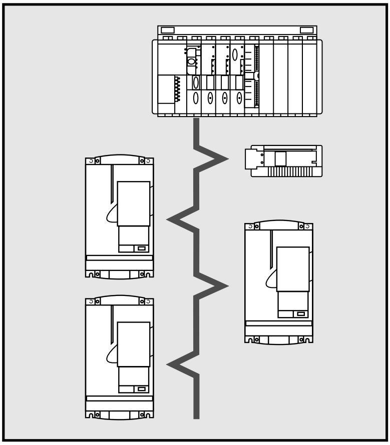
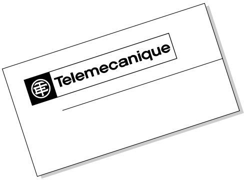
Altivar 58
Telemecanique

Guide d'exploitation
User's Manual

Carte de communication protocoles UNI-TELWAY, Modbus / Jbus
Communication card protocols UNI-TELWAY, Modbus / Jbus

VW3-A58303





GROUPE SCHNEIDER

■ Merlin Gerin ■ Modicon ■ Square D ■ Telemecanique

Altivar 58

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FRANÇAIS

ENGLISH

WARNING

When the speed controller is powered up, the power components and some of the control components are connected to the mains supply. *It is extremely dangerous to touch them. The speed controller cover must be kept closed*.

After switching the power to the ALTIVAR off, *wait for 3 minutes before working on the equipment*. This is the time required for the capacitors to discharge.

NOTE

Although every care has been taken in the preparation of this document, Schneider Electric SA cannot guarantee the contents and cannot be held responsible for any errors it may contain nor for any damage which may result from its use or application.

The products and options described in this document may be changed or modified at any time, either from a technical point of view or in the way they are operated. Their description can in no way be considered contractual.

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Hardware Setup

Introduction

The VW3-A58303 communication card is used to connect an Altivar® 58 speed controller to UNI-TELWAY et Modbus / Jbus networks.

It is delivered with a 3 meter connection cable equiped with two connectors :

– a 9 pin Sub D connector for the card,
– a 16 pin Sub D connector for the bus.

The Altivar 58 speed controller can receive and respond to data messages. This data exchange enables a network to access certain Altivar 58 functions such as :

- Remote loading of configuration parameters et de réglages,
- Command and Control,
- Monitoring,
- Diagnostics.

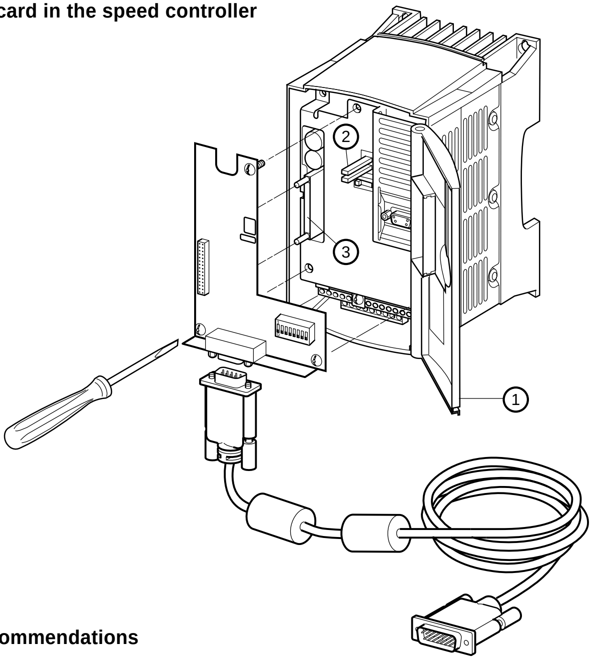
Installing the Card, Address

Acceptance

Ensure that the card reference printed 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 speed controller



Mounting Recommendations

Ensure that the speed controller is powered down.

To access the mounting slot for the option card, unlock cover 1 and open it.

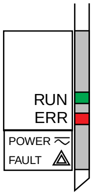
Check that there is no power to the DC bus. Green LED 2 (POWER) must be off : wait 3 minutes after powering down.

Open the flexible protection of the control card.

Mount the option card on the control card support by snapping it onto connector 3 and fix it by means of the three screws.

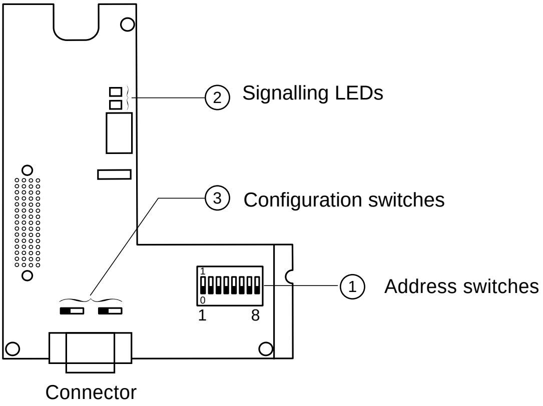
The cable is connected to the card by a 9 pin connector.

Put in place the label



The card is supplied with a self-adhesive label indicating the functions of the signalling LEDs.
Stick the label on the cover of the Altivar 58 below the existing label.

Card layout :



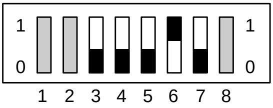
Coding the speed controller address :

An Altivar 58 is identified on the bus by its address, coded from 0 to 31.

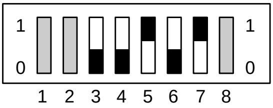
The address corresponds to the binary number given by setting the 8 switches 1 on the card to 1 or 0 (in fact only the switches 3 to 7 are used for the address).

Caution : the least significant bits are on the right.

Examples :



address 2



address 5

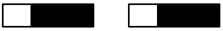
Setting all switches to 0 gives the address 0.

Signalling LED :

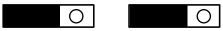
The UNI-TELWAY, Modbus/Jbus card has 2 lamps 2 whose function is detailled in the diagnostic chapter.

Configuration switches :

The card has two switches 3 for the protocol configuration.



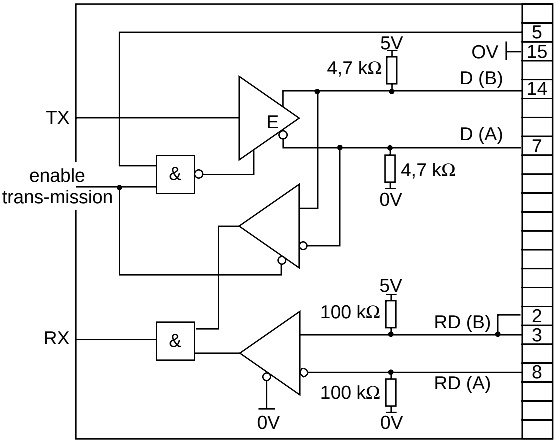
- UNI-TELWAY protocol

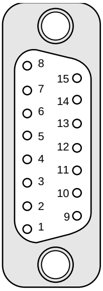


- Modbus/Jbus protocol

SUB-D connector pinout

The RS 485 standard transmission interface is electrically isolated from the speed controller. It is available on a 15-pin SUB-D connector.

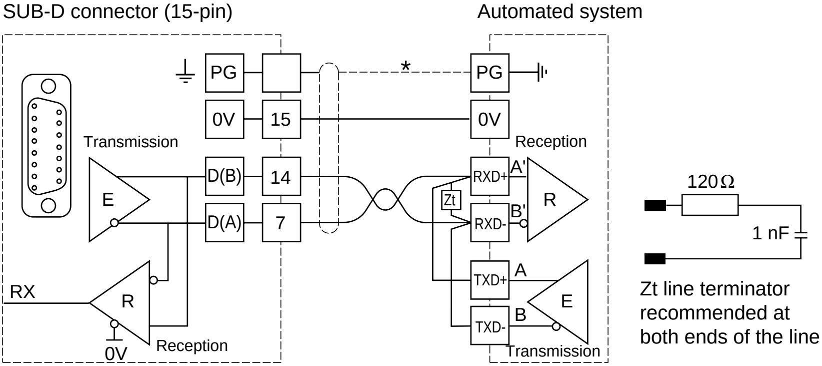




Seen from external contact side

Connection to the standard RS 485 bus

Pins to use



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.

Connection to the multidrop bus

The following accessories are available for connecting equipment.

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

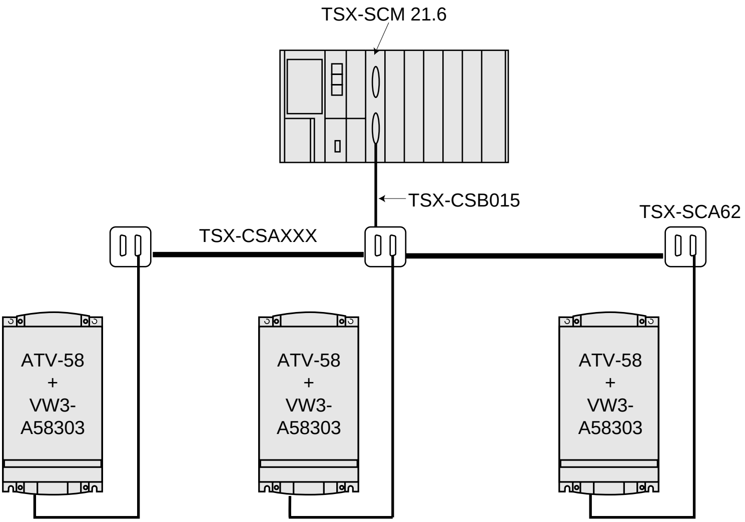
TSX-SCA62 subscriber connector

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



Configuring Communication Functions

Initial power-up

When the Altivar 58 is connected to the supply the card is automatically recognised. The configuration menu 8-COMMUNICATION will appear on the display terminal (or programming terminal or PC software).

Configuration

Select the menu 8-COMMUNICATION for access to the configuration parameters of the card. This menu enables configuration of all the communication parameters.
The first parameter is the network address of the drive, this parameter is only accessible on the terminal, because it is configured by switches 3 to 7. The second parameter is the choice of protocol.

Modification of the communication parameters is only possible when the motor has stopped.

Parameter	Code	Range	Factory setting	Comments
Address	AdrC	0 - 31	1	Drive address configurable by switches 3 to 7 (reading only)
Protocol	-Pro	UNI-TELWAY Modbus / RTU Modbus / ASCII	-	
Transmission speed	-bdr	4.8 9.6 19.2		Value in Kbit/s
Format (1)	-For	7o1 - 7E1 7o2 - 7E2 8o1		For Modbus ASCII only
		8E1 - 8n1 8n2		For Modbus / ASCII and Modbus / RTU only
		8o1		For all protocols

(1) Signification : 7 = 7 bits, 8 = 8 bits, o = uneven, E = even, n = without parity bit, 1-2 = number of "stop" bits.

Communication principle

Data structure

The adjustment, control, supervision and monitoring of the Altivar 58 are performed using data (or objects) which are specific to the product.

The data essentially comprises :

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 :

W401 = frequency reference (digital value),
W483 = fault register (16 fault bits).

Notation : W483,2 designates the bit in row 2 of register W483.

Access to data

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.

The variables of the ALTIVAR 58 and their control procedure are detailled in the manual "Internal communication variables".

UNI-TELWAY requests

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 :

Heading	Address	Request	Data	Check	End

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 (hexa)	Altivar 58
Identification Protocol version Mirror Read error counters Reset counters	H’0F’ H’30' H’FA’ H’A2' H’A4'	Yes Yes Yes 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.
Specific	H’F2'	See later

Identification request - Request code H'OF'

Response given by Altivar

Response code	= H'3F'
Product type	= H'18' for Altivar
Sub-type	= H'58' Altivar 58
Product version	= H'XX' software version (eg : H'21' for V2.1)
ASCII string*	= Altivar size (eg : ATV-58U18N4)

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

UNI-TELWAY requests

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’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.

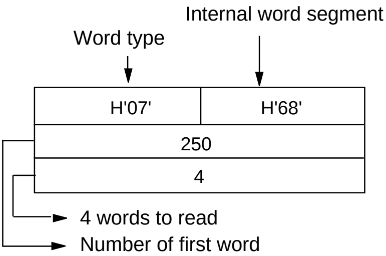
Example : programming on a TSX7 PLC using a text block.
READ words W250 to W253 of the Altivar 58.

– 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

Transmission table



Reception table

W250 (least sig.)	H'07'
W251 (least sig.)	W250 (most sig.)
W252 (least sig.)	W251 (most sig.)
W253 (least sig.)	W252 (most sig.)
	W253 (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.

Specific control request

This request is used to control the Altivar 58 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	= CMD
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	= ETA
Fault register	: word	= FLT
Motor current	: word	= LCR

Negative response

Response code	: byte	= H'FD'
Cause	: incorrect number of parameters	

Modbus / Jbus protocol

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).

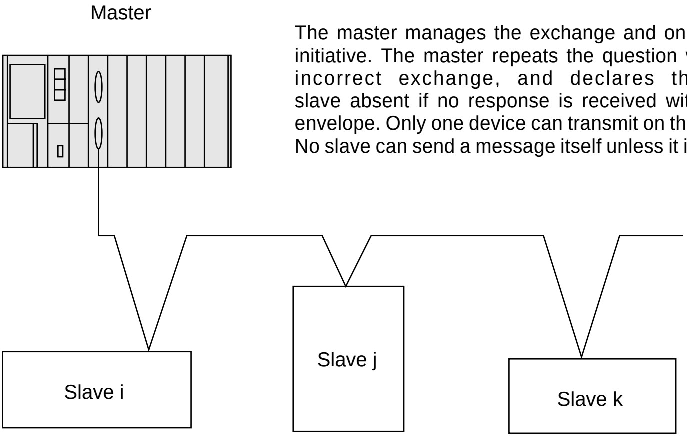
Principle

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

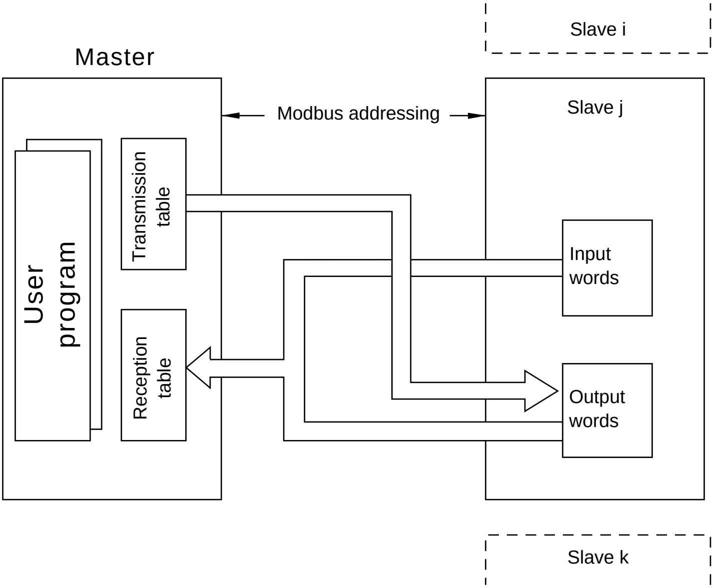
No lateral communication (ie. slave to slave) can be performed directly.
The application software of the master must therefore be designed to interrogate a slave and send back data received to another slave.

Accessible data

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

Consequently, word 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.



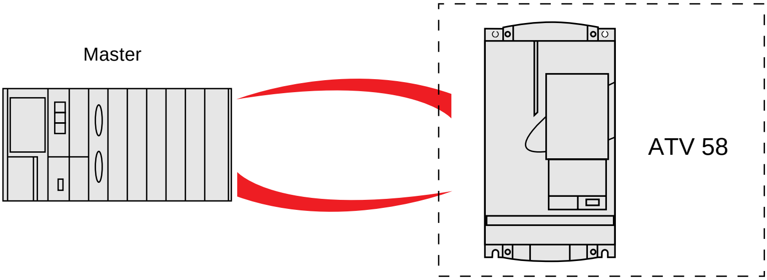
Exchanges

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.

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).

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 58 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 58
03	Read N output words		63 max
04	Read N input words		63 max
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 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 06 : write an output word
Used to write a 16-bit output word (can only be accessed in write).

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).

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).

Details of frames (RTU mode)

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.

Read N words : function 3 or 4

Question

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

Réponse

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

Example : read words W463 to W466 of slave 1

Question	01	03	01CF	0004	75CA		
Response	01	03	08	xxxx	----------------------	xxxx	CRC16
				Value of W463		Value of W466	

Write an output word : function 6

Question

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

Response

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

Example : write value H'0315' = 789 in word W252
of slave 1 (ACC = 78,9s)

Question and response	01	06	00FC	0315	88C5

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 6 and 500 in words W400 and W401 of slave 2.

Question	02	10	0190	0002	04	0006	01F4	1801

Response	02	10	0190	0002	402A

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.

ASCII mode

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

• •	Slave n°	Function code	Data	LRC MS | LS	CR	LF

Data identical to RTU mode, but coded differently

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 10 in word W252 of slave 2

Question and response

ASCII

3A	30 32	30 36	30304643	30303041	4632	0D	0A

Hexadecimal

:	0 2	0 6	0 0 F C	0 0 0 A	F 2	CR	LF

LRC calculation

Sum of the bytes in the frame :
H'02' + H'06' + H'00' + H'FC' + H'00' + H'0A' = H'10E' = 270

Modulo sum 256 : H'0E' = 14

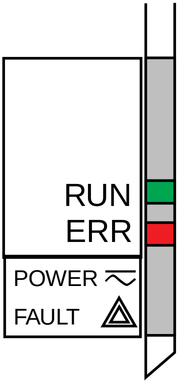
Modulo sum 256, 2's complement :
H'100' - H'0E' = 256 - 14 = 242 = H'F2'

Fault

For an explanation of the codes consult the manual «Internal communication variables».

Additional diagnostics

Check the state of the 2 lamps RUN and ERR mounted on the card and visible through the cover of the Altivar :



RUN : green lamp
ERR : red lamp

Lamp status :
0 = off 1/2 = slow flashing (500 ms)
1 = on 1/10 = fast flashing (100 ms)

RUN lamp green	ERR lamp red	Probable cause	Corrective action
1	0	Normal operation, bus and starter present	OK
0	0	Not operating	Check supply
0	1	Communication fault on the bus	Check the communication bus and the connectors. Also check the switches
0	1/10 *	Character error	Check communication configuration
1/10	0	Communication not configured	Configure communication
1/2	0	Communication fault between the Altivar and communication card	Check 30 pin connector between Altivar and card

* This display flashes for 6 x 100 ms if an incorrect character has been received. This short flashing is repeated after a period of five seconds if an incorrect character is received. This only occurs when the communication card is set for communication fault (no message received for 10 s for bus communication or 1 s for ASCII protocol).

If the card never changes to normal operation, this display indicates that the wiring is definitely correct but that the configuration is not suitable (speed or format).

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