



CPA300V

**COMMUNICATION
PROTOCOL**

Version 1 Revision 1

January 24th, 2019

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1.1 Introduction

The RS485 serial interface supports the MODBUS/JBUS (RTU) protocol. In this document only the information necessary to read/write from/to CPA has been reported (not all the parts of the protocol have been implemented).

For a complete description of the MODBUS protocol please refer to the "Modbus_Application_Protocol_V1_1a.pdf" document that is downloadable from the www.modbus.org web site.

1.2 MODBUS functions

These functions are available on CPA:

- Reading of n "Holding Registers" (code 03h)
- Writing of one "Holding Registers" (code 06h)

IMPORTANT:

- 1) In this document the "Modbus address" field is indicated in two modes:
 - 1.1) "**Modicom address**": it is the "6-digit Modicom" representation with Modbus function code 03 (Read Holding Registers).
 - 1.2) "**Physical address**": it is the "word address" value to be included in the communication frame.
- 2) The communication parameters are to be set according to the configuration of the instrument (refer to CPA instruction manual)

Function 03h (Read Holding Registers)

This function is used to read the contents of a contiguous block of holding registers (word). The Request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 5 registers (words) with a single request, when not differently specified.

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

Request frame

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	
Function code	1 byte	03h	
Starting address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of registers (N word)	2 bytes	1 to 10h (1 to 11)	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	
Function code	1 byte	03h	
Quantity of requested bytes	1 byte	N word * 2	
Register value	N *2 bytes		Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	83h	
Exception code	1 byte	01h, 02h, 03h, 04h (see note)	
CRC	2 bytes		

Function 06h (Write Single Holding Register)

This function code is used to write a single holding register. The Request frame specifies the address of the register (word) to be written and its content.

The correct response is an echo of the request, returned after the register content has been written.

Request frame

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	
Function code	1 byte	06h	
Starting address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	
Function code	1 byte	06h	
Starting address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

1.3 Application notes

RS485 general considerations

- To avoid errors due to the signal reflections or line coupling, it is necessary to terminate the bus at the beginning and at the end (inserting a 120 ohm 1/2W 5% resistor between line B and A in the last instrument and in the Host interface).
- The network termination is necessary even in case of point-to-point connection and/or of short distances.
- For connections longer than 1000m or if in the network there are more than 160 instruments (with 1/5 unit load as used in CPA interface), a signal repeater is necessary.
- For bus connection it is suggested to use an AWG24 balanced pair cable and to add a third wire for GND connection. Connect GND to the shield if a shielded cable is used.
- The GND is to be connected to ground only at the host side.
- If an instrument does not answer within the "max answering time", it is necessary to repeat the query. If the instrument does not answer after 2 or 3 consecutive queries, it is to be considered as not connected, faulty or reached with a wrong address. The same consideration is valid in case of CRC errors or incomplete response frames.

MODBUS timing

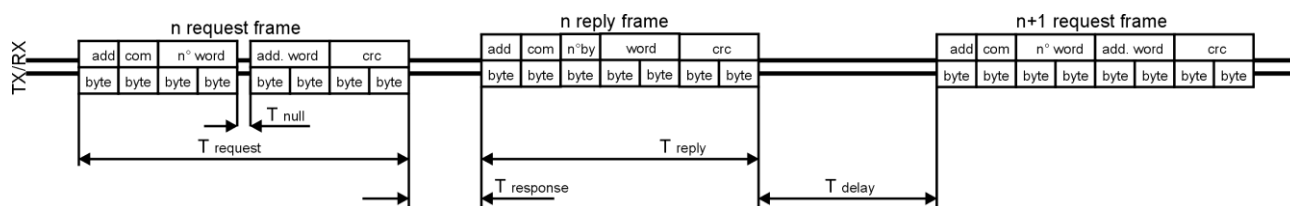


Fig. 1 : 2-wire timing diagram

Timing characteristics of reading function:	ms
T response: Max answering time	50ms
T response: Typical answering time	10ms
T delay: Minimum time before a new query	3.5char
T null: Max interruption time during the request frame	2.5char

2 TABLES

2.1 Data format representation In Carlo Gavazzi instruments

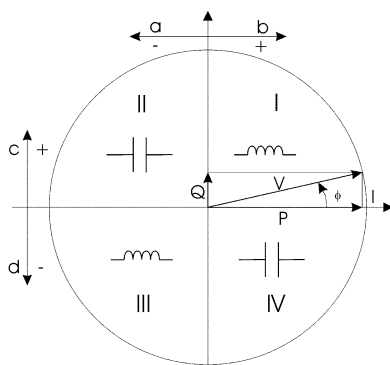
The variables are represented by integers or floating numbers, with 2's complement notation in case of "signed" format, using the following:

Format	IEC data type	Description	Bits	Range
INT16	INT	Integer	16	-32768 .. 32767
UINT16	UINT	Unsigned integer	16	0 .. 65535
INT32	DINT	Double integer	32	$-2^{31} .. 2^{31}$
UINT32	UDINT	Unsigned double int	32	0 .. $2^{32}-1$
IEEE754 SP		Single-precision floating-point	32	$-(1+[1 -2^{-23}])) \times 2^{127} .. 2^{128}$

For all the formats the byte order (inside the single word) is MSB->LSB. In INT32 and UINT32 formats, the word order is LSW->MSW.

Geometric representation

According to the signs of the power factor, the active power P and the reactive power Q, it is possible to obtain a geometric representation of the power vector, as indicated in the drawing below, according to EN 60253-23:



- a = Exported active power
- b = Imported active power
- c = Imported reactive power
- d = Exported reactive power

Fig. 2 : Geometric Representation

2.2 Instantaneous variables and meters (FLOAT LSW first)

MODBUS: read only mode with functions code 03 and 04

Table 2.2-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40037	0024h	2	A	FLOAT (LSW first)	Value weight: A
40053	0034h	2	Ah	FLOAT (LSW first)	Value weight: Ah

2.3 Instantaneous variables and meters (FLOAT MSW first)

MODBUS: read only mode with functions code 03 and 04

Table 2.3-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40051	0032h	2	A swapped	FLOAT (MSW first)	Value weight: A

2.4 Instantaneous variables and meters (INT16)

MODBUS: read only mode with functions code 03 and 04

Table 2.4-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40050	0031h	1	A	INT16	Value weight: A*100
40055	0036h	1	A Max	INT16	Value weight: A*100
40056	0037h	1	A Min	INT16	Value weight: A*100

2.5 Firmware version

MODBUS: read only mode

Table 2.5-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40002	0001h	1	Version code	UINT 16	Value=1: Revision 1

2.6 Carlo Gavazzi Controls identification code

MODBUS: read only mode

Table 2.6-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40001	0000h	1	Carlo Gavazzi Controls identification code	UINT 16	16=CPA300V

2.7 Programming parameter tables

Analogue Output configuration menu

MODBUS: read and write mode

Table 2.7-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40007	0006h	2	Start Input (A)	FLOAT (LSW first)	Default = 0
40009	0008h	2	Stop Input (A)	FLOAT (LSW first)	Default = 300
40011	000A	2	Start Output (mV)	UINT 16	0..10000 Default = 0
40012	000B	2	Stop Output (mV)	UINT 16	0..10000 Default = 10000

Measurement and filters

MODBUS: read and write mode

Table 2.7-2

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40013	000Ch	1	Number of samples for mobile average	UINT16	1...32 Default: 1 Note: 1=100ms
40014	000Dh	1	Second level filter for ripple problems on AC measurement	UINT16	1000..20000 Default: 4096

Serial port configuration menu

MODBUS: read and write mode

Table 2.7-3

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
40003	0002h	1	RS485 instrument address	UINT 16	Value min = 1 Value max = 247
40004	0003h	1	Machine answer delay (characters)	UINT16	Value min = 1 Value max = 1000 Default = 1
40005	0004h	1	RS485 baud rate	UINT 16	Value 0 = 1.2 kbps Value 1 = 2.4 kbps (Default) Value 2 = 4.8 kbps Value 3 = 9.6 kbps Value 4 = 19.2 kbps Value 5 = 38.4 kbps Value 6 = 57.6 kbps Value 7 = 115.2 kbps
40006	0005h	1	Parity	UINT16	Value 0 = no parity Value 1 = odd parity Value 2 = even parity

NOTE: The values are update after switching off and on again

3 Revisions

Version 1 Revision 1 24/01/2019:

- Document created

Version 1 Revision 2 24/01/2019:

- Added missing register (0024h)