Altivar Soft Starter ATS430

Soft Starter for Asynchronous Motors

Embedded Modbus RTU Manual

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www.se.com

Schneider Electric

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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, Safety Standards for Construction and Guide for Selection, Installation and Operation of Soft Starters.

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).

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 connect the Modbus RTU fieldbus on your soft starter.
- Show you how to configure the soft starter to use the Modbus RTU embedded for monitoring and control.
- Provide examples of setup using Modbus RTU communication.

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 ATS430	DIA2ED2240602EN (English) DIA2ED2240602FR (French)

Documentations

Title of documentation	Reference number
ATS430 Getting Started	PKR63383 (English), PKR63384 (French) PKR63385 (Spanish), PKR63386 (Italian) PKR63387 (German), PKR63388 (Chinese) PKR63389 (Portuguese), PKR63390 (Turkish)
ATS430 Getting Started Manual Annex for UL	PKR63391 (English)
ATS430 User Manual	PKR63392 (English), PKR63393 (French) PKR63394 (Spanish), PKR63395 (Italian) PKR63396 (German), PKR63397 (Chinese) PKR63398 (Portuguese), PKR63399 (Turkish)
ATS430 Embedded Modbus RTU Manual	PKR63401 (English)
ATS430 Communication Parameter Addresses	PKR63400 (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

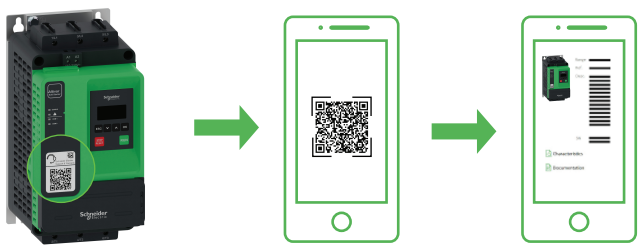
Title of documentation	Reference number
Video: Getting Started with ATS430	FAQ000263199 (English)

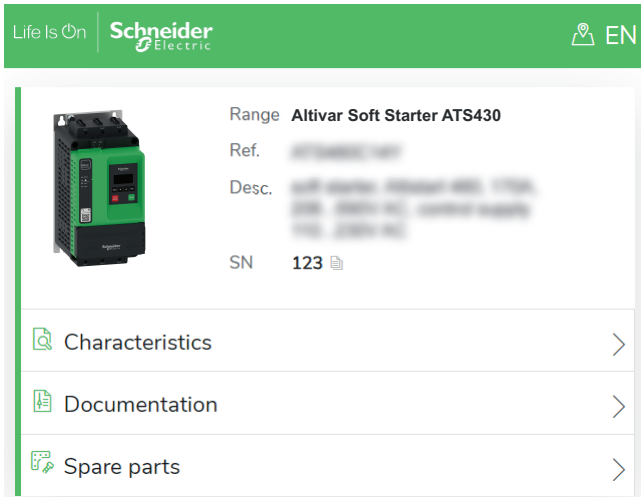
Software

Title of documentation	Catalog number
SoMove: FDT	SoMove FDT (English, French, German, Spanish, Italian, Chinese)
ATS430: DTM	ATS430 DTM Library EN (English – to be installed first) ATS430 DTM Lang FR (French) ATS430 DTM Lang SP (Spanish) ATS430 DTM Lang IT (Italian) ATS430 DTM Lang DE (German) ATS430 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

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Hardware Setup

What’s in This Part

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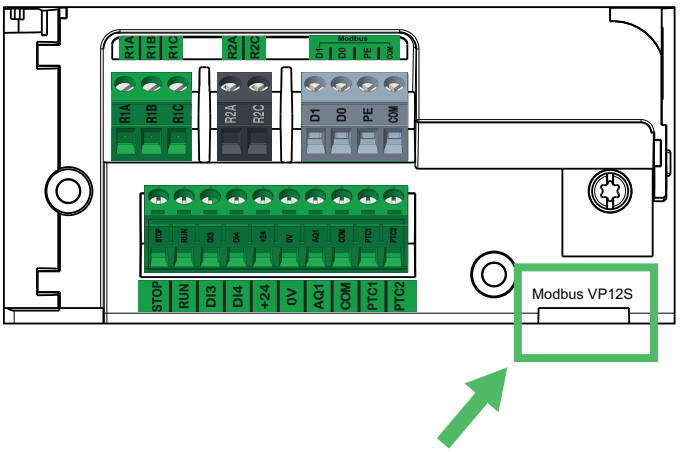
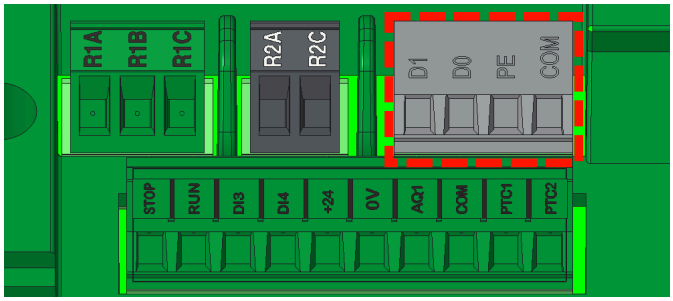
Modbus Serial Communication Port

The Modbus connection port can be access from:



NOTE: Modbus RTU VP12S port is recommended to be used for communication such as with PLC.

Also, it is possible to create a Modbus connection from the following port:



Open Style Modbus communication port (red square).

Only one port should be used at the same time to communicate with an external device. But a display terminal and a communication with an external device can be connected at the same time (one on each port). Also modifying the default settings of modbus can result in the impossibility to communicate with the display terminal.

⚠WARNING

LOSS OF CONTROL

- Never use the two available communication ports at the same time when they are connected to different PLC, otherwise any communication interruption cannot be detected.
- If the Open Style modbus communication port is connected to an external device, the Modbus RTU VP12S port can only be connected to a display terminal.

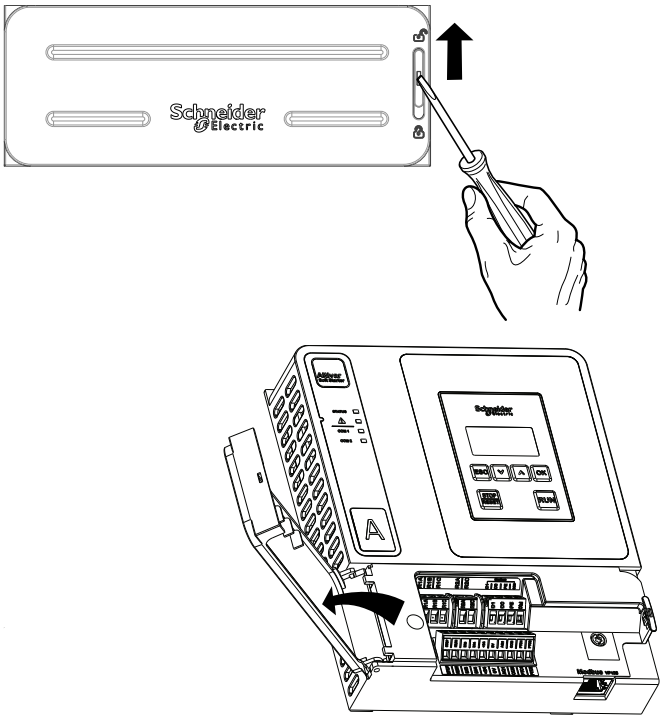
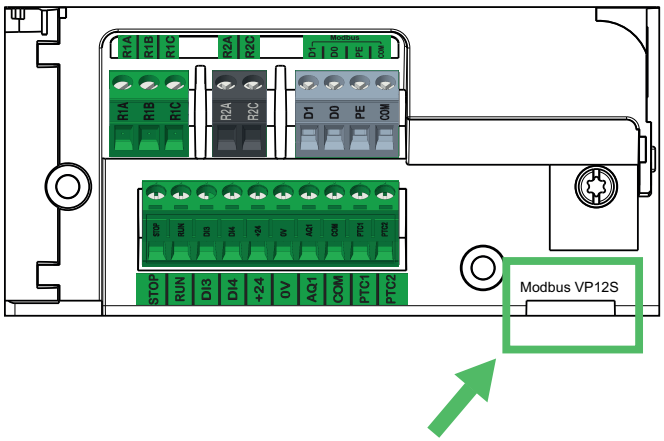
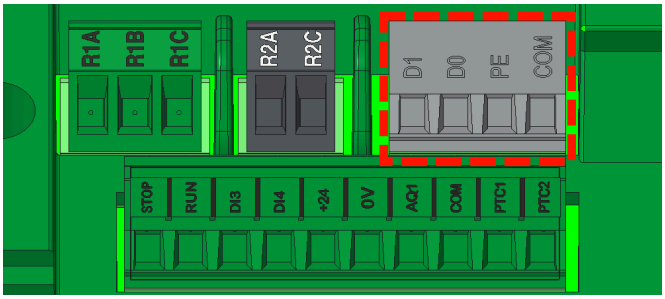
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connect to SoMove

It is possible to connect to SoMove using the Flashing Cordset (VW3A8127) or (TCSMCNAM3M002P) cable.

Procedure to access to the port of the Soft starter

Apply the following instructions to remove the front cover of the soft starter:

Step	Action	
1	Open the terminal cover	
2	Plug the RJ45 cable to the RJ45 socket identified with “Modbus VP12S”. It’s also possible to connect to the Open Style Modbus (D1,D0,PE,COM)	Modbus RTU VP12S communication port  Modbus In-Line communication port (red square). 

Electrical Data

Immunity Against Interference

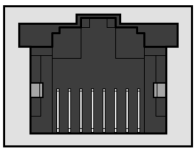
Keep the Modbus cable separated from the power cables (30 cm (11.8 in.) minimum).

Connection to the Soft starter

Connection accessories should be ordered separately (See the catalog for more details).

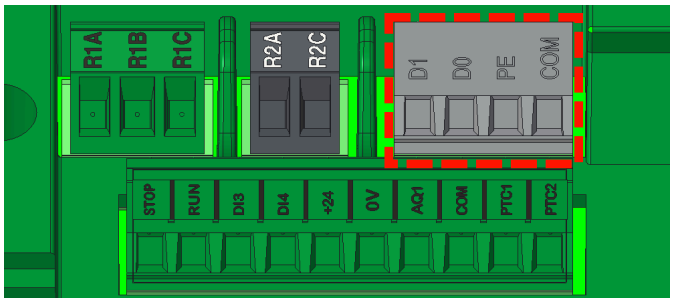
Connect the RJ45 cable connector to the device connector.

The table describes the pin out of the RJ45 connector of the device:



Pin	Signal
1	Reserved
2	
3	
4	D1 (1)
5	D0 (1)
6	Reserved
7	12 Vdc **NOTE:** Supply for RS232 / RS485 converter or a remote terminal.
8	Common (1)
(1) Modbus signals	

Open Style Modbus Connection



Pin	Signal
D1	Modbus signals
D0	Modbus signals
COM	Common (Modbus signals)
PE	Protective Earth connection

RS485 Bus Schematic

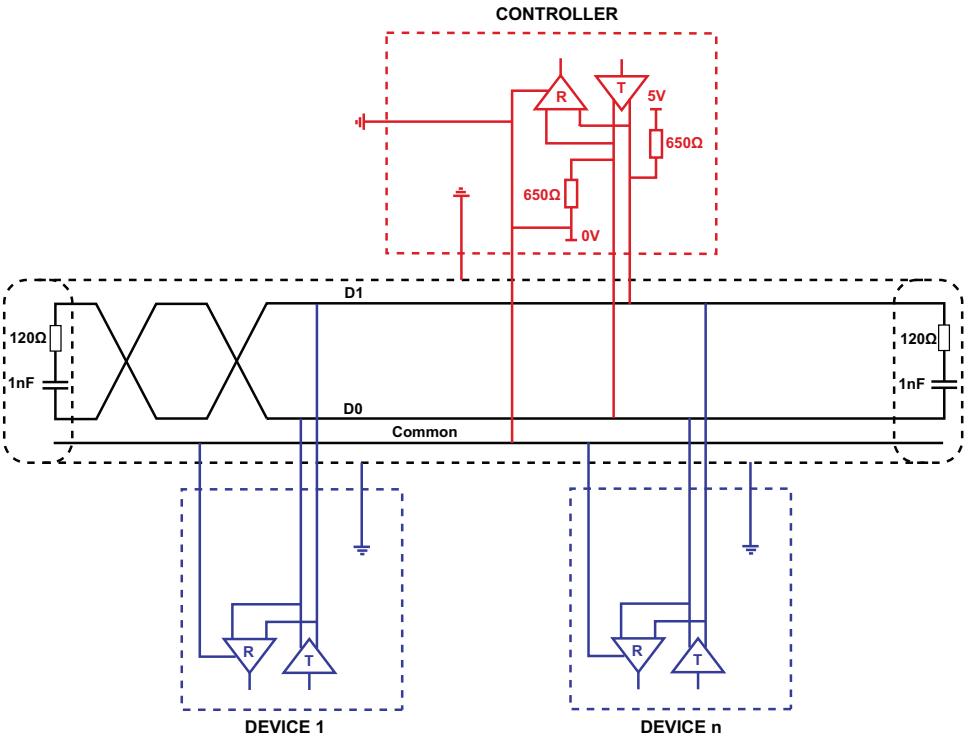
The RS485 standard allows variants of different characteristics:

- Polarization
- Line terminator
- Distribution of a reference potential
- Number of devices
- Length of bus

The Modbus specification published on the Modbus.org site contains precise details of all these characteristics. They are also summarized in standard schematic section. The new Schneider Electric devices conform to this specification.

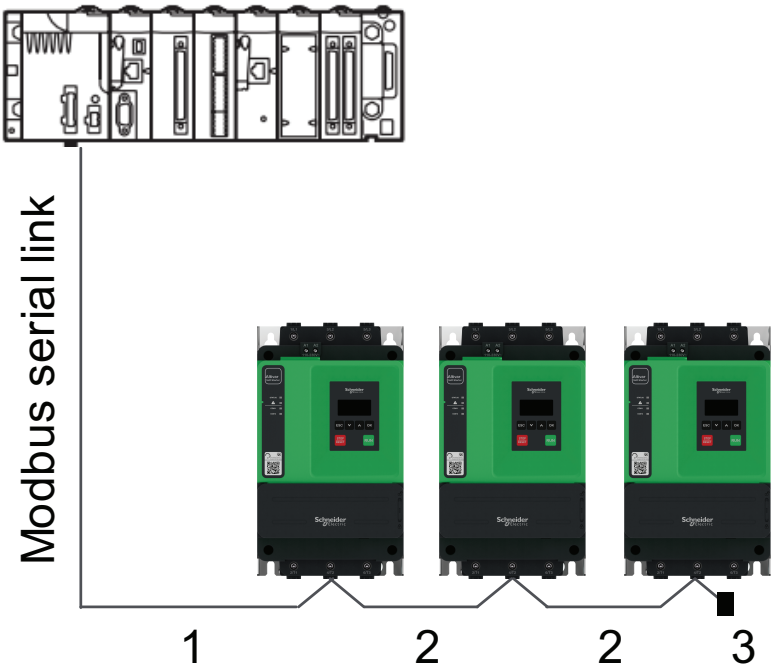
Schematic Diagram

The following is the RS485 bus schematic diagram:



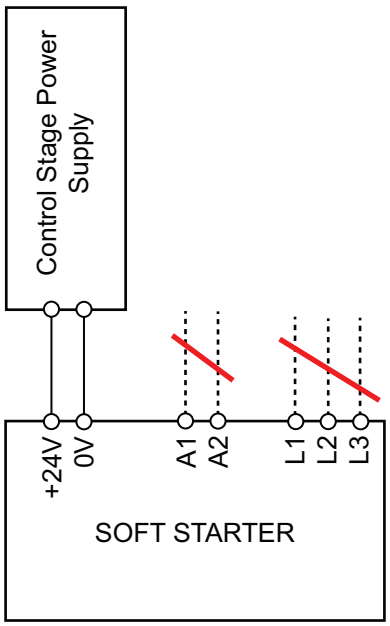
Characteristic	Definition
Type of trunk cable	Shielded cable with 1 twisted pair and at least a third conductor
Maximum length of bus	1000 m at 19200 bps
Maximum number of stations (without repeater)	32 stations that are 31 devices
Maximum length of tap links	• 20 m for 1 tape link • 40 m divided by the number of tape links on a multiple junction box
Bus polarization	• One 450...650 Ω pull-up resistor at 5 V (650 Ω recommended) • One 450...650 Ω pull-down resistor at the common (650 Ω recommended) This polarization is recommended for the controller.
Line termination	Two polarization of the pair are available with a R or RC circuit as line termination: • R circuit: One 150Ω resistor. • RC circuit: One 120Ω 0.25W resistor in series with 1nF 10V capacitor. **NOTE:** An analysis is to be carried out to determine which solution is best suited for the network topology.
Common polarity	The Common circuit (Signal and optional Power Supply Common) must be connected directly to protective ground, at **one point only** for the entire bus on the controller side.

Cable Routing practice with Modbus RTU with open style connector



Number in the diagram	Open Style Modbus serial link connection accessories	
	Description	Reference
1	Cable for modbus serial link, 1xRJ45 and free wires at the other end	VW3A8306D30
2	RS485 double shielded twisted pair Modbus cable	TSXCSA100
3	Line termination for screw terminals	
	R =120Ω C = 1nf	VW3A8306DRC
	R = 150Ω	VW3A8306DR

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.

Modbus Functions

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Modbus Protocol

Introduction

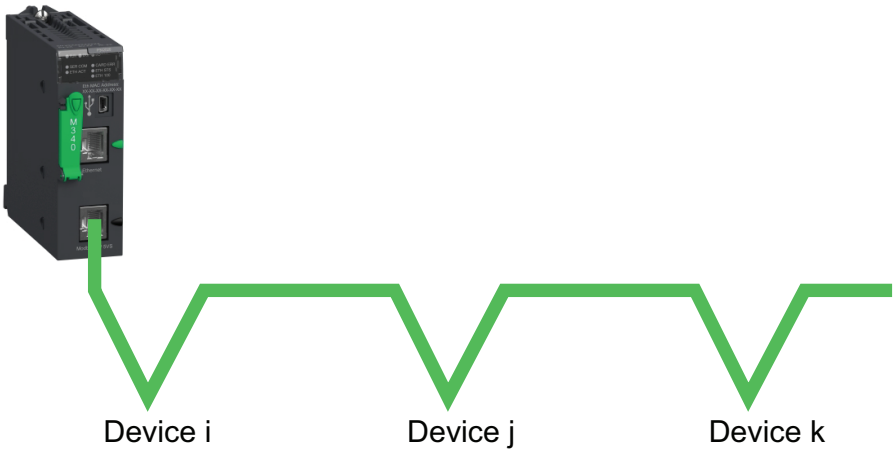
The transmission mode used is RTU. The frame does not contain message header and end of message bytes.

Device address	Request code	Data	CRC16

The data is transmitted in binary code.

The end of the frame is detected on a silence greater than or equal to three characters.

Principle



Only one device can transmit on the line at any time.

The controller manages the exchanges and only it can take the initiative.

It interrogates each of the devices in succession

No device can send a message unless it is invited to do so.

The controller repeats the question when there is an incorrect exchange, and declares the interrogated device absent if no response is received within a given time period.

If a device does not understand a message, it sends an exception response to the controller. The controller may or may not repeat the request.

Direct device-to-device communications are not possible.

For device-to-device communication, the application software must therefore be designed to interrogate a device and send back data received to the other device.

The 2 types of dialogue are possible between controller and devices:

- The controller sends a request to a device and waits for its response
- The controller sends a request to all devices without waiting for a response (broadcasting principle)

Addresses

Address specification:

- The device Modbus address can be configured from 1 to 247.
- Address 0 coded in a request sent by the controller is reserved for broadcasting. Devices take account of the request, but do not respond to it.

Supported Modbus Functions

Introduction

The soft starter supports the following Modbus functions:

Function Name	Code		Description	Remarks
	Dec.	Hex		
Read Holding Registers	03	03 hex	Read N output words	Maximum PDU length: 125 words
Write One Output Word	06	06 hex	Write 1 output word	–
Write Multiple Registers	16	10 hex	Write N output word	Maximum PDU length: 123 words
Read/write Multiple Registers	23	17 hex	Read/write multiple registers	Maximum PDU length: 125 words (R), 121 words (W)
(Subfunction) *Read Device Identification*	43/14	2B hex/ 0E hex	Encapsulated interface transport/ Read device identification	–
Diagnostics	08	08 hex	Diagnostics	–

Read Holding Registers (03 hex)

This function code is used to read the contents of a contiguous block of holding registers in a remote device.

The Request PDU specifies the starting register address and the number of registers. In the PDU Registers are addressed starting at zero. Therefore registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Request

Function code	1 byte	03 hex
Starting address	2 bytes	0000 hex...FFFF hex
Quantity of registers	2 bytes	1 to 125 (0x7D)

Response

Function code	1 byte	03 hex
Byte count	1 byte	2 x N(1)
Register value	N(1) x 2 bytes	–
(1) N: Quantity of registers		

Detected error

Detected error code	1 byte	83 hex
Exception code	1 bytes	01...04

Write 1 Output Word (06 hex)

This function code is used to write a single holding register in a remote device.

The Request PDU specifies the address of the register to be written. Registers are addressed starting at zero. Therefore register numbered 1 is addressed as 0.

The normal response is an echo of the request, returned after the register contents have been written.

Request

Function code	1 byte	06 hex
Register address	2 bytes	0000 hex...FFFF hex
Register value	2 bytes	0000 hex...FFFF hex

Response

Function code	1 byte	06 hex
Register address	2 bytes	0000 hex...FFFF hex
Register value	2 bytes	0000 hex...FFFF hex

Detected error

Detected error code	1 byte	86 hex
Exception code	1 bytes	01...04

Then, here an example of a request to write register @9060:

Write on:

Code	Name	Logic Address
ACC	Acceleration ramp time (s)	2364 hex= 9060

Write value 000D hex in device address 02 hex:

Code	Write	
	hex	dec.
ACC	000D hex	13

Request:

device no.	Function Code	Word number	Value of word	CRC16
02	06	2364	000D	0267

Response:

device no.	Function Code	Word number	Value of word	CRC16
02	06	2364	000D	0267

Analyzed:

Code	Read		Result
	hex	dec.	
ACC	000D hex	13	ACC = 13 s

Write Multiple Register (10 hex)

This function code is used to write a block of contiguous registers (1 to 123 registers) in a remote device.

The requested written values are specified in the request data field. Data is packed as two bytes per register.

The normal response returns the function code, starting address, and quantity of registers written.

Request

Function code	1 byte	10hex
Register address	2 bytes	0000 hex...FFFF hex
Register value	2 bytes	0000 hex...FFFF hex

Response

Function code	1 byte	10 hex
Register address	2 bytes	0000 hex...FFFF hex
Register value	2 bytes	0000 hex...FFFF hex

Detected error

Detected error code	1 byte	90 hex
Exception code	1 bytes	01...04

Then, here an example of a request to write registers @9060 and @9061:

Write on:

Code	Name	Logic Address
ACC	Acceleration ramp time (s)	2364 hex= 9060
DEC	Deceleration ramp time (s)	2365 hex= 9061

Write values on device address 02 hex:

Code	Write	
	hex	dec.
ACC	0014 hex	20
DEC	001E hex	30

Request

device no.	Request code	No. of first word	Number of words	Number of bytes	Value of first word	Value of Second word	CRC16
02 hex	10 hex	2364 hex	0002 hex	04 hex	0014 hex	001E hex	B60D hex

Response

device no.	Response code	No. of first word	No. of words	CRC16
02 hex	10 hex	2364 hex	0002 hex	0BA0 hex

Analyzed:

Code	Read		Result
	hex	dec.	
ACC	0014 hex	20	ACC = 20 s
DEC	001E hex	30	DEC = 30 s

Read/Write Multiple Registers (17 hex)

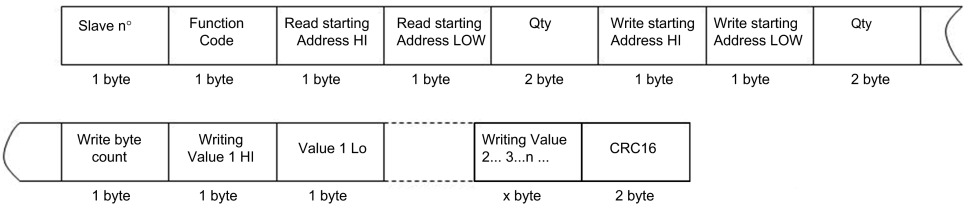
This function code performs a combination of one read operation and one write operation in a single MODBUS transaction. The write operation is performed before the read. Holding registers are addressed starting at zero. Therefore holding registers 1-16 are addressed in the PDU as 0-15.

The request specifies the starting address and number of holding registers to be read as well as the starting address, number of holding registers, and the data to be written. The byte count specifies the number of bytes to follow in the write data field.

The normal response contains the data from the group of registers that were read. The byte count field specifies the quantity of bytes to follow in the read data field.

For example

Description	Length in Byte	Value	Comment
Function code	1	17 hex	–
Read starting address	2	XXXX hex	Modbus address
Quantity	2	03 hex	Contain number of holding registers to be read
Write starting address	2	XXXX hex	Modbus address
Quantity	2	03 hex	Contain number of holding registers to be written
Write byte count	1	06 hex	The byte count specifies the number of bytes to follow in the field write register value
Write registers value	6	XXXXXX XXXXXX hex	Address to be written respectively in NCA1 to NCA4.



Read Device Identification (2B hex/0E hex)

This function code allows reading the identification and additional information relative to the physical and functional description of a remote device, only.

The Read Device Identification interface is modeled as an address space composed of a set of addressable data elements. The data elements are called objects and an object Id identifies them.

The interface consists of 3 categories of objects :

- Basic Device Identification:

  All objects of this category are mandatory : VendorName, Product code, and revision number.
- Regular Device Identification:

  In addition to Basic data objects, the device provides additional and optional identification and description data objects. All of the objects of this category are defined in the standard but their implementation is optional.
- Extended Device Identification:

  In addition to regular data objects, the device provides additional and optional identification and description private data about the physical device itself. All of these data are device dependent.

The table provides the device identification details:

ID	Name / Description	Type
00 hex	`VendorName`	ASCII String
01 hex	`ProductCode`	ASCII String
02 hex	`MajorMinorRevision`	ASCII String
06 hex	`ProductName`	ASCII String

Request

device no.	Function Code (2B)	Type of MEI 0E	Read Device Id 01	Object Id 00	CRC16	
					Lo	Hi
1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	

Response

device no.	2B	Type of MEI 0E	Read Device Id 01	Degree of conformity 02
1 byte	1 byte	1 byte	1 byte	1 byte

Example

Number of additional frames 00	Next object Id 00	Number of objects 03
1 byte	1 byte	1 byte

Id of object number 1 00	Length of object number 1 12	Value of object number 1 **Schneider Electric**
1 byte	1 byte	18 bytes

Id of object number 2 01	Length of object number 2 0B	Value of object number 2
1 byte	1 byte	11 bytes

Id of object number 3 02	Length of object number 3 04	Value of object number 3 **0201**
1 byte	1 byte	4 bytes

CRC16	
Lo	Hi
1 byte	1 byte

The total response size equals 49 bytes

The three objects contained in the response correspond to the following objects:

- Object number 1: Manufacturer name (always **Schneider Electric**, that is 18 bytes).
- Object number 2: Device reference (ASCII string; for example, **ATS430xxxxxx**, that is 11 bytes).
- Object number 3: Device version, in **MMmm** format where **MM** represents the determinant and **mm** the subdeterminant (4-bytes ASCII string; for example,: **0201** for version 2.1).

NOTE: The response to function 43 may be negative; in this case, the response located at the top of the next page is sent by the soft starter rather than the response described above.

Diagnostics (08 hex)

The function (08 hex) provides a series of tests for checking the communication system between a controller device and a device, or for checking various internal error conditions within a device.

The function uses a two–byte sub-function code field in the query to define the type of test to be performed. The device echoes both the function code and sub-function code in a normal response. Some of the diagnostics cause data to be returned from the remote device in the data field of a normal response.

In general, issuing a diagnostic function to a remote device does not affect the running of the user program in the remote device. User logic, like discrete and registers, is not accessed by the diagnostics. Certain functions can optionally reset error counters in the remote device.

A device device can, however, be forced into ‘Listen Only Mode’ in which it will monitor the messages on the communications system but not respond to them. This can affect the outcome of your application program if it depends upon any further exchange of data with the remote device. Generally, the mode is forced to remove a malfunctioning remote device from the communications system.

Subcode 00 hex: Echo

This function asks the device being interrogated to echo (return) the message sent by the controller in its entirety.

Subcode 0A hex: Counter reset

This function resets all the counters responsible for monitoring a device exchanges.

Subcode 0C hex: Read message counter responsible for counting messages received with checksum errors.

Subcode 0E hex: Read message counter responsible for counting messages addressed to device. Read a word indicating the total number of messages addressed to the device, regardless of type (excluding broadcast messages).

Request and response (the frame format is identical)

device no.	Function Code (08)	Subcode		Data		CRC16	
		Hi	Lo	Hi	Lo	Lo	Hi
1 byte	1 byte	2 bytes		N bytes		2 bytes	

Subcode	Request Data	Response Data	Function Executed
00	XX YY	XX YY	Echo
0A	00 00	00 00	Counter reset
0C	00 00	XX YY (= counter value)	Read message counter responsible for counting messages received with checksum errors
0E	00 00	XX YY (= counter value)	Read message counter responsible for counting messages addressed to device

Example

Values 31 hex and 32 hex echoed by device address 04 hex.

Request and response (the frame format is identical)

device no.	Request code or response code	Subcode		Value of first byte	Value of second byte	CRC16	
		Hi	Lo			Lo	Hi
02 hex	08 hex	00 hex	00 hex	31 hex	32 hex	74 hex	1B hex

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

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Modbus VP12S port configuration

Access path: **[Communication]➡ [Modbus Fieldbus]**

The Modbus VP12S port can be used to configure the soft starter with SoMove DTM through Modbus RTU or to communicate a PLC.

Connection with a display terminal

To connect a display terminal to the Modbus RTU port, this configuration must be set:

- **[Modbus Baud Rate]** must be set to **[19200 bps]**.
- **[Term word order]** must be set to **[ON]**.
- **[Modbus Format]** must be set to **[8-E-1]**.

Modbus VP12S menu configuration

HMI label	Setting	
[Modbus Address] ADD	Logic address: 1771 hex = 6001 Range: 0...247 Factory setting: 0 (OFF)	Type: UINT (Unsigned16) Read/write: R/WS
Device modbus address This parameter sets the embedded Modbus soft starter address. Address 0 is reserved for broadcast.		
[Modbus Baud Rate] TBR	Logic address: 1773 hex = 6003 Factory setting: **[19200 bps]**	Type: WORD (Enumeration) Read/write: R/WS Unit: bps
Modbus baud rate This parameter sets the embedded Modbus baud rate. • **[4800 bps]** : 4,800 bauds • **[9600 bps]** : 9,600 bauds • **[19200 bps]** : 19,200 bauds • **[38.4 Kbps]** : 38,400 bauds		
[Term word order] TWO	Logic address: 1776 hex = 6006 Factory setting: **[ON]**	Type: WORD (Enumeration) Read/write: R/WS
Terminal Modbus: Word order This parameter sets the embedded Modbus terminal word order. • **[OFF]** : Low word first • **[ON]** : High word first		
[Modbus Format] TFO	Logic address: 1774 hex = 6004 Factory setting: **[8-E-1]**	Type: WORD (Enumeration) Read/write: R/WS
Modbus format This parameter sets the embedded Modbus frame format. **NOTE:** Connection to SoMove is done using the format **[8-E-1]** . • **[8-O-1]** : 8 bits odd parity 1 stop bit • **[8-E-1]** : 8 bits even parity 1 stop bit • **[8-N-1]** : 8 bits no parity 1 stop bit • **[8-N-2]** : 8 bits no parity 2 stop bits		

HMI label	Setting	
[ModbusTimeout] TTO	Logic address: 1775 hex = 6005 Range: 0.1...30 s Factory setting: 5 s	Type: UINT (Unsigned16) Read/write: R/WS Unit: 0.1 s
Modbus timeout This parameter sets the embedded Modbus communication timeout. **NOTE:** For information, the communication timeout with the display terminal is 2 seconds and cannot be modified.		
[Modbus Error Resp] SLL	Logic address: 1B62 hex = 7010 Factory setting: **[Freewheel Stop]**	Type: WORD (Enumeration) Read/write: R/WS

Response to Modbus interruption

This parameter sets the type of stop applied to the motor when a loss of communication is detected on the Modbus channel for both ports.

- **[Ignore]**: Trigger **[Modbus Com Warn]** SLLA. The warning should be assigned to a warning group in **[Warning groups config]** to be visible when triggered. Refer to Warning Messages, page 82.
- **[Freewheel Stop]**: Error **[Modbus Com Interruption]** SLF1 is triggered and motor stops in freewheel.
- **[Configured Stop]**: Motor stops according to the value set in **[Type of stop]**, **[Modbus Com Warn]** SLLA is triggered.
- **[Deceleration]**: Motor stops in deceleration and an error **[Modbus Com Interruption]** SLF1 is triggered at the end of deceleration.

⚠WARNING

LOSS OF CONTROL

If this parameter is set to **[Ignore]**, Modbus 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	–	**[Not Assigned]** NO

Product restart

For more information, refer to Product Restart, page 44.

Modbus Open Style Terminal

This menu provides the parameters to manage the communication with the open style terminal.

Access path: **[Communication]**

HMI label	Setting	
[Modbus 3 baud rate] TBR3	Logic address: 1799 hex = 6041 Factory setting: **[19200 bps]**	Type: WORD (BitString16) Read/write: R/WS Unit: bps
Modbus 3 baud rate This parameter sets the baud rate of the Open Style Terminal port. • **[4800 bps]** : 4,800 bauds • **[9600 bps]** : 9,600 bauds • **[19200 bps]** : 19,200 bauds • **[38.4 Kbps]** : 38,400 bauds		
[Term 3 word order] TWO3	Logic address: 17A4 hex = 6052 Factory setting: **[ON]**	Type: WORD (BitString16) Read/write: R/WS
Terminal Modbus 3: Word order This parameter sets the terminal of the Open Style Terminal port word order. • **[OFF]** : Low word first • **[ON]** : High word first		
[Modbus 3 format] TFO3	Logic address: 179A hex = 6042 Factory setting: **[8-E-1]**	Type: WORD (BitString16) Read/write: R/WS
Modbus 3 format This parameter sets the frame format of the Open Style Terminal port. • **[8-O-1]** : 8 bits odd parity 1 stop bit • **[8-E-1]** : 8 bits even parity 1 stop bit • **[8-N-1]** : 8 bits no parity 1 stop bit • **[8-N-2]** : 8 bits no parity 2 stop bits		

Most Common parameters

For more information about the Communication Parameter Addresses, please refer to the ATS430 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

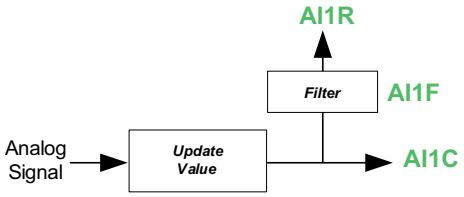
Code	Settings	
[Motor Current] LCR	Logic address: 0C84 hex = 3204	Type: UINT (Unsigned16) Read/write: R Unit: 0.1 A. or 1 A according to the soft starter rating.
Motor current RMS Motor current. Average of the three line currents based on the measurement of the fundamental of the motor line currents.		
[Motor Therm State] THR	Logic address: 259E hex = 9630	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	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	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	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	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 : "STOP" Digital inputs real image • Bit1 : "RUN" 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	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 **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	Type: INT (Signed16) Read/write: R Unit: -
Physical value AI1 This parameter is used to monitor the real value of the **[AI1]**.		
[AI1 filter] AI1F	**Setting range:** 0...10 s **Factory setting:** 0 s Logic address: 1164 hex= 4452	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	Type: INT (Signed16) Read/write: R Unit: -
Analog input 1 standardized value Real image of AI1 consumed by functions.		

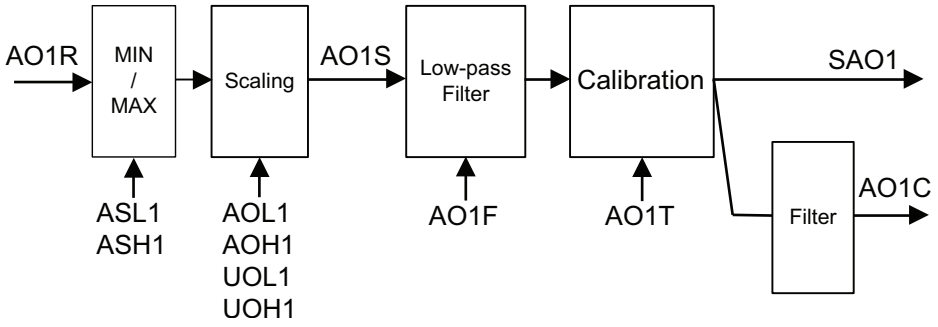
Analog outputs

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	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	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.		

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.

Operation

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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 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*** (N = 0 to 15 following profile selected) can be assigned to a specific function.
- ***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.
- Embedded display terminal.
- Embedded Modbus RTU.

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	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 Modbus RTU, use **[C1●●]**.

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	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.
- Bit15 = 1 : SoMove (via control panel).

Command Register and Status — [Standard Profile]

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Description of Operating States in [Standard Profile] 52
Command Register in [Standard Profile] 53
Status Word 54
Stop and Halt Commands 55

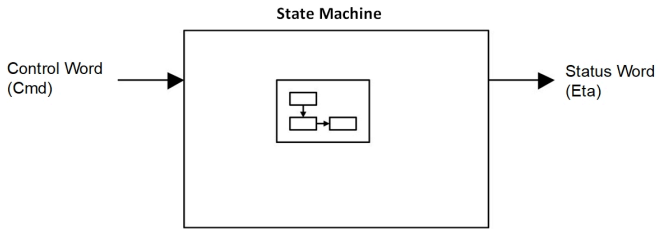
Functional Description

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:

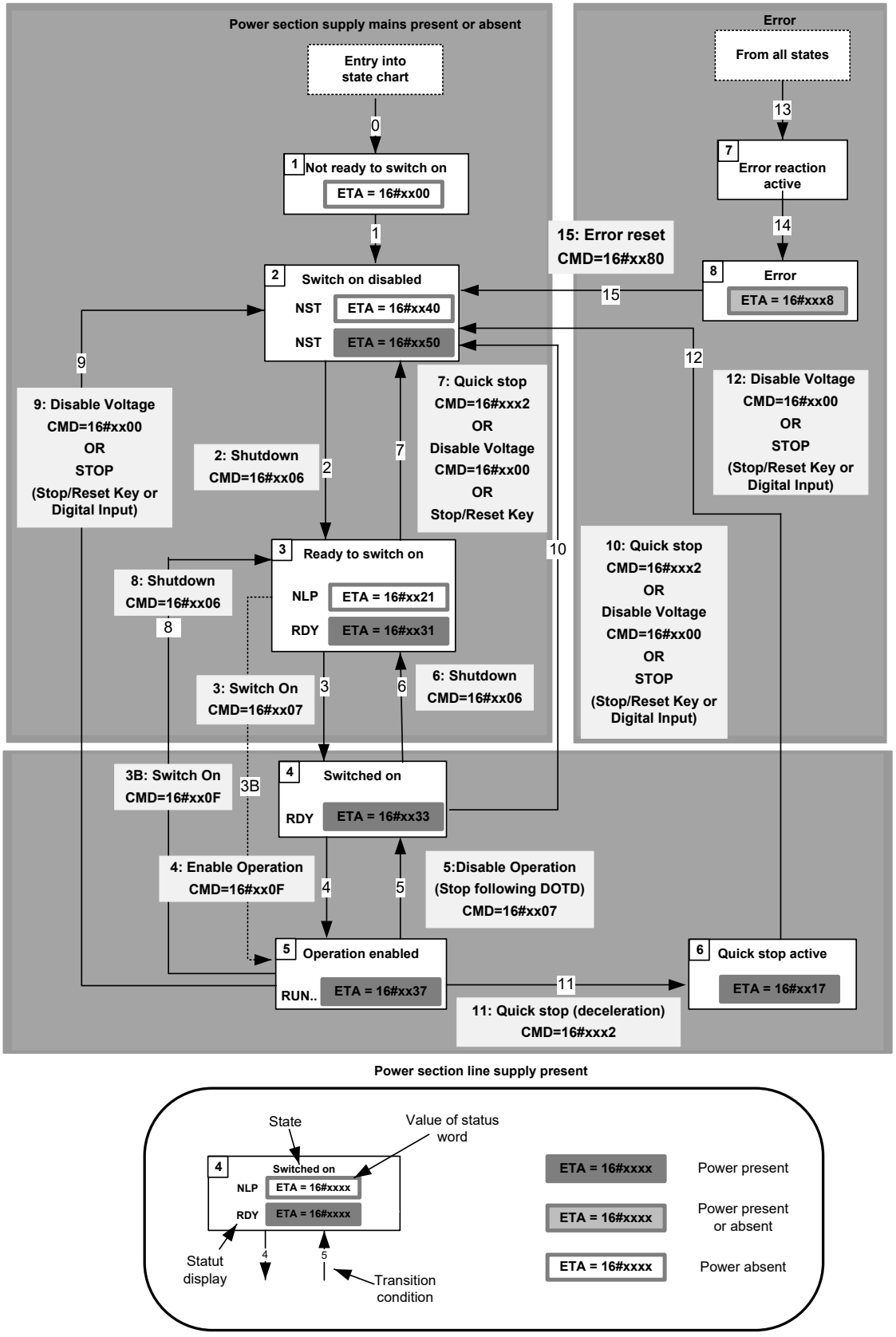


Operating State Diagram in [Standard Profile]

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.

NOTE: take into account that a phase is always present to the motor.

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 Status Word, page 54.

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]** or **[R2 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 63.

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***		***Manufacturer specific assignable***			***Decelerated stop order*** (1)	***Manufacturer specific assignable***
Bit at 0	Request not sent.						Deactivate.	
Bit at 1	Stop following **[Type of stop]**.						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	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 display terminal	**Reserved**
Bit at 0		Active.					Activate.	
Bit at 1		Not active.					Deactivate.	

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 pass 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, the digital input STOP must be connected to the +24V

Code	Settings	
[Cmd Register] CMD	Logic address: 2135 hex = 8501	Type: WORD (BitString16) Read/write: R/W
Command register • Bit0 : ***Run enable*** • Bit1 : ***Forward Direction*** • Bit2 to Bit15 : ***Free***		

A function input can be assigned to:

- A virtual input (Cd02 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 (DI3 & 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).
- **[Cy●●]**: Irrespective of the active command channel, the function can be activated / deactivated using the corresponding bit of the control word (only **[Command Switching]** only can be assigned to control words):

  A modbus control word (**[C102]** to **[C115]**).

Bit	Fixed assignments		
	Virtual Inputs	Terminals	Modbus
bit 0	-	-	-
bit 1	-	-	-
bit 2	Cd02	DI3	C102
bit 3	Cd03	DI4	C103
bit 4	Cd04	-	C104
bit 5	Cd05	-	C105
bit 6	Cd06	-	C106
bit 7	Cd07	-	C107

Bit	Fixed assignments		
	Virtual Inputs	Terminals	Modbus
bit 8	Cd08	-	C108
bit 9	Cd09	-	C109
bit 10	Cd10	-	C110
bit 11	Cd11	-	C111
bit 12	Cd12	-	C112
bit 13	Cd13	-	C113
bit 14	Cd14	-	C114
bit 15	Cd15	-	C115

Switched assignment

When **[Control Mode]** is set to **[I/O profile]**, the transition of the active command channel to fieldbus will create an immediate start if a run command is active on the **[Cmd Register]** CMD.

⚠WARNING

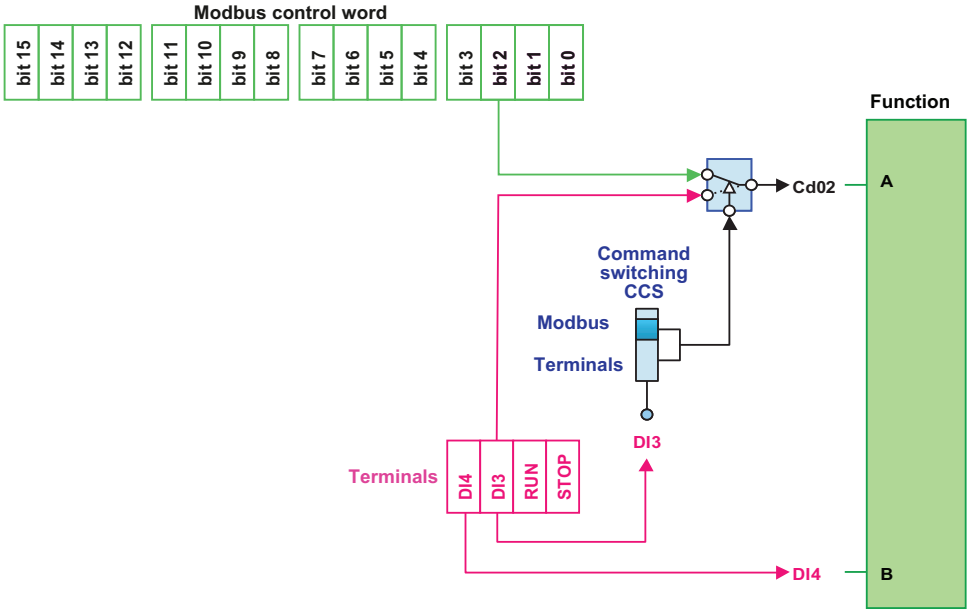
UNANTICIPATED EQUIPMENT OPERATION

- 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.

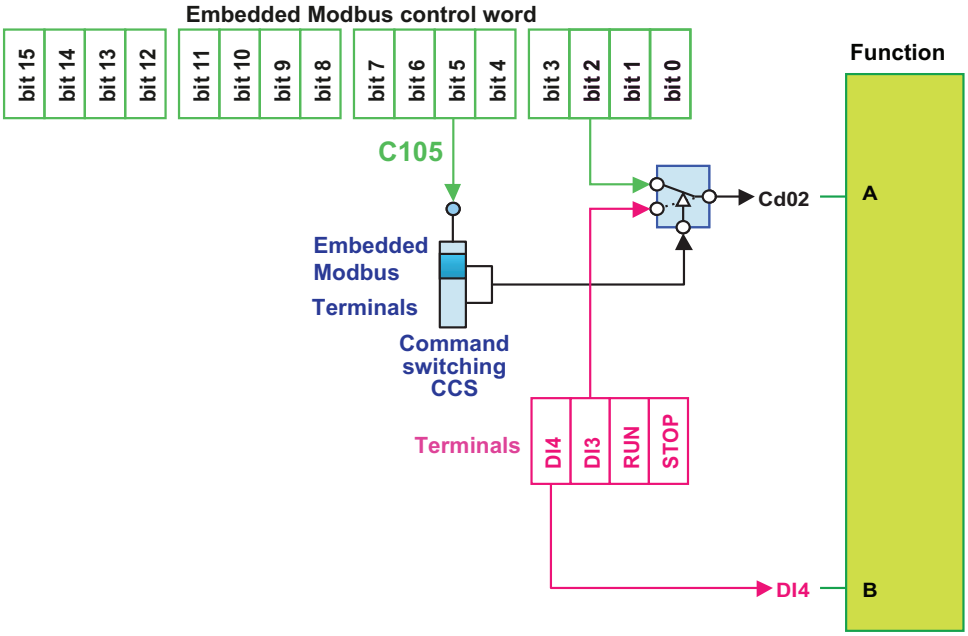
Example with:

- **[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]** = **[Embedded Modbus]**.
- **[Cmd channel 2]** = **[Terminal]**.



Example with:

- **[Command Switching]** managed by control word (here **C105**).
- A function assigned to a switched bit (here **CD02**).
- B function assigned to a digital input (here **DI4**).
- **[Cmd channel 1]** = **[Embedded Modbus]**.
- **[Cmd channel 2]** = **[Terminal]**.



When a function is assigned to a switched bit (Cd02 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 **[C105]** 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.

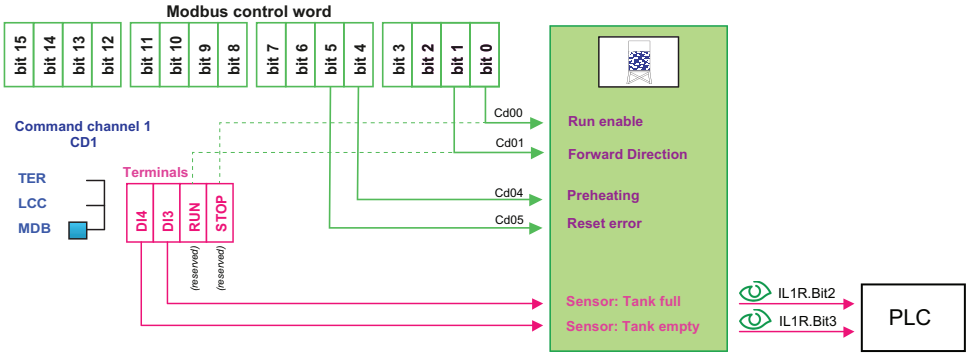
The soft starter is used to manage some functions as anti-jam.

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

Configuration

- **[Control Mode]** is set to **[I/O profile]**.
- **[Preheating Assign]** set to **[CD04]**
- **[Fault Reset Assign]** set to **[CD05]**
- **[Cmd channel 1]** set to **[Modbus]**.

Configuration schematic diagram:



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

In our example:

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

➡ Digital inputs STOP and RUN cannot be assigned.

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

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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	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	Bit 13	Bit 14	Bit 15
Function	***Reserved***					***Lock device when motor stopped***	***Reserved*** (must always be set to 0).	***Disable parameter consistency check***
Bit at 0						Deactivate.		All parameters are validated.
Bit at 1						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	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***	***Reserved***	***Starter in continuous operation***	***Thermal overload warning***:
Bit at 0	Not active.		Transient state.	Threshold for the active motor not reached.
Bit at 1	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***:		***Reserved***
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		
Bit at 1	Active.			

Starting Sequence

What's in This Chapter

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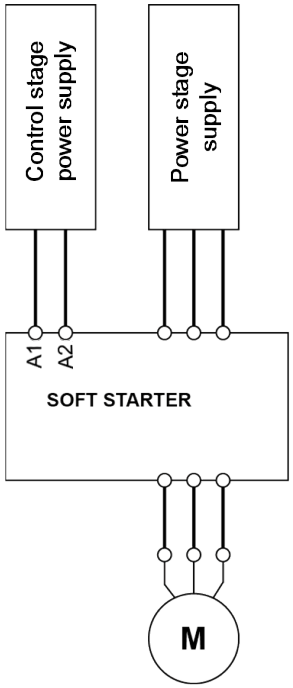
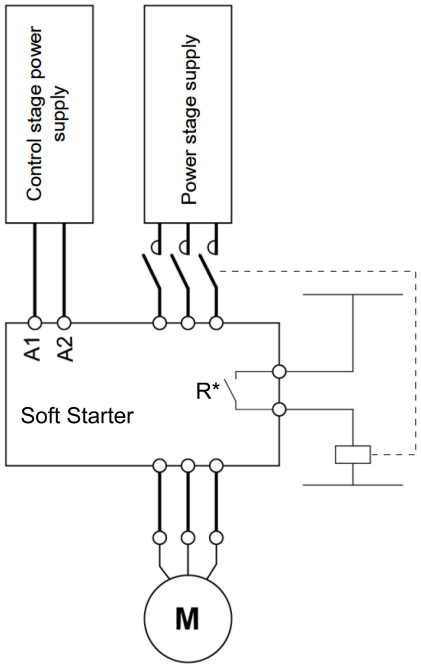
Sequence for a Soft starter with Mains Contactor Control 67

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 or **[R2 Assignment]** R2 is set to **[Mains Contactor]**.

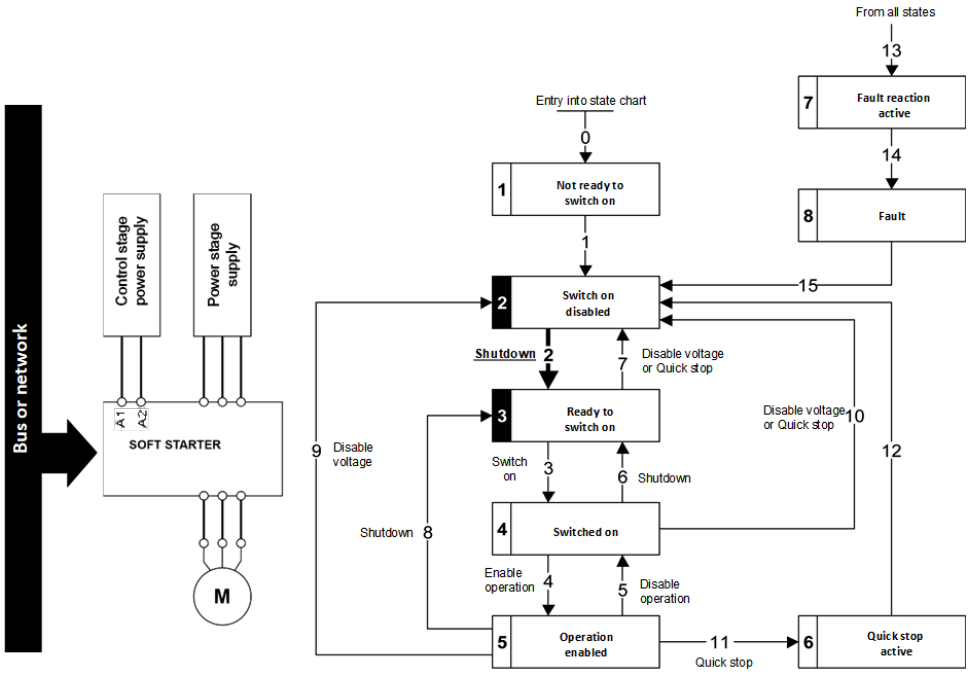
Sequence for a Soft starter

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 **[Modbus]** and active.
- The power stage supply is not necessarily present.
- Apply the *2 - Shut down* transition command.

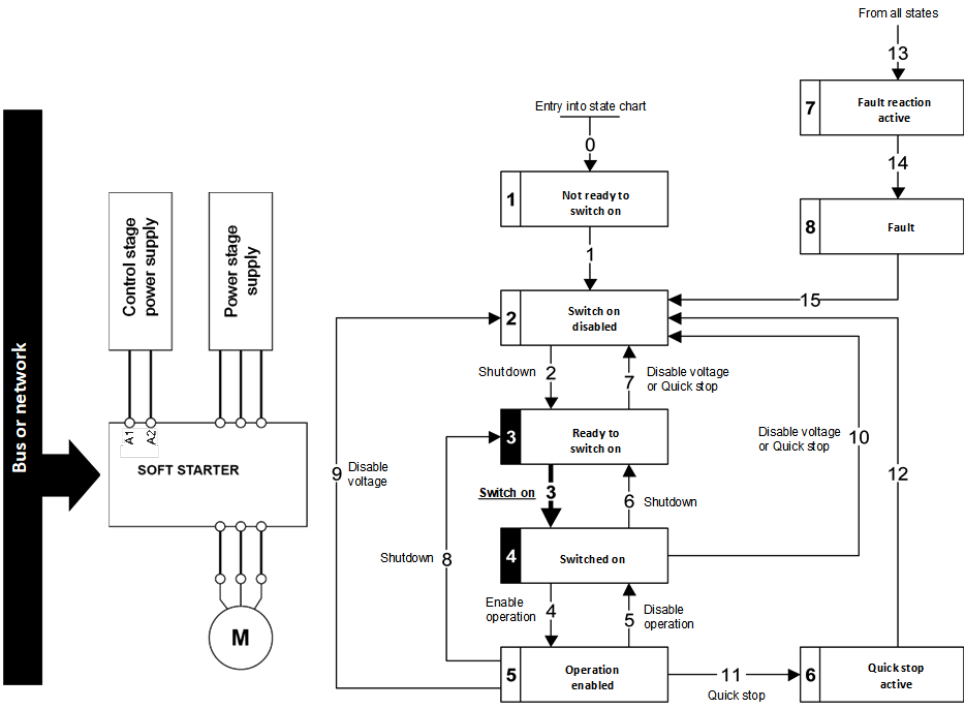


Step 2

- 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

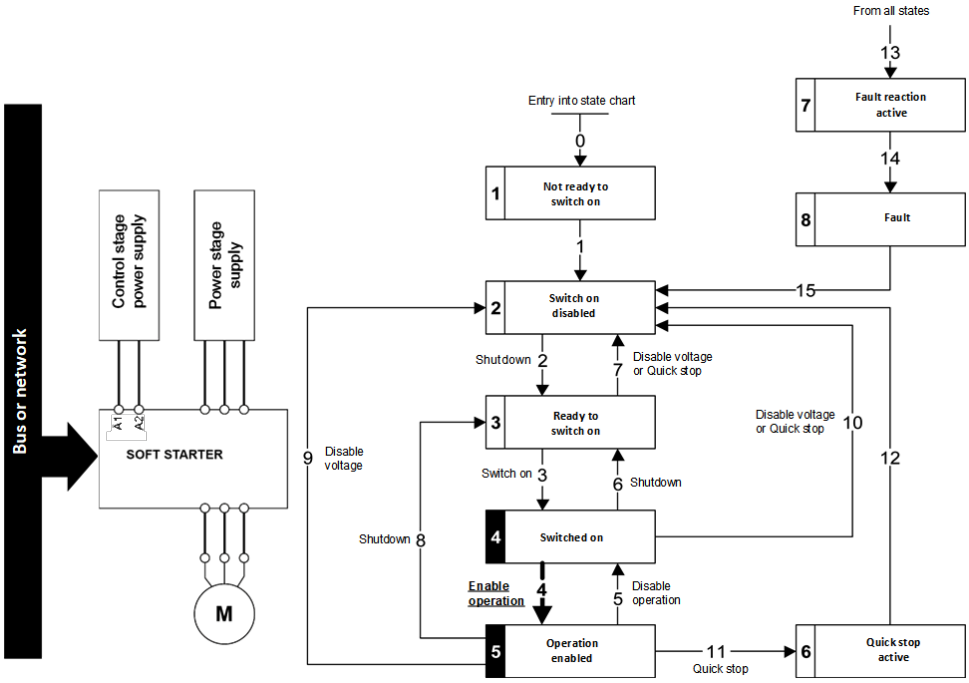
- Apply the *3 - Switch on* transition command



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.



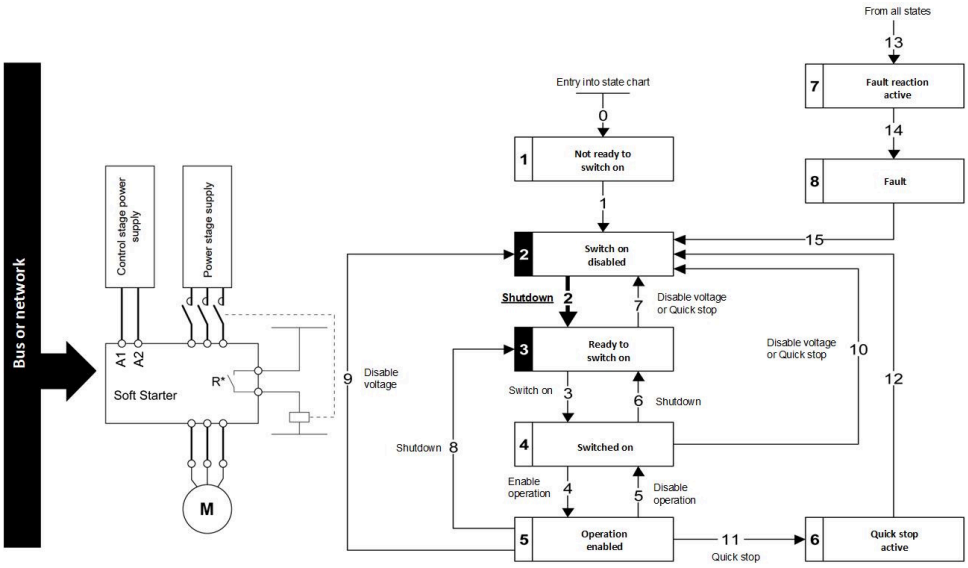
Sequence for a Soft starter with Mains Contactor Control

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 **[Modbus]** and active.
- The power stage supply is not present as the mains contactor is not being controlled.
- Apply the *2 - Shut down* transition command.

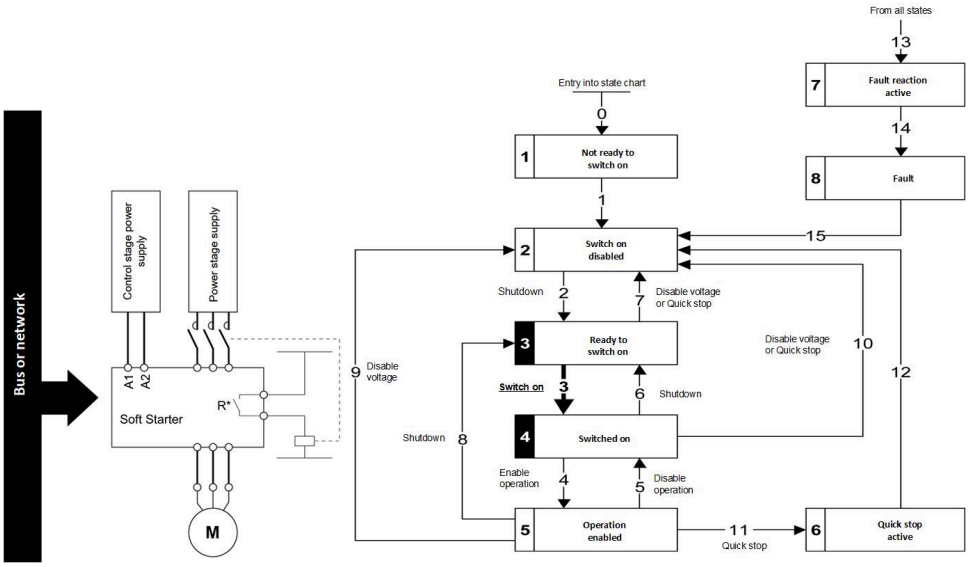


Step 2

- 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.

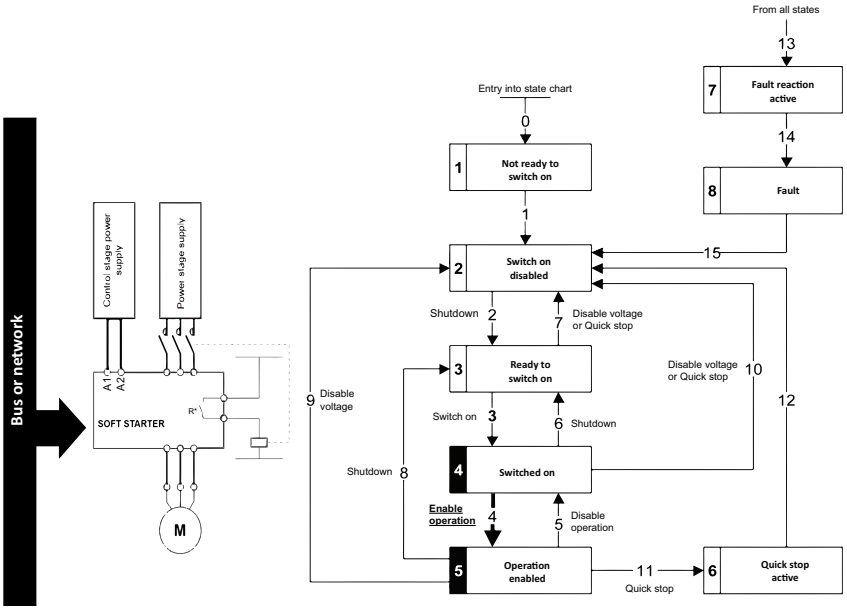


Step 3

- 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.



Communication Scanner

Local Configuration of the Communication Scanner

The communication scanner is useful when used in combination by the Modbus controller device with the function `Read/Write Multiple registers`: 23 (17 hex), which provides in a single telegram a read multiple registers and a write multiple registers. The detail of the function 23 is described in the supported Modbus functions.

The communication scanner **[Com. scanner input]** and **[Com. scanner output]** are accessible via the menu **[Communication]**.

An NCAx or NMAx parameter with a value of zero is not linked to a parameter in the soft starter.

The following table displays the list of Communication Scanners configuration parameters:

Sub Menu	Parameter description	Default assignment	Modbus address xxxxx (dec.) xxxx hex
[Com. scanner input] `ICS`	**[Scan. IN1 address]** `NMA1` Source address of the 1st input word	**[Status Register]** `ETA` (@3201)	12701 319D hex
	[Scan. IN2 address] `NMA2` Source address of the 2nd input word	**[Motor Current]** `LCR` (@3204)	12702 319E hex
	[Scan. IN3 address] `NMA3` Source address of the 3rd input word	**[Motor Therm State]** `THR` (@9630)	12703 319F hex
	[Scan. IN4 address] `NMA4` Source address of the 4th input word	**[CiA402 Error Code]** `ERRD` (@8606)	12704 31A0 hex
	[Scan. IN5 address] `NMA5` Source address of the 5th input word	0	12705 31A1 hex
	[Scan. IN6 address] `NMA6` Source address of the 6th input word	0	12706 31A2 hex
	[Scan. IN7 address] `NMA7` Source address of the 7th input word	0	12707 31A3 hex
	[Scan. IN8 address] `NMA8` Source address of the 8th input word	0	12708 31A4 hex

Sub Menu	Parameter description	Default assignment	Modbus address xxxxx (dec.) xxxx hex
[Com. scanner output] OCS	**[Scan.Out1 address]** NCA1 Destination address of the 1st output word	**[Cmd Register]** CMD (@8501)	12721 31B1 hex
	[Scan.Out2 address] NCA2 Destination address of the 2nd output word	0	12722 31B2 hex
	[Scan.Out3 address] NCA3 Destination address of the 3rd output word	0	12723 31B3 hex
	[Scan.Out4 address] NCA4 Destination address of the 4th output word	0	12724 31B4 hex
	[Scan.Out5 address] NCA5 Destination address of the 5th output word	0	12725 31B5 hex
	[Scan.Out6 address] NCA6 Destination address of the 6th output word	0	12726 31B6 hex
	[Scan.Out7 address] NCA7 Destination address of the 7th output word	0	12727 31B7 hex
	[Scan.Out8 address] NCA8 Destination address of the 8th output word	0	12728 31B8 hex

Monitoring the Communication Scanner

It is also possible to monitor the value of the parameters which has been configured in the communication scanner. This monitored values (**[Com. scanner input map]** and **[Com scan output map]**) are accessible via modbus address.

The following table displays the list of Communication Scanner monitoring parameters:

Sub Menu	Parameter description	Default assignment	Modbus address xxxxx (dec.) xxxx hex
[Com. scanner input map] ISA	**[Com Scan In1 val.]** NM1 Source value of the 1st input word	**[Status Register]** ETA (@3201)	12741 31C5 hex
	[Com Scan In2 val.] NM2 Source value of the 2nd input word	**[Motor Current]** LCR (@3204)	12742 31C6 hex
	[Com Scan In3 val.] NM3 Source value of the 3rd input word	**[Motor Therm State]** THR (@9630)	12743 31C7 hex
	[Com Scan In4 val.] NM4 Source value of the 4th input word	**[CiA402 Error Code]** ERRD (@8606)	12744 31C8 hex
	[Com Scan In5 val.] NM5 Source value of the 5th input word	0	12745 31C9 hex
	[Com Scan In6 val.] NM6 Source value of the 6th input word	0	12746 31CA hex
	[Com Scan In7 val.] NM7 Source value of the 7th input word	0	12747 31CB hex

Sub Menu	Parameter description	Default assignment	Modbus address xxxxx (dec.) xxxx hex
	[Com Scan In8 val.] NM8 Source value of the 8th input word	0	12748 31CC hex
[Com scan output map] OSA	**[Com Scan Out1 val.]** NC1 Destination address of the 1st output word	**[Cmd Register]** CMD (@8501)	12761 31D9 hex
	[Com Scan Out2 val.] NC2 Destination address of the 2nd output word	0	12762 31DA hex
	[Com Scan Out3 val.] NC3 Destination address of the 3rd output word	0	12763 31DB hex
	[Com Scan Out4 val.] NC4 Destination address of the 4th output word	0	12764 31DC hex
	[Com Scan Out5 val.] NC5 Destination address of the 5th output word	0	12765 31DD hex
	[Com Scan Out6 val.] NC6 Destination address of the 6th output word	0	12766 31DE hex
	[Com Scan Out7 val.] NC7 Destination address of the 7th output word	0	12767 31DF hex
	[Com Scan Out8 val.] NC8 Destination address of the 8th output word	0	12768 31E0 hex

Monitoring of Communication Channel

Communication channels are monitored if they are involved in the control word **[Cmd Register]** from the active command channel.

As soon as this register has been written once to a communication channel, it activates monitoring for that channel.

If an interruption of communication is triggered in accordance with the protocol criteria by a monitored port, the soft starter react according to **[Modbus Error Resp]** configuration, refer to Configuring Communication Error Response, page 78 for more information.

If an interruption of communication is triggered on a channel that is not being monitored, the soft starter does not trigger a communication error/warning.

Modbus Network Diagnostics

Used for the Modbus serial communication port at the bottom of the control block.

Access path: **[Communication]**

[Modbus network diag] menu

HMI label	Setting	Factory setting
[COM LED] MDB1	–	–
COM LED View of the Modbus communication LED.		
[Mdb Frame Nb] M1CT	Logic address: 177B hex = 6011 Range: 0...65535	Type: UINT (Unsigned16) Read/write: R Unit: bps
Mdb frame number Indicate the number of Modbus frames send or received. The counter counts both correct and incorrect frames. ***Mdb frame number*** is modulo 65 536 counters, this means that, the value is reset to zero once the value of 65 535 is reached.		
[Mdb CRC errors] M1EC	Logic address: 177A hex = 6010 Range: 0...65535	Type: UINT (Unsigned16) Read/write: R
Mdb CRC errors Indicate the number of Modbus frames containing checksum errors. By contrast of **[Mdb Frame Nb]**, the **[Mdb CRC errors]** remain at 65 535 once this value is reached.		
[Mdb com stat] COM1	Logic address: FA2F hex= 64047	Type: WORD (Enumeration) Read/write: R
Modbus com. status Modbus communication status. • **[R0T0]** : Modbus no reception, no transmission • **[R0T1]** : Modbus no reception, transmission • **[R1T0]** : Modbus reception, no transmission • **[R1T1]** : Modbus reception and transmission		

In the case of these two counters (**[Mdb CRC errors]** and **[Mdb Frame Nb]**), only frames that are destined for the device and whose Modbus address is supplied by the **[Modbus Address]** parameter are counted. Broadcast frames are not counted.

[Modbus Term Diag] menu

Used for the Open Style communication port:

Access path **[Communication]** – ➡ **[Modbus Term Diag]**

HMI label	Setting	Factory setting
[COM LED] MDB3	–	–
COM LED View of the Modbus communication LED.		
[Mdb Term frames] M3CT	Logic address: 179D hex = 6045 Range: 0...65535	Type: UINT (Unsigned16) Read/write: R
Mdb TERM frames Terminal Modbus 3: number of processed frames.		
[Mdb Term CRC errors] M3EC	Logic address: 179C hex = 6044 Range: 0...65535	Type: UINT (Unsigned16) Read/write: R
Mdb TERM CRC errors Terminal Modbus 3: number of CRC errors.		
[Mdb com stat] COM3	Logic address: FA5C hex = 64092	Type: WORD (Enumeration) Read/write: R
Modbus communication status Modbus port 3 activity display: • **[R0T0]** : Modbus no reception, no transmission • **[R0T1]** : Modbus no reception, transmission • **[R1T0]** : Modbus reception, no transmission • **[R1T1]** : Modbus reception and transmission		

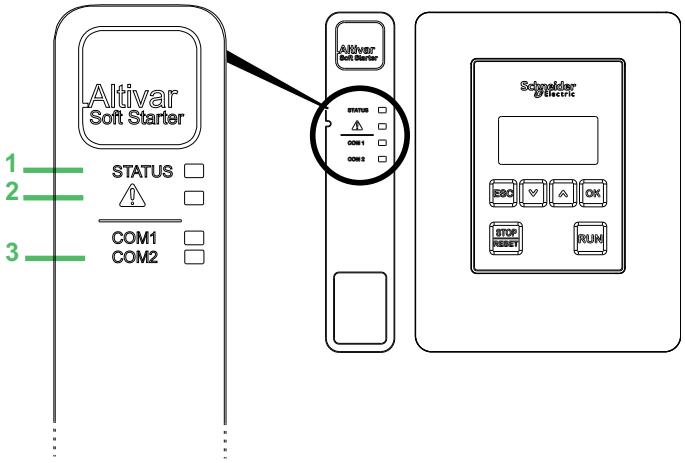
Diagnostics and Troubleshooting

What’s in This Part

Fieldbus Status LEDs 76
Configuring Communication Error Response 78
Communication troubleshooting 79
Troubleshooting 80
Warning Messages 82
Communication error codes 84

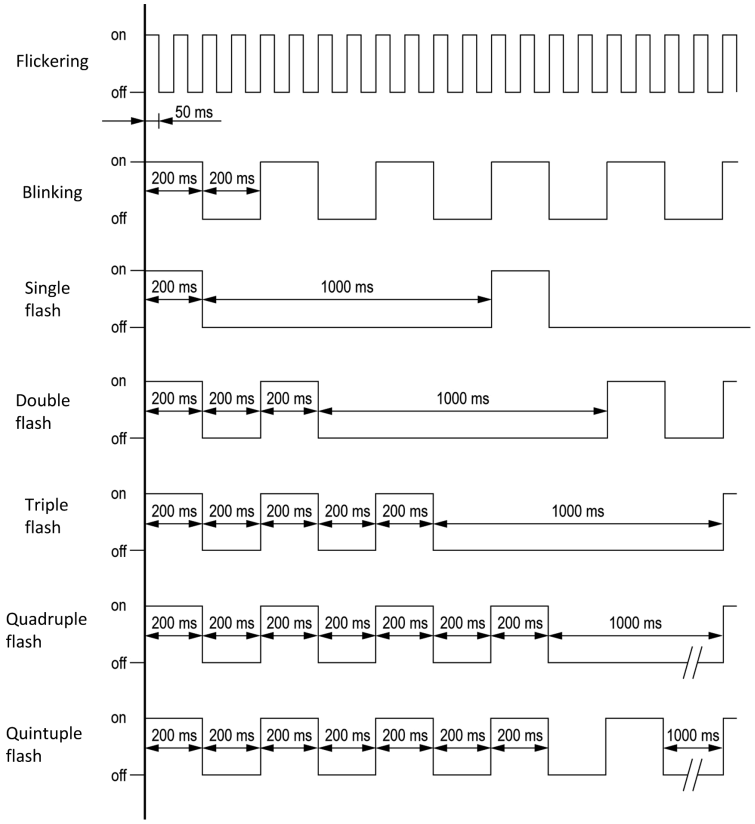
Fieldbus Status LEDs

LED Description



Item	LED	Color & status	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	**COM1**	Yellow flashing	Indicates embedded Modbus serial activity via Modbus VP12S port
	COM2	Yellow flashing	Indicates embedded Modbus serial activity via Open Style port

LED Behavior



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 **[ModbusTimeout]** parameter.

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

The values of the **[Modbus Error Resp]** parameter, which triggers a detected error **[Modbus Com Interruption]** SLF1 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.

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

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

⚠WARNING

LOSS OF CONTROL

If this parameter is set to **[Ignore]**, Modbus 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 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.

Compportment 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.

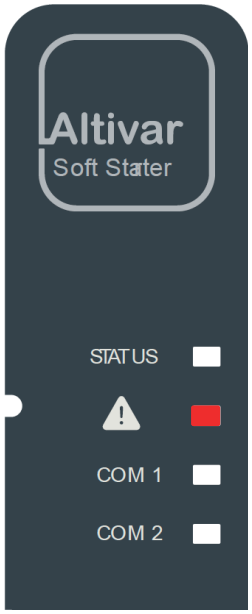
If a communication interruption appears:

1. **[ModbusTimeout]** is activated.
2. After the end of the delay of **[ModbusTimeout]**, the motor is stopped following the value set on **[Modbus Error Resp]**.
3. An error **[Modbus Com Interruption]** `SLF1` is triggered, and depending of **[Auto Fault Reset]**, **[R1 Assignment]** is deactivated (if set to **[Operating State Fault]** following the value set on **[Modbus Error Resp]**).

Troubleshooting

Soft Starter Does Not Start, Error Code Displayed

Step	Action
1	Disconnect all power, including external control power that may be present.
2	Lock all power switches in the open position.
3	Verify the absence of voltage using a properly rated voltage sensing device.
4	Find and correct the cause of the detected error. Refer to the list of possible detected errors.
5	Restore power to the soft starter to confirm that the detected error has been cleared.



When an error is triggered the Warning/Error led is red on.

The soft starter behavior can be set for the following errors:

- **[Ext Error Resp]** `EPL`
- **[Voltage Error Resp]** `MVFB`
- **[Overload ErrorResp]** `ODL`
- **[Underload ErrorResp]** `UDL`
- **[Modbus Error Resp]** `SLL`
- **[Long Start Error Resp]** `STB`
- **[AI1 Th Error Resp]** `TH1B`

For all other detected errors the soft starter stop in freewheel.

How To Clear the Error Codes?

The following table summarizes the possibilities to clear a detected error:

How to clear the error code after the cause has been removed	List of the cleared errors
Power reset: • Power reset of the soft starter. • **[Product restart]** or **[Prod Restart Assign]** used.	All detected errors.
Manual reset: Perform one of the following actions to reset the device: • Press **STOP / RESET** key, if the active command channel is the terminal. • Apply a rising edge to the digital input assigned to **[Fault Reset]** , if the active command channel is the terminal. • Activate the digital input *RUN* if **[Fault Reset]** is not assigned. Activate the digital input *RUN* a second time to start the motor. Consider the value set to the active command channel is the terminal. • In case of line channel action must be done through CMD (see the communication manual).	EPF1, OHF, OLF, SLF1, TJF, TLSF And all the error codes belonging to the following categories, after the automatic reset time is elapsed: • **Automatic reset** • **Automatic reset limited duration** • **Automatic reset limited retry and limited duration**
Automatic reset: • A series of automatic attempts are made to reset the error at given intervals for an unlimited time or number of attempts. • **[Auto Fault Reset]** must be set to **[Yes]** • In case of **[Supply Mains Overvoltage]** OSF or **[Supply Mains UnderV]** USF, the relay assigned to **[Operating State Fault]** does not open.	CLF, OSF, USF
Automatic reset limited duration: • A series of automatic attempts are made to reset the error with a maximum time for a successful automatic reset set with **[Fault Reset Time]** TAR • **[Auto Fault Reset]** must be set to **[Yes]** • At the end of the attempt, if the error is still present, the device remains in error state, and if a relay is assigned to **[Operating State Fault]**, it is opened. a **manual reset** or a **power reset** is then required.	INFB, SLF2, SLF3, T1CF, TH1F, ULF
Automatic reset limited duration and limited retry: • A series of automatic attempts are made to reset the error at given intervals for a configured time **[Fault Reset Time]** TAR before disabling the sequence if the current error persist. • **[Auto Fault Reset]** must be set to **[Yes]** • At the end of attempt, if the error is still present, the device remains in error state and if a relay is assigned to **[Operating State Fault]**, it is opened. A **manual reset** is then required. • **[Fault Reset Time]** is limited to ***3 hours***. • The error is logged only once during **[Fault Reset Time]**, the first time the error occurs. During **[Fault Reset Time]**, any new occurrence of a given error is considered a new attempt (if no other error has occurred in the meantime).	FRF, LCCF, LCF, MDDF, NOSF, OLC, OPF, PHF, PIF, SDF
Transient: • As soon as its cause has been removed.	CFF, CFI, CFI2, FWER, FWMC, FWPF, INFZ, SPFC, SPTF

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]**:

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

Setting	Code	Description
[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***.
[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***.
[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***.
[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.
[Serv. Access Auth.]	SMSA	***After-Services Access Authorized***, After Sales Services tab enabled.
[ByPass Ov.Curr Warn]	BYFA	***Bypass Contactor Overcurrent Warning***.

Communication error codes

What's in This Chapter

[Invalid Configuration] CFI 85
[Conf Transfer Error] CFI2 85
[Modbus Com Interruption] SLF1 85

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.

[Modbus Com Interruption] SLF1

Modbus communication interruption

Probable Cause	Communication interruption on the Modbus port.
Remedy	• Verify the communication bus. • Verify the timeout. • Refer to Communication troubleshooting, page 79.
Clearing the Error Code	This detected error can be cleared manually with the **[Fault Reset Assign]** parameter after its cause has been removed.

Fieldbus Integration Using Control Expert (M340)

What's in This Part

Soft Starter Configuration with SoMove 87
PLC Configuration with Control Expert 92

Introduction

The following figure shows the basic configuration to control the soft starter with a M340 PLC.

The following example is available when **[Control Mode]** is set to **[Standard Profile]**.

Soft Starter Configuration with SoMove

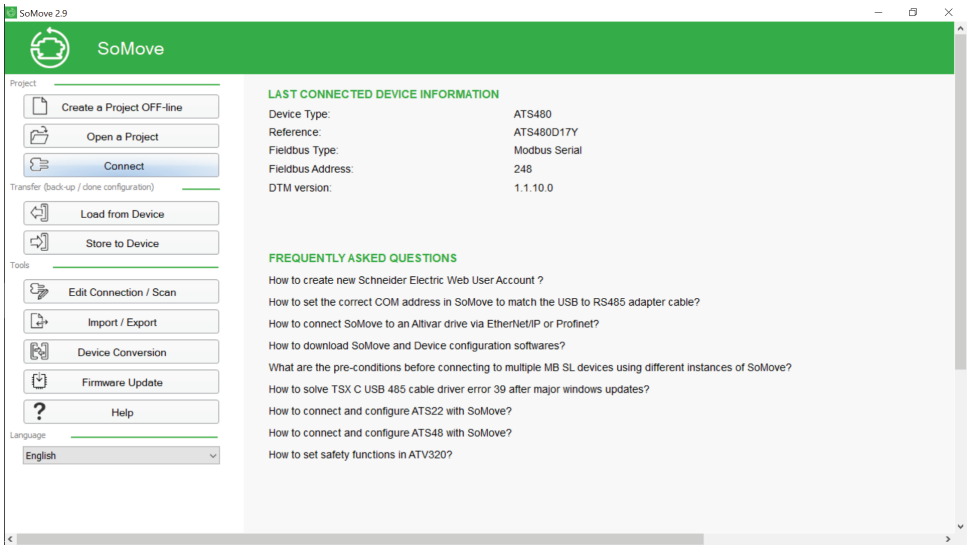
Overview

In the following example, the soft starter configuration must be done as follows in-order to establish communication between the soft starter and the PLC.

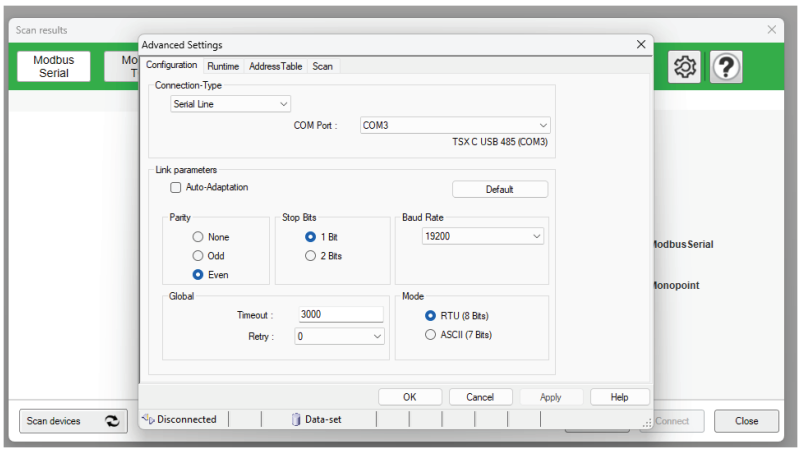
The soft starter configuration is done using the SoMove software and by downloading the DTM, page 13.

Connect to the soft starter

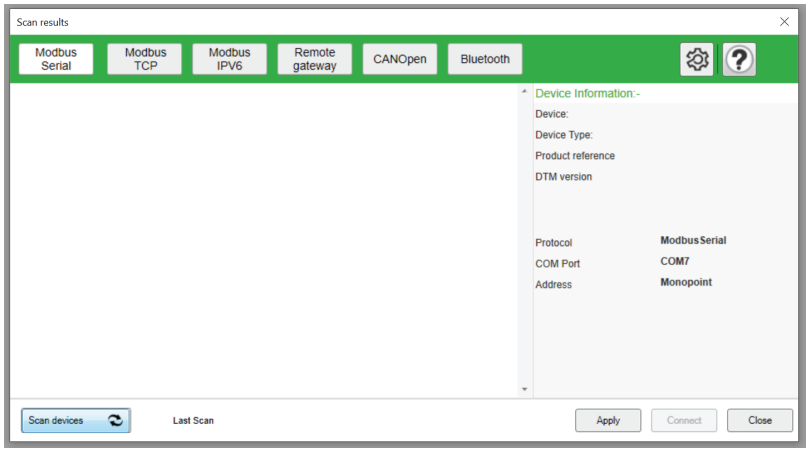
Click on **Connect**.



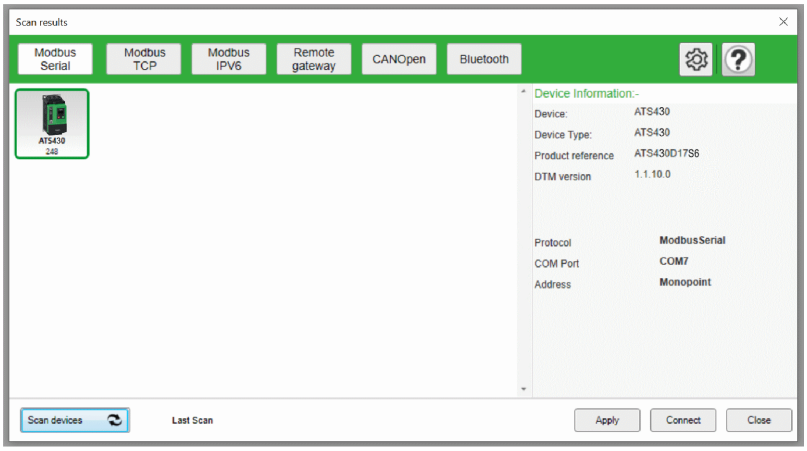
Check that the settings are good:



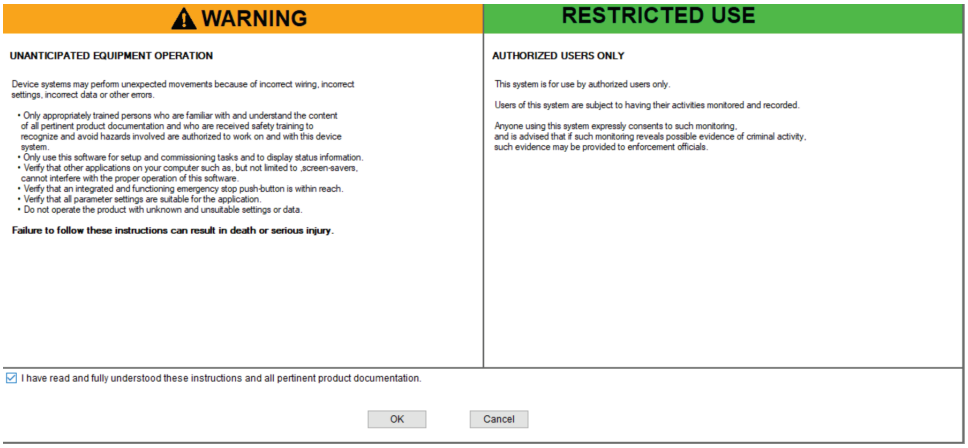
Click on **Scan devices** through **Modbus Serial**.



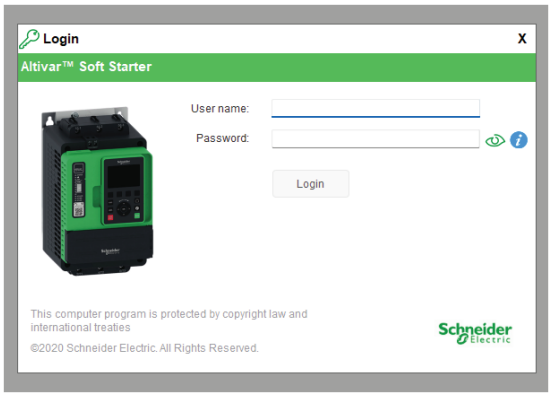
Select and connect to the ATS430D17Y.



Read and accept the following safety messages:



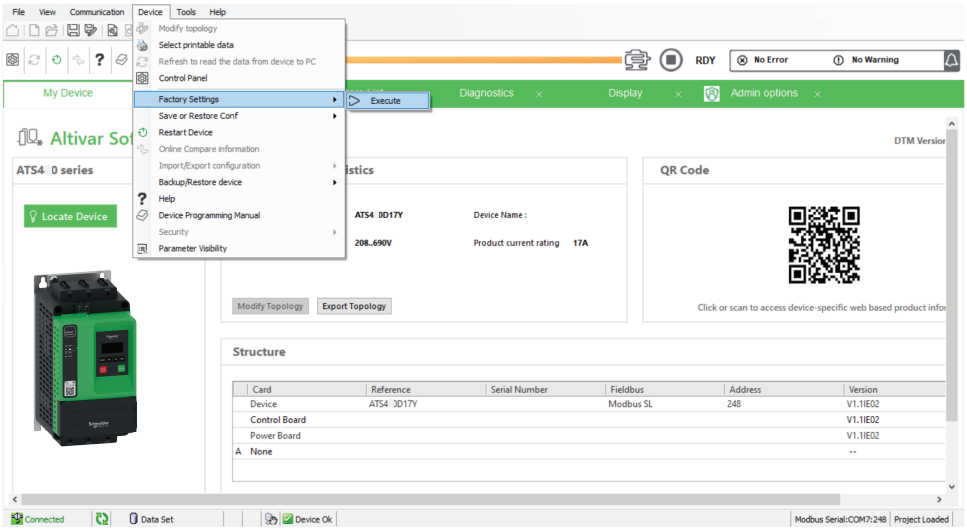
If cybersecurity protection is enabled, a login page is displayed:



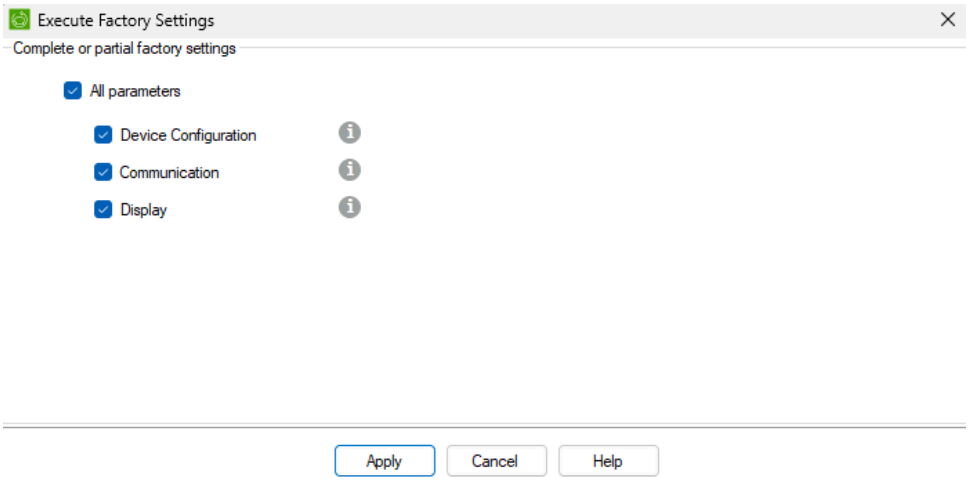
Factory Settings

To do a factory settings:

- Right click on the device, select **Device menu > Factory Settings > Execute**:

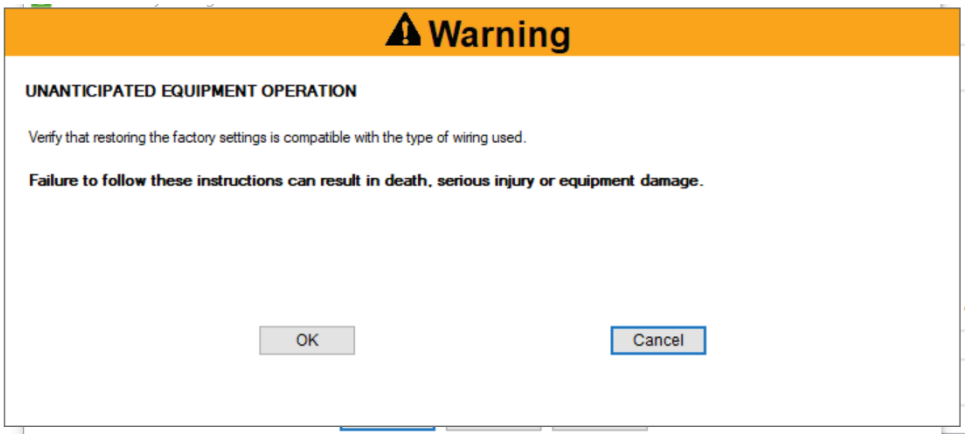


Result: Following window is displayed:



- Select **All parameters**, then click on **Apply**

Read and accept the following safety message:



Result: The factory setting is applied to the soft starter configuration

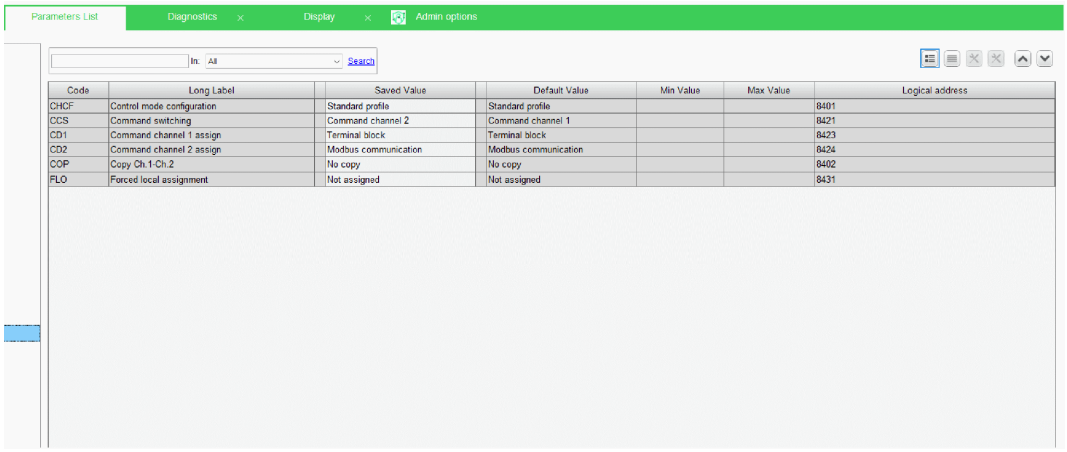
Command Configuration in [Standard Profile]

To control the soft starter with the Modbus Embedded in **[Standard Profile]**, select **Modbus Communication** as active command.

Go to:

- **Parameters List** tab
- Click on **Command channel** part

Result: Following window is displayed:



Code	Long Label	Saved Value	Default Value	Min Value	Max Value	Logical address
CHCF	Control mode configuration	Standard profile	Standard profile			8401
CCS	Command switching	Command channel 2	Command channel 1			8421
CD1	Command channel 1 assign	Terminal block	Terminal block			8423
CD2	Command channel 2 assign	Modbus communication	Modbus communication			8424
COP	Copy Ch.1-Ch.2	No copy	No copy			8402
FLO	Forced local assignment	Not assigned	Not assigned			8431

Modbus RTU Configuration

To perform the configuration of the Modbus Communication parameters of the soft starter, go to:

- **Communication, Modbus Serial – Fieldbus.**

Result: Following window is displayed:

Code	Long Label	Saved Value	Default Value	Min Value	Max Value	Logical address
ADD	Device modbus address	14	OFF	0	247	6001
TBR	Modbus baud rate	19200 bps	19200 bps			6003
TWO	Terminal Modbus: Word order	Modbus Word Order ON	Modbus Word Order ON			6006
TFO	Modbus format	8 bits even parity 1 stop bit	8 bits even parity 1 stop bit			6004
TTO	Modbus timeout	5 s	5 s	0.1 s	30 s	6005
SLL	Response to Modbus interruption	Freewheel stop	Freewheel stop			7010
Com. scanner input						
Com. scanner output						

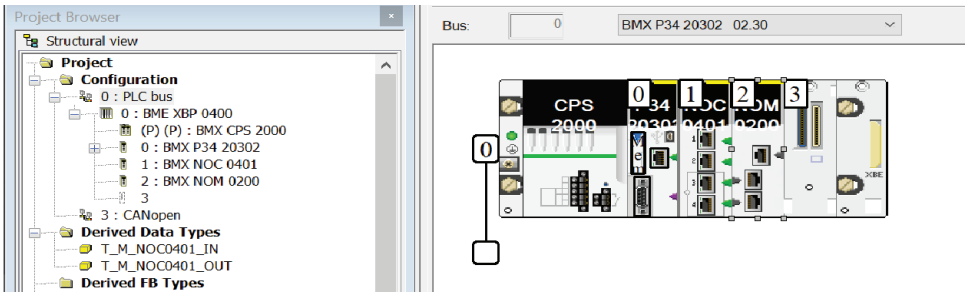
Set the**[Modbus Address]** to a selected address (here 14).

To know the address for table exchange, refers to the ATS430 Communication Parameter Addresses, page 12.

PLC Configuration with Control Expert

Create a new project

Create a new project, add the right M340 and the module Modbus RTU (BMX NOM 0200).

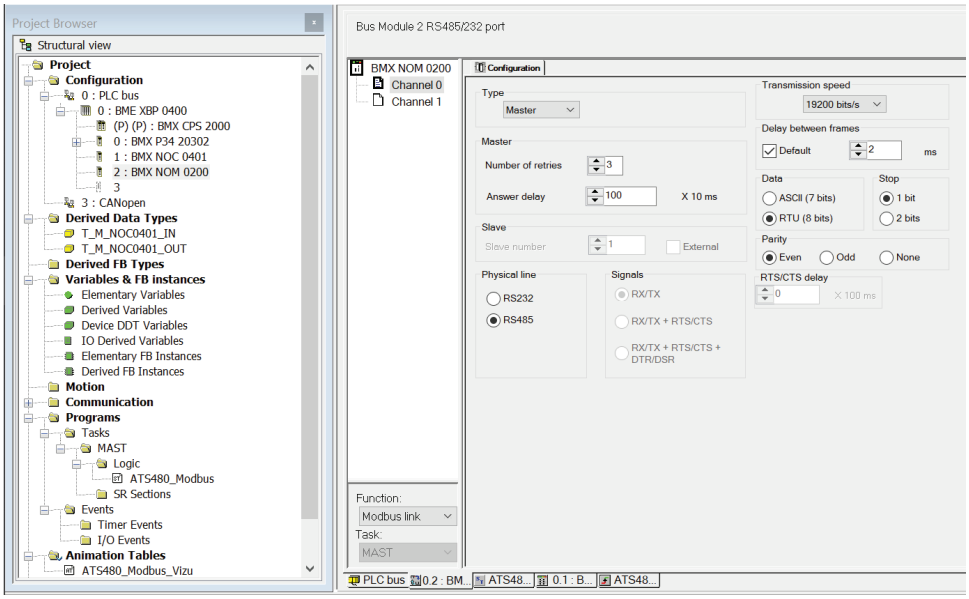


Connect a RJ45 cable between:

- a PC and the BMX P34 20302.
- a soft starter and the port RS485 of the BMX NOM 0200.

PLC Configuration

Open the Modbus RTU port configuration by double-clicking on BMX NOM 0200.

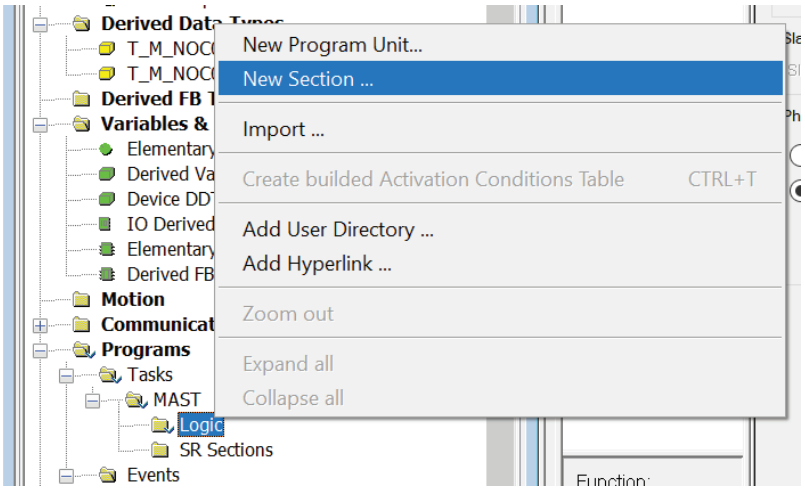


Information to be selected/checked in correspondence with the soft starter:

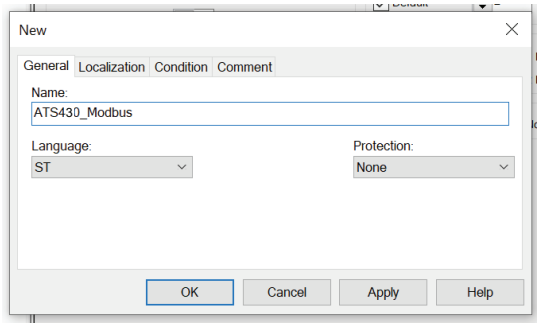
- **Type** : **Master**
- **Physical Line** : **RS485**
- **Transmission speed** : **19200 bits/s**
- **Data** : **RTU (8 bits)**
- **Parity** : **Even**
- **Stop** : **1 bit**

PLC Programming

Create a new section in **Programs** ➡ **Tasks** ➡ **MAST** ➡ **Logic**:



Enter a name of the section:



Create a program.

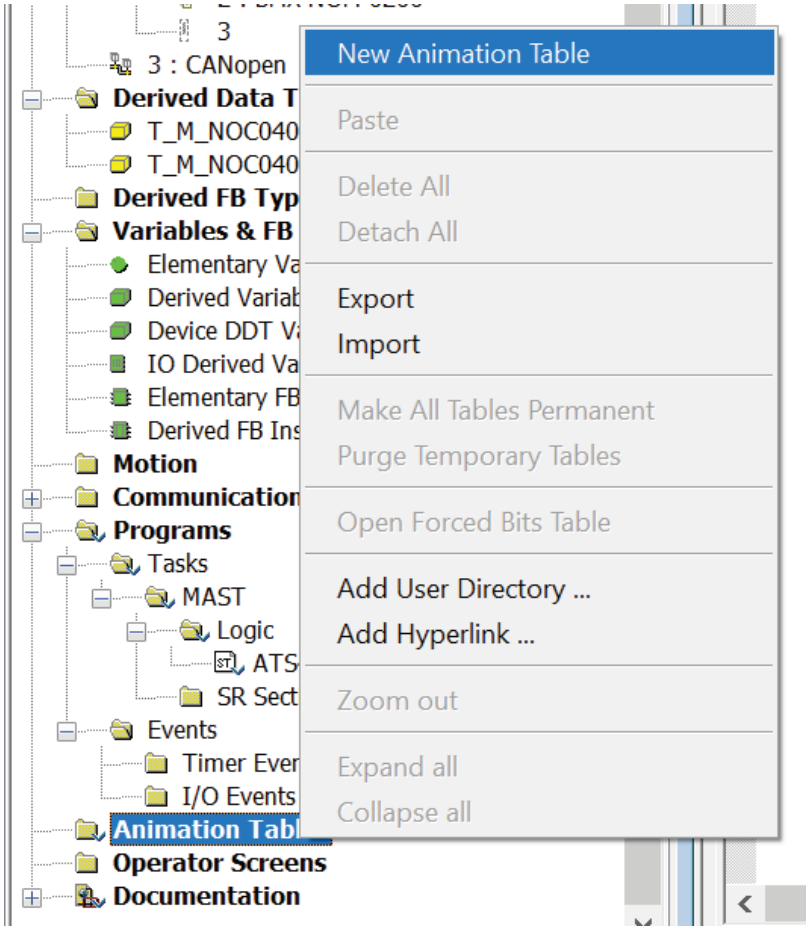
The following program is used to read the **[Acceleration]** ACC parameter:

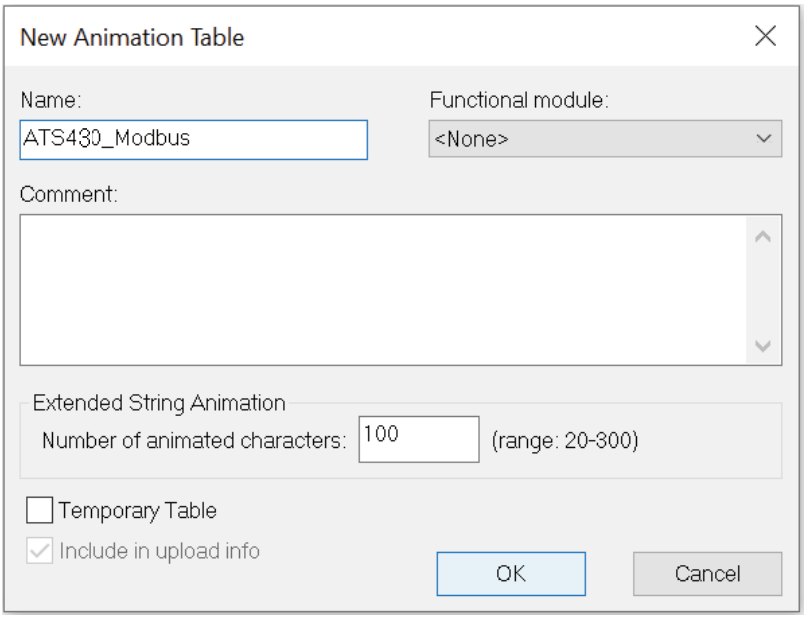
```
(* Read ACC parameter *)

if NOT Gst_Table_Read[0].0 then
Gst_Table_Read[2]:=5;(*Timeout value (x 100 ms) *)
Gst_Table_Read[3]:=2; (*Length in bytes *)
READ_VAR(ADDM('0.2.0.14'),'%MW',9060,1,Gst_Table_Read,Acc_Value);
end_if;
```

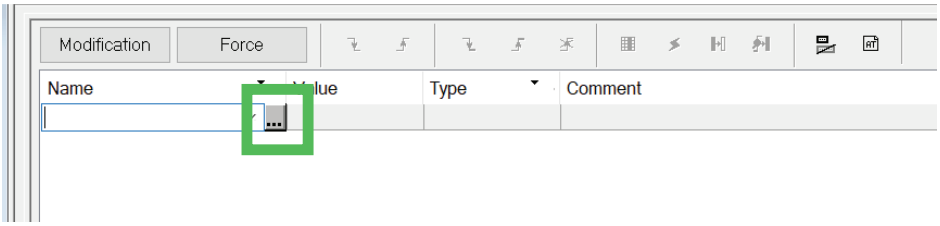
Create an animation table

To see the value, create a new animation table:



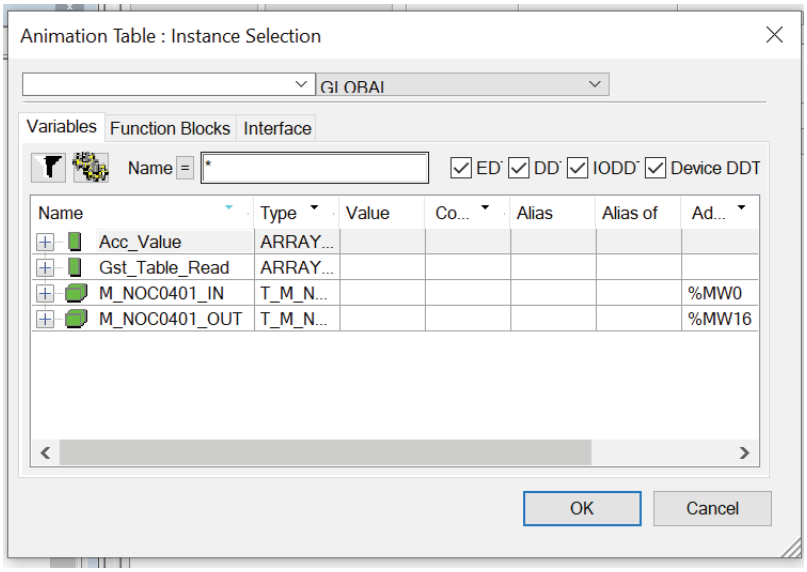


Click on the [...]:



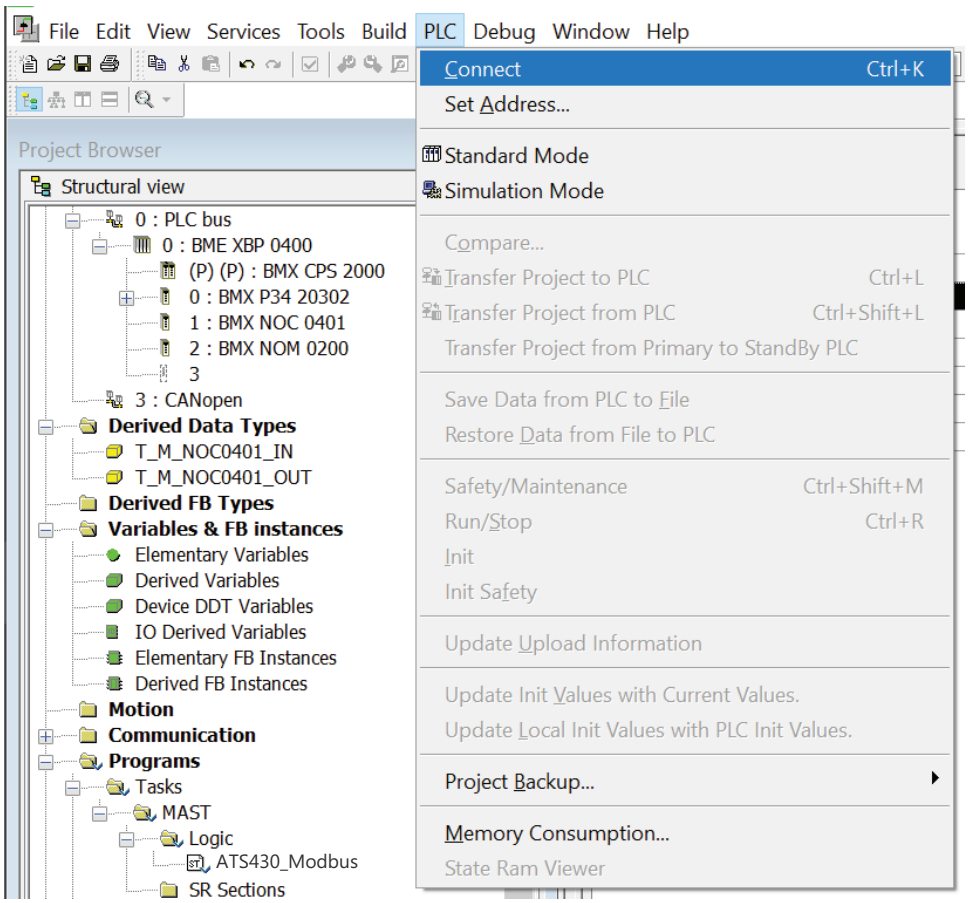
Add:

- **Acc_Value**
- **Gst_Table_Read**

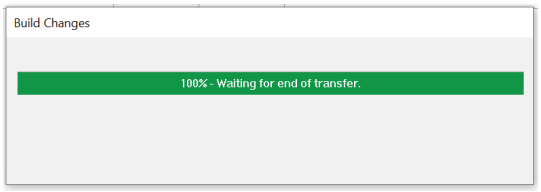


Connect the PLC

Connect the PLC:

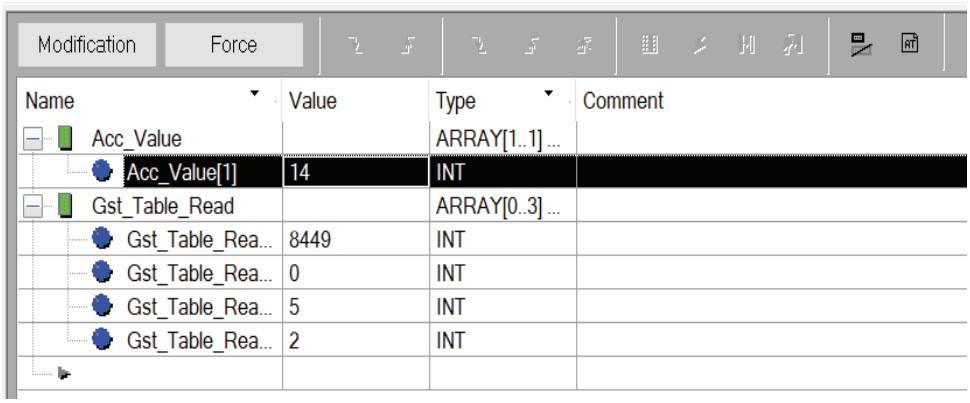


Wait for the end of transfer:

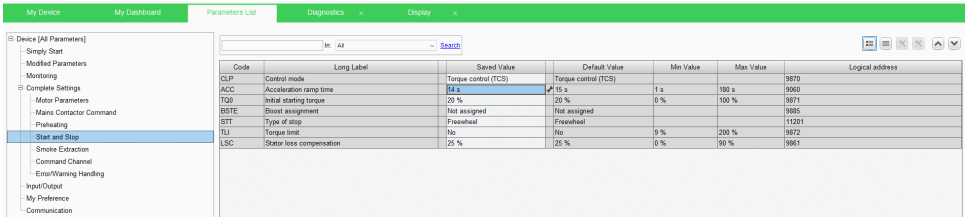


The **Animation Table** is refresh.

Wrote a value of **[Acceleration]** ACC, here 14:



Go back on SoMove, the value of **[Acceleration]** ACC is 14s.



Annex

What’s in This Part

How to interpret and react to a NST state 98
Soft Starter State 99

How to interpret and react to a NST state

Root causes of NST state

The following table provides possible root causes of NST status. Several causes can occur at the same time.

NST state	How to move from NST
Command via fieldbus	Check the CMD value. This depends on the control profile used (STD / IO) and the channel used. Refer to the communication manuals for more information.
Run order already present	Check that the digital or virtual inputs are switched back to low level before trying a new command such as preheating.
3 wire terminal	Check that the DI1 is at high level.
[Device Lock] LES	Check that the digital or virtual input assigned to **[Device Lock]** is at the right level.
HMI Stop Key	Check the HMI Stop key is not pressed.

NOTE: If a Stop command is applied via a channel different from the active command channel, the NST State is displayed as long as the RUN command from the active command channel is not removed.

Soft Starter State

List of possible soft starter states, visible on the Display Terminal.

State	Condition
Displayed error label	Detected error. The soft starter is in operating state Fault.
[Ready] RDY	No RUN command and mains supplied.
[No Mains Voltage] NLP	No RUN command and mains not supplied.
[Control Supply Loss] CLA	The warning **[Control Supply Loss]** triggers when control supply is lost, the soft starter is not running and **[Control Supply Loss]** is set to **[Warning]**
[Bypassed] BYP	Bypass active, soft starter running.
[Accelerating] ACC	Soft starter in acceleration phase.
[Decelerating] DEC	Soft starter in deceleration phase.
[Wait for Restart] TBS	Starting time delay not elapsed.
[Operating State "Fault"] FLT	Detected error. The soft starter is in operating state Fault.
[Freewheel] NST	Soft starter forced to freewheel stop by serial link.
[Current Limitation] CLI	Soft starter in current limitation.
[Motor Preheating] HEA	Motor preheating, correspond to one of the following step of the preheating sequence: • Preheating order applied but **[Time Before Preheat]** not elapsed, no preheating current injected yet • Preheating order applied and **[Time Before Preheat]** elapsed, preheating current is injected
[Small Motor Test] SST	Small motor test in progress
[Firmware Update] FWUP	Firmware update mode

When current limitation is active, the displayed value flashes.

It is still possible to modify the parameters if the soft starter detects an error.

Glossary

A

AC:

Alternating Current

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

C

Client:

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

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

CRC16:

Cyclical Redundancy Check.

D

DC:

Direct Current

dec.:

Decimal

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

M

MEI:

Modbus Encapsulated Interface

Monitoring function:

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

P

Parameter:

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

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.

S

Server:

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

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.

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

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