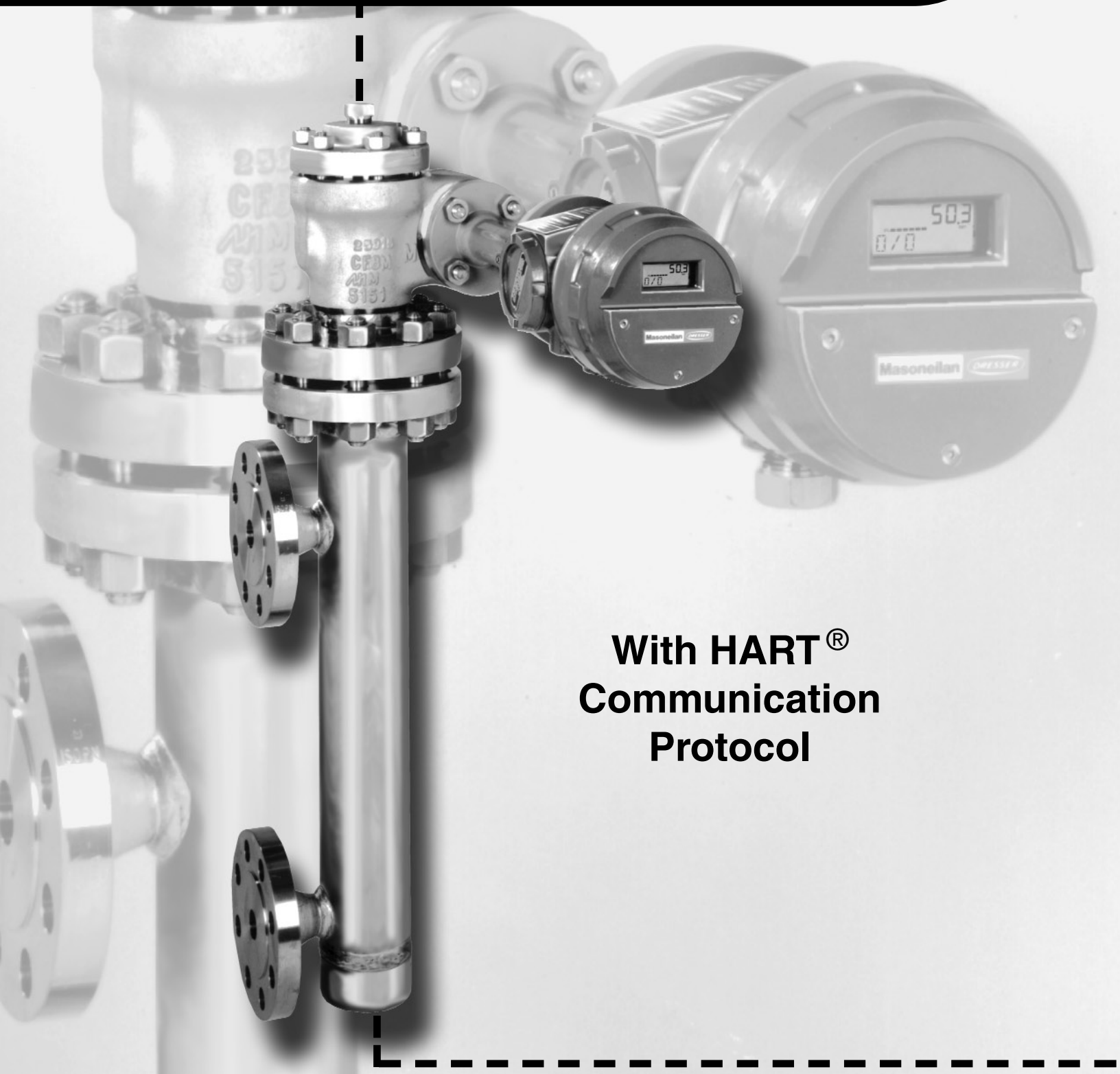
Model 12300 Digital Level Transmitter / Controller

Instruction No

EU 3000

03/00



With HART® Communication Protocol

a Halliburton company

DRESSER VALVE DIVISION

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Use of **DANGER, WARNING, CAUTION,** and **NOTE**.

These instructions contain **DANGER, WARNING, CAUTION,** and **NOTE** where necessary to alert you to safety related or other important information.

DANGER - Hazards which result in severe personal injury or death.
WARNING - Hazards which could result in personal injury.
CAUTION - Hazards which could result in equipment or property damage.
NOTE - Alerts you to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and the **CAUTION** hazards involve equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance which may lead to personal injury or death. Therefore, comply fully with all **DANGER, WARNING,** and **CAUTION** notices.

IMPORTANT: SAFETY WARNING

Please read these instructions carefully BEFORE this instrument is installed or maintained.
Products certified for use in explosionproof (flameproof) or intrinsically safe installations MUST

a) Be installed in accordance with local and national codes for hazardous area installations.

b) Only be used in situations which comply with the certification conditions stated in this handbook.

c) Only be maintained by qualified personnel with adequate training on hazardous area instrumentation.

Non-compliance with the rules and cautionary notes of this instruction may cause malfunction of the device or serious damage to it. In addition, such negligence may expose area personnel to severe hazards. Not intended for use in life support systems.

Items sold by Masoneilan Dresser are warranted to be free from defects in materials and workmanship for a period of one year from the date of manufacture, provided said items are used according to Masoneilan Dresser's recommended usages.

Masoneilan Dresser reserves the right to discontinue manufacture of any product or change product materials, design, or specifications without notice.

General

This manual provides installation, operation and maintenance instructions for the Masoneilan Model 12300 Digital Level Transmitter with HART® Communication protocol. It also includes a complete parts reference and a list of recommended spare parts.

Spare Parts

When performing maintenance, use Masoneilan spare parts only. Parts can be obtained through your local Masoneilan Representative or the Spare Parts Department. When ordering parts, always include the Model and Serial Number of the unit being repaired.

After Sales Department

Masoneilan has a highly skilled After Sales Department available for start-up, maintenance, and repair of our valves and instruments. Contact the nearest Masoneilan Sales Office or Representative or After Sales Department.

Training

A regularly scheduled training school is conducted at the Masoneilan plant for training customer service and instrumentation personnel in the operation, maintenance, and application of control valves and instruments. Arrangements for these services can be made through your local Masoneilan Representative or the Training Department of Masoneilan.

1. description-operation

The 12300 type Digital Level Transmitter is a high performance, easy-to-set instrument based on a modular design that permits quick, low-cost upgrades as new features are developed and as your needs change.

1.1 Principle of Operation

The Masoneilan 12300 series instrument is a 2-wire, loop powered, digital displacement level transmitter with HART® Communication that uses field proven buoyancy and torque tube principles.

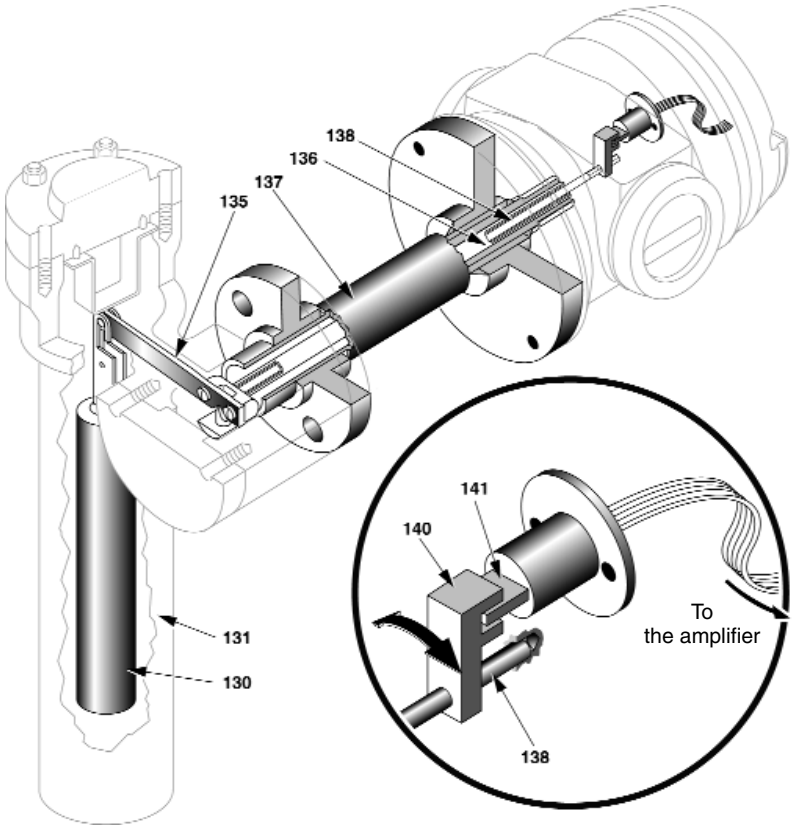
A change in liquid level varies the apparent weight of the displacer (130), which increases or decreases load on the torque tube (136) by an amount directly proportional to the change in liquid level.

The resulting rotation of the torque rod (138) modifies the magnetic field of a frictionless, non-contacting, Hall effect sensor (141). The signal generated by the sensor varies current in the loop in proportion to the level in the vessel.

1.2 Signal Processing

The analog signal is converted into an error-free digital signal that can be processed by the on-board micro-controller. After the signal has been processed, the digital result is converted to a 4-20 mA analog output signal *. The instrument is powered through the 2-wire series loop.

The instrument can be retrofitted to old style electronic or pneumatic heads to upgrade an instrument already in service.



* HART® digital signal is superimposed to the 4-20 mA analog signal.

PARTS REFERENCES

130	Displacer
131	Displacer chamber
135	Torque arm
136	Torque tube
137	Torque tube housing
138	Torque rod
140	Magnets
141	Hall effect sensor

Figure 1 — Diagram of Principle

2. protection standards

Installation in a hazardous atmosphere must be performed in accordance with the requirements specified in the applicable standard for protection against explosion.

WARNING : Improper replacement or substitution of electronic components or of certain parts whose characteristics do not meet requirements of the applicable standards for explosion protection may void this protection.

a) Transmitters Designed to be Installed in an Intrinsically Safe Circuit, according to European Standards EN 50014 and EN 50020 (CENELEC):

EEx ia IIC T6 (– 40 °C Ambient temperature 50 °C)
EEx ia IIC T5 (– 40 °C Ambient temperature 60 °C)
EEx ia IIC T4 (– 40 °C Ambient temperature 80 °C)

The main feature of this protection system is that no spark nor any thermal effect produced under the tests conditions required by the standard is capable of causing ignition of a given explosive atmosphere.

The complete circuit is defined in the approval document issued by a recognized certification agency :

Conformity Certificate : Sira No Ex 98E2107.

b) Transmitters with Flameproof Housing, according to European Standards EN 50014 and EN 50018 (CENELEC) :

EEx d IIC T6 (– 40 °C Ambient temperature 75°C)

EEx d IIC T5 (– 40 °C Ambient temperature 80°C)

WARNING : When servicing the instrument in the field, DO NOT REMOVE THE COVER OR THE CONNECTION COMPARTMENT WHILE THE INSTRUMENT IS ENERGIZED. FOLLOW THE SAFETY INSTRUCTIONS LISTED ON THE FRONT PLATE (80).

Following a failure, a spark caused by an internal part of the transmitter may ignite the explosive mixture enclosed in the case. The case, however, can resist the pressure developed by the internal explosion and prevent it from spreading to the outside explosive atmosphere.

Conformity Certificate : INERIS No 98.D 5018 X.

c) Factory Mutual * approved as :

Explosionproof Class I, Division 1, Groups B, C, D.
Dust-ignitionproof Class II, III, Division 1, Groups E, F, G.
T6 @ 80° C. Intrinsically Safe per Entity Requirements
Class I, II, III, Division 1, Groups A, B, C, D, E, F, G.
Nonincendive Class I, Division 2, Groups A, B, C, D.
Suitable for Class II, III, Division 2, Groups F, G.
T4 @ 80° C.

d) CSA * approved as :

Explosionproof Class I, Division 1, Groups C, D.
Dust-ignitionproof Class II, III, Division 1, Groups E, F, G.
T6 @ 80° C. Intrinsically Safe per Entity Requirements
Class I, Div. 1, Groups A, B, C, D ; Class II, Div. 1, Groups E, F, G.
Class III, Div. 1, Suitable for Class I, Div. 2, Groups A, B, C, D ;
Class II, Div. 2, Groups E, F, G ; Class III, Division 2.
T4 @ 80° C.

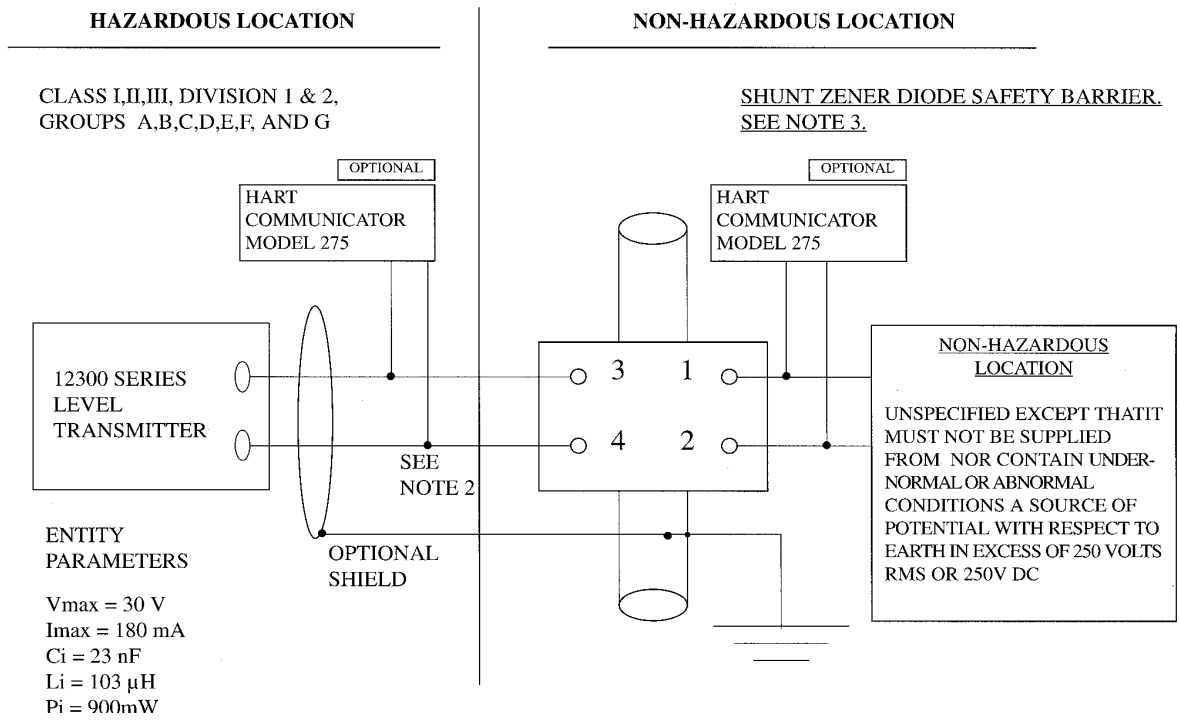
Class II /III, Division 1, Groups E, F and G.

e) Enclosure

The case and the connection /mechanism compartment of the 12300 Transmitter feature :

- Protection against strong water jets, sea waves, and immersion corresponding to classification IP 66 and IP 67 according to International Standard CEI 529.
- Protection against climatic attacks and environmental extremes as specified in American Standard NEMA 4X, 6P. CSA enclosure type 4X, 6P.

MODEL 12300 SERIES LIQUID LEVEL TRANSMITTERS FACTORY MUTUAL & CSA APPROVED INTRINSICALLY SAFE INSTALLATION CONTROL DRAWING



MODEL 12300 SERIES LIQUID LEVEL TRANSMITTERS FACTORY MUTUAL & CSA APPROVED INTRINSICALLY SAFE INSTALLATION CONTROL DRAWING

NOTES:

1. THE ELECTRICAL CIRCUIT IN THE HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS R.M.S. TO EARTH OR FRAME OF THE APPARATUS FOR 1 MINUTE.

2. CABLE CAPACITANCE AND INDUCTANCE PLUS THE I.S. APPARATUS UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) PLUS ANY HART COMMUNICATIONS DEVICE CAPACITANCE (Ci) AND INDUCTANCE (Li) MUST NOT EXCEED THE ALLOWED CAPACITANCE (Ca) AND INDUCTANCE (La) INDICATED ON THE ASSOCIATED APPARATUS.

3. ANY POSITIVE POLARITY SHUNT ZENER DIODE SAFETY BARRIER APPROVED BY FMRC AND CERTIFIED BY CSA FOR GROUPS A, B, C, D, E, F, AND G WHOSE OUTPUT PARAMETERS ARE:

Voc or Vt ≤ 30 V, but not less than 19 V.
Isc or It ≤ 180 mA
Ca ≥ Ci + C cable + C com. device
La ≥ Li + L cable + L com. device
Po ≤ 900 Mw (applies to FM only)

4. THE INSTALLATION INCLUDING THE BARRIER EARTHING REQUIREMENTS MUST COMPLY WITH THE INSTALLATION REQUIREMENTS OF THE COUNTRY OF USE, I.E., ANSI/ISA RP12.6 (INSTALLATION OF INSTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS) AND THE NATIONAL ELECTRICAL CODE, ANSI/NFPA 70 OR CANADIAN ELECTRICAL CODE PART 1. INSTALLATION MUST BE IN ACCORDANCE WITH MANUFACTURERS GUIDELINES. DIVISION 2 INSTALLATIONS MUST BE INSTALLED PER THE NATIONAL ELECTRICAL CODE, ANSI/NFPA 70 OR CANADIAN ELECTRICAL CODE DIVISION 2 WIRING METHODS.

5. TEMP. CODE T4 AT 80°C. MAXIMUM AMBIENT TEMPERATURE.

6. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II, AND III ENVIRONMENTS.

7. THE HART COMMUNICATION DEVICE MUST BE CERTIFIED INTRINSICALLY SAFE BY FMRC. HART COMMUNICATOR MODEL 275 MANUFACTURED BY FISHER-ROSEMOUNT OR EQUIVALENT WITH THE FOLLOWING ENTITY PARAMETERS : Voc=1.7Vdc, Isc =32mA, Vmax=30Vdc, Imax=300mA, Ci=0.07µF, Li=0 T4.
The model 275 Hand Held Communicator is not CSA approved with entity parameteres and must not be connected on the hazardous side of the barrier in a Canadian IS installation.

8. THE HART COMMUNICATION DEVICE MUST ONLY BE CONNECTED IN PARALLEL, IT MUST NOT BE CONNECTED IN SERIES.
Isc + Isc (HART COMMUNICATION DEVICE) MUST NOT EXCEED 180mA.

3. installation

3.1 STORAGE AND CONDITION AT DELIVERY

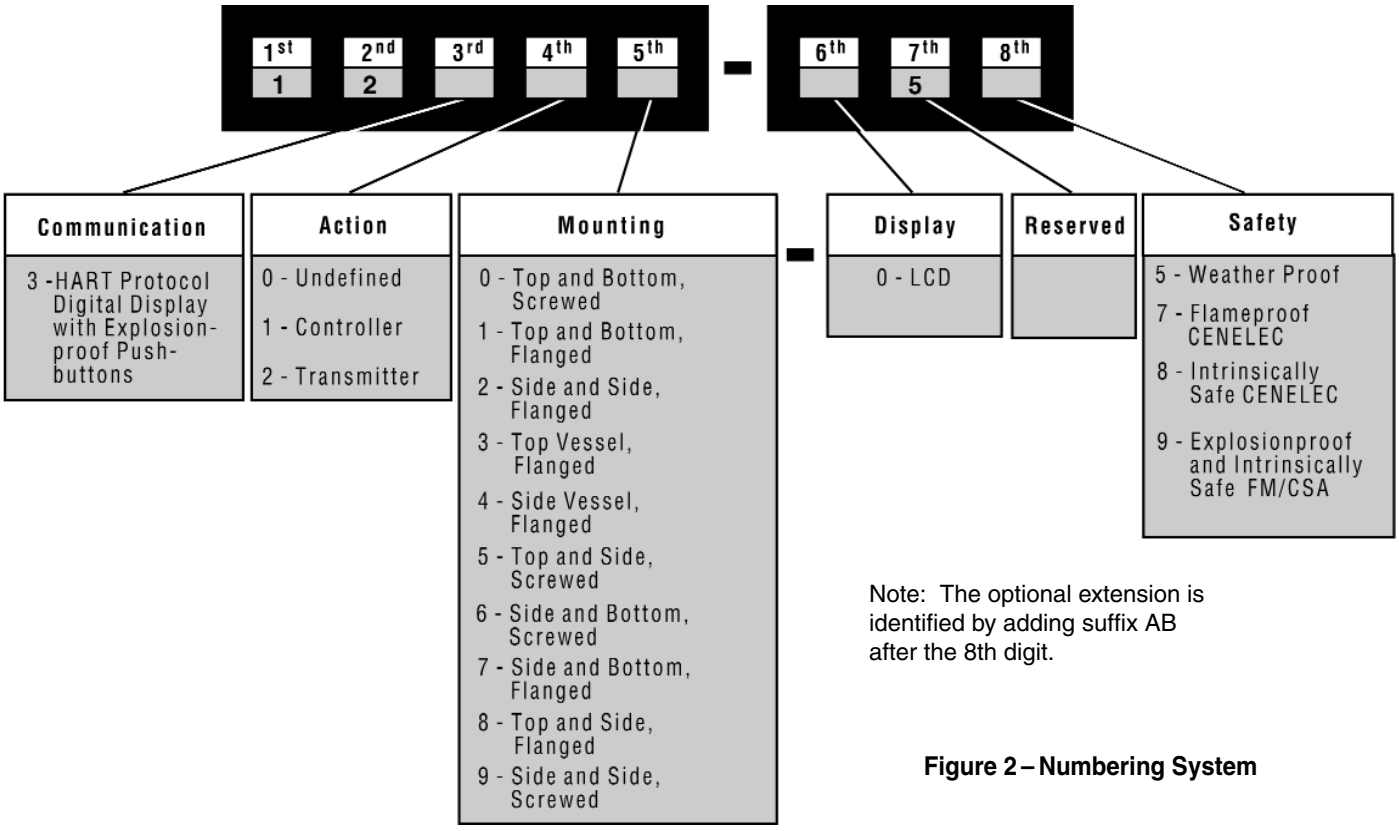
Level instrument have been carefully packed in our premises to prevent them from damage during handling and transportation.

Units must be stored in an area where temperature is between –45° C (–49° F) and +93° C (+200 F).

Units are factory dry calibrated (simulation by weight) to the service specific gravity specified by the customer. When service specific gravity has not been specified, units are factory dry calibrated to a specific gravity of 1.

It is recommended to recalibrate the unit when actual specific gravity differs from calibration specific gravity.

Recalibration is needed when verification of instrument performance is made with liquid in the displacer chamber.



Note: The optional extension is identified by adding suffix AB after the 8th digit.

Figure 2 – Numbering System

3.2 MOUNTING ON SITE

Unpack the unit carefully and record the serial number for future reference. Remove the shipping stud that secures the displacer in the chamber.

Whenever possible, locate the transmitter at some easily accessible, well-lighted place on the vessel. The location should be such that the ambient temperature at the transmitter case is within the range of – 40 °C to +80 °C.

Note : Do not remove instrument cover until the unit has been installed and is ready for calibration.

The codes shown on Figure 2 indicate the instrument designation as a function of various installation modes, displacer chamber connections, and environmental standard or protection of the case against explosion. Figures 3 and 6 show the various ways of installing the displacer chamber.

3.2.1 EXTERNAL MOUNTING (Chamber Type Model, Figures 3 and 6)

Install the transmitter in a vertical position on the side of the tank or vessel, so that the mid-range mark on the chamber is at normal level. The mid-range is marked on the chamber.

The equalizing lines between chamber and vessel should be the same size as the chamber connections. Install a block valve in each line. The use of a drain connection is recommended as shown in Figure 3.

3.2.2 INTERNAL MOUNTING

An internal mounting transmitter has no displacer chamber and the mechanism chamber flange bolts directly to the vessel nozzle flange.

a) Type 12303 Top Flange Mounted Transmitter (Figure 4)

There are two mounting possibilities :

1. *If the overhead space* necessary for mounting the instrument *is sufficient,* attach the displacer to the torque tube before bolting the chamber flange to the nozzle flange on the vessel.
2. *If the overhead space is insufficient,* install a detachable hanger extension. Before attaching the extension, however, lower the displacer partway into the tank.
   - After the extension has been fastened and pinned to the displacer, the displacer may be hooked to the torque arm and the entire unit lowered into position. When the extension consists of several detachable elements, this operation should be repeated for each element and the displacer lowered progressively into the tank.
   - Mount the instrument and bolt the mechanism chamber onto the nozzle flange.

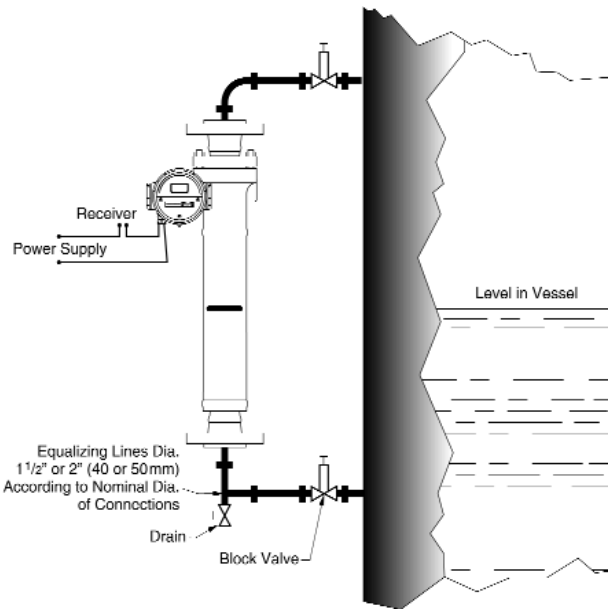


Figure 3 — Typical Installation

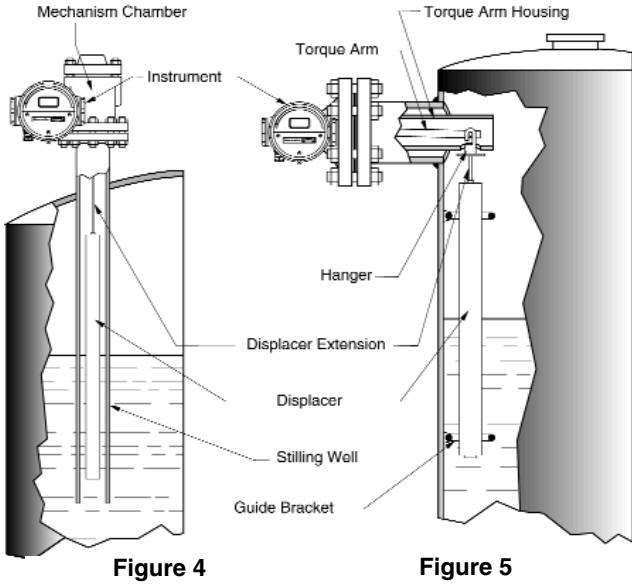


Figure 4
Type 12303

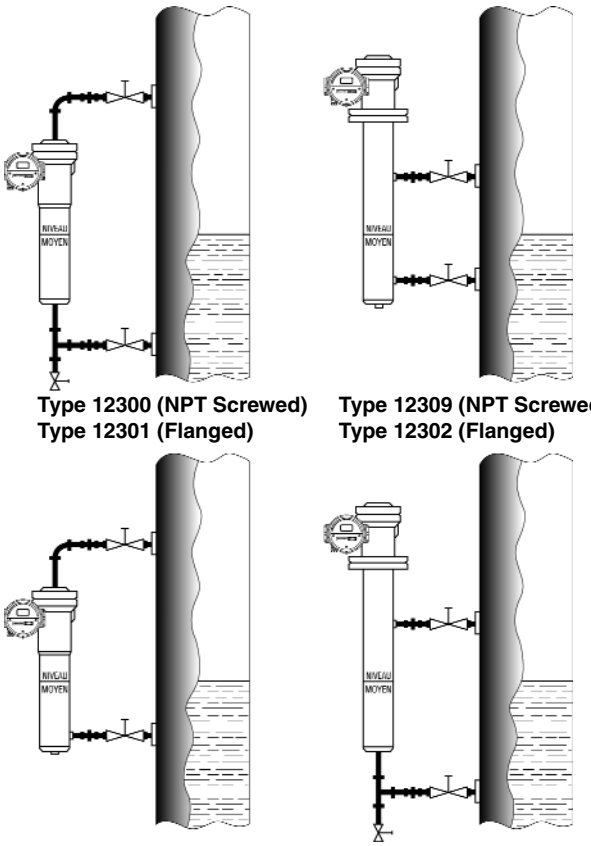
Figure 5
Type 12304

b) Type 12304 Side Flange Mounted Transmitter (Figure 5)

When the instrument is side flange mounted, enough clearance must be provided to permit attaching the displacer after the chamber flange is bolted in place. To attach the displacer, reach into the end of the protective case and depress the torque arm. Then bring the displacer hanger up through the hole in the bottom of the case and slip the displacer hanger over the torque arm pin. Lower the displacer until the pin engages the top of the slot in the hanger.

Guide Brackets for Type 12304 (Figure 5)

If the liquid is in motion, provide brackets as shown in Figure 5 to guide the lower end of the displacer. The diameter of the hole should be 25 to 35 mm (1" to 1 1/2") larger than the diameter of the displacer for ranges to 1.8 m (6 feet), and 50 to 70 mm (2" to 3") larger for greater ranges. The brackets should be placed at 50 to 70 mm (2" to 3") from each end of the displacer. Locate the centerline of the hole so that the displacer hangs freely.



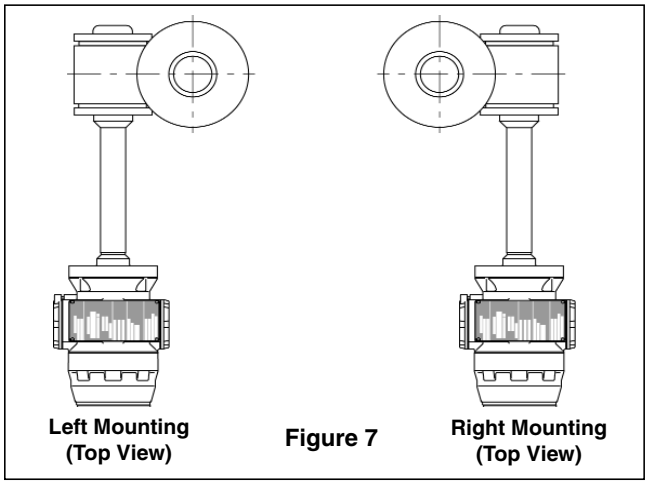
Type 12300 (NPT Screwed)
Type 12301 (Flanged)

Type 12309 (NPT Screwed)
Type 12302 (Flanged)

Type 12305 (NPT Screwed)
Type 12308 (Flanged)

Type 12306 (NPT Screwed)
Type 12307 (Flanged)

Figure 6



Left Mounting
(Top View)

Figure 7

Right Mounting
(Top View)

Stilling Well for Type 12303 (Figure 4)

If the liquid is turbulent, provide a stilling well as shown in Figure 4.

The well should be made from tubing or pipe of a suitable diameter to allow sufficient clearance between displacer and pipe. It should be mounted so that it extends at least 75 mm (3") below a free hanging displacer.

A hole at the top of the stilling well should be provided to equalize pressure between well and vessel.

Instrument Case Mounting (Figure 7)

The standard case mounting is left hand — with the case to the left of the displacer. Right hand mounting is optional. To reverse instrument case mounting, refer to Section 6 — Maintenance.

4. case description

The purpose of this section is to describe the various sub-assemblies of the instrument in order to facilitate their use and maintenance. (See Figures 19 to 21).

4.1 ELECTRONIC COMPARTMENT

The electronics compartment, located at the front of the transmitter, can be accessed by removing the main cover (20). This cover contains a window (22) and three push buttons (27).

The cover (20) is fully screwed on the case (2), making contact with O-ring (109). It may be necessary to unscrew the cover by less than a turn to align the window and LCD display and to install the safety screw (110).

The front plate (80), which is attached by three screws (125), protects the push buttons and provides a gasket seal (24).

The sensor (40) and its gasket (111) are attached by two screws (112), located in the upper part of the electronics compartment. The sensor is positioned so that the blue mark is oriented toward the lower part of the case (see Figure 10). Another blue mark on the case is a visual aid to the operator during reassembly.

The microprocessor, the display and the three push buttons are mounted on the potted electronic board which makes the amplifier. This subassembly is inserted into the case with the display facing the top of the case. It is assembled by four screws (207).

For wiring, refer to Section 4.4.

4.2 MECHANISM COMPARTMENT

The mechanism compartment (Figures 20 & 21) on the back of the case has an opening on the right side (operator facing instrument) which is closed by a threaded cover (107) and a gasket (108). A second opening at the bottom, closed by a special 3/4" NPT plug (190), allows access to the mechanical flexure (59), which is part of the beam.

The mechanism (50) [including parts (51 to 62)] is completely factory assembled and calibrated before being installed in the mechanism compartment. The pivot (51) is positioned toward the back of the case through two pins (52-53) and fastened by two screws (113). The beam (54) must be free to rotate without friction (up to 7 degrees max.).

Two set screws (114) are located in tapped holes in the side of the case. Holes are covered by two plugs (115). These set screws have no effect when mounting or dismounting the mechanism subassembly.

4.3 CONNECTION COMPARTMENT

The connection compartment is equipped with terminal board (90). The flat handle terminal block, the test switch/pins, the HART® connection pins and the terminal board connector are mounted on the terminal board. The terminal board is mounted with 2 screws (92).

The case is also equipped with radio frequency filter connections between the terminal board connector and the main electronic circuit.

To mount the safety screw (106), the cover must be fully screwed on the case and then unscrewed by less than a turn.

DANGER : Do not remove either compartment cover in an explosionproof area when the instrument is powered. In an intrinsically safe installation, follow code practice when servicing the instrument in the field.

4.4 ELECTRIC CIRCUIT

4.4.1 WIRING AND CONNECTIONS

FLAT HANDLE TERMINAL BLOCK (90A)

It is located on the top side of the terminal board in the connection compartment. Connect the power supply leads to the terminal block. Respect polarity. Refer to Figures 19 and 20.

TERMINAL BOARD CONNECTOR (90B)

It is located on the bottom side of the terminal board in the connection compartment. Ensure terminal board connection with radio frequency filters. Respect polarity. Refer to Figure 20.

NOTE : This connection is made at the factory and must not give rise to intervening from the customer, except if the terminal board must be replaced.

SUPPLY TO MAIN BOARD (AMPLIFIER) (7)

Facing the instrument it is located on the left bottom side of the main board in the electronics compartment. It connects the main board to the radio frequency filters. Refer to Figures 19 and 21.

NOTE : This connection is made at the factory and must not give rise to intervening from the customer, except if the amplifier must be replaced. Observe the connecting position by means of the locking lugs, (below).

SENSOR CONNECTOR (40)

Facing the instrument it is located on the top bottom side of the main board in the electronics compartment. It connects the sensor to the main board. Refer to Figures 19 and 21.

NOTE : This connection is made at the factory and must not give rise to intervening from the customer, except if the amplifier and/or sensor must be replaced. Observe the connecting position by means of the locking lugs, (above).

4.4.2 SUPPLY - OUTPUT SIGNAL

The standard transmitter provides a 4-20 mA output signal to remotely located receivers such as recorders, indicators or controllers.

The supply voltage is :

- For flameproof version, 9,5 to 50 volts max.
- For intrinsic safety, 9,5 to 30 volts max.

4.4.3 LOAD RESISTANCE

DANGER : All wiring shall be made in accordance with all local and national codes appropriate to the area in which the instrument is installed.

The maximum load resistance in terms of the supply voltage may be determined from the curves of Figure 9. The "R" values in brackets correspond to take account of an high alarm to 22 mA.

If more accuracy is required, the maximum load resistance (R) may be calculated as follows :

For a supply voltage **V** (**V** min. = 9,5 Volts) :

$$\mathbf{R}\ (\text{Ohms}) = \frac{\mathbf{V}\ (\text{Volts}) - \mathbf{9,5}}{\mathbf{I}\ \text{max. (Ampere)}}$$

In which :

I = Max loop current (information current of the liquid level : 3,8 to 20,5 mA ; alarm current : 3,6 to 23 mA).

4.4.4 ELECTRIC CONNECTION

Both the terminal strip and the ground terminal are located in an external junction box. A conduit connection (1/2" NPT or M 20) is provided in the lower part of the junction box for connecting the supply leads via a supplied stuffing box with an integrated cable clamp device or any cable gland with cable clamp device suitable for the considered hazardous area.

Connect the receiver (load) in series with either one of the power supply leads as shown in Figure 8.

Observe the polarities engraved on the terminal strip.

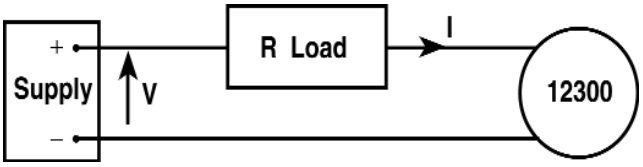


Figure 8 — Wiring Diagram

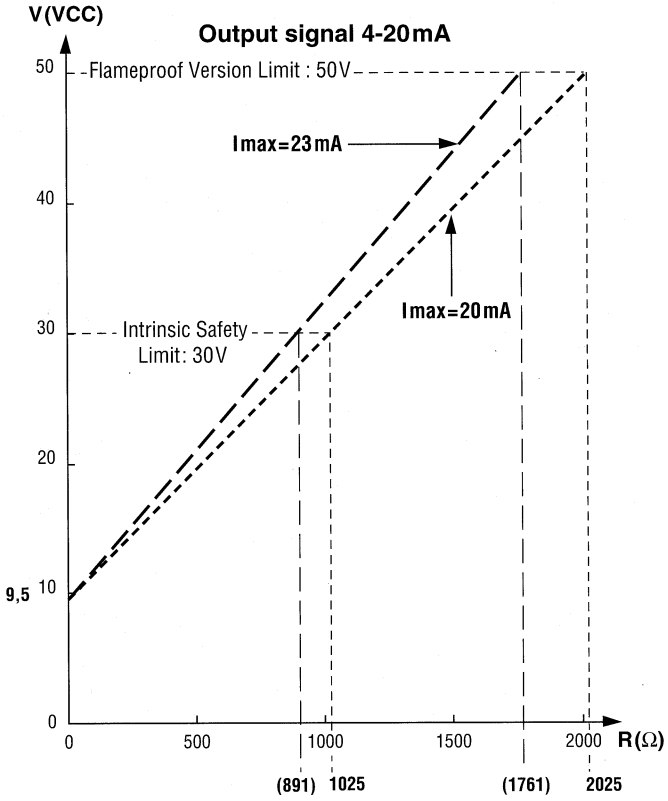
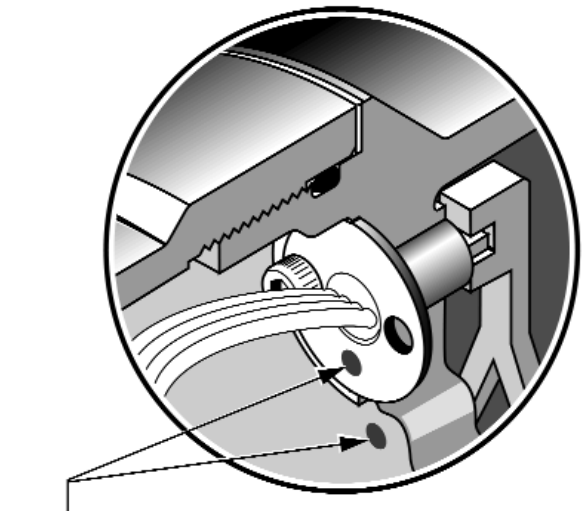


Figure 9 — Load Resistance Diagram



Two blue spots to mark the correct sensor position

Figure 10 — Sensor Installation Position

4.4.5 MILLIAMMETER CONNECTION

An external milliammeter may be connected to the transmitter to verify the signal without disconnecting the power supply.

Unscrew the safety screw (106) and unscrew the connection compartment cover (104). Put the switch on the "TEST" position. Connect the milliammeter on the two pins located on each side of the switch. Before disconnecting the milliammeter put the switch back on the position identified by "▲". Fully screw the connection compartment cover and unscrew it by less than 1 turn to screw the safety screw. See Figure 19.

5. operating the instrument

5.1 General Principles

All electronic calibrations of the DLT are made by means of three push buttons and a liquid crystal display on the front of the instrument. The codes or values displayed by the LCD can be seen through a window. Access to the three push buttons is obtained by removing the protective logo plate (80). It is not necessary to open the main cover for calibration or adjustment of the instrument. Except for maintenance, the cover should remain closed.

5.1.1 The Liquid Crystal Display

It displays two lines and a bargraph. The upper line can displays to five numerical digits and a decimal dot. The lower line can display alphanumeric digits.

On Normal operation, the LCD sequentially displays the loop current in mA and the level expressed in the unit displayed in the low left corner of the screen ; the level unit is generally % but an engineering unit can be selected through [UNIT] in CALIBRATION menu. The bargraph length is proportional to the loop current. The level value always increases with the height of liquid in the tank or displacer chamber whatever is the instrument action. For direct action, the current signal increases when level height increases ; for reverse action, the current decreases when level increases.

The display is also used to Configure, Calibrate and Diagnose the DLT.

To facilitate these operations, values, codes or short names appear on the display. The various parameters are listed in the menus (see APPENDIX A to C).

5.1.2 Pushbuttons

Three pushbuttons (27) are located under the plate (80) on the front of the instrument. Unscrew the three screws (125).

The left button is marked with a star ✱, the middle button with the sign –, and the right one with the sign +.

✱ means enter the function, accept or save to memory ; may be replaced by YES.

+ or – means : vertical movement in the program structure ; may be replaced by NO or NEXT or PREVIOUS.

Note : 1. Do not overpush on the buttons. A button should be maintained pushed during at least one second to perform the action.

2. Accidental pushing on one of the buttons will not cause any malfunction.

After using the buttons, reinstall the front plate (80) to be in NORMAL mode which one displays alternatively the current loop and the level of liquid.

5.1.3 Operating Modes

The instrument can operate under 3 modes :

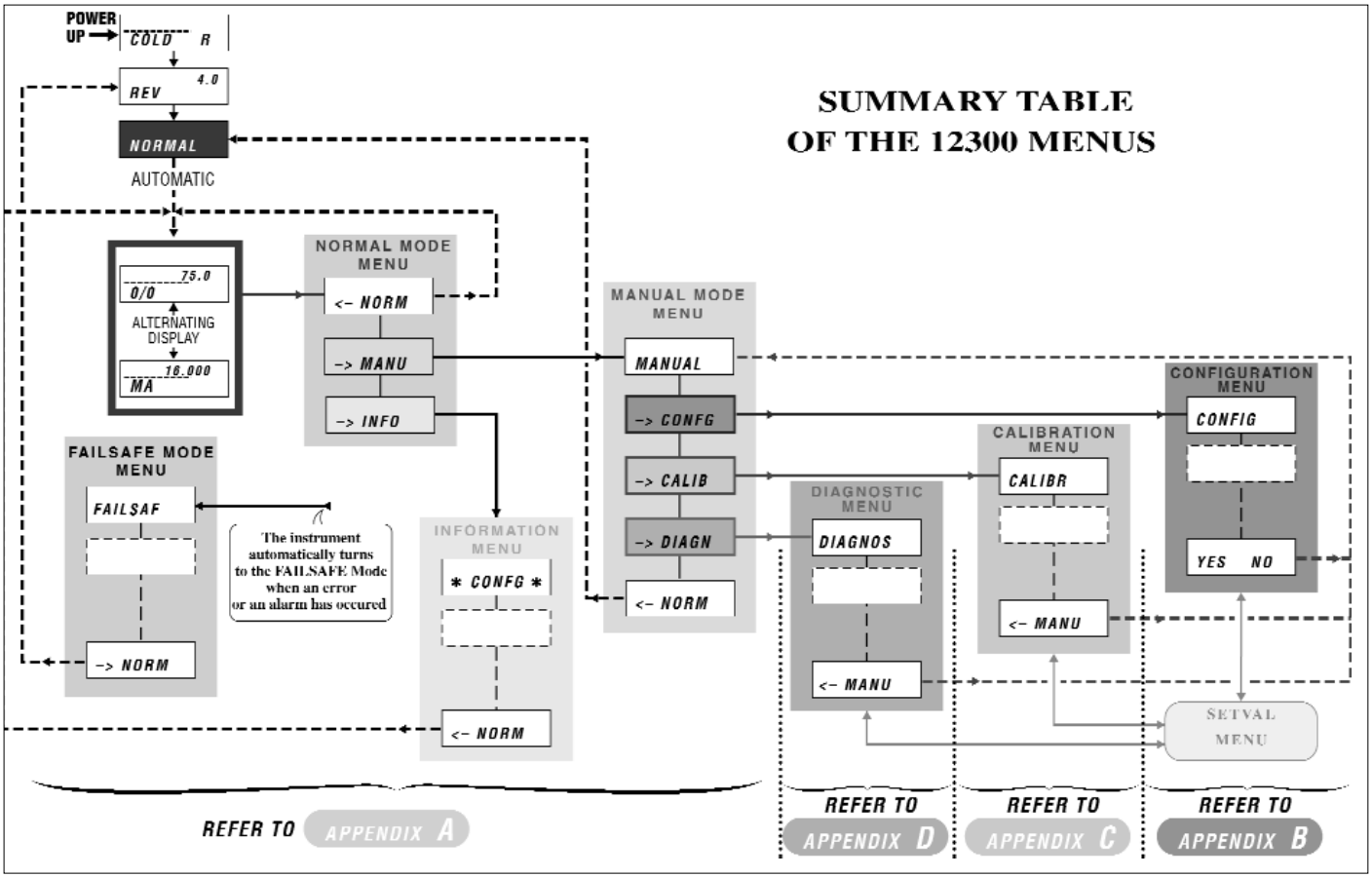
- NORMAL Mode : it is the normal operating mode. The 4-20 mA output current is proportional to the level in the tank. The local digital display sequentially displays loop current and level expressed in the unit (% or engineering unit) shown in the low left corner of the screen. Reading of instrument database is possible.
- MANUAL Mode : enter the manual mode when instrument configuration, calibration or diagnostic (set up or reading of diagnostic parameters) is required. The output current is not proportional to the tank level.
- FAILSAFE Mode : the instrument automatically turns to the failsafe mode when an error or an alarm has occurred. The output current is set to the value entered in the CONFIGURATION Menu.

5.1.4 Pushbuttons Menu Description And How To Use Them ?

The menu structure for operating the 12300 from the local pushbuttons is shown on the next page. Seven menus are provided to configure, calibrate, diagnose or exit the failsafe mode ; an additional menu is provided to set numerical values of a selected parameter.

Four APPENDIX A to C, displays the communication paths inside each menu, so that the descriptions and explanations of each screen.

- **NORMAL Mode Menu** (see APPENDIX A).
- **INFORMATION Menu** : (see APPENDIX A).
- **MANUAL Mode Menu** : (see APPENDIX A).



- **CONFIGURATION Menu** : (see APPENDIX B).
- **CALIBRATION Menu :** (see APPENDIX C).
- **DIAGNOSTIC Menu :** (see APPENDIX D).
- **FAILSAFE Mode Menu :** (see APPENDIX A).
- **SETVAL menu :** (see APPENDIX B).

Signs ✱, + and – in the menus mean these buttons should be pressed to move into the menu.

✱ means : enter the function, accept or save to memory; may be replaced by YES.

+ or – means : vertical movement in the program structure; may be replaced by NO or NEXT or PREVIOUS.

When screen [✱ – +/$^{nn.nnn}$] is displayed, stroke + to increase numerical value or – to decrease.

The various small screens in the menu diagram represent codes and/or numerical values displayed on the LCD : explanations on the codes, on the corresponding function and on the values limits are described in the APPENDIX A to D.

A momentary (>1 s) press of a button either allow to move into the menu or increase (or decrease) the displayed value by increments of 1 : see SETVAL menu.

5.1.4.1 NORMAL Mode Menu (APPENDIX A)

This menu will allow you to :

- move to the MANUAL Mode Menu [–> MANU] where the instrument is in MANUAL Mode and can be configured, calibrated or diagnosed,
- move to the INFORMATION Menu [–> INFO] where actual configuration, calibration and diagnostics data can be READ ONLY. Note also when you go to [–> INFO] the instrument is still in the NORMAL Mode and still generates a 4 to 20 mA signal proportional to the tank level,
- return to the NORMAL Mode.

To enter the NORMAL Mode Menu from the normal operating mode press any button.

5.1.4.2 INFORMATION Menu [–> INFO] (APPENDIX A)

When the instrument in the NORMAL Mode this menu will allow you to access databases to :

- **Read configuration data :** instrument function, direction of head mounting, action, failsafe option, high and low alarms, times before alarm flag are activated, language,
- **Read calibration data :** damping coefficient, low and high reference level current, low and high level, level unit, zero shift, reduced span, calibration specific gravity, service specific gravity, calibration specific gravity of specific gravity meter,

- **Read diagnostic data :** accumulated tank filling, time at low or high level, total time of working, electronic board temperature,
- **Read fault :** display all permanent faults which might have occurred since the last clear fault,
- **clear fault :** display the status of cleared faults.

NOTE : In the CONFIGURATION, CALIBRATION DIAGNOSTIC AND FAILSAFE menus of the APPENDIX A to D, the screens which can be displayed to be READ ONLY under [–>INFO] are spotted by means of the label INFO.

To enter the INFORMATION Menu from the NORMAL Mode press in sequence : ✱ (or + or –), +, +, ✱.

Then press the + or – button to move in the INFORMATION Menu and reach the database to be read.

Press ✱ to enter the database. To display data press + or –. To exit the database press ✱.

To exit the INFORMATION Menu and return to the NORMAL Mode move to [<– NORM] using + or - and press ✱.

5.1.4.2.1 To read the Calibration Specific Gravity [SG CAL] or the Service Specific Gravity [SG SER]

From the normal operating condition press ✱, +, +, to move to the INFORMATION Menu, press ✱, + to display [✱ CALIB ✱] then ✱ and + eight times to display [SG CAL] (or [LSG CAL] and [HSG CAL] for an interface level). Press + one more time to display the Service Specific Gravity [SG SER] or ([LSG SER] and [HSG SER] for an interface level).

5.1.4.3 MANUAL Mode Menu [MANUAL] (APPENDIX A)

The MANUAL Mode menu will allow you to move :

- to the CONFIGURATION Menu [–> CONFG] where configuration options are selected,
- to the CALIBRATION Menu [–> CALIB] where the instrument is calibrated,
- to the DIAGNOSTIC Menu [–> DIAGN] where diagnostic options are defined,

To enter the MANUAL Mode menu from the normal operating mode press ✱ to enter the NORMAL Mode menu, + to reach [–> MANU] , ✱ to enter the MANUAL Mode then any button to enter the MANUAL Mode menu,

To exit the MANUAL Mode menu move to [<– NORM] and press ✱. [NORMAL] appears for a few seconds and the instrument automatically returns to the NORMAL Mode display.

5.1.4.4 CONFIGURATION Menu [CONFIG] (APPENDIX B)

This menu allows to set the following configuration options :

- the instrument function (level or interface),
- the direction of head mounting (left or right displacer when facing the LCD window),
- the action (direct:current increases with level; reverse: current decreases when level increases),
- the FAILSAFE current,
- the high and low alarms,
- the time duration before to trigger off an alarm,
- the time duration before the instrument goes into the Failsafe mode,
- the language of the display.

To enter the CONFIGURATION Menu : enter the MANUAL Mode menu and move in the menu to [–> CONFG], press ✱ to display [CONFIG] then press any button to enter the menu.

To exit the CONFIGURATION Menu and return to the NORMAL Mode display, move into the menu until [< MANU] is displayed and press ✱ to display [STORAGE]. Press any button then ✱ (to save data) or + or – (no to save data) to display [MANUAL].

Then press ✱, –, ✱ : the instrument automatically returns to the NORMAL Mode display after [NORMAL] has been displayed for a few seconds.

5.1.4.4.1 To change the configuration from level service to interface level service

- From the normal operating condition press ✱, +, ✱, to display [MANUAL],
- Press any button then ✱ to display [CONFIG],
- Press any button to display [LEVEL],
- Press ✱ to display [INTERF]. The instrument is now configured as an interface level transmitter,
- To return to the NORMAL Mode and save the new configuration move into the menu using + or – to display [<– MANU],
- Press ✱, ✱, ✱, –, –, ✱ to return to the NORMAL Mode.

5.1.4.5 CALIBRATION Menu [CALIBR] (Appendix C)

This menu allows to :

- perform instrument coupling to the torque tube,
- perform the instrument calibration (transmitter and specific gravity meter),
- change the calibration and service specific gravity,
- adjust the damping coefficient applied to the loop current,

- set the current corresponding to the low and high levels,
- select the display unit,
- adjust the low and high loop current,
- adjust zero and span for the reduced scale,
- recalibrate the internal milliammeter and/or force a given loop current.

To enter the CALIBRATION Menu from the NORMAL Mode, press ✱, + ,✱ ,✱ to enter the MANUAL Mode menu and move in the menu to [–> CALIB]. Press ✱ to display [CALIBR] then press any button to enter the menu.

To exit the CALIBRATION Menu and return to the NORMAL Mode display, move into the menu until [<-MANU] is displayed and press ✱ to display [MANUAL].

Then press ✱, –, ✱: the instrument automatically returns to the NORMAL Mode display after [NORMAL] has been displayed for a few seconds.

5.1.4.5.1 To Change the Service Specific Gravity, [To avoid re-calibration if service specific gravity (ies) is (are) different from calibration specific gravity (ies)]

From the NORMAL Operating condition press ✱, +, ✱, to display [MANUAL].

- Press any button to enter the MANUAL Mode menu.
- Press + to display [–> CALIB] then ✱ to display [CALIBR].
- Press +, + to display [CHG SG].
- Press ✱ to display the specific gravity.

a) For a "level" instrument,

- Enter the Specific Gravity of Service [SG SER] .

b) For an "interface" instrument,

- Enter the Low and High Specific Gravities of Service [LSG SER] and [HSG SER].

- Press ✱ to enter SETVAL menu. See SETVAL menu (Section 5.1.4.8) to change the service specific gravity.
- After adjustment press ✱ to exit SETVAL menu.
- Press + or – to display [<–].
- Press ✱ to display [STORAGE]. Press any button then ✱ to save new specific gravity. and to display [CHG SG].
- To return to the NORMAL Mode move into the menu using + or –. to display [<– MANU].
- Press ✱, ✱, –, ✱ to return to the NORMAL Mode.

5.1.4.5.2 Calibration

To calibrate the instrument :

a) For a "level" instrument,

- Set the Specific Gravity value of the liquid used for calibration [SG CAL] and take the REF L [ZERO] and REF H [SPAN],

b) For an "interface" instrument,

- Set the Low and High Specific Gravities of the liquids used for calibration and take the REF L [ZERO] and REF H [SPAN],

c) For a "level" or an "interface" instrument,

- Set the currents and levels corresponding to REF L and REF H,
- Define the unit for level indication,
- Set the Zero and Span for reduced scale (Refer to Section 5.3.2.5),
- Set the damping action applied to the loop current (Refer to Section 5.3.2.4),
- Calibrate the specific gravity meter, (Refer to Section 5.3.2.1),

To enter the CALIBRATION Menu from the Normal operating mode, press in sequence : ✱ (or + or –), +, ✱, ✱, +, ✱, to display [CALIBR].

To quit the CALIBRATION Menu and return to Normal Operating mode, move into the menu until [<-MANU] is displayed, then press ✱ to display [MANUAL], via [STORAGE] and [YES NO].

Then press ✱, –, ✱ : [NORMAL] appears for a few seconds and the instrument automatically returns to Normal Operating displaying alternatively the current and the level.

5.1.4.5.3 Recalibration of the internal ammeter

CAUTION : Must be done only in case of trouble shooting (if current output is not the same that current displayed).

Move to sub-menu [4 20 MA]. (Refer to Section 7 – Trouble Shooting and APPENDIX C).

5.1.4.5.4 To force the current to display a required value

Allows to set another instrument (such that positioner) in series in the loop, generating a required output current. Move to sub-menu [4 20 MA] then [MA GENE] and proceed as indicated in APPENDIX C).

5.1.4.5.5 Reposition the Hall effect sensor towards the torque tube rod

Only necessary after installation of an instrument on the torque tube. Move to sub-menu [COUPLNG]. (Refer to Sections 6.2.3 or 6.2.4).

5.1.4.6 DIAGNOSTIC Menu [DIAGNOS] (Appendix D)

This menu allows :

- To get information on working data : accumulated tank filling, time during which the level was high or low, total time of working, board temperature,
- Test the Hall effect sensor,
- Tune manually or automatically the smart filtering function,
- Test the specific gravity meter,
- Get the history of faults (permanent and non permanent),
- Reset diagnostics database,

To enter the DIAGNOSTIC Menu from the NORMAL Mode press ✱, +, ✱ to enter the MANUAL Mode menu and move in the menu to [–> DIAGN]. Press ✱ to display [DIAGNOS] then press any button to enter the menu.

To exit the DIAGNOSTIC Menu and return to the NORMAL Mode display, move into the menu until [<– MANU] is displayed :and press ✱ to display [MANUAL].

Then press ✱, –, ✱ : the instrument automatically returns to the NORMAL Mode display after [NORMAL] has been displayed for a few seconds.

5.1.4.7 FAILSAFE Mode menu (Appendix A)

When instrument is in the FAILSAFE mode this menu allows to :

- Read fault which has occurred,
- Clear fault which has occurred,
- Reset to factory default settings,
- Return to NORMAL Mode.

When the instrument is in the FAILSAFE Mode it displays [FAILSAF]. To enter the FAILSAFE Mode menu press any button.

To exit move in the menu to [–> NORM] and press ✱. The instrument automatically returns to the NORMAL Mode display after [REV ^{xxx}] and [NORMAL] have been displayed for a few seconds.

5.1.4.8 SETVAL menu (Appendix B)

This setting values menu is used to set numerical values for any function requiring such an action. To enter or exit SETVAL menu from a function press ✱.

When entering SETVAL menu [<–$^{\#.\#\#\#}$] is displayed.

Push + to display [∧ $^{\#.\#\#\#}$], then + or – to shift the sign ∧ below the number to be changed.

Push ✱ to display [–$^{\#.\#\#\#}$+]. Push + to increase or – to decrease to change the number.

Validate by ✱. Repeat for each digit.

To exit the SETVAL menu press + or – to display [<–$^{\#.\#\#\#}$]. Then press ✱.

5.2 First Operating and Simple Calibration for a Level Instrument Service

To perform a first calibration and running in case of a level application of the instrument refer to APPENDIX E.

5.3 Detailed Calibration According to Means Instrument Applications

After the 12300 Level Instrument has been installed and connected, remove the front plate (80) located in front of the instrument to gain access to the push buttons and select all required configuration data as indicated in the Section 5.1.4.4. APPENDIX B, then proceed as follows:

NOTE : The electronic circuit has been factory adjusted during instrument manufacturing to 4-20 mA, using a reference milliammeter.

So, for calibration on site, no measurement instrument is required.

However, if the loop current must be verified and if full compliance with standards requirements for instruments installed in hazardous areas is insured, insert the milliammeter in series with the power supply or connect it to the electronic board provided into the connection compartment. Put the switch on the "TEST" position. Connect the milliammeter on the two pins located on each side of the switch. Before disconnecting the milliammeter put the switch back on the position identified by "▲". See Figure 19.

Danger : If area cannot be verified as safe, do not remove any cover.

5.3.1 Direct Reading on the Liquid Specific Gravity Meter [SGMETER]

Caution : Direct reading of specific gravity is correct only :

- ***If displacer volume is lower than 1270 cm^3 and service specific gravity X displacer volume is lower than 1270.***
- ***If the displacer is fully immersed in the liquid and if the [SGMETER] function has been preliminary calibrated.***

To calibrate the [SGMETER] function, refer to Section 5.3.2.1.

To read specific gravity of the process liquid :

- Fill the displacer chamber until the displacer is fully immersed into the process liquid.
- Move into the DIAGNOSTIC Menu (APPENDIX D) until [RD CTR] then [SGMETER] are displayed. Push ✱ to read the value. Return to normal operation.

5.3.2 To Set up Parameters

5.3.2.1 Calibrate the Specific Gravity Meter

This adjustment is made at the factory for complete instruments. It is needed to use the specific gravity function [SGMETER] that is an help to perform on site new calibration or simulation with or without liquid.

Caution : The Specific Gravity Meter function is factory calibrated at the specific gravity 1 for complete instrument only if displacer volume is lower than 1270 cm^3 and weight is 1362 g.

For instrument delivered alone with torque tube, the Specific Gravity Meter function is factory calibrated at the SG 1 for a displacer of 907 cm^3 / 1362 g.

If actual displacer characteristics differs from these values, recalibration is necessary and will be possible only if displacer volume is lower than 1270 cm^3 and service specific gravity x displacer volume is lower than 1270 :

Proceed as follows :

a. Move to CALIBRATION Menu (APPENDIX C) until [SGM CAL], then [SG CAL] are displayed. Validate by ✱ to enter SETVAL menu and set the specific gravity of 1. Store data.

b. Empty the chamber or simulate by weight the low level and stabilize the displacer (or the weight).

c. Display [ZERO] and press ✱ to take account the REF L.

NOTE : During the procedure, refer to Section 5.3.2.6 if the LCD displays [ERROR].

d. Attach a set of weights to the torque arm to simulate a high level or fill the displacer chamber until the high level is reached. Stabilize the displacer (or the weight).

- **On site :** Fill the displacer chamber until high level (REF H) is reached by a specific gravity 1 liquid.
- **In workshop :** Simulate by weights the high level (REF H) corresponding to the apparent weight of the actual displacer fully immersed in a specific gravity 1 liquid.

e. Display [SPAN] and press ✱ to take account the REF H,

f. Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [CAL Z S] is displayed,

g. Exit the CALIBRATION Menu via [<–MANU] and ✱ then move into the DIAGNOSTIC menu (APPENDIX D) until [RD CTR] then [SGMETER] are displayed. Push ✱ to read the value and check if the calibration is successful. Return to NORMAL Operation Mode.

5.3.2.2 Calibration Specific Gravity [SG CAL]

The calibration specific gravity is that of the liquid used (or simulated by weights) for calibration of zero and span in the CALIBRATION Menu.

It should be modified only if zero and span calibration are performed again for a liquid of different specific gravity. Refer to Section 5.3.3.4 — Calibration, Steps 1 to 7.

5.3.2.3 Service Specific Gravity [SG SER]

The service specific gravity is the one used for the function [SG SER] in the CALIBRATION Menu.

Its value is identical to that of [SG CAL] just after calibration. If the specific gravity of the process liquid is different, modify the value of [SG SER].

Two cases are possible :

a) If the specific gravity of the liquid is unknown, you must first measure specific gravity of the liquid by using the function [SGMETER]. See Section 5.3.1, then proceed as follows :

b) The specific gravity is known, it can be modified, regardless of what the liquid level in the displacer chamber is. To adjust the value :

Move into the CALIBRATION Menu until [CALIBR], [CHG SG] then [SG SER] are displayed.

Validate by ✱ to enter SETVAL menu and set the specific gravity. Return to normal operation.

Caution : In interface service , if the [LSG SER] and/or [HSG SER] are modified, an automatic calculation is performed to set a new value in [ZERO <–>].

5.3.2.4 Output Current Damping [DAMPING]

In case of rapid oscillations of the level or if the liquid is in motion, it may be necessary to filter the output signal. A first order digital filter is provided for adjusting the damping coefficient.

Enter the CALIBRATION Menu, move to display [VAR SET], then [DAMPING] and validate by ✱ to enter SETVAL menu and set the filtering coefficient. Return to normal operation.

5.3.2.5 Reduced Range and/or Zero Shift [SPAN >–<], [ZERO <–>]

For an application where the level change is smaller than the displacer height, it is possible to obtain the full signal range for this reduced level range.

- Enter the CALIBRATION Menu, move to display [VAR SET], then [ZERO <–>] and validate by ✱ to enter SETVAL menu and set the zero shift value. Return to the [ZERO <–>] screen by ✱,
- Move to display [SPAN >–<] and validate by ✱ to enter SETVAL menu and set the span reduction value. Return to display [SPAN >–<] screen by ✱,
- Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [VAR SET] is displayed,

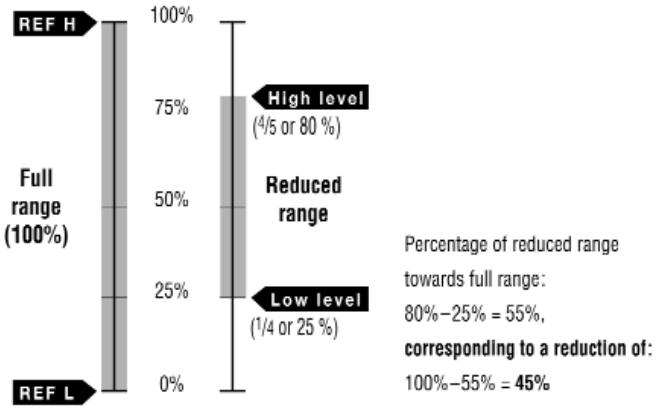


Figure 11
Schematic Example of Reduced Range

- Exit the CALIBRATION Menu via [<–MANU] and ✱ then return to NORMAL Operation Mode via the MANUAL Mode.

Example : *To modify a calibration so that 0 % corresponds to a displacer immersed to 1/4 of its height (25 %), and 100 % corresponds to a displacer immersed to 4/5 of its height (80 %), adjust zero shift to 25 % and span reduction to 45 %, (see schematic on Figure 11).*

Caution : If new calibration is performed, the parameters of the reduced range [SPAN >–<] and/or zero shift function [ZERO <–>] are automatically set to zero.
In interface service : If the [LSG SER] and/or [HSG SER] are modified, an automatic calculation is performed to set a new value in [ZERO <–>].

5.3.2.6 Error Code on Zero and Span Set

a) The value of the span can be accepted before or after the zero value is entered. If you accept the zero without simulating the corresponding level change, the LCD displays [ERROR]. Press ✱ to delete the message and then perform (or simulate) the level change before acquiring the new value.

b) The LCD may also display [ERROR] for a new calibration if :

- The zero value is higher or equal than the span of the preceding calibration. If so, accept and store the span first and then the zero.
- The span value of the new calibration is smaller than the zero value of the preceding calibration. If so, accept and store the zero value first and then the span.

5.3.3 Calibration (for a Level Instrument Service)

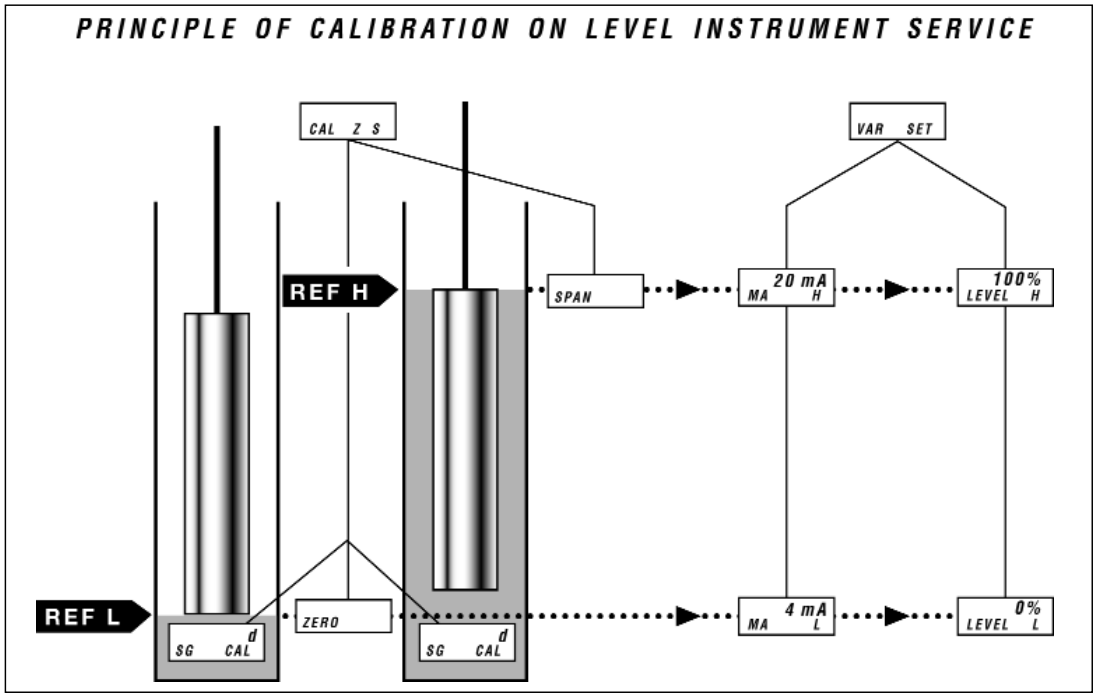
5.3.3.1 Principle of Calibration

The electronic circuit is calibrated towards two reference levels (REF L and REF H), see Schematic below :

- REF L corresponds to the displacer completely out of liquid.
- REF H corresponds to the displacer fully immersed in the liquid of Specific Gravity used for calibration [SG CAL].

The loop current corresponding to REF L may be set through [MA L] via [VAR SET] ; it is generally 4 mA.

The current corresponding to REF H may be set through [MA H] via [VAR SET] ; it is generally 20 mA.



The value of [MA H] shall always be higher than the value of [MA L].

The level indication corresponding to REF L is set through function [LEVEL L] via [VAR SET] ; it is expressed in the unit set through [UNIT] function ; if UNIT is "%", LEVEL L should be 0.0.

The level indication corresponding to REF H is set through function [LEVEL H] via [VAR SET] ; it is expressed in the unit set through [UNIT] function ; if UNIT is "%", LEVEL H should be 100.0.

The electronic circuit is calibrated so that the indicator range 4-20 mA corresponds to the indication of a milliammeter inserted in series with the supply circuit of the DLT. Therefore it is not necessary to connect a milliammeter when performing an on site calibration ; the instrument display is sufficient.

Danger : Connection of a milliammeter in series must be compatible with applicable hazardous area standards requirements. Refer to Section 4.4.4.

5.3.3.2 Conditions to Dry Calibration in Workshop (Simulation by Weights)

***Caution** : When performing a calibration, use the following parameter units wherever they apply :*

Parameter Name	S.I Units	English Units
Displacer Weight	g	lbm
Displacer Volume	cm^3	in^3
Water Density (WD)	1 g/cm^3	0.036 lbm/in^3

The effective change in level will be simulated by a set of weights corresponding to :

a) The weight of the actual displacer at low level (REF L), which allows you to calibrate the zero and obtain the minimum value [0,0%] of the signal (direct action).

b) The apparent displacer weight when the level is high (REF H). This allows you to calibrate the span and obtain the maximum value [100,0%] of the signal (direct action). The corresponding weight is calculated as :

Apparent Displacer Weight =
Displacer Actual Weight-(Displacer Actual Volume x S.G.xWD)

Caution : Actual volume and weight of the displacer can be read using HART® function only if they have been previously stored in the DLT head. Otherwise, actual volume of the displacer is marked on the specification plate (124).

Weight the displacer to get the actual weight.

Proceed as indicated under 5.3.3.4 Calibration :

5.3.3.3 Conditions to Calibration on Site in a Liquid

The effective change in level will be obtained by emptying and filling of the displacer chamber with a liquid.

Wait that the displacer is stabilized to validate the values displayed after each change in liquid level.

Take actions necessary to allow a change in the liquid level in the chamber : open/close isolation valves, vent, purge, etc.

Proceed as indicated under 5.3.3.4 Calibration :

5.3.3.4 Calibration

1. Switch on the power. Attach a set of weights to the torque arm to simulate a low level or empty the displacer chamber.
2. Enter the CALIBRATION Menu and press in sequence : ✱ (or + or –), +, ✱, ✱, +, ✱, to display [CALIBR],
3. Set the Specific Gravity value of the liquid used for calibration [SG CAL]. Refer to Section 5.1.4.8 for the SETVAL sub-menu,
4. Display [ZERO] and press ✱ to take account the REF L,

   NOTE : During the procedure, refer to Section 5.3.2.6 if the LCD displays [ERROR].
5. Attach a set of weights to the torque arm to simulate a high level or fill the displacer chamber until the high level is reached,
6. Display [SPAN] and press ✱ to take account the REF H,
7. Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [CAL Z S] is displayed,
8. Move to [VAR SET] to display successively [MA L], [MA H], [LEVEL L], [LEVEL H] and, if needed, set the currents and levels corresponding to REF L and REF H,
9. Display [UNIT] and define the unit for level indication,
10. If necessary, display [DAMPING] and set the damping action applied to the loop current. (Ref. to Section 5.3.2.4),
11. If necessary, set zero and span for reduced range. (Ref. to Section 5.3.2.5),
12. Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [VAR SET] is displayed,
13. When the calibration is completed, move into the menu until [<–MANU] is displayed, then press ✱ to exit the CALIBRATION Menu and to display [MANUAL],
14. Press ✱, –, ✱ : [NORMAL] appears for a few seconds and the instrument automatically returns to Normal Operating display,
15. Reinstall the front plate (80) with the three screws (125).

NOTE : The calibration specific gravity [SG CAL] is automatically stored in the service specific gravity function [SG SER]. If the instrument is to be used with a liquid of different specific gravity, reenter the CALIBRATION Menu to set and accept this new value in [SG SER]. (See Section 5.3.2.3).

5.3.4 Calibration of an Instrument for Liquid Interface Service

5.3.4.1 Principle of Calibration

The level transmitter is used to measure the interface level of two immiscible liquids of different specific gravities. The displacer must be always fully immersed.

The electronic circuit is calibrated towards two reference levels (REF L and REF H) :

- REF L corresponds to the displacer completely out of liquid.
- REF H corresponds to the displacer fully immersed in the liquid of Specific Gravity used for calibration [SG CAL].

The loop current corresponding to REF L may be set through [MA L] via [VAR SET] ; it is generally 4 mA.

The current corresponding to REF H may be set through [MA H] via [VAR SET] ; it is generally 20 mA.

The value of [MA H] shall always be higher than the value of [MA L].

The level indication corresponding to REF L is set through function [LEVEL L] via [VAR SET] ; it is expressed in the unit set through [UNIT] function ; if UNIT is "%", LEVEL L should be 0.0.

The level indication corresponding to REF H is set through function [LEVEL H] via [VAR SET] ; it is expressed in the unit set through [UNIT] function ; if UNIT is "%", LEVEL H should be 100.0.

The electronic circuit is calibrated so that the indicator range 4-20 mA corresponds to the indication of a milliammeter inserted in series with the supply circuit of the DLT.

Therefore it is not necessary to connect a milliammeter when performing an on site calibration ; the instrument display is sufficient.

Danger : Connection of a milliammeter in series must be compatible with applicable hazardous area standards requirements. Refer to Section 4.4.4.

5.3.4.2. General on interface service displacers

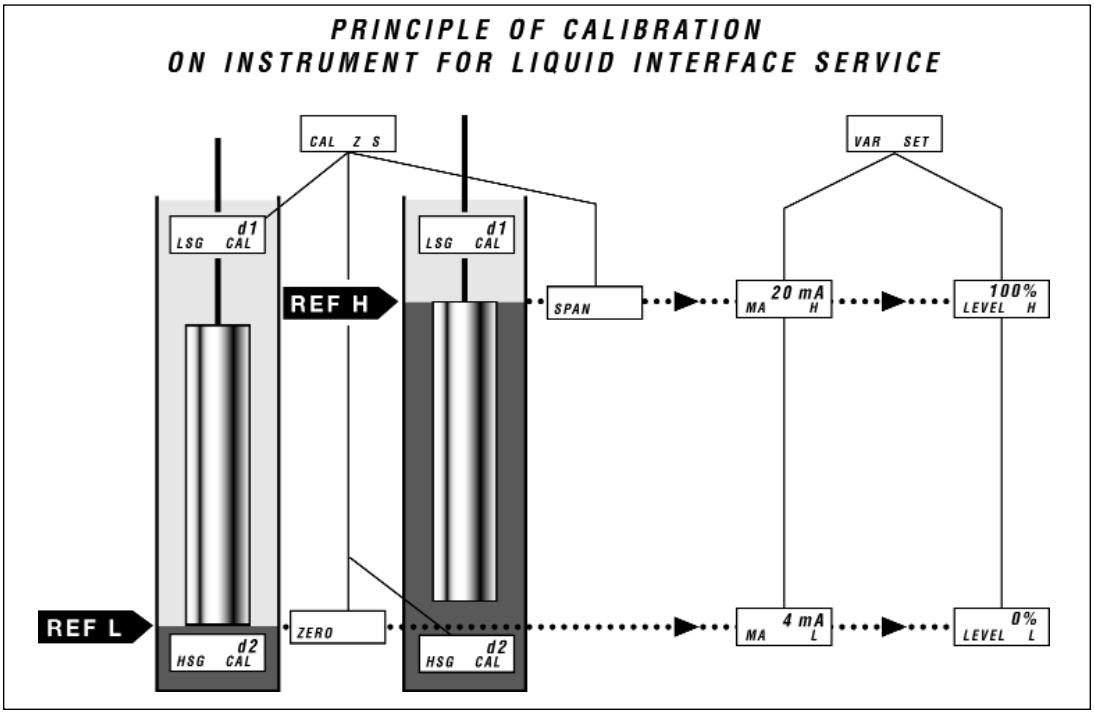
Under Section we will consider as a standard displacer any displacer with the following characteristics :

- *Volume **V** : 1270 cm^3 (77 in^3), marked on specification plate (124),*
- *Product of V x SG 1270,*
- *Weight = 1362 g (3 lbm).*

A standard displacer may be used when the liquid specific gravity difference is between 0.1 and 1.4 (with lower accuracy between 0.1 to 0.2). The lowest specific gravity (d_1) liquid is 1.3 max. The highest specific gravity (d_2) liquid is between 0.1 and 1.4.

Caution : Special displacer may be provided for specific applications (material, service conditions...). In this case, volume and/or weight will differ from standard displacer characteristics.

Actual volume and weight of the displacer can be read using HART® function only if they have been previously stored in the DLT head. Otherwise, actual volume of the displacer is marked on the specification plate (124).



Weight of the displacer is only necessary on dry calibration to simulate the apparent weight of the displacer immersed into the liquids : Weight the displacer to get the actual weight.

NOTE : *During following procedures, refer to Section 5.3.2.6 if the LCD displays [ERROR].*

5.3.4.2.1 Wet Calibration

The effective change in level will be obtained by emptying and filling of the displacer chamber with the two liquids .

Wait that the displacer is stabilized to validate the values displayed after each change in interface of liquids.

Take actions necessary to allow a change in the interface of liquids in the chamber : open/close isolation valves, vent, purge, etc.

The procedure is identical to the one used for calibrating a level transmitter in a liquid on site (see Section 5.3.3.4), *except for the differences outlined below.*

a. With the Process Liquids

1. Enter the specific gravities to be used for calibration by *using the functions [LSG CAL] and [HSG CAL].*
2. Take any action to allow change in liquid interface level in the displacer chamber, isolating, vent, purge valves etc....It is then necessary to put liquids in chamber to :
3. Set the [ZERO] *when the displacer is fully immersed in the lowest specific gravity liquid (d_1).*
4. Set the [SPAN] *when the displacer is fully immersed in the highest specific gravity liquid (d_2).*
5. Complete the calibration as indicated in Steps 7 to 15 of the Section 5.3.3.4.

b. With the Highest Specific Gravity Liquid (d_2)

Caution : This procedure is only possible if the [SGMETER] function has been calibrated. Refer to Section 5.3.1.

1. Take any action to allow change in liquid interface level in the displacer chamber, isolating, vent, purge valves etc.... and then :
2. Enter the CALIBRATION Menu.
3. Enter the specific gravities to be used for calibration by *using the functions [LSG CAL] and [HSG CAL].*
4. Admit liquid (d_2) into the chamber to fully immerse the displacer.
5. Set and store [SPAN] for interface configuration.
6. Quit CALIBRATION Menu.
7. In the DIAGNOSTIC Menu, move to [SGMETER]. The specific gravity displayed must correspond to the specific gravity of the liquid in chamber. *This assumes the [SGMETER] has been calibrated.*
8. Slowly empty the chamber until the LCD displays the lowest S.G. value (d_1) and take note of this.
9. Quit the [SGMETER] function and the DIAGNOSTIC Menu.
10. Return to CALIBRATION Menu.
11. Set the [ZERO] for interface configuration.
12. Complete the calibration as indicated in Steps 7 to 15 of the Section 5.3.3.4.

c. On Site Using Water if the Highest Specific Gravity (d_2) is 1

Caution : This procedure is only possible if the [SGMETER] function has been calibrated. Refer to Section 5.3.1.

1. Take any action to allow change in liquid interface level in the displacer chamber, isolating, vent, purge valves etc.... and then empty the chamber.
2. Enter the DIAGNOSTIC Menu and move to [SGMETER].
3. Increase the water level in displacer chamber until LCD displays the value of the process lowest specific gravity (d_1).
4. Quit [SGMETER] and enter the CALIBRATION Menu. Move until [CAL Z S], then [LSG CAL] and [HSG CAL] is displayed to enter (d_1) and (d_2).
5. Set and store [ZERO] for this water level (d_1).
6. Quit the CALIBRATION Menu and return to [SGMETER] in the DIAGNOSTIC Menu.
7. Increase the water level in the displacer chamber until the LCD displays the value of the highest specific gravity (d_2).
8. Quit [SGMETER] and the DIAGNOSTIC Menu, then return to CALIBRATION Menu.
9. Set and store the [SPAN] for this new water level (d_2).
10. Complete the calibration as indicated in Steps 7 to 15 of the Section 5.3.3.4.

5.3.4.2.2. Dry Calibration

Conditions to Dry Calibration in Workshop (Simulation by Weights)

***Caution** : When performing a calibration, use the following parameter units wherever they apply :*

Parameter Name	S.I Units	English Units
Displacer Weight	g	lbm
Displacer Volume	cm^3	in^3
Water Density (WD)	1 g/cm^3	0.036 lbm/in^3

Caution : Actual volume and weight of the displacer can be read using HART® function only if they have been previously stored in the DLT head. Otherwise, actual volume of the displacer is marked on the specification plate (124).

Weight of the displacer is only necessary on dry calibration to simulate the apparent weight of the displacer immersed into the liquids : Weight the displacer to get the actual weight.

a. In the Workshop (Simulation by Weights)

The procedure is identical to the one used for a normal level transmitter service (see Section 5.3.3.4), *except the set of weights is calculated as follows :*

- To simulate an interface at 0 % **(REF L)** and calibrate the zero, attach to the torque arm a weight equal to the *actual displacer weight when fully immersed in the lowest specific gravity liquid*, which is calculated as :

Displacer Apparent Weight for REF L =
Displ. Actual Weight – (Displ. Actual Volume x d_1 x WD)

Caution : During the dry calibration without mechanism chamber, DO NOT ATTACH SPECIAL INTERFACE SERVICE DISPLACER (OR ITS EQUIVALENT EFFECTIVE WEIGHT) on the torque arm. Indeed, these displacers being more heavy than those for liquid level service and any mechanical stop being possible out of mechanism chamber, the torque tube and/or the DLT mechanism would be inevitably damaged.

- To simulate an interface at 100 % **(REF H)** and calibrate the span, attach to the torque arm a weight equal to the *effective displacer weight when fully immersed in the highest specific gravity liquid,* which is calculated as :

Displacer Apparent Weight for REF H =
Displ. Actual Weight – (Displ. Actual Volume x d_2 x WD)

Enter in [LSG CAL] and [HSG CAL] the process liquids specific gravities (d_1) and (d_2).

b. With or Without Liquid in the Displacer Chamber (Use of Adjusting Screws to calibrate)

Caution : This procedure is only possible if the [SGMETER] function has been calibrated. Refer to Section 5.3.1.

This method uses the [SGMETER] function (set in workshop), to adjust the screws (114) to the interface specific gravities.

If a milliammeter is not required, this calibration may be performed with the case closed.

Open the access plug (107) on the right side of the case to look at the simulation mechanism. Remove plug (190) and the two 1/8" NPT plugs (115). (Use a 5 mm Hex. wrench).

Through this hole, use your finger to move the flexure (59) in the direction of the torque tube until the flexure touches the adjusting screw post (114). While maintaining contact, slide the flexure left or right along the surface of the screw post, (Figure 12).

Adjusting the Screws (114)

Adjust the screw (114) on the displacer side, relative to the instrument axis, to simulate the force on the displacer resulting from the highest specific gravity of the process liquids (d_2).

Adjust the screw (114) on the opposite side to the displacer to simulate the force on the displacer resulting from the lowest specific gravity of the process liquids (d_1).

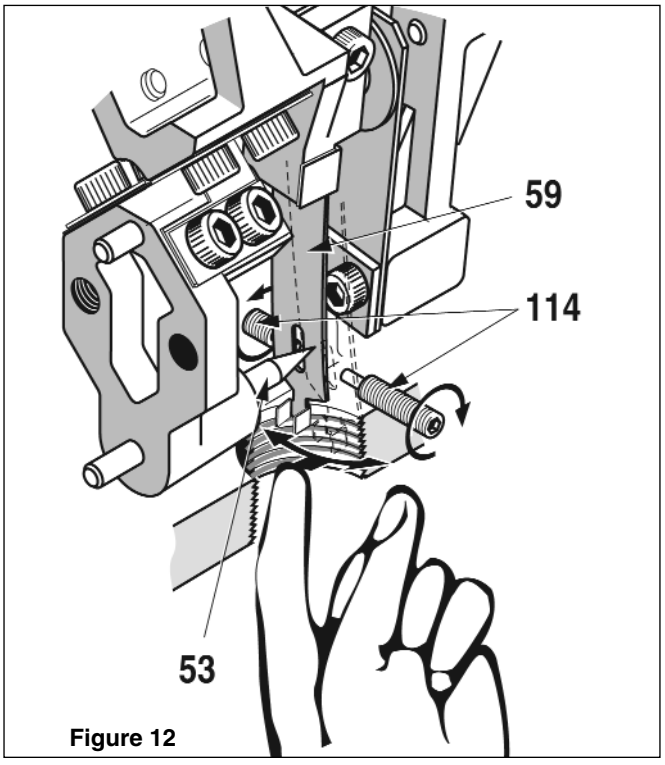


Figure 12

Proceed as follows :

1. Remove the front plate (80). Enter the DIAGNOSTIC Menu then move to [SGMETER] and accept by ∗.
2. Press the flexure (59) against the adjusting screw shoulder (114) which corresponds to the lowest specific gravity, d_1. While maintaining contact and using a 3 mm hex wrench, turn the adjusting screw until LCD displays d_1.
3. Press the flexure (59) against the adjusting screw shoulder (114) which corresponds to the highest specific gravity, d_2. While maintaining contact and using a 3 mm hex wrench, turn the adjusting screw until LCD displays d_2.
4. Slowly move from one shoulder to the other (to avoid displacer oscillations) and verify the value displayed. Correct adjustments if necessary.
5. Quit the [SGMETER] function and return to [MANUAL] display.

Calibration with screws (114)

1. Enter the CALIBRATION Menu and move to display [CHG SG], then [LSG SER] and [HSG SER]. Read these two values and return to [CHG SG].
2. Move to [CAL Z S] then to [LSG CAL] and [HSG CAL] to enter the specific gravities (d_1) and (d_2).
3. Move to display [ZERO]. Press the flexure (59) to contact the lowest specific gravity adjusting screw (114) (opposite to the displacer side). Wait for a few seconds until the displacer stabilizes and accept the zero value.
4. Move to display [SPAN]. Move the flexure (59) to contact the shoulder of the screw (114) corresponding to the highest specific gravity (on displacer side). Wait a few seconds until displacer is stable and accept the span value.
5. Release the flexure.
5. Complete the calibration as indicated in Steps 7 to 15 of the Section 5.3.3.4.
7. Reinstall plugs (107), (190), and (115).

NOTE : If the displacer chamber is empty, the LCD will display an incorrect negative value.

The zero of the LCD is correct only when the displacer is fully immersed in the lowest specific gravity liquid.

Moving the flexure from one shoulder to the other varies the display and the loop current from 0 to 100 %.

6. maintenance

CAUTIONS

1. **Do not remove the main cover (20) or the connection compartment cover (104) without first switching off the power supply or verifying that the instrument is installed in an intrinsically safe circuit or is not installed in an explosive atmosphere.**
2. **Operations described below may require you to open the mechanism compartment. Before returning the instrument to normal operation, verify that both covers and the plug are correctly reassembled with gaskets in good condition.**
   Use only original Masoneilan parts. Pay particular attention to the plug (190), which includes a compressible gasket (192).

6.1 Removing the DLT Case From the Torque Tube (Figures 13, 14, 15 & 21).

a. Switch off power supply. Unscrew (106) until it disengages from the case and remove the cover (104) of the connection compartment. Disconnect supply wires from terminals (90).

b. Remove cover (107) of the mechanism compartment. Using a 2.5 mm hex wrench, loosen screw (62) to uncouple the beam (54) from the torque rod.

c. While holding the case to prevent it from falling, loosen the four screws (121), using a 5 mm hex wrench, and remove them along with the washers (122). Remove the case by pulling it along the axis of the torque tube while being careful to prevent any deformation of the coupling flexure (70).

d. If the original case or an identical one will be reinstalled on the same torque tube, do not remove the coupling flange (116) from the torque rod. Also, do not disconnect the coupling flexure subassembly (70). As an alternative, loosen screws (119) using a 1.5 mm hex wrench and remove the coupling flange-flexure sub-assembly (116-70).

e. If the torque tube is not the 12300 type, remove the DLT case adapter kit, if necessary. This kit includes a flange, a gasket, and screws, (see Figure 14).

6.2 How to Install a DLT on a Torque Tube (see Figures 1, 13, 17 & 21)

6.2.1 On a 12200/300 Series Torque Tube

a. Mount the torque tube (137) on a support. The knife pivot at the back of the tube must be oriented toward the top.

b. On the transmission rod (138), mount the coupling flange (116), coupling flexure S/A (70) [incl. flexure (71), pin (72) and washer (73)], flange (117) and its two ***loosened*** screws (118). Tighten screws (118) so that the sub-assembly is free to slide on the transmission rod, (see Figure 13).

c. Position the sub-assembly ***vertically*** on the rod so that the distance between the coupling flexure (71) and the torque tube flange, (see Figure 21) is 59.5 mm ± 0.5. Firmly tighten this sub-assembly to the rod, using the two lateral screws (119).

d. Mount a new O-ring (120) on the torque tube flange.

e. Verify that screw (62) on the beam (54) is loose.

f. Position the case correctly oriented toward the front and in line with the axis of the torque tube.

g. Slide the case into the torque tube flange while observing through the side opening that the pin (72) is inserted into the beam coupling end. Use a flat tool to easy backup the coupling flexure (71).

h. When the case is in contact with the torque tube flange, verify that the beam is free to rotate by placing your finger on the flexure (59) through the lower 3/4" NPT hole.

i. Fasten the case with four screws (121) and washers (122). Firmly tighten.

j. Verify again that the beam is free to rotate and that the coupling flexure (71) is not deformed. The coupling on the beam (54) will be tightened later.

NOTE: At this point, if instrument service conditions are well defined, refer to Section 6.2.3 — Instrument Coupling to the Torque Tube in Workshop or Section 6.2.4 — Instrument Coupling to the Torque Tube on Site

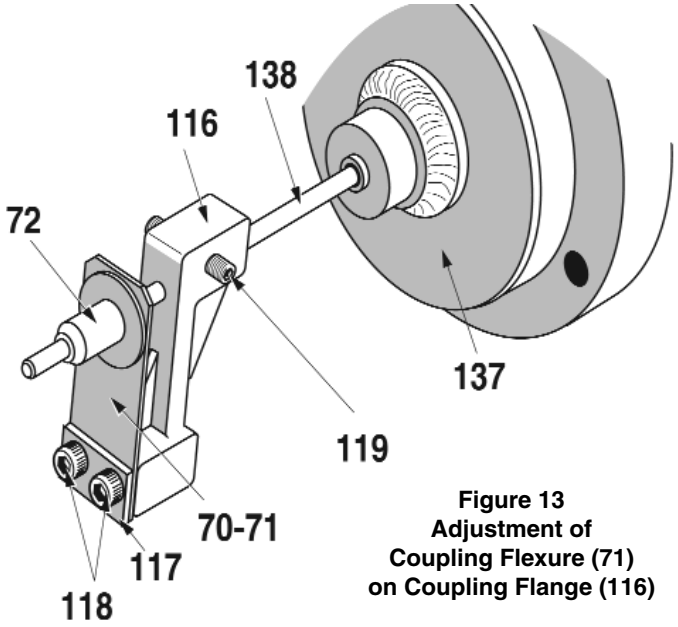


Figure 13
Adjustment of Coupling Flexure (71) on Coupling Flange (116)

6.2.2 12120/12800 Series Torque Tube (See Figure 14)

The transmitter can be mounted on different types of existing torque tubes. Kits including flange, gasket, and screws are provided for the adapter tubes.

6.2.3 Instrument Coupling to the Torque Tube in Workshop (by weights)

Coupling between torque tube and mechanism is achieved by simulating a 1.4 specific gravity liquid. The value of the weights is determined by the below formula, (under § d).

NOTE: It is necessary to know the mounting direction (right or left) and the action direction of the signal (direct or reverse) — refer to Section 5.1.4.4 – CONFIGURATION Menu and APPENDIX B.

a. Using a support, install the transmitter and its torque tube.

b. Remove the screw (106), the covers (104 & 107) of the connection and mechanism compartments, and the plug (190) located at the bottom of the instrument.

c. Assemble the standard torque arm on the right or left side as required. (Refer to Figure 7).

d. Attach to the torque arm a weight equivalent to that of a displacer half immersed in a 1.4 specific gravity liquid:

$$\text{Calibr. Weight} = \text{Displacer Actual Weight} - \left(\frac{\text{Displacer Actual Volume} \times \text{WD} \times 1.4}{2}\right)$$

e. Connect a 24 V dc supply (switch OFF) to the terminals in the connection compartment in series with a milliammeter. Respect polarities.

f. Proceed with configuration of the instrument. *Refer to Section 5.1.4.4 – CONFIGURATION Menu and APPENDIX B.*

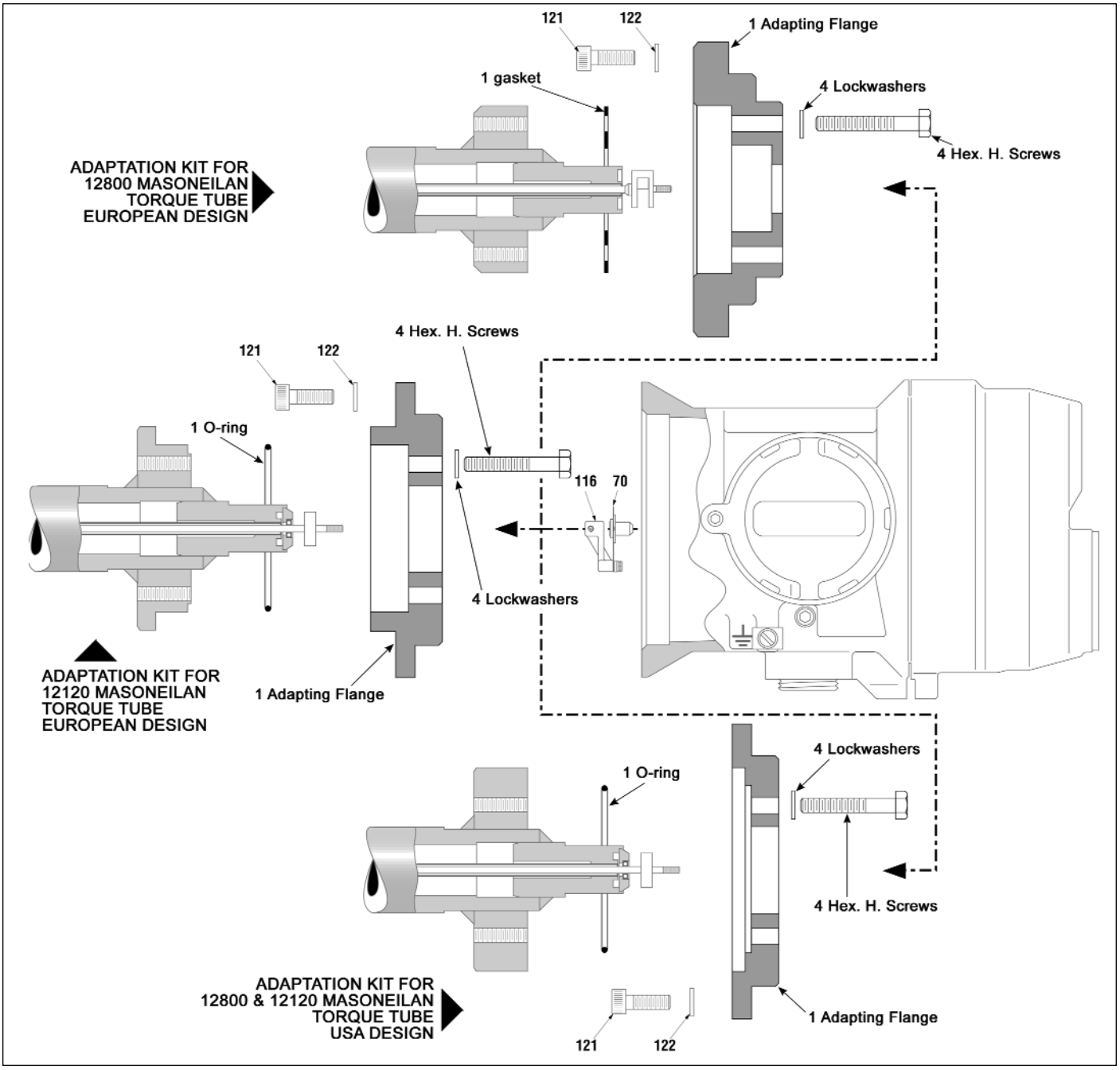


Figure 14 — Adaptation on 12800/12120 Torque Tube

g. Move to CALIBRATION menu to display [COUPLNG].

h. By looking through the side orifice, verify that the screw (62) coupling end of the beam (54) is loose. Through the 3/4" NPT hole at the bottom of the case, press the flexure (59) with your finger to verify it is possible to move the beam (54) from left to right. The value displayed should vary accordingly. ***Pin (72) must rotate freely inside the coupling end of the beam.***

i. Look at the mechanism through the lateral orifice and, by bending the flexure (59) toward the case front, index the oval hole of the flexure towards the special conical ended pin (53), (see Figure 15). Note the value read on the LCD — it should be between –5 and +5 %.

NOTE: At this step, verify that the weight used to simulate the displacer is stable. To obtain the ideal value (around 0 %), it can be necessary to slightly bend the flexure towards left or right (while keeping the conical pin (53) into the oval hole of the flexure).

j. While holding the flexure (59) in that position, slightly but firmly tighten the screw (62) using a 2.5 mm Allen wrench.

k. Remove your finger so that the flexure disengages the conical pin.

l. Read the value on the LCD. It should be remained between –5 and +5 %.

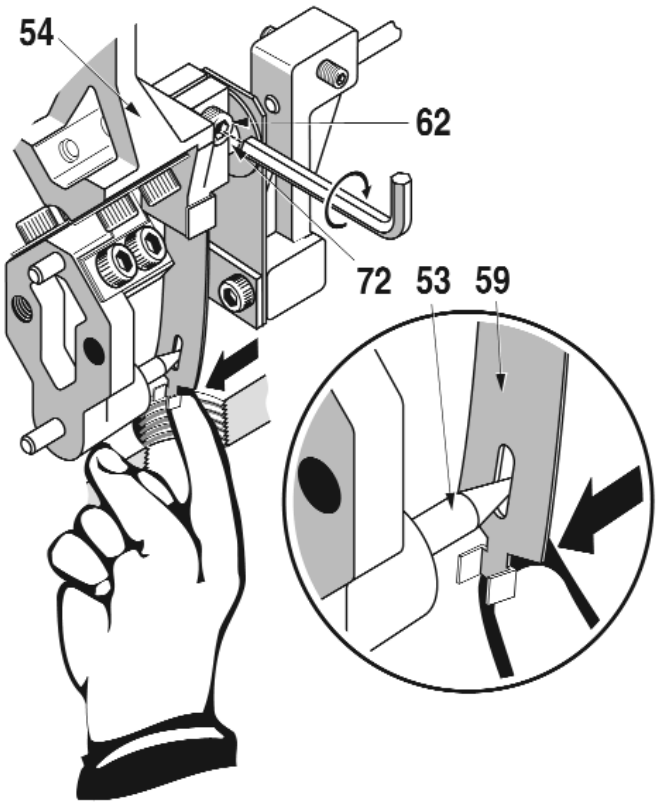


Figure 15
Indexing for Coupling Adjustment

NOTE : The torque applied to tight screw (62) inevitably modify the value read after Step i.

*So, if the displayed value is not acceptable, take note of the values gap between before and after tightening screw (62). Loose screw (62) and repeat steps **h** to **m** taking account of this values gap during the new Step i.*

m. If the displayed value is acceptable, adjust the specific gravity meter function [SGMETER] into [SGM CAL] (Section 5.3.2.1). Set adjusting screws (Section 6.2.5). Perform instrument calibration (Section 5.3.3 or 5.3.4).

6.2.4 Instrument Coupling to the Torque Tube on Site (in the Process Liquid)

The DLT case can be mounted on an already installed torque tube. In this case, procedures described in Section 6.2.3 should be performed on site.

In coupling the torque tube to the mechanism subassembly (which begin by step 6.2.3. d), two situations may occur :

- If the ***specific gravity (or the difference of the SG in case of an interface service)*** of the available liquid ***is between 0.7 and 1.4 :*** simulate half level $h_{(1.4)}$ of a 1.4 specific gravity liquid with a calculated value $h_{(d)}$ of the available liquid (refer to chart Figure 16).

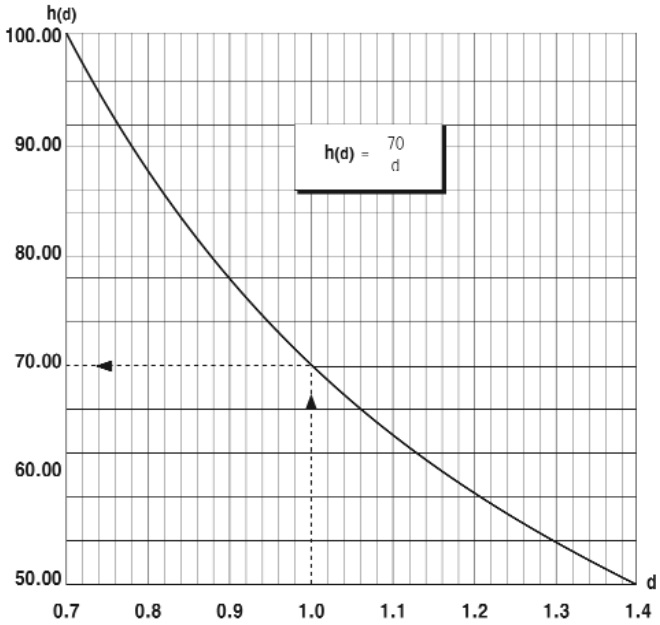


Figure 16
Curve of Half Level Simulation
in a Liquid with S.G. Between 0.7 and 1.4

- If the ***specific gravity*** (d3) ***(or the difference of the SG in case of an interface service)*** of the available liquid ***is below 0.7,*** perform the coupling at a high level.

  Caution : In this situation, the instrument must be used for specific gravities (or the difference of SG) ranging from 0.2 to 2 d_3.

a. If necessary, assemble the right adapter kit and verify that the torque tube is satisfactory — *See Sections 6.2.1 or 6.2.2.*

b. Install the instrument — *see Section 6.2.1 or 6.2.2.*

c. Make electrical connections — *See Section 4.4.*

d. Proceed with configuration of the instrument. *Refer to Section 5.1.4.4 – CONFIGURATION menu.*

e. Set the coupling between torque tube and mechanism subassembly — *See Section 6.2.3, Steps g to m.*

f. Calibrate the instrument — *See Section 5.3.3 or 5.3.4.*

6.2.5 Setting of Adjusting Screws for SG 1 in Level Service (Figures 12 & 19 to 21)

Two screws (114) are located in holes on the side of the case, closed by two plugs 1/8" NPT (115). They are positioned at factory assembly at the step following specific gravity meter calibration, (refer to Section 5.3.2.1). They can be adjusted at the time of calibration.

These adjusting screws allow the user on site :

- **For level interface service :** To calibrate the instrument, with or without liquid, (see Section 5.3.4.2.2, b.).
- **For liquid level service :** To simulate, without liquid, a change in level of a specific gravity 1 liquid.

In this last case, proceed as follows :

Caution : This procedure is only possible if the [SGMETER] function has been calibrated. Refer to Section 5.3.1.

To adjust stops, put the instrument into the preceding calibrated specific gravity meter function [SGMETER] (Refer to APPENDIX D).

Open the access plug (107) to look at the simulation mechanism. Remove the 3/4" NPT plug (190) located at the bottom of instrument.

Through the 3/4 " NPT opening, use your finger to move the flexure (59) in the direction of the torque tube until it seats on the smooth end of the screws (114). While maintaining pressure, slide the flexure to the right or the left until it stops against the screw shoulder. See Figure 12.

Relative to the instrument axis, adjust the screw on displacer side to simulate a high level of S.G. 1 liquid **(REF H)**. Use the screw on the side opposite to the displacer to simulate a low level **(REF L)** (displacer chamber empty).

In practice, proceed as follows :

a. Simulate low level **(REF L)** :

In the workshop, attach to the displacer arm a weight equal to actual displacer.

On site, the displacer chamber should be empty.

b. Using a 5 mm hex wrench, remove plugs (115).

c. Using push buttons, enter the DIAGNOSTIC Menu and move to the specific gravity meter function [SGMETER]. Validate by ✱. The LCD display a value around [0.000].

d. With the finger, move the flexure (59) until it seats on the shoulder of the screw opposite to displacer. Adjust screw (114) until LCD displays a value as near as possible of [0.000].

e. Move the flexure (59) until it contacts the shoulder of the displacer side screw. Adjust screw until LCD displays a value as near as possible of [1.000].

f. Quit the DIAGNOSTIC Menu and return to NORMAL Operation.

g. Release the flexure.

h. Screw the plugs (115-107-190).

6.3 Removing a DLT Case and Torque Tube Sub-assembly (see Figure 17)

a. Switch off power supply.

b. On instruments that include a displacer chamber, close isolation valves, and purge the chamber.

c. Remove upper flange (146) and blind flange (144).

d. Lower the torque arm (135) and unhook the displacer (130). A hook-shaped 3 mm steel wire will facilitate unhooking and holding of the displacer. The wire may be inserted through the clevis hole.

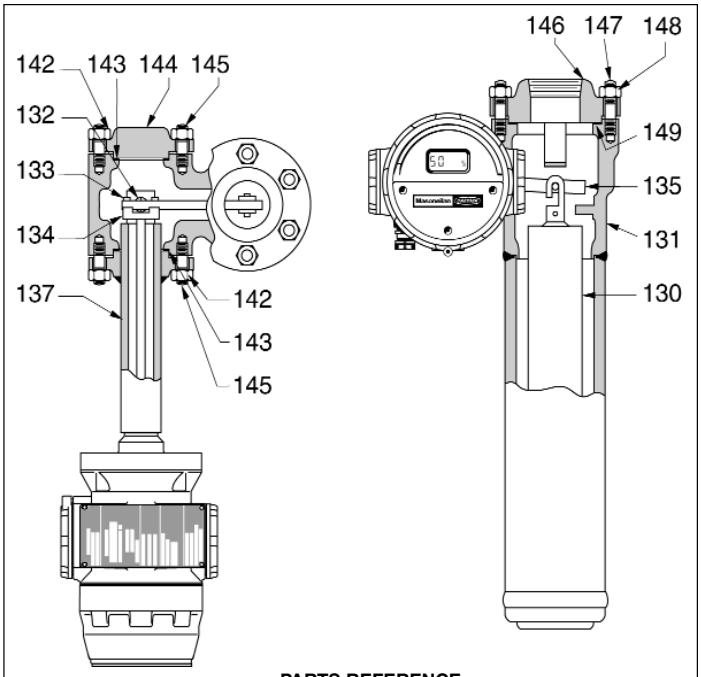
e. Remove the two torque arm screws (133) and remove the torque arm (135) from the chamber.

f. Remove displacer from its chamber (131) or tank.

g. Be sure that requirements for instruments installed in explosive areas are strictly followed.

Remove screw (106) from connection compartment and unscrew cover (104). Disconnect supply electric wires and other equipments from terminals (90).

h. Remove nuts holding the torque tube sub-assembly and slide the subassembly out of the mechanism chamber.



PARTS REFERENCE

130. Displacer	142. Stud Nut
131. Displacer Chamber	143. Gasket
132. Internal Knife Edge Block	144. Blind Flange
133. Torque Arm Screw	145. Stud
134. Torque Arm Block	146. Top Flange
135. Torque Arm	147. Top Flange Stud
137. Torque Tube Housing Assembly	148. Top Flange Stud Nut
	149. Top Flange Gasket

Figure 17

6.4 Installing a DLT Case and Torque Tube Sub-assembly (Figure 18)

CAUTION : The following method is valid only if the coupling between beam and torque rod has already been adjusted for the required mounting direction. (See Section 6.2.3).

The case mounting direction for which the coupling has been made may be identified as follows :

When the case is mounted and coupled to the torque tube (without torque arm nor displacer), the tip of the conical pin (53) is aligned with one side of the oval hole in the flexure (59) :

- **Left mounting : see Figure 18 a.**
- **Right mounting : see Figure 18 b.**

For installation, reverse the procedure outlined for removing a DLT case and torque tube subassembly (Section 6.3). It is recommended that new gaskets (143 - 149) be used when installation is performed, (refer to Figure 17).

NOTE : If the coupling does not match the mounting direction, verify that the screw (62) is loose and pin (72) is free to rotate in the coupling end of the beam (54) before hooking the displacer on the torque arm (135).

*Continue by performing operations **g** to **i** of Section 6.5, unless the instrument is already prepared and calibrated for the specific application required by the customer. In such a case, however, it is recommended that you check the adjustments of the specific gravity meter function and adjusting screws, as well as the calibration, before returning the instrument to normal service.*

6.5 To Reverse Instrument Case Mounting Relating to Displacer Position (Left or Right) (Figures 17, 19 to 21)

a. Follow instructions of Section 6.3 — Removing a DLT case and torque tube sub-assembly.

b. Install the case/torque tube subassembly on the opposite side of mechanism chamber [in place of flange (144)] and open the cover (107) of the mechanism compartment. It is recommended that you install a new gasket (143) when reassembling.

c. Using a 2,5 mm hex wrench, loosen the screw (62) of beam (54) to uncouple it from the torque rod.

d. Replace the displacer in the chamber (131) or in the tank and hold it temporarily with a 3 mm steel hook.

e. Insert torque arm (135) in mechanism chamber and assemble it to plate (134) by two screws (133).

f. Lower the free end of the torque arm (135) and hook the displacer (130). Reassemble the top flange (146) and blind flange (144) using new gaskets (149 & 143).

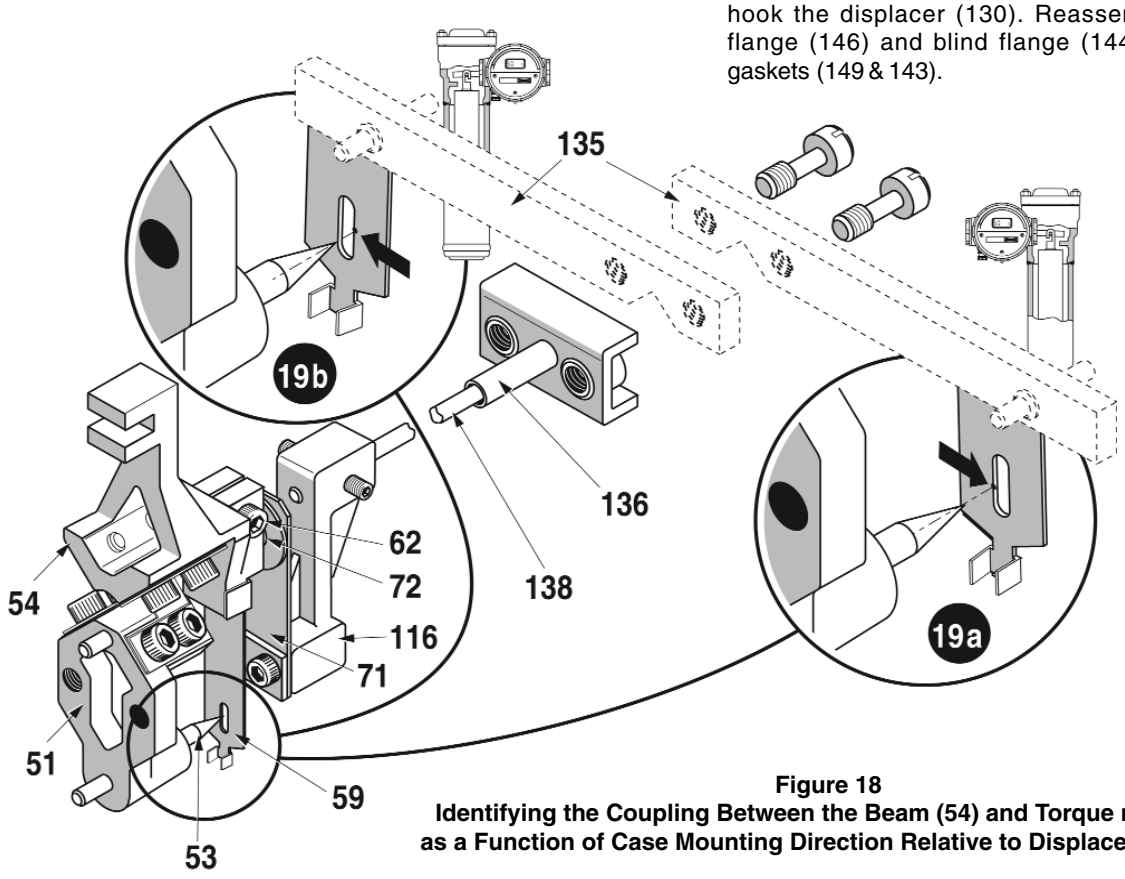


Figure 18
Identifying the Coupling Between the Beam (54) and Torque rod (138) as a Function of Case Mounting Direction Relative to Displacer Position

g. Remove the front plate (80) located in front of the instrument to gain access to the push buttons (27).

h. Enter the CONFIGURATION Menu and select the required configuration data corresponding to the new instrument position (refer to Section 5.1.4.4 and APPENDIX B).

i. Perform the coupling adjustment according to Section 6.2.4. If necessary, calibrate the specific gravity meter function and set adjusting screws per Sections 5.3.2.1 and 6.2.5. Proceed with calibration following Sections 5.2, 5.3.3 or 5.3.4.

NOTE : The specific gravity meter function and the adjusting screws are features of the transmitter. They permit a user to perform simulations that facilitate calibration in situations such as a no liquid low level when special interface displacers are used and for calibration with or without liquid in case of a level interface using a standard displacer. If such conditions are not present, however, these adjustments are optional.

6.6 Replacing the Amplifier and/or the Sensor

6.6.1 Removing (Figures 10, 19 & 21)

a. Switch off power supply. Partially unscrew safety screw (110) from main cover (20) so that it disengages from the case. Remove main cover (20).

b. Progressively and alternatively loosen the four screws (201) to remove the amplifier (200).

c. Disconnect the sensor connector (40) and connector (7) from the back of amplifier (200).

d. If the sensor shall be removed, unscrew the two screws (112) and remove the sensor (40) and its O-ring (111).

CAUTION : Do not pull on the sensor wires to remove the sensor from the case. Be careful not to damage the sensor or mechanism subassembly during this operation.

6.6.2 Installing (See Figures 10, 19 & 21)

a. If the sensor has been removed, slide the new sensor, equipped with new O-ring (111), into the case while observing the following :

- Orient the blue point toward the center of the case (another blue mark on the back of the case helps to verify correct position of the sensor).
- Do not turn the sensor while sliding into the case.
- Maintain horizontal alignment of both holes, **especially at the end of the insertion procedure.**
- Insert and tighten the two screws (112).

b. Connect the sensor connector (40) and connector (7) at the back of amplifier (200). Take care to correct position by means of the locking lugs. ***(above for the (40) connector and below for the (7) one).*** *Refer to Figures 19 and 21.*

c. Insert the amplifier (200) with four screws (201) inserted into the front of the case with the LCD facing the top.

d. Progressively and alternately insert the four screws (201) while pushing the amplifier against the bottom of the case. Tighten the four screws.

e. Close the main cover (20) and tighten safety screw (110). Switch on the power supply.

f. Configure the transmitter for the required service characteristics. Refer to Section 5.1.4.4.

g. Calibrate the specific gravity meter function and perform calibration. Refer to proper Sections 6.2.5 & 5.2 or 5.3.). Return to NORMAL Operating Mode.

6.7 Replacing the Mechanism Subassembly (50), (Figures 20 & 21)

CAUTION : Parts which constitute the mechanism subassembly (50), including elements (51 to 62) are assembled at the factory using high precision tools that guarantee highly accurate positioning, which is required to achieve specified performance. They should never been disassembled unless a malfunction occurs. The whole sub-assembly must then be replaced or returned to the factory for rebuild.

6.7.1 Removing

a. Switch off power supply. Unscrew safety screw (106) enough to disengage it from case. Remove cover (104) of the connection compartment. Disconnect supply wires from terminals (90).

b. Remove cover (107) of mechanism compartment. Using a 2.5 mm hex wrench, loosen screw (62) on beam (54) to uncouple it from the transmission rod.

c. While holding the case to prevent it from falling, loosen the four screws (121) with a 5 mm hex wrench and remove them and the associated washers (122). Remove the case by pulling it along the axis of the torque tube, using care to prevent any deformation of the coupling flexure (70).

NOTE : Do not remove flange (116) from torque rod (138) nor the coupling flexure subassembly (70).

d. Using a 3 mm hex wrench, remove the two screws (113) that fasten the mechanism subassembly to the case.

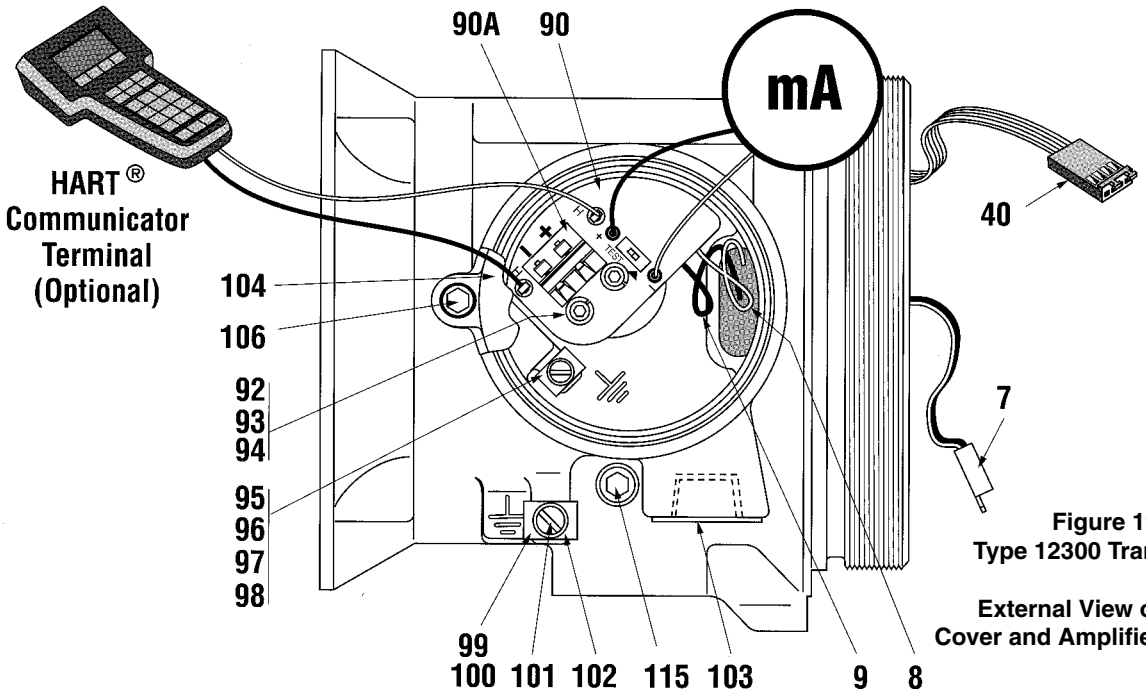


Figure 19
Type 12300 Transmitter

External View of Case, Cover and Amplifier Removed

Type 12300 Transmitter
Cross Section View
From Back

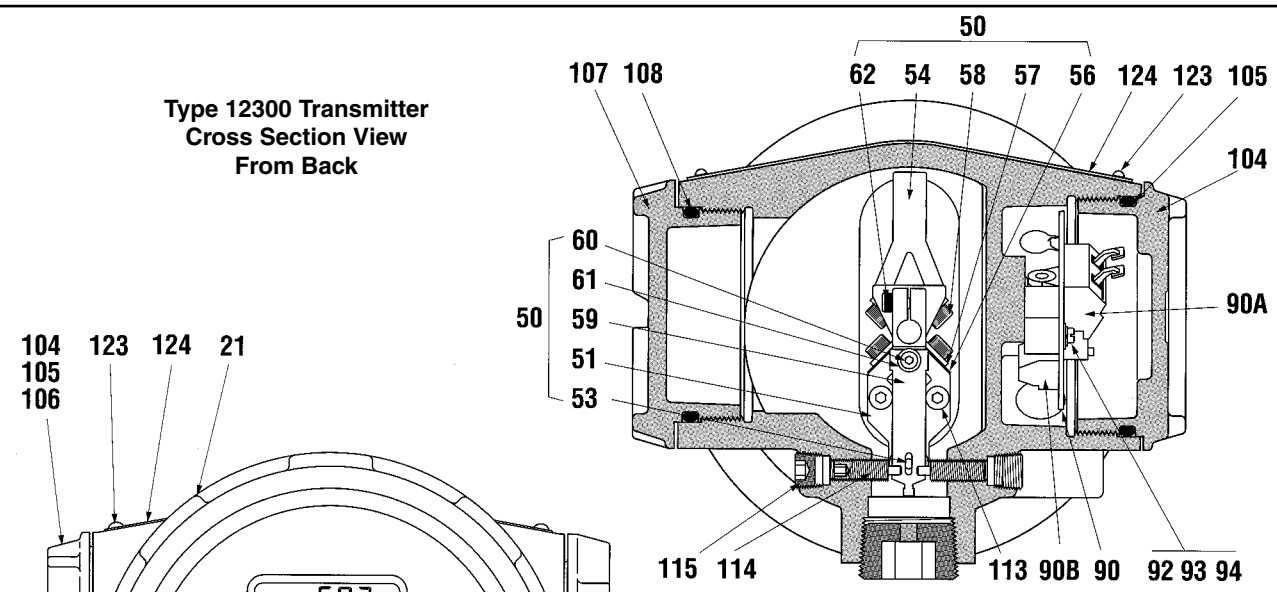
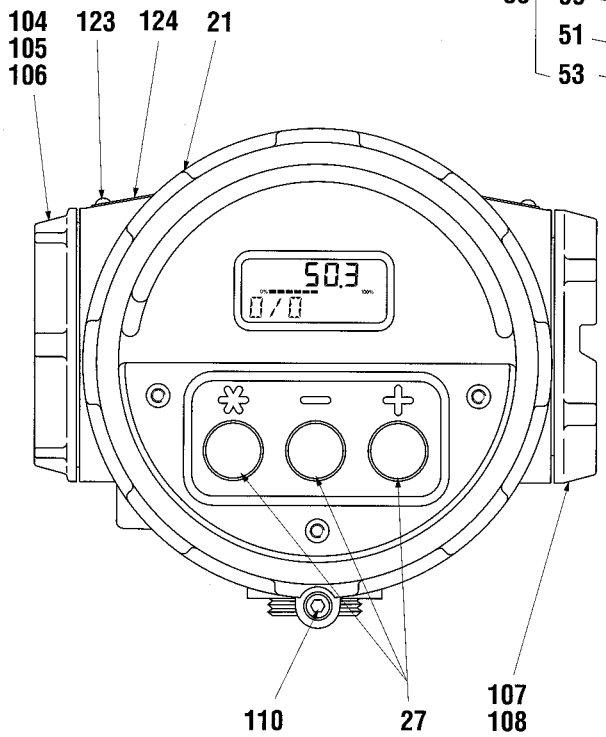


Figure 20



Type 12300 Transmitter
Front View

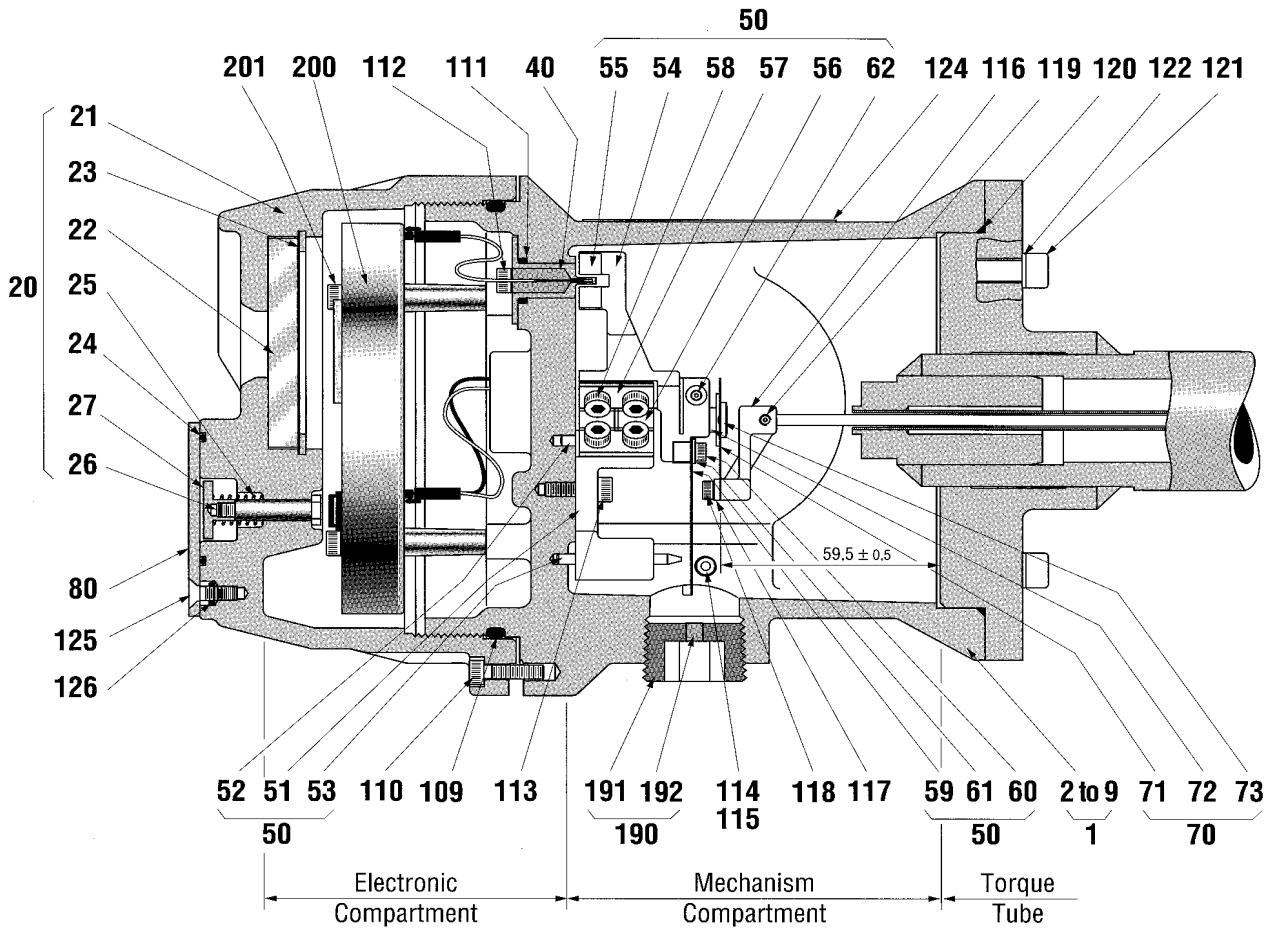


Figure 21 — Cross Section of Type 12300 Electronic Level Transmitter

PARTS REFERENCE

Ref. No	Qty	Parts Name
1	**1**	**Case S/A (incl. 2 to 9)**
2	1	Case
❑ 3	2	Radio Frequency Filter
7	1	Connecting Plug
8	1	Isolated Red Wire
9	1	Isolated Black Wire
20	**1**	**Main Cover S/A (incl. 21 to 27)**
21	1	Main Cover
22	1	Window
23	1	Truarc Ring
● 24	1	O-Ring (Front Plate)
25	3	Button Spring
26	3	Button Axis
27	3	Button
40	**1**	**Sensor S/A**
50	**1**	**Mechanism S/A (incl. 51 to 62)**
51	1	Pivot
52	1	Drive Pin
53	1	Conical Pin
54	1	Beam
55	2	Magnet
56	2	"U" Flexure
57	4	Flange (Flexure)
58	8	Screw (Fastening of Flexure)
59	1	Adjusting Flexure
60	1	Screw (Fast.^{ng} of Adj.^{ng} Flexure)
61	1	Washer
62	1	Adjusting Screw
70	**1**	**Coupling Flexure S/A (incl. 71 to 73)**
71	1	Coupling Flexure
72	1	Pin
73	1	Coupling Flexure Washer
80	**1**	**Front Plate S/A**
90	**1**	**Terminal Board**
90A	1	Flat Handle Terminal Block
90B	1	Terminal Board Connector
92	2	Screw (Term. Board Fastening)
93	2	Washer (Term. Board Fastening)
94	2	Lockwasher (Term. Board Fast.^{ng})
95	1	Washer
96	1	Clamp
97	1	Screw (Clamp)
98	1	Lockwasher
99	1	Washer
100	1	Clamp
101	1	Screw (Clamp)
102	1	Washer
103	1	Caplug (Only for Shipment)
104	1	Connection Compartment Cover
● 105	1	O-Ring (Connection Compart.^{nt})
106	1	Screw (Connection Compartment)
107	1	Access Plug
● 108	1	O-Ring (Access Plug)
● 109	1	O-Ring (Main Cover)
110	1	Safety Screw (Main Cover)
● 111	1	O-Ring (Sensor)
112	2	Screw (Fast.^{ng} of sensor)
113	2	Screw (Fast.^{ng} of Mechan. S/A)
114	2	Adjusting Screw
115	2	1/8" NPT Plug (Adjusting Screw)
116	1	Coupling Flange
117	1	Flexure Flange
118	2	Screw (Fastening of Coupling Flexure/Flange)
119	2	Screw (Fast.^{ng} of Coupling Fl. on Torque T Transm. Rod)
● 120	1	O-Ring (Case S/A on T. Tube)
121	4	Screw (Fast.^{ng} of Case S/A on T T.)
122	4	Lockwasher
123	4	Drive Screw
124	1	Specifications Plate
125	3	Screw (Front Plate/Main Cover)
● 126	3	O-Ring (Screw 125)
● **190**	**1**	**3/4" NPT Plug S/A (incl. 191 & 192)**
191	1	3/4"NPT Plug
192	1	Spongy Gasket
200	**1**	**Type 300 Circuit Board S/A**
201	4	Screw

❑ Not Shown

● Recommended Spare Parts

Bold Type : No Dissociable Sub-assembly

NOTE : After removing the two screws (113), dismounting the mechanism subassembly will be facilitated by using a M5 threaded rod with about four threads engaged in pivot (51) in place of right screw (113). The same threaded rod will also be useful during reassembly. (See Figures 20 & 21).

6.7.2 Installing

a. Install the new mechanism subassembly by engaging the two pins (52 & 53) in the case holes.

b. Assemble the two screws (113) and tighten them progressively and alternately. Be sure that pivot (51) perfectly contacts the back surface of the case so that the beam (54) will move in a plane strictly parallel to this surface.

c. Place a new gasket (120) on the torque tube flange. Verify that screw (62) of the coupling part of beam (54) is loose.

d. Continue the procedure by performing steps **f** to **j** of Section 6.2.1. — Mounting a DLT case on a torque tube.

e. Adjust coupling (Refer to proper Section 6.2.3 or 6.2.4).

f. Calibrate the specific gravity meter function, (Refer to Section 5.3.2.1). Set adjusting screws, (Refer to Section 6.2.5).

g. Recalibrate the instrument, (Refer to proper Section 5.2, 5.3.3 or 5.3.4)

7. trouble shooting

7.1 No Signal :

- Check connection wires to transmitter.
- Check polarities.
- Verify the correct position of the connectors (7) and (40) on the amplifier, (refer to Figures 19 & 21).

7.2 No Display but Signal Exists :

- Replace the amplifier.

7.3 Signal is Steady, No Change When Level Varies:

- Verify that the instrument is not in FAILSAFE Mode. If not, verify that the instrument display the Normal Operating screen [the instrument displays alternatively the loop current and the level expressed in the unit (% or engineering unit)],
- Verify coupling between transmission rod mechanism subassembly by moving flexure (59), which allows you to simulate a level change,
- Move to [SNR TST] in the DIAGNOSTIC Menu to verify Hall effect sensor. Refer to APPENDIX D.

7.4 If current output is not the same that current displayed :

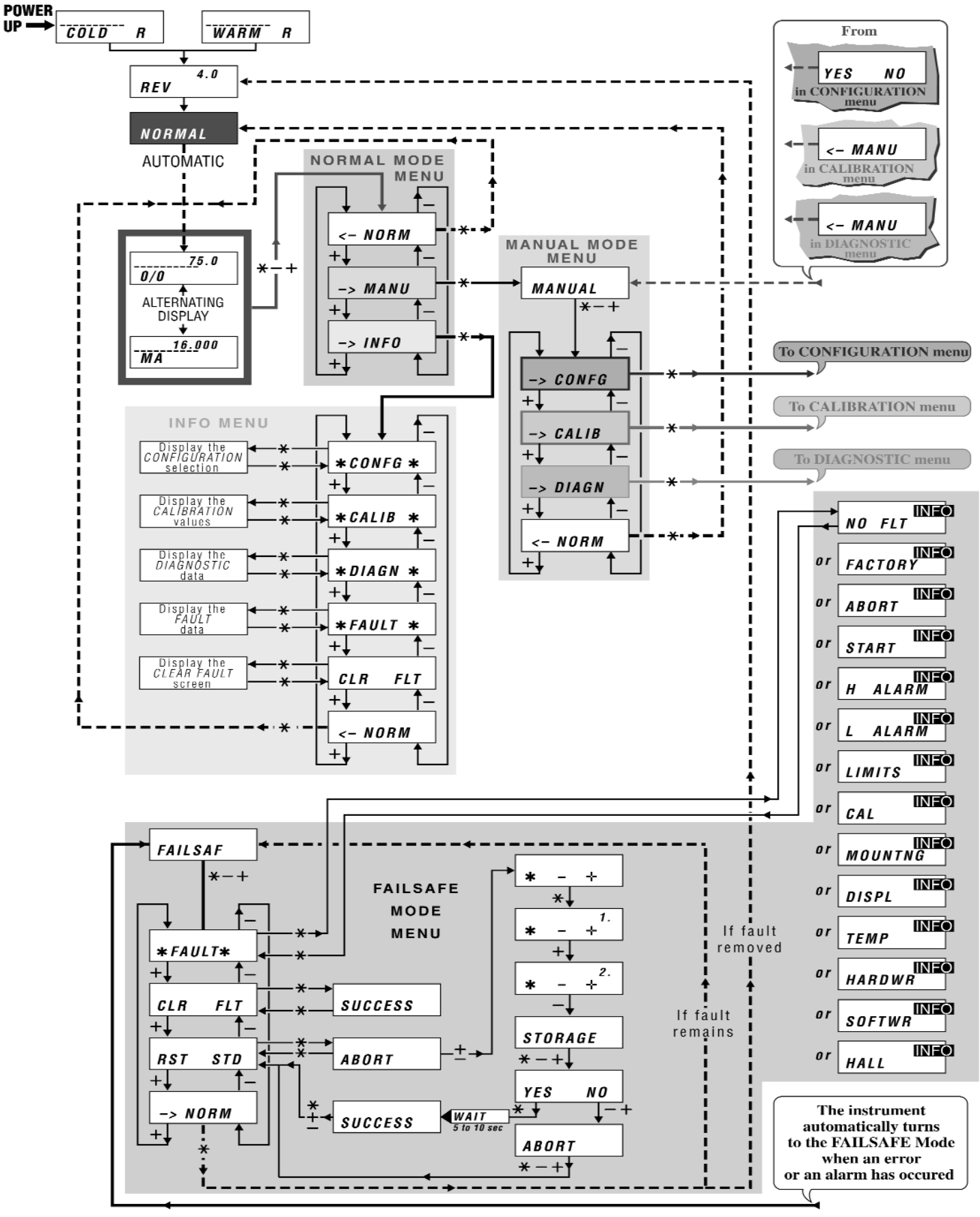
DANGER : Full compliance with standards requirements for instruments installed in hazardous areas must be insured.

- Insert a reference milliammeter in series with the power supply or connect it to the electronic board provided into the connection compartment,

  Put the switch on the "TEST" position. Connect the milliammeter on the two pins located on each side of the switch,
- To recalibrate the internal milliammeter, move to sub-menu [4 20 MA] via [CALIBR] in the CALIBRATION Menu. Refer to APPENDIX C,
- Move to [4 MA] then display [✱ – +$^{\#\#\#\#}$] by ✱. Decrease or increase value (ranges from 2900 to 3500 increment 1) until the reference milliammeter indicates 4.000 mA. Push ✱ again to return to [4 MA],
- Move to [20 MA] then display [✱ – +$^{\#\#\#\#}$] by ✱. Decrease or increase value (ranges from 2000 to 3500 increment 1) until the reference milliammeter indicates 20.000 mA. Push ✱ again to return to [20 MA],
- Move to [MA GENE] to generate different output current to verify the current loop regarding the reference milliammeter,
- Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens, then return to the [4 20 mA],
- When the setting is completed, move into the menu until [<–MANU] is displayed, then press ✱ to exit the CALIBRATION Menu and to display [MANUAL],
- Press ✱, –, ✱ : [NORMAL] appears for a few seconds and the instrument automatically returns to Normal Operating display,
- Before disconnecting the milliammeter put the switch back on the position identified by "▲". See Figure 19.

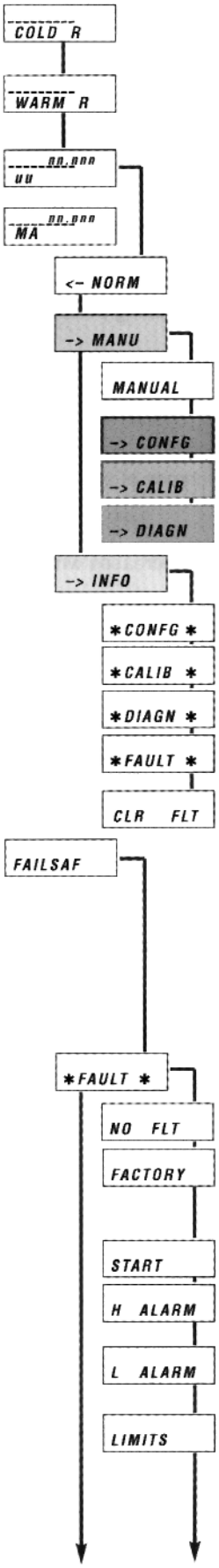
APPENDIX A

Normal Mode, Manual Mode, Failsafe Mode and Information Menu Screen Descriptions



APPENDIX A – Continuation

Normal Mode, Manual Mode, Failsafe Mode and Information Menu Screen Descriptions



COLD RESTART — Fugitive display appearing when the instrument is powered on after a long power cut.

WARM RESTART — Fugitive display appearing when the instrument is powered on after a micro power cut.

Display the value of the level or interface plan in the unit indicated in low left corner.

Display the value of the output current in mA.

NORMAL — In NORMAL MODE the screen displays in sequence the value of the level and of the output current. Validate by ✱ to return to *[NORMAL]*.

MANUAL — Validate by ✱ to go to MANUAL MODE Menu.

MANUAL — Validate by ✱/–/+ to enter sub-menu *[–>CONFG], [–>CALIB], [–>DIAGN]* and exit by *[–>NORM]*.

CONFIGURATION — Validate by ✱ to go to CONFIGURATION Menu.

CALIBRATION — Validate by ✱ to go to CALIBRATION Menu.

DIAGNOSTIC — Validate by ✱ to go to DIAGNOSTIC Menu.

INFORMATION — Validate by ✱ to read the various informations stored in the memory of the instrument.

CONFIGURATION — Validate by ✱ to read the actual configuration data.

CALIBRATION — Validate by ✱ to read the actual calibration data.

DIAGNOSTIC — Validate by ✱ to read the actual diagnostic data.

FAULT — Validate by ✱ to read the possible fault(s) which may have occured since the last "CLEAR FAULT" was performed.

CLEA**R F**AU**LT** — Validate by ✱ to read informations on the cleared faults.

FAILSAFE — Displayed when instrument has gone to Failsafe mode ; this may occur when :

- The alarm(s) have been set on and the level is higher than *[ALRMH]* or lower than *[ALRML]*.
- The Hall effect sensor is disconnected.
- The current loop is frozen to :
  - The last value before going to FAILSAFE if *[FAIL O]* was selected in CONFIGURATION Menu.
  - The value set if *[FAIL I]* was configured.

FAULT — Validate by ✱ to know the fault which has induced going to FAILSAFE Mode.

NO FAU**LT**

FACTORY — Set in CALIBRATION Menu if "RESET STANDARD" is performed and SPECIFIC GRAVITY METER has never been previously calibrated by the Factory.

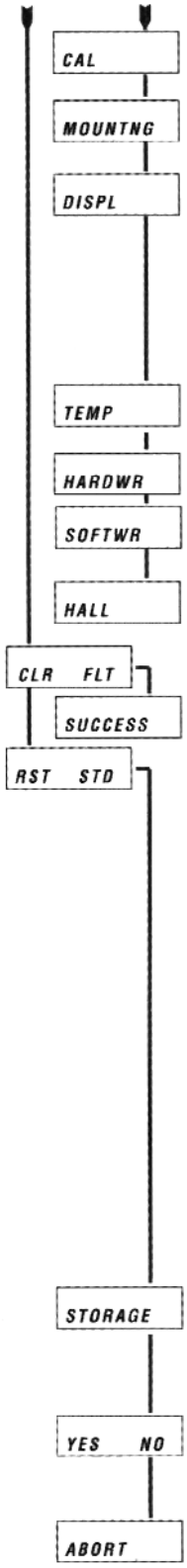
START — Set after every power on or HART® reset command.

HIGH **ALARM** — Set after TIME 1 has elapsed with level (in engineering unit) > *[H ALARM]* ± 5%. Set if TIME 2 has elapsed.

LOW **ALARM** — Set after TIME 1 has elapsed with level (in engineering unit) < *[L ALARM]* ± 5%. Set if TIME 2 has elapsed.

LIMITS — Set if : specific gravity of calibration or service is below .01 for level transmitter or difference of specific gravities of calibration or service is below .01 for interface transmitter.
Set if : displacer characteristics specified in the transmitter data base are not adapted regarding specific gravity of calibration or specific gravity used.

Normal Mode, Manual Mode, Failsafe Mode and Information Menu Screen Descriptions



CALIBRATION

Transmitter / Sgmeter calibration impossible regarding tests : Tank empty or full left or right mounting.

MOUNTING

Mounting configuration (left or right) conflicts ZERO and SPAN transmitter calibration : Recoupling torque tube is necessary or recalibrate.

DISPLACER

Set if :

- Level range (*[LEVEL H] – [LEVEL L]*) expressed in engineering unit (length) is greater than the displacer height entered in the instrument data base.
- Instrument configured for interface and the Low Specific Gravity of Service *[LSG SER]* is set to a value smaller than Low Specific Gravity of Calibration *[LSG CAL].*

TEMPERATURE

Temperature sensor on electronic board out of service or board temperature out of normal range (< – 50 °C or > 100 °C).

HARDWARE

Voltage reference out of normal range or E^2 PROM write procedure failed.

SOFTWARE

No refreshed data from the A/D converter or watch dog set : Software in closed loop or bad main logic initialization.

HALL

Sensor disconnected or sensor fault (set during *[SNR TST]* in DIAGNOSTIC Menu) or Hall output out of electronic board input or Hall current incorrect.

CLEA**R F**AU**LT**

Validate by ✱ to perform CLEAR FAULT procedure.

SUCCESS

Indicates that procedure has been correctly executed.

RESET STANDARD

Validate by ✱ to return instrument to factory settings :

CONFIGURATION		CALIBRATION		DIAGNOSTIC	FILLING
LEVEL	100.0 ALRMH 0	0.0 DAMPING	1.000 SG CAL	0.0 FILLING	4.0 W INTG
LEFT	– 1.0 TIME 1	4.000 MA L	1.000 SG SER	0.0 TIME L	0.61 DZ INTG
DIRECT	– 1.0 TIME 2	20.000 MA H	1.000 SGM CAL	0.0 TIME H	0.1 W VAL
CTRL 0	ENGLISH	0.0 LEVEL L		0.0 TIME W	
3.600 FAIL 0		100. LEVEL H	0.0 LSG CAL		
0.0 ALRML 0		0/0	1.0 HSG CAL		
		0.00 ZERO <–>	0.0 LSG SER		
		0.00 SPAN >–<	1.0 HSG SER		

AFTER A "RESET STANDARD" ALL PARAMETERS SHALL BE DONE AGAIN

STORAGE

Validate by ✱ to start the storage procedure of the "resetted to standard" parameters in the instrument memory. Storage of standard configuration and calibration will be effective only after completion of next step.
It is necessary to go through this step to return to Failsafe sub-menu.

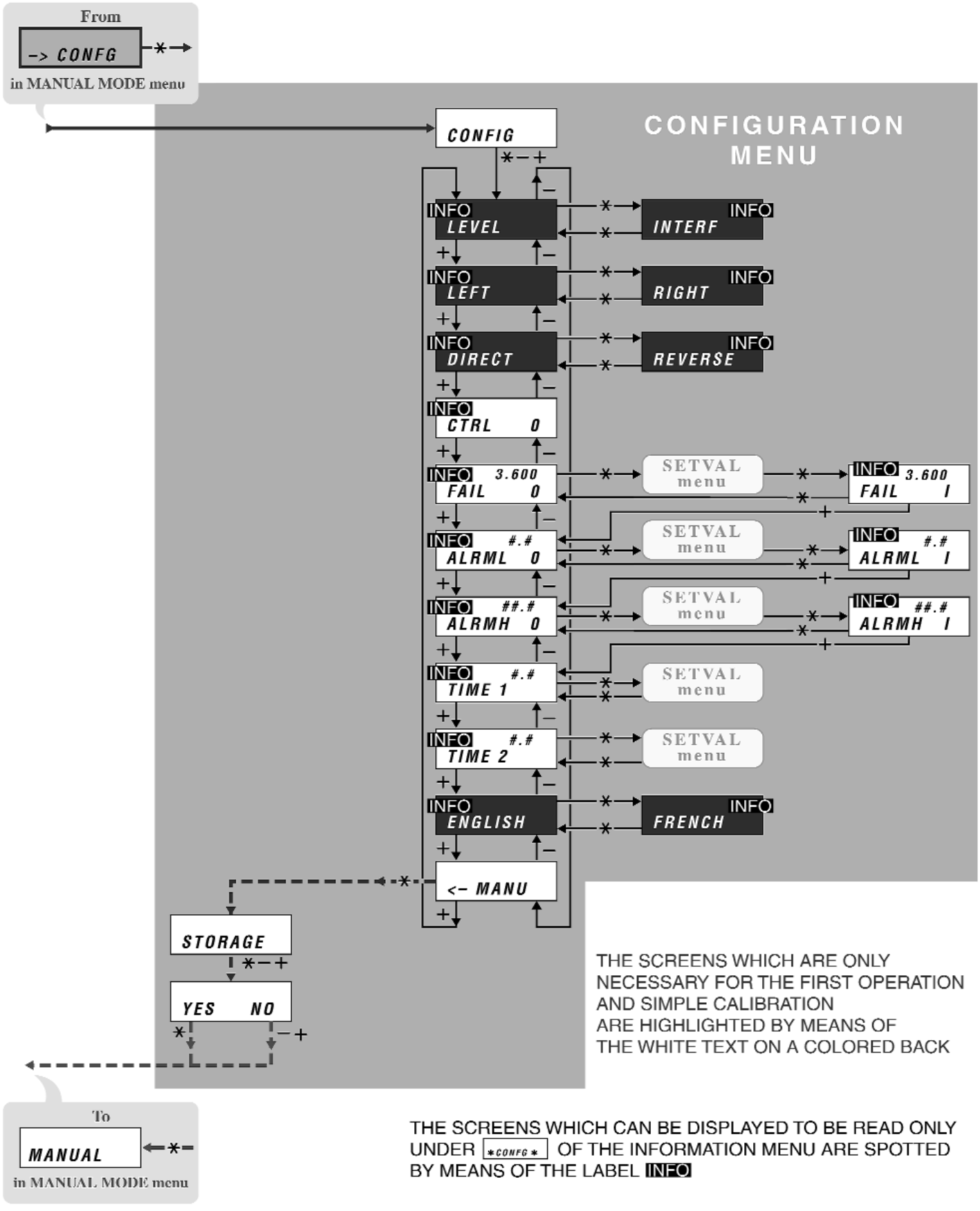
YES NO

Validate by ✱ (YES) to finalize the storing procedure of the "resetted to standard" parameters. Pushing + or – (NO) will abort the storage ; the configuration and calibration parameters set previously will stay in the instrument memory.

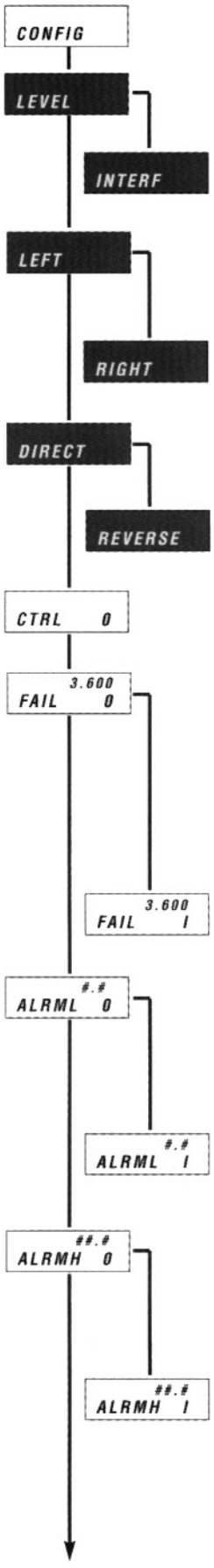
ABORT

Validate by ✱ to avoid running the Reset to Standard procedure.

APPENDIX B


From
-> CONFG
in MANUAL MODE menu
CONFIG
CONFIGURATION MENU
INFO LEVEL
INFO INTERF
INFO LEFT
INFO RIGHT
INFO DIRECT
INFO REVERSE
INFO CTRL 0
INFO 3.600 FAIL 0
SETVAL menu
INFO 3.600 FAIL I
INFO #.# ALRML 0
INFO #.# ALRML I
INFO ##.# ALRMH 0
INFO ##.# ALRMH I
INFO #.# TIME 1
INFO #.# TIME 2
INFO ENGLISH
INFO FRENCH
<- MANU
STORAGE
YES NO
To
MANUAL
in MANUAL MODE menu
THE SCREENS WHICH ARE ONLY NECESSARY FOR THE FIRST OPERATION AND SIMPLE CALIBRATION ARE HIGHLIGHTED BY MEANS OF THE WHITE TEXT ON A COLORED BACK
THE SCREENS WHICH CAN BE DISPLAYED TO BE READ ONLY UNDER *CONFG* OF THE INFORMATION MENU ARE SPOTTED BY MEANS OF THE LABEL INFO

APPENDIX B – Continuation



CONFIGURATION — Validate by ✱ to enter the CONFIGURATION Menu.

LEVEL — The instrument measures the level of a liquid in which the displacer is partially immersed.

INTERFACE — The transmitter is used to measure the interface level between 2 non miscible liquids of different specific gravities. The displacer must be always immersed.

LEFT — This item should be selected in accordance with the relative mounting positions of the displacer versus the instrument housing ; The standard mounting positions "LEFT", also called "Left hand mounting". Refer to Figure 7.

RIGHT — Optionally, the mounting position may be "RIGHT", also called "Rigth hand mounting".

DIRECT — Standard action is "Direct" ; an increase in level induces an increase of the loop current.

REVERSE — Optionally, a Reverse action can be selected : The loop current decreases when the level increases.

CON**TR**O**L**LER **O**FF — A built in process controller may be available in the future. Not yet implemented in the instrument.

FAILSAFE **O**FF — Validate by ✱ to enter SETVAL menu and set the loop current value (from 3.6 mA to 23 mA) which will occur in case of failsafe mode but only if *[FAIL I]* is validated . Push ✱ again to go out of SETVAL menu and to display *[FAIL I]*, then push + to validate *[FAIL I]* and go to next step *[ALRML O]* in CONFIGURATION Menu.

If *[FAIL O]* is kept in Configuration, the loop current when instrument goes to FAILSAFE mode will be frozen to the value just before *[FAILSAF]* is displayed.

FAILSAFE **I**N — Validate by pushing + to go to next step in CONFIGURATION MODE menu. If ✱ is pushed, *[FAIL O]* is displayed.

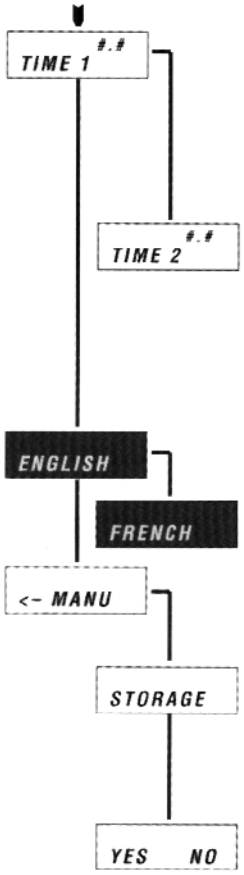
ALA**RM L**OW **O**FF — Validate by ✱ to enter SETVAL menu and set the level (value expressed in the unit choosen in CALIBRATION Menu ; value from *[LEVEL L]* to *[LEVEL H]*) below which a Low Alarm will be set (only if *[TIME 1]* is > 0) and instrument will go to Failsafe (only if *[TIME 2]* is > 0).
Push ✱ again to go out of SETVAL menu and to display *[ALRML I]*.

ALA**RM L**OW **I**N — When displayed, push + to validate : The next step in configuration *[ALRMH O]* will appear. To skip setting the Low Alarm On, push ✱ ; *[ALRML O]* is displayed.

ALA**RM H**IGH **O**FF — Validate by ✱ to enter SETVAL menu and set the level (value expressed in the unit choosen in CALIBRATION Menu ; value from *[LEVEL L]* to *[LEVEL H]*) above which a High Alarm will be set (only if *[TIME 1]* is > 0) and instrument will go to Failsafe (only if *[TIME 2]* is > 0).
Push ✱ again to go out of SETVAL menu and to display *[ALRMH I]*.

ALA**RM H**IGH **I**N — When displayed, push + to validate : The next step in configuration *[TIME 1]* will appear. To skip setting the High Alarm On, push ✱ ; *[ALRMH O]* is displayed.

CONFIGURATION MENU SCREENS DESCRIPTION



TIME 1

Validate by ✱ to enter SETVAL sub-menu. Set the time duration in seconds which will elapse between the moment the level goes higher than ALRMH value (or lower than ALRML) and the moment the Alarm information is set in FAULTS list. This function is disabled if *[TIME 1]* is a negative number. Can be set only if *[ALRML I]* or *[ALRMH I]* is configured. Value from –1 to 1000 seconds.

TIME 2

Validate by ✱ to enter SETVAL sub-menu. Set the time duration in seconds which will elapse between the moment the level goes higher than ALRMH value (or lower than ALRML) and the moment the instrument goes in FAILSAFE mode. This function is disabled if *[TIME 2]* is a negative number. Can be set only if *[ALRML I]* or *[ALRMH I]* is configured. Value from –1 to 1000 seconds.

ENGLISH

The symbols displayed on the screen will be in English language.

FRENCH

The symbols displayed on the screen will be in French language.

to **MANU**AL

Validate by ✱ to quit the CONFIGURATION Menu and return to *[–> CONFG]* in Normal Mode menu.This is the only way to quit the CONFIGURATION Menu.

STORAGE

Validate by ✱ to start the storage procedure of the configuration parameters set above in the instrument memory. Storage of new configuration will be effective only after completion of next step. It is necessary to go through this step to quit the CONFIGURATION Menu.

YES NO

Validate by ✱ (YES) to finalize the storing procedure of the new configuration. Pushing **+** or **–** (NO) will abort the storage ; the configuration changes made previously will not become effectif and the old configuration will be kept in the instrument memory.

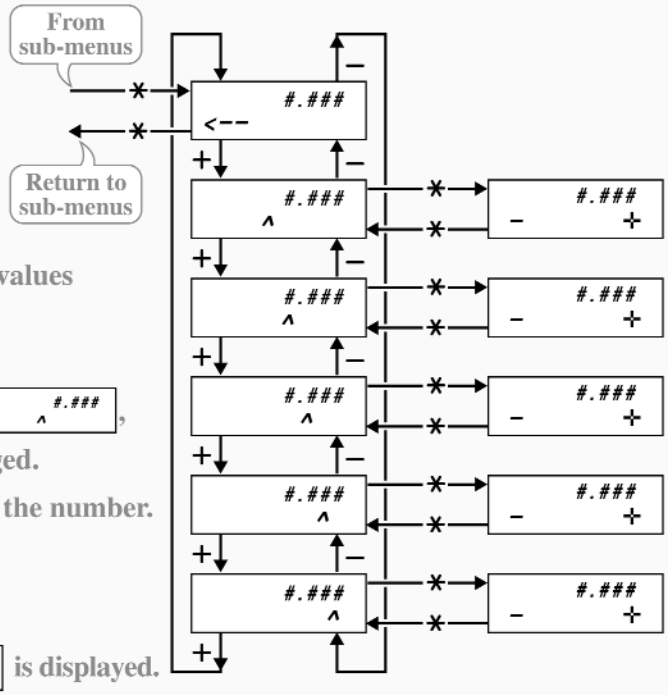
SETVAL MENU

This SETting VALues menu is used to set numerical values for any function requiring such an action.

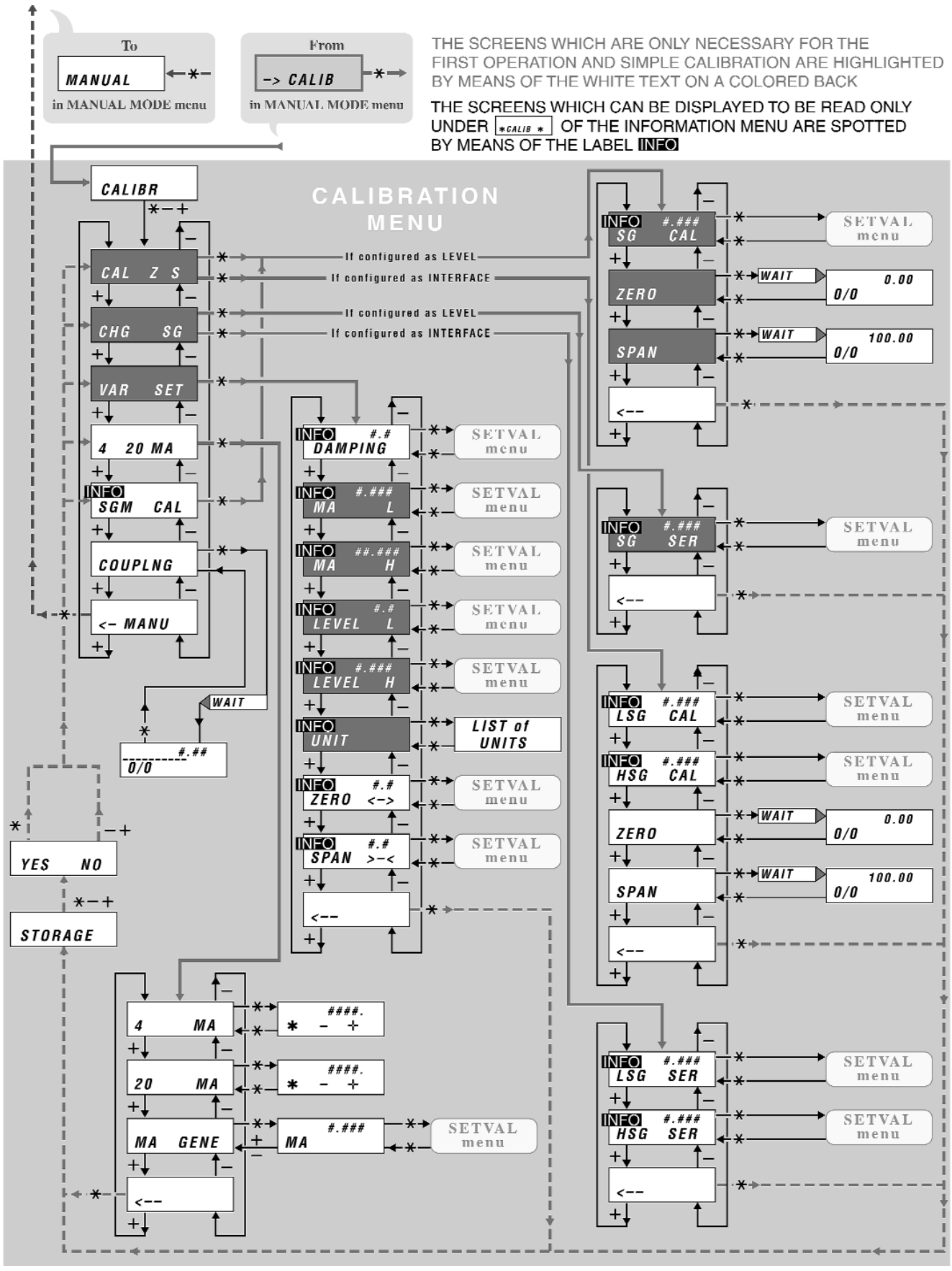
When <-- #.### is displayed, push + to display ^ #.###, then to shift the sign ^ below the number to be changed.
Push ✱ to display – #.### +. Push + or – to change the number.

Validate by ✱. Repeat for each digit.

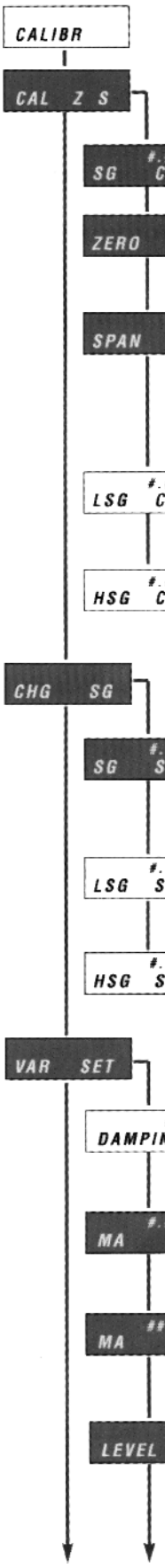
Quit the SETVAL menu by pushing ✱ when <-- #.### is displayed.



APPENDIX C


To
MANUAL
in MANUAL MODE menu
From
-> CALIB
in MANUAL MODE menu
THE SCREENS WHICH ARE ONLY NECESSARY FOR THE FIRST OPERATION AND SIMPLE CALIBRATION ARE HIGHLIGHTED BY MEANS OF THE WHITE TEXT ON A COLORED BACK
THE SCREENS WHICH CAN BE DISPLAYED TO BE READ ONLY UNDER *CALIB * OF THE INFORMATION MENU ARE SPOTTED BY MEANS OF THE LABEL INFO
CALIBRATION MENU
CALIBR
CAL Z S
CHG SG
VAR SET
4 20 MA
INFO SGM CAL
COUPLNG
<- MANU
If configured as LEVEL
If configured as INTERFACE
If configured as LEVEL
If configured as INTERFACE
INFO #.# DAMPING
INFO #.### MA L
INFO ##.### MA H
INFO #.# LEVEL L
INFO #.### LEVEL H
INFO UNIT
INFO #.# ZERO <->
INFO #.# SPAN >-<
<--
LIST of UNITS
SETVAL menu
WAIT
#.## 0/0
YES NO
STORAGE
4 MA
20 MA
MA GENE
<--
####.
#.###
MA
INFO #.### SG CAL
ZERO
SPAN
<--
WAIT
0.00
0/0
100.00
0/0
INFO #.### SG SER
INFO #.### LSG CAL
INFO #.### HSG CAL
INFO #.### LSG SER
INFO #.### HSG SER

APPENDIX C – Continuation



CALIBRATION

Validate by ✱ to enter CALIBRATION Menu.

CALIBRATION
ZERO **S**PAN

Validate by ✱ to get to sub-menu for Specific Gravity of Calibration setting, Zero and Span calibration.

SPECIFIC **G**RAVITY for **CAL**IBRATION

Validate by ✱ to enter SETVAL menu and set the specific gravity of the liquid used during the calibration procedure. Settable value ranges from 0.001 to 10.

ZERO

When displayed, put (or simulate) displacer fully out of liquid. Wait till the displacer is stable before pushing ✱ to let instrument know **(REF L).** (See Section 5.3.3.1).

SPAN

When displayed, put (or simulate) displacer fully immersed in liquid. Wait till the displacer is stable before pushing ✱ to let instrument know **(REF H)** , (See Section 5.3.3.1); *[ERROR]* may be displayed if displacer is still in situation described previously (*[ZERO]*) while pushing ✱.

LOW **S**PECIFIC **G**RAVITY of **CAL**IBRATION

Used in case of an Interface instrument. Validate by ✱ to enter SETVAL menu and declare the Specific Gravity of the lighter liquid used for calibration. Settable values range from .001 to the value of *[HSG CAL]*.

HIGH **S**PECIFIC **G**RAVITY of **CAL**IBRATION

Used in case of an Interface instrument. Validate by ✱ to enter SETVAL menu and declare the Specific Gravity of the heavier liquid used for calibration. Settable values range from the value of *[LSG CAL]* to 10.0.

CHAN**G**E **S**PECIFIC **G**RAVITY

Enter that function to set the specific gravity of service in case it is different from the Specific Gravity of Calibration.

SPECIFIC **G**RAVITY of **SER**VICE

Validate by ✱ to enter SETVAL menu and set the Specific Gravity of the liquid of service if it is different from the Specific gravity of Calibration. Settable value ranges from 0.001 to 10.

LOW **S**PECIFIC **G**RAVITY of **SER**VICE

Used in case of an Interface instrument. Validate by ✱ to enter SETVAL menu and set the Specific Gravity of the lighter liquid in service if it is different from *[LSG CAL]*. Settable values range from .001 to the value of *[HSG SER]* .

HIGH **S**PECIFIC **G**RAVITY of **SER**VICE

Used in case of an Interface instrument. Validate by ✱ to enter SETVAL menu and set the Specific Gravity of the heavier liquid in service if it is different from *[HSG CAL]*. Settable values range from *[LSG SER]* to 10.0.

VARIABLES **SET**TINGS

Validate by ✱ to enter sub-menu to calibrate *[DAMPING], [MA L], [MA H], [LEVEL L], [LEVEL H], [UNIT]* and ZERO and SPAN for reduced scale.

DAMPING

First order filtering function which acts on the loop current ; Time set corresponds to response at 63 % assuming a level step change. Can be set between 0.1 s and 32 s. Validate by ✱ to enter SETVAL menu.

MILLI**A**MP **L**OW

Validate by ✱ to enter SETVAL menu and set the current corresponding to **(REF L)** (see Section 5.3.3.1). Allows to correct for best independant linearity. Value ranges from 3.8 mA to the value of *[MA H]* .

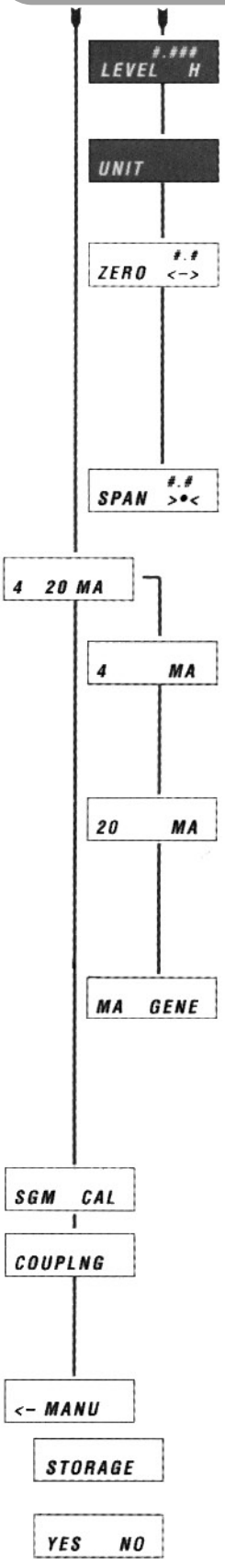
MILLI**A**MP **H**IGH

Validate by ✱ to enter SETVAL menu and set the current corresponding to **(REF H),** (see Section 5.3.3.1). Allows to correct for best independant linearity. Value ranges from value of *[MA L]* to 20.5 mA.

LEVEL LOW

Validate by ✱ to enter SETVAL menu and set the level expressed in industrial unit in correspondance with **(REF L),** (see Section 5.3.3.1)**.** Always set at 0 if UNIT is %. Value ranges from 0 to value of *[LEVEL H]* .
Since *[LEVEL L]* must be always smaller than *[LEVEL H]*, it may be necessary to set the value of *[LEVEL H]* before the one of *[LEVEL L]*.

CALIBRATION MENU SCREENS DESCRIPTION



LEVEL HIGH

Validate by ✱ to enter SETVAL menu and set the level expressed in industrial unit in correspondance with **(REF H),** (see Section 5.3.3.1). Always set at 100 if UNIT is %. Value ranges from value of *[LEVEL L]* to 9999.9.

UNIT

Validate by ✱ to display a list of units (one unit at a time) to express the level value (push **+** to scroll through the list) ; may be % of REF range or heigth or volume of liquid in tank, etc…

ZERO

Validate by ✱ to enter SETVAL menu and set the zero of a reduced range (see Section 5.3.2.5). In case of an interface instrument, when the specific gravities of service *[LSG SER]* and *[HSG SER]* are different from those of calibration *[LSG CAL]* and *[HSG CAL], [ZERO <–>]* will be automatically set to the value resulting from formula :

([LSG SER] – [LSG CAL]) / ([HSG SER] – [LSG SER])

Value ranges from – 9999.9 % to 9999.9 % .

SPAN

Validate by ✱ to enter SETVAL menu and set the span of a reduced range (see Section 5.3.2.5). Value ranges from 0.0 % to 99 %.

4 20 MA

Validate by ✱ to enter the sub-menu allowing to calibrate the internal ampmeter or force the loop current to a value set through function *[MA GENE].*

4 MILLIA**M**P

Allows to calibrate the internal current measurement. ***This re-calibration is normally not necessary and requires to put in serie with the instrument a very precise ampmeter.*** If nevertheless required, validate by ✱ to display *[✱ – +$^{\#\#\#\#}$]*. Decrease or increase value (ranges from 2900 to 3500 ; increment 1) until the reference ampmeter indicates 4.000 mA. Push ✱ again to return to *[4 MA].*

20 MILLI**A**MP

Allows to calibrate the internal current measurement. ***This re-calibration is normally not necessary and requires to put in serie with the instrument a very precise ampmeter.*** Validate by ✱ to display *[✱ – +$^{\#\#\#\#}$]*. Decrease or increase value (ranges from 2000 to 3500 ; increment 1) until the reference ampmeter indicates 20.000 mA. Push ✱ again to return to *[20 MA]*.

MILLI**A**MP **GENE**RATOR

Allows to set another instrument (such that positioner) in serie in the loop, to generating the required output current. Validate by ✱ to display *[MA $^{\#.\#\#\#}$]* and set the loop current to any value between 3.6 and 23.0 mA. Default value is 4.000 mA. Push ✱ again to enter SETVAL menu and push ✱ again to display *[MA $^{\#.\#\#\#}$]* and force the current to the displayed value. Push **+** or **–** to return to *[MA GENE].* The value set is not put in the instrument memory.

SPECIFIC **G**RAVITY **M**ETER **CAL**IBRATION

Validate by ✱ to calibrate the Specific Gravity Meter Proceed with *[CAL Z S]* sub-menu. Refer to Sections 5.3.1 & 5.3.2.1.

COUPLING

Only necessary on instrument head delivered alone. Function used while mechanically couple the sensor to the torque tube rod. Requires to simulate a displacer half immersed in a liquid of SG 1.4. The value read should be between – 5 % and + 5 %. See Sections 6.2.3 & 6.2.4.

MANUAL

Validate by ✱ to return to *[MANUAL]* in Normal Mode menu.

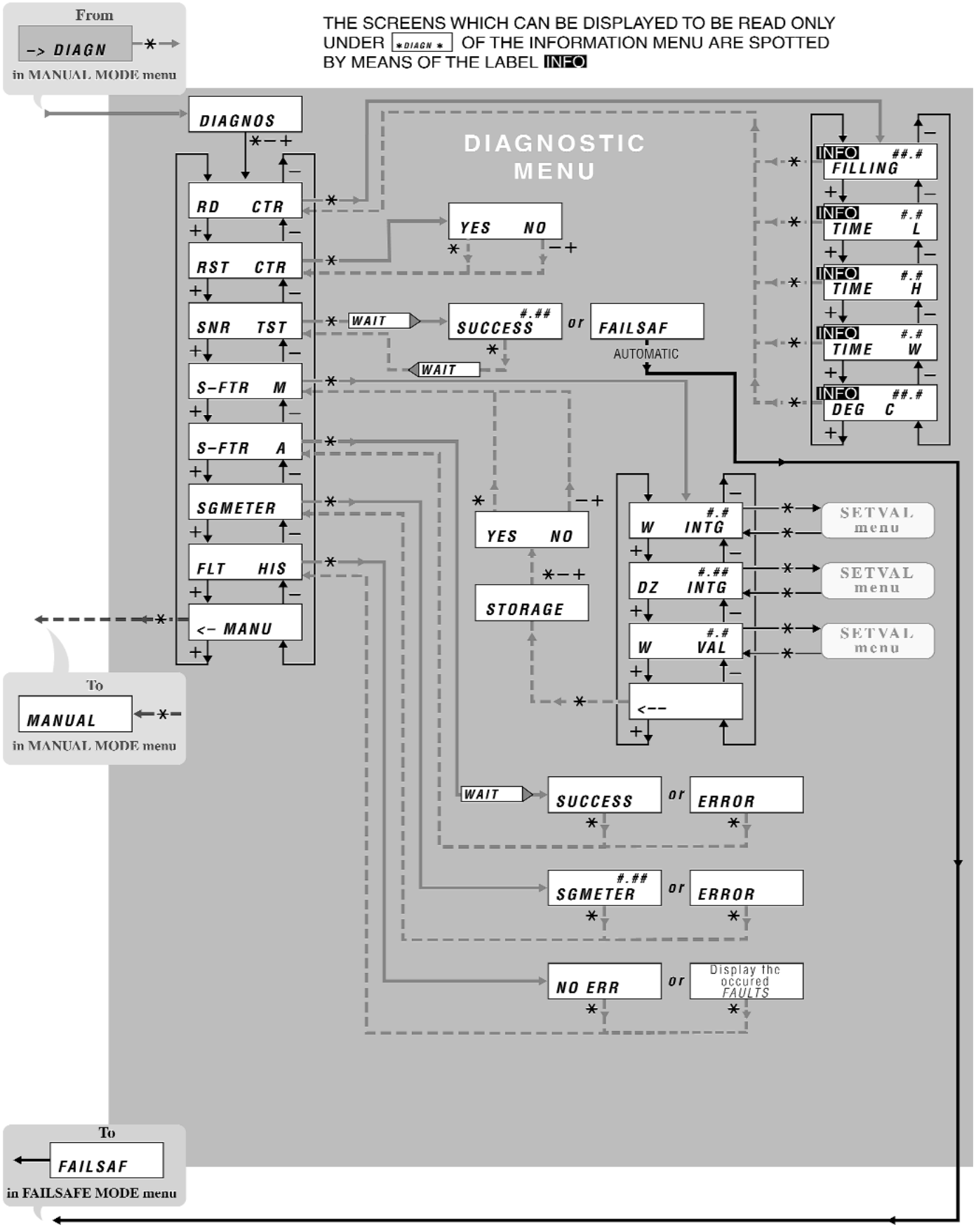
STORAGE

Starts the procedure to store the various calibration data into the memory of the instrument.

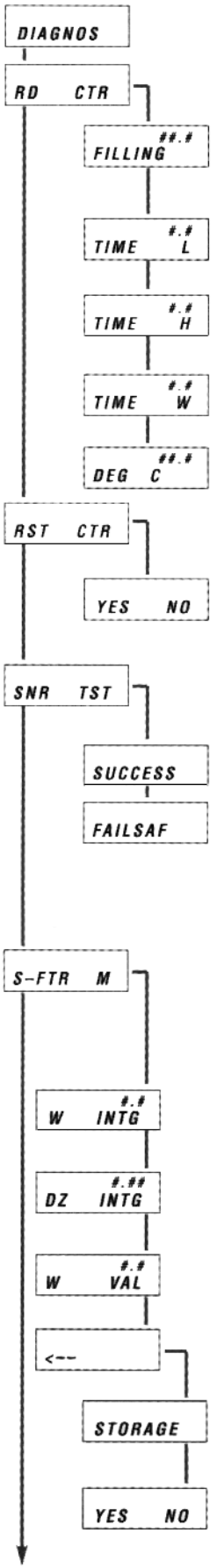
YES NO

Validate by ✱ to finalize the storing procedure or push **+** (or **–**) to abort and keep the previous data. In both case, the instrument remains in the CALIBRATION Menu.

APPENDIX D

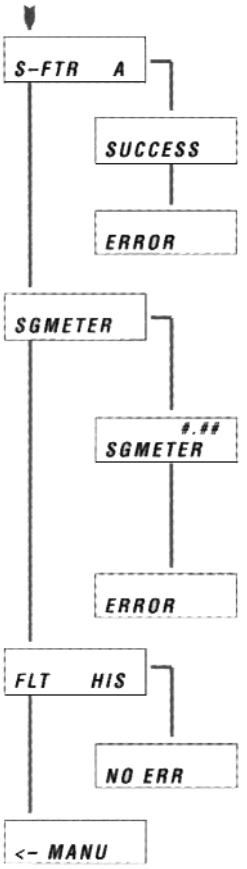

From
-> DIAGN
in MANUAL MODE menu
THE SCREENS WHICH CAN BE DISPLAYED TO BE READ ONLY UNDER * DIAGN * OF THE INFORMATION MENU ARE SPOTTED BY MEANS OF THE LABEL INFO
DIAGNOS
DIAGNOSTIC MENU
RD CTR
RST CTR
SNR TST
S-FTR M
S-FTR A
SGMETER
FLT HIS
<- MANU
YES NO
WAIT
SUCCESS #.##
or
FAILSAF
AUTOMATIC
INFO ##.# FILLING
INFO #.# TIME L
INFO #.# TIME H
INFO #.# TIME W
INFO ##.# DEG C
W INTG #.#
DZ INTG #.##
W VAL #.#
SETVAL menu
STORAGE
<--
SUCCESS
ERROR
SGMETER #.##
NO ERR
Display the occured FAULTS
To
MANUAL
in MANUAL MODE menu
To
FAILSAF
in FAILSAFE MODE menu

APPENDIX D – Continuation



DIAGNOSTIC	Validate by ∗ or + or – to access to the diagnostic sub-menu.
REA**D** **C**OUN**T**E**R**	Validate by ∗ to access to the accumulated data sub-menu.
FILLING	Totalizes the amount of liquid entering the tank. Counter increments by 1 when accumulated positive change in level correspond to one height of displacer.
TIME - **L**OW DAY	Time (days) during which the instrument worked within 5 % of low level that is between – 5% and + 5% of calibrated value.
TIME - **H**IGH DAY	Time (days) during which the instrument worked within 5 % of high level that is between 95 % and 105 % of calibrated value.
TIME WORKING DAY	Time (days) during which the instrument has been on service.
DEGREE **C**ELSIUS	Instantaneous temperature (° Celsius) inside housing (printed board).
RESET COUN**T**E**R**	Validate by ∗ to display *[YES NO].* Push ∗ again to confirm <Reset counter> procedure or + (or –) to keep the diagnostic data in memory.
YES NO	Push ∗ to finalize Storage or + (or –) to abort the Storage procedure and keep the previous values.
SE**N**SO**R** **T**E**ST**	Validate by ∗ to perform a test of the Hall effect sensor. The level of liquid shall remain constant during the test.
SUCCESS	Indicates that result of Hall sensor test is correct.
FAILSAFE	Indicates the instrument is in Failsafe mode. If *[FAIL O]* was configured, loop current locks on the last value before *[FAILSAF]* is displayed. If *[FAIL I]* was configured, the loop current is the value entered through CONFIGURATION Menu.
SMART **F**IL**T**E**R**ING **M**ANUAL	Validate by ∗ to enter the sub-menu to set manually the smart filtering parameters. Smart filtering act on digitally converted sensor signal : it eliminates unwanted sensor signal oscillations ; it has no damping or delaying effect on fast level changes.
WINDOW of **INTEG**RATION	Validate by ∗ to enter SETVAL menu and set the window width in seconds : from 0.1 s to 32 s. Factory set value (generally suitable) : 4 s.
DEAD **Z**ONE of **INTEG**RATION	Validate by ∗ to enter SETVAL menu and set the integration dead band : from .01% to 10%. Factory set value (generally suitable) : 0.3 %.
WINDOW **VAL**IDATION	Validate by ∗ to enter SETVAL menu and set the time after which a new value is validated : from 0.1 s to 32 s. Factory set value (generally suitable) : 0.1 s.
	Validate by ∗ to start the storage procedure : at this step it is still possible to keep the previous values ; see *[YES NO]* below.
STORAGE	Intermediate step of Storage procedure ; validate by ∗ to reach next step *[YES NO].*
YES NO	Push ∗ to finalize Storage or + (or –) to abort the Storage procedure and keep the previous values.

DIAGNOSTIC MENU SCREENS DESCRIPTION



SMART **F**IL**T**E**R**ING **A**UTOMATIC	Validate by ✱ to proceed to automatic smart filtering parameters setting. Target is to bring influence of noise and waves below 0.3 % of range.
SUCCESS	Indicates that automatic smart filtering parameters *[S - FTR A]* procedure has been correctly achieved.
ERROR	Displayed when the automatic TUNE failed.
SPECIFIC **G**RAVITY **METER**	Validate by ✱ to display the value of Specific Gravity of the liquid when the displacer is fully immersed: the Specific Gravity Meter must have been previously calibrated. If not, the case *[ERROR]* will be displayed.
SPECIFIC **G**RAVITY **METER**	Display the value of the liquid specific gravity. This value is valid only if the displacer is fully immersed in the liquid . If the Specific gravity Meter has not been calibrated, the screen *[ERROR]* is displayed : this is the only to know if the Specific Gravity Meter has been previously calibrated. In both case, push ✱ to return to main DIAGNOSTIC Menu.
ERROR	Displayed when the Specific Gravity Meter has not been calibrated.
F**AULT HIS**TORY	Validate by ✱ to read the list (if any) of defaults which occured in the operating system ; this info is stored in RAM and thus lost when instrument is switched off.
NO ERROR	
MANUAL	Validate by ✱ to return to *[MANUAL]* in Normal Mode menu.

APPENDIX E

First Operating and Simple Calibration for a Level Instrument Service

The purpose of this Section is to facilitate the first calibration and running in case of a level application of the instrument.

Danger : If area cannot be verified as safe, do not remove any covers.

- Before installation, connection and start to running, carefully read Section 2. Protection Standard and Section 3. Installation.
- For explanations to general principles, the liquid crystal display, the push buttons and how to use the menus, refer to Sections 5.1 and 5.1.1 to 5.1.3.
- For the menus description, refer to Section 5.1.4.
- To perform the instrument calibration proceed as follows :

  After the 12300 Level Transmitter has been installed, remove the front plate (80) located in front of the instrument to gain access to the push buttons.

  In NORMAL MODE (refer to APPENDIX A), the instrument displays alternatively the loop current and the level expressed in the unit (% or engineering unit) shown in the low left corner of the screen.

  Stroking any of the button enters a sub-menu which allows to go to a MANUAL MODE where the instrument can be configured, calibrated and diagnosed :

  NOTE : In the CONFIGURATION AND CALIBRATION menus of APPENDIX B & C, the screens which are only necessary for the first operation and simple calibration are highlighted by means of the white text on a colored background.

CONFIGURATION (Appendix B)

To enter the CONFIGURATION Menu from the Normal operating mode, press in sequence : ✱ (or + or –), +, ✱, ✱, ✱, to display [CONFIG].

Select all required configuration data indicated bellows :

- the instrument function (level or interface),
- the direction of head mounting (left or right towards the displacer when facing the LCD window),
- the action (direct :current increases with level ; reverse : current decreases when level increases),
- the language of the display (english or french).

To quit the CONFIGURATION Menu and return to Normal Operating mode, move into the menu until [<–MANU] is displayed, then press ✱ to display [MANUAL], via [STORAGE] and [YES NO].

Then press ✱, –, ✱ : [NORMAL] appears for a few seconds and the instrument automatically returns to Normal Operating displaying alternatively the current and the level.

CALIBRATION (Appendix C)

Conditions to Dry Calibration in Workshop (Simulation by Weights)

***Caution** : When performing a calibration, use the following parameter units wherever they apply :*

Parameter Name	S.I Units	English Units
Displacer Weight	g	lbm
Displacer Volume	cm^3	in^3
Water Density (WD)	1 g/cm^3	0.036 lbm/in^3

The effective change in level will be simulated by a set of weights corresponding to :

a) The weight of the actual displacer at low level (REF L), which allows you to calibrate the zero and obtain the minimum value [0,0%] of the signal (direct action).

b) The apparent displacer weight when the level is high (REF H). This allows you to calibrate the span and obtain the maximum value [100,0%] of the signal (direct action). The corresponding weight is calculated as :

Apparent Displacer Weight =
Displacer Actual Weight – (Displacer Actual Volume x S.G.x WD)

Caution : Special displacer may be provided for specific applications (material, service conditions...). In this case, volume and/or weight will differ from standard displacer characteristics.

Actual volume and weight of the displacer can be read using HART function only if they have been previously stored in the DLT head. Otherwise, actual volume of the displacer is marked on the specification plate (124).

Weight the displacer to get the actual weight.

APPENDIX E - Continuation

Now, proceed as indicated under Calibration :

Conditions to Calibration on Site in a Liquid

The effective change in level will be obtained by emptying and filling of the displacer chamber with a liquid.

Wait that the displacer is stabilized to validate the values displayed after each change in liquid level.

Take actions necessary to allow a change in the liquid level in the chamber : open/close isolation valves, vent, purge, etc.

Now, proceed as indicated under Calibration :

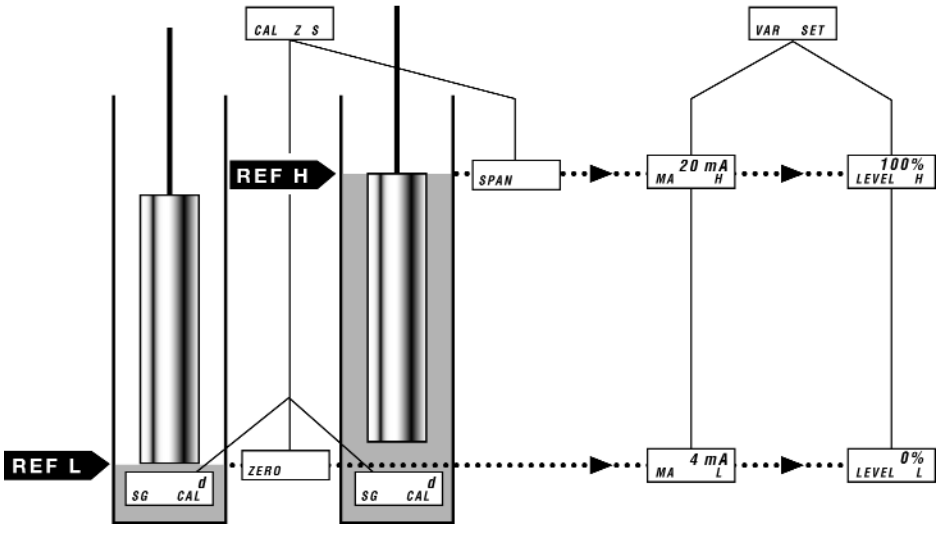
Calibration

1. Attach a set of weights to the torque arm to simulate a low level or empty the displacer chamber. Switch on the power,
2. Enter the CALIBRATION Menu and press in sequence : ✱ (or + or –), +, ✱, ✱, +, ✱, to display [CALIBR],
3. Set the Specific Gravity value of the liquid used for calibration [SG CAL]. Refer to Section 5.1.4.8 for the SETVAL sub-menu,
4. Display [ZERO] and press ✱ to take account the **REF L,**

   NOTE : During the procedure, refer to Section 5.3.2.6 if the LCD displays [ERROR].
5. Attach a set of weights to the torque arm to simulate a high level or fill the displacer chamber until the high level is reached,
6. Display [SPAN] and press ✱ to take account the **REF H,**
7. Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [CAL Z S] is displayed,
8. Display successively **[MA L], [MA H], [LEVEL L], [LEVEL H]** and, if needed, set the currents and levels corresponding to **REF L** and **REF H,**
9. Display [UNIT] and define the unit for level indication,
10. Move until [<–] is displayed and press ✱ to store data via [STORAGE] and [YES NO] screens. [VAR SET] is displayed,
11. When the calibration is completed, move into the menu until [<–MANU] is displayed, then press ✱ to exit the CALIBRATION Menu and to display [MANUAL],
12. Press ✱, –, ✱ : [NORMAL] appears for a few seconds and the instrument automatically returns to Normal Operating display,
13. Reinstall the front plate (80) with the three screws (125).

    NOTE : The calibration specific gravity [SG CAL] is automatically stored in the service specific gravity function [SG SER]. If the instrument is to be used with a liquid of different specific gravity, reenter the CALIBRATION Menu to set and accept this new value in [SG SER] to avoid the re-calibration. (See Section 5.3.2.3).

PRINCIPLE OF CALIBRATION ON LEVEL INSTRUMENT SERVICE



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