

*Precise*<sup>TM</sup>

**DAT 400 Series  
Digital / Analog Transmitters**

**Installation & Operating  
Manual  
(version 0.5)**



*Precise Instrument Corp.*

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# Technical Specifications

## **Power Requirements**

Input Voltage	24 Vdc $\pm$ 15%
Power Consumption	7.5 Watts
Isolation	Class II
Category	Category II

## **Environmental**

Operating Temperature	+ 14 to + 122°F (-10 to +50°C)
Storage Temperature	- 4 to + 158°F (-20 to +70°C)
Relative Humidity	85% non-condensing

## **Display**

Type	6-digit red LED, 7 segment 0.55" high
Status LED's	(4) Red LED's
Keyboard	(4) Keys (tactile feedback)

## **Performance**

Excitation Voltage	5 volts fixed, short circuit proof
Load Current	85 mA (six 350 $\bullet$ load cells)
Conversion Rate	50 updates / second (no filtering)
Resolution	60,000 counts
Sensitivity	0.02 $\mu$ V / count
Linearity	< 0.01% of full scale
Temperature Creep	< 0.001% of FS / $^{\circ}$ C
A/D Converter	24 bits
Signal Input Range	- 0.5 mV/V to + 3.5 mV/V (- 3.9 mV/V to + 3.9 mV/V optional)
Filter	0.1 Hz to 25 Hz selectable
Increment Size	x1, x2, x5, x10, x20, x50
Decimal Point	0.0, 0.00, 0.000
Calibration Methods	Computer interface or via front panel

## **Analog Output (Isolated)**

Type	16 bit D/A conversion
Voltage	0-10 Vdc (10K $\bullet$ min load)
Current	4-20 mA (300 $\bullet$ max load)
Linearity	< 0.012% of full scale
Temperature Creep	< 0.001% of FS / $^{\circ}$ C

## **Inputs & Outputs**

(2) Logic Inputs	Opto-isolated, 24 Vdc PNP (requires ext. power supply)
(2) Logic Outputs	Solid-state relays, (maximum load 24 Vdc / 100 mA each)
Serial Output	RS-232, RS-422 or RS-485
Maximum Cable Length	50 feet RS-232, 3200 feet for RS-422 and RS-485
Standard Protocols	ASCII, Modbus RTU
Baud Rate	2400, 9600, 19200, 38400, or 115200 selectable

## **Enclosure**

Overall Dimensions	4.17" x 3.54" x 2.28" (L x H x D)
Mounting	DIN Rail
Enclosure	ABS Plastic
Protection (front)	IP20
Weight	8 Ounces
Wiring Connections	Terminal blocks (pitch = 0.196")

Specifications are subject to change without notice

## Installation

### Mounting

Install the instrument in a location where it will not be subjected to excessive heat, humidity or vibration. For best results, avoid direct sunlight on the front of the instrument. The unit should be installed at eye level so as to allow viewing the display and access to the front panel keys.

### Cable Types and sizes

Use a 6 x 0.5 mm<sup>2</sup> shielded cable for the load cell/s connection. Use a 3 x 0.34 mm<sup>2</sup> shielded cable for the RS-232 connection, and a 2 x 0.34 mm<sup>2</sup> shielded cable for the RS-485 connection.

### Power and Wiring Considerations

The instrument is powered from an external 24 vdc source. The instrument can be operated from a computer, therefore, a "clean" power source is required for reliable operation.

The incoming power should come from a source that is isolated from other process equipment.

Cables carrying primary and switched power should be routed away from load cell and other signal cables to avoid electrical interference.

Relays, motor starters and other inductive devices connected to the equipment must have reliable and effective arc suppression.

Always connect the shield lead where indicated on the drawing, and on one end only.

High voltage devices such as megohmmeters, etc. should *never be used* to check the wiring connections.

Plastic insulating tape should not be used on load cell connections.

### Environmental Considerations

Heavy electrical equipment should not be installed close to the weighing equipment.

Excessive vibration will affect the accuracy of the weigh system and depending on the severity can cause damage to electrical and electronic components.

The atmosphere should be dust free and not contain any corrosive gasses or materials which could adversely affect the equipment.

### Hazardous areas

If the weighing system will be installed in a hazardous area, please refer to the drawing shown on page 40.

### NOTES:

WELDING on or in the vicinity of the equipment is **strictly prohibited**.

STATIC loads, caused by thunderstorms, must be prevented from developing by using reliable lightning conductors.

ENSURE that the cooling of the equipment is not obstructed.

## Introduction

This manual provides general information on the installation, configuration, calibration, and operation of the Precise™ 400 Series Digital / Analog Transmitters. There are two models within this series, the Model 400 which features a four-button keyboard, 6-digit Red LED display, and four status LED's. The Model 450 is a blind unit which can only be configured and calibrated remotely via the serial port. Both models are packaged in ABS Plastic DIN-Rail mounted enclosures.

All units include the following features:

- Drives up to six 350 ohm load cells
- Supports 4 and 6 wire connections
- RS-232, RS-422, or RS-485 outputs
- (2) Logic inputs
- (2) Logic outputs (setpoints)
- Isolated analog output 4/20mA, 0-5 Vdc or 0-10Vdc output utilizing a 16 bit DAC

The Precise™ 400 Series Transmitters have three different modes of operation:

### Operating mode

In this mode the unit displays gross weight, net weight, or peak force readings as required.

### Setup mode

This mode is used for configuration and calibration of the unit.

### Test mode

The test mode enables you to test the inputs, outputs, and analog output.

### Front panel key functions - Operating Mode (Model 400)

The "SET" key enables you to enter values for Setpoints 1 and 2. Press the "SET" key, Set 1 appears on the display. Press the "PRG" key to view the current value. To change the current value, press the "O" key to select a digit, then use the "UP" or "DOWN" keys to increment or decrement the value.

Repeat this procedure for the remaining digits, then press the "PRG" key to enter the new value. To change the value for Setpoint 2, press the "SET" key again and repeat the above procedure or press the "O" key to exit.

The "FUN" key is used to switch the unit from Gross mode to Net mode, or Peak Hold mode. To switch to Peak Hold mode, press and hold the "FUN" key until a 'P' appears on the display.

The "O" key is used to zero the unit in Gross mode, tare the unit in Net mode, and reset the value to zero in Peak Hold mode.

The "PRG" key is used to send the data to the RS-232 serial port for use with a computer.

### Front panel key functions - Setup Mode

In setup mode three of the front panel keys are used as directional keys to scroll through the various menus. A label on the lower half of each key identifies the direction provided by the key.

The "SET" and "FUN" keys are used to navigate through the main menu and sub-menus. They are also used to increment or decrement the numerical value of a selected digit.

The "O" key is used to move through certain sub-menu parameters, or to select a specific digit when numerical values are displayed. It is also used to return to the main menu from any of the sub-menus.

The "PRG" key switches the unit to the "Basic Configuration" mode. It is also used to enter the sub-menus, and store parameter changes.

The "PRG" key when used in conjunction with the "SET" key switches the unit to the "Complete Configuration" mode. It is also used to enter the sub-menus, and store parameter changes.

### Status LED's (Model 400 only)

There are four status LED's on the front of the unit, one for Motion, one for Net mode, and one for each of the outputs.

### Enabling/Disabling front panel keys.

In order to prevent any access to the instrument by non-authorized personnel, a procedure to lock the keyboard is also available.

#### How to LOCK the front panel keys:

Press and hold the "PRG" and "O" keys. The "O" key *must be pressed after the "PRG" key*.

Release both keys when the message LOCK appears on the display.

Press the "PRG" key to confirm.

Now the keys are disabled.

#### How to UNLOCK the front panel keys:

Press and hold the "PRG" and "O" keys.

The "O" key *must be pressed after the "PRG" key*.

Release both keys when the message UNLOCK appears on the display.

Press the "PRG" key to confirm.

Now the keys are enabled.

Note:

When the keyboard is locked the message LOCK appears for a while during the power-on sequence.

**Main Power Connections**

Use terminal 8 for the (+) input, and terminal 9 for the (-) input. The supply voltage must be 24 Vdc  $\pm$  15%. The external power supply must have a minimum rating of 5 watts.

**Transducer/s Connections**

Attach cable from transducer/s to transmitter (terminals 13 through 18). If using a 4-conductor cable, (no remote sensing) jumpers *must* be installed between the + Excitation and + Sense leads (terminals 14 to 15) and between the - Excitation and - Sense leads (terminals 13 to 16) as shown below in Figure 1.

**Logic Input Connections**

Use terminal 4 for Input (1), and terminal 5 for Input (2). Terminal 6 is the common for both inputs. These are powered inputs, which require an input voltage of 24 Vdc to activate them. See Figure 1 for additional information.

Input (1) is used to zero the unit in Gross mode, tare the unit in Net mode, and reset the peak value when operating in Peak Hold mode.

**Logic Input Connections (cont'd)**

Input (2) functions as a "send data" command, closing the input causes the weight data to be sent to the RS-232 serial port.

**Logic Output Connections**

Use terminal 1 for Output (1) and terminal 2 for Output (2). Terminal 3 is the common for both outputs. The outputs utilize solid-state relays with a maximum load rating of 24 Vdc @ 100mA

**Analog Output Connections**

Use terminal 10 for the 4/20mA output (300 Ohm load max), or terminal 11 for a 0 to 5 Vdc or 0 to 10 Vdc output (10K Ohm load max). Terminal 12 is used as the common for either output.

**Serial Output Connections**

The transmitters serial port supports RS-232, RS-422 or RS-485 communications. Serial parameter selections can be found on page 18. A detailed description of the serial data formats is provided on pages 20 through 23. Wiring connections are shown on pages 24 through 25.

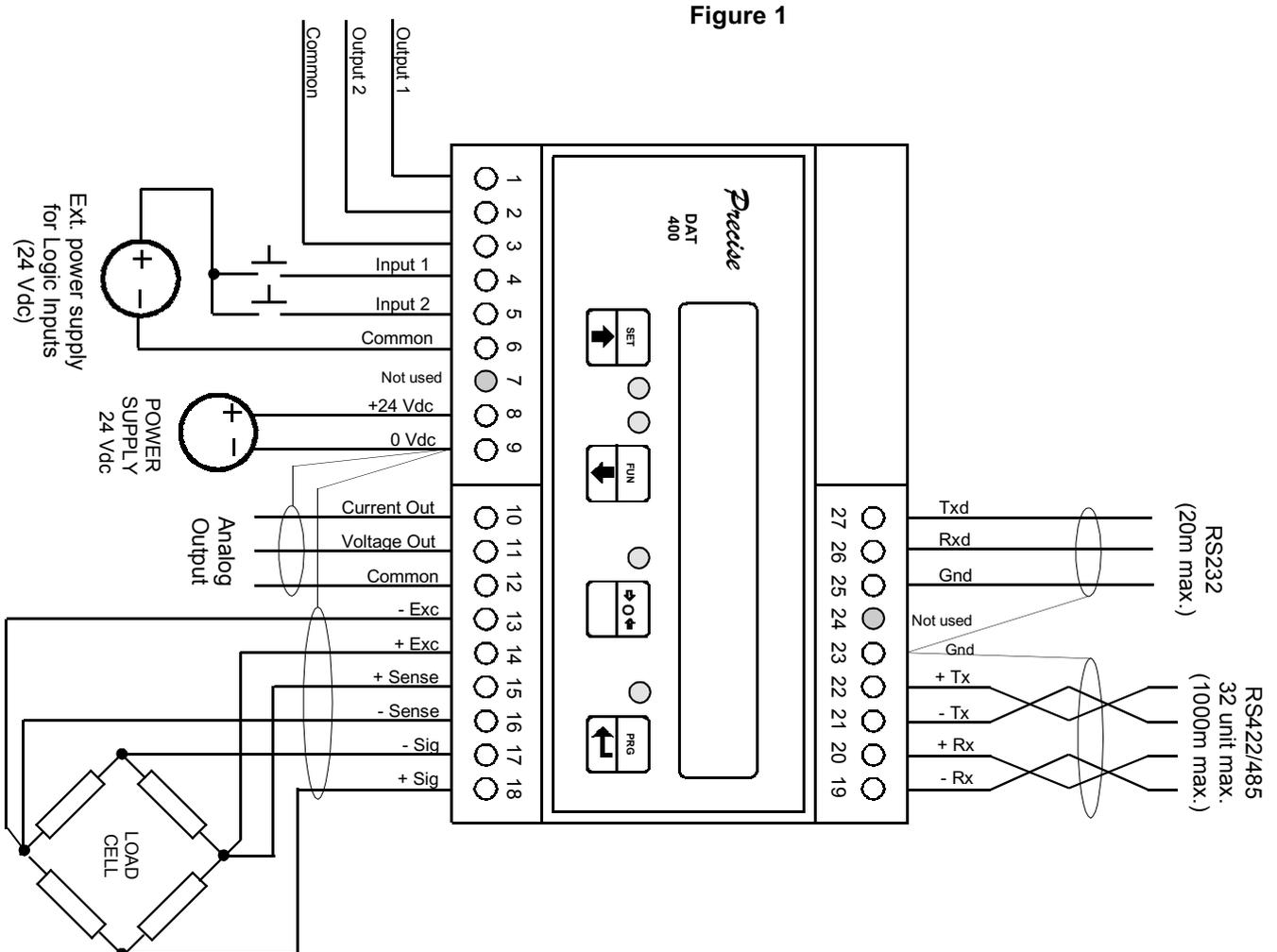


Figure 1

When no programming procedures are in progress, the display shows the weight value. In some particular conditions the following **ERROR MESSAGES** are displayed:

	<p>The weight displayed by the instrument is more than 9 divisions over the “Live” weight value (see “NET” parameter, page 12)</p>
	<p>The load cells input signal is lower than - 0,5 (-3,9) mV/V.          The load cells input signal is higher than +3,5 (+3,9) mV/V.          The load cell input signal is missing</p>

The values in brackets refer to the instruments having load cells input signal range from - 3,9 to + 3,9 mV/V (optional)

### Configuration Methods

The Precise™ 400 Series Digital / Analog Transmitters can be configured by using the front panel keys (Model 400) to navigate through a series of menus, or by sending configuration and calibration data to the RS-232 port with INOVATION™ an MS Windows based program included with the unit. INOVATION™ simplifies the configuration and calibration procedure.

### Configuration Procedures

There are two procedures available for setup of the Precise™ 400 Series Transmitters, “Basic Configuration” or “Complete Configuration”.

The “Basic Configuration” procedure allows you to change selective parameters, whereas, the “Complete Configuration” procedure allows you to change all of the parameters.

For example, if the transmitter requires calibration only, the “Basic Configuration” procedure is recommended.

The following pages provide a detailed explanation of both configuration procedures.

### Basic Configuration via the Front Panel

To perform a “Basic Configuration”, press and hold the “PRG” key until the display shows CAPAC. Use either the “UP” or “DOWN” keys to navigate through the eight basic configuration sub-menus shown below.

Display	Sub-menu Functions
CAPAC	Total capacity of transducer/s
SENSIT	Rated output of the transducer/s
NET	Net (live) weight value
DEAD L	Dead load weight value
DSPDIV	Increment size (resolution)
SIGNAL	Transducer/s input signal (view)
CALIBR	Calibration procedure
ANALOG	Full scale value for analog output

### Basic Configuration (cont'd)

To set one of the following parameters, CAPAC, SENSIT, NET, DEAD L, DSPDIV, or ANALOG, press the “PRG” key to view the default or previously selected value for that parameter. To change the value, press the “O” key to select a digit, then use the “UP” or “DOWN” keys to increment or decrement the value of the selected digit. When the desired value appears on the display, press the “PRG” key to store the new value. Press either the “UP” or “DOWN” keys to move to the next parameter.

The SIGNAL parameter enables you to view the actual input signal from the transducer/s. Press the “O” key to move to the next parameter.

The CALIBR parameter is used to calibrate the transmitter. The unit can be calibrated using either the data sheet or dead load procedure.

The data sheet calibration procedure allows the transmitter to be calibrated without a transducer simulator or test weights. This procedure is based on the capacity and certified, full scale mV/V output (sensitivity) of the transducer/s.

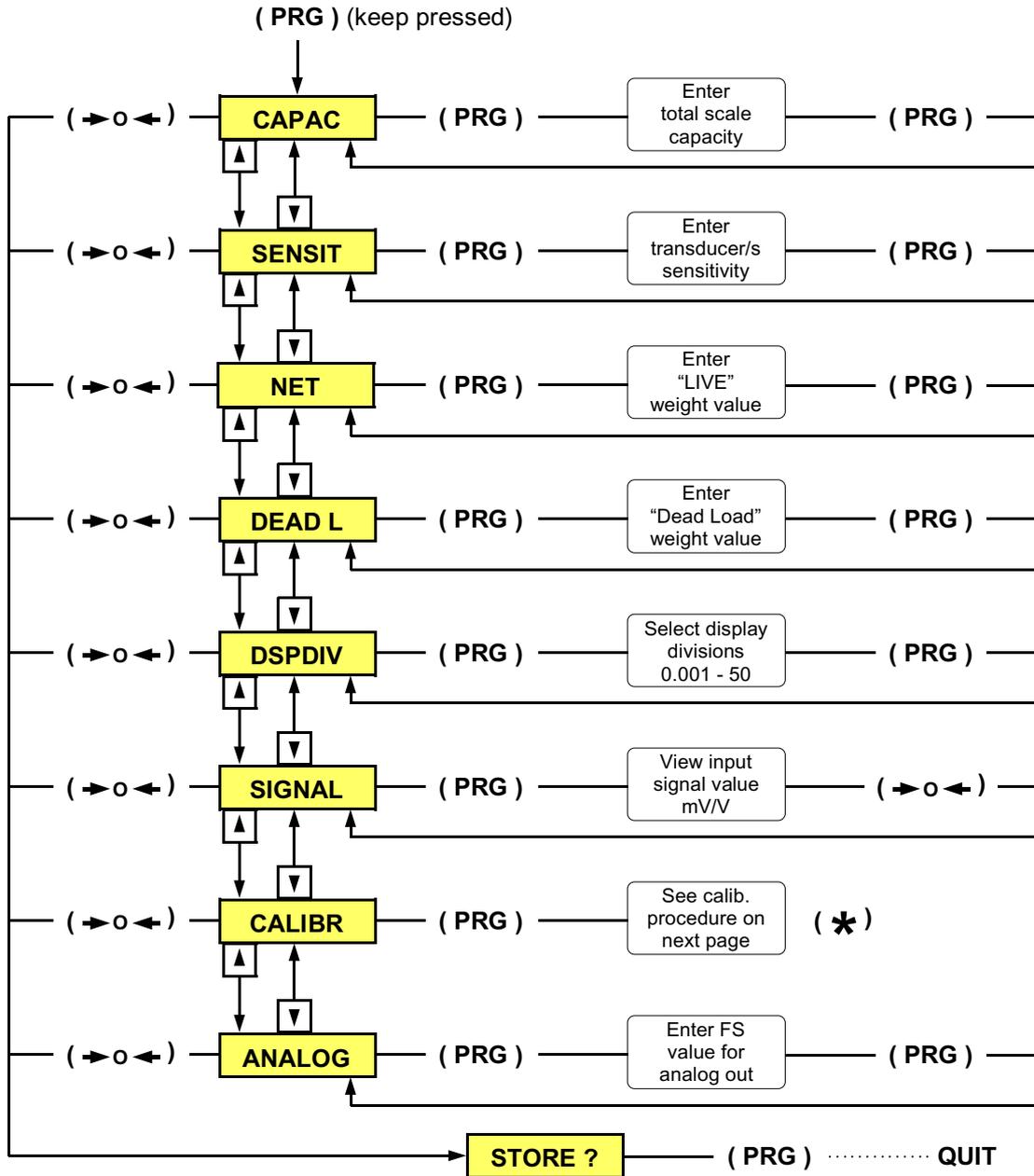
To perform a data sheet calibration, enter the total scale capacity, sensitivity, net weight, dead load weight, and display resolution, then press the “O” key. The display will indicate STORE ?, press the “PRG” key to save the changes and return to the operating mode.

See page 8 for a detailed explanation of the calibration procedure using test weights.

The ANALOG parameter is used to enter the full scale weight value that you want the analog output to represent. The default is net weight value.

To exit from the setup procedure, press the “O” key when any one of the following parameters are displayed CAPAC, SENSIT, ... ANALOG. The display will indicate STORE ?, press the “PRG” key to save the changes and return to the operating mode.

## Basic Configuration Menu

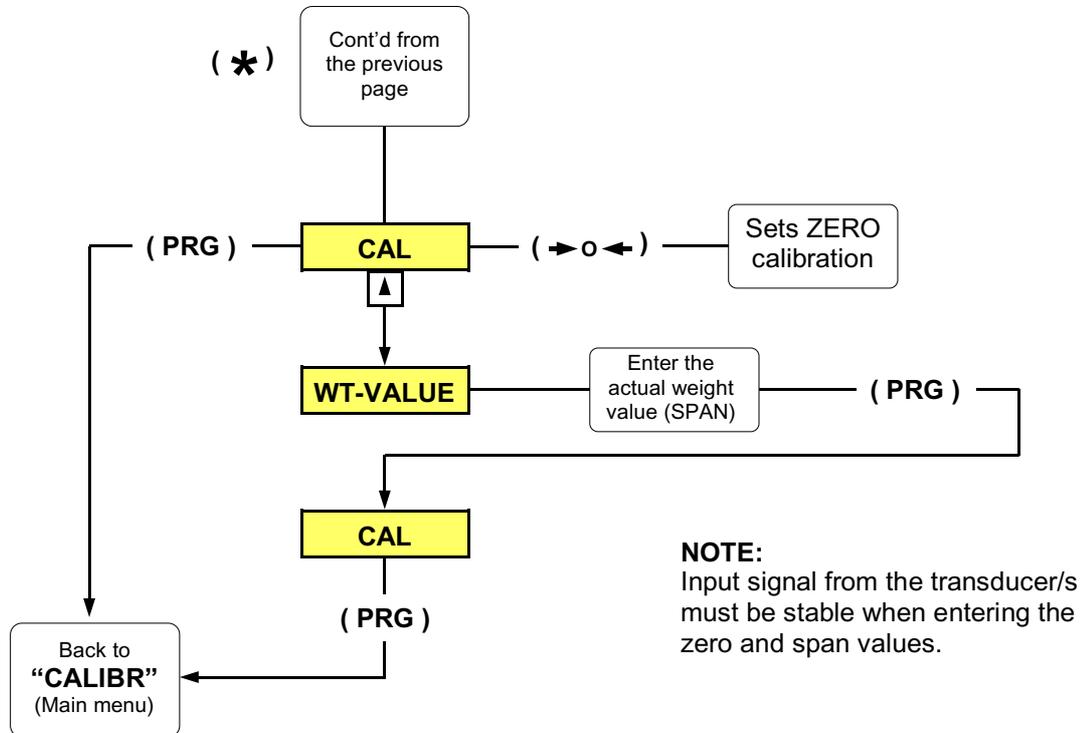


Place the unit in “Basic Configuration” mode by pressing and holding the “PRG” key until the display shows CAPAC. Use either the “UP” or “DOWN” keys to scroll through the eight basic configuration menus shown above. To set one of the following parameters, CAPAC, SENSIT, NET, DEAD L, DSPDIV, or ANALOG, press the “PRG” key to view the default or previously selected value for that parameter. To change the value, press the “O” key to select a digit,

then use the “UP” or “DOWN” keys to increment or decrement the value of the selected digit. Press the “PRG” key to enter the new value, then press either the “UP” or “DOWN” keys to move to the next parameter. To exit the setup procedure, press the “O” key when any one of the sub-menu parameters are displayed. The display will indicate STORE ?, press the “PRG” key to save the changes and return to the operating mode.

## Basic Configuration Menu (cont'd)

**NOTE:** In order to ensure greater stability during the calibration procedure, the digital filter increases to the maximum value automatically (value 9), therefore the weight indication updates very slowly at this stage. Once the calibration procedure has been completed, the digital filter will return to the previous value automatically.



The Precise™ 400 Series Transmitters can be calibrated via the front panel keys (Model 400), or with the INOVATION™ configuration utility.

Both methods consist of the following steps.

- Zero calibration
- Apply a known load (test weight)
- Edit weight value
- Span calibration
- Optional linearization (See page 14)

### 2-point calibration via the front panel keys

To calibrate the transmitter with the front panel keys, proceed as follows:

1. With the unit in "Basic Configuration" mode and the message "CALIBR" displayed, press the "PRG" key (CAL will be blinking on the display).
2. With the system unloaded, press the "O" key to perform the ZERO calibration.
3. Apply a known load *not less than 10% of the net weight value* and press the "UP" key.

4. Enter the actual weight value using the "O" key to select each digit, then use the "UP" or "DOWN" keys to increment or decrement the value of the selected digit.
5. Press the "PRG" key to enter the setting (CAL will be blinking on the display).
6. Press the "PRG" key, (the display indicates CALIBR), press either the "UP" or "DOWN" keys to move to the next parameter.
7. If no additional parameter changes are required, press the "O" key (the display indicates STORE ?), press the "PRG" key to save the changes and return to the operating mode.

Should it be necessary to erase either of the previous calibration entries, proceed as follows:

When the message CAL is blinking on the display, to erase the zero calibration, press and hold the "FUN" key, and then press the "O" key. Release both keys, the previous zero calibration entry has been erased. To erase the span calibration, press and hold the "FUN" key, and then press the "SET" key. Release both keys, the previous span calibration entry has been erased. End the procedure as described above (points 6 and 7).

## Complete Configuration via the Front Panel (Model 400)

In order to perform a complete configuration, the unit must be placed in setup mode. To enter the setup mode, press and hold the “PRG” and SET” keys on the front of the unit. The “SET” key *must be pressed after the “PRG” key*. Release both keys when the word CONFIG is shown on the display. The CONFIG menu is the first of six main menus used to completely configure the instrument. Use either the “UP” or “DOWN” keys to navigate through the six main menus shown below.

Display	Main Menu Functions
<b>CONFIG</b>	Parameters for total scale capacity, transducer sensitivity, net and dead load weight values, display divisions.
<b>CALIBR</b>	Zero and full scale calibration.
<b>PARAM</b>	Parameters for digital filtering, motion, auto zero and zero tracking
<b>IN-OUT</b>	Operating mode selection for outputs, and input and output test.
<b>SERIAL</b>	Serial output configuration.
<b>ANALOG</b>	Analog output configuration and calibration.

Press the “PRG” key to move down to the sub-menu or parameter desired. Press the “PRG” key to view the default or previously selected value for that parameter.

To change a parameter, press either the “UP” or “DOWN” keys to view the choices for that parameter. When the desired selection appears on the display, press the “PRG” key to enter the selection and move to the next parameter.

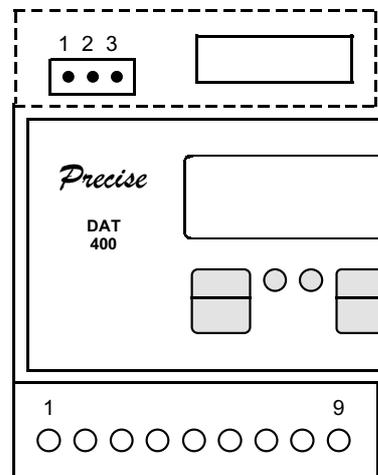
To edit numerical values, use the “O” key to select the digit, then use either the “UP” or “DOWN” keys to increment or decrement the value of the selected digit. Once the value has been entered, press the “PRG” key to store the value and move to the next parameters. Press the “O” key until the display indicates STORE ?, press the “PRG” key to save the changes and return to the operating mode.

## Configuration using INOVATION™

To configure the Precise™ 400 Series Digital / Analog Transmitters with the INOVATION™ program, proceed as follows:

1. Install INOVATION™ on an IBM-compatible computer running Windows 95, 98, Me or XP.
2. Minimum system requirements are 8MB of extended memory and at least 5MB of available hard drive space.
3. Remove power from both units, and connect the PC’s serial port to the RS-232 terminals on the transmitter. Refer to page 25 for wiring.
4. Apply power to the PC and the transmitter, then start the INOVATION™ program.
5. Switch the transmitter into remote mode by removing the upper left cover and moving jumper (J1) to the remote control position as shown below. The Model 400 can also be switched into remote mode by going into complete configuration and then selecting ‘Remote’ from the serial menu. See page 18.

Pins 1 - 2 = Remote Control  
Pins 2 - 3 = Default Setting



When viewing either model from a computer, the current weight value will be displayed under the icon representing the unit being configured.

If ERROR appears under the transmitters icon, re-check all of the wiring connections, verify that the unit is in remote mode, and make sure the icon being displayed matches the address of the transmitter to be configured.

Double-clicking on the transmitters icon will bring you to the INOVATION™ Main Setup Screen.

## Configuration using INOVATION™ (cont'd)

On this screen you can switch the display among net, gross and peak reading, set the serial address, enter values for the two setpoints, check the two logic inputs status and the software release of the instrument.

Click on the SETUP button, seven file folders will appear on the lower half of the screen. The first file folder labeled "Parameters" will be open.

The top section in this folder is for entering the total scale capacity, sensitivity, net weight, and dead load weight values (required parameters for performing a data sheet calibration)

The data sheet calibration procedure allows the transmitter to be calibrated without a transducer simulator or test weights. This procedure is based on the capacity and certified, full scale mV/V output (sensitivity) of the transducer/s.

To perform a data sheet calibration, enter the above values, then click on the SEND button for that group of parameters.

The next section in this file folder is used to select the display resolution. It consists of a drop down menu and a SEND button.

The Precise™ units allow to count by 1's up to 60,000 counts, Yet, for values greater than 10,000, the units automatically select a lower resolution to ensure greater stability. After selecting the desired resolution, press the SEND button for this parameter. *Do not press* any of the other SEND buttons in this folder or the unit will revert back to a default setting of x2, x5, etc.

**Changes to the display resolution should only be done after the unit has already been calibrated using the data sheet or dead load procedure.**

The bottom parameter selection in this file folder is labeled "Operating Mode". It enables the unit to retain the mode of operation in the event of a power loss. When the power is re-applied, the transmitter automatically returns to the mode that it was operating in prior to the power loss.

Changes to the Operating Mode cause an automatic power off - power on sequence of the instrument when the configuration will be saved. This allows the new Operating Mode to take effect.

The second file folder enables you to calibrate the unit with a transducer simulator or actual weight, (recommended method of calibration).

Inside this 2nd file folder, once the zero calibration has been performed, the program asks the operator if the new zero has to modify the "Data sheet" calibration.

If the operator answers "Yes", the "Dead load" value inside the first file folder will change automatically according to the new zero. If the operator answers "No", the "Dead load" value inside the first file folder will remain set to the previous value.

The third file folder contains the parameter selections for digital filtering, zero tracking, etc.

The fourth file folder contains the parameter selections for configuring the inputs and outputs

The fifth file folder contains the parameter selections for the serial output.

The sixth folder contains the parameter selections for the analog output,

The seventh folder provides a means for testing the outputs and analog output

The Main Setup Screen and file folders 1 through 6 all have SEND buttons on them for downloading the various parameter changes.

When configuration and calibration has been completed, the data can be saved on a PC or floppy disk or downloaded (sent) to the transmitter. This method of configuring and calibrating is very beneficial when several transmitters with similar configurations are being set up, or when a transmitter has to be replaced.

To exit INOVATION™, click on the Exit Setup icon. Now click on Option in the upper left corner of the screen, from the drop down menu select EXIT, a "Save Changes" window will appear, click on OK. This will return you to the Configuration Utility Screen, click on QUIT.

Figure 2 shows an example of one of the INOVATION™ configuration screens.

Figure 2

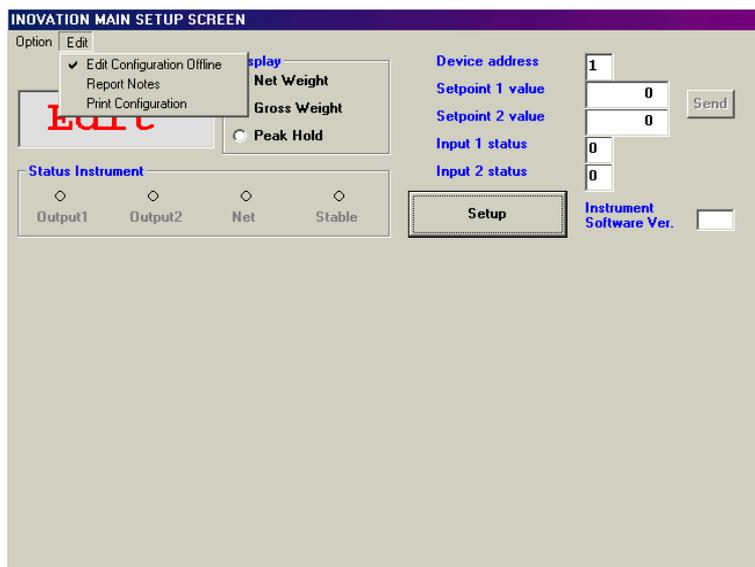
The screenshot displays the 'INOVATION MAIN SETUP SCREEN' with a purple header. At the top left, there are 'Option' and 'Edit' buttons. The main area is divided into several sections:

- Display:** A large digital display shows '1000'. Below it are radio buttons for 'Net Weight', 'Gross Weight' (selected), and 'Peak Hold'.
- Device address:** A text box contains '1'.
- Setpoint 1 value:** A text box contains '1500' with a 'Send' button to its right.
- Setpoint 2 value:** A text box contains '3500' with a 'Send' button to its right.
- Input 1 status:** A text box contains '0'.
- Input 2 status:** A text box contains '0'.
- Status Instrument:** Four indicator lights are shown: 'Output1' (off), 'Output2' (off), 'Net' (off), and 'Stable' (on).
- Exit Setup:** A button with a right-pointing arrow.
- Instrument Software Ver.:** A text box contains '2.0'.

Below these sections is a tabbed interface with the following tabs: 'Parameters' (selected), 'Calibration', 'Filters/z-track', 'Output config', 'Serial', 'Ana. output', and 'Test'. The 'Parameters' tab is active and shows the following settings:

- Total capacity of transducers:** 10000
- Full scale output value (mV/V):** 2.0000
- Net weight (value):** 8000 (with a 'Send' button)
- Dead load (value):** 1998
- Display resolution:** 1 (with a 'Send' button)
- Input signal (mV/V) (Reference only):** 0.599
- Internal counts (Reference only):** 155740
- Operating mode:** Net (with a 'Send' button')

Figure 2.1



The Inovation software also allows the operator to create new configurations, save new files and open existing files **without having any instrument connected to the computer.**

Thanks to this feature, the download of a given configuration to the instrument can be performed at any time.

To perform the operation mentioned above click on the "Edit" menu at the left end upper corner (See figure 2.1), then enable the function "Edit Configuration Offline".

The message "Edit" will appear on the display, showing this particular condition.

Another useful function concern the possibility to print out a report in which all the parameters of a given configuration are included.

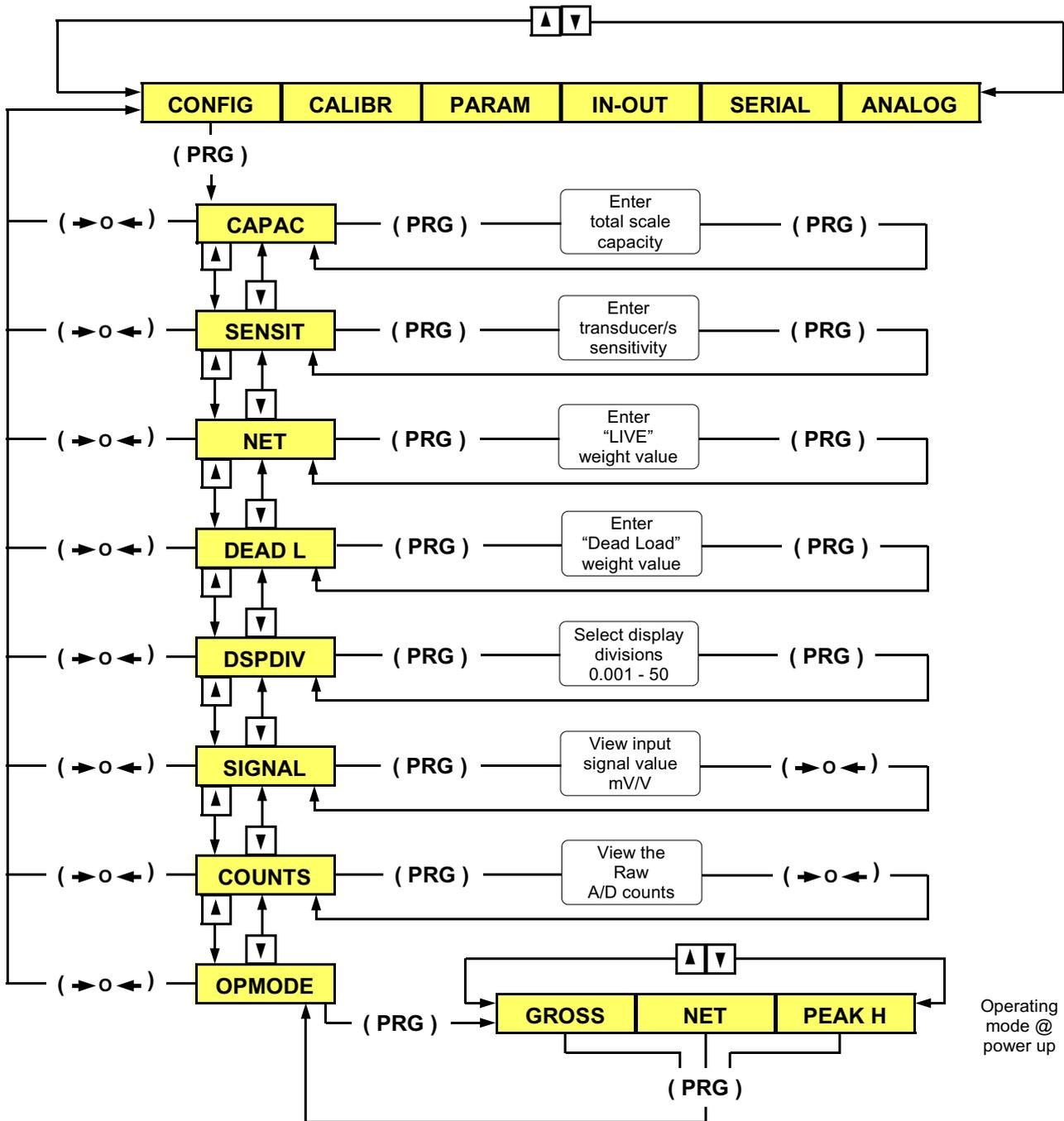
The "Print" command can be performed by clicking on "Print Configuration".

Besides, the command "Report Notes" allows the operator to include a heading in the report, in order to identify the plant, the customer name or any other useful information.

An example of a printed report is given on the right side of this page:

PRINT CONFIGURATION	
Date	12/01/2004 Test Procedure for DAT instruments
<b>Status Instrument</b>	
Device address	2
Setpoint 1 value	1500
Setpoint 2 value	3500
Input 1 status	0
Input 2 status	0
Instrument software version	0.4
<b>Parameters</b>	
Total capacity of transducers	10000
Full scale output value (mV/V)	2.0000
Net weight (value)	8000
Dead load (value)	1500
Display resolution	1
Input signal	0.599
Internal counts (Reference only)	155729
Operating mode	Net
<b>Filters / z-track</b>	
Digital filter value (0 to 9: 0 = no filter; 9 = max filter; default 5)	5
Motion band value (0 to 4: 0 = minimum; 4 = maximum; default 2)	1
Auto zero range setting at power up (0 to 10.0% of net weight: 0 = disable)	0.0
Zero tracking (0 to 4: default 2)	2
<b>Output config. Out 1</b>	
Operating mode	Net
Contact status below setpoint value	N. Open
Positive / Negative weight comparison	Positive
Immediate activation / activation after stabilization	Immediate
Hysteresis (default 2)	2
Setpoint activation time length (in 1/10 sec.) (0 = disable)	0
Time delay for activating setpoint (in 1/10 sec.) (0 = disable)	0
<b>Output config. Out 2</b>	
Operating mode	Gross
Contact status below setpoint value	N. Closed
Positive / Negative weight comparison	Positive
Immediate activation / activation after stabilization	Immediate
Hysteresis (default 2)	50
Setpoint activation time length (in 1/10 sec.) (0 = disable)	0
Time delay for activating setpoint (in 1/10 sec.) (0 = disable)	0
<b>Serial</b>	
Baud Rate (default 9600)	9600
Serial port mode (default Continuous transmission)	Slave
Serial address (ID Code) (from 01 to 32)	2
Response delay (Demand or Modbus mode) (in 1/100 sec. Max 1 sec.)	25
Data Format (N-8-2 / E-8-1 / O-8-1 for MODBUS mode)	N-8-1
Com2 Protocol (None for MODBUS mode)	None
Com2 Address (Profibus/DeviceNet Address from 1 to 126)	001
Com2 Baud Rate (Only DeviceNet)	250
<b>Ana. Output</b>	
Full scale value (default = Net weight value)	8000
Analog output source (Net Gross Peak H)	Net
Analog output selection	0-20mA
No load zero input value	0

## Complete Configuration Menu



Place the unit in complete configuration mode by pressing and holding the “PRG” and SET” keys on the front of the unit. The “SET” key *must be pressed after the “PRG” key*. Release both keys when CONFIG is displayed.

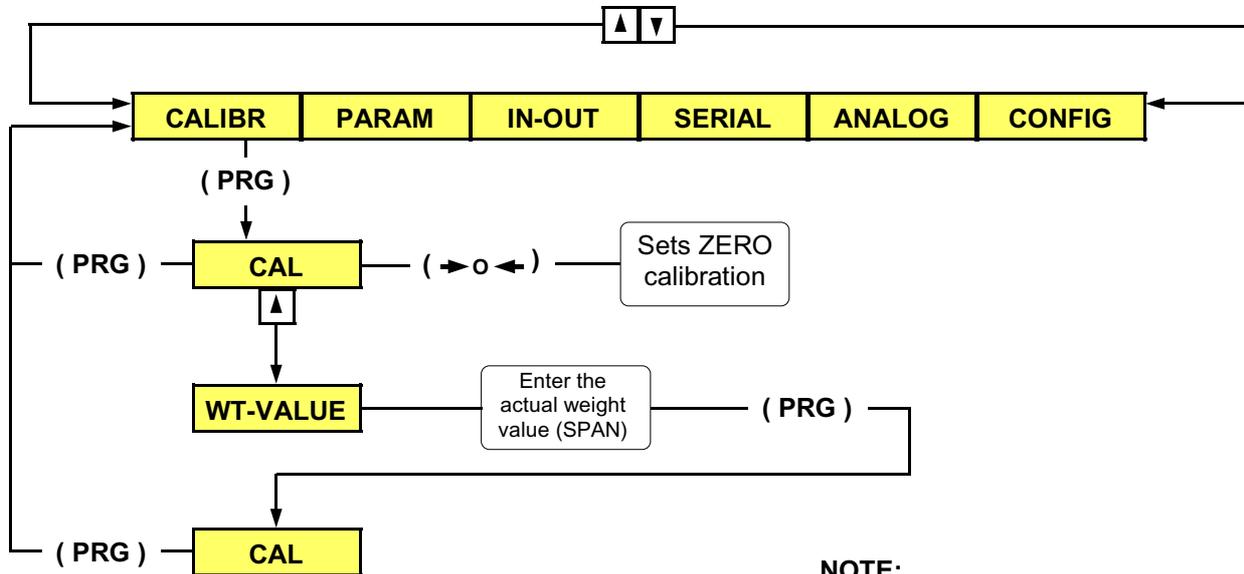
Press the “PRG” key to enter the sub-menu, then use either the “UP” or “DOWN” keys to select one of the sub-menu parameters. Press the “PRG” key to view the default or previously selected value for that parameter.

To change the value, press the “O” key to select a digit, then use the “UP” or “DOWN” keys to increment or decrement the value of the selected digit. Press the “PRG” key to enter the new value, then press either the “UP” or “DOWN” keys to move to the next sub-menu parameter or press the “O” key to return to the main menu.

To exit the configuration procedure, return to the main menu and press the “O” key, (the display will indicate STORE ?), press the “PRG” key to save the changes and return to the operating mode.

## Complete Configuration Menu (cont'd)

**NOTE:** In order to ensure greater stability during the calibration procedure, the digital filter increases to the maximum value automatically (value 9), therefore the weight indication updates very slowly at this stage. Once the calibration procedure has been completed, the digital filter will return to the previous value automatically.



**NOTE:**  
Input signal from the transducer/s must be stable when entering the zero and span values.

**NOTE:** Prior to calibration, the transmitter must be configured, thus giving it a set of operating parameters.

The unit can be calibrated using the 2-point method or the optional multi-point (linearity compensation) method. See page 14 for a detailed description of the multi-point calibration procedure.

### 2-Point calibration via the front panel keys

To calibrate the transmitter using the front panel keys, proceed as follows:

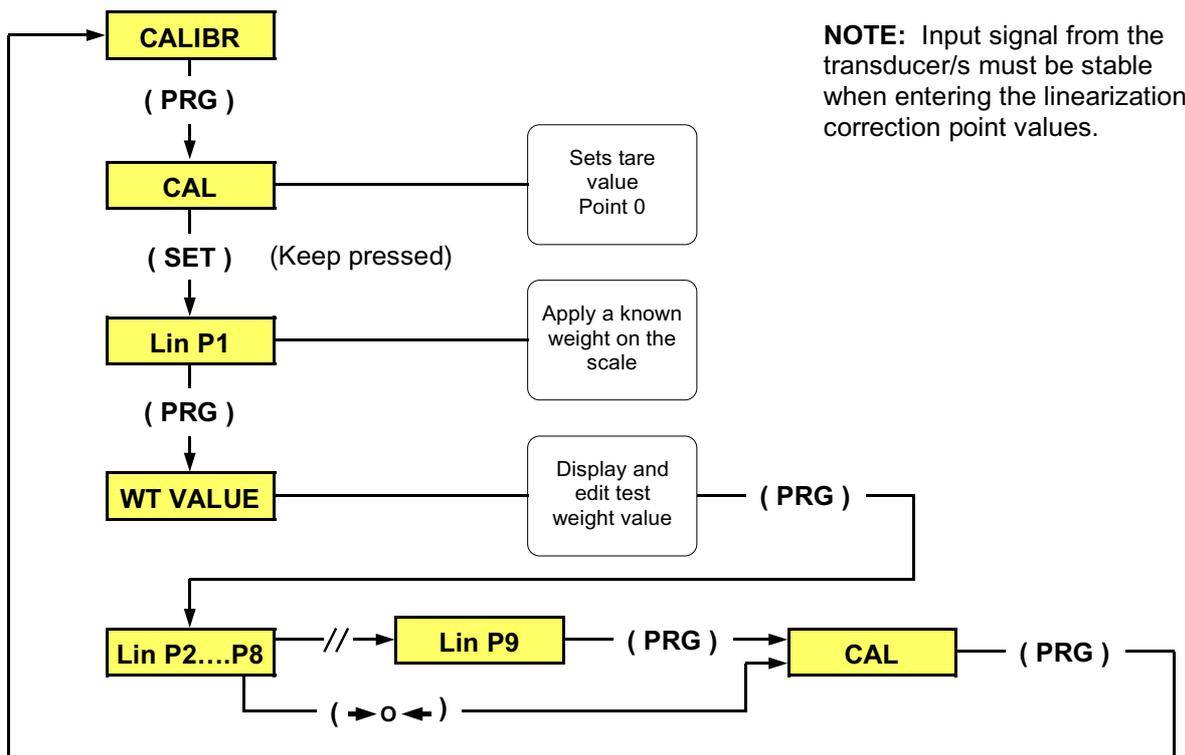
1. With the unit in "Complete Configuration" mode, press either the "UP" or "DOWN" keys until CALIBR is shown on the display.
2. Press the "PRG" key (CAL will be blinking on the display).
3. With the system unloaded, press the "O" key.
4. Apply a known weight *not less than 10% of the net weight value* and press the "UP" key.

5. Enter the actual weight value using the "O" key to select each digit, then use the "UP" or "DOWN" keys to increment or decrement the value of the digit. Press the "PRG" key to enter the setting (CAL will be blinking on the display).
6. Press the "PRG" key, (the display indicates CALIBR), press either the "UP" or "DOWN" keys to move to the next parameter.
7. If no additional parameter changes are required, press the "O" key (the display indicates STORE ?), press the "PRG" key to save the changes and return to the operating mode.

Should it be necessary to erase either of the previous calibration entries, proceed as follows:

To erase the zero calibration, press and hold the "FUN" key, and then press the "O" key. Release both keys, the previous zero calibration entry has been erased. To erase the span calibration, press and hold the "FUN" key, and then press the "SET" key. Release both keys, the previous span calibration entry has been erased.

## Complete Configuration Menu (cont'd)



**NOTE:** Input signal from the transducer/s must be stable when entering the linearization correction point values.

The Model 400 features a 10-point linearization option (available only with the front panel keys). Any number of points up to 10 may be used, however, the last point *must always be* the full scale value of the weighing system.

**Example:** A one point linearization correction would require a total of two points, one point within the range, and one point for full scale.

Prior to performing the linearization correction, at least the zero of the unit must have already been calibrated, while the full scale value is not mandatory. The unit must be in CALIBR mode, and you should have known weights available equal to the points being set.

### Multi-point Calibration via Front Panel Keys

1. With the unit in either "Basic or Complete Configuration" mode, press the "PRG" key (CAL will be blinking on the display).
2. Press and hold the "SET" key until Lin P1 is blinking on the display.
3. Apply a known weight for the first linearization point, and press the "PRG" key.
4. Enter the actual weight value using the "O" key to select each digit, then use the "UP" and "DOWN" keys to increment or decrement the value of the selected digit.

5. Press the "PRG" key. The unit will increment to the next linearization point (Lin P2).
6. Repeat steps 3 through 5 for additional points.
7. If all 10 points will be linearized, follow the 1st. procedure. For linearization correction using less than 10 points, follow the 2nd. procedure.

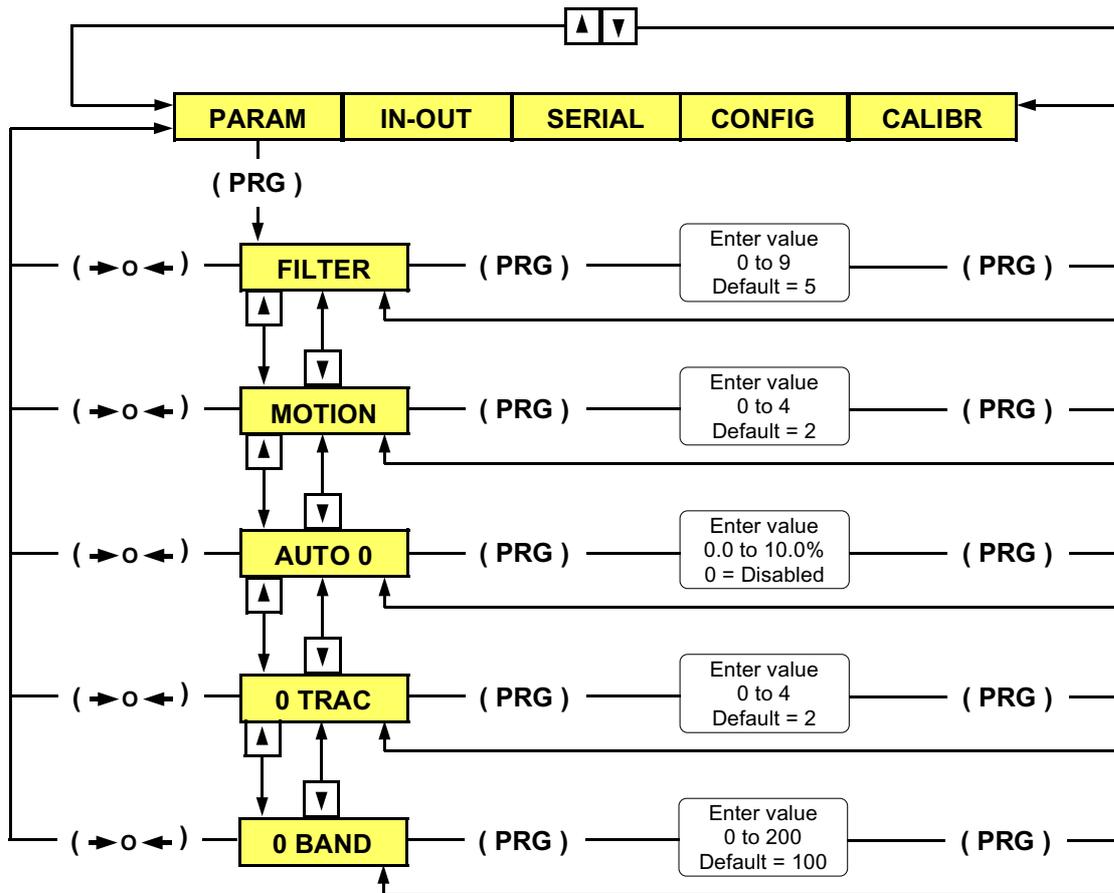
### 1st Procedure (10-point linearization)

- 7a. Enter the weight value for linearization point Lin P9, and press the "PRG" key (CAL will be blinking on the display). Press the "PRG" key again, (the display indicates CALIBR).
- 7b. Press the "O" key (the display will indicate STORE ?), press the "PRG" to save the changes and return to the operating mode.

### 2nd. Procedure (less than 10-point linearization)

- 7a. The last linearization point *must be* the full scale value. Press the "O" key, (CAL will be blinking on the display).
- 7b. Press the "PRG" key (the display will show CALIBR). Press the "O" key (the display will indicate STORE ?).
- 7c. Press the "PRG" key to save the changes and return to the operating mode.

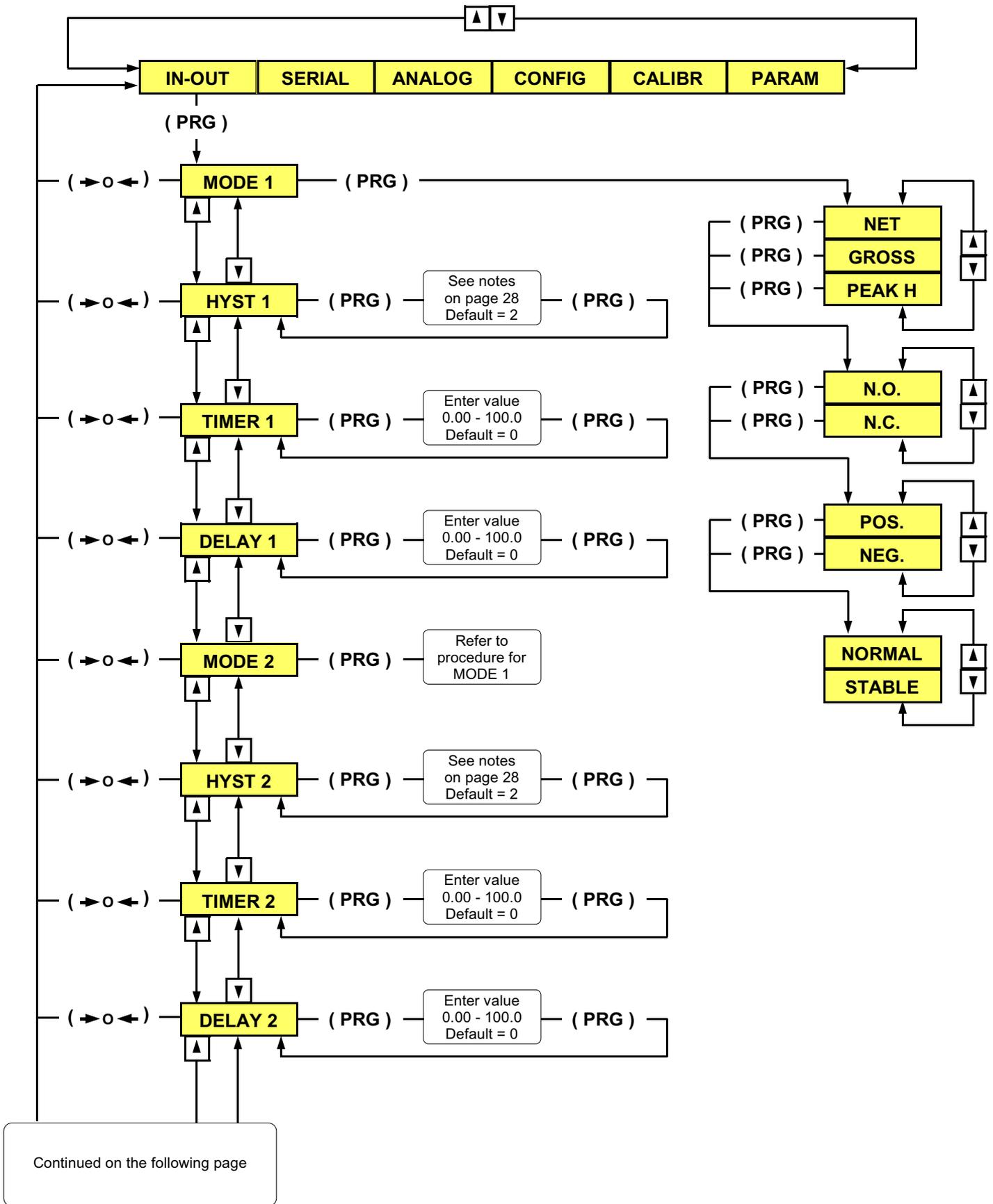
## Complete Configuration Menu (cont'd)



1. With the unit in "Complete Configuration" mode, press either the "UP" or "DOWN" keys until PARAM is shown on the display.
2. Press the "PRG" key to enter the sub-menu, then use either the "UP" or "DOWN" keys to select one of the sub-menu parameters.
3. Press the "PRG" key to view the default or previously selected value for that parameter.
4. To change the value, press the "O" key to select a digit, then use the "UP" or "DOWN" keys to increment or decrement the value of the selected digit.
5. Press the "PRG" key to enter the new value, then press either the "UP" or "DOWN" keys to move to the next sub-menu parameter or press the "O" key to return to the main menu.
6. To exit the configuration procedure, return to the main menu and press the "O" key, (the display indicates STORE ?), press the "PRG" key to save the changes and return to the operating mode.

See Table 2 on page 26 for a detailed explanation of the "PARAM" parameter selections

# Complete Configuration Menu (cont'd)



## Complete Configuration Menu (cont'd)

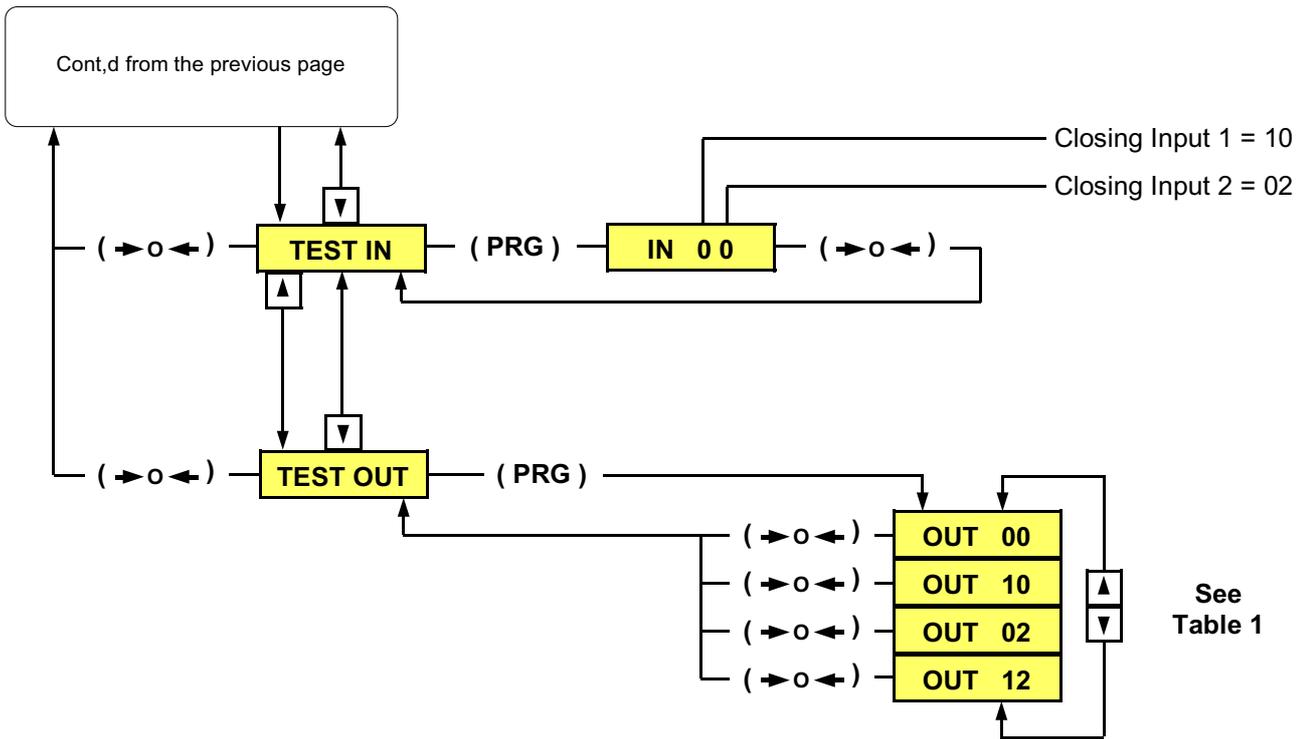
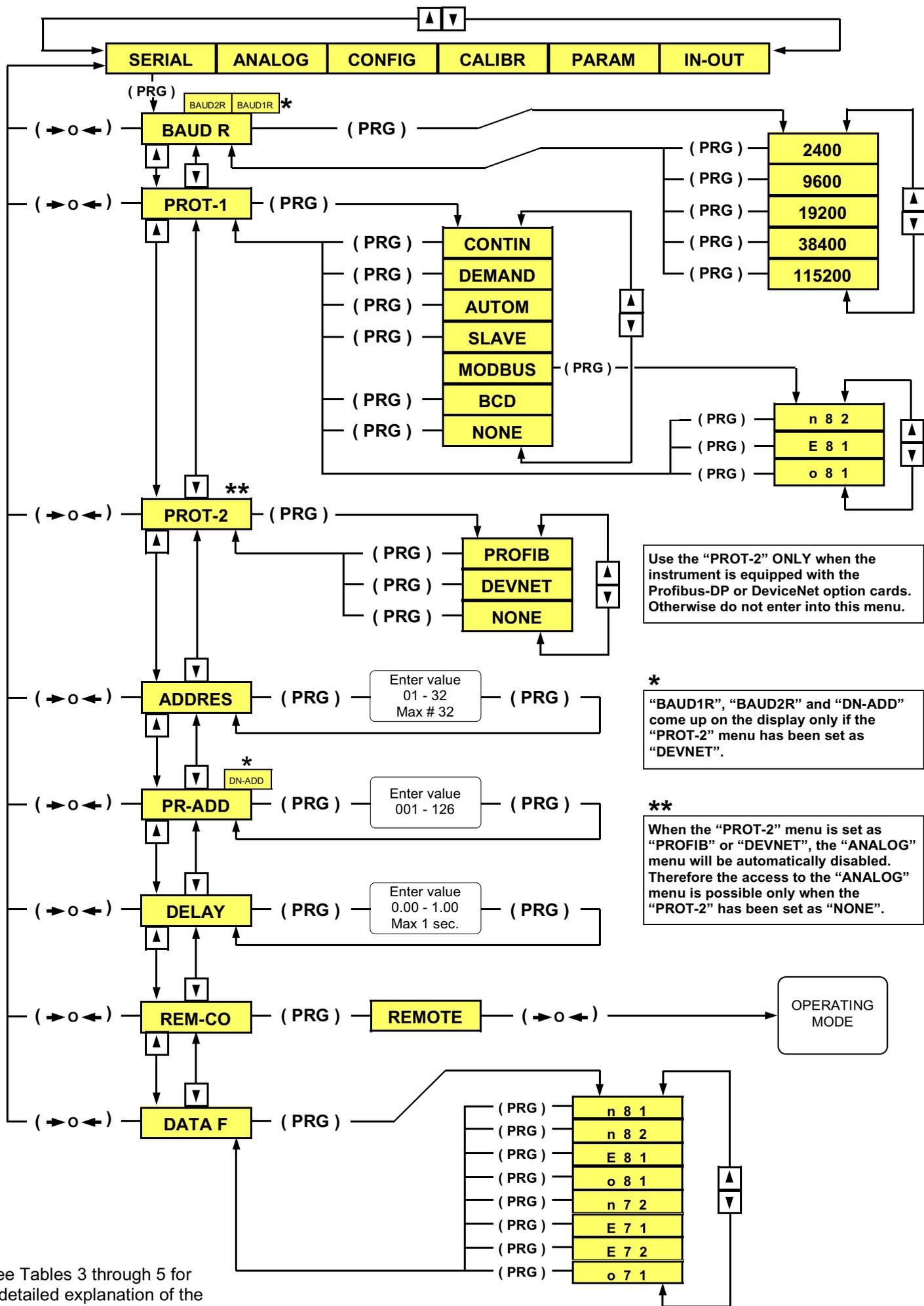


Table 1

Display	OUTPUT 1 (status)	OUTPUT 2 (status)
OUT 00	OFF	OFF
OUT 10	ON	OFF
OUT 02	OFF	ON
OUT 12	ON	ON

See Table 6 on page 28 for a detailed explanation of the “IN - OUT” parameter selections



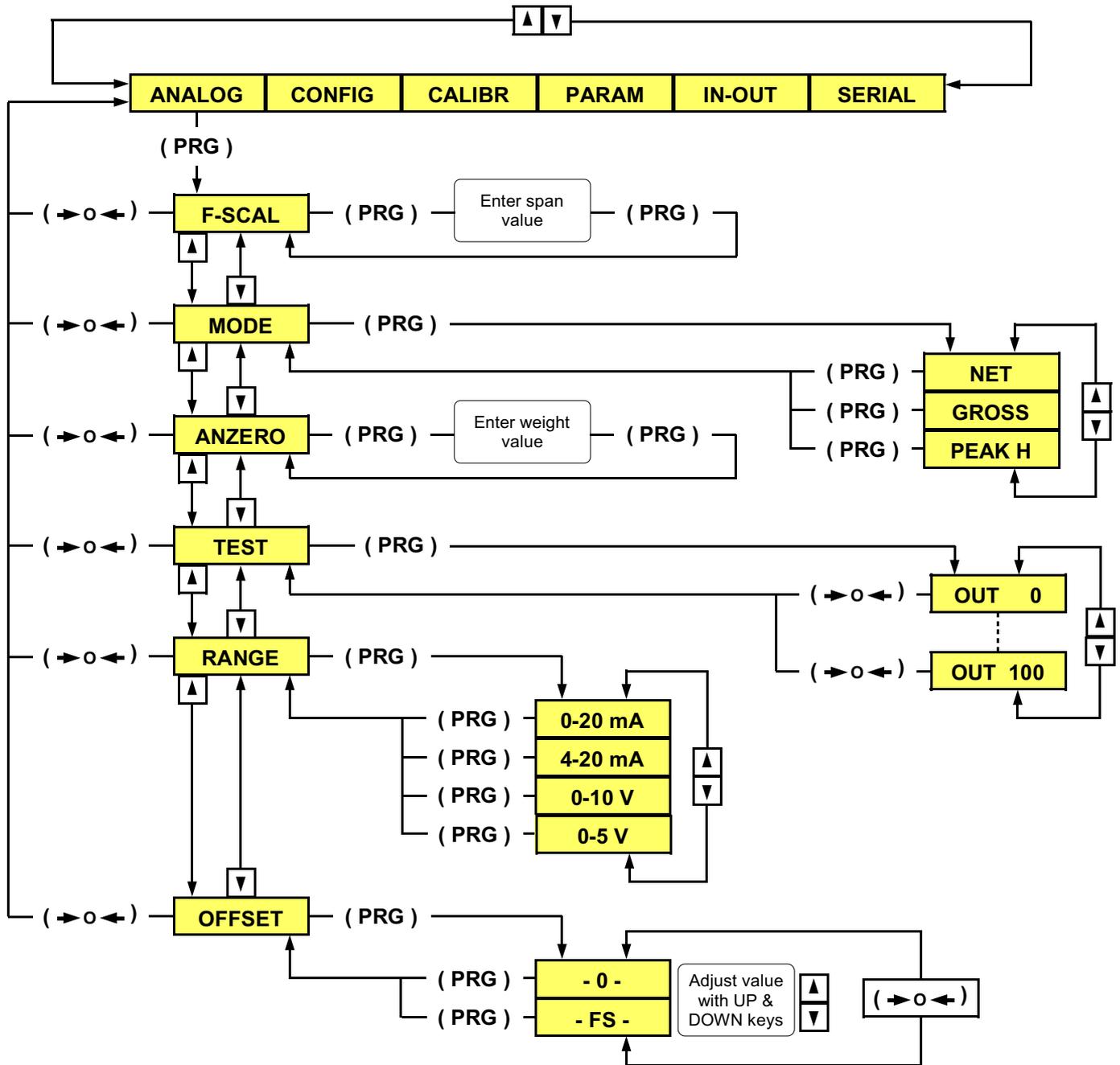
Use the "PROT-2" ONLY when the instrument is equipped with the Profibus-DP or DeviceNet option cards. Otherwise do not enter into this menu.

\*  
"BAUD1R", "BAUD2R" and "DN-ADD" come up on the display only if the "PROT-2" menu has been set as "DEVNET".

\*\*  
When the "PROT-2" menu is set as "PROFIB" or "DEVNET", the "ANALOG" menu will be automatically disabled. Therefore the access to the "ANALOG" menu is possible only when the "PROT-2" has been set as "NONE".

See Tables 3 through 5 for a detailed explanation of the "SERIAL" parameter selections

## Complete Configuration Menu (cont'd)



1. With the unit in "Complete Configuration" mode, press either the "UP" or "DOWN" keys until ANALOG is shown on the display.

2. Press the "PRG" key to enter the sub-menu, then use either the "UP" or "DOWN" keys to select one of the sub-menu parameters.

3. Press the "PRG" key to view the default or previously selected value for that parameter.

4. To change a parameter, press either the "UP" or "DOWN" keys to view the choices for that parameter.

When the desired selection appears on the display, press the "PRG" key to enter the selection and move to the next parameter.

5. To edit numerical values, use the "O" key to select the digit, then use either the "UP" or "DOWN" keys to increment or decrement the value of the selected digit.

6. Press the "PRG" key to enter the new value, then press either the "UP" or "DOWN" keys to move to the next sub-menu parameter or press the "O" key to return to the main menu.

The "ANZERO" parameter is a negative weight value to which the zero offset of the analog output can be referred.

Example: If the selected range is 4/20 mA and the "ANZERO" value is "10", the analog output value will be 4 mA when the weight will be "-10"

## Serial Communication

### Baud Rates

2400, 9600, 19200, 38400, and 115200

### Data Formats

All serial characters are in ASCII format, and consist of the following.

1 Start Bit, 7 or 8 Data Bits, 1 or 2 Stop Bit, Parity No, Even or Odd.

The above data depend on the selection made in the "SERIAL" menu (see Table 3 on page 26)

Transmission of the serial data can be initiated in several ways as described below.

### Automatic mode

The "Automatic" mode is used to interface with printers or other data acquisition devices. The serial data is transmitted automatically, *upon stabilization* whenever the weight value has increased or decreased more than 20 divisions.

This function is not performable when the "MOTION" parameter is set to 0 (weight stability check disabled).

### Continuous mode

The "Continuous" mode is used to interface with computers, remote displays, or other types of devices that require constant data updating.

### Demand mode

The "Demand" mode is used to interface with printers and requires a manual print command from the front panel keys (Model 400) or a remote contact closure to initiate the output.

In the above modes, the transmitter sends serial data using the format shown below:

STX	<status>	<net weight>	<gross weight>	<peak value>	ETX	<chksum>	EOT
-----	----------	--------------	----------------	--------------	-----	----------	-----

STX (start of text) = 02h    ETX (end of text) = 03h    EOT (end of transmission) = 04h

**<status>** = 1 ASCII character consisting of the following:  
    **"S"** = Stable  
    **"M"** = Motion  
    **"O"** = Overload  
    **"E"** = Error  
**<net weight>** = 6 ASCII characters  
**<gross weight >** = 6 ASCII characters  
**<peak value>** = 6 ASCII characters  
**<checksum>** = 2 ASCII characters (STX & ETX are not included in the checksum)

NOTE: The brackets "<" ">" are not sent, they are only shown for clarification.

The checksum control value is obtained by performing the XOR operation.

It is expressed with 2 Hexadecimal digits. Example: 25 = 1D

The result of the above calculation equals 1 character, which can be a numerical value of 0 to 9 or A to F (Hexadecimal)

## Serial Communication (cont'd)

### Slave mode

The slave mode is used for interfacing with distributed control systems (DCS) or programmable logic controllers (PLC). This mode requires a data request from the master to initiate the output.

In this mode the host sends serial data to the transmitter using the formats shown below:

<addr>	"N"	EOT
--------	-----	-----

After receiving the request, the transmitter responds with the following data string.

<addr>	"N"	<status>	<net weight>	<gross weight>	<peak value>	ETX	<chksum>	EOT
--------	-----	----------	--------------	----------------	--------------	-----	----------	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

<addr> serial address + 80h Example: address 1 would be 1 + 80h = 81h  
ETX (end of text) = 03h EOT (end of transmission) = 04h

### Character strings

<status>	= 1 ASCII character consisting of the following:
"S"	= Stable
"M"	= Motion
"O"	= Overload
"E"	= Error
<net weight>	= 6 ASCII characters
<gross weight >	= 6 ASCII characters
<peak value>	= 6 ASCII characters
<checksum>	= 2 ASCII characters (<Addr> & ETX are not included in the checksum)

NOTE: The brackets "<" ">" are not sent, they are only shown for clarification.

The checksum control value is obtained by performing the XOR operation.

It is expressed with 2 Hexadecimal digits. Example: 25 = 1D

The result of the above calculation equals 1 character, which can be a numerical value of 0 to 9 or A to F (Hexadecimal)

### Programming the set-points

Command from the host

<addr>	"S"	<s1>	<s2>	ETX	<chksum>	EOT
--------	-----	------	------	-----	----------	-----

<s1> = 6 ASCII characters for set-point 1  
<s2> = 6 ASCII characters for set-point 2

The transmitter responds with the following data string:

<addr>	ACK	EOT
--------	-----	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

The programmed values are stored in RAM, however, they are not retained if the power is removed. There is no limit on the number of times that these commands can be performed.

## Store set-point values in Eeprom

Command from the host

<addr>	"M"	EOT
--------	-----	-----

The transmitter responds with the following data string:

<addr>	"M"	EOT
--------	-----	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

This command is used to store the programmed set-point values in Eeprom. This command can be performed up to 100,000 times.

## Request set-point values

Command from the host

<addr>	"R"	EOT
--------	-----	-----

The transmitter responds with the following data string:

<addr>	"R"	<s1>	<s2>	ETX	<chksum>	EOT
--------	-----	------	------	-----	----------	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

## "Net mode" / "Gross mode" switch command

This command performs the same function of the "FUN" key.

### Switch to Gross weight mode

Command from the host

<addr>	"C"	"L"	EOT
--------	-----	-----	-----

The transmitter responds with the following data string:

<addr>	"C"	"L"	ACK	EOT
--------	-----	-----	-----	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

## Switch to Net weight mode

Command from the host

<addr>	"C"	"N"	EOT
--------	-----	-----	-----

The transmitter responds with the following data string:

<addr>	"C"	"N"	ACK	EOT
--------	-----	-----	-----	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

## Zero / Tare / Peak reset command

This command performs the same function of the "0" key and/or logic input (1).

It's used to zero the unit when in Gross mode, tare the unit when in Net mode, and reset the value to zero when operating in Peak Hold mode.

Command from the host

<addr>	"A"	"A"	EOT
--------	-----	-----	-----

The transmitter responds with the following data string:

<addr>	"A"	"A"	ACK	EOT
--------	-----	-----	-----	-----

In case of an error, the transmitter will respond with the following data string.

<addr>	NAK	EOT
--------	-----	-----

## Modbus mode

The Modbus mode is used to communicate with Modicon Programmable Controllers using a unique message structure that the controllers can understand regardless of the type of networks being used.

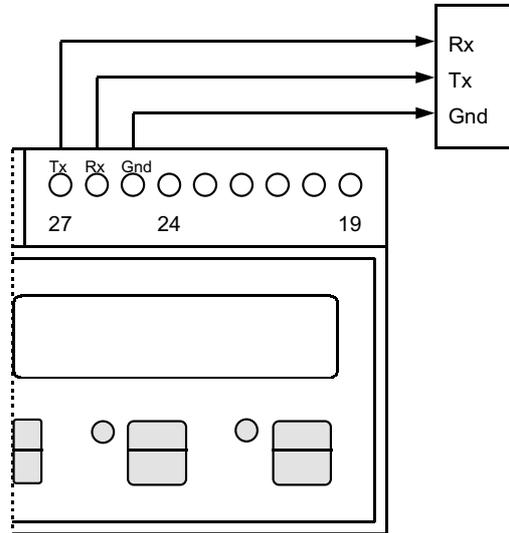
Please refer to the tables on pages 29 through 39 for information regarding the MODBUS RTU Protocol Specifications.

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## Serial Output Wiring Connections

**RS-232** serial connections to a computer, remote serial display or other data acquisition device. See Figure 3.

**Figure 3**



**RS-422/485** multi-drop serial configuration allows connection of up to 32 units to a distributed control system (DCS) or programmable logic controller (PLC). See **Figure 4** for the **RS422** connection and **Figure 5** for the **RS485** connection.

**Figure 4 RS422 connection**

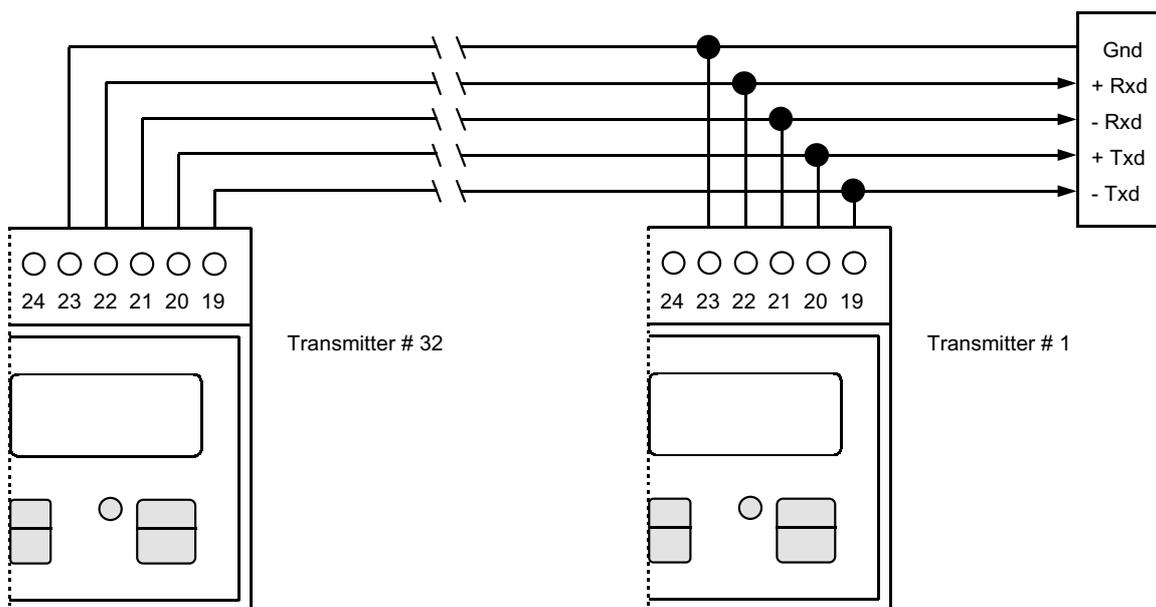
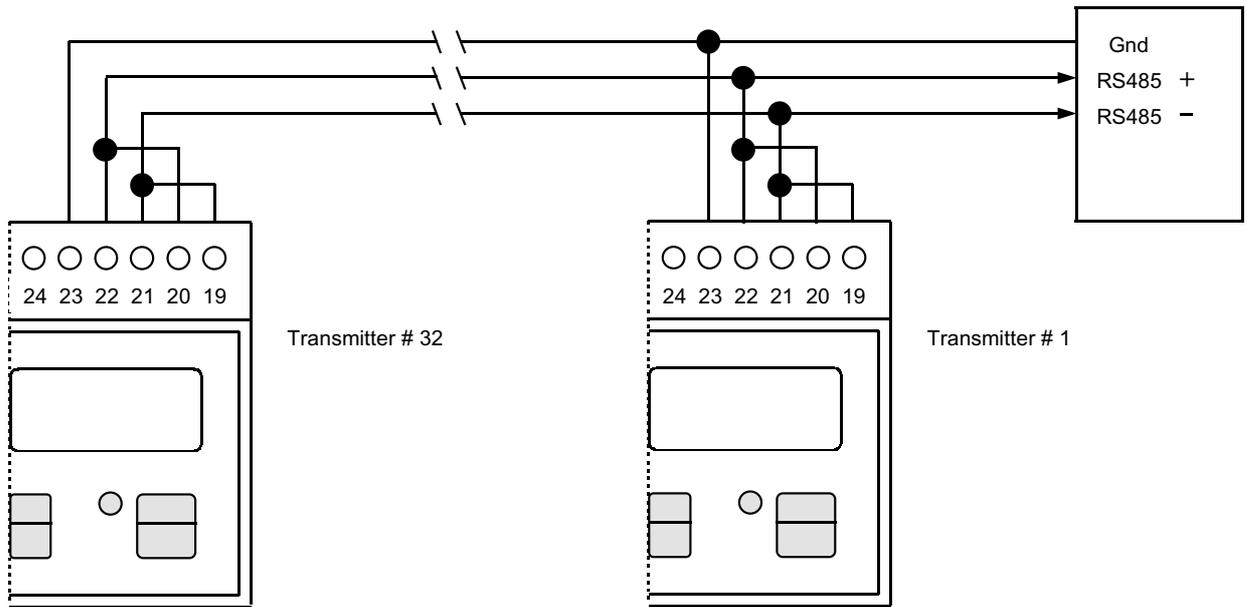
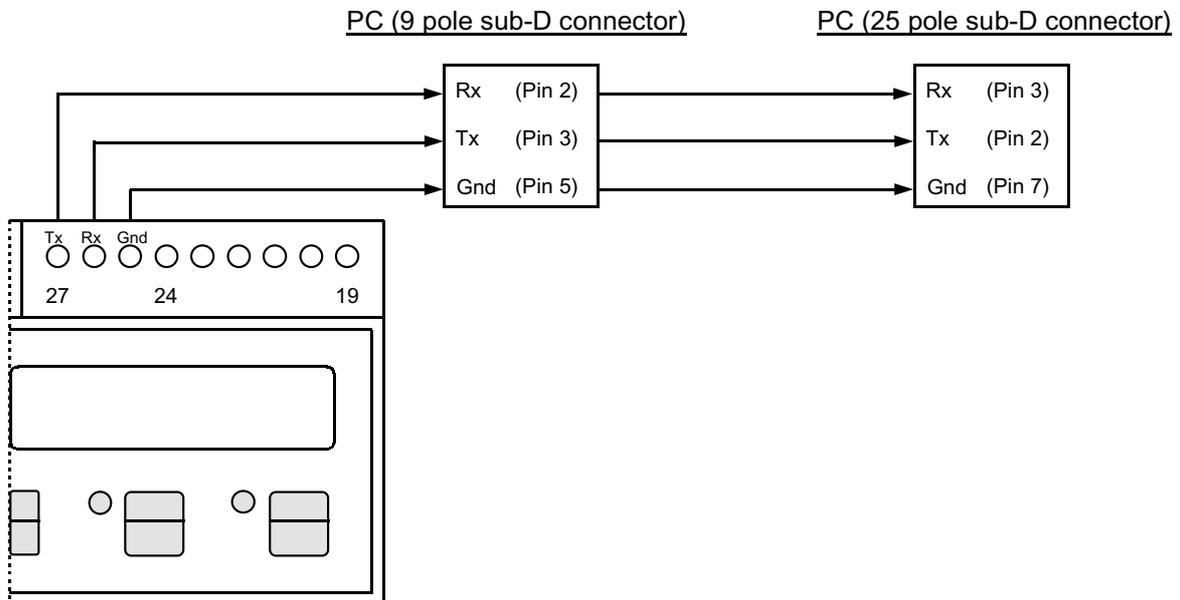


Figure 5 RS485 Connection



“INOVATION” Software: RS232 wiring to PC (COM1 / 2)



Not only the RS232, but also the RS422 or RS485 can be used for the communication with the Innovation software. Refer to Figures 3, 4, 5 depending on the desired connection.

## Sub-menu parameter selections

**Table 2 “PARAM” Menu**

PARAMETERS	SELECTIONS	DESCRIPTION	VALUES
FILTER (See notes below)	0 to 9 (Default = 5)	Digital filtering value	0 = no filtering 9 = maximum filtering
MOTION	0 to 4 (Default = 2)	Weight stabilization	0 = Weight always stable 1 = slow stabilization 4 = fast stabilization
AUTO 0	0.0 to 10.0% (of net weight value)	Auto zero range @ power up.	0 = function disabled
0 TRAC	0 to 4 (Default = 2)	Zero tracking range	0 = function disabled
0 BAND (See notes below)	0 to 200 divisions (Default = 100)	“Zero” key operating range	0 = function disabled

**Digital filtering** affects the update rate and speed of the unit.

Filter setting = 0	Update rate = 25 Hz
Filter setting = 1	Update rate = 10 Hz
Filter setting = 2	Update rate = 5 Hz
Filter setting = 3	Update rate = 2.5 Hz
Filter setting = 4	Update rate = 1.5 Hz
Filter setting = 5	Update rate = 1 Hz
Filter setting = 6	Update rate = 0.7 Hz
Filter setting = 7	Update rate = 0.4 Hz
Filter setting = 8	Update rate = 0.2 Hz
Filter setting = 9	Update rate = 0.1 Hz

**0 BAND:**

this parameter defines the operating range of the “Zero” key (and Input 1), used to zero the unit in Gross mode.

**Table 3 “SERIAL” Menu**

PARAMETERS	SELECTIONS	DESCRIPTION
BAUD R	2400, 9600, 19200, 38400, 115200	COM1 Baud rate selection Standard baud rate: 9600
PROT-1	NONE CONTIN (ASCII) DEMAND (ASCII) AUTOM (ASCII) SLAVE (ASCII) MODBUS (*) BCD	COM1 Serial port transmission mode selection Standard transmission mode: Continuous  (* ) The possible Data Format selection for this protocol are: N 8 2 ; E 8 1 ; o 8 1 (Parity, Data bits, Stop bits)
PROT-2	PROFIB DEVNET NONE	COM2 Serial port transmission mode selection
ADDRES	01 to 32	COM1 Identification address, selectable from 1 to 32
PR ADD DN ADD	001 to 126	Profibus-DP or DeviceNet node address
DELAY	0.00 to 1.00	Delay in responding to a data request from the host in “Demand” or “MODBUS” modes (COM1). Time unit: 1/100 second (maximum 1 second)
REM-CO	REMOTE	Enables communication with “INOVATION” without re-positioning jumper (J1) as described on page 9.
DATA F	N-8-1 N-8-2 E-8-1 O-8-1 N-7-2 E-7-1 E-7-2 O-7-1	Data Format selection for the ASCII protocols (Parity, Data bits, Stop bits). See “PROT-1”

## Sub-menu parameter selections (cont'd)

### Continuous transmission:

The transmission speed depends on the digital filter setting and the baud rate value selected. See Table 4 below for additional information.

Table 4

BAUD RATE						
D I G I T A L  F I L T E R		2400	9600	19,200	38,400	115,200
	0	6 Hz	25 Hz	50 Hz	50 Hz	50 Hz
	1	6 Hz	25 Hz	50 Hz	50 Hz	50 Hz
	2	6 Hz	25 Hz	50 Hz	50 Hz	50 Hz
	3	6 Hz	25 Hz	25 Hz	25 Hz	25 Hz
	4	6 Hz	25 Hz	25 Hz	25 Hz	25 Hz
	5	6 Hz	12 Hz	12 Hz	12 Hz	12 Hz
	6	6 Hz	12 Hz	12 Hz	12 Hz	12 Hz
	7	6 Hz	12 Hz	12 Hz	12 Hz	12 Hz
	8	6 Hz	6 Hz	6 Hz	6 Hz	6 Hz
	9	6 Hz	6 Hz	6 Hz	6 Hz	6 Hz

### Driver for the optional BCD Board:

The transmission speed depends on the digital filter setting and the baud rate value selected. See Table 5 below for additional information.

Table 5

BAUD RATE			
D I G I T A L  F I L T E R		2400	9600
	0	12 Hz	50 Hz
	1	12 Hz	50 Hz
	2	12 Hz	50 Hz
	3	12 Hz	25 Hz
	4	12 Hz	25 Hz
	5	12 Hz	12 Hz
	6	12 Hz	12 Hz
	7	12 Hz	12 Hz
	8	6 Hz	6 Hz
	9	6 Hz	6 Hz

## Sub-menu parameter selections (cont'd)

Table 6

"IN - OUT" MENU		
PARAMETERS	SELECTIONS	DESCRIPTION
MODE 1	GROSS NET PEAK H	Operating mode selection for output number 1.
	N.O N.C	Contact status below the setpoint value
	POS. NEG.	Comparison with positive or negative weight values
	NORMAL STABLE	Output enabled <i>only after</i> the weight reading has stabilized.
HYST - 1 (See notes below)	(Default = 2)	Hysteresis setting, used to eliminate chattering of the relay @ coincidence point.
TIMER 1	0.0 to 10.0 (0 = disabled)	The output is disabled after the time period has expired. (1/10 second increments )
DELAY 1	0.0 to 10.0 (0 = disabled)	Time delay before the output is enabled. (1/10 second increments)
Same parameter selections as above for output 2		
TEST IN	See page 17	Test procedure for inputs
TEST OUT		Test procedure for outputs

### NOTES:

1. The hysteresis setting *must be less* than it's respective setpoint value. Entering a hysteresis setting greater than the setpoint value will automatically be replaced with a default setting of (2) counts.
2. Hysteresis settings of within 10 counts of their respective setpoint values are possible, however, much smaller values are normally sufficient.
3. A large hysteresis setting (4,990 counts) could be used as follows:

Setpoint 1 is used to fill a vessel with 5,000 lbs. of product, and setpoint 2 will be used as a high weight alarm. When the weight in the vessel reaches 5,000 lbs., relay # 1 de-energizes stopping the flow, feed, etc. The product is drawn from the vessel as required, when the weight in the vessel reaches 10 lbs., setpoint # 1's relay re-energizes and automatically refills the vessel to 5,000 lbs.

## MODBUS RTU PROTOCOL SPECIFICATIONS

### 1. PRECAUTIONS

The Modbus protocol writes directly into the memory of the instrument.

Use caution when sending data to the instrument:

The data being sent must be within the specified ranges given in the tables on the following pages.

Some of the data is written into the E2prom's memory (refer to the column in the tables "Stored in E2prom") for additional information. This memory can only be written to 100,000 times, therefore, you should avoid writing continuously into this memory.

To confirm the storage of a new value in the E2prom, perform the MAKE - BACKUP function. If this function is not performed, all of the newly stored data will be lost when power is removed from the instrument.

The "Set point" setting does not require the MAKE - BACKUP function to be performed.

#### **The set point values are expressed as number of divisions**

This means that any set point value (temporary or permanent) has to be multiplied by the "Display division" data, in order to obtain the actual value of the set point.

E.G. Assuming that the "display division" value is 0.2; if the PLC asks for a set point value and get the data "3949" from the instrument, this means that the actual value of the set point is 789.8 (3949 x 0.2 = 789.8)

Even the other **weight values** are given as number of divisions, except for the "Net weight" and "Gross weight".

**"Net weight" and "Gross weight" (Modbus addresses 40006 and 40007) are given as absolute values**

#### Note:

The numeric values on the following pages for (addresses, codes, and data) are represented as decimal values.

The addresses given in the following tables refer to the standards provided in the Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev J.

### 2. DATA FORMAT

- Start Bit : 1
- Data Bits : 8, the Least Significant Bit (LSB) is sent first.
- Parity : No, Even, Odd
- Stop Bits : 1, 2

Possible Data Format Selection: **N-8-2 E-8-1 O-8-1**

### 3. LIST OF FUNCTIONS SUPPORTED

Function	Description
01 (01)	READ COIL STATUS
03 (03)	READ HOLDING REGISTERS
04 (04)	READ INPUT REGISTERS
05 (05)	FORCE SINGLE COIL
06 (06)	PRESET SINGLE REGISTER
15 (0F)	FORCE MULTIPLE COILS
16 (10)	PRESET MULTIPLE REGISTERS

Hexadecimal values between brackets

Each single function is explained in detail on pages 32, 33 and 34 of the operator's manual.

Each function is composed by a **Query** (request master → instrument) and a **Response** (answer instrument → master). Queries and responses are composed by a sequence of data that are briefly explained here below (\*\*\*), please note that the code "0x" before any value indicates that the value is represented as hexadecimal value.

Besides, **all the Modbus addresses** (the ones mentioned in the left end column on pages 36 and 37) have to be represented as hexadecimal values, but, only for these addresses, there is an **important rule to be taken into consideration:**

**Before converting the address into an hexadecimal value, the 1<sup>st</sup> digit on the left has not to be considered and the remaining 4 digits have to be decremented by "1".**

1<sup>st</sup> Example:

To represent the address 40150 ("display division" on page 36) as hexadecimal value, exclude the digit "4" (remains "0150"), then decrement by 1 the number "0150". The result is "0149", now perform the conversion into hexadecimal. The result is "00 95". This is the value to be used in the query.

2<sup>nd</sup> Example:

To represent the address 40102 ("load cells sensitivity" on page 36) as hexadecimal value, exclude the digit "4" (remains "0102"), then decrement by 1 the number "0102". The result is "0101", now perform the conversion into hexadecimal. The result is "00 65". This is the value to be used in the query.

(\*\*\*)

**Address:** is the number of the instrument's address, represented as hexadecimal value (in this case do not decrement by 1 the number).

**Function:** is the number of the function to be performed (see the table above)

**1<sup>st</sup> Output address:** is the address number where the reading of the outputs status has to start

**Number of outputs:** is the number of the outputs to be read

**1<sup>st</sup> Input address:** is the address number where the reading of the inputs has to start

**Number of inputs:** is the number of the inputs to be read

**Number of bytes:** represents the number of bytes which compose a data

**2 byte CRC:** "Cyclical Redundancy Check". It's an algorithm used as checksum.

**Total byte:** Total number of bytes transmitted. **This data is not included in the strings.**

4. INSTRUMENT RESPONSE TIME

The response time for most data requests is within 20 milliseconds.

Exceptions:

- E2prom Backup command (Maximum time = 350 milliseconds)
- Writing of the following registers: Load cell/s total capacity, load cell/s sensitivity, Net weight, Tare weight, and Filter (Maximum time = 550 milliseconds).

4.1 RESPONSE TIME WHEN CONNECTING SEVERAL SLAVES

Single twisted pair

Query Master to slave 01	Response time slave 01	Response slave 01	20 mSec delay	Query Master to slave 02
--------------------------	------------------------	-------------------	---------------	--------------------------

Double twisted pair

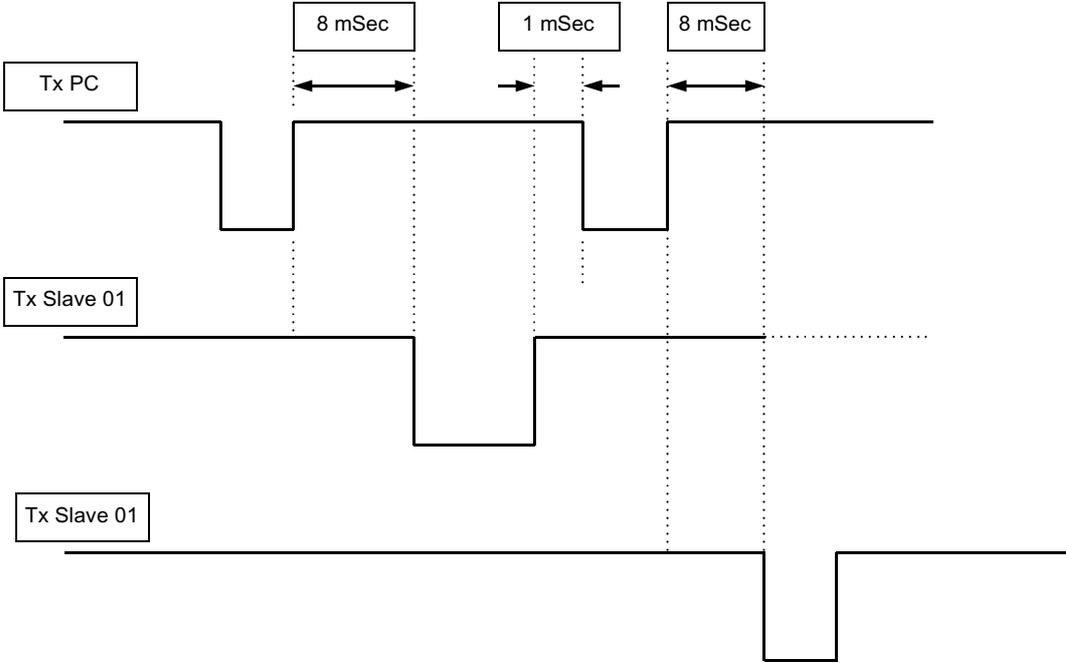
Query Master to slave 01	Response time slave 01	Response slave 01	delay	Query Master to slave 02
--------------------------	------------------------	-------------------	-------	--------------------------



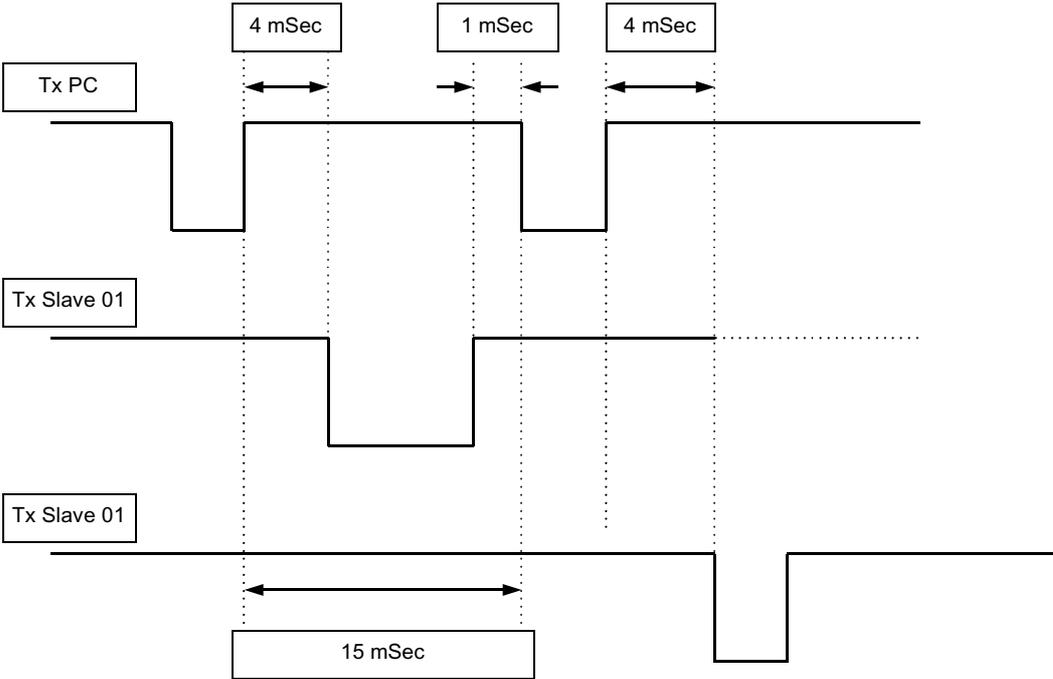
With a baud rate of 19200 Time = 15 to 20 milliseconds

Scheme of the communication time in a Master-Slave RS-485 system, using a double twisted pair.

RTU Baud 9600



RTU Baud 19200



## 5. LIST OF TRANSMISSION STRINGS

<b>Symbols used in the strings</b>
A = 1 byte for slave address (Example: Slave N° 17: <b>A = 0 x 11</b> )

### 5.1. FUNCTION 1: READ COIL STATUS

#### **QUERY**

Address	Function	1st. Output address	Number of outputs	2 byte	Total byte
A	0 x 01	0 x 0000	0 x 0008	CRC	8

#### **RESPONSE**

Address	Function	Number of bytes	Status of outputs	2 byte	Total byte
A	0 x 01	0 x 01	0 x 00	CRC	6

Status of outputs: In this byte each output is identified by 1 bit  
 The address of the 1st. output is the least significant bit (LSB) in this byte. (1 = On, 0 = Off).

### 5.2. FUNCTION 2: READ INPUT STATUS

**NOT USED**

### 5.3. FUNCTION 3: READ HOLDING REGISTERS

#### **QUERY**

Address	Function	1st. Register address	Number of register	2 byte	Total byte
A	0 x 03	0 x 0000	0 x 0002	CRC	8

#### **RESPONSE**

Address	Function	Number of bytes	1st. Register	2nd. Register	2 byte	Total byte
A	0 x 03	0 x 04	0 x 0064	0 x 00C8	CRC	3 + 2 x N° of registers + 2

### 5.4 FUNCTION 4: READ INPUT REGISTERS ("read only")

#### **QUERY**

Address	Function	1st. Register address	Number of register	2 byte	Total byte
A	0 x 04	0 x 0000	0 x 0001	CRC	8

#### **RESPONSE**

Address	Function	Number of bytes	1st. register	2 byte	Total byte
A	0 x 04	0 x 02	0 x 0064	CRC	3 + 2 x N° of registers + 2

### **5.5. FUNCTION 5: FORCE SINGLE COIL**

#### **QUERY**

Address	Function	Output address	Status of output	2 byte	Total byte
A	0 x 05	0 x 0000	0 x FF00	CRC	8

#### **RESPONSE**

Address	Function	Output address	Status of output	2 byte	Total byte
A	0 x 05	0 x 0000	0 x FF00	CRC	8

Status of output: (FF00 = On, 0000 = Off)  
The response includes the echo of the query

### **5.6. FUNCTION 6: PRESET SINGLE REGISTER**

#### **QUERY**

Address	Function	Register address	Register value	2 byte	Total byte
A	0 x 06	0 x 0000	0 x 1234	CRC	8

#### **RESPONSE**

Address	Function	Register address	Register value	2 byte	Total byte
A	0 x 06	0 x 0000	0 x 1234	CRC	8

The response includes the echo of the query

### **5.7 FUNCTION 7: READ EXCEPTION STATUS** **NOT USED**

### **5.8 FUNCTION 8: DIAGOSTIC** **NOT USED**

### **5.11 FUNCTION 11: FETCH COMM EVENT CTR** **NOT USED**

### **5.12 FUNCTION 12: FETCH COMM EVENT LOG** **NOT USED**

### **5.15 FUNCTION 15: FORCE MULTIPLE COILS**

#### **QUERY**

Address	Function	1st. Output address	N° of outputs	N° of bytes	Status of outputs	2 byte	Total byte
A	0 x 0F	0 x 0000	0 x 0002	0 x 01	0 x 00	CRC	10

#### **RESPONSE**

Address	Function	1st. Output address	N° of outputs	2 byte	Total byte
A	0 x 0F	0 x 0000	0 x 0002	CRC	8

Number of outputs: Number of the output to be written, starting from the address.  
Number of bytes: Number of bytes transmitted as status of outputs (8 outputs each byte)  
Status of outputs: 1 output each bit (1 = On, 0 = Off); the 1st. Output coincides with the least significant bit (LSB) of the 1st. Byte. Non-significant bits are set to zero.  
The response includes the identification of the modified outputs.

## 5.16 FUNCTION 16: PRESET MULTIPLE REGISTERS

### QUERY

Address	Function	1st. Register output	Number of register	Number of bytes	1st. Register value	2nd. Register value	2 byte	Total byte
A	0 x 10	0 x 0000	0 x 0002	0 x 04	0 x 0000	0 x 0000	CRC	7 + 2 x N° of registers + 2

### RESPONSE

Address	Function	1st. Register address	N° of registers	2 byte	Total byte
A	0 x 10	0 x 0000	0 x 0002	CRC	8

Number of registers: Number of the registers to be written, starting from the address.  
 Number of bytes: Number of bytes transmitted as registers value (2 bytes each register)  
 Registers value: Content of the registers, starting from the 1st.  
 The response includes the identification of the modified registers.

## 6 BROADCAST MODE

This function is not implemented in the instrument

### 7.1. COMMUNICATION ERRORS

The communication strings are controlled by the CRC (Cyclical Redundancy Check). If a communication error occurs, the slave unit doesn't answer. The master unit controls a timeout when waiting for the response from the slave. If the slave doesn't answer during this timeout, it means that a communication error has occurred.

### 7.2. ERRORS IN THE RECEIVED DATA

If the string is received correctly but is not executable, the slave answers the master with an EXCEPTION RESPONSE. The field "function" is transmitted having the most significant digit (MSD) set to 1.

#### EXCEPTION RESPONSE

Address	Function	Exception code	2 byte
A	Function + 80h	0 x 01	CRC

Description of the Exception codes.

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

## **6 BROADCAST MODE**

This function is not implemented in the instrument

### **7.1. COMMUNICATION ERRORS**

The communication strings are controlled by the CRC (Cyclical Redundancy Check). If a communication error occurs, the slave unit doesn't answer. The master unit controls a timeout when waiting for the response from the slave. If the slave doesn't answer during this timeout, it means that a communication error has occurred.

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#### ***EXCEPTION RESPONSE***

Address	Function	Exception code	2 byte
A	Function + 80h	0 x 01	CRC

Description of the Exception codes.

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

**List of the Holding Registers (4x)**

Modbus Address	Description		Range Value	Stored in E2prom
	<b>Set Points and Weight values</b>	<b>Relevant menu</b>		
40001	Set point 1 temporary		0 to full scale	NO
40002	Set point 2 temporary		0 to full scale	NO
40003	Command register		01-05, 10, 12-13, 20 (Hex)	See relative table (page 39)
40004	Set point 1 permanent	SET 1	0 to full scale	YES
40005	Set point 2 permanent	SET 2	0 to full scale	YES
40006 40007	Gross weight value (H) Gross weight value (L)		0 to full scale	
40008	Input status byte			See relative table (page 38)
40009 40010	Net weight value (H) Net weight value (L)		0 to full scale	
	<b>Peak Value</b>			
40020	Peak gross weight		0 to full scale	NO
	<b>Command data and status registers</b>			
40081	Command data register		11 (Hex)	See relative table (page 39)
40082	Status register		00, 03-05 (Hex)	See relative table (page 39)
40083	Status data register		06 (Hex)	See relative table (page 39)
	<b>Basic Configuration</b>			
40100 40101	Load cell/s total capacity (kg) H Load cell/s total capacity (kg) L	CAPAC	0-500000 (1)	YES
40102	Sensitivity of load cell/s	SENSIT	1.0000 - 4.0000 (5)	YES
40103 40104	Net weight of the weighing system (H) Net weight of the weighing system (L)	NET	0 to full scale (1)	YES
40105 40106	Dead load of the weighing system (H) Dead load of the weighing system (L)	DEAD L	0 to full scale (1)	YES
40110	Operating mode	OPMODE	0-2 (3)	YES
40150	Display divisions	DSPDIV	0 - 14 (2) See Table "A"	YES
	<b>Weighing Parameters</b>			
40180	Digital filter value	FILTER	0-9 (3)	YES
40181	Motion band value	MOTION	0-4 (3)	YES
40182	Auto zero value	AUTO 0	0.1-10.00 (3) (5)	YES
40183	Zero tracking value	0 TRAC	0-4 (3)	YES
	<b>Set Points Configuration</b>			
40200	Operating mode Set point 1	MODE 1		YES
40201	Hysteresis Set point 1	HYST 1	0 to full scale	YES
40202	Timer Set point 1	TIMER1	0.1-100.0 (5)	YES
40203	Delay Set point 1	DELAY1	0.1-100.0 (5)	YES
40204	Operating mode Set point 2	MODE 2		YES
40205	Hysteresis Set point 2	HYST 2	0 to full scale	YES
40206	Timer Set point 2	TIMER2	0.1-100.0 (5)	YES
40207	Delay Set point 2	DELAY2	0.1-100.0 (5)	YES

Holding Register Table continued on the following page.

**List of the Holding Registers (4x) cont'd**

	<b>Serial Configuration</b>	<b>Relevant menu</b>		
40300	Baud rate	BAUD R	0-4 (3)	YES
40301	Serial address	ADDRES	1-32	YES
40302	Response delay	DELAY	0-100	YES
	<b>Analog Output</b>			
40400	Analog output full scale	F-SCAL	0 to full scale	YES
40401	Analog output operating mode	MODE	0-3 (3)	YES
40402	Analog output range	RANGE	0-3 (3)	YES
40403	Zero offset	OFFSET		(4)
40404	Full scale offset	OFFSET		(4)
40405	An-Zero (negative weight value for zero analog output)	ANZERO		YES

- (1) The combined theoretical net and tare weight values must not exceed the total capacity value.
- (2) Refer to the 15 values from 0.001 to 50
- (3) For the list of values please refer to the user manual.
- (4) They are stored in the E2prom if writing the function 0000 in the status register.
- (5) When setting these values the decimal point has not to be included.

**Serial parameter specifications:**

- Once the "serial address" and "response delay" have been modified, they take effect immediately.
- The serial port mode can't be modified via Modbus.
- When setting a new baud rate value, the power to the instrument must be removed and re-applied in order for the changes to take effect.

**TABLE "A"  
IDENTIFICATION CODES**

Code	Display divisions
0 (00)	0.001
1 (01)	0.002
2 (02)	0.005
3 (03)	0.01
4 (04)	0.02
5 (05)	0.05
6 (06)	0.1
7 (07)	0.2
8 (08)	0.5
9 (09)	1
10 (0A)	2
11 (0B)	5
12 (0C)	10
13 (0D)	20
14 (0E)	50

Hexadecimal values between brackets

**Table of the Input Status bytes**

Description	Bit's meaning	
	0	1
Net weight polarity	+	-
Gross weight polarity	+	-
Stable weight	no	yes
Millivolt polarity	+	-
Underload condition	no	yes
Overload condition	no	yes
Off range condition	no	yes
Preset tare condition	no	yes
Input 1 status	De-activated	Activated
Input 2 status	De-activated	Activated
Relay output 1 status	De-activated	Activated
Relay output 2 status	De-activated	Activated
Scale unloaded (*)	no	yes
Keyboard status	Unlocked	Locked

1  
0  
1  
0  
0  
0  
0  
1  
0  
0  
1  
0  
0  
1

The Modbus address 40008 is composed by 2 bytes. The conversion of these 2 bytes from hex into binary gives the meaning of each single bit described in this table.

E.g.  
if the bytes in the address 40008 are **24 85**, the conversion into binary gives the sequence of bits **100100 10000101**.

The digit at the right hand side matches with the 1st bit (Net weight polarity), therefore the values given in the above mentioned example are equivalent to:

- Net weight polarity = 1 = negative
- Gross weight polarity = 0 = positive
- Weight stability = 1 = yes
- Millivolt polarity = 0 = positive
- Underload condition = 0 = no
- Overload condition = 0 = no
- Off range condition = 0 = no
- Preset tare condition = 1 = yes
- Input 1 status = 0 = de-activated
- Input 2 status = 0 = de-activated
- Relay output 1 status = 1 = activated
- Relay output 2 status = 0 = de-activated
- Scale unloaded = 0 = no
- Keyboard status = 1 = locked

(\*) The scale is considered unloaded (empty) when the weight value is within the "0 Band" range (see "Table 2", page 26)

**List of the Input Registers (3x)**

Modbus Address	Description
30003	A/D converter internal counts H
30004	A/D converter internal counts L
30005	Millivolt value
30006	Instrument software release
30007	Instrument "On-line" (*)

Modbus address 30007 = 00 01: the weight value is shown on the display. The instrument is "On-line"  
 Modbus address 30007 = 00 00: one of the error conditions (underload, overload, offrange) occurs, or any programming procedure is underway. The instrument is "Off-line".

**List of the coils (0x)**

Modbus Address	Description	Bit's meaning		Range value	Stored in E2prom
		0	1		
00001	Logic output 1	De-activated	Activated	1 bit	NO
00002	Logic output 2	De-activated	Activated	1 bit	NO

**List of the functions “Command register”**

Function Codes	Description	Function Command Data Register	Stored in E2prom
0001 (01 Hex)	Semi-automatic zero	-	NO
0002 (02 Hex)	Auto tare	-	NO
0003 (03 Hex)	Peak reset	-	NO
0004 (04 Hex)	Force net weight visualization	-	NO
0005 (05 Hex)	Force gross weight visualization	-	NO
0016 (10 Hex)	Zero calibration	-	YES
0017 (11 Hex)	Full scale calibration	Sample weight	YES
0018 (12 Hex)	Reset zero calibration	-	YES
0019 (13 Hex)	Reset full scale calibration	-	YES
0032 (20 Hex)	Back-up E2prom	-	YES

**List of the functions “Status register”**

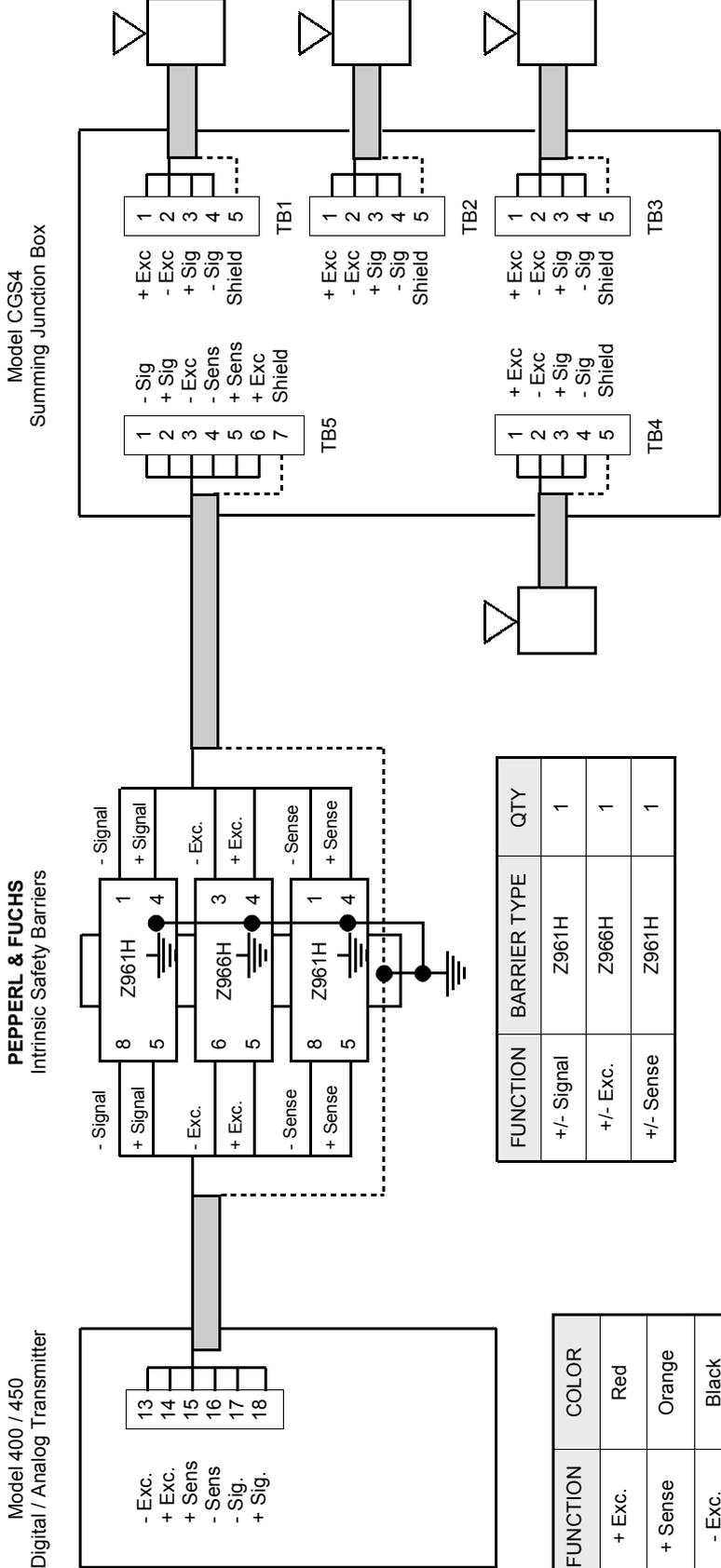
Function Codes	Description	Function Status Data Register	Stored in E2prom
0000 (00 Hex)	None of the functions are activated	-	NO
0003 (03 Hex)	Analog output zero offset adjustment	-	YES
0004 (04 Hex)	Analog output full scale offset adjustment	-	YES
0005 (05 Hex)	Test input / output	-	NO
0006 (06 Hex)	Test analog output	Analog output (0-64000)	NO

For additional information regarding the Modbus protocol, please refer to the Modbus Protocol Manual PI-MBUS-300 Rev J.

# Intrinsic Safety Barriers

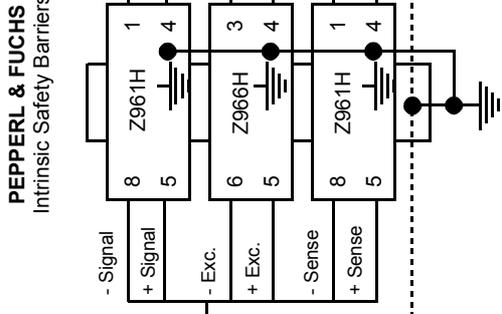
HAZARDOUS AREA

SAFE AREA



Model 400 / 450  
Digital / Analog Transmitter

13	- Exc.
14	+ Exc.
15	+ Sens
16	- Sens
17	- Sig.
18	+ Sig.



FUNCTION	BARRIER TYPE	QTY
+/- Signal	Z961H	1
+/- Exc.	Z966H	1
+/- Sense	Z961H	1

FUNCTION	COLOR
+ Exc.	Red
+ Sense	Orange
- Exc.	Black
- Sense	Yellow
+ Signal	Green
- Signal	White
Shield	Bare

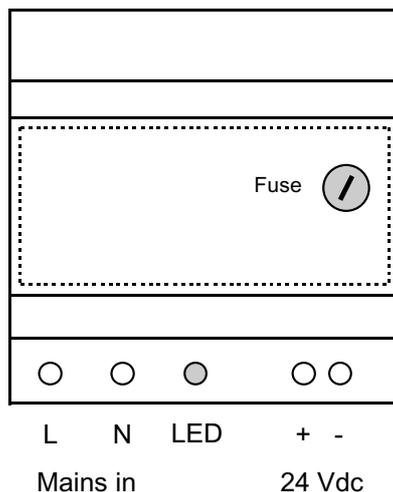
## Options

*Precise™*  
**24 Volt Power Supply**

### Installation

- Make sure the installation complies with local regulations and electrical codes.
- Connect AC voltage to the terminals marked “L” and “N”.
- The DC voltage is available on the terminals marked “+” and “-”. The second set of terminals are used when powering two transmitters from a single power supply (See notes).
- A red LED is illuminated when the power supply is “ON”.

**Notes:** The power supply should be used to power two transmitters *only when* a single load cell is connected to each transmitter. For multiple load cell applications it is recommended that an individual power supply be used for each transmitter. This enables the power supply to compensate for any fluctuations in the incoming line voltage. Recent field experiences have shown that voltage drops of greater than 10% can cause the transmitters to drift and become unstable.



### Fuse Replacement

The following procedures require work inside the power supply enclosure and should be performed by qualified service personnel.

- Before opening the unit, disconnect the AC voltage.
- Remove the front cover from the power supply.
- Press down gently on the cover of the fuse holder, and turn counter-clockwise.
- Pull out the cover and fuse as an assembly, replace fuse with a new one.
- Re-install fuse and cover as an assembly, press down gently and turn clockwise.
- Replace the front cover on the power supply.
- Re-apply AC voltage to the unit.

In the event of a malfunction, please contact the nearest distributor for assistance.  
Any attempt to modify or repair the power supply will void the manufacturers warranty.

# EC DECLARATION OF CONFORMITY



**We: Pavone Sistemi S.r.l.**  
**Via dei Chiosi, 18**  
**20040 CAVENAGO BRIANZA (MI)**

Hereby declares that the product: **DAT 400**  
Complies with the essential requirements of the directives 73/23/CEE, 89/336/CEE, 93/68/CEE,  
when used for its intended purpose

The product is made in accordance with the following standards

## **ELECTROMAGNETIC COMPATIBILITY:**

**EN 61000-3-2**  
**EN 61000-3-3**  
**EN 61000-6-2**  
**EN 61000-6-3**  
**EN 61326-1**

## **ELECTRICAL SAFETY:**

**EN 61010-1**

**The CE mark has been applied on the product**

Cavenago Brianza, April 15, 2004

A handwritten signature in black ink, appearing to be 'Pavone', is written over a solid horizontal line.

The Manager