

智能电浮筒液位计



红旗仪表（江苏）有限公司

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The transmitter is designed to measure liquid level, boundary or liquid density. The measurement is based on the Archimedes buoyancy principle. Remote configuration and monitoring is easy with a PC or Universal Communicator. The instrument can also be set up routinely using the on-site buttons. All I/A Series measurements can be integrated via the FOXCOM communication protocol. The transmitter is certified for use in hazardous areas.

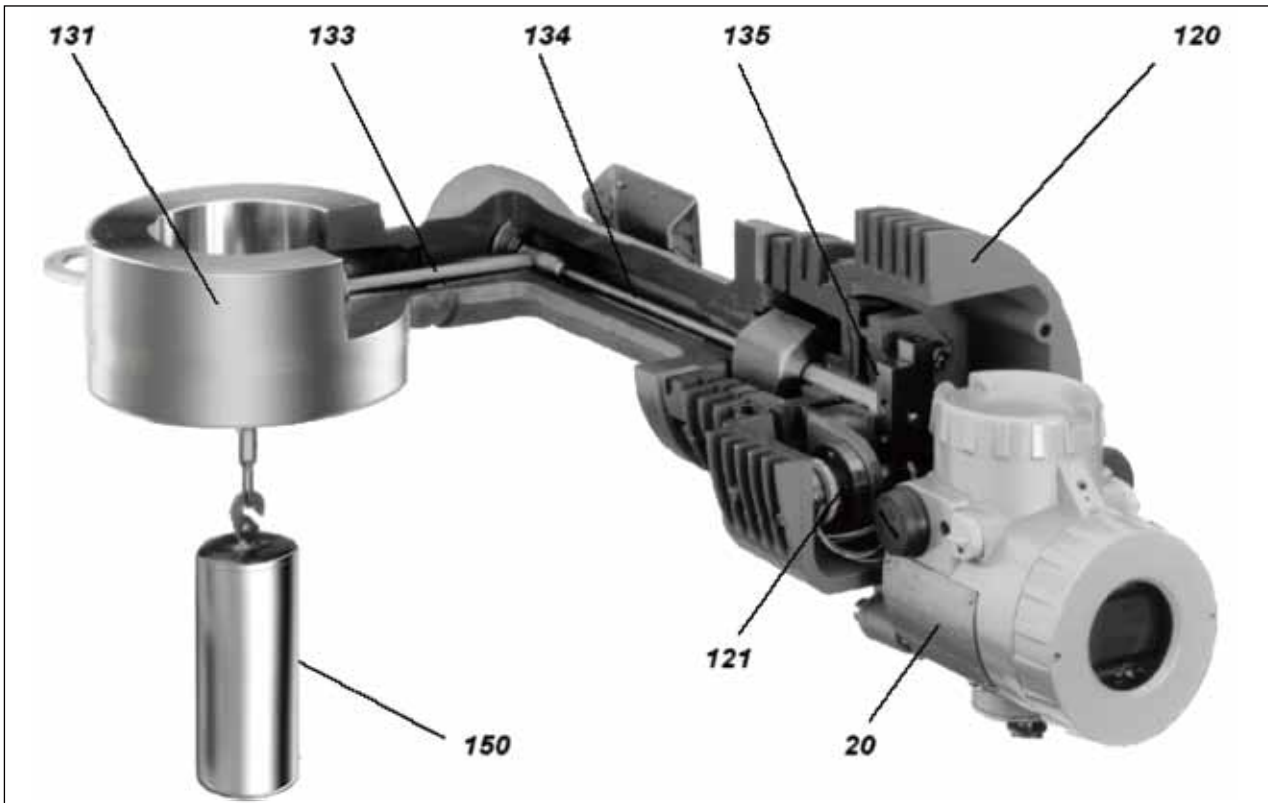
Characteristics

- HART or FOXCOM communication
- Use the live button for normal operation
- Easy to adapt to measurements without office calibration
- Measurement point backup
- Continuous self-diagnosis
- Configurable safety value
- Live button and reconfigure software lockable
- Analog output simulation for loop detection
- Fields can display physical units such as % and mA
- Suppress signal noise with intelligent filtering
- Linear or user-required characteristics
- Process temperature range $-196^{\circ}\text{C} \sim +400^{\circ}\text{C}$
- A variety of materials to adapt to corrosive media
- Metal film sensor technology
- The sensor with remote mounting bracket amplifier can be installed separately

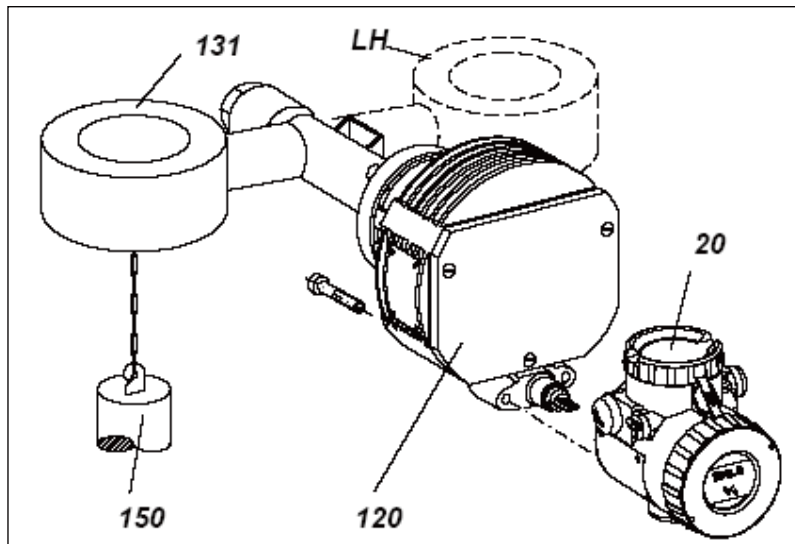
Contents

Design	1
Working principle	1
Installation	2
Electrical connection	3
Transmitter into use	4
Transmitter disabled	4
Transmitter calibration	5
LCD indicator	13
Maintenance, repair	13

1 Design



- 120 Sensor housing
- 20 Electronic amplifier
- 131 With heat sink and torque tube clamping
- 150 Pontoon with chain
- LH Left hand mounting type
- 133 Float rod
- 134 Torque tube
- 135 Fastening handle
- 121 Sensor



2 Working principle

The buoyancy of the pontoon is transmitted to the working rod of the sensor through the pontoon rod and the torque tube and then acts on the free end of the sensor element. Four thin film metal strain measuring elements are sprayed onto the sensor element, changing resistance with pull or pressure. The four thin film metal strain measuring elements are connected into a Wheatstone bridge powered by an amplifier, and the diagonal bridge voltage proportional to the effective weight is fed back as an input signal to the electronic amplifier. This voltage is converted to a 4 to 20 mA two-wire output signal by an electronic amplifier.

3 Installation

The transmitter can be mounted directly above the container or on the side-mounted float chamber 104DC.

Attention must be paid to the allowable static pressure and ambient temperature range during installation.

3.1 High temperature medium

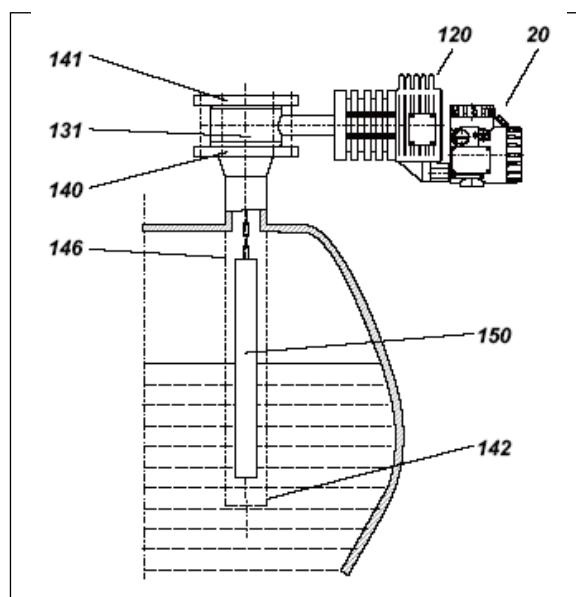
For certain high temperature media applications, care must be taken to limit the ambient temperature to within the allowable range. If used for high heat capacity concentrated media (such as about 300 °C saturated steam), or with a hot jacket heated with hot oil (about 300 °C), the ambient temperature acting directly on the sensor casing and amplifier should not exceed 50 °C .

If the maximum allowable temperature is exceeded (150 °C for the sensor housing, 85 °C for the amplifier, 70 °C for the LCD indicator), all radiant heat components (cage, chamber, container) must be insulated to ensure that no thermal radiation reaches the sensor. Housing or amplifier. The sensor and amplifier housing should be protected from direct sunlight.

The design temperature of the clamping body thermal jacket is PN25/Class300LB.

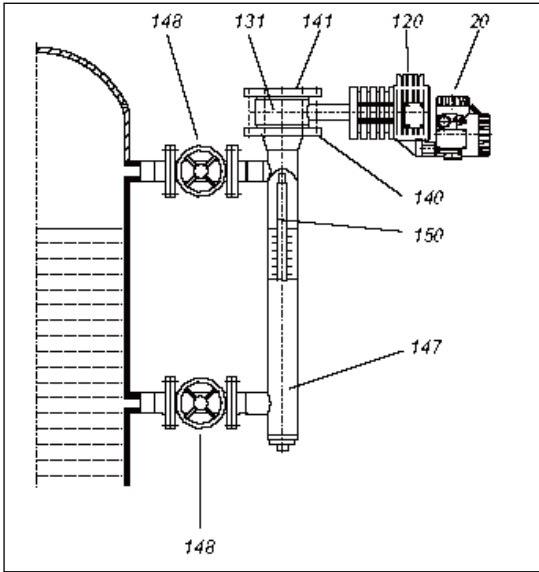
3.2 Mounted on the top of the tank

When the liquid in the tank fluctuates drastically, it is necessary to use a protective cylinder/tube. On the protective tube, there should be a vent above the maximum liquid level. The gap between the protective cylinder/tube and the pontoon should be at least 5 to 10 mm.



- 20 Amplifier
- 120 Sensor
- 131 Holder
- 140 Connection flange
- 141 Blind flange
- 142 Protection tube
- 146 Vent
- 150 Pontoon 104DE

3.3 Mounted on the tank side



- 147 Float chamber 104DC
- 148 Shut-off valve

When applied in Zone 0, fasteners that prevent spark penetration must be used.

If the user has not installed the float chamber, it must be mounted on the container with suitable bolts and gaskets (not included in the scope of delivery). At the same time, it must be ensured that the float chamber is completely vertical.

There must be a clearance of at least 5 to 10 mm between the protective cylinder or tube and the pontoon.

Note: For explosion-proof equipment or WHG and VbF over-protection equipment, attention must be paid to the product parameter plate and the mark on the certificate.

4 Electrical connection

4.1 Signal line connection

Check that the threads are matched before installing the cable connector, otherwise the housing may be damaged. Cable connector 38 and wire plug 39 are interchangeable.

The transmitter is not equipped with a cable connector, and the user should be responsible for the cable connector must comply with Ex.

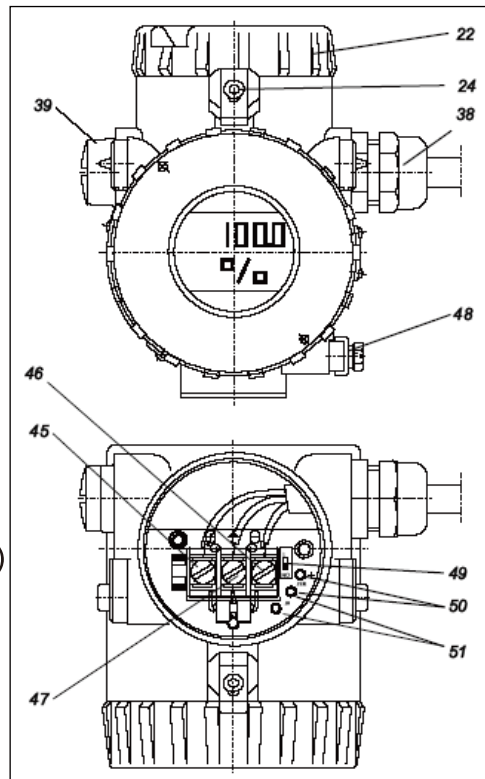
Operating:

- Loosen the cover locking screw 24 (if provided), lower cover 22
- Route the cable through the cable connector to the terminals 45, 46, 47
- Connect the ground terminal as needed
- The appropriate installation of the cable connector must be visible
- Tighten the cover 22, install the cover locking screw 24 (if provided)

Note:

For explosion-proof equipment, please refer to "140 Series Safety Operation" Guided by the document.

- 22 Connecting parts cover
- 24 Lid locking screw
- 38 Cable connector (cable diameter 6 to 12mm)
- 39 Plug
- 48 External ground terminal
- 45 Connection terminal +
- 46 Connection terminal -
- 47 Ground terminal (45, 46, 47 wire cross-sectional area up to 2.5mm²)
- 50 Overvoltage protection Test terminal block on terminal block



4.2 Grounding

If the system side requires grounding (such as equipotential, electromagnetic interference protection), there must be an appropriate connection (ground connection or external connection).

If a non-conductive gasket is used, the holder must be connected to the sensor via a ground wire.

5 Transmitter application

Installation and safety checks are usually required before the product is officially put into service.

After the installation is correct, the signal cable (voltage > 12V), isolation valve, etc. should be prepared.

If you want to configure a low range value, the high range value and damping time must also be checked.

When using it, it is also necessary to consider protecting the environment and preventing leakage of measured substances.

Output signal check

For inspection, an ammeter must be connected in the output loop.

Setting check

Check the low range value of the level measurement

For liquid level measurement, except for the measurement range migration, the float weight F_G is equal to the low range of gravity F_0 , low range value can be checked when the float is free to hang in the case of an empty can.

Check the low range value in the case of measurement range migration

The low range value can only be checked if the tank level corresponds to the weight corresponding to F_0 or office calibration.

Check the low range values for boundary and density measurements

The low range value F_0 can only be checked in the following way:

- The pontoon is completely submerged in low density liquid
- Office standard hanging suspension F_0 corresponding weight

High range value

The high range value F_{100} can be checked in the following ways:

- reach the corresponding level, boundary or density, providing the correct media density
- Office calibration specified F_{100} corresponding weight

Damping

The factory set damping is 8s, which can be checked and modified on site by the LCD indicator.

Calibration of low range values, high range values, and damping time (see Chapter 9, "Transmitter Calibration")

6 Transmitter disabled

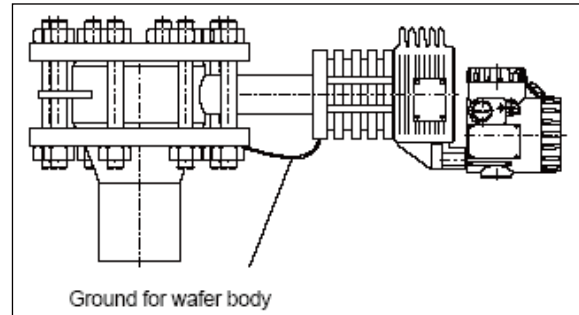
Care should be taken to avoid confusion before disabling the transmitter:

- Pay attention to explosion protection
- cut the power
- Pay attention to dangerous process media

Pay attention to the corresponding safety regulations for toxic and harmful process media

When disassembling the transmitter, the procedure should be followed:

- for equipment or float chamber
- Excluding the measuring medium of the float chamber
- Also consider protecting the environment, preventing leakage of measured substances, etc.



7 Transmitter calibration

The zero position, low range value, high range value and transmitter damping are all set at the factory according to user requirements. Therefore, normal

In the case where the meter is enabled, it is no longer necessary to calibrate. However, when the conditions of use are not provided when ordering, the transmitter defaults to the following data:

- Buoy weight = 1.500kg
- Buoyancy = 5.848N (0.600kg)
- Indication = %
- Damping = 8s (63% time)

The set operational data and pontoon data are stored in the transmitter. Need to be used when the actual application deviates from the stored value recalibrate the transmitter.

The transmitter is designed to have a maximum weight of 2.500kg and a buoyancy range of 2 to 20N.

The calibration method of the transmitter is as follows (subject to the order specifications of the transmitter):

Calibrate the device by operating the button

Calibration can be done via the transmitter field button:

- Through the external adjustment button on the amplifier housing, see 9.1 "Calibrating via Field Button"
- Through the buttons on the display, see 9.3 "Calibrating through the Display Buttons"

Calibration by HART protocol

- Calibration by HT991 handheld terminal
- Calibration via PC, display and user interface ABO991
- Basic calibration via PC and transmitter service program TSP991 (required when sensor or amplifier is replaced)

Calibration by FOXCOT protocol

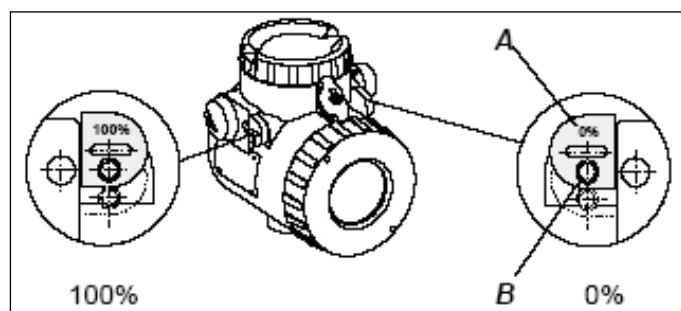
- HHT calibration via FOXCOT handheld terminal (non-144LD serial number starting from 93/...)
- Calibration by PC, PC10/20 software
- I/A Series IFDC Software System
- Basic calibration via the PC and transmitter service program "Fingerprint Data Series 140 (SP140)" (required when the sensor or amplifier is replaced)

7.1 Calibration by button

Operation and on-site button functions

There are two field buttons on the outside of the junction box. 0%, 100%, used to set the low and high range values, the initial value of the analog output and the damping.

Amplifier junction box with live button



Remove the button cover 1. Insert a screwdriver or adjusting pin ($\varphi \leq 3\text{mm}$) into the hole 2 and press it to the second pressure point. Depending on the length of the press, the two buttons have two designated functions.

Zero point

Press the 0% button for less than 3 seconds: the output signal is set to 0 (4mA)

Low range value

Set the low range value of the analog output: If the 0% key is pressed for more than 5 seconds, the output signal will be adjusted to 4mA.

High range value

If the 100% button is pressed for more than 5 seconds, the output signal will be adjusted to 20mA.

Damping

The damping time (electronic damping) is set to 8s at the factory. The damping time can be adjusted from 0 to 8 s (63% time) using the on-site button.

Pressing the 100% button for less than 3s will indicate the current damping value. Pressing the 100% button again will gradually increase (cycle) the damping time. Once you have made your selection, press the 0% key for a short time to confirm. (With a handheld terminal or PC, the damping time can be adjusted from 0 to 32 s)

Calibration and inspection of low and high range values**Equipment:**

- Regulated power supply: DC24V, 30mA
- Configure the field display as % corresponding to mA, or a multimeter to measure current
- Screwdriver ($\varphi \leq 3\text{mm}$)
- Weight group up to 2.5kg (accuracy class M1)
- Weighing pan that can be hung in the pontoon position

Operation:

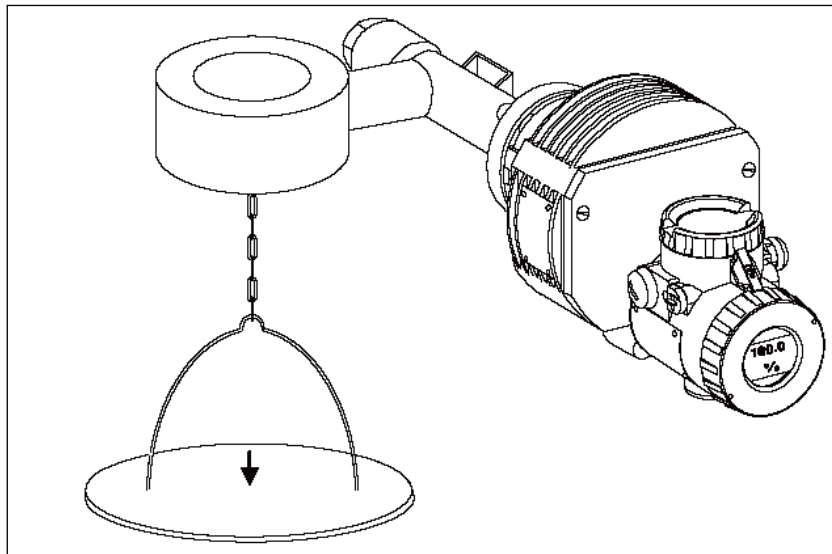
- Place the transmitter in the working position and connect the transmitter

Low range value

- Lower the weight corresponding to the range value (F0) Note: The weight of the weighing pan must taken into account when placing the weight
- Set the current value to a low range value: press 0% key for more than 5s
- The measurement range remains the same

High range value

- The weight corresponding to the height range value (F100)
- Set the current value to the high range value: press the 100% key for more than 5s
- low range values remain unchanged



Wet calibration

If the process conditions allow low and high range values to be set during installation, the transmitter can also be in safety calibrate after installation.

Equipment:

- Configure the field display as % corresponding to mA, or a multimeter to measure current
- Screwdriver ($\varphi \leq 3\text{mm}$)

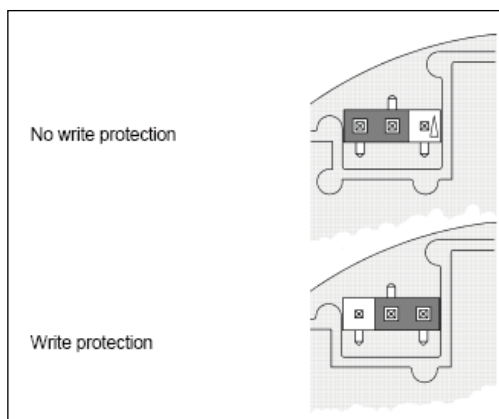
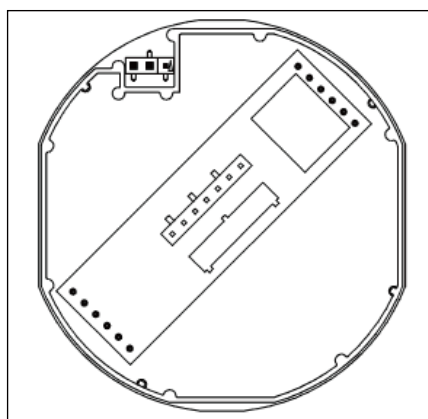
Operation:

- Set the working state to the state corresponding to the low range value (for example, set the liquid level to the level corresponding to 4 mA)
- Set the current value to a low range value: press 0% key for more than 5s
- Set the working status to the state corresponding to the high range value (for example, set the liquid level to the level corresponding to 20 mA)
- Set the current value to the high range value: press the 100% key for more than 5s

7.2 Hardware write protection (serial number 93/... begins)

Hardware write protection is used to prevent changes to the transmitter configuration. To make the transmitter writable, the jumper must be placed in the position shown.

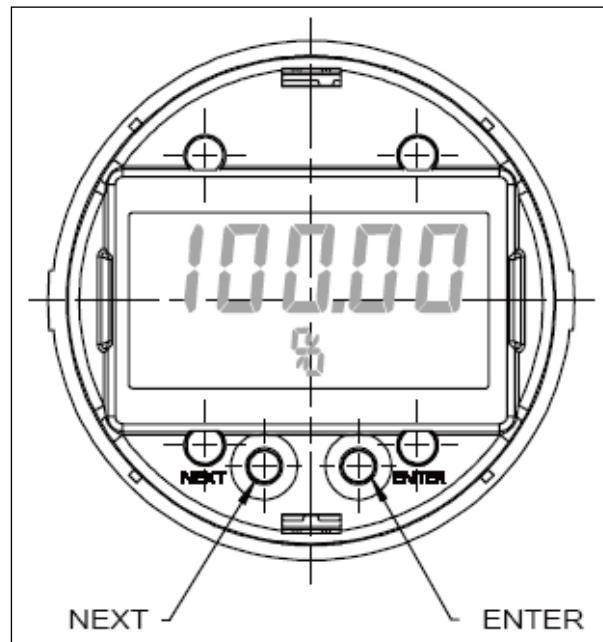
Note: If the jumper is not set, the transmitter will write protect.



7.3 Calibration by display button (sequence number 93/... starts)

The transmitter can be configured and calibrated directly according to the menu via the NEXT and ENTER buttons. (For I/A 140 Series transmitters, the menu structure can be identified using the HART or FOXC0M communication protocol).

Note: Observe the restrictions on the opening of the junction box in the hazardous area, see the document "Safety Operation Guide for Series 140".



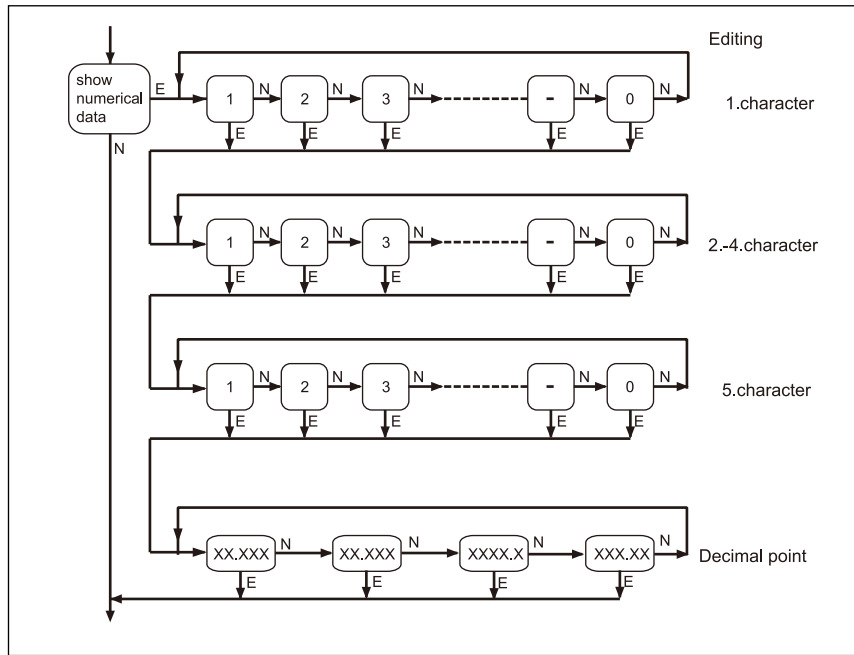
Menu selection

When the submenu is selected, the currently selected menu point will be displayed first, then the next menu point will be selected, and the ENTER key will be pressed to confirm.

Digital input

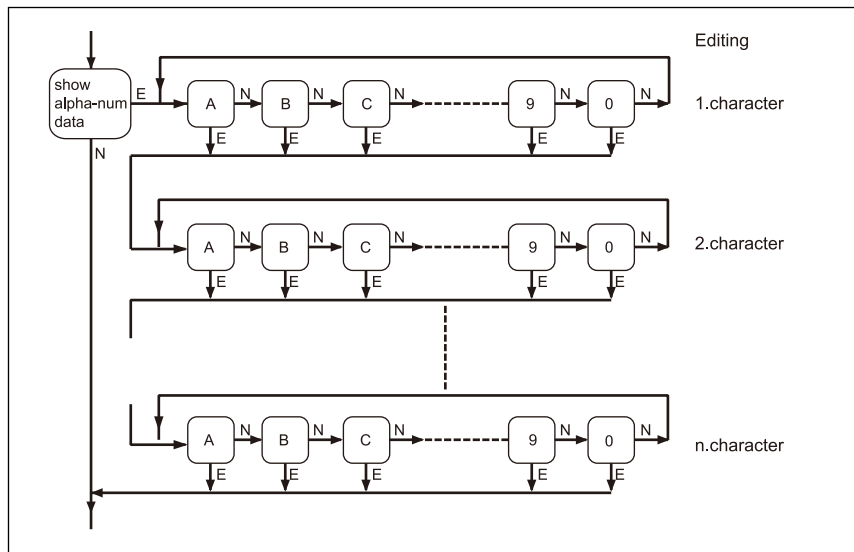
If the menu requires a digital input, the current parameter value and parameter name will be displayed. Press the NEXT key, the menu value will not exit without modification; press the ENTER key to enter the value modification, press the NEXT key to increment the flashing character from 0 to 9. After the number is required, press ENTER to enter the next data modification. When all the characters are flashing, you can modify the decimal point position, press NEXT to reposition the decimal point position, and press ENTER to save the data.

During the data storage process, the meter will check the value range. If the data is wrong, the error message will flash and return to the menu node "Cancel".



Character input

If the menu requires character input, the current selection string will be displayed. Press NEXT, the menu value will not exit without modification; press ENTER to enter the value modification, press NEXT to increment the flashing characters from 0 to Z, and press ENTER to enter the next data modification.



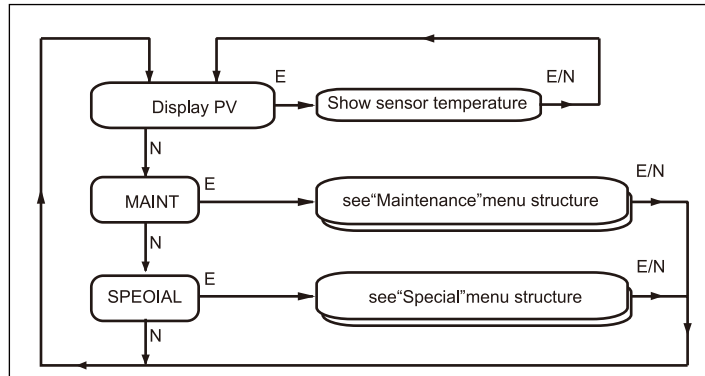
Abbreviation:

- E ENTER key
- N NEXT button (corresponds to multiple independent operations, automatically repeats when long, continuous operations)
- LRL low range limit
- LRV low range value
- PV raw variable
- URL high range limit
- URV high range value

Menu structure

The top menu provides three submenus: "Show PV", "Maintenance" and "Professional".

7.3.1 Menu node "Display measurement value"



The display is based on the configuration instructions in the menu "Professional" - "Other":

Not shown

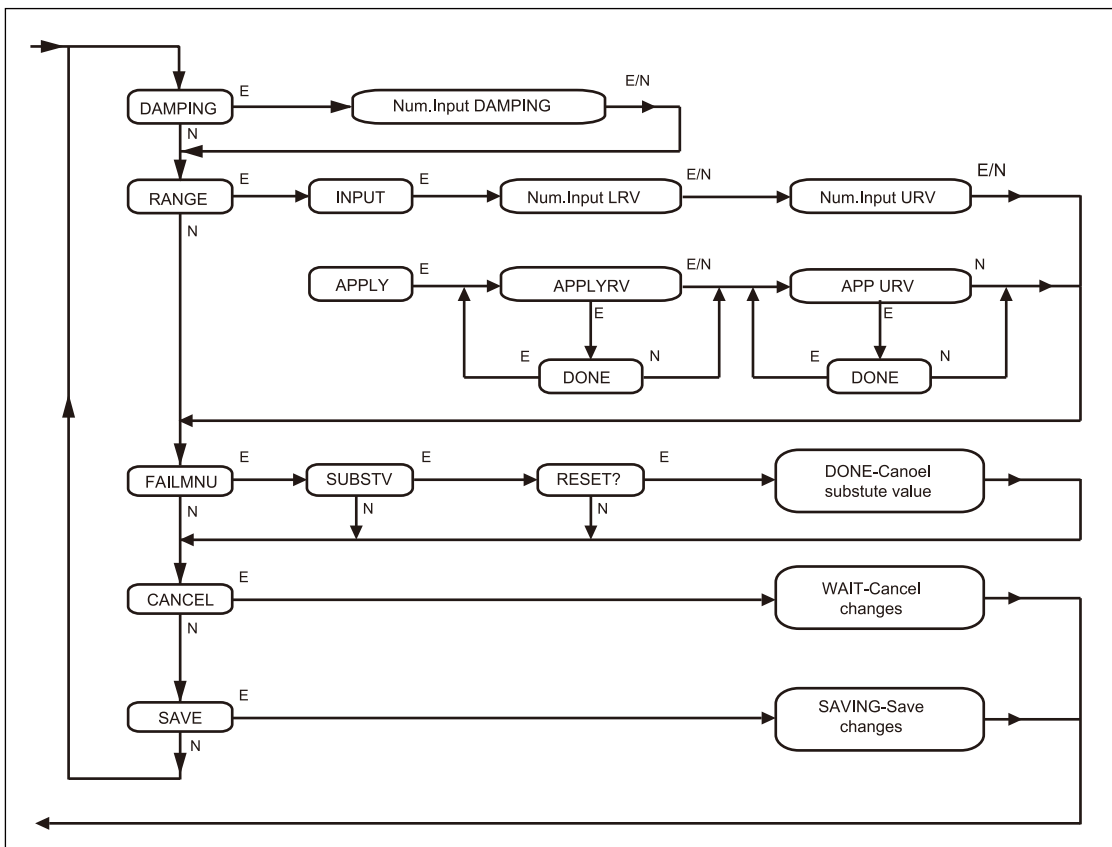
2. PV value and physical unit display
3. PV value (%) corresponding to LRV and URV
4. PV value (mA) display corresponding to LRV and URV

"Show sensor temperature"

- Display the sensor temperature in °C.

7.3.2 Menu node "MAINT Maintenance"

Maintenance menu branch (no password protection)



7.3.2.1 Menu node "DAMPING damping"

PV damping configuration.

Menu node "Digital Input Damping"

Display / input PV damping (unit: second s), setting range: 0 ~ 32s.

7.3.2.2 Menu node "RANGE range"

LRV and URV configuration of PV. You can select "INPUT" or "APPLY" to set the range.
wai: LRL ~ URL

Menu node "Input / Digital Input LRV"

Input LRV configuration

Menu node "Input / Digital Input URV"

Enter URV configuration

Menu node "Application / Application LRV"

The LRV configuration is set to the current display value and pressing the ENTER key LRV is accepted.

Menu node "Application / Application URV"

The URV configuration is set to the current display value and pressing the ENTER key URV value is accepted.

7.3.2.3 Menu node "FAIL MNU failure menu"

"Failed Menu" branch

Menu node "SUBST V/ RESET"

The configured substitute value is canceled manually, and if the substitute value is automatically canceled, the menu is invalid.

7.3.2.4 Menu node "CANCEL Cancel"

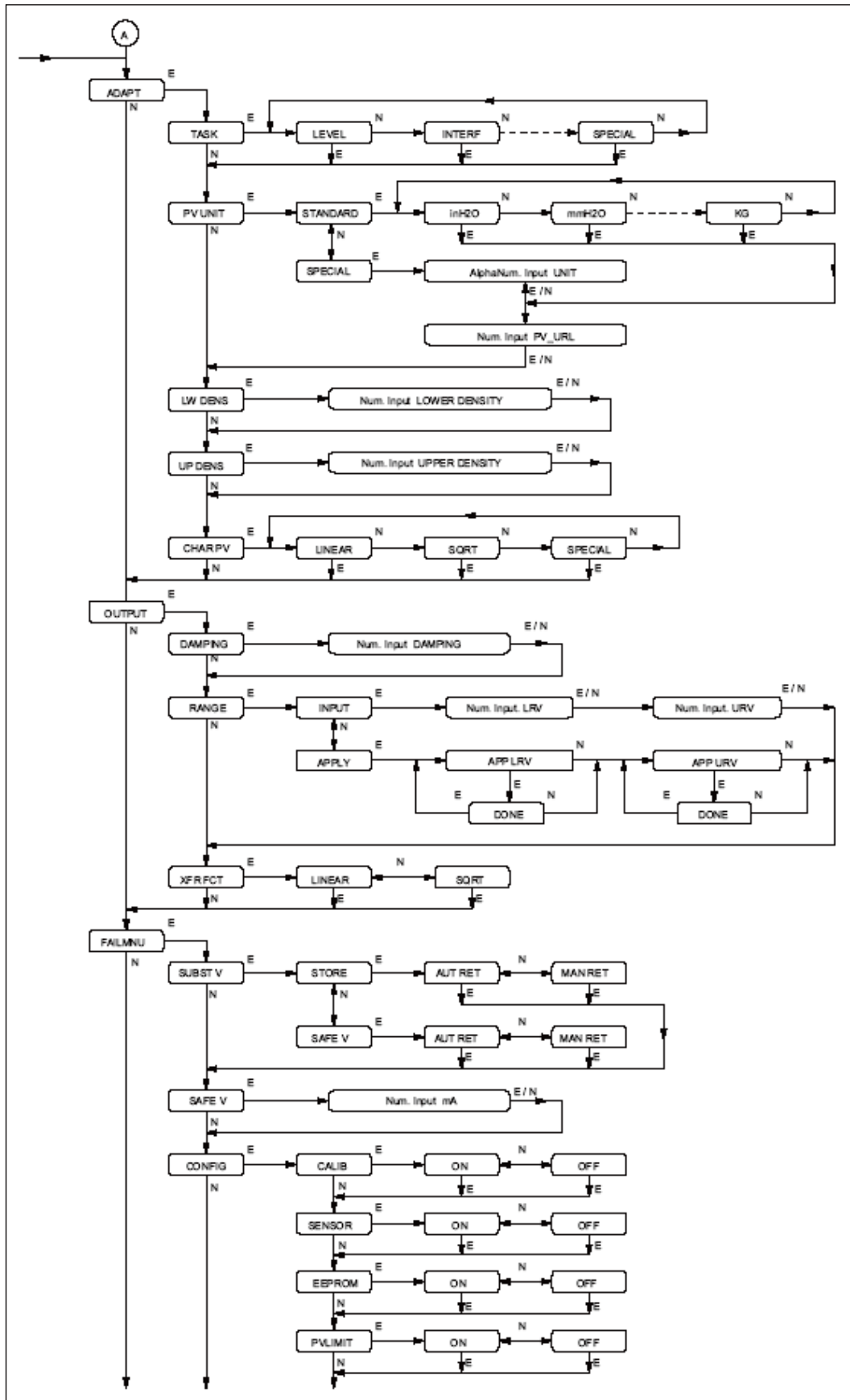
Press ENTER to cancel all modifications.

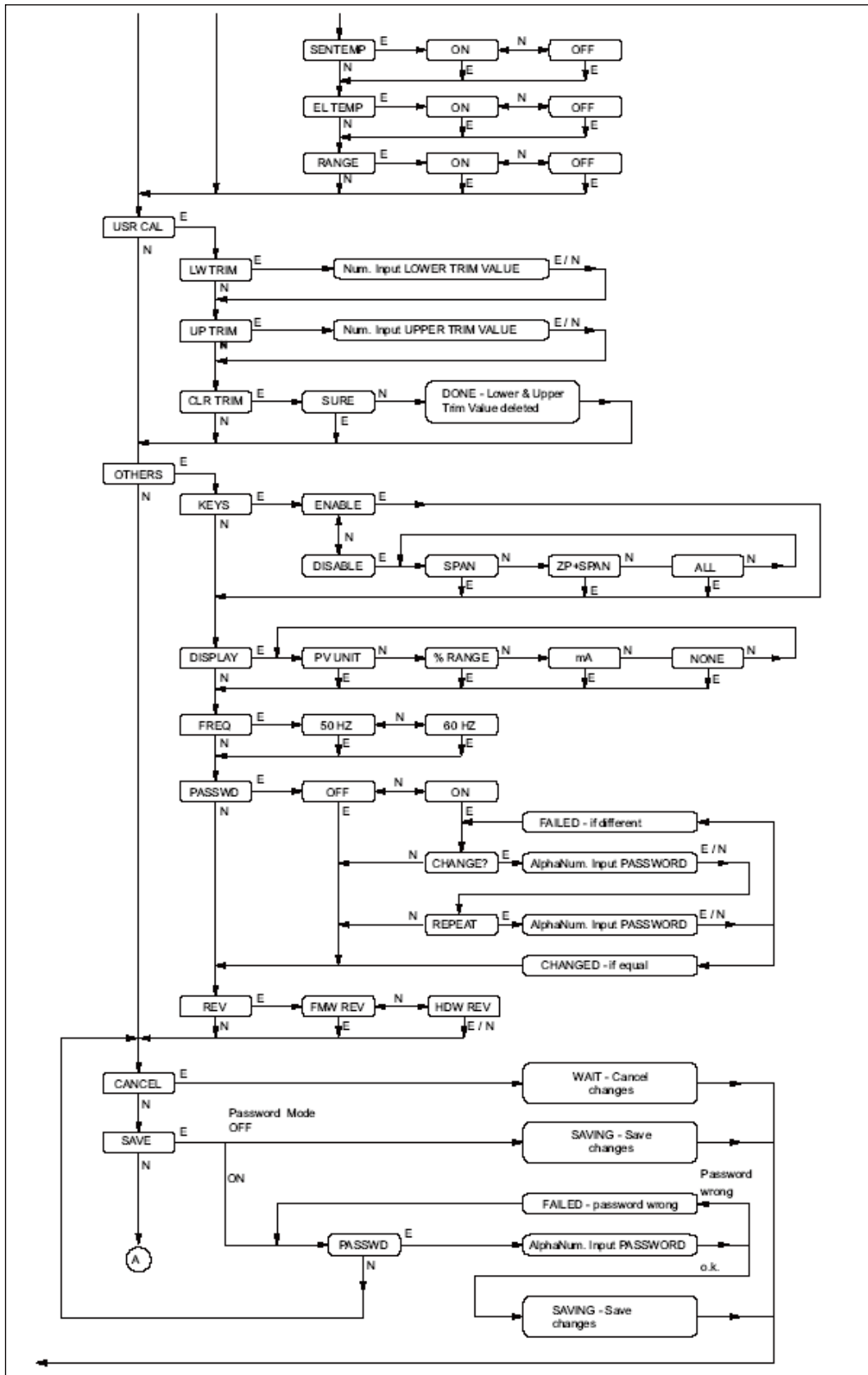
7.3.2.5 Menu node "SAVE save"

Press ENTER to save all changes.

9.3.3 Menu node "SPECIAL Professional"

As a branch of the "Professional" menu, it corresponds to the "Maintenance" menu, which has more configuration and calibration functions and can be configured with a password for protection.





7.3.3.1 Menu node "ADAPT adaptation"

This menu is a configuration branch that adapts to sensor measurements.

Menu node "task"

Measurement task configuration: Select the measurement task in the menu. This configuration is only information characters and has no effect on the transmitter function.

Menu node "PV unit / standard"

PV standard unit configuration: Select the PV standard unit in the menu, if the new unit is derived from the old unit (such as mbar to bar), or the unit changes (such as from % to a pressure unit), LRV, URV, LRL and The value of the URL will be implicitly converted and the calculated URL will be displayed but cannot be changed. If both old and new units are not recognized, the URL is set to 0.0 and must be entered.

Menu node "PV unit/special"

PV special unit configuration: You can define the unit of up to 6 characters (see "character input"). If both old and new unit units are recognized, the current URL is displayed and modified. If both old and new units are not recognized, The URL is set to 0.0 and must be entered.

Menu nodes "LW DENS" and "UP DENS"

Density configuration of the measured media (low density and / or high density). The unit is kg/m³, which is a pure information character and has no effect on the function of the transmitter.

Menu node "CHAR PV"

Transmitter PV characterization configuration, select output features in the menu:

- LINER - Linearity
- SQRT - Square root output characteristics
- SPECIAL - User Defined Features

The data pair "XEC" related to the characteristic "SPECIAL" cannot be input through the display menu.

7.3.3.2 Menu node "OUTPUT output"

A submenu for configuring the current output of the transmitter.

Menu nodes "DAMPING" and "RANGE"

See "MAINT"

Menu node "XFR FCT"

Configure the transmitter output current function and select the transmission function in the menu.

7.3.3.3 Menu node "FIAL MNU failure menu"

Expired menu branch

Menu node "SUBSTV/STORE"

Behavior configuration during "Save last value". When an error occurs, the transmitter maintains the last valid output current until barrier elimination (automatic return to AUT RET) or until the substitute value is manually returned (MAN RET).

Menu node "SUBST V/SAFE V"

Configure the substitute value and when an error occurs, the transmitter will change the output current to the configured substitute value and will remain output current to fault cancellation (automatic return to AUT RET) or to substitute value is manually returned (MAN RET).

Menu node "SAFE V"

The configuration of the substitute values allows a value range of 3.6 to 23 mA and is only meaningful if the "alternative value" is configured to replace the "store last value". In the event of a fault, this value becomes the output current of the transmitter.

Menu node "CONFIG"

Fault information configuration submenu. The signal can be activated (ON) or suppressed (OFF) in 7 areas.

1. CALIB internal calibration is invalid
2. SENSOR can withstand a pressure peak of $\pm 150\%$ in the normal range
3. EEPROM is not writable EEPROM
4. PVLIMIT normal PV range $\pm 110\%$
5. SENTEMP sensor temperature is out of limits
6. EL TEMP electrical temperature exceeds $-45^{\circ}\text{C} \sim 85^{\circ}\text{C}$
7. RANGE configuration measurement range is invalid

7.3.3.4 Menu node "USR CAL User Calculation"

User PV standard stator menu.

Menu node "LW TRIM"

Low correction point calibration. The measured value indication corresponds to the low correction point and the input value. Correction point input makes the transmitter based on repair the punctuality and measured values calculate a new zero point for the output.

Menu node "UP TRIM"

High correction point calibration. The measured value indication corresponds to the high correction point and the input value. Correction point input makes the transmitter based on repair the punctuality and measured values calculate a new zero and end point for the transmitted output.

Menu node "UP TRIM"

High correction point calibration. The measured value indication corresponds to the high correction point and the input value. Correction point input makes the transmitter based on repair the punctuality and measured values calculate a new zero and end point for the transmitted output.

Menu node "CLRTRIM"

Clear user calibration (clear correction point)

7.3.3.5 Menu node "OTHERS Other"

Menu node "KEYS/ENABLE"

All functions of the transmitter's external buttons (0% and 100%) are released.

Menu node "KEYS/DISABLE"

The function of the transmitter's external buttons (0% and 100%) is off.

SPAN URV	Configuration is off
ZP+SPAN LRV and URV	Configuration are off
ALL	All features off

Menu node "display"

Measurement display mode configuration.

PV UNIT	Displays PV values and units
%RANGE	Shows PV percentage
MA	Displays PV mA value
NONE	No display

Menu node "FREQ"

Select the noise filter frequency as the line frequency

Menu node "PASSWD"

Password management submenu. Password protection protects the security of the "Professional" menu, such as password query can be set activate (ON) or not (OFF). The password can be modified when the password query is activated. Two inputs make the modification valid.

Menu node "REV"

Display firmware and hardware version number

7.3.3.6 Menu node "CANCEL Cancel"

Press ENTER to cancel all modifications.

7.3.3.7 Menu node "SAVE save"

In the inactive password query mode, press ENTER to save all changes. When you activate the password query mode, you need to enter the correct password (the old password must be used when configuring the new password) to save the changes.

7.3.4 Error Messages

The possible error messages are as follows:

BADDAMP	BADDAMP invalid damping range
BAD LRV	BAD LRV is invalid LRV range
BAD URV	BAD URV is invalid URV range
BAD LRV	BADSPAN range upper correction point - lower correction point < 2% of the maximum allowable measurement range
BAD PAR	BAD PAR invalid upper and lower correction point range
BADPROC	BADPROC invalid upper and lower correction point value
BAD URL	BAD URL invalid URL range
BAD MA	BAD MA invalid Output Current Range
WR PROT	WR PROT transmitter is write protected

If one of the above errors occurs, the input will not be accepted, exit by activating CANCEL.

7.3.5 Warning Message

The configuration that activates the alarm is accepted, specified by SAVE

The warning message is as follows:

WRNSPAN	WRNSPAN observes the technical data of the extension >1:20 (TIEMP0600G-(en))
WRN URV	WRN URV invalid URV range due to incorrect configuration

7.3.6 Timeout monitoring

Entered in the menu node "MAINT", all the buttons of the "Maintenance" and "Professional" menus will start timing for 120s.

Re-time after each key press.

Extended monitoring time All previous changes will be canceled, menu node "Show PV"

The menu steps are only relevant to the menu nodes "USR CAL" and "APPLY".

7.4 Calibration by Communicator

The transmitter's range, parameters, etc. can be set by the communicator. If there is no FOXBORO-ECKARDT software in the communicator, the general information of the transmitter and the zero point and full point value can be modified through the GENERIC menu.

8 LCD indicator

As an add-on to the digital transmitter, a 5-digit LCD indicator can display %, mA or physical units. For transmitters with HART communication, the display can only be configured via the Communicator or PC.

9 Maintenance, repair

Must pay attention to safety needs.

Pay attention to the calibration data!

Factory calibrated data is indicated on all parts of the transmitter. These values for the delivered 144LD are also stored in the software of the amplifier.

a) When the amplifier is replaced, these debug data can be transferred to the new amplifier, which can be supplied by the manufacturer (floppy disk) and requires the transmitter service program TSP991 (HART) and FTSP (FOXCOM);

b) If the torque tube or sensor element is replaced, the manufacturer must provide new commissioning data.

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