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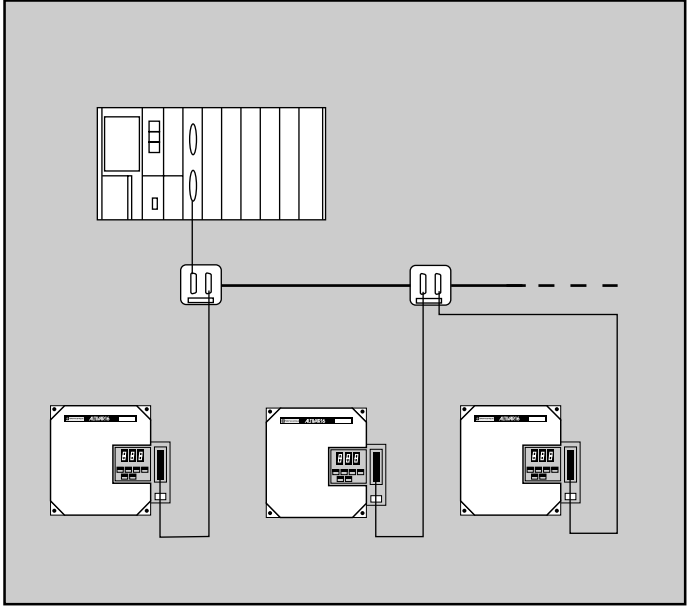
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ALTIVAR® 16

carte de communication PCMCIA

protocoles
UNI-TELWAY, MODBUS/JBUS

PCMCIA communication card

protocols
UNI-TELWAY, MODBUS/JBUS

VW3-A66301

guide d'exploitation
user's manual

Telemecanique
GROUPE SCHNEIDER

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FRANÇAIS

Carte de communication PCMCIA ..... page 2

protocoles

UNI-TELWAY, MODBUS / JBUS

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PCMCIA communication card ..... page 52

protocols

UNI-TELWAY, MODBUS / JBUS

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The communication card, reference **VW3-A66301**, is designed to be used with Altivar 16 speed controllers which are fitted with a VW3-A16303 communication interface.

It is designed to integrate these power switching components into modern control system architectures by enabling them to be connected to an industrial multidrop bus.

Data exchanges enable all the functions of the Altivar 16 to be used :

- function configuration,
- downloading of settings,
- control and supervision,
- monitoring,
- diagnostics.

The **VW3-A66301** communication card (PCMCIA type 3 format) has a 3 m connection cable fitted with a 15-pin SUB-D connector.

The card manages the following communication protocols :

- UNI-TELWAY,
- MODBUS/J BUS.

Only VW3-A16303 communication interface with software version above or equal to V1.3 IE04 can be used with VW3-A66301 PCMCIA communication card.

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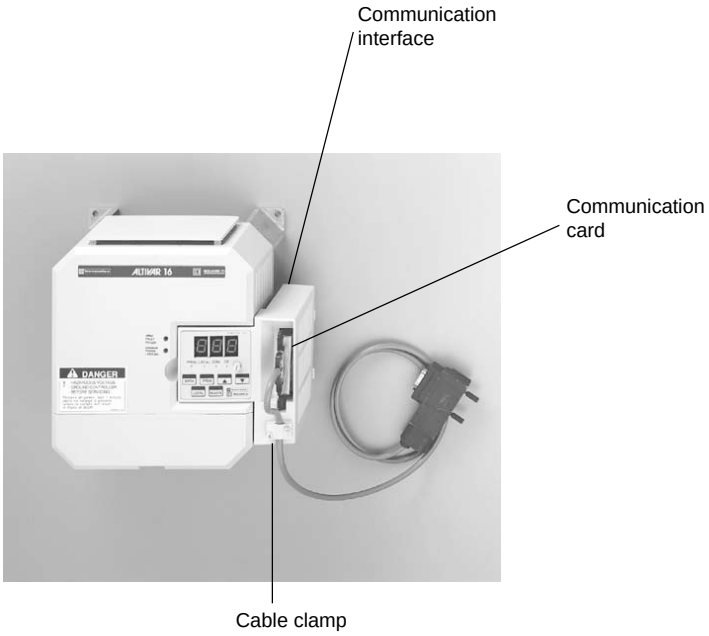
Before performing any operation on the speed controller switch it off and wait for the capacitors to discharge (approximately 1 min after switching off).

• Check that the speed controller is connected to earth via terminal G.

• Install the **VW3-A16303** communication interface on the speed controller (see user's manual).

• Insert the **VW3-A66301** communication card in its guide so that the connection cable, which is 3 meters long, falls towards the base of the product.

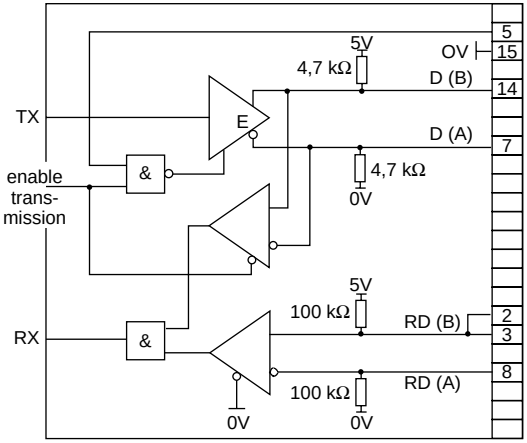
• Run the connection cable through the cable clamp located below the communication card slot.

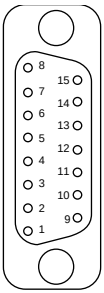


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SUB-D connector pinout

The RS 485 and RS 422 (RS 232 C compatible) standard transmission interface is electrically isolated from the speed controller. It is available on a 15-pin SUB-D connector.



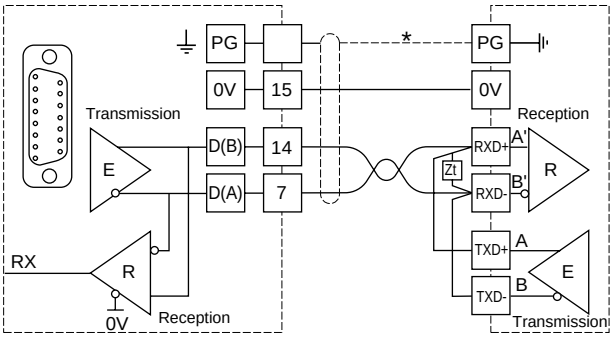


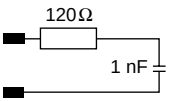
Seen from external contact side

Connection to the standard RS 485 bus

Pins to use

SUB-D connector (15-pin) Automated system





Zt line terminator recommended at both ends of the line

* Connection of the shielding to both ends depends on installation constraints

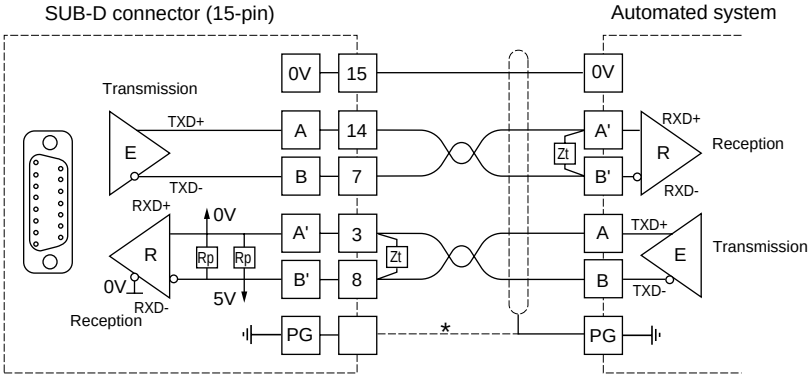
Recommendations

- use a shielded cable with 2 pairs of twisted conductors,
- connect the reference potentials to each other,
- maximum length of the line : 1000 meters,
- maximum length of a tap-link : 20 meters,
- do not connect more than 28 stations on a bus,
- cable routing : keep the bus away from the power cables (30 cm minimum), and make right-angle crossovers if necessary; connect the cable shielding to the earth of each device,
- fit a line terminator at both ends of the line.

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Connection to standard RS 422 bus

Pins to use

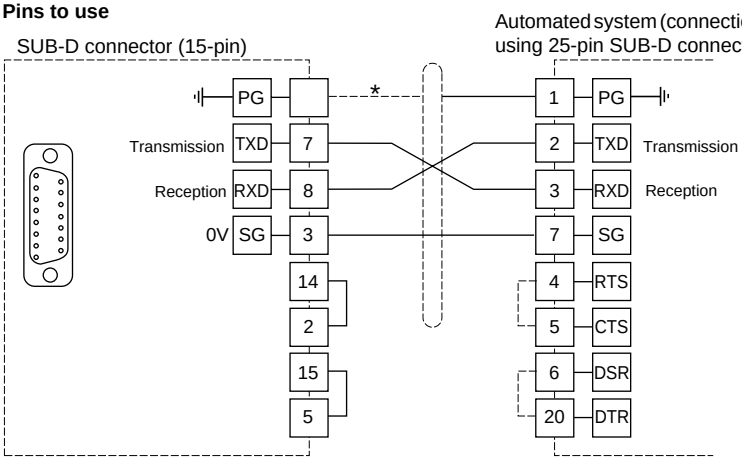


* Connection of the shielding to both ends depends on the electrical constraints on the installation.

Using the ABE-6SD15F wiring interface enables connection to a screw terminal block via the 15-pin SUB-D connector.

RS 232 C connection

Pins to use



* Connection of the shielding to both ends depends on the electrical constraints on the installation.

Using the ABE-6SD15F wiring interface enables connection to a screw terminal block via the 15-pin SUB-D connector.

Configuring communication functions

Refer to the operating manual of the PCMCIA communication interface of Altivar 16.

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The following accessories are available for connecting equipment.

TSX-CSA… cables for bus sold in 100, 200 or 500 m lengths.

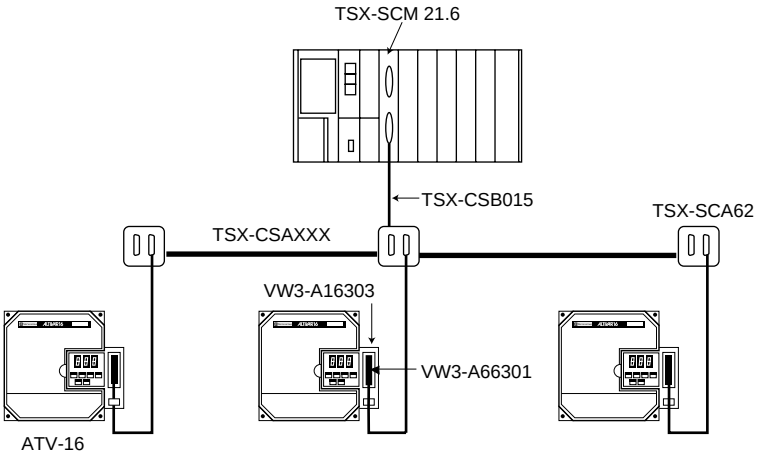
TSX-SCA62 subscriber connector

This passive unit comprises a printed circuit fitted with screw terminals for connecting 2 devices to the bus. It includes an end of line terminator when the connector is located at the end. The switches on the connector must be set in the following way

switch number	switch position
2	OFF
3	OFF
5	OFF

the position of the other switches has no effect.

Example of connection to a UNI-TELWAY bus



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Connecting the speed controller

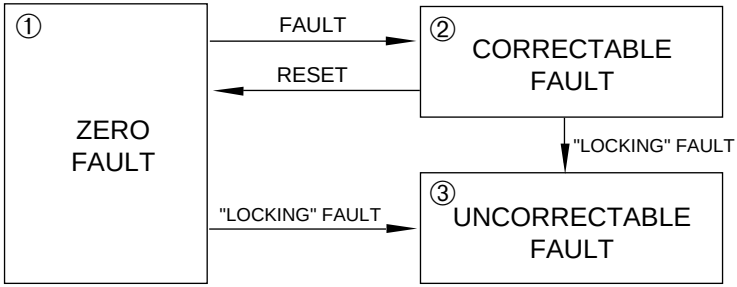
The Altivar 16 can be connected according to the diagrams shown in the catalogue.
The communication function provides the facility of remote control of the speed controller safety relay (contacts brought out to terminals SA-SC-SB). Using these contacts in the control circuit of the line contactor enables the power to be switched on and off remotely.

Note : Since the power and control supplies are the same, power-up through the serial link isn't possible. Therefore, the line contactor release stops the communication.

Nevertheless, the safety function of the relay is maintained, and continues to have **priority** over the remote control facility : the contact will open if a speed controller fault occurs.

Status of the Altivar 16

The following diagram shows the three stable states of the speed controller.



① ZERO FAULT : in this state the safety relay is closed.

② CORRECTABLE FAULT : this state is the result of the appearance of a type of fault which may disappear on its own (motor overheating, for example). This type of fault causes the speed controller safety relay to open.

When the fault has disappeared, if contacts SA-SC, SC-SB are not used in the speed controller supply sequence, the Altivar 16 reset command (bit 0 of word W3050) acknowledges the fault and re-energizes the safety relay.

③ UNCORRECTABLE FAULT : this state is reached as soon as a serious or "locking" fault, which requires corrective action, occurs (overcurrent due to a short-circuit, for example).
The safety relay can only be reset by a speed controller switch-on sequence.

When a communication fault occurs, the speed controller can change to 2 states depending on its configuration :
- Changing from line mode to local mode via an application-specific card logic input :
  the speed controller changes from the line frequency to the frequency required at the analog inputs with the acceleration or deceleration ramp.
- Changing from local mode to line mode :
  the speed controller brakes on the deceleration ramp and takes the speed and operating direction required by the serial link.

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Data structure

The adjustment, control, supervision and monitoring of the Altivar 16 are performed using data (or objects) which are specific to the product.

The data essentially comprises :

• BITS : named Bi (i = bit number) which are used to execute logic commands.

Example : B5 = start / stop command.

• WORDS (of 16 bits) : named Wi (i = word number) which are used for storage, either of complete digital values (- 32768 to + 32767), or of 16 independent logic states (in which case these words are termed registers).

Examples :

W3051 = frequency reference (digital value),
W3069 = fault register (16 fault bits).

Notation : W3069,2 designates the bit in row 2 of register W3069.

Access to data

The following tables give the list of parameters which can be accessed via the communication link. The exact function of each parameter and its effect on the behavior of the speed controller are described in the user's manual and catalogue for the speed controller.

Some data can be accessed in both read and write : these are the bits and words corresponding to adjustments, references and commands. This data is used by the speed controller.

However, data produced by the speed controller can only be accessed in read : signalling or fault data, etc. If written, they have no meaning and are rejected.

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Units

These words are always expressed as signed numeric integer values (-32768 to +32767). The unit is defined for each of them.

Example : W3052 : frequency reference, unit = 0.1 Hz,
W3052 = 455 corresponds to a frequency reference of + 45.5 Hz.

Range

The range permitted by the speed controller is specified for each of the parameters.
A value which is outside limits is always accepted, but will be automatically adjusted by the speed controller to either its lower or upper limit.

Example : W3029 : slip compensation, range = 0.... 5 Hz.

Any negative value is adjusted to 0 (0 Hz).
Any value above 50 is adjusted to 50 (5 Hz).

Values on switching on

Each time it is switched on, the Altivar 16 is initialized with the configuration and the adjustments stored in the EEPROM memory.

The speed controller is systematically placed in LOCAL control mode (orders are expected on its terminal block).

To control it via the multidrop bus, its commands must be assigned to
LINE mode : command word W3050 is written by setting bits DLI and FLI to 1.

Altivar 16 variables

Some Altivar 16 variables can be accessed at two different addresses :
• in the 3000 to 3078 address zone reserved for the Altivar 16,
• in the 0 to 127 address zone already used by the Altivar 45 2.

While the control system is operating (control, monitoring or modification of the speed controller adjustments), only one zone should be used.

1– Address zone reserved for the Altivar 16 (3000 to 3078)
This address zone contains all the speed controller parameters for optimum use of the facilities of the Altivar 16.

2– Address zone (0 to 127) common to the Altivar 16 and the Altivar 45 2
This address zone should only be used when integrating an Altivar 16 in a control system which until now has only included Altivar 45 2 controllers. Not all Altivar 16 parameters appear here, in particular those connected with functions which require reconfiguration of the application-specific card. In certain cases, using these addresses avoids the necessity of modifying the program.
Small differences in relation to the Altivar 45 2 are shown in the comments.

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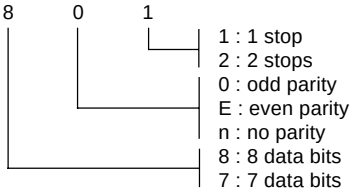
Configuring communication

The following parameters can be set using the terminal :

- *Pro* : defines the communication protocol :
  - *UtL* : UNI-TELWAY
  - *ASC* : Modbus ASCII
  - *rtu* : Modbus RTU / JBUS
  - *FIP* : FIPIO

- *bdr* : defines the data rate in kbps.
  Possible values : 0.3 / 0.6 / 1.2 / 2.4 / 4.8 / 9.6 / 19.2

- *For* : format of the data frame



- *Adr* : Logic address of the speed controller

	UtL	rTu	ASC	FIP
bdr	All values	All values	All values	
For	8.0.1	8.0.7 / 8.E.1 8.n.7 / 8.n.2	8.0.7 / 8.E.1 8.n.1 / 8.n.2 7.0.1 / 7.E.1 7.0.2 / 7.E.2	
Adr	1 to 31	1 to 31	1 to 31	1 to 63

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Diagnostics

On power-up, and after the protocol has been configured, the COM lamp on the PCMCIA card indicates whether or not communication is functioning.

UNI-TELWAY - FIPIO protocol :

Green COM indicator lamp : Normal operation
Red ERR indicator lamp : Communication fault
Flashing green indicator lamp: Serial link not configured.

Modbus RTU/JBUS protocol :

Green COM indicator lamp : Data transfer in progress.
Red ERR indicator lamp : Waiting for data transfer

Note : For further information, refer to the diagnostics page.

List of faults which may or may not be reset via communication

When a fault occurs, the speed controller freewheels to a stop. To restart, the operator must acknowlege the fault and reset the speed controller (W3050.0). However, 2 types of fault cannot be reset via communication but require action on the speed controller (see table below) :

Description	Not possible to reset speed controller (1)	Possible to reset speed controller (2)	Code displayed
Speed controller internal fault	X		INF
Communication fault		X	SLF
EEPROM memory fault	X		EEF
External fault		X	SRF
Supply too low		X	USF
Supply too high		X	OSF
Supply phase missing		X	PnF
Speed control fault		X	SPF
Overcurrent - overheating	X		DRF
Overvoltage due to harsh braking		X	OBF
Overcurrent due to harsh braking		X	OBF
Motor overload		X	OLF
Capacitor charging relay fault		X	CRF

(1) To reset the speed controller it is necessary to switch the power off then on again.

(2) The speed controller can be reset after the fault has been cleared.

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Reading parameters

All the speed controller data can be read when the motor is running or stopped.

Signalling words (words W3060 - W3078) are read-only.

Example of reading words W3020 to 3043 (24 words) with the UNI-TELWAY protocol.

Description	Request Code	Category Code	Type of object		Object address	Object number
Format	byte	byte	byte	byte	Word	Word
Code	H'36'	H'07'	H'68'	H'07'	H'OBCC'	H'0018'
Comments	read object		internal words	specific byte	(3020 in hex)	Number of words (24 in hex)

Text block for transmission
TxTi, C = H'0736'
TxTi, L = 4

Transmission table

H'07'	H'68'
H'CC'	H'OB'
H'18'	H'00'

Reception table

W3020 least sig.	H'07'
W3021 least sig.	W3020 most sig.
	W3021 most sig.

Response code :

- Positive response : H'FE'
- Negative response : H'FD' Reason : incorrect parameter number or wrong address

Note : For further information about the UNI-TELWAY protocol, refer to the UNI-TELWAY requests page.

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It is possible to write Altivar 16 parameters for :

- command words (motor running or stopped),
- adjustment words (motor running or stopped),
- configuration words (motor stopped).

To control the speed controller from the multidrop bus, it is necessary to execute commands on line : command word W3050 is written by setting bits DLI and FLI to 1. Bits DLI and FLI of the command register offer the possibility of partially assigning the commands which can be executed from the bus.

Note : setting bit NTO to 1 in the command register inhibits the communication fault check (Altivar 16 "SLF" fault).
For safety reasons, care must be taken when using this command.

Setting word W3050 to the value 5 with Modbus protocol (RTU frame)

Description	Slave no.	Function Code	Word no.	Value of the word	CR16
Format	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Code	01	06	OB ¦ EA	00 ¦ 05	6A ¦ 19
Comment		Writing a word	3050 in Hex. = OBEA		

Note : For further information on Modbus frames, see the end of this guide (Modbus / Jbus Protocol).

The following table shows all the functions of the Altivar 16 with its various application-specific cards.

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Altivar 16 variables

Applications	ATV16	General usage	Materials handling	Variable torque	High speed
Drive functions					
Maximum frequency	▲ 40 ... 200Hz	▲40 ... 200Hz	▲40 ... 200 Hz	▲40 ... 70/80Hz	▲40 ... 400Hz
Voltage/frequency ratio selection **(1)**	■ n-P-L	■ n-L	■ n-L	● P	■ n-L
Slip compensation	■ yes/no	■ yes/no	■ yes/no	no	no
Switching frequency	■ 5/10kHz	■ 5/10kHz	● 5kHz	■ 5/10kHz	● 5kHz
Current limit	●1.5 In	▲0.5 to 1.5 In	●1.5 In	●1.2 In	●1.2 In
Braking to a standstill by DC injection (f<0.1 Hz)	■ yes/no	■ yes/no	no	no	■ yes/no
Functions in the application-specific cards					
• ± 10 V analog input					
Summing		■	■	■	■
Speed regulation		■	■		
PI controller		■		■	
• Logic inputs					
2nd ramps		■	■	■	■
Preset speeds		■	■		■
Current limit		■			
+/- speed			■		
Step by step operation (JOG)		■			■
Fast stop			■		
Freewheel stop		■		■	■
DC injection				■	
Automatic/manual				■	
Start/stop		■	■		
Reset after fault		■	■		
Change motor power			■		
Speed controller forced in local mode **(3)**		■	■	■	■
• Logic outputs					
Brake control sequence			▲		
Speed reference reached		■		■	■
Low speed reached		■	■		
High speed reached		■		■	
Current limit reached		■	■		
1.1 In overload reached		■	■		■
100% thermal state reached		■			
• Analog output					
Motor frequency		■	■	■	■
Motor current		■	■		■
Preprogrammed and programmable characteristics					
– S ramps	■	■	■		
– Skip frequencies				■	
– Controlled stop on AC supply break **(2)**	■	■	■	■	■
– Automatic catching a spinning load	■	■		■	■
– Automatic restart	■	■		■	

(1) n : constant torque (normal applications), P : variable torque,
L : constant torque (heavily-loaded machines).
(2) ATV16 U..N4 speed controller only.
(3) Only the Altivar 16 with software version IE07.
● - fixed, programmed function
■ - programmable function
▲ - function with adjustable value

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Address zone reserved for Altivar 16

Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3000	LI1	0…10		Assignment of logic input LI1	0 = not assigned 1 = start/stop 2 = fast stop 3 = fault reset 4 = + speed 5 = freewheel stop 6 = switching to ramp 2 7 = reduction of current limit 8 = Jog 9 = change motor power 10 = local forcing
W3001	LI2	0…11		Assignment of logic input LI2	0 = not assigned 1 = 3rd speed 2 = fast stop 3 = fault reset 4 = - speed 5 = freewheel stop 6 = automatic / manual switching 7 = switching to ramp 2 8 = reduction of current limit 9 = Jog 10 = change motor power 11 = local forcing
W3002	LI3	0…10		Assignment of logic input LI3	0 = not assigned 1 = 4th speed 2 = fast stop 3 = DC injection 4 = fault reset 5 = freewheel stop 6 = switching to ramp 2 7 = reduction of current limit 8 = Jog 9 = change motor power 10 = local forcing
W3003	AI1	0…5		Assignment of analog input AI1	0 = not assigned 1 = speed feedback 2 = speed feedback + backdriving control 3 = summing reference 2 input 4 = PI feedback 5 = manual reference input

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Address zone reserved for Altivar 16

Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3004	LO1	0…6		Assignment of logic output LO	0 = not assigned 1 = 100% thermal state reached 2 = frequency reference reached 3 = current limit reached 4 = LSP reached 5 = HSP reached 6 = 1.1 Ith overload reached
W3005	SAB	0…4		Assignment of relay S2A S2B	0 = not assigned 1 = 100% thermal state reached 2 = frequency reference reached 3 = HSP reached 4 = brake control
W3006	AO1	0…2		Assignment of analog output AO	0 = not assigned 1 = motor frequency 2 = motor current
W3007	CPM	0…4		Motor power coefficient	0 = coefficient 1/1 1 = coefficient 1/2 2 = coefficient 1/3 3 = coefficient 1/4 4 = coefficient 1/5
W3008	TIC	0…3		Type of DC injection	0 = no injection 1 = injection for f < 0.1 Hz 2 = injection for f < LSP 3 = injection for f < SRF
W3009	TFR	40…400 Hz	0.1 Hz	Maximum frequency	
W3010	UNS	0…7		Motor nominal voltage	0 = 208 V 1 = 220 V 2 = 230 V 3 = 240 V 4 = 380 V 5 = 400 V 6 = 415 V 7 = 460 V
W3011	FRS	40…400 Hz	0.1 Hz	Motor nominal frequency	
W3012	UFT	0…2		Type of voltage/ frequency ratio	0 = linear N 1 = quadratic P 2 = linear L

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Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3013	CF1			Specific functions configuration register	
				W3013,0 Reserved	
	RPS			W3013,1 S ramp	0 = linear 1 = S
	FLR			W3013,2 Flying restart	0 = no 1 = yes
	ATR			W3013,3 Automatic restart	0 = no 1 = yes
	SFR			W3013,4 10 kHz switching frequency	0 = 5 kHz 1 = 10 kHz
				W3013,5 Reserved	
	STP			W3013,6 Controlled stop on AC supply break	0 = no 1 = yes
	BRA			W3013,7 Adaptation of the deceleration ramp	0 = no 1 = yes
	SLP			W3013,8 Slip compensation	0 = no 1 = yes
	RBL			W3013,9 Activation of the + / – speed reference	0 = no 1 = yes
	SCE			W3013,A Speed ref. in EEPROM memory	0 = no 1 = yes
	BST			W3013,B Inhibit boost at start-up	0 = no 1 = yes
				W3013,C Reserved W3013,D Reserved W3013,E Reserved W3013,F Reserved	
W3014 to W3019 : Reserved					

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Address zone reserved for Altivar 16

Adjustment words (read and write)

WORD	NAME	RANGE	UNIT	DESCRIPTION
W3020	LSP	0…HSP	0.1 Hz	Low speed
W3021	HSP	LSP…TFR	0.1 Hz	High speed
W3022	ACC	0.1…600s	0.1 s	Acceleration time
W3023	DEC	0.1…600s	0 1 s	Deceleration time
W3024	FLG	0…100	1	Frequency loop gain (if FLG=100 : frequency loop inhibited)
W3025	UFR	0…100	1	Set voltage / frequency ratio
W3026	ITH	0.5…1.15 In	0.1 A	Thermal current
W3027	IDC	0.5…1.5 Ith	0.1 A	DC current amplitude
W3028	TDC	0…5.1 s	0.1s	DC injection time (if TDC= 5.1s : continuous DC injection)
W3029	CGL	0…5 Hz	0.1 Hz	Slip compensation
W3030	AC2	0.1…600 s	0.1 s	Acceleration time 2
W3031	DE2	0.1…600 s	0.1 s	Deceleration time 2
W3032	JOG	0.1…10 Hz	0.1 Hz	JOG speed
W3033	SP3	LSP…HSP	0.1 Hz	3rd speed
W3034	SP4	LSP…HSP	0.1 Hz	4th speed
W3035	JF1	0…TFR	0.1 Hz	Skip frequency 1
W3036	JF2	0…TFR	0.1 Hz	Skip frequency 2
W3037	RGP	0…100	0.1	PI controller proportional gain
W3038	RGI	0…100	0.1	PI controller integral gain
W3039	IBR	0…1.15 In	0.12 A	Brake control level
W3040	SMF	0…LSP	0.1 Hz	Brake application level
W3041	SRF	0…LSP	0.1 Hz	Brake release level
W3042	TMF	0…5 s	0.1 s	Brake application time
W3043	LTI	0.5…1.5 In	0.1 A	Current limit level
W3044 to W3049 : Reserved				

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Command words (read and write)

WORD	NAME	RANGE	UNIT	DESCRIPTION
W3050	COM			Command register
	RST			W3050,0 Reset speed controller
	DLI			W3050,1 Assign commands on line
	FLI			W3050,2 Assign frequency reference on line **(1)**
				W3050,3 Reserved
	NTO			W3050,4 Communication check inhibited **(2)**
	RUN			W3050,5 Start / stop command **(1)**
	DCB			W3050,6 DC injection braking command
				W3050,7 Reserved
	CAL			W3050,8 Select freewheel stop
	CAR			W3050,9 Select fast stop
				W3050,A Reserved
				W3050,B Reserved
				W3050,C Reserved
				W3050,D Reserved
	EFL			W3050,E External fault command
				W3050,F Store in EEPROM **(3)**
W3051	FRH	LSP…HSP		Signed line frequency reference
W3052	LOL			Write logic outputs on line (only if they are not assigned)
				W3053,0 Value applied at S2A-S2B
				W3053,1 Value applied at LO
				W3053,2 to F Reserved
W3053	AOL	0…255		Write analog output AO on line (only if AI not assigned)
W3054 to W5059 : Reserved				

The bits are active at state 1

(1) The same message should not be used to assign FLI and RUN. Use 2 messages, the 1st for FLI, the 2nd for RUN.

(2) The Altivar 16 changes to fault condition SLF :
• in UNI-TELWAY when there has been no polling for 10 s,
• in MODBUS if more than 10 s elapse between requests.
Setting this bit to 1 inhibits this check. For safety reasons, this should only be performed during debugging phases.

(3) Global command to store all the adjustments and the entire configuration in the speed controller EEPROM. The storage takes a few seconds, and access to the speed controller is refused while it is being performed. For this function, the speed controller must be on line and the motor stopped.

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Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3060	STR			Speed controller status register	
	LOC			W3060,0 All commands in local mode	
	RDY			W3060,1 Speed controller ready (RDY or SLC)	
	FAI			W3060,2 Faulty	
	REN			W3060,3 Reset authorized (following correctable fault)	
				W3060,4 Reserved	
	FLO			W3060,5 Speed controller forced in Local mode	
	NTO			W3060,6 Communication check inhibited	
	CFA			W3060,7 Correctable fault	
	RNG			W3060,8 Motor running	
	RVE			W3060,9 Direction of rotation	0 = forward 1 = reverse
	BRE			W3060,A DC injection braking	
	SST			W3060,B Steady state	
	OVL			W3060,C Motor thermal overload alarm	1= thermal state ≥100%
	OBR			W3060,D Overbraking alarm	
	LIM			W3060,E Current limit	
				W3060,F Reserved	
W3061	FRR		0.1 Hz	Actual rotation frequency (signed value)	
W3062	LCR		0.1 A	Motor current	
W3063	ULN		0.1 V	Mains supply voltage	
W3064	IOL			Speed controller logic I/O status register W3064,0 FW input state W3064,1 RV input state W3064,2 LI1 input state W3064,3 LI2 input state W3064,4 LI3 input state W3064 5 S2A-S2B output state W3064 6 LO output state W3064,7 to W3064,F Reserved	
W3065	AIV	0…10000		AIV or AIC analog input value	
W3066	IAI	-10000…+10000		AI analog input value	
W3067	IAO	0…255		AO output value	
W3068	FRE		0.1 Hz	Effective frequency reference (signed value)	

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Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3069	FLT			Fault register : fault which has caused speed controller to stop	
	INF			W3069,0 Speed controller internal fault **(*)**	
	SLF			W3069,1 Communication fault	
	EEF			W3069,2 Storage fault in EEPROM	
	SRF			W3069,3 External fault (generated by an EFL command)	
	USF			W3069,4 Mains supply undervoltage	
	OSF			W3069,5 Mains supply overvoltage	
	PHF			W3069,6 Supply phase(s) failure	
				W3069,7 Reserved	
				W3069,8 Speed regulation fault / tachogenerator absent	
	DRF			W3069,9 Overcurrent, PWM overheating **(*)**	
	OBF			W3069,A Overvoltage caused by overbraking	
	OBF.			W3069,B Overcurrent caused by overbraking	
	OLF			W3069 C Motor overload	
				W3069,D Reserved	
				W3069,E Reserved	
	CRF			W3069,F Capacitor charging relay fault	
W3070	DPR			Register of current faults	
	INF			W3070,0 Speed controller internal fault	
	SLF			W3070,1 Communication fault	
	EEF			W3070,2 Storage fault in EEPROM	
	SRF			W3070,3 External fault (generated by an EFL command)	
	USF			W3070,4 Mains supply undervoltage	
	OSF			W3070,5 Mains supply overvoltage	
	PHF			W3070,6 Supply phase(s) failure	
				W3070,7 Reserved	
				W3070,8 Speed regulation fault / tachogenerator absent	
	DRF			W3070,9 Overcurrent	
	OBF			W3070,A Overvoltage caused by overbraking	
	OBF.			W3070,B Overcurrent caused by overbraking	
	OLF			W3070,C Motor overload	
				W3070,D Reserved	
				W3070,E Reserved	
	CRF			W3070,F Capacitor charging relay fault	

(*) These faults are uncorrectable and cannot be acknowledged by the communication link.

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Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W3071	DP1			Past fault 1	each of these words has the same structure as W3069
W3072	DP2			Past fault 2	
W3073	DP3			Past fault 3	
W3074	DP4			Past fault 4	
W3075	DP5			Past fault 5	
W3076	DP6			Past fault 6	
W3077	DP7			Past fault 7	
W3078	DP8			Past fault 8	

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Address zone common to Altivar 16 and Altivar 45 2

Control bits (read and write)

BIT	NAME	DESCRIPTION	FUNCTION
B0	TST	De-energization of speed controller safety relay	Disconnects the Altivar 16 power supply if the contact of the relay is used for the hold-in circuit of the line contactor
B1 **(*)**	RST	Fault reset (Speed controller reset)	Acknowledges a correctable fault which has disappeared and resets the safety relay
B2 **(*)**	CLO	Assignment of control to LOCAL mode	The Altivar 16 can only be controlled via its terminals (logic and analog inputs)
B3 **(*)**	CLI	Assignment of control to LINE mode	The Altivar 16 is controlled via the multidrop bus
B4	NTO	Inhibition of communication check	The Altivar 16 changes to fault condition SLF : • in UNI-TELWAY after no polling for 10 s • in MODBUS if more than 10 s elapse between two requests Setting this bit to 1 inhibits this check. For safety reasons this feature should only be used during debugging phases
B5	RUN	Start / stop command	1 = start 0 = stop
B6	REV	Frequency reference sign	1 = negative 0 = positive The direction of rotation can be reversed by changing the state of this bit or by providing a frequency reference of opposite sign in word W19
B7	DCB	Braking control	Takes priority over the RUN bit
B8	CAL	Selection of a freewheel stop	Active when there is a stop command
B9	CAR	Selection of a fast stop	Active when there is a stop command
B10		Reserved	

(*) These bits initiate the action shown when they are written as 1. They are reset to zero by the speed controller.
If they are written as zero they have no effect and are always read as zero.

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Address zone common to Altivar 16 and Altivar 45 2

Adjustment words (read and write)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W0	–	–	–	Reserved	
W1	–	–	–	Reserved	
W2	CGL	[0... 5Hz]	0.1Hz	Slip compensation	
W3			–	Not used	
W4	–	–	–	Not used	
W5	–	–	–	Not used	
W6	–	–	–	Not used	
W7	IDC	[0.5... 1.5Ifh]	0.1A	DC amplitude when stopping	With ATV 45 2 range from 0.5 to 1.5 In
W8	TDC	[0... 4s]	0.1s	DC injection time when stopping	
W9	UFR	[0... 100]	1	Voltage/frequency ratio adjustment coefficient	With ATV 45 2 range from 0 to 99
W10	ITH	[0.45... 1.05In]	0.1A	Motor thermal current	
W11	FLG	[0... 99%]	1%	Frequency loop gain	With ATV 45 2 range from 0 to 100
W12	–	–	–	Not used	
W13	–	–	–	Not used	
W14	LSP	[0...HSP]	0.1Hz	Low speed	
W15	HSP	[LSP... TFR]	0.1Hz	High speed	Adjust TFR in W3009
W16	ACC	[0.1... 600s]	0.1s	Acceleration time	With ATV 45 2 range from 0.2 to 990 s
W17	DEC	[0.1... 600s]	0.1s	Deceleration time	With ATV 45 2 range from 0.2 to 990 s

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Address zone common to Altivar 16 and Altivar 45 2

Command words (read and write)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W18	COM	–	–	Command register	
				W18,0 (RST) Reset speed controller (fault reset)	
				W18,1 (DLI) Assign logic commands on LINE	See **note 1**
				W18,2 (FLI) Frequency reference on LINE	See **notes 1 and 2**
				W18,3 Reserved	
				W18,4 (NTO) Inhibit communication check	
				W18,5 (RUN) Start / stop command	See **note 2**
				W18,6 (DCB) Braking control	
				W18,7 Reserved	
				W18,8 (CAL) Select freewheel stop	
				W18,9 (CAR) Select fast stop	
				W18,A Not used	
				W18,B Reserved	
				W18,C Reserved	
				W18,D Reserved	
				W18,E Reserved	
				W18,F Storage in EEPROM	See **note 3**
W19	FRH	[LSP... HSP]	0.1Hz	Signed frequency reference	Signed value

The bits are active at state 1.

note 1 : Bits W18,1 and W18,2 can be used to partially assign commands which can be executed from the multidrop bus. It is important to set them correctly each time the COM register is written.

note 2 : Do not use the same message to assign FLI and RUN. Use 2 messages : the 1st for FLI, the 2nd for RUN.

note 3 : Global command to store all the adjustments (W0 to W17) and the entire configuration (W33 to W66) in the speed controller EEPROM.
This command should be used with care : the storage takes a few seconds, and access to the speed controller is refused while it is being performed.

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Address zone common to Altivar 16 and Altivar 45 2

Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W20	STR	–		Status register	
				W20,0 (LOC) All commands assigned in LOCAL mode	
				W20,1 (RDY) Speed controller ready	
				W20,2 (FAI) Faulty	
				W20,3 (REN) Reset authorized	
				W20,4 Not used	
				W20,5 (FLO) Speed controller forced in LOCAL mode	
				W20,6 (NTO) Communication check inhibited	
				W20,7 (CFA) Correctable fault	
				W20,8 (RNG) Running	Motor rotating
				W20,9 (RVE) Direction of operation	0 = forward 1 = reverse
				W20,A (BRE) DC injection braking	
				W20,B (SST) Steady state	
				W20,C (OVL) Motor thermal overload alarm	
				W20,D (OBR) Overbraking alarm	
				W20,E (LIM) Current limit	
				W20,F Not used	

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Address zone common to Altivar 16 and Altivar 45 2

Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W21	FLT		–	Fault register	
				W21,0 (INF) Speed contr. internal fault **(*)**	
				W21,1 (SLF) Communication fault	
				W21,2 (EEF) EEPROM fault	
				W21,3 (SRF) Fault generated by the TST command	
				W21,4 (USF) Mains supply undervoltage	
				W21,5 (OSF) Mains supply overvoltage	
				W21,6 (PHF) Supply phase(s) failure	
				W21,7 Not used	
				W21,8 (SPF) Speed regulation fault	
				W21,9 (DRF) Overcurrent, PWM overheating, underheating of PWM control **(*)**	With ATV 45 2, this bit indicates an overcurrent
				W21,A (OBF) Overvoltage caused by overbraking	
				W21,B (OBF.) Overcurrent caused by overbraking	
				W21,C (OLF) Motor overload	
				W21,D Not used	
				W21,E Reserved	
				W21,F (CRF) Charging relay fault	
W22	LCR		0.1A	Motor current	
W23	RFR		0.1Hz	Actual rotation frequency	Signed value
W24	–		–	Not used	
W25	ULN		1V	Mains voltage	
W26	–		–	Not used	
W27	–		–	Reserved	
W28	–		–	Reserved	

(*) These faults are uncorrectable and cannot be acknowledged by the communication link.

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Address zone common to Altivar 16 and Altivar 45 2

Signalling words (read only)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W29	DIN		–	Speed controller logic input status register	
				W29,0 FW input	
				W29,1 RV input	
				W29,2 Not used	
				W29,3 Not used	
				W29,4 Not used	
				W29,5 to W29,F : reserved	
W30	DAI	[0... 1000]		Value of speed controller analog input	0 = 0V or 0 mA or 4 mA 1000 = 10V or 20 mA
W31	–		–	Reserved	
W32	–		–	Reserved	

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Address zone common to Altivar 16 and Altivar 45 2

Configuration

Configuration words can only be written when the speed controller is stopped

They are stored in the EEPROM memory via the COM command register (bit W18,F).

Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W33	–	–		Not used	
W34	–	–		Not used	
W35	–	–		Configuration register	
				W35,0 Not used	
				W35,1 Not used	
				W35,2 Not used	
				W35,3 Not used	
				W35,4 (SLP) Slip compensation	0 = no and 1 = yes
				W35,5 Not used	
				W35,6 Not used	
				W35,7 Not used	
				W35,8 Not used	
				W35,9 Not used	
				W35,A Not used	
				W35,B Not used	
				W35,C Not used	
				W35,D Not used	
				W35,E Not used	
				W35,F Not used	

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Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	POSSIBLE VALUES
W36	–	–		Configuration register 2	
				W36,0 (FLR) Flying restart (automatic catching a spinning load)	0 = no and 1 = yes
				W36,1 Not used	
				W36,2 Not used	
				W36,3 (ATR) Automatic restart	0 = no and 1 = yes
				W36,4 to W36,F : not used	
W37		–		Not used	
W38		–		Not used	
W39		–		Not used	
W40		–		Not used	
W41	RPS	0...1		Ramp shapes **(1)**	0 = linear 1 = S
W42		–		Not used	
W43		–		Not used	
W44		–		Not used	
W45	BRA	0...1		Deceleration ramp adaptation	0 = no 1 = yes
W46	UFT	0...2		Voltage/frequency ratio **(2)**	0 = linear N 1 = quadratic P 2 = linear L

(1) Parabolic ramp not available on the Altivar 16
(2) The F type does not exist on the Altivar 16

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Address zone common to Altivar 16 and Altivar 45 2

Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W47	–	–		Not used	
W48	–	–		Not used	
W49	–	–		Not used	
W50	–	–		Not used	
W51	–	–		Not used	
W52	IBR	0...In	0.1 A	Brake control level	
W53	AC2	0.1...600 s	0.1 s	Acceleration time 2	on the ATV 45 2 : adjustable from 0.2 to 990 s
W54	DE2	0.1...600 s	0.1 s	Deceleration time 2	on the ATV 45 2 : adjustable from 0.2 to 990 s
W55	–	–		Not used	
W56	–	–		Not used	

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Address zone common to Altivar 16 and Altivar 45 2

Configuration words (read and write) (write when motor is stopped)

WORD	NAME	RANGE	UNIT	DESCRIPTION	COMMENTS
W57	–	–		Not used	
W58	–	–		Not used	
W59	–	–		Not used	
W60	–	–		Not used	
W61	–	0...LSP	0.1Hz	Brake application level	
W62	–	0...LSP	0.1 s	Brake release level	
W63	–	0...5 s	0.1 s	Brake application time adjustable from 0 to 4 s	
W64	–	–		Not used	
W65	–	–		Not used	
W66	–	40...200 Hz	0.1 s	Nominal frequency	
W61 to W119 : Reserved					

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Maintenance

The following words can be used for diagnostics and maintenance. They contain a list of the **8 most recent faults** which have caused the speed controller to stop (power cuts are not considered as faults).

These 8 words are managed on a stacking principle : the appearance of a fault causes the stack to move downwards and the fault which has appeared is stored in the 1st W120 word. This principle continues to be used when the stack is full.
These words cannot be modified or reset to zero.

Words for maintenance (read only)

WORD	NAME	DESCRIPTION	COMMENTS
W120 W121 . . to . . W127	DP1 DP2 DP8	Register of the most recent fault etc. Register of the eighth fault recorded	Each of these words has the same format as the FLT signalling register [W21] The value 0 indicates that there is no fault

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General

The exchange of data between computer systems, PLCs and other intelligent systems must be performed using a common language.
This language should be as simple as possible and understood by everyone involved. Nevertheless, it must be possible to check every exchange to ensure the integrity of the transfers. The variables exchanged are therefore inserted in a frame which generally comprises the following :



Each protocol defines the presence, the format and the contents of the various groups of variables which surround the data zone.

This structuring makes it possible to define the start and the size of messages, if necessary the system to which the data is addressed, the type of function required, the variables themselves, a control parameter and an end code which validates the whole message.
The form and content of this frame are different for each type of protocol.

List of requests

The following table describes the requests accepted by the Altivar 16 and their limits.
Details of the coding of the requests are given in the UNI-TELWAY reference manual.

Request	Code (hex)	Altivar 16
Identification Protocol version Status Mirror Read error counters Reset counters	H'0F' H'30' H'31' H'FA' H'A2' H'A4'	Yes Yes Yes Yes Yes Yes
Read a bit Write a bit	H'00' H'10'	Yes Yes
Read a word Write a word	H'04' H'14'	Yes Yes
Read objects Write objects	H'36' H'37'	63 words max. 60 words max.
Event data	– –	Yes 2 words
Specific	H'F2'	See later

Identification request - Request code H'OF'

Response given by Altivar

Response code	= H'3F'
Product type	= H'14' for Altivar
Sub-type	= H'16' Altivar 16
Product version	= H'XX' software version (eg : H'21' for V2.1)
ASCII string*	= product reference (eg : ATV-16U29N4)

* The first byte of an ASCII string always corresponds to the length of the string.

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Request status - Request code H'31'

Response given by Altivar

Response code	= H'61'
Current status	= H'XX'
	bit 0 : internal fault
	bit 1 : correctable fault
	bit 2 : uncorrectable fault
	bit 3 : not significant
	bit 4 : not significant
	bit 5 : not significant
	bit 6 : speed controller stopped (RDY or SLC or fault)
	bit 7 : speed controller in LOCAL control
Status mask	= H'C7' indicates the significant bits for the current status

UNI-TELWAY frame

Heading	Target address	Transmitter address	Length of message	Category + request	Data	Check

Requests to read and write objects

These requests are used to access several words within the limits described on the previous page.
These requests can be coded by specifying :

Question code (TXTi,C)	= H'36' (read) or H'37' (write)
Category	= 0...7
Segment	= H'68' (internal word)
Object type	= H'06' for a byte (8 bits) in reading or H'07' for a word (16 bits) in reading and writing
Object address	= H'xxxx'
Etc	

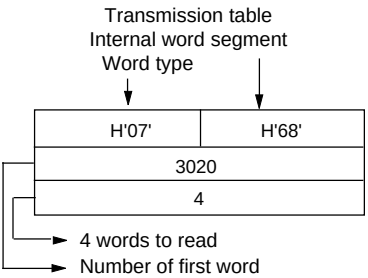
Words reserved or not used are read to 0 and their write is not significant.
The response to a "write objects" request is accepted if a word is written at least.

Example : programming on a TSX7 PLC using a text block.
READ words W3020 to W3023 of the Altivar 16.

– Using word type object = H'07'

Transmission text block
TxTi,C = H'0736' (category + request)
TxTi,L = 6
+ transmission table

Reception text block
TxTi,V = H'66' (confirm)
TxTi,S = 9 (9 bytes received)
+ reception table



Reception table

W3020 (least sig.)	H'07'
W3021 (least sig.)	W3020 (most sig.)
W3022 (least sig.)	W3021 (most sig.)
W3023 (least sig.)	W3022 (most sig.)
	W3023 (most sig.)

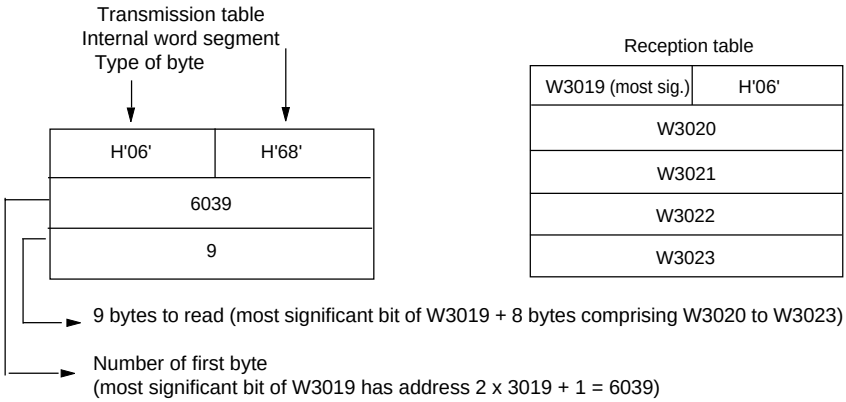
The data received in the reception table is offset by one byte. It is the application program which must correct the data (for example by successive offsets) before using it.

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– **Using byte type object = H'06'**

Transmission text block
TxTi,C = H'0736' (category + request)
TxTi,L = 6
+ transmission table

Reception text block
TxTi,V = H'66' (confirm)
TxTi,S = 10 (10 bytes received)
+ reception table



Reading the most significant bit W3019 can be used to obtain a correct framework of the following words in the reception table, and to avoid shifts between the most and least significant bits in these words.

Event data

The Altivar 16 transmits data on its own initiative to the UNI-TELWAY link master without having first received a question.

This data is sent via the "unsolicited data" request and does not require a response from the receiver.

Data is transmitted in the following 2 cases :
– When a fault appears or disappears (rising or falling edge at status register bit W3060,2).
– When the speed controller is forced into local control via one of its logic inputs, if that input has been assigned to this function (rising or falling edge at this input), or via the local key on the interface for the PCMCIA communication card.

Size of event data : 2 words of 16 bits sent in the following order :
– STR status register (word W3060).
– FLT fault register (word W3069).

To transmit unsolicited data, the Altivar 16 must have an address between 1 and 32.

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Summary :
the use of event data with a TSX PLC requires :

– Correct configuration of the UNI-TELWAY link master module.
– Regular monitoring of the indicators which display the arrival of unsolicited data and the addresses of the transmitters.
– Acquisition of this data via the request to read event data.

Specific control request

This request is used to control the Altivar 16 and to obtain in return data essential for controlling the speed controller.

Request format

Request code	: byte	= H'F2'
Category	: byte	= 0...7
Specific request code	: byte	= 0
Reserved	: byte	= 0
Command	: word	= COM
Reference	: word	= FRH
Acceleration	: word	= ACC
Deceleration	: word	= DEC

Confirm format

Response code	: byte	= H'F2'
Specific response code	: byte	= H'30'
Reserved	: byte	= 0
Reference	: word	= FRH
Status register	: word	= STR
Fault register	: word	= FLT
Motor current	: word	= LCR

Negative response

Response code	: byte	= H'FD'

Cause : incorrect number of parameters

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MODBUS frames

Note : In the rest of this document MODBUS and JBUS functions are grouped together under the heading MODBUS.

Two transmission modes can be used, only one of them being used in a system.

RTU mode

The frame defined for the MODBUS protocol has neither message heading bytes nor end of message bytes. It is defined as follows :

Address	Request	Data	CRC16

The data is transmitted in binary code.
CRC16 : cyclical redundancy check.
The end of frame is detected on a silence of 3 characters or more.

ASCII mode

The frame is complete and is defined in the following way :

Heading	Address	Request	Data	LRC	End "CRLF"

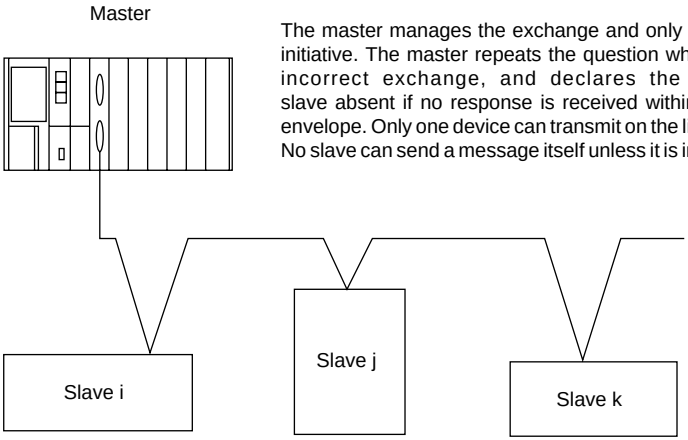
– heading = ":" (H'3A),
– the data is coded in ASCII : each byte is divided into 2 four-bit bytes, each of which is coded by an ASCII character (0 to F),
– LRC : longitudinal redundancy check,
– end : "CR" "LF" (H'0D and H'0A).

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Principle

The MODBUS protocol is a dialogue protocol which creates a hierarchical structure (a master and several slaves).
The MODBUS protocol enables the master to interrogate one or more intelligent slaves. A multidrop link connects the master and slaves.
Two types of dialogue are possible between master and slaves :
– the master talks to a slave and waits for a response,
– the master talks to all the slaves without waiting for a response (broadcasting principle).
The slaves are numbered from 1 to 255, and number 0 is reserved for broadcasting.



The master manages the exchange and only it can take the initiative. The master repeats the question when there is an incorrect exchange, and declares the interrogated slave absent if no response is received within a given time envelope. Only one device can transmit on the line at any time. No slave can send a message itself unless it is invited to do so.

Note

No lateral communication (ie. slave to slave) can be performed directly.
The application software of the master must therefore be designed to interrogate a slave and send back data received to another slave.

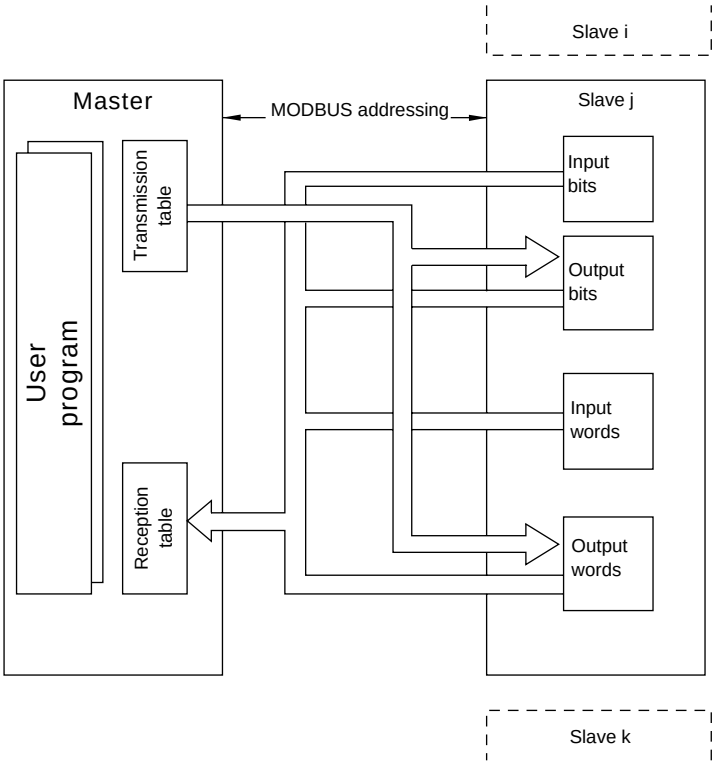
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Accessible data

The MODBUS protocol enables data (bits and words) to be exchanged between a master and several slaves, and checks these exchanges.

Consequently, bit areas are defined in each slave unit which will be read or written by the master.

An input object can only be read.
An output object can be read or written.



Exchanges

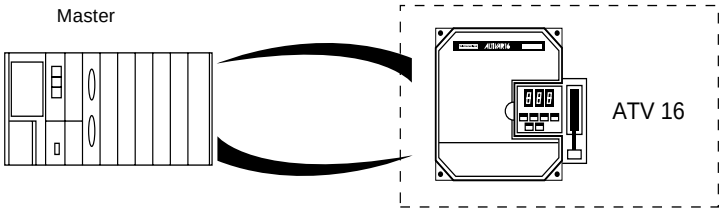
The master, or supervision device, takes the initiative in exchanges. The master addresses a slave by supplying it with four types of data :
– the address of the slave,
– the function required of the slave,
– the data area (variable depending on the request),
– the exchange check.

The link master waits for the response of the slave before transmitting the next message, thus avoiding any conflict on the line. Operation in half duplex is therefore authorized.

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Control and monitoring

All control of exchanges between two units which are communicating via asynchronous serial link naturally includes exception messages when exchange faults occur. Various incorrect messages may be sent to a slave. In this event, the slave will tell the master that it does not understand, and the master will decide whether or not to repeat the exchange.



The master has access to a certain amount of data which is stored and managed by the slave. The master can access this data using special function codes (diagnostic mode, read event counter, etc).

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MODBUS functions

MODBUS functions include :
– main functions for exchanging data,
– additional functions for exchange diagnostics.

The following table shows the functions which are managed by the ALTIVAR 16 communication function, and specifies its limits.

The definition of the "read" and "write" functions are understood from the point of view of the master.

Code	Type of function	D	ALTIVAR 16
01	Read N output bits		1 max
02	Read N input bits		1 max
03	Read N output words		63 max
04	Read N input words		63 max
05	Write one output bit	D	Yes
06	Write one output word	D	Yes
08	Diagnostics (see details below)		Yes
11	Read event counter		Yes
16	Write N output words	D	60 max

Functions marked «D» can be broadcast.
The message transmitted by the master must specify slave number = 0.
A response message is never returned.

Detailed information on functions

Code 01 : read N output bits.
This function is used to read output bits (bits which can be written and read in the slave by the master).

Code 02 : read N input bits.
As above, but applies to input bits (bits which the master can only read).

Code 03 : read N output words.
This function is used to read output words (words which can be written and read in the slave by the master).

Code 04 : read N input words.
As above, but applies to input words (words which the master can only read).

Code 05 : write an output bit.
Used to set an output bit to 0 or 1 (can only be accessed in write).

Code 06 : write an output word
Used to write a 16-bit output word (can only be accessed in write).

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Diagnostic function code 08 is always accompanied by a sub-code.

Code 08/00 : echo.
This function requests the interrogated slave to send back the whole message sent by the master.

Code 08/01 : channel reinitialization.
This function is used to reinitialize communication of a slave and in particular to make it leave listen only mode (LOM) by transmission of a data H'0000 ou H'FF00.

Code 08/03 : change of ASCII delimiter.
In ASCII mode, messages are delimited by the line feed character (LF = H'0A). This function is used to change this character.

Code 08/04 : change to LOM mode.
This function is used to force a slave into listen only mode (LOM). In this mode the slave does not process messages which are addressed to it, and only transmits a response when the channel is reinitialized.

Code 08/0A : counter reset.
This function resets to zero all the counters monitoring the exchanges of a slave.

Code 08/0B : number of correct messages seen on the line without CRC error or checksum error.This function reads a 16-bit counter (incremented from 0 to H'FFFF) which totals the messages seen on the line and processed by the slave.

Code 08/0C : number of messages received with checksum error (reads a 16-bit counter).

Code 08/0D : number of exception responses.
Reads a 16-bit counter which totals the number of exception messages transmitted to the master by a slave (following an incorrect frame).

Code 08/0E : number of messages addressed to the slave except for broadcasts.
Reads a 16-bit counter which totals the number of all types of messages addressed to the slave.

Code 08/0F : number of broadcast messages received.
Reads a 16-bit counter which totals the number of all types of messages addressed to the slave.

Code 08/10 : read number of NAQ responses. The value read is always 0.

Code 08/11 : read of number of responses from the slave that is not ready. The value read is always 0.

Code 08/12 : read the number of characters which are not processed (incorrect).

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Code 11 : read event counter.
– a status (always zero),
– a counter which is incremented each time a correct message sent to the slave is received (form and content) except for exception messages.

Code 16 : write N output words.
This function enables the master to write output words to the slave (words which can be written or read).

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Details of frames (RTU mode)

Read N bits : function 1 or 2

Question

Slave n°	01 or 02	N° of 1st bit MS | LS	Number of bits MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave n°	01 or 02	Number of bytes read	Value	----------	Value	CRC16
1 byte	1 byte	1 byte				2 bytes

Example : read bit B4 of slave 2

Question	02	01	0004	0001	BC38	
Response	02	01	01	00	51CC	if B4 = 0
	02	01	01	01	900C	if B4 = 1

Bit B4 can always be used and can be read at 1 or at 0.

Read N words : function 3 or 4

Question

Slave n°	03 or 04	N° of 1st word MS | LS	Number of words MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave n°	03 or 04	Number of bytes read	Value of 1st word MS | LS	------	Value of last word MS | LS	CRC16
1 byte	1 byte	1 byte	2 bytes		2 bytes	2 bytes

Example : read words W3020 to W3023 of slave 2

Question	02	04	0BCC	0004	33E1	
Response	02	04	08	xxxx	----------	xxxx CRC16
				Value of W3020		Value of W3023

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Write an output bit : function 5

Question

Slave n°	05	Bit n° MS | LS	Bit value |	CRC16
1byte	1 byte	2 bytes	2 bytes	2 bytes

The "bit value" field has two possible values only, and can take no other value :
– bit at 0 = 0000
– bit at 1 = FF00

Response

Slave n°	05	Bit n° MS | LS	Bit value |	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example : write value 1 in bit B3 of slave 2

Question and response	02	05	0003	FF00	7C09

Write an output word : function 6

Question

Slave n°	06	Word number MS | LS	Word value MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave n°	06	Word number MS | LS	Word value MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example : write value H'0315' = 789 in word W3022
of slave 2 (ACC = 78,9s)

Question and response	02	06	0BCE	0315	2B1D

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Diagnostic : function 8

Question and response

Slave n°	08	Sub-code	Data	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Sub-code	Question data	Response data	Function executed
00	XX YY	XX YY	Echo
01	00 00	00 00	Reinitialization
03	XX 00	XX 00	XX = new delimiter
04	00 00	No response	Change to LOM mode
0A	00 00	00 00	Reset counters to 0
0B	00 00	XX YY	XXYY = counter value
0C	00 00	XX YY	XXYY = counter value
0D	00 00	XX YY	XXYY = counter value
0E	00 00	XX YY	XXYY = counter value

Read event counter : function 11 (H'0B')

Question

Slave n°	0B	CRC16
1 byte	1 byte	2 bytes

Response

Slave n°	0B	00 00	Counter value MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Write N output words : function 16 (H'10')

Question

Slave n°	10	N° of 1st word MS | LS	Number of words	Number of bytes	Value of 1st word MS | LS	----	CRC16
1 byte	1 byte	2 bytes	2 bytes	1 byte	2 bytes		2 bytes

Response

Slave n°	10	N° of 1st word MS | LS	Number of words MS | LS	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example : write values 2 and 3 in words W3022 and W3023 of slave 2

Question	02	10	0BCE	0002	04	0002	0003	E3C6
Response	02	10	0BCE	0002	2220			

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Exception responses

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

Format of an exception response :

Slave n°	Response code	Error code	CRC16
1 byte	1 byte	1 byte	2 bytes

Response code : function code of the request + H'80 (the most significant bit is set to 1).

Error code :
1 = the function requested is not recognized by the slave.
2 = the bit and word numbers (addresses) indicated in the request do not exist in the slave.
3 = the bit and word values indicated in the request are not permissible in the slave.
4 = the slave has started to execute the request, but cannot continue to execute it completely.

CRC16 calculation

The CRC16 is calculated based on all the bytes of the message by applying the following method.

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

Enter the first to the last byte of the message :
CRC X0R <byte> —> CRC
Enter 8 times
Move the CRC one bit to the right
If the output bit = 1, enter CRC X0R H'A001—> CRC
End enter

End enter

The CRC obtained will be transmitted least significant byte first, then most significant.

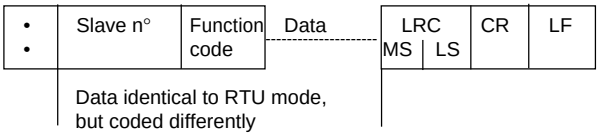
X0R = exclusive OR.

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ASCII mode

In this mode, the MODBUS frame has the following structure :



Delimiters : ":" = H'3A', CR = H'0D', LF = H'0A'.

Data : the data field is analogous to the RTU frames, but coded in ASCII characters. Each byte is divided into 2 four-bit bytes, each of which is coded by its ASCII equivalent.

Example : the byte containing the slave number 06 will be coded by 2 ASCII characters "0" and "6", ie. by H'30' and H'36'.

LRC : modulo 256 hexadecimal sum of the contents of the frame (without the delimiters) before ASCII coding, 2's complement.
The byte obtained is then coded in the form of 2 ASCII characters as above.

Example : write value 1 in bit B3 of slave 2

Question and response

Hexadecimal

3A	30 32	30 35	30303033	46463030	4637	0D	0A

ASCII

:	0 2	0 5	0 0 0 3	F F 0 0	F 7	CR	LF

LRC calculation

Sum of the bytes in the frame :
H'02' + H'05' + H'00' + H'03' + H'FF' + H'00' = H'109' = 265

Modulo sum 256 : H'09' = 9

Modulo sum 256, 2's complement :
H'100' - H'09' = 256 - 9 = 247 = H'F7'

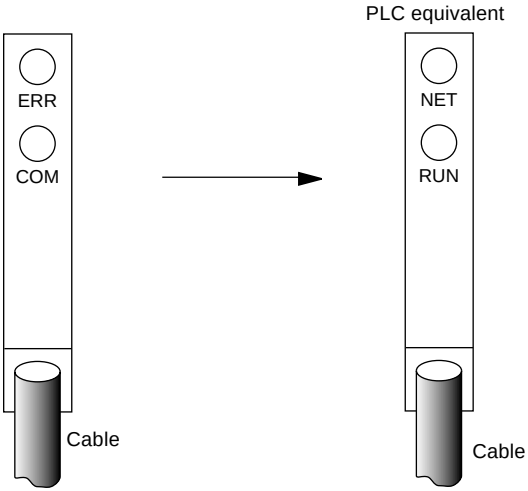
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Fault

For the communication fault codes refer to the user's manual for the PCMCIA communication card interface.

Additional diagnostics

Check the state of the two indicator lamps located on the front panel of the VW3-A66301 communication card.



State of indicator lights : 0 = off **1/2 = flashing** **1 = on**

Green light COM	Red light ERR	Probable causes	Corrective actions
1	0	Normal operation	
1/2	0	Incorrect communication configuration or communication fault with l'Altivar 16.	Check configuration. Check software compatibility.
0	1	Communication fault on the bus (Wait for request in MODBUS or no polling in UNI-TELWAY)	Check the position of TSX-SCA62 subscriber connector switches of the Altivar 16. Check the connections. Check that master link is installed, and check its configuration and operation.
0	0	Fault of PCMCIA card or speed controller.	Check the Altivar 16 by removing the PCMCIA card. If necessary, replace the Altivar 16 or the card.

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