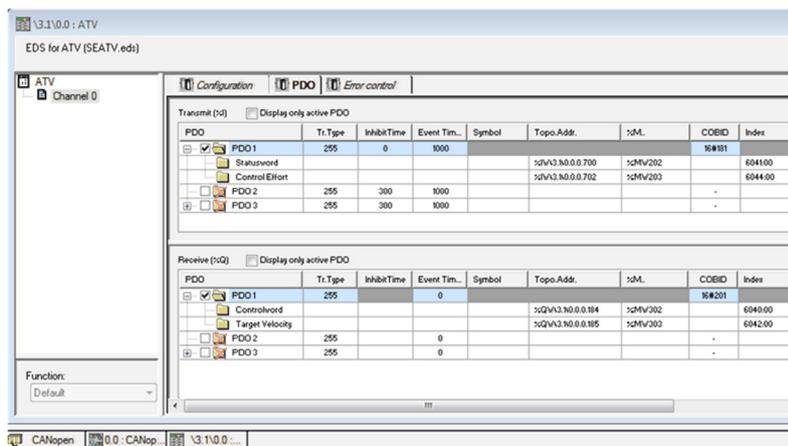
PDOs are linked to the %Mw variables, the mapping is automatically generated by Unity according to the index defined in the master configuration panel and to the PDOs and to the slave Node ID.

Chapter 5
Operations

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Operating States

Configuring Communication Error Response

Description

The response of the drive in the event of a CANopen communication interruption can be configured. Configuration can be performed using the display terminal from the **[Complete settings]** $C 5 t -$, **[Error/Warning handling]** $C 5 W \Pi -$, **[Communication Module]** $C o \Pi o -$ menu via the **[CANopen Error Resp]** $C o L$ submenu.

The values of the **[CANopen Error Resp]** $C o L$ parameter, which triggers a drive detected error **[CANopen Com Interrupt]** $C o F$ are:

Value	Meaning
[Freewheel Stop] $y E 5$	Freewheel stop (factory setting)
[Ramp stop] $r \Pi P$	Stop on ramp
[Fast stop] $F 5 t$	Fast stop
[DC injection] $d C i$	DC injection stop

The values of the **[CANopen Error Resp]** $C o L$ parameter, which does not trigger a transition to the operating state faults are:

Value	Meaning
[Ignore] $n o$	Detected error ignored
[Per STT] $5 t t$	Stop according to configuration of **[Type of stop]** $5 t t$
[Fallback Speed] $L F F$	Change to fallback speed, maintained as long as the detected error persists and the run command has not been removed
[Speed maintained] $r L 5$	The drive maintains the speed at the time the detected error occurred, as long as the detected error persists, and the run command has not been removed

The fallback speed can be configured in the **[Complete settings]** $C 5 t -$, **[Error/Warning handling]** $C 5 W \Pi -$ menu, **[Fallback speed]** $L F F -$ submenu, using the **[FallbackSpeed]** $L F F$ parameter.

⚠ WARNING

LOSS OF CONTROL

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

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

Section 5.2
Operating Modes

What Is in This Section?

This section contains the following topics:

Configuring the Control Channel

Overview

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

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

Configuration of the Drive for Operation in I/O Profile

Description

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

[Forward] is assigned to $\mathit{C\,\Pi\,d}$ bit 0

[Complete settings] ($\mathit{C\,S\,t\,-}$),
[Cmd and Reference] ($\mathit{C\,r\,P\,-}$),
[Reverse Assign] ($\mathit{r\,r\,S}$)
is assigned to $\mathit{C\,\Pi\,d}$ bit 1

[Complete settings] ($\mathit{C\,S\,t\,-}$),
[Error/Warning handling] ($\mathit{C\,S\,W\,\Pi}$),
[Fault Reset] ($\mathit{r\,S\,t\,-}$)
[Fault Reset Assign] ($\mathit{r\,S\,F}$) is assigned to
$\mathit{C\,\Pi\,d}$ bit 7

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

Error Reset

Run reverse

Run forward
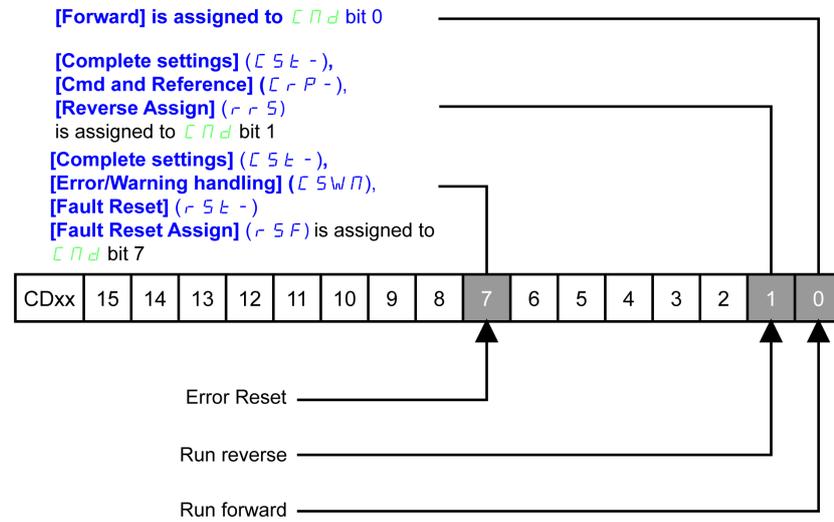
The settings are the following:

[Ref Freq 1 Config] $\mathit{F\,r\,1}$	**[HMI]** $\mathit{H\,\Pi\,1}$
[Control Mode] $\mathit{C\,H\,C\,F}$	**[I/O profile]** $\mathit{1\,o}$
[Command switching] $\mathit{C\,C\,S}$	**[Cmd Channel 1]** $\mathit{C\,d\,1}$
[Cmd channel 1] $\mathit{C\,d\,1}$	
	[CANopen] $\mathit{C\,A\,n}$

The bits of the command word can now be configured.

In the menu configure:

[Reverse Assign] $\mathit{r\,r\,S}$	**[CD01]** $\mathit{C\,d\,0\,1}$

In the menu, **[Fault Reset]** $\mathit{r\,S\,t\,-}$ submenu, configure:

[Fault Reset] $\mathit{r\,S\,F}$	**[CD07]** $\mathit{C\,d\,0\,7}$

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

Description

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

In the
- **[Ref Freq Channel 1]** *F r 1*: is set on according to the communication source you can choose in the following table:

Origin of the Control	Ref1 Channel Setting
Modbus CANopen	**[CANopen]** *C A n*

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

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

Profile	Ref1 Channel setting
CiA 402 combined mode	**[Not separ.]** *S i M*
CiA 402 separate mode	**[Separate]** *S E P*
I/O profile	**[I/O profile]** *i o*

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

Description

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

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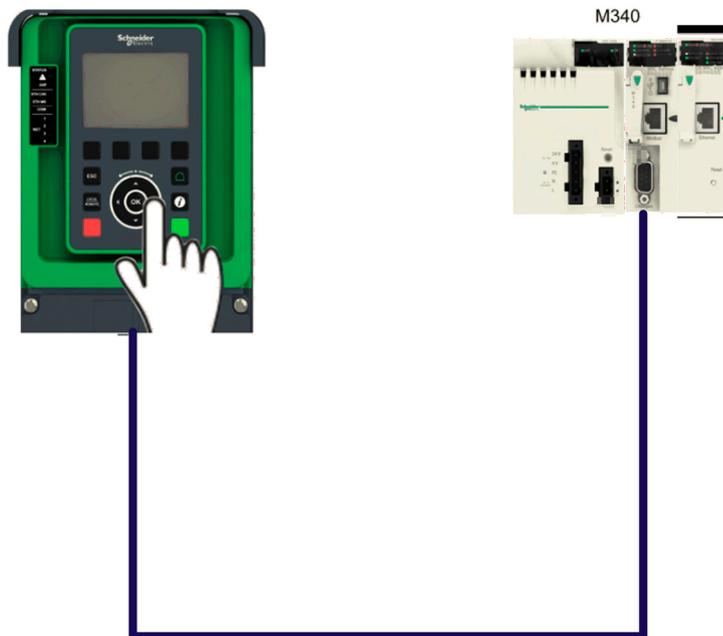
The drive is controlled from the communication (CANopen) but the reference value is adjusted on the display terminal. The control word comes from the controller and is written according to CiA 402 profile.

The settings are as shown in the table:

[Ref Freq 1 Config] *F r 1*	[HMI] *H П ı*
[Control Mode] *C H C F*	[Separate] *S E P*
[Cmd channel 1] *C d 1*	[CANopen] *C A n*
[Freq Switch Assign] *r F C*	[Ref Freq Channel 1] *F r 1*
[Command Switching] *C C S*	[Cmd channel 1] *C d 1*

Chapter 6
Diagnostics and Troubleshooting

What Is in This Chapter?

This chapter contains the following topics:

Fieldbus Status LEDs

LED Indicators

The following figure describes the LEDs status for the module::
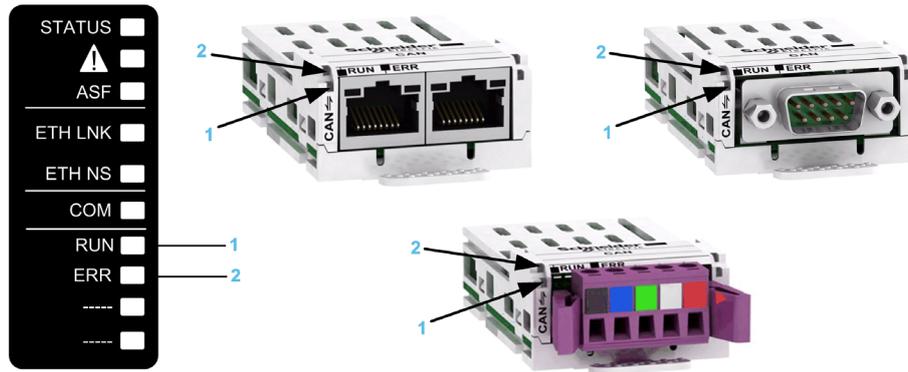
LED Description

Item	LED	Description
1	CAN_RUN	CANopen status
2	CAN_ERR	CANopen error

CANopen Status

This LED indicates the CANopen status:

Color & Status	Description
OFF	The CANopen controller is in `OFF` state
Green single flash	The Altivar 6xx is in `STOPPED` state
Green blinking	The Altivar 6xx is in `PRE-OPERATIONAL` state
Green ON	The Altivar 6xx is in `OPERATIONAL` state

Error Status

This LED indicates the CANopen error status:

Color & Status	Description
OFF	No detected error reported
Red single flash	Detected error reported by the CANopen controller of the Altivar 6xx (example: too many detected error frames)
Red double flash	Detected error due to the occurence of a Node Guarding or a Hearbeat event
Red ON	The CANopen controller is in Bus OFF state
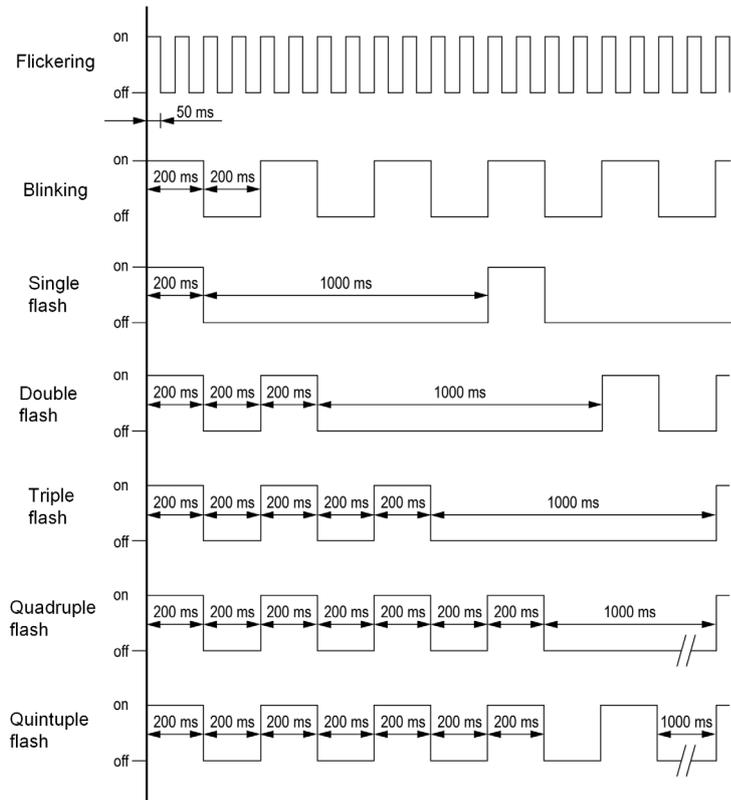
NMT Chart

The [CANopen NMT state] $nMtS$ parameter (logic address 6057, CANopen index/subindex 201E hex/3A) indicates the NMT chart state. The various possible values are [Boot], [Stopped], [Operation] and [Pre-op] (Pre-operational).

This parameter is accessible in the [Display] $Mon-$ → [Communication map] $CMM-$ → [CANopen map] $CnM-$ menu.

PDO Counter

[Number of RX PDO] $nbrP$ and [Number of TX PDO] $nbtP$ indicate the number of PDOs received and the number of PDOs transmitted by the drive (all PDO sets - PDO1, PDO2, and PDO3 - combined).

The values of the counters are reset to zero once 65535 is reached.

This parameter is accessible in the [Display] $Mon-$ → [Communication map] $CMM-$ → [CANopen map] $CnM-$ menu.

Last CANopen Detected Error

The **[Error code]** $E\ r\ \Box\ o$ parameter (index/subindex 201E hex/39) indicates the last active CANopen detected error and maintains its value until the last detected error has been cleared.

This parameter is accessible:
- in the **[Display]** $\Pi\ \Box\ n\ -$ → **[Communication map]** $\Box\ \Pi\ \Pi\ -$ → **[CANopen map]** $\Box\ n\ \Pi\ -$ menu
- in the **[Communication]** $\Box\ \Box\ \Pi$ → **[Comm Parameters]** $\Box\ \Pi\ P$ →**[CANopen]** $\Box\ n\ \Box\ -$ menu.

The possible values are listed below:

Display	Description
[0]	No errors detected since the start of CANopen communication.
[1]	Bus off or CAN overrun.
[2]	Node guarding error requiring a return to the NMT initialization state.
[3]	CAN overrun (possible alternative values: 32, 64 or 128).
[4]	Heartbeat error requiring a return to the NMT initialization state.
[5]	NMT state chart error

PDO Value Display

The value of parameters mapped in PDOs can be displayed using **[PDO1 image]** $P\ \Box\ 1\ -$, **[PDO2 image]** $P\ \Box\ 2\ -$ and **[PDO3 image]** $P\ \Box\ 3\ -$ submenus.

These submenus are available in **[Display]** $\Pi\ \Box\ n$ → **[Communication map]** $\Box\ \Pi\ \Pi$ → **[CANopen map]** $\Box\ n\ \Pi\ -$ menu.

The following figure shows the content of **[PDO1 image]** $P\ \Box\ 1\ -$ submenu:

NOTE: In each of these screens and for each PDO transmitted or received, only the **[Transmit PDOo-o]** or **[Received PDOo-o]** words transmitted and received on the CANopen bus are displayed. This means, for example, PDO2 containing only 4 data bytes (that is, RP21 and RP22), the fields **[Received PDO2-3]** and **[Received PDO2-4]** are not displayed.

Connection for Fieldbus Mode

Description

If the product cannot be addressed via the fieldbus, first check the connections. The productmanual contains the technical data of the device and information on network and device installation. Check the following:
- Power connections to the device.
- Fieldbus cable and fieldbus wiring.
- Network connection to the device.

Monitoring of Communication Channel

Command and Reference Channels

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

Parameter Name	Parameter Code				
	Taken Into Account by the Drive	Modbus Serial	CANopen	Fieldbus Module	Ethernet Embedded
Control word	CMd	$CMd1$	$CMd2$	$CMd3$	$CMd5$
Extended control word	CMi	$CMi1$	$CMi2$	$CMi3$	$CMi5$
Reference speed (rpm)	$LFrd$	$LFd1$	$LFd2$	$LFd3$	$LFd5$
Reference frequency (0.1 Hz)	LFr	$LFr1$	$LFr2$	$LFr3$	$LFr5$
Reference value supplied by PI controller	$PiSP$	$Pir1$	$Pir2$	$Pir3$	$Pir5$
Reference value supplied by analog multiplier function	MFr	$MFr1$	$MFr2$	$MFr3$	$MFr5$

Monitoring of Communication Channels

Communication channels are monitored if they are involved in one of the following parameters:
- The control word ([Cmd Register] CMd) from the active command channel
- The control word containing the command switch (bit configured on [Cmd switching] CCS)
- The control word containing the switch for reference value 1'1B (bit configured on [Ref 1B switching] rCb)
- The control word containing the switch for reference value 1'2 (bit configured on [Freq Switch Assign] rFC)
- The reference frequency or reference speed ([Ref Frequency] LFr or $LFrd$: Nominal speed value) from the active channel for reference value
- Summing reference frequency or reference speed ([Ref Frequency] LFr or $LFrd$: Nominal speed value) 2 (assigned to [Summing Input 2] $SA2$)
- Summing reference frequency or reference speed ([Ref Frequency] LFr or $LFrd$: Nominal speed value) 3 (assigned to [Summing Input 3] $SA3$)
- Subtracting reference frequency or reference speed ([Ref Frequency] LFr or $LFrd$: Nominal speed value) 2 (assigned to [Subtract Ref Freq 2] $dA2$)
- Subtracting reference frequency or reference speed ([Ref Frequency] LFr or $LFrd$: Nominal speed value) 3 (assigned to [Subtract Ref Freq 3] $dA3$)
- The reference value given by the PID controller $PiSP$
- The PID controller feedback ([AI Virtual 1] $Aiu1$)
- The multiplication coefficient of the reference values ([Multiplying coeff.] MFr 2 (assigned to [Ref Freq 2 Multiply] $MA2$)
- The multiplication coefficient of the reference values ([Multiplying coeff.] MFr 3 (assigned to [Ref Freq 3 Multiply] $MA3$)

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

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

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

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

Enabling of Communication Channels

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

For example:

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

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

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

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

Control-Signal Diagnostics

Introduction

On the display terminal, the **[Display]** _∏ o n -_ , **[Communication map]** _C ∏ ∏ -_ submenu can be used to display control-signal diagnostic information between the drive and the controller:

- Active command channel **[Command Channel]** _C ∏ d C_
- Value of the control word **[Cmd Register]** _C ∏ d_ from the active command channel **[Command Channel]** _C ∏ d C_
- Active reference frequency channel **[Ref Freq Channel]** _r F C C_
- Value of the reference frequency **[Pre-Ramp Ref Freq]** _F r H_ from the active target channel **[Ref Freq Channel]** _r F C C_
- Value of the operating state word **[CIA402 State Reg]** _E t A_
- Specific data for all available fieldbus are in dedicated submenus.
- In the **[Command word image]** _C W i -_ submenu: control words from all channels
- In the **[Freq. ref. word map]** _r W i -_ submenu: reference frequency values produced by all channels

Control Word Display

The **[Command Channel]** _C ∏ d C_ parameter indicates the active command channel.

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

The **[Command word image]** _C W i -_ submenu **[CANopen Cmd.]** _C ∏ d 2_ parameter is used to display the hexadecimal value of the control word from he fieldbus module.

Reference Frequency Display

The **[Ref Freq Channel]** _r F C C_ parameter indicates the active channel for reference frequency.

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

The **[Freq. ref. word map]** _r W i -_ submenu **[CAN Ref Freq]** _L F r 2_ parameter is used to display the value (in 0.1 Hz units) of the reference frequency from the fieldbus.

Operating State Word Display

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

The table provides the bit details of _E t A_ parameter:

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

Chapter 7
Appendix A - Object Dictionary

What Is in This Chapter?

This chapter contains the following topics:

Communication Profile Area

Communication Objects

The table provides the drive supported communication objects:

Index	Subindex	Access	Type	Default value	Description
1000 hex	00 hex	Read only	Unsigned32	00410192 hex	Device type: Bits 16-23 = Device type mode Bits 00-15 = Device profile number (402)
1001 hex	00 hex	Read only	Unsigned8	00 hex	Detected error register: detected error (1) or no detected error (0)
1003 hex	00 hex	Read only	Unsigned32	00000005 hex	Number of detected errors: No detected error (0) or one or more detected errors (>0) in object 16#1003; only the value 0 can be written
	01 hex	Read only	Unsigned32	00000000 hex	Standard detected error Field: Bits 16-31 = Additional information (all 0 s) Bits 00-15 = error code (Errd)
1005 hex	00 hex	Read/write	Unsigned32	00000080 hex	COB ID SYNC MESSAGE
1008 hex	00 hex	Read only	Visible string	ATV6XX	Device name
100C hex	00 hex	Read/write	Unsigned16	0000 hex	Guard Time: By default, the Node Guarding Protocol is inhibited; the unit of this object is 1 ms.
100D hex	00 hex	Read/write	Unsigned16	0000 hex	Life Time Factor: Multiplier applied to the `Guard Time` in order to obtain a `Life Time`.
1010 hex	00 hex	Read only	Unsigned32	0002 hex	Store parameters: Number of entries
	01 hex	Read/write	Unsigned32	0000 hex	Store parameters: Save All parameters
	02 hex	Read/write	Unsigned32	0000 hex	Store parameters: Save Communication parameters
1011 hex	00 hex	Read only	Unsigned8	0002 hex	Restore default parameters: Number of entries
	01 hex	Read/write	Unsigned32	0000 hex	Restore default parameters: Restore All parameters
	02 hex	Read/write	Unsigned32	0000 hex	Restore default parameters: Restore COM parameters
1014 hex	00 hex	Read only	Unsigned32	00000080 hex + Node ID	COB-ID Emergency message: COB-ID used for the EMCY service
1016 hex	00 hex	Read only	Unsigned8	01 hex	Consumer Heartbeat Time - Number of entries
	01 hex	Read/write	Unsigned32	00000000 hex	Consumer Heartbeat Time: Bits 16-23 = Node-ID of the producer Bits 00-15 = Heartbeat time (unit = 1 ms)
1017 hex	00 hex	Read/write	Unsigned32	00000000 hex	Producer Heartbeat time

SDO Server Parameters

Communication Object

The table provides the communications objects used by the SDO server of the drive:

Index	Subindex	Access	Type	Default Value	Description
1200 hex	00 hex	Read only	Unsigned 8	02 hex	SDO Server - Number of entries
	01 hex	Read only	Unsigned 32	00000600 hex + node ID	SDO Server - COB-ID Client → Drive (receive)
	02 hex	Read only	Unsigned 32	00000580 hex + node ID	SDO Server - COB-ID Client ← Drive (transmit)

Receive PDOs Parameters

Communication Objects

The table provides the communications objects used for receive PDOs configuration of the drive:

Index	Subindex	Access	Type	Default value	Description
1400 hex	00 hex	Read only	Unsigned8	02 hex	Receive PDO1 - Number of entries
	01 hex	Read/write	Unsigned32	00000200 hex + node ID	Receive PDO1 - COB-ID
	02 hex	Read/write	Unsigned32	000000FF hex	Receive PDO1 - Transmission type: Default value: event driven
1401 hex	00 hex	Read only	Unsigned8	02 hex	Receive PDO2 - Number of entries
	01 hex	Read/write	Unsigned32	80000300 hex + node ID	Receive PDO2 - COB-ID
	02 hex	Read/write	Unsigned32	000000FF hex	Receive PDO2 - Transmission type: Default value: event driven
1402 hex	00 hex	Read only	Unsigned8	02 hex	Receive PDO3 - Number of entries
	01 hex	Read/write	Unsigned32	80000400 hex + node ID	Receive PDO3 - COB-ID
	02 hex	Read/write	Unsigned32	000000FF hex	Receive PDO3 - Transmission type: Default value: event driven

Receive PDO1, PDO2, and PDO3 Mapping

Communication Objects

The table provides the communication objects used for the PDOs mapping of the drive:

Index	Subindex	Access	Type	Default value	Description
1600 hex	00 hex	Read/write	Unsigned8	02 hex	Receive PDO1 mapping - Number of mapped objects: 0 to 4 objects can be mapped for this PDO
	01 hex	Read/write	Unsigned32	60400010 hex	Receive PDO1 mapping - first mapped object: Control word *С П d d* (6040 hex)
	02 hex	Read/write	Unsigned32	60420010 hex	Receive PDO1 mapping - second mapped object: Velocity reference *L F r d* (6042 hex)
	03 hex	Read/write	Unsigned32	00000000 hex	Receive PDO1 mapping: No third mapped object
	04 hex	Read/write	Unsigned32	00000000 hex	Receive PDO1 mapping: No fourth mapped object
1601 hex	00 hex	Read/write	Unsigned8	00 hex	Receive PDO2 mapping - Number of mapped objects: 0 to 4 objects can be mapped for this PDO
	01 hex	Read/write	Unsigned32	00000000 hex	Receive PDO2 mapping -: No first mapped object
	02 hex	Read/write	Unsigned32	00000000 hex	Receive PDO2 mapping -: No second mapped object
	03 hex	Read/write	Unsigned32	00000000 hex	Receive PDO2 mapping: No third mapped object
	04 hex	Read/write	Unsigned32	00000000 hex	Receive PDO2 mapping: No fourth mapped object
1602 hex	00 hex	Read only	Unsigned8	04 hex	Receive PDO3 mapping - Number of mapped objects: 0 to 4 objects can be mapped for this PDO
	01 hex	Read only	Unsigned32	20613E10 hex	Receive PDO3 mapping - first mapped object: NC1 (Comm. Scanner first data)
	02 hex	Read only	Unsigned32	20613F10 hex	Receive PDO3 mapping - second mapped object: NC2 (Comm. Scanner second data)
	03 hex	Read only	Unsigned32	20614010 hex	Receive PDO3 mapping - third mapped object: NC3 (Comm. Scanner third data)
	04 hex	Read only	Unsigned32	20614110 hex	Receive PDO3 mapping - fourth mapped object: NC4 (Comm. Scanner fourth data)

Transmit PDOs Parameters

Communication Objects

The table provides the communications objects used for transmit PDOs configuration of the drive:

Index	Subindex	Access	Type	Default value	Description
1800 hex	00 hex	Read only	Unsigned8	05 hex	Transmit PDO1 - Number of entries
	01 hex	Read/write	Unsigned32	00000180 hex + Node ID	Transmit PDO1 - COB-ID
	02 hex	Read/write	Unsigned8	FF hex	Transmit PDO1 - - Transmission type: Three modes are available for this PDO: asynchronous (255), synchronously cyclic (1-240), and synchronously acyclic (0)
	03 hex	Read/write	Unsigned16	300	Transmit PDO1 - Inhibit time: Minimum time between two transmissions; Unit = 100 Ms
	04 hex	Read/write	Unsigned8	—	Transmit PDO1 - Reserved
	05 hex	Read/write	Unsigned16	1000	Transmit PDO1 - Event timer: In asynchronous mode, this object sets a minimum rate of transmission for this PDO; Unit = 1 ms
1801 hex	00 hex	Read only	Unsigned8	05 hex	Transmit PDO2 - Number of entries
	01 hex	Read/write	Unsigned32	80000280 hex + Node ID	Transmit PDO2 - COB-ID
	02 hex	Read/write	Unsigned8	FF hex	Transmit PDO2 - - Transmission type: Three modes are available for this PDO: asynchronous (255), synchronously cyclic (1-240), and synchronously acyclic (0)
	03 hex	Read/write	Unsigned16	300	Transmit PDO2 - Inhibit time: Minimum time between two transmissions; unit = 100 Ms
	04 hex	Read/write	Unsigned8	—	Transmit PDO2 - Reserved
	05 hex	Read/write	Unsigned16	1000	Transmit PDO2 - Event timer: In asynchronous mode, this object sets a minimum rate of transmission for this PDO; unit = 1 ms
1802 hex	00 hex	Read only	Unsigned8	05 hex	Transmit PDO3 - Number of entries
	01 hex	Read/write	Unsigned32	80000380 hex + Node ID	Transmit PDO3 - COB-ID
	02 hex	Read/write	Unsigned8	FF hex	Transmit PDO3 - - Transmission type: Three modes are available for this PDO: asynchronous (255), synchronously cyclic (1-240), and synchronously acyclic (0)
	03 hex	Read/write	Unsigned16	30	Transmit PDO3 - Inhibit time: Minimum time between two transmissions; Unit = 1 Ms
	04 hex	Read/write	Unsigned8	—	Transmit PDO3 - Reserved
	05 hex	Read/write	Unsigned16	1000	Transmit PDO3 - Event timer: In asynchronous mode, this object sets a minimum rate of transmission for this PDO; Unit = 1 ms

Transmit PDO1, PDO2, and PDO3 Mapping

Communication Object

The table provides the communication objects used for the PDOs mapping of the drive:

Index	Subindex	Access	Type	Default value	Description
1A00 hex	00 hex	Read/write	Unsigned8	02 hex	Transmit PDO1 mapping - Number of mapped objects.
	01 hex	Read/write	Unsigned32	60410010 hex	Transmit PDO1 mapping - first mapped object: Status word $E\,t\,A$ (6041 hex)
	02 hex	Read/write	Unsigned32	60440010 hex	Transmit PDO1 mapping - second mapped object: Control effort $r\,F\,r\,d$ (6044 hex)
	03 hex	Read/write	Unsigned32	00000000 hex	Transmit PDO1 mapping: No third mapped object
	04 hex	Read/write	Unsigned32	00000000 hex	Transmit PDO1 mapping: No fourth mapped object
1A01 hex	00 hex	Read/write	Unsigned8	00 hex	Transmit PDO2 mapping - Number of mapped objects
	01 hex	Read/write	Unsigned32	00000000 hex	Not mapped
	02 hex	Read/write	Unsigned32	00000000 hex	Not mapped
	03 hex	Read/write	Unsigned32	00000000 hex	Not mapped
	04 hex	Read/write	Unsigned32	00000000 hex	Not mapped
1A02 hex	00 hex	Read only	Unsigned8	04 hex	Transmit PDO3 mapping - Number of mapped objects.
	01 hex	Read only	Unsigned32	20612A10 hex	Transmit PDO3 mapping - first mapped object: NM1 - Comm. Scanner first data
	02 hex	Read only	Unsigned32	20612B10 hex	Transmit PDO3 mapping - second mapped object: NM2 - Comm. Scanner second data
	03 hex	Read only	Unsigned32	20612C10 hex	Transmit PDO3 mapping - third mapped object: NM3 - Comm. Scanner third data
	04 hex	Read only	Unsigned32	20612D10 hex	Transmit PDO3 mapping - 4th mappedobject: NM4 - Comm. Scanner 4th data

Manufacturer Specific Area

Description

The ATV600 parameters are based and documented with their CANopen address.

NOTE: In the communication parameters excel sheet you find CANopen addresses.

Application Profile Area

Standardized Objects

The table provides the standardized objects, in conformance with CiA402 velocity mode profile, supported by the drive:

Index	Description	
603F hex	Error code	
6040 hex	Control Word	
6041 hex	Status Word	
6042 hex	Target velocity	
6043 hex	Velocity demand	
6044 hex	Control Effort	
6046 hex	01 hex	Velocity min. amount
	02 hex	Velocity max amount
6048 hex	Velocity acceleration	
	01 hex	Delta speed
	02 hex	Delta time
604B hex	Set Point factor	
	01 hex	Set Point factor numerator
	02 hex	Set Point factor denominator
605 A hex	Quick stop option code	
605C hex	Disable option code	
6060 hex	Modes of operation	
6061 hex	Modes of operation Display	
6077 hex	Torque actual value	
6502 hex	Supported drive modes	

Glossary

A

Abbreviations

Req. = Required

Opt. = Optional

C

CAN

Controller Area Network is an internally standardized serial bus system

COB

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

COB ID

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

D

Display terminal

The display terminal menus are shown in square brackets.

For example: **[Communication]**

The codes are shown in round brackets.

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

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

For example: **[Fallback Speed]**

Parameter codes are displayed in round brackets.

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

E

Error

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

F

Factory setting

Default configuration of the product.

Fault

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

Fault Reset

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

L

LSB

Least Significant Byte

M

Monitoring function

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

MSB

Most Significant Byte

N

NMT

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

P

Parameter

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

PDO

Process Data Object

PELV

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

PLC

Programmable logic controller

Power stage

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

Q

Quick Stop

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

R

RPDO

Receive PDO

S

SYNC

Synchronization Object

T

TPDO

Transmit PDO

W

Warning

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

Z

Zone of operation

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