

# TECHNICAL MANUAL



## **DAT 200** Serial and PROFIBUS weighing Indicator/Trasmitter

Software version PW0302



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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.

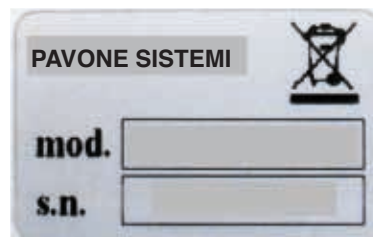
### Fieldbus available:

PROFIBUS

PROFINET

DEVICENET

### 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	PROFIBUS DP V1
Connection	D-Sub- 9 poles female connector
Baud rate	9.6 kbaud $\div$ 12 Mbaud with automatic selection
Address	1 $\div$ 125
In compliance with the standards	EN61000-6-2, EN61000-6-3 for EMC EN61010-1 for Electrical Safety



# INSTALLATION

## GENERAL INFORMATION

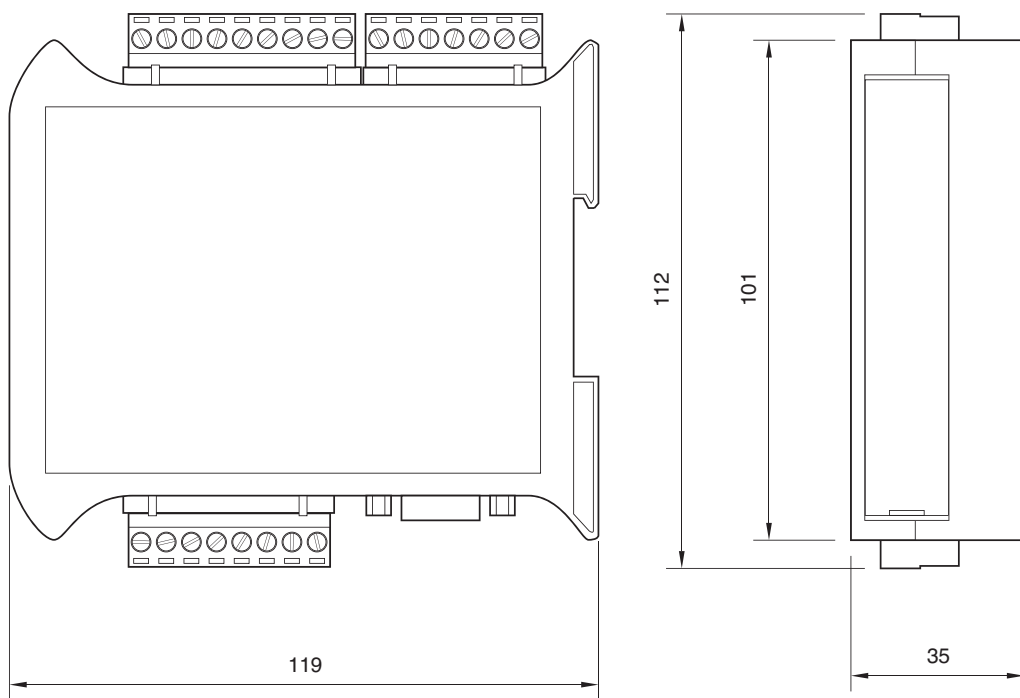
The DAT 200 consists of a motherboard, to which are added the options available, accommodated in a plastic enclosure for DIN rail 35mm.



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



## ELECTRIC INSTALLATION



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

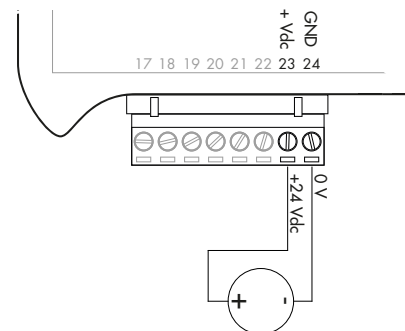
The load cell cable must be shielded and channeled away from power cables to prevent electromagnetic interferences.

## INSTRUMENT POWER SUPPLY

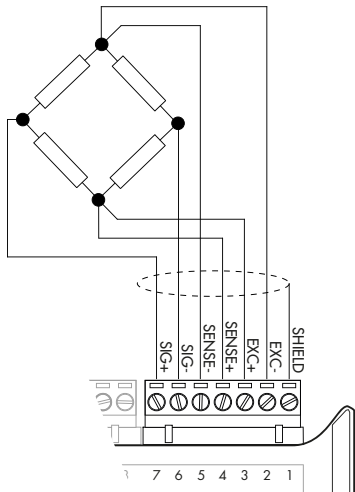
The instrument is powered through the terminals 23 and 24. The power supply cable must be channeled separately from other cables.

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.

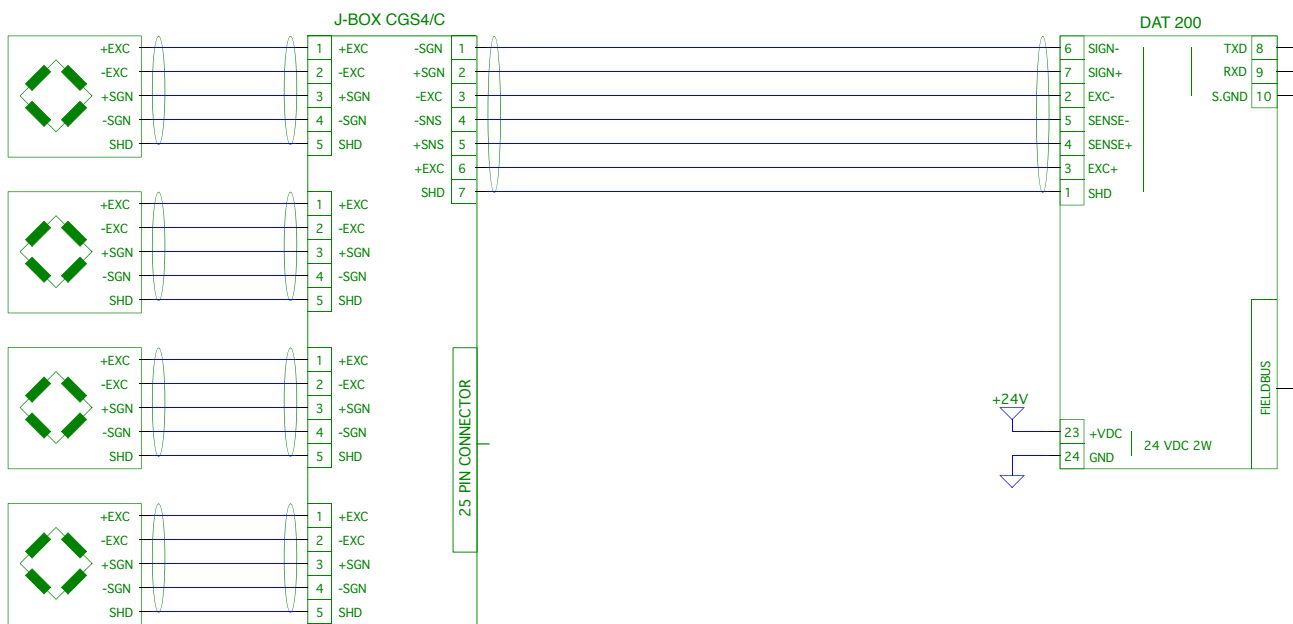
The instrument can be connected up to maximum 4 load cells of 350 ohm in parallel. The supply voltage of the load cells is 4 Vdc and is protected by temporary short circuit.

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).



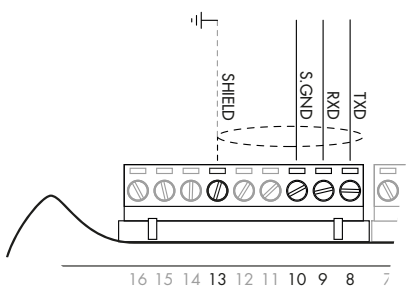
## SERIAL COMMUNICATION

### 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), beyond which you should take the optional RS485 interface.

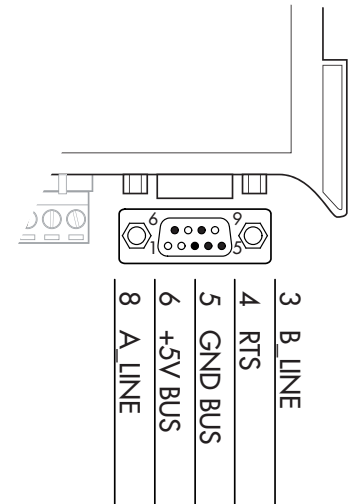




## FIELDBUS CONNECTION

PROFIBUS DP:

Pin	Signal	Description
1	-	-
2	-	-
3	B line	+RxD/+TxD, level RS485
4	RTS	Request to send
5	GND	Ground (isolated)
6	+ 5V Bus Output	+5V termination (isolated)
7	-	-
8	A line	-RxD/-TxD, level RS485
9	-	-
Housing	Cable shield	Internally connected to protective earth according to Profibus specification



For connection to the Profibus Master, use a standard Profibus cable.

For a reliable operation of the Fieldbus, should be used a line termination at both ends.

In the case of multiple DAT 200 instruments, use the line termination at only one instrument.

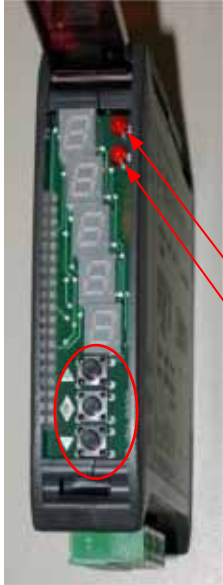
For configuring the instrument, the GSD file is available (hms\_1810.GSD) that must be installed in the master.

## 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:

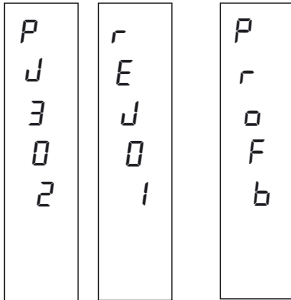
KEY	FUNCTIONS IN WEIGHT INDICATION CONDITIONS
▲	Short press: Display switches from Gross to Net weight. Long press: Display switches from Weight to Peak
◆	Short press: Display switches from Numerical to Bar-graph of to gross weight. Long press: Zeroing of the weight/peak displayed.
▼	Short press: Sending 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.

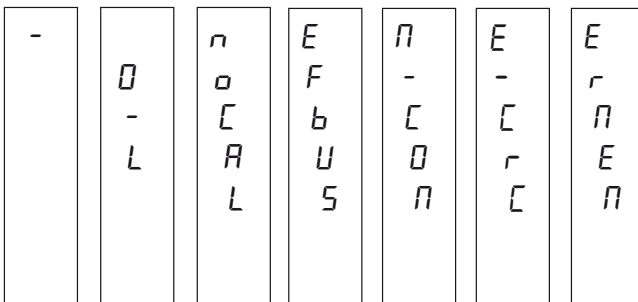



*Pr o F b* Profibus DP hardware module

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

### ERRORS NOTIFICATION

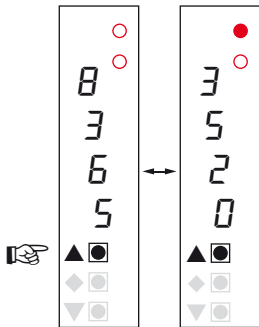
In the operating mode, the display can report the following error codes.



- 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.
- n o C A L* NOCAL: Transmitter not calibrated. Recalibration needed.
- E F b u S* EFBUS: Fieldbus interface absent or not working.
- n - c o m* N-COM: Fieldbus interface of the instrument is not connected to the network.
- E - C r C* E-CRC: CRC error during communication with the fieldbus interface of the instrument.
- E r M E M* 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

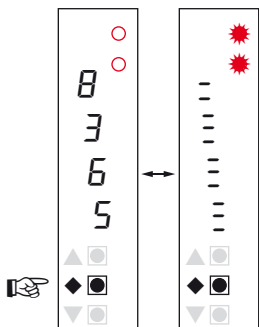
When the instrument is switched ON, the display shows the current net weight.



## 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.

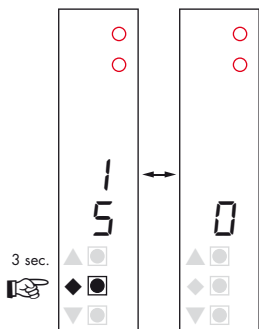
In case of negative weight, it is displayed the minus sign before the most significant digit. In case of negative weight greater than 9999, the minus sign is displayed alternatively with the most significant digit.



## 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).

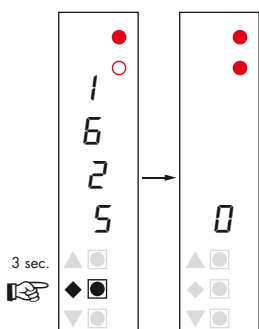
Press ◆ key for 3 seconds to to perform Autotare function. Led 2 switched on. The automatic tare command does not run under the following conditions:

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).

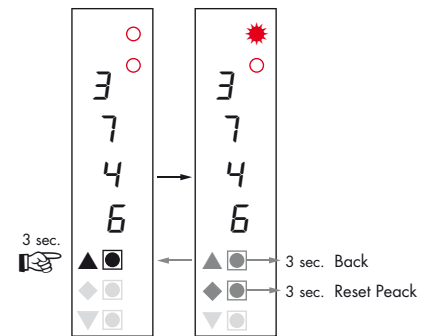


## PEAK FUNCTION

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

## GENERAL 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.

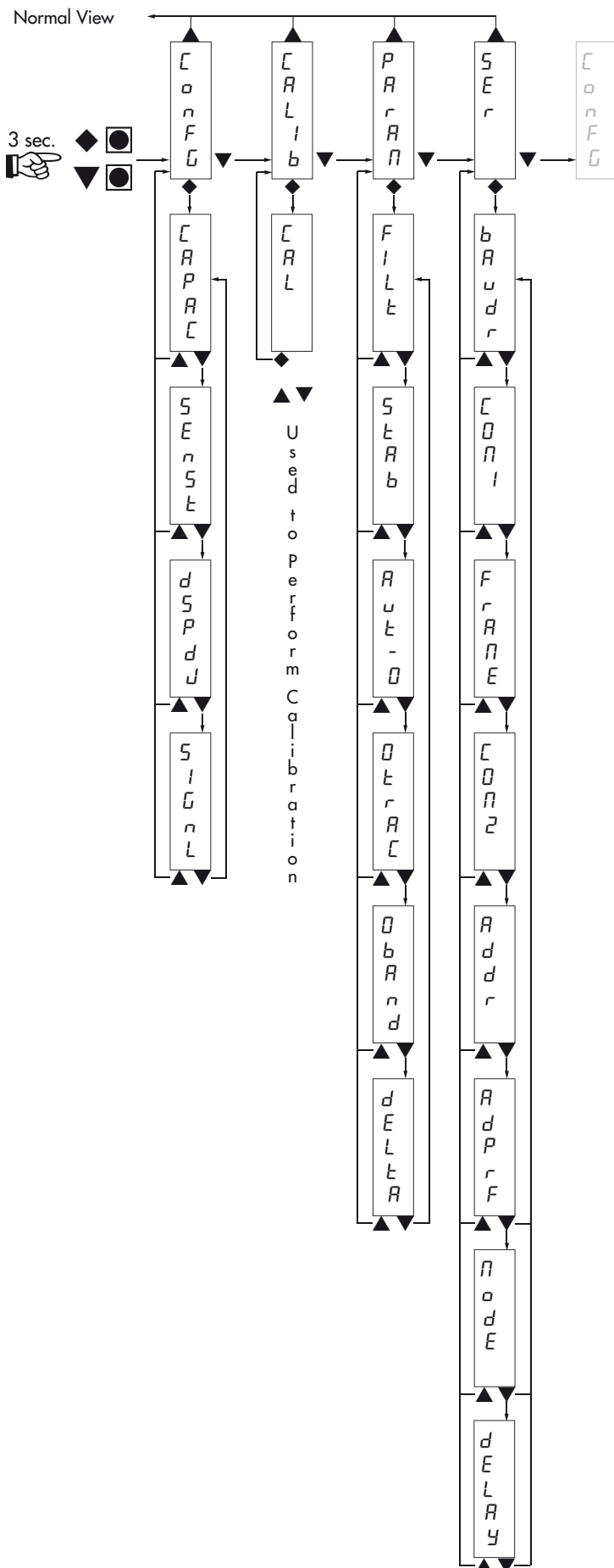
 key. Increment the flashing digit, select the next alternative value, goes back to the higher level or exits the setup menu.

 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.

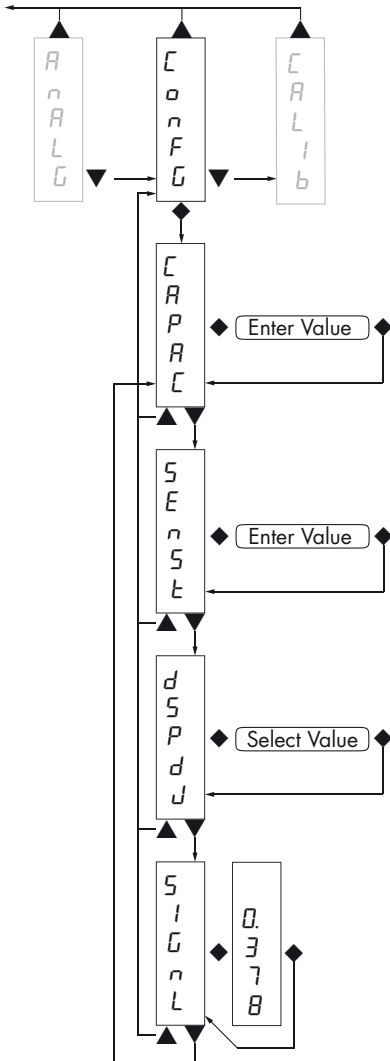
NB. To exit and save the changed data, press the  button until the indicator returns to the operating mode.

# 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:

0.001 - 0.002 - 0.005

0.01 - 0.02 - 0.05

0.1 - 0.2 - 0.5

1 - 2 - 5

10 - 20 - 50

Default: 1

### **SIGNAL TESTING THE LOAD CELLS SIGNAL**

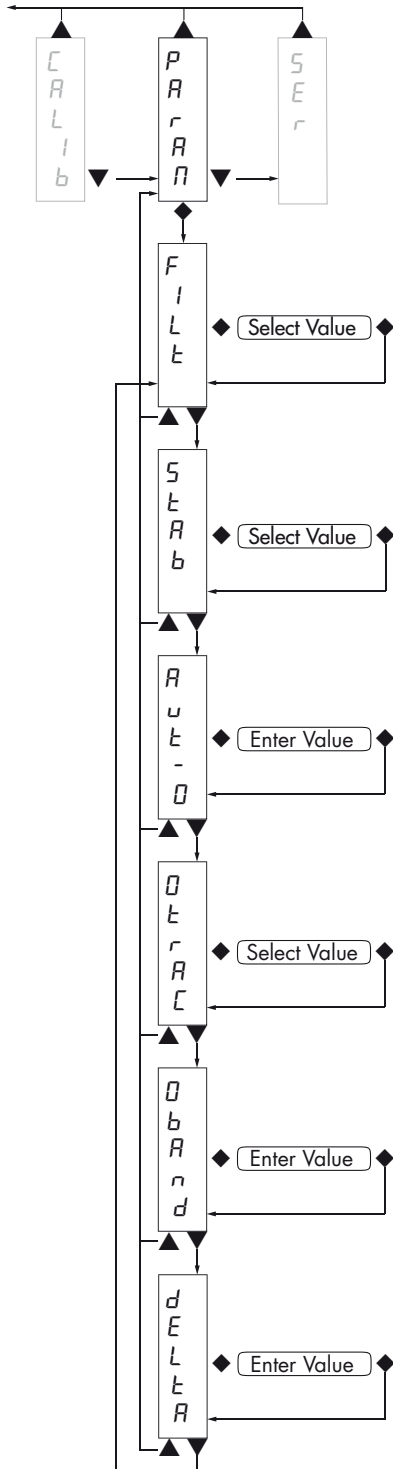
It's displayed the signal acquired from the load cells expressed in mV / V.





## 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

### ***dELTA* 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.

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

*Default: 0*

### ***dBand* 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*

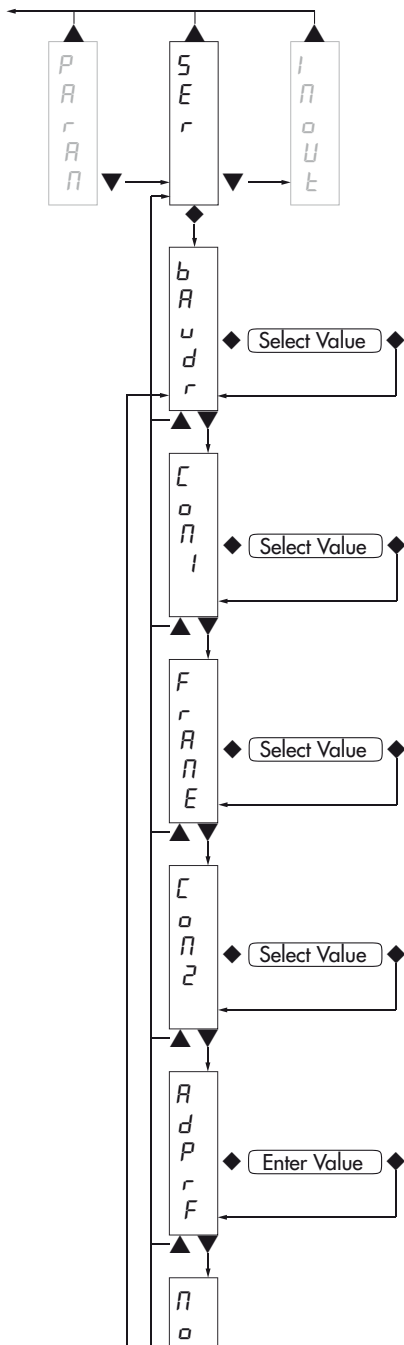
### ***dELTA* WEIGHT DELTA**

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



## baudr **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

**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

### *FRAN1* **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*

*CONF2* **COM2:** It defines the use of the PROFIBUS.

**None:** PROFIBUS communication OFF

**ProFb:** Enable PROFIBUS Fieldbus

*Selectable Values:*

*None*

*ProFb*

*Default: ProFb*

### *AdPrF* **ADDRES PROFIBUS**

Setting the PROFIBUS address. The communication speed is automatically configured

*Values: from 1 to 126:*

*Default: 000*

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

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

*Selectable Values:*

*Net*

*Gross*

*Peak*

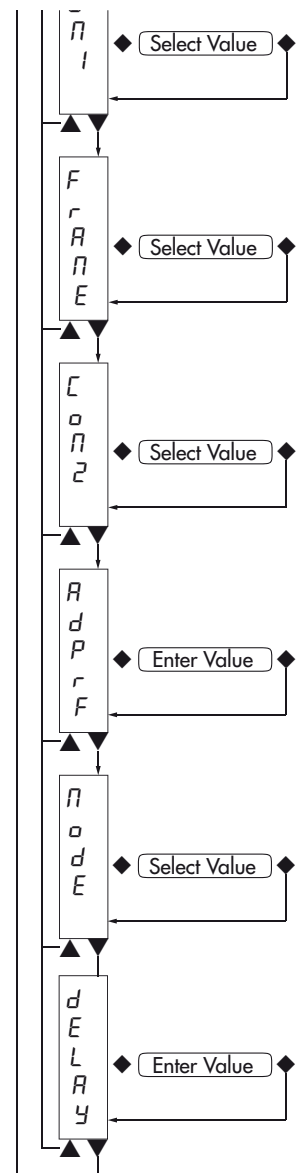
*Default: Gross*

### *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*



# 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.
- Auto-tare command.
- Semiautomatic zero command.

- Peak value reset command.

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 <chksum> EOT

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

Master: <Addr> "N" EOT

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

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

Master: <Addr> "P" EOT

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

#### *AUTOTARE COMMAND*

Master: <Addr> "A" EOT

    DAT 200: <Addr> "A" ACK EOT

#### *SEMI-AUTOMATIC ZERO COMMAND*

Master: <Addr> "Z" EOT

    DAT 200: <Addr> "Z" ACK EOT

#### *PEAK VALUE RESET COMMAND*

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	Notes
40001	Status Register	R	Refer to corresponding chart
40002	N. weight decimal figures	R	
40003	Gross weight (MSB)	R	2's complement signed value.
40004	Gross weight (LSB)	R	
40005	Net weight (MSB)	R	2's complement signed value.
40006	Net weight (LSB)	R	
40007	Peak (MSB)	R	2's complement signed value.
40008	Peak (LSB)	R	
40051	Data Register (MSB)	W	Write before or with the same query of Command Register
40052	Data Register (LSB)	W	
40053	Command Register	W	Refer to corresponding chart
40100	Load cells capacity (MSB)	R/W	
40101	Load cells capacity (LSB)	R/W	
40102	Load cells sensitivity	R/W	
40103	Weight division value	R/W	Refer to corresponding chart
40200	Weight filter factor	R/W	
40201	Weight stability factor	R/W	
40202	Auto-zero threshold	R/W	
40203	Zero-tracking factor	R/W	
40204	Zero band	R/W	
40205	Delta weight	R/W	

## REGISTER STATUS CODING TABLE

BIT	15	14	13	12	11	10	9	8
Description	-	-	-	-	-	-	-	-

BIT	7	6	5	4	3	2	1	0
Description	-	Wrong weight	Over-load	Under-load	Tare entered	Zero band	Stable weight	Zero center

WARNING: bits from 15 to 7 are always 0.

**COMMAND REGISTER CODING TABLE FOR MODBUS PROTOCOL**

Register value	COMMAND REGISTER FUNCTION	DATA REGISTER FUNCTION
0x0001	Semiautomatic zero	-
0x0002	Auto-tare	-
0x0003	Peak reset	-
0x0010	Calibration of the Zero weight	-
0x0011	Calibration of the full scale	Sample weight
0x0020	Saving the data in the permanent memory	-

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

**CODING DIVISION VALUE TABLE**

Register value	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Division value	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50

## PROFIBUS PROTOCOLS

The data exchange with Fieldbus is done on two separate areas of memory, described in the tables below.

The "Input Data Area" is 38 bytes (register from 1 to 19) and the "Output Data Area" is 30 bytes (register from 1 to 15).

### INPUT DATA AREA

Register	Address	Holding Register	R/W	Note
1	0X0001	Status Register	R	See relevant table
2	0X0002	Division value	R	See relevant table
3	0X0003	Gross weight (MSB)	R	2's complement signed value
4	0X0004	Gross weight (LSB)	R	Signed value
5	0X0005	Net weight (MSB)	R	2's complement signed value
6	0X0006	Net weight (LSB)	R	Signed value
7	0X0007	Peak (MSB)	R	2's complement signed value
8	0X0008	Peak (LSB)	R	Signed value
9	0X0009	Monitor Register	R	
<b>VALUE WRITTEN ONLY IF MODIFIED</b>				
10	0X000A	Load cell capacity (MSB)	R/W	
11	0X000B	Load cell capacity (LSB)	R/W	
12	0X000C	Load cell Sensitivity	R/W	
13	0X000D	Weight division value	R/W	See relevant table
14	0X000E	Weight filter factor	R/W	
15	0X000F	Weight stability factor	R/W	
16	0X0010	Auto-zero at power ON	R/W	
17	0X0011	Zero tracking factor	R/W	
18	0X0012	Zero band	R/W	
19	0X0013	Delta Weight	R/W	

The addresses from 0x0001 to 0x0009 are always written in the input area with a frequency of 25 Hz.

The addresses from 0x000A to 0x0013 are written in the input area at switch on, or if one of these parameters is modified.

## OUTPUT DATA AREA

Register	Address	Holding Register	R/W	Note
1	0X1001	Data Register (MSB)	W	Signed value
2	0X1002	Data Register (LSB)	W	Signed value
3	0X1003	Command Register	W	See relevant table
<b>WEIGHIN SETUP PARAMETERS</b>				
4	0X1004	Load cell capacity (MSB)	R/W	
5	0X1005	Load cell capacity (LSB)	R/W	
6	0X1006	Load cell sensitivity	R/W	
7	0X1007	Weight division value	R/W	See relevant table
<b>WEIGHING PARAMETERS</b>				
8	0X1008	Weight filter factor	R/W	
9	0X1009	Weight stability factor	R/W	
10	0X100A	Auto-zero at power ON	R/W	Signed value
11	0X100B	Zero tracking factor	R/W	
12	0X100C	Zero band	R/W	
13	0X100D	Weight Delta	R/W	
<b>MONITOR</b>				
14	0X100E	Monitor register	W	

### CAUTION:

To program the parameters via FIELDBUS, you must choice to write block of data from the Register 4 to Register 13, then write the appropriate exadecimal value in Command Register (Register 3).

To store values in permanet memory write command 0X0020 in Command Register.

If the sequence is not observed, the data previously stored in the registers 4-15, will be reset and consequently lost the whole instrument programming.

## COMMAND REGISTER CODING TABLE FOR PROFIBUS PROTOCOL

Register value	COMMAND REGISTER FUNCTION	DATA REGISTER FUNCTION
0x0001	Semiautomatic zero	-
0x0002	Auto-tare	-
0x0003	Peak reset	-
0x0010	Calibration of the Zero weight	-
0x0011	Calibration of the full scale	Sample weight
0x0020	Saving the data in the permanent memory	-
0x0030	Write all parameters in DAT200	
0x0031	Write weighing setup parameters in DAT200	
0x0032	Write weight parameters in DAT200	

The value in the data register must be entered when the command register is programmed.

Example of full scale calibration: The sample weight to be set must be equal to the value that you want to calibrate, taking into account also the decimals. For instance, if you have 30 kg scales with a 0.02 division value and if you want to perform a 15 kg calibration in sample weight, you need to put 1500 (0x05DC), that correspond to 15.00 kg.

## TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
The display shows the O-L message.	The weight gained is not detectable because the cell is absent or incorrectly connected	Check the connections of the cells.
The display shows the upper hyphen on the display	The weight gained cannot be shown because it exceeds the available five digits or is greater than the capacity of the cells.	
The display shows the lower underscore on the display.	The weight gained is not representable because negative, more than -9999.	
The number of decimal places is wrong.	You have not selected the correct division value.	Select the correct division value in the main menu.
The serial communication does not work properly.	You have not performed the installation correctly. 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, you need to 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**

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: 16/01/2017

Di Reda Donato - Manager









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Industrial Electronic Weighing Systems since 1963

