scaime

AXD-D / AAD-D / DVX-D / DVS-D

Digital load-cell

CANopen®
communication protocol

AXD-D / AAD-D / DVX-D / DVS-D

Digital load-cell

Document revisions		
version	**date**	**description**
A	12/09	- Document creation
B	06/10	- V114 firmware new functions presentation (dynamic dosing / dynamic zero) - dosing error report updated
C	02/13	- Update for AAD and v2.01 release - Add zero and tare in determined time command
D	04/17	- V 2.03 firmware new Feed mode (CF / CF + FF) - Add DVX-D and DVS-D
E	11/18	- Add CAN H and L on C1 (pins 3 and 4) for DVX/DVS (2x8-pins connectors version)

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1 INSTALLATION

1.1 CAN bus connection

Digital load cell is equipped with a CAN 2.0A compatible interface supporting **CANopen® communication protocol**.

Digital load cell can be connected to a CAN bus using **CANH** and **CANL** connections which are differently located depending of the load cell version :

Connector 1 (C1)
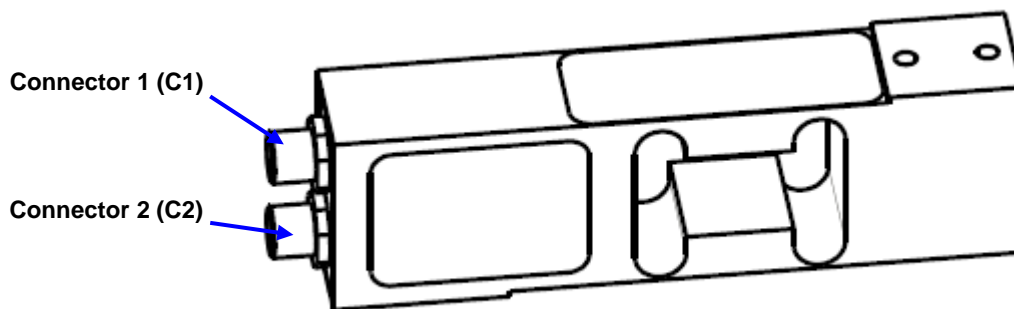
Connector 2 (C2)

➢ **2 x 5-pins connectors version :**
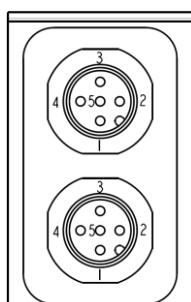
- CANH : pin 4 of C1 connector
- CANL : pin 5 of C1 connector

➢ **2 x 8-pins connectors version :**
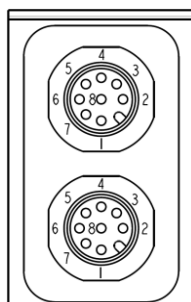
- CANH : pin 3 and 5 of C1 connector
- CANL : pin 4 and 6 of C1 connector

WARNING : Digital load cell is also equipped with a 2-wires RS485 output. If the load cell receives a valid frame (ModBus-RTU or SCMBus) by the RS485 output, it switches automatically into this communication mode (using the memorized communication protocol) and stops to transmitting on the CAN bus.

The load cell returns to **CANopen®** protocol after next reset (hardware or software).

By default, the baud rate for CAN communication is **125 kbauds**. It can be modified during sensor setting up phase with *eNodView* software.

1.2 Bus length and bit rate

The bit rate on the CAN bus for data transfer depends on the bus length. The following table shows the bit rates supported by the digital load cell and the corresponding maximum bus length :

Bit rate	Bus max length	Nominal bit time
1 Mbit/s	25 m	1 µs
800 kbit/s	50 m	1,25 µs
500 kbit/s	100 m	2 µs
250 kbit/s	250 m	4 µs
125 kbit/s	500 m	8 µs
50 kbit/s	1000 m	20 µs

Notes :

- ➢ for bus whose length is greater than 200 m, using optocouplers is recommended.
- ➢ for bus whose length is greater than 1000 m, using repeaters may be necessary to ensure the quality of transmissions.

The baud rate used by the digital load cell can be selected and modified either by writing a specific code in the appropriate entry of the object dictionary (cf. § 4.1.2), either by modifying the appropriate register in ModBus-RTU or SCMBus protocols (using *eNodView* makes this operation easy).

A **« bit Timing »** adapted to each baud rate is also specified by CANopen® specification. A bit is composed of **time quantas** and is characterized by the **Sample point**, which corresponds to the moment at which the bit state is taken into account.

Thus, the data transfers have to respect the following values, according to CANopen® specifications :

Bit rate	Recommended "Sample point" location	Sensor sample point location
1 Mbit/s	75% à 90%	80%
800 kbit/s	75% à 90%	68%
500 kbit/s	85% à 90%	85%
250 kbit/s	85% à 90%	87.5%
125 kbit/s	85% à 90%	87.5%
50 kbit/s	85% à 90%	87.5%

1.3 Line terminations

So as to avoid signal reflection phenomena that may lead to communication errors, the CAN bus **must** be closed through termination resistors. 150-ohm resistors must be placed at each bus extremity.
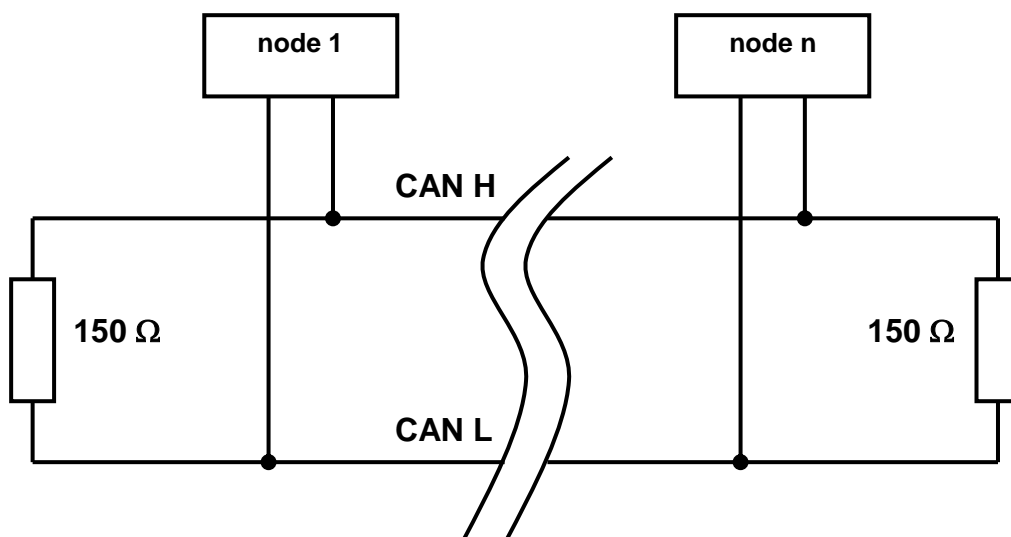
The cables, connectors and termination resistors used in CANopen networks shall meet the requirements defined in /ISO11898-2/. In addition, here are given some guidelines for selecting cables and connectors. The following table shows some standard values for DC parameters for CANopen networks with less than 64 nodes.

Bus length [m]	Caractéristiques du câble en DC		Termination resistance [Ω]	Bit-rate [kbit/s]
	Length-related resistance [mΩ/m]	Cross-section [mm2]		
0 to 40	70	0.25 to 0.34	124	1000 to 40m
40 to 300	<60	0.34 to 0.6	150 to 300	≤500 to 100m
300 to 600	<40	0.5 to 0.6	150 to 300	>100 to 500m
600 to 1000	<26	0.75 to 0.8	150 to 300	>50 to 1km

Recommended cable AC parameters: 120-Ω impedance and 5-ns/m specific line delay.

Besides the cable impedance, the actual impedance of the connectors shall be considered, if calculating the voltage drop. The transmission resistance of one connector should be in the range of 2,5 to 10 mΩ.

The following table defines the maximum wiring length is given for different bus cables and different number of connected bus nodes.

Wire cross-section [mm2]	Maximum wiring length for different bus cables and different number of connected nodes		
	Nb de nœuds <32	Nb de nœuds <64	Nb de nœuds <100
0.25	200	170	150
0.5	360	310	270
0.75	550	470	410

2 CANopen® PROTOCOL DESCRIPTION

2.1 CAN 2.0A frame format

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

SOF 1 bit	COB-ID 11 bits	RTR 1 bit	reserved 2 bits	DLC 4 bits	DATA 0 $\Rightarrow$ 64 bits	CRC 16 bits	ACK 2 bits	EOF 7 bits

Arbitration field   Control field
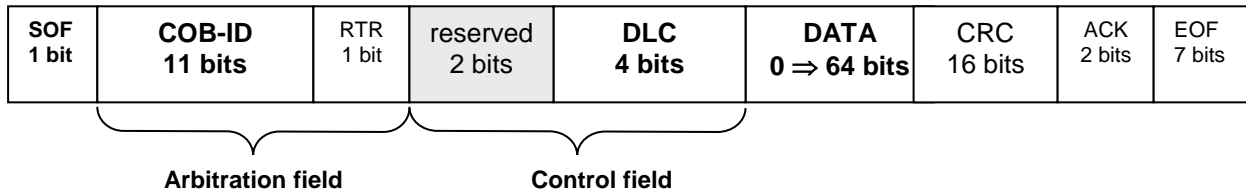
- **Start of frame (SOF) : 1 bit**
  The beginning of a request or a data frame is indicated by the transmission of one dominant bit.

- **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 $0 \leq DLC \leq 8$.

- **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.

2.2 General informations

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 <u>mandatory</u>.**

There are 6 different message types :

⇨ 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**

CANopen® messages	COB-ID (hex)
NMT	0
SYNC	80
EMCY	81-FF
TPDO1	181 – 1FF
RPDO1	201 – 280
TPDO2	281 – 2FF
TPDO3	381 – 3FF
SDO (Tx)	581 – 5FF
SDO (Rx)	601 – 67F
Heartbeat/Boot-up	701 – 77F

2.3 Digital load cell status management

For the CANopen® network, sensor digital load cell 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, digital load cell 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 :
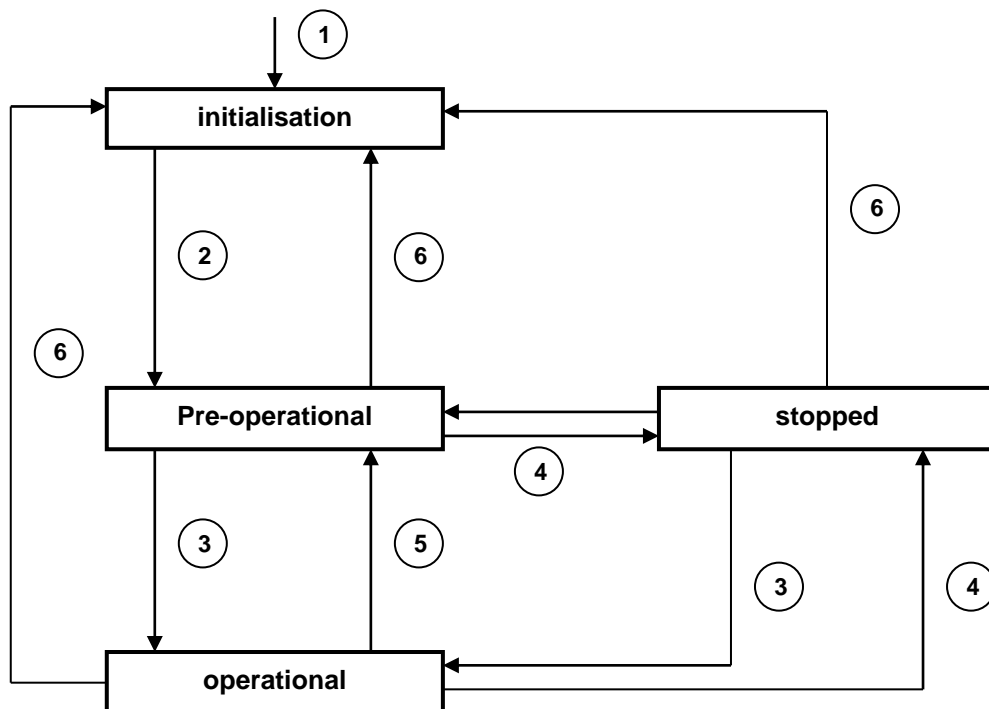
- ➤ 1 : Sensor device power-up
- ➤ 2 : automatic transition after the end of initialization
- ➤ 3 : reception of a **'Start Node'** indication
- ➤ 4 : reception of a **'Stop Node'** indication
- ➤ 5 : reception of an **'Enter pre-operational mode'** indication
- ➤ 6 : reception of a **'Reset node'** or a **'Reset communications'** indication

Digital load cell communication capacities for each state are given in the following table :

	Initialisation	Pre-operational	Operational	Stopped
SDO		●	●	
PDO			●	
SYNC		●	●	
Emergency		●	●	
NMT		●	●	●
Boot-up	●			
Heartbeat		●	●	●

2.3.1 NMT state commands

Except during the initialisation phase, sensor digital load cell 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-bytes 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. Digital load cell is set into **operational** state

➪ **« Stop node »** : 02_H. Digital load cell is set into **stopped** state

➪ **« Reset node »** : 81_H. Resets digital load cell (with the same effects as a power-up), back into **initialisation** state.

➪ **« Reset communication »** : 82_H. back into **initialisation** state.

➪ **« Enter pre-operational mode »** : 80_H. Digital load cell is set into **pre-operational** state

2.3.2 Synchronisation messages

SYNC messages are emitted on the bus by a producer node. 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). Digital load cell is only seen as a SYNC messages consumer whose COB-ID is equal to 80_H as it is indicated at index 1005_H, sub-index 00_H of the object dictionary.

2.3.3 Emergency messages

The internal errors of the digital load cell 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 sensor	8	emergency code		error register content	additional informations				

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 the digital load cell 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
8220	PDO excess length
Additional informations (hex.)	
4B4F (ASCII:OK)	no error
474C (LG)	life time has elapsed
564F (OV)	sensor signal outside of the input signal range
5054 (TP)	CAN transmitter in error passive state
5052 (RP)	CAN receiver in error passive state
4546(FE))	flow rate failure / cycle starting error
504C(LP)	PDO length error

The error register value is also part of the emergency frame (cf. § 3.2.1) 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$_H$.

2.4 Error control services

CANopen® uses smart mechanisms to control permanently the nodes state on the bus. digital load cell 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.

2.4.1 Heartbeat and Boot-up

Digital load cell state control can be done through the use of Heartbeat and boot-up mechanisms :

➢ **Boot-up** : this message sent by the sensor means that initialisation 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 sensor	1	0

➢ **Heartbeat** : if a Heartbeat period (in ms) different from 0 is set in the entry «Producer heartbeat time» of the object dictionary, digital load cell generates at its 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 sensor	1	sensor NMT state

Sensor 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.

2.4.2 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 sensor. Digital load cell 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 the other.
> ➢ l**ife 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, digital load cell **sends an emergency telegram then switches to stopped 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.
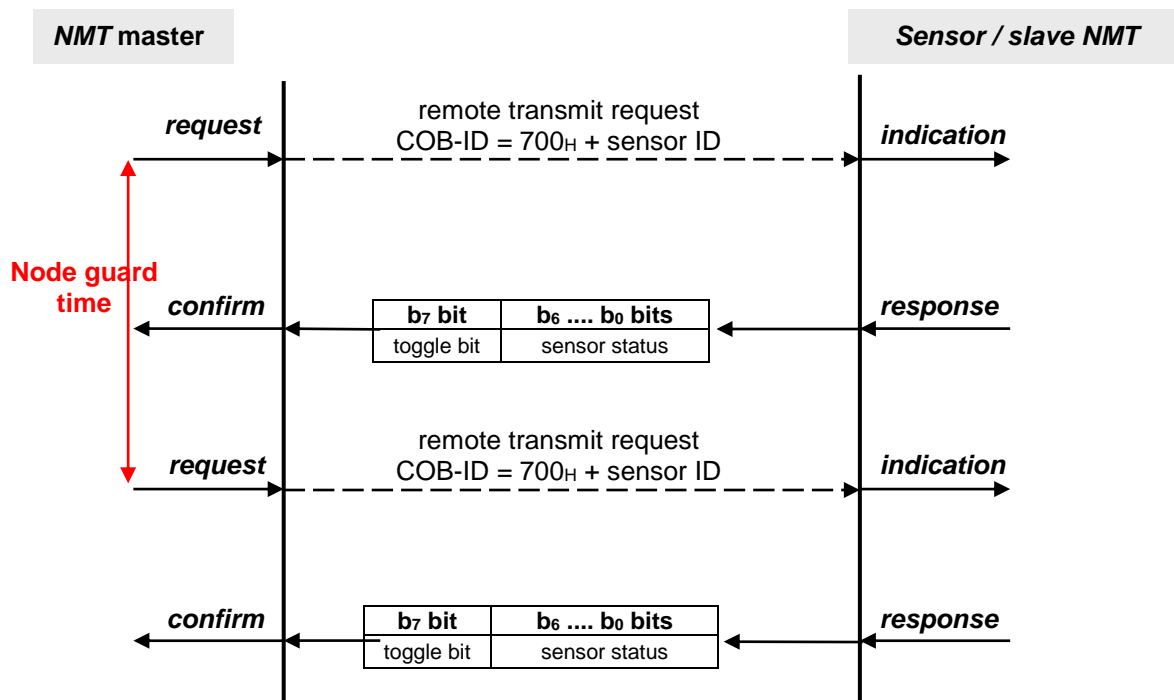
Switching to the stopped NMT state because of a node guarding error may cause sensor to be set into a configurable safety mode where parts of its functioning are inhibited (cf. § 4.6.8).

2.5 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	standardised device profile area
A000 ⇒ FFFF	reserved

Only the greyed elements of the table are accessible through sensor OD.
The whole object dictionary is accessible and can be configured from usual CANopen® configuration tools. This can be done using **sensor available EDS file (named 195709_sensorName-X.eds)**.

2.5.1   SDO communications :

The model for SDO communication is a client/server model as described below :
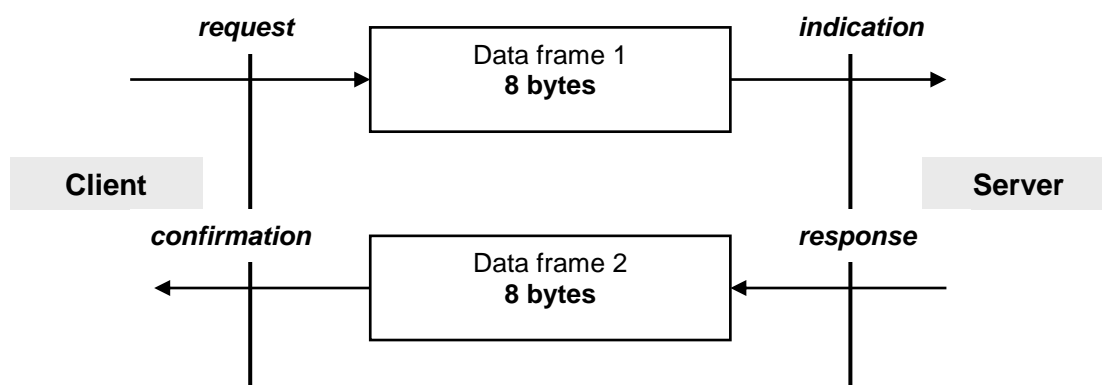
The node that sends the request is the client application whereas sensor only behaves as the server application. There are two types of requests, write and read requests. Both have the same structure :

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$_H$ ou 600$_H$ + ID sensor	8	see table	LSB	MSB	/	LSB	-	-	MSB

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

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, digital load cell 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.

Error code (hex.)	Description
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)
6090011	Sub-Index does not exist
6090012	data type does not match, length of service parameter too high
6090013	data type does not match, length of service parameter too low
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

2.5.2   PDO communications

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

The model used for PDO transmissions is also 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. Digital load cell uses **3 TPDO** (2 are programmable) and **1 RPDO**.

The PDO transmission mode can be set in the corresponding object with the following attributes :

> ⇨ **Synchronous** : PDO transmission is triggered by the reception of one ore more SYNC messages. Several options are available :

- cyclic : PDO is sent 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 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 after a SYNC message following one of these events : - activation of a logical input assigned to « send TPDO » - mapped object variation superior to +/- delta
01 – F0 (= n)	X		X		X	PDO transmission after n SYNC messages
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
FF				X	X	Periodic PDO emission. Period can be configured (min = 1 ms).

3 CANopen® OBJECTS DICTIONNARY : COMMUNICATION OBJECTS

Index	Max sub-index	Description	Access	mappable (PDO)	Type
0x1000	0	device profile	RO	N	unsigned32
0x1001	0	error register	RO	N	unsigned8
0x1003	1	pre-defined error field	variable	N	/
0x1005	0	SYNC messages COB-ID	RO	N	unsigned32
0x1008	0	device name	CO	N	visible string
0x1009	0	hardware version	CO	N	visible string
0x100A	0	software version	CO	N	visible string
0x100C	0	life guard	R/W	N	unsigned16
0x100D	0	life time factor	R/W	N	unsigned8
0x1010	1	store parameters	variable	N	/
0x1014	0	emergency messages COB-ID	RO	N	unsigned32
0x1017	0	producer heartbeat time	R/W	N	unsigned16
0x1018	1	device identity	RO	N	/
0x1400	2	RPDO1 communication parameter	RO	N	/
0x1600	1	RPDO1 mapping parameter	CO	N	/
0x1800	2	TPDO1 communication parameter	RO	N	/
0x1801	5	TPDO2 communication parameter	variable	N	/
0x1802	5	TPDO3 communication parameter	variable	N	/
0x1A00	1	TPDO1 mapping parameter	CO	N	/
0x1A01	3	TPDO2 mapping parameter	R/W	N	/
0x1A02	3	TPDO3 mapping parameter	R/W	N	/

> R/W : Read/Write
> RO : Read Only
> CO : Constant value
> Y : Yes
> N : No
> / : the sub-index of the entry have different sizes

3.1 Device identification

3.1.1 0x1000 : Device profile

This entry describes the device and if it respects a standard profile.
Access : Read only
Default value : 00000000$_H$
Digital load cell does not follow any CIA® standardised profile

3.1.2   0x1008 : Device name

The device name is coded as a 4-bytes string (ASCII).
Access : Read only
Default value : 44445841$_H$

$$
\begin{array}{lll}
\text{MSB} & - \text{0x44} \Rightarrow \textbf{D} \\
           & - \text{0x44} \Rightarrow \textbf{D} \\
           & - \text{0x58} \Rightarrow \textbf{X} \\
\text{LSB} & - \text{0x41} \Rightarrow \textbf{A}
\end{array}
$$

3.1.3   0x1009 : Hardware version

The device hardware version is coded as a 4-bytes string (ASCII).
Access : Read only
Default value : 31302E31$_H$

$$
\begin{array}{lll}
\text{MSB} & - \text{0x31} \Rightarrow \textbf{1} \\
           & - \text{0x30} \Rightarrow \textbf{0} \\
           & - \text{0x2E} \Rightarrow \textbf{.} \\
\text{LSB} & - \text{0x31} \Rightarrow \textbf{1}
\end{array}
$$

3.1.4   0x100A : Software version

The device software current version is coded as a 4-bytes string (ASCII).
Access : Read only
Default value : 34312E31$_H$

$$
\begin{array}{lll}
\text{MSB} & - \text{0x33} \Rightarrow \textbf{4} \\
           & - \text{0x31} \Rightarrow \textbf{1} \\
           & - \text{0x2E} \Rightarrow \textbf{.} \\
\text{LSB} & - \text{0x31} \Rightarrow \textbf{1}
\end{array}
$$

3.1.5   0x1018 Product identifier

This index includes SCAIME **« vendor ID »** supplied by CAN in Automation (CiA®).

Sub-index	Description	Access	Default value	mappable (PDO) ?	Type
0x00	index max	RO	0x01	N	unsigned8
0x01	Vendor-ID	RO	0x00000142	N	unsigned32

3.2   CANopen® settings

3.2.1   0x1001 : Error register

The device internal errors are indicated by flag bits of this byte.
Access : Read only
Default value : /

bit set to 1	Meaning
b0	generic error detected
b1	reserved (0)
b2	A/D converter input voltage error
b3	reserved (0)
b4	CAN bus communication error

b5	reserved (0)
b6	reserved (0)
b7	EEPROM error

Bit 0 (generic error) is set to 1 if at least one error is detected.

3.2.2   0x1003 : Pre-defined error field

This entry of the OD stores the errors that have been reported by emergency telegrams.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	reported errors counter	R/W	0	N	unsigned 8
0x01	last reported error	RO	0	N	unsigned 32

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.

For the writing of all other values, digital load cell transmits the error code 0x06090030.

3.2.3   0x1005 : Synchronization messages COB-ID

This object contains the messages COB-ID value supported by digital load cell as synchronization messages (Used for PDO activating).

Access : Read only

Default value: 80$_H$

3.2.4   0x100C : Life guard

The life guard is one of the two parameters used by the node guarding protocol (errors detection). When Heartbeat is inactive and Life guard is different from 0, digital load cell responds to NMT master periodic (period equal to life guard) remote transmit requests.

Access : Read/Write

Default value : 0$_H$

3.2.5   0x100D : Life time factor

By multiplying the life guard by the life time factor the node life time (cf. §2.4.2) can be determined. When node guarding is active, if the node has not been polled within this duration (in ms), **sensor state** is set to **stopped**. Sensor behaviour while stopped can be configured via the object at index 0x4800.

Access : Read/write

Default value: 0$_H$

3.2.6   0x1010 : Store parameters

This entry can be used to store in non-volatile memory (EEPROM) sensor current settings. It allows keeping them despite a power failure and some of them only apply after storage in EEPROM followed by a reset (hardware or software) procedure. The entry has two sub-indexes.

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

Storing all settings in EEPROM requires writing the ASCII string « save » (65766173$_H$) to sub-index 01$_H$.

- 0x65 $\Rightarrow$ **e**
- 0x76 $\Rightarrow$ **v**
- 0x61 $\Rightarrow$ **a**
- 0x73 $\Rightarrow$ **s**

When accessing to sub-index 1 with a read request, digital load cell responds with value of 1 that means that parameters are stored in non-volatile memory only on request.

3.2.7   0x1014 : Emergency COB-ID

The COB-ID of emergency messages transmitted by sensor is stored at this index.
Its value is automatically updated if the node identifier is modified.
Access : read only
Default value : 81$_H$

3.2.8   0x1017 : Producer heartbeat time

If a period different from 0 is written to this index, sensor periodically generates a Heartbeat frame (see §2.4.1). It is expressed in ms and must be comprised between 1 and 65535.
Access : Read/write
Default value : 0$_H$

3.2.9   0x1400 : RPDO1 communication parameters

This entry contains information concerning the data transmission made by PDO to digital load cell. It includes three sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	COB-ID RPDO1	RO	0x00000200+ ID sensor	N	unsigned32
0x02	Transmission type	RO	0xFF	N	unsigned8

- ➤ The RPDO1 messages COB-ID is automatically updated when sensor identifier is modified.
- ➤ The transmission type for RPDO1 messages cannot be overwritten. A value of FF$_H$ means that the RPDO are taken into account by sensor upon reception.

3.2.10 RPDO1 mapping parameters

The RPDO1 mapping parameter contains the index (byte 3, byte 2), the sub-index (byte 1) and the size of the mapped object (byte 0) where received data are automatically transferred.
This entry has two sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Size
0x00	number of mapped objects	RO	0x01	N	unsigned8
0x01	1st object mapping	RO	0x20030008	N	unsigned32

The data stored in sub-index 01$_H$ can be read as :

- 0x2003 $\Rightarrow$ OD entry index
- 0x00 $\Rightarrow$ OD entry sub-index
- 0x08 $\Rightarrow$ 8-bits size

This RPDO is especially dedicated to accept functional commands coded on one byte such as **'Tare'** or **'Zero'**. The possible commands are listed below :

Code (hex.)	Effect	Note
00	set command register to IDLE state	⇨ no command to execute
D0	reset	⇨ Same as boot up
D1	EEPROM saving	⇨ Save all factory parameters in sensor EEPROM
D2	Initialize sensor to default parameters	⇨ **WARNING**! All factory parameters are restored included node address, bit rate and calibration.
D3	zero acquisition	⇨ requires measure stability, if stability is not reached after 5 seconds, the command is cancelled ⇨ this new zero value will be the new current value but won't be stored in EEPROM ; limited to a ±10% range of the maximum capacity or ±2% in legal for trade
D4	tare request	⇨ requires measure stability, if stability is not reached after 5 seconds, the command is cancelled
D6	Cancel current command	⇨ Cancel current command (tare, zero adjustment, physical calibration)
D7	user's span adjustment	⇨ must be followed by the *« save calibration »* command
D8	zero adjustment	⇨ must be followed by the *« save calibration »* command ⇨ OR by the *« physical calibration »* command
EC	physical calibration	⇨ allows to physically adjust the span by using a calibration load, must be preceded by the *« zero adjustment »* command and must be followed by the *« save calibration »* command. (the calibration load corresponds to the number assigned to '*calibration load*')
DE	save calibration	⇨ stores the calibration into EEPROM
DF	clear	⇨ stops current cycle and resets all the calculated variables
E4	start dosing cycle	⇨ starts a cycle of dosing by filling or dosing by unloading (depending of the functioning mode) if start conditions are respected
E5	stop cycle	⇨ stops the current dosing cycle

E6	cancel tare	⇨ erases last tare value
E7	forcing output 1 state	⇨ only in *« transmitter » functioning mode*, if the concerned output is assigned to '*level on request*'
E8	forcing output 2 state	
E9	forcing output 3 state	⇨ send this command to activate the corresponding output (depending of the chosen logic), resend this command again to desactivate it and so on.
EA	forcing output 4 state	
EB	erase max peak value	⇨ max peak = current gross value
ED	dynamic zero	⇨ zero determination without stability criterion calculated during the 'dynamic zero time' ⇨ limited to a ±10% range of the maximum capacity
F0	Zero in specified time	⇨ Zero set with stability criterion after a calculation time "time for tare determination / result
F1	Tare in specified time	⇨ Tare set with stability criterion after a calculation time "time for tare determination / result"

Note: Zero in determined time: When measure is not stable, zero or tare is set dynamically within the "time for tare determination / result" if superior to the value in the follow table. It depends on conversion frequency.
If motion criterion is reach before the determined time, zero or tare is set immediately.

Measures/s	Min time	Measures/s	Min time
6,5	160	7,5	133
12,5	160	15	133
25	120	30	100
50	100	60	83
100	90	120	75
200	85	240	70
400	82,5	480	68
800	81,25	960	67
1600	80,625	1920	67

3.2.11 0x1800 : TPDO1 communication parameters

 The information concerning the data sent by sensor via PDO communication is stored in this entry of the OD. This entry has three sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	COB-ID TPDO1	RO	0x00000180+ ID sensor	N	unsigned32
0x02	transmission type	RO	0xFE	N	unsigned8

> ➢ The TPDO1 messages COB-ID is automatically updated when sensor identifier is modified.
> ➢ The transmission type for TPDO1 messages cannot be overwritten. A value of FE_H means that the TPDO is sent upon a variation of the mapped value.
> ➢ This PDO is sent by digital load cell to signal the current state of the functional command to execute (in progress, complete, error).

3.2.12 0x1A00 : TPDO1 mapping parameters (constant)

The TPDO1 mapping parameter contains the index (byte 3, byte 2), the sub-index (byte 1) and the size of the mapped object (byte 0) that is sent. The corresponding entry manages the current state of the last functional command :

⇨ 0x01 ⇒ **command execution in progress**
⇨ 0x02 ⇒ **command execution complete**
⇨ 0x03 ⇒ **error during command execution**

This entry has two sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	number of mapped objects	RO	0x01	N	unsigned8
0x01	1st object mapping	RO	0x20040008	N	unsigned32

The mapped object corresponds to the answer register of the sensor*.*
The content of the sub index 01_H is:

- 0x2004 ⇒ Object index
- 0x00 ⇒ Object Sub-index
- 0x08 ⇒ Object size (8 bits length)

3.2.13 0x1801/0x1802 : TPDO2/TPDO3 communication parameters

Both objects are similar and aim at describing transmits PDO they are assigned to. Each object is constituted by 4 sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Size
0x00	largest sub-index	RO	0x05	N	unsigned8
0x01	TPDO2 or TPDO3 COB-ID	R/W	0x00000280 ou 0x00000380 + ID sensor	N	unsigned32
0x02	transmission type	R/W	0x01 ou 0xFE	N	unsigned8
0x05	timer event	R/W	0	N	unsigned16

> The TPDO2 and TPDO3 messages COB-ID is automatically updated when sensor identifier is modified. **Both TPDO can be enabled/disabled by setting to 0 bit 31 of their COB-ID (sub-index 01$_H$).**
> By default, TPDO2 and TPDO1 are enabled.
> The transmission type and the timer event duration can be chosen according to the table in § 2.5.2

3.2.14 0x1A01 : TPDO2 mapping

The TPDO2 mapping parameter contains the index (byte 3, byte 2), the sub-index (byte 1) and the size of the mapped object (byte 0) included in TPDO2 frames. **Up to 3 objects can be mapped in the same PDO but the total data length cannot exceed 8 bytes.**
This entry has four sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	number of mapped objects	R/W	0x01	N	unsigned8
0x01	1st object mapping	R/W	0x50010020	N	unsigned32
0x02	2nd object mapping	R/W	0	N	unsigned32
0x03	3rd object mapping	R/W	0	N	unsigned32

❑ The object mapped at sub index 0x01 correspond to the object "gross measure" of index 0x5001, sub index 00h, 32 bits size (20h).
❑ **Note :** TPDO2 mapping can only be modified in pre-operational state. First, it is necessary to switch to 1 bit b31 of its COB-ID (cf. 3.2.13) and force sub-index 0x00 to 0 (Number of objects transmitted equal to 0).

3.2.15 0x1A02 : TPDO3 mapping

The TPDO3 mapping parameter contains the index (byte 3, byte 2), the sub-index (byte 1) and the size of the mapped object (byte 0) included in TPDO3 frames. **Up to 3 objects can be mapped in the same PDO but the total data length cannot exceed 8 bytes.**
This entry has four sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	number of mapped objects	R/W	0x02	N	unsigned8
0x01	1st object mapping	R/W	0x50040220	N	unsigned32
0x02	2nd object mapping	R/W	0x50050210	N	unsigned32
0x03	3rd object mapping	R/W	0	N	unsigned32

- ❑ **Note :** TPDO3 mapping can only be modified in pre-operational state. First, it is necessary to switch to 1 bit b31 of its COB-ID (cf. 3.2.13) and to force sub-index 0 to 0.
- ❑ The object mapped at sub index 0x01 is "gross measure": index 0x5004, sub index 02h, 32 bits size (20h).
- ❑ The object mapped at sub index 0x02 is "quality information": index 0x5005, sub index 00h, 32 bits size (20h).
- ❑ TPD03 mapping can only be modified in pre operational state. First it is necessary to disabled (bit31 of its COB-ID, cf 3.2.13) and force sub-index 0x00 to 0 (Number of objects transmitted equal to 0).

4 DIGITAL LOAD CELL SPECIFIC OBJECTS

Index	Max sub-index	Description	Access	Mappable (PDO) ?	Type
Communication parameters					
0x2000	0	functioning mode	R/W	N	unsigned8
0x2001	0	CAN bus baud rate	R/W	N	unsigned8
0x2002	0	Sensor identifier (ID)	R/W	N	unsigned16
0x2003	0	functional command register	R/W	Y (RPDO1)	unsigned8
0x2004	0	command state register	RO	Y (TPDO1)	unsigned8
Calibration settings					
0x3000	0	maximum capacity	R/W	N	unsigned32
0x3001	0	scale interval	R/W	N	unsigned16
0x3002	0	global span adjusting coefficient	R/W	N	unsigned32
0x3003	0	calibration load	R/W	N	unsigned32
0x3004	0	g coefficient value	R/W	N	unsigned32
0x3005	0	Zero calibration	R/W	N	integer32
0x3006	0	User scale coefficient	R/W	N	real32
Legal for trade settings					
0x3500	0	motion	R/W	N	unsigned8
0x3501	0	zero mode	R/W	N	unsigned16
0x3600	0	legal for trade switch	R/W	N	unsigned8
0x3601	2	legal metrology indicators	RO	N	/
0x3602	0	dynamic zero acquisition time	R/W	N	unsigned16
Filtering parameters					
0x4000	0	A/D conversion frequency	R/W	N	unsigned16
0x4001	0	self-adaptive filter	R/W	N	unsigned8
0x4002	9	digital filter settings	variable	N	/
Logical Inputs/Outputs					
0x4501	3	logical inputs configuration	variable	N	/
0x4509	4	logical outputs configuration	variable	N	/
0x4601	5	set points 1 & 2 configuration	variable	N	/
0x4609	5	set points 3 & 4 configuration	variable	N	/
Dosing settings					
0x4700	0	target weight	R/W	N	unsigned32
0x4701	7	cycle timings	variable	N	/
0x4702	2	tolerances	variable	N	/
0x4703	2	reloading variables	variable	N	/
0x4704	6	dosing levels	variable	N	/

0x4705	7	cycle management options	variable	N	/
0x4706	2	flow rate control	variable	N	/
Other objects					
0x4800	0	safety mode	R/W	N	unsigned8
0x4900	0	delta min TPDO2	R/W	N	unsigned32
0x4901	0	delta min TPDO3	R/W	N	unsigned32
Measures					
0x5000	0	net measurement	RO	Y	integer32
0x5001	0	gross measurement	RO	Y	integer32
0x5002	0	A/D converter points	RO	Y	integer32
0x5003	0	measurement status	RO	Y	unsigned16
0x5004	6	results	RO	Y	/
0x5005	0	dosing cycle duration	RO	Y	unsigned16
0x5006	0	max peak value	RO	Y	integer32
0x5007	0	dosing error report	RO	Y	unsigned8
0x5008	0	dosing errors counter	RO	Y	unsigned8
0x5009	2	standard deviations for dynamic dosing mode	RO	Y	/
0x5100	0	logical inputs level	RO	Y	unsigned8
0x5200	0	logical outputs level	RO	Y	unsigned8

Note : All the bits that are not mentioned in the description of the settings below are reserved and always set to 0.

4.1 Communication parameters

4.1.1 0x2000 : Functioning mode

This entry allows selecting one of sensor functioning modes. The settings are applied after an EEPROM saving followed by a reset. The functioning mode is coded on the bits b0 and b1. Bit b3 can be used so as to shunt digital filters, non-linearity correction and set point management.
Access : Read/Write
Defaut value : 01$_H$

bits b1, b0	Functioning mode	Notes
000	transmitter	active after save and reset
001	Dosing by feeding	
010	Dosing by unloading	
bit b3	**Signal processing**	
0	treatment enabled	digital filters, set point management and non-linearity correction activation
1	treatment disabled	

4.1.2   0x2001 : CAN bus baud rate

This entry is used to choose the baud rate employed on the CAN bus. Any modification of this parameter is affective only after an EEPROM saving followed by a reset (hardware or software).
Access : Read/Write
Default value : 03$_H$

The codes corresponding to the different possible bit rates are given below :

-	0x02	$\Rightarrow$	**50 kbit/s**
-	0x03	$\Rightarrow$	**125 kbit/s**
-	0x04	$\Rightarrow$	**250 kbit/s**
-	0x05	$\Rightarrow$	**500 kbit/s**
-	0x06	$\Rightarrow$	**800 kbit/s**
-	0x07	$\Rightarrow$	**1 Mbit/s**

4.1.3   0x2002 : Sensor identifier (ID)

On a CANopen® network, each COB is uniquely identified by one COB-ID which depends on the node identifier. Digital load cell ID can be changed. A modification of this parameter is applied only after saving it in EEPROM followed by a reset (hardware or software). Sensor CAN identifier is equal to the address used for RS485 communication. This setting is stored at this index of the OD and can be assigned a value between 1 and 127 (01$_H$ and 7F$_H$).
Access : Read/Write
Default value : 01$_H$

4.1.4   0x2003/0x2004 : Command/response register

Access : Read/write (0x2003) and Read only (0x2004)
Default value : 00$_H$

4.2   Calibration settings

4.2.1   0x3000 : Maximum capacity

The maximum capacity entry allows to define the gross value delivered by the load cell at its maximum load (for example : 30000 pts for 30 kg). This parameter value is used as part of *'user span adjustment'* command (D7$_H$).
When the absolute value of the gross measure exceeds this value plus 9 divisions, the b3 bit (positive overloading) or the b2 bit (negative overloading) of the status bytes associated to the measure is set to 1.
The zero acquisition (on request or at power-up) is handled only if the value is lower than ±10% range of the maximum capacity or ±2% in legal for trade. The admitted values for this parameter are contained between 0 et 1000000$_d$.
Access : Read/write
Defaut value : 7A120$_H$

4.2.2   0x3001 : Scale interval

The scale interval is the minimal difference between two consecutive indicated values (gross/net).
Admitted values are listed below :

-	1d	$\Rightarrow$	**0x0001**
-	2d	$\Rightarrow$	**0x0002**
-	5d	$\Rightarrow$	**0x0005**
-	10d	$\Rightarrow$	**0x000A**
-	20d	$\Rightarrow$	**0x0014**
-	50d	$\Rightarrow$	**0x0032**
-	100d	$\Rightarrow$	**0x0064**

Access : Read/write
Default value : 01$_H$

4.2.3   0x3002 : Global span adjusting coefficient

Initial calibration can be adjusted through to the global scale adjusting coefficient. Adjustment applies on the whole curve. The unity for this coefficient is 1E-6 that means 1000000_d = 1. Admitted values are between 900000_d and 1100000_d. A modification of this setting is only taken into account after EEPROM storage and a reset (hardware or software) procedure.
Access : Read/write
Default value : $F4240_H$

4.2.4   0x3003 : Calibration load

Digital load cell span can be adjusted by learning with a standard load. The equivalence between the standard load and the corresponding points number is set by the 'calibration load' value used during the physical calibration procedure (EC_H).
Access : Read/write
Default value : 2710_H

4.2.5   0x3004 : Gravity coefficient (g) adjustment

As the digital load cell is calibrated in Annemasse (France), depending on the terrestrial geographical coordinates where the load cell is used, the gravity difference can affect the measure aptness.
In order to compensate this error, it is possible to modify this gravity coefficient to adjust it to the using place. It is expressed without point, and multiplied by one million (for example, 9.805 is traduced by 9805000 in the load cell). This correction is taken in account after a saving in EEPROM followed by a reset, then the span adjustment is automatic.
Access : Read/write
Default value : $959E9E_H$ (= 9.805470, gravity at calibration place)

4.2.6   0x3005 : User zero value (Calibration)

A/D value of the zero. This value is determined by the "zero adjustment" command.
Access : Read/write
Default value : 0_H

4.2.7   0x3006 : User scale coefficient

The user scale coefficient is calculated by the ***sensor during a "user span adjustment " or a "physical calibration"***
Access : Read/write
Default value : $3F800000_H$ (1.0)

4.3 Legal for trade parameters

4.3.1 0x3500 : Motion

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 reference measurement. X depends on the Analog to Digital (A/D) conversion rate.

A modification of this setting is only taken into account after an EEPROM storage and a reset (hardware or software) procedure.

Access : Read/write
Default value : 02_H

bits b2 b1 b0	Stability interval	Notes
000	no motion detection	
001	0.25d	
010	0.5d	1d = 1 division
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

4.3.2 0x3501 : Zero mode

Zero tracking and/or initial zero setting can be activated by setting b1/b0 bits of this entry :
Access : Read/write
Defaut value: 0_H

bit b0	Zero tracking	Notes
1	zero tracking active	⇨ zero tracking is active in the range of ±10% of the maximum capacity or ±2% in legal for trade applications
0	without zero tracking	
bit b1	**Initial zerosetting**	**Notes**
1	initial zero setting enabled	⇨ initial zero setting is active in the range of ±10% of the maximum capacity or ±2% in legal for trade applications
0	initial zero setting disabled	

4.3.3 0x3600 : Legal for trade switch

This entry activates or deactivates (through the b0 bit) criteria and parameters related to the use of digital load cell in OIML compliance.

The *'legal for trade'* activation leads to the following changes :

- the legal for trade counter is incremented every time a storage in EEPROM is requested if a metrological setting has been modified.

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

- taring is now impossible if gross measurement is negative

- zero acquisition range is reduced from 10% of the capacity to 2%.

- the weight value is set to –1 during the 15 seconds that follow a load cell reset

- the motion criterion is forced to *0.25d* and cannot be modified anymore. An attempt to change its value is refused and digital load cell sends a SDO error frame.

Access : Read/write

Default value : 0$_H$

4.3.4 0x3601 : Legal for trade indicators

If the legal for trade option is activated (cf. §4.3.3), two indicators allow to insure the traceability during legal for trade application. The legal metrology counter and the legal metrology CRC-16 are incremented every time a storage in EEPROM is requested if one (or several) of these settings has been modified :

- global span adjusting coefficients
- user scale coefficient
- scale interval
- maximum capacity
- legal metrology activation
- initial zero setting and zero tracking
- functioning mode
- motion criterion
- A/D converter zero points

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	legal for trade counter	RO	0	N	unsigned16
0x02	Legal for trade CRC-16	RO	0	N	unsigned16
0x03	metrological program version	RO	3	N	unsigned16

4.3.5 dynamic zero acquisition time

The *'dynamic zero acquisition time'* is a duration in ms comprised between 0 and 65535$_d$. In dosing functioning mode when an input assigned to *the 'dynamic zero'* function is activated or if a *'dynamic zero command'* is received by the load cell an average value is calulated during this time to determine the new zero value. This new zero is effective if it is included within a a ±10% range of the specified maximum capacity.

Access : Read/write

Default value : 64h

4.4 Filtering parameters

4.4.1 0x4000 : A/D conversion rate

A modification of this setting is only taken into account after EEPROM storage and a reset (hardware or software).

Access : Read/write

Default value : 1_H

The different admitted frequencies and their corresponding binary codes are listed in the following table:

bit b0	Rejection	
1	**50 Hz rejection**	
0	60 Hz rejection	
bits b4 b3 b2 b1	**A/D conversion rate (meas/s)**	
	50 Hz	**60Hz**
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

4.4.2 0x4002 : Digital filters settings

This entry gives an access to the configuration of the low-pass and band-stop digital filters that can be used by digital load cell. The low-pass filter order is configurable, possible orders are 0 (filter disabled), 2, 3 or 4**. It is coded on the b2, b1 and b0 bits**. The band-stop filter activation can be done by **setting b8 bit to 1** of the same sub-index.

The filter recurrence relation of these filters are as follows :

- **digital low-pass filter :**

$$2^{nd} \text{ order} : s_n = 1/A(e_n + 2e_{n-1} + e_{n-2} - Bs_{n-1} - Cs_{n-2})$$
$$3^{rd} \text{ order} : s_n = 1/A(e_n + 3e_{n-1} + 3e_{n-2} + e_{n-3} - Bs_{n-1} - Cs_{n-2} - Ds_{n-3})$$
$$4^{th} \text{ order} : s_n = 1/A(e_n + 4e_{n-1} + 6e_{n-2} + 4e_{n-3} + e_{n-4} - Bs_{n-1} - Cs_{n-2} - Ds_{n-3} - Es_{n-}$$

- **digital band-stop filter :**

$$2^{nd} \text{ order} : s_n = X(e_n + e_{n-2}) + Y(e_{n-1} - s_{n-1}) - Zs_{n-2}$$

This entry of the OD is constituted by 10 sub-indexes :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x09	N	unsigned8
0x01	filter order	R/W	0x03	N	unsigned16

0x02	1/A coefficient	R/W	0x3B2F8D59 (= 0.00267871306)	N	real32
0x03	B coefficient	R/W	0xC4557BFD (= -853.937317)	N	real32
0x04	C coefficient	R/W	0x4425AF13 (= 662.735535)	N	real32
0x05	D coefficient	R/W	0xC32E1C9C (= -174.111755)	N	real32
0x06	E coefficient	R/W	0	N	real32
0x07	X coefficient	R/W	0x3F6DCC83 (= 0,92890471)	N	real32
0x08	Y coefficient	R/W	0xBEDBB2BD (= -1,7163921)	N	real 32
0x09	Z coefficient	R/W	0x3F5B995F (= 0,857809)	N	real 32

Note: With a 0 value sub index 0x01 deactivate the low pass filter.

By default, the low-pass filter is enabled and set for a 100 measures per second and a 10 Hz cut-off frequency. It is a 3rd order filter.

Cutoff frequency settings are: 400 measures per second, 50 Hz rejection in a +/- 10 Hz range. This filter is disabled by default. Before activation, be careful to update coefficients to your needs.

Coefficients could be computed with eNodView software.

4.4.3 0x4001 : Self-adaptive filter

This type of filter can be set in cascade after the previous filters. It is particularly useful for static measurements, avoid using it in dynamic or dosing process. The aim of this filter is to eliminate erratic measurements and to average consistent measurements. It can be enabled **by setting b0 bit to 1.**

Access : Read/write

Default value : 0$_H$

bit b0	Note
1	⇨ self-adaptive filter enabled
0	⇨ self-adaptive filter disabled

4.5 Logical inputs/outputs configuration

4.5.1 0x4501 : Logical inputs configuration

Depending on the version (2x5 pins or 2x8 pins), digital load cell has one or two logical inputs which can be configured in different ways described below :

bits b2 b1 b0	Input assignement	Notes
000	none	⇨ input is ignored
001	tare	⇨ tare command
010	zero	⇨ set to zero the gross measure ; limited at ± 10% of the max capacity or ±2% in legal for trade applications (cf. §4.3.3)
011	Either send TPDO2 (IN 1) Or send TPDO3 (IN 2) Or reset max peak	⇨ in transmitter functioning mode, triggers the emission of a TPDO if it is event-triggered ⇨ in dosing functioning mode, maximum stored = current gross value
100	dynamic zero	⇨ in dosing mode, set to zero without motion criterion after the "zero dynamic time"
101	cancel tare / suspend cycle	⇨ in transmitter functioning mode, cancels the tare ⇨ in dosing functioning mode (by filling or unloading), cancels the current cycle and reset the calculated variables
110	start / restart dosing cycle	⇨ in dosing functioning mode (by filling or unloading)
111	stop current cycle	⇨ in dosing functioning mode (by filling or unloading), stops the current cycle by inhibiting the different outputs involved
bit b3	**Logic**	
0	negative	
1	positive	

Note: if 2 inputs are set as TPDO sending, action on input 1 has priority. Input 2 is disabled.
In dosing mode, if 2 inputs are assigned to as "start cycle", "suspend cycle", or "stop cycle", input 2 has priority. Input 1 is disabled.

The minimal holding time, in ms, is the minimum time before the level change on input is validated. It reduce perturbation and contact rebound on line.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x03	N	unsigned8
0x01	minimal holding time (ms)	R/W	0x50	N	unsigned16
0x02	input 1 assignment	R/W	0	N	unsigned8
0x03	input 2 assignment	R/W	0	N	unsigned8

The *'debounce time'* corresponds to the minimum required stabilisation time of the logical inputs before their activation. If the input state varies within this interval, it is ignored. This allows to eliminate possible parasites and also to eliminate possible contacts bounces.

4.5.2 0x4509 : Logical outputs configuration

Depending of the version, digital load cell includes up to 4 logical outputs which can be configured in different ways described below :

❑ **Note :** Digital load cell with 2 5-pins connectors do not have digital outputs available on connectors. Nevertheless these outputs *exist in a virtual state* and can be affected for specific function management. Then, their changing of state is managed by the communication bus.

bits b3, b2, b1 et b0	Output assignment	Notes
0000	set point	⇨ set point 1 affected to output 1 ⇨ set point 2 affected to output 2 ⇨ set point 3 affected to output 3 ⇨ set point 4 affected to output 4
0001	motion	
0010	dosing result available	⇨ indicates that a new dosing result has been determined
0011	cycle in progress	⇨ indicates that a dosing cycle is in progress
0100	defective measurement	⇨ error flag, contained in the status byte
0101	input (1 or 2) image	⇨ outputs 1 & 3 assigned to input 1 ⇨ outputs 2 & 4 assigned to input 2
0110	fine feed or level on request	⇨ in dosing by filling or by unloading functioning modes ⇨ in transmitter mode
0111	coarse feed or programmed mode	⇨ in dosing by filling or by unloading functioning modes ⇨ in transmitter mode
1000	emptying / reloading or programmed mode	⇨ in dosing by filling mode, activated during the emptying phase that follows the final stabilization time ⇨ in dosing by unloading mode, activated during the reloading phase that occurs at the end or at the start of the cycle ⇨ in transmitter mode programmed mode
1001	dosing result out of tolerances	⇨ in dosing functioning modes, indicates that the result is out of the fixed tolerances
1010	flow rate failure	⇨ in dosing functioning modes, indicates that a flow rate defect has occurred
1011	dosing failure	⇨ in dosing functioning modes, indicates that a flow rate defect has occurred, **or** that the result is out of the fixed tolerances

bit b4	Logic	
0	negative	
1	positive	

Note: When several outputs are assigned to current cycles or available results, only the higher number will be set to this function.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x04	N	unsigned8
0x01	output 1 assignment	R/W	0x16	N	unsigned8
0x02	output 2 assignment	R/W	0x17	N	unsigned8
0x03	output 3 assignment	R/W	0x18	N	unsigned8
0x04	output 4 assignment	R/W	0x19	N	unsigned8

Default values:
- ➔ Output 1 assigned to "FF", positive logic level
- ➔ Output 2 assigned to "CF", positive logic level
- ➔ Output 3 assigned to "unloading/feed", positive logic level
- ➔ Output 4 assigned to "Result out of tolerances", positive logic level

4.5.3 0x4601/0x4609 : Set points configuration

Set point 1 is assigned to output 1 and set point 2 to output 2. Each set point is defined by a functioning defined at sub-index 1 and by high and low limits values (sub-index 2 to 5). The coding corresponding to the different functioning possible is provided in the following table :

bit b0	Set point 1 (or 3) commutation mode
1	hysteresis
0	window
bit b1	**Set point 1 (or 3) comparison measurement**
1	net
0	gross
bit b4	**Set point 2 (or 4) commutation mode**
1	hysteresis
0	window
bit b5	**Set point 2 (or 4) comparison measurement**
1	net
0	gross

➢ **0x4601 : set points 1 & 2 configuration :**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x05	N	unsigned8
0x01	set points 1 & 2 functioning	R/W	0x33 (set point 1 and set point 2 on net and hysteresis)	N	unsigned8
0x02	set point 1 low value	R/W	0x00011170 (70000_d)	N	integer32
0x03	set point 1 high value	R/W	0x00013880 (80000_d)	N	integer32
0x04	set point 2 low value	R/W	0x0000C350 (50000_d)	N	integer32
0x05	set point 2 high value	R/W	0x0000EA60 (60000_d)	N	integer32

> **0x4609 : set points 3 & 4 configuration :**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x05	N	unsigned8
0x01	set points 3 & 4 functioning	R/W	0x33 (set point 1 and set point 2 on net and hysteresis)	N	unsigned8
0x02	set point 3 low value	R/W	0x00007530 (30000_d)	N	integer32
0x03	set point 3 high value	R/W	0x00009C40 (40000_d)	N	integer32
0x04	set point 4 low value	R/W	0x00002710 (10000_d)	N	integer32
0x05	set point 4 high value	R/W	0x00004E20 (20000_d)	N	integer32

4.6 Dosing settings

See dosing functioning modes in use manual ref 195702.

4.6.1 0x4700 : Target weight

In dosing functioning mode (by filling or by unloading), the target weight represents the measurement to reach at the end of the dosing process. Admitted values are comprised between 0 and 1000000d,
Access : Read/write
Defaut value : 2710_H

4.6.2 0x4701 : Cycle timings

In dosing (by filling or by unloading) functioning modes, a cycle is divided into several phases that are delimited by levels and timings. This entry contains 8 sub-index corresponding to the timers involved in dosing cycles :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x05	N	unsigned8
0x01	start delay	R/W	0x00C8	N	unsigned16
0x02	final stabilization time	R/W	0x01F4	N	unsigned16
0x03	coarse feed effect neutralization time	R/W	0x0032	N	unsigned16
0x04	fine feed effect neutralization time	R/W	0x0032	N	unsigned16
0x05	emptying / reloading holding time	R/W	0x0064	N	unsigned16
0x06	tare determination time	R/W	0x0064	N	unsigned16
0x07	end of cycle waiting time	R/W	0x0064	N	unsigned16

> **0x01 : start delay :**
- dosing by filling : if the *'automatic taring at start'* option is enabled, this timer stands for the stabilization time that precedes the tare execution.
- dosing by unloading : this timer stands for the tank level stabilization time that precedes the reference weight acquisition.

> **0x02 : final stabilization time :**
In dosing functioning modes (by filling or by unloading), the final stabilization time defines the duration that follows the fine feed stop and digital load cell proceeds to the result determination as soon as the stability is reached.

> **0x03 : coarse feed effect neutralization time :**
During this delay, the flow rate control and the level monitoring are disabled so as to limit the impact of dynamic effects on the signal caused by the coarse feed activation.

> **0x04 : fine feed effect neutralization time :**
During this delay, the flow rate control and the level monitoring are disabled so as to limt the impact of dynamic effects on the signal caused by the flow rate change.

> **0x05 : emptying / reloading holding time :**
- dosing by filling : the emptying holding time defines how long the *'emptying'* output remains active after that the gross value has become inferior to the *'emptying end level'*
- dosing by unloading : the reloading holding time defines how long the *'reloading'* output remains active after that the gross value has become superior to the *'reloading max level'*.

> **0x06 : tare determination time :**
- dosing by filling : if the *'automatic taring at start'* option is enabled, this time defines the interval during which stability is monitored for the tare acquisition. If the stability cannot be found before this time out ends, the tare value is set to the current net measurement.
- dosing by unloading : this time defines the interval during which stability is monitored for the reference weight acquisition. If the stability cannot be found before this time out ends, the reference weight value is set to the current gross measurement.
- in both functioning modes : the motion time out is also used when the final stabilization time ends. The dosing result is acquired as soon as no motion is detected. If the stability cannot be found before this time out ends, the dosing result is set to the current net (dosing by filling) or gross (dosing by unloading) measurement.

> **0x07 : end of cycle waiting time :**
This delay occurs either :
- after the control of tolerances
- at the end of the reloading phase in dosing by unloading functioning mode if the reloading mode is set to *'at the end of the cycle'*

- at the end of the emptying phase (if used) in dosing by filling functioning mode
A dosing cycle is finished as soon as this delay ends. The statistic variables (number of cycles, running total, average value and standard deviation) are then updated. If an output is assigned to the '*cycle in progress*' function it is also disabled.

4.6.3 0x4702 : Tolerances

The tolerance settings define the acceptable range for dosing results. An output assigned to the '*out of tolerances*' function or '*dosing failure*' is set active if the dosing result is not within the range **[target weight – (tolerance -) ; target weight + (tolerance +)]**.
If the result is inferior to the default low tolerance threshold and if the '*restart fine feed*' option is enabled, then the fine feed output is restarted.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	high tolerance	R/W	0x000A	N	unsigned16
0x02	low tolerance	RW	0x000A	N	unigned16

4.6.4 0x4703 : Reloading variables (dosing by unloading)

In dosing by unloading mode, if the reloading management is active (cf. §4.6.6), the tank reloading takes place :
- At cycle's end : reloading at the end of the cycle : an output assigned to the '*reloading*' function is automatically set if after the result determination the gross measurement is inferior to the '*reloading min level*'. The output remains active until the end of the '*reloading holding time*' that begins immediately after that the '*reloading max level*' has been exceeded. (cf. §4.6.2).
- Reloading at the start of the cycle : at every cycle start, digital load cell checks that there is enough product to reach the dosing target weight. Else if the reloading mode is set to '*at the start of the cycle*', an output assigned to the '*reloading*' function is automatically set active until the gross measurement gets superior to the '*reloading max level*'. It remains then active during the '*reloading holding time*'. After the reloading phase end, the dosing cycle begins normally.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	reloading max level	R/W	0x00004E20	N	unsigned32
0x02	reloading min level	R/W	0x000003E8	N	unsigned32

4.6.5 0x4704 : Dosing levels

This object contains all the levels that define the different steps of the dosing process.
Note : The parameters : *end of emptying level*, *min empty weight* and *max empty weight* are only used in the dosing by filling functioning mode. Other parameters are used in both dosing functioning mode of digital load cell.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x06	N	unsigned8
0x01	fine feed level	R/W	0x000003E8	N	unsigned32
0x02	coarse feed level	R/W	0x00001F40	N	unsigned32
0x03	end of emptying level	R/W	0x000000C8	N	unsigned32
0x04	inflight weight value	R/W	0x000000FA	N	integer32
0x05	max empty weight	R/W	0x000001F4	N	unsigned32
0x06	min empty weight / residual weight	R/W	0x00000064	N	unsigned32

➢ **0x01 : Fine feed level :**
The fine feed level expressed as a subtraction of the target weight gives the level (net for filling and gross for dosing by unloading) that causes the coarse feed to be disabled and the fine feed to go on.

➢ **0x02 : Coarse feed level :**
The coarse feed level defines the transition level between *the fine feed* phase and the *coarse feed* when the used process implies a start in fine feed phase followed by a *coarse feed* phase followed again by a *fine feed* phase to finish the dosing (cf. §4.6.6).

➢ **0x03 : emptying end level (dosing by filling only) :**
During the emptying phase, the *'emptying'* output is disabled if the gross value becomes inferior to this level and if the *'emptying holding time'* has elapsed.

➢ **0x04 : Inflight weight value :**
The inflight value corresponds to the weight of product that carries on falling after the *'fine feed'* output disabling. Its value can be automatically corrected thanks to the inflight correction mechanism (cf. §4.6.6and user's instructions ref. 195702)

➢ **0x05 and 0x06 : Max/min empty weight (filling) and residual weight (unloading) :**
The min and max empty weight are involved only in dosing by filling functioning mode **if** the option *tare at start* and/or the option *automatic start* is active (cf. §4.6.6). Their influence on the cycle management is given in the following table :

Conditions	Action at cycle start
min empty weight ≤ gross measurement ≤ max empty weight - *checking packaging present and empty*	⇨ tare then start in coarse feed (or fine if run in fine/coarse/fine)
min empty weight = max empty weight = 0 - *no packaging presence checking*	⇨ tare then start in coarse feed (or fine if run in fine/coarse/fine)

In dosing by unloading functioning mode, the residual weight (0x05) conditions the possibility to start a cycle. Digital load cell points out an error if *Gross measurement < (target weight + residual weight)*. This parameter allows to take into account product accumulation problems.

4.6.6 0x4705 : Cycle management options

This object contains all the cycle management options that can be used during dosing cycles. It is divided into 8 sub-index :

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x07	N	unsigned8
0x01	cycle options	R/W	0x03	N	unsigned8
0x02	reloading mode	R/W	0x01	N	unsiged8
0x03	automatic correction and cycle recovery authorization	R/W	0x00	N	unsigned8
0x04	correction in percent	R/W	0x64 (=100)	N	unsigned8
0x05	flow rates sequence	R/W	0	N	unsigned16
0x06	min inflight weight	R/W	0x02EE (=750)	N	integer16
0x07	max inflight weight	R/W	0xFF06 (= -250)	N	integer16

> **0x01 : Cycle options**
> **- bit b0 Tare at cycle start (filling mode) :** This option can be activated by setting at 1 the b0 bit of the byte located at the sub-index 01_H. The tare takes place after the *'start delay'* and before the activation of the outputs *'fine feed'* and *'coarse feed'*. If a lack of stability makes the tare impossible, the gross value is set as the new tare value at the end of the *'motion time out'*.
> **- bit b1 Cycle recovery (filling mode) :** This option is activated by setting to 1 the b1 bit of the byte located at the index 01_H. It allows the filling cycle to start even if, during the packaging check, the measured weight is lower to the target *'tolerance'* (cf. table §4.6.3).
> **- bit b2 Automatic start (filling mode) :** This option is activated by setting to 1 the b2 bit of the byte located at the index 01_H. Then, dosing cycles start automatically when a packaging is detected on the weighing area.
> A cycle is triggered as soon as the gross weight is included between *'min empty weight'* and *'max empty weight'* values during a time equal to the *'start delay'*. This time is reset if the weight gets out of the specified range.
> **- bit b3 Dynamic dosing mode :** This option is activated by setting to 1 the b3 bit of the byte located at the index 01_H. For dynamic dosing description, see dosing cycles descriptions in user's instructions document ref. 195702

> **0x02 : Reloading mode (unloading mode) :**
> This object allows to define the reloading mode managed by digital load cell :
>   - not used $\Rightarrow$ **0x00**
>   - at the end of the cycle $\Rightarrow$ **0x01**
>   - at the start of the cycle $\Rightarrow$ **0x02**

> **0x03 : In-flight automatic correction and fine feed restart :**

b0	Effect	Notes
1	automatic correction enabled	weighted by the correction coefficient at sub-index 04_H
0	automatic correction disabled	
b1		
1	fine feed restart enabled	fine feed is restarted if the dosing result is inferior to the low tolerance
0	fine feed restart disabled	
b2		
1	correction coefficient x3 if out of tolerances	if the automatic correction is enabled
0	correction coefficient not modified	

> **0x04 : Correction percentage :**

The correction percentage is used to balance the in-flight automatic correction.
Admissible values for this parameter are between 1 and 100 (%).

> **0x05 : Flow rate sequence :**

During a dosing cycle (filling or unloading), the flow rate sequence is configured by the b0, b1 and b2 bits, of this object. If only one flow rate is used, one output must be assigned to the « coarse feed » function.

b2, b1, b0	Function	Description
000	CF then FF	
001	CF+FF then FF	
010	CF only	see dosing cycle descriptions in user's instructions document ref. 195702
011	FF / CF / FF	
100	FF / FF+ CF / FF	
101	CF / CF + FF	

> **0x06 : Max in flight value :**

If the Inflight value is over this value, the Inflight correction is not effective.

> **0x07 : Min in flight value :**

If the Inflight value is under this value, the Inflight correction is not effective.

4.6.7 0x4706 : Flow rate control

The flow rate control can be enabled in filling mode or in unloading mode. If it is used, it is implemented at each cycle but inhibited during neutralization time (cf. §4.6.2). If during the specified time defined in the parameter *time interval*, the net measurement has sustained a variation smaller than the *minimal weight variation* specified then the cycle is stopped and a flow rate error is detected. **The flow rate control is disabled if the parameter *time interval* is set at 0.**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	largest sub-index	RO	0x02	N	unsigned8
0x01	minimal weight variation	R/W	0x03E8	N	unsigned16
0x02	time interval	R/W	0x0000	N	unsigned16

4.7 Other settings

4.7.1 0x4800 : Safety mode

This entry defines digital load cell functioning when in stopped NMT state. The safety mode is used when the bit b0 of the byte is set to 1. The functioning modes (dosing or transmitter) are then inhibited and outputs logical level are given by b1, b2, b3 and b4 bits. Digital load cell leaves the safety mode upon reception of a new NMT command.
Access : Read/write
Default value : 0$_H$

b0	Effect	Notes
0	safety mode disabled	**only valid in stopped state**
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	
b4		
0	output 4 inhibited	depending on the chosen logic
1	output 4 set active	

4.7.2 0x4900 : Delta min TPDO2

If TPDO2 transmission type is *'event-triggered'* (codes 0x00 or 0xFE) and if input 1 is not assigned to *'send TPDO2'* function then TPDO2 is sent when the value **of the first mapped object** (32 bits) varies from ± delta.
Access : Read/write
Default value : 64$_H$

4.7.3 0x4901 : Delta min TPDO3

If TPDO3 transmission type is *'event-triggered'* (codes 0x00 or 0xFE) and if input 1 is not assigned to *'send TPDO3'* function then TPDO3 is sent when the value **of the first mapped object** (32 bits) varies from ± delta.
Access : Read/write
Default value : 1$_H$

4.8 Measurement

4.8.1 0x5000/0x5001/0x5002 : Current measures

These three entries contain the current measurement value (net, gross and A/D converter points). All these variables can be mapped into a PDO.

Access : Read/write
Default value : /

➢ **0x5000 : Net measurement :**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	net measurement	RO	/	Y	RO

➢ **0x5001 : Gross measurement :**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	gross measurement	RO	/	Y	integer32

➢ **0x5002 : A/D converter points :**

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	A/D converter points	RO	/	Y	integer32

4.8.2 0x5003 : Current measurement status

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	status	RO	/	Y	Unsigned 16

Internal errors and other information are coded on two bytes that can be mapped into a PDO. There are coded in accordance with the following table :

bits b15,...b0	Function	Notes
b1, b0		
XX	non-significant	
b3,b2		
00	measurement within the admissible range	causes an output assigned to the *'defective measurement'* function to be set active
01	negative overloading	
10	positive overloading	
11	analog signal out of range	
bit b4		
0	motion	causes an output assigned to the *'motion'* function to be set active
1	no motion	
bit b5		
0	measurement out of the ¼ of division	

1	zero in the ¼ of division	
bit b6		
0	EEPROM OK	
1	EEPROM failure	
bit b7		
1	reserved	
bit b8		
0	IN$_1$ low level	copy of input 1 logical level
1	IN$_1$ high level	
bit b9		
0	IN$_2$ low level	copy of input 2 logical level
1	IN$_2$ high level	
bit b10		
0	OUT$_1$ low level	copy of output 1 logical level
1	OUT$_1$ high level	
bit b11		
0	OUT$_2$ low level	copy of output 2 logical level
1	OUT$_2$ high level	
bit b12		
0	OUT$_3$ low level	copy of output 3 logical level
1	OUT$_3$ high level	
bit b13		
0	OUT$_4$ low level	copy of output 4 logical level
1	OUT$_4$ high level	
bit b14		
0	no tare	
1	at least a tare has been processed	
bit b15		
1	reserved	

4.8.3 0x5004 : Results

This entry divided into 7 sub-indexes contains the different measurement results calculated by digital load cell during dosing cycles (by filling or unloading). It also contains the tare value in A/D converter points.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	max sub-index	RO	0x06	N	unsigned8
0x01	tare value	RO	0	Y	integer32
0x02	dosing result	RO	0xFFFFFFFF	Y	integer32
0x03	number of processed cycles	RO	0	Y	integer32
0x04	average value	RO	0	Y	integer32
0x05	running total	RO	0	Y	integer32
0x06	standard deviation	RO	0	Y	real32

4.8.4 0x5005 : Dosing cycle duration

As soon as a dosing cycle (by filling or unloading) is started, this clock in ms is reset. It is stopped as soon as the cycle result is available.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	dosing cycle duration	RO	/	Y	unsigned16

4.8.5 0x5006 : Max peak value

In dosing functioning mode, the max gross measurement is stored in this variable. It is permanently updated and can be reset by the transmission of the command Reset max peak value (cf. §3.2.10) or with an input assigned to this function (cf. §4.4.1).

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	max peak value	RO	/	Y	integer32

4.8.6 0x5007 : Dosing error report

The dosing error report give a code that correspond to the last error which appear. It is reset at each new cycle start.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	dosing error report	RO	/	Y	unsigned8

The error report provides an identification of the last dosing error that occurred.

bits b7...b0	Function	Note
b0		
1	flow rate failure	only if the flow rate control is active
0		
b1		
1	dosing result superior to the specified max tolerance	
0	dosing result within the specified tolerance or not determined yet	
b2		
1	dosing result superior to the specified max tolerance	
0	dosing result within the specified tolerance or not determined yet	
b3		
1	unable to start cycle	▪ outside of the starting range in dosing by filling mode ▪ insufficient quantity of product in dosing by unloading functioning

		mode
0	cycle normally started	
b4		
1	dosing result determined with no stability (*'motion time out'* has elapsed)	only in static dosing mode
0	dosing result determined under stability condition	
b5		
1	tare acquisition (dosing by filling) or reference weight acquisition (dosing by unloading) processed with no stability (*'motion time out'* has elapsed)	only in static dosing mode
0	tare /weight reference acquired under stability condition	

4.8.7 0x5008 : Dosing errors counter

The *'dosing errors counter'* provides a statement of the dosing errors that occurred during cycles.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	dosing errors counter	RO	/	Y	unsigned8

4.8.8 0x5009 : Standard deviations in dynamic dosing mode

If the *'dynamic dosing'* option (cf. §4.6.6) is active, a standard deviation is calculated every time an average value is determined for the tare/reference weight and dosing result acquisitions. These standard deviations are stored into this object and may serve as a reliability indicator for the dosing results provided by digital load cell.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	max sub-index	RO	0x02	N	unsigned8
0x01	standard deviation on result determination	RO	0	O	real32
0x02	standard deviation on tare/reference acquisition	RO	0	O	real32

4.8.9 0x5100 : Logical inputs level

This entry contains inputs 1 & 2 logical level.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	logical inputs level	RO	/	Y	unsigned8

bit b0	input 1 state
0	low
1	high
bit b1	**input 2 state**

0	low
1	high

4.8.100x5200 : Logical outputs state

This entry contains outputs 1, 2, 3 and 4 logical level.

Sub-index	Description	Access	Default value	Mappable (PDO) ?	Type
0x00	logical outputs level	RO	/	Y	unsigned8

bit b0	output 1 level
0	Low
1	High
bit b1	**output 2 level**
0	Low
1	High
bit b2	**output 3 level**
0	Low
1	High
bit b3	**output 4 level**
0	Low
1	high