CONTO IMP

CONTENTS

1.0 INTRODUCTION

2.0 DATA MESSAGE DESCRIPTION
2.1 Data field description
2.2 Data format
2.3 Description of CRC calculation
2.4 Error management
2.5 Timing

3.0 COMMANDS

4.0 VARIABLES
4.1 Data addresses

1.0 INTRODUCTION

Data link level

The communication protocol used is MODBUS / JBUS compatible.
Up to 255 different instruments can be managed by the protocol.
Data are transmitted in messages and are checked by mean of a CRC16 WORD
There are no limitations to the number of possible retries done by the master.

Physical level

The physical 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 polling the slave instruments and waiting for the answers.

On the same physical 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 programmable as described in the proper user manual.

2.0 DATA MESSAGE 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 Data field 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 (not used)

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 and the number 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

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.

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 readable in other variables.

2.3 Description of CRC calculation

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

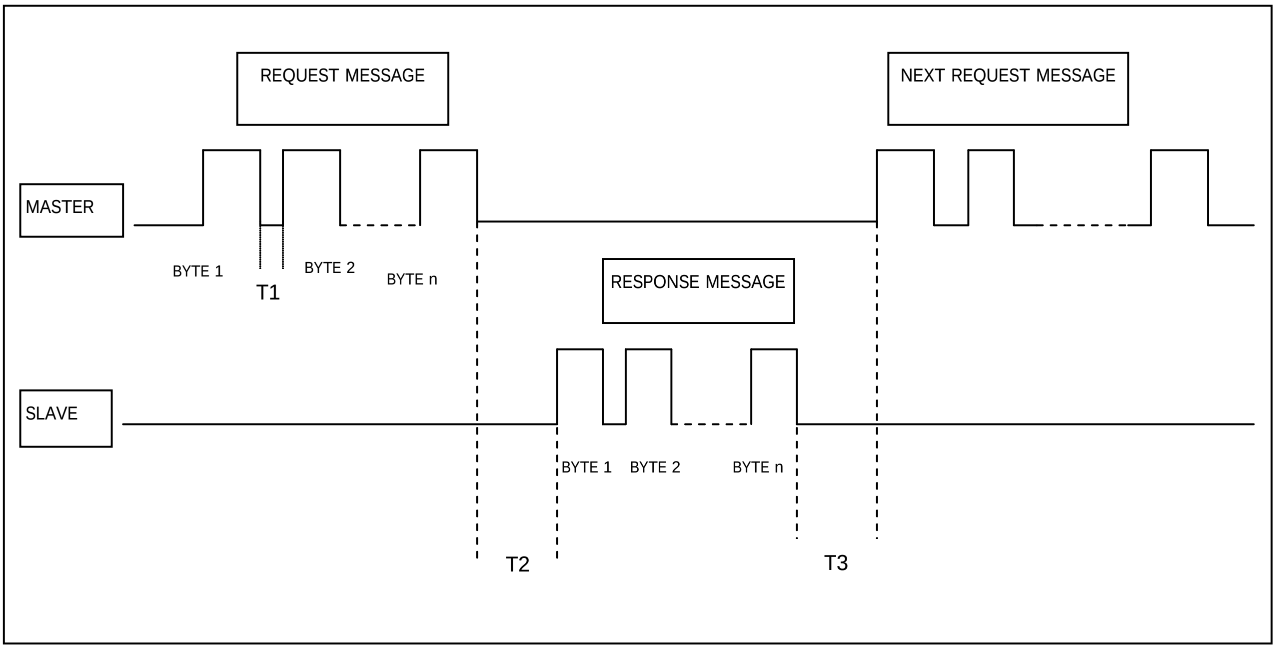
```
unsigned int calc_crc (char *ptbuf, unsigned int num)
/*     *****************************************************************
 *     Descrizione : calculates a data buffer CRC WORD
 *     Input       : ptbuf = pointer to the first byte of the buffer
 *                   num   = number of bytes
 *     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 kept */
              crc16 = crc16 >> 1;                  /* LSBit di crc16 is lost */
              if (flag != 0)
                   crc16 = crc16 ^ 0x0a001;        /* crc16 XOR with 0x0a001 */
        }
        ptbuf++;                                   /* points 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.
If the message is correct but there are errors (wrong functional code or data) 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



Values :

T1 (time between characters) = 25 msec (max)
T2 (slave response time) = 100 msec (max)
T3 (delay time) = 25 msec (min)

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 (wrong request) :

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 : writing 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 (wrong request) :

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

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

4.0 VARIABLES

4.1 Data addresses

The following table must be used to retrieve all information of the real time measurements.

Address	Byte n.	Description	Unit
0x800	4	Counter 1	(1)
0x804	4	Counter 2	(1)
0x808	4	Counter 3	(1)
0x80C	4	Counter 4	(1)
0x810	4	Counter 5	(1)
0x814	4	Counter 6	(1)
0x818	4	Counter 7	(1)(10)
0x81C	4	Counter 8	(1)(10)
0x820	4	Counter 9	(1)
0x824	4	Counter 10	(1)
0x828	4	Counter 11	(1)
0x82C	4	Counter 12	(1)
0x830	4	State of the inputs	(2)
0x1000	4	Counter 1	(1)
0x1002	4	Counter 2	(1)
0x1004	4	Counter 3	(1)
0x1006	4	Counter 4	(1)
0x1008	4	Counter 5	(1)
0x100A	4	Counter 6	(1)
0x100C	4	Counter 7	(1)
0x100E	4	Counter 8	(1)
0x1010	4	Counter 9	(1)
0x1012	4	Counter 10	(1)
0x1014	4	Counter 11	(1)
0x1016	4	Counter 12	(1)
0x1018	4	Unit Counter 1	(3)
0x101A	4	Unit Counter 2	(3)
0x101C	4	Unit Counter 3	(3)
0x101E	4	Unit Counter 4	(3)
0x1020	4	Unit Counter 5	(3)
0x1022	4	Unit Counter 6	(3)
0x1024	4	Unit Counter 7	(3)
0x1026	4	Unit Counter 8	(3)
0x1028	4	Unit Counter 9	(3)
0x102A	4	Unit Counter 10	(3)
0x102C	4	Unit Counter 11	(3)
0x102E	4	Unit Counter 12	(3)
0x1030	4	Pulse Weight 1	(4)
0x1032	4	Pulse Weight 2	(4)
0x1034	4	Pulse Weight 3	(4)
0x1036	4	Pulse Weight 4	(4)
0x1038	4	Pulse Weight 5	(4)
0x103A	4	Pulse Weight 6	(4)
0x103C	4	Pulse Weight 7	(4)
0x103E	4	Pulse Weight 8	(4)
0x1040	4	Pulse Weight 9	(4)
0x1042	4	Pulse Weight 10	(4)
0x1044	4	Pulse Weight 11	(4)
0x1046	4	Pulse Weight 12	(4)

0x1048	4	CT 1	(5)
0x104A	4	CT 2	(5)
0x104C	4	CT 3	(5)
0x104E	4	CT 4	(5)
0x1050	4	CT 5	(5)
0x1052	4	CT 6	(5)
0x1054	4	CT 7	(5)
0x1056	4	CT 8	(5)
0x1058	4	CT 9	(5)
0x105A	4	CT 10	(5)
0x105C	4	CT 11	(5)
0x105E	4	CT 12	(5)
0x1060	4	VT 1	(6)
0x1062	4	VT 2	(6)
0x1064	4	VT 3	(6)
0x1066	4	VT 4	(6)
0x1068	4	VT 5	(6)
0x106A	4	VT 6	(6)
0x106C	4	VT 7	(6)
0x106E	4	VT 8	(6)
0x1070	4	VT 9	(6)
0x1072	4	VT 10	(6)
0x1074	4	VT 11	(6)
0x1076	4	VT 12	(6)
0x1078	4	TOFF 1	(7)
0x107A	4	TOFF 2	(7)
0x107C	4	TOFF 3	(7)
0x107E	4	TOFF 4	(7)
0x1080	4	TOFF 5	(7)
0x1082	4	TOFF 6	(7)
0x1084	4	TOFF 7	(7)
0x1086	4	TOFF 8	(7)
0x1088	4	TOFF 9	(7)
0x108A	4	TOFF 10	(7)
0x108C	4	TOFF 11	(7)
0x108E	4	TOFF 12	(7)
0x1092	4	Counter type	(8)
0x1094	4	Tarif 1 : counting for Positive Active Energy	(9)
0x1096	4	Tarif 1 : counting for Positive Reactive Energy	(9)
0x1098	4	Tarif 1 : counting for Negative Active Energy	(9)
0x109A	4	Tarif 1 : counting for Negative Reactive Energy	(9)
0x109C	4	Tarif 2 : counting for Positive Active Energy	(9)
0x109E	4	Tarif 2 : counting for Positive Reactive Energy	(9)
0x10A0	4	Tarif 2 : counting for Negative Active Energy	(9)
0x10A2	4	Tarif 2 : counting for Negative Reactive Energy	(9)

0x10A4	4	Tarif 3 : counting for Positive Active Energy	(9)
0x10A6	4	Tarif 3 : counting for Positive Reactive Energy	(9)
0x10A8	4	Tarif 3 : counting for Negative Active Energy	(9)
0x10AA	4	Tarif 3 : counting for Negative Reactive Energy	(9)
0x10AC	4	Tarif 4 : counting for Positive Active Energy	(9)
0x10AE	4	Tarif 4 : counting for Positive Reactive Energy	(9)
0x10B0	4	Tarif 4 : counting for Negative Active Energy	(9)
0x10B2	4	Tarif 4 : counting for Negative Reactive Energy	(9)
0x10B4	4	counting for Positive Active Energy multitarif	(9)
0x10B6	4	counting for Positive Reactive Energy multitarif	(9)
0x10B8	4	counting for Negative Active Energy multitarif	(9)
0x10BA	4	counting for Negative Reactive Energy multitarif	(9)
0x1100	4	Counting 1	(1)
0x1102	4	Counting 2	(1)
0x1104	4	Counting 3	(1)
0x1106	4	Counting 4	(1)
0x1108	4	Counting 5	(1)
0x110A	4	Counting 6	(1)
0x110C	4	Counting 7	(10)
0x110E	4	Counting 8	(10)
0x1120	4	Counting 9	(1)
0x1122	4	Counting 10	(1)
0x1124	4	Counting 11	(1)
0x1126	4	Counting 12	(1)
0x1200	4	Counting 1 as displayed	(12)
0x1202	4	Counting 2 as displayed	(12)
0x1204	4	Counting 3 as displayed	(12)
0x1206	4	Counting 4 as displayed	(12)
0x1208	4	Counting 5 as displayed	(12)
0x120A	4	Counting 6 as displayed	(12)
0x120C	4	Counting 7 as displayed	(12)
0x120E	4	Counting 8 as displayed	(12)
0x1210	4	Counters 9 as displayed	(12)
0x1212	4	Counting 10 as displayed	(12)
0x1214	4	Counting 11 as displayed	(12)
0x1216	4	Counting 12 as displayed	(12)
0x1218	4	T1:Positive Active Energy as displayed	(12)

0x121a	4	T 1 : Positive Reactive Energy as displayed	(12)
0x121c	4	T 1 : Negative Active Energy as displayed	(12)
0x121e	4	T 1 : Negative Reactive Energy as displayed	(12)
0x1220	4	T 2 : Positive Active Energy as displayed	(12)
0x1222	4	T 2 : Positive Reactive Energy as displayed	(12)
0x1224	4	T 2 : Negative Active Energy as displayed	(12)
0x1226	4	T 2 : Negative Reactive Energy as displayed	(12)
0x1228	4	T 3 : Positive Active Energy as displayed	(12)
0x122a	4	T 3 : Positive Reactive Energy as displayed	(12)
0x122c	4	T 3 : Negative Active Energy as displayed	(12)
0x122e	4	T 3 : Negative Reactive Energy as displayed	(12)
0x1230	4	T 4 : Positive Active Energy as displayed	(12)
0x1232	4	T 4 : Positive Reactive Energy as displayed	(12)
0x1234	4	T 4 : Negative Active Energy as displayed	(12)
0x1236	4	T 4 : Negative Reactive Energy as displayed	(12)
0x1400	4	Counting 1	(11)
0x1402	4	Counting 2	(11)
0x1404	4	Counting 3	(11)
0x1406	4	Counting 4	(11)
0x1408	4	Counting 5	(11)
0x140A	4	Counting 6	(11)
0x140C	4	Counting 7	(11)
0x140E	4	Counting 8	(11)
0x1410	4	Counters states	(11)
0x1412	4	Counting 9	(1)
0x1414	4	Counting 10	(1)
0x1416	4	Counting 11	(1)
0x1418	4	Counting 12	(1)

(1) Internal number from **0** to **999 999 999** for instance :

1234 => 1234 pulses

To give a meaning to pulses it is necessary to take in account the pulse weight.
For example, if :

Pulse weight = 0.01 kWh
Energy value (terminal side) = 1234 * 0.01 = 12.34 kWh

(2) Bit mapped **b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0** for counters:

b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Counter 12	Counter 11	Counter 10	Counter 9	Counter 8	Counter 7	Counter 6	Counter 5	Counter 4	Counter 3	Counter 2	Counter 1
0=open	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**	**0=open**
1=close	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**	**1=close**

(3) Unit for any counters :

Value	Meaning
0	Pulses
1	kWh
2	kvarh
3	kVAh
4	mc
5	Nmc

(4) Pulse weight for any counters :

Value	Meaning
0	0.001 kWh/Kvarh/KVA/mc/Nmc
1	0.01 kWh/Kvarh/KVA/mc/Nmc
2	0.1 kWh/Kvarh/KVA/mc/Nmc
3	1 kWh/Kvarh/KVA/mc/Nmc
4	10 kWh/Kvarh/KVA/mc/Nmc
5	100 kWh/Kvarh/KVA/mc/Nmc
6	1000 kWh/Kvarh/KVA/mc/Nmc

NOTE : Only in the case of option **S0**, it is possible to set the pulse weight for counters 7,8,9 and 10 as a free number from **0** to **60000** as number of pulses / kWh
For instance if a GME Enel Meter is used, set **10000** pulses/KWh (the same number is valid for kvarh) .

(5) CT is from **1** to **9999** .

(6) VT is expressed in 1/10, from **10** to **30000** (**1,0** to **3000,0**)

(7) Time OFF is minimum time to wait before pulse may be considered complete :

```
         ___________
_____|           |______________

                 |*******| TOFF
```

Value	Meaning
0	5 ms
1	10 ms
2	20 ms
3	40 ms
4	50 ms
5	100 ms
6	200 ms
7	300 ms

(8) Counter type : for details see the user manual and the insertion diagrams

Value	Meaning
0	Potential live
1	Potential free and all counters can be of different type
2	Potential free and all counters of the same type
3	S0

(9)

Only if S0 counter type is selected.

To give a meaning to pulses it is necessary to take in account the pulse weight. For example :

All energies have following meaning :

Current counting = 12345678
Pulses per kWh = 10000

Energy value (terminal side) = 12345678 / 10000 = 1234.5678 kWh

(10) If S0 input has been selected :

Counters 7 and 8 contain the Total Positive Active Energy (7) and Total Positive Reactive Energy (8)as pulse numbers :

for instance **12345** value means **12345 PULSES**.

In all other cases they normally give the counts of input 7 and 8.

(11) Internal number from **0** to **999 999 999** for instance :

1234 => 1234 pulses

To give a meaning to pulses it is necessary to take in account the pulse weight. For example, if :

Pulse weight = 0.01 kWh
Energy value (terminal side) = 1234 * 0.01 = 12.34 kWh

NOTE : this set of registers was added for compatibility with the old product IFR0 with 8 inputs only

(12) The communicated value is displayed value and not internal counting.
For istance :
First case
8000 pulses per 1KWh

Internal counting = **2000**

Value on display **00000.25 kWh**

Communicated value **25**

Second case
1 pulse any 0.1 kWh

Internal counting = **5000**

Value on display **00000500 kWh**

Communicated value **500**