

# TECHNICAL MANUAL



**DAT 200** Serial and PROFINET/ETHERNET IP weighing Indicator/Trasmitter

Software version PW310



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## WARNINGS

READ this manual BEFORE operating or servicing on the instrument.

FOLLOW these instructions carefully.

SAVE this manual for future use.



### CAUTION

The installation and maintenance of this instrument must be allowed to qualified personnel only.

Be careful when you perform inspections, testing and adjustment with the instrument switched on.

Failure to observe these precautions may be dangerous.

**DO NOT** allow untrained personnel to work, clean, inspect, repair or tamper with this instrument.

# INTRODUCTION

The DAT 200 is a weight transmitter to be matched to the load cells to detect the weight in every situation. The module is easy to install and can be mounted on 35 mm DIN rail.

The display allows easy reading of the weight, the configuration parameters and errors.

The 3 keys located below the display and protected by the front door allow the Operator to perform the functions of ZERO and CALIBRATION as well as datasheet and real calibration.

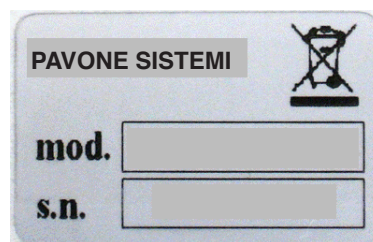
The DAT 200 use RS232 serial port with ASCII and Modbus RTU protocols to be connected to PC, PLC and remote units.

The presence of the most common fieldbus, also allows interfacing the transmitter with any supervision device currently offered by the market.

## Fieldbus available:

- **DAT 200/ETHERNET IP:** weight transmitter with serial output RS232 and ETHERNET IP.
- **DAT 200/PROFINET:** weight transmitter with serial output RS232 and PROFINET.

## IDENTIFICATION PLATE OF THE INSTRUMENT



It's important to communicate this data, in the event of a request for information. The software number and release number are shown on the cover of the manual and also displayed when the instrument is switched on.



## WARNINGS

The following procedures must be performed by qualified personnel. All connections must be performed when the instrument is switched off.

## TECHNICAL FEATURES

Power supply	24 Vdc $\pm$ 10% protected against reverse polarity. Protection with resettable fuse.
Max. absorption	2W
Isolation	Class II
Operating temperature	-10°C $\div$ +50°C (max. humidity 85% non-condensing)
Storage temperature	-20°C $\div$ +60°C
Weight display	Numerical with 5 red led digits and 7 segments (h 7 mm)
Led	2 LEDs of 3 mm
Keyboards	3 mechanical keys (behind the red front door)
Overall dimensions	112 x 119 x 35 mm (l x h x w), including terminal boards.
Installation	Brackets for DIN section or OMEGA bar
Material	Self-extinguishing Blend PC/ABS
Connections	Removable terminal boards with screws, pitch 5.08 mm
Input of the load cells with following features	max. 4 of 350 $\Omega$ in parallel (or 8 cells of 700 $\Omega$ ).
Load cell excitation	4 Vdc
Linearity	<0.01% of the full scale
Temperature drift	<0.001% of the full scale / °C
Internal resolution	24 bit
Measuring range	-3.9 $\div$ +3.9 mV/V
Digital filter	To be selected from 0.2 Hz to 25 Hz
Number of decimals weight	0 $\div$ 4 decimal places
Calibration of zero and full scale	From the buttons.
Check of load cell cable interruption	Always present
Serial ports	RS232 half duplex
Baud rate	2400 $\div$ 115200 baud
Maximum cable length	15m
Fieldbus	PROFINET / ETHERNET IP
Connection	RJ45 connector
Buffer size	128 byte IN - 128 byte OUT
In compliance with the standards	EN61000-6-2, EN61000-6-3, EN61326-1 for EMC EN61010-1 for Electrical Safety UL: FILE NO E474362



# INSTALLATION

## GENERAL INFORMATION

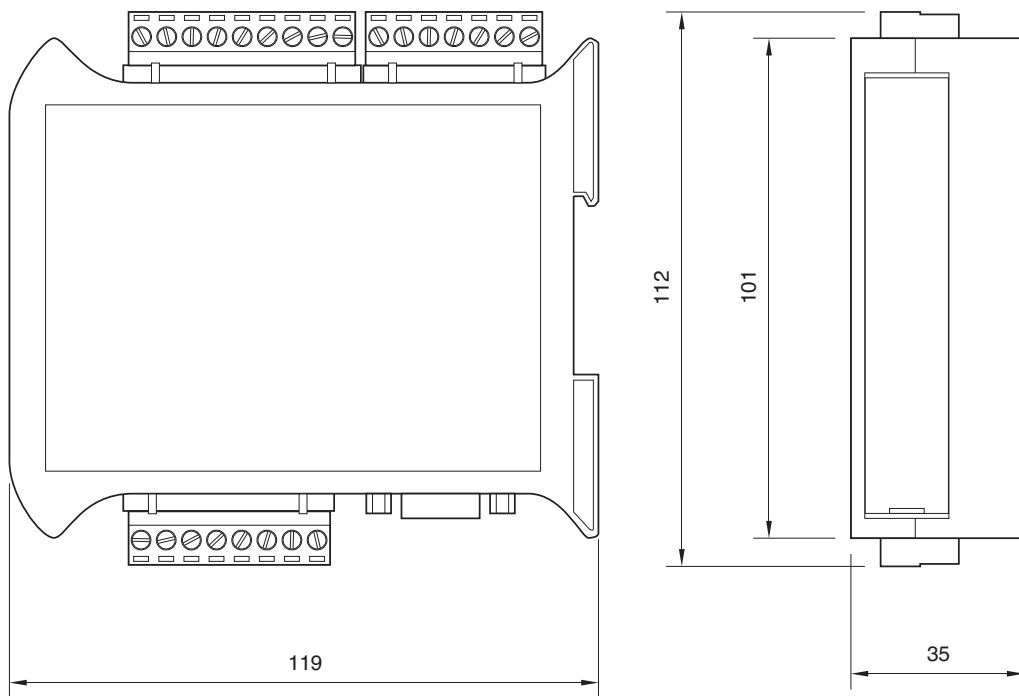
The DAT 200 consists of a motherboard, to which are added the options available, accommodated in a plastic enclosure for DIN rail 35mm.



The DAT 200 should not be immersed in water, subjected to jets of water and cleaned or washed with solvents.

Do not expose to heat or direct sunlight.

## OVERALL DIMENSIONS



## ELECTRICAL INSTALLATION



DAT 200 is equipped with removable screw, pitch 5.08 mm.

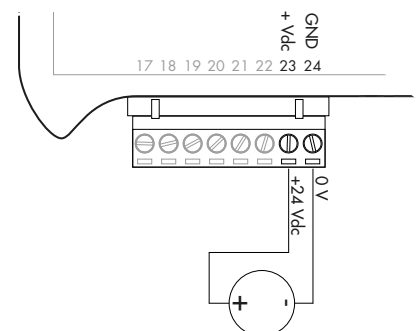
The load cell cable must be shielded and channeled away from power cables to prevent electromagnetic interferences.

## INSTRUMENT POWER SUPPLY

The instrument is powered through the terminals 23 and 24. The power supply cable must be channeled separately from other cables.

The internal circuit is galvanically isolated from the supply voltage.

Power supply voltage: 24 Vdc  $\pm$  10%, max. 2W



## LOAD CELL CONNECTIONS

The cable of the load cell (or load cells) should not be channeled with other cables, but has to follow its own path.

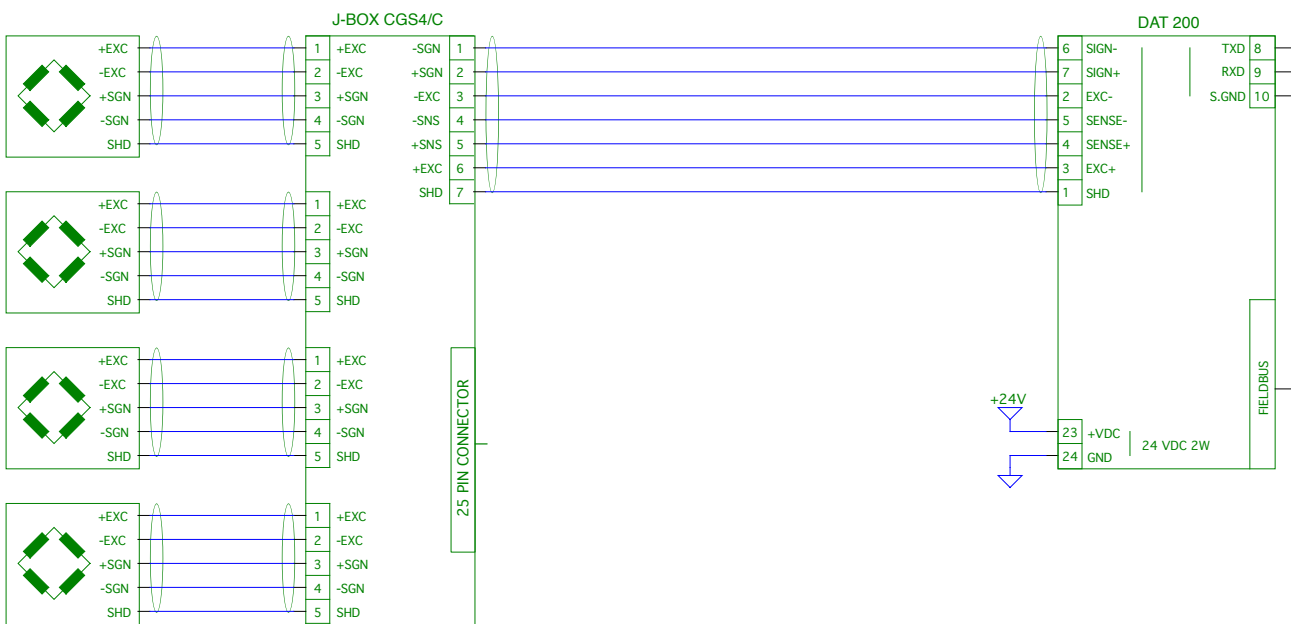
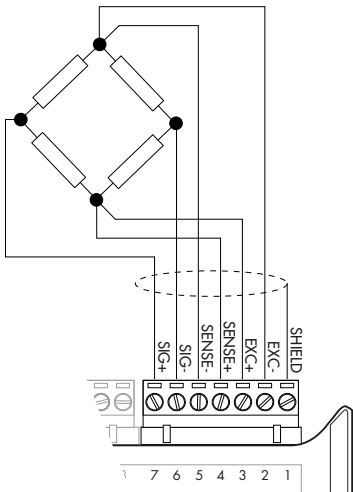
The instrument can be connected up to maximum 4 load cells of 350 ohm in parallel. The supply voltage of the load cells is 4 Vdc and is protected by temporary short circuit.

The measuring range of the instrument involves the use of load cells with a sensitivity of up to 3.9 mV/V.

The cable of the load cells must be connected to terminals 2-7 of the 7-pin removable terminal board. In the case of 4-wire load cell cable, jump terminals 2 with 5 and 3 with 4.

Connect the cell cable shield to the terminal 1.

In the case of the usage of two or more load cells, use special junction boxes (CEM4/C or CSG4/C).



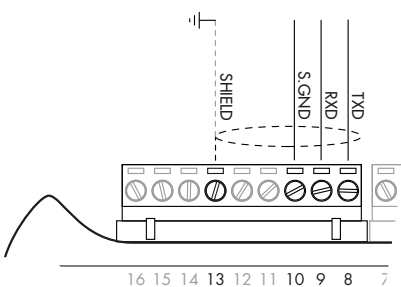
## SERIAL COMMUNICATION

### RS232:

The RS232 serial port is always present and can handle several protocols.

To achieve the serial connection use a suitable shielded cable and make sure to ground the screen at one of the two ends: to pin 13, if attached on the side of the instrument, to the ground, if connected on the other side.

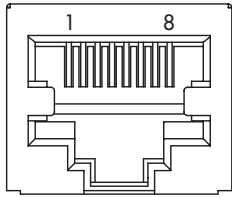
The cable must not be channeled with power cables, maximum length of 15 meters (EIA RS-232-C).





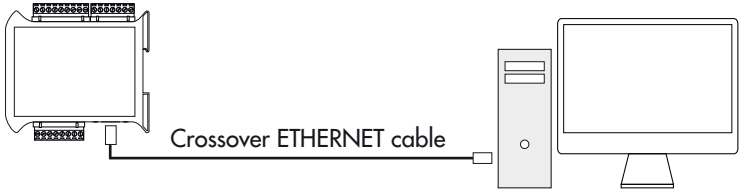
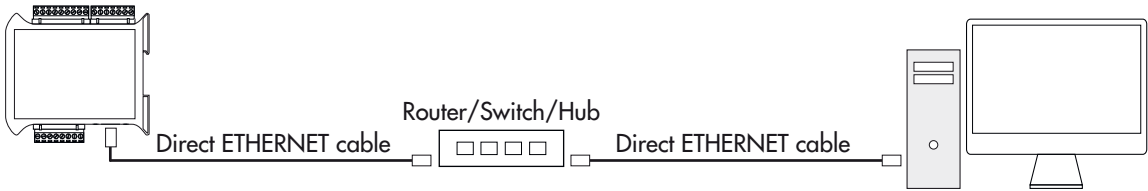
**FIELD BUS CONNECTION**

Pin	Description
1	TX+
2	TX-
3	RX+
4	
5	
6	RX-
7	
8	



- 1 TX+
- 2 TX-
- 3 RX+
- 6 RX-

To connect to the MASTER Profinet /Ethernet IP, use a standard twisted pair Ethernet cable with RJ45 connector.

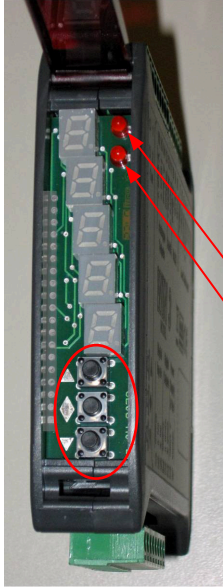


## FRONT PANEL

The DAT 200 transmitter has a front door that protects the 5 digits display, the 2 status LEDs and the three front keys.

In operating mode the display shows the weight and the LEDs indicate the status of weight (net-gross).

The set-up parameters are easily accessible and can be changed through the use of the three front keys used to select, edit, confirm and save the new settings.



### DISPLAY

On the 5 digits display the lowest digit indicates the least significant digit. Normally, the display shows the measured weight. During set-up procedure, the display shows the sequence of the parameters and their values, that allow the operator to set the instrument.

### LED INDICATORS

In the upper part of the display there are two LED indicators:

LED 1 (on = net weight, off = gross weight, flashing = peak)

LED 2 (on = tare entered, off = no tare)

In bar-graph view, both LEDs are flashing.

## USING THE KEYBOARD

The instrument is programmed and controlled through the 3 keys keyboard, with the following functions:

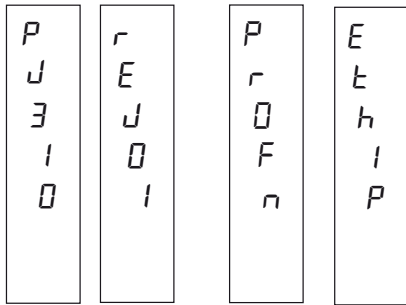
KEY	FUNCTIONS IN WEIGHT INDICATION CONDITIONS
▲	Short press: Display switches from Gross to Net weight. Long press: Display switches from Weight to Peak
◆	Short press: Display switches from Numerical to Bar-graph of to gross weight. Long press: Zeroing of the weight/peak displayed.
▼	Short press: Sending the data to the serial line (if the manual protocol was selected) Long press: Set point programming (DAT 200/A)
▼ ◆	Pressed at the same time: Accessing the Main Menu

KEY	FUNCTION IN THE MANAGEMENT OF THE set up MENU
▲	Exits the set up menu or returns to the higher level.
◆	Access its submenu, or access the set up or confirms the selected parameter.
▼	Goes to the next menu item.

KEY	FUNCTION IN THE MANAGEMENT OF THE SET UP SUBMENU
▲	Increases the blinking digit / select the higher value.
◆	Select the next digit. If the flashing digit is the last one, confirm the value and end the set up / selection.
▼	Decrease the blinking digit / select the lower value.

## DISPLAY INFO

When the instrument is switched ON the test-display is performed. In sequence there are: software code, software version and hardware version.



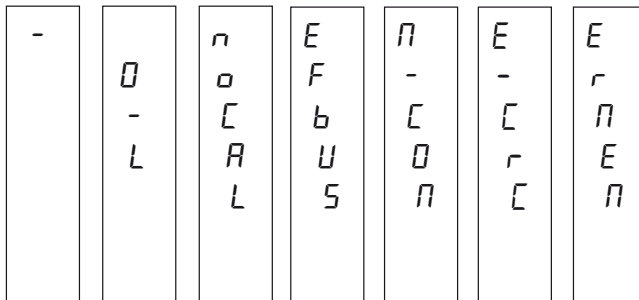
*Pr0Fn* Profinet hardware module

*Pr0Fb* Profibus DP hardware module

It's important to communicate these data in the event of a request for assistance.

## ERRORS NOTIFICATION

In the operating mode, the display can report the following error codes.



- Overload: The weight applied to the load cell exceeds by more than 9 divisions the maximum capacity of the weighing system.


*0-L* O-L : No signal from the load cells or outside of the field of measurement mV/V.

*n0CAL* NOCAL: Transmitter not calibrated. Recalibration needed.

*EFBUS* EFBUS: Fieldbus interface absent or not working.

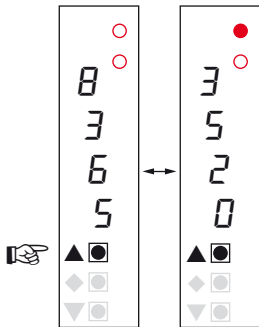
*n-com* N-COM: Fieldbus interface of the instrument is not connected to the network.

*E-CRC* E-CRC: CRC error during communication with the fieldbus interface of the instrument.

*ERMEN* ERMEM: Error in E<sup>2</sup>PROM. You can reprogram the instrument to the factory settings, erasing any calibration by pressing  key.

# VIEWING, ZEROING THE WEIGHT AND AUTO TARE

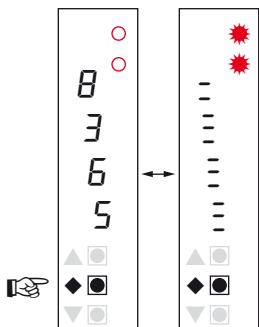
When the instrument is switched ON, the display shows the current net weight.



## VIEWING THE NET WEIGHT/GROSS WEIGHT

Press the key ▲ to toggle between the net weight to gross weight and vice versa. The value displayed is reported by the LED 1 (lit: net weight). If you have not entered the tare, the net weight is equal to the gross weight.

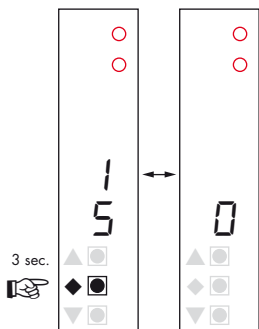
In case of negative weight, it is displayed the minus sign before the most significant digit. In case of negative weight greater than 9999, the minus sign is displayed alternatively with the most significant digit.



## NUMERICAL VIEWING/BAR-GRAPH OF THE GROSS WEIGHT

Press the key ◆ to toggle from numerical display of the weight to the graphical representation of the gross weight and vice versa. The resolution is limited to 15 divisions and therefore each segment represents 1/15 of full scale.

The bar-graph display is indicated by both LEDs flashing.



## ZEROING THE WEIGHT

This operation is performed to correct small movements of the zero of the scale. To perform the reset function, it is necessary to switch the display to gross weight.

Press ◆ key for 3 seconds to zeroing gross weight.

The gross weight reset command does not run under the following conditions:

Unstable weight.

Gross weight greater (positive or negative) than the OBAND value set.

If you previously performed the autotare function, this is automatically delayed. When the instrument is switched off, it is restored the value of Zero made during calibration.

## AUTOMATIC TARE

To perform the auto-tare function, it is necessary to switch the display to Net weight (LED 1 on).

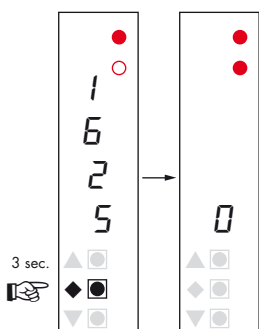
Press ◆ key for 3 seconds to to perform Autotare function. Led 2 switched on. The automatic tare command does not run under the following conditions:

Unstable weight.

Negative gross weight.

Gross weight greater than the maximum capacity.

If the automatic tare is performed with gross weight = 0, the display shows again gross weight (Led 1 switched off).

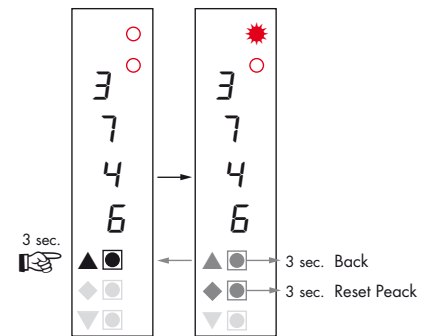


## PEAK FUNCTION

The peak is related to the gross weight and is always calculated, even when it is not displayed. When you see the peak, the top LED flashes.

To store the value press ▲ key for 3 seconds. To go back to weight display press ▲ key for 3 seconds. To reset the peak value press ◆ key for 3 seconds.

The calculated peak is not retained at power off.



# SET UP

## GENETAL INFO

All functions of the DAT 200 can be and amended through a simple setup menu, shown on the next page. All the settings activated or selected are stored even after switching off the transmitter.

The DAT 200 is factory set. See the "default" parameters on the following pages.

At the first installation in the field some parameters need to be amended to obtain a correct indication of the displayed weight (datasheet adjustment).

This procedure may be required when you purchase the DAT 200.


The settings of the setup menu can be changed using the three front buttons.

## CHANGING AND ENTERING THE PARAMETERS:




The setup parameters are grouped into a number of main menus.




To access the setup menu press simultaneously for 3 seconds  and  keys.

The display shows the message `CONF` which is the first of the main menus


Use the  and  keys to select the menu to edit


Press the  key to enter the selected menu.

KEY	PROGRAMMING FUNCTION DURING THE MAIN MENU
	Exits the programming menu or returns to the higher level.
	Access the relevant menu or programming or confirm the selected parameter.
	Skip to the next menu.

KEY	FUNCTION DURING PARAMETERS PROGRAMMING
	Increases the blinking digit / select the higher value.
	Select the next digit. If the flashing digit is the last, confirms the value and ends the programming / selection.
	Decreases the blinking digit / select the lower.

The parameters of the menu can take selectable values and numerical value.

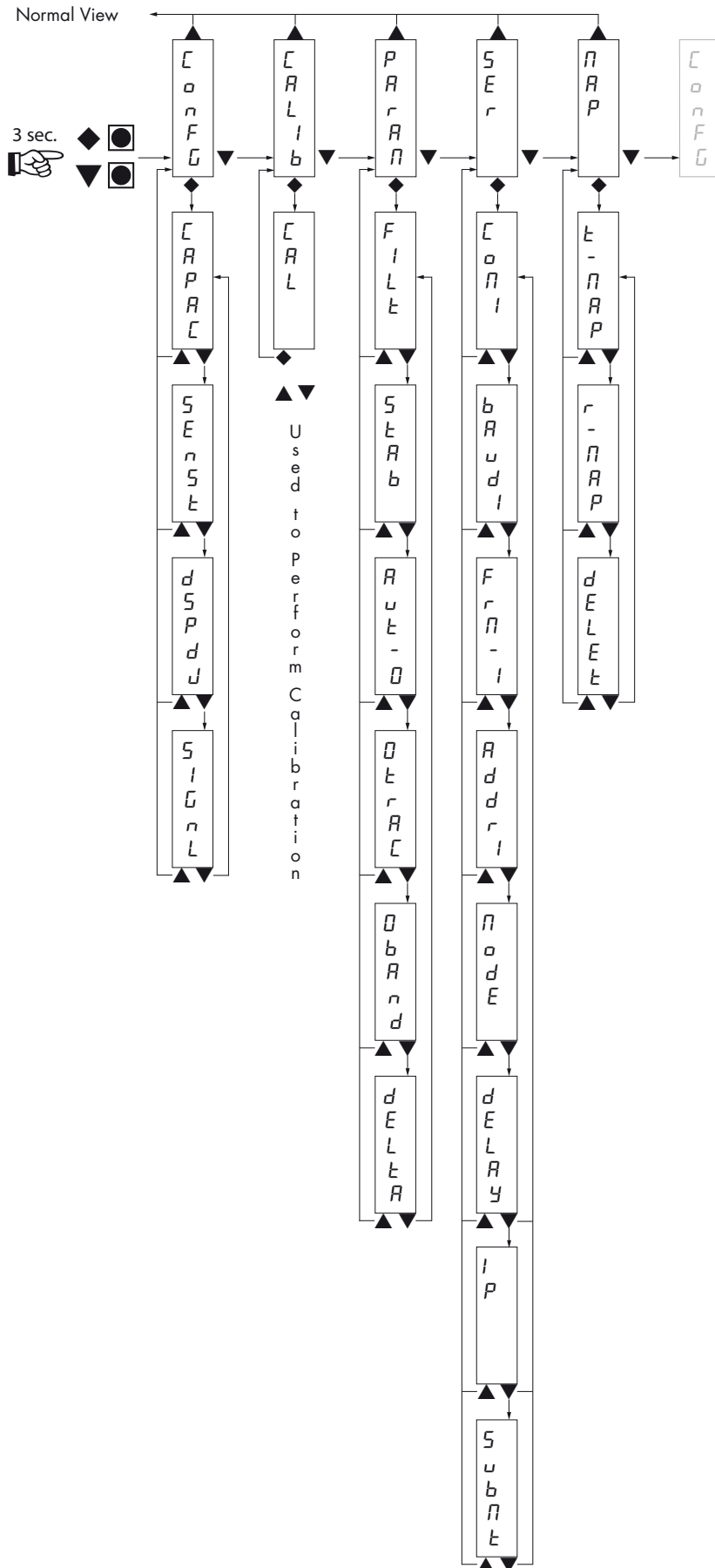
 key. Increment the flashing digit, select the next alternative value, goes back to the higher level or exits the setup menu.

 key. Select the next digit, confirm the setting of the selected parameter, access the set up parameters and access the set up submenu.

 key. Decrement the flashing digit, select the previous alternative value.

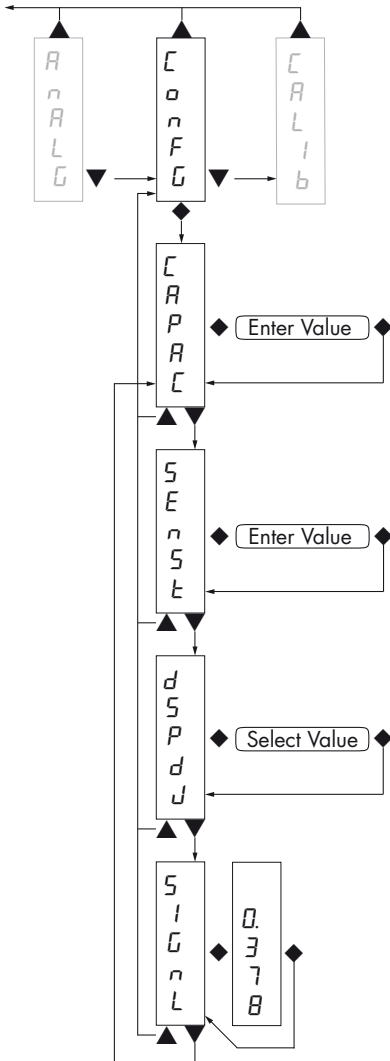
NB. To exit and save the changed data, press the  button until the indicator returns to the operating mode.

# FLOW CHART MENU



## CONFIGURATION PARAMETERS

Through the setting of the parameters listed below, the DAT 200 Full Scale datasheet calibration is performed. You must complete these steps with the zero calibration described on the next page. The procedure ensures, in the absence of mechanical problems, a good accuracy of the system (maximum error <1% FS).



### CAPAC CAPACITY OF THE WEIGHING SYSTEM

It defines the value corresponding to the sum of the rated capacity of the load cells. In case of single load cell systems and "N" fixed supports, enter the capacity value of the load cell for the total number of supports. This figure represents the full scale value of the weighing system. Following the change of the parameter value, the datasheet calibration of the weight is recalculated.

Values: from 1 to 99999

Unit: the same of that displayed

Default: 10000

### SENS LOAD CELLS SENSITIVITY

Set the value corresponding to the sensitivity average of the load cells, in mV/V. The instrument accepts values between 0.5 and 4 mV/V. If no values are entered, the unit assumes it is 2 mV/V.

Following the change of the sensitivity value, the datasheet calibration is recalculated.

Values: from 0.5000 to 4.0000 mV/V

Default: 2.0000

### dSPdJ DIVISION VALUE

The ratio between the maximum capacity of the system and the division value is the resolution of the system (number of divisions).

Following the change of the capacity of the system, it is automatically selected the division value to the best of 5000 divisions.

Following the change of the division value, if the maximum capacity does not change, the calibration of the weight is automatically corrected.

Selectable Values:

0.0001 - 0.0002 - 0.0005

0.001 - 0,002 - 0,005

0.01 - 0.02 - 0.05

0.1 - 0.2 - 0.5

1 - 2 - 5

10 - 20 - 50

Default: 1

### SIGNL TESTING THE LOAD CELLS SIGNAL

It's displayed the signal acquired from the load cells expressed in mV / V.



# CALIB - CALIBRATION

The calibration method below, is used to correct or reduce the linearity error of the weighing system. The calibration should be performed with the use of sample weight or pre-weighed product on a sample weighing system.

Before proceeding with the calibration of the full scale, always perform the zero calibration.

During the calibration phase, the display shows the weight intermittently with the inscription  $EARL$ .

ATTENTION: at power off without exiting the set-up menu, the programming executed are not stored.

NB In the event that after calibration the system has linearity errors, verify that the structure weighed is completely free from mechanical constraints.

## ZERO CALIBRATION

Perform the operation when the system is empty (including the fixed tare) and the weight is stable. The zero of the system is done by pressing the ▼ key. The display shows  $2-00$  confirming the operation.

The weight displayed resets and the display shows  $EARL$  alternated by  $0$ . It is possible to repeat this operation more times.

## CALIBRATION OF FULL SCALE

Prior F.S. calibration load the sample weight on the system and wait for the stabilization; the display shows a weight value.

Press the ▲ key to adjust the weight. The display shows  $00000$  with the first digit flashing.

Use the ▲ or ▼ keys, enter the weight value starting with the first digit flashing. Switch to the next digit by pressing ◆. The confirmation of the last digit performs the correction of the weight. The display shows  $EARL$  alternated to the weight entered.

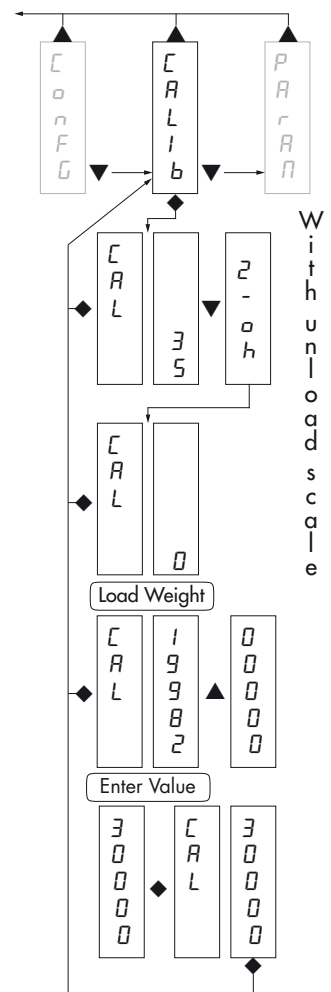
If the weight value is higher than the resolution, it is not accepted and the display shows an error message for a few seconds.

You can always repeat the F.S. calibration.

## EXIT FROM CALIBRATION MENU

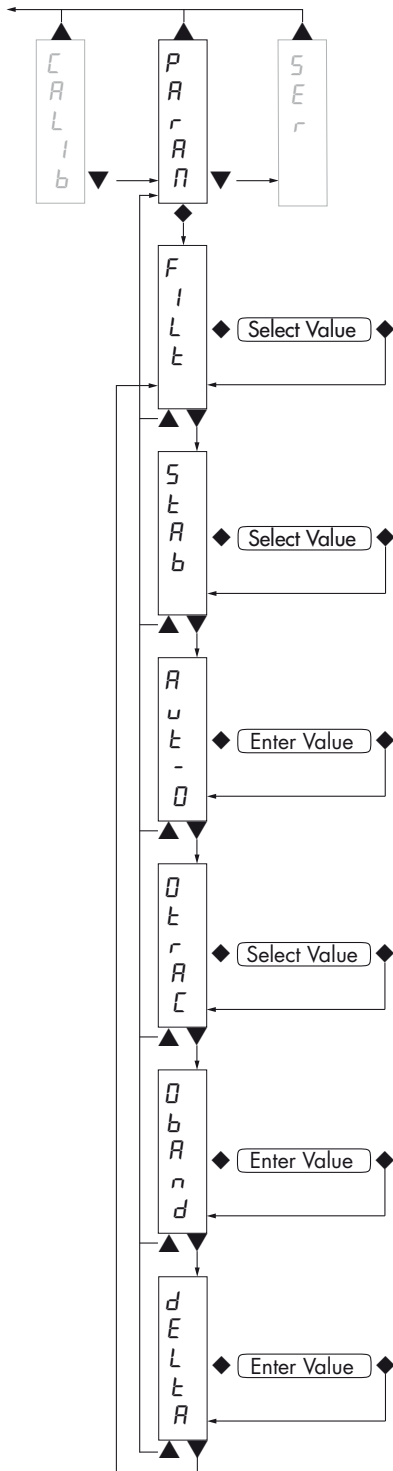
The exit from the menu  $EARL b$  is done by pressing ◆ key.

The display shows  $EARL b$ . To store the new setting and exit the setup menu, press the ▲ key.



## PARAM - WEIGHING PARAMETERS

The parameters in this menu allow to adjust the timing of the acquisition and updating of the display and the manual or automatic zeroing that the transmitter performs.



### **FILTER WEIGHT FILTER**

This parameter adjusts the refresh speed of the display and the analog output.

Low values of the filter speed up the display refresh.

High values of the filter slow down the display refresh.

Value	Updated	Response
0	123 Hz	25 Hz
1	62 Hz	16 Hz
2	50 Hz	8 Hz
3	33 Hz	5 Hz
4	16 Hz	2.5 Hz
5	12 Hz	1.5 Hz
6	10 Hz	1 Hz
7	8 Hz	0.7 Hz
8	6 Hz	0.4 Hz
9	4 Hz	0.2 Hz

Default: 5

### **StAb WEIGHT STABILITY**

This parameter defines the divisions number needed to deem the weight stable.

A large number of divisions allows the transmitter to detect quickly the weight stability, which is needed when executing tare and print commands.

Value      Change

0      Always stable weight

1      Stability reached quickly

2      Stability reached with medium parameters

3      Stability reached accurately

4      Stability reached with the highest accuracy

Default: 2

### **Aut-0 AUTOZERO AT POWER ON**

This parameter defines the maximum resettable weight upon power on.

This operation corresponds to a zero calibration of the system and is executed only if the weight is stable and below the set value.

Value from 0 to the value of the CAPAC parameter.

Default: 0

### **0tRc TRACKING THE ZERO**

This function allows a momentary zero calibration compensating the eventual temperature drift of the weight.

At power off it automatically returns to the previous calibration.

The maximum weight resettable by this parameter is 2% of the range of the system.

To disable this feature, use the value 0.

Value	Change
0	Control OFF
1	0.5 div/sec
2	1 div/sec
3	2 div/sec
4	3 div/sec

Default: 0

### **0bRn d ZERO BAND**

This parameter defines the number of divisions resettable by pressing the zero front button or Input 1.

Values: from 0 to 200

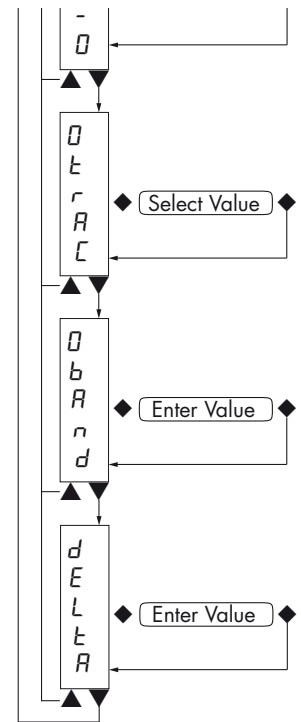
Default: 100

### **dELtA WEIGHT DELTA**

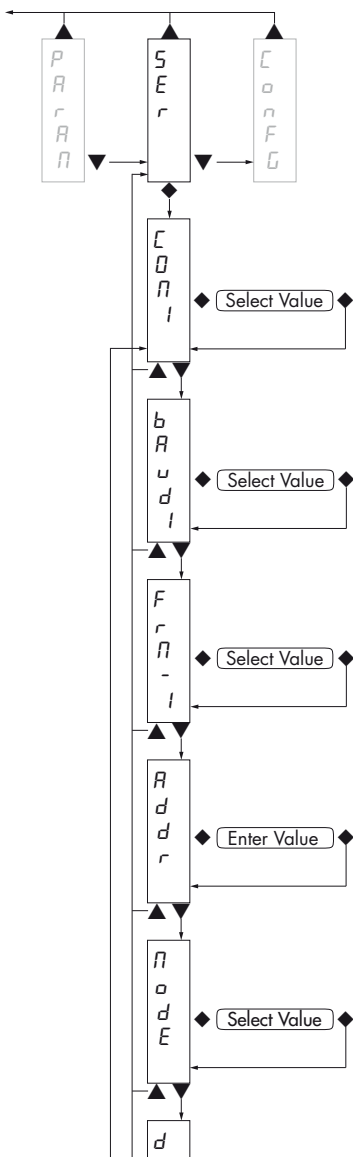
It defines the minimum number of divisions needed to discriminate two consecutive weighing in serial transmissions of the weight.

Values: from 0 to 200

Default: 20



## SER - SETTING THE SERIAL COMMUNICATION PORTS



**COM1 COM1:** It defines the use of the COM1 serial port.

**None:** Serial communication OFF

**Contn:** Continuous transmission of the weight string. It can be used, for example, to drive a remote display. See details in the relevant paragraph.

**Deman:** When the Operator presses the front button or through Input 2, a string of weight is transmitted. The command is accepted if the weight is stable. Between two consecutive transmissions the weight must have a variation of at least the parameter "Weight delta".

**Autom:** It's automatically transferred to a string of weight when the weight stabilizes at a value higher than the minimum weight (20 divisions). Between two consecutive transmissions the weight must have a variation of at least the value set in the parameter "Delta Weight".

**Slave:** ASCII protocol. See details in the relevant paragraph.

**Modbs:** MODBUS RTU (slave) protocol. See details in the relevant paragraph.

*Selectable Values:*

None  
Contn  
Deman  
Autom  
Slave  
Modbs  
Default: Modbs

**bAUDI BAUD RATE COM1**

It defines the RS232 serial port baudrate.

The value must be set to the same value of the PC / PLC or remote display.

*Selectable Values:*

2400  
4800  
9600  
19200  
38400  
57600  
115200  
Default: 9600

### *Frn-1* **COM1 DATA FORMAT**

It defines the data format of the RS232 serial port.

The value must be set to the same value of the PC / PLC or remote display.

In the case of MODBUS or SLAVE protocol, selections of the 7-bit data formats (E-7-1 and O-7-1) are not accepted (error message "Nvalid").

*Selectable Values:*

N-8-1

N-8-2

E-8-1

O-8-1

E-7-1

O-7-1

*Default:* N-8-1

### *Addr* **COM1 / COM2 SERIAL COMMUNICATION ADDRESS**

Configuration of the address used in the transmission protocols and in the MODBUS protocol.

*Value from 000 to 99.*

*Default:* 01

### *ModE* **TRANSMITTED DATA WEIGHT COM1 / COM2**

Selecting the value transmitted with continuous, automatic and manual protocols (see relevant paragraph).

*Selectable Values:*

Net

Gross

Peak

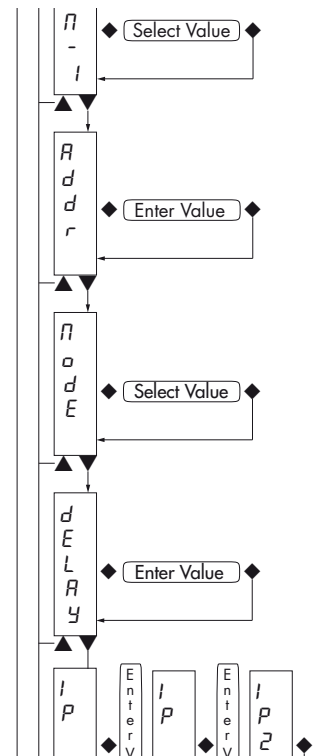
*Default:* Gross

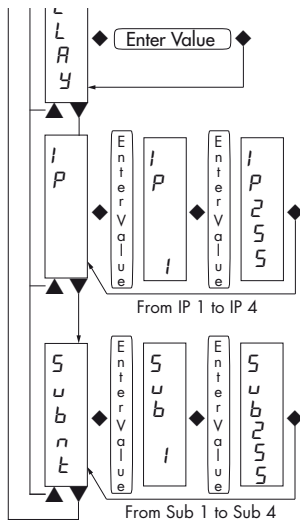
### *dELAY* **DELAYED RESPONSE OF THE SLAVE AND MODBUS RTU COM1 PROTOCOLS**

Value in milliseconds, representing the delay of the instrument when sending the response to the request of the master.

*Values: from 0 to 999*

*Default:* 000





## **IP PROGRAMMING THE IP ADDRESS FOR THE PROFINET PROTOCOL**

The 4 bytes that define the IP address must be programmed in sequence. In IP 1 enter via the ▲ e ▼ pushbuttons the value of the first three digits of the address. Once you have confirmed the value with the ◆ key, the display shows IP 2. Enter the value of the second group of numbers and repeat until complete insertion of the address.

*Values: from 000 to 255*

*Default: 000*

## **Subnet PROGRAMMING THE SUBNET MASK**

The 4 bytes that define the subnet mask, must be programmed in sequence with the same methods used for programming of the IP address.

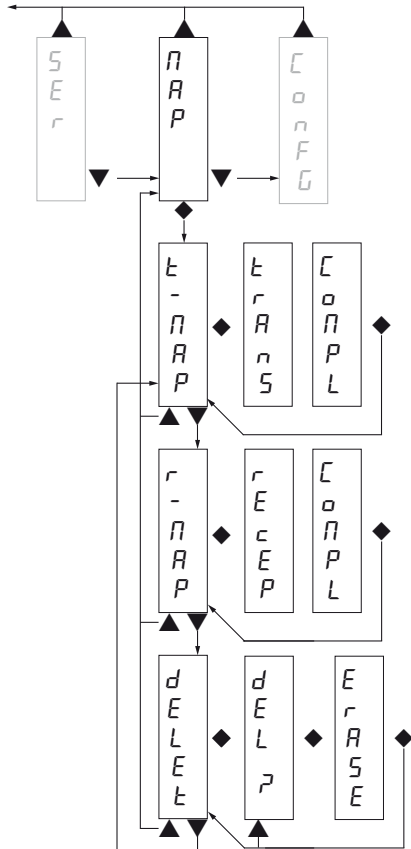
*Values: from 000 to 255*

*Default: 000*

# MAP - MAPPING FUNCTION SETTING

This function not allows for the user, change the mapping of the data exchanged via the fieldbus.

**N.B. Do not use this configuration menu if you do not need**



## t-*MAP* SENDING DATA TO PC

This function allows you to transfer the mapping of registers from WT 2 instrument, to the PC program. Before starting the transmission, on the PC must be enabled the reception of the map (Receive button). During transmission display shown *TRANS*, and at the end of the transmission shown *COMPL*.

In order to finish the procedure of transfer of the mapping pressing the **◆** key.

## r-*MAP* RECEIVING DATA FROM PC

This function allows you to receive the mapping of register from PC program.

Before starting transmission from PC program, it is necessary press the **◆** key on WT 2 transmitter. Display will shown *RECEP* and at the end of the transmission shown *COMPL*.

In order to finish the procedure of transfer of the mapping pressing the **◆** key.

## dELETE DATA RESET

This function allows you to reset the default setting map of the instrument. During transmission display shown *ERASE*.

In order to finish the procedure of transfer of the mapping pressing the **◆** key.

# SERIAL COMMUNICATION PROTOCOLS

## CONTINUOUS, AUTOMATIC AND MANUAL TRANSMISSION PROTOCOL

These protocols have been programmed into their programming menu.

The string transmitted is as follows:

STX	<state>	<weight>	ETX	<chksum>	EOT
-----	---------	----------	-----	----------	-----

Where

STX (start of text) = 0x02h

ETX (end of text) = 0x03h

EOT (end of transmission) = 0x04.

<state> = character encoded as per the following table (bit = 1 if condition TRUE)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	Tare entered	Zero band	Stable weight	Zero center

<weight> = field consisting of 8 ASCII characters with the weight value justified on the right. (without leading zeros, with possible decimal point and negative sign).

The weight value transmitted can be the net weight, the gross weight or the peak value based on the selection of the transmitted data (MODE parameter) in the setting menu of the serial communication ports (see relevant paragraph).

Under conditions of overload, the weight field assumes the value: "^^^^^^".

Under conditions of underload (negative weight greater than 99999), the weight field assumes the value: " \_ \_ \_ \_ \_ \_ \_ \_".

In reading error conditions, the weight field assumes the value: " O-L".

<csum> = checksum of the string data. It is calculated by performing the exclusive OR (XOR) of all characters from STX (or from <ind>) to ETX excluded the latter; the result of the XOR is decomposed into 2 characters by considering separately the upper 4 bits (first character) and lower 4 bits (second character); the 2 characters obtained are then ASCII encoded (example: XOR = 5Dh; <csum> = "5Dh" namely 35h and 44h).

In the case of continuous communication protocol, the given string is transmitted at a frequency of 10 Hz, regardless of the weight filter selected.

In the case of automatic and manual communication protocols, between 2 consecutive weight transmissions, they must undergo a corresponding change to the value set in DELTA parameter, in the setup menu of weighing parameters (see relevant paragraph).



## **SLAVE TRANSMISSION PROTOCOL**

LIST OF THE CONTROLS AVAILABLE:

- Request of the current gross weight.
- Request of the current net weight.
- Request of the current peak value.
- Control of self-calibration.
- Control of semi-automatic zero.
- Control to reset the peak value.

The unit connected to the instrument (typically a personal computer) acts as a MASTER and is the only unit that can start a process of communication.

The process of communication must be made by the transmission of a string by the MASTER, followed by a reply from the SLAVE concerned.

### **CONTROLS FORMAT DESCRIPTION:**

The double quotes enclose constant characters (observe upper and lower case); the <and> symbols contain variable numeric fields.

#### *REQUEST OF THE CURRENT GROSS WEIGHT*

Master: <Addr> "L" EOT

    DAT 200: <Addr> "L" <status> <gross> ETX <checksum> EOT

#### *REQUEST OF THE CURRENT NET WEIGHT*

Master: <Addr> "N" EOT

    DAT 200: <Addr> "N" <status> <net> ETX <checksum> EOT

#### *REQUEST OF THE CURRENT PEAK VALUE*

Master: <Addr> "P" EOT

    DAT 200: <Addr> "P" <status> <peak> ETX <checksum> EOT

#### *CONTROL OF SELF-CALIBRATION*

Master: <Addr> "A" EOT

    DAT 200: <Addr> "A" ACK EOT

#### *CONTROL OF SEMI-AUTOMATIC ZERO*

Master: <Addr> "Z" EOT

    DAT 200: <Addr> "Z" ACK EOT

#### *CONTROL TO RESET THE PEAK VALUE*

Master: <Addr> "X" EOT

    DAT 200: <Addr> "X" ACK EOT

In the case of communication error or otherwise unrecognized command from DAT 200, it will respond with the following string:

    DAT 200: <Addr> NAK EOT

**FIELDS DESCRIPTION**

The double quotes enclose constant characters (observe upper and lower case); the <and> symbols contain variable numeric fields.

STX (start of text) = 0x02h,

ETX (end of text) = 0x03h,

EOT (end of transmission) = 0x04h,

ACK (acknowledgment) = 0x06h,

NAK (No acknowledgment) = 0x15h.

<Addr> = Serial communication address + 0x80h (i.e., address 2: <Addr> = 0x82h (130 decimal number)).

<status> = character encoded as per the following table (bit = 1 if condition TRUE)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	Tare entered	Zero band	Stable weight	Zero center

<gross>, <net>, <peak> = field consisting of 8 ASCII characters with the weight value justified on the right (no leading zeros, with possible decimal point and negative sign).

Under conditions of overload, the weight field assumes the value: "^^^^^^^^".

Under conditions of underload, the weight field assumes the value: " \_ \_ \_ \_ \_ \_ \_ \_".

In reading error conditions, the weight field assumes the value: " O-L".

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	0	0	not used	not used

<csum> = checksum of the string data. It is calculated performing the exclusive OR (XOR) of all characters from STX (or from <ind>) to ETX excluded the latter; the result of the XOR is decomposed into 2 characters considering separately the upper 4 bits (first character) and lower 4 bits (second character); the 2 characters obtained are then ASCII encoded (example: XOR = 5Dh; <csum> = "5Dh" namely 35h and 44h).

## MODBUS RTU PROTOCOL

WARNINGS: The addresses listed in the tables below follow the standard routing specified in the reference guidelines of the Modicon PI-MBUS-300 Rev.J ([www.modbus.org](http://www.modbus.org)), referred to below is an excerpt that helps the user to communicate with the instrument.

*"All data addresses in Modbus messages are referenced to zero. The first occurrence of a data item is addressed as item number zero. For example:*

*The coil known as 'coil 1' in a programmable controller is addressed as coil 0000 in the data address field of a Modbus message.*

*Coil 127 decimal is addressed as coil 007E hex (126 decimal).*

*Holding register 40001 is addressed as register 0000 in the data address field of the message. The function code field already specifies a 'holding register' operation. Therefore the '4XXXX' reference is implicit."*

The values of the registers with address greater than 40100 are permanently stored in memory only after the data save command (see Command Register table). If this function is not performed by turning off the instrument, it will return to the value before the change.

If not otherwise specified, the numerical values (such as addresses, codes and data) are expressed as decimal values.

## COMMUNICATION ERRORS HANDLING

In case of MODBUS RTU, the communication strings are controlled by the CRC (Cyclic Redundancy Check). In the case of a communication error, the slave does not respond with a string. The master must consider a timeout for the receipt of the response. In case of no answer there is a communication error.

## RECEIVED DATA ERROR HANDLING

In the case of string received correctly, but that cannot be executed, the slave responds with an EXCEPTION RESPONSE according to the following table.

Code	Description
1	ILLEGAL FUNCTION (The function is not valid or not supported)
2	ILLEGAL DATA ADDRESS (The address of the specified data is not available)
3	ILLEGAL DATA VALUE (The received data have invalid value)

## SUPPORTED FUNCTIONS

- FUN 03 READ HOLDING REGISTER
- FUN 06 WRITE SINGLE REGISTER
- FUN 16 WRITE MULTIPLE REGISTERS

## LIST OF THE MODBUS PROTOCOL HOLDING REGISTERS

Address	Holding Register	R/W	Format	Notes
40001	Status Register	R	INT	See Table A.
40002	Gross weight (MSB)	R	INT	
40003	Gross weight (LSB)	R	INT	
40004	Net weight (MSB)	R	INT	
40005	Net weight (LSB)	R	INT	
40006	Peak (MSB)	R	INT	
40007	Peak (LSB)	R	INT	
40501	Data Register (MSB)	W	INT	Writing before or with the same query of Command Register.
40502	Data Register (LSB)	W	INT	Writing before or with the same query of Command Register.
40503	Command Register	W	INT	See Table B page 27.
41001	Load cell capacity (MSB)	R/W	INT	
41002	Load cell capacity (LSB)	R/W	INT	
41003	Load cell Sensitivity	R/W	INT	
41004	Weight division value	R/W	INT	See Table C page 27.
41101	Weight filter factor	R/W	INT	
41102	Weight stability factor	R/W	INT	
41103	Auto-zero at power ON	R/W	INT	
41104	Auto-zero at power ON	R/W	INT	
41105	Zero tracking factor	R/W	INT	
41106	Zero band	R/W	INT	
41107	Weight Delta	R/W	INT	
42000	Monitor register	W	INT	The programmed value is automatically copied to Monitor Register (42100).
42100	Monitor register	R	INT	

**TABLE A: STATUS REGISTER**

BIT	15	14	13	12	11	10	9	8
Description	Not used	Not used	0	0	0	0	Memory Flag	Not used

BIT	7	6	5	4	3	2	1	0
Description	Not calibrated	Wrong weight	Over-load	Under-load	Tare entered	Zero band	Stable weight	Center of Zero

**WARNING: bits 13, 12, 11 and 10 are always 0.**

**TABLE B: COMMAND REGISTER**

Register value	COMMAND REGISTER FUNCTION	DATA REGISTER FUNCTION
0x0001	Semiautomatic zero	-
0x0002	Self-calibration	-
0x0003	Peak reset	-
0x0004	Switch in Gross mode	-
0x0005	Switch in Net mode	-
0x0006	Switch in Peak mode	-
0x0010	Calibration of the weight zero	-
0x0011	Calibration of the full weight scale	sample weight
0x0020	Saving the data in the permanent memory	-
0x7FFF	Direct access memory	

**Warning:** the value entered in the Command Register is always active until you write again 0x0000.

Address	Data stored in memory with command 0x0020
41001-41002	Load cells capacity
41003	Load cells sensitivity
41004	Weight division value
41101	Weight filter factor
41102	Weight stability factor
41103-41104	Auto-zero SET POINT
41105	Zero tracking factor
41106	Zero band
41107	Weight Delta

**TABLE C: DIVISION VALUE**

Register value	0	1	2	3	4	5	6	7	8
Division value	0.0001	0.0002	0.0005	0.001	0.002	0.005	0.01	0.02	0.05

Register value	9	10	11	12	13	14	15	16	17
Division value	0.1	0.2	0.5	1	2	5	10	20	50

# PROFINET PROTOCOL

FIELD BUS data exchange takes place on two separate memory areas, which are described on page 38.

## WARNING:

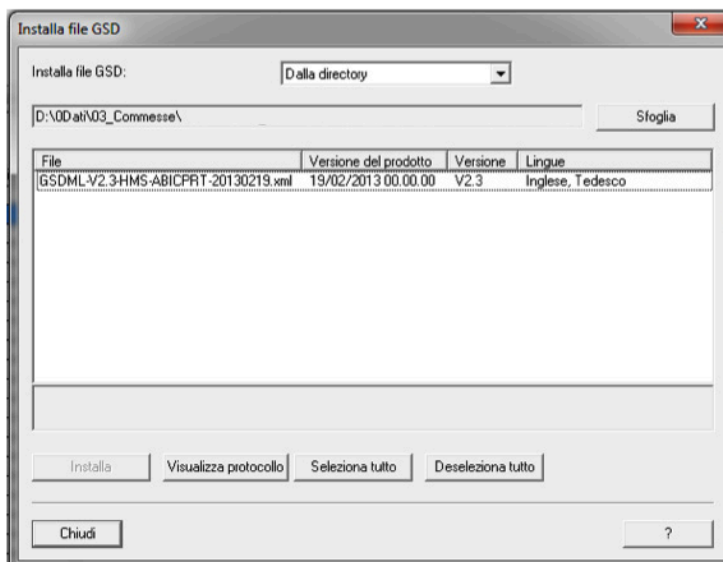
The "Input Data Area" and the "Output Data Area" are of 128 bytes

To transfer the parameters of the Output Data Area to the instrument you need to enable direct access to the memory, writing the hexadecimal value 0x7FFF in the Command Register (1 word in writing) in order to avoid that the instrument resets all its variables in the case of uninitialized Output Data Area

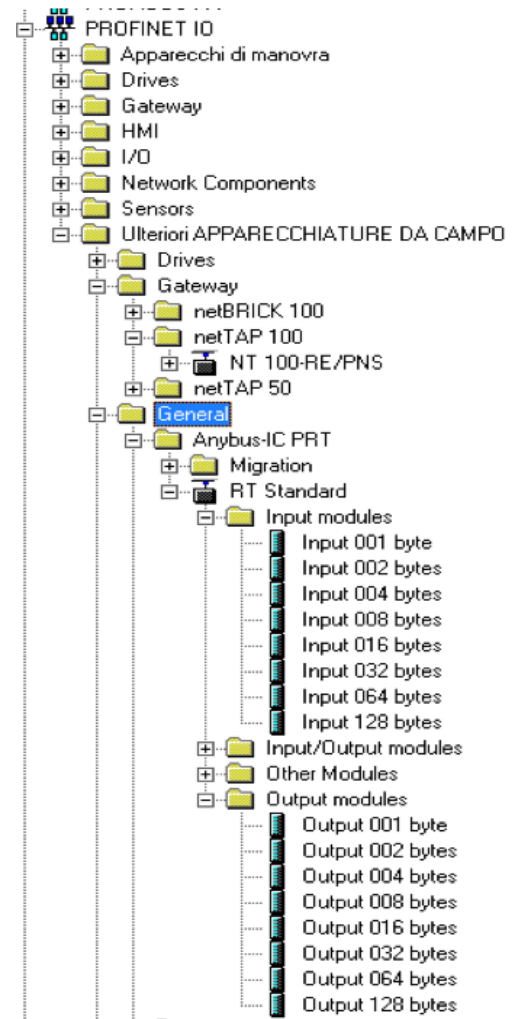
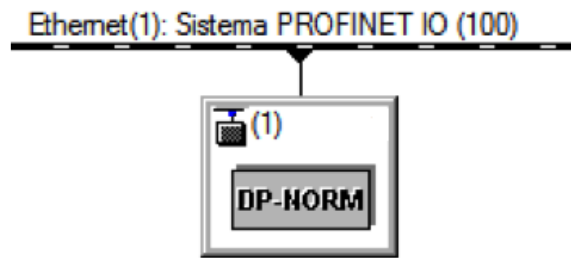
This command must be sent before the connection to inform the instrument that the parameters have been initialized by the master. Now, the instrument continually tests the changes made to the parameters and stores them only in case of real change.

## PROFINET S7 300 PROCEDURE CONNECTION

1. gsd file installation.



- In the Siemens catalog, path Profinet IO, General, Anybus-IC PRT, select the standard RT module and add in the profinet network.



- Enter inputs and outputs to 128 bytes and associate desired address, define the name of the object eg. DAT 200, it will serve for naming the network.

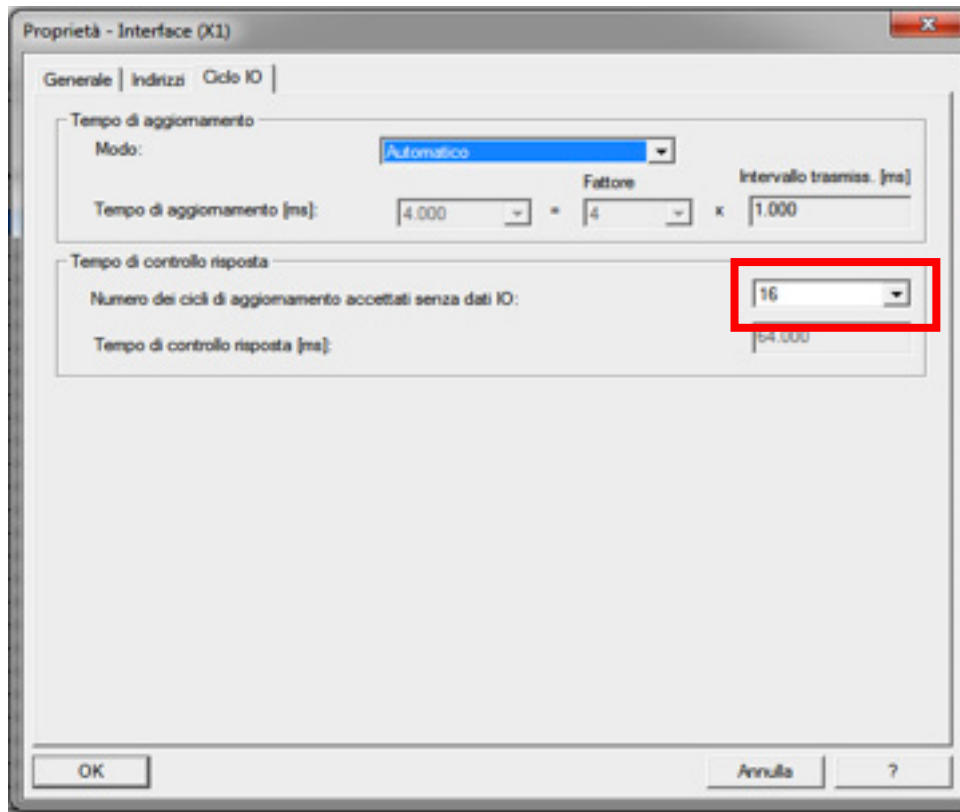
The 'UR' table shows the following configuration:

Posto	Unità
1	
2	CPU 315-2 PN/DP
X1	MPI/DP
X2	PN-IO
X2 P1 R	Porta 1
X2 P2 R	Porta 2
3	
4	
5	
6	
7	
8	

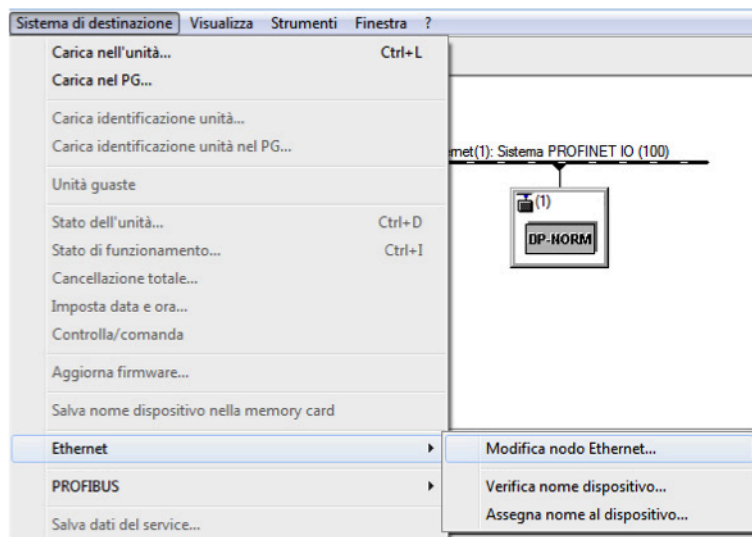
The 'Module name' configuration window shows the following table:

Posto connettore	Unità	Numero di ordinazione	Indirizzo E	Indirizzo A	Indirizzo di diagnostica	Commento
0	Module name	ABIC-PRT			2042*	
X1	Interface				2041*	
P1	RJ45 100 MBit/s				2040*	
1	Input 128 bytes		256...383			
2	Output 128 bytes			256...383		
3						

4. Open interface properties and change in the folder IO cycle the value of the number of cycles without updating data. If this value won't be not changed, the cpu will continue to generate communication errors and the module won't recognized on the network, or will continues to give communication errors.



5. Select the procedure ethernet node editing.





- Using the Browse button, select the module to be parameterized, define in the DAT 200 configuration the IP address, see PARAMETERS SERIAL OUTPUT. Give to the module the IP configuration and device name; The device name must be the same as defined in the hardware configuration DEVICE NAME; if the IP address and the NAME UNIT are not defined and equal, the module is not recognized in the profinet network.

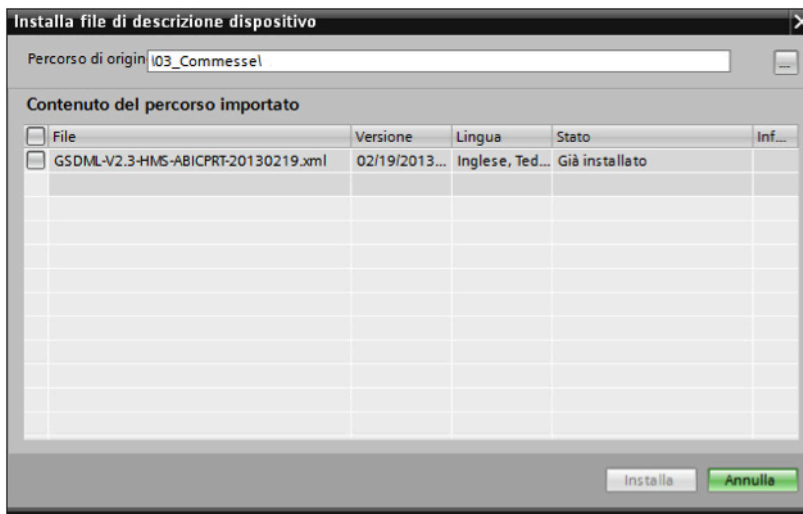
The image shows a software window titled "Modifica del nodo Ethernet" (Modify Ethernet node). The window is divided into several sections:

- Nodo Ethernet:** Contains a text field for "Indirizzo MAC" with the value "00-30-11-08-7F-76" and a "Sfoglia..." (Browse...) button. To the right, there is a checkbox labeled "Nodo raggiungibile online" (Node reachable online).
- Impostazione configurazione IP:** This section is expanded and contains:
  - A radio button labeled "Utilizzo parametri IP" (Use IP parameters) which is selected.
  - Text fields for "Indirizzo IP:" (192.168.0.100) and "Maschera sotto-rete:" (255.255.255.0).
  - Radio buttons for "Accoppiamento ad altra rete" (Coupling to other network), with "Non utilizzare nessun router" (Do not use any router) selected and "Utilizza router" (Use router) unselected.
  - A secondary "Indirizzo:" field with the value "192.168.0.100".
- A radio button labeled "Rilevamento dell'indirizzo IP da un altro server DHCP" (IP address detection from another DHCP server) is unselected.
- Below this, a section "identificato tramite" (identified by) has three radio buttons: "ID client" (selected), "Indirizzo MAC" (unselected), and "Nome apparecchio" (unselected). An "ID client:" text field is present below these options.
- An "Assegna configurazione IP" (Assign IP configuration) button is located at the bottom of this section.
- Assegnazione nome apparecchio:** Contains a text field for "Nome apparecchio:" with the value "dat200" and an "Assegna nome" (Assign name) button.
- Reset delle impostazioni della fabbrica:** Contains a "Reset" button.

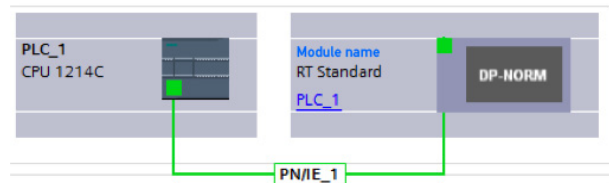
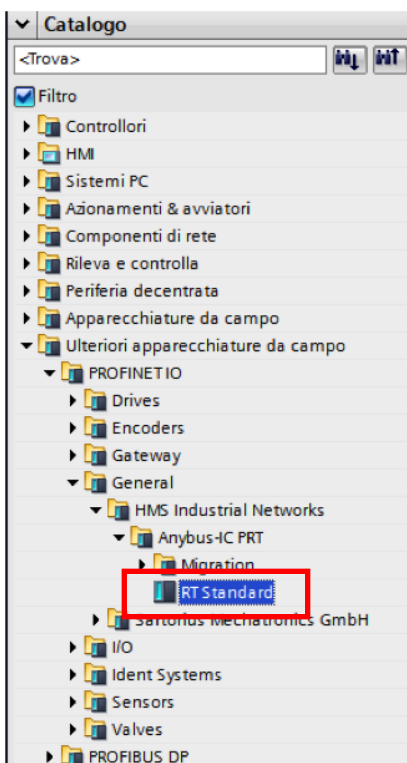
At the bottom of the window, there are "Chiudi" (Close) and "?" buttons.

## PROFINET S7 1200 PROCEDURE CONNECTION

1. gsd file installation.



2. In the Siemens catalog, path Profinet IO, General, Anybus-IC PRT, select the standard RT module and add in the profinet network.



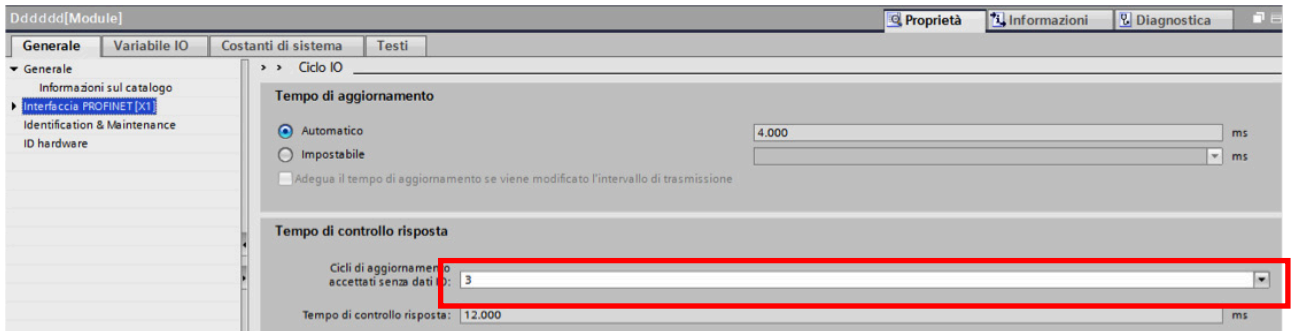
Vista generale dispositivi

Unità	Telaio...	Posto ...	Indirizzo I	Indirizz...	Tipo	N° di ord.
▼ Module name	0	0			RT Standard	ABIC-PRT
▶ Interface	0	0 X1			ABIC-PRT	
Input 128 bytes_1	0	1	256...383		Input 128 bytes	
Output 128 bytes_1	0	2		256...383	Output 128 bytes	
	0	3				
	0	4				
	0	5				
	0	6				
	0	7				
	0	8				
	0	9				
	0	10				
	0	11				
	0	12				
	0	13				
	0	14				
	0	15				
	0	16				
	0	17				
	0	18				
	0	19				
	0	20				
	0	21				
	0	22				

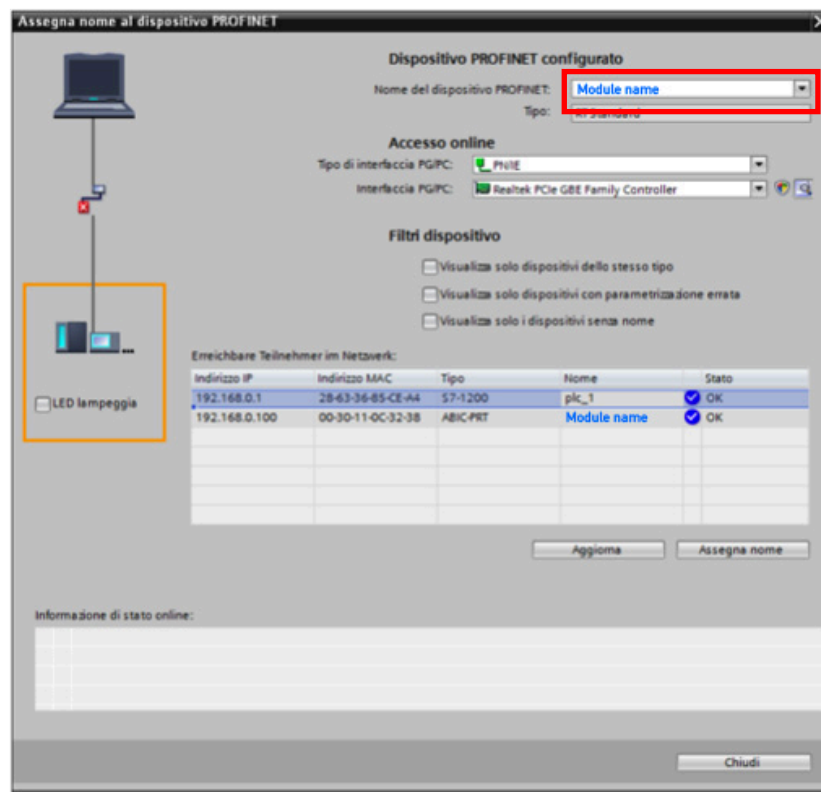
Catalogo

- ▼ Modulo di intestazione
- ▼ Modulo
  - Input modules
    - Input 001 byte
    - Input 002 bytes
    - Input 004 bytes
    - Input 008 bytes
    - Input 016 bytes
    - Input 032 bytes
    - Input 064 bytes
    - Input 128 bytes
  - Output modules
    - Output 001 byte
    - Output 002 bytes
    - Output 004 bytes
    - Output 008 bytes
    - Output 016 bytes
    - Output 032 bytes
    - Output 064 bytes
    - Output 128 bytes
- Input/Output modules
- Other Modules

- Open interface properties and change in the folder IO cycle the value of the number of cycles without updating data. If this value won't be not changed, the cpu will continue to generate communication errors and the module won't recognized on the network, or will continues to give communication errors.



- Through assigns name to the device, select the module to be parameterized, define in the configuration of DAT 200 the IP address, see PARAMETERS SERIAL OUTPUT. Assign to the module the IP configuration and device name; The device name must be the same as defined in the hardware configuration DEVICE NAME. If the IP address and the NAME UNIT are not defined and equal, the module is not recognized in the profinet network.



# ETHERNET IP PROTOCOL

FIELDBUS data exchange takes place on two separate memory areas, which are described in the tables on page 38.

## WARNING:

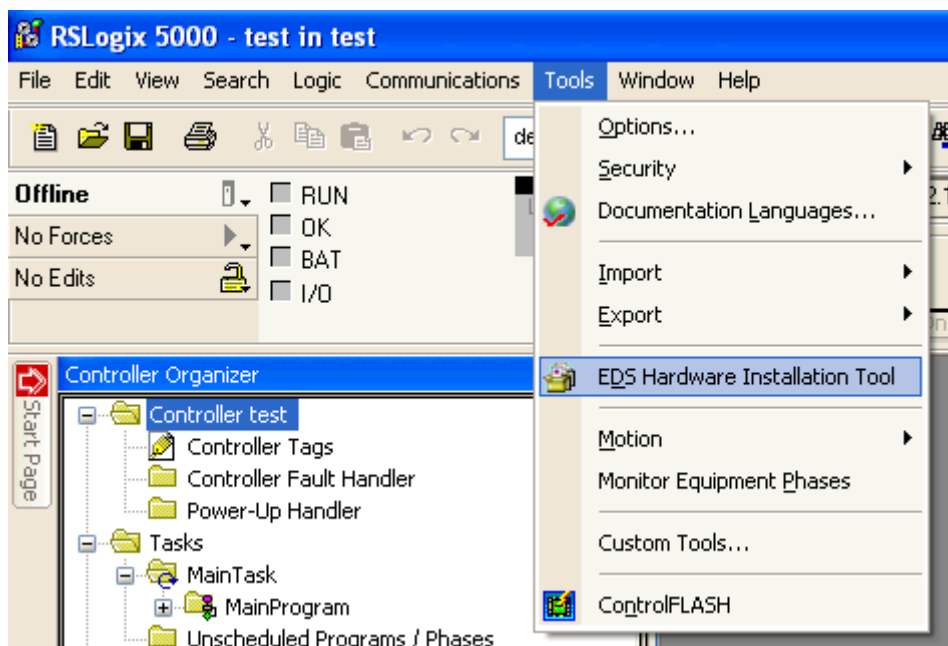
The "Input Data Area" and the "Output Data Area" are of 128 bytes

To transfer the parameters of the Output Data Area to the instrument you need to enable direct access to the memory, writing the hexadecimal value 0x7FFF in the Command Register (1 word in writing) in order to avoid that the instrument resets all its variables in the case of uninitialized Output Data Area

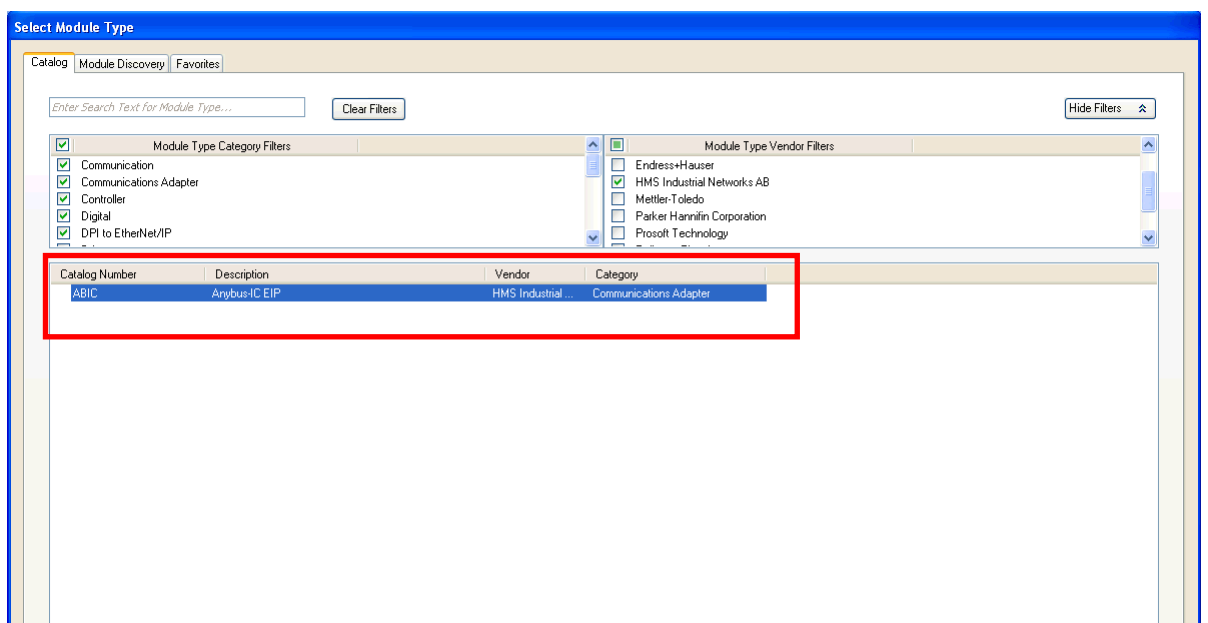
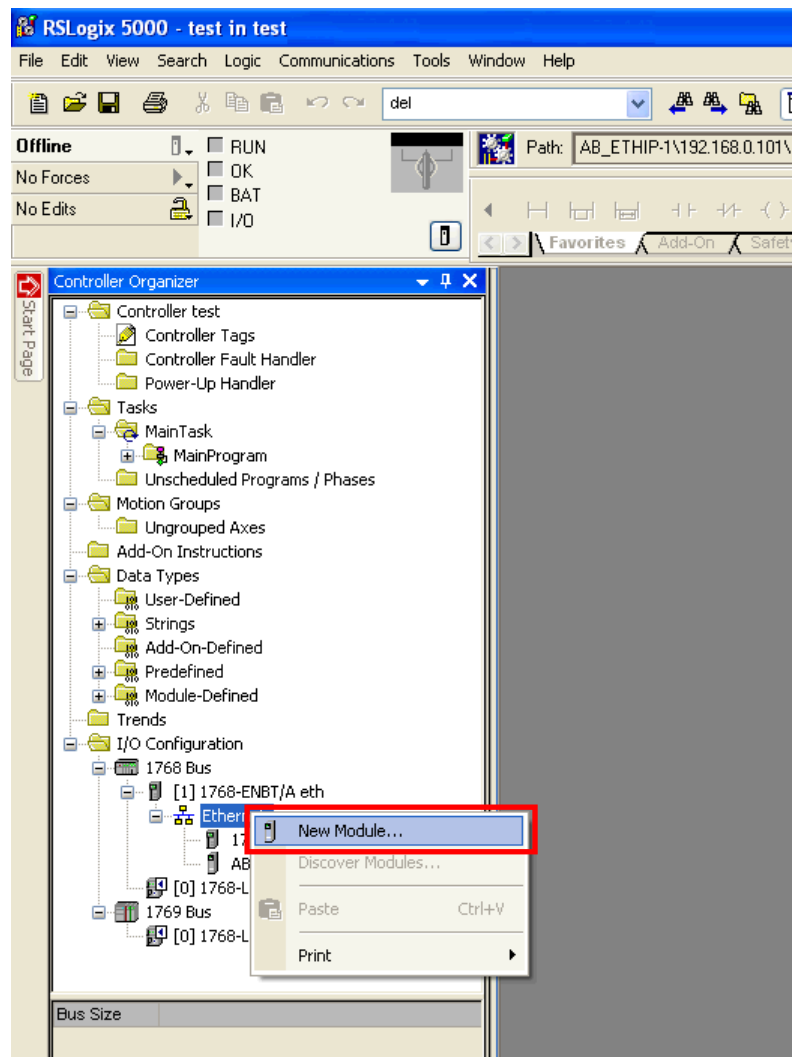
This command must be sent before the connection to inform the instrument that the parameters have been initialized by the master. Now, the instrument continually tests the changes made to the parameters and stores them only in case of real change.

## LOGIX 5000 SOFTWARE PROCEDURE CONNECTION

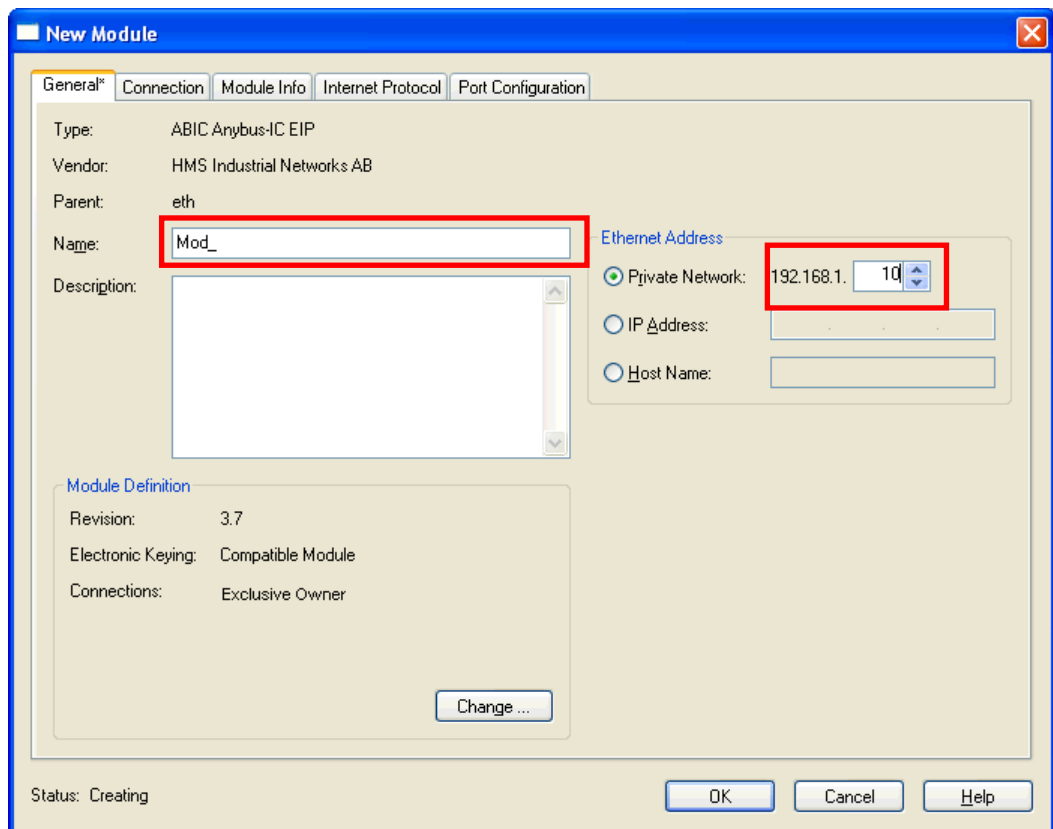
1. eds file installation.
2. In the Tools menu of the RSLogix 5000 software, select "EDS Hardware Installation Tool" to perform installation of the .eds file provided with the instrument.



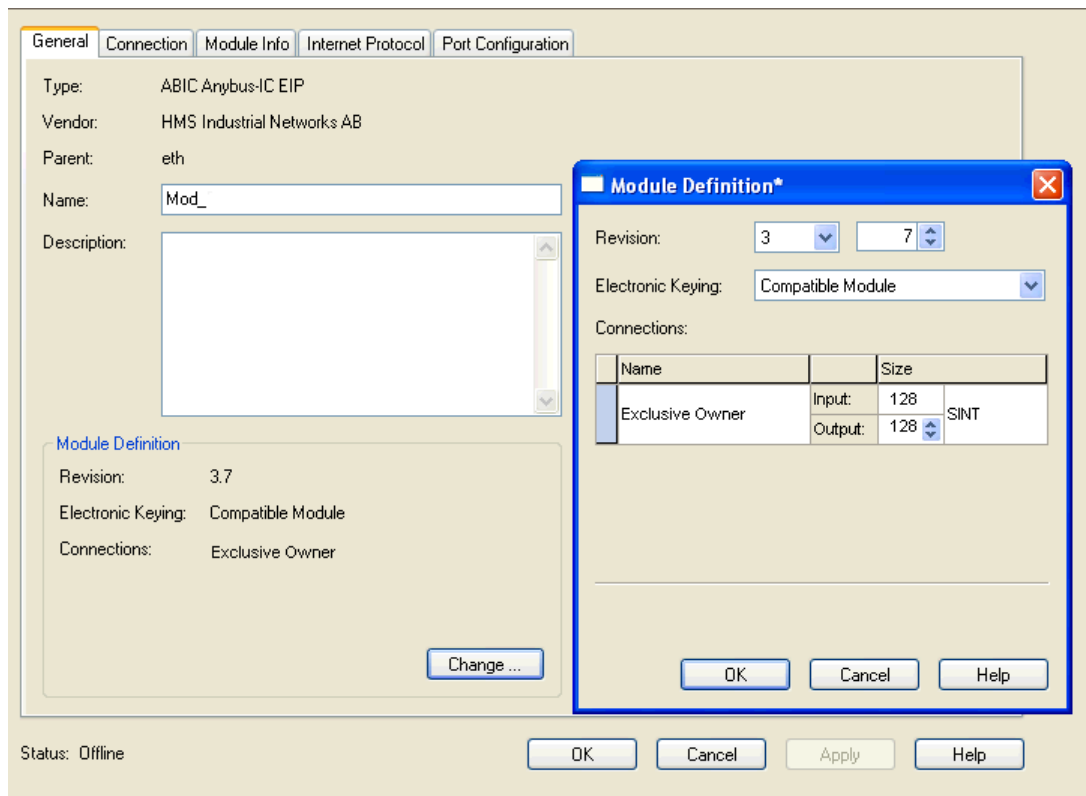
3. In the Controller Organizer window, I/O Configuration folder, choose the Ethernet subfolder click the right mouse button and select New Module.

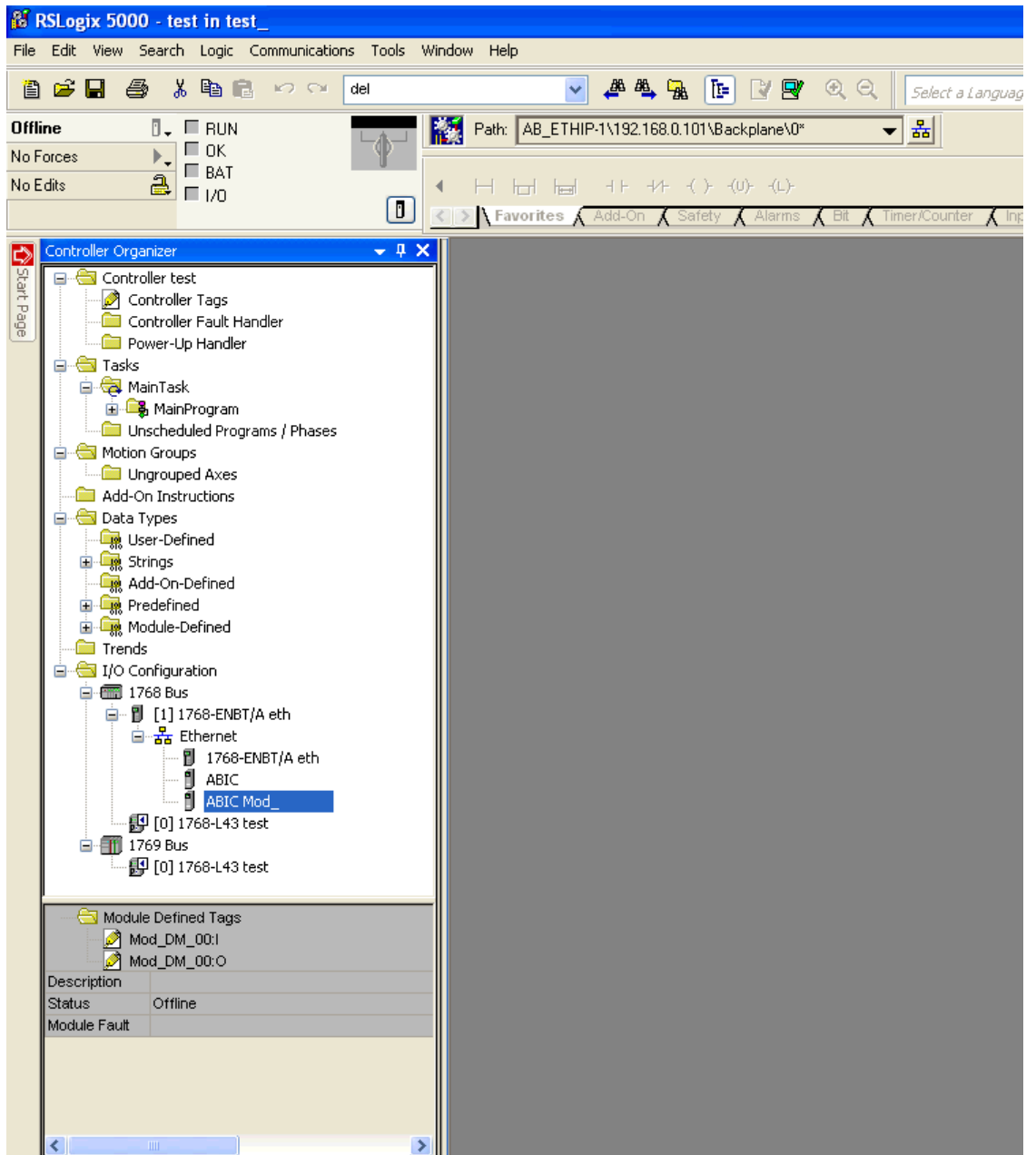


- Name the module with a desired name, enter the same IP address of the instrument, see page 31, as shown in the following figure.

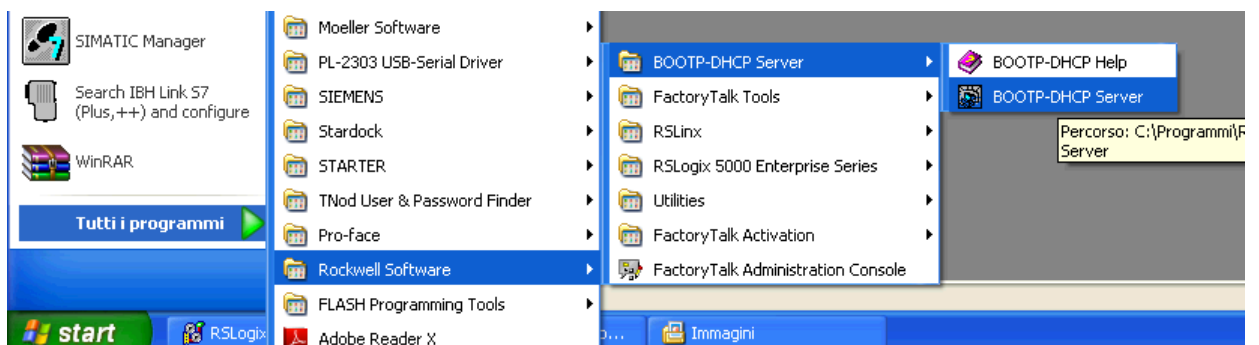


- Then select inputs and outputs at 128 byte in INTEGER mode.





- Through BOOT DHCP Server software, perform boot configuration. ETHERNET configuration is complete.



## INPUT DATA AREA

ADDRESS		Description	Format	Note
Byte	Bit			
0	0	Not used	BYTE	
1	0	Center_of_Zero	BOOL	
1	1	Stable_Weight	BOOL	
1	2	Zero_Band	BOOL	
1	3	Tare_entered	BOOL	
1	4	Under_Load	BOOL	
1	5	Over_Load	BOOL	
1	6	Off_Range	BOOL	
2	0	Gross_Weight	DINT	
6	0	Net_Weight	DINT	
10	0	Peak_Weight	DINT	
14	0	Load_Cell_Capacity	DINT	
18	0	Load_Cell_Sensitivity	INT	
20	0	Weight_Division_Value	INT	
22	0	Weight_Stability_value	INT	
24	0	Autozero_Set	DINT	
28	0	Tracking_Factor	INT	
30	0	Zero_Band	INT	
32	0	Delta_Weight	INT	
34	0	Monitor_Register	INT	

## OUTPUT DATA AREA

Address		Description	Format	Note
Byte	Bit			
128	0	Data_Register	DINT	
132	0	Command_Register	INT	See table B on page 27
134	0	Load_Cell_Capacity	DINT	
138	0	Load_Cell_Sensitivity	INT	
140	0	Weight_Division_Value	INT	See table C on page 27
142	0	Weight filter factor	INT	
144	0	Weight Stability value	INT	
146	0	Autozero_Set	DINT	
150	0	Tracking_Factor	INT	
152	0	Zero_Band	INT	
154	0	Delta_Weight	INT	
192	0	Monitor_Register	INT	



### READING EXAMPLE

To read the gross weight on the DAT 200 it is needed to read the addresses from 2 to 5 of the Input Area.

To read the net weight it is needed to read the addresses from 6 to 9 of the Input Area.

When the display shows the gross weight value of 12351 in the corresponding bytes there will be:

	Byte 2	Byte 3	Byte 4	Byte 5
Hex	00	00	30	3F
	0		12351	

### WRITING EXAMPLES

To write the set-up parameters following the example:

In the byte 132 (Command Register) write value Hex 7FFF. This value opens the writing area of the DAT 200.

Example: to change the default values of the DAT 200 like the Capacity of the load cells, the Sensitivity and Division value to 15000, 2.9965 and 2:

Capacity	Byte 134	Byte 135	Byte 136	Byte 137
Hex	00	00	3A	98
Dec	15000			

Sensitivity	Byte 138	Byte 139
Hex	75	0D
Dec	29965	

Division	Byte 140	Byte 141
Hex	00	0D
Dec	13	

Save the data by writing the value Hex 20 in Command Register. In case Zero and FS Calibration is not performed, put value Hex 0 in Command Register.

N.B. The DAT 200 does not accept writing of the same values already written.

To perform Zero and FS Calibration it is not needed to abilitate the internal Writing Area of the DAT 200.

#### Zero Calibration:

Whit empty system put Hex 10 in Command Register (byte 132). The new Zero value is stored. To de-activated the Zero Calibration command put value Hex 0 in Command Register.

#### Full Scale Calibration:

Put a know weight on the system and write its value in the Data Register (from byte 128 to 131). Put value Hex 11 in Command Register. The weight value will be displayed.

To store the new value put value Hex 20 in Command Register.

To end the procedure put value Hex 0 in Command Register.

## TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
The display shows the O-L message	The weight is not detectable because the cell is absent or incorrectly connected	Check the connections of the cells.
The display shows the hyphen in the upper display	The weight cannot be shown because it exceeds the available five digits or is greater than the capacity of the cells.	
The display shows the underscore on the lower display.	The weight cannot be shown because negative, more than -9999.	
The number of decimal places is wrong.	Incorrect division value selected.	Select the correct division value in the main menu.
The serial communication does not work properly.	Installation wrong. The selection of the operation of the serial interface is incorrect.	Check the connections as described in the installation manual. Select the settings as appropriate.
The function of semiautomatic zero doesn't work.	The gross weight exceeds the action limit of semi-automatic zero. The weight doesn't stabilize.	To re-establish the zero, calibrate the weight. Wait for the stabilization of the weight or adjust the weight filter parameter.
The semiautomatic tare function does not work.	The gross weight is negative or exceeds the maximum capacity. The weight doesn't stabilize.	Check the gross weight. Wait for the stabilization of the weight or adjust the weight filter parameter.

# EU Declaration of conformity (DoC)

We

Pavone Sistemi s.r.l.  
Via Tiberio Bianchi, 11/13/15  
20863 Concorezzo, MB

**declare that the DoC issued under our sole responsibility and belongs to the following product:**

Apparatus model/Product: **DAT 200**  
Type: Weighing instrument

The object of the declaration described above used as indicated in the installation manual and use, is in conformity with the relevant Union harmonisation legislation:

Directive **EMC 2014/30/EU** Electromagnetic Compatibility

The following harmonized standards and technical specification have been applied:

**EN 61000-6-2:2005**  
**EN 61000-6-3:2007 + A1 2011**  
**EN 61326-1: 2013**

Directive **LVD 2014/35/EU** Low Voltage Directive

The following harmonized standards and technical specification have been applied:

**EN 61010-1:2011**

Signed for end on behalf of:  
Concorezzo: 15/07/2019

  
Di Reda Donato - Manager



**PAVONE**SYSTEMS

**PAVONE SISTEMI S.R.L.**

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Industrial Electronic Weighing Systems since 1963

