Static Energy Meter Conto D4-Pd
MODBUS/JBUS compatible

INDEX

1.0 INTRODUCTION

Logical level

The communication protocol used is MODBUS / JBUS compatible.
Up to 255 different instruments can be managed by the protocol.
The data are transmitted in a packet form (message) and are checked by a word (CRC).
There are no limitations to the number of possible retries done by the master.

Phisical level

The phisical communication line respects the EIA-RS485 standard in half-duplex modality.
In this case, as only two wires are used, only one instrument at a time can engage the line; this means that there must be a master which polls the slave instruments so the demand and the request are alternated.

On the same phisical line only 32 instruments can be attached (master included). In order to increase the number of the slave instrument, the necessary repeaters must be used.

The communication parameters are :

speed : programmable
19200, 9600, 4800 Baud/s
bit n. : 8
stop bit : 1
parity : programmable

2.0 DATA PACKET DESCRIPTION

The generic data message is composed as following :

Instrument address	Functional code	Data	CRC word

Two answers are possible :

Answer containing data

Instrument address	Functional code	Data	CRC word

Error answer

Instrument address	Functional code + 0x80	Error code	CRC word

2.1 Parameter description

Instrument address : instrument identification number in the network
It must be the same for the demand and the answer.
Format : 1 BYTE from 0 to 0xff
0 is for broadcast messages with no answer

Functional code : command code
Used functional code :
Format : 1 BYTE
0x03 : reading of consecutive words
0x10 : writing of consecutive words

Data : they can be :
- the address of the required words (in the demand)
- the data (in the answer)

CRC word : it is the result of the calculation made on all the bytes in the message

2.2 Data format

Three types of format are used for the data :

* BYTE
* WORD : two BYTES
* long : two WORDS

The base data format is the WORD.
If the required data is in a BYTE format, a WORD with the MSB (Most Significant Byte) set to 0 is anyway transmitted and this BYTE comes before the LSB (Least Significant Byte).
If the required data is in a long format, 2 WORDS are transmitted and the MSW comes before the LSW.
Briefly :

MSB	LSB	MSB	LSB
Most Significant WORD		Least Significant WORD	

Example : 1000 = 0x 03 e8 or
0x 00 00 03 e8 (if long)

MSB	LSB	MSB	LSB
0x00	0x00	0x03	0xe8

All data are positive and the sign indications are reported in other variables.

2.3 Description of CRC calculation

The following is an example of the CRC calculation in C language.

```
unsigned int calc_crc (char *ptbuf, unsigned int num)
/*    ****************************************************************
 *    Descrizione : calculates a data buffer CRC WORD
 *    Input       : ptbuf = pointer to the first byte of the buffer
 *                  num   = number of bytes
 *    Output      : //
 *    Return      :
**    ****************************************************************/
 {
  unsigned int crc16;
  unsigned int temp;
  unsigned char c, flag;


  crc16 = 0xffff;                       /* init the CRC WORD */
  for (num; num>0; num--) {
        temp = (unsigned int) *ptbuf;   /* temp has the first byte */
        temp &= 0x00ff;                 /* mask the MSB */
        crc16 = crc16 ^ temp;           /* crc16 XOR with temp */
        for (c=0; c<8; c++) {
              flag = crc16 & 0x01;      /* LSBit di crc16 is mantained */
              crc16 = crc16 >> 1;       /* Lsbit di crc16 is lost */
              if (flag != 0)
                   crc16 = crc16 ^ 0x0a001;  /* crc16 XOR with 0x0a001 */
        }
        ptbuf++;                        /* pointer to the next byte */
  }

  crc16 = (crc16 >> 8) | (crc16 << 8);  /* LSB is exchanged with MSB */

  return (crc16);

} /* calc_crc */
```

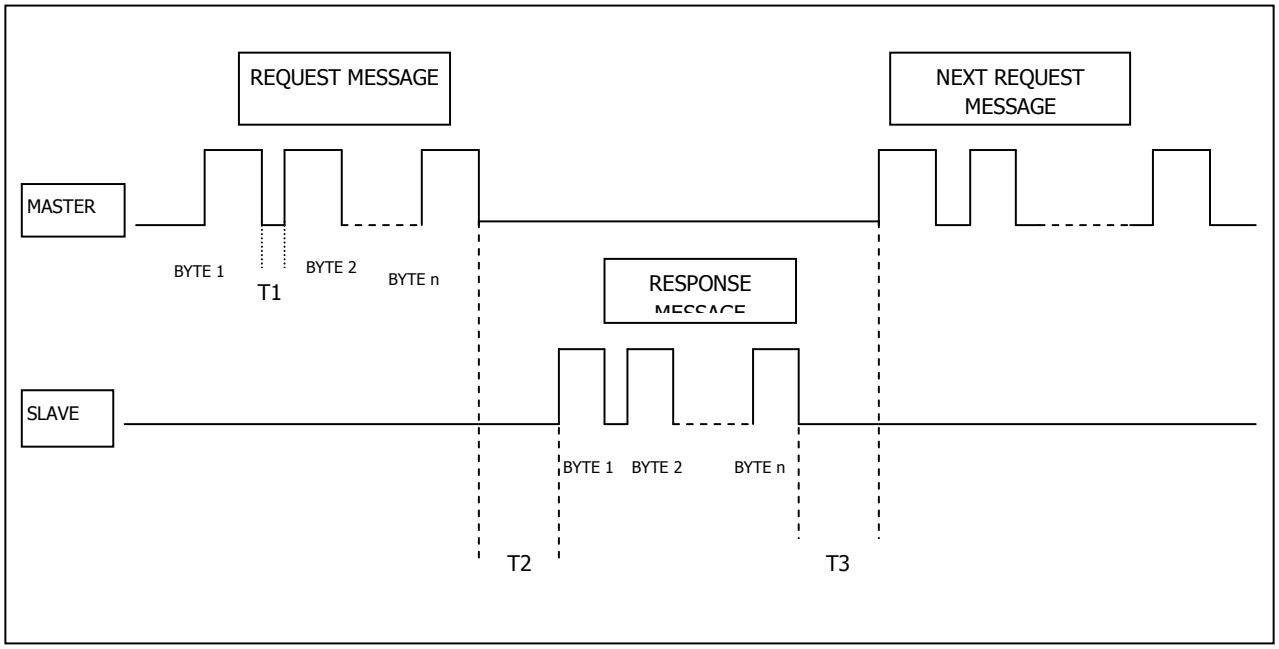
2.4 Error management

If the received message is incorrect (CRC16 is wrong) the polled slave doesn't answer.
the message is correct but there are errors (wrong functional code or data) and so it can't be accepted, the slave answers with an error message.

The error codes are defined in the following part of the document.

2.5 Timing

2.5.1 TIMING DIAGRAM FOR CONTO D4S COMMUNICATION



Where:

TIME	DESCRIPTION	Min & Max VALUES
T1	**Time between characters.** If this time exceeds the max. time allowed, the message is not considered by device.	Max < 20 ms.
T2	Slave response time Minimum and maximum response time of device to the Master request.	Min = 20 ms. Max = 300ms.
T3	Time before a new message request from the Master	Min = 20 ms.

3.0 COMMANDS

Code 0x03 : reading of one or more consecutive WORDS

Command format :

BYTE	BYTE	MSB LSB	MSB LSB	MSB LSB
Instrument address	Funct. Code	First WORD address	WORDS number	CRC16

Answer format (containing data) :

BYTE	BYTE	BYTE	MSB LSB	MSB LSB	MSB LSB
Instrument Address	Funct. Code	BYTES number	WORD 1	WORD N.	CRC16

The BYTES number must always match the WORDS number (in the demand) * 2.

Answer format (the demand was wrong) :

BYTE	BYTE	BYTE	MSB LSB
Instrument Address	Funct. Code + 0x80	Error code	CRC16

Error codes :
* 0x01 : incorrect functional code
* 0x02 : wrong first WORD address
* 0x03 : incorrect data

Code 0x10 : writining of more consecutive WORDS

Command format :

BYTE	BYTE	MSB LSB	MSB LSB	BYTE	MSB LSB MSB LSB	MSB LSB
Instr. address	Funct. Code	First WORD address	WORDS number	BYTE numbers	Word Value	CRC16

Answer format (containing data) :

BYTE	BYTE	BYTE	MSB LSB	MSB LSB	MSB LSB
Instrument Address	Funct. Code	BYTES number	First WORD address	00 00	CRC16

The BYTES number must always match the WORDS number (in the demand) * 2.

Answer format (the demand was wrong) :

BYTE	BYTE	BYTE	MSB LSB
Instrument Address	Funct. Code + 0x80	Error code	CRC16

Error codes :
* 0x01 : incorrect functional code
* 0x02 : wrong first WORD address
* 0x03 : incorrect data

4.0 VARIABLES

4.1 Data addresses

Both variables and groups of variables can be required.
All the variables with consecutive addresses can be required at one time.
The following is the table with the addresses and the meaning of the variables.

Address		Read/Write	Format	Description
HEX	DEC			
				Energy
0x325	805	R	Long	3-phase : Total positive active energy
0x329	809	R	Long	3-phase : Total positive reactive energy
0x32d	813	R	Long	3-phase : Partial positive active energy
0x331	817	R	Long	3-phase : Partial positive reactive energy

The following table must be used to retrieve all information of the real time measurements.
The user can poll on both tables without any more operation, just change the Modbus address in the protocol data message.

Address	Byte n.	**Description**	**Unit**
0x1000	Long	Phase 1 : phase voltage	mV
0x1002	Long	Phase 2 : phase voltage	mV
0x1004	Long	Phase 3 : phase voltage	mV
0x1006	Long	Phase 1 : current	mA
0x1008	Long	Phase 2 : current	mA
0x100a	Long	Phase 3 : current	mA
0x100c	Long	0	
0x100e	Long	Chained voltage : L1-L2	mV
0x1010	Long	Chained voltage : L2-L3	mV
0x1012	Long	Chained voltage : L3-L1	mV
0x1014	Long	3-phase : active power	W/100
0x1016	Long	3-phase : reactive power	W/100
0x1018	Long	3-phase : apparent power	W/100
0x101a	WORD	3-phase : sign of active power	(2)
0x101b	WORD	3-phase : sign of reactive power	(2)
0x101c	Long	3-phase : total positive active energy	kWh/100
0x101e	Long	3-phase : total positive reactive energy	kvarh/100
0x1020	Long	For future use	
0x1022	Long	0	
0x1024	WORD	3-phase : power factor	1/100
0x1025	WORD	3-phase : sector of power factor (cap or ind)	(1)
0x1026	WORD	Frequency	Hz/10
0x1027	Long	3-phase : average power	W/100
0x1029	Long	3-phase : peak maximum demand	W/100
0x102b	WORD	Time counter for average power	minutes
0x102c	Long	Phase 1 : active power	W/100
0x102e	Long	Phase 2 : active power	W/100
0x1030	Long	Phase 3 : active power	W/100
0x1032	WORD	Phase 1 : sign of active power	(2)
0x1033	WORD	Phase 2 : sign of active power	(2)
0x1034	WORD	Phase 3 : sign of active power	(2)
0x1035	Long	Phase 1 : reactive power	var/100
0x1037	Long	Phase 2 : reactive power	var/100
0x1039	Long	Phase 3 : reactive power	var/100
0x103b	WORD	Phase 1 : sign of reactive power	(2)
0x103c	WORD	Phase 2 : sign of reactive power	(2)
0x103d	WORD	Phase 3 : sign of reactive power	(2)
0x103e	Long	3-phase : partial/second tariff positive active energy	kWh/100
0x1040	Long	3-phase : partial/second tariff positive reactive energy	kvarh/100
0x1042	Long	3-phase : second tariff peak maximum demand	W/100
0x1044	Long	0	
0x1046	Long	0	
0xC8	WORD	Parameter reset	(3)
0300	WORD	Device identifier	0x77

(1) ----------

0 : PF = 0 or 1
1 : ind
2 : cap

(2) ----------

0 : positive
1 : negative

(3) ----------

WRITABLE ONLY

0x01 : reset partial active energy
0x02 : reset partial reactive energy
0x10 : reset Peak Maximum Demand tariff 1 (when selected)
0x20 : reset Peak Maximum Demand tariff 2 (when selected)

4.2 Variables description

Energy

Positive energy
Format : long
Measurement unit : Hundreds of kWh/kvarh

Average power

Average power
This is the power calculated with the shifting average algorithm. It is updated every minute.
Format : long
Measurement unit : W/100
Peak maximum demand
This is the power obtained as the maximum of the average powers and it is updated at the end of average period.
Format : long
Measurement unit : W/100

Operating time counter

Format : long
Measurement unit : min

Example

Demand of 4 WORDS (8 BYTES – 2 variables) starting from the address 0x0325 :

BYTE	BYTE	MSB | LSB	MSB | LSB	MSB | LSB
Instrum. address 0x01	F.code 0x03	1st WORD address 0x03 | 0x25	WORDS number 0x00 | 0x04	CRC16 0x55 | 0x86

Answer

BYTE	BYTE	BYTE	MSB | LSB	MSB | LSB	MSB | LSB	MSB | LSB	MSB | LSB
		BYTES number	WORD 1	WORD 2	WORD 3	WORD 4	CRC16
0x01	0x03	0x08	0x00|0x00	0x64|0x8c	0x00|0x00	0x35|0x54	0x9a|0x83

In the above case, the information is :

WORD 1 ,WORD 2 : Total active energy 0x0000648C = 25740

WORD 3 ,WORD 4 : Total reactive energy 0x00003554 = 13652