

Altivar 312

Variable speed drives
for asynchronous motors

PROFIBUS DP communication manual

10/2009



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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, serious injury or equipment damage.

CAUTION

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

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in equipment 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 product.

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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

- Read and understand this manual before installing or operating the Altivar 312 drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/- or across the DC bus capacitors.
- Before servicing the drive:
 - Disconnect all power, including external control power that may be present.
 - Place a "DO NOT TURN ON" label on all power disconnects.
 - Lock all power disconnects in the open position.
 - WAIT 15 MINUTES to allow the DC bus capacitors to discharge.
 - Measure the voltage of the DC bus between the PA/+ and PC/- terminals to ensure that the voltage is less than 42 Vdc.
 - If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.
- Install and close all covers before applying power or starting and stopping the drive.

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 Altivar 312 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 certain 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 and overtravel stop.

- 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.^a

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

a. For 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 312 technical documents are available on the Schneider Electric website (www.schneider-electric.com) as well as on DVD-ROM (reference VW3A8200).

Installation manual

This manual describes how to install and wire the drive.

Programming manual

This manual describes the functions, parameters and use of the drive terminal (integrated display terminal, optional graphic display terminal and optional remote terminal).

The communication functions are not described in this manual, but in the manual for the bus or network used.

Simplified manual

This manual is an extract from programming and installation manual. This manual is delivered with the drive.

Quick Start sheet

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

Communication manuals: CANopen, DeviceNet, Modbus and PROFIBUS DP

These manuals describe the assembly, connection to the bus or network, signaling, diagnostics, and configuration of the communication-specific parameters.

They also describe the protocol communication services.

Communication variables guide

This manual defines the drive control processes and the drive variables which can be accessed by the communication buses.

Introduction

Presentation

This guide contains information on installation and describes the PROFIBUS DP services available. The "communication variables" guide describes the operating modes, as well as the Altivar 312 variables and parameters which can be accessed via the communication bus.

The PROFIBUS DP communication card (catalog number VW3 A312 07) is used to connect an Altivar 312 drive to a PROFIBUS DP bus.

Data is exchanged in order to make use of all the Altivar 312 functions:

- Configuring functions
- Uploading adjustment parameters
- Control-signaling
- Monitoring
- Diagnostics

The PROFIBUS DP card has an open style connector.

The cable for connection to the PROFIBUS DP bus must be ordered separately.

Drive terminal displays

The graphic display terminal menus, available with the remote graphic display terminal option, are shown in square brackets.

Example: [MOTOR CONTROL] (drC-).

The integrated 7-segment display terminal menus are shown in round brackets.

Example: (COM-).

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

Example: [Fallback speed]

Parameter codes are displayed on the integrated 7-segment display terminal in round brackets.

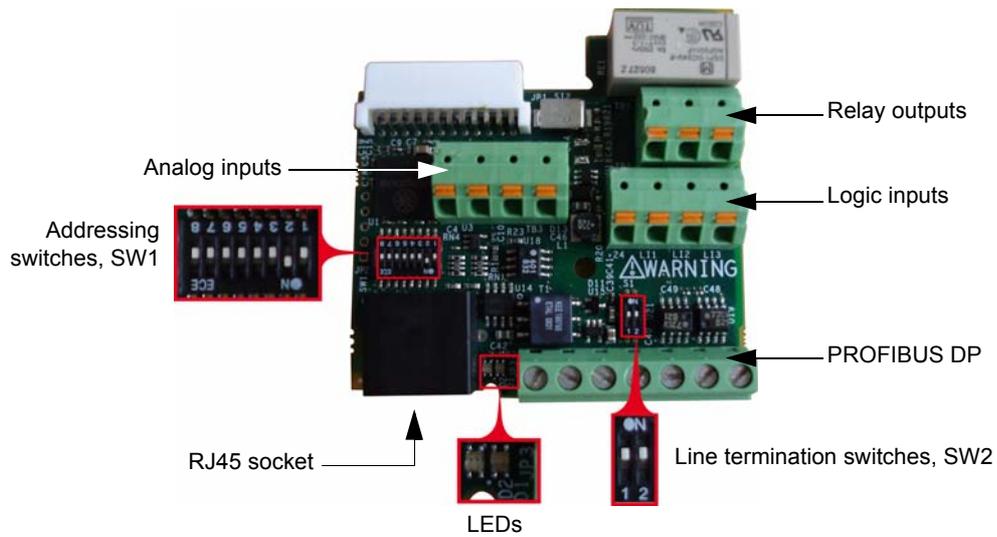
Example: (LFF).

Formats

In this manual, hexadecimal values are written as follows: 16#.

Hardware setup

Presentation



Receipt

- Check that the card catalog number marked on the label is the same as that on the delivery note corresponding to the purchase order.
- Remove the option card from its packaging and check that it has not been damaged in transit.

Installing the card in the drive

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Do not plug or unplug the terminal board while drive is powered.
- Check the tightening of the fixing screw after any manipulation on the terminal board.

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

⚡ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

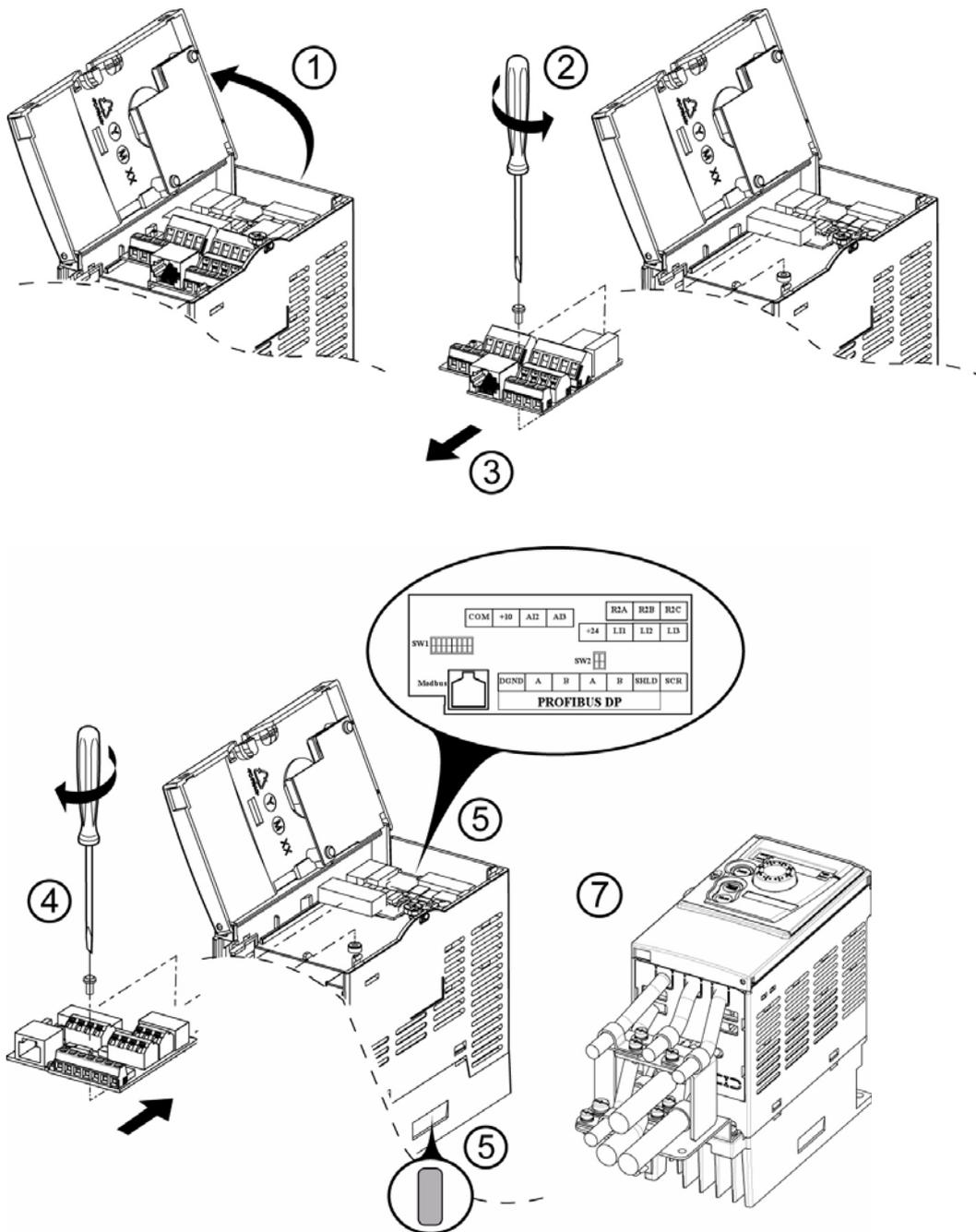
Do not touch the terminal board before:

- removing power on the drive,
- removing any voltage on input and output terminals.

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

Hardware setup

Install the card in ATV312 as follows:



1. Open the ATV312 front cover.

2 & 3. Remove the terminal board fixing screw and take off the ATV312 standard terminal board. (Be careful not to lose the terminal board fixing screw when removed since it may be used again.) This step does not apply if you are using an ATV312.... B (product without standard IO terminal).

4. Install the PROFIBUS DP card and secure it with the board fixing screw (M3 tapping screw tightening torque: 0.7 to 0.8Nm).

5. Stick the new cabling label above the PROFIBUS DP option card. Stick the PROFIBUS DP card nameplate near the ATV312 nameplate. (Be careful not to cover slits on the ATV312 enclosure)

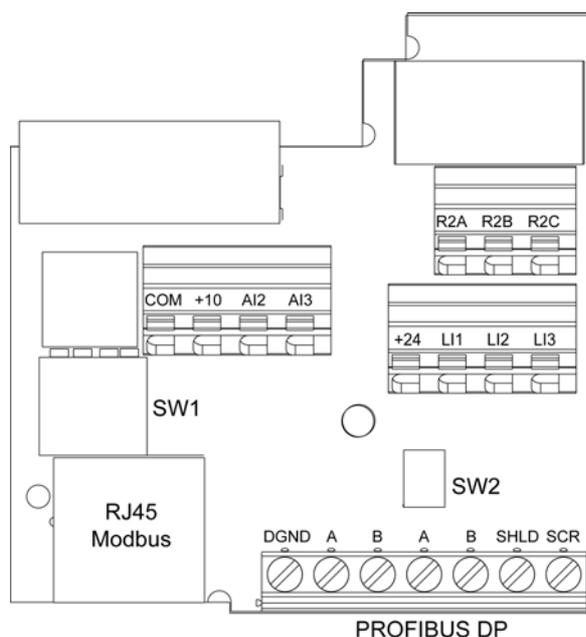
6. Perform wiring on the PROFIBUS DP card (see page 11).

7. Wire and screw the EMC clamps for the PROFIBUS DP cables (and control wires if required).

Note: To install or remove the terminal board, make it slide in or out in parallel with board.

Hardware setup

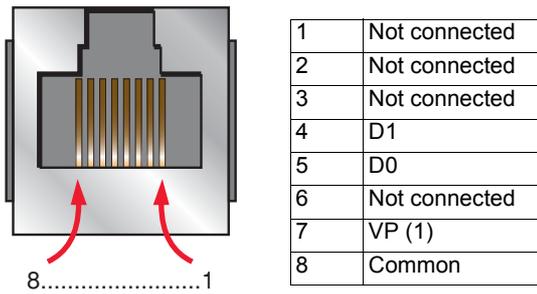
Characteristics and functions of the terminals



Terminal	Function	Electrical characteristics
R2A R2B R2C	Configurable relay outputs: 1 relay logic output, one "N/C" contact and one "N/O" contact with common point.	<ul style="list-style-type: none"> • Minimum switching capacity: 10 mA for 5 V \dots • Maximum switching capacity on resistive load ($\cos \varphi = 1$ and $L/R = 0$ ms): 5 A for 250 V \sim and 30 V \dots • Maximum switching capacity on inductive load ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 V \sim and 30 V \dots • Sampling time: 8 ms • Service life: 100,000 operations at maximum switching power
COM	Analog I/O common	0 V
+10	Power supply for reference potentiometer (2.2 to 10 k Ω)	<ul style="list-style-type: none"> • +10 V (+ 8% - 0%) • 10 mA max • Protected against short-circuits and overloads
AI2	Analog voltage input	Bipolar analog input 0 ± 10 V (maximum safe voltage ± 30 V) The + or - polarity of the voltage on AI2 affects the direction of the setpoint and therefore the direction of operation. <ul style="list-style-type: none"> • Impedance: 30 kΩ • Resolution: 0.01 V, 10-bit + sign converter • Precision $\pm 4.3\%$, linearity $\pm 0.2\%$, of maximum value • Sampling time: 8 ms • Operation with shielded cable 100 m maximum
AI3	Analog current input	Analog current input X-Y mA by programming X and Y from 0 to 20 mA: <ul style="list-style-type: none"> • Impedance: 250 Ω
+24	Logic input power supply	<ul style="list-style-type: none"> • + 24 V protected against short-circuits and overloads, minimum 19 V, maximum 30 V • Maximum customer current available: 100 mA
LI1 LI2 LI3	Logic inputs	Programmable logic inputs <ul style="list-style-type: none"> • Impedance: 3.5 kΩ • + 24 V internal or 24 V external power supply (min. 19 V, max. 30 V) • Max. current: 100 mA • Max. sampling time: 4 ms Source position: Positive logic State 0 if < 5 V or logic input not wired, state 1 if > 11 V
RJ45	Communication port	Connection for SoMove software, Modbus, remote display, loader tools.
SW1	Addressing switches	See page 14 .
SW2	Line termination switches	See page 11 .
PROFIBUS DP	Communication	PROFIBUS DP open style connector for connection to the fieldbus, see page 11 .

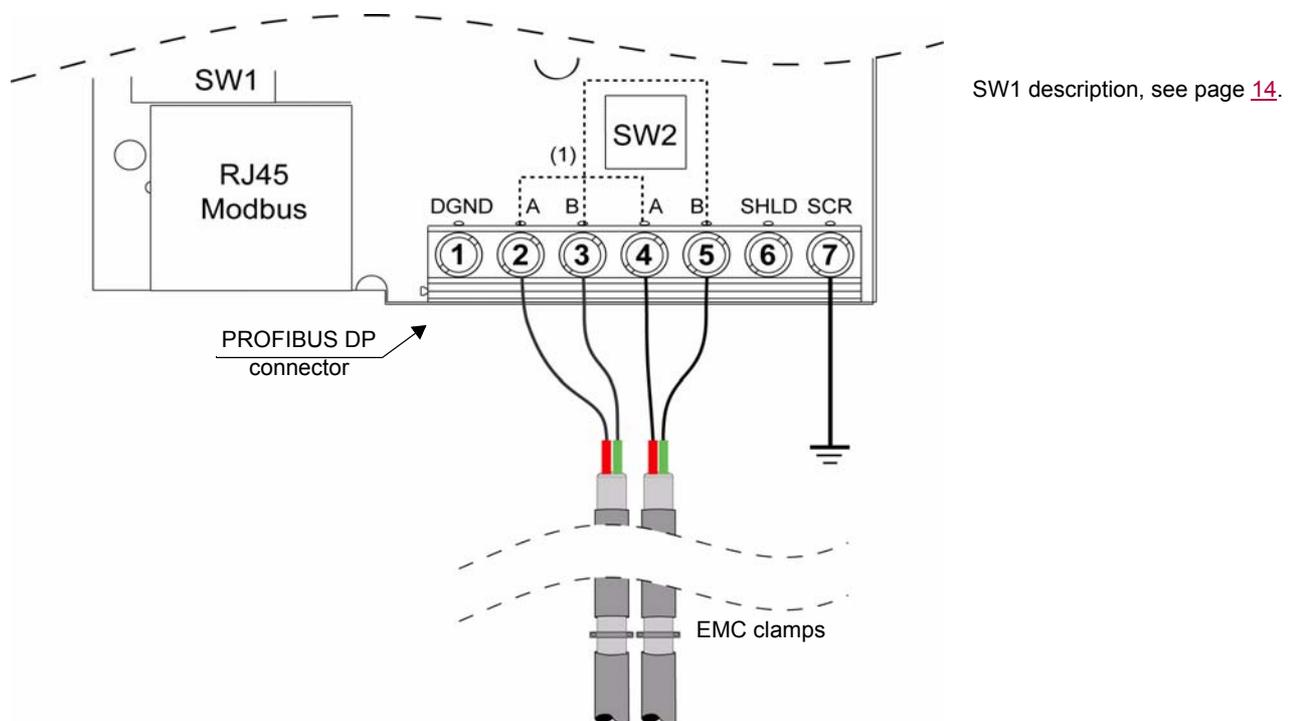
Hardware setup

Connection to the Modbus base port



(1) Reserved for RS232/RS485 converter

Connection to the PROFIBUS DP network



(1): pins A and pins B are internally connected.

Number	Terminal	Electrical characteristics
1	DGND	Data Ground: Not Connected
2	A	RxD/TxD-N: Receive/Transmit-Data-N
3	B	RxD/TxD-P: Receive/Transmit-Data-P
4	A	RxD/TxD-N: Receive/Transmit-Data-N
5	B	RxD/TxD-P: Receive/Transmit-Data-P
6	SHLD	SHIELD Note: If EMC clamp is not connected, wire the PROFIBUS DP cable shield to SHLD.
7	SCR	SCREEN: Connect to the ground

The line termination is activated with the switches SW2 (dip switches 1 and 2 to ON position).

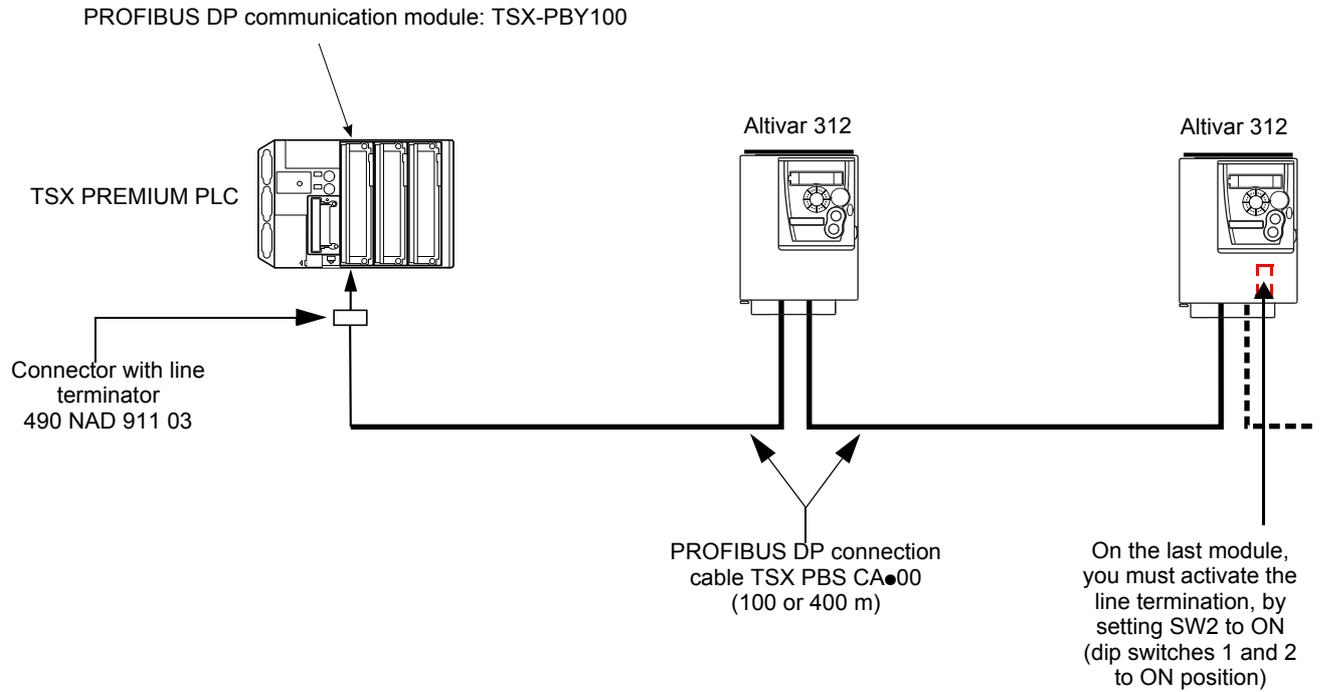
Hardware setup

Connection accessories

PROFIBUS DP bus connection cables

Description	Length	Catalog number
PROFIBUS DP connection cables	100 m	TSX PBS CA 100
	400 m	TSX PBS CA 400

Example of connection:



Hardware setup

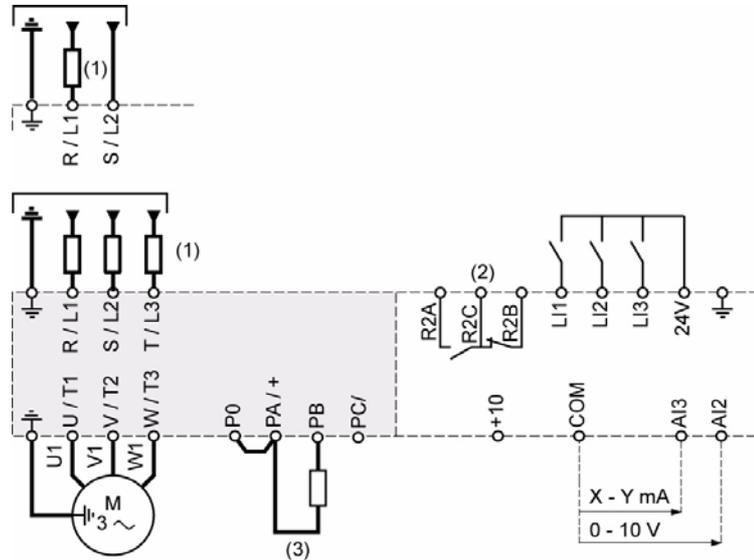
Recommendations

- The user can select the data rate from a range of 9.6 kbps to 12 Mbps. This selection, made when starting up the network, applies to all the bus subscribers.
- The maximum segment length is in inverse proportion to the data rate.

Data rate in kbps	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Distance/segment in meters (feet)	1200 (3937)	1200 (3937)	1200 (3937)	1200 (3937)	1000 (3281)	400 (1312)	200 (656)	100 (328)	100 (328)	100 (328)

- Repeaters can be used to cover greater distances.
- The bus ends with a line terminator at each end of the segment.
- Do not connect more than 32 stations per segment without a repeater, or more than 127 with a repeater.
- Keep the bus away from the power cables (clearance of at least 30 cm (11.9 in)).
- If it is necessary for power cables to cross each other, be sure they cross at right angles.

Wiring diagram for ATV 312 equipped with VW3 A312 07



(1) Line choke, if used (single phase or 3-phase).

(2) Fault relay contacts, for remote indication of the drive status.

(3) If a braking resistor is connected, set [\[Dec ramp adapt.\] \(brA\)](#) parameter to [\[No\] \(nO\)](#) (refer to the programming manual).

Note: Use interference suppressors on all inductive circuits near the drive or coupled to the same circuit (relays, contactors, solenoid valves, etc).

Wire sizes

ATV312 Control terminals	Applicable wire size (1) mm ² (AWG)	Tightening torque (2) N·m (lb.in)
R2A, R2B, R2C	0.75 to 2.5 (18 to 14)	0.5 to 0.6 (4.4 to 5.3)
Other terminals	0.14 to 2.5 (26 to 16)	

(1) The value in bold corresponds to the minimum wire gauge to permit secureness.

(2) Recommended to maximum value.

Configuration

Coding the drive address

An Altivar 312 is identified on the bus by its address, coded between 0 and 126.

The address corresponds to the binary number given by position 0 (up/OFF) or 1 (down/ON) of the 7 switches on the left of the card.

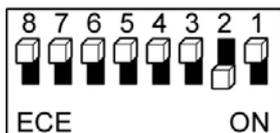
The least significant bits are on the right.

The table below indicates the positions of the switches for all configurable addresses:

Address	Switches 7-6-5-4-3-2-1								
0	000 0000	26	001 1010	52	011 0100	78	100 1110	104	110 1000
1	000 0001	27	001 1011	53	011 0101	79	100 1111	105	110 1001
2	000 0010	28	001 1100	54	011 0110	80	101 0000	106	110 1010
3	000 0011	29	001 1101	55	011 0111	81	101 0001	107	110 1011
4	000 0100	30	001 1110	56	011 1000	82	101 0010	108	110 1100
5	000 0101	31	001 1111	57	011 1001	83	101 0011	109	110 1101
6	000 0110	32	010 0000	58	011 1010	84	101 0100	110	110 1110
7	000 0111	33	010 0001	59	011 1011	85	101 0101	111	110 1111
8	000 1000	34	010 0010	60	011 1100	86	101 0110	112	111 0000
9	000 1001	35	010 0011	61	011 1101	87	101 0111	113	111 0001
10	000 1010	36	010 0100	62	011 1110	88	101 1000	114	111 0010
11	000 1011	37	010 0101	63	011 1111	89	101 1001	115	111 0011
12	000 1100	38	010 0110	64	100 0000	90	101 1010	116	111 0100
13	000 1101	39	010 0111	65	100 0001	91	101 1011	117	111 0101
14	000 1110	40	010 1000	66	100 0010	92	101 1100	118	111 0110
15	000 1111	41	010 1001	67	100 0011	93	101 1101	119	111 0111
16	001 0000	42	010 1010	68	100 0100	94	101 1110	120	111 1000
17	001 0001	43	010 1011	69	100 0101	95	101 1111	121	111 1001
18	001 0010	44	010 1100	70	100 0110	96	110 0000	122	111 1010
19	001 0011	45	010 1101	71	100 0111	97	110 0001	123	111 1011
20	001 0100	46	010 1110	72	100 1000	98	110 0010	124	111 1100
21	001 0101	47	010 1111	73	100 1001	99	110 0011	125	111 1101
22	001 0110	48	011 0000	74	100 1010	100	110 0100	126	111 1110
23	001 0111	49	011 0001	75	100 1011	101	110 0101		111 1111
24	001 1000	50	011 0010	76	100 1100	102	110 0110		
25	001 1001	51	011 0011	77	100 1101	103	110 0111		

- Addresses 0 and 1 are usually reserved for the PROFIBUS DP masters and must not be used to configure the PROFIBUS DP address on an Altivar 312.
- It is not advised to use address 126, which is incompatible with SSA service (Set Slave Address) and with some network configuration softwares (Sycon, ...).

Example for DP address = 2:



Dip switch 8 is not connected.

Configuration

Drive behaviour at first Power on with a PROFIBUS DP option card

At the first power on, the message (CFF) [Incorrect config.] appears on the product.
Press Enter to see [Restore config.] (FCS) menu.
Select the [Config. CFG] (InI) parameter to recover the factory settings.

For more information, see the [Restore config.] (FCS) parameter in ATV312 programming manual on www.schneider-electric.com

DANGER

UNINTENDED EQUIPMENT OPERATION

Check that the modification of the current configuration is compatible with the wiring diagram used.

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

Drive default values

At first power on with a PROFIBUS DP option card

After a first power on, the following parameter settings are applied to the drive:

[Ref.1 channel] (Fr1) = AIV1
[Ref.2 channel] (Fr2) = No
[Summing ref. 2] (SA2) = AI2
[HMI command] (LCC) = No
[4 preset speeds] (PS4) = No
[8 preset speeds] (PS8) = No

Power on after removing the PROFIBUS DP option card

If the PROFIBUS DP option card is removed and replaced by the original terminal board, the drive recovers the following default values:

[CANopen address] (AdCO) = 0
[CANopen bit rate] (bdCO) = 125.0
[Ref.1 channel] (Fr1) = AI1
[Ref.2 channel] (Fr2) = No
[HMI command] (LCC) = No
[Select ATV31 conf.] (ArE) = No

Configuration

Control of an ATV 312 from a PROFIBUS DP option card

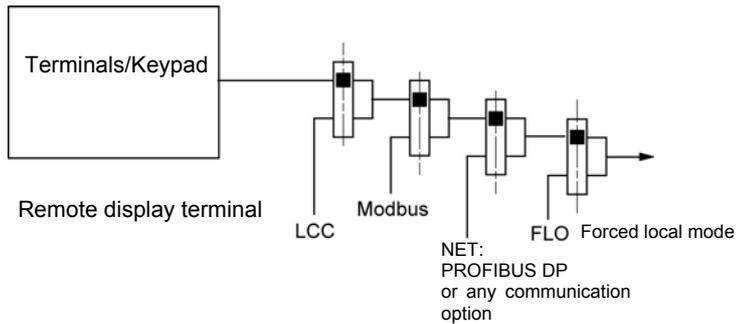
There are several ways to control an ATV 312 from a communication card:

- The control word and the speed reference are controlled from the network in the same time.
- The control word and the speed reference come from separate sources.

However, separate mode is only allowed when the [ACCESS LEVEL] (LAC) parameter in the [COMMAND] (CtL-) menu is set to L3. The control of the drive is also detailed in the programming manual of the ATV312 in the chapter "Control Menu".

Control of the drive when LAC = L1 or L2

There is no particular settings, the channels are managed in order of priority.



Control of the drive when LAC = L3

When configured with LAC = L3, several configurations are possible:

- Control and reference come from the communication card,
- Control via PROFIBUS DP or the terminals in native profile (CiA402),
- Control is separated from reference channel.

Configure the following parameters:

Parameter	Value	Comment
Profile	Combined native profile (CiA402)	The run commands are in native profile (CiA402), the command and the target come from the same channel.
Target 1 configuration	Network card	The command comes from PROFIBUS DP.

Configuration via the graphic display terminal or the integrated display terminal:

Menu	Parameter	Value
[COMMAND] (CtL-)	[Profile] (CHCF)	[Not separ.] (SIM) (factory setting)
	[Ref.1 channel] (Fr1)	[Network] (nEt)

Configuration

Control via PROFIBUS DP in native profile (CiA402)

The command and the target both come from PROFIBUS DP. Input LI3 at the terminals is used to switch between PROFIBUS DP and the terminals.

Control is in native profile (CiA402).

Configure the following parameters:

Parameter	Value	Comment
Profile	Combined native profile (CiA402)	The run commands are in native profile (CiA402), the command and the target come from the same channel.
Target 1 configuration	Network card	Target 1 comes from PROFIBUS DP.
Target 2 configuration	Analog input 2 on the terminals	Target 2 comes from input AI2 on the terminals.
Target switching	Input LI3	Input LI3 switches the target (1 ↔ 2) and the command.

Configuration via the graphic display terminal or the integrated display terminal:

Menu	Parameter	Value
[COMMAND] (CtL-)	[Profile] (CHCF)	[Not separ.] (SIM)
	[Ref.1 channel] (Fr1)	[Network] (nEt)
	[Ref.2 channel] (Fr2)	[AI2] (AI2)
	[Ref 2 switching] (rFC)	[LI3] (LI3) (1)

(1) LI4 to LI6 and AI1 are assignable in the menus but their value is always forced to 0.

Control via PROFIBUS DP or the terminals in native profile (CiA402)

The command and the target both come from PROFIBUS DP or the terminals. Input LI3 at the terminals is used to switch between PROFIBUS DP and the terminals.

Control is in native profile (CiA402).

Configure the following parameters:

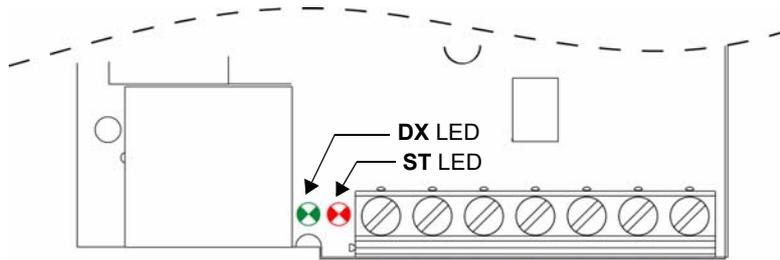
Parameter	Value	Comment
Profile	Combined native profile (CiA402)	The run commands are in native profile (CiA402), the command and the target come from separate channels.
Target 1 configuration	Network card	Target 1 comes from PROFIBUS DP.
Target 2 configuration	Analog input 2 on the terminals	Target 2 comes from input AI2 on the terminals.
Target switching	Input LI3	Input LI3 switches the target (1 ↔ 2) and the command.

Menu	Parameter	Value
[COMMAND] (CtL-)	[Profile] (CHCF) is configured in separate mode	[Separate] (SEP)
	[Cmd channel 1] (Cd1) Channel 1 is used with the communication	[Network] (nEt)
	[Cmd channel 2] (Cd2) Channel 2 is used with the terminal blocks	[Terminal] (tEr)
	[Cmd switching] (CCS) LI3 is used for switching between channel 1 and 2 (see also the programming manual of the ATV312 for more details).	[LI3] (LI3) (1)

(1) LI4 to LI6 and AI1 are assignable in the menus but their value is always forced to 0.

Diagnostics

Diagnostic LEDs



The PROFIBUS DP card has two LEDs, **ST** and **DX**, visible on the communication card.

- The status of the PROFIBUS DP card is indicated by the **ST** (status) red LED.
- The status of the PROFIBUS DP communication link is indicated by the **DX** (data exchange) green LED.

The table below gives the meaning of the various states of these two LEDs:

DX Green LED Status

State	Meaning	Corrective actions in the event of malfunction
 On	The card is in the "data exchange" state, and error-free data exchange is taking place.	
 Off	No communication on the bus, no data is being exchanged.	Check the connection to the PROFIBUS DP bus, start up the PLC.

ST Red LED Status

State	Meaning	Corrective actions in the event of malfunction
 Off	The card has been configured and its parameters set correctly by the master.	
 flashing 0.5 s	The card is in Idle state, waiting configuration from the master.	Enter an address value between 2 and 125 using the switches on the option card.
 flashing 0.1 s	The card is waiting parameters or waiting configuration.	Check the connection to the PROFIBUS DP bus, start up the PLC and, if the drive has a communication card detected fault (CnF), reset it.
 On	The card is in (ILF) detected fault mode.	Check the connection between the PROFIBUS DP card and the drive.

LED states

LED state	Visual description of the LED state
	The LED is OFF
	The LED is FLASHING
 	The LED is ON

Diagnostics

Communication fault management

The behaviour of the drive in case of communication interruption is described in the ATV312 programming manual.

The communication between the master (external management system) and the drive is broken:
In this case, the drive will generate a (CnF) error message.

The communication card is not working properly:
In this case, the drive will generate a (COF) message.

Code	Name	Probable cause	Remedy
CFF	[INCORRECT CONFIG.]	<ul style="list-style-type: none">The current configuration is inconsistent.Addition or removal of an option	<ul style="list-style-type: none">Return to factory settings or retrieve the backup configuration, if it is valid. See the [Restore config.] (FCS) parameter in ATV312 programming manual.
CnF	[NETWORK FAULT]	<ul style="list-style-type: none">Communication detected fault on the communication card	<ul style="list-style-type: none">Check the environment (electromagnetic compatibility).Check the wiring.Check the time out.Replace the option card.See the [CANopen fault mgt] (COL) parameter in the ATV312 programming manual to define the stop mode with a (CnF).
COF	[CANopen FAULT]	<ul style="list-style-type: none">Interruption in communication between the option card and the drive	<ul style="list-style-type: none">Check the communication bus.Check the option card.
ILF	[INTERNAL LINK FAULT]	<ul style="list-style-type: none">Interruption in communication between the option card and the drive	<ul style="list-style-type: none">Replace the option card.

(CnF) [Network fault]: Option card fault code

This parameter is read-only and is only visible if an option card is present.
The fault code remains saved in the parameter, even if the cause disappears.
The parameter is reset after the drive is disconnected and then reconnected.

The values of this parameter is:

1: Time out on the reception of the periodic variables addressed to the drive

For the full list of the fault detected codes, see ATV312 programming manual on www.schneider-electric.com

PROFIBUS DP mapping

PROFIBUS DP protocol

Data is exchanged according to the master-slave principle.

Only the master can initialize communication. The slaves behave like servers responding to requests from masters.

Several masters can coexist on the same bus. In this case, the slave I/O can be read by all the masters. However, a single master has write access to the outputs. The number of data items exchanged is defined at the time of configuration.

A GSD file contains the configuration information for the Altivar 312 with PROFIBUS DP. This file is used by the PLC during the configuration phases.

The GSD file is unique to the whole Altivar 312 range. It does not describe the drive parameters, just the communication information. This file appears on the CD-ROM supplied with the drive.

The PROFIBUS DP card for Altivar 312 drives supports Type 5 (Byte-String 28) cyclic frames in PPO (Parameter-Process Data-Object) format.

Type 1 PPO cyclic frames feature 6 periodic variables that are used for 2 types of service:

- I/O exchanges (PZD)
- Aperiodic exchanges (PKW) for parameter setting, configuration and diagnostics

PKW aperiodic exchanges are included in the cyclic frames and do not require special frames. An aperiodic exchange is used to read or write a parameter. The Altivar 312 PKW service is the same as the one for the Altivar 61/71 with the VW3 A3 307 PROFIBUS DP option.

PROFIBUS DP mapping

Output PZDs

The first eight bytes contain an aperiodic request (PKW) to write or read a parameter.
The remaining 4 bytes contain the output PZDs (written from the PROFIBUS DP master).

1	2	3	4	5	6	7	8	9	10	11	12
PKW								PZD1		PZD2	
PKE		0	R/W	PWE				CMD		LFRD	

PKW request	
PKE	Parameter logic address
RIW	Request code: 0: No request 1: Read 2: Write
PWE	For a read request: Not used For a write request: Parameter value

Cyclic control and adjustment parameters:

PZD1: Communication scanner output word 1 (NC1)

PZD2: Communication scanner output word 2 (NC2)

The default assignment of the periodic output data is:

- PZD1 = Command word
- PZD2 = Speed target

1	2	3	4	5	6	7	8	9	10	11	12
PKW								PZD1		PZD2	
PKE		0	R/W	PWE				Command word		Speed target	

Input PZDs

The first eight bytes contain the response (PKW) to the aperiodic read/write request.
The remaining 4 bytes contain the input PZDs (read mode).

1	2	3	4	5	6	7	8	9	10	11	12
PKW								PZD1		PZD2	
PKE		0	R/W/N	PWE				ETA		RFRD	

PKW request	
PKE	Parameter logic address
R/W/N	Response code: 0: No request 1: Successful read report 2: Successful write report 7: Error report
PWE	For a successful request: Parameter value For an incorrect request: 0: Incorrect address 1: Write access denied

Cyclic monitoring parameters:

PZD1: Communication scanner input word 1 (ETA)

PZD2: Communication scanner input word 2 (RFRD)

The default assignment of the periodic input data is:

- PZD1 = Status word (ETA)
- PZD2 = Output speed (RFRD)

1	2	3	4	5	6	7	8	9	10	11	12
PKW								PZD1		PZD2	
PKE		0	R/W	PWE				Status word		Output speed	

PROFIBUS DP mapping

PKW aperiodic service

The PKW service, consisting of PKE, R/W, R/W/N and PWE, enables aperiodic access to Altivar 312 parameters in read and write mode.

Output PKWs

PKE

Parameter logic address

R/W

0: No request
1: Read
2: Write

One-off read and write requests can be triggered continuously while R/W equals 1 or 2.

Note:

Values other than 0, 1 and 2 should not be used.

PWE

If write: Value to be written

Input PKWs

PKE

Copies the output PKE value

R/W/N

0: No request
1: Correct read operation
2: Correct write operation
7: Read or write error

PWE

- If correct read operation: Parameter value. This can be limited by the drive if the maximum value is exceeded by the write operation.
- If correct write operation: Value of the write PWE
- If there is an error:
 - 0: Incorrect address
 - 1: Write operation refused

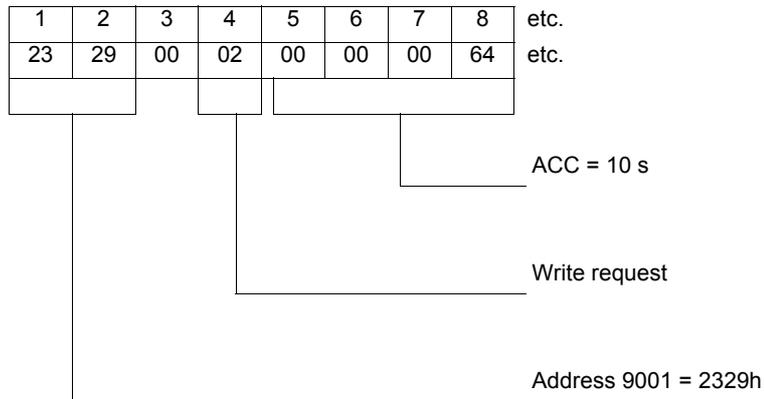
Note:

The parameters in the output PZDs should not be changed by the PKW service.
Parameters linked to output PZDs should not be changed by the PKW service.
Example: The speed target and the frequency target.

PROFIBUS DP mapping

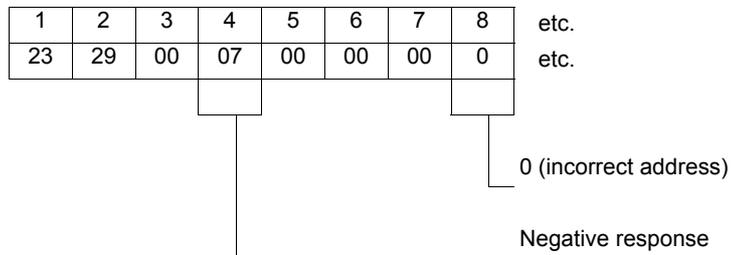
Examples of PKW aperiodic exchanges

Example of aperiodic write operation: Acceleration time ACC (address 9001) = 10 s, unit 0,1s (values in hexadecimal format).



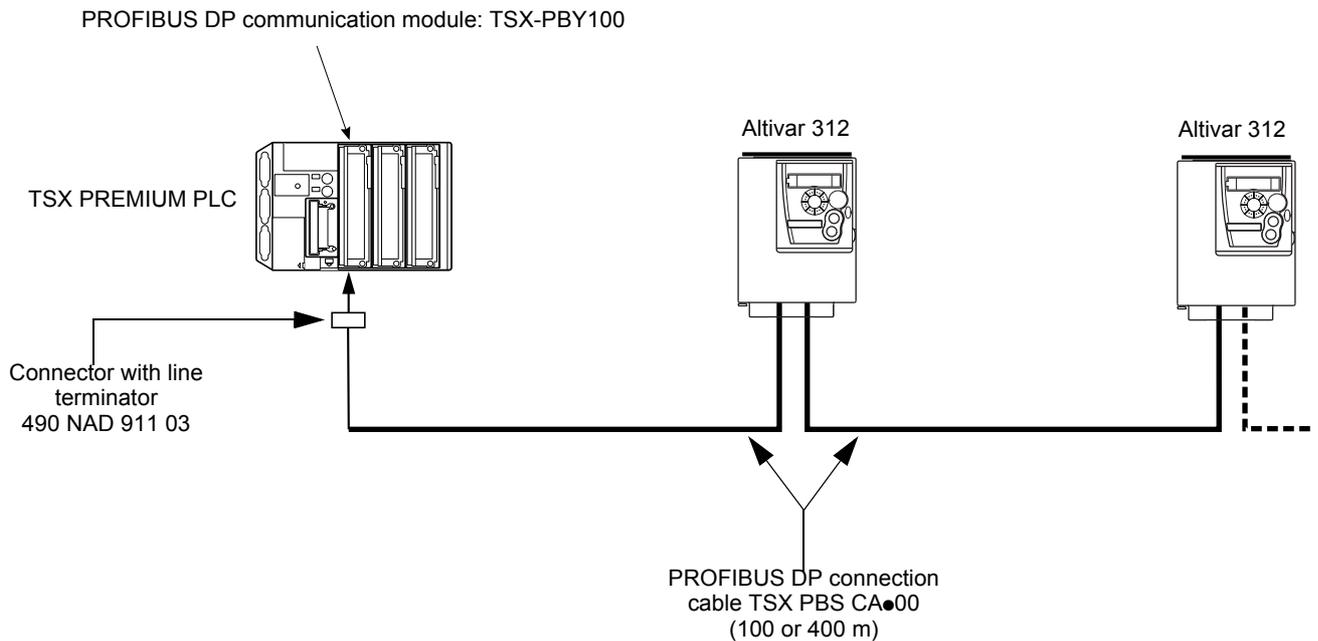
The positive response is identical to the write request, aperiodic part (bytes 1 to 8).

Example of negative response:



Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

The following chapter describes how to integrate an ATV 312 equipped with a VW3 A312 07 option module on a PROFIBUS DP based configuration.



Configuration of the communication

With Unity, cyclic exchanges between the PROFIBUS DP master (TSX Premium PLC + TSX PBY100 module) and the Altivar 312 take the form of input words %IWxy.0.k and output words %QWxy.0.k, where "x" = number of the PLC rack and "y" = location of the PROFIBUS DP module in the PLC rack.

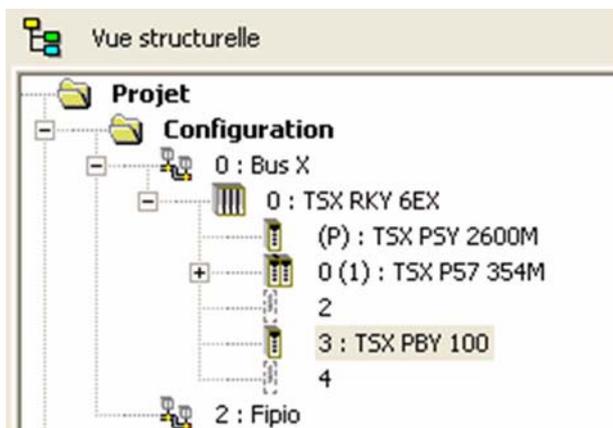
PROFIBUS DP	PL7 output word	Altivar 312 parameter
PKW	%QWxy.0	PKE
	%QWxy.0.1	R/W
	%QWxy.0.2	Not used
	%QWxy.0.3	PWE
PZD1	%QWxy.0.4	CMD
PZD2	%QWxy.0.5	LFRD

PROFIBUS DP	PL7 input word	Altivar 312 parameter
PKW	%IWxy.0	PKE
	%IWxy.0.1	R/W/N
	%IWxy.0.2	Not used
	%IWxy.0.3	PWE
PZD1	%IWxy.0.4	ETA
PZD2	%IWxy.0.5	RFRD

Project configuration

The TSX Modicon PLCs can be used as PROFIBUS DP Master Device in association with the PBY 100 Profibus card.

Tree view of PLC configuration under a Unity project:



Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

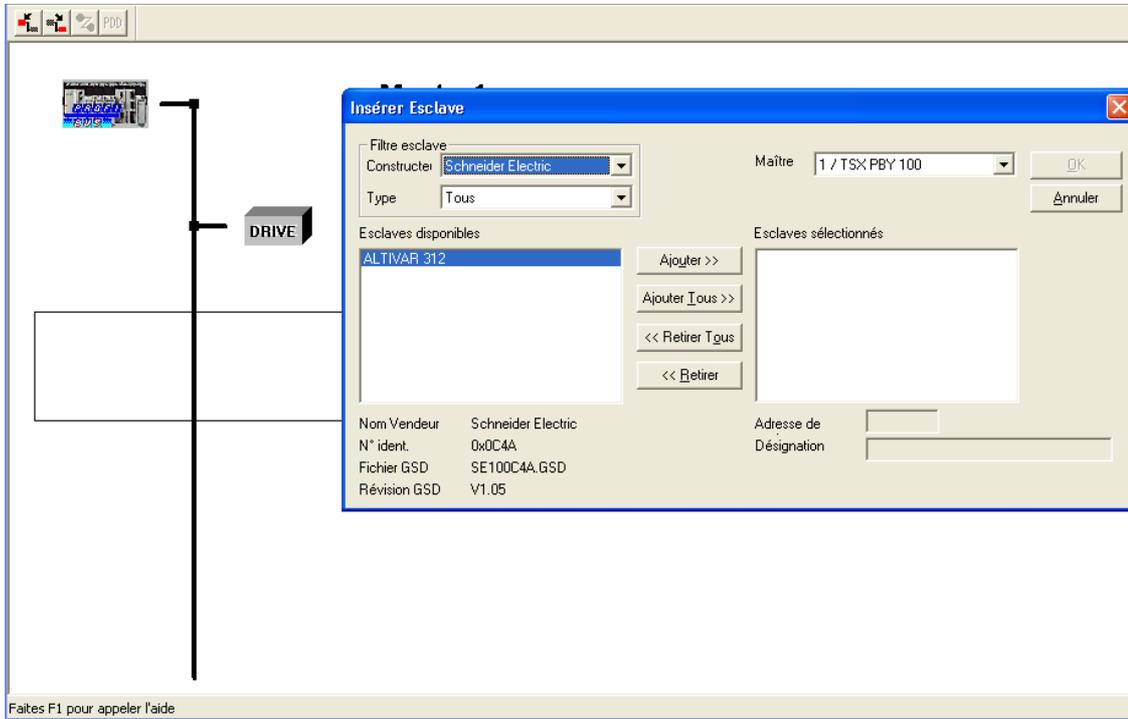
Configuration with SyCON additional Software

To configure an ATV312 as a slave device on the PBY 100 master, you must configure the PROFIBUS DP with the SyCON configuration tool. For the first time configuration, you must add the GSD file of the ATV312 (available on Schneider-electric.com) to the configuration tool:

- File Menu > Copy GSD file

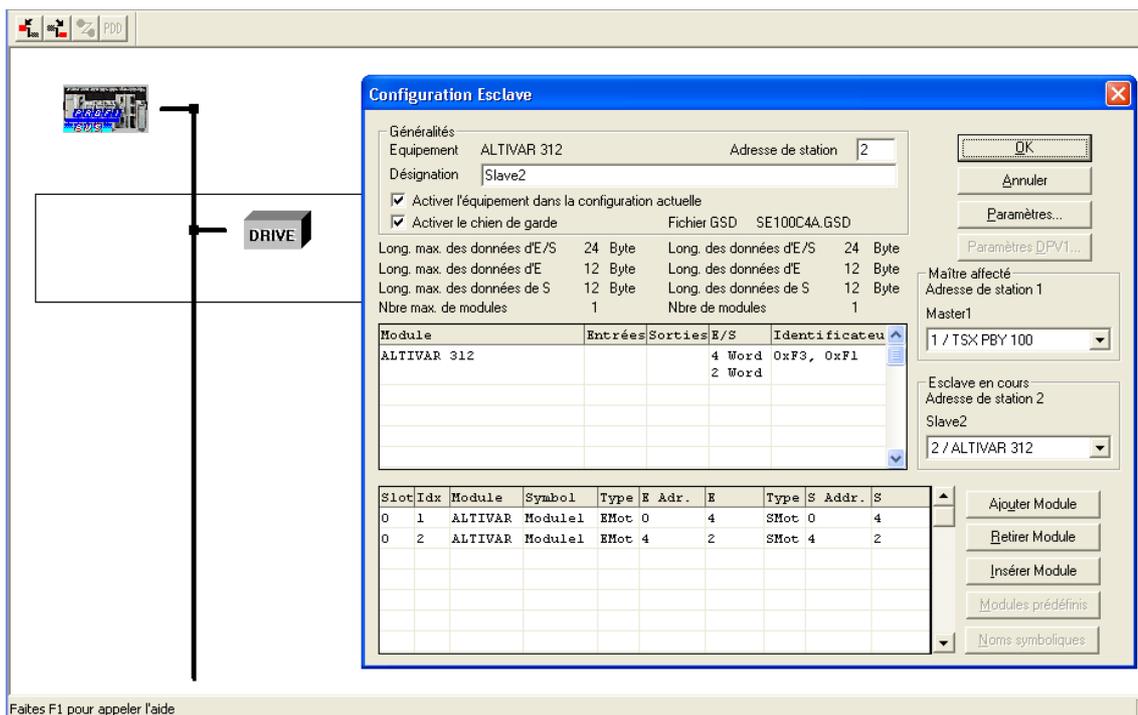
Once done, you can add a slave device by selecting:

- Schneider Electric as Vendor
- Altivar 312 as slave Device



Configuration of the slave

Define the address, in accordance with the DIP switches of the VW3 A312 07, and define a name to the Device. There are no additional configurations given that the Altivar 312 PROFIBUS DP module provides an unique mapping.



Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

Save the projet

When all your PROFIBUS DP network devices are configured save the project and export it to Unity.

The screenshot shows the 'Configuration' window for a TSX-PBY 100 project. The 'PROFIBUS-DP Slave Configuration' table is as follows:

Addr.	ID	Act.	Group ID	Watchdog
1				
2	0xC4A	1	0	1

The 'PROFIBUS-DP General Configuration' panel includes:

- Outputs: Maintain, Reset
- No. of I/W/QW: In Words: 128, In Bytes: 32
- Diagnostic Length: In Bytes: 32
- PROFIBUS-DP Tool: [View]
- PROFIBUS-DP Configuration File: [Load CNF] D:\DOCUMENTS AND SETTINGS\STP0428\
- PROFIBUS-DP Slave Data:

Addr.	Symbol
%IW0.3.0.3	
%IW0.3.0.4	
%IW0.3.0.5	

Addr.	Symbol
%QW0.3.0.3	
%QW0.3.0.4	
%QW0.3.0.5	

Summary statistics at the bottom:

Total	No. of slaves	No. of %IW	No. of %QW
	1	6	6

Annotations on the right side of the image:

- Load the .cnf file
- Addresses of the slave outputs image
- Addresses Of the slave inoutputs image

In the PBY 100 configuration tab of the project you may load now the file generated by SyCON. You can check the %IW and %QW linked to the slave device by selecting its number (2 in the example above).

PLC IO image / Altivar 312 DP slave mapping

With the Altivar 312 DP slave module The 1st Slot defines the addresses of the PKW area , used for parameters management. The 2nd slot defines the addresses of the PZD data (control and status of the drive). The configuration dialog box enables you to define the PEW and PAW assigned to the Altivar 312. The table below shows this configuration and its pending drive's parameters.

PZD area

Altivar 312 parameter	TSX-P57 %QW IO memory	TSX-P57 %IW IO memory
CMD	%QWx.y.z.4 (1)	
LFRD	%QWx.y.z.5	
ETA		%IWx.y.z.4
RFRD		%IWx.y.z.5

(1): For x,y,z definition, please refer to the TSX Modicon platform communication manuals.

Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

PKW area

Altivar 312	TSX P57 354M IO memory	TSX P57 354 M IO memory
Parameter logic address (Modbus address*)	%QWx.y.z.0	
Response code: 0: No request 1: Read 2: Write	%QWx.y.z.1	
Value to write if write request	%QWx.y.z.2	
	%QWx.y.z.3	
Parameter logic address (Modbus address*)		%IWx.y.z.0
Response code: 0: No request 1: successful Read 2: successful Write 7: Error report		%IWx.y.z.1
Parameter value if the request was successful. 0: Incorrect address. 1: Write access denied.		%IWx.y.z.2
		%IWx.y.z.3

* : The description of the Altivar 312 parameter addresses can be found in the communication variable spreadsheet available on Schneider-electric.com.

** : Not significant here: The Altivar 312 doesn't manage 32bits integer values.

You can now build and download your project to the PLC, if no errors occurs , your DP system should start and you should be able to monitor directly the data exchanged between the PLC and its slave.

The following screen displays the ON line status of the PBY 100 Master module. The slave 2 (ATV312 here) is currently monitored:

MODULE PROFIBUS-DP Version : 1.20

TSX PBY 100
Voie 0

Configuration esclave PROFIBUS-DP

Adr.	ID	Act.	ID group	Chien de g
1				
2	0xC4A	1	0	1

Données de diagnostic PROFIBUS-DP

ID ESCLAVE : 0xC4A
Diagnostics créés par l'esclave
Chien de garde esclave actif
Adresse maître : 1
00 0c 00 01 0c 4a

Outil PROFIBUS-DP
hilscher

Configuration maître
Visualiser

Editer %Qw
Valider

Format
 Bin Hex Déc

Données esclave PROFIBUS-DP

Adr.	Symbole	Valeur
%IW0.3.0.3		0
%IW0.3.0.4		1575
%IW0.3.0.5		1200

Adr.	Symbole	Valeur
%Qw0.3.0.3		0
%Qw0.3.0.4		15
%Qw0.3.0.5		1200

Total
Nb esclaves: 1
Nb. %IW: 6
Nb. %QW: 6

In this view we can see %IW0.3.0.4 which corresponds to ETA , and the value of the current speed (in rpm) in %IW0.3.0.5 which represents RFRD.

Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

Example of Control of the Drive

Here is a SR section extract link to an operator view which displays and enables the control of the CiA402 state machine of the drive.

```
%MW200:=%IW0.3.0.4 AND 16#006F;
%MW201:=%IW0.3.0.4 AND 16#000F;

IF (%MW201=16#0008 OR %MW201=16#000F)AND(%QW0.3.0.4=16#0080) then
    %QW0.3.0.4:=16#0000;
END_IF;
(* switch on disabled *)
IF(%MW200=16#0040 OR %MW200=16#0060)AND %M102 THEN
    %QW0.3.0.4:=16#0006;
END_IF;
(* Ready for switch on *)
IF((%MW200=16#0021 OR %MW200=16#0001)AND %M103)OR(%MW200=16#0023 AND %M101)OR((%MW200=16#0007 OR
%MW200=16#0003)AND %M111)OR(%MW200=16#0027 AND %M100)THEN
    %QW0.3.0.4:=16#0000;
END_IF;

(* Switched On *)
IF(%MW200=16#0023 AND %M105)OR(%MW200=16#0027 AND %M112)THEN
    %QW0.3.0.4:=16#0006;
END_IF;

(*switched on*)
IF((%MW200=16#0021 OR %MW200=16#0001)AND %M104)OR(%MW200=16#0027 AND %M107)THEN
    %QW0.3.0.4:=16#0007;
END_IF;

(*Operation enable Forward Command*)
IF %MW200=16#0023 AND %M106 THEN
    %QW0.3.0.4:=16#000F;
END_IF;

(* fast stop*)
IF %MW200=16#0027 AND %M108 THEN
    %QW0.3.0.4:=16#000B;
END_IF;

(* Quick stop active*)
IF(%MW200=16#0007 OR %MW200=16#0003)AND %M109 THEN
    %QW0.3.0.4:=16#000F;
END_IF;

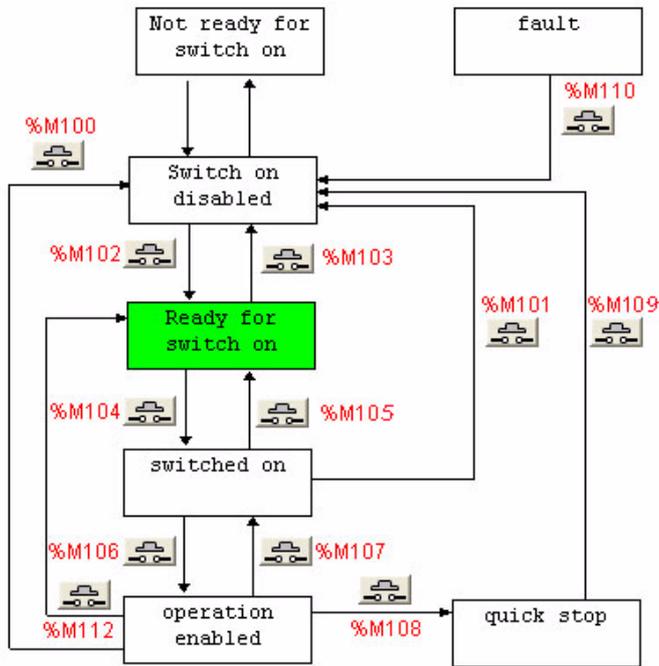
(*fault state*)
IF(%MW201=16#0008 OR %MW201=16#000F)AND %M110 THEN
    %QW0.3.0.4:=16#0080;
END_IF;
```

Integration of the ATV312 in a PROFIBUS DP network controlled by a Modicon TSX P57 354M

Animated operator screen (example)

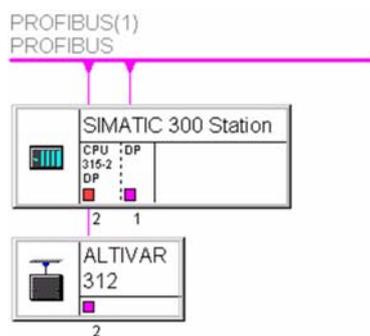
The following animation screen linked to the ST code section in the previous page illustrates the behaviour of the drive state machine. This is also detailed in the chapter " Supervision and control in LINE mode".

The push buttons linked to internal bits enable you to control manually the drive.



Integration of the ATV312 in a PROFIBUS DP network controlled by a Simatic S7©

The example below shows an Altivar 312 controlled by a Simatic S7-315 DP CPU.

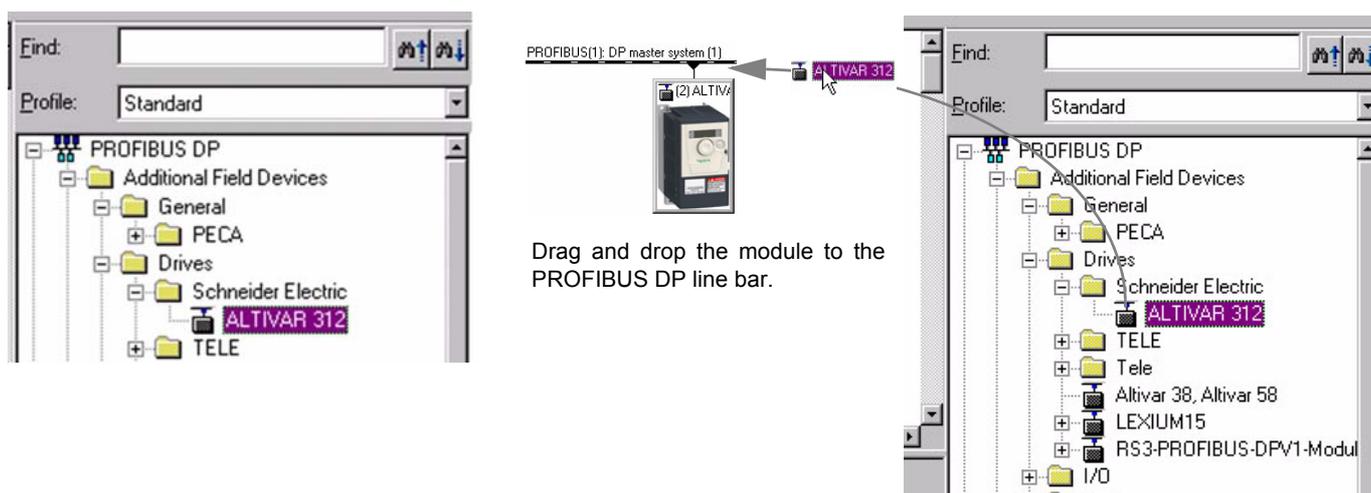


GSD installation

You must import to your Simatic Step7 tool the GSD file of the Altivar 312. This import must be done before starting the configuration of the PROFIBUS DP network.

Configuration of the device

Once you have defined the Hardware configuration of the master and the network properties, you can start to add slave devices. To add an Altivar 312, go to the PROFIBUS DP device library:



Integration of the ATV312 in a PROFIBUS DP network controlled by a Simatic S7©

Then double-click on the Altivar 312 icon to define the address of the slave device in the PLC IOs memory image.

The screenshot displays the SIMATIC Manager HW Config interface. The main window shows a rack configuration with a CPU315-2DP(1) and two Altivar 312 units. A 'Properties - DP slave' dialog box is open, showing the following configuration:

Slot	Order Number / Designation	I Address	Q Address	Comment
1	4A ALTVAR 312	256...263	256...263	
2	2A ALTVAR 312	264...267	264...267	

The 'Properties - DP slave' dialog box shows the following configuration:

Address / ID: [Empty]
I/O Type: Out-input
Output:
Start: 256, End: 263, Length: 4, Unit: Words, Consistent over: Total length
Input:
Start: 256, End: 263, Length: 4, Unit: Words, Consistent over: Total length
Data for Specific Manufacturer: [Empty]
(Maximum 14 bytes hexadecimal, separated by comma or blank space)

Integration of the ATV312 in a PROFIBUS DP network controlled by a Simatic S7©

PLC IO image / Altivar 312 DP slave mapping

With the Altivar 312 DP slave module:

- The 1st slot defines the addresses of the PKW area, used for parameters management.
- The 2nd slot defines the addresses of the PZD data (control and status of the drive).

The configuration dialog box enables you to define the PEW and PAW assigned to the Altivar 312.

The table below shows this configuration and its pending drive's parameters:

PZD area

Altivar 312 parameter	S7-315 PEW IO memory (1)	S7 - 315 PAW IO memory (1)
CMD	%PAW264	
LFRD	%PAW266	
ETA		%PEW264
RFRD		%PEW266

(1) These values are related to the example in the previous page

PKW area

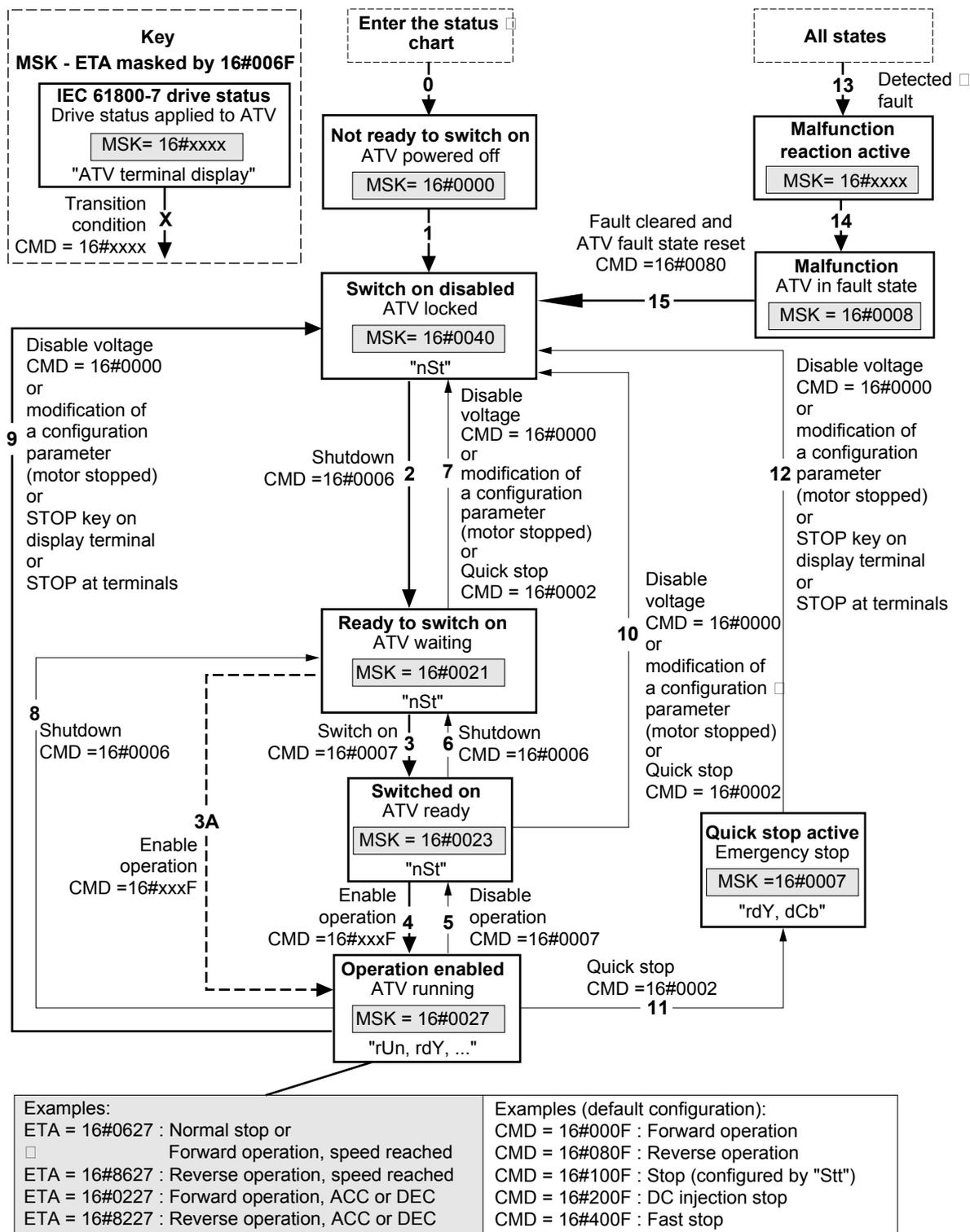
Altivar 312 parameter	S7-315 PAW IO memory	S7 - 315 PEW IO memory
Parameter logic address (Modbus address*)	%PAW256	
Response code: 0 : No request 1 : Read 2 : Write	%PAW258 or %PAB259	
Value to write if write request	%PAW260 **	
	%PAW262	
Parameter logic address (Modbus address*)		%PEW256
Response code: 0 : No request 1 : successful Read 2 : successful Write 7 : Error report		%PEW258 or %PEB259
Parameter value if the request was successful.		%PEW260
		%PEW262

* : The description of the Altivar 312 parameter addresses can be found in the communication variables spreadsheet available on Schneider- electric.com.

** : Not significant here: The Altivar 312 doesn't manage 32bits integer values.

Supervision and control in LINE mode

IEC 61800-7 status chart



Exiting the "Operation enabled" status via a "Disable voltage" (9) or "Shutdown" (8) command causes a freewheel stop.

Supervision and control in LINE mode

The Altivar control process using the communication bus is based on the CiA 402 profile status chart compatible with the IEC 61800-7 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.
If all or part of the configuration and settings are to be loaded, we recommend disabling the consistency check function during the transfer (CMI W8504, bit 15 = 1). On completion of the transfer, the consistency check must be enabled (CMI W8504, bit 15 = 0).
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 detection):

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

Malfunction (Detected fault):

The drive is locked.

Difference between a fast stop and a Quick stop

A fast stop (CMD = 16#400F) is a stop on a short ramp that maintains the drive in the "Operation enabled" state.
The drive remains locked after a fast stop.
A run command can be executed immediately after a fast stop.

A Quick stop (CMD = 16#0002) is an emergency stop that causes a stop on a short ramp followed by locking in the "Quick stop active" state.
To be able to restart the drive, you must first change to the "Switch on disabled" state via the "Disable voltage" command (CMD = 16#0000).
It is not possible, therefore, to execute a run command immediately after a Quick stop.

Note:

In access level L1 or L2 (parameter LAC):

- Priorities between channels are managed by the drive.
- At switch-on, the drive is in control via the terminals and changes automatically to the "Operation enabled" state. This means that, when a run command is applied (for example: CMD = 16#000F), it starts without needing to follow the IEC 61800-7 status chart procedure.

When the drive is controlled via a communication bus, it is advisable to configure the access level LAC = L3:

- The active channel is set by configuring the following parameters: [\[Profile\] \(CHCF\)](#), [\[Ref. 2 switching\] \(rFC\)](#), [\[Cmd switching\] \(CCS\)](#), [\[Cmd channel 1\] \(Cd1\)](#), [\[Cmd channel 2\] \(Cd2\)](#), [\[Ref.1 channel\] \(Fr1\)](#) and [\[Ref.2 channel\] \(Fr2\)](#).
- At switch-on, the drive configured for control via the bus changes to the "Switch on disabled" state. This means that it must follow the IEC 61800-7 status chart procedure to be able to start, and to help prevent any unwanted behaviour.

Supervision and control in LINE mode

CMD control word (W8501)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Fault state reset	0	0	0	Enable operation	Quick stop (active at 0)	Enable voltage	Switch on
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
(1)	(1)	(1)	(1)	(1)	0	0	0

(1) This bit action depends on the [\[ACCESS LEVEL\] \(LAC\)](#) parameter and the functions configured by the user. For example, to use bit 15 to switch the ramp, simply configure LAC = L3 (Access to advanced functions and management of mixed modes) and set the [\[Ramp switch ass.\] \(rPS\)](#) configuration parameter to Cd15.

Command	Transition address	Final state	bit 7	bit 3	bit 2	bit 1	bit 0	Typical value of CMD (W8501)
			Reset	Enable operation	Quick stop	Enable voltage	Switch on	
Shut down	2, 6, 8	Ready to switch on	x	x	1	1	0	16#0006
Switch on	3	Switched on	x	x	1	1	1	16#0007
Enable operation	4	Operation enabled	x	1	1	1	1	16#000F
Disable operation	5	Switched on	x	0	1	1	1	16#0007
Disable voltage	7, 9, 10, 12	Switch on disabled	x	x	x	0	x	16#0000
Quick stop	11	Quick stop active	x	x	0	1	x	16#0002
	7, 10	Switch on disabled						
Fault state reset	15	Switch on disabled	0 → 1	x	x	x	x	16#0080

x: State not significant
0 → 1: Change from 0 to 1

Supervision and control in LINE mode

ETA status word (W3201)

bit 7	bit 6	bit 5	bit 4
Alarm	Switch on disabled	Quick stop active at 0	0

bit 3	bit 2	bit 1	bit 0
Malfunction	Operation enabled	Switched on	Ready to switch on

bit 15	bit 14	bit 13	bit 12
Direction of rotation	Stop via STOP key	0	0

bit 11	bit 10	bit 9	bit 8
Reference exceeded	Reference reached	Forced local mode (active at 0)	0

State	bit 6	bit 5	bit 3	bit 2	bit 1	bit 0	MSK = ETA (W3201) masked by 16#006F
	Switch on disabled	Quick stop	Malfunction	Operation enabled	Switched on	Ready to switch on	
Not ready to switch on	0	x	0	0	0	0	16#0000 16#0020
Switch on disabled	1	x	0	0	0	0	16#0040 16#0060
Ready to switch on	0	1	0	0	0	1	16#0021
Switched on	0	1	0	0	1	1	16#0023
Operation enabled	0	1	0	1	1	1	16#0027
Malfunction	0	x	1	0	0	0	16#0008 16#0028
Malfunction reaction active	0	x	1	1	1	1	16#000F 16#002F
Quick stop active	0	0	0	1	1	1	16#0007

x: State not significant

