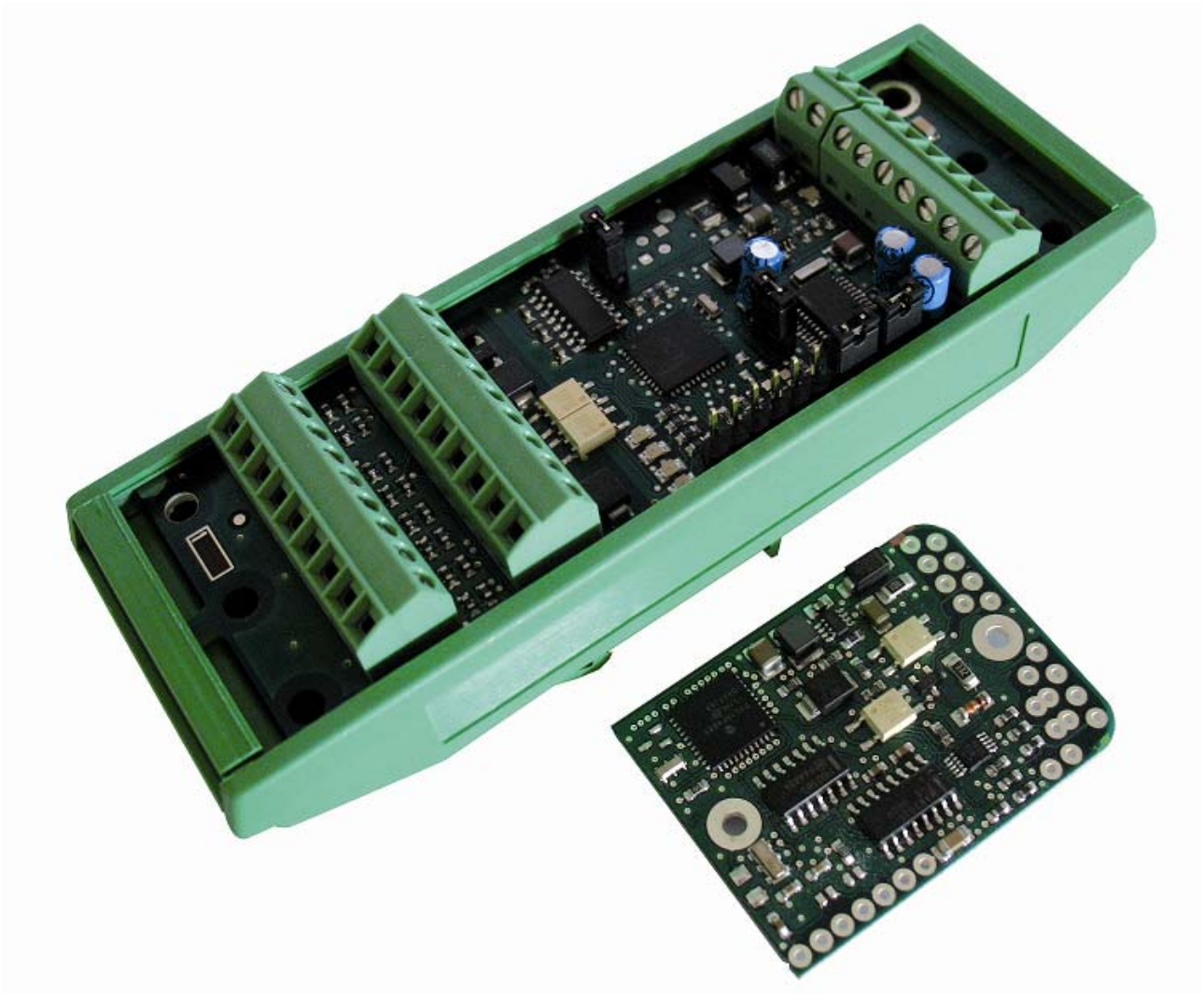
SCMBUS
COMMUNICATION PROTOCOL



Document revisions		
version	**date**	**description**
A	06/2010	- creation

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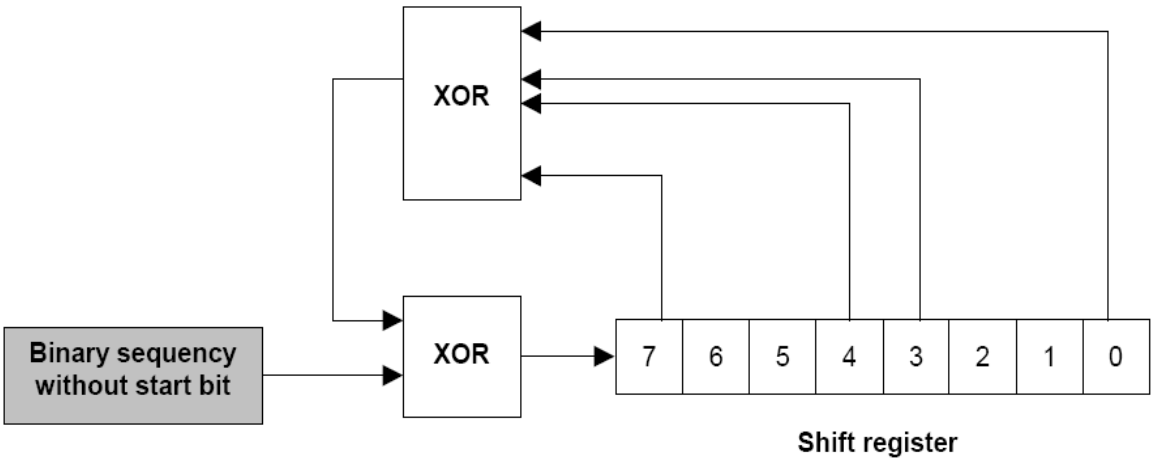
1 SCMBUS & FAST SCMBUS COMMUNICATION PROTOCOLS

1.1 Byte format :

- Format:
  - 1 start bit
  - 8 data bits without parity
  - 2 stop bits
- ASCII bytes :
  ASCII numeral characters (30_H,...39_H) and ASCII hexadecimal characters ($3A_H$,...$3F_H$).
- CRC-8 byte:
  generated by the following polynomial :

$$G(x) = x^8 + x^7 + x^4 + x^3 + 1$$

The CRC-8 polynomial result can be determined by programming the algorithm corresponding to the following diagram:



Note: The frame error detection can be ignored. Value **0xFF** of the CRC-8 always is admitted by ***eNod1-T & eNod3-T*** and a received frame with such a CRC-8 is considered as a right frame without any error.

1.2 Frame format

- Transmission order:
  - frame: address first
  - bytes: LSB first
  - multi-bytes data type: MSB first

1.2.1 Functional commands, writing commands:

Request:

Address	Command	Value	CR	CRC
1 **Hex.** byte	1 **Hex.** byte (command)	N **ASCII** hexa. bytes	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

Response:
When a writing or a functional command is acknowledged by ***eNod1-T & eNod3-T***, the device sends back the same frame as the one that was received.

Address	Command	Value	CR	CRC
1 **Hex.** byte	1 **Hex.** byte (command)	N **ASCII** hexa. bytes	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

1.2.2 Reading commands:

Request:

Address	Command	CR	CRC
1 **Hex.** byte	1 **Hex.** byte (command)	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

Response:

Address	Command	Value	CR	CRC
1 **Hex.** byte	1 **Hex.** byte (command)	N **ASCII** hexa. bytes	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

1.2.3 Transmit measurement, status bytes:

Request:

Address	Command	CR	CRC
1 **hex.** byte	1 **Hex.** byte (command)	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

Response:

- Standard format:

Address	Status	Value	CR	CRC
1 **Hex.** byte	2 **Hex.** bytes	N **ASCII** hexa. bytes	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

- Fast format :

This specific format is especially dedicated to very fast measurements transmission. We recommend using ***eNodView*** software with this format so as to save an acquisition file that can be used for dynamic analysis. It allows the user to define the best settings related to his application.

Fast format can be only used in transmitter functioning mode with gross, net or A/D converter points.

STX	Status	Value	Cks	ETX
02_H	2 **Hex.** bytes	3 signed **Hex.** bytes (2's complement)	Σ of previous bytes and b7 forced to 1	03_H

Measurements encoding: because values are encoded in signed hexadecimal format, some bytes can be equal to STX (02_H), ETX (03_H) or DLE (10_H) so before those specific bytes values a DLE (10_H) byte is inserted. The device address is omitted in the frame.

- the frame starts with STX (02_H) byte and ends with ETX (03_H) byte
- values are encoded in signed hexadecimal (two's complement)
- checksum is obtained by summing every previous bytes and setting bit b7 to 1

Status bytes:

bits b0,...b15	Function	Notes
bit b0		
0	A/D converter measurement within the admissible range	causes an output assigned to the *'defective measurement'* function to be set active
1	input signal > A/D converter input range	
bit b1		
0	measurement within the admissible range	causes an output assigned to the *'defective measurement'* function to be set active
1	Measurement > capacity	
bit b2		
0	A/D converter measurement within the admissible range	causes an output assigned to the *'defective measurement'* function to be set active
1	Input signal < A/D converter input range in negative value (bi-polar functioning)	
bit b3		
0	measurement within the admissible range	causes an output assigned to the *'defective measurement'* function to be set active
1	Measurement < capacity in negative value	
bit b4		
0	Motion	causes an output assigned to the *'motion'* function to be set active
1	No motion	
bit b5		
0	measurement out of the ¼ of division	
1	zero in the ¼ of division	
bit b6		
0	EEPROM OK	causes an output assigned to the *'defective measurement'* function to be set active
1	EEPROM failure	
bit b7		
1	reserved	
bit b8 b9		
00	A/D converter points	Type of measure
01	Net measurement	
10	Gross measurement	
11	Tare value	
bit b10		
0	Input 1 logical state	Input 1 image
1		
bit b11		
0	Input 2 logical state	Input 2 image
1		
bit b12		
0	Output 1 logical state	Output 1 image
1		
bit b13		
0	Output 2 logical state	Output 2 image
1		
bit b14		
0	no tare	the tare can be cancelled by an input or by a command
1	at least a tare has been processed	
bit b15		
1	reserved	

1.2.4 Exception frame:

Address	Error code	CR	CRC
1 **Hex.** byte	1 **Hex.** byte (error code)	1 **ASCII** byte ($0D_H$)	1 **Hex.** byte

Error codes:

Error codes	Meaning	Notes
FE_H	unknwon command / invalid format	
FF_H	error during command execution	ex. : tare request when gross meas. < 0

2 COMMANDS:

2.1 FUNCTIONAL COMMANDS (N = 0) :

Command	Hex. codes	Description
cancel tare	35_H	erases last tare value
output 1 activation	37_H	Output 1 must be assigned to 'Level on request'
output 2 activation	38_H	cf. output 1 activation
output 1 inhibition	39_H	Output 1 must be assigned to 'Level on request'
output 2 inhibition	$3A_H$	cf. output 1 inhibition
reset	80_H	similar to power-up – No response
EEPROM storage	81_H	saves the whole settings table into the EEPROM memory
put in physical calibration mode	$C8_H$	1st step of the physical calibration procedure
zero acquisition	$C9_H$	2nd step of the physical calibration procedure
calibration with load 1	CA_H	3rd step of the physical calibration procedure
calibration with load 2 (optional)	CB_H	4th step of the physical calibration procedure
calibration with load 3 (optional)	CC_H	5th step of the physical calibration procedure
save calibration	CD_H	stores the calibration into EEPROM memory following commands $C8_H$ to CC_H or $D1_H$ or $D4_H$
Restores ***eNod1-T*** & ***eNod3-T*** default configuration	CE_H	**Warning** : all the default settings are recovered including the stored calibration
zero	CF_H	This new zero value becomes the current zero value. It is not stored in EEPROM. limited to ±10% range of the maximum capacity.

tare	$D0_H$	
zero adjustment	$D1_H$	calibration zero acquisition ; must be followed by the save calibration command (CD_H)
RAZ status	$D2_H$	
abort calibration	$D3_H$	allows to leave the calibration procedure
sensitivity adjustment	$D4_H$	calibration using the sensor sensitivty and the sensor capacity ; must be followed by the save calibration command (CD_H)
start continuous transmission gross measurements	EF_H	Continuous transmission pilot
start continuous transmission net measurements	$F9_H$	
start continuous transmission A/D converter points	FA_H	
stop continuous transmission	$F0_H$	

2.2 READ / WRITE COMMANDS LIST :

Write commands are generally associated to a read command. Both might be used with up to N bytes. See description in the corresponding §.

Command	Write hex. codes	Note	Read hex. codes
communication protocol and functioning mode	82_H	N = 2	$A5_H$
address ***eNod1-T or eNod3-T***	96_H	N = 1 to 3	$B9_H$
RS/CAN buses baud rates	$97_H/60_H$	Write N = 1 / Read N = 2	BA_H
firmware version	-	read-only ; N = 5	$B8_H$
calibration load 1	86_H	N = 1 to 8	$A9_H$
calibration load 2	87_H	N = 1 to 8	AA_H
calibration load 3	88_H	N = 1 to 8	AB_H
number of calibration segments	89_H	N = 1	AC_H
global span correction coefficient	$8A_H$	N = 7 to 8	AD_H
polynomial correction A coefficient	$8B_H$	N = 10	AE_H
polynomial correction B coefficient	$8C_H$	N = 10	AF_H
polynomial correction C coefficient	$8D_H$	N = 10	$B0_H$
maximum capacity	$8E_H$	N = 1 to 8	$B1_H$
sensor sensitivity	$2C_H$	Write N = 6 / Read N = 8	$E9_H$
sensor capacity	90_H	N = 1 to 8	$B3_H$
calibration zero	91_H	in A/D converter points N = 1 to 8	$B4_H$
scale coefficient 1	$D5_H$	N = 8	$D6_H$
scale coefficient 2	$D7_H$	N = 8	$D8_H$

scale coefficient 3	$D9_H$	N = 8	DA_H
metrological program version	-	read-only ; N = 5	61_H
legal fot trade switch	92_H	N = 1	$B5_H$
legal for trade counter	-	read-only ; N = 5	DC_H
legal for trade CRC-16	-	read-only ; N = 5	DD_H
initial zerosetting/zero tracking	93_H	N = 1	$B6_H$
A/D converter configuration	85_H	N = 3	$A8_H$
Low-pass filter order	20_H	N = 1 (W) / N = 2 (R)	21_H
low-pass filter 1/A coefficient	22_H	N = 8	23_H
low-pass filter B coefficient	24_H	N = 8	25_H
low-pass filter C coefficient	26_H	N = 8	27_H
low-pass filter D coefficient	28_H	N= 8	29_H
low-pass filter E coefficient	$2A_H$	N = 8	$2B_H$
Band-stop filter activation	56_H	N = 1 (W) / N = 2 (R)	21_H
band-stop filter X coefficient	51_H	N = 8	50_H
band-stop filter Y coefficient	53_H	N = 8	52_H
band-stop filter Z coefficient	55_H	N = 8	54_H
self-adaptive filter activation	94_H	N = 1	$B7_H$
stability criterion	$2E_H$	N = 1	$B7_H$
scale interval	$8F_H$	predefined values N = 1 to 3	$B2_H$
user text box	99_H	N = 16	BC_H
inputs assignment	83_H	N = 4	$A6_H$
outputs 1 assignment	84_H	N = 2	$A7_H$
output 1 activation duration	$3C_H$	N = 1 to 5	$3B_H$
output 2 activation duration	$3E_H$	N = 1 to 5	$3D_H$
set point 2 high value	$9A_H$	N = 1 to 8	BD_H
set point 2 low value	$9B_H$	N = 1 to 8	BE_H
set point 1 high vlaue	$9C_H$	N = 1 to 8	BF_H
set point 1 low value	$9D_H$	N = 1 to 8	$C0_H$
set points functioning	$9E_H$	N = 2	$C1_H$
output measurement period	$A3_H$	N = 1 to 5	$C6_H$
debounce time	$A4_H$	N = 1 to 5	$C7_H$
gross	-	SCMBus standard/fast format	$2F_H$
tare	-	SCMBus standard format	30_H
net	-	SCMBus standard/fast format	31_H
A/D converter points	-	SCMBus standard/fast format	32_H

3 COMMANDS DESCRIPTION :

The data accessible through SCMBus communication protocol are described in the following section. Each setting has its own reading and/or writing command, a format and activation conditions.

Data storage *:

- **Y**: the setting **must** be stored into EEPROM. Its new value will be taken into account after next reset.
- **N**: the new setting value is immediately **used by the device** and has no need to be stored into EEPROM to be in use.

- **NOTE:** the whole set of parameters except the read-only datas, can be stored into EEPROM. Their values are so preserved if the power supply is disconnected or if a reset is requested.

3.1 Communication settings :

3.1.1 *eNod1-T or eNod3-T* address :

read command	*write command*	*N*	*data storage**
$B9_H$	96_H	***1 (Write)*** ***3 (Read)***	***Y***

Format: hexadecimal when write, admitted values are between 01_H and $F7_H$; ASCII format when read values are between 1_D to 247_D **Default value: 01_D**
Description: ***eNod1-T or eNod3-T*** address on the network.
The address 00_H is always valid address, that means each ***eNod1-T or eNod3-T*** react to this address.
Don't use 00_H address if ***eNod1-T or eNod3-T*** is connected on a bus.
Switching from one address to another requires the following steps:

- Storage in EEPROM of the new address (command 81_H).

Doing a reset (it can be done with power off, then power on, or command 80_H).

3.1.2 Communication protocol and functioning mode:

read command	*writ command*	*N*	*data storage**
$A5_H$	82_H	***2***	***Y***

Format/description:

N1, N2		Function
N1 (Write)	N1 (Read)	Protocole
30	00	***SCMBus***
31	01	***ModBus-RTU***
33	03	***SCMBus fast format***
N2 (Write)	**N2 (Read)**	**Functioning mode**
30	00	transmitter
38	08	fast transmitter *

* Fast transmitter: in this functioning mode, digital filters, set points management and non-linear polynomial correction are disabled.
Switching from one protocol/functioning mode to another requires the following steps:

- Storage in EEPROM of the new protocol (command 81_H).
- Doing a reset (it can be done with power off, then power on, or command 80_H).

3.1.3 Serial bus baud rates:

Read command[(1)]	*Write command*[(1)]	*N*	*data storage**
BA_H	97_H	***1 (Write)*** ***2 (Read)***	***Y***

(1) Note : - Read command gives baud rates of serial bus and CAN bus, see ***table 1***.
- 97_H Write command allows changing only serial bus baud rate.
- For a CANBus baud rate changing use 60_H command.

Format/description:

Table 1

N1	RS485/422 or RS232 baud rate	Notes
31	9600	**by default**
32	19200	
33	38400	
34	57600	
35	115200	
N2	**CANBus baud rate**	
31	20000	
32	50000	
33	125000	**by default**
34	250000	
35	500000	
36	800000	
37	1000000	

Switching from one baud rate to another requires the following steps:

- Storage in EEPROM of the new baud rate (command 81_H).
- Doing a reset (it can be done with power off, then power on, or command 80_H).

3.2 Calibration settings :

3.2.1 Number of calibration segments :

read command	*write command*	*N*	*data storage**
AC_H	89_H	***1***	***N***

Format: ASCII.
Description: the number of calibration segments is limited to 3. In general, one segment is sufficient, 2 or 3 can be useful in case of non-linearity problems.

3.2.2 Physical calibration loads:

setting	*read command*	*write command*	*N*	*data storage**
calibration load 1	$A9_H$	86_H	***1 to 8***	***N***
calibration load 2	AA_H	87_H	***1 to 8***	***N***
calibration load 3	AB_H	88_H	***1 to 8***	***N***

Format: ASCII (non significant zeros not necessary) ; admitted values between 1 and 1000000_d.
Description: each load corresponds to the termination of a calibration segment. Calibration loads are used during the physical calibration procedure.

3.2.3 Scale coefficients :

setting	read command	write command	N	data storage*
scale coeff. 1	$D6_H$	$D5_H$	**8**	**N**
scale coeff. 2	$D8_H$	$D7_H$	**8**	**N**
scale coeff. 3	DA_H	$D9_H$	**8**	**N**

Format: ASCII hexadecimal; the scale coefficients are expressed as single precision float variables (32 bits). Their value is divided into successive quartets.
Description: these coefficients are automatically calculated during one of the calibration procedures. Writing these coefficients is only valid for a copy of a previous calibration.

3.2.4 Global span correction coefficient :

read command	write command	N	data storage*
AD_H	$8A_H$	**7 to 8**	**N**

Format: ASCII (unsigned) ; the unit for this setting is 1/1000000 (1E-6) that means 1000000_d = 1. Maximal and minimal values are 1100000_d and 900000_d. It corresponds to a coefficient equal to 1.1 and 0.9.
Description: The calibration curve slope can be adjusted by this coefficient. It is applied on the whole curve.

3.2.5 Polynomial correction coefficients :

setting	read command	write command	N	data storage*
A coefficient	AE_H	$8B_H$	**10**	**N**
B coefficient	AF_H	$8C_H$	**10**	**N**
C coefficient	$B0_H$	$8D_H$	**10**	**N**

Format: ASCII (signed, sign first) ; each coefficient has its own unit due to their range :

- The unit for A coefficient is 1/1000000000000 (1E-12), that means 1 000 000 000 000_d = 1.
- The unit for B coefficient is 1/ 1000000000 (1E-9), that means 1 000 000 000_d = 1.
- C is directly express as A/D converter points.

Description: the coefficient determination can be achieved using ***eNodView*** software.
The correction relation is the following:

> Corrected measurement = Meas – A (Meas)^2 – B (Meas) – C
> where Meas = current measurement in A/D converter points

3.2.6 Maximum capacity:

read command	write command	N	data storage*
$B1_H$	$8E_H$	**1 to 7**	**N**

Format: ASCII (non significant zeros not necessary) ; admitted values between 1 and 1000000_d.
Description: when the absolute value of the gross measurement plus 9 divisions exceeds the specified capacity, bit b3 (positive overloading) or bit b2 (negative overloading) of the status register is set to 1.

3.2.7 Scale interval :

read command	write command	N	data storage*
$B2_H$	$8F_H$	**1 to 3**	**N**

Format: ASCII (non significant zeros not necessary); admitted values among the following pre-defined values: 1, 2, 5, 10, 20, 50, 100.
Description: minimal difference between two consecutive calibrated measurements.

3.2.8 Sensor capacity:

read command	write command	N	data storage*
$B3_H$	90_H	**1 to 8**	**N**

Format: ASCII (non significant zeros not necessary) ; admitted values between 1 and 1000000_d.
Description: the sensor capacity is used in association with the sensor sensitivity for a theoretical calibration.

3.2.9 Sensor sensitivity:

read command	write command	N	data storage*
$E9_H$	$2C_H$	**Write N = 6** **Read N = 8**	**N**

Format: ASCII; the unit for this setting is mV/V x 10^{-5}. For example, 2.024 mV/V is written as 202400.
Description: the sensor sensitivity is used in association with the sensor capacity for a theoretical calibration.

3.2.10 Calibration zero:

read command	write command	N	data storage*
$B4_H$	91_H	**1 to 8**	**Y**

Format: ASCII (non significant zeros not necessary)
Description: value in A/D converter points of the zero reference.
During a physical calibration, this zero value is acquired in the first step of the procedure. It can also be set for a theoretical calibration or corrected using the *'zero adjustment'* command.

3.3 Filtering options :

3.3.1 A/D converter configuration:

read command	write command	N	data storage*
$A8_H$	85_H	**3**	**Y**

Format/description:

N1, N2 et N3	Function	
N1	**Analog input signal range**	
36	**7.8mV/V**	
N2	**Signal type**	
30	bipolar with 60 Hz rejection	
31	unipolar with 60 Hz rejection	
32	bipolar with 50 Hz rejection	**default configuration**
33	**unipolar with 50 Hz rejection**	

N3	A/D conversion rate (meas/s)		
	50 Hz rejection	50 Hz rejection	
34	6.25	7.5	
33	12.5	15	
32	25	30	
31	50	60	
30	100	120	**default configuration**
3C	200	240	
3B	400	480	
3A	800	960	
39	1600	1920	

3.3.2 Low-pass filter :

The filter recurrence relations of the low-pass filter, Bessel or Butterworth type are as follows:

2^{nd} order: $S_n = 1/A(e_n + 2e_{n-1} + e_{n-2} - BS_{n-1} - CS_{n-2})$
3^{rd} order: $S_n = 1/A(e_n + 3e_{n-1} + 3e_{n-2} + e_{n-3} - BS_{n-1} - CS_{n-2} - DS_{n-3})$
4^{th} order: $S_n = 1/A(e_n + 4e_{n-1} + 6e_{n-2} + 4e_{n-3} + e_{n-4} - BS_{n-1} - CS_{n-2} - DS_{n-3} - ES_{n-4})$

Coefficients (A,B,C,D,E) are linked to A/D converter conversion rate and to desired cut-off frequency. The determination of these coefficients can be easily achieved using ***eNodView*** simulation tools. Low-pass filter order and low-pass coefficients have to be set simultaneously.

3.3.2.1 Low-pass filter ordre

read command [2]	***write command*** [2]	***N***	***data storage****
21_H	20_H	***1 (Write)*** ***2(Read)***	***N***

[2] Note : - Read command gives low-pass filter activation or order and band-stop filter activation.
- 20_H Write command allows changing activation or order of low-pass filter, use N1 in ***table 2***.
- For band-stop filter activation use 56_H command and N2 in ***table 2***, see § 3.3.3.1.

Format / description :

Table 2

N1	Low-pass filter activation and order
30	Low-pass filter unused
32	Bessel/Butterworth low-pass filter 2^{nd} order
33	Bessel/Butterworth low-pass filter 3^{rd} order
34	Bessel/Butterworth low-pass filter 4^{th} order
N2	**Band-stop filter activation**
31	Band-stop filter used
30	Band-stop filter unused

3.3.2.2 Low-pass filter coefficients:

setting	read command	write command	N	data storage*
1/A coefficient	23_H	22_H	8	N
B coefficient	25_H	24_H	8	N
C coefficient	27_H	26_H	8	N
D coefficient	29_H	28_H	8	N
E coefficient	$2B_H$	$2A_H$	8	N

Format: ASCII hexadecimal; the low-pass filter coefficients are expressed as single precision float variables (32 bits). Their value is divided into successive quartets.

3.3.3 Band-stop filter :

The filter recurrence relation of the band-stop filter is as follows:

$$\text{Ordre 2 : } S_n = X(e_n + e_{n-2}) + Y(e_{n-1} - S_{n-1}) - ZS_{n-2}$$

Coefficients (X,Y,Z) are linked to A/D converter conversion rate and to band width frequency to attenuate. The determination of these coefficients can be easily achieved using ***eNodView*** simulation tools.

3.3.3.1 Band-stop filter activation :

read command(3)	write command(3)	N	data storage*
21_H	56_H	1 (Write 2(Read)	N

(3) Note : - Read command gives low-pass filter activation or order and band-stop filter activation, see ***table 2*** § 3.3.2.1.
- 56_H Write command allows changing activation of band-stop filter, use N2 in ***table 2*** § 3.3.2.1..
- For low-pass filter activation or order use 20_H command and N1 in ***table 2*** § 3.3.2.1.

3.3.3.2 Band-stop filter coefficients :

setting	read command	write command	N	data storage*
X coefficient	50_H	51_H	8	N
Y coefficient	52_H	53_H	8	N
Z coefficient	56_H	55_H	8	N

Format: ASCII hexadecimal; the low-pass filter coefficients are expressed as single precision float variables (32 bits). Their value is divided into successive quartets.
Description: The determination of these coefficients can be easily achieved using ***eNodView*** simulation tools.

3.3.4 Self-adaptive filter

This type of filter can be set in cascade after the previous filters. It is particularly useful for static measurements, avoid using it in dynamic or dosing process. The aim of this filter is to eliminate erratic measurements and to average consistent measurements

3.3.4.1 Self-adaptive filter activation:

read command(4)	write command(4)	N	data storage*
$B7_H$	94_H	1 (write) 2 (read)	N

(4) Note : - Read command gives self-adaptive filter activation and stability criterion see ***table 3***
- 94_H write command allows activation of self –adaptive filter, use N1 in ***table 3***
- For stability criterion use $2E_H$ command and N2 in ***table 3***.

Table 3

N1	Self-adaptive filter activation	
30	self-adaptive filter unused	self-adaptive filter activation
31	self-adaptive filter used	
N2	**Stability criterion**	
30	no motion detection	Signal considered as always stable
31	0.25 d	stability criterion
32	0.5d	
33	1d	
34	2d	

3.3.5 Stability criterion:

read command[5]	*write command*[5]	*N*	*data storage**
$B7_H$	$2E_H$	***2 (read)*** ***1 (write)***	***Y***

[5] Note : - Read command gives self-adaptive filter activation and stability criterion see ***table 3*** § 3.3.4.1.
- $2E_H$ write command allows choosing of stability criterion, use N2 in ***table 3*** § 3.3.4.1.
- For self-adaptive filter activation use 94_H command and N1 in ***table 3*** § 3.3.4.1.

Format: ASCII
Description: motion is indicated by bit b4 of the status bytes.
Stability interval coding see § 3.3.4.1 ***table 3*** § 3.3.4.1.
d is the scale interval value.
Current measurement is stable if X consecutive measurements following the reference measurement are included in the stability interval else it becomes the new reference. X depends on the A/D conversion rate, see ***table 4***

Table 4

A/D conversion rate (meas/s)		X
50 Hz rejection	60 Hz rejection	
6,25	7,5	1
12,5	15	2
25	30	3
50	60	5
100	120	9
200	240	17
400	480	33
800	960	65
1600	1920	129

3.4 Logical inputs / Outputs assignment :

3.4.1 Logical inputs assignment :

read command	*write command*	*N*	*data storage**
$A6_H$	83_H	***4***	***N***

N1 and N2 or N3 and N4		Assignement	Notes
N1 or N3			
30		gross	transmission of gross measurements
32		net	transmission of net measurements
34		A/D converter points	transmission of A//D converter points
N2 or N4			
negative logic	positive logic		
30	38	none	logical inputs have no effect
31	39	tare	
32	3A	zero	limited to a ±10% range of the maximum capacity or ±2% in legal for trade functioning
33	3B	transmit measurement	transmits the measurement defined by N2/N4 on a rising or a falling edge (depending on the logic)
34	3C	measurement window	transmits the measurements defined by N2/N4 at the sampling period while the input is maintained
35	3D	cancel tare	cancels current tare

3.4.2 Debounce time:

read command	*write command*	*N*	*data storage**
$C7_H$	$A4_H$	***1 to 5***	***N***

Format: ASCII (non significant zeros not necessary) ; duration expressed in ms, comprised between 0 and 65535 ms.
Description: debounce time corresponds to the minimum required stabilization time of the logical inputs before their activation. If the input state varies within this interval, it is ignored.

3.4.3 Logical outputs assignment :

setting	*read command*	*write command*	*N*	*data storage**
outputs 1&2	$A7_H$	84_H	***2***	***N***

Format: ASCII; byte N1 corresponds to output 1 and byte N2 corresponds to output 2.
Description:

N1 or N2		Assignement	Notes
negative logic	positive logic		
30	38	set point	set point 1 assigned to output 1 set point 2 assigned to output 2
31	39	motion	
34	3C	defective measurement	see status
35	3D	input image	Copy the image of the corresponding input
36	3E	level on request	Output driver on request

3.4.4 Outputs activation duration :

setting	read command	write command	N	data storage*
outputs 1	$3B_H$	$3C_H$	**1 to 5**	**N**
outputs 1	$3D_H$	$3E_H$	**1 to 5**	

Format: ASCII (unsigned, non significant zeros not necessary) ; duration expressed in ms, comprised between 0 and 65535 ms.
Description: Output 1 or 2 activation duration is only taken into account if the corresponding output is assigned to the function 'Level on request'. When an 'output activation' command is received, the output remains activated until:

- The reception of an 'output inhibition' command if the output activation duration is equal to 0.
- The specified activation duration has elapsed.

3.4.5 Set points levels :

setting	read command	write command	N	data storage*
set point 2 high level	BD_H	$9A_H$	**1 to 8**	**N**
set point 2 low level	BE_H	$9B_H$	**1 to 8**	**N**
set point 1 high level	BF_H	$9C_H$	**1 to 8**	**N**
set point 1 low level	$C0_H$	$9D_H$	**1 to 8**	**N**

Format: ASCII (non significant zeros not necessary) ; admitted values between 0 and $\pm 1000000_d$.
Description: these settings give the high and low limits for each set point. The set points are also described by their functioning mode (hysteresis or window).

3.4.6 Set points functioning:

read command	write command	N	data storage*
$C1_H$	$9E_H$	**2**	**N**

Format: byte N1 corresponds to set point 1 (output 1), N2 to set point 2 (output 2),

N1 or N2		Function
set point in window mode	set point in hysteresis mode	
30	31	compared to gross measurement
32	33	compared to net measurement

3.5 Legal for trade settings :

3.5.1 Legal for trade switch:

read command	write command	N	data storage*
$B5_H$	92_H	**1**	**Y**

Format: the activation or deactivation of the conditions of using ***eNod3-T*** to comply with OIML R76 can be done by sending:

- ⇨ 30 : legal for trade options disabled
- ⇨ 31 : legal for trade options enabled

Description: switching this option ON have the following consequences:

- The legal for trade counter is incremented every time storage in EEPROM is requested if a metrological setting has been modified.
- A new legal for trade CRC-16 value is calculated every time a storage in EEPROM is requested if a metrological setting has been modified

- Reading a measurement during 15 seconds after power-up or a software reset is impossible (display ????????)
- Taring is now impossible if gross measurement is negative
- Zero acquisition range is reduced from 10% of the capacity to 2%.
- Reading the net value during tare acquisition or the gross value during zero acquisition is impossible (display ????????) .
- The A/D converter is set into *unipolar* mode and can not be modified anymore. An attempt to change its value is refused and an error frame is transmitted.
- The motion criterion is forced to *0.25d* and can not be modified anymore. An attempt to change its value is refused and an error frame is transmitted.

3.5.2 Legal for trade counter:

read command	*write command*	*N*	*data storage**
DC_H	*/*	***5***	*/*

*Format: A*SCII.
Description: If the *'legal for trade'* option is switched ON, this counter is incremented every time a storage in EEPROM is requested if one of these metrological settings has been modified:

- scale coefficients (directly written or after a calibration)
- global span adjusting coefficient
- non-linearity correction coefficients
- scale interval
- sensor capacity
- maximum capacity
- zero calibration in A/D converter points (directly written or after a zero adjustment)
- legal for trade switch
- initial zero setting and zero tracking
- stability criterion

3.5.3 Legal for trade CRC-16:

read command	*write command*	*N*	*data storage**
DD_H	*/*	***5***	*/*

Format: ASCII.
Description: If the *'legal for trade'* option is switched ON, a CRC-16 is calculated and stored from the memory contents every time a storage in EEPROM is requested if one of the settings listed in §2.3.16 has been modified.

3.5.4 Initial zero setting/zero tracking:

read command	*write command*	*N*	*data storage**
$B6_H$	93_H	***1***	***Y***

Format/description:

N1	Function	Notes
30	zero tracking disabled initial zero setting disabled	
31	zero tracking enabled initial zero setting disabled	the zero acquisition is limited to a ±10% range of the maximum capacity
32	zero tracking disabled initial zero setting enabled	
33	zero tracking enabled initial zero setting enabled	

3.5.5 Metrological program version

read command	write command	N	data storage*
61_H	/	5	/

Format: ASCII (non significant zeros not necessary) ; admitted values between 0 and 65535_d.
Description: This number identifies the version of the part of the software that is dedicated to the metrology and the measurement exploitation

3.6 Other parameters :

3.6.1 Firmware version:

read command	write command	N	data storage*
$B8_H$	/	5	/

Format: ASCII; read-only parameter.
Description: identification of ***eNod1-T or eNod3-T*** firmware version.

3.6.2 Text area:

read command	write command	N	data storage*
BC_H	99_H	16	N

Format: a 16-bytes free memory area for ASCII codes storage.
Description: this is a user memory space that can be used to store some information like the last calibration date

3.7 Measurements:

3.7.1 Sampling period:

read command	write command	N	data storage*
$C6_H$	$A3_H$	1 to 5	N

Format: ASCII (unsigned, non significant zeros not necessary) ; duration expressed in ms, comprised between 0 and 65535 ms.
Description: the *'sampling period'* setting defines the measurements transmission period when continuous transmission is active (*'measurement window'* or after a *'start continuous transmission'* command).
If this setting is set to 0, **measurements transmissions are synchronized on the A/D conversion period** (for example at a 400 meas/s conversion rate, a measurement is transmitted every 2.5 ms).

3.7.2 Gross:

read command	write command	N	data storage*
$2F_H$	/	8 or 3	/

Format: the current gross measurement is coded on:
- 8 ASCII bytes in ***SCMBus standard format.***
- 3 hexadecimal bytes in ***SCMBus fast format.***.

If the *'legal for trade'* option is switched ON, during the **10 seconds** that follow the power-up, this variable is set to **????????** as for a zero request.

3.7.3 Tare:

read command	write command	N	data storage*
30_H	/	8 or 3	/

Format: the last tare value is coded on:
- 8 ASCII bytes in ***SCMBus standard format.***

3 hexadecimal bytes in ***SCMBus fast format.***

3.7.4 Net:

read command	*write command*	*N*	*data storage**
31_H	**/**	**8 or 3**	**/**

Format: the current net measurement is coded on:

- 8 ASCII bytes in ***SCMBus standard format.***
- 3 hexadecimal bytes in ***SCMBus fast format.***.

If the *'legal for trade'* option is switched ON, during the **10 seconds** that follow the power-up, this variable is set to **????????** as for a tare or a zero request.

3.7.5 A/D converter points:

read command	*write command*	*N*	*data storage**
32_H	**/**	**8 or 3**	**/**

Format: the measurement in A/D converter points is coded on:

- 8 ASCII bytes in ***SCMBus standard format.***
- 3 hexadecimal bytes in ***SCMBus fast format.***