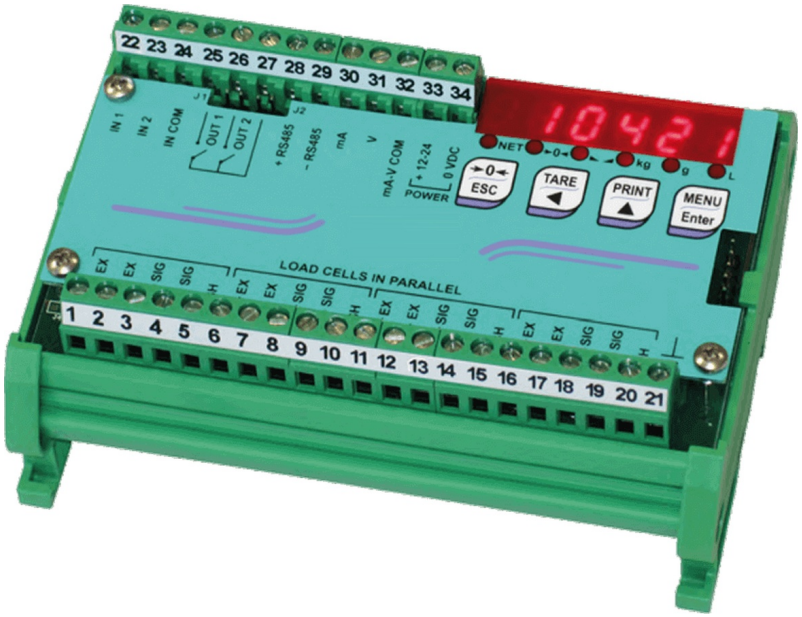
OCTOGON

MANUAL

ETLF

WEIGHT TRANSMITTER WITH DISPLAY

Installation and user manual



Document	Version	Date	Applies to
Installation and user manual	V00x	10/2026	ETLF, analogue output and RS485

This manual describes installation, connection and operation of the ETLF weight transmitter with display, analogue output and RS485 serial port, as well as the communication protocols (continuous transmission, ASCII, Modbus RTU).

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1 About this manual

Display texts are set in a fixed-width typeface, as they appear on the display, for example **CALIb**. Keys are written in square brackets (section 8.2). A menu path is a sequence of keys and display texts, for example:

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO**

000000 stands for the weight display. "[ENTER]+[ESC]" means: press [ENTER] immediately followed by [ESC].

1.1 Symbols

Notice	Meaning
Caution	Risk of electric shock, or: this operation must be performed by skilled personnel.
Important	Pay particular attention to the following instructions.
Note	Further information.

2 Safety, warranty and disposal

2.1 Recommendations for the proper use

- Keep away from heat sources and direct sunlight.
- Protect the instrument from rain (except special IP versions).
- Do not wash with water jets (except special IP versions).

- Do not dip in water.
- Do not spill liquid on the instrument.
- Do not use solvents to clean the instrument.
- Do not install in areas subject to explosion hazard (except special Atex versions).

2.2 Warranty

24 months from the date of the delivery note. Warranty covers only failures of defective components (due to construction defects or defects in materials) and includes replacement or repair of the components and related labour costs.

Warranty is automatically forfeited in the event of:

- tampering, deletion, removal of the identification label and/or serial number of the product;
- misuse, transformation, alteration, repair of products not carried out by the manufacturer.

A 1-year warranty from the date of the delivery note applies to defects in material or manufacture of the battery.

2.3 Guidelines for proper disposal

The disposal symbol on the product or packaging indicates that:

- this is electrical/electronic equipment and cannot be disposed of as municipal solid waste, but must be delivered to a recycling centre;
- improper use or disposal can pollute the environment or damage human health;
- non-compliance with these guidelines will be penalised in accordance with the regulations in force in the country of destination;
- it is recommended to dispose of the packing and packaging as required by local regulations.

3 Installation

3.1 Installation of the instrument

The terminals indicated on the instrument's wiring diagram to be connected to earth must have the same potential as the weighed structure (same earthing pit or earthing system). If you are unable to ensure this condition, connect with an earthing wire the terminals of the instrument (including the terminal 0 VDC) to the weighed structure.

- The cell cable must be individually led to its panel input and not share a conduit with other cables; connect it directly to the instrument terminal strip without breaking its route with support terminal strips.
- Use RC filters on the instrument-driven solenoid valve and remote control switch coils.
- Avoid inverters in the instrument panel; if inevitable, use special filters for the inverters and separate them with sheet metal partitions.
- The panel installer must provide electric protections for the instruments (fuses, door lock switch etc.).
- It is advisable to leave the equipment always switched on to prevent the formation of condensation.

Maximum cable lengths

Connection	Length
RS485	1000 m with AWG24, shielded and twisted cables
RS232	15 m for baud rates up to 19200

3.2 Installation of the load cells

Sizing of load cells capacity

For safety reasons, in case of static weighing, use the load cells at a maximum of 70–80 % of their nominal capacity (assuming that the load is uniformly distributed over the entire weighed structure); depending on the handling mode of the load (e.g. forklifts, bridge cranes), consider reducing the percentage further. In case of weighing with dynamic loads, the installer has to estimate the thrust speed, the acceleration, the frequency etc.

Installing load cells

The load cells must be placed on rigid, stable in-line structures; it is important to use the mounting modules for load cells to compensate for misalignment of the support surfaces.

Protection of the cell cable

Use water-proof sheaths and joints in order to protect the cables of the cells.

Mechanical restraints (pipes etc.)

When pipes are present, use hoses and flexible couplings with open mouthpieces with rubber protection; in case of hard pipes, place the pipe support or anchor bracket as far as possible from the weighed structure (at a distance at least 40 times the diameter of the pipe).

Connecting several cells in parallel

Connect several cells in parallel by using, if necessary, a watertight junction box with terminal box. The cell connection extension cables must be shielded, led individually into their piping or conduit and laid as far as possible from the power cables (in case of 4-wire connections, use cables with 4 × 1 mm^2 minimum cross-section).

Welding

Avoid welding with the load cells already installed. If this cannot be avoided, place the welder ground clamp close to the required welding point to prevent sending current through the load cell body.

Windy conditions, knocks, vibrations

The use of weigh modules is strongly recommended for all load cells to compensate for misalignment of the support surfaces. The system designer must ensure that the plant is protected against lateral shifting and tipping relating to shocks and vibration, windy conditions, seismic conditions in the installation setting and stability of the support structure.

Earthing the weighed structure

By means of a copper wire with suitable cross-section, connect the cell upper support plate with the lower support plate, then connect all the lower plates to a single earthing system. Electrostatic charges accumulated because of the product rubbing against the pipes and the weighed container walls are discharged to the ground without going through or damaging the load cells. Failure to implement a proper earthing system might not affect the operation of the weighing system; this, however, does not rule out the possibility that the cells and connected instrument may become damaged in the future. It is forbidden to ensure earthing system continuity by using metal parts contained in the weighed structure.

Important Failure to follow the installation recommendations will be considered a misuse of the equipment.

4 Testing the load cells

4.1 Load cell input test (quick access)

Menu **000000** › **[UP] 3 s** › **mV-CEL**

From the weight display, press [UP] for 3 seconds: the response signal of the load cells is displayed, expressed in mV with four decimals.

4.2 Load cell testing

Load cell resistance measurement (with a digital multimeter)

– Disconnect the load cells from the instrument and check that there is no moisture in the cell junction box caused by condensation or water infiltration; if so, drain the system or replace it if necessary.

– The value between the positive signal wire and the negative signal wire must be equal or similar to the one indicated in the load cell data sheet (output resistance).

– The value between the positive excitation wire and the negative excitation wire must be equal or similar to the one indicated in the load cell data sheet (input resistance).

– The insulation value between the shield and any other cell wire and between any other cell wire and the body of the load cell must be higher than 20 MΩ.

Load cell voltage measurement (with a digital multimeter)

– Take out the load cell to be tested from underneath the container, or alternatively, lift the container support.

– Make sure that the excitation of the load cell connected to the instrument is 5 V DC ± 3 %.

– Measure the response signal between the positive and the negative signal wires by directly connecting them to the tester; it must be between 0 and ± 0.5 mV.

– Apply load to the cell and make sure that there is a signal increment.

Important If one of the above conditions is not met, please contact the technical assistance service.

5 Product description

5.1 Main specifications

– Weight transmitter with display for Omega/DIN rail mounting, suitable for back panel or junction box. Six-digit semi-alphanumeric display (8 mm h), 7 segment. Four-key keyboard. Dimensions 123 × 92 × 50 mm.

– IP67 box version (170 × 140 × 95 mm). Four fixing holes, diameter 4 mm (centre distance 122 × 152 mm).

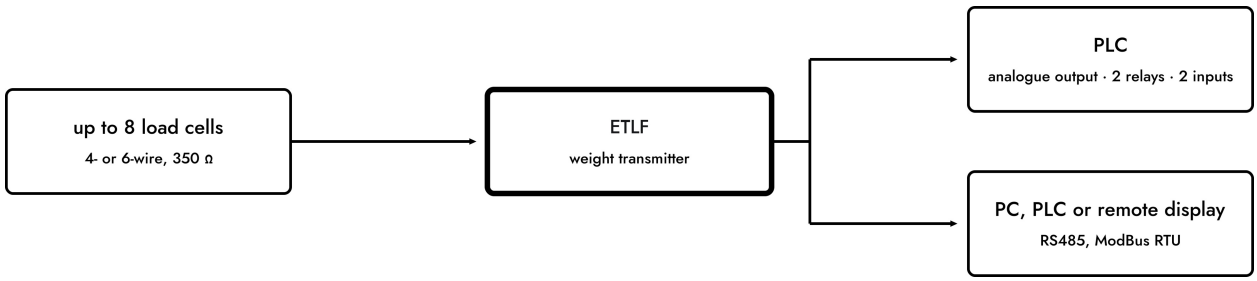
– Displays the gross weight; from external contact it allows to zero set or to display the net weight (both values will be lost when the instrument is turned off).

– Peak weight function.

– Transmits the gross or net weight via opto-isolated 16 bit analogue output, current 0 ... 20 mA, 4 ... 20 mA or voltage 0 ... 10 V, 0 ... 5 V (± 10 V / ± 5 V by closing a soldering jumper, chapter 14).

– Transmits the gross or net weight via RS485 serial port, by means of the protocols Modbus RTU, ASCII bidirectional protocol and continuous transmission (chapters 19–21).

– 2 digital outputs (opto relay) and 2 digital inputs (opto-isolated, externally supplied).



Overview: up to 8 load cells in parallel; output to PLC (analogue output, relays, inputs) and to PC, PLC or remote display (RS485).

5.2 Device

Feature	Version
Design	weight transmitter with display, Omega/DIN rail mounting
Input	up to 8 load cells 350 Ω in parallel
Outputs	analogue output (current or voltage), 2 opto relays, RS485
Manufacturer type	TLS

6 Technical specifications

Item	Value
Power supply and consumption	12 ... 24 V DC ± 10 %; 5 W
No. of load cells in parallel and supply	max. 8 (350 Ω); 5 V DC / 120 mA
Linearity / analogue output linearity	< 0.01 % F.S.; < 0.01 % F.S.
Thermal drift / analogue output thermal drift	< 0.0005 % F.S./°C; < 0.003 % F.S./°C
A/D converter	24 bit (16 000 000 points)
Max. divisions (with measurement range ± 10 mV = sens. 2 mV/V)	± 999999
Measurement range	± 19.5 mV
Max. sensitivity of usable load cells	± 3 mV/V
Max. conversions per second	80
Display range	– 999999 ... + 999999
No. of decimals / display increments	0 ... 4 / x1 x2 x5 x10 x20 x50 x100
Digital filter / readings per second	10 levels / 5 ... 80 Hz
Opto logic outputs	2 – max. 24 V DC; 60 mA
Digital inputs	2 – opto-isolated, 5 ... 24 V DC PNP
Serial port	RS485
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 115200
Humidity (non condensing)	85 %
Storage temperature	–30 ... +80 °C
Working temperature	–20 ... +60 °C
Opto-isolated analogue output, 16 bit = 65535 divisions	0 ... 20 mA; 4 ... 20 mA (max. 300 Ω); 0 ... 10 V DC; 0 ... 5 V DC; ± 10 V DC; ± 5 V DC (min. 10 kΩ)

UL version

Item	Value
Opto relay outputs	2 – max. 24 V DC; 60 mA
Working temperature	–20 ... +60 °C
Supply	equipment to be powered by 12 ... 24 V DC LPS or Class 2 power source

7 Electrical connections

7.1 Basic information

– It is recommended that the power supply negative pole be grounded.
– It is possible to supply up to eight 350 Ω load cells or sixteen 700 Ω load cells.
– Connect terminal 0 VDC to the RS485 common of the connected instruments in the event that these receive alternating current input or that they have an opto-isolated RS485.
– In case of an RS485 network with several devices, activate the 120 Ω termination resistance on the two devices located at the ends of the network (section 15.2).

7.2 Terminals

Terminal	Marking	Connection
1 · 6 · 11 · 16	– EX	– excitation of the load cell
2 · 7 · 12 · 17	+ EX	+ excitation of the load cell
3 · 8 · 13 · 18	– SIG	– signal of the load cell
4 · 9 · 14 · 19	+ SIG	+ signal of the load cell
5 · 10 · 15 · 20	SH	shield of the cell cable
21	earth symbol	earth
22 · 23	IN1 · IN2	input 1 · input 2 (5 ... 24 V DC, + of the external supply via the contact)
24	IN COM	inputs common (– of the external supply)
25 · 26	OUT1 · OUT2	output 1 · output 2 (opto relay, 24 V DC, 60 mA)
27	–	outputs common (not marked in the wiring diagram)
28 · 29	+ RS485 · – RS485	RS485 serial port
30 · 31	mA · V	analogue output current (+) · voltage (+)
32	mA-V COM	analogue output – (common)
33 · 34	+ 12-24 · 0 VDC	power supply 12 ... 24 V DC

– Up to 4 load cells directly on the terminal groups 1–5, 6–10, 11–15 and 16–20 (load cells in parallel); further cells through a junction box (section 3.2).

– 6-wire load cell: connect –REF together with –EXCITATION to – EX, +REF together with +EXCITATION to + EX.

– The shields of the RS485 and the analogue cable are connected to 0 VDC (terminal 34); 0 VDC is earthed.

– Analogue output: current max. load 300 Ω, voltage min. load 10 kΩ.

– The RS485 termination resistors are activated with the jumpers J1 and J2 ("RS485 termination") (section 15.2).

2 outputs: settable setpoints or remote output management via protocol. 2 inputs (default: input 1 = SEMI-AUTOMATIC ZERO, input 2 = NET/GROSS), settable to SEMI-AUTOMATIC ZERO, NET/GROSS, PEAK or REMOTE CONTROL (section 12.3).

8 Display, LEDs and keys

8.1 LED functions

LED	Main function	Secondary function *
NET	net weight (semi-automatic tare or preset tare)	LED lit: input 1 closed
>0<	zero (deviation from zero not more than ± 0.25 divisions)	LED lit: input 2 closed
Stability	weight stability	LED lit: output 1 closed
kg	unit of measure: kg	LED lit: output 2 closed
g	unit of measure: g	no meaning
L	other unit of measure	no meaning

* To activate the secondary LED function, during weight display press and hold down [ENTER] and [UP] at the same time (press [ENTER] immediately followed by [UP]).

8.2 Keys

Key	Short press	Long press (3 s)	Into menus
[ESC] (>0< ESC)	semi-automatic zero	tare resetting	cancel or return to the previous menu
[LEFT] (TARE, left arrow)	gross › net	net › gross	select the figure to be modified or return to the previous menu item
[UP] (PRINT, up arrow)	–	gross weight: mV load cell test · net weight: temporarily display the gross weight	modify the selected figure or go to the next menu item
[ENTER] (MENU/Enter)	setting setpoints and hysteresis	–	confirm or enter in submenu
[ENTER]+[ESC]	setting general parameters	–	–
[ENTER]+[LEFT]	setting preset tare	–	–

"+" means: press the first key immediately followed by the second. The LEDs light up in sequence to indicate that a setting and not a weight is being viewed. Within the menu, the changes are applied immediately after pressing [ENTER] (no further confirmation).

8.3 Menu map

Access	Menu	Items	Section
[ENTER]	**SEt 01 SEt 02**	**HYStE1 HYStE2**	17
[ENTER]+[ESC]	**CALIb**	**FS-tEO SEnSIb dIVIS mASS 2ErO INP 0 WEIGHt unIt COEFF**	10, 11
	FILtEr	–	11.1
	PArA 0	**0 SEt AUtO 0 trAC 0**	11.3
	AnALOG	**tYPE mOdE AnA 0 AnA FS Cor 0 Cor FS**	14
	SErIAL	**rS485**: **nOnE ModbUS ASCII COntIn rIP HdrIP HdrIPn YHL · bAUd Addr HErt2 dELAY PArItY StOP**	15
	Out-In	**Out 1 Out 2 In 1 In 2**	12
	tESt	**In Out AnALOG mV-CEL**	16.1
	InFO	**GEnrIC**	16.2
[ESC] 3 s	**2ErO**	–	10.3
[UP] 3 s	**mV-CEL**	–	4.1
[ENTER]+[LEFT]	**P-tArE**	–	13.2

The menus below **CALIb** are selected with [LEFT] and [UP].

9 Instrument commissioning

Upon switch-on, the display shows in sequence:

- the instrument model;
- **SU** followed by the software code;
- the program type: **bASE** (base);
- **r** followed by the software version;
- **HU** followed by the hardware code;
- the serial number.

Check that the display shows the weight and that when loading the load cells there is an increase in weight. If there is not, check and verify the connections and correct positioning of the load cells.

Instrument already theoretically calibrated

(plant system identification tag present on the instrument and on the cover: load cells' rated data already entered)

- Reset to zero (section 10.3).
- Check the calibration with sample weights and correct the indicated weight if necessary (section 10.5).

Instrument not calibrated

(missing plant system identification tag) – proceed with calibration:

- If load cell data are unknown, follow the procedure in section 10.5.
- Enter the rated data of the load cells following the procedure in section 10.1.
- Reset to zero (section 10.3).
- Check the calibration with sample weights and correct the indicated weight if necessary (section 10.5).
- If you use the analogue output, set the desired analogue output type and the full scale value (chapter 14).
- If you use serial communication, set the related parameters (chapter 15).
- If setpoints are used, set the required weight values and the relevant parameters (chapters 17 and 12).

10 System parameters and calibration

From the weight display, press [ENTER] immediately followed by [ESC] to access the parameter setting. Into menus:

Key	Function
[ENTER]	enter a menu / confirm the data entry
[UP]	modify the displayed value or menu item
[LEFT]	select a new value or modify the displayed menu item
[ESC]	cancel and return to the previous menu

10.1 Theoretical calibration

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[ENTER]** › **SEnSIb** › **[ENTER]** › **dIVIS**

This function allows the load cell rated values to be set. Set the following parameters in sequence:

– **FS-tEO** (default: **dEMO**): the system full scale is given by one cell capacity multiplied by the number of cells used. Example: 4 cells of 1000 kg › full scale = 1000 × 4 = 4000. The instrument is supplied with a theoretical full scale value **dEMO** corresponding to 10000. To restore factory values, set 0 as full scale.

– **SEnSIb** (default: 2.00000 mV/V): the sensitivity is a load cell rated parameter expressed in mV/V. Set the average sensitivity indicated on the load cells, between 0.50000 and 7.00000 mV/V. Example of a 4-cell system: 2.00100, 2.00150, 2.00200, 2.00250 › enter 2.00175, calculated as (2.00100 + 2.00150 + 2.00200 + 2.00250) / 4.

– **dIVIS**: the division (resolution) is the minimum weight increment value which can be displayed. It is calculated automatically from the calibration so that it equals 1/10000 of full scale. It can be changed between 0.0001 and 100 with x1 x2 x5 x10 increments.

Important By modifying the theoretical full scale or the sensitivity, the real calibration is cancelled and the theoretical calibration only is considered valid; the system's parameters containing a weight value (setpoint, hysteresis etc.) are set to default values. If the theoretical full scale and the full scale recalculated in real calibration are equal, the calibration in use is theoretical; if they are different, it is the real calibration based on sample weights.

10.2 Maximum capacity

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **mASS**

mASS: maximum displayable weight (from 0 to full scale; default: 0). When the weight exceeds this value by 9 divisions, the display shows ----. To disable this function, set 0.

10.3 Tare weight zero setting

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **2ErO**

This menu may also be accessed directly from the weight display by holding down [ESC] for 3 seconds. Perform this procedure after having set the theoretical calibration data. Use it to set to zero the weight of the empty system after commissioning and later on to compensate zero variations due to the presence of product residues.

– Confirm the message **2ErO** (zero) by pressing [ENTER].

– The weight value to be set to zero is displayed; in this phase all of the LEDs are flashing.

– Confirm once again: the weight is set to zero (the value is stored to the permanent memory).

– Press [UP] to display the value of the total weight reset by the instrument, given by the sum of all of the previous zero settings.

10.4 Zero value manual entry

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **INP 0**

Caution Perform this procedure only if it is not possible to reset the weighed structure tare, for example because it contains product that cannot be unloaded.

Set in this parameter the estimated zero value (from 0 to 999999; default: 0).

10.5 Real calibration with sample weights

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **WEIGHt**

After the theoretical calibration and the tare weight zero setting, this function allows calibration with sample weights of known value and correction of any deviations of the indicated value. Load onto the weighing system a sample weight of at least 50 % of the maximum quantity to be weighed.

- Confirm **WEIGHt**: the flashing value of the weight currently on the system is displayed; all LEDs are off.
- Adjust the value on display with the arrow keys if necessary.
- Confirm: the new set weight appears with all the LEDs flashing.
- Confirm again: **WEIGHt** is restored; press [ESC] repeatedly to return to the weight display.

Example: for a system of maximum capacity 1000 kg and 1 kg division, two sample weights of 500 kg and 300 kg are available. Load both and correct the indicated weight to 800. Remove the 300 kg weight: the system must show 500; remove the 500 kg weight too: the system must read zero. If not, a mechanical problem is affecting the system linearity.

Caution Identify and correct any mechanical problems before repeating the procedure. If the correction changes the previous full scale by more than 20 %, all the parameters with settable weight values are reset to default values.

Linearisation on up to 8 points

The procedure can be repeated for up to eight points with eight different sample weights. It ends by pressing [ESC] or after entering the eighth value; afterwards only a new real calibration is possible – return to the weight display and re-enter the calibration menu. Pressing [UP] after confirming the sample weight shows the full scale recalculated from the maximum sample weight and the cell sensitivity (**SEnSIb**).

11 Weight parameters

11.1 Filter on the weight

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **FILtEr**

Setting this parameter allows a stable weight display to be obtained. To increase the effect (weight more stable) increase the value (from 0 to 9, default 4).

- By confirming **FILtEr**, the currently programmed filter value is displayed.
- By changing and confirming the value, the weight is displayed and its stability can be verified.
- If stability is not satisfactory, confirming brings back **FILtEr** and the filter may be modified again until an optimum result is achieved.

The filter stabilises a weight as long as its variations are smaller than the corresponding response time. Set it according to the application and the full scale.

Filter value	Response time [ms]	Display and serial port refresh [Hz]
0	80	80
1	190	80
2	260	40
3	450	26
4 (default)	900	13
5	1700	13
6	2500	13
7	4200	10
8	6000	10
9	7500	5

11.2 Anti Peak

When the weight is stable, the anti peak filter removes any sudden disturbances with a maximum duration of 1 second. Confirm the filter on the weight with [ENTER] and select:

- **AntPOn**: anti peak filter enabled (default);
- **AntPOF**: anti peak filter disabled.

11.3 Zero parameters

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **PArA 0**

- **0 SEt** – resettable weight setting for small weight changes (from 0 to full scale; default 300, considered decimals 300 – 30.0 – 3.00 – 0.300): maximum weight value resettable by external contact, keypad or serial protocol.
- **AUtO 0** – automatic zero setting at power-on (from 0 to 10 % of full scale; default 0): if at switch-on the weight value is lower than this value, the weight is reset. To disable, set 0.
- **trAC 0** – zero tracking (from 1 to 5, default **nOnE**): when the zero weight value is stable and, after a second, deviates from zero by a number of divisions smaller than or equal to this value, the weight is set to zero. To disable, set **nOnE**.

Example: **dIVIS** = 5 and **trAC 0** = 2 – the weight is automatically set to zero for variations smaller than or equal to 10 (**dIVIS** × **trAC 0**).

11.4 Units of measure

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **unIt**

Display	Unit
HILOG	kilograms
G	grams
t	tons
Lb	pounds *
nEUton	newton *
LItrE	litres *
bAr	bar *
AtM	atmospheres *
PIECE	pieces *
nEU-M	newton metres *
HILO-M	kilogram metres *
OtHEr	other generic unit of measure not included in the list *

* For these units the display coefficient **COEFF** can be set as well (section 11.5). To use **COEFF** it is necessary to enable it, closing the **COEFF** input (section 12.3).

11.5 Display coefficient

Menu **[ENTER]+[ESC]** › **CALIb** › **[ENTER]** › **FS-tEO** › **[LEFT] [UP]** › **COEFF**

By setting the coefficient **COEFF** the display is changed accordingly. If one of the inputs is set to **COEFF** mode (section 12.3), the value modified according to **COEFF** is displayed while the input is closed; when it is opened the standard weight display is restored. **COEFF** (max. 99.9999; default 1.0000) has different meanings according to the unit set in **unIt**:

- **Lb**, **nEUton**, **bAr**, **AtM**, **nEU-M**, **HILO-M**, **OtHEr**: the value set in **COEFF** is multiplied by the weight value currently displayed.
- **LItrE**: set in **COEFF** the specific weight in kg/l, assuming that the system is calibrated in kg.
- **PIECE**: set in **COEFF** the weight of one piece.

Caution All other settings (setpoints, hysteresis, calibration ...) are expressed in weight value. If you want to convert them to the new unit of measurement, change the system calibration as described below; **COEFF** must then remain set to 1.0000.

Theoretical calibration for other units of measure

Set in **FS-tEO** the full scale value divided by the conversion coefficient from kg to the new unit of measure. Example: 4 load cells of 1000 kg under a scale for olive oil with a specific gravity of 0.916 kg/l – with full scale (4 × 1000) / 0.916 = 4367 the system works in litres of olive oil. With **unIt** = **LItrE** the system displays "l" instead of "kg".

Real calibration for other units of measure

Load a known quantity of product litres on the scale (at least 50 % of the maximum amount to be weighed) and enter in **WEIGHt** the loaded value in litres. With **unIt** = **LItrE** the system displays "l" instead of "kg".

12 Outputs and inputs

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **Out-In** › **[ENTER]** › **Out 1 / Out 2 / In 1 / In 2**

12.1 Outputs

Default: **OPEn** / **SEt** / **POSnEG** / **OFF**. Possible operation modes:

– **OPEn** (normally open): the relay is de-energised and the contact is open when the weight is lower than the programmed setpoint; it closes when the weight is higher than or equal to the setpoint.

– **CLOSE** (normally closed): the relay is energised and the contact is closed when the weight is lower than the programmed setpoint; it opens when the weight is higher than or equal to the setpoint.

– **SEt**: the contact switches on the basis of weight, according to setpoints (chapter 17).

– **PLC**: the contact does not switch on the basis of weight, but is controlled by remote protocol commands.

– **StAbLE**: relay switching occurs when the weight is stable.

If the operation mode **SEt** is selected, the following options are also active:

– **GrOSS**: switching on the basis of gross weight; **nEt**: on the basis of net weight (if the net function is not active, on the basis of gross weight).

– **POSnEG**: switching for both positive and negative weight values; **POS**: for positive values only; **nEG**: for negative values only.

By confirming with [ENTER], the setpoint operation at the value 0 is set:

– **OFF**: relay switching does not occur if the setpoint value is 0.

– **On** with **POSnEG**: relay switching occurs when the weight is 0; the relay switches again when the weight is different from zero, taking hysteresis into account (positive and negative weights).

– **On** with **POS**: relay switching occurs for a weight higher than or equal to 0; the relay switches again for values below 0, taking hysteresis into account.

– **On** with **nEG**: relay switching occurs for a weight lower than or equal to 0; the relay switches again for values above 0, taking hysteresis into account.

12.2 Switching examples (output 1)

Seven examples for the setting of output 1:

Setting Out 1	SEt 1	HYStE 1
OPEn / **SEt** / **GrOSS** / **POS** / **OFF**	500 kg	0 kg
CLOSE / **SEt** / **GrOSS** / **POS** / **OFF**	500 kg	0 kg
OPEn / **SEt** / **GrOSS** / **POS** / **OFF**	500 kg	100 kg
OPEn / **SEt** / **GrOSS** / **nEG** / **OFF**	500 kg	0 kg
OPEn / **SEt** / **GrOSS** / **POSnEG** / **OFF**	500 kg	0 kg
OPEn / **SEt** / **GrOSS** / **POS** / **On**	0 kg	0 kg
OPEn / **SEt** / **GrOSS** / **POSnEG** / **On**	0 kg	0 kg

12.3 Inputs

Default: input 1 = **2ErO**, input 2 = **nE-LO**. Possible operation modes:

– **nE-LO** (NET/GROSS): closing this input for no more than one second performs a semi-automatic tare and the display shows the net weight. To display the gross weight again, hold the input closed for 3 seconds.

– **2ErO**: closing the input for no more than one second sets the weight to zero (section 13.3).

– **PEAH**: keeping the input closed, the maximum weight value reached remains on display; opening the input, the current weight is displayed.

– **PLC**: closing the input, no operation is performed; the input status may however be read remotely by way of the communication protocol.

– **COntIn**: closing the input for max. one second, the weight is transmitted once over the serial connection according to the fast continuous transmission protocol (only if **COntIn** is set in **SErIAL**).

– **COEFF**: when the input is closed the weight is displayed based on the set coefficient (section 11.5), otherwise the weight is displayed.

13 Tare, zero and peak

13.1 Semi-automatic tare (net/gross)

Important The semi-automatic tare operation is lost upon instrument power-off.

To perform a net operation, close the NET/GROSS input or press [LEFT] for less than 3 seconds: the instrument displays the net weight (just set to zero) and the NET LED lights up. To display the gross weight again, keep the NET/GROSS input closed or press [LEFT] for 3 seconds. The operation can be repeated many times by the operator to allow the loading of several products.

Example – weighing fruit in a box: put the box on the scale – the display shows the box weight; press [LEFT] – the display shows the net weight as zero; put the fruit into the box – the display shows the fruit weight.

Note During the net weight display, keep [UP] pressed to temporarily display the gross weight; as soon as the key is released, the net weight is displayed again. The semi-automatic tare operation is not allowed if the gross weight is zero.

13.2 Preset tare (subtractive tare device)

Menu **000000** › **[ENTER]+[LEFT]** › **P-tArE**

A preset tare value can be set manually and subtracted from the displayed value, provided that **P-tArE** ≤ max capacity. By default the last programmed preset tare is shown: to apply it press [UP] and then [ENTER]. Back in the weight display, the net weight (minus the preset tare) is shown and the NET LED lights up. To delete it and return to the gross weight, hold down [LEFT] for about 3 seconds or keep the NET/GROSS input (if any) closed for the same time; the preset tare is set to zero and the NET LED goes off.

- During the net weight display, keeping [UP] pressed temporarily displays the gross weight.
- If a semi-automatic tare (net) is entered, it is not possible to access the preset tare function.
- If a preset tare is entered, it is still possible to access the semi-automatic tare function; the two different types of tare are added.
- All the semi-automatic tare and preset tare functions are lost when the instrument is turned off.

13.3 Semi-automatic zero

Closing the SEMI-AUTOMATIC ZERO input sets the weight to zero. Alternatively press [ESC]: **StOrE?** is displayed for 3 seconds; pressing [ENTER] sets the weight to zero. This function is only allowed if the weight is lower than **0 SEt** (section 11.3); otherwise the alarm **t---** appears and the weight is not set to zero. The zero setting is lost upon instrument power-off.

13.4 Peak

Keeping the PEAK input closed, the maximum weight value reached remains displayed; opening the input, the current weight is displayed. To view a sudden variation peak, set the filter on the weight to 0.

14 Analogue output

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **AnALOG** › **[ENTER]** › **tYPE**

tYPE: analogue output type (4 ... 20 mA, 0 ... 20 mA, 0 ... 10 V, 0 ... 5 V, –10 ... +10 V, –5 ... +5 V; default 4 ... 20 mA).

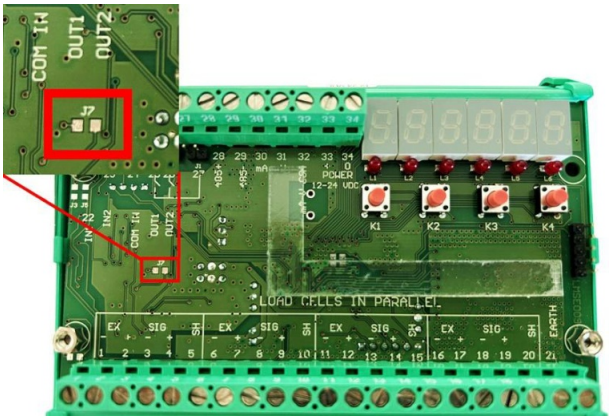
Important For the output –10 ... +10 V and –5 ... +5 V the soldered jumper J7 must be closed:

– Remove the face plate of the instrument by removing the screws that attach it to the little columns on the printed circuit board.

– On the circuit board below, find jumper J7, situated above the terminals 3 and 4 at about mid board.

– Scrape away the solder from the jumper bay, until the copper underneath is uncovered.

– Close the jumper by short-circuiting the bays; it is recommended that a small piece of copper wire without insulation or a leg wire be used to facilitate the operation.



Position of the soldered jumper J7.

– **mOdE**: operating mode – **GrOSS**: the analogue output varies according to gross weight; **nEt**: according to net weight; **PLC**: remote control (section 21.5).

– **AnA 0**: weight value for which you wish to obtain the minimum analogue output value. Only set a value different from zero to limit the range – e.g. for a full scale of 10000 kg, 4 mA at 5000 kg and 20 mA at 10000 kg: set 5000 kg instead of zero.

– **AnA FS**: weight value for which you wish to obtain the maximum analogue output value; it must correspond to the value set in the PLC program (default: calibration full scale). E.g. 4 ... 20 mA, in the PLC 20 mA = 8000 kg › set 8000.

– **Cor 0**: analogue output correction to zero, allowing the PLC to indicate 0; the sign "–" can be set for the last digit on the left. E.g. 4 ... 20 mA, with the minimum analogue setting the PLC or tester reads 4.1 mA › set 3.9 to obtain 4.0.

– **Cor FS**: full scale analogue output correction, allowing the PLC to indicate the value set in **AnA FS**. E.g. 4 ... 20 mA, with the analogue set to full scale the PLC or tester reads 19.9 mA › set 20.1 to obtain 20.0.

Minimum and maximum values which can be set for the zero and full scale corrections:

Analogue output type	Minimum	Maximum
0 ... 10 V	–0.150	10.200
0 ... 5 V	–0.150	5.500
–10 ... +10 V	–10.300	10.200
–5 ... +5 V	–5.500	5.500
0 ... 20 mA	–0.200	22.000
4 ... 20 mA	–0.200	22.000

The analogue output may also be used in the opposite manner: the weight corresponding to the analogue zero (**AnA 0**) may be greater than the weight set for the analogue full scale (**AnA FS**); the output then increases as the weight decreases. Example with 0 ... 10 V, **AnA 0** = 10000, **AnA FS** = 0: 0 kg › 10 V, 5000 kg › 5 V, 10000 kg › 0 V.

Important All analogue outputs of the instrument are ACTIVE and SINGLE ENDED type; they can be connected only to PASSIVE receiver devices. Minimum load of the voltage outputs 10 kΩ, maximum load of the current outputs 300 Ω.

15 Serial communication

15.1 Setting

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **SErIAL** › **[ENTER]** › **rS485**

rS485: communication port. According to the chosen protocol only the necessary settings are displayed in sequence.

- **nOnE**: disables any type of communication (default).
- **ModbUS**: MODBUS-RTU protocol; addresses from 1 to 99 (chapter 21).
- **ASCII**: ASCII bidirectional protocol; addresses from 1 to 99; items **MOdU60** and **MOd td** (chapter 20).
- **COntIn**: continuous weight transmission at the frequency set in **HErt2** (10 to 80) – **MOd t** or **MOd td**, each with **PArItY** = **nOnE**, **StOP** = 1 (section 19.1).
- **rIP**: continuous weight transmission to remote displays; the remote display shows the net or gross weight according to its settings (**bAUd** = 9600, **PArItY** = **nOnE**, **StOP** = 1; section 19.2).
- **HdrIP**: as **rIP** (**bAUd** = 9600, **PArItY** = **nOnE**, **StOP** = 1; section 19.2).
- **HdrIPn**: continuous weight transmission to remote displays (**bAUd** = 9600, **PArItY** = **nOnE**, **StOP** = 1; section 19.2). When the remote display is set to gross weight, it shows the gross weight if the instrument displays the gross weight, and the net weight alternated with **nEt** if the instrument shows the net weight.
- **YHL**: continuous weight transmission protocol (section 19.3).

Parameter	Meaning
bAUd	transmission speed 1200, 2400, 4800, 9600, 19200, 38400, 115200 (default 9600)
Addr	instrument address, 1 to 99 (default 1)
HErt2	maximum transmission frequency with **COntIn**: 10 – 20 – 30 – 40 – 50 – 60 – 70 – 80 Hz (default 10)
dELAY	delay in milliseconds before the instrument replies, 0 to 200 ms (default 0)
PArItY	**nOnE** parity none (default) · **EUEn** even parity · **Odd** odd parity
StOP	stop bit 1 or 2 (default 1)

HErt2 maximum	Minimum baud rate
20 Hz	2400
40 Hz	4800
80 Hz	9600

15.2 RS485 serial connection

The instruments are connected in parallel to a shielded cable via + RS485 (terminal 28), – RS485 (29) and 0 VDC (34) (up to 500 m in the connection example of the source document); a PC with RS232 is connected through an RS232/RS485 interface converter.

Important If the RS485 network exceeds 100 metres in length or baud rates over 9600 are used, close the two jumpers "RS485 termination" (J1, J2) on the furthest instruments to activate two 120 Ω terminating resistors between the "+" and "–" terminals of the line. Should there be different instruments or converters, refer to their manuals to determine whether it is necessary to connect the resistors.

15.3 Direct connection RS485 – RS232 without converter

A two-wire RS485 output may be used directly on the RS232 input of a PC or remote display:

Instrument	RS232
RS485 –	RXD
RS485 +	GND

Caution This type of connection allows A SINGLE instrument to be used in a ONE WAY mode.

16 Test and info

16.1 Test

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **tESt**

– Input test – **In**: ensure that 0 is displayed for each open input, 1 when the input is closed.
– Output test – **Out**: setting 0 ensure that the corresponding output opens; setting 1 ensure that it closes.
– Analogue output test – **AnALOG**: the analogue signal can range between the minimum and the maximum values, starting from the minimum; **mA** current output test, **VOLt** voltage output test.
– Millivolt test – **mV-CEL**: displays the load cell response signal in mV with four decimals.

16.2 Info menu

Menu **[ENTER]+[ESC]** › **CALIb** › **[LEFT] [UP]** › **InFO** › **[ENTER]** › **GEnrIC**

GEnrIC: identification data of the instrument – **InStrM** instrument model, **SU COd** software code, **FU UEr** software version, **SEr nu** serial number.

17 Setpoints programming

Menu **000000** › **[ENTER]** › **SEt 01** › **[ENTER]** › **000000** › **[ENTER]** › **SEt 02 ...**

From the weight display, press [ENTER] to access the setpoints setting (keys as in chapter 10); **HYStE1** and **HYStE2** are selected with [LEFT] and [UP].

– **SEt** (from 0 to full scale; default 0): setpoint – relay switching occurs when the weight exceeds this value; the type of switching is settable (section 12.1).
– **HYStE** (from 0 to full scale; default 0): hysteresis – value subtracted from the setpoint to obtain contact switching for decreasing weight. Example: setpoint 100, hysteresis 10 – switching occurs at 90 for decreasing weight.

Note These values are set to zero if the calibration is changed significantly (sections 10.1 and 10.5).

18 Alarms

Display	Meaning
ErCEL	the load cell is not connected or is incorrectly connected; the load cell signal exceeds 39 mV; the conversion electronics (A/D converter) is malfunctioning.
Er OL	the weight display exceeds 110 % of the full scale.
Er Ad	internal instrument converter failure; check load cell connections, if necessary contact technical assistance.
-----	the weight exceeds the maximum weight by 9 divisions.
Er OF	maximum displayable value exceeded (higher than 999999 or lower than –999999).
t----	weight too high: zero setting not possible.
mAH-PU	appears in the sample weight setting, in real calibration, after the eighth sample weight value has been entered.
Error	the value set is beyond the permitted values; press [ESC] to quit the setting leaving the previous value unchanged. Examples: more decimals than the display can show at full scale; value above the maximum setting value; the sample weight does not match the detected mV increase; the analogue output correction goes beyond the permitted limits.
bLOC	lock active on menu item, keypad or display.
nOdISP	the number cannot be displayed properly (greater than 999999 or less than –999999).
In2ErO	gross weight equal to zero: the semi-automatic tare cannot be performed.
ErrCHH	issues with data contained in external memory, contact technical assistance.

18.1 Serial protocol alarms

Protocol	ErCEL	Er OL	Er Ad	-----	Er OF	t----
Modbus RTU, status register (bit LSB 76543210)	xxxxxxx1	xxxx1xxx	xxxxxx1x	xxxxx1xx	gross xxx1xxxx · net xx1xxxxx	zero command: error "value not valid" (code 3)
ASCII	__O-F_	__O-L_	__O-F_	__O-L_	__O-F_	&aa#CR
RIP *	__O-F_	__O-L_	__O-F_	__O-L_	__O-F_	__O-F_
HDRIP-N	_ERCEL	_ER_OL	_ER_AD	######	_ER_OF	O__SET
CONTIN	_ERCEL	_ER_OL	_ER_AD	^^^^^^	_ER_OF	O__SET

* For remote displays with protocol **rIP**, ----- appears if the message exceeds 5 digits. If an alarm becomes active the relays open and the analogue output goes to the lowest possible value:

Range	0 ... 20 mA	4 ... 20 mA	0 ... 5 V	0 ... 10 V	–10 ... 10 V	–5 ... 5 V
Output value	–0.2 mA	3.5 mA	–0.5 V	–0.5 V	0 V	0 V

19 Continuous transmission protocols

19.1 Fast continuous transmission protocol

This protocol allows for automatic weight reception via a serial connection at high update frequencies: up to 80 strings per second with a minimum transmission rate of 9600 baud. Communication modes (section 15.1): **MOd t** and **MOd td** – two variants compatible with older instruments.

MOd t: the following string is transmitted to PC/PLC:

xxxxxxCRLF

Character	Meaning
xxxxxx	6 ASCII characters for gross weight (ASCII 48 ... 57)
CR	back to start (ASCII 13)
LF	new line (ASCII 10)

MOd td: the following string is transmitted to PC/PLC:

&TzzzzzzPzzzzzz\ckckCR

Character	Meaning
&	initial string character (ASCII 38)
T, P	1 character of gross weight identification each
zzzzzz	6 characters of gross weight (ASCII 48 ... 57)
\	separation character (ASCII 92)
ckck	2 ASCII control characters: XOR of the 8-bit ASCII codes of the characters between "&" and "\" (both excluded), as two hexadecimal digits 0 ... 9, A ... F
CR	end of string (ASCII 13)

With negative weight the first character from the left is "–" (ASCII 45). In case of error or alarm, the 6 weight characters are replaced by the messages of section 18.1. Fast transmission via external contact: the weight can also be transmitted just once by closing an input for no more than a second (sections 12.3 and 15.1).

19.2 Continuous transmission to remote displays

The instrument transmits the weight continuously to remote displays; the string is transmitted 10 times per second. Communication modes (section 15.1, each **bAUd** = 9600, **PArItY** = **nOnE**, **StOP** = 1): **rIP** – e.g. octogon EDLD, the remote display shows the net or gross weight according to its settings; **HdrIP** – e.g. octogon EDLF, EDLG, net or gross weight according to its settings; **HdrIPn** – as **HdrIP**.

&NxxxxxxLyyyyyy\ckckCR

Character	Meaning
&	initial string character (ASCII 38)
N	net weight identification (ASCII 78)
xxxxxx	6 characters of net weight or PEAK if present (ASCII 48 ... 57)
L	gross weight identification (ASCII 76)
yyyyyy	6 characters of gross weight (ASCII 48 ... 57)
\	separation character (ASCII 92)
ckck	control characters as in section 19.1
CR	end of string (ASCII 13)

- With negative weight the first character from the left is "–" (ASCII 45).
- With **HdrIP** the decimal point at the position shown on the display can also be transmitted. If the value exceeds 5 digits, only the 5 most significant digits are transmitted, with a negative value no more than the 4 most significant digits; the decimal point shifts consistently.
- With **HdrIPn**, in addition, the instrument transmits **nEt** every 4 seconds in the gross weight field if a net operation has been carried out on the instrument (section 13.1).
- Below –99999 the minus sign "–" is sent alternated with the most significant figure.
- In case of error or alarm, the 6 characters of gross and net weight are replaced by the messages of section 18.1.

19.3 Continuous weight transmission protocol

The communication string is transmitted 5 times per second. **YHL**: if a net operation has been performed (section 13.1) the net weight is transmitted, otherwise the gross weight.

=xxxxxxxxx

Character	Meaning
=	initial string character (ASCII 62)
xxxxxxxxx	9 characters of net or gross weight (ASCII 48 ... 57), LITTLE ENDIAN sorting

With negative weight the first character from the right is "–" (ASCII 45); the decimal point can also be transmitted at the position determined by the calibration. Example: gross weight –20.7 kg › **=7.02000-**. In case of error or alarm, the 9 characters are replaced by "999999999".

20 ASCII bidirectional protocol

The instrument replies to the requests sent from a PC/PLC; a waiting time before the response can be set (**dELAY**, section 15.1). Communication modes: **MOdU60** and **MOd td** – two variants compatible with older weighing instruments.

20.1 Captions

Character	Meaning
$	beginning of a request string (ASCII 36)
& or &&	beginning of a response string (ASCII 38)
aa	2 characters for instrument address (ASCII 48 … 57)
!	correct reception (ASCII 33)
?	reception error (ASCII 63)
#	error in the command execution (ASCII 35)
ckck	2 ASCII characters for checksum (section 20.14)
CR	end of string (ASCII 13)
\	separation character (ASCII 92)

The underlined part of each string is the part used for the checksum.

20.2 Setpoint values setting

Direction	String
PC transmits	**$aaxxxxxxyckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

xxxxxx = 6 characters for the setpoint value (ASCII 48 … 57); y = A: set the value in setpoint 1, y = B: set the value in setpoint 2.

20.3 Setpoints storage into EEPROM memory

Direction	String
PC transmits	**$aaMEMckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

Setpoints programmed via the PC are stored in the volatile RAM and lost upon power-off; this command saves them permanently in the EEPROM. The number of writings allowed in the EEPROM is limited (about 100000).

20.4 Reading weight, setpoint or peak

Direction	String
PC transmits	**$aajckckCR**
correct reception	**&aaxxxxxxj\ckckCR**
incorrect reception	**&&aa?\ckckCR**
peak not configured	**&aa#CR**

j = a: setpoint 1; j = b: setpoint 2; j = t: gross weight; j = n: net weight; j = p: gross weight peak if **ASCII** is set as **MOdU60** – if **ASCII** is set on **MOd td**, the gross weight is read. To read the points, set **FS-tEO** equal to 50000. xxxxxx = 6 characters of the weight value. With negative weight the first character from the left is "–" (ASCII 45); below –99999 "–" is sent alternated with the most significant figure. In case of an alarm for exceeding 110 % of full scale or 9 divisions above **mASS** the instrument sends **&aassO-Lst\ckck**, in case of faulty load cell connection or another alarm **&aassO-Fst\ckck** (s = space, ASCII 32); see chapter 18.

20.5 Semi-automatic zero

Direction	String
PC transmits	**$aaZEROckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**
weight over the maximum resettable value	**&aa#CR**

The zero setting is not maintained after an instrument power-off.

20.6 Switching from gross to net weight

Direction	String
PC transmits	**$aaNETckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

20.7 Switching from net to gross weight

Direction	String
PC transmits	**$aaGROSSckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

20.8 Reading of decimals and division

Direction	String
PC transmits	**$aaDckckCR**
correct reception	**&aaxy\ckckCR**
incorrect reception	**&&aa?\ckckCR**

x = number of decimals; y = 3, 4, 5, 6, 7, 8, 9 for division value 1, 2, 5, 10, 20, 50, 100.

20.9 Tare weight zero setting

Direction	String
PC transmits	**$aazckckCR**
correct reception	**&aaxxxxxxt\ckckCR**
incorrect reception	**&&aa?\ckckCR**
instrument not in gross weight display	**&aa#CR**

z = weight zeroing command (ASCII 122); xxxxxx = weight value; t = weight identification (ASCII 116). The scale must be empty or the instrument must measure the corresponding mV signal. Example address 2: query **$02z78(Cr)**, response **&02000000t\76(Cr)** – with correct zero setting "000000". The zero values are stored in the EEPROM, the number of writings allowed is limited (about 100000); if the weight has to be reset often, do it in the PC or PLC program, keeping the weight deviation from the instrument zero.

20.10 Real calibration (with sample weights)

Direction	String
PC transmits	**$aasxxxxxxckckCR**
correct reception	**&aaxxxxxxt\ckckCR**
incorrect reception or full scale zero	**&&aa?\ckckCR**

After the tare weight zero setting load a sample weight of at least 50 % of full scale (or make sure that the instrument measures a corresponding mV signal). s = calibration command (ASCII 115); xxxxxx = sample weight (negative values are not allowed);

in the response xxxxxx = current weight, t = gross weight identification (ASCII 116) – with correct calibration equal to the sample weight. Example address 1, 20000 kg: query **$01s02000070(Cr)**, response **&01020000t\77(Cr)**.

20.11 Keypad lock

Direction	String
PC transmits	**$aaKEYckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

20.12 Keypad unlock

Direction	String
PC transmits	**$aaFREckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

20.13 Display and keypad lock

Direction	String
PC transmits	**$aaKDISckckCR**
correct reception	**&&aa!\ckckCR**
incorrect reception	**&&aa?\ckckCR**

20.14 Checksum calculation

The two control characters ckck represent a hexadecimal number in ASCII characters: the XOR (exclusive OR) of the 8-bit ASCII codes of only the characters of the underlined part of the string. Example with the characters 0, 1, t:

Character	decimal	hexadecimal	binary
0	48	30	00110000
1	49	31	00110001
t	116	74	01110100
XOR	117	75	01110101

The result 0x75 gives the checksum made of the characters “7” and “5”.

21 Modbus RTU protocol

The Modbus RTU protocol allows the reading and writing of the registers listed below according to the Modicon PI-MBUS-300 specification. Selection: section 15.1. Check whether the Modbus master (or the development tool) numbers the registers from 40001 or from 0; in the second case the register is the table value minus 40001 (e.g. 40028 › 27).

When indicated, data are written directly to the EEPROM, whose writing operations are limited (100000); avoid unnecessary writings. The instrument does not write if the value equals the stored one. Numbers without prefix are decimal, with 0x hexadecimal.

21.1 Data format and functions

1 start bit; 8 data bits, least significant bit sent first; parity bit and stop bit settable on the instrument. Use only the following functions – others may not be interpreted correctly and could generate errors or system shut-downs:

Function	Description
03 (0x03)	READ HOLDING REGISTER (programmable register reading)
16 (0x10)	PRESET MULTIPLE REGISTERS (multiple register writing)

The interrogation frequency is linked with the communication rate (the instrument stands by for at least 3 bytes before calculating a response); **dELAY** (section 15.1) adds a further delay.

Function 3 – read holding registers

	Address	Function	Content	CRC	Bytes
Query	A	0x03	1st register 0x0000 · no. registers 0x0002	2 bytes	8
Response	A	0x03	no. bytes 0x04 · register 1 0x0064 · register 2 0x00C8	2 bytes	3 + 2 × no. registers + 2

Function 16 – preset multiple registers

	Address	Function	Content	CRC	Bytes
Query	A	0x10	1st register 0x0000 · no. registers 0x0002 · no. bytes 0x04 · value 1 0x0000 · value 2 0x0000	2 bytes	7 + 2 × no. registers + 2
Response	A	0x10	1st register 0x0000 · no. registers 0x0002	2 bytes	8

The response contains the number of registers changed starting from the first address.

21.2 Broadcast requests and communication errors

– Broadcast (address 0): read requests are not executed and not answered; write requests are executed but not answered.

– The strings are checked by CRC (Cyclical Redundancy Check). In case of a communication error the slave does not respond; the master must allow for a time-out and infer a communication error.

– If a string is received correctly but is not executable, the slave responds with an exceptional response: address, function + 0x80 (msb at 1), code, CRC.

Code	Description
1	ILLEGAL FUNCTION (function not valid or not supported)
2	ILLEGAL DATA ADDRESS (the specified data address is not available)
3	ILLEGAL DATA VALUE (the data received have no valid value)

21.3 List of usable registers

A maximum of 32 registers can be read or written in a single query or response. R = read only, W = write only, R/W = read and write; H/L = high/low half of the DOUBLE WORD.

Register	Description	Saving to EEPROM	Access
40001	firmware version	–	R
40002	type of instrument	–	R
40003	year of production	–	R
40004	serial number	–	R

Register	Description	Saving to EEPROM	Access
40005	active program	–	R
40006	COMMAND REGISTER	no	W
40007	STATUS REGISTER	–	R
40008 / 40009	gross weight H / L	–	R
40010 / 40011	net weight H / L	–	R
40012 / 40013	peak weight H / L	–	R
40014	divisions and units of measure	–	R
40015 / 40016	coefficient H / L	–	R
40017 / 40018	setpoint 1 H / L	only after command 99	R/W
40019 / 40020	setpoint 2 H / L	only after command 99	R/W
40021 / 40022	hysteresis 1 H / L	only after command 99	R/W
40023 / 40024	hysteresis 2 H / L	only after command 99	R/W
40025	inputs	–	R
40026	outputs	no	R/W
40037 / 40038	sample weight for calibration H / L	with command 101	R/W
40043 / 40044	weight value corresponding to the zero of the analogue output H / L	only after command 99	R/W
40045 / 40046	weight value corresponding to the full scale of the analogue output H / L	only after command 99	R/W
40122 ... 40131	REGISTER 1 ... REGISTER 10	no	R/W

Caution At the time of writing, the setpoints, hysteresis values and the analogue output zero and full scale values are saved to the RAM and lost upon the next power-off; to store them permanently to the EEPROM, send command 99 to the Command Register.

21.4 Real calibration commands

– Unload the system and reset the displayed weight to zero with command 100 "tare weight zero setting for calibration" of the Command Register.
– Load a sample weight on the system and send its value to the registers 40037–40038.
– Command 101 "save first sample weight for calibration": saves the first value and removes the previously saved values.
– Command 106 "add sample weight for calibration": stores a further value and keeps the previously saved values.
– Up to 8 different sample weights can be saved to perform a linearisation on multiple points; the same sample weight only once per calibration, zero sample weight values cannot be saved.

If the operation is successfully completed, the two sample weight registers are set to zero. Command 104 cancels the real calibration and returns to the theoretical calibration; the tare reset is not cancelled. To set the sample weight correctly, consider the division register (40014): 100 kg with division 0.001 › enter 100000 (100 / 0.001). Write a negative sample weight as a 32-bit signed number (in two's complement if the development system does not handle signed numbers), e.g. –56 kg:

Register	Description	hex	decimal
40037	sample weight for calibration H	0xFFFF	–1
40038	sample weight for calibration L	0xFFC8	–56

21.5 Analogue output via Modbus

With **mOdE** = **GrOSS** or **nEt** (chapter 14):

– Writing the analogue output zero: write the value into registers 40043 (H) and 40044 (L), then send command 99 to the Command Register (saving to EEPROM). Reading: read registers 40043 and 40044.
– Writing the analogue output full scale: write the value into registers 40045 (H) and 40046 (L), then send command 99. Reading: read registers 40045 and 40046.

With **mOdE** = **PLC** (chapter 14) the analogue output value is set remotely: to write it, multiply the value by 10000; to read it, divide the register value by 10000.

Operation	Steps
Writing the current value	value in mA × 10000 · write the H part into REGISTER 1 (40122), the L part into REGISTER 2 (40123) · send command 6811 to the Command Register
Reading the current value	send command 6812 to the Command Register · read REGISTER 1 (40122) and REGISTER 2 (40123) · divide the value by 10000
Writing the voltage value	value in V × 10000 · write the H part into REGISTER 1 (40122), the L part into REGISTER 2 (40123) · send command 6813 to the Command Register
Reading the voltage value	send command 6814 to the Command Register · read REGISTER 1 (40122) and REGISTER 2 (40123) · divide the value by 10000

Examples: writing 14 mA › 140000; reading 0x0000CF76 = 53110 › 5.3110 V.

	REGISTER 1 (H)	REGISTER 2 (L)	Total
14 mA, hexadecimal	0x0002	0x22E0	0x000222E0
14 mA, decimal	2	8928	140000
5.3110 V, hexadecimal	0x0000	0xCF76	0x0000CF76
5.3110 V, decimal	0	53110	53110

21.6 Status, input and output registers

Bit	STATUS REGISTER (40007)
0	cell error
1	A/D converter malfunction
2	maximum weight exceeded by 9 divisions
3	gross weight higher than 110 % of full scale
4	gross weight beyond 999999 or less than –999999
5	net weight beyond 999999 or less than –999999
7	gross weight negative sign
8	net weight negative sign
9	peak weight negative sign
10	net display mode
11	weight stability
12	weight within ± ¼ of a division around zero

Inputs (40025, read only): bit 0 = input 1 status, bit 1 = input 2 status. Outputs (40026, read and write): bit 0 = output 1 status, bit 1 = output 2 status. The output status can be read at any time but can be written only if the output has been set as **PLC** (section 12.1).

21.7 Divisions and units of measure (40014)

This register contains the current setting of the division (**dIVIS**, L byte) and of the unit of measure (**unIt**, H byte); use it together with the coefficient registers to calculate the value displayed by the instrument.

L byte value	Divisor	Decimals	L byte value	Divisor	Decimals
0	100	0	10	0.05	2
1	50	0	11	0.02	2
2	20	0	12	0.01	2
3	10	0	13	0.005	3
4	5	0	14	0.002	3
5	2	0	15	0.001	3
6	1	0	16	0.0005	4
7	0.5	1	17	0.0002	4
8	0.2	1	18	0.0001	4
9	0.1	1			

H byte value	Unit of measure	Use of the coefficient with the gross weight
0	kilograms	does not intervene
1	grams	does not intervene
2	tons	does not intervene
3	pounds	does not intervene
4	newton	multiplies
5	litres	divides
6	bar	multiplies
7	atmospheres	multiplies
8	pieces	divides
9	newton metres	multiplies
10	kilogram metres	multiplies
11	other	multiplies

21.8 Commands for the Command Register (40006)

Command	Meaning
0	no command
7	semi-automatic tare enabling (net display)
8	semi-automatic zero
9	semi-automatic tare disabling (gross display)
21	keypad lock
22	keypad and display unlock
23	keypad and display lock
99	save data in EEPROM
100	tare weight zero setting for calibration
101	save first sample weight for calibration
104	real calibration cancellation
106	add sample weight for calibration
130	preset tare enabling
6811	writing the current value requested at the analogue output
6812	reading the current value requested at the analogue output
6813	writing the voltage value requested at the analogue output
6814	reading the voltage value requested at the analogue output

21.9 Communication examples

For additional examples and the generation of correct control characters (CRC16) refer to the Modicon PI-MBUS-300 manual.

Values in hexadecimal notation with prefix h; instrument address h01, CRC16 = the last two bytes. Example 1 – function 16 (h10): write 0 to register 40017 and 2000 to register 40018 (first register h00 h10, number h00 h02, byte count h04, data h00 h00 and h07 hD0):

Direction	String
Query	h01 h10 h00 h10 h00 h02 h04 h00 h00 h07 hD0 hF1 h0F
Response	h01 h10 h00 h10 h00 h02 h40 h0D

Example 2 – function 16 (h10): write the two setpoint values 2000 and 3000 (first register h00 h10, number h00 h04, byte count h08, data h00 h00 h07 hD0 and h00 h00 h0B hB8):

Direction	String
Query	h01 h10 h00 h10 h00 h04 h08 h00 h00 h07 hD0 h00 h00 h0B hB8 hB0 hA2
Response	h01 h10 h00 h10 h00 h04 hC0 h0F

Example 3 – function 3 (h03): read gross weight (4000) and net weight (3000) from 40008 to 40011 (first register h00 h07, number h00 h04; response with byte count h08 and the data h00 h00 h0F hA0 and h00 h00 h0B hB8):

Direction	String
Query	h01 h03 h00 h07 h00 h04 hF5 hC8
Response	h01 h03 h08 h00 h00 h0F hA0 h00 h00 h0B hB8 hB3 h30

22 Reserved for the installer

22.1 Menu locking

This procedure blocks the access to any menu. Select the menu to lock (e.g. **CALIb**) and press [ESC], [LEFT] and [UP] simultaneously for 3 seconds: the display shows **C.ALIb** – the left point indicates that the menu item is locked. If the operator tries to enter this menu, access is denied and **bLOC** is displayed.

22.2 Menu unlocking

Select the locked menu (**C.ALIb**) and press [ENTER], [LEFT] and [UP] simultaneously for 3 seconds: the display shows **CALIb**, the point is off.

22.3 Temporary menu unlocking

At **C.ALIb** press [UP] and [LEFT] simultaneously for 3 seconds: all menus, including the locked ones, can be entered and modified. Returning to the weight display restores the lock.

22.4 Program selection

Caution Operation must only be performed after contacting technical assistance.

Menu **power-on, hold [ESC]** › **PrOG** › **[ENTER]** › **bASE** › **[ENTER]**

Upon instrument power-on, hold down [ESC] until the display shows **PrOG**. Program selection: **bASE** – basic program, setpoint management only. By confirming the displayed program, the system variables are set with default values. Pressing [ESC] quits without introducing any changes. If you do not have a specific manual for the newly set program, you can request it from technical assistance.

22.5 Keypad or display locking

Press [ESC] immediately followed by [UP] and hold them down for about 5 seconds (also possible via the MODBUS and ASCII protocols):

- **FrEE**: no lock.
- **HEY**: keypad lock – when a key is pressed, **bLOC** is displayed for 3 seconds.
- **dISP**: keypad and display lock – the keypad is locked and the display shows the instrument model (weight is not displayed); when a key is pressed, **bLOC** is displayed for 3 seconds.

23 Dimensions, directives and standards

23.1 Dimensions

Item	Value
Instrument (Omega/DIN rail mounting)	123 × 92 × 50 mm
IP67 box version	170 × 140 × 95 mm
Fixing holes of the box	4 × Ø 4 mm, centre distance 122 × 152 mm
Display	6 digits, digit height 8 mm

23.2 Directives and standards

According to the manufacturer's declarations of conformity (EU and United Kingdom, 26/06/2026) for all analogue output versions:

Directive	Standards
2014/35/EU Low Voltage	EN 61010-1:2010+A1:2019 – not applicable for the VDC type (only for 230/115 VAC type)
2014/30/EU EMC	EN 55011:2016+A1+A11:2020 · EN 61000-6-2:2019 · EN 61000-6-4:2019 · EN 61000-4-2:2009 · EN 61000-4-3:2006+A2:2010 · EN 61000-4-4:2012 · EN 61000-4-5:2014+A1:2017 · EN 61000-4-6:2014
2014/31/EU NAWI (only if the M mark is applied)	EN 45501:2015 · OIML R76-1:2006
United Kingdom	Electrical Equipment (Safety) Regulations 2016 (not applicable for the VDC type), Electromagnetic Compatibility Regulations 2016 – with the corresponding BS EN standards

The declarations of conformity are available on request.