

Altivar ATV310

Variable speed drives for asynchronous motors and synchronous motors

Modbus Communication Manual

04/2026



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Important Information

NOTICE

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



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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

NOTICE, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in property damage.

PLEASE NOTE

The word "drive" as used in this manual refers to the controller portion of the adjustable speed drive as defined by NEC.

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.

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Before you begin

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

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

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

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

DANGER

UNINTENDED EQUIPMENT OPERATION

- Read and understand this manual before installing or operating the ATV310 drive.
- Any changes made to the parameter settings must be performed by qualified personnel.

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

WARNING

DAMAGED DRIVE EQUIPMENT

Do not operate or install any drive or drive accessory that appears damaged.

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. (a)
- 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.

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

Documentation structure

The following Altivar 310 technical documents are available on the Schneider Electric website (www.schneider-electric.com).

ATV310 Quick Start Guide [EAV96127 \(Chinese\)](#), [EAV96135 \(English\)](#)

The Quick Start Guide is delivered with the drive and describes how to wire and configure the drive to start motor quickly and simply for simple applications.

ATV310 Complete Parameters list [EAV96129 \(Chinese\)](#), [EAV96136 \(English\)](#)

This manual gives the full parameter list of the drive in english and in Chinese.

ATV310 User manual [EAV94276 \(Chinese\)](#), [EAV94277 \(English\)](#)

This manual describes how to install, program and operate the drive.

ATV310 Modbus Communication manual ([EAV94278](#))

This manual describes the assembly, connection to the bus or network, signaling, diagnostics, and configuration of the communication-specific parameters via the 7 segment LED display.

It also describes the communication services of the Modbus protocol.

This manual includes all Modbus addresses. It explains the operating mode specific to communication (state chart).

ATV310 & ATV305 Modbus parameters description file ([EAV94279](#))

All the parameters are grouped together in an Excel file with the following data:

- Code
- Name
- Modbus Addresses
- Category
- Read/write access
- Type: signed numerical, unsigned numerical, etc.
- Unit
- Factory setting
- Minimum value
- Maximum value
- Display on the 7-segment integrated display terminal
- Relevant menu
- This file offers the option of sorting and arranging the data according to any criterion chosen by the user.

CS-Best-Practices-2019-340 [7EN52-0390 \(English\)](#)

Recommended Cybersecurity Best Practices

DANGER

UNINTENDED EQUIPMENT OPERATION

- Read and understand this manual before installing or operating the ATV310 drive.
- Any changes made to the parameter settings must be performed by qualified personnel.
- The excel file does not describe the behaviour of the parameters. Before any modification, refer to the ATV310 User Manual.

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

Presentation

The Modbus socket on the ATV310 can be used for the following functions:

- Configuration
- Settings
- Control
- Monitoring

The ATV310 fc drive supports:

- The 2-wire RS485 physical layer
- The RTU transmission mode

Connection to RS485 bus

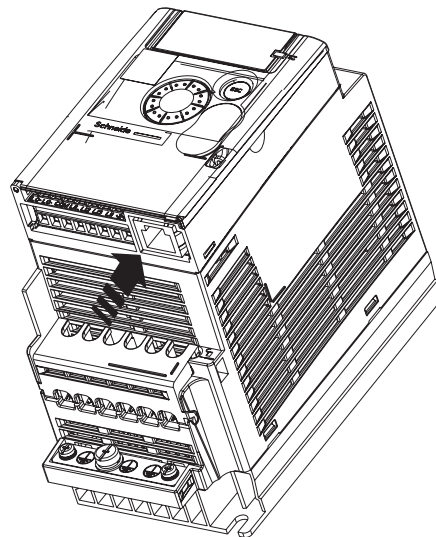
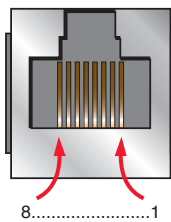
Connection to ATV310

Connection accessories should be ordered separately (please consult our catalogues).

Connect the RJ45 cable connector to the ATV310 connector.

Pin out of the ATV310 RJ45 Connector

View from underneath



| Pin | Signal |
|-----|---|
| 1 | Reserved |
| 2 | |
| 3 | |
| 4 | D1 (1) |
| 5 | D0 (1) |
| 6 | Reserved |
| 7 | VP Note: Supply for RS232 / RS485 converter or a remote terminal. |
| 8 | Common (1) |

NOTICE

RISK OF SERIAL PORT DAMAGE
Do not connect shield layer of the cable to Common (pin8).
Failure to follow these instructions can result in equipment damage.

(1) Modbus signals.

Protection against interference

- Use the Schneider Electric cable with 2 pairs of shielded twisted conductors (reference: TSXCSEA100, TSXCSEA200, TSXCSEA500).
- Keep the Modbus cable separated from the power cables (30 cm (11.8 in.) minimum).
- Make any crossovers of the Modbus cable and the power cables at right-angles, if necessary.

For more information, please refer to the TSX DG KBL E manual: "Electromagnetic compatibility of industrial networks and fieldbuses".

RS485 bus schematic

The RS485 standard allows variants of different characteristics:

- polarisation
- line terminator
- distribution of a reference potential
- number of servers
- length of bus

The new Modbus specification published on the Modbus.org site in 2002 contains precise details of all these characteristics. They are also summarised in Standard schematic section. The new Schneider Electric devices conform to this specification.

Connection to RS485 bus

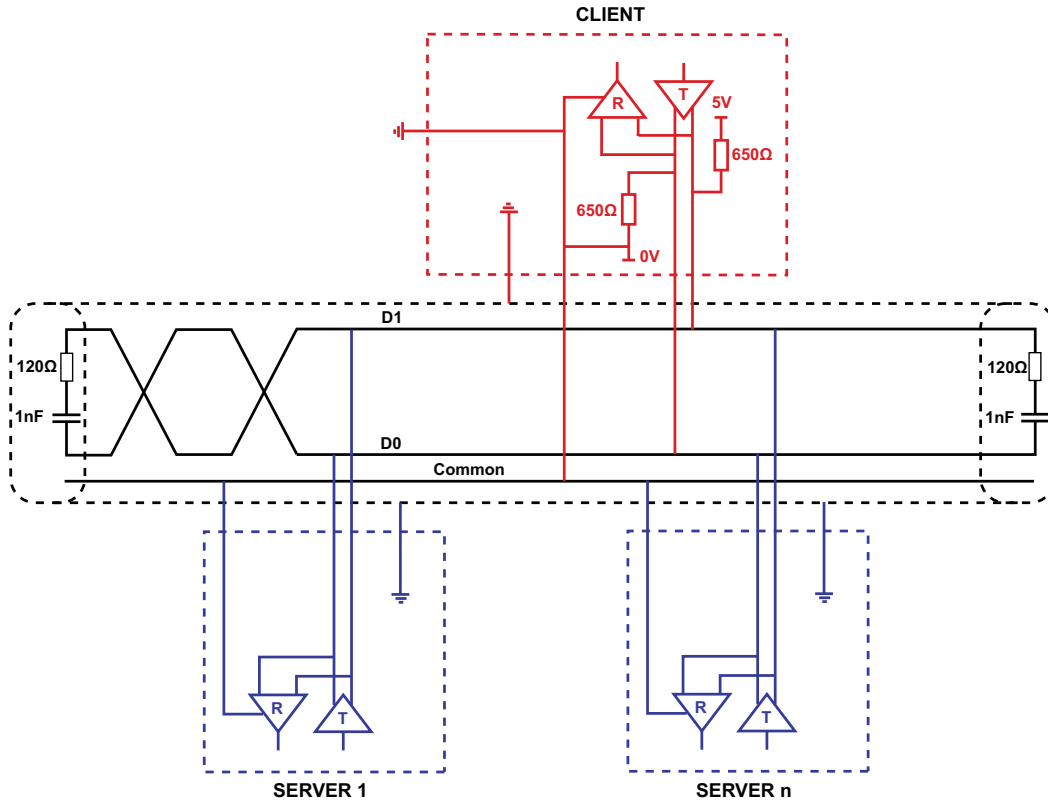
Standard schematic

The standard schematic corresponds to the Modbus specification published on the Modbus.org site in 2002 (Modbus_over_serial_line_V1.pdf, Nov 2002) and in particular to the schematic of the 2-wire multidrop serial bus.

The ATV310 drive follows this specification.

Schematic Diagram

The following is the RS485 bus schematic diagram:

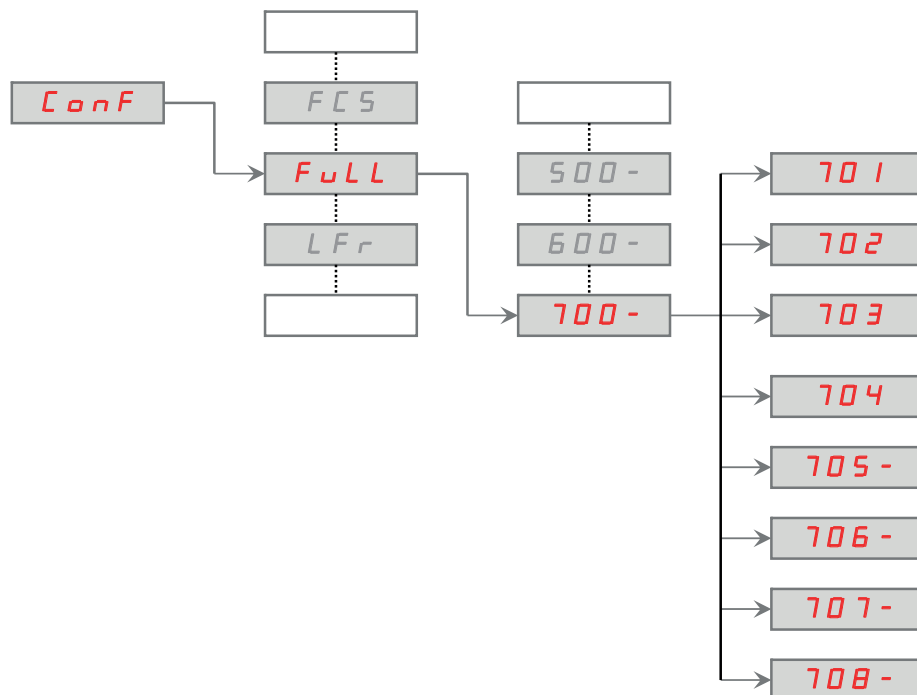


| | |
|---|--|
| Type of trunk cable | Shielded cable with 1 twisted pair and at least a 3 rd conductor |
| Maximum length of bus | 1000 m at 19200 bps |
| Maximum number of stations (without repeater) | 32 stations that are 31 servers |
| Maximum length of tap links | <ul style="list-style-type: none"> • 20 m for 1 tap link • 40 m divided by the number of tap links on a multiple junction box |
| Bus polarisation | <ul style="list-style-type: none"> • One 450 to 650 Ω pull-up resistor at 5 V (650 Ω recommended) • One 450 to 650 Ω pull-down resistor at the Common (650 Ω recommended) This polarisation is recommended for the client. |
| Line terminator | One 120 Ω 0.25 W resistor in series with a 1nF 10 V capacitor |
| 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 client device side. |

Configuration of the communication parameters

Communication Menu Structure

The communication parameters are part of the COM- submenu.
This menu is accessible as follows:



Communication configuration - Parameters description

| Parameter description | Range or listed values | default | Possible Value | Modbus address |
|---|---|-----------|--|-----------------|
| MODBUS address of the drive 701 | 1 to 247 0: OFF (broadcast only) | OFF | OFF 1...247 | 16#1771 = 06001 |
| MODBUS baud rate 702 | 4.8 kbps 9.6 kbps 19.2 kbps 38.4 kbps | 19.2 kbps | 4.8 9.6 19.2 38.4 | 16#1773 = 06003 |
| MODBUS format 703 | 8O1: 8 bits, odd parity, 1 stop bit. 8E1: 8 bits, even parity, 1 stop bit. 8N1: 8 bits, no parity, 1 stop bit 8N2: 8 bits, no parity, 2 stop bits. | 8E1 | 8O1 8E1 8N1 8N2 | 16#1774 = 06004 |
| MODBUS Time out 704 | Adjustable from 0.1 to 30s | 10.0 s | 0.1...30 | 16#1775 = 06005 |
| 705 - | Communication scanner submenus :Detailed in the next chapter | | | |
| 706 - | | | | |
| 707 - | | | | |
| 708 - | | | | |

The behaviour of the ATV310 when a time-out occurs is defined by the **611** parameter, this parameter can be found in the menu **600 -** (see User Manual [EAV94276](#) (Chinese), [EAV94277](#) (English)).

⚠ WARNING

LOSS OF CONTROL
If **Modbus fault management (611) = fault ignore (00)**, communication control will be inhibited. For safety reasons, inhibition of communication fault should only be used for adjustment or special applications purpose.

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

IO Scanner configuration parameters

Integrated communication scanner

The communication scanner is useful when used in combination by the Modbus client device with the function "Read/Write Multiple registers" : 23 (0x17), 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

Local configuration of the communication scanner

The communication scanner is accessible via the following menus : **700 -** and **705 - 706 -** submenus.

The 8 output variables and the 8 input variables are assigned by means of parameters **706.0** to **706.7** and **705.0** to **705.7**. An **706** or **705** parameter with a value of zero indicates that the parameter is not active. These 16 parameters are described in the table.

NCA or NMA defines the addresses. All these parameters are Modbus eligible addresses.

| Submenu | On the local HMI, it is parameter description | Factory setting parameter | Modbus address |
|--------------|---|---------------------------------|----------------------------------|
| 705 - | NMA1 (705.0) Source drive address of the 1st input word | Address of ETA=3201 16#0C81 | 705.0 address 16#319D = 12701 |
| | NMA2 (705.1) Source drive address of the 2nd input word | Address of RFRD=8604 16#219C | 705.1 address 16#319E = 12702 |
| | NMA3 (705.2) Source drive address of the 3rd input word | 0 | 705.2 address 16#319F = 12703 |
| | NMA4 (705.3) Source drive address of the 4th input word | 0 | 705.3 address 16#31A0 = 12704 |
| | NMA5 (705.4) Source drive address of the 5th input word | 0 | 705.4 address 16#31A1 = 12705 |
| | NMA6 (705.5) Source drive address of the 6th input word | 0 | 705.5 address 16#31A2 = 12706 |
| | NMA7 (705.6) Source drive address of the 7th input word | 0 | 705.6 address 16#31A3 = 12707 |
| | NMA8 (705.7) Source drive address of the 8th input word | 0 | 705.7 address 16#31A4 = 12708 |
| 706 - | NCA1 (706.0) Destination drive address of the 1st output word | Address of CMD=8501 16#2135 | 706.0 address 16#31B1 = 12721 |
| | NCA2 (706.1) Destination drive address of the 2nd output word | Address of LFRD=8602 16#219A | 706.1 address 16#31B2 = 12722 |
| | NCA3 (706.2) Destination drive address of the 3rd output word | 0 | 706.2 address 16#31B3 = 12723 |
| | NCA4 (706.3) Destination drive address of the 4th output word | 0 | 706.3 address 16#31B4 = 12724 |
| | NCA5 (706.4) Destination drive address of the 5th output word | 0 | 706.4 address 16#31B5 = 12725 |
| | NCA6 (706.5) Destination drive address of the 6th output word | 0 | 706.5 address 16#31B6 = 12726 |
| | NCA7 (706.6) Destination drive address of the 7th output word | 0 | 706.6 address 16#31B7 = 12727 |
| | NCA8 (706.7) Destination drive address of the 8th output word | 0 | 706.7 address 16#31B8 = 12728 |

IO Scanner configuration parameters

Monitoring the communication scanner

It is also possible to monitor the parameters value that have been configured in the communication scanner. This monitored values are accessible via the following menus : **700 -** and **707 - 708 -** submenu.

The 8 output variable values and the 8 input variable values are located into parameters **708.0** to **708.7** and **707.0** to **707.7**.

| Submenu | On the local HMI, it is parameter description | Factory setting parameter | Modbus address |
|--------------|--|---------------------------|----------------------------------|
| 707 - | NM1 (707.0) Source drive value of the 1st input word | ETA value | 707.0 address 16#31C5 = 12741 |
| | NM2 (707.1) Source drive value of the 2nd input word | RFRD value | 707.1 address 16#31C6 = 12742 |
| | NM3 (707.2) Source drive value of the 3rd input word | 0 | 707.2 address 16#31C7 = 12743 |
| | NM4 (707.3) Source drive value of the 4th input word | 0 | 707.3 address 16#31C8 = 12744 |
| | NM5 (707.4) Source drive value of the 5th input word | 0 | 705.4 address 16#31C9 = 12745 |
| | NM6 (707.5) Source drive value of the 6th input word | 0 | 705.5 address 16#31CA = 12746 |
| | NM7 (707.6) Source drive value of the 7th input word | 0 | 705.6 address 16#31CB = 12747 |
| | NM8 (707.7) Source drive value of the 8th input word | 0 | 705.7 address 16#31CC = 12748 |
| 708 - | NC1 (708.0) Destination drive value of the 1st output word | CMD value | 708.0 address 16#31D9 = 12761 |
| | NC2 (708.1) Destination drive value of the 2nd output word | LFRD value | 708.1 address 16#31DA = 12762 |
| | NC3 (708.2) Destination drive value of the 3rd output word | 0 | 708.2 address 16#31DB = 12763 |
| | NC4 (708.3) Destination drive value of the 4th output word | 0 | 708.3 address 16#31DC = 12764 |
| | NC5 (708.4) Destination drive value of the 5th output word | 0 | 708.4 address 16#31DD = 12765 |
| | NC6 (708.5) Destination drive value of the 6th output word | 0 | 708.5 address 16#31DE = 12766 |
| | NC7 (708.6) Destination drive value of the 7th output word | 0 | 708.6 address 16#31DF = 12767 |
| | NC8 (708.7) Destination drive value of the 8th output word | 0 | 708.7 address 16#31E0 = 12768 |

IO Scanner configuration parameters

Configuration example

In this example the communication scanner is configured as follow, **706.0**, **706.1**, **705.0**, **705.1** are used with their default values. **706.2** is configured with the address of **CN**, Extended control word (Modbus 8504 16#2138). **705.2** is configured with the address of **EE**, Extended status word (Modbus 3206 16#0C86).

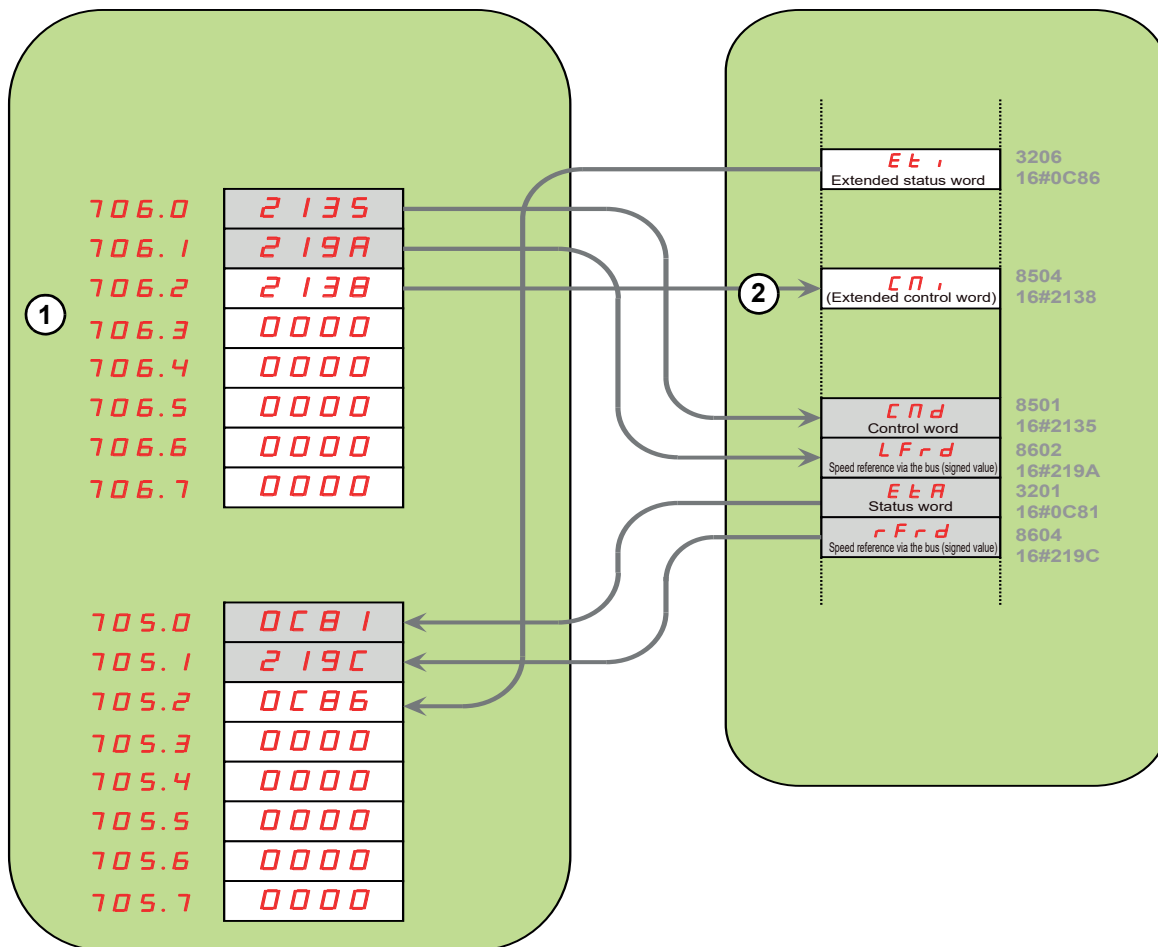
How to read the diagram below

Example for **706.2**:

706.2 (1) contain the logical address (**2138**) of **CN**, Extended control word (2)

Communication scanner

- menu **700 -**
- submenu **705 - , 706 -**



The required telegram to perform the exchange is the Modbus function 23, Obviously a sequence of requests based on Modbus functions 03 and 16 is also possible.

(See also the chapters Modbus Functions).

Modbus Functions

Modbus Protocol

The transmission mode used is RTU mode. The frame contains no message header byte, nor end of message bytes. It is defined as follows:



The data is transmitted in binary code.

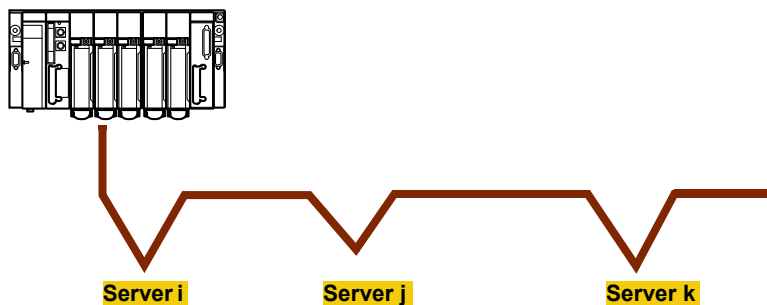
CRC16: cyclical redundancy check.

The end of the frame is detected on a silence greater than or equal to 3 characters.

Principle

The Modbus protocol is a client-server protocol.

Client



Only one device can transmit on the line at any time. The client manages the exchanges and only it can take the initiative.

It interrogates each of the servers in succession. No server can send a message unless it is invited to do so. The client repeats the question when there is an incorrect exchange, and declares the interrogated server absent if no response is received within a given time period.

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

Direct server-to-server communications are not possible.

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

Two types of dialogue are possible between client and servers:

- the client sends a request to a server and waits for its response
- the client sends a request to all servers without waiting for a response (broadcasting principle)

Addresses

- The drive Modbus address can be configured from 1 to 247.
- Address 0 coded in a request sent by the client is reserved for broadcasting. ATV310 drives take account of the request, but do not respond to it.

Supported Modbus functions

The ATV310 supports the following Modbus functions.

| Function name | Code | Description | Remarks |
|--|-------------------------|--|---|
| Read holding registers | 03 16#03 | Read N output words | Max PDU length : 63 words |
| Write one output word | 06 16#06 | Write one output word | |
| Write multiple registers | 16 16#10 | Write N output words | Max PDU length : 61 words |
| Read/write Multiple registers | 23 16#17 | Read/write multiple registers | Max PDU length : 4 words (W), 4 words (R) |
| (Sub-function) Read device Identification | 43/14 16#2B 16#0E | Encapsulated interface transport / Read device identification | |

Modbus Functions

The following paragraphs describes each supported function.

Read Holding registers

Request

| | | |
|-----------------------|---------|------------------|
| Function code | 1 Byte | 0x03 |
| Starting Address | 2 Bytes | 0x0000 to 0xFFFF |
| Quantity of Registers | 2 Bytes | 1 to 63 (0x 3F) |

Response

| | | |
|----------------|--------------|-------------|
| Function code | 1 Byte | 0x03 |
| Byte count | 1 Byte | 2 x N* |
| Register value | N* x 2 Bytes | |

*N: Quantity of Registers

Error

| | | |
|----------------|--------|---|
| Error code | 1 Byte | 0x83 |
| Exception code | 1 Byte | 01 or 02 or 03 or 04 (see details on page 19) |

Example

NOTE: Hi = high order byte, Lo = low order byte.

This function can be used to read all ATV310 words, both input words and output words.

Request

| | | | | |
|------------|--------|------------------------------|----------------------------|------------------|
| Server no. | 03 | No. of first word Hi Lo | Number of words Hi Lo | CRC16 Lo Hi |
| 1 byte | 1 byte | 2 bytes | 2 bytes | 2 bytes |

Response

| | | | | | | |
|------------|--------|----------------------|-----------------------------|-------|----------------------------|------------------|
| Server no. | 03 | Number of bytes read | First word value Hi Lo | ----- | Last word value Hi Lo | CRC16 Lo Hi |
| 1 byte | 1 byte | 1 byte | 2 bytes | | 2 bytes | 2 bytes |

Example: read 4 words W3102 to W3105 (16#0C1E to 16#0C21) in server 2, using function 3, where:

- 315 = Switching frequency = 4 kHz (W3102 = 16#0028)
- 308 = Maximum output frequency = 60 Hz (W3103 = 16#0258)
- 512.2 = High speed = 50 Hz (W3104 = 16#01F4)
- LSP = Low speed = 0 Hz (W3105 = 16#0000)

| | | | | | |
|---------|----|----|------|------|------|
| Request | 02 | 03 | 0C1E | 0004 | 276C |
|---------|----|----|------|------|------|

| | | | | | | | | |
|----------|----|----|-------------|-------|-------|-------|-------|------|
| Response | 02 | 03 | 08 | 0028 | 0258 | 01F4 | 0000 | 52B0 |
| | | | Value of: | W3102 | W3103 | W3104 | W3105 | |
| | | | Parameters: | 315 | 308 | 512.2 | 512.0 | |

Modbus Functions

Write one output word

Request

| | | |
|------------------|---------|------------------|
| Function code | 1 Byte | 0x06 |
| Register Address | 2 Bytes | 0x0000 to 0xFFFF |
| Register value | 2 Bytes | 0x0000 to 0xFFFF |

Response

| | | |
|------------------|---------|------------------|
| Function code | 1 Byte | 0x06 |
| Register Address | 2 Bytes | 0x0000 to 0xFFFF |
| Register value | 2 Bytes | 0x0000 to 0xFFFF |

Error

| | | |
|----------------|--------|---|
| Error code | 1 Byte | 0x86 |
| Exception code | 1 Byte | 01 or 02 or 03 or 04 (see details on page 19) |

Example

Request and response (the frame format is identical)

| | | | | |
|------------|--------|-------------|---------------|---------|
| Server no. | 06 | Word number | Value of word | CRC16 |
| | | Hi Lo | Hi Lo | Lo Hi |
| 1 byte | 1 byte | 2 bytes | 2 bytes | 2 bytes |

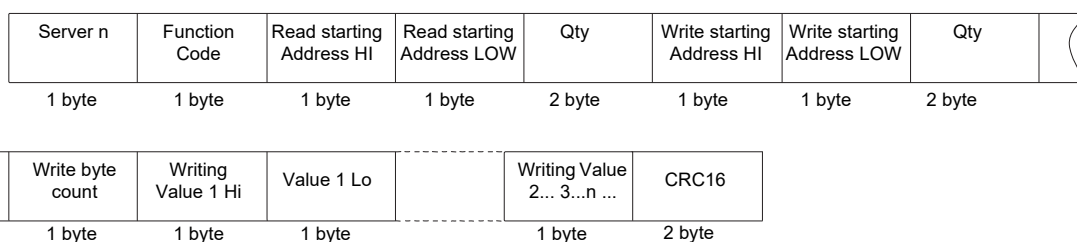
Example: write value 16#000D in word W9001 (16#2329) in Server 2 (ACC = 13 s).

| | | | | | |
|----------------------|----|----|------|------|------|
| Request and response | 02 | 06 | 2329 | 000D | 9270 |
|----------------------|----|----|------|------|------|

Read/write Multiple registers

| Description | Length in byte | Value | Comment |
|------------------------|-------------------------------------|-----------------------------|---|
| Function code | 1 | 16#17 | |
| Read starting address | 2 | 16#XXXX | Always Modbus address |
| Quantity to read | 2 | 16#03 | Contain number of holding registers to be read. |
| Write starting address | 2 | 16#XXXX | Always Modbus address |
| Quantity to write | 2 | 16#03 | Contain number of holding registers to be written. |
| Write Byte count | 1 | 16#06 | The byte count specifies the number of bytes to follow in the field Write Register Value. |
| Write Registers Value | Nx2 Bytes (N: quantity to write) | 16#XX XXXX XXXX XX | Value to be written respectively in 706.0 to 706.2, so the configured example: CMD, LFRD, CMI. |

Example



Modbus Functions

Read Device Identification

| ID | Name / Description | Type |
|------|--------------------|--------------|
| 0x00 | VendorName | ASCII String |
| 0x01 | ProductCode | ASCII String |
| 0x02 | MajorMinorRevision | ASCII String |

Example

Default values to be detailed

Request

| | | | | | | |
|------------|--------|-------------------|--------------------|-----------------|------------------|--|
| Server no. | 2B | Type of MEI 0E | ReadDeviceld 01 | Object Id 00 | CRC16 Lo Hi | |
| 1 byte | 1 byte | 1 byte | 1 byte | 1 byte | 2 bytes | |

Response

| | | | | | | |
|------------|--------|-----------------------------------|------------------------------|---|-------------------------|-------|
| Server no. | 2B | Type of MEI 0E | ReadDeviceld 01 | Degree of conformity 02 | ----- | |
| 1 byte | 1 byte | 1 byte | 1 byte | 1 byte | | |
| ----- | | Number of additional frames 00 | | Next object Id 00 | Number of objects 03 | ----- |
| | | 1 byte | | 1 byte | 1 byte | |
| ----- | | Id of object no. 1 00 | Length of object no. 1 12 | Value of object no. 1 "Schneider Electric" | | ----- |
| | | 1 byte | 1 byte | 18 bytes | | |
| ----- | | Id of object no. 2 01 | Length of object no. 2 0B | Value of object no. 2 "ATV310H037N4" | | ----- |
| | | 1 byte | 1 byte | 12 bytes | | |
| ----- | | Id of object no. 3 02 | Length of object no. 3 04 | Value of object no. 3 "0201" | | ----- |
| | | 1 byte | 1 byte | 4 bytes | | |
| ----- | | CRC16 Lo Hi | | | | |
| | | 1 byte | 1 byte | | | |

The total response size equals 50 bytes

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

- Object no. 1: Manufacturer name (always "Schneider Electric", ie. 18 bytes).
- Object no. 2: Device reference (ASCII string; *for example*: "ATV310H037N4", ie. 12 bytes).
- Object no. 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 ATV310 rather than the response described above.

Modbus Functions

Error management

Exception responses

An exception response is returned by a server when it is unable to perform the request which is addressed to it.

Format of an exception response:

| | | | | |
|------------|---------------|------------|---------|----|
| Server no. | Response code | Error code | CRC16 | |
| | | | Lo | Hi |
| 1 byte | 1 byte | 1 byte | 2 bytes | |

Response code: request function code + 16#80.

Error code:

- 1 = The function requested is not recognized by the server
- 2 = The bit or word addresses indicated in the request do not exist in the server
- 3 = The bit or word values indicated in the request are not permissible in the server
- 4 = The server has started to execute the request but cannot continue to process it completely

CRC16 calculation

The CRC16 is calculated on all the message bytes by applying the following method:

Initialize the CRC (16-bit register) to 16#FFFF.

Enter the first to the last byte of the message:

```
CRC      XOR      <byte> —> CRC
Enter    8 times
          Move the CRC one bit to the right
          If the output bit = 1, enter CRC XOR 16#A001—> CRC
          End enter
          End enter
```

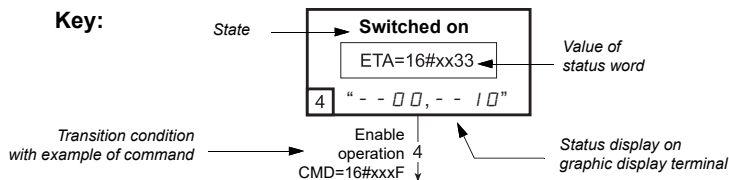
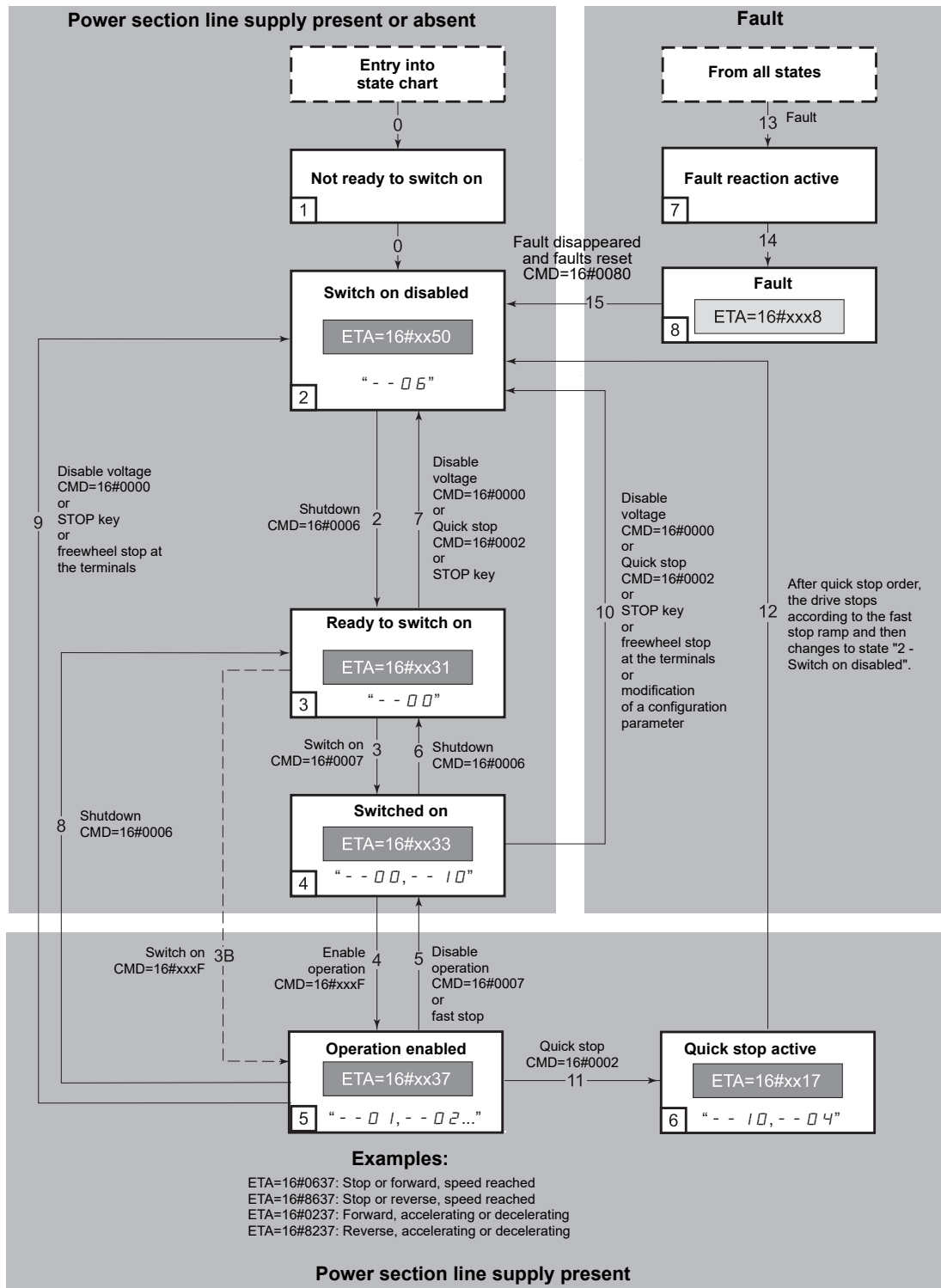
The CRC obtained will be transmitted with the low order bytes sent first, followed by the high order ones (unlike the other data contained in Modbus frames).

XOR = exclusive OR.

ATV310 Operating states

State diagram based on IEC 61800-7*

The state diagram below shows the relationships between the operation states and the state transitions, monitored by the status word (ETA) parameter, and the Command Word (CMD). CiA® and CANopen® are registered Community Trademarks of CAN in Automation e.V.
 *:Since 2007, CiA402 profile is part of the IEC standard 61800-7. Therefore DriveCom or CiA402 terminology is no more used.



ATV310 Operating states

Description of operating states

The Altivar control process using the communication bus follows IEC 61800-7 profile status chart compatible with the DRIVECOM standard. Each state represents an aspect of the internal behaviour of the drive.

This chart evolves according to whether the control word is sent (CMD W8501) or an event occurs (example: lock following malfunction). The drive status can be identified by the value of the status word (ETA W3201).

Not ready to switch on (Initialization):

Communication is being initialized.
Transient state invisible to the communication bus.

Switch on disabled (Configuration):

Initialization of the drive is complete.
The configuration and adjustment parameters can be modified. The drive is locked.

Ready to switch on and Switched on (Drive initialized):

The drive is locked.
The power stage of the drive is ready to operate, but voltage has not yet been applied to the output.
The configuration and adjustment parameters can be modified, but modifying a configuration parameter returns the drive to the "Switch on disabled" state.

Operation enabled (Operational):

The drive is unlocked and voltage can be applied to the motor terminals.
Auto-tuning (tUn) requires an injection of current. The drive must therefore be in this state to perform this command.
The adjustment parameters can be modified even if a run command or a DC injection current is present. However, a configuration parameter can only be modified if the motor is stopped, and this returns the drive to the "Switch on disabled" state.

Quick stop active (Emergency stop active):

Fast stop
Restarting is only possible after the drive has changed to the "Switch on disabled" state.

Malfunction reaction active (Reaction on fault):

Transient state during which the drive performs an action appropriate to the type of fault detection.

Malfunction (Fault):

The drive is locked.

Summary

| State | Power supplied to motor | Modification of configuration parameters |
|----------------------------|---|---|
| 1 - Not ready to switch on | No | Yes |
| 2 - Switch on disabled | No | Yes |
| 3 - Ready to switch on | No | Yes |
| 4 - Switched on | No | Yes, return to "2 - Switch on disabled" state |
| 5 - Operation enabled | Yes, except at zero reference or "halt" | No |
| 6 - Quick stop active | Yes, during fast stop | No |
| 7 - Fault reaction active | Depends on fault management configuration | - |
| 8 - Fault | No | Yes |

ATV310 Operating states

Command word description CMD - 8501

| bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
|------------------------------------|---------------|---------------|---|--|--|---|-----------|
| 0 to 1 transition : Fault reset | Reserved (=0) | Reserved (=0) | 0:Free wheel staying in "Operation Enabled" | Enable operation Drivecom state activation | Quick stop Drivecom state activation (bit active at 0) | Switch on disabled. Drivecom state activation (bit active at 0) | Switch on |

| bit 15 | bit 14 | bit 13 | bit 12 | bit 11 | bit 10 | bit 9 | bit 8 |
|----------|----------------|----------|----------|---|---------------|---------------|---|
| Reserved | Not assignable | Reserved | Reserved | Direction of rotation asked 0: Forward 1: Reverse | Reserved (=0) | Reserved (=0) | Set to 1: Halt Stop according to the [Type of stop] (5 0 2 . 0) parameter without leaving the Operation enabled state |

| Command | Transition address | Final state | bit 7 | bit 3 | bit 2 | bit 1 | bit 0 | Example value |
|-------------------|--------------------|------------------------|-------------|------------------|------------|--------------------|-----------|---------------|
| | | | Fault reset | Enable operation | Quick stop | Switch on disabled | Switch on | |
| Shutdown | 2, 6, 8 | 3 - Ready to switch on | x | x | 1 | 1 | 0 | 16#0006 |
| Switch on | 3 | 4 - Switched on | x | x | 1 | 1 | 1 | 16#0007 |
| Enable operation | 4 | 5 - Operation enabled | x | 1 | 1 | 1 | 1 | 16#000F |
| Disable operation | 5 | 4 - Switched on | x | 0 | 1 | 1 | 1 | 16#0007 |
| Disable voltage | 7, 9, 10, 12 | 2 - Switch on disabled | x | x | x | 0 | x | 16#0000 |
| Quick stop | 11 | 6 - Quick stop active | x | x | 0 | 1 | x | 16#0002 |
| | 7, 10 | 2 - Switch on disabled | | | | | | |
| Fault reset | 15 | 2 - Switch on disabled | 0 ◦ 1 | x | x | x | x | 16#0080 |

x: Value is of no significance for this command.

0 ◦ 1: Command on rising edge.

ATV310 Operating states

Status word description ETA - 3201

| bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
|---------------------|--------------------|------------------------------|---------------------------------|-----------------|-------------------|-------------|--------------------|
| Reserved (always 0) | Switch on disabled | Quick stop (bit active at 0) | Voltage enabled (bit always on) | Fault detection | Operation enabled | Switched on | Ready to switch on |

| bit 15 | bit 14 | bit 13 | bit 12 | bit 11 | bit 10 | bit 9 | bit 8 |
|---|-------------------|---------------|---------------|-------------------------------------|----------------------------------|------------------------------|---------------|
| 0: Motor rotation in forward direction (or stopped) | Stop via STOP key | Reserved (=0) | Reserved (=0) | Reference exceeded (< LSP or > HSP) | Reference reached (steady state) | Local mode (bit active at 0) | Reserved (=0) |

| Status | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 | ETA masked by 16#006F (1) |
|---------------------------|--------------------|------------|-----------------|-----------------|-------------------|-------------|--------------------|---------------------------|
| | Switch on disabled | Quick stop | Voltage enabled | Fault detection | Operation enabled | Switched on | Ready to switch on | |
| 1 -Not ready to switch on | 0 | x | x | 0 | 0 | 0 | 0 | - |
| 2 - Switch on disabled | 1 | x | x | 0 | 0 | 0 | 0 | 16#0050 |
| 3 - Ready to switch on | 0 | 1 | x | 0 | 0 | 0 | 1 | 16#0031 |
| 4 - Switched on | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 16#0033 |
| 5 - Operation enabled | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 16#0037 |
| 6 - Quick stop active | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 16#0017 |
| 7 - Fault reaction active | 0 | x | x | 1 | 1 | 1 | 1 | - |
| 8 - Fault | 0 | x | x | 1 | 0 | 0 | 0 | 16#0018 (2) or 16#0038 |

x: In this state, the value of the bit can be 0 or 1.

(1) This mask can be used by the PLC program to test the chart state.

(2) Fault following state "6 - Quick stop active".

Software Setup with MachineExpert (M241)

Connecting an ATV310 to a M241 PLC

Here is an example of an application that shows how to control an ATV310 from a M241 PLC equipped with a Modbus client serial port. You can control the drive directly via MachineExpert. The version of MachineExpert is V2.2.1.

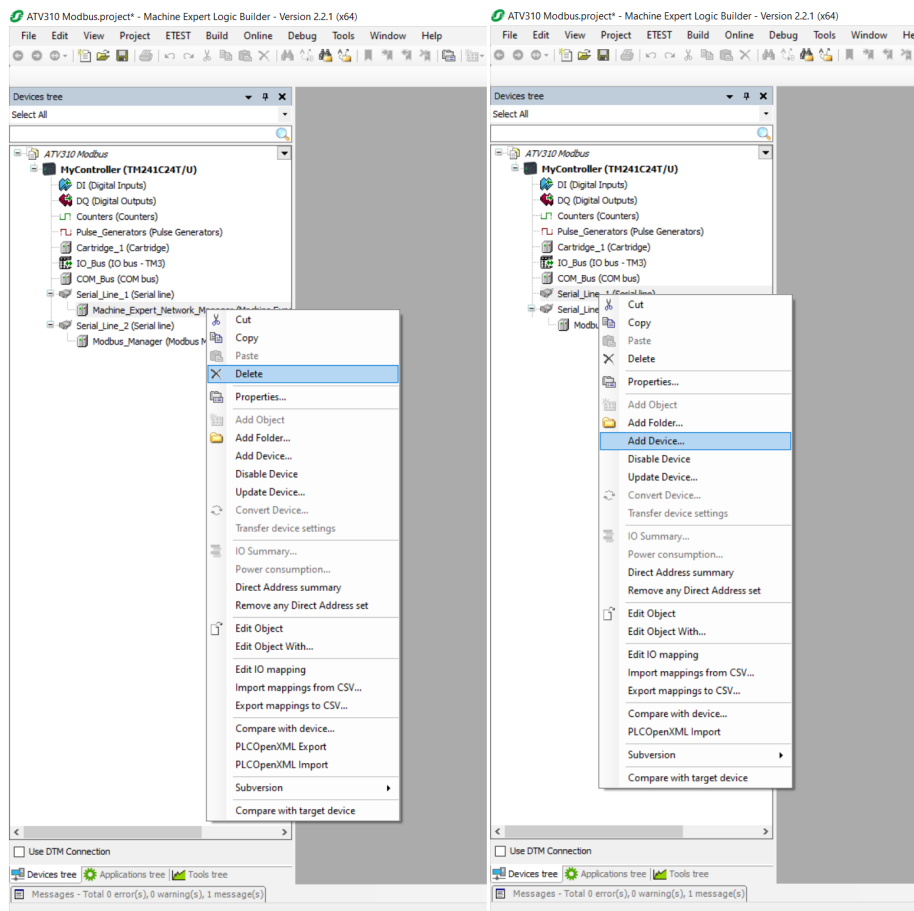
The communication scanner of the drive is used. The PLC sends the command and the reference speed value to the drive and read the status word and the actual speed from the drive.

Configuration of the Modbus Client

The default settings of the serial port used as a Modbus client are compliant with the default settings of the ATV310. In the following example, Modbus master configuration is done with MachineExpert.

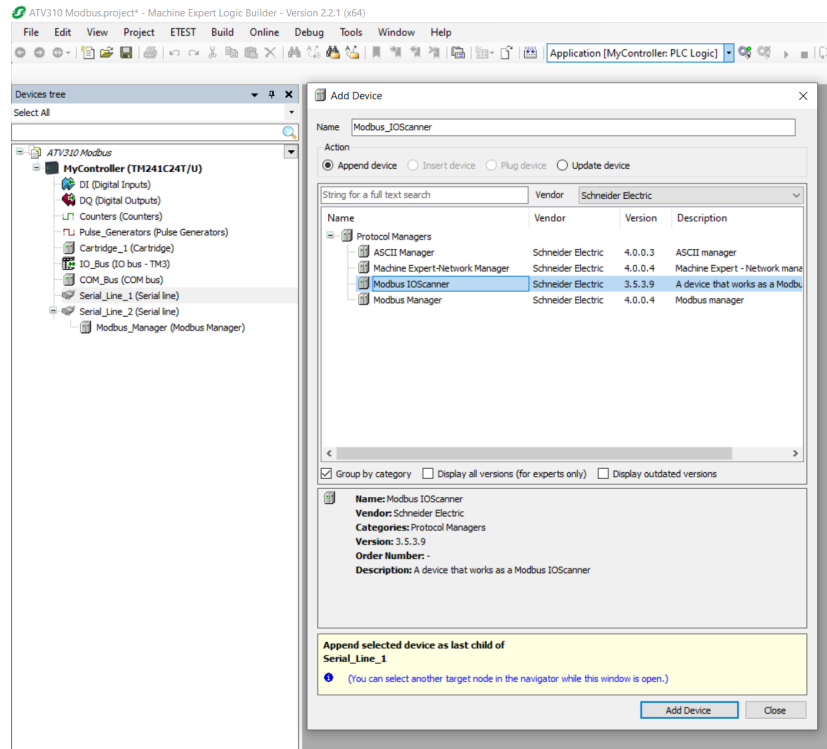
Add Modbus IO Scanner Device

- Right-click **Machine_Expert_Network_Manager** and then click **Delete**.
- Right-click **Serial_Line_1 (Serial line)** and then click **Add Device**.



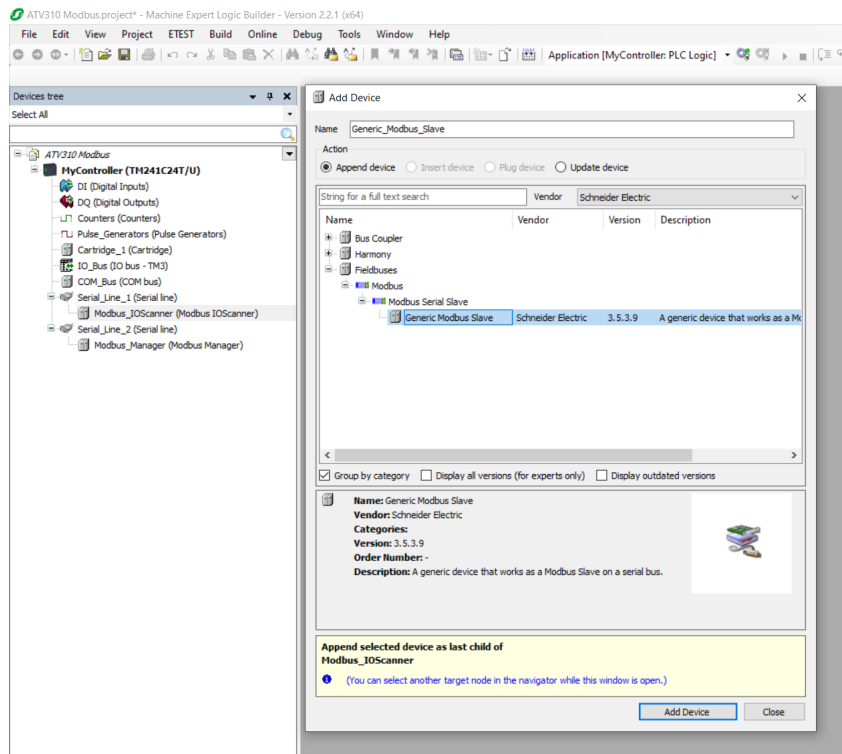
Software Setup with MachineExpert (M241)

- In the **Add Device** dialog box, select **Modbus IOScanner**.



Add Generic Modbus Device

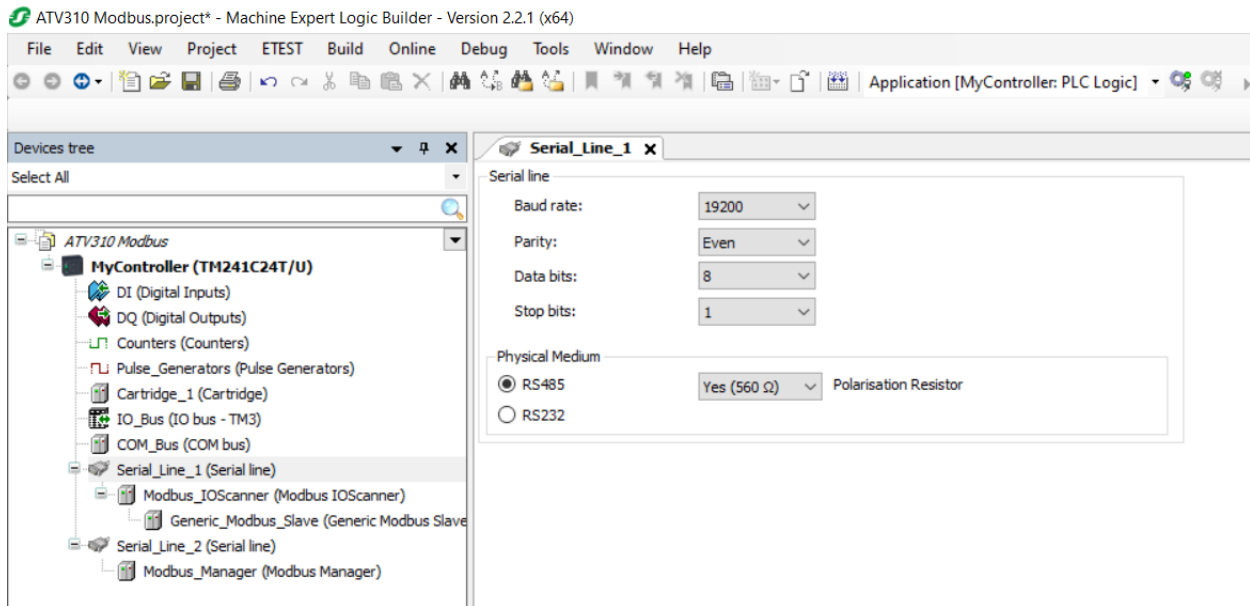
- Right-click **Modbus IOScanner (Modbus IOScanner)** and then click **Add Device**.
- In the **Add Device** dialog box, select **Generic Modbus Slave**.



Software Setup with MachineExpert (M241)

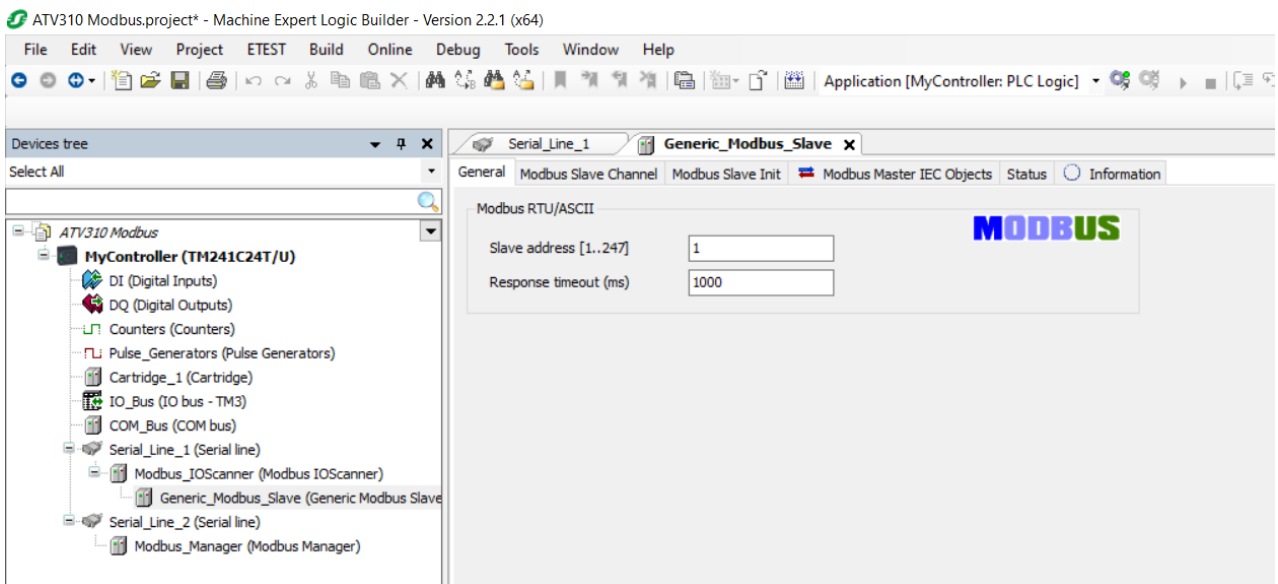
Serial Line Configuration

- Double-click **Serial_Line_1 (serial line)** to configure the serial line. Polarisation Resistor are recommended to be enable to improve the immunity from interference.



Modbus I/O Scanner Configuration

- Double-click **Generic_Modbus_Slave (Generic Modbus Slave)**
- In the **Modbus Slave Configuration** tab, under **Modbus-RTU/ASCII** configure the **Slave Address [1...247]** and **Response Timeout [ms]**.



Software Setup with MachineExpert (M241)

The communication is based on the READ/WRITE Multiple register functions.

In this example, the application manages the Modbus function 23 Hex which includes 2 requests:

- A read request of 4 words, starting at Modbus address 12741. It is the address of the first word of the input scanner of the drive : NM1 (707.0). The information is sent from the drive to the PLC. The first 2 words are mapped by default.

| Name | Address | Comment |
|--------------------|-----------------|----------------------------------|
| ATV310_NM1 (707.0) | 16#31C5 = 12741 | ATV310 ETA (status word) |
| ATV310_NM2 (707.1) | 16#31C6 = 12742 | ATV310 RFRD (actual speed value) |
| ATV310_NM3 (707.2) | 16#31C7 = 12743 | - |
| ATV310_NM4 (707.3) | 16#31C8 = 12744 | - |

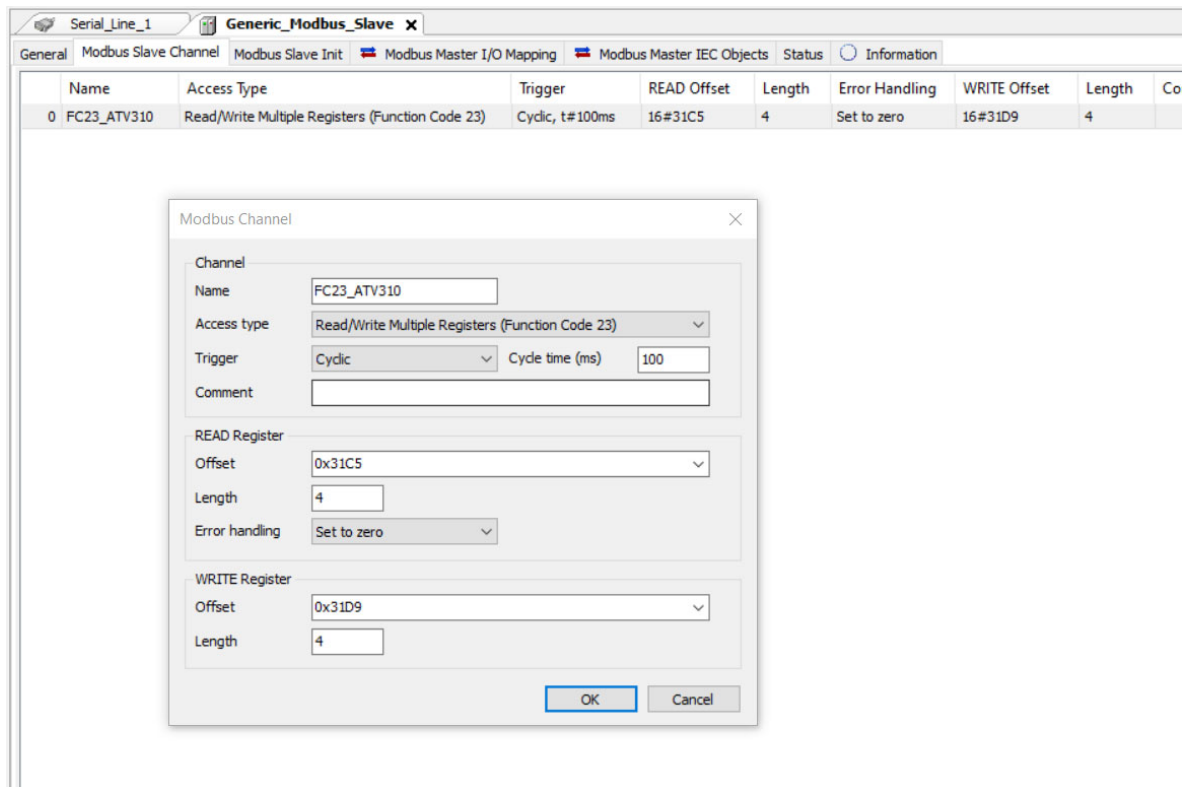
- A write request of 4 words starting at Modbus address 12761. It is the address of the first word of the output scanner of the drive : NC1 (708.0). The information is sent from the PLC to the drive. The first 2 words are mapped by default.

| Name | Address | Comment |
|--------------------|-----------------|-------------------------------------|
| ATV310_NC1 (708.0) | 16#31D9 = 12761 | ATV310 CMD (command word) |
| ATV310_NC2 (708.1) | 16#31DA = 12762 | ATV310 LFRD (reference speed value) |
| ATV310_NC3 (708.2) | 16#31DB = 12763 | - |
| ATV310_NC4 (708.3) | 16#31DC = 12764 | - |

In **Modbus Slave Channel** tab,

- Click **Add Channel**

Result: Opens **ModbusChannel** dialog box.



Software Setup with MachineExpert (M241)

- In the **ModbusChannel** dialog box
 - Select **Read/Write Multiple Registers (Function Code 23)** in the **Access Type** box.
 - Select the **Offset** and **Length** under **READ Register**.
 - Select the **Offset** and **Length** under **WRITE Register**.
 - Click the **OK** button to validate the configuration.
- In the **Modbus Master I/O Mapping** tab, create the variable you wish to use in this application.

| Variable | Mapping | Channel | Address | Type | Default Value | Unit | Description |
|--------------------------------|---------|----------------|---------|----------------------|---------------|------|-------------------------------|
| | | FC23_ATV310 | %IW2 | ARRAY [0..3] OF WORD | | | Read/Write Multiple Registers |
| Application.SR_Main.ATV310_NM1 | | FC23_ATV310[0] | %IW2 | WORD | | | 0x31C5 |
| Application.SR_Main.ATV310_NM2 | | FC23_ATV310[1] | %IW3 | WORD | | | 0x31C6 |
| Application.SR_Main.ATV310_NM3 | | FC23_ATV310[2] | %IW4 | WORD | | | 0x31C7 |
| Application.SR_Main.ATV310_NM4 | | FC23_ATV310[3] | %IW5 | WORD | | | 0x31C8 |
| | | FC23_ATV310 | %QW2 | ARRAY [0..3] OF WORD | | | Read/Write Multiple Registers |
| Application.SR_Main.ATV310_NC1 | | FC23_ATV310[0] | %QW2 | WORD | | | 0x31D9 |
| Application.SR_Main.ATV310_NC2 | | FC23_ATV310[1] | %QW3 | WORD | | | 0x31DA |
| Application.SR_Main.ATV310_NC3 | | FC23_ATV310[2] | %QW4 | WORD | | | 0x31DB |
| Application.SR_Main.ATV310_NC4 | | FC23_ATV310[3] | %QW5 | WORD | | | 0x31DC |

EAV94278

ATV310_Modbus_EN_EAV94278_04

04/2026