Contents

1.0 ABSTRACT

Physical level

The physical communication line complies with 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 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 :

Baud rate : programmable (device dependant)
bit n. : 8
stop bit : 1
parity : programmable (device dependant)

Data link level

The data are transmitted in a packet form (message) and are checked by a word (CRC).
See the description of the data packet in the next paragraphs for more details.

Application level

The communication protocol used is MODBUS / JBUS compatible.
Up to 255 different instruments can be managed by the protocol.
There are no limitations to the number of possible retries done by the master.
A delay between the response from the slave and the next command could be necessary and it is specified for each device (timing).

2.0 DATA MESSAGE DESCRIPTION

The generic data message is composed as following :

Device address	Functional code	Data	CRC word

Two answers are possible :

Answer containing data

Device address	Functional code	Data	CRC word

Error answer

Device address	Functional code + 0x80	Error code	CRC word

2.1 Parameters description

Device address : device 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 done on all the bytes in the message

2.2 Data format

The following types of format are used for the data values :

* U_WORD : one WORD - unsigned
* S_WORD : one WORD - signed
* UD_WORD : two WORDS - unsigned
* SD_WORD : two WORDS - signed

If the required data is in a DWORD format, 2 WORDS are transmitted and the MSW comes before the LSW (depending on the setting in the NEMO 96 : **big endian / little endian / swap WORDS**

MSB	LSB	MSB	LSB
Most Significant WORD		Least Significant WORD	

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

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

2.3 Description of CRC calculation

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

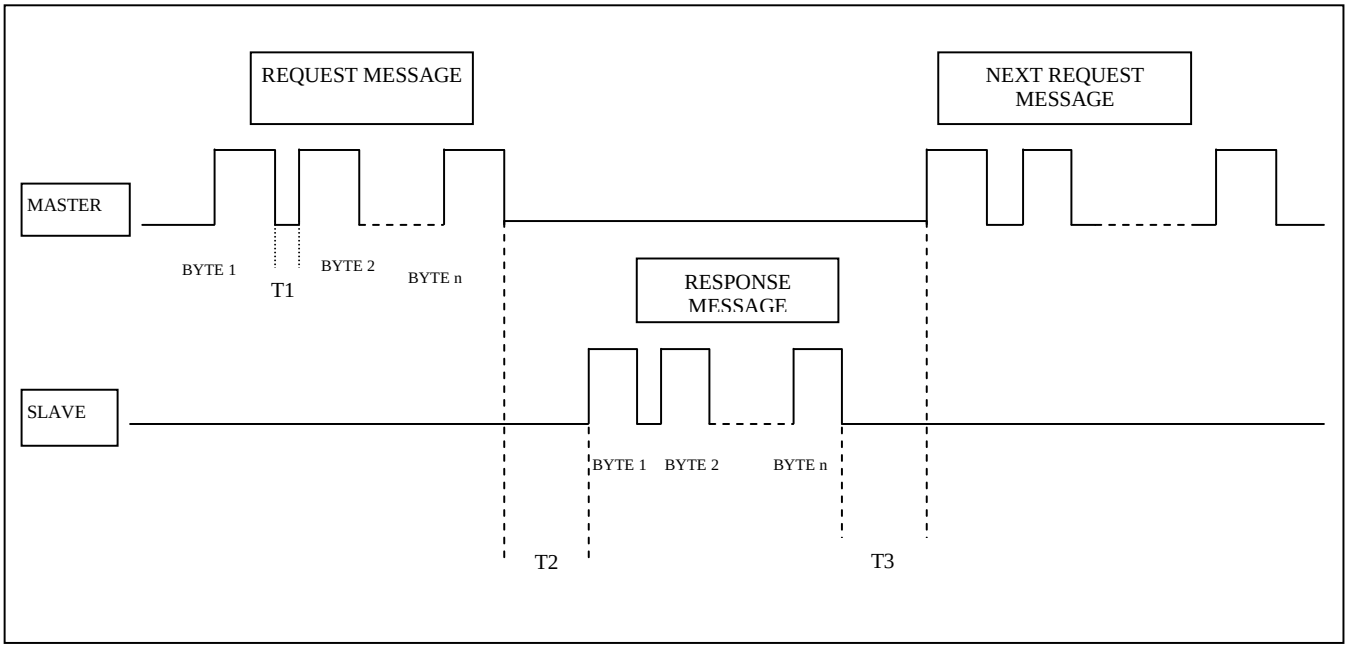
```
unsigned int calc_crc (char *ptbuf, unsigned int num)
/*     ************************************************************
 *     Descrizione : calculates a data buffer CRC WORD
 *     Input       :       ptbuf = pointer to the first byte of the buffer
 *                  num   = number of bytes
 *     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.
If the message is correct but there are errors (wrong functional code or data) it can't be accepted, so the slave answers with an error message.

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

2.5 Timing



TIME	DESCRIPTION	Min & Max VALUES
T1	**Time between characters.** If this time exceeds the max. time allowed, the message is not considered by device.	Min = 3 msec Max = 99 msec
T2	**Slave response time** Minimum response delay to Master request.	Min = 10 ms.
T3	Time before a new message request from the Master can be issued	Min = 1 ms.

Be careful : among the setup parameters there is a timeout value that may be programmed
The value of 20 msec is suggested to keep compatibility with older IME devices.
The minimum value is 3 msec.

3.0 COMMANDS

Code 0x03 : reading of one or more consecutive WORDS

Command format :

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

Answer format (containing data) :

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

Answer format (containing data) :

BYTE	BYTE	BYTE	MSB	LSB	MSB	LSB		
Device 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		
Device address	Funct. Code + 0x80	Error code	CRC16	

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

4.0 VARIABLES

Variables or groups of variables may be required up to 240 BYTES

0x100	**U_WORD**	Current transformer ratio (KTA)	No unit
0x102	**U_WORD**	Voltage transformer ratio (KTV)	1/100 (hundredths)
0x300	**U_WORD**	Device identifier	0x05

Address	Format	Description	Unit
0x1000	**UD_WORD**	Phase 1 : phase voltage	mV
0x1002	**UD_WORD**	Phase 2 : phase voltage	mV
0x1004	**UD_WORD**	Phase 3 : phase voltage	mV
0x1006	**UD_WORD**	Phase 1 : current	mA
0x1008	**UD_WORD**	Phase 2 : current	mA
0x100a	**UD_WORD**	Phase 3 : current	mA
0x100c	**UD_WORD**	Neutral current	mA
0x100e	**UD_WORD**	Chained voltage : L1-L2	mV
0x1010	**UD_WORD**	Chained voltage : L2-L3	mV
0x1012	**UD_WORD**	Chained voltage : L3-L1	mV
0x1014	**UD_WORD**	3-phase : active power	(3)
0x1016	**UD_WORD**	3-phase : reactive power	(3)
0x1018	**UD_WORD**	3-phase : apparent power	(3)
0x101a	**U_WORD**	3-phase : sign of active power	[6]
0x101b	**U_WORD**	3-phase : sign of reactive power	[6]
0x101c	**UD_WORD**	3-phase : positive active energy	(4)
0x101e	**UD_WORD**	3-phase : positive reactive energy	(4)
0x1020	**UD_WORD**	3-phase : negative active energy	(4)
0x1022	**UD_WORD**	3-phase : negative reactive energy	(4)
0x1024	**S_WORD**	3-phase : power factor	1/100 signed
0x1025	**U_WORD**	3-phase : sector of power factor (cap or ind)	0 : PF = 1 1 : ind 2 : cap
0x1026	**U_WORD**	Frequency	Hz/10
0x1027	**UD_WORD**	3-phase : average power	(3)
0x1029	**UD_WORD**	3-phase : peak maximum demand	(3)
0x102b	**U_WORD**	Time counter for average power	minutes
0x102c	**UD_WORD**	Phase 1 : active power	(3)
0x102e	**UD_WORD**	Phase 2 : active power	(3)
0x1030	**UD_WORD**	Phase 3 : active power	(3)
0x1032	**U_WORD**	Phase 1 : sign of active power	[6]
0x1033	**U_WORD**	Phase 2 : sign of active power	[6]
0x1034	**U_WORD**	Phase 3 : sign of active power	[6]
0x1035	**UD_WORD**	Phase 1 : reactive power	(3)
0x1037	**UD_WORD**	Phase 2 : reactive power	(3)
0x1039	**UD_WORD**	Phase 3 : reactive power	(3)
0x103b	**U_WORD**	Phase 1 : sign of reactive power	[6]
0x103c	**U_WORD**	Phase 2 : sign of reactive power	[6]
0x103d	**U_WORD**	Phase 3 : sign of reactive power	[6]
0x103e	**UD_WORD**	Phase 1 : apparent power	(3)
0x1040	**UD_WORD**	Phase 2 : apparent power	(3)
0x1042	**UD_WORD**	Phase 3 : apparent power	(3)
0x1044	**S_WORD**	Phase 1 : power factor	1/100 signed
0x1045	**S_WORD**	Phase 2 : power factor	1/100 signed
0x1046	**S_WORD**	Phase 3 : power factor	1/100 signed
0x1047	**U_WORD**	Phase 1 : power factor sector	0 : PF = 1 1 : ind 2 : cap
0x1048	**U_WORD**	Phase 2 : power factor sector	0 : PF = 1 1 : ind 2 : cap
0x1049	**U_WORD**	Phase 3 : power factor sector	0 : PF = 1 1 : ind 2 : cap
0x104a	**U_WORD**	Phase 1 : THD V1	% (0..100.0)
0x104b	**U_WORD**	Phase 2 : THD V2	% (0..100.0)

0x104c	**U_WORD**	Phase 3 : THD V3	% (0..100.0)
0x104d	**U_WORD**	Phase 1 : THD I1	% (0..100.0)
0x104e	**U_WORD**	Phase 2 : THD I2	% (0..100.0)
0x104f	**U_WORD**	Phase 3 : THD I3	% (0..100.0)
0x1050	**UD_WORD**	Phase 1 : I1 average	mA
0x1052	**UD_WORD**	Phase 2 : I2 average	mA
0x1054	**UD_WORD**	Phase 3 : I3 average	mA
0x1056	**UD_WORD**	Phase 1 : I1 peak maximum	mA
0x1058	**UD_WORD**	Phase 2 : I2 peak maximum	mA
0x105a	**UD_WORD**	Phase 3 : I3 peak maximum	mA
0x105c	**UD_WORD**	(I1+I2+I3)/3	mA
0x105e	**UD_WORD**	Phase 1 : V1 min	mV
0x1060	**UD_WORD**	Phase 2 : V2 min	mV
0x1062	**UD_WORD**	Phase 3 : V3 min	mV
0x1064	**UD_WORD**	Phase 1 : V1 max	mV
0x1066	**UD_WORD**	Phase 2 : V2 max	mV
0x1068	**UD_WORD**	Phase 3 : V3 max	mV
0x106a	**UD_WORD**	3-phase : active partial energy	(4)
0x106c	**UD_WORD**	3-phase : reactive partial energy	(4)
0x106e	**U_WORD**	Run hour meter	Hour
0x106f	**U_WORD**	Output relay status	(2)
0x1070	**UD_WORD**	3-phase : active average power	(3)
0x1072	**UD_WORD**	3-phase : reactive average power	(3)
0x1074	**UD_WORD**	3-phase : apparent average power	(3)
0x1076	**UD_WORD**	3-phase : active PMD power	(3)
0x1078	**UD_WORD**	3-phase : reactive PMD power	(3)
0x107a	**UD_WORD**	3-phase : apparent PMD power	(3)
0x107c	**UD_WORD**	Run hour meter	minutes

0x1200	**U_WORD**	Current transformer ratio (KTA)	No unit
0x1201	**U_WORD**	Voltage transformer ratio (KTV)	1/100 (hundredths)
0x1202	**UD_WORD**	Future developments	---
0x1204	**U_WORD**	Device identifier	0x05
0x1205	**U_WORD**	Future developments	---
0x1206	**U_WORD**	RFU	

0x1250	**UD_WORD**	3-phase Positive total active energy	(4)
0x1252	**UD_WORD**	3-phase Positive total reactive energy	(4)
0x1254	**UD_WORD**	3-phase Negative total active energy	(4)
0x1256	**UD_WORD**	3-phase Negative total reactive energy	(4)
0x1258	**UD_WORD**	3-phase Positive partial active energy tariff 1 active energy (if option tariffs)	(4)
0x125a	**UD_WORD**	3-phase Negative partial active energy tariff 2 active energy (if option tariffs)	(4)
0x125c	**UD_WORD**	3-phase Positive partial reactive energy tariff 3 active energy (if option tariffs)	(4)
0x125e	**UD_WORD**	3-phase Negative partial reactive energy tariff 4 active energy (if option tariffs)	(4)

0x1500	**UD_WORD**	Positive Active Energy - Low	Wh
0x1502	**UD_WORD**	Positive Active Energy – High	MWh
0x1504	**UD_WORD**	Positive Reactive Energy - Low	varh
0x1506	**UD_WORD**	Positive Reactive Energy – High	Mvarh
0x1508	**UD_WORD**	Negative Active Energy - Low	Wh
0x150A	**UD_WORD**	Negative Active Energy – High	MWh
0x150C	**UD_WORD**	Negative Reactive Energy - Low	varh
0x150E	**UD_WORD**	Negative Reactive Energy – High	Mvarh
0x1510	**UD_WORD**	Partial Active Energy - Low	Wh
0x1512	**UD_WORD**	Partial Active Energy - High	MWh
0x1514	**UD_WORD**	Partial Reactive Energy – Low	varh
0x1516	**UD_WORD**	Partial Reactive Energy - High	Mvarh
0x1518	**SD_WORD**	Signed 3-ph Active Power	W
0x151A	**SD_WORD**	Signed 3-ph Reactive Power	var
0x151C	**SD_WORD**	Signed Phase1 Active Power	W
0x151E	**SD_WORD**	Signed Phase2 Active Power	W
0x1520	**SD_WORD**	Signed Phase3 Active Power	W
0x1522	**SD_WORD**	Signed Phase1 Reactive Power	var
0x1524	**SD_WORD**	Signed Phase2 Reactive Power	var
0x1526	**SD_WORD**	Signed Phase3 Reactive Power	var
0x1528	**SD_WORD**	Signed 3-ph Power Factor	1/1000
0x152A	**SD_WORD**	Signed Phase1 Power Factor	1/1000
0x152C	**SD_WORD**	Signed Phase2 Power Factor	1/1000
0x152E	**SD_WORD**	Signed Phase3 Power Factor	1/1000

0x1530	**UD_WORD**	Apparent power	W
0x1532	**UD_WORD**	3-phase : active average power	W
0x1534	**UD_WORD**	3-phase : reactive average power	var
0x1536	**UD_WORD**	3-phase : apparent average power	VA
0x1538	**UD_WORD**	3-phase : active PMD power	W
0x153a	**UD_WORD**	3-phase : reactive PMD power	var
0x153c	**UD_WORD**	3-phase : apparent PMD power	VA
0x1540	**U_WORD**	Active positive energy wrap around	(*)
0x1541	**U_WORD**	Reactive positive energy wrap around	(*)
0x1542	**U_WORD**	Active negative energy wrap around	(*)
0x1543	**U_WORD**	Reactive negative energy wrap around	(*)

0x1580	**U_WORD**	Phase 1 : phase voltage crest factor	1/1000
0x1581	**U_WORD**	Phase 2 : phase voltage crest factor	1/1000
0x1582	**U_WORD**	Phase 3 : phase voltage crest factor	1/1000
0x1583	**U_WORD**	Phase 1 : current crest factor	1/1000
0x1584	**U_WORD**	Phase 2 : current crest factor	1/1000
0x1585	**U_WORD**	Phase 3 : current crest factor	1/1000
0x1586	**U_WORD**	Chained voltage : L1-L2 crest factor	1/1000
0x1587	**U_WORD**	Chained voltage : L2-L3 crest factor	1/1000
0x1588	**U_WORD**	Chained voltage : L3-L1 crest factor	1/1000

(*) wrap around means : when the main register of the energy value increases over 100 000 000 , the register is then reset to 0 and the wrap around value is incremented by 1

0x1600	**U_WORD**	phase displacement V1-V2 (V12-V23)	0.1 °
0x1601	**U_WORD**	phase displacement V2-V3 (V23-V31)	0.1 °
0x1602	**U_WORD**	phase displacement V3-V1 (V31-V12)	0.1 °
0x1603	**U_WORD**	phase displacement I1-I2	0.1 °
0x1604	**U_WORD**	phase displacement I2-I3	0.1 °
0x1605	**U_WORD**	phase displacement I3-I1	0.1 °
0x1606	**U_WORD**	phase displacement V1-I1	0.1 °
0x1607	**U_WORD**	phase displacement V2-I2	0.1 °
0x1608	**U_WORD**	phase displacement V3-I3	0.1 °
0x1609	**U_WORD**	phase displacement 3-ph	0.1 °

0x1620	**UD_WORD**	Not used	
0x1622	**UD_WORD**	Not used	
0x1624	**UD_WORD**	Not used	
0x1626	**UD_WORD**	Not used	
0x1628	**U_WORD**	0 – RFU	
0x1629	**U_WORD**	0 – RFU	
0x162a	**U_WORD**	0 – RFU	
0x162b	**U_WORD**	0 – RFU	

0x1700	**UD_WORD**	Positive Active Energy - Low	Wh
0x1702	**UD_WORD**	Positive Active Energy – High	MWh
0x1704	**UD_WORD**	Positive Reactive Energy - Low	varh
0x1706	**UD_WORD**	Positive Reactive Energy – High	Mvarh
0x1708	**UD_WORD**	Negative Active Energy - Low	Wh
0x170A	**UD_WORD**	Negative Active Energy – High	MWh
0x170C	**UD_WORD**	Negative Reactive Energy - Low	varh
0x170E	**UD_WORD**	Negative Reactive Energy – High	Mvarh
0x1710	**UD_WORD**	Partial+ Active Energy - Low	Wh
0x1712	**UD_WORD**	Partial+ Active Energy - High	MWh
0x1714	**UD_WORD**	Partial+ Reactive Energy – Low	varh
0x1716	**UD_WORD**	Partial+ Reactive Energy - High	Mvarh
0x1718	**UD_WORD**	Partial- Active Energy - Low	Wh
0x171a	**UD_WORD**	Partial- Active Energy - High	MWh
0x171c	**UD_WORD**	Partial- Reactive Energy – Low	varh
0x171e	**UD_WORD**	Partial- Reactive Energy – High	Mvarh
0x1720	**SD_WORD**	Signed 3-ph active power	W
0x1722	**SD_WORD**	Signed 3-ph reactive power	var
0x1724	**SD_WORD**	Signed phase1 active power	W
0x1726	**SD_WORD**	Signed phase2 active power	W
0x1728	**SD_WORD**	Signed phase3 active power	W
0x172A	**SD_WORD**	Signed phase1 reactive power	var
0x172C	**SD_WORD**	Signed phase2 reactive power	var
0x172E	**SD_WORD**	Signed phase3 reactive power	var
0x1730	**SD_WORD**	Signed 3-ph Power Factor	1/100
0x1732	**SD_WORD**	Signed phase1 Power Factor	1/100
0x1734	**SD_WORD**	Signed phase2 Power Factor	1/100
0x1736	**SD_WORD**	Signed phase3 Power Factor	1/100

0x7000	**U_WORD**	Current phase 1 – fundamental	1000
0x7001	**U_WORD**	Current phase 1 - 2nd harmonic (percentage)	1/10 %
------	------	----------	
0x7031	**U_WORD**	Current phase 1 - 50th harmonic (percentage)	1/10 %
0x7040	**U_WORD**	Current phase 2 – fundamental	1000
0x7041	**U_WORD**	Current phase 2 - 2nd harmonic (percentage)	1/10 %
------	-----	----------	
0x7071	**U_WORD**	Current phase 2 - 50th harmonic (percentage)	1/10 %
0x7080	**U_WORD**	Current phase 3 – fundamental	1000
0x7081	**U_WORD**	Current phase 3 - 2nd harmonic (percentage)	1/10 %
------	------	----------	
0x70B1	**U_WORD**	Current phase 3 - 50th harmonic (percentage)	1/10 %
0x70C0	**U_WORD**	Voltage phase 1 (V12) - fundamental	1000
0x70C1		Voltage phase 1 (V12) - 2nd harmonic (percentage)	1/10 %
------	------	----------	
0x70F1	**U_WORD**	Voltage phase 1 (V12) - 50th harmonic (percentage)	1/10 %
0x7100	**U_WORD**	Voltage phase 2 (V23) – fundamental	1000
0x7101	**U_WORD**	Voltage phase 2 (V23) - 2nd harmonic (percentage)	1/10 %
------	------	----------	
0x7131	**U_WORD**	Voltage phase 2 (V23) - 50th harmonic (percentage)	1/10 %
0x7140	**U_WORD**	Voltage phase 3 (V31) – fundamental	1000
0x7141	**U_WORD**	Voltage phase 3 (V31) - 2nd harmonic (percentage)	1/10 %

0x7171	**U_WORD**	Voltage phase 3 (V31) - 50th harmonic (percentage)	1/10 %
0x7200	**UD_WORD**	Current phase 1 - fundamental (rms)	mA

0x7262	**UD_WORD**	Current phase 1 - 50th harmonic (rms)	mA
0x7280	**UD_WORD**	Current phase 2 – fundamental (rms)	mA

0x72E4	**UD_WORD**	Current phase 2 - 50th harmonic (rms)	mA
0x7300	**UD_WORD**	Current phase 3 – fundamental (rms)	mA

0x7364	**UD_WORD**	Current phase 3 - 50th harmonic (rms)	mA
0x7380	**UD_WORD**	Voltage phase 1 (V12) – fundamental (rms)	mV

0x73E2	**UD_WORD**	Voltage phase 1 (V12) - 50th harmonic (rms)	mV
0x7400	**UD_WORD**	Voltage phase 2 (V23) – fundamental (rms)	mV

0x7462	**UD_WORD**	Voltage phase 2 (V23) - 50th harmonic (rms)	mV
0x7480	**UD_WORD**	Voltage phase 3 (V31) – fundamental (rms)	mV

0x74E2	**UD_WORD**	Voltage phase 3 (V31) - 50th harmonic (rms)	mV

0x7500	**U_WORD**	THD I1	1/10 %
0x7501	**U_WORD**	THD I2	1/10 %
0x7502	**U_WORD**	THD I3	1/10 %
0x7503	**U_WORD**	THD V1 (V12)	1/10 %
0x7504	**U_WORD**	THD V2 (V23)	1/10 %
0x7505	**U_WORD**	THD V3 (V31)	1/10 %

2) ----------

Device programmed in “Alarm Output” mode :

0: No active Alarm
1: Alarm active

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

W, var, VA / 100 if KTA*KTV < 5000
W, var, VA if KTA*KTV >= 5000

(4) ----------

Transformer ratio	**Measurement unit**	**Display Format**	**Protocol Format**
1 ≤ KTA*KTV < 10	Wh(varh) * 10	xxxxxx.yy k	xxxxxxyy
10 ≤ KTA*KTV < 100	Wh(varh) * 100	xxxxxxx.y k	xxxxxxxy
100 ≤ KTA*KTV < 1000	kWh(kvarh)	xxxxxxxx k	xxxxxxxx
1000 ≤ KTA*KTV < 10000	kWh(kvarh) * 10	xxxxxx.yy M	xxxxxxyy
10000 ≤ KTA*KTV < 100000	kWh(kvarh) * 100	xxxxxxx.y M	xxxxxxxy
100000 ≤ KTA*KTV	kWh(kvarh) * 100	xxxxxxxx M	xxxxxxxx

6) ----------

0 : positive
1 : negative

5.0 SETUP PARAMETERS

NEMO D4-Le parameters may be red and written accordingly to the procedure described in the following.
The variable table to read and write the parameters are located at the same address.
It is allowed to write the setup parameters addressed at 0x2000 and 0x2200 only by a single telegram for each group.

Standard Setup parameters (read and write)

Length : 16 BYTES

0x2000	**U_WORD**	RFU	
0x2001	**U_WORD**	RFU	
0x2002	**U_WORD**	RFU	
0x2003	**U_WORD**	RFU	
0x2004	**U_WORD**	Percentage of rated 3phase active power run hour meter	50..5000 means (0.5%..50.00%)
0x2005	**U_WORD**	Run hour meter active on	0:V1 1:P
0x2006	**U_WORD**	RFU	
0x2007	**U_WORD**	RFU	
0x2008	**U_WORD**	Backlight intensity	0:0% 1:35% 2:70% 3:100%
0x2009	**U_WORD**	RFU	
0x200a	**U_WORD**	Power Averaging time	0:5min 1:8min 2:10min 3:15min 4:20min 5:30min 6:60min
0x200b	**U_WORD**	Insertion type	0:3n-3e 1: 3-3e 2: 3-2e 3:1n-1e 4:3n-1e 5: 3-1e
0x200c	**U_WORD**	Measure on line 1 of custom page	0:V1 1:V12 2:I1 3:In 4:P 5:Q 6:S 7:P1 8:Q1 9:S1
0x200d	**U_WORD**	Measure on line 2 of custom page	0:V2 1:V23 2:I2 3:P 4:Q 5:S 6:P2 7:Q2 8:S2 9:Freq

0x200e	**U_WORD**	Measure on line 3 of custom page	0:V3 1:V31 2:I3 3:P 4:Q 5:S 6:P3 7:Q3 8:S3 9:PFt
0x200f	**U_WORD**	RFU	-

Output option Setup parameters (read and write)

Length : 24 BYTES

0x2200	**U_WORD**	RFU	
0x2201	**U_WORD**	RFU	
0x2202	**U_WORD**	RFU	
0x2203	**U_WORD**	RFU	
0x2204	**U_WORD**	RFU	
0x2205	**U_WORD**	RFU	
0x2206	**U_WORD**	RFU	
0x2207	**U_WORD**	RFU	
0x2208	**U_WORD**	RFU	
0x2209	**U_WORD**	RFU	
0x220a	**U_WORD**	Pulse output or Alarm or output controlled remotely	0: Pulse out 1: Alarm out 2: Dual stable remote control 3: Remote Timer control
0x220b	**U_WORD**	Pulse duration	0: 50msec 1: 100msec 2: 200msec 3: 300msec 4: 400msec 5: 500msec
0x200c	**U_WORD**	Pulse weight	0: 0.01 kWh 1: 0.10 kWh 2: 1.00 kWh 3:10.0 kWh 4: 0.10 MWh 5: 1.00 MWh 6:10.0 MWh
0x200d	**U_WORD**	Pulse on	0:Act Energy 1:Rea Energy
0x220e	**U_WORD**	Output set as Alarm option = 1 : delay to OFF after condition has finished Output set as remote control option 2 : pulse period after the remote command has been issued option 3 : delay to OFF after the remote OFF command has been issued	seconds
0x220f	**U_WORD**	Output set as Alarm option = 1 : delay to ON after condition has been reached Output set as remote control option 2 : delay to ON after the remote command has been issued option 3 : delay to ON after the remote command has been issued	seconds
0x2210	**U_WORD**	Hysteresis	% (no decimals)
0x2211	**U_WORD**	Relay (NO/NC)	0: NO 1: NC
0x2212	**U_WORD**	Alarm on Min Value or Max Value	0: Min 1: Max
0x2213	**U_WORD**	Alarm set point	

0x2214	**U_WORD**	RFU	-
0x2215	**U_WORD**	Unit of set point	0: X.XXX 1: XX.XX 2: XXX.X 3: X.XXX k 4: XX.XX k 5: XXX.X k 6: X.XXX M 7: XX.XX M 8: XXX.X M
0x2216	**U_WORD**	Sign of Alarm set point	0: + 1: -
0x2217	**U_WORD**	Type of measurement	0: V1 1: V2 2: V3 3: V12 4: V23 5: V31 6: I1 7: I2 8: I3 9: Freq 10:Act Power 11:Rea Power

E.g. **Request**

FF 03 **22 00** 00 18 5A 66

Answer :

	0x2200	0x2201	0x2202	0x2203	0x2204	0x2205	0x2206	0x2207	0x2208
FF 03 30	**W0**	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**
	0x2209	0x220a	0x220b	0x220c	0x220d	0x220e	0x220f	0x2210	0x2211
	W9	**W10**	**W11**	**W12**	**W13**	**W14**	**W15**	**W16**	**W17**
	0x2212	0x2213	0x2214	0x2215	0x2216	0x2217			
	W18	**W19**	**W20**	**W21**	**W22**	**W23**	CRC WORD		

FF 03 30 | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** |
00 00 | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** | **00 00** |
00 00 | **00 00** | **00 00** | **00 00** | **00 01** | **00 02** | 6D C1

W0 .. W9 / W20 are not used.

Procedure to write

Every write operation must be preceded by a “Master Unlock Key” command.

Address 0x2700 : write word with value = 0x5AA5 (Master Unlock Key)

Reset of NEMO parameters

Any writing operation of any parameter will have effect **only** in the volatile memory (RAM).
After any writing operation of parameters described in the following of the document, if necessary to go back to the default it is mandatory to send the following commands :

Address 0x2700 : write WORD with value = 0x 5AA5 (Master Unlock Key)
Address 0x2800 : write WORD with value = 0x YYYY (any value)

This command will reset the NEMO and in this way all changes will be lost so returning to the previous conditions.

EEPROM savings

If it is necessary to save the new parameters in EEPROM it is mandatory to send these following messages :

Address 0x2700 : write WORD with value = 0x 5AA5 (Master Unlock Key)
Address 0x2600 : write WORD with value = 0x YYYY (any value)

Write address table

Address	Format	Description	Value
0x100	**U_WORD**	Current transformer ratio	1 - 9999
0x102	**U_WORD**	Voltage transformer ratio	1/10 (e.g. 4.3 Reading 43)
0x2000	**16 U_WORD**	Standard setup parameters	(16)
0x2200	**24 U_WORD**	Programming parameters of pulse and/or alarm output	(16)
0x2400	**U_WORD**	Reset Hour Meter, Maximum Powers, Maximum Voltages, Maximum Currents, Minimum Voltages, Active Partial Energy, Reactive Partial Energy	(12)
0x2600	**U_WORD**	Saving in EEPROM parameters changed by Remote commands	(13)
0x2700	**U_WORD**	Enable Remote Writing Operation	(14)
0x2800	**U_WORD**	Load previous setup parameters stored in EEPROM	(15)

(12) To reset desired measurements write the following word (in binary) :

0|0|0|0|0|0|0|0|b8|b7|b6|b5|b4|b3|b2|b1|b0

b0 = 1 => Reset Hour Meter
b1 = 1 => Reset Peak Maximum Demand
b2 = 1 => Reset Maximum Voltage values
b3 = 1 => Reset Maximum Current values
b4 = 1 => Reset Minimum Voltage values
b5 = 1 => Reset Active Partial Energy
b6 = 1 => Reset Reactive Partial Energy
b7 = 0 => Not used
b8 = 0 => Not used
b9 .. b15 = 0

(13) Write any value to save the new parameters changed by Remote commands

(14) To do any remote programming write operation, it’s mandatory to write a safety key = 0x5AA5.

(15) Write any value to abort any remote programming write operation and reload the previous values.

(16) The parameters are read and written with the same sequence.