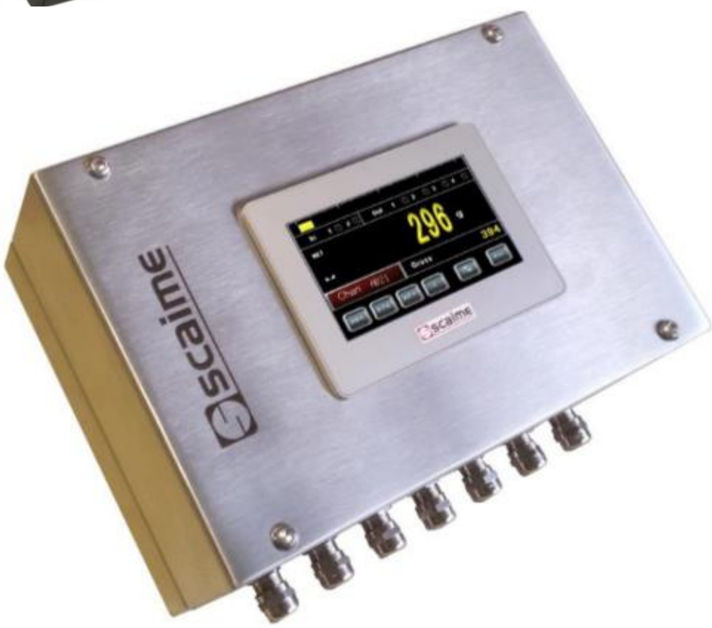
Software User Manual

eNod4-F

Digital Process Transmitter



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1 ENOD4 PRODUCT RANGE

1.1 General presentation

eNod4 is a high speed digital process transmitter with programmable functions and powerful signal processing capabilities. ***eNod4*** offers operating modes for advanced process control both static and dynamic.

Quick and accurate:

- Analog to digital conversion rate up to 1920 meas/s with maximum scaled resolution of ±500 000 points.
- Digital filtering and measurement scaling.
- Measurement transmission up to 1 000 meas/s.

Easy to integrate into automated system:

- **USB**, **RS485** and **CAN** communication interfaces supporting ***ModBus RTU***, ***CANopen®*** and ***PROFIBUS-DPV1*** (depending on version) communication protocols.
- Digital Inputs/Outputs for process control.
- Setting of node number by rotary switches and communication baud rate by dip switches.
- Integrated selectable network termination resistors.
- Wiring by plug-in terminal blocs.

1.2 Versions

1.2.1 Communication protocol versions

- Strain gauges load-cell conditioner with ***CANopen®*** and ***ModBus RTU*** communication.
- Strain gauges load-cell conditioner with ***Profibus DP-V1*** and ***ModBus RTU*** communication.
- Strain gauges load-cell conditioner with ***Modbus TCP*** and ***ModBus RTU*** communication.
- Strain gauges load-cell conditioner with ***EtherNet/IP*** and ***ModBus RTU*** communication.
- Strain gauges load-cell conditioner with ***Profinet IO*** and ***ModBus RTU*** communication.
- Strain gauges load-cell conditioner with ***EtherCAT*** and ***ModBus RTU*** communication.

EDS, GSD, ESI and GSDML configuration files for above protocols can be downloaded from our web site: http://www.scaime.com

1.2.2 IO+ version

In conjunction with all communication protocol versions, ***eNod4*** can supports an opto-insulated board fitted with:

- 2 additional digital inputs and 1 speed sensor dedicated input.
- 0-5V or 0-10V analog output voltage.
- 4-20mA, 0-24mA, 0-20mA or 4-20mA with alarm at 3.6mA analog output current.

1.3 eNodView Software

So as to configure ***eNod4***, SCAIME provides eNodView software tool. ***eNodView*** is the software dedicated to eNod devices and digital load cell configuration from a PC. This simple graphical interface allows accessing the whole functionalities of ***eNod4*** for a complete setting according to the application.

eNodView features and functions:

- eNod4 control from a PC
- Calibration system
- Modification/record of all parameters
- Measure acquisition with graphical display
- Numerical filters simulation
- Frequential analysis FFT
- Process control
- Network parameter

eNodView software is available in English and French version and can be downloaded from our web site: http://www.scaime.com or ordered to our sales department on a CD-ROM support.

2 COMMUNICATION AND FUNCTIONING MODES

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Functioning mode / Serial protocol AUX/USB	*0x003E*	*0x2000/0x00*	*R : 0x02E8 W: 0x02E9*	*0x07 / 0x39*	*Uint*	*RW*
Nom IHM	*0x0034*	*0x3701/0x00*	*/*	*0x0B / 0x00*	*String*	*RW*

2.1 Communication protocols Modbus RTU and SCMBus

Modbus RTU, SCMBus, and fast SCMBus communication protocols are accessible through AUX, USB. Modbus RTU or Profibus only depending on version on DB9 connection.
The protocol can be changed via the « Functioning mode/ serial protocol » register (see below).

bits b9b8	Protocol
00	*SCMBus*
01	*Modbus RTU*
11	*Fast SCMBus*

Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).

2.2 Functioning mode

The « Functioning mode/ serial protocol » register offers the possibility to change the eNod4 application according to the following list:

bits b_1b_0	Functioning mode				
	eNod4-T	*eNod4-C*	*eNod4-D*	*eNod4-F*	*eNod4-B*
00	*Transmitter*	*Transmitter*	*Transmitter*	*Transmitter*	*Transmitter*
01	*/*	*Checkweigher transmitter on request*	*Dosing by filling*	*Dosing*	*Belt scale*
10	*/*	*/*	*Dosing by unfilling*	*/*	*Belt weigh feeder*

Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).

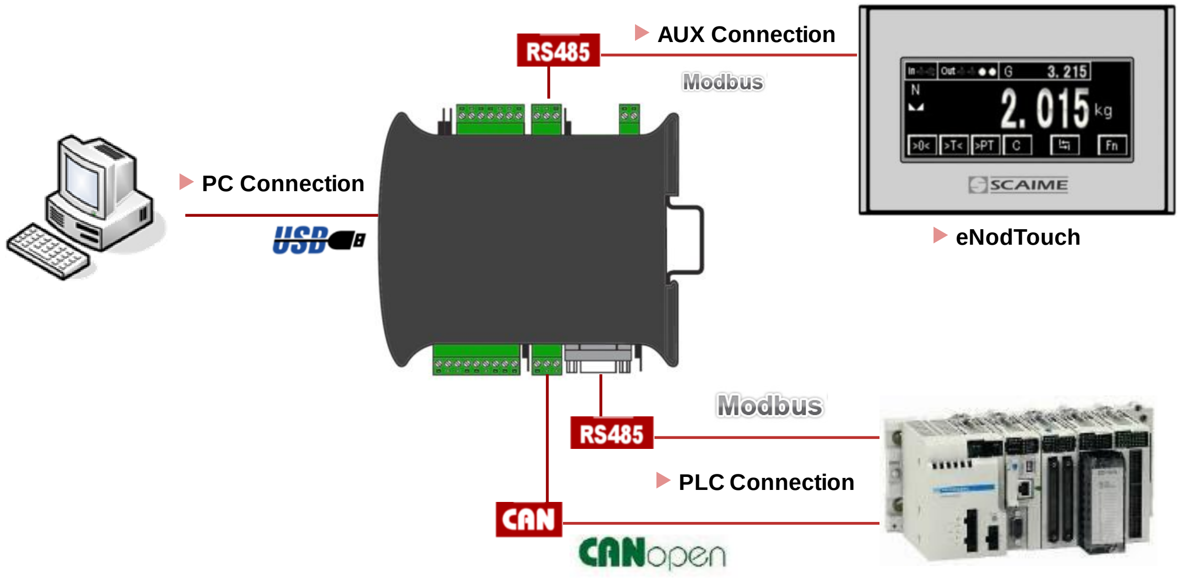
2.3 HMI name

The “HMI name” is a string of 4 characters freely usable to identify the node on any HMI connected to eNod.

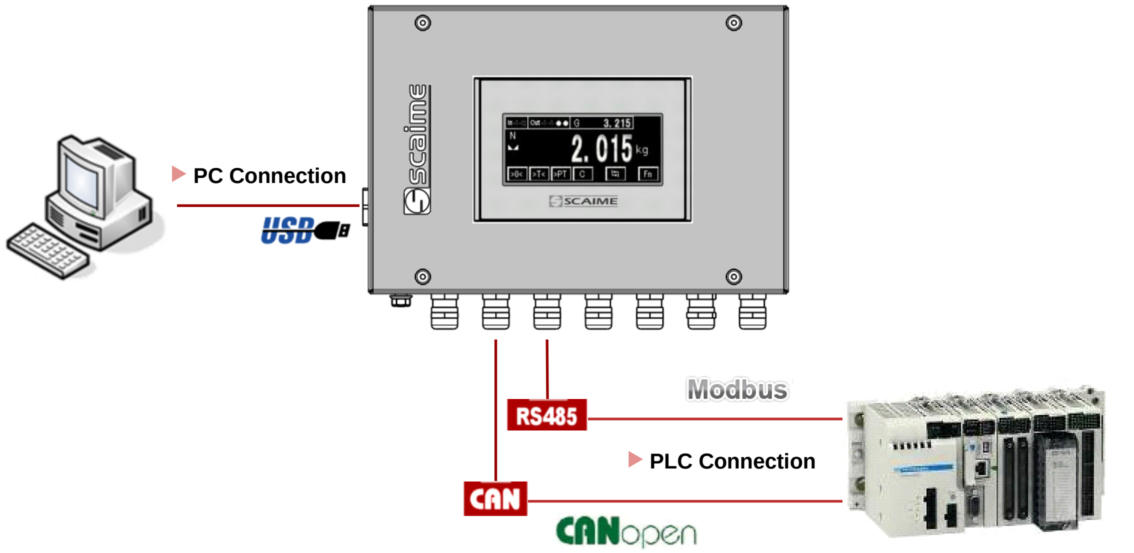
2.4 Simultaneous functioning of communications

2.4.1 Standard version

- **DIN Version**



- **BOX Version**

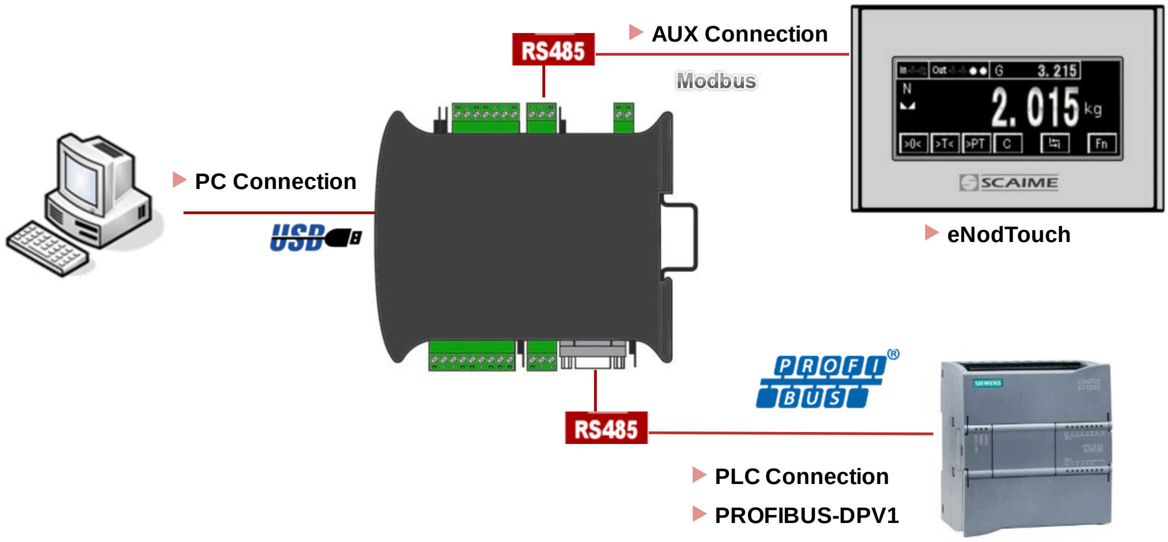


Simultaneous Communication	*RS485 PLC*	*RS485 AUX*	*CAN*
USB	*Yes**	*No*	*Yes**
RS485 PLC		*Yes*	*No*
RS485 AUX			*Yes**

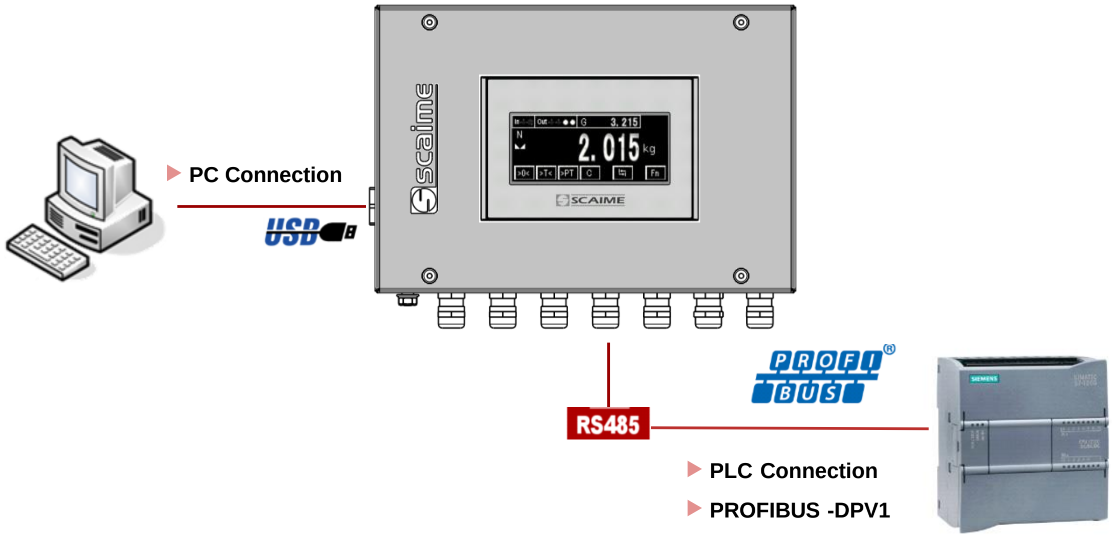
(*)Simultaneous use of CAN or RS485 PLC communication with USB or RS485 AUX can reduce performance of this interface.

2.4.2 Profibus version

- **DIN Version**



- **BOX Version**

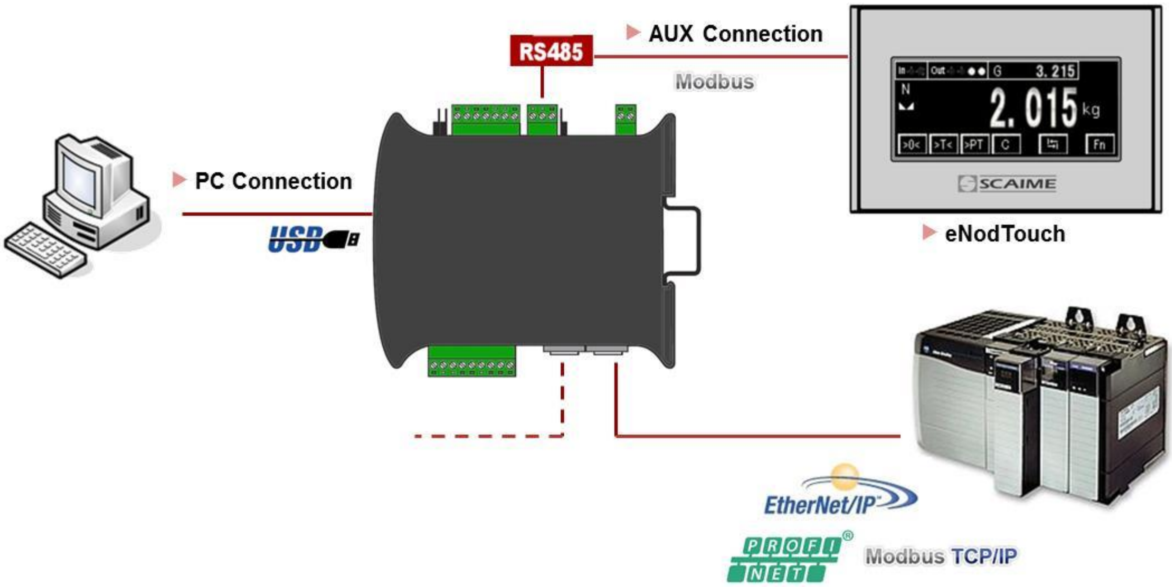


Simultaneous Communication	*Profibus*	*RS485 AUX*
USB	*Yes**	*No*
Profibus		*Yes**

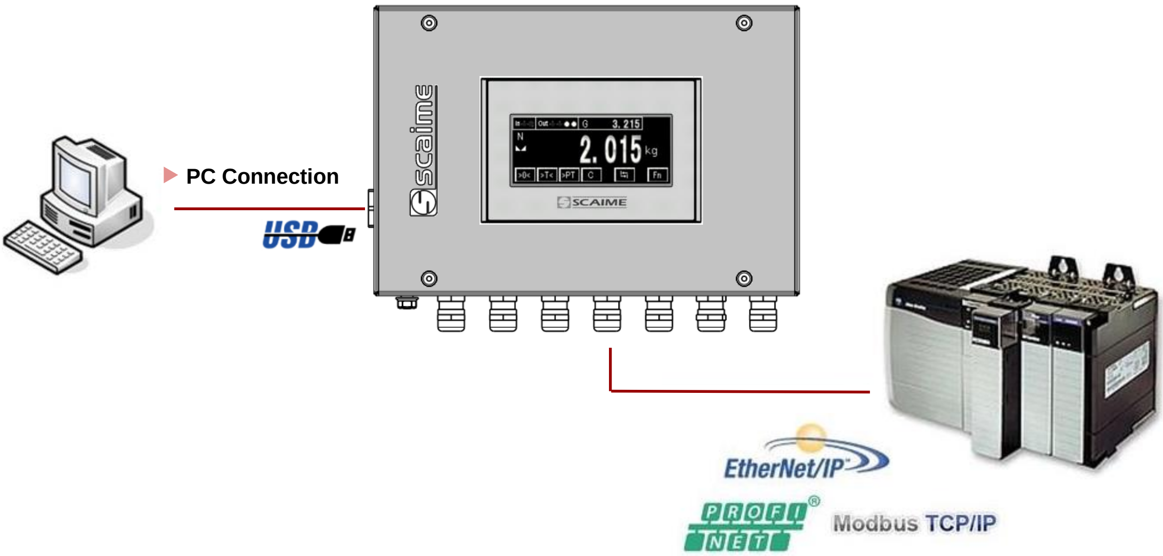
(*)Simultaneous use of Profibus with USB or RS485AUX can reduce performance of this interface.

2.4.3 Ethernet versions

- **DIN Version**



- **BOX Version**



Simultaneous Communication	*Ethernet*	*RS485 AUX*
USB	*Yes**	*No*
Ethernet		*Yes**

(*)Simultaneous use of Ethernet with USB or RS485 AUX can reduce performance of this interface.

3 MODBUS RTU

3.1 Physical interfaces

Modbus RTU communication protocol can be used either through ***eNod4*** USB port, AUX port. Modbus RTU or Profibus only depending on version on DB9 connection.
USB port behaves as a full duplex interface whereas the DB9 and AUX ports support half-duplex RS485 communication. Supported baud rates are 9600, 19200, 38400, 57600, and 115200.
For a complete description of the recommendations about ***eNod4*** RS485 connection, please refer to the user manual "characteristics and functioning" of the ***eNod4***.
Note: using ***eNod4*** through USB requires installing first the necessary USB drivers available on the website http://www.scaime.com.

3.2 Byte format

Data transmitted to ***eNod4*** thanks to Modbus RTU communication protocol must respect following format:

- 1 start bit
- 8 data bits
- no parity
- 2 stop bits

Every Modbus RTU frame is ended by a CRC-16 2-bytes code whose polynomial generator is

$$G(x) = x^{16} + x^{15} + x^2 + 1$$

(cf. CRC-16 calculation algorithm).

3.3 Modbus RTU supported functions

As a Modbus RTU slave, ***eNod4*** supports following Modbus RTU functions:

Function	*Code*
read N registers*	*03_H / 04_H*
write 1 register*	*06_H*
write N registers*	*10_H*

** 1 register = 2 bytes, maximum admitted value for N is 30.*
Note: Broadcast addressing is not allowed by ***eNod4***.

3.4 Frames structure

During a read or write transaction, the two bytes of a register are transmitted MSB first then LSB.
If a data is coded on **4 bytes** (that means it requires two registers), **the two LSB are stored in the low address register and the two MSB are stored in the high address register.**

3.4.1 Function (03H/04H) – read N input registers (N = 30 max)

- request command sent to the slave :

slave address	*03_H or 04_H*	*starting register offset*	*N registers*	*CRC16*
1 byte	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

- slave response :

slave address	*03_H or 04_H*	*NB **	*data 1*	*...*	*CRC16*
1 byte	*1 byte*	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

* NB: number of read bytes (= N*2)

3.4.2 Function (06H) – write single register

- request command sent to the slave :

slave address	*06_H*	*register offset*	*data*	*CRC16*
1 byte	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

- slave response :

slave address	*06_H*	*register offset*	*data*	*CRC16*
1 byte	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

3.4.3 Function (10H) – preset multiple registers (N = 30 max)

- request command sent to the slave :

slave address	*10_H*	*starting register offset*	*N registers*	*NB*	*Data 1*	*…*	*CRC16*
1 byte	*1 byte*	*2 bytes*	*2 bytes*	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

- slave response :

slave address	*10_H*	*starting register offset*	*N registers*	*CRC16*
1 byte	*1 byte*	*2 bytes*	*2 bytes*	*2 bytes*

3.4.4 Error frames

- frame format in case of a transaction error :

slave address	*Function code + 80_H*	*error code*	*CRC16*
1 byte	*1 byte*	*1 byte*	*2 bytes*

- Error codes meaning :

Error code	*Meaning*	*description*
01_H	*illegal function*	*Modbus-RTU function not supported by eNod4*
02_H	*illegal data address*	*register address requested out of eNod4 register table*
03_H	*illegal data value*	*forbidden data values for the requested register*
04_H	*eNod4 not ready*	*eNod4 is not ready to answer (for example measurement request during a taring operation)*

3.5 Address and Baud rate

Address Modbus RTU	*Meaning*	*Access*	*Type*
0x0001	*Address and Baud rate*	*RO*	*Uint*

Reads the address and baud rate selected on the front panel via the rotary switches and dipswitches.

3.6 Product identification

Software and product versions of the ***eNod4*** are accessible via Modbus RTU.

Address Modbus RTU	*Meaning*	*Access*	*Type*
0x0000	*SW and product version*	*RO*	*Uint*

The 12 LSB bits define the software version (073_H = 115) and the 4 MSB bits define the product version (6_H for the ***eNod4***).

3.7 Measurement transmission

As a master/slave protocol, measurement transmission in Modbus protocol is only done on master request.

3.8 EEPROM error management

Functioning and calibration parameters are stored in EEPROM. After every reset the entireness of parameters stored in EEPROM is checked. If a default appears, measurements are set to 0xFFFF and default is pointed out in measurement status.

4 SCMBUS / FAST SCMBUS

4.1 Physical interfaces

SCMBus and fast SCMBus communication protocols can be used either through ***eNod4*** USB port and AUX port. USB port behaves as a full duplex interface whereas the DB9 and AUX ports support half-duplex RS485 communication. Supported baud rates are 9600, 19200, 38400, 57600, and 115200.
For a complete description of the recommendations about ***eNod4*** RS485 connexion, please refer to the user manual "characteristics and functioning" of the ***eNod4***.
Note : using ***eNod4*** through USB requires installing first the necessary USB drivers available on the website http://www.scaime.com.

4.2 SCMBus and fast SCMBus features

SCMBus and its variant fast SCMBus can be imbricate into ModBus RTU protocol if the setting *'communication protocol'* is set to SCMBus or fast SCMBus. That means that ***eNod4*** continues answering Modbus RTU frames but it also allows the device to send frames coded according to SCMBus/fast SCMBus format.
Each protocol has its advantages:

- in SCMBus measurements are transmitted as ASCII with the decimal point and the unit integrated to the frame
- fast SCMBus is dedicated to fast measurement transmission as the frames are the most compact as possible
- both protocols allow to communicate without any master request (continuous transmission or sampling triggered by a logical input)

4.3 Byte format

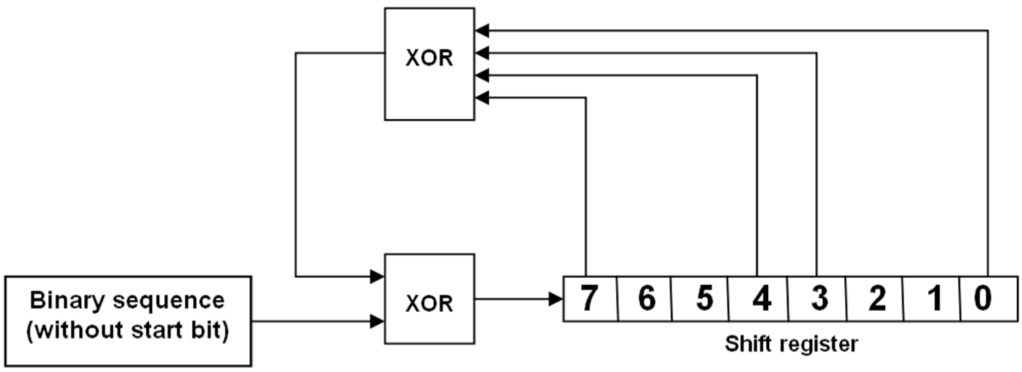
Data transmitted to ***eNod4*** thanks to SCMBus or fast SCMBus communication protocol must respect following format:

- 1 start bit
- 8 data bits
- no parity
- 2 stop bits

in SCMBus protocol, data is encoded as ASCII numeral characters (30_H ..... 39_H) and ASCII hexadecimal characters ($3A_H$ ..... $3F_H$).
in fast SCMBus protocol, data is encoded as signed hexadecimal (see frame structure paragraph) below.
SCMBus CRC-8 byte is 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 ***eNod4*** and a received frame which is ended by such CRC-8 is considered as a frame without any error.

- Fast SCMBus checksum byte is obtained by summing all the frame previous bytes then setting b7 bit to 1.

4.4 Frames structure

4.4.1 Transmission organization

- frame : ***eNod4*** address first
- byte : lsb first

- multi-bytes data : MSB first

4.4.2 Reading request

- request

Address	Command	CR	CRC
*1 **Hex** byte*	*1 **Hex** byte (command)*	*1 **ASCII** byte (0D$_H$)*	*1 **Hex** byte*

- SCMBus response

Address	Status	Value	CR	CRC
*1 **Hex** byte*	*2 **Hex** bytes*	*N **ASCII** Hex bytes*	*1 **ASCII** byte (0D$_H$)*	*1 **Hex** byte*

If the *'decimal point position'* and the *'unit'* settings are assigned to a non-null value, the response frame when transmitting measurement contains the decimal point character (2E$_H$) and the unit that is separated from the measurement value by a space ASCII character (20$_H$).

- Fast SCMBus response

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

Note: Because values are encoded in signed hexadecimal bytes format (2's complement) some data bytes can be equal to **STX (02$_H$) or ETX (03$_H$) or DLE (10$_H$)** so before those specific bytes values a **DLE (10$_H$)** byte is inserted. The ***eNod4*** address is not transmitted in the frame.

4.4.3 Functional command request (tare, zero...)

- request :

Address	Command	CR	CRC
*1 **Hex** byte*	*1 **Hex** byte (command)*	*1 **ASCII** byte (0D$_H$)*	*1 **Hex** byte*

- response (SCMBus and fast SCMBus) :

Address	Command	CR	CRC
*1 **Hex** byte*	*1 **Hex** byte (command)*	*1 **ASCII** byte (0D$_H$)*	*1 **Hex** byte*

If the command execution is successful, ***eNod4*** sends back the request frame that has been received as an acknowledgement.

4.4.4 Error frame

In case of an error upon reception of a request, ***eNod4*** sends back an error frame that contains an error code:

- response (SCMBus and fast SCMBus) :

Address	Error code	CR	CRC
*1 **Hex** byte*	*1 **Hex** byte (command)*	*1 **ASCII** byte (0D$_H$)*	*1 **Hex** byte*

- The error codes are listed below:

Error code	Meaning	Description
FE$_H$	*unknown command*	*requested command is not supported by **eNod4***
FF$_H$	*error during command execution*	*ex. : tare when gross meas.<0*

4.5 Address and Baud rate

Address and baud rate identical to Modbus RTU (See § Modbus RTU)

4.6 Product identification

Product identification identical to Modbus RTU (See § Modbus RTU)

4.7 Measurement transmission

Measurement transmission can be triggered by a master request but it might also be triggered and used through the following options:

- transmission triggered by a rising or falling edge on a logical input

- transmission at a configurable period (defined in ms) while a logical input is maintained at a given logical level
- continuous transmission at a configurable period (defined in ms) after a master request. The transmission is then stopped by another master instruction, be careful not to use this mode in half-duplex at a too high rate.

4.8 Continuous transmission

SCMBus and fast SCMBus communication protocols allow ***eNod4*** to transmit measurements at a user-defined rate without the need for successive master queries. To perform this measurement acquisition mode, it is necessary to set first the *'sampling period'* (in ms):

Address SCMBus	*Description*	*Accès*	*Type*
0x003F	*SCMBus Measurement transmission period*	*RW*	*Uint*

A value of 0 implies that measurement transmission is synchronized on the A/N conversion rate. The continuous transmission is triggered and stopped by reception of the following commands:

SCMBus/fast SCMBus functional command	*Command code*
start net measurement transmission	*$E0_H$*
start factory calibrated points transmission	*$E1_H$*
start brut measurement transmission	*$E2_H$*
stop continuous transmission	*$E3_H$*

Note 1: the measurement transmission rate also depends on the baud rate. So, to achieve the fastest transmission, it is necessary to use the highest baud rate.
Note 2: as RS485 is a half-duplex communication medium, it can be a little hard to transmit the '*stop continuous transmission'* query if the bandwidth is saturated. Therefore, prefer USB communication channel to reach the highest measurement transmission rate.

4.9 EEPROM error management

EEPROM management identical to Modbus RTU (See § Modbus RTU)

5 CANOPEN

5.1 Physical interface

eNod4 is equipped with a CAN 2.0A compatible interface supporting **CANopen® communication protocol**. The device can be connected to a CAN bus using **CANH** and **CANL** connections. A REF pin can also be connected. Supported baud rates are 50000, 125000, 250000, 500000 and 1000000.

For a complete description of the recommendations about ***eNod4*** CAN connexion, please refer to documentation *"characteristics and functioning"*.

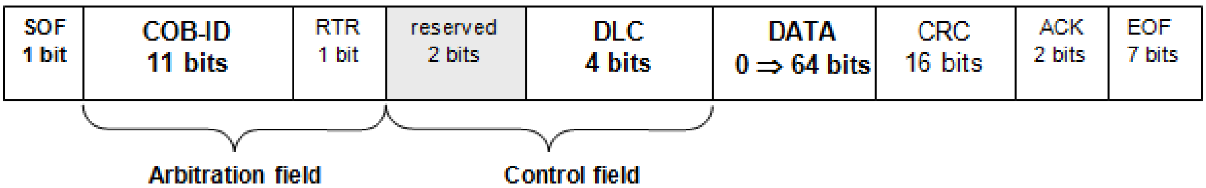
5.2 LED CANopen

The subsequent table describes the meaning of the LEDs for the CAN:

Color	*State*	*Meaning*
Red	*Single Flash*	*At least one of the error counters of the CAN controller has reached or exceed the warning level (too many error frame)*
	Double Flash	*A guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer) has occurred*
	On	*The CAN controller is bus off*
	Flash	*Self-test: while the device is performing its power up testing, the LED shall be flashing red*
Green	*Blinking*	*The device is in state PRE OPERATIONAL*
	Single Flash	*The device is in state STOPPED*
	On	*The device is in state OPERATIONAL*

5.3 Frame format

Every data frame sent on the CAN bus has the following structure:



- **Start of frame (SOF) : 1 bit**

  The beginning of a request or a data frame is indicated by the transmission of one dominant bit.

- **Arbitration field : 12 bits**

  This field contains the message COB-ID on 11 bits and the RTR bit, dominant for data frames and recessive for remote frames.

- **Control field : 6 bits**

  The first two bits are reserved and must be transmitted as dominant. The four remaining bits encode the size of the transmitted data in bytes. This is called **«Data length code» (DLC)** with **0 ≤ DLC ≤ 8**.

- read/write requests : **SDO** (Service Data Object)
- real time transfers : **PDO** (Process Data Object)
- nodes state management : **NMT** (Network Management)
- warnings : **EMCY** (Emergency)
- synchronization events : **SYNC** (Synchronization)
- node status indications : **Boot-up/Heartbeat** and **Node guarding**

- **Data : de 8 à 64 bits**

For each byte, the most significant bit (MSB) is transmitted first.

- **Cyclic Redundancy Check (CRC) : 16 bits**

The result of the CRC calculation is made up of 15 bits that guarantee the integrity of the transmitted message. The last bit is used to delimit the field and always is transmitted as dominant.

- **Acknowledgement (ACK) : 2 bits**

During two bus clock periods, the bus is available for acknowledgement of the message. All the nodes that received the message without error generate a dominant bit. Else, an error frame is generated. The second bit is always recessive.

- **End of frame (EOF) : 7 bits**

The end of the frame is represented by a sequence of 7 consecutive recessive bits.

The CANopen® layer defines particularly the content of the arbitration and the control fields and the data field structure.

5.4 Messages transfers hierarchy

CANopen® is a communication protocol especially dedicated to industrial applications. It allows connecting up to 127 different devices on a same bus giving them the possibility to access the bus at any time. Simultaneous emissions are managed by an arbitration system that uses priority levels.

This control hierarchy of data transfers guarantees that there is no frame collision on the bus while ensuring a high level of reliability in communications. The low priority messages are cancelled and reissued after a delay.

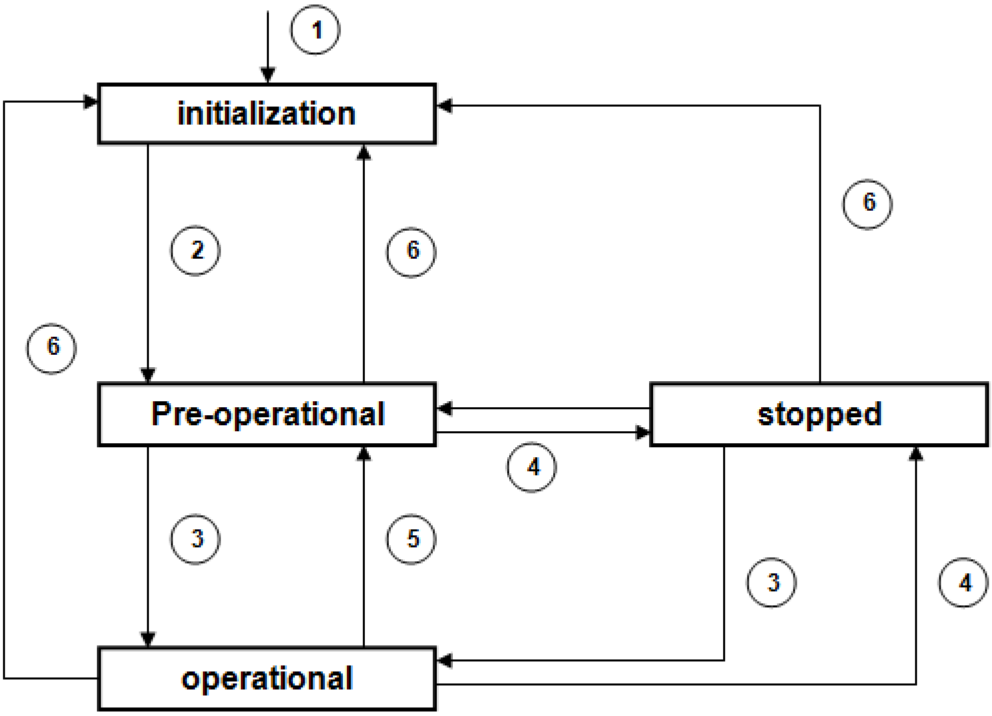
The protocol defines several message types characterized by their COB-ID (Communication Object Identifier) that determines the message priority level. The COB-ID is composed of a function code and the node identifier (between 1 and 127).
The node identifier is the device's address on the network. The function code specifies the priority and the purpose of the message. **Assignment of a particular identifier to each device connected to the bus is mandatory.**
eNod4 supports 6 different message types :

CANopen® messages	*COB-ID (hex)*
NMT	*0*
SYNC	*80*
EMCY	*81-FF*
TPDO1	*181 – 1FF*
RPDO1	*201 – 280*
RPDO2	*301 – 380*
RPDO3	*401 – 480*

RPDO4	*501 – 580*
RPDO5(IO+ version)	*681 – 6FF*
TPDO2	*281 – 2FF*
TPDO3	*381 – 3FF*
SDO (Tx)	*581 – 5FF*
SDO (Rx)	*601 – 67F*
Heartbeat/Boot-up	*701 – 77F*

5.5 eNod4 status remote management

For the CANopen® network, ***eNod4*** is considered as a **NMT slave**. It means that its state can be modified by a **NMT master** present on the bus.
As other CANopen® nodes, ***eNod4*** can be set into one of the four existing states, allowing or forbidding the reception/emission of CAN messages.
These four states constitute the following NMT state machine:



- 1 : ***eNod4*** device power-up
- 2 : automatic transition after the end of initialization
- 3 : reception of a **'Start Node'** indication
- 4 : reception of a **'Stop Node'** indication
- 5 : reception of an **'Enter pre-operational mode'** indication
- 6 : reception of a **'Reset node'** or a **'Reset communications'** indication

eNod4 communication capacities for each state are given in the following table :

	Initialization	*Pre-operational*	*Operational*	*Stopped*
SDO		***X***	***X***	
PDO			***X***	
SYNC		***X***	***X***	
Emergency		***X***	***X***	
NMT		***X***	***X***	***X***

Boot-up	***X***			
Heartbeat		***X***	***X***	***X***

5.5.1 NMT commands

Except during the initialization phase, ***eNod4*** is able to handle any NMT master's requests for changing its current state. All these network management messages are constituted the same way: **a two-byte data frame with a COB-ID equal to zero:**

COB-ID	DLC	byte 1	byte 2
0	2	NMT code	Node identifier

The 2nd byte of the data field contains the node identifier of the device concerned by the request. Its value must be between 0_H and $7F_H$. The 0_H value means that the NMT command concern all the nodes of the network.
The 1st byte codes the command sent to the node. There are five existing commands supported:

- ⇨ **« Start node »**: 01_H. ***eNod4*** is set into **operational** state
- ⇨ **« Stop node »:** 02_H. ***eNod4*** is set into **stopped** state
- ⇨ **« Reset node »**: 81_H. Resets ***eNod4*** (with the same effects as a power-up), back into **initialization** state.
- ⇨ **« Reset communication »**: 82_H. Back into **initialization** state and communication parameters reset.
- ⇨ **« Enter pre-operational mode »**: 80_H. ***eNod4*** is set into **pre-operational** state

5.5.2 Synchronization messages

SYNC messages are emitted on the bus by a producer node (generally the NMT master). This service is unconfirmed so the consumer nodes do not have to respond to SYNC messages. A SYNC message does not carry any data (DLC = 0).
eNod4 is only seen as a SYNC messages consumer whose COB-ID is stored at index 1005_H, sub-index 00_H of the object dictionary.

5.5.3 Emergency messages

eNod4 internal errors are reported via emergency frames. Two types of errors can trigger the transmission of an emergency message:

- communication errors
- A/D converter input signal range exceeded

Every emergency frame is built as follows:

COB-ID	*DLC*	*byte 0*	*byte 1*	*byte 2*	*byte 3*	*byte 4*	*byte 5*	*byte 6*	*byte 7*
*80_H + ID **eNod4***	*8*	*emergency code*		*error register content*	*additional information*				

Emergency message is an unconfirmed service. A frame is emitted when a new error occurs and when it is acknowledged. The table below describes the emergency standard codes supported by ***eNod4-T*** and the translation of the additional information bytes (in ASCII):

Emergency codes (hex.)	*Meaning*
0	*error acknowledged*
3200	*voltage error*
8120	*CAN bus communication error*
8130	*life guard error*
Additional information's (hex.)	
4B4F	*no error*
474C	*life time has elapsed or Heart Beat not received*

564F	*sensor signal outside of the input signal range*
5054	*CAN transmitter in error passive state*
5052	*CAN receiver in error passive state*

The error register value is also part of the emergency telegram so as to indicate if other internal errors have been detected.
The number of reported errors is given by an error counter in the **pre-defined error field** located at index 1003_H, sub-index 00_h and the last reported error can be read from the same entry at sub-index 01_H.

5.6 Error control services

CANopen® uses smart mechanisms to control permanently the nodes state on the bus. ***eNod4*** supports **Boot-up** and **Heartbeat** messages and **Node guarding protocol**. Using both services is not allowed. If both are configured so as to be functional, only the Heartbeat mechanism is used.

5.6.1 Heartbeat and boot-up

eNod4 state control can be achieved through the use of Heartbeat and boot-up mechanisms :

⇨ **Boot-up**: this message sent by ***eNod4*** means that its initialization phase is complete and that the node has entered into **pre-operational** state. It consists in the following frame :

COB-ID	DLC	byte 1
700_H + ID eNod4	**1**	**0**

⇨ **Heartbeat** :
- **producer mode** : if a Heartbeat period (in ms) different from 0 is set in the entry *'producer heartbeat time'* of the object dictionary, ***eNod4*** generates at this period a frame containing its state coded on one byte. The corresponding frame is similar to the **Boot-up** mechanism frame:

COB-ID	DLC	byte 1
700_H + ID eNod4	**1**	**eNod4 NMT state**

eNod4 NMT state byte can take the different following values :

⇨ 04_H : the node is in the **«stopped»** state
⇨ 05_H : the node is in the **«operational»** state
⇨ $7F_H$: the node is in the **«pre-operational»** state

Using Heartbeat protocol allows a NMT master to check that all nodes connected to the bus are working correctly.
- **Consumer mode**: ***eNod4*** also can be configured so as to monitor the NMT state of one particular node of the network (generally the NMT master). The node ID and a period are defined in the entry *'consumer heartbeat time'* of the object dictionary
If corresponding heartbeat is not received within this time, then ***eNod4*** sends an emergency telegram and switches to pre-operational state.

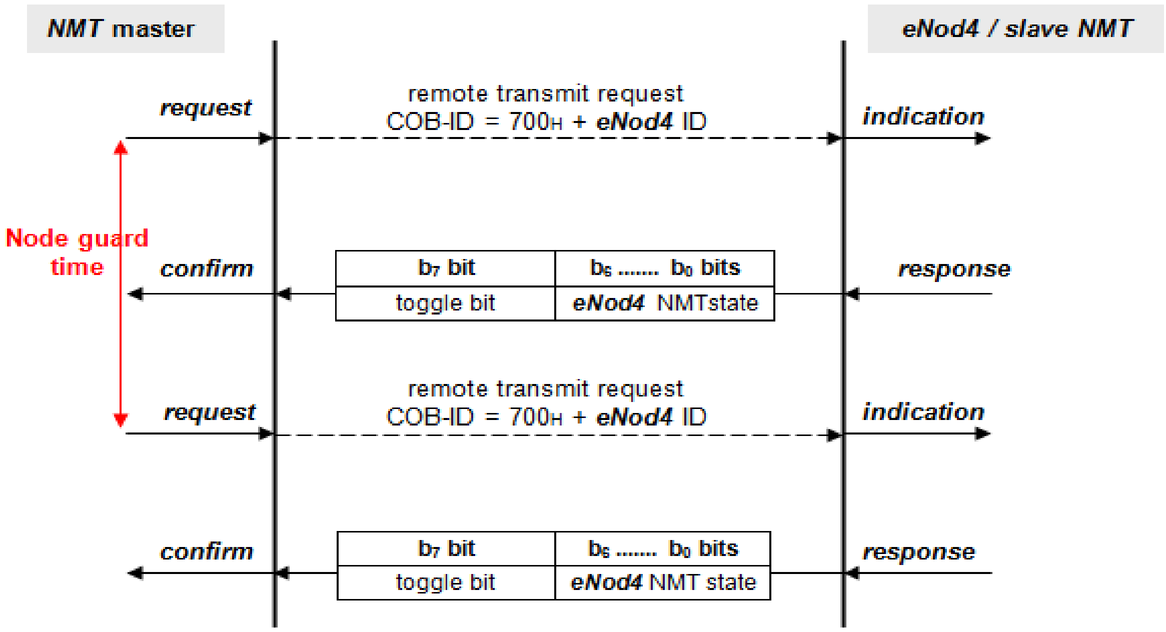
5.6.2 Node guarding

Node guarding protocol is another way to check the nodes state. But unlike Heartbeat protocol, it needs requests from a NMT master. In this case, the NMT master sends periodically a remote transmit request (remote frame) to the node with **COB-ID 700_H +** ID ***eNod4***. ***eNod4*** has to respond by sending a single-byte data frame with its coded state.
This frame is similar to Heartbeat frame but there is an important difference. Most significant bit of the state byte is a toggle-bit. The value of this bit must alternate between two consecutive responses from the NMT slave. The value of the toggle-bit of the first response after the Guarding Protocol becomes active is 0.
It is only reset to 0 when a *'reset communications'* or a *'reset node'* command is received. If two consecutive responses have the same value of the toggle-bit, then the new response should be handled as if it was not received by the NMT master.

Two parameters of the object dictionary are necessary to set and define node guarding protocol: the **'guard time'** and the **'life time factor'**:

- ⇨ **Guard time**: this parameter expressed in milliseconds indicates the period with which the node is being polled by the NMT master. This value can be different from one node to another.
- ⇨ **Life time factor**: when node guarding protocol is active, **node life time** is given by multiplication of the guard time and the life time factor.

Node guarding activation is effective when guard time has been set (and if Heartbeat protocol is not used) and after reception of the first remote transmit request. If life time factor is also configured and if no remote transmit request is handled within the node life time, ***eNod4* sends an emergency telegram then switches to pre-operational state**. The life guarding error is acknowledged when the state is changed by a NMT command and after reception of a new remote transmit request.
Switching to the stopped NMT state because of a node guarding error may cause ***eNod4*** to be set into a configurable safety mode where parts of its functioning are inhibited



5.7 Access to the object dictionary

The most important element of a CANopen® compatible device is its **object dictionary (OD)**. Each node object that can be accessed via the bus is part of a table called object dictionary. The dictionary entries can be addressed by a couple of an index (2 bytes) and a sub-index (1 byte) with the following organization:

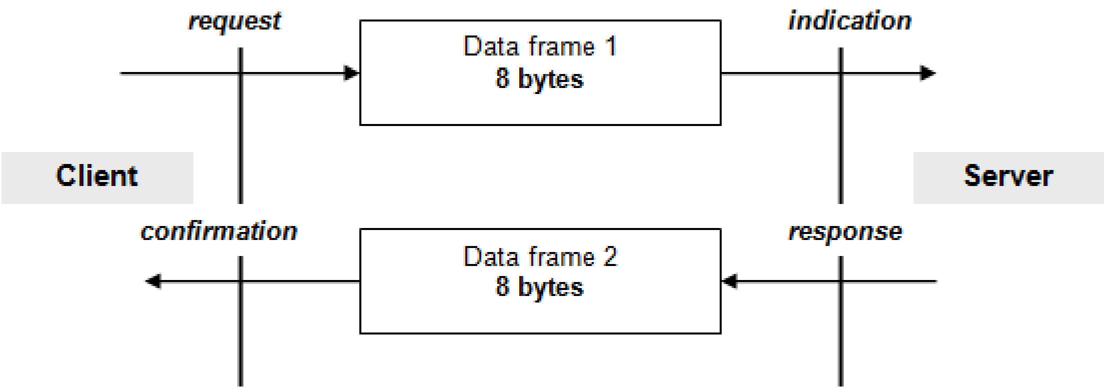
Index (hex.)	*Object type*
0000	*reserved*
0001 ⇒ 001F	*static data types*
0020 ⇒ 003F	*complex data types*
0040 ⇒ 005F	*manufacturer specific complex data bytes*
0060 ⇒ 007F	*device profile specific static data types*
0080 ⇒ 009F	*device profile specific complex data types*
00A0 ⇒ 0FFF	*reserved*
1000 ⇒ 1FFF	***communication profile area***
2000 ⇒ 5FFF	***manufacturer specific profile area***
5FFF ⇒ 9FFF	*standardized device profile area*
A000 ⇒ FFFF	*reserved*

Only the greyed elements of the table are accessible through ***eNod4*** OD.

The whole object dictionary is accessible and can be configured from usual CANopen® configuration tools. This can be done using ***eNod4* available EDS file.**

5.7.1 SDO communication

The model for SDO communication is a client/server model as described below:



The node that sends the request is the client application whereas ***eNod4*** only behaves as the server application. There are two types of requests, write and read requests. Both have the same structure:

COB-ID	*DLC*	*byte 0*	*byte 1*	*byte 2*	*byte 3*	*byte 4*	*byte 5*	*byte 6*	*byte 7*
11 bits	***1 byte***	***Command byte***	***Index***		***sub-index***	***Data***			
580$_H$ or 600$_H$ + ID ***eNod4***	*8*	*see table*	*LSB*	*MSB*	*/*	*LSB*	*-*	*-*	*MSB*

The client request uses the SDO(Rx) COB-ID (600$_H$ + ID ***eNod4*** and the server uses the SDO(Tx) COB-ID (580$_H$ + ID ***eNod4***).

The **command byte** depends on the requested data length:

Client request	*Server response*
read data ⇒ 40$_H$	***43$_H$ ⇒ 4-bytes data***
	4B$_H$ ⇒ 2-bytes data
	4F$_H$ ⇒ 1-byte data
write 4-bytes data ⇒ 23$_H$	***60$_H$***
write 2-bytes data ⇒ 2B$_H$	
write 1-byte data ⇒ 2F$_H$	

For a read request, the value of the four last bytes of the frame (data) does not matter.

If an error occurs during a SDO communication ***eNod4*** responds with the command byte 80$_H$ and the four data bytes contain one of the following SDO abort codes. The data transfer is aborted.

SDO abort codes (hex.)	*Description*
5040001	*SDO command specifier not supported*
6010001	*unsupported access to an object*
6010002	*attempt to write a read-only object*
6020000	*the object does not exist in the object dictionary*
6040042	*the number and length of the objects to be mapped would exceed PDO length*
6040047	*impossible operation (for example reading a net/gross value during a tare or a zero)*

6070012	*data type does not match, length of service parameter too high*
6070013	*data type does not match, length of service parameter too low*
6090011	*Sub index object does not exist.*
6090030	*value range of parameter exceeded*
6090031	*value of parameter written too high*
6090032	*value of parameter written too low*
8000020	*data cannot be stored to the application*
8000022	*data cannot be transferred or store to the application because of the present device state*

5.7.2 PDO communications

SDO protocol is not the only way to access the object dictionary. PDO allow to transfer data without including their index and sub-index in the frame. Both are stored in an OD specific field called PDO mapping.

The model used for PDO transmissions also is different. It is a Producer/Consumer model in which data are sent by a producer node (TPDO) to a consumer node (RPDO) without any confirmation.
Each PDO is described by a combination of two parameters of the OD: the **PDO communication parameters** and the **PDO mapping**. The PDO communication parameters describe the functioning of the PDO and the PDO mapping describes its content. ***eNod4*** uses **3 TPDO** (2 are programmable) and **5 RPDO**.
The PDO transmission mode can be set in the corresponding object with the following attributes:

- ⇨ **Synchronous:** PDO transmission/reception is triggered by the reception of one or more SYNC messages. Several options are available :
    - cyclic: PDO is sent/received after reception of n ($1 \leq n \leq 240$) SYNC messages.
    - acyclic: PDO is sent at reception of the first SYNC message following a specific device event (activation of a logical input assigned to *'send TPDO'* or data variation superior to +/- delta)
    - on remote transmit request : PDO is sent after the first SYNC message following a remote transmit request frame with the PDO COB-ID.
- ⇨ **Asynchronous:** PDO transmission/reception does not depend on the SYNC messages on the CAN bus. Several options are available :
    - on remote transmit request : PDO is sent at reception of a remote transmit request frame with the PDO COB-ID.
    - activation of a logical input assigned to *'send TPDO'* or data variation superior to +/- delta)
    - on a timer event : PDO is sent periodically (with an adjustable period).

The following table recaps the trigger modes that can be chosen by entering the hexadecimal code in the PDO communication parameter:

Code (hex)	cyclic	acyclic (event)	synchronous	asynchronous	remote transmit request	Effect
00		***X***	***X***		***X***	***PDO transmission/reception after a SYNC message following one of these events :*** *- activation of a logical input assigned to 'send TPDO'* *- mapped object variation superior to +/- delta* *- Receipt of remote transmit request.*
01 – F0 (= n)	***X***		***X***		***X***	***PDO transmission after n SYNC messages*** *- Or after receipt of remote transmit request following at less one SYNC.*
F1 - FB	*reserved*					
FC			***X***		***X***	***data update at reception of a remote transmit request and PDO transmission after reception of a SYNC message***
FD				***X***	***X***	***data update and PDO transmission at reception of a remote transmit request***
FE				***X***	***X***	***PDO transmission is triggered by one of these events :*** *- activation of a logical input assigned to 'send TPDO'* *- mapped object variation superior to +/- delta* *- receipt of remote transmit request more for TPDO2 and 3, functioning is identical to code FF*
FF				***X***	***X***	***Periodic TPDO emission****. Period can be configured (min = 1 ms).* *RPDO handled upon reception* *TPDO emission after receipt of remote transmit request*

- **Note 1:** for RPDO1-2-3-4-5 and TPDO1, only the transmission types FF_H and 00_H are supported. That means data are updated either immediately upon reception (FF_H) or after next **SYNC** following the RPDO reception (00_H). For TPDO1, the FE_H transmission type means that the TPDO1 is emitted by ***eNod4*** every time it's mapped value changes. The 00_H transmission type is similar but the emission is triggered by the reception of a **SYNC** object.

- **Note 2:** RPDO1-2-3-4-5 and TPDO1 mapping are configured with default values that cannot be modified.

5.8 CANopen command and response registers

In CANopen® communication protocol, the ***'command register'*** is mapped into **RPDO1** and the ***'response register'*** is mapped into **TPDO1**. When in operational NMT state, ***eNod4*** is able to handle the **functional commands** received through **RPDO1** and the ***'response register'*** value changes are automatically transmitted through **TPDO1**.

5.9 Communication objects

Some settings are specific as defined by the CANopen® communication specification.

5.9.1 0x1001 / 0x00 : error register

- **access : RO**
- **data type : unsigned8**
- **default value : 0**
- **mappable ? : N**
- **admitted values : see table below**

Description: The device internal errors are indicated by flag bits of this byte. b_0 bit (generic error) is set to 1 if at least one error is detected.

Bit se to 1	*Meaning*
b_0	*generic error detected*
b_1	*reserved (0)*
b_2	*A/D converter input voltage error*
b_3	*reserved (0)*
b_4	*CAN bus communication error*
b_5	*reserved (0)*
b_6	*reserved (0)*
b_7	*EEPROM error*

5.9.2 0x1003 : Pre-defined error field

Sub-index	*Description*	*Access*	*Default value*	*Mappable (PDO) ?*	*Type*
0x00	*reported errors counter*	*R/W*	*0*	*N*	*unsigned8*
0x01	*last reported error*	*RO*	*0*	*N*	*unsigned32*

Description: This entry of the object dictionary stores the errors that have been reported by emergency telegrams. The reported errors counter (sub-index 00_H) is accessible through write or read request but 0 is the only allowed value for writing transactions. By writing a zero to this sub-index, the error counter is reset and the last reported error (sub index 01_H) is erased. An attempt to write another value is ignored and ***eNod4*** answers the SDO abort code 0x06090030.

5.9.3 0x1005 / 0x00 : synchronization messages COB-ID

- **access : R/W**
- **data type : unsigned32**
- **default value : 0x80**
- **mappable ? : N**
- **admitted values : 0x80 or from 0x7E0 up to to 0x7E3**

Description: This object contains the message COB-ID value supported by ***eNod4*** as synchronization messages (used for PDO activating).

5.9.4 0x100C / 0x00 : guard time

- **access : R/W**
- **data type : unsigned16**
- **default value : 0**
- **mappable ? : N**
- **admitted values : from 0 up to 65535**

Description: The *'life guard'* is one of the two parameters used by the node guarding protocol (errors detection). When *'Heartbeat time'* is inactive and *'life guard'* is different from 0, ***eNod4*** responds to NMT master periodic (period equal to life guard) remote transmit requests.

5.9.5 0x100D / 0x00 : life time factor

- **access : R/W**
- **data type : unsigned8**
- **default value : 0**
- **mappable ? : N**
- **admitted values : from 0 up to 255**

Description: By multiplying the *'life guard'* by the *'life time factor'*, the node life time (cf. §4) can be determined. When node guarding is active, if the node has not be polled within this duration (in ms), ***eNod4*** state is set to stopped. ***eNod4*** behavior while stopped can be configured via the object at index 0x4800.

5.9.6 0x1010 : Store parameters

Sub-index	*Description*	*Access*	*Default value*	*Mappable (PDO) ?*	*Type*
0x00	*largest sub-index*	*RO*	*0x01*	*N*	*unsigned8*
0x01	*save all parameters*	*R/W*	*0x01*	*N*	*unsigned32*

In CANoppen® communication protocol, storing all settings into ***eNod4*** EEPROM memory requires writing through SDO the ASCII string « save » (65766173_H) to sub-index 0x01 of entry 0x1010 of the object dictionary (called *'save all parameters'* in the EDS file).

- **0x65 ⇒ e**
- **0x76 ⇒ v**
- **0x61 ⇒ a**
- **0x73 ⇒ s**

When accessing to sub-index 1 with a SDO read request, ***eNod4*** cell responds with a value of 1 that means that parameters are stored in non-volatile memory only on request.
Note: Restore to default settings functional command is not available in CANopen® communication protocol.

5.9.7 0x1014 / 0x00 : Emergency COB-ID

- **access : RO**
- **data type : unsigned32**
- **default value : 0x81**
- **mappable ? : N**
- **admitted values : from 0x81 up to 0xFF**

Description: The COB-ID of emergency messages transmitted by ***eNod4*** is stored at this index. Its value automatically is updated if the node identifier is modified.

5.9.8 0x1016 : Heartbeat consumer time

Sub-index	*Description*	*Access*	*Default value*	*Mappable (PDO) ?*	*Type*
0x00	*max. sub-index*	*RO*	*1*	*N*	*unsigned8*
0x01	*heartbeat consumer time*	*RW*	*0*	*N*	*unsigned32*

Description: eNod4 is able to monitor the Heartbeat generated by another node (see §4) of the network (in general the master). Two settings must be defined through the object at sub-index 0x01:

- ⇨ **the heartbeat time period**, coded on the 16 LSB bits
- ⇨ **the node ID** of the heartbeat producer to monitor, coded on the 16 MSB bits (from 0x01 up to 0x7F)

5.9.9 0x1017 / 0x00 : Heartbeat producer time

- **access : R/W**
- **data type : unsigned16**
- **default value : 0**
- **mappable ? : N**
- **admitted values : from 0 up to 65535**

Description: If a period different from 0 is written into this index, ***eNod4*** periodically generates a Heartbeat frame. It is expressed in ms and must be comprised between 1 and 65535.

5.9.10 0x4800 : Safety mode

- **access : R/W**
- **data type : unsigned8**
- **default value : 0H**
- **admitted values : see table below**

Description: This entry defines ***eNod4*** functioning when in stopped NMT state. The safety mode is used when the bit b0 of the byte is set to 1. The functioning mode is then inhibited and outputs logical level are given by b1, b2, b3 and b4 bits. The ***eNod4*** leaves the safety mode upon reception of a new NMT command.

Warning: In safety mode, when the ***eNod4*** is in stopped NMT state, functioning is also inhibited using Modbus and SCMBus communication. For example, it is not possible to tare or make a zero using RS 485 AUX port, or eNodView connected via USB.

b0	***Effect***	***Notes***
0	*safety mode disabled*	***only valid in stopped state No action possible also using Modbus or SCMBus communication***
1	*safety mode enabled*	
b1		
0	*output 1 inhibited*	*depending on the chosen logic*
1	*output 1 set active*	
b2		
0	*output 2 inhibited*	*depending on the chosen logic*
1	*output 2 set active*	
b3		
0	*output 3 inhibited*	*depending on the chosen logic*
1	*output 3 set active*	
b2		
0	*output 4 inhibited*	*depending on the chosen logic*
1	*output 4 set active*	

5.9.11 Error behavior

Sub-index	***Description***	***Access***	***Default value***	***Mappable (PDO) ?***	***Type***
0x00	*Number of error classes*	*LS*	*1*	*N*	*unsigned 8*
0x01	*communication error*	*L/ E*	*0*	*N*	*unsigned 8*

Description: If a communication error occurs in operational mode, ***eNod4*** shall enter by default autonomously the pre-operational mode.
Alternatively, by error class coding in object 0x1029 ***eNod4*** can enter in the following states:

- **0: Pre-operational**
- **1: No state change**
- **2: Stopped. refer to '*Safety mode*'**

5.10 PDO-related communication objects

5.10.1 RPDO default mapping

- *0x1600 : RPDO1 mapping parameters*

Sub-index	*Description*	*Access*	*Default value*	*Type*
0x00	*number of supported objects*	*RO*	*1*	*unsigned8*
0x01	*1st object mapping*	*RO*	*0x20030008 (command register)*	*unsigned32*

When in operational NMT state, ***eNod4*** is able to handle the **functional commands** received through **RPDO1** and the ***'response register'*** value changes are automatically transmitted through **TPDO1**.

- *0x1601 : RPDO2 mapping parameters*

Sub-index	*Description*	*Access*	*Default value*	*Type*
0x00	*number of supported objects*	*RO*	*1*	*unsigned8*
0x01	*1st object mapping*	*RO*	*0x30010120 (calibration load 1)*	*unsigned32*

- *0x1602 : RPDO3 mapping parameters*

Sub-index	*Description*	*Access*	*Default value*	*Type*
0x00	*number of supported objects*	*RO*	*2*	*unsigned8*
0x01	*1st object mapping*	*RO*	*0x25000020 (zero offset)*	*unsigned32*
0x02	*2nd object mapping*	*RO*	*T, C : 0x30050120 D, F, B : 0x30060120 (span adjusting coefficient)*	*unsigned32*

- *0x1603 : RPDO4 mapping parameters*

Sub-index	*Description*	*Access*	*Default value*	*Type*
0x00	*number of supported objects*	*RO*	*2*	*unsigned8*
0x01	*1st object mapping*	*RO*	*0x30020020 (maximum capacity)*	*unsigned32*
0x02	*2nd object mapping*	*RO*	*0x30040020 (sensitivity)*	*unsigned32*

- *0x1604 : RPDO5 mapping parameters*

Sub-index	*Description*	*Access*	*Default value*	*Type*

0x00	*number of supported objects*	*RO*	*1*	*unsigned8*
0x01	*1st object mapping*	*RO*	*0x50500010 (External value to control analog output)*	*unsigned32*

Note: RPDO5 is default deactivated. To use it you have first to activate it setting 0 to the 32nd bit of the RPDO5 COB-ID object (0x1404/0x01).

5.11 Product identification

The device identification settings are a part of the communication profile area of the object dictionary.

- ***0x1009 : Manufacturer hardware version***

Sub-index	Description	Access	Default value	Type
0x00	*manufacturer hardware version*	*RO*	*0x32302E31 (1.04)*	*visible string*

- ***0x100A : Manufacturer software version***

Sub-index	Description	Access	Default value	Type
0x00	*manufacturer software version*	*RO*	*0x30302E31 (1.00)*	*visible string*

- ***0x1018 : Identity object***

Sub-index	Description	Access	Default value	Type
0x00	*max. sub-index*	*RO*	*0x04*	*unsigned8*
0x01	*vendor ID*	*RO*	*0x00000142*	*unsigned32*
0x02	*product code*	*RO*	*0x000816E0*	*unsigned32*
0x03	*revision number*	*RO*	*0x00010000*	*unsigned32*
0x04	*serial number*	*RO*	*0x000186A1*	*unsigned32*

5.12 Measurement transmission

CANopen® includes smart transmission mechanisms that are presented in § "PDO communication". All the measurements can be exchanged either through SDO read requests or through TPDO.
TPDO trigger sources are described in a table of § "PDO communication" and all these communication modes are possible for measurement transmission. Thanks to the various TPDO transmission types, ***eNod4*** offers possibility to have a high measurement transmission rate (up to 1000 meas/s) or to limit the bus occupation by causing the exchange on an event.

5.13 EEPROM error management

Functioning and calibration parameters are stored in EEPROM NOV RAM. After every reset the entireness of parameters stored in EEPROM is checked. If a default appears, measurements are set to 0xFFFF and default is pointed out to object dictionary (see bit 6 of object 0x5003/0x00).

6 CANOPEN TPDO MAPPING

6.1 Default TPDOs Mapping

- ***0x1A00 : TPDO1 mapping***

Sub-index	Description	Access	Default value	Type
0x00	*number of supported objects*	*RO*	*0x05*	*Unsigned8*
0x01	*1st mapped object*	*RO*	*0x20040008 (response register)*	*Unsigned32*
0x02	*2nd mapped object*	*RO*	*0X50070110 (Dosing status)*	*Unsigned32*
0x03	*3rd mapped object*	*RO*	*0X51000008 (logical inputs level)*	*Unsigned32*
0x04	*4st mapped object*	*RO*	*0X52000008 (logical outputs level)*	*Unsigned32*
0x05	*5st mapped object*	*RO*	*0X50070210 (Dosing errors report)*	*Unsigned32*

In NMT operational state, ***eNod4*** is able to execute any received command through RPDO1 and consequently changes of response register are sent through TPDO1

- ***0x1A01 : TPDO2 mapping***

Sub-index	Description	Access	Default value	Type
0x00	*number of supported objects*	*R/W*	*0x02*	*Unsigned8*
0x01	*1st mapped object*	*R/W*	*0X50050120 (Instant flow rate)*	*Unsigned32*
0x02	*2nd mapped object*	*R/W*	*0X50050220 (average flowrate)*	*Unsigned32*
0x03	*3rd mapped object*	*R/W*	*0*	*Unsigned32*

- ## *0x1A02 : TPDO3 mapping*

Sub-index	Description	Access	Default value	Type
0x00	*number of supported objects*	*R/W*	*0x02*	*Unsigned8*
0x01	*1st mapped object*	*R/W*	*0x50060120 (Totalizer value (Great WU)*	*Unsigned32*
0x02	*2nd mapped object*	*R/W*	*0x50060210 (Complementary totalizer value)*	*Unsigned32*
0x03	*3rd mapped object*	*R/W*	*0*	*Unsigned32*

Note : TPDO2 and TPDO3 mapping are programmable. TPDO1 mapping is not programmable.
To set a new mapping, the procedure is as following:

- Set *eNod4-F* in '*pre-operational mode*' (default state after a reset or a power on).
- Disable current TPDO mapping setting to zero *number of supported objects* (sub-index 0x00).
- Write new mapping.
- Write in sub-index 0x00 *number of supported objects* the exact number of objects to map.
  Save in EEPROM (SAVE command in object 0x1010 sub-index 0x00).

7 PROFIBUS DPV1

7.1 Physical interface

An ***eNod4*** device compatible version can be connected to a Profibus DPV1 network thanks to the SUBD 9-pin female connector. ***eNod4*** supports baud rates between 9600 kbps and 12 Mbps with automatic detection.
For a complete description of the recommendations about ***eNod4*** Profibus DPV1 connection, please refer to "*Characteristics and functioning*" documentation.

7.2 GSD file

eNod4 capabilities for Profibus communication are described in the corresponding GSD file (that can be easily read as an ASCII text file). Here are the main information's contained in this file:

- *product and vendor identifications*
- *hardware and software versions*
- *supported baud rates*
- *description of the IN/OUT cyclic modules*
- *DPV0/DPV1 supported functions*
- *name of the associated bitmap*

7.3 Cyclic exchanges

7.3.1 Cyclic inputs modules

eNod4 GSD file defines several modules that can be integrated to the Profibus DP cyclic frames. All types of measurements processed by ***eNod4*** can be selected (net/gross/factory calibrated measurement). Moreover it is possible to add the data that contain information about the measurement or the device status.

7.3.2 Cyclic inputs/outputs modules

eNod4 cyclic outputs might be used in combination with cyclic inputs so as to request specific commands to ***eNod4*** (like tare, calibration...) or to modify the values of some settings (for example, set point values). A simple protocol described below allows writing or reading data by writing commands into ***eNod4*** cyclic outputs.

- The module "**Reg. Command/Response**" uses the eNod4 functional command mechanism defined in another chapter. The only difference concerns the "reset" and "restore default parameters" commands which cannot be sent via cyclic exchanges immediately after an eNod4 reboot. To use them with this cyclic exchange module, another command should be used before (cancel tare for example).
  The *'command/response register'* described by ***eNod4 GSD*** file is constituted by 2 IN/OUT bytes and is working almost the same way. Its functioning will be detailed later in this document.
- **The *'read/write request register'*** described by ***eNod4*** GSD file is constituted by 6 IN/OUT bytes :

IN	*OUT*
Transaction status (2 bytes)	***Transaction request (2 bytes)***
Data read/written (4 bytes)	***Data to be written (4 bytes)***

⇨ the Profibus DP master can transmit a read or write request to ***eNod4*** by writing a specific code (see the codes listed in the appendix) into the transaction request register.
⇨ for a write request, the 4 following OUT bytes can be used so as to enter the new value of the accessed setting
⇨ ***eNod4*** IN are then updated :
- Transaction status is set to 0xFFFF in case of an error otherwise it takes the same value as the one entered in the transaction request word.
- For a read transaction, the value of the requested setting is copied into the four IN following bytes.
- For a write transaction the value of the data to be written is copied into the four IN following bytes.

- For 16-bits size data, the data is read/written through the 16 last bits. Ignore the 16 upper bits.

❑ **Note**: the transaction request register **must** be set to 0x0000 before every new transaction.

7.4 Acyclic exchanges

For DPV1 class 1 and class 2 masters, another mechanism is available to write/read data into/from ***eNod4*** device. Acyclic exchanges are supported authorizing a class 1 master to send acyclic requests so as to read or write data into memory area defined by a couple of slot/index.
A class 2 master can also send the same requests after initiating a connexion (up to 2) with ***eNod4***. The communication happens without disturbing the cyclic data exchange established between the device and the class 1 master.

❑ **Note:** be careful when using acyclic read/write requests. The 4-bytes size data are transmitted as 2x16 bits blocks that need to be inverted so as to keep their consistency. For example 500 000$_d$ (0007A120$_H$) is read/written through acyclic requests as A1200007$_H$.

7.5 eNod4 Profibus DP features

7.5.1 Sync

The *Sync* command can be transmitted from a master to one or more slaves. When receiving this command, ***eNod4*** device is set into *Synchro* mode. Thus, the cyclic outputs of all the addressed slaves are maintained in their current state. The cyclic outputs state is not updated until a new *Sync* command is received. The *Synchro mode* stops upon reception of a *Unsync* command.

7.5.2 Freeze

The reception of a *Freeze* command causes ***eNod4*** cyclic inputs to be frozen. Their state is not updated until a new *Freeze* command is received. The *Frezze mode* stops upon reception of an *Unfreeze* command.

7.5.3 Fail-safe

eNod4 supports the Profibus DP *Fail-safe* mode. When the Profibus DP master asks ***eNod4*** to switch to *Fail-Safe* mode, ***eNod4*** functioning changes according to following rules:

- ⇨ ***eNod4*** Profibus DP cyclic inputs goes on being refreshed
- ⇨ ***eNod4*** Profibus DP cyclic outputs are no more received

eNod4 remains as a "read-only device" until the master goes back to a normal working mode.

7.5.4 Profibus DP standard and extended diagnoses

eNod4 diagnosis frame is composed of a standard and a specific (called extended) parts that allow to inform the Profibus DP master about the device functioning on the communication bus and about device internal errors. The Profibus diagnosis frame has the following structure:

bytes 1-4				*bytes 5-6*		*byte 7*	*bytes 8-9*
standard diagnosis						***length of extended diagnosis***	***extended diagnosis content***
status 1	*status 2*	*status 3*	*Address*	*Ident Hi*	*Ident Low*	***03***	*XX XX (see table below)*

- ⇨ **status 1 & status 2 bytes** : both bytes describe ***eNod4*** current state from the Profibus point of view. Bit b_3 of status 1 byte is set to 1 if the extended diagnosis contains one or several errors.
- ⇨ **status 3 byte** : always 00$_H$
- ⇨ **Address** : Profibus address if the DP master that parameterized ***eNod4*** device
- ⇨ **Ident. High/Ident. Low bytes** : contain ***eNod4*** ident number (0D2D$_H$)
- ⇨ **extended diagnosis content** :

bits	meaning	note
b_0		
0	/	
1	input analog signal out of the A/D conversion range (negative quadrant)	
b_1		
0	/	
1	input analog signal out of the A/D conversion range (positive quadrant)	
b_2		
0	/	see §8 for the 'maximum capacity' setting description
1	gross meas.< (- max capacity)	
b_3		
0		see §8 for the 'maximum capacity' setting description
1	gross meas. > (max capacity)	
b_4		
0	EEPROM OK	
1	Default EEPROM	
b_{15}..... b_5		
0	reserved	

7.6 Product identification

As a DPV1 compatible device, ***eNod4*** supports record 0 of Identification and Maintenance (I&M0). A Profibus master can access its content through standard DPV1 request.

7.7 Measurement transmission

In Profibus DPV1 communication protocol, measurements (except for tare value) can be included in the cyclic input frame. The modular slave structure allows the user to select the variables according to his needs. These data cannot be accessed through acyclic requests.

7.8 EEPROM error management

Functioning and calibration parameters are stored in EEPROM NOV RAM. After every reset the entireness of parameters stored in EEPROM is checked. If a default appears, measurements are set to 0xFFFF and default is pointed out into module 1 and bit b_4 of extended diagnoses register.

8 PROFIBUS MODULES LIST

Name	Input data size in byte	Provided data	Output data consumed size in byte	Consumed data	Module ID
Status+Gross Meas. (6 bytes IN)	6	Measurement status (2 bytes) Gross measurement (4 bytes)	0	NA	1
StatIO+Net+Fact (10 bytes IN)	10	Inputs – Outputs levels (2 bytes) Net measurement (4 bytes) Factory calibrated points (4 bytes)	0	NA	2
Flow rates Meas.. (12 b IN)	12	Instant flow rate (4 bytes) Average flow rate (4 bytes) Dosing quality factor (4 bytes)	0	NA	3
Output control (6 bytes IN)	6	Flow rate control output (4 bytes) Control output value (2 bytes)	0	NA	4
Totalization (10 bytes IN)	10	Totalizer value (Great WU) (4 bytes) Complementary totalizer value (2 bytes) Totalization flow rate (4 bytes)	0	NA	5
Cmd/Resp Reg (2 b IN/OUT)	2	Response register	2	Command register (see § functional commands)	6
R/W req Reg. (6 b IN/OUT)	6	Transaction status (2 bytes) Data read/written (4 bytes)	6	Transaction request (2 octets) Data to be written (4 octets)	7
Status/Errors (12 b IN)	12	Dosing status (2 bytes) Dosing errors report (2 bytes)	0	NA	8

Name	Input data size in byte	Provided data	Output data consumed size in byte	Consumed data	Module ID
		Dosing errors counter (2 bytes)			
		Last dosing error (2 bytes)			
		Dosing quality factor (4 bytes)			
Other totals (8 b IN)	*8*	*Grand total in weight unit x1000 (4 bytes)*	*0*	*NA*	*9*
		General total in weight unit x1000 (4 bytes)			
Ana. Output (2 b IN/OUT)	*2*	*External value to control analog output (2 bytes)*	*2*	*External value to control analog output (2 bytes)*	*10*

The module "Cmd/Resp Reg" uses the mechanism of ***eNod4*** functional commands defined in another chapter. The only difference is for "reset" and "Restore default settings" commands which cannot be sent via cyclic exchanges immediately after a restart of ***eNod4***. To be able to use these commands, it must first be processed another command ("cancel Tare" for example).
Note: The "Command register" data **must be** set to 0x0000 before each new command.

The "Ana. Output(2 b IN/OUT)" module allows writing directly the analog output value. This is only possible when the analog output function assignment is set to « Level on request ».

9 MEASUREMENT AND STATUS

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Measurement status	0x007D	0x5003 / 0x00 (M)	Module 1 (2 first bytes)	/	Uint	RO
Gross measurement	0x007E	0x5001 / 0x00 (M)	Module 1 (4 last bytes)	/	Long	RO
Tare value	0x0080	0x5004 / 0x01 (M)	R 0x0470	/	Long	RO
Net measurement	0x0082	0x5000 / 0x00 (M)	Module 2 (4 bytes starting 3rd byte)	/	Long	RO
Factory calibrated points	0x0084	0x5002 / 0x00 (M)	Module 2 (4 last bytes)	/	Long	RO
Preset Tare	0x0097	0x5004 / 0x02 (M)	R: 0x04C4 W: 0x04C5	0x03 / 0x08	Ulong	RW
Defective measurement debounced time	0x0A48	0x4509/0x06	R:0x0206 W:0x0207	0x06 / 0x0D	Uint	RW
Defective measurement alarm activation time	0x0A49	0x4509/0x07	R:0x0208 W:0x0209	0x06 / 0x0E	Uint	RW
Sensor input control reference	0x0A44	0x5004 / 0x03 (M)	R : 0x044C W: 0x044D	0x0A / 0x00	long	RW
Sensor input control result	0x0A46	0x5004 / 0x04 (M)	R : 0x024E	0x0A / 0x01	Int	RO
Sensor input control result max. tolerance	0x0A47	0x5004 / 0x05	R: 0x020A W: 0x020B	0x0A / 0x02	Uint	RW

9.1 Measurement transmission

The ***eNod4*** transmits measurement after signal and data processing through different protocols available. The accessible variables are:

9.1.1 Gross measurement

The *'gross measurement'* stands for the digital value after measurement scaling. It is affected by all the *'zero'* functions (power-up zero, zero tracking and zero requests).

9.1.2 Net measurement

The *'net measurement'* stands for the digital value after measurement scaling and tare subtraction.

9.1.3 Tare value

The *'tare value'* stores the calibrated value that is subtracted from the *'gross measurement'* so as to give the *'net measurement'*.

9.1.4 Factory calibrated points

The *'factory calibrated points"* contains the measurement value without the user calibration layer. It is directly linked to the analog input voltage.

9.1.5 Preset Tare value

A previous calculated tare can be restored using this variable.

9.1.6 Measurement status

The measurement status contains information on eNod4 measurement parameters.

The *'measurement status'* bytes contain information about every measurement processed by ***eNod4***. See the flags meaning in the table below:

bits	Meaning	Note
b_1 b_0		
00	*gross measurement*	*only in SCMBus/fast communication protocols* *not significant otherwise (00)*
01	*net measurement*	
10	*factory calibrated measurement*	
11	*tare value*	
b_3 b_2		
00	*measurement OK*	
01	*Defect: sensor input control result out of tolerances OR Sensor input control command in progress OR failed (timeout) OR Sensor input reference command in progress*	*causes a logical output assigned to the 'defective measurement' function to be set active. Causes the analog output assigned to a weight or flow rate image to be set in error mode.*
10	*gross meas.< (- max capacity) OR gross meas. > (max capacity)*	
11	*analog signal out of the A/D converter input range*	
b_4		
0	*motion*	*causes an output assigned to the 'motion' function to be set active*
1	*no motion*	
b_5		
0	*measurement out of the ¼ of division*	
1	*zero in the ¼ of division*	
b_6		
0	*EEPROM OK*	*See Note 1*
1	*EEPROM failure*	
b_7		
0 **1**	*reserved*	*1 in SCMBus and fast SCMBus, 0 otherwise*
b_8		
0 **1**	*IN1 logical level*	
b_9		
0 **1**	*IN2 logical level*	

bits	Meaning	Note
b₁₀		
0	*OUT1 logical level*	
1		
b₁₁		
0	*OUT2 logical level*	
1		
b₁₂		
0	*OUT3 logical level*	
1		
b₁₃		
0	*OUT4 logical level*	
1		
b₁₄		
0	*no tare*	
1	*at least a tare has been processed*	
b₁₅		
0	*reserved*	*1 in SCMBus and fast SCMBus, 0 otherwise*
1		

Note 1: Functioning and calibration parameters are stored in EEPROM. After every reset the entireness of parameters stored in EEPROM is checked. If a defect appears, measurements are set to 0xFFFF and defect is pointed out in measurement status. Causes a logical output assigned to the 'defective measurement' function to be set active. Causes the analog output assigned to a weight or flow rate image to be set in error mode.

9.2 Weighing diagnosis

9.2.1 Global weighing diagnosis

An internal alarm flag reflects the integrity of the whole measurement chain. It's used to set logical output active or optional analog output in an error mode in order to warn about any defection on the measurement chain (defective measurement).
This variable is set active when at least one of the followings conditions occurs:

- all that set bit2 or bit3 of ***Measurement status:***
  - sensor input control result out of tolerances
  - sensor input control command in progress
  - sensor input control command failed (timeout)
  - sensor input reference command in progress
  - gross meas. < (- max capacity)
  - gross meas. > (max capacity)
  - analog signal out of the A/D converter input range
- the one that set bit6 of ***Measurement status:*** EEPROM failure

This internal alarm flag is featured with adjustable specific de-bounced time and minimal activation time:

9.2.1.1 Defective measurement debounced time

The internal alarm flag is set active only after error conditions have always been true during this de-bounced time. It's expressed in ms.

9.2.1.2 Defective measurement alarm activation time

The internal alarm flag remains active for this minimal *"defective measurement alarm activation time"* when it come to be active and whatever the error conditions are during activation. It is expressed in ms.

9.2.2 Sensor input control

eNod4 features a weighing diagnosis system allowing to check the integrity of analog sensor input by electrically simulating a load, resulting to a simulated weight value. This diagnostic system can be used together with the others defects detection systems in order to achieve overall integrity check of the measurement chain. This system involves two phases initiated by the user:

- The first, just after user calibration, allows taking a simulated reference weight value when the measuring chain integrity is OK.
- The second, when the user wants to check the integrity of the system, allows to make the difference between a new simulated weight value and the reference. Then this difference can be compared with a dedicated maximum tolerance value.

9.2.2.1 Sensor input control reference

Reference value expressed in factory calibrated points for the sensor(s) input control test. The value is automatically determined and stored after executing the ***sensor input reference*** command. When the ***sensor input reference*** command is in progress the bits b3b2 in the ***Measurement status*** are set to 0b01. Its default value is zero.

9.2.2.2 Sensor input control result

Result of sensor(s) input control test expressed in 1/10 of user weight unit. Its value is automatically determined and stored after executing the ***sensor input control*** command. This test result represents the weight difference between the reference value and the current test value. It is set to **-1** when the ***sensor input control*** command is in progress or the command failed, these conditions cause the bits b3b2 in the ***Measurement status*** to be set to 0b01. Its default value is zero.

9.2.2.3 Sensor input control result max. tolerance

The ***Sensor input control result*** variable is compared with the ***Sensor input control result max. tolerance*** parameter which is expressed in 1/10 of user weight unit and has a default value of 30. If the ***sensor input control result*** value is greater than or equal to ***Sensor input control result max. tolerance*** then the bits b3b2 in the ***Measurement status*** are set to 0b01.

10 PROCESSING FUNCTIONAL COMMANDS

Name	*Modbus address*	*CANopen® Index/sub-index*	*Profibus cyclic IN/OUT*	*Acyclic DPV1 slot/index*	*Type*	*Access*
Command register	*0x0090*	*0x2003 / 0x00 (M)*	*Module 6*	*/*	*Uint*	*RW*
Response register	*0x0091*	*0x2004 / 0x00 (M)*	*Module 6*	*/*	*Uint*	*RO*

10.1 Principles

eNod4 device is able to handle several functional commands thanks to a couple of registers (except in SCMBus protocols):

the command register : dedicated to accept the functional commands

the response register : gives the state of the command currently being processed by ***eNod4*** (no command, in progress, finished, failed)

- **00_H** ⇒ free to accept a new command
- **01_H** ⇒ command execution in progress
- **02_H** ⇒ command execution complete
- **03_H** ⇒ error during command execution

Note: **IMPORTANT** except in SCMBus/fast SCMBus protocols, to accept a new command, the command register **must be set to 00_H** first. This causes the response register to be set back to **00_H.**

10.2 Functional commands list

Functional command	Command code	Note
Set to idle (00_H) response register	00_H	See § above
reset*	$D0_H$	
EEPROM storage	$D1_H$	
Restore default settings	$D2_H$	
Zero*	$D3_H$	
Tare*	$D4_H$	
Cancel tare*	$D5_H$	
Cancel current command	$D6_H$	
Theoretical scaling	$D7_H$	
Zero adjustment	$D8_H$	
Start physical calibration	$D9_H$	
Calibration zero acquisition	DA_H	
Segment 1 acquisition	DB_H	physical calibration procedure
Segment 2 acquisition	DC_H	
Segment 3 acquisition	DD_H	
Store calibration	DE_H	end of calibration (physical/theoretical) procedure
OUT1 activation/deactivation*	$E6_H$	
OUT2 activation/deactivation*	$E7_H$	only possible if the outputs are assigned to the associated function
OUT3 activation/deactivation*	$E8_H$	
OUT4 activation/deactivation*	$E9_H$	
zero offset adjustment	$F0_H$	
Dynamic zero acquisition	$F1_H$	
Preset tare*	$F2_H$	
Sensor input reference	EF_H	
Sensor input control	FD_H	
Totalization / errors clear	DF_H	
Dosing / batch start / resume	$E4_H$	
Dosing / batch stop / cancel	$E5_H$	
Suspend batch	$F7_H$	
Emptying hopper (cleaning)	$F4_H$	
Refilling start	$F5_H$	

Functional command	Command code	Note
Refilling stop	*F6H*	
Learning cycle on next cycle	*F3H*	
Auto Measurement in two points for flow rate calibration	*C9H*	
Auto Measurement in three points for flow rate calibration	*CAH*	
Flow rate calibration	*F8H*	
PID parameters auto-adjustment	*F9H*	
Clear grand total	*EDH*	
Clear general total	*EEH*	

Note: only the commands with a * can be handled by ***eNod4*** in SCMBus and fast SCMBus protocols.

10.3 Functional commands description

10.3.1 Reset

The *'reset'* functional command execution is similar to the device power-up. This reboot phase is necessary if the address or/and the baud rate are modified and some settings changes are only taken into account after an EEPROM storage followed by a reset.

10.3.2 EEPROM storage

eNod4 configuration and calibration are stored in a non-volatile memory (EEPROM). If changes are made in the device configuration, sending to ***eNod4*** the *'EEPROM storage'* functional command will allow ***eNod4*** to keep these modifications after a power shutdown or the reception a *'reset'* functional command.
Moreover the settings listed below need to be stored and will only be taken into account at the next device reboot:

- span adjusting coefficient
- calibration place **g** value
- place of use **g** value
- stability criterion
- legal for trade activation switch
- power-up zero
- A/D conversion rate
- Functioning mode and communication protocol
- Analog output voltage and current

10.3.3 Restore default settings

The *'restore default settings'* command causes ***eNod4*** to be set back to its default configuration. The default configuration corresponds to the one on delivery that means with factory settings. Be careful when using this command, all the default settings are recovered including the stored calibration and the legal for trade indicators.
Note: this functional command is not available in CANopen® communication protocol.

10.3.4 Zero

When receiving a *'zero'* functional command***, eNod4*** acquires a volatile zero (gross measurement is set to 0) value if the following conditions are respected:

- measurement is stable
- Current gross measurement is within a ±10% (±2% if the legal for trade option is enabled) range of the *'maximum capacity'*.

Otherwise, after five seconds the command is cancelled and an execution error is reported. This value is not stored in EEPROM.

10.3.5 Tare

When receiving a *'tare'* functional command***, eNod4*** acquires a volatile tare (net measurement is set to 0) value if the measurement is stable otherwise, after five seconds the command is cancelled and an execution error is reported. If the tare acquisition is successful b_{14} bit of the *'measurement status'* is set to 1.

10.3.6 Cancel tare

This command erases the current tare value if at least one tare has been previously processed. It also causes b_{14} bit of the *'measurement status'* to be set back to 0.

10.3.7 Cancel last command

This command sets the response register to **00**$_H$ and allows ***eNod4*** to ignore the functional command previously received and not yet issued (for example to exit a sequential procedure like a physical calibration).

10.3.8 Theoretical scaling

The *'theoretical scaling'* functional command involves the *'maximum capacity'* and *the 'sensor sensitivity'* settings. When used, this command realizes an automatic scaling to migrate from the factory calibration to the user calibration. This calibration must then be saved by sending to ***eNod4*** the '*store calibration'* functional command. Using the *'zero adjustment'* functional command is also recommended so as to completely adapt ***eNod4*** to the application.

10.3.9 Zero adjustment

The *'zero adjustment'* functional command allows the user to set his calibration zero value by asking ***eNod4*** to acquire the current factory calibrated measurement. This acquisition duration depends on the measurement stability; if stability is not reach after 5 seconds, '*zero adjustment*' command is cancelled and an execution error is reported. If it is correctly achieved, this calibration zero modification must then be saved by sending to ***eNod4*** the '*store calibration'* functional command. This functional command can be used any time and has no effect on the user-span that can have been previously configured through a physical or a theoretical calibration procedure.

10.3.10 Start physical calibration

In order to handle a physical calibration with 1 up to 3 know references, ***eNod4*** first must be told to enter the physical calibration mode. It is the first step of a sequential procedure.

10.3.11 Calibration zero acquisition

The *'calibration zero acquisition'* is the second step of the physical calibration procedure. It can only be used if the *'start physical calibration'* functional command has been previously received. This acquisition duration depends on the measurement stability; if stability is not reach after 10 seconds, '*calibration zero acquisition*' command is cancelled and an execution error is reported.
Note: In specific cases (silo for example), this step is not mandatory because it is possible to command a "zero adjustment" when the silo is empty.

10.3.12 Segment 1 acquisition

It consists in applying a known reference on the sensor then sending the *'segment 1 acquisition'* functional command. This acquisition duration depends on the measurement stability; if stability is not reach after 10 seconds, *'actual segment acquisition'* command is cancelled and an execution error is reported.

10.3.13 Segment 2/3 acquisition

Only if the *'calibration zero acquisition'* and *"Segment 1 acquisition"* are successful, next step consists in applying a known reference on the sensor then sending the 'segment X acquisition' functional command where X depends on the value stored in the 'number of calibration segments' register. This acquisition duration depends on the measurement stability; if stability is not reach after 10 seconds, *'actual segment acquisition'* command is cancelled and an execution error is reported.

10.3.14 Store calibration

Only if the *'segment 1/2/3 acquisition'* is successful, next step consists in validating the new calibration by storing the zero and the span that have been determined in EEPROM.
Note: This functional command has to be transmitted at the end of a physical calibration, after a *'zero adjustment'*, a *'theoretical scaling'* or a *'zero offset'*.

10.3.15 Logical outputs 1-4 activation/deactivation

If the corresponding logical outputs are assigned to the *'level on request'* function, they can be enabled/disabled by transmitting one of these functional commands. Upon first reception, the corresponding output is enabled and on next reception it will be disabled. If the requesting logical output is assigned to the wrong function, ***eNod4*** reports an error.

10.3.16 Zero offset adjustment

It is also possible to adjust the calibration zero value without acquiring a new one. By entering a positive or negative value into the *'delta zero'* register, the user can quantify the offset (in factory calibrated points) that has to be added or subtracted from the actual calibration zero. This calibration zero modification must then be saved by sending to ***eNod4*** the *'store calibration'* functional command.

10.3.17 Dynamic zero acquisition

When receiving a ***dynamic zero acquisition*** command ***eNod4*** calculates the average of successive weight measures during the time specified in ***dynamic zero acquisition time*** parameter. A new zero is then used if the averaged value is within a ±10% (±2% if the legal for trade option is enabled) range of the ***maximum capacity***.
There is no stability criteria required. Dynamic zero acquisition can also be launch by an input assigned to this function. ***Dynamic zero acquisition*** can be interrupted by sending ***cancel current command***.

10.3.18 Preset tare

With this command it is possible to retrieve a tare value defined previously.
Important: ***Preset tare*** parameter value must be stored before sending this command.

10.3.19 Sensor input reference

Sensor input reference command will cause ***eNod4*** to handle special sequence to acquire ***sensor input control reference*** value of the load cell sensor input. This command must not be realized when any process cycle that use weight is in progress (because weight variables do not reflect the real weight whilst command is in progress). This command can fail (error in response register) in case of stability timeout on sensor input. The execution time of this command depends on the weight filtering settings. For any further information about this functionality and result variables see "Weighing diagnosis" § in the MEASUREMENT AND STATUS §.

10.3.20 Sensor input control

Sensor input control command will cause eNod4 to handle special test on sensor input and to deliver a test result. This command must not be realized when any process cycle that use weight is in progress (because weight variables do not reflect the real weight whilst command is in progress). This command can fail (error in response register) in case of stability timeout on sensor input. The execution time of this command depends on the weight filtering settings. For any further information about this functionality and result variables see "Weighing diagnosis" § in the MEASUREMENT AND STATUS §.

10.3.21 Clear totalization & errors counter

This command triggers the main totalizer reset. The two parts of the totalizer, the main in ***weight unit*** x 1000, and the complementary part in ***weight unit*** are then reset.
The variables ***dosing errors report***, ***dosing errors counter*** and ***last dosing error*** are also reset.

10.3.22 Dosing / batch start / resume

In *batch mode* this command launches or resumes a cycle. A cycle can also be launched by an input assigned to this function. When the command is sent through the ***command register***, ***eNod4*** answers back the control state value through the ***response register***.
This command will not issue if a flow rate calibration has not been previously performed.
When a cycle starts and depending on parameters setting of eNod4, there will be firstly a refilling. Totalizer may be cleared and a learning cycle initiated.
If a batch has been previously suspended, this command allows resuming the cycle and the totalization. The ***dosing status*** variable allows monitoring enod4 state during the dosing cycle.
Attention: an input can only be assigned to ***start/stop dosing*** or ***suspend/resume batch***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic.

10.3.23 Dosing stop / batch cancel

In loss in weight feeder mode, this command allows stopping the running dosing cycle. If a batch is pending, it will be stopped with any possible resumption.
Attention: an input can only be assigned to ***start/stop dosing*** or ***suspend/resume batch***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic.

10.3.24 Suspend batch

In *batch mode* this command suspends dosing. It allows any cleaning operation without clearing a batch. Launching a *Dosing / batch start/* resume command will resume the dosing cycle.

<u>Warning</u>: an input can only be assigned to ***suspend/resume batch***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic.

10.3.25 Emptying hopper (cleaning)

In loss in weight feeder mode, this command allows to automatically emptying the hopper (or silo) in preparation of a cleaning process or for changing the dosing product. Dosing is running and totalization works until the gross weight reaches the ***empty hopper level***.
An input can be assigned to ***start/stop hopper emptying***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic. It's not possible to suspend an emptying.
The command ***start/stop dosing*** or ***suspend/resume batch*** systematically lead to the emptying shutdown.

10.3.26 Refilling start

This command allows refilling activation. Refilling stops when the gross weight reaches the ***refilling high level*** minus the ***refilling inflight value***. Inflight value is not adjusted automatically at each cycle.
Refilling can also be initiated/stopped by an input assigned to ***start/stop refilling***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic.

10.3.27 Refilling stop

This command will stop refilling immediately. Refilling can also be initiated/stopped by an input assigned to ***start/stop refilling***, with a functioning in a bistable mode and on rising or falling front depending on the selected logic.

10.3.28 Learning cycle on next cycle

If ***PID activation***, ***smart refill mode*** and ***acquisition of flow rate refill references on learning cycle*** options are activated, this command will launch a learning cycle after the next refilling phase. This smart refill mode compensates for the flow rate variation due to the product thrust in the hopper or silo so that the flow rate always remains constant throughout the phase. New values for ***reference flow rate control output start refilling*** and ***reference flow rate control output end refilling*** parameters will be determined.

10.3.29 Flow rate calibration

So that ***eNod4*** can carry out an expected flow rate dosing in the best possible conditions, the flow rate calibration is required. This also applies when ***eNod4*** is used both as constant flow rate totalizer and as loss in weight feeder.
From this calibration will depend the accuracy of the flow rate obtained and on the settling time, if a PID controller is activated. This calibration is carried out in minimum two segments by the variable ***segments number for the calibration curve of flow rate***. In case the extraction device has a nonlinear response it is recommended to define maximum segments for the flow rate calibration.
In order to calibrate the flow rate, if the control of extraction device is directly provided by ***eNod4*** through an analog control output in current or voltage, analog output functioning of ***eNod4*** must be allocated to ***level on request*** function first.
For each calibration point of the variable ***control output value,*** read the appropriate *average flow rate.* Then provide each of the ***Calibration of flow rate point n (control output)*** and ***Calibration of flow rate point n (flow rate value)*** matching with control output value.
<u>Validate the flow rate calibration by sending ***calibration of flow rate*** command.</u>
Finally allocate in the end the current or voltage analog output of ***eNod4*** to ***flow rate control output*** function.

10.3.30 Auto Measurement in two or three points for flow rate calibration

In order to calibrate the flow rate, if the control of extraction device is directly provided by ***eNod4*** through an analog control output in current or voltage, analog output functioning of ***eNod4*** must be allocated to ***level on request*** function first. There are two commands, the first allows automatic measurement of flow rate in two points (35% & 70% of control output). The second allows automatic measurement of flow rate in three points (20%, 50% & 80%).

At the end of procedure, the flow rate calibration is validating automatically.

10.3.31 PID parameters auto-adjustment

The configuration of the PID controller can be made in a totally automatic way. The behavior of PID controller (slow, fast or stable) must be previously configured. You have also to configure ***PID adjustment flow rate*** parameter that will be used for PID auto-adjustment.

So that this controller automatic adjusting device works, both the weight calibration and the flowrate calibration must be previously carried out.

PID parameters auto-adjustment command will cause ***eNod4*** to perform successive dosing cycle sequence to calculate optimized PID coefficients ***Kp, Ti*** and ***Td***. The number of cycle sequence can be fixed by user (parameter). It is strongly recommended that ***Td*** parameter does not exceeded value **5**.

10.3.32 Clear grand total

Clear great total command allows individual reset of ***Grand total*** (in ***weight unit*** x1000) totalizer.

10.3.33 Clear general total

Clear general total command allows individual reset of ***General total*** (in ***weight unit*** x1000) totalizer.

11 CALIBRATION SETTINGS AND PROCEDURES

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Maximum capacity	*0x000C*	*0x3002 / 0x00 (M)*	*R : 0x0420 W: 0x0421*	*0x02 / 0x00*	*Ulong*	*RW*
Number of calibration segments	*0x000E*	*0x3000 / 0x00*	*R : 0x0222 W: 0x0223*	*0x02 / 0x01*	*Uint*	*RW*
Calibration load 1	*0x000F*	*0x3001 / 0x01 (M)*	*R : 0x0424 W: 0x0425*	*0x02 / 0x02*	*Ulong*	*RW*
Calibration load 2	*0x0011*	*0x3001 / 0x02*	*R : 0x0426 W: 0x0427*	*0x02 / 0x03*	*Ulong*	*RW*
Calibration load 3	*0x0013*	*0x3001 / 0x03*	*R : 0x0428 W: 0x0429*	*0x02 / 0x04*	*Ulong*	*RW*
Sensor sensitivity	*0x0015*	*0x3004 / 0x00 (M)*	*R : 0x042A W: 0x042B*	*0x02 / 0x05*	*Ulong*	*RW*
Scale interval	*0x0017*	*0x3003 / 0x00*	*R : 0x022C W: 0x022D*	*0x02 / 0x06*	*Uint*	*RW*
Zero calibration	*0x0018*	*0x3005 / 0x00*	*R : 0x0434 W: 0x0435*	*0x03 / 0x04*	*Long*	*RW*
Span coefficient 1	*0x001A*	*0x3006 / 0x04*	*R : 0x0436 W: 0x0437*	*0x03 / 0x05*	*Float*	*RW*
Span coefficient 2	*0x001C*	*0x3006 / 0x05*	*R : 0x0438 W: 0x0439*	*0x03 / 0x06*	*Float*	*RW*
Span coefficient 3	*0x001E*	*0x3006 / 0x06*	*R : 0x043A W: 0x043B*	*0x03 / 0x07*	*Float*	*RW*
Span adjusting coefficient	*0x0020*	*0x3006 / 0x01 (M)*	*R : 0x042E W: 0x042F*	*0x03 / 0x00*	*Ulong*	*RW*
Calibration place g value	*0x0022*	*0x3006 / 0x02*	*R : 0x0430 W: 0x0431*	*0x03 / 0x01*	*Ulong*	*RW*
Place of use g value	*0x0024*	*0x3006 / 0x03*	*R : 0x0432 W: 0x0433*	*0x03 / 0x02*	*Ulong*	*RW*
Zero offset	*0x0092*	*0x2500 / 0x00 (M)*	*R : 0x0472 W: 0x0473*	*0x03 / 0x03*	*Long*	*RW*

11.1 Principles

eNod4 is factory calibrated to deliver **500 000 counts for 2mV/V** with a load cell on the **A3** input connector.
The measurement scaling in ***eNod4*** can be adapted to his application by the user. Some settings and the 2 calibration methods allow the user to define his specific span according to his sensors characteristics.

When using eNod4 for legal for trade purpose, it is imperatively required to activate the legal for trade switch BEFORE any calibration procedure (cf § legal for trade switch).

11.2 Calibration methods

Measurement scaling can be defined using one of the two following methods:

- **Theoretical calibration** involving the sensitivity of the sensor and a user-defined corresponding capacity
- **Physical calibration** involving 1, 2 or 3 know loads (for a load cell)

Both can be achieved thanks to the functional commands.

11.3 Settings description

11.3.1 Maximum capacity

The *'maximum capacity'* stands for the maximum sensor/load cell signal range. When the absolute value of the gross measurement exceeds its value plus 9 divisions, the b_3 bit (positive overloading) or the b_2 bit (negative overloading) of the measurement status is set to 1 (it can activate a logical output if it is assigned to the *'defective measurement'* function).
The zero acquisition (on request or at power-up) is done only if the gross measurement value is contained between a ±10% range of the *'maximum capacity'* (±2% if the *legal for trade* option is active).
The *'maximum capacity'* setting also allows calibrating ***eNod4*** in case of a theoretical calibration in association with the sensor sensitivity. Measurement scaling will be automatically adapted so as to deliver a gross measurement value equivalent to the *'maximum capacity'* for an analog signal corresponding to the sensor sensitivity.
After a theoretical calibration, the maximum capacity can be changed to fit to the application.
Admitted values : from 1 up to 10000000.

11.3.2 Number of calibration segments

The *'number of calibration segments'* defines how many calibration segments are used during the physical calibration procedure. Linear installations only need one segment.
Admitted values : from 1 up to 3.

11.3.3 Calibration loads 1/2/3

Before starting a physical calibration procedure, each calibration segment must be given a corresponding user value (for example, 1000 points for a 1 kg load).
Admitted values : from 1 up to 10000000.

11.3.4 Sensor sensitivity

The *'sensor sensitivity'* setting is used to achieve a theoretical calibration. The stored value for this parameter is the load cell sensitivity in **mV/V**.
The user can adapt the value delivered by ***eNod4*** for the associated signal using the *'maximum capacity'* and the *'sensor sensitivity'*.
This setting is expressed with a 10^{-5} factor (197500 is equivalent to a 1.975 mV/V load cell sensitivity or a 1.975 V input voltage).
Admitted values : from 1 up to 1000000.

11.3.5 Scale interval

The *'scale interval'* is the minimal difference between two consecutive indicated values (either gross or net).
Modification of scale interval is taking into account after a new calibration.
Admitted values : 1/2/5/10/20/50/100

11.3.6 Zero calibration

Zero calibration value corresponds to the A/D converter points measured during the '*zero acquisition*' step of a physical calibration.
For a theoretical calibration this value must be set. It can be set automatically with the '*zero adjustment*' command.
Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).
Admitted values : from 0 up to +-10000000

11.3.7 Span coefficients 1/2/3

These coefficients are computed and written during calibration process. Writing these coefficients could be done if you want to restore a previous calibration.
Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).
Admitted values : different from 0.

11.3.8 Span adjusting coefficient

The *'span adjusting coefficient'* allows adjusting initial calibration. Adjustment applies linearly on the whole calibration curve. This coefficient has a 10^{-6} factor (1000000 is equivalent to a span adjusting coefficient that is equal to 1).
Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).
Admitted values : from 900000 up to 1100000.

11.3.9 Calibration place g value / place of use g value

When the calibration place and the place of use of a measuring chain are different, a deviation can appear due to the difference of g (gravity) between the 2 places.
The ***eNod4*** calculates a ratio applied to the measure which compensates the difference of gravity between the 2 places.
The g value are expressed in 10^{-6} $m.s^{-2}$ (9805470 is equivalent to g = 9.805470 $m.s^{-2}$).
The ***eNodView*** software can help to determine the g value of a place.
Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).
Admitted values : different from 0.

11.3.10 Zero offset

The *'Zero offset'* value contains the offset in factory calibrated points that can be added/subtracted (if its value is positive or negative) to the zero calibration value when using the *'zero offset'* functional command. Once the command has been successfully achieved, this register is set to 0.
Note: The 'Zero offset' value is not stored into EEPROM memory and is always equal to 0 after a device power-up or a software reset

Admitted values: different from 0.

12 FILTERS

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
A/D conversion rate	0x0036	*0x4000 / 0x00*	*R : 0x0240* *W: 0x0241*	*0x04 / 0x00*	Uint	RW
filters activation	0x0037 LSB	*0x4001 / 0x01 (byte)*	*R : 0x0242* *W: 0x0243*	*0x04 / 0x01*	Byte	RW
Low-pass order	0x0037 MSB	*0x4001 / 0x02 (byte)*			Byte	
Low-pass cut-off frequency	0x0038	*0x4001 / 0x03*	*R : 0x0244* *W: 0x0245*	*0x04 / 0x02*	Uint	RW
Depth of moving average filter on weight	0x0039	*0x4001 / 0x04*	*R : 0x0246* *W: 0x0247*	*0x04 / 0x03*	Uint	RW
Tolerance of clipping filter on instant flow rates	0x003A	*0x4001 / 0x05*	*R : 0x0248* *W: 0x0249*	*0x04 / 0x04*	Uint	RW
Average flow rate determination depth	0x0059	*0x4700 / 0x03*	*R : 0x0278* *W: 0x0279*	*0x07 / 0x02*	Uint	RW

12.1 Principles

eNod4 contains 4 filtering layers that are user-configurable :

- filtering related to the A/D conversion rate (with rejection of the mains frequency)
- a low-pass Bessel-type filter
- a moving average weight filter
- a self-adaptive filter

Except for the A/D conversion rate that is always enabled, none of these filters is mandatory. However, to perform accurate measurements we recommend setting a combination of filters. ***eNodView*** software may be helpful in designing the best filter configuration for the application.

12.2 Settings description

12.2.1 A/D conversion rate

It contains a code which represents the A/D conversion rate and the rejection. See table below:

b_4	Rejection	
0	*60 Hz*	
1	*50 Hz*	
$b_3\ b_2\ b_1\ b_0$	A/D conversion rate (measures/s)	
	50-Hz rejection	60-Hz rejection
0000	*100*	*120*
0001	*50*	*60*
0010	*25*	*30*
0011	*12.5*	*15*
0100	*6.25*	*7.5*
1001	*1600**	*1920**
1010	*800**	*960**
1011	*400**	*480**
1100	*200*	*240*

* values that can only be selected in transmitter mode.

Note: To be applied, any modification of this setting must be followed by an EEPROM back up and device reboots (hardware or software).

12.2.2 Filters activation & order

This setting allows to define what filters are enabled in ***eNod4*** signal processing chain.
Note: the filters activation & order setting can be accessed through a 16-bits register except in CANopen® communication protocol where this word is divided into 2 8-bits registers:

b_1	Meaning
0	*self-adaptive filter disabled*
1	*self-adaptive filter enabled*
$b_{10}\ b_9\ b_8$	
000	*low-pass filter disabled*
010	*2nd order low-pass filter*
011	*3rd order low-pass filter*
100	*4th order low-pass filter*

Note: In CANopen® communication protocol (according to version), this word is divided into 2 bytes of 8-bits registers. Bits b8 to b15 are therefore equivalent to bits b0 to b7 of the corresponding address (see CANopen® Register table).

12.2.3 Low-pass filter cut-off frequency

This register contains the low-pass filter cut-off frequency expressed in Hz and multiplied by 100. That means that 690 is equivalent to 6.90 Hz. The value must be compliant with the table shown below.
Admitted values: from 10 up to 20000.

12.2.4 Limitations

Recursive filters like ***eNod4*** low-pass filters are computed according to the filter order, the desired cut-off frequency and the sampling rate. There are some limitations to respect in order to ensure a safe functioning of the signal processing. They are listed in the table below:

A/D conversion rate (meas/s)	*min low-pass cut-off frequency (Hz)*		*A/D conversion rate (meas/s)*	*min low-pass cut-off frequency (Hz)*	
	50 Hz rejection			***60 Hz rejection***	
	2nd order	***3rd order***		***2nd order***	***3rd order***
6.25	*0.10*	*0.10*	***7.5***	*0.10*	*0.10*
12.5	*0.10*	*0.10*	***15***	*0.10*	*0.15*
25	*0.10*	*0.15*	***30***	*0.15*	*0.20*
50*	*0.15*	*0.25*	***60****	*0.20*	*0.30*
100*	*0.25*	*0.50*	***120****	*0.30*	*0.60*
200*	*0.50*	*1.00*	***240****	*0.60*	*1.20*
400	*1.00*	*2.00*	***480***	*1.20*	*2.40*
800	*2.00*	*4.00*	***960***	*2.40*	*4.80*
1600	*4.00*	*8.00*	***1920***	*4.80*	*9.60*

(*) values of A/D conversion rate that are accessible in feeder mode.

12.2.5 Depth of moving average filter on weights

A moving average filter on weight can be set in cascade after previous filters. This filter is used to smooth the weight value in case of random interferences. If enable, this filter computes the mean of a specified last number of measures which are output of the previous filters. The number of measures is defined by ***depth of moving average filter on weights*** parameter. A high filter depth will give a better stability, with a longer response time.

Filter depth admitted values: 0(disabled) up to 128.

12.2.6 Tolerance of clipping filter on instant flow rates

When eNod4 is used in loss in weight feeder, it's possible to operate a clipping filter on the successive values of flow rate. Clipping range is defined in 0.1% of the nominal flow rate. This filter will substitute flow rate values outside the clipping range by the meaning of precedent flow rate values. It allows to suppress short asynchronous physical disturbances on weight measures due to the environment. The filter is disabled when parameter is cleared.

12.2.7 Average flow rate determination depth

This parameter specifies the depth of the moving average filter on successive instant flow rate values in order to produce the average flow rate. The average flow rate is only produced for display and generally it is appropriate to set average flow rate determination depth parameter to the maximal value 128. The filter is disabled when parameter is cleared.

13 CONFIGURATION OF INPUT/OUTPUT

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Logical input 1 functioning	*0x0042 LSB*	*0x4501 / 0x02*	*R : 0x0250* *W: 0x0251*	*0x05 / 0x00*	*byte*	*RW*
Logical input 2 functioning	*0x0042 MSB*	*0x4501 / 0x03*			*byte*	
Logical input 3 functioning (IO+ version)	*0x0041 LSB*	*0x4501 / 0x04*	*R : 0x026A* *W: 0x026B*	*0x05 / 0x02*	*byte*	*RW*
Logical input 4 functioning (IO+ version)	*0x0041 MSB*	*0x4501 / 0x05*			*byte*	
holding time	*0x0043*	*0x4501 / 0x01*	*R : 0x0252* *W: 0x0253*	*0x05 / 0x01*	*Uint*	*RW*
Analog output functioning (IO+ version)	*0x0040*	*0x4509 / 0x05*	*R : 0x026C* *W: 0x026D*	*0x06 / 0x0B*	*Uint*	*RW*
External value to control analog output (IO+ version)	*0x0032*	*0x5050 / 0x00 (M)*	*R : 0x023C* *W: 0x023D* *+ See modules list*	*0x06 / 0x0C*	*Uint*	*RW*
Output 1 functioning	*0x0044 LSB*	*0x4509 / 0x01*	*R : 0x0254* *W: 0x0255*	*0x06 / 0x00*	*byte*	*RW*
Output 2 functioning	*0x0044 MSB*	*0x4509 / 0x02*			*byte*	
Output 3 functioning	*0x0045 LSB*	*0x4509 / 0x03*	*R : 0x0256* *W: 0x0257*	*0x06 / 0x01*	*byte*	*RW*
Output 4 functioning	*0x0045 MSB*	*0x4509 / 0x04*			*byte*	
Weight quantity per pulse on logical output	*0x0057*	*0x4707 / 0x00*	*R : 0x02AE* *W: 0x02AF*	*0x07 / 0x1D*	*Uint*	*RW*
Set point 1 high value	*0x0046*	*0x4601 / 0x02*	*R : 0x025A* *W: 0x025B*	*0x06 / 0x02*	*Long*	*RW*
Set point 1 low value	*0x0048*	*0x4601 / 0x03*	*R : 0x025C* *W: 0x025D*	*0x06 / 0x03*	*Long*	*RW*
Set point 2 high value	*0x004A*	*0x4601 / 0x04*	*R : 0x025E* *W: 0x025F*	*0x06 / 0x04*	*Long*	*RW*
Set point 2 low value	*0x004C*	*0x4601 / 0x05*	*R : 0x0260* *W: 0x0261*	*0x06 / 0x05*	*Long*	*RW*
Set point 3 high value	*0x004E*	*0x4609 / 0x02*	*R : 0x0262* *W: 0x0263*	*0x06 / 0x06*	*Long*	*RW*
Set point 3 low value	*0x0050*	*0x4609 / 0x03*	*R : 0x0264* *W: 0x0265*	*0x06 / 0x07*	*Long*	*RW*
Set point 4 high value	*0x0052*	*0x4609 / 0x04*	*R : 0x0266* *W: 0x0267*	*0x06 / 0x08*	*Long*	*RW*
Set point 4 low value	*0x0054*	*0x4609 / 0x05*	*R : 0x0268* *W: 0x0269*	*0x06 / 0x09*	*Long*	*RW*
1&2 Set points functioning	*0x0056 LSB*	*0x4601 / 0x01*	*R : 0x0258*	*0x06 / 0x0A*	*byte*	*RW*

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
3&4 Set points functioning	*0x0056 MSB*	*0x4609 / 0x01*	*W: 0x0259*		*byte*	
Logical input level	*0x0094 LSB*	*0x5100 / 0x00 (M)*	*Module 2*	*/*	*Byte*	*RO*
Logical ouput level	*0x0094 MSB*	*0x5200 / 0x00 (M)*			*Byte*	

13.1 Principles

eNod4 device is fitted with 2 logical inputs (4 logical inputs for IO+ version) and 4 logical outputs that are fully configurable.

13.1.1 Logical inputs

Each input can work individually in positive or negative logic. A holding time (de-bounced time) attached to all inputs can be configured.
Available functions see hereunder table:

Function	Operating mode	
	transmitter	***Loss in weight feeder***
None	●	●
Tare	●	●
Cancel tare	●	●
Zero	●	●
Transmit measurement (in SCMBus/fast SCMBus, in CANopen TPDO2 sending if input 1, TPDO3 sending if input 2)	●	
Continuous measurement transmit (SCMBus/fast SCMBus only)*	●	
Dynamic zero	●	●
Start/Stop refilling**		●
Start/Stop emptying hopper**		●
Start/Stop dosing**		●
Suspend/Resume batch**		●
Emergency stop		●
Reset totalization and dosing error counter		●
Sensor input control	●	●

* command operates on logical level
** these commands operates on front in a bistable functioning mode. For example for the Start/Stop refilling command, the first front initiates refilling, the second stops it.

Note: Most of functions set to logical inputs can also be sent by '*functional commands*'; for a precise description see § 'functional commands'.

- **None :** the input has no function
- **Tare :** a rising (positive logic) or a falling edge (negative logic) causes a tare function to be triggered .
- **Cancel tare :** a rising (positive logic) or a falling edge (negative logic) causes the current stored tare to be erased.
- **Zero :** a rising (positive logic) or a falling edge (negative logic) causes a zero function to be triggered.
- **Transmit measurement** : only available in CANopen® and SCMBus/fast SCMBus protocols and in transmitter mode only. A rising (positive logic) or a falling edge (negative logic) triggers a measurement transmission.
- **Continuous transmit measurement** : only available in SCMBus/fast SCMBus protocols. Measurements are continuously transmitted at a rate defined by the ***measurement transmission period*** parameter while the input is maintained at the chosen level.
- **Dynamic zero** : this input activation will cause ***eNod4*** to perform zero function. This zeroing acquisition is not conditioned by stability criterion and consists in a moving average of measures during an adjustable parameter ***dynamic zero acquisition time***. The new current zero is not stored permanently and can be canceled by a reset of the module.
- **Start/Stop refilling :** this command operates on front in a bistable functioning mode. In dosing mode, the first rising or falling edge (according to the configured logic) on this input causes a refilling procedure. The second one will stop it.
- **Start/Stop emptying hopper :** this command operates on front in a bistable functioning mode. In dosing mode, the first rising or falling edge (according to the configured logic) on this input causes an emptying procedure. The second one will stop it.
- **Start/Stop dosing :** this command operates on front in a bistable functioning mode. In dosing mode, the first rising or falling edge (according to the configured logic) on this input starts dosing. The second one stops it.
- **Suspend/Resume batch :** this command operates on front in a bistable functioning mode. In dosing mode, the first rising or falling edge (according to the configured logic) on this input suspends the batch. The second one resumes it.
- **Emergency stop :** a rising (positive logic) or a falling edge (negative logic) triggers an emergency stop which immediately stops the dosing, the totalization and eventually the refilling.
- **Reset totalization and dosing error counter :** a rising (positive logic) or a falling edge (negative logic) triggers the main totalizer reset. Both parts of the totalizer, the main in ***weight unit*** x1000 and the complementary part in ***weight unit*** are then reset.
  The ***dosing errors counter*** variable is also reset.
- **Sensor input control :** a rising (positive logic) or a falling edge (negative logic) triggers a test routine of the sensor input and produces a test result.

13.1.2 Analog output (IO+ version)

An optional analog board in *current* and *voltage* might be used with ***eNod4*** to provide IO+ version. This must be asked when ordering ***eNod4*** product.
Voltage output might be set either 0-5V or 0-10V, and the current output to 4-20mA, 0-24mA , 0-20mA or 4-20mA with alarm at 3.6mA. Both output (current and voltage) might separately be enable. Settings are effective after ***eNod4*** reset.
Analog output affectation function is common to both *current* and *voltage* output and might be assigned to followings:

function	Operating mode	
	transmitter	***loss in weight feeder***
none	●	●
gross measurement	●	●
net measurement	●	●
level on request	●	●
flow rate control output		●
instant flow rate	●	●
average flow rate	●	●

- **None :** analog outputs have no function.
- **Gross measurement :** analog outputs can be assigned to gross measurement copy. Maximal level value is related to ***Maximum Capacity*** parameter and works in mono-quadrant functioning. Bi-quadrant option can only be applied to gross measurement copy. When this option is activated, the lowest value of current and voltage levels corresponds to -***MC*** and the highest value to +***MC***.
- **Net measurement :** analog outputs can be assigned to net measurement copy. Maximal value is related to ***Maximum Capacity*** parameter and works in mono-quadrant functioning only. The highest value of current and voltage levels corresponds to +***MC*** in only one quadrant.
- **Level on request :** analog outputs are driven by master requests through the ***external value to control analog output*** variable (in 0.01% of the full scale of current or voltage analog outputs).
- **Flow rate control output :** PID controller output data (activated or not) drives current or voltage outputs generally coupled to the extraction device. Data is expressed in 0.01% of the high value of current or voltage analog outputs. Maximal level output value corresponds to the maximal flowrate (see § flow rate calibration).
- **Instant flow rate :** analog outputs can be assigned to instant flow rate copy. Maximal level output value corresponds to the maximal flowrate (see § flow rate calibration).
- **Average flow rate :** analog outputs can be assigned to average flow rate copy. Maximal level output value corresponds to the maximal flowrate (see § flow rate calibration).

When analog output is assigned to “Gross measurement”, “Net measurement”, “Instant flow rate**”** or **“**Average flow rate” its value jumps to a special error value when the internal alarm flag described in “Weighing diagnosis” § in the MEASUREMENT AND STATUS § is activated. This allows to warn about defection of the measurement chain.
The error value on analog output is defined depending on voltage or current settings as described in following table:

Setting	Analog output error mode value
0 - 5V	***5.5 V***
0 - 10V	***11 V***
4 - 20mA	***no output current***
0 - 20mA*	***no output current***
0 - 24mA*	***no output current***
4 mA - 20 mA with alarm at 3.6 mA	***3.6 mA, voltage output is deactivated (High-Z state)***

* no error detection possible in this setting

13.1.3 Logical outputs

Each output can work individually in positive or negative logic

The available functions are:

function		*Operating mode*
	transmitter	***Loss in weight feeder***
none	●	●
set point	●	●
motion	●	●
defective measurement	●	●
input image	●	●
level on request	●	●
cycle in progress		●
External totalizer		●
Flow rate alarm		●
Batch complete		●
Refilling in progress		●
Extraction activated		●
Volumetric phase		●

- **None :** the output has no function
- **Setpoint :** each output can be assigned to a configurable set point (set point 1 corresponds to output 1, set point 2 to output 2, set point 3 to output 3 and set point 4 to output 4).
- **Motion :** the output is dedicated to copying the stability flag level.
- **Defective measurement :** the output level is set when the internal alarm flag described in "Weighing diagnosis" § in the MEASUREMENT AND STATUS § is activated. This allows to warn about defection of the measurement chain. Flowrate, refilling, empty or full hopper or too long batch alarms are not considered as defective measurements.
- **Input image :** the output is dedicated to copying a logical input level (outputs 1 and 3 correspond to inputs 1 and 3, outputs 2 and 4 correspond to input 2 and 4).
- **Level on request :** the input level is driven by master requests.
- **Cycle in progress :** in dosing mode, indicates that a dosing cycle is running.
- **External totalizer :** this output is dedicated to deliver pulses for external totalizer device.
  If a logical output is assigned to ***external totalizer*** function, ***eNod4*** will send a pulse every time totalization result will reach a multiple of weight value defined in ***weight quantity per pulse on logical output*** parameter expressed in ***weight unit*** x1000.
- **Flowrate alarm :** the output is dedicated to copying dosing alarms. Alarms might be flow rate, control output level, refilling, batch too long, empty hopper, full hopper or external totalizer overflow.
- **Batch complete :** in dosing mode, indicates that a batch is complete.
- **Refilling in progress :** indicates that a refilling process is running.
- **Extraction activated :** in dosing mode, indicates that the extraction device is activated.
- **Volumetric phase :** in dosing mode, indicates volumetric or gravimetric phases.

13.2 Settings description

13.2.1 Logical inputs assignment

The following table describes the possible assignments.

bits	meaning	note
$b_3 b_2 b_1 b_0$	**input 1 (and input 3 if IO+ version) assignment**	
0000	*none*	*the input has no function*
0001	*tare*	*equivalent to the functions described in § functional commands*
0010	*zero*	
0011	*cancel tare*	
0100	*transmit measurement*/send TPDO2***	*data is transmitted on the bus at every rising or falling edge (depending on the chosen logical)* ***Transmitter mode only***
0101	*Continuous transmit measurement**	*Data is transmitted on the bus while the input is maintained at the right level (depending on the chosen logical). Transmission rate is fixed by the* ***measurement transmission period*** *setting*
0110	*Dynamic zero*	*Same like equivalent functional command describe in § functional commands*
0111	*Start / Stop refilling***	*Not directly equivalent compared to functional commands*
1000	*Start / Stop hopper emptying***	*Not directly equivalent compared to functional commands*
1001	*Start/Stop dosing***	*Not directly equivalent compared to functional commands*
1010	*Suspend / Resume batch***	*Not directly equivalent compared to functional commands*
1011	*Emergency stop*	*There is no associated functional command*
1100	*Clear totalization and errors counter*	*Same like equivalent functional command describe in § functional commands*
1101	*Sensor input control*	*Same like equivalent functional command describe in § functional commands*
b_4	**input 1&3 logical**	
0	*negative logic*	*defines the edge (or level) that triggers input 1 function*
1	*positive logic*	
$b_6 b_5$	**measurement to be transmitted**	
00	*gross*	*only for SCMBus/fast SCMBus*

bits	meaning	note
01	net	protocols, no effect otherwise
10	factory calibrated measurement	
bits	**meaning**	**note**
b11 b10 b9 b8 (or b3 b2 b1 b0 in CANopen®)	**input 2 (and input 4 if IO+ version) assignment**	
0000	none	the input has no function
0001	tare	equivalent to the functions described in § functional commands
0010	zero	
0011	cancel tare	
0100	transmit measurement*/send TPDO3**	data is transmitted on the bus at every rising or falling edge (depending on the chosen logical) **Transmitter mode only**
0101	Continuous transmit measurement*	Data is transmitted on the bus while the input is maintained at the right level (depending on the chosen logical). Transmission rate is fixed by the **measurement transmission period** setting
0110	Dynamic zero	Same like equivalent functional command describe in § functional commands
0111	Start / Stop refilling**	Not directly equivalent compared to functional commands
1000	Start / Stop hopper emptying**	Not directly equivalent compared to functional commands
1001	Start/Stop dosing**	Not directly equivalent compared to functional commands
1010	Suspend / Resume batch**	Not directly equivalent compared to functional commands
1011	Emergency stop	There is no associated functional command
1100	Clear totalization and errors counter	Same like equivalent functional command describe in § functional commands
1101	Sensor input control	Same like equivalent functional command describe in § functional commands
b_{12} (or b_4 in CANopen®)	**input 2&4 logical**	
0	negative logic	defines the edge (or level) that triggers input 1 function
1	positive logic	

bits	meaning	note
b_{14} b_{13} (or b_6 b_5 in CANopen®)	***measurement to be transmitted***	
00	*gross*	*only for SCMBus/fast SCMBus protocols, no effect otherwise*
01	*net*	
10	*factory calibrated measurement*	

** these commands operates on front in a bistable functioning mode. For example for the Start/Stop refilling command, the first front initiates refilling, the second stops it.

Note 1: the functions with a * only are possible in SCMBus and fast SCMBus protocols.

Note 2: in CANopen® communication protocol, to use the *'send TPDOX'* function, it is necessary to configure the TPDO communication parameters (and particularly the communication type) and the mapping for the corresponding TPDO.

13.2.2 Holding time (debounced time)

The holding time (de-bounced time) corresponds to the minimum required stabilization time of the logical inputs before their activation. If the input level varies within this interval, it is ignored.

13.2.3 Analog output(s) assignment (IO+ version)

The following tables describe the possible assignments.

bits	*meaning*	*note*
b3 b2 b1 b0	***analog output(s) assignment***	
0000	*none*	*the output level does not vary*
0001	*copy gross weight*	*Adjustable polarity*
0010	*copy net weight*	
0011	*level on request*	*parameter **External value to control analog output** will drive analog output*
0100	*flow rate control output*	*in loss in weight feeder mode (for extraction device control)*
0101	*copy instantaneous flow rate*	
0110	*copy average flow rate*	
b4	***polarity***	
0	*unipolar*	*could be set only with gross measurement*
1	*bipolar*	
b_7 b_6 b_5	***output voltage settings***	
000	*disable*	
001	*0 V - 5 V*	
010	*0 V - 10 V*	
b_{10} b_9 b_8	***output current settings***	
000	*disable*	
001	*4 mA - 20 mA*	
010	*0 mA - 20 mA*	
011	*0 mA - 24 mA*	
100	*4 mA - 20 mA with alarm at 3.6 mA*	*voltage output is inactive (High-Z state)*

13.2.4 External value to control analog output (IO+ version)

If an external device (e.g. PLC) would like to control extraction command through ***eNod4*** analog output, so that output must be set on ***level on request*** function. In this configuration ***eNod4*** will copy ***external value to control analog output*** parameter on analog output in current and voltage.
The external value parameter is expressed in 0.01% of full scale of analog output current or voltage.

13.2.5 Logical outputs 1&2 assignment

The following table describes the possible assignments.

bits	meaning	note
b3 b2 b1 b0	**output 1 assignment**	
0000	None	the output level does not vary
0001	Set point 1	functioning described by the 'set point functioning' setting and by the 'set point 1 high and low values'
0010	Motion	copies the motion flag of the status bytes (cf. § status register)
0011	Defective measurement	reflect the internal alarm flag described in "Weighing diagnosis" § in the MEASUREMENT AND STATUS §
0100	Input 1 image	copies input 1 level
0101	Level on request	output 1 level is driven by the 'OUT1 activation/deactivation' functional command (cf. § functional commands)
0110	Cycle in progress	In loss in weight feeder mode
0111	External totalizer	In loss in weight feeder mode
1000	Flowrate alarm	In loss in weight feeder mode
1001	Batch complete	In loss in weight feeder mode
1010	Refilling in progress	In loss in weight feeder mode
1011	Extraction activated	In loss in weight feeder mode
1100	Volumetric phase	In loss in weight feeder mode
b4	**output 1 logical**	
0	negative logic	defines the output level when enabled
1	positive logic	
b11 b10 b9 b8 (or b3 b2 b1 b0 in CANopen®)	**output 2 assignment**	
0000	none	the output level does not vary
0001	set point 2	functioning described by the 'set point functioning' setting and by the 'set point 2 high and low values'
0010	motion	copies the motion flag of the status bytes (cf. § status register)
0011	defective measurement	reflect the internal alarm flag described in "Weighing diagnosis" § in the MEASUREMENT AND STATUS §
0100	input 2 image	copies input 2 level
0101	level on request	output 2 level is driven by the 'OUT2 activation/deactivation' functional command (cf. § functional commands)

bits	meaning	note
0110	*Cycle in progress*	*In loss in weight feeder mode*
0111	*External totalizer*	*In loss in weight feeder mode*
1000	*Flowrate alarm*	*In loss in weight feeder mode*
1001	*Batch complete*	*In loss in weight feeder mode*
1010	*Refilling in progress*	*In loss in weight feeder mode*
1011	*Extraction activated*	*In loss in weight feeder mode*
1100	*Volumetric phase*	*In loss in weight feeder mode*
b12 (or b4 in CANopen®)	***output 2 logical***	
0	*negative logic*	*defines the output level when enabled*
1	*positive logic*	*defines the output level when enabled*

13.2.6 Logical outputs 3&4 assignment

Similar to the outputs 1&2 configuration parameter, see previous paragraph (replacing all references to output 1 by output 3 and all references to output 2 by output 4).

13.2.7 Weight quantity per pulse on logical output

When a logical output is assigned to ***external totalizer***, a pulse is generated every time the totalization increases a multiple of a ***weight quantity per pulse on logical output***. The maximum pulse frequency is 10 Hz and pulse duration is fixed at 50ms. The output pulse is not rounded (i.e. the pulse is issued only once ***weight quantity per pulse on logical output*** is strictly exceeded).

13.2.8 Set points functioning

The following table describes the possible assignments.

bits	***meaning***	***note***
b0	***set point 1 commutation mode***	
0	*window*	*only if output 1 assigned to the 'set point' function*
1	*hysteresis*	
b2 b1	***set point 1 comparison measurement***	
00	*gross*	
01	*net*	
10	*Sensor input control result*	
b3	***reserved (0)***	
b4	***set point 2 commutation mode***	
0	*window*	*only if output 2 assigned to the 'set point' function*
1	*hysteresis*	
b6 b5	***set point 2 comparison measurement***	
00	*gross*	
01	*net*	
10	*Sensor input control result*	
b7	***reserved (0)***	
b8 (or b0 in CANopen®)	***set point 3 commutation mode***	
0	*window*	*only if output 3 assigned to the 'set point' function*
1	*hysteresis*	
b10 b9 (or b2 b1 in CANopen®)	***set point 3 comparison measurement***	
00	*gross*	
01	*net*	
10	*Sensor input control result*	
b11 (or b3 in CANopen®)	***reserved (0)***	
b12 (or b4 in CANopen®)	***set point 4 commutation mode***	
0	*window*	*only if output 4 assigned to the 'set point' function*
1	*hysteresis*	
b14 b13 (or b6 b5 in CANopen®)	***set point 4 comparison measurement***	

bits	*meaning*	*note*
00	*gross*	
01	*net*	
10	*Sensor input control result*	
b15 ***(or b7 in CANopen®)***	***reserved (0)***	

13.2.9 Set points high and low values

Each set point is described by its commutation mode (hysteresis/window) and by a couple of values that are constantly compared to the gross or net measurement or to dosing result or dosing running total (depending on the configuration the set point has been given) in order to define the corresponding output logical level. For more details about the set points functioning, please refer to documentation ***eNod4*** "characteristics and functioning".
Admitted values: from -1000000 to 1000000.

13.3 Input/output level

The level of the ***eNod4*** Input/output can be read according to the following table:

Bits	*Meaning*	*Note*
b0		
0	*low*	*IN1 level*
1	*high*	
b1		
0	*low*	*IN2 level*
1	*high*	
b2	***With IO+ version only, else 0***	
0	*low*	*IN3 level*
1	*high*	
b3	***With IO+ version only, else 0***	
0	*low*	*IN4 level*
1	*high*	
b7 ... b4		
0	*reserved (0)*	
b8 (note 1)		
0	*low*	*OUT1 level*
1	*high*	
b9 (note 1)		
0	*low*	*OUT2 level*
1	*high*	
b10 (note 1)		
0	*low*	*OUT3 level*
1	*high*	
b11 (note 1)		
0	*low*	*OUT4 level*
1	*high*	
b15 ... b12 (note 1)		
0	*reserved (0)*	

Note 1: In CANopen® communication protocol (according to version), this word is divided into 2 bytes of 8-bits registers. Bits b8 to b15 are therefore equivalent to bits b0 to b7 of the corresponding address (see CANopen® Register table).

14 LEGAL FOR TRADE OPTIONS

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Legal for trade version	*0x0004 LSB*	*0x3600 / 0x02*	*R : 0x0210 W: 0x0211*	*0x01 / 0x00*	*Byte*	*RO*
Legal for trade switch	*0x0004 MSB*	*0x3600 / 0x01*			*Byte*	*RW*
Legal for trade counter	*0x0005*	*0x3600 / 0x03*	*R : 0x0212*	*0x01 / 0x01*	*Uint*	*RO*
Legal for trade checksum	*0x0006*	*0x3600 / 0x04*	*R : 0x0214*		*Uint*	
Zero functions	*0x0007*	*0x3501 / 0x01*	*R : 0x0216 W: 0x0217*	*0x01 / 0x02*	*Byte*	*RW*
Stability criterion	*0x0008 LSB*	*0x3605 / 0x00*	*R : 0x0218 W: 0x0219*	*0x01 / 0x03*	*Byte*	*RW*
decimal point position	*0x0008 MSB*	*0x3700 / 0x02*			*Byte*	
Weight unit	*0x0009*	*0x3700 / 0x01*	*R : 0x041A W: 0x041B*	*0x01 / 0x04*	*String*	*RW*
Flow rate time unit	*0x005A*	*0x3700 / 0x03*	*R : 0x021E W: 0x021F*	*0x01 / 0x06*	*Uint*	*RW*

14.1 Principles

The legal for trade options are a set of functions and indicators that are generally used in weighing applications. They have an impact on the device behavior regarding the metrological requirements and track every configuration change that may affect the measurement determination.

14.2 Settings description

14.2.1 Legal for trade switch

This setting activates (**b_0 bit set to 1**) or deactivates (**b_0 bit set to 0**) criteria and parameters related to the use of ***eNod4*** in OIML compliance.
The *'legal for trade'* option activation leads to the following changes:

- the *'legal for trade counter'* is incremented every time a storage into EEPROM is requested if one or several metrological settings have been modified.
- a new *'legal for trade checksum'* value is calculated every time a storage into EEPROM is requested if one or several metrological settings have been modified.
- taring is now impossible if gross measurement is negative.
- the measurement value variations cannot be read during the 15 seconds that follow the device reset (error frame in Modbus RTU, value set to -1 in CANopen® and in Profibus DP) and during zero and tare acquisitions

14.2.2 Legal for trade software version

This RO value identifies the version of the part of the software that is dedicated to the metrology and the measurement exploitation.

14.2.3 Legal for trade counter

If the *'legal for trade'* option is enabled, the legal for trade counter is incremented every time a backup into EEPROM is requested if at least one (or several) of these settings has been modified:

- legal for trade switch
- stability criterion
- decimal point position
- maximum capacity
- number of calibration segments

- calibration loads 1/2/3
- scale interval
- span adjusting coefficient
- calibration place/place of use g values
- sensitivity
- A/D conversion rate
- filtering configuration (activation option, order and cut-off frequencies)
- weight unit
- flow rate time unit
- zero functions

14.2.4 Legal for trade checksum

If the 'legal for trade' option is enabled, a new legal for trade checksum is calculated every time a backup into EEPROM is requested if at least one (or several) of the settings listed above has been modified.

14.2.5 Zero functions

The zero tracking and the initial zero setting can be respectively enabled by setting b_0 bit or b_1 bit to 1. When activated, both options are effective on a ±10% range of the *'maximum capacity'* (±2% if the *'legal for trade'* option is enabled).

When the initial zero is used, you must use a stability criterion other than 0 to be not affected by transient effects at power-up.

14.2.6 Stability criterion

The stability criterion defines the interval on which measurements are considered as stable. Motion is indicated by b_4 bit of the measurement status register. A measurement is stable if X consecutive measurements following the reference measurement are included in the stability interval (see following table) else the current measurement becomes the new reference measurement. X depends on the A/D conversion rate.

Bits b2 b1 b0	***Stability criterion***	***Note***
000	*no motion detection (always stable)*	
001	*0,25d*	*1d = 1 scale interval*
010	*0,5d*	
011	*1d*	
100	*2d*	

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*

14.2.7 Decimal point position

Although ***eNod4*** measurements are integer values it is however possible to store a '*decimal point position'* so as to design a display related to the application. Its value represents the number of decimal digits. If the variable is set to Zero, it means that decimal point is not used.
Decimal point position has a consistency and influences flow rate values.
Note: the decimal point is directly integrated to SCMBus protocol frames (see § SCMBus).
Admitted values: from 0 up to 7.

14.2.8 Weight unit

It is possible to store the display weight unit into the ***eNod4***.
This weight unit is a combination of 4 characters and data has no consistency. There is no automatic calculation to adjust flowrate values neither flowrate calibration values.
Note: the unit is directly integrated to SCMBus protocol frames (see § SCMBus).

14.2.9 Flow rate time unit

It is possible to store the display *flow rate time unit* into the ***eNod4***.
Flow rate time unit is a combination of 2 characters and there is no automatic calculation to adjust flow rate value if modified.

In loss in weight feeder mode, following values are permitted for *flow rate time unit* parameter:

- 0x2073 for seconds (**s**)
- 0x6D6E for minutes(**mn**)
- 0x2068 for hours (**h**)

In opposition to the ***weight unit*** behaviour, the ***flowrate unit*** is consistent for instant and average flowrate determination. However and when the time unit is modified, there is no automatic redetermination of calibration flowrate values.

14.2.10 Save Tare and Zero in non-volatile memory

There are two options for saving TARE or ZERO request value in non-volatile memory. These options are accessible through the "dosing cycle options" Object.

15 LOSS IN WEIGHT FEEDER

15.1 Settings list

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Instant flow rate	0x0086	0x5005 / 0x01 (M)	R : 0x0400 + See modules list	/	float	RO
Instant flow rate determination time	0x0058	0x4700 / 0x01	R : 0x0274 W: 0x0275	0x07 / 0x00	Uint	RW
Instant flow rate correction factor	0x002C	0x4700 / 0x02	R : 0x0476 W: 0x0477	0x07 / 0x01	Ulong	RW
Average flow rate	0x0088	0x5005 / 0x02 (M)	R : 0x046E + See modules list	/	float	RO
Nominal flow rate	0x007A	0x4706 / 0x00	R : 0x04AC W: 0x04AD	0x07 / 0x1C	float	RW
Dosing weight deviation	0x0095	0x5007 / 0x05 (M)	R : 0x04FA + See modules list	/	float	RO
Flow rate control output	0x008A	0x5005 / 0x03 (M)	R : 0x04EA + See modules list	/	float	RO
Control output value	0x008C	0x5005 / 0x04 (M)	R : 0x02EC + See modules list	/	Uint	RO
Refilling low level	0x0060	0x4701 / 0x05	R : 0x0482 W: 0x0483	0x07 / 0x07	Ulong	RW
Refilling high level	0x0062	0x4701 / 0x06	R : 0x0484 W: 0x0485	0x07 / 0x08	Ulong	RW
Refilling inflight value	0x0064	0x4701 / 0x07	R : 0x0486 W: 0x0487	0x07 / 0x09	long	RW
Cycle and alarm options	0x005F	0x4701 / 0x04	R : 0x0280 W: 0x0281	0x07 / 0x06	Uint	RW
Fixed flow rate during refilling	0x0066	0x4701 / 0x08	R : 0x0488 W: 0x0489	0x07 / 0x0A	float	RW
End of refill and cycle start stabilization time	0x005E	0x4701 / 0x03	R : 0x027E W: 0x027F	0x07 / 0x05	Uint	RW
Weight to totalize (Great WU)	0x0075	0x4705 / 0x01	R : 0x04A6 W: 0x04A7	0x07 / 0x19	Ulong	RW
Complementary weight to totalize	0x0077	0x4705 / 0x02	R : 0x02A8 W: 0x02A9	0x07 / 0x1A	Uint	RW
Weight to totalize inflight value	0x0078	0x4705 / 0x03	R : 0x04AA W: 0x04AB	0x07 / 0x1B	long	RW
Learning cycle end of refill delay	0x005C	0x4701 / 0x01	R : 0x027A W: 0x027B	0x07 / 0x03	Uint	RW
Learning cycle flow rates reference determination time	0x005D	0x4701 / 0x02	R : 0x027C W: 0x027D	0x07 / 0x04	Uint	RW
Empty hopper level	0x0068	0x4702 / 0x01	R : 0x048E W: 0x048F	0x07 / 0x0D	Ulong	RW
Full hopper level	0x0A3E	0x4702 / 0x02	R : 0x0404 W: 0x0405	0x07 / 0x0F	Ulong	RW
Min permissible instant flow rate	0x006E	0x4704 / 0x01	R : 0x0298 W: 0x0299	0x07 / 0x12	Uint	RW

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Max permissible instant flow rate	*0x006F*	*0x4704 / 0x02*	*R : 0x029A* *W: 0x029B*	*0x07 / 0x13*	*Uint*	*RW*
Min permissible flow rate control output	*0x0070*	*0x4704 / 0x03*	*R : 0x029C* *W: 0x029D*	*0x07 / 0x14*	*Uint*	*RW*
Max permissible flow rate control output	*0x0071*	*0x4704 / 0x04*	*R : 0x029E* *W: 0x029F*	*0x07 / 0x15*	*Uint*	*RW*
Inhibit time of flow rates alarms at start	*0x0072*	*0x4704 / 0x05*	*R : 0x02A0* *W: 0x02A1*	*0x07 / 0x16*	*Uint*	*RW*
Inhibit time of flow rates alarms in service	*0x0073*	*0x4704 / 0x06*	*R : 0x02A2* *W: 0x02A3*	*0x07 / 0x17*	*Uint*	*RW*
Maximum time for refilling start	*0x006B*	*0x4703 / 0x01*	*R : 0x0290* *W: 0x0291*	*0x07 / 0x0E*	*Uint*	*RW*
Time interval for weight variation control on refilling	*0x006C*	*0x4703 / 0x02*	*R : 0x0294* *W: 0x0295*	*0x07 / 0x10*	*Uint*	*RW*
Maximum refilling time	*0x006D*	*0x4703 / 0x03*	*R : 0x0296* *W: 0x0297*	*0x07 / 0x11*	*Uint*	*RW*
Maximum batch time	*0x0074*	*0x4704 / 0x07*	*R : 0x02A4* *W: 0x02A5*	*0x07 / 0x18*	*Uint*	*RW*
Totalizer value (Great WU)	*0x008D*	*0x5006 / 0x01 (M)*	*R : 0x04F0* *+ See modules list*	*/*	*Ulong*	*RO*
Complementary totalizer value	*0x008F*	*0x5006 / 0x02 (M)*	*R : 0x02F2* *+ See modules list*	*/*	*Uint*	*RO*
Dosing status	*0x009A*	*0x5007 / 0x01 (M)*	*R : 0x02FC* *+ See modules list*	*/*	*Uint*	*RO*
Dosing errors report	*0x009B*	*0x5007 / 0x02 (M)*	*R : 0x02FE* *+ See modules list*	*/*	*Uint*	*RO*
Dosing errors counter	*0x009C*	*0x5007 / 0x03 (M)*	*R : 0x023E* *+ See modules list*	*/*	*Uint*	*RO*
Last dosing error	*0x009D*	*0x5007 / 0x04 (M)*	*R : 0x024A* *+ See modules list*	*/*	*Uint*	*RO*
Dosing quality factor	*0x009E*	*0x5005 / 0x05 (M)*	*R : 0x04EE* *+ See modules list*	*/*	*float*	*RO*
Totalization flow rate	*0x00A0*	*0x5006 / 0x03 (M)*	*R : 0x04F8* *+ See modules list*	*/*	*float*	*RO*
Grand total (Great WU)	*0x00A2*	*0x5006 / 0x04 (M)*	*R : 0x04F4* *+ See modules list*	*/*	*Ulong*	*RO*
General total (Great WU)	*0x00A4*	*0x5006 / 0x05 (M)*	*R : 0x04F6* *+ See modules list*	*/*	*Ulong*	*RO*
Extraction time	*0x00A6*	*0x5007 / 0x06 (M)*	*R : 0x0402*	*/*	*float*	*RO*
Calibration of flow rate point 1 (control output value)	*0x0A00*	*0x470A / 0x01*	*R : 0x02B4* *W: 0x02B5*	*0x07 / 0x20*	*Uint*	*RW*
Calibration of flow rate point 2 (control output value)	*0x0A01*	*0x470A / 0x02*	*R : 0x02B6* *W: 0x02B7*	*0x07 / 0x21*	*Uint*	*RW*

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Calibration of flow rate point 3 (control output value)	0x0A02	0x470A / 0x03	R : 0x02B8 W: 0x02B9	0x07 / 0x22	Uint	RW
Calibration of flow rate point 4 (control output value)	0x0A03	0x470A / 0x04	R : 0x02BA W: 0x02BB	0x07 / 0x23	Uint	RW
Calibration of flow rate point 5 (control output value)	0x0A04	0x470A / 0x05	R : 0x02BC W: 0x02BD	0x07 / 0x24	Uint	RW
Calibration of flow rate point 6 (control output value)	0x0A05	0x470A / 0x06	R : 0x02BE W: 0x02BF	0x07 / 0x25	Uint	RW
Calibration of flow rate point 7 (control output value)	0x0A06	0x470A / 0x07	R : 0x02C0 W: 0x02C1	0x07 / 0x26	Uint	RW
Calibration of flow rate point 8 (control output value)	0x0A07	0x470A / 0x08	R : 0x02C2 W: 0x02C3	0x07 / 0x27	Uint	RW
Calibration of flow rate point 9 (control output value)	0x0A08	0x470A / 0x09	R : 0x02C6 W: 0x02C7	0x07 / 0x28	Uint	RW
Calibration of flow rate point 10 (control output value)	0x0A09	0x470A / 0x0A	R : 0x02C8 W: 0x02C9	0x07 / 0x29	Uint	RW
Calibration of flow rate point 1 (flow rate value)	0x0A0A	0x470B / 0x01	R : 0x04CA W: 0x04CB	0x07 / 0x2A	float	RW
Calibration of flow rate point 2 (flow rate value)	0x0A0C	0x470B / 0x02	R : 0x04CC W: 0x04CD	0x07 / 0x2B	float	RW
Calibration of flow rate point 3 (flow rate value)	0x0A0E	0x470B / 0x03	R : 0x04CE W: 0x04CF	0x07 / 0x2C	float	RW
Calibration of flow rate point 4 (flow rate value)	0x0A10	0x470B / 0x04	R : 0x04D0 W: 0x04D1	0x07 / 0x2D	float	RW
Calibration of flow rate point 5 (flow rate value)	0x0A12	0x470B / 0x05	R : 0x04D2 W: 0x04D3	0x07 / 0x2E	float	RW
Calibration of flow rate point 6 (flow rate value)	0x0A14	0x470B / 0x06	R : 0x04D4 W: 0x04D5	0x07 / 0x2F	float	RW
Calibration of flow rate point 7 (flow rate value)	0x0A16	0x470B / 0x07	R : 0x04D6 W: 0x04D7	0x07 / 0x30	float	RW
Calibration of flow rate point 8 (flow rate value)	0x0A18	0x470B / 0x08	R : 0x04D8 W: 0x04D9	0x07 / 0x31	float	RW
Calibration of flow rate point 9 (flow rate value)	0x0A1A	0x470B / 0x09	R : 0x04DA W: 0x04DB	0x07 / 0x32	float	RW
Calibration of flow rate point 10 (flow rate value)	0x0A1C	0x470B / 0x0A	R : 0x04DC W: 0x04DD	0x07 / 0x33	float	RW
Segments number for the calibration curve of flow rate	0x0A1E	0x4709 / 0x00	R : 0x02B2 W: 0x02B3	0x07 / 0x1F	Uint	RW
Reference flow rate control output start refilling	0x0A31	0x4701 / 0x09	R : 0x048A W: 0x048B	0x07 / 0x0B	float	RW
Reference flow rate control output end refilling	0x0A33	0x4701 / 0x0A	R : 0x048C W: 0x048D	0x07 / 0x0C	float	RW
Kp	0x0A35	0x470C / 0x01	R : 0x04DE W: 0x04DF	0x07 / 0x34	float	RW
Ti	0x0A37	0x470C / 0x02	R : 0x04E0 W: 0x04E1	0x07 / 0x35	Ulong	RW
Td	0x0A39	0x470C / 0x03	R : 0x04E2 W: 0x04E3	0x07 / 0x36	Ulong	RW
PID behaviour	0x0A3B	0x470C / 0x04	R : 0x02E4 W: 0x02E5	0x07 / 0x37	Uint	RW
PID adjustment flow rate	0x0A3C	0x470C / 0x05	R : 0x04E6 W: 0x04E7	0x07 / 0x38	float	RW
Number of cycles for PID adjust	0x0A50	0x470C / 0x06	/	0x0B / 0x01	Uint	RW

Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Cut-off frequency of totalization flow rate (x100)	*0x0A51*	*0x4001/ 0x06*	*/*	*0x0B / 0x02*	*Uint*	*RW*
Time unit of totalization flow rate	*0x0A52*	*0x3700/ 0x04*	*/*	*0x0B / 0x03*	*Uint*	*RW*
Weight unit of totalization flow rate	*0x0A53*	*0x3700/ 0x05*	*/*	*0x0B / 0x04*	*Ulong*	*RW*
Dynamic zero acquisition time	*0x005B*	*0x4708 / 0x00*	*R 0x02B0 W 0x02B1*	*0x07 / 0x1E*	*Uint*	*RW*

15.2 Settings description

- **Instant flowrate:** loss in weight during a period of time expressed in ***weight unit*** per ***flow rate time unit***.
- **Instant flow rate determination time:** time in seconds used for ***instant flow rate*** determination.
- **Instant flow rate correction factor:** correction factor coefficient expressed in 10^{-6}, so 1000000 corresponds to a correction factor coefficient of 1.00000 applied on the ***instant flow rate***.
- **Average flow rate:** flow rate output of moving average filter on successive values of instant flowrate.
- **Nominal flow rate:** target of flow rate expressed in ***weight unit*** per ***flow rate time unit***.
- **Dosing weight deviation:** weight deviation between the totalization of weight during 1 second and what should have been totalized at nominal flowrate.
- **Flow rate control output:** this is the flow rate to control the extraction device, expressed in ***weight unit*** per ***flow rate time unit***. It can take either a fixed value of flow rate, or the output of PID controller, if enabled, or a variable flowrate function of weight value in the hopper (or silo) during refilling phase (in smart refilling mode).
- **Control output value:** control value of the analog output expressed in 0.01% of maximum output current or voltage.
- **Refilling low level:** gross weight level below which a refilling has to operate if the ***auto refilling*** option is activated, cf § refilling.
- **Refilling high level:** gross weight level above which a refilling has to stop when there is no ***refilling inflight value***.
- **Refilling inflight value:** refilling stops when the gross weight will reach ***refilling high level*** - ***refilling inflight value*.**

- **Cycle and alarm options:** this register defines cycle and alarms functioning, cf § alarms. See following table:

bits set to 1	***Meaning***
b_7 … b_0	***Cycle options***
b_0	*Batch dosing*
b_1	*Clear totalization when starting a new batch cycle*
b_2	*Auto refilling*
b_3	*Smart refill mode*
b_4	*Acquisition of flow rate refill references on learning cycle*
b_5	*PID activation*
b_6	*End of batch refill suppression*
b_7	***Reserved (0)***
b_{15} … b_8	***Alarm options***
B_8	*Stop dosing and refilling / suspend batch on alarm*
B_9	*Refilling to last value of flow rate*
B_{10}	*Save Tare in non-volatile memory*
B_{11}	*Save Zero in non-volatile memory*
b_{15} … b_{12}	***Reserved (0)***

- **Fixed flow rate during refilling:** flow rate fixed value used during refilling phase when the option ***smart refill mode*** is deactivated, cf § refilling.
- **End of refill stabilization time:** delay in seconds that ensures that the instant flow rate has reached the flow rate target before starting instant flow rate determination phase. This period should be the lowest possible to reduce this volumetric phase to a minimum, cf § refilling.
- **Weight to totalize (Great WU):** in batch mode, the main part of batch target value in ***weight unit*** x 1000, cf § totalization.
- **Complementary weight to totalize:** in batch mode, the complementary part of batch target value in ***weight unit***, cf § totalization.
- **Weight to totalize inflight value:** in batch mode, inflight value target in ***weight unit*** to apply to the weight to totalize, cf § totalization.
- **Learning cycle end of refill delay:** delay in seconds that ensures the average flow rate to be null before activation of the extraction device. It is better to choose a long period to be sure there is no more fall of material and also the average flow rate to be stabilized to zero before activation of the extraction device, cf § learning cycle end of refill delay.
- **Learning cycle flow rates reference determination time:** time in seconds during which the flow rate referencing is carrying out, which will be used to drive the extraction during refilling when the ***smart refill mode*** option is activated, cf § learning cycle flow rates reference determination time.
- **Empty hopper level:** gross weight level under which the dosing stops and an empty hopper alarm occurs.
- **Full hopper level:** gross weight level over which the dosing stops and a full hopper alarm occurs (dosing and refilling are stopped).
- **Min permissible instant flow rate:** low limit of flow rate value under which a flow rate alarm occurs, cf § flow rate / control output alarms. Expressed in 0.1% of nominal flow rate.
- **Max permissible instant flow rate:** high limit of flow rate value over which a flow rate alarm occurs, cf § flow rate / control output alarms. Expressed in 0.1% of nominal flow rate.
- **Min permissible flow rate control output:** low limit of flow rate control output value under which a flow

rate control output occurs, cf § flow rate / control output alarms. Expressed in 0.1% of nominal flow rate.

- **Max permissible flow rate control output:** high limit of flow rate output control value over which a flow rate control output occurs, cf § flow rate / control output alarms. Expressed in 0.1% of nominal flow rate.
- **Inhibit time of flow rates alarms at start:** time throughout no flow rate alarm or flowrate control output alarm will occur when a cycle is starting to allow dosing stabilization, cf § flow rate / control output alarms. Expressed in seconds.
- **Inhibit time of flow rates alarms in service:** time throughout flow rate or flow rate control output values should be kept outside the limit specified for an alarm to occur and after the ***Inhibit time of flow rates alarms at start***, cf § flow rate / control output alarms. Expressed in seconds.
- **Maximum time for refilling start:** maximal delay to the gross weight to be higher than its value at refilling start. The aim is to detect no material fall when activating the refilling whether it is a manual or automatic control (lack of material, clogging, valve or control failure), cf § refilling alarms. Expressed in seconds.
- **Time interval for weight variation control on refilling:** time during which a weight variation should be positive. The aim is to detect any malfunction during the refilling phase (lack of material or clogging), cf § refilling alarms. Expressed in seconds.
- **Maximum refilling time:** maximal time for the refilling phase to complete, cf § refilling alarms. Expressed in second.
- **Totalizer value (Great WU)):** the main totalization result in ***weight unit*** x 1000, cf § totalization.
- **Complementary totalizer value:** the complementary totalization result in ***weight unit***., cf § totalization.
- **Dosing status:** this register describes dosing cycle phases and additional information on the feeder functioning. See following table:

bits set to 1	***Meaning***
b_7 … b_0	***Dosing steps***
b_0	*Stop*
b_1	*Refilling*
b_2	*Learning cycle end of refill delay*
b_3	*End of refilling stabilization*
b_4	*Flow rate determination*
b_5	*Dosing*
b_6	*Batch suspended*
b_7	*Hopper emptying*
b_8	***Reserved (0)***
b_{15} … b_9	***Additional informations***
b_9	*Learning cycle*
b_{10}	*Flow rate calibrated*
b_{11}	*Volumetric dosing*
b_{12}	*Extraction activated*
b_{13}	*Refilling in progress*
b_{14}	*Dosing cycle in progress*
b_{15}	*Batch complete*

- **Dosing errors report:** this register describes exclusively the status of alarms that can occur, cf § alarms. See coding definition in the table below:

b_{15} … b_0 ***bits set to 1***	***Meaning***
b_0	*Instant flow rate > Max permissible instant flow rate*
b_1	*Instant flow rate < Min permissible instant flow rate*
b_2	*Flow rate control output > Max permissible flow rate control output*
b_3	*Flow rate control output < Min permissible flow rate control output*
b_4	*No weight variation on refilling*
b_5	*Too long refilling time*
b_6	*Empty hopper*
b_7	*External totalizer output overflow*
b_8	*Too long dosing batch time*
b_9	*Full hopper*
b_{15} … b_{10}	***Reserved (0)***

- **Dosing errors counter:** this register counts the dosing errors that may occur during dosing cycles. This counter can only be cleared by ***totalization / errors clear*** command, cf § alarms.
- **Last dosing error:** the last dosing error that occurs is stored in this register. Coding definition is equal to the variable ***dosing errors report***. This register can only be cleared by ***totalization / errors clear*** command, cf § functional commands.
- **Dosing quality factor:** every second a standard deviation of the ***dosing weight deviation*** successive values is calculated. Lower is the value, more constant is the flow rate.
- **Totalization flow rate:** information of flow rate that reflects the flow rate used for totalization and can be used for external display purpose (remote display or HMI). It has its own unity and filter.
- **Grand total (Great WU):** high level totalization in ***weight unit*** x 1000. This totalization can be cleared separately by the ***clear grand total*** command. The data of this totalizer is being permanently backed up internally, cf § totalization.
- **General total (Great WU):** high level totalization in ***weight unit*** x 1000. This totalization can be cleared separately by the ***clear general total*** command. The data of this totalizer is being permanently backed up internally, cf § totalization.
- **Extraction time:** time measurement of extraction activation, expressed in seconds. This value is cleared each time the extraction is activated. This parameter may be used for the evaluation of the flow rate accuracy of the loss in weight feeder.
- **Calibration of flow rate point n (control output value):** expressed in 0.01% of maximum output current or voltage. Up to 10 calibration points can be configured, see flow rate calibration, cf § flow rate calibration.
- **Calibration of flow rate point n (flow rate value):** expressed in ***weight unit*** per ***flow rate time unit***. Up to 10 calibration points can be configured, see flow rate calibration, cf § flow rate calibration.
- **Segments number for the calibration curve of flow rate:** when the flow rate of an extraction device has a nonlinear response in function of the flow rate output control, up to 9 segments can be configured, see flow rate calibration, cf § flow rate calibration.
- **Reference flow rate control output start refilling:** reference flow rate value corresponding to the flowrate control output that is applied at the beginning of refilling phase in smart refill mode. In this mode, the flow rate output control value is a function of the gross weight of the hopper or silo. This parameter can be determined automatically by a learning cycle, cf § refilling.
- **Reference flow rate control output end refilling:** reference flow rate value corresponding to the flowrate control output that is applied at the end of refilling phase in smart refill mode. In this mode, the flow rate output control value is a function of the gross weight of the hopper or silo. This parameter can be determined automatically by a learning cycle, cf § refilling.
- **Kp :** proportional coefficient of the PID controller that drives the extraction device. An increase of this

parameter will degrade stability, reduce the rise time and increase the overshoot.

- **T_i :** integration time constant of the PID controller that drives the extraction device, expressed in ms. An increase of this parameter will reduce the steady state error but will degrade stability and increase time rise and overshoot.
- **Td :** derivate time constant of the PID controller that drives the extraction device. Adding some derivate can improve time rise and overshoot. The great majority of extraction devices don't accept derivate correction or a very low value for the derivate term.
- **PID behaviour:** ***eNod4*** is fitted with an automatic adjustment device of the PID parameters. Slow, Fast or stable behaviour can be selected by the ***PID behaviour*** variable that takes **2**, **1** or **0** values respectively.
- **PID adjustment flow rate:** flow rate value that will be used for the automatic adjustment of PID parameters. In addition to the ***PID behaviour*** variable, the variable has to be defined previously to the ***PID parameters auto-adjustment*** command execution.
- **Number of cycles for PID adjust:** It’s the number of cycles during which PID coefficients are calculated. If this number is large, sequence will be longer but computing accuracy will be greater. We advise to fix this number at 10.

16 REGISTERS TABLE

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Protocol	***Program version***	*0x0000*	*0x100A / 0x00*	*R : 0x021C*	*0x01 / 0x05*	*Uint*	*RO*
Protocol	***Address /***	*0x0001*	*0x2002 / 0x00*	*/*	*/*	*Byte*	*RO*
Protocol	***baudrate***		*0x2001 / 0x00*			*Byte*	*RO*
Protocol	***Serial number (not managed)***	*0x0002*	*0x1018 / 0x04*	*/*	*/*	*Ulong*	*RO*
Metrology	***Legal for trade version***	*0x0004 LSB*	*0x3600 / 0x02*	*R : 0x0210 W: 0x0211*	*0x01 / 0x00*	*Byte*	*RO*
Metrology	***Legal for trade switch***	*0x0004 MSB*	*0x3600 / 0x01*			*Byte*	*RW*
Metrology	***Legal for trade counter***	*0x0005*	*0x3600 / 0x03*	*R : 0x0212*	*0x01 / 0x01*	*Uint*	*RO*
Metrology	***Legal for trade checksum***	*0x0006*	*0x3600 / 0x04*	*R : 0x0214*		*Uint*	
Metrology	***Zero functions***	*0x0007*	*0x3501 / 0x01*	*R : 0x0216 W: 0x0217*	*0x01 / 0x02*	*Uint*	*RW*
Metrology	***Stability criterion***	*0x0008 LSB*	*0x3605 / 0x00*	*R : 0x0218 W: 0x0219*	*0x01 / 0x03*	*Byte*	*RW*
Metrology	***decimal point position***	*0x0008 MSB*	*0x3700 / 0x02*			*Byte*	
Metrology	***Weight unit***	*0x0009*	*0x3700 / 0x01*	*R : 0x041A W: 0x041B*	*0x01 / 0x04*	*String*	*RW*
	Reserved (2 bytes)	*0x000B*					
Calibration	***Maximum capacity***	*0x000C*	*0x3002 / 0x00 (M)*	*R : 0x0420 W: 0x0421*	*0x02 / 0x00*	*Ulong*	*RW*
Calibration	***Number of calibration segments***	*0x000E*	*0x3000 / 0x00*	*R : 0x0222 W: 0x0223*	*0x02 / 0x01*	*Uint*	*RW*
Calibration	***Calibration load 1***	*0x000F*	*0x3001 / 0x01 (M)*	*R : 0x0424 W: 0x0425*	*0x02 / 0x02*	*Ulong*	*RW*
Calibration	***Calibration load 2***	*0x0011*	*0x3001 / 0x02*	*R : 0x0426 W: 0x0427*	*0x02 / 0x03*	*Ulong*	*RW*
Calibration	***Calibration load 3***	*0x0013*	*0x3001 / 0x03*	*R : 0x0428 W: 0x0429*	*0x02 / 0x04*	*Ulong*	*RW*
Calibration	***Sensor sensitivity***	*0x0015*	*0x3004 / 0x00 (M)*	*R : 0x042A W: 0x042B*	*0x02 / 0x05*	*Ulong*	*RW*
Calibration	***Scale interval***	*0x0017*	*0x3003 / 0x00*	*R : 0x022C W: 0x022D*	*0x02 / 0x06*	*Uint*	*RW*
Calibration	***Zero calibration***	*0x0018*	*0x3005 / 0x00*	*R : 0x0434 W: 0x0435*	*0x03 / 0x04*	*Long*	*RW*
Calibration	***Span coefficient 1***	*0x001A*	*0x3006 / 0x04*	*R : 0x0436 W: 0x0437*	*0x03 / 0x05*	*Float*	*RW*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Calibration	***Span coefficient 2***	*0x001C*	*0x3006 / 0x05*	*R : 0x0438* *W: 0x0439*	*0x03 / 0x06*	*Float*	*RW*
Calibration	***Span coefficient 3***	*0x001E*	*0x3006 / 0x06*	*R : 0x043A* *W: 0x043B*	*0x03 / 0x07*	*Float*	*RW*
Calibration	***Span adjusting coefficient***	*0x0020*	*0x3006 / 0x01 (M)*	*R : 0x042E* *W: 0x042F*	*0x03 / 0x00*	*Ulong*	*RW*
Calibration	***Calibration place g value***	*0x0022*	*0x3006 / 0x02*	*R : 0x0430* *W: 0x0431*	*0x03 / 0x01*	*Ulong*	*RW*
Calibration	***Place of use g value***	*0x0024*	*0x3006 / 0x03*	*R : 0x0432* *W: 0x0433*	*0x03 / 0x02*	*Ulong*	*RW*
	Reserved (12 bytes)	*0x0026*					
Dosing	***Instant flow rate correction factor***	*0x002C*	*0x4700 / 0x02*	*R : 0x0476* *W: 0x0477*	*0x07 / 0x01*	*Ulong*	*RW*
	Reserved (8 bytes)	*0x002D*					
Inputs/outputs	***External value to control analog output (IO+ version)***	*0x0032*	*0x5050 / 0x00 (M)*	*R : 0x023C* *W: 0x023D* *+ See modules list*	*0x06 / 0x0C*	*Uint*	*RW*
	Reserved (2 bytes)	*0x0033*					
HMI	***HMI name***	*0x0034*	*0x3701 / 0x00*	*/*	*0x0B / 0x00*	*String*	*RW*
Filtering	***A/D conversion rate***	*0x0036*	*0x4000 / 0x00*	*R : 0x0240* *W: 0x0241*	*0x04 / 0x00*	*Uint*	*RW*
Filtering	***filters activation***	*0x0037 LSB*	*0x4001 / 0x01 (byte)*	*R : 0x0242* *W: 0x0243*	*0x04 / 0x01*	*Byte*	*RW*
Filtering	***Low-pass order***	*0x0037 MSB*	*0x4001 / 0x02 (byte)*			*Byte*	
Filtering	***Low-pass cut-off frequency***	*0x0038*	*0x4001 / 0x03*	*R : 0x0244* *W: 0x0245*	*0x04 / 0x02*	*Uint*	*RW*
Filtering	***Depth of moving average filter on weight***	*0x0039*	*0x4001 / 0x04*	*R : 0x0246* *W: 0x0247*	*0x04 / 0x03*	*Uint*	*RW*
Filtering	***Tolerance of clipping filter on instant flow rates***	*0x003A*	*0x4001 / 0x05*	*R : 0x0248* *W: 0x0249*	*0x04 / 0x04*	*Uint*	*RW*
	Reserved (6 bytes)	*0x003B*					
Protocol and functioning mode	***Functioning mode / Serial protocol AUX/USB***	*0x003E*	*Functioning mode 0x2000/0x00 (byte)*	*R : 0x02E8* *W: 0x02E9*	*0x07 / 0x39*	*Uint*	*RW*
	Reserved (2 bytes)	*0x003F*					
Inputs/outputs	***Analog output functioning (IO+ version)***	*0x0040*	*0x4509 / 0x05*	*R : 0x026C* *W: 0x026D*	*0x06 / 0x0B*	*Uint*	*RW*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Inputs/outputs	***Logical input 3 functioning (IO+ version)***	*0x0041 LSB*	*0x4501 / 0x04*	*R : 0x026A W: 0x026B*	*0x05 / 0x02*	*byte*	*RW*
Inputs/outputs	***Logical input 4 functioning (IO+ version)***	*0x0041 MSB*	*0x4501 / 0x05*			*byte*	
Inputs/outputs	***Logical input 1 functioning***	*0x0042 LSB*	*0x4501 / 0x02*	*R : 0x0250 W: 0x0251*	*0x05 / 0x00*	*byte*	*RW*
Inputs/outputs	***Logical input 2 functioning***	*0x0042 MSB*	*0x4501 / 0x03*			*byte*	
Inputs/outputs	***holding time***	*0x0043*	*0x4501 / 0x01*	*R : 0x0252 W: 0x0253*	*0x05 / 0x01*	*Uint*	*RW*
Inputs/outputs	***Output 1 functioning***	*0x0044 LSB*	*0x4509 / 0x01*	*R : 0x0254 W: 0x0255*	*0x06 / 0x00*	*byte*	*RW*
Inputs/outputs	***Output 2 functioning***	*0x0044 MSB*	*0x4509 / 0x02*			*byte*	
Inputs/outputs	***Output 3 functioning***	*0x0045 LSB*	*0x4509 / 0x03*	*R : 0x0256 W: 0x0257*	*0x06 / 0x01*	*byte*	*RW*
Inputs/outputs	***Output 4 functioning***	*0x0045 MSB*	*0x4509 / 0x04*			*byte*	
Inputs/outputs	***Set point 1 high value***	*0x0046*	*0x4601 / 0x02*	*R : 0x025A W: 0x025B*	*0x06 / 0x02*	*Long*	*RW*
Inputs/outputs	***Set point 1 low value***	*0x0048*	*0x4601 / 0x03*	*R : 0x025C W: 0x025D*	*0x06 / 0x03*	*Long*	*RW*
Inputs/outputs	***Set point 2 high value***	*0x004A*	*0x4601 / 0x04*	*R : 0x025E W: 0x025F*	*0x06 / 0x04*	*Long*	*RW*
Inputs/outputs	***Set point 2 low value***	*0x004C*	*0x4601 / 0x05*	*R : 0x0260 W: 0x0261*	*0x06 / 0x05*	*Long*	*RW*
Inputs/outputs	***Set point 3 high value***	*0x004E*	*0x4609 / 0x02*	*R : 0x0262 W: 0x0263*	*0x06 / 0x06*	*Long*	*RW*
Inputs/outputs	***Set point 3 low value***	*0x0050*	*0x4609 / 0x03*	*R : 0x0264 W: 0x0265*	*0x06 / 0x07*	*Long*	*RW*
Inputs/outputs	***Set point 4 high value***	*0x0052*	*0x4609 / 0x04*	*R : 0x0266 W: 0x0267*	*0x06 / 0x08*	*Long*	*RW*
Inputs/outputs	***Set point 4 low value***	*0x0054*	*0x4609 / 0x05*	*R : 0x0268 W: 0x0269*	*0x06 / 0x09*	*Long*	*RW*
Inputs/outputs	***1&2 Set points functioning***	*0x0056 LSB*	*0x4601 / 0x01*	*R : 0x0258 W: 0x0259*	*0x06 / 0x0A*	*byte*	*RW*
Inputs/outputs	***3&4 Set points functioning***	*0x0056 MSB*	*0x4609 / 0x01*			*byte*	
Inputs/outputs	***Weight quantity per pulse on logical output***	*0x0057*	*0x4707 / 0x00*	*R : 0x02AE W: 0x02AF*	*0x07 / 0x1D*	*Uint*	*RW*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	*Instant flow rate determination time*	*0x0058*	*0x4700 / 0x01*	*R : 0x0274 W: 0x0275*	*0x07 / 0x00*	*Uint*	*RW*
Filtering	*Average flow rate determination depth*	0x0059	*0x4700 / 0x03*	*R : 0x0278 W: 0x0279*	*0x07 / 0x02*	Uint	RW
Metrology	*Flow rate time unit*	*0x005A*	*0x3700 / 0x03*	*R : 0x021E W: 0x021F*	*0x01 / 0x06*	*Uint*	*RW*
Measures	*Dynamic zero acquisition time*	*0x005B*	*0x4708 / 0x00*	*R 0x02B0 W 0x02B1*	*0x07 / 0x1E*	*Uint*	*RW*
Dosing	*Learning cycle end of refill delay*	*0x005C*	*0x4701 / 0x01*	*R : 0x027A W: 0x027B*	*0x07 / 0x03*	*Uint*	*RW*
Dosing	*Learning cycle flow rates reference determination time*	*0x005D*	*0x4701 / 0x02*	*R : 0x027C W: 0x027D*	*0x07 / 0x04*	*Uint*	*RW*
Dosing	*End of refill and cycle start stabilization time*	*0x005E*	*0x4701 / 0x03*	*R : 0x027E W: 0x027F*	*0x07 / 0x05*	*Uint*	*RW*
Dosing	*Cycle and alarm options*	*0x005F*	*0x4701 / 0x04*	*R : 0x0280 W: 0x0281*	*0x07 / 0x06*	*Uint*	*RW*
Dosing	*Refilling low level*	*0x0060*	*0x4701 / 0x05*	*R : 0x0482 W: 0x0483*	*0x07 / 0x07*	*Ulong*	*RW*
Dosing	*Refilling high level*	*0x0062*	*0x4701 / 0x06*	*R : 0x0484 W: 0x0485*	*0x07 / 0x08*	*Ulong*	*RW*
Dosing	*Refilling inflight value*	*0x0064*	*0x4701 / 0x07*	*R : 0x0486 W: 0x0487*	*0x07 / 0x09*	*long*	*RW*
Dosing	*Fixed flow rate during refilling*	*0x0066*	*0x4701 / 0x08*	*R : 0x0488 W: 0x0489*	*0x07 / 0x0A*	*float*	*RW*
Dosing	*Empty hopper level*	*0x0068*	*0x4702 / 0x01*	*R : 0x048E W: 0x048F*	*0x07 / 0x0D*	*Ulong*	*RW*
	Reserved (2 bytes)	*0x006A*					
Dosing	*Maximum time for refilling start*	*0x006B*	*0x4703 / 0x01*	*R : 0x0290 W: 0x0291*	*0x07 / 0x0E*	*Uint*	*RW*
Dosing	*Time interval for weight variation control on refilling*	*0x006C*	*0x4703 / 0x02*	*R : 0x0294 W: 0x0295*	*0x07 / 0x10*	*Uint*	*RW*
Dosing	*Maximum refilling time*	*0x006D*	*0x4703 / 0x03*	*R : 0x0296 W: 0x0297*	*0x07 / 0x11*	*Uint*	*RW*
Dosing	*Min permissible instant flow rate*	*0x006E*	*0x4704 / 0x01*	*R : 0x0298 W: 0x0299*	*0x07 / 0x12*	*Uint*	*RW*
Dosing	*Max permissible instant flow rate*	*0x006F*	*0x4704 / 0x02*	*R : 0x029A W: 0x029B*	*0x07 / 0x13*	*Uint*	*RW*
Dosing	*Min permissible flow rate control output*	*0x0070*	*0x4704 / 0x03*	*R : 0x029C W: 0x029D*	*0x07 / 0x14*	*Uint*	*RW*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	***Max permissible flow rate control output***	*0x0071*	*0x4704 / 0x04*	*R : 0x029E* *W: 0x029F*	*0x07 / 0x15*	*Uint*	*RW*
Dosing	***Inhibit time of flow rates alarms at start***	*0x0072*	*0x4704 / 0x05*	*R : 0x02A0* *W: 0x02A1*	*0x07 / 0x16*	*Uint*	*RW*
Dosing	***Inhibit time of flow rates alarms in service***	*0x0073*	*0x4704 / 0x06*	*R : 0x02A2* *W: 0x02A3*	*0x07 / 0x17*	*Uint*	*RW*
Dosing	***Maximum batch time***	*0x0074*	*0x4704 / 0x07*	*R : 0x02A4* *W: 0x02A5*	*0x07 / 0x18*	*Uint*	*RW*
Dosing	***Weight to totalize (Great WU)***	*0x0075*	*0x4705 / 0x01*	*R : 0x04A6* *W: 0x04A7*	*0x07 / 0x19*	*Ulong*	*RW*
Dosing	***Complementary weight to totalize***	*0x0077*	*0x4705 / 0x02*	*R : 0x02A8* *W: 0x02A9*	*0x07 / 0x1A*	*Uint*	*RW*
Dosing	***Weight to totalize inflight value***	*0x0078*	*0x4705 / 0x03*	*R : 0x04AA* *W: 0x04AB*	*0x07 / 0x1B*	*long*	*RW*
Dosing	***Nominal flow rate***	*0x007A*	*0x4706 / 0x00*	*R : 0x04AC* *W: 0x04AD*	*0x07 / 0x1C*	*float*	*RW*
	Reserved (2 bytes)	*0x007C*					
Measures	***Measurement status***	*0x007D*	*0x5003 / 0x00 (M)*	*Module 1 (2 first bytes)*	*/*	*Uint*	*RO*
Measures	***Gross measurement***	*0x007E*	*0x5001 / 0x00 (M)*	*Module 1 (4 last bytes)*	*/*	*Long*	*RO*
Measures	***Tare value***	*0x0080*	*0x5004 / 0x01 (M)*	*R 0x0470*	*/*	*Long*	*RO*
Measures	***Net measurement***	*0x0082*	*0x5000 / 0x00 (M)*	*Module 2 (4 bytes from 3rd)*	*/*	*Long*	*RO*
Measures	***Factory calibrated points***	*0x0084*	*0x5002 / 0x00 (M)*	*Module 2 (4 last bytes)*	*/*	*Long*	*RO*
Dosing	***Instant flow rate***	*0x0086*	*0x5005 / 0x01 (M)*	*R : 0x0400* *+ See modules list*	*/*	*float*	*RO*
Dosing	***Average flow rate***	*0x0088*	*0x5005 / 0x02 (M)*	*R : 0x046E* *+ See modules list*	*/*	*float*	*RO*
Dosing	***Flow rate control output***	*0x008A*	*0x5005 / 0x03 (M)*	*R : 0x04EA* *+ See modules list*	*/*	*float*	*RO*
Dosing	***Control output value***	*0x008C*	*0x5005 / 0x04 (M)*	*R : 0x02EC* *+ See modules list*	*/*	*Uint*	*RO*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	***Totalizer value (Great WU)***	*0x008D*	*0x5006 / 0x01 (M)*	*R : 0x04F0* *+ See modules list*	*/*	*Ulong*	*RO*
Dosing	***Complementary totalizer value***	*0x008F*	*0x5006 / 0x02 (M)*	*R : 0x02F2* *+ See modules list*	*/*	*Uint*	*RO*
Commands	***Command register***	*0x0090*	*0x2003 / 0x00 (M)*	*Module 6*	*/*	*Uint*	*RW*
Commands	***Response register***	*0x0091*	*0x2004 / 0x00 (M)*	*Module 6*	*/*	*Uint*	*RO*
Calibration	***Zero offset***	*0x0092*	*0x2500 / 0x00 (M)*	*R : 0x0472* *W: 0x0473*	*0x03 / 0x03*	*Long*	*RW*
Inputs/outputs	***Logical input level***	*0x0094 LSB*	*0x5100 / 0x00 (M)*	*Module 2*	*/*	*Byte*	*RO*
Inputs/outputs	***Logical ouput level***	*0x0094 MSB*	*0x5200 / 0x00 (M)*			*Byte*	
Dosing	***Dosing weight deviation***	*0x0095*	*0x5007 / 0x05 (M)*	*R : 0x04FA* *+ See modules list*	*/*	*float*	*RO*
Measures	***Preset Tare***	*0x0097*	*0x5004 / 0x02 (M)*	*R : 0x04C4* *W : 0x04C5*	*0x03 / 0x08*	*Ulong*	*RW*
	Reserved (2 bytes)	*0x0099*					
Dosing	***Dosing status***	*0x009A*	*0x5007 / 0x01 (M)*	*R : 0x02FC* *+ See modules list*	*/*	*Uint*	*RO*
Dosing	***Dosing errors report***	*0x009B*	*0x5007 / 0x02 (M)*	*R : 0x02FE* *+ See modules list*	*/*	*Uint*	*RO*
Dosing	***Dosing errors counter***	*0x009C*	*0x5007 / 0x03 (M)*	*R : 0x023E* *+ See modules list*	*/*	*Uint*	*RO*
Dosing	***Last dosing error***	*0x009D*	*0x5007 / 0x05 (M)*	*R : 0x024A* *+ See modules list*	*/*	*Uint*	*RO*
Dosing	***Dosing quality factor***	*0x009E*	*0x5005 / 0x04 (M)*	*R : 0x04EE* *+ See modules list*	*/*	*float*	*RO*
Dosing	***Totalization flow rate***	*0x00A0*	*0x5006 / 0x03 (M)*	*R : 0x04F8* *+ See modules list*	*/*	*float*	*RO*
Dosing	***Grand total (Great WU)***	*0x00A2*	*0x5006 / 0x04 (M)*	*R : 0x04F4* *+ See modules list*	*/*	*Ulong*	*RO*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	***General total (Great WU)***	*0x00A4*	*0x5006 / 0x05 (M)*	*R : 0x04F6* *+ See modules list*	*/*	*Ulong*	*RO*
Dosing	***Extraction time***	*0x00A6*	*0x5007 / 0x06 (M)*	*R : 0x0402*	*/*	*float*	*RO*
	Reserved (16 bytes)	*0x00AE*					

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Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	***Calibration of flow rate point 1 (control output value)***	*0x0A00*	*0x470A / 0x01*	*R : 0x02B4* *W: 0x02B5*	*0x07 / 0x20*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 2 (control output value)***	*0x0A01*	*0x470A / 0x02*	*R : 0x02B6* *W: 0x02B7*	*0x07 / 0x21*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 3 (control output value)***	*0x0A02*	*0x470A / 0x03*	*R : 0x02B8* *W: 0x02B9*	*0x07 / 0x22*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 4 (control output value)***	*0x0A03*	*0x470A / 0x04*	*R : 0x02BA* *W: 0x02BB*	*0x07 / 0x23*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 5 (control output value)***	*0x0A04*	*0x470A / 0x05*	*R : 0x02BC* *W: 0x02BD*	*0x07 / 0x24*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 6 (control output value)***	*0x0A05*	*0x470A / 0x06*	*R : 0x02BE* *W: 0x02BF*	*0x07 / 0x25*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 7 (control output value)***	*0x0A06*	*0x470A / 0x07*	*R : 0x02C0* *W: 0x02C1*	*0x07 / 0x26*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 8 (control output value)***	*0x0A07*	*0x470A / 0x08*	*R : 0x02C2* *W: 0x02C3*	*0x07 / 0x27*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 9 (control output value)***	*0x0A08*	*0x470A / 0x09*	*R : 0x02C6* *W: 0x02C7*	*0x07 / 0x28*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 10 (control output value)***	*0x0A09*	*0x470A / 0x0A*	*R : 0x02C8* *W: 0x02C9*	*0x07 / 0x29*	*Uint*	*RW*
Dosing	***Calibration of flow rate point 1 (flow rate value)***	*0x0A0A*	*0x470B / 0x01*	*R : 0x04CA* *W: 0x04CB*	*0x07 / 0x2A*	*float*	*RW*
Dosing	***Calibration of flow rate point 2 (flow rate value)***	*0x0A0C*	*0x470B / 0x02*	*R : 0x04CC* *W: 0x04CD*	*0x07 / 0x2B*	*float*	*RW*
Dosing	***Calibration of flow rate point 3 (flow rate value)***	*0x0A0E*	*0x470B / 0x03*	*R : 0x04CE* *W: 0x04CF*	*0x07 / 0x2C*	*float*	*RW*
Dosing	***Calibration of flow rate point 4 (flow rate value)***	*0x0A10*	*0x470B / 0x04*	*R : 0x04D0* *W: 0x04D1*	*0x07 / 0x2D*	*float*	*RW*

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Dosing	Calibration of flow rate point 5 (flow rate value)	0x0A12	0x470B / 0x05	R : 0x04D2 W: 0x04D3	0x07 / 0x2E	float	RW
Dosing	Calibration of flow rate point 6 (flow rate value)	0x0A14	0x470B / 0x06	R : 0x04D4 W: 0x04D5	0x07 / 0x2F	float	RW
Dosing	Calibration of flow rate point 7 (flow rate value)	0x0A16	0x470B / 0x07	R : 0x04D6 W: 0x04D7	0x07 / 0x30	float	RW
Dosing	Calibration of flow rate point 8 (flow rate value)	0x0A18	0x470B / 0x08	R : 0x04D8 W: 0x04D9	0x07 / 0x31	float	RW
Dosing	Calibration of flow rate point 9 (flow rate value)	0x0A1A	0x470B / 0x09	R : 0x04DA W: 0x04DB	0x07 / 0x32	float	RW
Dosing	Calibration of flow rate point 10 (flow rate value)	0x0A1C	0x470B / 0x0A	R : 0x04DC W: 0x04DD	0x07 / 0x33	float	RW
Dosing	Segments number for the calibration curve of flow rate	0x0A1E	0x4709 / 0x00	R : 0x02B2 W: 0x02B3	0x07 / 0x1F	Uint	RW
	Reserved (36 bytes)	0x0A1F					
Dosing	Reference flow rate control output start refilling	0x0A31	0x4701 / 0x09	R : 0x048A W: 0x048B	0x07 / 0x0B	float	RW
Dosing	Reference flow rate control output end refilling	0x0A33	0x4701 / 0x0A	R : 0x048C W: 0x048D	0x07 / 0x0C	float	RW
Dosing	Kp	0x0A35	0x470C / 0x01	R : 0x04DE W: 0x04DF	0x07 / 0x34	float	RW
Dosing	Ti	0x0A37	0x470C / 0x02	R : 0x04E0 W: 0x04E1	0x07 / 0x35	Ulong	RW
Dosing	Td	0x0A39	0x470C / 0x03	R : 0x04E2 W: 0x04E3	0x07 / 0x36	Ulong	RW
Dosing	PID behavior	0x0A3B	0x470C / 0x04	R : 0x02E4 W: 0x02E5	0x07 / 0x37	Uint	RW
Dosing	PID adjustment flow rate	0x0A3C	0x470C / 0x05	R : 0x04E6 W: 0x04E7	0x07 / 0x38	float	RW
Dosing	Full hopper level	0x0A3E	0x4702 / 0x02	R : 0x0404 W: 0x0405	0x07 / 0x0F	Ulong	RW
	Reserved (8 bytes)	0x0A40					
Measures	Sensor input control reference	0x0A44	0x5004 / 0x03 (M)	R : 0x044C W: 0x044D	0x0A / 0x00	long	RW

Chapter	Name	Modbus address	CANopen® Index/sub-index	Profibus cyclic IN/OUT	Acyclic DPV1 slot/index	Type	Access
Measures	***Sensor input control result***	*0x0A46*	*0x5004 / 0x04 (M)*	*R : 0x024E*	*0x0A / 0x01*	*Int*	*RO*
Measures	***Sensor input control result max. tolerance***	*0x0A47*	*0x5004 / 0x05*	*R: 0x020A* *W: 0x020B*	*0x0A / 0x02*	*Uint*	*RW*
Measures & Inputs/ outputs	***Defective measurement debounced time***	*0x0A48*	*0x4509 / 0x06*	*R:0x02EC* *W:0x02ED*	*0x06 / 0x0D*	*Uint*	*RW*
Measures & Inputs/ outputs	***Defective measurement alarm activation time***	*0x0A49*	*0x4509 / 0x07*	*R:0x02EE* *W:0x02EF*	*0x06 / 0x0E*	*Uint*	*RW*
Dosing	***Number of cycles for adjustment PID***	*0x0A50*	*0x470C / 0x06*	*/*	*0x0B / 0x01*	*Uint*	*RW*
Measures	***Cut-off frequency for totalization flow rate (x100)***	*0x0A51*	*0x4001 / 0x06*	*/*	*0x0B / 0x02*	*Uint*	*RW*
Measures	***Time unit for totalization flow rate***	*0x0A52*	*0x3700 / 0x04*	*/*	*0x0B / 0x03*	*Uint*	*RW*
Measures	***Weight unit for totalization flow rate***	*0x0A53*	*0x3700 / 0x05*	*/*	*0x0B / 0x04*	*Ulong*	*RW*
	Reserved (8 bytes)	*0x0A4A*					

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