



DCT1

COMMUNICATION PROTOCOL

Internal version

rev. 1.1

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1 Introduction

The RS485 serial interface supports the MODBUS (RTU) protocol. In this document only the information necessary to read/write from/to DCT1 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 latest revision of the "Modbus_Application_Protocol" document that is downloadable from the www.modbus.org web site.

2 MODBUS functions

These functions are available on DCT1 SERIES:

- Reading of n "Holding Registers" (code 03h)
- Reading of n "Input Register" (code 04h)
- Writing of one "Holding Registers" (code 06h)
- Writing of one "Holding Registers" (code 10h)

IMPORTANT:

- 1) In this document the "Modbus address" field is indicated in two modes:
 - 1.1) "**Modicon address**": it is the "6-digit Modicon" representation with Modbus function code 04 (Read Input Registers). It is possible to read the same values with function code 03 (Read Holding Registers) replacing the first digit ("3") with the number "4".
 - 1.2) "**Physical address**": it is the "word address" value to be included in the communication frame.
- 2) The functions 03h and 04h have exactly the same effect and can be used indifferently.
- 3) The communication parameters are to be set according to the configuration of the instrument

2.1 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 125 registers (words) [250 bytes] with a single request.

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 14h (1 to 20)	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		

2.2 Function 04h (Read Input Registers)

This function code is used to read the contents of a contiguous block of input registers (word). The Request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 125 register (word) [250 bytes] with a single request.

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	04h	
Starting address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of registers (N word)	2 bytes	1 to 14h (1 to 20)	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	04h	
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	84h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

2.3 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		

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	86h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

2.4 Function 10h (Write multiple registers)

This function code is used to write a block of contiguous registers (maximum 123 word [246 bytes]). The requested values to be written are specified in the request data field. Data is packed as two bytes per register. The correct response returns the function code, starting address, and the quantity of written registers.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
Byte count	1 byte	N word * 2	
Register value	N * 2 bytes	value	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	90h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

2.5 Application notes

2.6 RS485 general considerations

1. To avoid errors due to the signal reflections or line coupling, it is necessary to terminate the bus at the beginning (master side, if not already embedded, by inserting a 120 ohm 1/2W 5% resistor between line B and A) and at the end (in DCT1 by inserting a 120 ohm 1/2W 5% resistor between the terminal B+ and the terminal A- in the last instrument).
2. The network termination is necessary even in case of point-to-point connection and/or of short distances.
3. For connections longer than 1000m or if in the network there are more than 160 instruments (with 1/5 unit load as used in DCT1 interface), a signal repeater is necessary.
4. For bus connection it is suggested to use an AWG24 balanced pair cable and to add a third wire for GND connection. If a shielded cable is used, connect the shield to GND.
5. The GND should be connected to ground only at the host side.
6. 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.

2.7 MODBUS timing

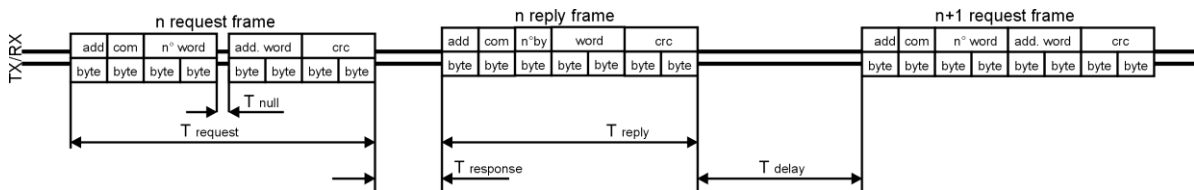


Fig. 1 : 2-wire timing diagram

TIMING CHARACTERISTICS OF READING FUNCTION (note: register "RS485 Delay on reply (ms)" set at 20ms)	ms
T response: Max answering time	160 ms
T response: Typical answering time	20 ms
T delay: Minimum time before a new query	3,5 char
T null: Max interruption time during the request frame	2,5 char

3 Data Format, Variables and param

3.1 Data format representation in Carlo Gavazzi instrument

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 integer	32	$0 .. 2^{32}-1$
UINT64	ULINT	Unsigned long integer	64	$0 .. 2^{64}-1$
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, UINT32 and UINT64 formats, the word order is LSW-> MSW.

4 Part number available

Table 4.1

Part Number	Family	SubFamily	Gavazzi Identification Code		Note
			Decimal Format	Hex16 format	
DCT1A60V10LS1X	DCT1	S1	1808	0710	DC meter 600A/1000V Modbus
DCT1A60V10LS2EC	DCT1	S2	1809	0711	DC meter 600A/1000V Modbus w/ signature 256bit
DCT1A60V10LS3EC	DCT1	S3	1810	0712	DC meter 600A/1000V Modbus w/ signature 384bit
DCT1A30V10LS1X	DCT1	S1	1812	0714	DC meter 300A/1000V Modbus
DCT1A30V10LS2EC	DCT1	S2	1813	0715	DC meter 300A/1000V Modbus w/ signature 256bit
DCT1A30V10LS3EC	DCT1	S3	1814	0716	DC meter 300A/1000V Modbus w/ signature 384bit

5 Modbus communication protocol

Important notes:

- Reading values in addresses not specified in the below tables returns an illegal data address exception

5.1 Real time values

5.1.1 Instantaneous variables and meters (INT)

MODBUS: read only mode with functions code 03 and 04

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300001	0000h	2	V	INT32	Value weight: Volt*10
300003	0002h	2	A	INT32	Value weight: Ampere*1000
300005	0004h	2	W	INT32	Value weight: Watt*10
300017	0010h	2	kWh (+) TOT	INT32	Value weight: kWh*10
300019	0012h	2	Ah (+) TOT	INT32	Value weight: Ah*10
300021	0014h	2	kWh (+) PAR	INT32	Value weight: kWh*10
300023	0016h	2	Ah (+) PAR	INT32	Value weight: Ah*10
300033	0020h	2	kWh (-) TOT	INT32	Value weight: kWh*10
300035	0022h	2	Ah (-) TOT	INT32	Value weight: Ah*10
300037	0024h	2	kWh (-) PAR	INT32	Value weight: kWh*10
300039	0026h	2	Ah (-) PAR	INT32	Value weight: Ah*10
300045	002Ch	2	Run hour meter	INT32	Value weight: h*100
300047	002Eh	2	Run hour meter kWh-	INT32	Value weight: h*100
300049	0030h	2	Run hour meter ON time	INT32	Value weight: h*100
300051	0032h	2	Run hour meter PAR	INT32	Value weight: h*100
300053	0034h	2	Run hour meter kWh- PAR	INT32	Value weight: h*100
300055	0036h	2	Run hour meter ON time PAR	INT32	Value weight: h*100
300081	0050h	2	T1	INT32	Value weight: °C *10
300083	0052h	2	T2	INT32	Value weight: °C * 10

5.1.2 Instantaneous variables and meters (INT)

MODBUS: read only mode with functions code 03 and 04

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300257	0100h	2	V	INT32	Value weight: Volt*10
300259	0102h	2	A	INT32	Value weight: Ampere*1000
300261	0104h	2	W	INT32	Value weight: Watt*10
300263	0106h	2	kWh (+) TOT	INT32	Value weight: kWh*10
300265	0108h	2	Ah (+) TOT	INT32	Value weight: Ah*10
300267	010Ah	2	kWh (+) PAR	INT32	Value weight: kWh*10
300269	010Ch	2	Ah (+) PAR	INT32	Value weight: Ah*10
300271	010Eh	2	kWh (-) TOT	INT32	Value weight: kWh*10
300273	0110h	2	Ah (-) TOT	INT32	Value weight: Ah*10
300275	0112h	2	kWh (-) PAR	INT32	Value weight: kWh*10
300277	0114h	2	Ah (-) PAR	INT32	Value weight: Ah*10
300279	0116h	2	Run hour meter	INT32	Value weight: h*100
300281	0118h	2	Run hour meter kWh-	INT32	Value weight: h*100
300283	011Ah	2	Run hour meter ON time	INT32	Value weight: h*100
300285	011Ch	2	Run hour meter PAR	INT32	Value weight: h*100
300287	011Eh	2	Run hour meter kWh- PAR	INT32	Value weight: h*100
300289	0120h	2	Run hour meter ON time PAR	INT32	Value weight: h*100
300291	0122h	2	T1	INT32	Value weight: °C *10
300293	0124h	2	T2	INT32	Value weight: °C * 10

5.1.3 Instantaneous variables and meters (FLOAT)

MODBUS: read only mode with functions code 03 and 04

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300513	0200h	2	V	FLOAT	Value weight: Volt
300515	0202h	2	A	FLOAT	Value weight: Ampere
300517	0204h	2	W	FLOAT	Value weight: Watt
300519	0206h	2	kWh (+) TOT	INT32	Value weight: kWh*10
300521	0208h	2	Ah (+) TOT	INT32	Value weight: Ah*10
300523	020Ah	2	kWh (+) PAR	INT32	Value weight: kWh*10
300525	020Ch	2	Ah (+) PAR	INT32	Value weight: Ah*10
300527	020Eh	2	kWh (-) TOT	INT32	Value weight: kWh*10
300529	0210h	2	Ah (-) TOT	INT32	Value weight: Ah*10
300531	0212h	2	kWh (-) PAR	INT32	Value weight: kWh*10
300533	0214h	2	Ah (-) PAR	INT32	Value weight: Ah*10
300535	0216h	2	Run hour meter	INT32	Value weight: h*100
300537	0218h	2	Run hour meter kWh-	INT32	Value weight: h*100
300539	021Ah	2	Run hour meter ON time	INT32	Value weight: h*100
300541	021Ch	2	Run hour meter PAR	INT32	Value weight: h*100
300543	021Eh	2	Run hour meter kWh- PAR	INT32	Value weight: h*100
300545	0220h	2	Run hour meter ON time PAR	INT32	Value weight: h*100
300547	0222h	2	T1	FLOAT	Value weight: °C
300549	0224h	2	T2	FLOAT	Value weight: °C

5.1.4 High resolution meters

MODBUS: read only mode with functions code 03 and 04

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
301281	0500h	4	kWh (+) TOT	INT64	Value weight: Wh
301285	0504h	4	Ah (+) TOT	INT64	Value weight: mAh
301289	0508h	4	kWh (+) PAR	INT64	Value weight: Wh
301293	050Ch	4	Ah (+) PAR	INT64	Value weight: mAh
301297	0510h	4	kWh (-) TOT	INT64	Value weight: Wh
301301	0514h	4	Ah (-) TOT	INT64	Value weight: mAh
301305	0518h	4	kWh (-) PAR	INT64	Value weight: Wh
301309	051Ch	4	Ah (-) PAR	INT64	Value weight: mAh
301313	0520h	2	Run hour meter	INT32	Value weight: seconds
301315	0522h	2	Run hour meter kWh-	INT32	Value weight: seconds
301317	0524h	2	Run hour meter ON time	INT32	Value weight: seconds
301319	0526h	2	Run hour meter PAR	INT32	Value weight: seconds
301321	0528h	2	Run hour meter kWh- PAR	INT32	Value weight: seconds
301323	052Ah	2	Run hour meter ON time PAR	INT32	Value weight: seconds
301325	052Ch	2	T1	INT32	Value weight: °C *10
301327	052Eh	2	T2	INT32	Value weight: °C *10

5.1.5 High resolution meters (resolution 0.1Wh)

MODBUS: read only mode with functions code 03 and 04

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
301537	0600h	4	kWh (+) TOT	INT64	Value weight: Wh *10
301541	0604h	4	kWh (-) TOT	INT64	Value weight: Wh *10

5.1.6 Signed map (energy and temperature, available only in models with signature)

MODBUS: read only mode with functions code 03 and 04 (**)

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
301793	0700h	4	kWh (+) TOT OBIS code	CHAR[8]	Fixed value 0100010800FF0000h which is the representation in byte of OBIS code "1-0:1.8.0*255"
301797	0704h	1	kWh (+) TOT engineering unit	UINT16	engineering unit 30 (Wh)
301798	0705h	1	kWh (+) TOT multiplier	INT16	Multiplier = 0 ($10^0 = 1Wh$)
301799	0706h	4	kWh (+) TOT	INT64	
301803	070Ah	4	kWh (-) TOT OBIS code	CHAR[8]	Fixed value 0100020800FF0000h which is the representation in byte of OBIS code "1-0:2.8.0*255"
301807	070Eh	1	kWh (-) TOT engineering unit	UINT16	engineering unit 30 (Wh)
301808	070Fh	1	kWh (-) TOT multiplier	INT16	Multiplier = 0 ($10^0 = 1Wh$)
301809	0710h	4	kWh (-) TOT	INT64	
301813	0714h	4	Temperature on shunt 1 Manufacturer OBIS code	CHAR[8]	Fixed value 01008007FFFF0000h which is the representation in byte of Manufacturer OBIS code "1-0:128.7.255*255"
301817	0718h	1	Temperature engineering unit	UINT16	engineering unit 9 (°C)
301818	0719h	1	Temperature multiplier	INT16	Multiplier = -1 ($10^{-1} = 0.1°C$)
301819	071Ah	2	Temperature on shunt 1	INT32	
301821	071Ch	4	Temperature on shunt 2 Manufacturer OBIS code	CHAR[8]	Fixed value 01008107FFFF0000h which is the representation in byte of Manufacturer OBIS code "1-0:129.7.255*255"
301825	0720h	1	Temperature engineering unit	UINT16	engineering unit 9 (°C)
301826	0721h	1	Temperature multiplier	INT16	Multiplier = -1 ($10^{-1} = 0.1°C$)
301827	0722h	2	Temperature on shunt 2	INT32	
301829	0724h	4	Cable loss OBIS code	CHAR[8]	Fixed value 0100000A02FF0000h which is the representation in byte of OBIS code "1-0:0.10.2*255"
301833	0728h	1	Cable loss engineering unit	UINT16	engineering unit 38 (Ω)
301834	0729h	1	Cable loss multiplier	INT16	Multiplier = -3 ($10^{-3} = 0.001Ω$)
301835	072Ah	2	Cable loss	INT32	
301837	072Ch	4	Device status OBIS code	CHAR[8]	Fixed value 0000600A01FF0000h which is the representation in byte of OBIS code "0-0:96.10.1*255"
301841	0730h	1	Device status engineering unit	UINT16	engineering unit 255 (no unit)
301842	0731h	1	Device status multiplier	INT16	Multiplier = 0 ($10^0 = 1$)
301843	0732h	1	Device status	UINT16	See meaning @ register 5012h
301844	0733h	10	Model	CHAR[20]	Device Model
301854	073Dh	7	Device Serial Number	CHAR[14]	Device Serial Number with the formatting shown in the relevant table
301861	0744h	8	Device Tag	CHAR[16]	Defined by customer during configuration with the formatting shown in the relevant table
301869	074Ch	(*)	Signature	CHAR[**]	Signature of data starting from kWh (+) TOT Obis code to end of Device Tag.

(*) depend on signature type, 256 or 384 bits, see following tables

(**) Mandatory to read whole block

5.1.6.1 256-bit signature

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
301869	074Ch	1		UINT16	MSB: most significative byte of signature LSB: 2 nd byte of signature
301870	074Dh	1		UINT16	MSB: 3 rd byte of signature LSB: 4 th byte of signature

301900	076Bh	1		UINT16	MSB: 63 rd byte of signature LSB: 64 th byte of signature

NOTE: 256-bit signature is 32 word long, therefore CHAR[64]

5.1.6.2 384-bit signature

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
301869	074Ch	1		UINT16	MSB: most significative byte of signature LSB: 2 nd byte of signature
301870	074Dh	1		UINT16	MSB: 3 rd byte of signature LSB: 4 th byte of signature

301916	077Bh	1		UINT16	MSB: 95 th byte of signature LSB: 96 th byte of signature

NOTE: 384-bit signature is 48 word long, therefore CHAR[96]

5.1.7 Signed map (energy and instantaneous variables, available only in models with signature)

MODBUS: read only mode with functions code 03 and 04 (**)

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
302049	0800h	4	kWh (+) TOT OBIS code	CHAR[8]	Fixed value 0100010800FF0000h which is the representation in byte of OBIS code "1-0:1.8.0*255"
302053	0804h	1	kWh (+) TOT engineering unit	UINT16	engineering unit 30 (Wh)
302054	0805h	1	kWh (+) TOT multiplier	INT16	Multiplier = 0 ($10^0 = 1Wh$)
302055	0806h	4	kWh (+) TOT	INT64	
302059	080Ah	4	kWh (-) TOT OBIS code	CHAR[8]	Fixed value 0100020800FF0000h which is the representation in byte of OBIS code "1-0:2.8.0*255"
302063	080Eh	1	kWh (-) TOT engineering unit	UINT16	engineering unit 30 (Wh)
302064	080Fh	1	kWh (-) TOT multiplier	INT16	Multiplier = 0 ($10^0 = 1Wh$)
302065	0810h	4	kWh (-) TOT	INT64	
302069	0814h	4	Power OBIS code	CHAR[8]	Fixed value 0100010700FF0000h which is the representation in byte of OBIS code "1-0:1.7.0*255"
302073	0818h	1	Power engineering unit	UINT16	engineering unit 27 (W)
302074	0819h	1	Power multiplier	INT16	Multiplier = -1 ($10^{-1} = 0.1W$)
302075	081Ah	2	Power	INT32	
302077	081Ch	4	Voltage OBIS code	CHAR[8]	Fixed value 01000C0700FF0000h which is the representation in byte of OBIS code "1-0:12.7.0*255"
302081	0820h	1	Voltage engineering unit	UINT16	engineering unit 35 (V)
302082	0821h	1	Voltage multiplier	INT16	Multiplier = -1 ($10^{-1} = 0.1V$)
302083	0822h	2	Voltage	INT32	
302085	0824h	4	Current OBIS code	CHAR[8]	Fixed value 01000B0700FF0000h which is the representation in byte of OBIS code "1-0:11.7.0*255"
302089	0828h	1	Current engineering unit	UINT16	engineering unit 33 (A)
302090	0829h	1	Current multiplier	INT16	Multiplier = -3 ($10^{-3} = 0.001A$)
302091	082Ah	2	Current	INT32	
302093	082Ch	4	Cable loss OBIS code	CHAR[8]	Fixed value 0100000A02FF0000h which is the representation in byte of OBIS code "1-0:0.10.2*255"
302097	0830h	1	Cable loss engineering unit	UINT16	engineering unit 38 (Ω)
302098	0831h	1	Cable loss multiplier	INT16	Multiplier = -3 ($10^{-3} = 0.001\Omega$)
302099	0832h	2	Cable loss	INT32	
302101	0834h	10	Model	CHAR[20]	Device Model
302111	083Eh	7	Device Serial Number	CHAR[14]	Device Serial Number with the formatting shown in the relevant table
302118	0845h	8	Device Tag	CHAR[16]	Defined by customer during configuration with the formatting shown in the relevant table
302126	084Dh	(*)	Signature	CHAR[**]	Signature of data starting from kWh (+) TOT Obis code to end of Device Tag.

(*) depend on signature type, 256 or 384 bits, see following tables

(**) Mandatory to read whole block

5.1.7.1 256-bit signature

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
302126	084Dh	1		UINT16	MSB: most significative byte of signature LSB: 2 nd byte of signature
302127	084Eh	1		UINT16	MSB: 3 rd byte of signature LSB: 4 th byte of signature

302157	086Ch	1		UINT16	MSB: 63 rd byte of signature LSB: 64 th byte of signature

NOTE: 256-bit signature is 32 word long, therefore CHAR[64]

5.1.7.2 384-bit signature

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
302126	084Dh	1		UINT16	MSB: most significative byte of signature LSB: 2 nd byte of signature
302127	084Eh	1		UINT16	MSB: 3 rd byte of signature LSB: 4 th byte of signature

302173	087Ch	1		UINT16	MSB: 95 th byte of signature LSB: 96 th byte of signature

NOTE: 384-bit signature is 48 word long, therefore CHAR[96]

5.1.8 Firmware version and revision code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300771	0302h	1	Major, Minor and Revision	UINT16	MSB: Bit 0..3=Minor Bit 4..7=Major LSB: Revision

5.1.9 Carlo Gavazzi Controls identification code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300012	000Bh	1	Carlo Gavazzi Controls identification code	UINT16	See table 4.1

5.2 Programming parameter tables

5.2.1 Run hour meter configuration

MODBUS: read and write mode only with function 10h

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
304360	110Bh	2	Start up current of run hour counter (mA)	UINT32	Value weight: Ampere*1000 Value min = 480 (equivalent to 480mA) (default) Value max = 600000 (equivalent to 600A)

5.2.2 Easy connection

MODBUS: read and write mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
304356	1103h	1	Easy connection	UINT16	Value 0 = disabled (default) Value 1 = enabled

NOTE: enabled only on standard version

5.2.3 Serial port configuration menu

MODBUS: read and write mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
308193	2000h	1	RS485 instrument address	UINT16	Value min = 1 (default) Value max = 247
308194	2001h	1	RS485 baud rate	UINT16	Value 1 = 9.6 kbps (default) Value 2 = 19.2 kbps Value 3 = 38.4 kbps Value 4 = 57.6 kbps Value 5 = 115.2 kbps
308195	2002h	1	RS485 parity	UINT16	Value 1= no parity (default) Value 2 = even parity
308196	2003h	1	Stop bit	UINT16	Value 1= 1 (default) Value 2 =2
308197	2004h	1	RS485 Delay on reply (ms)	UINT16	Value min = 0 Value max =1000 Default = 20

NOTE: the values are updated only after sending the "update serial communication setting" command or switching off and on the instrument

5.2.4 Update serial communication setting command

MODBUS: read and write

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
308209	2010h	1	Update serial communication settings	UINT16	Value = 1: command executed Value ≠ 1: no effect

NOTE: for this register the write operation triggers the relative function but the register value does not change. Read value is always 0.

5.2.5 Signature type

MODBUS: read only mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
309472	24FFh	1	Signature type	UINT16	0: 256-bit signature 1: 384-bit signature 2: no signature

5.2.6 Public key for 256-bit signature (if available)

MODBUS: read only mode (*)

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
309473	2500h	1		UINT16	MSB: 04h (constant prefix) LSB: most significative byte of public key
309474	2501h	1		UINT16	MSB: 2 nd byte of public key LSB: 3 rd byte of public key
309475	2502h	1		UINT16	MSB: 4 th byte of public key LSB: 5 th byte of public key
...
309504	251Fh	1		UINT16	MSB: 62 nd byte of public key LSB: 63 rd byte of public key
309505	2520h	1		UINT16	MSB: 64 th byte of public key LSB: not used (always read as 00h)

(*) Mandatory to read whole block with starting address 2500h

5.2.7 Public key for 384-bit signature (if available)

MODBUS: read only mode (*)

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
309473	2500h	1		UINT16	MSB: 04h (constant prefix) LSB: most significative byte of public key
309474	2501h	1		UINT16	MSB: 2 nd byte of public key LSB: 3 rd byte of public key
309475	2502h	1		UINT16	MSB: 4 th byte of public key LSB: 5 th byte of public key
...
309520	252Fh	1		UINT16	MSB: 94 th byte of public key LSB: 95 th byte of public key
309521	2530h	1		UINT16	MSB: 96 th byte of public key LSB: not used (always read as 00h)

(*) Mandatory to read whole block with starting address 2500h

5.2.8 Reset commands

MODBUS: read and write

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
316388	4003h	1	In not certified version: reset of total energy counters, total Ah counters, total run hour counters and total lifetime In certified version: reset of total Ah counters, total run hour counters and total lifetime	UINT16	Value = 1: command executed Value ≠ 1: no effect
316389	4004h	1	Reset of partial energy counters, partial Ah counters, partial run hour counters and partial lifetime	UINT16	Value = 1: command executed Value ≠ 1: no effect
316417	4020h	1	Factory setting (Restore default)	UINT16	Write 0x0A0A; after this, there are 5 seconds to write 0xC1A0 (into this register) to trigger a "Restore Default". Restores all parameters to their default and restores wizard (no counter)

NOTE: for these registers the write operation triggers the relative function but the register value does not change. Read value is always 0.

5.2.9 Serial number

MODBUS: read only mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
320481	5000h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320482	5001h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320483	5002h	1	Letter 5 (from SX) Letter 6 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320484	5003h	1	Letter 7 (from SX) Letter 8 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320485	5004h	1	Letter 9 (from SX) Letter 10 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320486	5005h	1	Letter 11 (from SX) Letter 12 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320487	5006h	1	Letter 13 (from SX)	UINT16	MSB: ASCII code LSB: not used
320488	5007h	1	Production year	UINT16	4 digits

5.2.10 Device tag

MODBUS: read and write

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320489	5008h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320490	5009h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320491	500Ah	1	Letter 5 (from SX) Letter 6 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320492	500Bh	1	Letter 7 (from SX) Letter 8 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320493	500Ch	1	Letter 9 (from SX) Letter 10 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320494	500Dh	1	Letter 11 (from SX) Letter 12 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320495	500Eh	1	Letter 13 (from SX) Letter 14 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320496	500Fh	1	Letter 15 (from SX) Letter 16 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code

5.2.11 Cable loss

5.2.11.1 Cable loss value

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320737	5100h	2	Cable loss value	INT32	Cable Loss value in [mΩ]

5.2.11.2 Cable loss occurrences used

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320737	5FF0h	1	Number of row already used	INT16	Number of rows of cable Loss datalogger already used

NOTE: valid only for certified devices

5.2.11.3 Total Cable loss occurrences

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320738	5FF1h	1	Max entry of cable loss datalogger	UINT16	Max entry of cable loss datalogger for whole device life.

NOTE: valid only for certified devices

NOTE: once "Cable loss occurrences used" = "Total Cable loss occurrences" the cable loss procedure is inhibited

5.2.11.4 Cable Loss Datalogger

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
324557	6000h	18	Datalogger row 1	Cable Loss Row Struct	First row of cable loss datalogger struct
324575	6012h	18	Datalogger row 2	Cable Loss Row Struct	Second row of cable loss datalogger struct
...
325459	6372h	18	Datalogger row 49	Cable Loss Row Struct	Last row of cable loss datalogger struct

NOTE: valid only for certified devices

Cable Loss Row Struct

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
	Base +0	1	Record id	UINT16	From 0 to 49
	Base +1	1	Datalogger field	UNIT16	Cable Loss = 99
	Base +2	4	Timestamp	UINT64	Timestamp, 32 bit and 64bit format
	Base +6	4	kWh positive	UINT64	kWh positive stored still now with the cable loss in this Datalogger row
	Base +10	4	kWh negative	UINT64	kWh negative stored still now with the cable loss in this Datalogger row
	Base +14	2	Cable loss value	INT32	Cable loss Value used to calculate the energy value starting from previous datalogger row timestamp to current row timestamp
	Base +16	2	CRC value	UINT32	CRC value of current datalogger row

5.2.12 Device state

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320499	5012h	1	Device state	UINT16	Bit field(*)
320500	5013h	1	Shunt temperature position 1	UINT16	Value weight: °C *10 e.g 255=25.5 °C
320501	5014h	1	Shunt temperature position 2	UINT16	Value weight: °C *10 e.g 307=30.7 °C

(*)Device state bitfield

Bit of Word	INFO
Bit 0	0 = Below absolute maximum voltage value 1 = Over maximum range (-1150.1 V > Voltage or Voltage > +1150.1 V)
Bit 1	For all DCT1A60V models: 0 = Below absolute maximum current value 1 = Over maximum range (-600.1 A > Current or Current > +600.1 A) For all DCT1A30V models: 0 = Below absolute maximum current value 1 = Over maximum range (-300.1 A > Current or Current > +300.1 A)
Bit 2	0 = Temperature terminal 1 >= Tmin (-25.1°C) 1 = Temperature terminal 1 < Tmin (-25.1°C)
Bit 3	0 = Temperature terminal 1 <= Tmax (120.1°C) 1 = Temperature terminal 1 > Tmax (120.1°C)
Bit 4	0 = Temperature terminal 2 >= Tmin (-25.1°C) 1 = Temperature terminal 2 < Tmin (-25.1°C)
Bit 5	0 = Temperature terminal 2 <= Tmax (120.1°C) 1 = Temperature terminal 2 > Tmax (120.1°C)
Bit 6 to 14	Reserved
Bit 15	0 = all works 1 = Internal Fault device KO

5.2.13 Firmware CRC32

MODBUS: read only mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
320513	5020h	2	Firmware CRC32 value	UINT32	

NOTE: valid only for certified devices

5.2.14 Maintenance Mode: Cable Loss Set Procedure

During the maintenance mode the following maps are the ones active:

- Maintenance Mode: Cable Loss Set Procedure
- Maintenance Mode: Datalogger
- Maintenance Mode: Additional Information

During the 5 seconds after power on is possible sent a Modbus command to put device in maintenance mode.

The following three registers are necessary to set the cable loss.

5.2.14.1 Maintenance Mode Command

MODBUS: write only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
312545	3100h	1	Active maintenance mode	UINT16	Every value permitted After this command the "Maintenance mode" is maintained up to 10 seconds

5.2.14.2 Timestamp Synchronization Command

MODBUS: read and write mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
312546	3101h	4	Timestamp value	UINT64	After this command the "Maintenance mode" is refreshed and maintained up to other10 seconds

5.2.14.3 Cable loss value

MODBUS: read and write mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
312550	3105h	2	New cable Loss value	UINT32	After this command the "Maintenance mode" is considered complete and the device shall move in "Runtime mode"

5.2.15 Maintenance Mode: Datalogger

These registers are always available, from power on of instrument until the end of maintenance mode.

5.2.15.1 Cable loss occurrences used

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
312561	3110h	1	Number of row already used	INT16	Number of row of cable Loss datalogger already used

NOTE: valid only for certified devices

5.2.15.2 Total Cable loss occurrences

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
312562	3111h	1	Max entry of cable lose datalogger	UINT16	Max entry of cable loss datalogger for whole device life.

NOTE: valid only for certified devices

NOTE: once "Cable loss occurrences used" = "Total Cable loss occurrences" the cable loss procedure is inhibited

5.2.15.3 Cable Loss Datalogger

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
324557	6000h	18	Datalogger row 0	Cable Loss Row Struct	First row of cable loss datalogger struct
324575	6012h	18	Datalogger row 1	Cable Loss Row Struct	Second row of cable loss datalogger struct
..
325459	6372h	18	Datalogger row 49	Cable Loss Row Struct	Last row of cable loss datalogger struct

NOTE: valid only for certified devices

Cable Loss Row Struct

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
	Base +0	1	Record id	UINT16	From 0 to 49
	Base +1	1	Datalogger field	UNIT16	Cable Loss = 99
	Base + 2	4	Timestamp	UINT64	Timestamp, 32 bit and 64bit format
	Base +6	4	kWh positive	UINT64	Last value of kWh (+) TOT counter calculated using the cable loss value that appears in this Datalogger row
	Base + 10	4	kWh negative	UINT64	Last value of kWh (-) TOT counter calculated using the cable loss value that appears in this Datalogger row
	Base + 14	2	Cable loss value	INT32	Cable loss value used to calculate the energy values starting from previous datalogger row timestamp up to current datalogger row timestamp
	Base +16	2	CRC value	UINT32	CRC value of current datalogger row

5.2.16 Maintenance Mode: Additional Information

These registers are always available, from power on of instrument until the end of maintenance mode.

5.2.16.1 Firmware version and revision code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300771	0302h	1	Major, Minor and Revision	UINT16	MSB: Bit 0..3=Minor Bit 4..7=Major LSB: Revision

5.2.16.2 Carlo Gavazzi Controls identification code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300012	000Bh	1	Carlo Gavazzi Controls identification code	UINT16	See table 4.1

5.2.16.3 Serial port configuration menu

MODBUS: read and write mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
308193	2000h	1	RS485 instrument address	UINT16	Value min = 1 (default) Value max = 247
308194	2001h	1	RS485 baud rate	UINT16	Value 1 = 9.6 kbps (default) Value 2 = 19.2 kbps Value 3 = 38.4 kbps Value 4 = 57.6 kbps Value 5 = 115.2 kbps
308195	2002h	1	RS485 parity	UINT16	Value 1= no parity (default) Value 2 = even parity
308196	2003h	1	Stop bit	UINT16	Value 1= 1 (default) Value 2 =2

NOTE: the values are automatically updated after exiting maintenance mode

5.2.16.4 Serial number

MODBUS: read only mode

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
320481	5000h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320482	5001h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320483	5002h	1	Letter 5 (from SX) Letter 6 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320484	5003h	1	Letter 7 (from SX) Letter 8 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320485	5004h	1	Letter 9 (from SX) Letter 10 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320486	5005h	1	Letter 11 (from SX) Letter 12 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320487	5006h	1	Letter 13 (from SX)	UINT16	MSB: ASCII code LSB: not used
320488	5007h	1	Production year	UINT16	4 digits

5.2.16.5 Device tag

MODBUS: read and write

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320489	5008h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320490	5009h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320491	500Ah	1	Letter 5 (from SX) Letter 6 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320492	500Bh	1	Letter 7 (from SX) Letter 8 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code

320493	500Ch	1	Letter 9 (from SX) Letter 10 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320494	500Dh	1	Letter 11 (from SX) Letter 12 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320495	500Eh	1	Letter 13 (from SX) Letter 14 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code
320496	500Fh	1	Letter 15 (from SX) Letter 16 (from SX)	UINT16	MSB: ASCII code LSB: ASCII code

5.2.16.6 Cable loss value

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320737	5100h	2	Cable loss value	INT32	Cable Loss value in [mΩ]

5.2.16.7 Cable loss occurrences used

MODBUS: read only mode

Modicon address	Physical address	Length [word]	VARIABLE ENG. UNIT	Data Format	Notes
320737	5FF0h	1	Number of row already used	INT16	Number of rows of cable Loss datalogger already used

6 Changelog

Revisions	Date	Authors	Note
Rev. 1.0	06/Jun/2020	A. Minella	First release
Rev. 1.1	05/Jul/2023	L. De Col	Minor text corrections.