Altivar Soft Starter ATS490

Soft Starter for Asynchronous Motors

CANopen Manual – VW3A3608, VW3A3618, VW3A3628

PKR63426.01
12/2024

www.se.com

Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

The Schneider Electric brand and any trademarks of Schneider Electric SE and its subsidiaries referred to in this document are the property of Schneider Electric SE or its subsidiaries. All other brands may be trademarks of their respective owner.

Schneider Electric does not grant any right or license for commercial use of the document or its content, except for a non-exclusive and personal license to consult it on an "as is" basis.

Schneider Electric reserves the right to make changes or updates with respect to or in the content of this document or the format thereof, at any time without notice.

To the extent permitted by applicable law, no responsibility or liability is assumed by Schneider Electric and its subsidiaries for any errors or omissions in the informational content of this document, as well as any non-intended use or misuse of the content thereof.

Table of Contents

Safety Information

Important Information

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 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.

Product related information

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

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only appropriately trained persons who are familiar with and fully understand the contents of the present manual and all other pertinent product documentation and who have received all necessary training to recognize and avoid hazards involved are authorized to work on and with this equipment.
- Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Only use properly rated, electrically insulated tools and measuring equipment.
- Do not touch unshielded components or terminals with voltage present.
- Prior to performing any type of work on the equipment, block the motor shaft to prevent rotation.
- Insulate both ends of unused conductors of the motor cable.

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

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Before performing work on the equipment:

- Use all required personal protective equipment (PPE).
- Disconnect all power, including external control power that may be present. Take into account that the circuit breaker or main switch does not de-energize all circuits.
- Place a "Do Not Turn On" label on all power switches related to the equipment.
- Lock all power switches in the open position.
- Verify the absence of voltage using a properly rated voltage sensing device.

Before applying voltage to the equipment:

- 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.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- Do not use renewable link fuses in fused switches.

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

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.

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.

Your application consists of a whole range of different interrelated mechanical, electrical, and electronic components, the soft starter being just one part of the application. The soft starter by itself is neither intended to nor capable of providing the entire functionality to meet all safety-related requirements that apply to your application. Depending on the application and the corresponding risk assessment to be conducted by you, a whole variety of additional equipment is required such as, but not limited to, external monitoring devices, guards, etc.

As a designer/manufacturer of machines, you must be familiar with and observe all standards that apply to your machine. You must conduct a risk assessment and determine the appropriate Performance Level (PL) and/or Safety Integrity Level (SIL) and design and build your machine in compliance with all applicable standards. In doing so, you must consider the interrelation of all components of the machine. In addition, you must provide instructions for use that enable the user of your machine to perform any type of work on and with the machine such as operation and maintenance in a safe manner.

The present document assumes that you are fully aware of all normative standards and requirements that apply to your application. Since the soft starter cannot provide all safety-related functionality for your entire application, you must ensure that the required Performance Level and/or Safety Integrity Level is reached by installing all necessary additional equipment.

⚠WARNING

INSUFFICIENT PERFORMANCE LEVEL/SAFETY INTEGRITY LEVEL AND/ OR UNINTENDED EQUIPMENT OPERATION

- Conduct a risk assessment according to EN ISO 12100 and all other standards that apply to your application.
- Use redundant components and/or control paths for all critical control functions identified in your risk assessment.
- Verify that the service life of all individual components used in your application is sufficient for the intended service life of your overall application.
- Perform extensive commissioning tests for all potential error situations to verify the effectiveness of the safety-related functions and monitoring functions implemented, for example, but not limited to, speed monitoring by means of encoders, short circuit monitoring for all connected equipment, correct operation of brakes and guards.
- Perform extensive commissioning tests for all potential error situations to verify that the load can be brought to a safe stop under all conditions.

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

Product 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.

⚠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.

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, SE recommended Cybersecurity Best Practices*).
- 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.

(*) : SE Recommended Cybersecurity Best Practices can be downloaded on SE.com.

⚠WARNING

LOSS OF CONTROL

Perform a comprehensive commissioning test to verify that communication monitoring properly detects communication interruptions.

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

This product meets the EMC requirements according to the standard IEC 60947-4-2. This device has been designed for environment A. Use of this product in a domestic environment (B environment) may cause unwanted radio interference.

⚠WARNING

RADIO INTERFERENCE

- In a domestic environment (B environment), this product may cause radio interference in which case supplementary mitigation measures may be required.

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

NOTICE

DESTRUCTION DUE TO INCORRECT MAINS VOLTAGE

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

Failure to follow these instructions can result in equipment damage.

About the Book

Validity note

Original instructions and information given in the present document have been written in English (before optional translation).

NOTE: The products listed in the document are not all available at the time of publication of this document online. The data, illustrations and product specifications listed in the guide will be completed and updated as the product availabilities evolve. Updates to the guide will be available for download once products are released onto the market.

This documentation is valid only for ATS490.

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.

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

Step	Action
1	Go to the Schneider Electric home page *www.se.com*.
2	In the Search box type the reference of the 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.**

Document Scope

The purpose of this document is to:

- Show you how to install the CANopen fieldbus on your soft starter.
- Show you how to configure soft starter to use CANopen for monitoring and control.
- Provide examples of setup using Control Expert.

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

Related Documents

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on www.se.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 soft starter, listed below:

Catalog

Title of documentation	Reference number
Catalog: Altivar Soft Starter ATS490	DIA2ED2240603EN (English) DIA2ED2240603FR (French)

Documentations

Title of documentation	Reference number
ATS490 Getting Started	PKR63410 (English), PKR63411 (French) PKR63412 (Spanish), PKR63413 (Italian) PKR63414 (German), PKR63415 (Chinese) PKR63416 (Portuguese), PKR63417 (Turkish)
ATS490 Getting Started Manual Annex for UL	PKR63418 (English)
ATS490 User Manual	PKR52680 (English), PKR52681 (French) PKR52682 (Spanish), PKR52683 (Italian) PKR52684 (German), PKR52685 (Chinese) PKR52686 (Portuguese), PKR52687 (Turkish)
ATS490 Embedded Safety Function Manual	PKR63419 (English)
ATS490 ATEX Manual	BQT74920 (English)
ATS490 Embedded Modbus RTU Manual	PKR63421 (English)
ATS490 EtherNet Manual	PKR63423 (English)
ATS490 PROFIBUS DP Manual (VW3A3607)	PKR63425 (English)
ATS490 CANopen Manual (VW3A3608, VW3A3618, VW3A3628)	PKR63426 (English)
ATS490 Communication Parameter Addresses	PKR63420 (English)
Recommended Cybersecurity Best Practices	CS-Best-Practices-2019–340 (English)

You can download there technical publications and other technical information from our website at www.se.com/en/download.

Videos

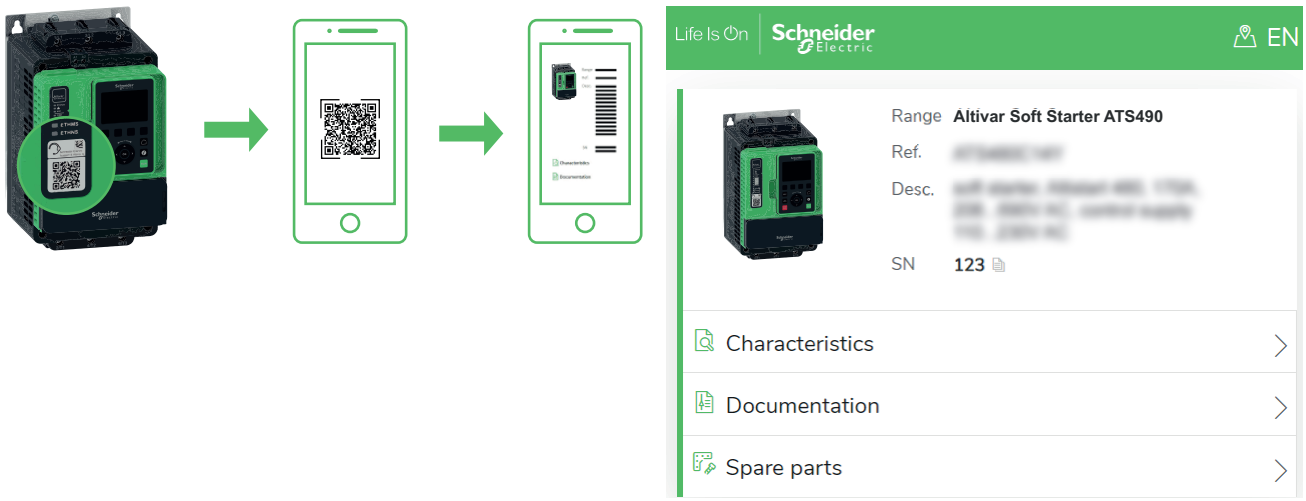
Title of documentation	Reference number
Video: Getting Started with ATS490	FAQ000263202 (English)

Software

Title of documentation	Reference number
SoMove: FDT	SoMove FDT (English, French, German, Spanish, Italian, Chinese)
ATS490: DTM	ATS490 DTM Library EN (English – to be installed first) ATS490 DTM Lang FR (French) ATS490 DTM Lang SP (Spanish) ATS490 DTM Lang IT (Italian) ATS490 DTM Lang DE (German) ATS490 DTM Lang CN (Chinese)

Electronic product data sheet

Scan the QR code in front of the soft starter to get the product data sheet.



Scanning the QR Code gives you access to :

- Product ID Card : Product range, Reference, short description and a Serial Number (Use the serial number to retrieve the product's manufacturing date).
- The product characteristics : Main characteristics, environment, packing units, sustainability...
- Documentation : Technical Guidance at Glance (Presentation, Dimensions, Mounting, Wiring, Commissioning...) and Product Documentation (User guide, Instructions sheets, Certificates, How To videos...)
- Spare parts for your product

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 soft starters 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:

- 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
- IEC 60947–1 Low–Voltage Switchgear and Control Gear – General rules
- IEC 60947–4-2 Semiconductor Motor controllers, Starters and Soft Starters
- IEC 62443: Security for industrial automation and control systems

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.

Also see the glossary at the end of this manual.

Structure of the Parameter Table

General Legend

Pictogram	Description
	Power cycle must be performed after setting this parameter.
	Read only parameter, mainly used for monitoring.
	Expert mode required to access this parameter.

Contact us

Select your country on www.se.com/contact.

Schneider Electric Industries SAS

Head Office

35, rue Joseph Monier

92500 Rueil-Malmaison

France

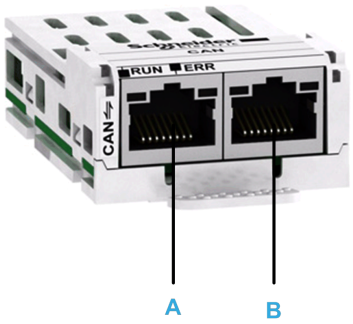
Hardware Setup

What’s in This Part

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

Installation of the fieldbus module

Before starting

Verify that the catalog number printed on the label corresponds to the purchase order.

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

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

⚠⚠DANGER

ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION

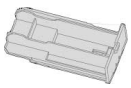
Do not use damaged products or accessories.

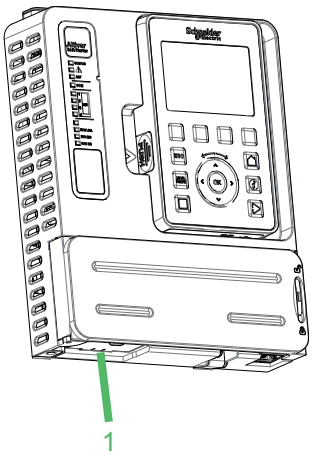
Failure to follow these instructions will result in death or serious injury.

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

Inserting the fieldbus module

The table provides the procedure for insertion of the CANopen fieldbus module in the soft starter:

Step	Action
1	Ensure that the power is off.
2	Locate the fieldbus module slot on the bottom of the control part.
3	Remove the plastic cover module with the help of a screwdriver. 
4	Insert the module.
5	Check that the module is correctly inserted and locked mechanically in the soft starter.
6	Wire the CANopen fieldbus module to the CANopen automate.
7	Add the corresponding sticker on the LED front panel of the soft starter.



1 Fieldbus Module Slot

Removing the fieldbus module

The table provides the procedure for removal of the CANopen fieldbus module from the soft starter:

Step	Action
1	Ensure that the power is off.
2	Remove the CANopen connection cables.
3	Press the strip. 
4	Remove the module while maintaining the strip pressed.

NOTE: When removing or inserting the module at next power on, an error can be triggered if the device topology has changed.

NOTE: If the message is validated, a reset of the error is performed due to a factory setting.

NOTE: In case of incompatible module, the error INF6 is triggered (due to option module version number).

Firmware and Description File

Compatibility

The associated EDS file is named as the following example:

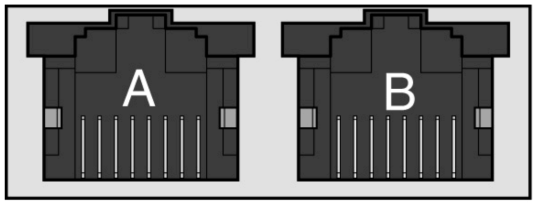
SEATS490_010101E.eds

The files are available on www.se.com.

Electrical Installation

Pin Layout of VW3A3608

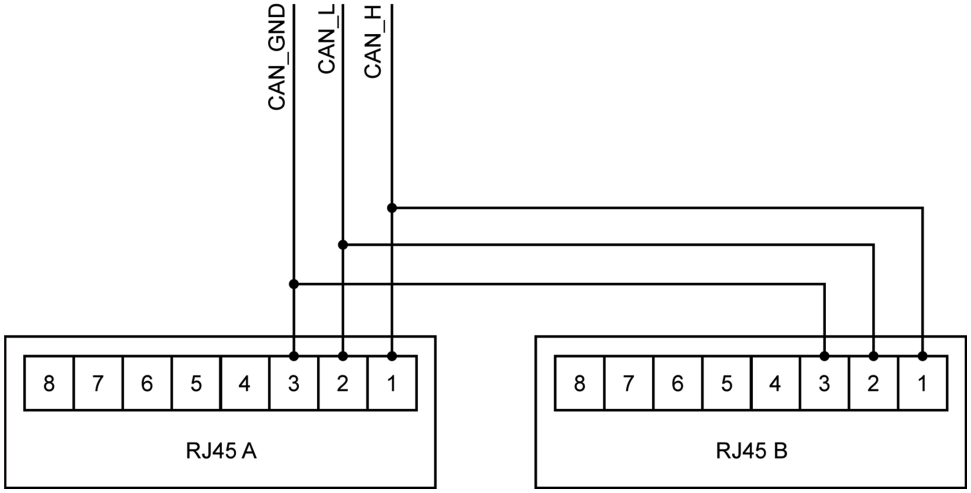
The VW3A3608 option module is equipped with 2 RJ45 female sockets for the CANopen connection.



The table provides the pin out details of each RJ45 connector:

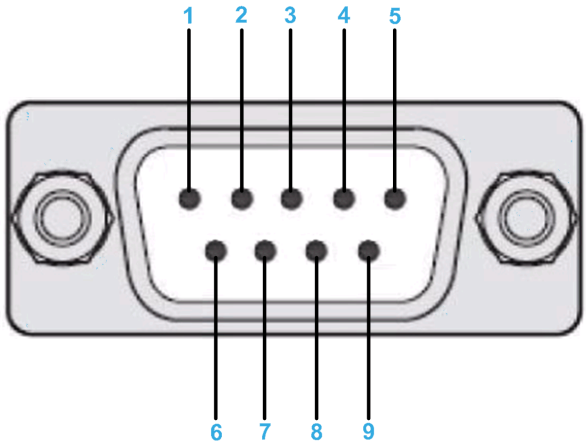
Pin	RJ45 signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	Not connected
5	Not connected
6	Not connected
7	Not connected
8	Not connected

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.

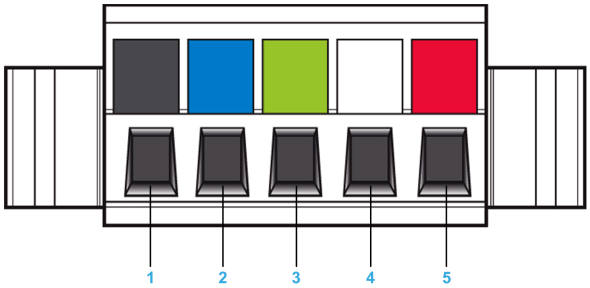


The table provides the pin out details of the SUB-D 9 connector:

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

Pin	Signal
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 soft starters equipped with VW3A3608 CANopen modules.

NOTE: A 120 ohm terminating resistor between CAN_L and CAN_H is used for this purpose.

Accessories Presentation

Introduction

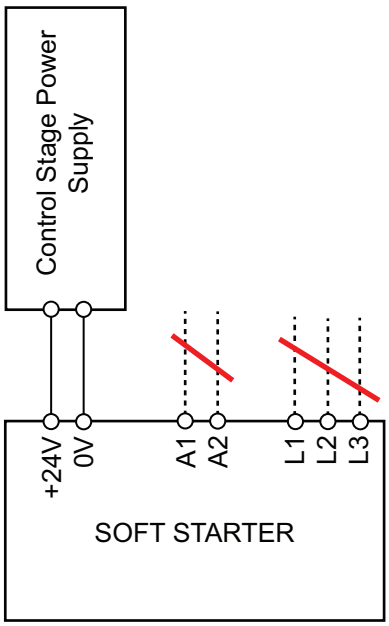
Both ends of a CAN bus line must be terminated.

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 cordsets equipped with 2 RJ45 connectors 0.3m	VW3CANCARR03
	CANopen cordsets equipped with 2 RJ45 connectors 1m	VW3CANCARR1
	CANopen junction box	VW3ACANTAP2
CANopen SubD9 module VW3A3618	CANopen cables Standard cable, e mark Low smoke zero halogen. Flame-retardant (IEC 60332-1) 50m	TSXCANCA50
	CANopen cables Standard cable, e mark Low smoke zero halogen. Flame-retardant (IEC 60332-1) 100m	TSXCANCA100
	CANopen cables Standard cable, e mark Low smoke zero halogen. Flame-retardant (IEC 60332-1) 300m	TSXCANCA300
	CANopen cables UL certification, e mark Flame-retardant (IEC 60332-2) 50m	TSXCANCB50
	CANopen cables UL certification, e mark Flame-retardant (IEC 60332-2) 100m	TSXCANCB100
	CANopen cables UL certification, e mark Flame-retardant (IEC 60332-2) 300m	TSXCANCB300
	CANopen cables Cable for harsh environments or mobile installations, e mark Low smoke zero halogen Flame-retardant (IEC 60332-1) 50m	TSXCANCD50
	CANopen cables Cable for harsh environments or mobile installations, e mark Low smoke zero halogen Flame-retardant (IEC 60332-1) 100m	TSXCANCD100
	CANopen cables Cable for harsh environments or mobile installations, e mark Low smoke zero halogen Flame-retardant (IEC 60332-1) 300m	TSXCANCD300
	IP 20 straight CANopen connector 9-way female SUB-D connector with line terminator that can be deactivated	TSXCANKCD-F180T

Automation Commissioning Only

Control stage supplied via +24 V of the control board	Use case
	By supplying the product only with +24V, only programming is possible. No motor power supply is possible.

Cybersecurity Generalities

The objective of Cybersecurity is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for their intended users.

No single Cybersecurity approach is adequate. Schneider Electric recommends a defense-in-depth approach. Conceived by the National Security Agency (NSA), this approach layers the network with security features, appliances, and processes.

The basic components of this approach are:

- Risk assessment
- A security plan built on the results of the risk assessment
- A multi-phase training campaign
- Physical separation of the industrial networks from enterprise networks using a demilitarized zone (DMZ) and the use of firewalls and routing to establish other security zones
- System access control
- Device hardening
- Network monitoring and maintenance

This chapter defines the elements that help you configure a system that is less susceptible to cyber-attacks.

Network administrators, system integrators and personnel that commission, maintain or dispose of a device should:

- Apply and maintain the device's security capabilities.
- Review assumptions about protected environments.
- Address potential risks and mitigation strategies.
- Follow recommendations to optimize cybersecurity.

For detailed information on the system defense-in-depth approach, refer to the TVDA: How Can I Reduce Vulnerability to Cyber Attacks (STN V3.0) on se.com.

To submit a Cybersecurity question, report security issues, or get the latest news from Schneider Electric, visit the Schneider Electric website.

⚠WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default password to help prevent unauthorized access to device settings and information.
- Disable unused ports/services and default accounts, where possible, to minimize pathways for malicious attacks.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example: least rights, separation of duties) to help prevent unauthorized exposure, loss or modification of data and logs, interruption of services, or unintended operation.

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

For more details about cybersecurity, refer to the User Manual.

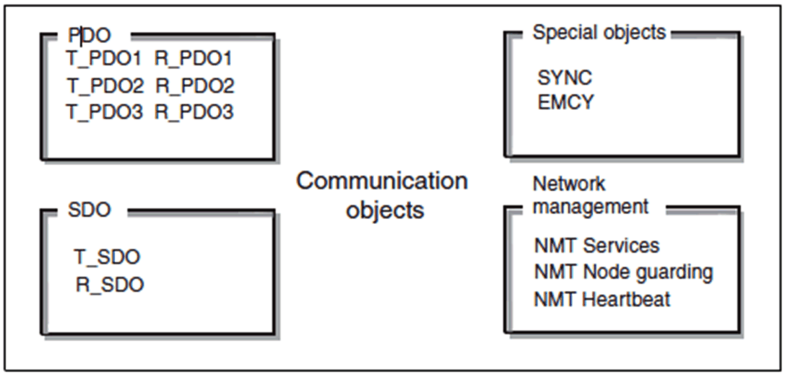
Software Setup

What’s in This Part

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.

Basics

What’s in This Chapter

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.

Description Object Dictionary

The description object dictionary is made of separate chapters:

- Communication profile area
- RPDO
- TPDO
- Manufacturer specific

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	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, page 97	

Communication Object Identifier

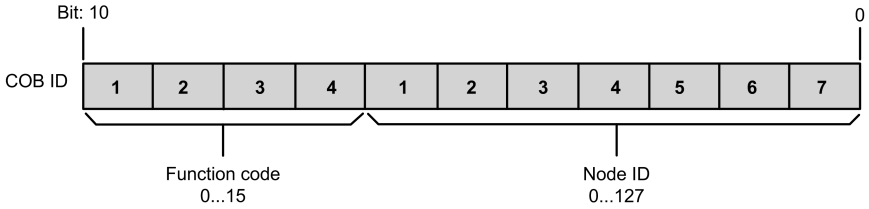
Description

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 **1** 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 a soft starter 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: **Controller → Soft Starter**

	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: **Controller ← Soft Starter**

	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 a soft starter 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: **Controller → Soft Starter**

	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: **Controller ← Soft Starter**

	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) corresponds 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 dictionary
0604 0041 hex	PDO object assignment: the object cannot be assigned to the PDO, this error is triggered when writing to parameters assign to 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 dictionary
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.

The communication of the device embeds a specific soft starter profile based on the CIA402 named "standard profile".

For more information about the Communication Parameter Addresses, please refers to the ATS490 Communication Parameter Addresses, page 12.

PDO1 Details

The first PDO set (PDO1) is a specific soft starter adaptation based on CIA402.

For the input TPDO1, from Device to Controller:

- **[Status Register]** ETA (6041/0 hex).
- **[Motor Current]** LCR (2002/05 hex)
- **[Motor Therm State]** THR (2042/1F hex)
- **[CiA402 Error Code]** ERRD (2038/07 hex)

For the output RPDO1, from Controller to Device:

- **[Cmd Register]** CMD (6040/0 hex).

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 mapped by default. Deactivated by default, it be configured and comprises:

- RPDO3 (receive), containing four output (from Controller to Device) words of the communication scanner NC1 to NC4
- TPDO3 (transmit), containing four input (from Device to Controller) 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 controller. 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 devices.

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 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 controller 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

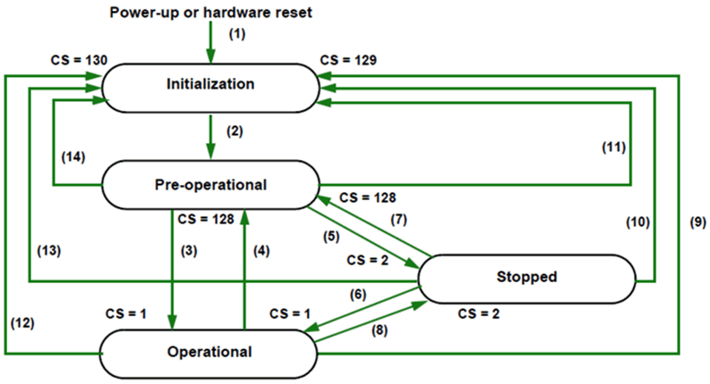
The NMT services for device control are transmitted as unconfirmed messages with COB ID 0. By default, they have the highest priority on the CAN bus.

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 devices.		

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 soft starter, 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 controller can only perform SDO (the monitoring is not activated).

In operation mode, the controller 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 controller cannot perform SDO and PDO.

In the event of a resettable detected error, the soft starter must be in the Operational NMT state in order that the PDO carrying the control word CMD can reset the soft starter 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 of these two services can be active at any one time. The Node guarding service is deactivated by default.

The controller scans the soft starter 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 soft starter has not received the RTR:

- It triggers a `Life Guarding` error
- Sends an emergency telegram (`EMCY`)

Node Guarding Frame Description

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

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

Bit 6-0 (node state):

- Current NMT state of the soft starter:
  - 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 soft starter 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 soft starter.
- 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 soft starter.
- 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 than the `Consumer Heartbeat Time`.

  NOTE:

  If the soft starter has been configured as a consumer and a period equal to the `Consumer Heartbeat Time` elapses without a `Heartbeat message` being received, the soft starter 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 soft starter contains a `Heartbeat Producer state` field (byte 0), described here:

Bit 6-0:

- Current NMT state of the soft starter:
  - Initialization (00 hex)
  - Stopped (04 hex)
  - Operational (05 hex)
  - Pre-Operational (7F hex)

Bit 7 (toggle bit):

- This bit is equal to 0.

Emergency Object

An Emergency object (`EMCY`) is sent by the soft starter 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 `ERRD`		Error register	0	0	0	0	0
	LSB	MSB	Bit 0 = 0 (no error) or 1 (error)	–	–	–	–	–

The error code `ERRD`, and its possible values, is described in the communication parameter file available on the ATS490 Communication Parameter Addresses, page 12.

Basic Settings

What’s in This Chapter

CANopen fieldbus

The menu **[CANopen]** provides the parameters to set the CANopen fieldbus communication. This menu is visible only if the module VW3A3608, VW3A3618 or VW3A3628 is plugged into the soft starter.

Access path: **[Communication]**

[CANopen] menu

HMI label	Setting	
[CANopen Address] ADCO 	Logic address: 17A3 hex = 6051 CANopen index: 201E/34 hex Range: 0..127	Type: UINT (Unsigned16) Read/write: R/WS Factory setting: **[OFF]** OFF
This parameter defines the address of the soft starter on the network. This parameter can be set to: • **[OFF]**: CANopen address is not assigned (value: 0). • **[1 to 127]**: CANopen address is assigned (value : 1...127).		
[CANopen Baudrate] BDCO 	Logic address: 17A5 hex = 6053 CANopen index: 201E/36 hex	Type: WORD (Enumeration) Read/write: R/WS Unit: bps Factory setting: **[250 kbps]** 250K
This parameter defines the baud rate at which data is transferred. This parameter can be set to: • **[50 kbps]**: Baud rate is set to 50 Kbps (value: 38). • **[125 kbps]**: Baud rate is set to 125 Kbps (value: 52). • **[250 kbps]**: Baud rate is set to 250 Kbps (value: 60). • **[500 kbps]**: Baud rate is set to 500 Kbps (value: 68). • **[1 Mbps]**: Baud rate is set to 1 Mbps (value: 76).		

HMI label	Setting	
[CANopen Error Resp] COL	Logic address: 1B63 hex = 7011 CANopen index: 2028/C hex	Type: WORD (Enumeration) Read/write: R/WS Factory setting: **[Freewheel Stop]** YES

This parameter defines the CANopen error stop mode:

- **[Ignore]**: Trigger **[CANopen Com Warn]** COLA (internal bit and configurable digital output). The warning should be assigned to a warning group in **[Warning groups config]** to be visible when triggered. Refer to Warning Messages, page 91.
- **[Freewheel Stop]**: Error **[CANopen Com Interrupt]** COF is triggered and motor stops in freewheel.
- **[Configured Stop]**: Motor stops according to the value set in **[Type of stop]**, **[CANopen Com Warn]** COLA is triggered.
- **[Deceleration]**: Motor stops in deceleration and an error **[CANopen Com Interrupt]** COF is triggered at the end of deceleration.
- **[Braking]**: Motor stops in dynamic braking stop and an error **[CANopen Com Interrupt]** COF is triggered at the end of stop.

⚠WARNING

LOSS OF CONTROL

If this parameter is set to **[Ignore]** NO, 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.

[Product restart] RP	Logic address: 1BD8 hex = 7128 CANopen index: 2029/1D hex	Type: WORD (Enumeration) Read/write: R/WS Factory setting:**[No]**

Product restart

For more information, refer to Product Restart, page 46.

CANopen map

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

Access: **[Communication]** – ➡ **[CANopen map]** –

HMI label	Setting	
[Canopen NMT state] NMTS 	Logic address: 17A9 hex = 6057 CANopen index: 201E/3A hex	Type: WORD (Enumeration) Read/write: R
Canopen NMT state This parameter indicates the NMT state. • **[Boot]**: Bootup state (value is 0). • **[Operation]**: Operational state (value is 1). • **[Stopped]**: Stopped state (value is 2). • **[Pre-op]**: Pre-operational state (value is 4). **NOTE:** If the motor is running, a **[CANopen Com Interrupt]** COF is triggered in case of change of NMT state.		
[Number of TX PDO] NBTP 	Logic address: 330E hex = 13070 CANopen index: 2064/47 hex Range: 0..65535	Type: UINT (Unsigned16) Read/write: R
Number of TX PDO This parameter indicates the number of transmit PDO.		
[Number of RX PDO] NBRP 	Logic address: 330F hex = 13071 CANopen index: 2064/48 hex Range: 0..65535	Type: UINT (Unsigned16) Read/write: R
Number of RX PDO This parameter indicates the number of received PDO.		
[CANopen Error] ERCO 	Logic address: 17A8 hex = 6056 CANopen index: 201E/39 hex Range: 0..5	Type: UINT (Unsigned16) Read/write: R
CANopen error This parameter indicates the last active CANopen detected error. In the following list, the value and the description: • **[0]**: No errors detected since the last 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 states chart error. **NOTE:** If the motor is running, a **[CANopen Com Interrupt]** COF is triggered in case of change of NMT state.		

HMI label	Setting	
[RX Error Counter] REC1 	Logic address: 17AB hex = 6059 CANopen index: 201E/3C hex Range: 0..65535	Type: UINT (Unsigned16) Read/write: R
RX error counter This parameter indicates the CANopen controller Rx error counter.		
[TX Error Counter] TEC1 	Logic address: 17AA hex = 6058 CANopen index: 201E/3B hex Range: 0..65535	Type: UINT (Unsigned16) Read/write: R
TX error counter This parameter indicates the CANopen controller Tx error counter.		

Product Restart

HMI label	Setting	
[Product restart] RP	Logic address: 1BD8 hex = 7128 Factory setting: **[No]**	Type: WORD (Enumeration) Read/write: R/WS

Product restart

This parameter is automatically set to **[No]** after restart.

- **[No]**: No restart
- **[Yes]** : Restart the soft starter. After select **[Yes]**, this safety message is displayed:
  The Restart function performs a Fault Reset and then restarts the device. During this Restart procedure, the device goes through the same steps as if it had been switched off and on again. Depending on the wiring and the configuration of the device, this may result in immediate and unanticipated operation.

⚠WARNING

UNANTICIPATED EQUIPMENT OPERATION

The Restart function performs a Fault Reset and restarts the device.

- Verify that activating this function does not result in unsafe conditions.

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

Confirm the message and the soft starter will restart.

Most Common parameters

For more information about the Communication Parameter Addresses, please refer to the ATS490 Communication Parameter Addresses, page 12.

NOTE: Cannot write cyclically configuration parameters (as the device can remain in **[Freewheel]** NST) tagged by R/WS.

Base Monitoring

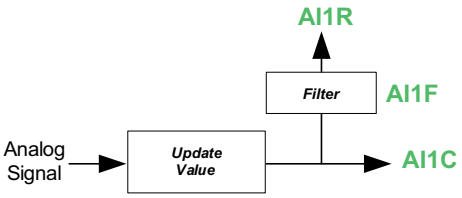
Code	Settings	
[Motor Current] LCR	Logic address: 0C84 hex = 3204 CANopen index: 2002/5 hex	Type: UINT (Unsigned16) Read/write: R Unit: 0.1 A. or 1 A according to the soft starter rating.
Motor current RMS Motor current. Average of the three line currents based on the measurement of the fundamental of the motor line currents.		
[Motor Therm State] THR	Logic address: 259E hex = 9630 CANopen index: 2042/1F hex	Type: UINT (Unsigned16) Read/write: R Unit: 1 %
Motor thermal state This parameter monitors the motor thermal state. 100% corresponds to the nominal thermal state at the nominal motor current set to **[Motor Nom Current]**.		
[Motor Run Time] RTH via communication	Logic address: 0CAC hex = 3244 CANopen index: 2002/2D hex	Type: UINT (Unsigned32) Read/write: R Unit: 1 s
Motor run time This parameter monitors how long the motor has been energized.		
[Motor Run Time] RTHH via Display Terminal	Logic address: 0CCA hex = 3274 CANopen index: 2002/4B hex	Type: UINT (Unsigned32) Read/write: R/WS Unit: 1 s
Motor run time This parameter monitors how long the motor has been energized.		
[Elc Energy Cons] OCK	Logic address: 299C hex = 10652 CANopen index: 204C/35 hex	Type: UINT (Unsigned32) Read/write: R Unit: kWh
Electrical energy consumed by the motor (kWh) This parameter monitors how much energy consumed by the motor in kWh.		

Digital I/O

Code	Settings	
[Logic Inputs States] IL1R	Logic address: 1452 hex = 5202 CANopen index: 2016/3 hex	Type: WORD (BitString16) Read/write: R Unit: -
Logic inputs states This parameter is used to monitor the real value of the **[Logic Inputs States]**. • Bit0 : "DI1" Digital inputs real image • Bit1 : "DI2" Digital inputs real image • Bit2 : "DI3" Digital inputs real image • Bit3 : "DI4" Digital inputs real image **NOTE:** The status of inputs can be read via **[Logic Inputs States]** IL1R to which a position or level sensor has been wired.		
[Logic Outputs States] OL1R	Logic address: 145C hex = 5212 CANopen index: 2016/D hex	Type: WORD (BitString16) Read/write: R/W Unit: -
Logic outputs states This parameter is used to write output value or monitor the value depending on if a function is assigned to the corresponding output: • Bit0 : "R1" relay real image • Bit1 : "R2" relay real image • Bit2 : "R3" relay real image • Bit8 : "DQ1" Digital outputs real image • Bit9 : "DQ2" Digital outputs real image **NOTE:** To write an output through communication, no function should be assigned to the corresponding output. Otherwise, writing on the bit linked to the corresponding output has no impact. If an error is triggered, outputs written through communication returns to 0. **NOTE:** It is only possible to write the output through the active command channel. Consequently, forced outputs can not be disabled on local channel (such as display terminal).		

Analog input

The following diagram explains how the analog input works:



- AI1C **[AI1]**
- AI1F **[AI1 filter]**
- AI1R **[Analog Input 1 Standardized Value]**

Code	Settings	
[AI1] AI1C	Logic address: 147A hex = 5242 CANopen index: 2016/2B hex	Type: INT (Signed16) Read/write: R Unit: -
Physical value AI1 This parameter is used to monitor the real value of the **[AI1]**. • **[PTC]** (0.01kOhm) • **[KTY]** (1 Ohm) • **[PT100]**: PT100 (0.1 Ohm) • **[PT100 in 3 wires]**: PT100 in 3 wires (0.1 Ohm) • **[PT1000]**: PT1000 (1 Ohm) • **[PT1000 in 3 wires]**: PT1000 in 3 wires (1 Ohm)		
[AI1 filter] AI1F	**Setting range:** 0...10 s **Factory setting:** 0 s Logic address: 1164 hex= 4452 CANopen index: 200E/35 hex	Type: UINT (Signed16) Read/write: R/W Unit: seconds
AI1 filter This parameter sets the cutoff time of the low filter for PTC1/AI1. The low pass filter aims to suppress electrical noise and avoid interference issue in the input signal.		
[Analog Input 1 Standardized Value] AI1R	Logic address: 1470 hex= 5232 CANopen index: 2016/21 hex	Type: INT (Signed16) Read/write: R Unit: -
Analog input 1 standardized value Real image of AI1 consumed by functions.		

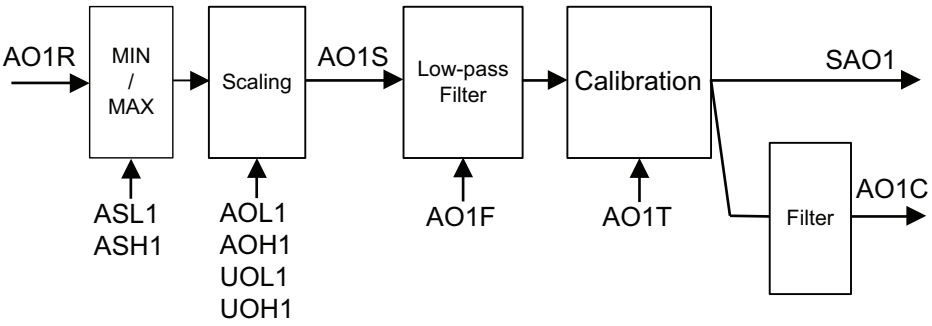
Analog outputs

The analog outputs can be controlled via the network. Simply write these parameters. The outputs to be controlled must not be assigned to a function, otherwise the write operation has no effect.

NOTE: To write an output through communication, no function should be assigned to the corresponding output. Otherwise, writing on the register linked to the corresponding output has no impact. If an error is triggered, outputs written through communication returns to 0.

NOTE: It is only possible to write the output through the active command channel. Consequently, forced outputs can not be disabled on local channel (such as display terminal).

The following diagram explains how the analog output works:



- AO1R **[Analog Output 1 Standardized Value]**
- ASL1 **[Scaling AQ1 Min]**
- ASH1 **[Scaling AQ1 Max]**
- AOL1 **[AQ1 min output]**
- AOH1 **[AQ1 max output]**
- UOL1 **[AQ1 min Output]**
- UOH1 **[AQ1 max Output]**
- AO1S **[AQ1 Scaling]**
- AO1F **[AQ1 Filter]**
- AO1T **[AQ1 Type]** : is too select between mA and V.
- SAO1 **[AO1 Physical Value Without Filter]**
- AO1C **[AQ1]**

Code	Settings	
[Analog Output 1 Standardized Value] AO1R	Logic address: 148D hex = 5261 CANopen index: 2016/3E hex	Type: INT (Signed16) Read/write: R/W Unit: -
Analog output 1 standardized value This parameter is used to read and write a value on AO1. Real image of AO1 consumed by functions.		
[AQ1] AO1C	Logic address: 1497 hex = 5271 CANopen index: 2016/48 hex	Type: INT (Signed16) Read/write: R/W Unit: -
AQ1 physical value This parameter is used to read and write a value, readable on display terminal.		

Operation

What’s in This Part

Profile

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
- ...

Application Profile

Application profile defines the services to be provided by the devices on a machine.

Interchangeability

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

Functional Profiles Supported by the Altivar Soft Starter

Two functional profiles are supported by the Altivar Soft Starter:

- Standard Profile via **[Control Mode]** set to **[Standard Profile]**.
- I/O Profile via **[Control Mode]** set to **[I/O profile]**.

Standard Profile

The Standard Profile supported by the Altivar Soft Starter is based on the CiA402, which has been adapted to the characteristics of the Altivar Soft Starter and therefore to all communication ports.

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

NOTE:

- Altivar Soft Starter starts up following a command sequence
- After switching on and when an operating mode is started, Altivar Soft Starter goes through several operating states

I/O Profile

This profile supported by all channel commands. It mirrors the use of the terminal by allowing to use 1 bit of command register to activate a function.

- I/O profile can also be used when controlling via a fieldbus.
- N bits of ***Command register*** can be assigned to a specific function.
  - N from 1 to 15 if 2 wires control
  - N from 2 to 15 if 3 wires control.
- ***Status Register*** is standardized as **[Standard Profile]**.
- According to command sent via ***Command register*** to operating states diagram, a ***Status Register*** is updated.

Configuration of the Soft starter command channel according to the selected Profile

This section describes how to configure the command channel settings of the soft starter.

In order to switch in **[Standard Profile]**, **[Expert]** level access should be configured.

The active command channel is then defined by CD1 or CD2 according to **[Command Switching]** (expected if forced local feature is used).

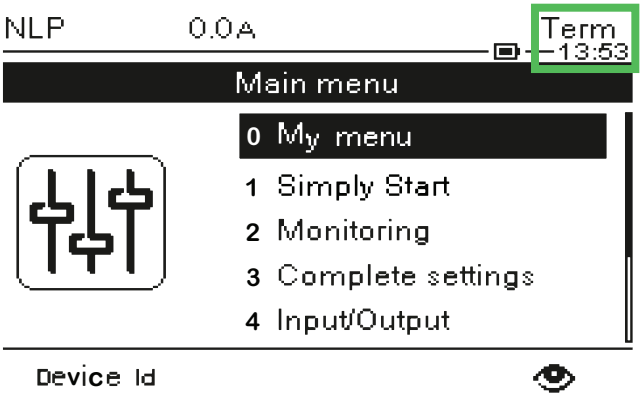
NOTE: for more information about **[Forced Local Assign]** and **[HMI L/R cmd]**, refer to the user manual.

Command Channel

In the **[Complete settings]** menu, **[Command channel]** submenu the user can set the following value to **[Cmd channel 1]** and **[Cmd channel 2]**:

- Terminal board.
- Graphic display terminal.
- Embedded Modbus RTU.
- CANopen option module.
- Other fieldbus option module.
- Embedded Ethernet.

On the right-top of the graphic display terminal screen, the information of the active command is displayed:



With **[Command Switching]**, user chooses which channel takes the command of the device by switching between **[Cmd channel 1]** and **[Cmd channel 2]**.

Access path: [Complete settings] ➡ [Command channel]

Code	Settings	
[Command Switching] CCS	Logic address: 20E5 = 8421 CANopen index: 2036/16	Type: WORD (Enumeration) Read/write: R/WS

Command switching

⚠WARNING

UNANTICIPATED EQUIPMENT OPERATION

This parameter can cause unintended movements, for example, inversion of the direction of rotation of the motor, sudden acceleration or stops.

- Verify that the setting of this parameter does not cause unintended movements.
- Verify that the setting of this parameter does not result in unsafe conditions.

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

This parameter sets which channel takes the command of the soft starter.

- **[Cmd channel 1]**: Channel 1 is the command channel (in this case, switching between **[Cmd channel 1]** and **[Cmd channel 2]** is not possible).
- **[Cmd channel 2]**: Channel 2 is the command channel (in this case, switching between **[Cmd channel 1]** and **[Cmd channel 2]** is not possible).
- **[DI●]** : Command channel switching assigned to digital input.
- **[Cy●●]** : Command channel switching assigned to line channel.

  NOTE: with CANOpen, use **[C2●●]**.

When assigned to a digital input:

- **[Cmd channel 1]** active at low level.
- **[Cmd channel 2]** active at high level.

[Active Command Channel] CCC	Logic address: 20FA = 8442 CANopen index: 2036/2B	Type: WORD (BitString16) Read/write: R

Active command channel

Reading this value allows to monitor which is the active command channel who is controlling the device.

- Bit0 = 1 : Terminal board.
- Bit2 = 1 : Display Terminal.
- Bit3 = 1 : Embedded Modbus RTU.
- Bit6 = 1 : CANopen option module.
- Bit9 = 1 : Other fieldbus option module.
- Bit11 = 1 : Embedded Ethernet.
- Bit15 = 1 : SoMove (via control panel).

Command Register and Status — [Standard Profile]

What's in This Chapter

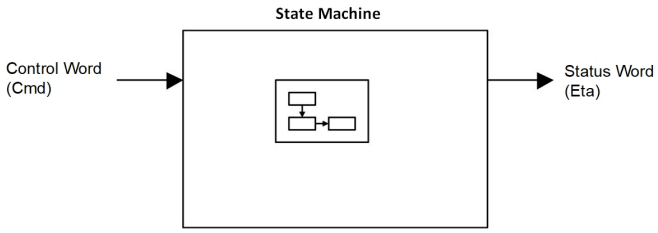
Functional Description

Introduction

Soft starter operation involves one main function, which is illustrated in the diagrams below.

Altivar Soft Starter

The following figure shows the control diagram for soft starter operation:

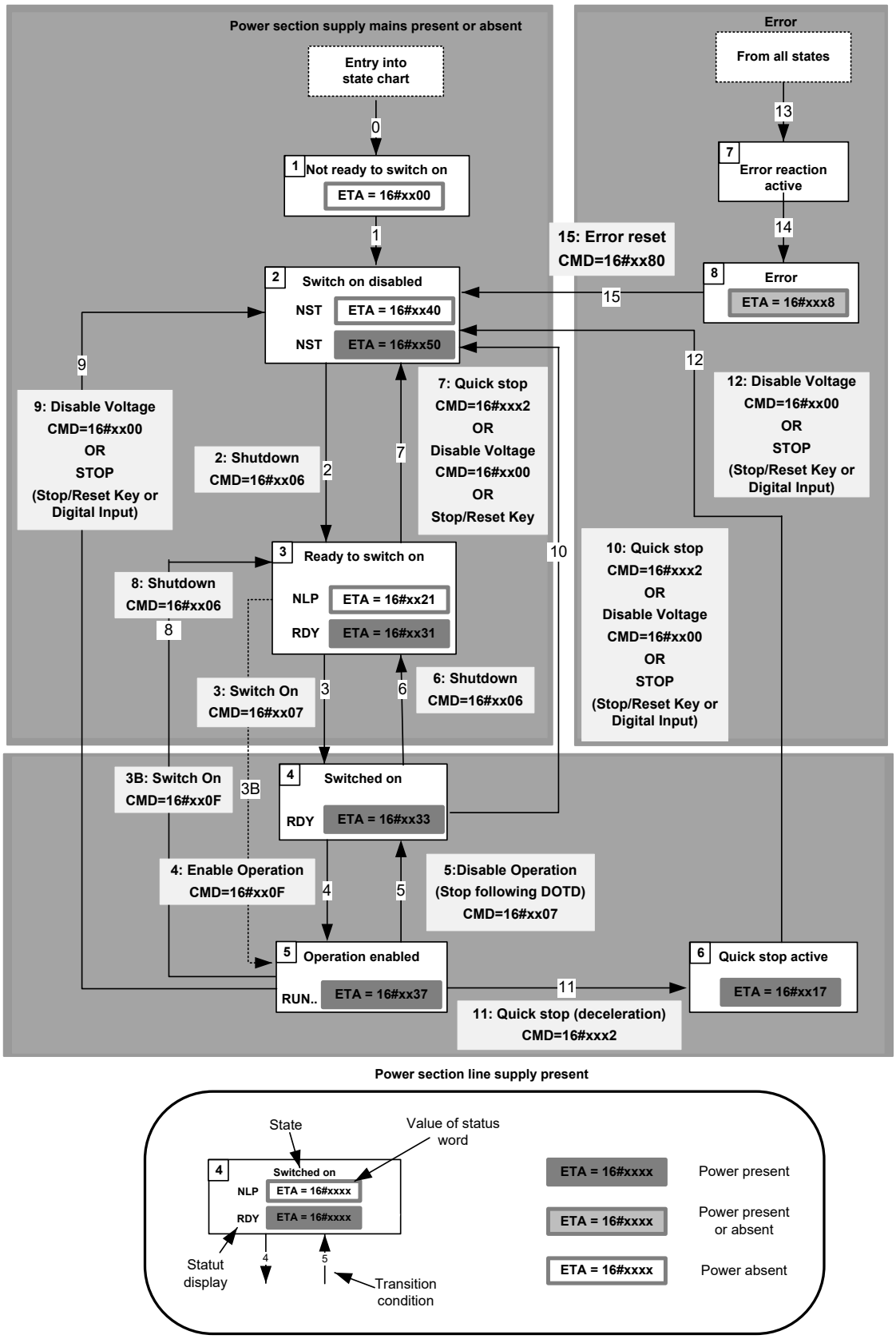


Operating State Diagram in [Standard Profile]

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 **[Standard Profile]** state diagram:



NOTE: The transition 3B is possible but not included in the CIA402 operating state diagram.

Device Status Summary

Operating State	Power Supply to Power 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
5 - Operation enabled	Required	Yes	No
6 - Quick stop active	Required	Yes, during deceleration	No
7 - Fault reaction active	Depends on error response configuration	Depends on error response configuration	No
8 - Fault	Not required	No	Yes

NOTE:

- Configuration parameters are described in communication parameter file as R/WS access type parameters.
- An adjustment parameter can be accessed in all operating state of the soft starter.

Description of Operating States in [Standard Profile]

Each state represents an internal reaction by the soft starter.

The operating state of the soft starter changes depending on whether the control word is sent to **[Cmd Register]** CMD or an event occurs (an error detection, for example).

The soft starter operating state can be identified by the value of the status word **[Status Register]** ETA. For more information, refer to the **[Status Register]** ETA chapter.

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 L1/L2/L3 is not ready to switch on. • The control stage A1/A2 must be supplied to set the configuration and adjustment parameters. • The soft starter is locked, no power is supplied to the motor.
3 - Ready to switch on	• The power stage L1/L2/L3 is ready to switch on. • With the control stage A1/A2 supplied, it is not necessary to supply the power stage, but the system expects it in order to change to state *4 - Switched on* • The soft starter 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. • The power stage of the soft starter is ready to operate, but voltage has not yet been applied to the output. • The adjustment parameters can be modified. **NOTE:** By default, Relay R1 **[R1 Assignment]** is set to **[Operating State Fault]** then the mains contactor is closed. The soft starter is locked, no power is supplied to the motor. **NOTE:** If mains contactor is wired on a relay (**[R1 Assignment]**, **[R2 Assignment]** or **[R3 Assignment]** is set to **[Mains Contactor]**), we reach temporarily this state once Run command is applied and mains contactor is closed allowing presence of power stage before switching to *5 - Operation enabled*. For more information about Starting sequence, refer to Starting Sequence, page 70.

Operating State	Description
5 - Operation enabled	• Power stage is enabled. The soft starter is in running state. • For a separate control stage with mains contactor, the contactor is closed. • The soft starter is unlocked, power is supplied to the motor. • The soft starter functions are activated and voltage is applied to the motor terminals. • If the `Halt` command is applied, no power is supplied to the motor expect in preheating. • The adjustment parameters can be modified. • The configuration parameters cannot be modified. • From this state the reaction of the soft starter to a `Disable operation` command depends on the value of the **[SwitchOnDisable Stp]** `DOTD` parameter: ◦ If the **[SwitchOnDisable Stp]** `DOTD` parameter is set to 0, the soft starter changes to operating state *4 - Switched on* and stops in freewheel stop. ◦ If the **[SwitchOnDisable Stp]** `DOTD` parameter is set to 1, the soft starter stops following to the **[Type of stop]** and then changes to operating state *4 - Switched on*.
6 - Quick stop active	• The soft starter performs a deceleration ramp. After the motor has stopped, the soft starter switches to state *2 - Switch on disabled*.
7 - Fault reaction active	• Transient state during which the soft starter performs a stop due to a detected error. • If behavior of the detected error is configurable, then the reaction will depend on setting of its **error response**.
8 - Fault	• End of the stop caused by change to the previous state *7 - Fault reaction active*. • Power stage is disabled. The soft starter is locked, no power is supplied to the motor if an error detection has been triggered. Else the soft starter change to the step *2- switch on disable*. • The soft starter function is disabled.

Command Register in [Standard Profile]

[Cmd Register] is used to control the product defined as followed:

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Function	***Switch***	***Enable / Disable voltage***	***Quick Stop***	***Operation Run command***	***Reserved***			***Error reset request***
Bit at 0	Off.	Disable.	Activate.	Disable.				Active on rising edge.
Bit at 1	On.	Enable.	Deactivate.	Enable.				

	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15
Function	***Halt command***	***Reserved***		***Reverse Direction request*** (1) **NOTE:** for more information about Reverse function, refer to the user manual.	***Manufacturer specific assignable***	***Dynamic braking stop*** (1)	***Decelerated stop order*** (1)	***Manufacturer specific assignable***
Bit at 0	Request not sent.			Deactivate.		Deactivate.	Deactivate.	
Bit at 1	Stop following **[Type of stop]**.			Activate.		Activate.	Activate.	

(1) The Bit can be set to an other function (factory setting).

NOTE: If no function is assigned, the Bit will return to his factory setting.

Bit Mapping of the Control Word

Command	State Transition	Final Operating State	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	Example Value
			Fault Reset	Enable Operation	Quick Stop	Enable Voltage	Switch On	
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	7, 10, 11	*6 - Quick stop active*	X	X	0	1	X	0002 hex
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.

Status Word

[Status Register] is used to gives status register as followed:

Code	Settings	
[Status Register] ETA	Logic address: 0C81 hex = 3201 CANopen index: 6041/0 hex	Type: WORD (BitString16) Read/write: R Unit: -
Status Register		

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Function	***Ready to Switch on***	***Switched on***	***Operation enabled Running***	***Detected error***	***Voltage enabled***	***Quick stop***	***Switch on disabled***	***Warning***
Bit at 0	Not ready.	Not ready.	Not running.	No error.	Power stage supply absent.	Active.	Not active. Power section line supply opened.	No warning.
Bit at 1	Ready.	Ready.	Running.	Error is present.	Power stage supply present.	Not active.	Active. Power section line supply locked.	Warning is present.

	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15
Function	**Reserved**	***Local channel active***	**Reserved**				**Stop imposed by STOP key** on graphic display terminal	***Direction***
Bit at 0		Active.					Activate.	Forward.
Bit at 1		Not active.					Deactivate.	Reverse.

Bit Mapping of the Status Word

Operating State	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	ETA Masked by 006F H (1)
	Switch On Disabled	Quick Stop	Voltage Enabled	Fault	Operation Enabled	Switched On	Ready to Switch On	
2 -Switch on disabled	1	0	X	0	0	0	0	0040 hex 0050 hex
3 -Ready to switch on	0	1	X	0	0	0	1	0021 hex 0031 hex
4 -Switched on	0	1	1	0	0	1	1	0033 hex
5 -Operation enabled	0	0	1	0	1	1	1	0037 hex
6 -Quick stop active	0	0	1	0	1	1	1	0017 hex
8 -Fault	X	X	X	1	0	0	0	xxx8 hex(2)... xx28 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.

Stop and Halt Commands

BIT 13 and BIT 14 of Command register

Only available if **[Control Mode]** is set to **[Standard Profile]**. When ***dynamic braking stop*** or ***decelerated stop order*** is activated, the soft starter performs a ***braked stop*** or a ***decelerated stop*** and remains locked in the operating state *5 - Operation enabled*.

BIT 8 : Halt command

Only available if **[Control Mode]** is set to **[Standard Profile]**. 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]** `STT` parameter.

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

I/O Profile

I/O Profile via **[Control Mode]** is set to **[I/O profile]**.

As well as physical digital inputs commanding the soft starter in terminal command, the soft starter can be commanded by line channel and each bit of the control word can be assigned to a dedicated function if the bit is free. **[I/O profile]** makes it possible to go from 4 physical digital inputs to 16 virtual digital inputs.

NOTE: The customer must monitor the **[Device State]** HMIS.

NOTE: When communication is used to control the soft starter and **[2/3-Wire Control]** is set to **[3-Wire Control]** / **[Hardwired ctrl mode]**, DI1 must be connected to the +24V

Code	Settings	
[Cmd Register] CMD	Logic address: 2135 hex = 8501 CANopen index: 6040/0 hex	Type: WORD (BitString16) Read/write: R/W
Command register If the **[2/3-Wire Control]** parameter is set to : • **[2-Wire Control]**, the ***Command register*** bits are: ◦ Bit0 : ***Run enable + Forward Direction*** ◦ Bit1 to Bit15 : ***Free*** • **[3-Wire Control]** / **[Hardwired ctrl mode]** , the ***Command register*** bits are: ◦ Bit0 : ***Run enable*** ◦ Bit1 : ***Forward Direction*** ◦ Bit2 to Bit15 : ***Free***		

A function input can be assigned to:

- A virtual input (Cd00 to Cd15) according to the active command channel, corresponding bit of the control word or digital input of the terminal must be used to activate / deactivate the function.
- A terminal input (DI1 to DI4) irrespective of the active command channel, the function can be activated / deactivated using the corresponding digital input (exception for some function that requires to have the terminal as active command channel to activate / deactivate the function).

The function **[Command Switching]** can be activated / deactivated, irrespective of the active command channel, using the corresponding bit of a terminal input or of the control word **[Cy●●]**:

- A modbus control word (**[C100]** to **[C115]**)
- A CANopen control word (**[C200]** to **[C215]**).
- A fieldbus module, such as PROFIBUS, control word (**[C300]** to **[C315]**).
- An embedded ethernet control word (**[C500]** to **[C515]**)

Bit	Fixed assignments		
	Virtual Inputs	Terminals	CANopen
bit 0	Cd00	DI1	C200
bit 1	Cd01	DI2	C201
bit 2	Cd02	DI3	C202
bit 3	Cd03	DI4	C203
bit 4	Cd04	-	C204
bit 5	Cd05	-	C205
bit 6	Cd06	-	C206
bit 7	Cd07	-	C207

Bit	Fixed assignments		
	Virtual Inputs	Terminals	CANopen
bit 8	Cd08	-	C208
bit 9	Cd09	-	C209
bit 10	Cd10	-	C210
bit 11	Cd11	-	C211
bit 12	Cd12	-	C212
bit 13	Cd13	-	C213
bit 14	Cd14	-	C214
bit 15	Cd15	-	C215

Switched assignment

When **[Control Mode]** is set to **[I/O profile]**, the transition of the active command channel to fieldbus does not follow the configuration of the parameters **[2/3-Wire Control]** and **[2-wire type]**. An immediate start will be observed if a run command is active on the **[Cmd Register]** CMD.

⚠WARNING

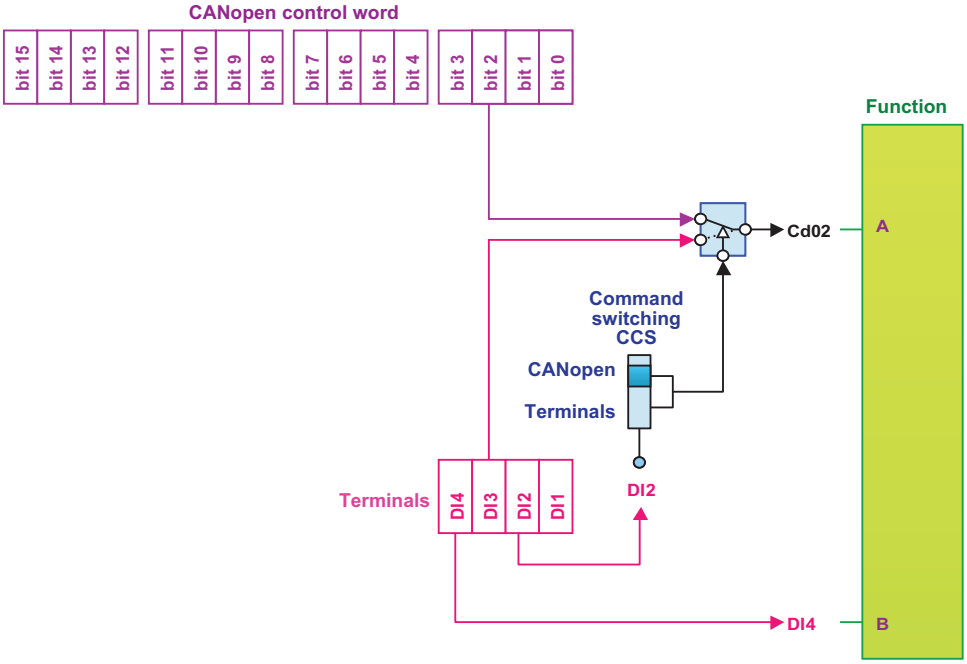
UNANTICIPATED EQUIPMENT OPERATION

- Verify that this behavior does not result in unsafe conditions by performing extensive commissioning tests.
- If the start on transition is not desired, the bits corresponding to the run command must always be reset before switching the active command channel to fieldbus.

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

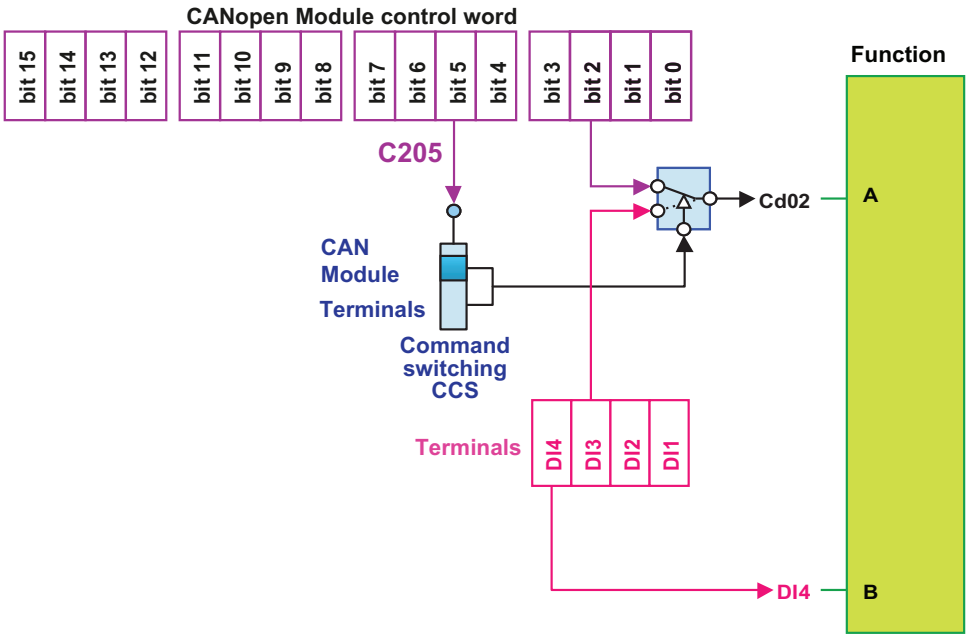
Example with:

- **[Command Switching]** managed by digital input.
- A function assigned to a switched bit (here **CD02**).
- B function assigned to a digital input (here **DI4**).
- **[Cmd channel 1]** = **[CANopen]**.
- **[Cmd channel 2]** = **[Terminal]**.



Example with:

- **[Command Switching]** managed by control word (here **C205**).
- A function assigned to a switched bit (here **CD02**).
- B function assigned to a digital input (here **DI4**).
- **[Cmd channel 1]** = **[CANopen]**.
- **[Cmd channel 2]** = **[Terminal]**.



When a function is assigned to a switched bit (Cd00 to Cd15), the function can be activated via Terminals or selected communication channel according to the active command channel. To switch between Terminals and communication modules, use **[Command Switching]** function.

NOTE: A single function can be assigned to a bit at the same time, here as **[C205]** is assigned to **[Command Switching]**, Cd05 cannot be assigned to another function.

Exemple: I/O profile with monitoring of tank by flow sensors

In this example, a PLC is used to monitor the water level in a tank.

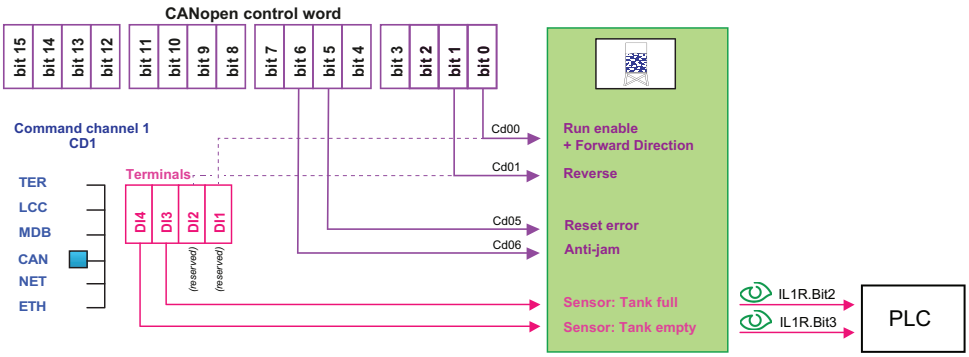
The soft starter is used to manage some functions as anti-jam.

The PLC and the soft starter are connected via a CANopen network. The PLC controls the operation of the installation via the CANopen bus.

Configuration

- **[Control Mode]** is set to **[I/O profile]**.
- **[2/3-Wire Control]** set to **[2-Wire Control]**.
- **[Reverse Assign]** set to **[CD01]**
- **[Fault Reset Assign]** set to **[CD05]**
- **[Ext Anti-Jam Trigger]** set to **[CD06]**.
- **[Cmd channel 1]** set to **[CANopen]**.

Configuration schematic diagram:



NOTE: Some digital inputs are reserved because bits are already assigned.

In our example:

- Cd00 is assigned to **Run enable + Forward direction**.
- Cd01 is assigned to **Reverse**.

➡ DI1 and DI2 cannot be assigned.

Extended Control Word and Internal State register in [Standard Profile] & [I/O Profile]

What's in This Chapter

Extended Control Word

When a configuration parameter is modified by fieldbus, it is not stored automatically in the EEPROM. The value will be lost after a power cycle if the request to store the new configuration has not been done.

⚠WARNING

LOSS OF PARAMETER CONFIGURATION AFTER A POWER CYCLE

Bit 1 of **[Extended Control Word]** CMI must be written at 1 each time the configuration is modified by fieldbus.

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

NOTE: Do not write **[Extended Control Word]** BITs cyclically (especially BIT 1), as this may damage the EEPROM.

[Extended Control Word] is used to control the product defined as followed:

Code	Settings	
[Extended Control Word] CMI	Logic address: 2138 hex = 8504 CANopen index: 2037/5 hex	Type: WORD (BitString16) Read/write: R/W Unit: -
Extended control word		

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Function	***Restore factory settings***	***Store customer parameters***	***Restore saved customer parameters***	***External error***	***Reserved***			
Bit at 0	Active on rising edge when motor is powered off. Once request is considered, this bit is automatically reset.	Active on rising edge. Once request is considered, this bit is automatically reset.	Active on rising edge when motor is powered off. Once request is considered, this bit is automatically reset.	Active on rising edge.				
Bit at 1								

	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12 In [Standard Profile]:	Bit 12 In [I/O profile]:	Bit 13	Bit 14	Bit 15
Function	***Reserved***				***Reverse direction request***	***Reserved***	***Lock device when motor stopped***	***Reserved*** (must always be set to 0).	***Disable parameter consistency check***
Bit at 0					Request not sent.		Deactivate.		All parameters are validated.
Bit at 1					Request sent. Motor can start in reverse direction (only if CMD bit 11 is assigned to specific function other than reverse).		Activate.		No check of parameter consistency and device is locked when stopped.

Internal State register

[Internal State Reg] is used to gives the extended internal status register as followed:

Code	Settings	
[Internal State Reg] ETI	Logic address: 0C86 hex = 3206 CANopen index: 2002/7 hex	Type: WORD (BitString16) Read/write: R Unit: -
Internal State register		

	Bit 0	Bit 1	Bit 2	Bit 3
Function	***Write parameter authorization***	***Parameter consistency check***	***Starter reset authorization***	***Motor preheating***
Bit at 0	Access to the non-volatile memory stopped.	Not active.	The device: • is not in operating state "Error" • is in operating state "Error" and the error is active.	Not active.
Bit at 1	Access to the non-volatile memory in progress.	Active.	The device is in operating state "Error" and the error is no longer active (not reset).	Active.

	Bit 4	Bit 5	Bit 6	Bit 7
Function	***Motor operating status***	***Braking***	***Starter in continuous operation***	***Thermal overload warning***:
Bit at 0	Not active.	Not active.	Transient state.	Threshold for the active motor not reached.
Bit at 1	Active.	Active.	Steady state.	Threshold for the active motor reached.

	Bit 8	Bit 9	Bit 10	Bit 11
Function	***Reserved***	***Starter accelerating***	***Starter decelerating***	***Current limit warning***
Bit at 0		Not active.	Not active.	Not active.
Bit at 1		Active.	Active.	Active.

	Bit 12	Bit 13	Bit 14	Bit 15
Function	***Torque limit warning***	***Active mode***:		***Direction***
Bit at 0	Not active.	• Bit 13 = 0 + Bit 14 = 0: Device controlled by terminal • Bit 13 = 1 + Bit 14 = 0: Device controlled by the display terminal • Bit 13 = 0 + Bit 14 = 1: Device controlled by Embedded Modbus • Bit 13 = 1 + Bit 14 = 1: Device controlled by fieldbus card		Forward operation applied before the ramp.
Bit at 1	Active.			Reverse operation applied before the ramp.

Starting Sequence

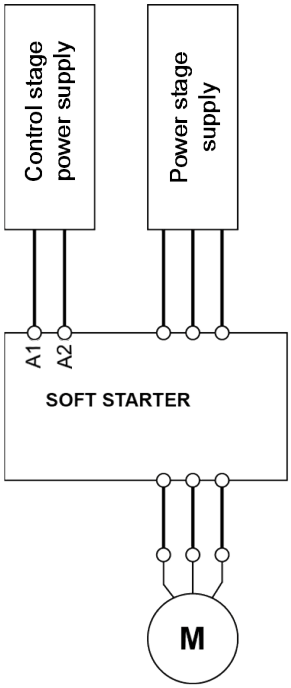
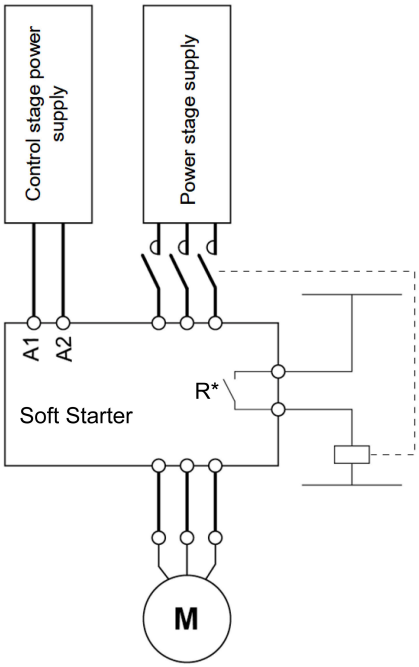
What's in This Chapter

Description

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

NOTE: This example is given when **[Control Mode]** is set to **[Standard Profile]**.

There are 2 possible scenarios:

		
Power stage supply	Mains contactor controlled by another device	Mains contactor controlled by the soft starter (1)

NOTE:

(1) and R*: **[R1 Assignment]** R1, **[R2 Assignment]** R2 or **[R3 Assignment]** R3 assigned to **[Mains Contactor]**.

NOTE: If **[Mains Contactor]** is set to a specific relay (R1, R2 or R3) no other relay can be assigned to this function.

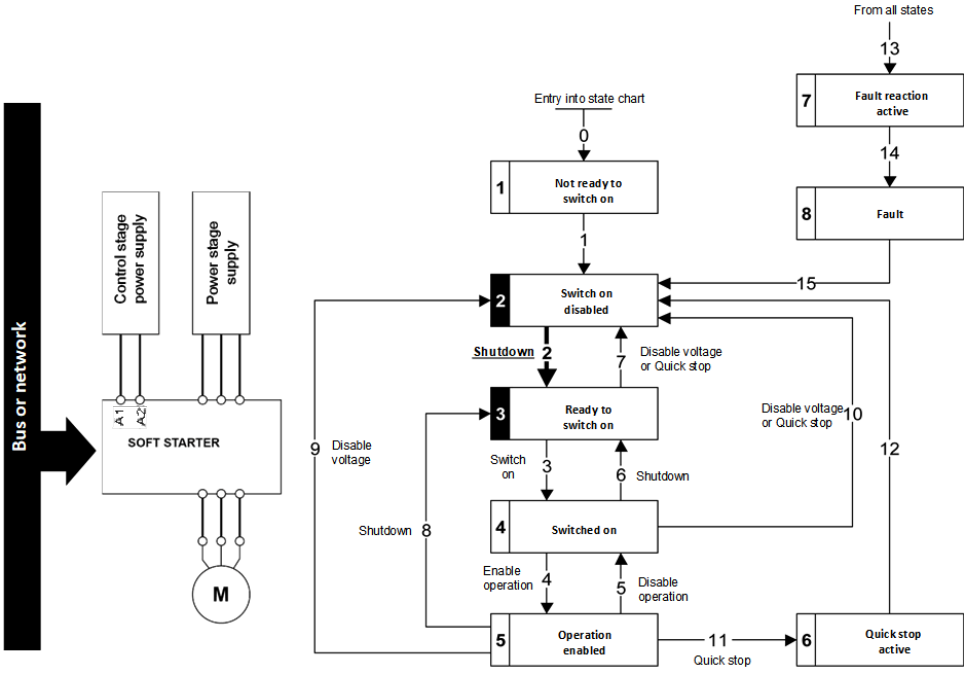
Sequence for a Soft starter

Description

Power is supplied separately to the power and control stages. The following sequence must be applied:

Step 1

- In **[Standard Profile]**, **[Cmd channel 1]** or **[Cmd channel 2]** must be set to **[CANopen]** and active.
- The power stage supply is not necessarily present.
- Apply the *2 - Shut down* transition command.

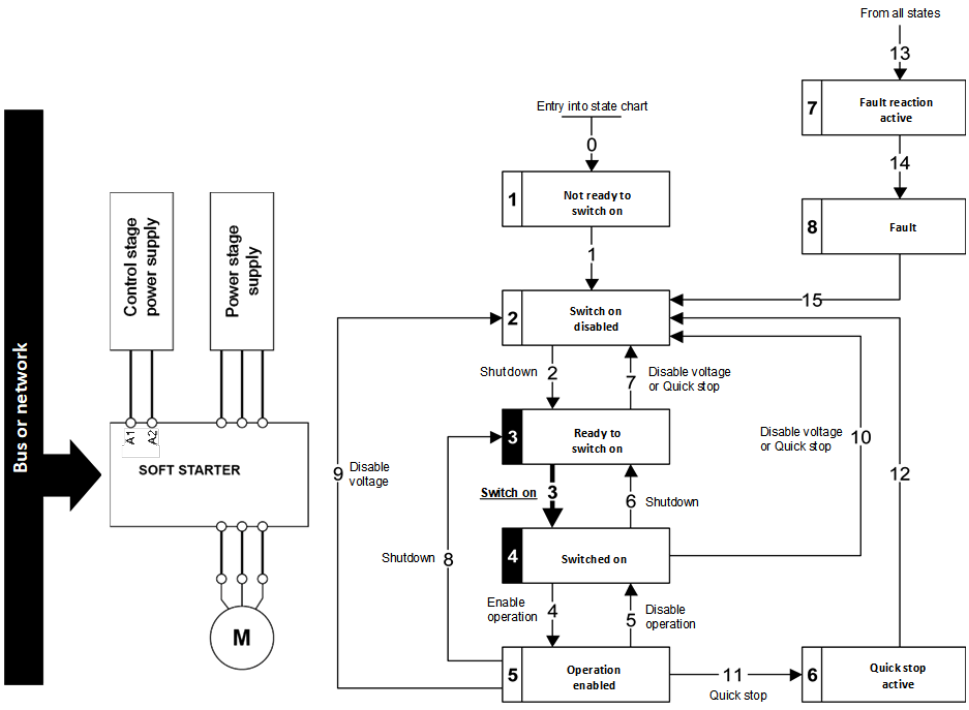


Step 2

- Check that the soft starter is in the operating state *3 - Ready to switch on*.
- The power stage supply could be present (*Voltage enabled* of the status word).

Power Stage Supply	Terminal Display	Status Word
Absent	NLP	21 hex
Present	RDY	31 hex

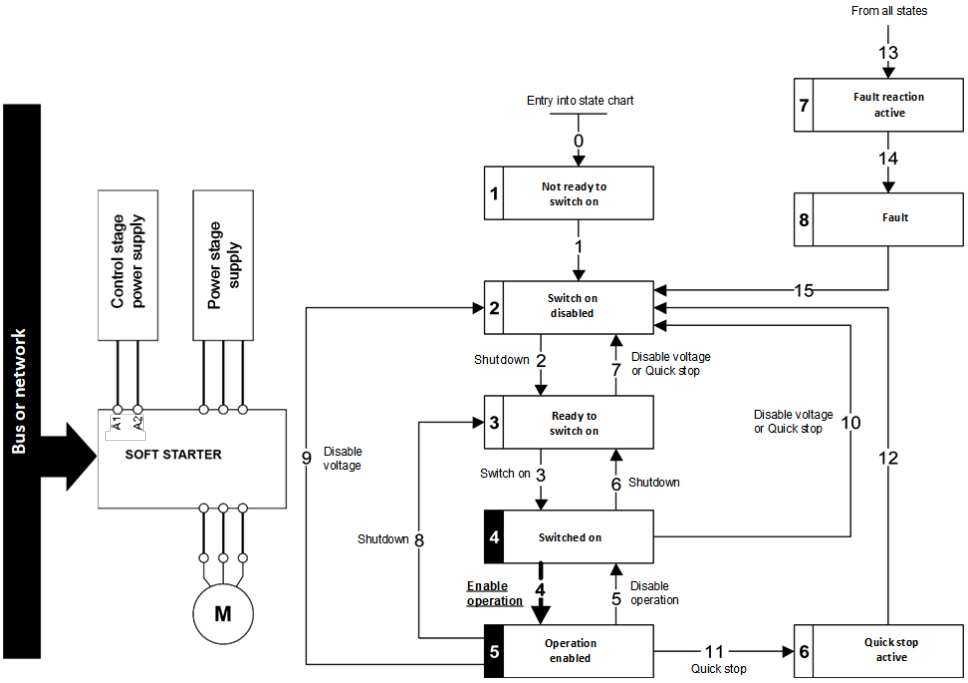
- Apply the *3 - Switch on* transition command



Step 3

- If power supply is present; check that the soft starter is in the operating state *4 - Switched on*.

  NOTE: If power supply is not present, we stay in *3 - Ready to switch on*.
- Then apply the *4- Enable operation* transition command.
- The motor starts.



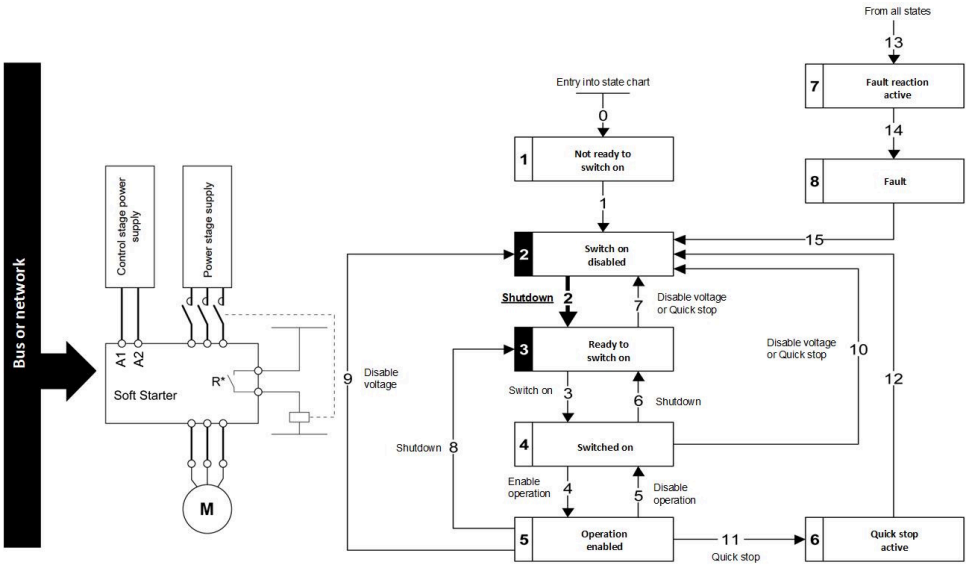
Sequence for a Soft starter with Mains Contactor Control

Description

Power is supplied separately to the power and control stages. If the soft starter controls the mains contactor the following sequence must be applied:

Step 1

- In **[Standard Profile]**, **[Cmd channel 1]** or **[Cmd channel 2]** must be set to **[CANopen]** and active.
- The power stage supply is not present as the mains contactor is not being controlled.
- Apply the *2 - Shut down* transition command.

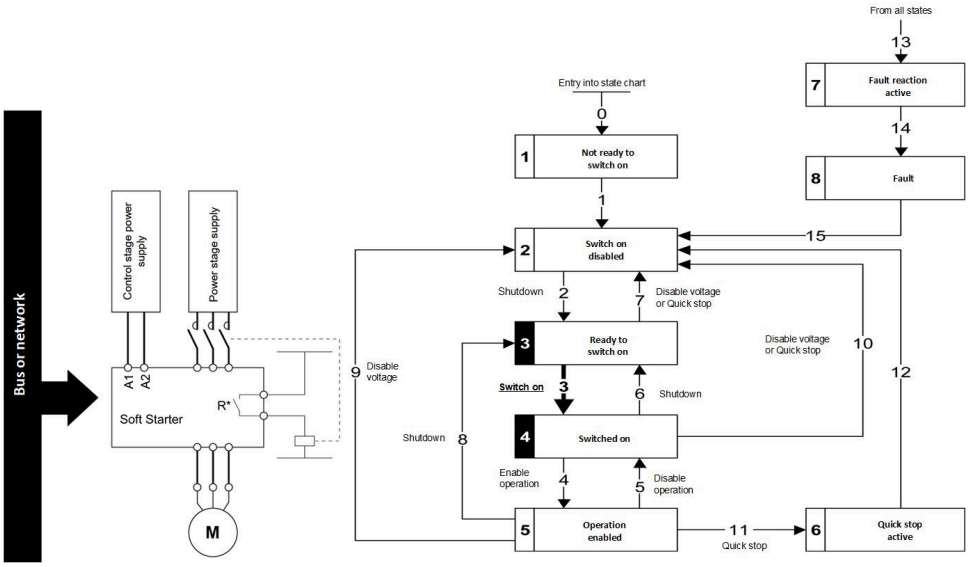


Step 2

- Check that the soft starter is in the operating state *3 - Ready to switch on*.

Power Stage Supply	Terminal Display	Status Word
Absent	NLP	21 hex

- Apply the *3 - Switch on* transition command.

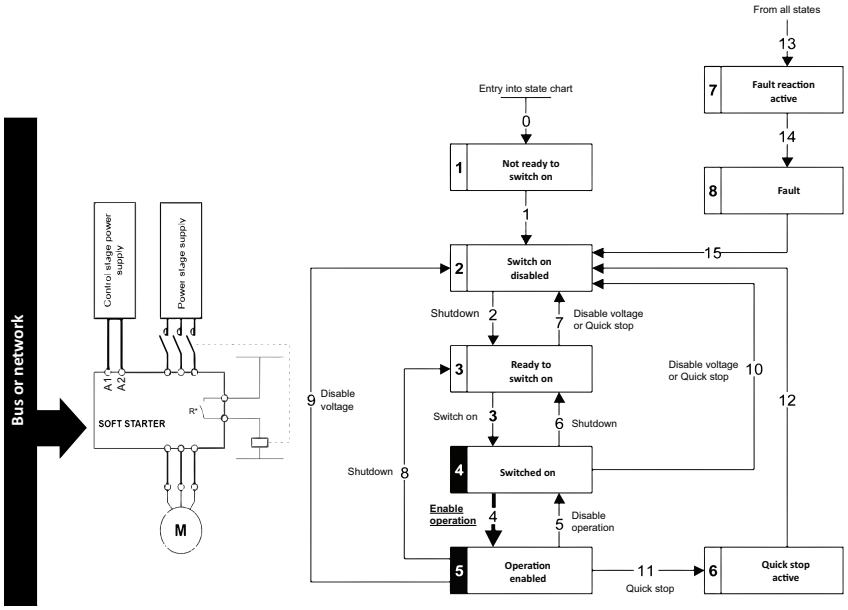


Step 3

- Apply the *4- Enable operation* transition command which closes the mains contactor and switch on the power stage supply by giving RUN command.

  NOTE: If the power stage supply is still not present in the operating state *5 - Operation enabled* after a time delay **[Mains V. time out]**, the soft starter triggers an error **[Input Contactor]**.

- The motor starts.



Software Setup with EcoStruxure (M580)

What’s in This Part

Introduction

Overview

Here is an example of an application that shows how to control a soft starter with a M580 PAC equipped with a CANopen port. The operator can control the soft starter directly from EcoStruxure. The version of EcoStruxure used here is EcoStruxure Control Expert.

Soft Starter Configuration

Factory Settings

Before configuring the soft starter, it is advised to revert to the factory settings. Go to:

[Device Management] menu and **[Restore Configuration]** submenu

Then configure **[Go to Factory Settings]** parameter to **OK**

Command Configuration

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

Go to:

[Complete settings] menu and **[Command channel]** submenu.

Then configure **[Cmd channel 1]** parameter to **[CANopen]** value.

Communication Configuration

Select the CANopen address and the Baud rate in the menu:

[Communication] menu and **[CANopen]** submenu.

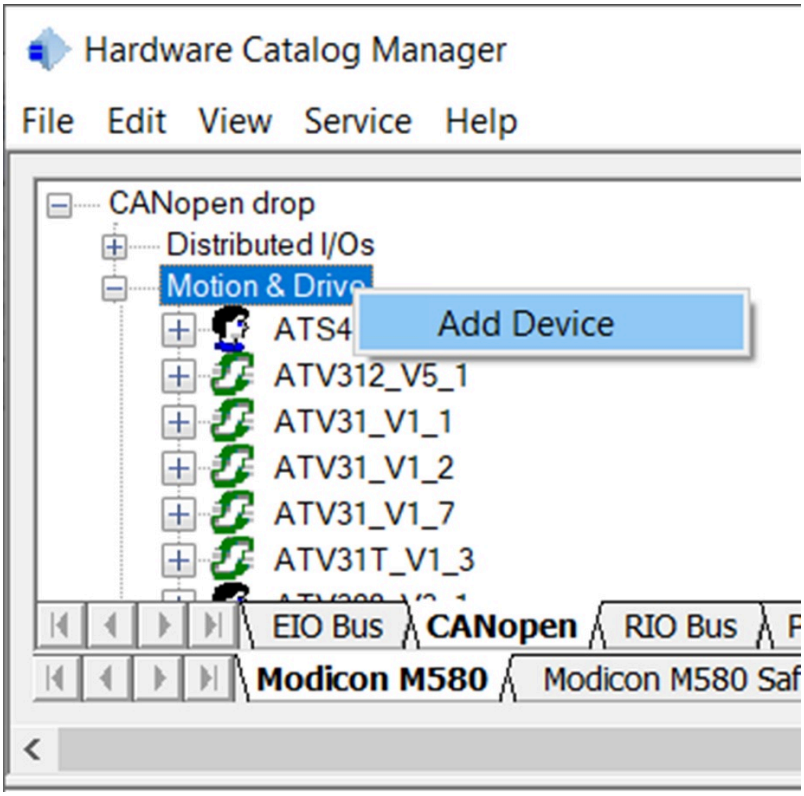
Then configure

- **[CANopen Address]** parameter to **[2]** .
- **[CANopen Baudrate]** parameter to **[500 kbps]** .

The soft starter must be restarted (**[Product restart]** parameter to **[Yes]**) in order to take into account the CANopen address.

EDS Integration

If your EcoStruxure Control Expert software does not contain the soft starter in the CANopen catalog. You must add the EDS file to the hardware catalog manager installed with EcoStruxure Control Expert .



Once imported, you should see the soft starter in the **Motion & Drive** section. The two topics **default** and **PDOs only** are used in the CANopen device configuration screen of EcoStruxure Control Expert to select which objects are mapped and linked to an application variable.

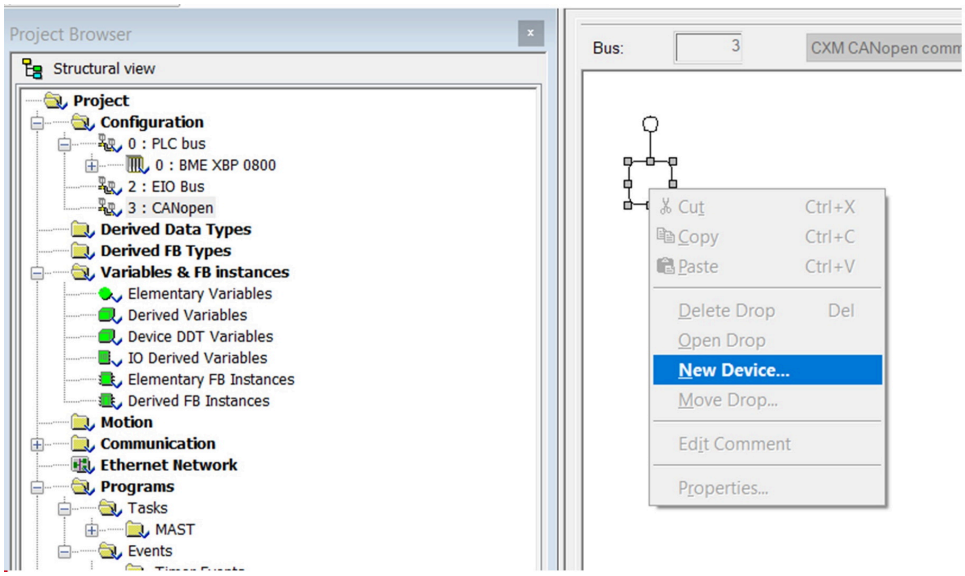
- Default: all the objects described in the EDS have reserved memory in the PLC application.
- PDOs only: Only the TPDO and RPDO objects are mapped in PLC memory. (The current example uses this function).

Your hardware catalog manager is now updated and contains the soft starter. 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 EcoStruxure Control Expert project is removed from the hardware catalog manager.

Configuring the soft starter in the CANopen Controller Project

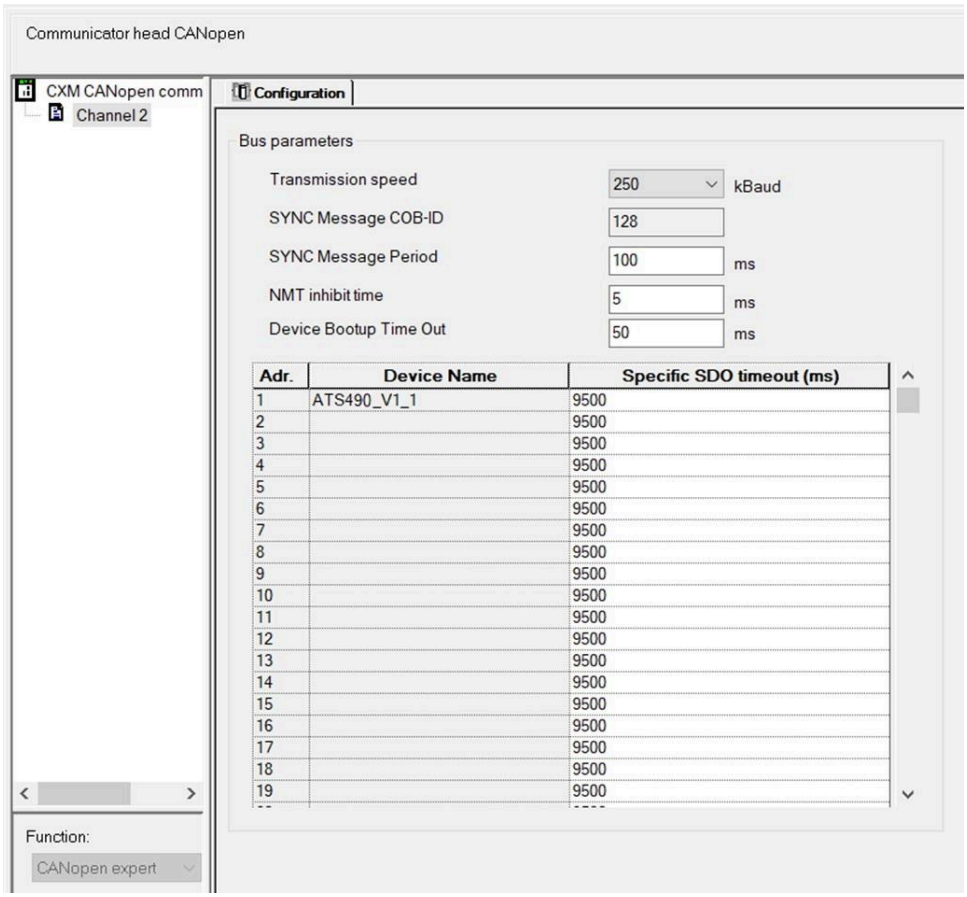
From the project browser opens the CANopen configuration tool by double-clicking the CANopen drop:



Configuration of the Controller

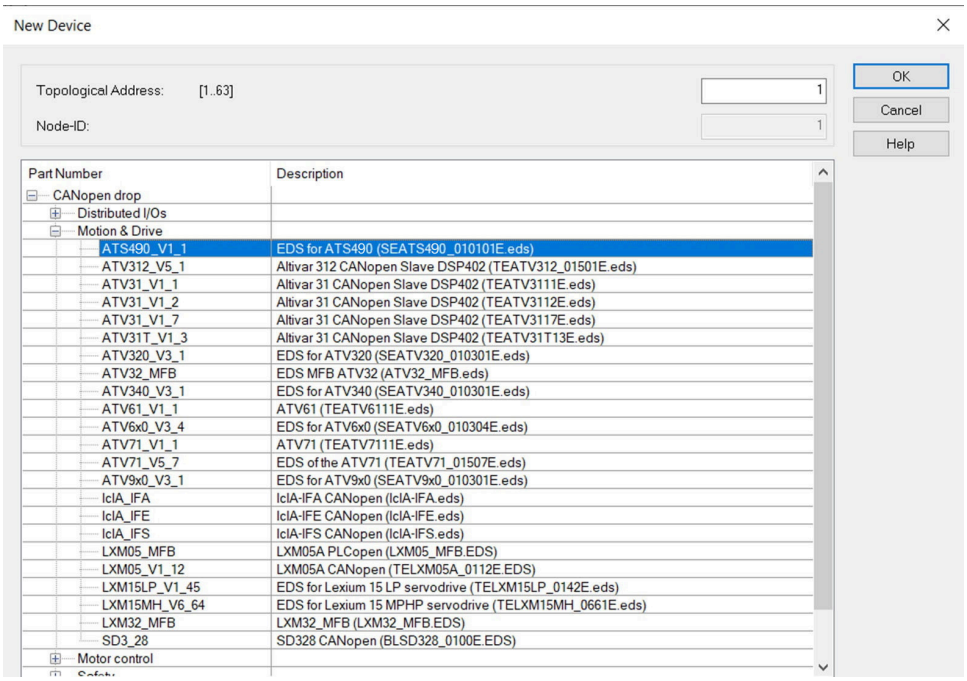
The controller configuration consists of:

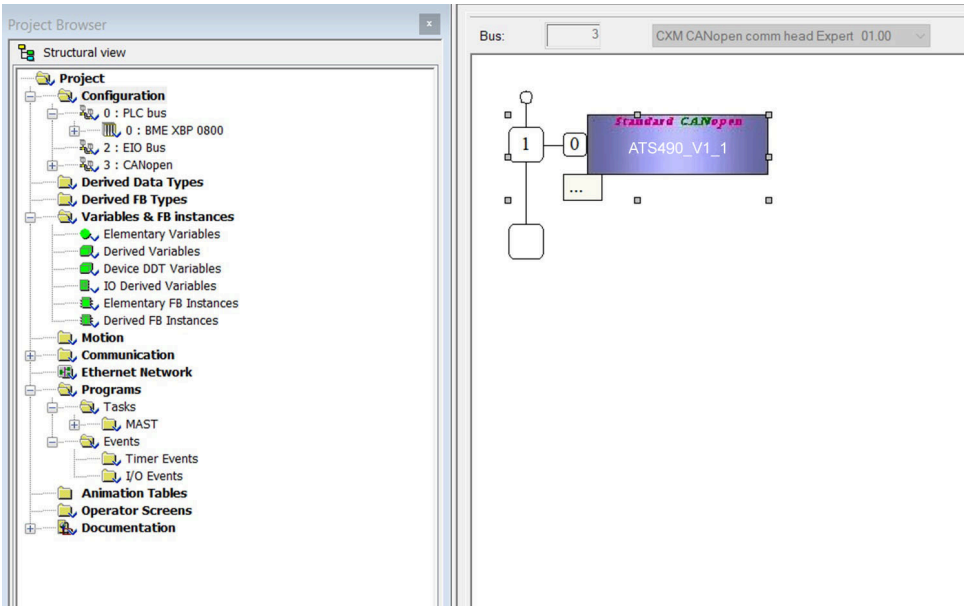
- Setting the baud rate
- Setting the SYNC message period
- Configuring the memory area which is the image of the whole PDOs handled by the PLC.



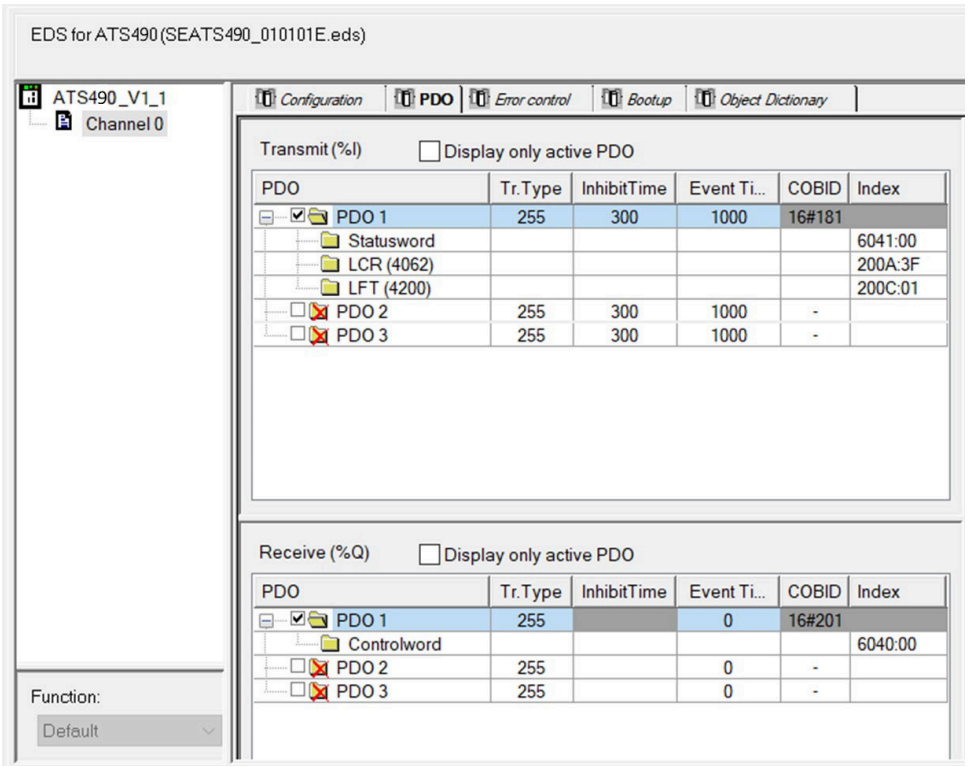
Configuration of the Device

Add a new device and select the soft starter in the catalog. The soft starter was previously added to the catalog by importing the EDS file of the soft starter.





In the example below, TPDO1 and RPDO1 are selected which provides the basic control command of the soft starter with the Standard mode profile.



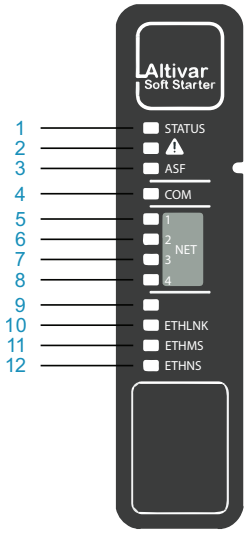
PDOs are linked to the %Mw variables, the mapping is automatically generated by EcoStruxure Control Expert according to the index defined in the controller configuration panel and to the PDOs and to the device Node ID.

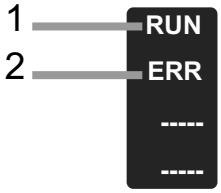
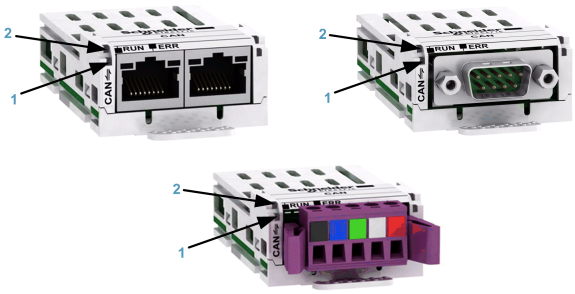
Diagnostics and Troubleshooting

What’s in This Part

Fieldbus Status LEDs

LED Description



Item	LED		Description
1	**STATUS**	OFF	Indicates that the soft starter is not ready to start
		Green flashing	Indicates that the soft starter is not running, ready to start
		Green blinking	Indicates that the soft starter is in transitory status (acceleration, deceleration, and so on)
		Green on	Indicates that the soft starter is running
		Yellow on	Indicates that the soft starter localization is in progress
2	**Warning/ Error**	Red flashing	Indicates that the soft starter has detected a warning
		Red on	Indicates that the soft starter has detected an error
3	**ASF**	OFF	Indicates Safety Function STO is not active.
		Yellow on	Indicates Safety Function STO is triggered.
4	**COM**	Yellow flashing	Indicates Modbus serial activity on port Modbus VP12S port.
5	**NET 1**	Green/ Yellow	  1. CAN_RUN: CANopen status 2. CAN_ERR: CANopen error
6	**NET 2**	Green/Red	
7	**NET 3**	Green/Red	
8	**NET 4**	Green/ Yellow	
9	Reserved		
10	**ETHLINK**	Green/ Yellow	Indicates port activity
11	**ETHMS**	Green/Red	Indicates module status.
12	**ETHNS**	Green/Red	Indicates network status

CANopen Status

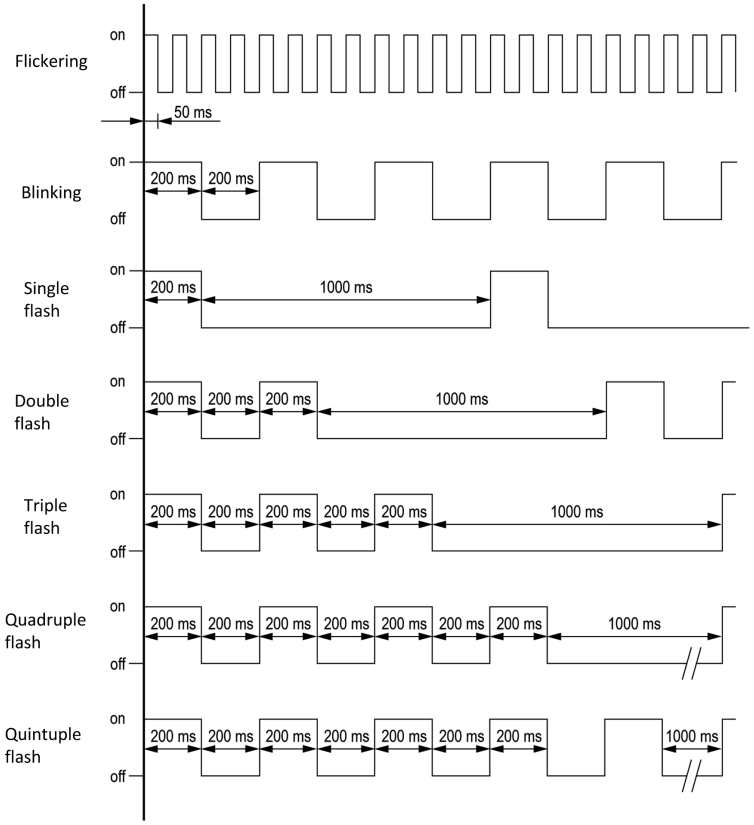
This LED indicates the CANopen status:

Color & Status	Description
OFF	The CANopen controller is in `OFF` state
Green single flash	The Altivar Soft Starter 4xx is in `STOPPED` state
Green blinking	The Altivar Soft Starter 4xx is in `PRE-OPERATIONAL` state
Green ON	The Altivar Soft Starter 4xx 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 Soft Starter 4xx (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]** 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 **[Communication]** → **[CANopen map]** menu.

PDO Counter

[Number of RX PDO] and **[Number of TX PDO]** indicate the number of PDOs received and the number of PDOs transmitted by the soft starter (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 **[Communication]** → **[CANopen map]** menu.

Last CANopen Detected Error

The **[CANopen Error]** 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 **[Communication]** → **[CANopen]** menu.
- in the **[Communication]** → **[CANopen map]** menu.

The possible values are listed below:

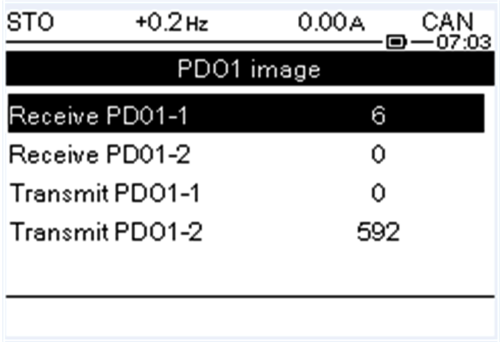
Display	Description
[0]	No errors detected since the start of CANopen communication.
[1]	Bus off or CAN overrun.
[2]	Node guarding error requiring a return to the NMT initialization state.
[3]	CAN overrun (possible alternative values: 32, 64 or 128).
[4]	Heartbeat error requiring a return to the NMT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

PDO Value Display

The value of parameters mapped in PDOs can be displayed using **[PDO1 image]**, **[PDO2 image]** and **[PDO3 image]** submenus.

These submenus are available in the **[Communication]** → **[CANopen map]** menu.

The following figure shows the content of **[PDO1 image]** 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, **[PDO1 image]** containing only 4 data bytes (that is **[Receive PDO1-1]** and **[Receive PDO1-2]**), the fields **[Receive PDO1-3]** and **[Receive PDO1-4]** are not displayed.

Configuring Communication Error Response

⚠WARNING

LOSS OF CONTROL

Perform a comprehensive commissioning test to verify that communication monitoring properly detects communication interruptions.

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

The timeout of Communication Error Response can be set via parameter.

The response of the soft starter in the event of a communication interruption can be configured through **[CANopen Error Resp]** in the **[Communication]** menu of the graphic display terminal.

The values of the **[CANopen Error Resp]** parameter, which triggers a soft starter detected error **[CANopen Com Interrupt]** COF are:

Value	Meaning
[Freewheel Stop] YES	Motor triggers in error and is stopped in freewheel. **Factory setting**
[Deceleration] DEC	Motor is stopped in deceleration and triggers in error at the end of stop.
[Braking] BRK	Motor is stopped in dynamic braking and triggers in error at the end of stop.

The values of the **[CANopen Error Resp]** COL parameter which does not trigger a detected error are:

Value	Meaning
[Ignore] NO	Detected error ignored.
[Configured Stop] STT	Motor is stopped according to **[Type of stop]** STT parameter.

⚠WARNING

LOSS OF CONTROL

If this parameter is set to **[Ignore]** NO, 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.

Communication troubleshooting

Checking Connections

If the product cannot be addressed using the fieldbus, verify that:

- The connector is plugged in correctly.
- The soft starter and the PLC are supplied.
- The wires are correctly connected to the port (if possible).
- The ends of line resistors are connected on both sides of the complete network.
- The ends of line resistors have the good values.
- The wiring of the all devices on the network is consistent.

Comportment when an communication error occurs

Send a word with **[Cmd Register]** to validate the **[Cmd channel 1]** or the **[Cmd channel 2]** to activate this channel.

If a communication interruption appears:

1. After the end of the delay of timeout, the motor is stopped.
2. An error **[CANopen Com Interrupt]** COF is triggered, and depending of **[Auto Fault Reset]**, **[R1 Assignment]** is deactivated (if set to **[Operating State Fault]** following the value set on **[CANopen Error Resp]**).

Control-Signal Diagnostics

On the display terminal, the **[Communication]**– menu can be used to display control-signal diagnostic information between the soft starter and the controller:

- Active command channel **[Command Channel]**.
- Value of the control word **[Cmd Register]** from the active command channel **[Command Channel]**.
- Value of the operating state word **[Status Register]**.
- Specific data for all available fieldbuses are in dedicated submenus.

Warning Messages

List of Available Warning Messages

Any warning that is triggered and assigned to a warning group, will be :

- signaled by the LED of the soft starter;
- signaled by the icon on the graphic display terminal;
- logged in the warning history.

Access paths to assign to a warning group:

- **[Diagnostics] ➡ [Warnings]**
- **[Complete settings] ➡ [Error/Warning handling] ➡ [Warning groups config]**

By default the following warnings are assigned to the **[Warn grp 1 definition]**:

- **[PumpCycle warning]**
- **[Low Battery Warn]**
- **[No Battery Warn]**
- **[Invalid RTC Warn]**
- **[Nameplate Mismatch]**
- **[Mains Loss Warn]**
- **[Output Phase Loss]**
- **[Static Port/Serv Warn]**
- **[Serv. Access Auth.]**
- **[ByPass Ov.Curr Warn]**

Setting	Code	Description
[PumpCycle warning]	PCPA	***Pump cycle warning***.
[Anti-Jam Warning]	JAMA	***Anti-Jam warning***.
[Device Therm Warn]	THA	***Device thermal state warning***.
[Therm Junction Warn]	TJA	***Thermal junction warning***.
[Fan Counter Warning]	FCTA	***Fan counter warning***.
[Fan Feedback Warning]	FFDA	***Fan feedback warning***.
[Ext. Error Warning]	EFA	***External error warning***.
[Undervoltage Warning]	USA	***Undervoltage warning***.
[Forced Run]	ERN	***Device in forced run***.
[Process Undld Warning]	ULA	***Process underload warning***.
[Process Overload Warning]	OLA	***Process overload warning***.
[Dev Thermal reached]	TAD	***Device thermal threshold reached***.
[Ethernet Internal Warning]	INWM	***Ethernet Internal warning***.
[AI1 Th Warning]	TP1A	***AI1 thermal sensor warning***.
[Motor Overload Warn]	OLMA	***Motor overload warning***.
[Low Battery Warn]	RBLA	Soft starter ***Low Battery warning***.
[No Battery Warn]	RBNA	Soft starter ***Battery not detected warning***.
[Invalid RTC Warn]	RTCA	***Invalid RTC warning***
[Bypass Warn]	BPA	***Bypass warning***
[Modbus Com Warn]	SLLA	***Modbus comm interruption warning***.
[Fieldbus Com Warn]	CLLA	***Fieldbus comm interruption warning***.
[CANopen Com Warn]	COLA	***CANOpen comm interruption warning***.
[Inhibited Errors Warn]	INH	***Inhibited errors warning***.
[Temp Sens AI1 Warn]	TS1A	***Temperature sensor AI1 warning***.
[Mains Loss Warn]	PHF	***Mains Loss warning***.
[Output Phase Loss]	OPF	***Output Phase Loss warning***.
[Bypass Cont Excess]	BPCA	***Recommended bypass contactor cycles exceeded***, the bypass contactor cycles exceeded 90% of total service life.
[Overvoltage Warn]	OSA	***Overvoltage warning***.
[Volt Unbalance Warn]	ULBA	***Mains unbalance warning***.
[Voltage Sag Warn]	SAGA	***Voltage sag detection warning***.
[Voltage Inconsistent]	MTVA	***Motor voltage vs. Mains inconsistency warn***.
[Nameplate Mismatch]	MNIA	***Nameplate Inconsistency Alarm***.
[Curr Unbalance Warn]	ILBA	***Current unbalance warning***.
[Mains Freq Warn]	FRQA	***Mains frequency warning***.
[Config Recover Warn]	CBRA	***Configuration recovery warning***.
[Sys. Log. Warning]	SLGA	***System Log Warning***, application and log limits is almost reached (or reached), logs must be downloaded.

Setting	Code	Description
[Serv. Access Auth.]	SMSA	***After-Services Access Authorized***, After Sales Services tab enabled.
[FDR Set Serv Warn]	FDSA	***FDR setting service warning***.
[IP Set Serv Warn]	IPSA	***IP setting service warning***.
[RSTP Set Serv Warn]	RSSA	***RSTP setting service warning***.
[Static Port/Serv Warn]	PSSA	***Static port/service warning***.
[ByPass Ov.Curr Warn]	BYFA	***Bypass Contactor Overcurrent Warning***.

Communication error codes

What's in This Chapter

In this chapter, a list of some of the errors that can be triggered by the communication-related soft starter can be found, for a full description please refer to the user manual.

[Invalid Configuration] CFI

Invalid configuration

Probable Cause	Inconsistent, invalid, unauthorized or out-of-bound value written to a parameter via a fieldbus or communication link. The written value is rejected, the previous one is kept and this error is triggered.
Remedy	• Writing a correct value on any parameters via communication or fieldbus link. • Writing a correct value on any parameters via any HMI (display terminal, SoMove...). • Reset to factory settings, new configuration transfer or configuration restoration.
Clearing the Error Code	This detected error is cleared as soon as its cause has been removed.

[Conf Transfer Error] CFI2

Configuration transfer error

Probable Cause	• The configuration transfer to the soft starter was not successful or interrupted. • The configuration loaded is not compatible with the soft starter.
Remedy	• Verify the configuration loaded previously • Load a compatible configuration • Use a PC software commissioning tool to transfer a compatible configuration • Perform a factory setting **NOTE:** When this error is triggered, the current security configuration is kept valid and applied.
Clearing the Error Code	This detected error is cleared as soon as its cause has been removed.

[CANopen Com Interrupt] COF

CANopen communication interruption

Probable Cause	Communication interruption on the CANopen® fieldbus.
Remedy	• Verify the communication fieldbus. • Verify the timeout • Refer to the CANopen® user manual
Clearing the Error Code	This detected error can be cleared with the **[Auto Fault Reset]** or manually with the **[Fault Reset Assign]** parameter after its cause has been removed.

[CANopen Init Error] COLF

CANopen initialization error

Probable Cause	CANopen could not initialize because the device baudrate is incompatible with the controller baudrate.
Remedy	• Verify the device baudrate • Verify the baudrate of other devices on the network • If the error persists, disconnect the device from the network
Clearing the Error Code	This detected error requires a power reset of the device after its cause has been removed.

[External Error] EPF1

External detected error

Probable Cause	• Error raised based on **[Ext Error assign]** configuration via **[DI●]** or **[CD●●]**. • Duplicate or invalid IP address.
Remedy	Remove the cause of the external error.
Clearing the Error Code	This detected error can be cleared manually with the **[Fault Reset Assign]** parameter after its cause has been removed.

Appendix A - Object Dictionary

What's in This Part

Communication Profile Area

Communication Objects

The table provides the soft starter supported communication objects:

Index	Subindex	Access	Type	Default value	Description
1000 hex	00 hex	Read only	Unsigned32	00410192 hex	Device type: 0
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/write	Unsigned8	00 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		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	Unsigned8	0000 hex	Life Time Factor: Multiplier applied to the `Guard Time` in order to obtain a `Life Time`.
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	00 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
1018 hex	01 hex	Read only	Unsigned32	0200005A hex	Vendor ID
	02 hex	Read only	Unsigned32	490	Product code
	03 hex	Read only	Unsigned32	00010101 hex	Revision ID: B0..7: [ID_Card1SoftwareVersion] evolution B8..15: [ID_Card1SoftwareVersion] version B16: Fix (1)
1029 hex	00 hex	Read only	Unsigned8	01 hex	Number of entries
	01 hex	Read/write	Unsigned8	00 hex	Communication error

SDO Server Parameters

Communication Object

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

Index	Subin-dex	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 → Soft starter (receive)
	02 hex	Read only	Unsigned 32	00000580 hex + node ID	SDO Server - COB-ID Client ← Soft starter (transmit)
1201 hex	00 hex	Read only	Unsigned8	03 hex	2nd SDO server - Highest sub-index supported
	01 hex	Read/write	Unsigned32	80000000 hex	2nd SDO server - COB-ID Client → Soft starter (receive)
	02 hex	Read/write	Unsigned32	80000000 hex	2nd SDO server - COB-ID Client ← Soft starter (transmit)
	03 hex	Read/write	Unsigned8	00 hex	2nd SDO server - COB-ID

Receive PDOs Parameters

Communication Objects

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

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
	03 hex	Read/write	Unsigned16	00 hex	Receive PDO1 - Inhibit timer
	05 hex	Read/write	Unsigned16	00 hex	Receive PDO1 - Event Timer Unit = 1 ms
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
	03 hex	Read/write	Unsigned16	00 hex	Receive PDO2 - Inhibit timer
	05 hex	Read/write	Unsigned16	00 hex	Receive PDO2 - Event Timer Unit = 1 ms
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
	03 hex	Read/write	Unsigned16	00 hex	Receive PDO3 - Inhibit timer
	05 hex	Read/write	Unsigned16	00 hex	Receive PDO3 - Event Timer Unit = 1 ms

Receive PDO1, PDO2, and PDO3 Mapping

Communication Objects

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

Index	Subindex	Access	Type	Default value	Description
1600 hex	00 hex	Read/write	Unsigned8	01 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 CMD (6040 hex)
	02 hex	Read/write	Unsigned32	00000000 hex	Receive PDO1 mapping: No second mapped object
	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		Unsigned8	04 hex	Receive PDO3 mapping - Number of mapped objects: 0 to 4 objects can be mapped for this PDO
	01 hex		Unsigned32	20613E10 hex	Receive PDO3 mapping - first mapped object: NC1 (Comm. Scanner first data)
	02 hex		Unsigned32	20613F10 hex	Receive PDO3 mapping - second mapped object: NC2 (Comm. Scanner second data)
	03 hex		Unsigned32	20614010 hex	Receive PDO3 mapping - third mapped object: NC3 (Comm. Scanner third data)
	04 hex		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 soft starter:

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 = 100 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 soft starter:

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 ETA (6041 hex)
	02 hex	Read/write	Unsigned32	20020510 hex	Transmit PDO1 mapping - second mapped object: Motor current LCR (2002/5 hex)
	03 hex	Read/write	Unsigned32	20421F10 hex	Transmit PDO1 mapping: Motor Therm State THR (2042/1F hex)
	04 hex	Read/write	Unsigned32	20380710 hex	Transmit PDO1 mapping: Malfunction code ERRD (2038/7 hex)
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		Unsigned8	04 hex	Transmit PDO3 mapping - Number of mapped objects.
	01 hex		Unsigned32	20612A10 hex	Transmit PDO3 mapping - first mapped object: NM1 - Comm. Scanner first data
	02 hex		Unsigned32	20612B10 hex	Transmit PDO3 mapping - second mapped object: NM2 - Comm. Scanner second data
	03 hex		Unsigned32	20612C10 hex	Transmit PDO3 mapping - third mapped object: NM3 - Comm. Scanner third data
	04 hex		Unsigned32	20612D10 hex	Transmit PDO3 mapping - fourth mappedobject: NM4 - Comm. Scanner fourth data

Manufacturer Specific Area

Description

The 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 standard mode profile, supported by the soft starter:

Index	Description
603F hex	Error code
6040 hex	Control Word
6041 hex	Status Word
605C hex	Disable option code
6060 hex	Modes of operation
6061 hex	Modes of operation Display
6502 hex	Supported soft starter modes

Glossary

A

AC:

Alternating Current

Adjustment parameter: A parameter always accessible as **[Access Level]**.

C

CAN:

Controller Area Network is an internally standardized serial bus system

COB ID:

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

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.

Configuration Parameter: A parameter affects by the operating states of the machine as**[Motor Nom Current]**.

Controller:

A **controller** is a device that is actively polling for data from one or multiple devices.

Similar to a **Master**, a **Client** or a **Scanner**.

D

DC:

Direct Current

dec.:

Decimal

Device:

A **device** is the passive device, waiting for the **controller** to poll for data to actually send it.

Similar to a **Slave**, an **Adapter** or a **Server**.

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:

Machine status in factory settings when the product was shipped.

Fault Reset:

A function used to restore the soft starter 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.

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.

H

hex:

Hexadecimal

L

LSB:

Least Significant Byte

M

MEI:

Modbus Encapsulated Interface

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

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

R/WS:

Read and write (write only possible when the soft starter is not in RUN mode). It is not possible to write these parameters in "5-Operation enabled" or "6-Quick stop active" states. If the parameter is written in the "4-Switched on" state, transition to "2-Switch on disabled" is activated.

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 error 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.

Schneider Electric
35 rue Joseph Monier
92500 Rueil Malmaison
France

+ 33 (0) 1 41 29 70 00

www.se.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

PKR63426.01 – 12/2024