141GP Intelligent Gauge Pressure Transmitter
142AP Intelligent Absolute Pressure Transmitter

Intelligent transmitter for gauge and absolute pressure measurements of liquids and gases in vessels, pipes and hydraulic systems. Easy remote configuration and supervision via PC or Universal Handterminal. The devices also can be operated conventionally using local keys. Total I/A Series measurement integration is possible through FOXCOM communication protocol. The transmitters are approved for use in hazardous areas.

FEATURES

- Communication HART or FOXCOM
- Conventional operation via local keys
- Easy adaptation to the measuring point without calibration at the workshop
- Backdocumentation of measuring point
- Continuous self-diagnostics
- Configurable safety value
- Software lock for local keys and reconfiguration
- Simulation of analog output for loop-check
- Local display in %, mA or physical units
- Signal noise suppression Smart Smoothing
- Linear or customized characteristic
- Process temperature of -50 °C to +120 °C (-60 °F to +250 °F)
- Materials for use with aggressive media
- Micro sintermetal sensor technology
- Separate mounting of sensor and amplifier with remote amplifier mounting kit possible

Repair and maintenance operations must be carried out by qualified personnel!

FOXBORO ECKARDT

CONTENTS

Further documentation:

Master Instruction MI EMO0110 A-(en)
HT991 Universal Hand Terminal for HART Devices

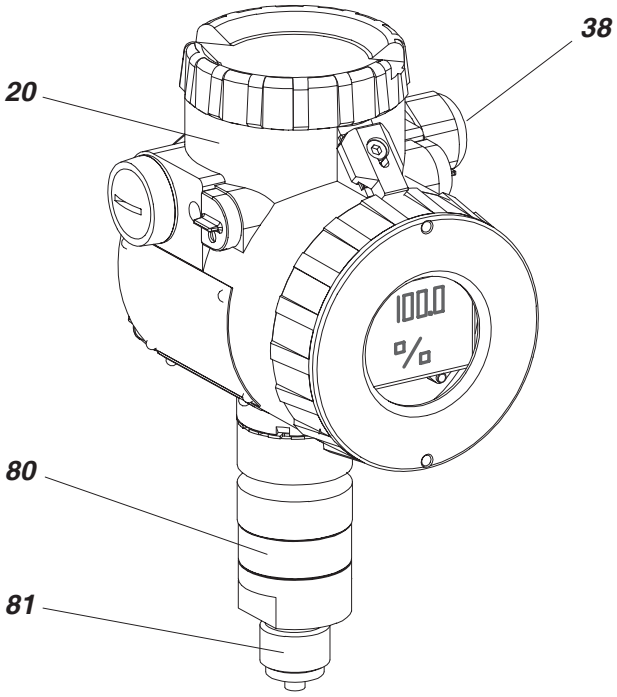
Master Instruction MI EMO0120 A-(en)
ABO991 Display and User Interface for HART Devices
WPP 991 Write Protection Program

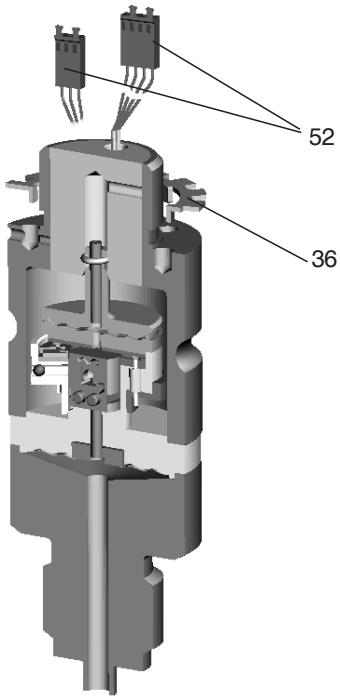
HHT Instruction Book 3372
I/A Series Hand Held Terminal

PC10 Instruction Book 3466
Intelligent Transmitter Configurator

PC20 Instruction MI020-495
Intelligent Field Device Configurator

1 DESIGN





Example: Sensor 141GP for 25 bar

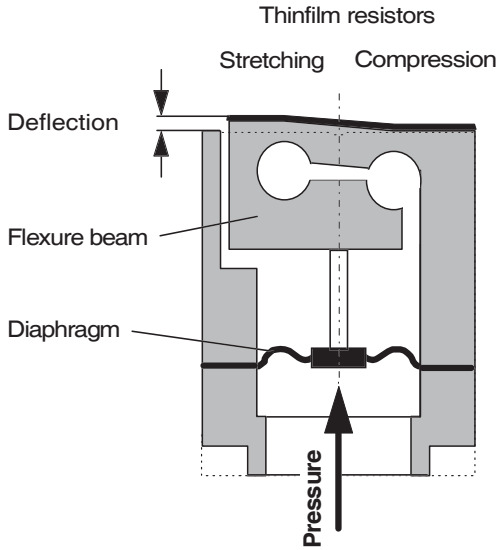
20 Amplifier
38 Cable gland
80 Sensor with flexure beam
81 Process connection

36 Twist lock
52 Terminal block

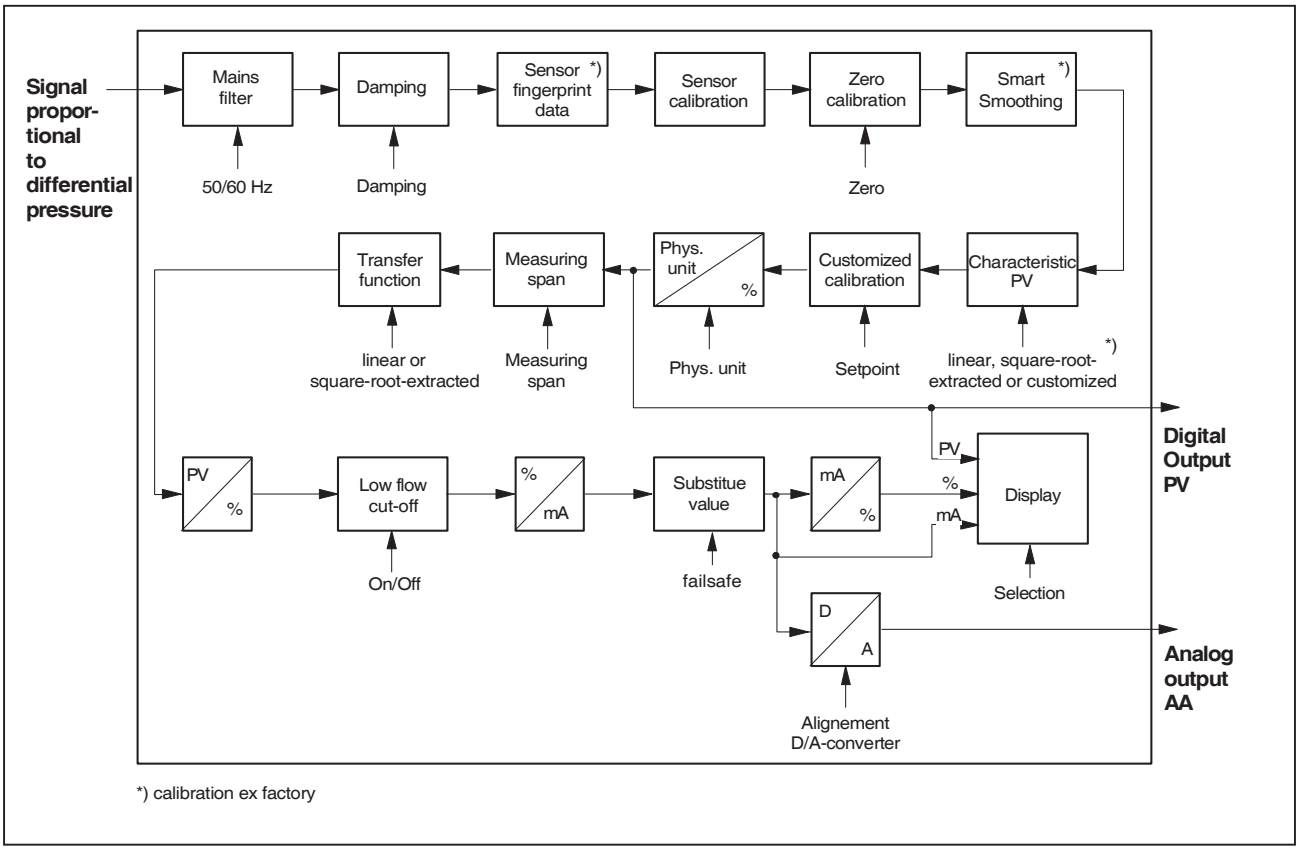
2. MEASURING PRINCIPLE

The pressure acts via diaphragm on the flexure beam. The surface of the flexure beam is coated with thin film strain gauges.
Under pressure 2 resistors are compressed and 2 resistors are stretched. This leads to a pressure proportional electric signal, which is transformed by the digital electronics (see block diagram, chap. 2).
To protect against destruction, the flexure beam stretching is limited mechanically by two bars, which are arranged at right angle to the flexure beam. The diaphragm has a thickness of 0.06 to 0.15 mm and therefore, is suited for harsh process environment.
The gauge pressure sensor contains a transmission liquid (Silicone oil or inert fluid), whereas the absolute pressure sensor has no filling.

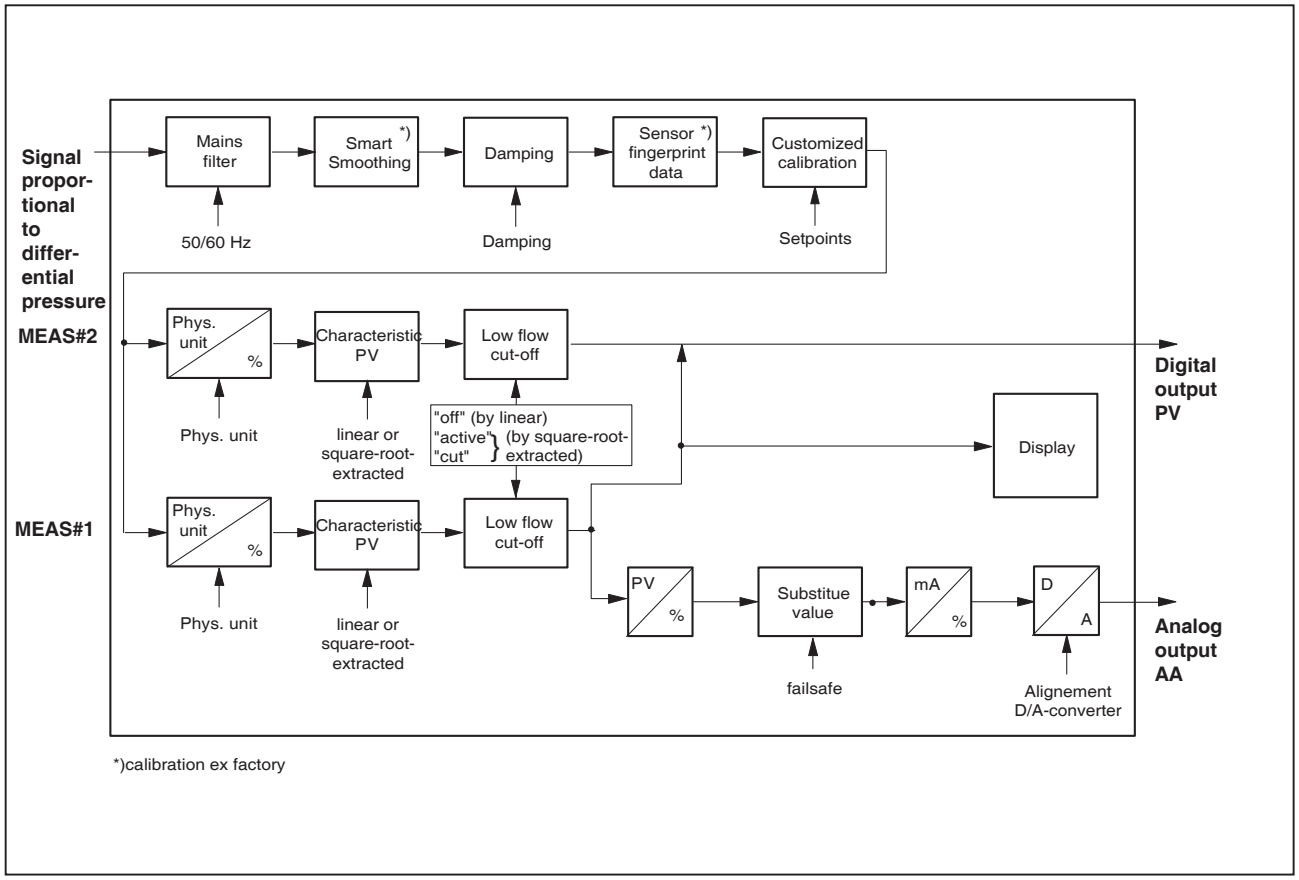
Measuring principle



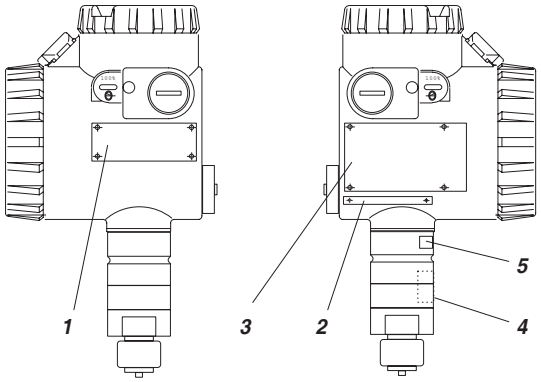
2.1 Block diagram (for HART and FOXCOM (from Ser.Nr. 93/...))



2.2 Block diagram (for FOXCOM (up to Ser.Nr. 82/...))



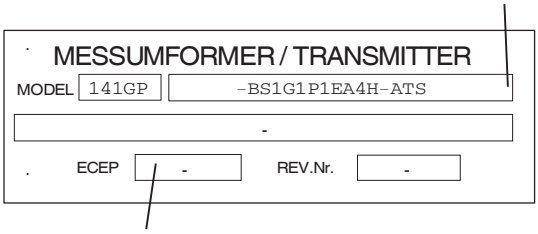
3 IDENTIFICATION



The transmitter is identified by three labels and a sensor marking: Transmitter nameplate ***1*** clearly describes the intrument by the complete Model Code. Amplifier nameplate ***3*** shows the certification data and the serial number.
Tag No. label ***2*** optionally contains the tag number.
The laser burned sensor marking ***4*** identifies the sensor. (sensor code, span limit, fill fluid and material)
Optionally, an oxygen label ***5*** is fixed.

3.1 Transmitter nameplate (Example)

Instrument specification, Model Code



ID for special engineered version

3.2 Tag No. label (Example)

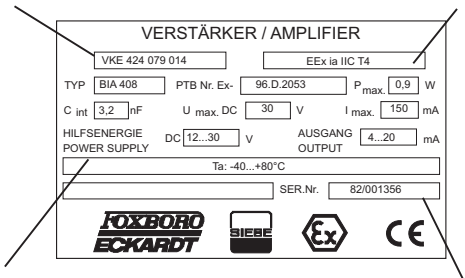
Directly fixed or attached.

PIC 08/15

3.3 Amplifier nameplate *(Examples)*

Up to Serial number 82/.....

Amplifier ID number Type of protection

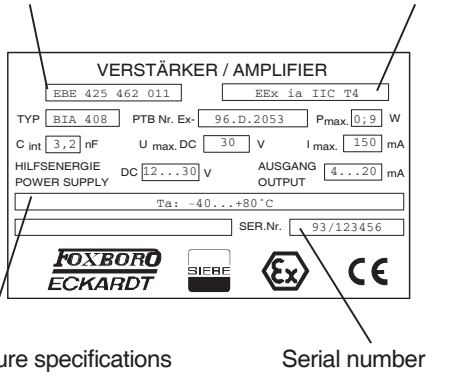


Ambient temperature specifications

Serial number

Starting at Serial number 93/...

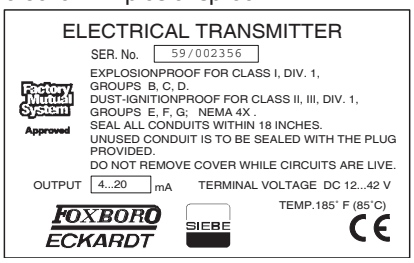
Amplifier ID number Type of protection



Ambient temperature specifications

Serial number

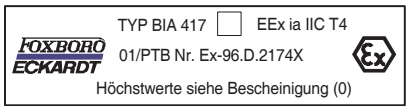
Type of protection “Explosionsproof” FM



3.4 Sensor marking (Example)

DMS-Code	FBEBB
Material	1.4404
max. span	1600 bar
Fill fluid	SILIKON

3.5 Zone 0 marking (Example)



3.6 O_2 marking (Example)

Oil and grease free for application with oxygen

O_2

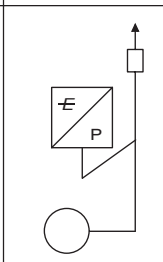
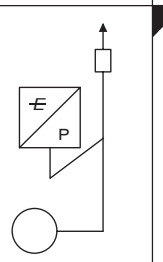
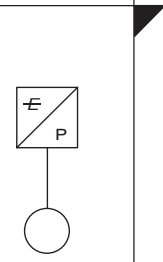
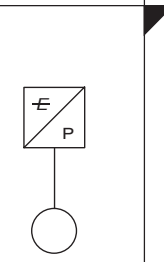
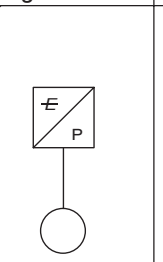
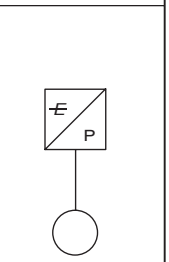
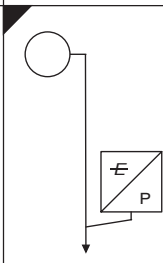
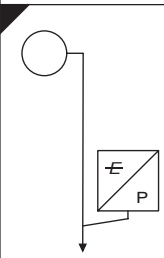
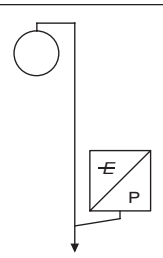
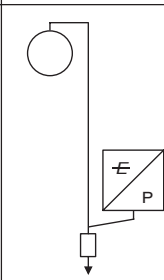
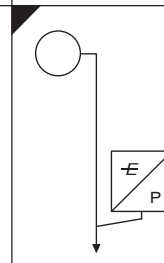
FREI VON ÖLEN UND FETT
OIL AND GREASE FREE
SANS HUILE NI GRAISSE

4 INSTALLATION

The safety requirements have to be observed (see Chapter 11).

4.1 Measuring arrangements

Detailed measuring arrangement and description see VDE/VDI 3512 Sheet 3

State of process medium	liquid			gaseous		
Condition of process fluid at measuring point	liquid	partly gaseous	completely evaporated	gaseous	partly condensed	completely condensed
Examples	condensate	boiling liqiuds	liquid gases	dry air	moist air, flue gases	water vapor
Transmitter above outlet port						
Transmitter below outlet port						

Key to symbol: Apparatus, Transmitter, Separator, Preferred arrangement

4.2 Mechanical connection

The location of installation should be accessible, low in vibrations and protected against heat radiation.
The permitted ambient temperatures have to be observed. (See Product Specifications PSS EMP0610 A-(en)

The transmitter can be installed directly on top of the vessel.
The transmitter may be installed at the wall or at tubes (max. ∅ 60 mm) by means of a mounting kit. Thereby the standardized accessories can be used, depending on the pressure.

To adapt to mounting position of transmitters up to serial number 82/... , the local display can be twisted in 90 ° steps.

To adapt to mounting position of transmitters from serial number 93/... and higher, the electronic unit (within the local display) can be twisted in 90 ° steps.

5 ELECTRICAL CONNECTION

5.1 Signal wire connection

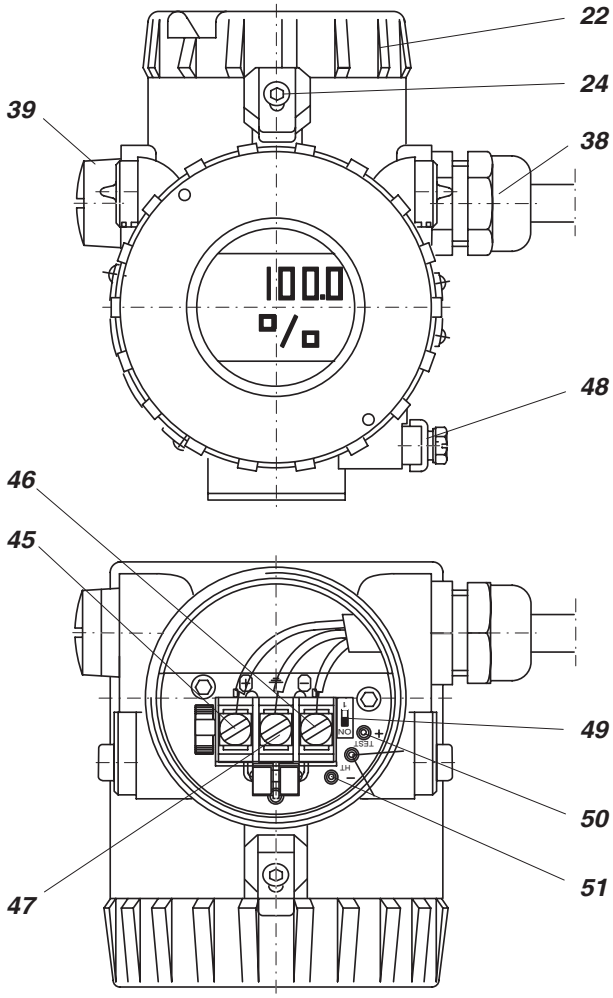
Transmitter with PG 13.5 threads can be supplied with cable gland ***38*** and cover screw ***39*** . Cable gland and cover screw are interchangeable.

Transmitter with NPT or M20 thread are supplied without cable gland. The cable gland used has to conform to possible Ex. requirements.
This is the user's responsibility.

Actions::

- Tighten cover lock ***24*** (if provided) and unscrew cover ***22***.
- Guide cable through cable gland and connect to terminals ***45***, ***46*** and ***47***.
- Proper installation of cable gland has to be observed.
- Screw cover ***22*** and install cover lock ***24*** (if provided).
- If necessary connect external ground terminal ***48***.

Note:
For explosion-proof devices follow reference for cable gland and cover screw in chapter 11



22 Connecting compartment cover
24 Cover lock
38 Cable gland
(permitted cable diameter 6 to 12 mm)
39 Cover screw
45 Connection terminal **+**
46 Connection terminal **–**
47 Ground terminal
} wire cross section max. 2.5 mm^2
48 External ground terminal
49 Switch for bridging interlock diode
50 Test sockets (∅ 2 mm)
51 Sockets for hand terminal resp. modem (∅ 2 mm)

6 COMMISSIONING

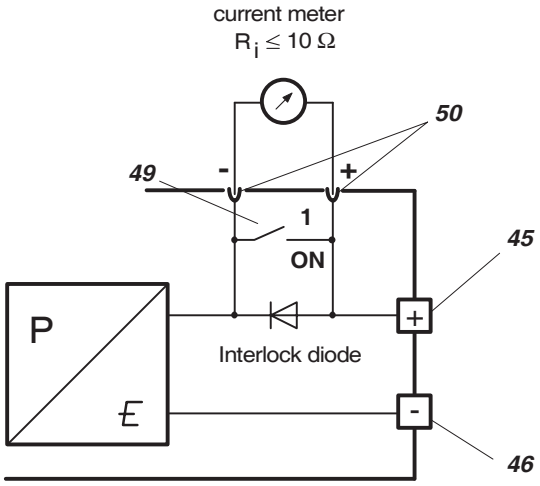
Generally installation and adherence to safety regulations have to be checked prior to start-up.
After correct installation, signal wire connection and opening of any existing isolating valves, the transmitter is ready for operation.
If necessary the configuration of lower range value, upper range value and damping has to be checked.

Checking of output signal

Supply voltage > **12,7 V**

With a transmitter supply voltage of > 12.7 V, the output signal can be checked uninterruptably at the test sockets ***50*** with a low load ampere meter (Ri ≤ 10 Ω). The switch ***49*** must be in position "**1**" (see figure in chapter 5).

Uninterruptable checking of output signal



Supply voltage ≤ **12,7 V**
With a transmitter supply voltage of 12 ... 12.7 V, move switch ***49*** to "**ON**" . Herewith the interlock diode for uninterrupted check of output signal, is shortcircuited. No signal can be measured at test sockets ***50*** .

For checking purposes an ampere meter has to be switched into output circuit ***45 - 46.***

7 DECOMMISSIONING

Prior to decommissioning take precautions to avoid disturbances:
- Observe Ex. protection.
- Switch off power supply.
- Caution with hazardous process media!
  With toxic or harmful process media, observe relevant safety regulations.

Before removing the transmitter, depressurize the process pipe between transmitter and isolating valve.

Note:
Be careful of possible contact with diaphragm during installation work.
Don't damage diaphragm!

8 CALIBRATION OF TRANSMITTER

Zero point, lower and upper range value and damping of transmitter are factory calibrated according to the order. Therefore, no calibration is necessary at start-up.

The operating data is stored in the transmitter in accordance with the order.
If the actual operating data deviates from the order calibration becomes necessary.

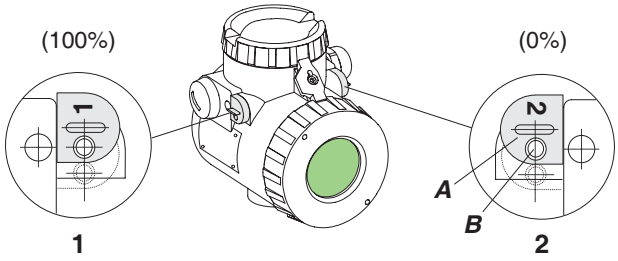
Calibration via local keys
A calibration can be done via local keys at the transmitter, if
- the amplifier compartment is designed with external keys, see chapter 8.1. calibration via local keys
- or the display is provided with keys (display keys) see chapter 8. 3 calibration via display keys.

Calibration via HART protocol
- Calibartion via handterminal HT991
- Calibration via PC,
  display and user interface ABO991 / PC20
- Basic calibration via PC and Transmitter Service Program TSP991
  (necessary if sensor or amplifier were changed).

Calibration via FOXCOM protocol
- Calibration via FOXCOM handterminal HHT
  (not 141GP/142AP starting from Ser.No. 93/...)
- Calibration via PC, software PC10 / PC20
- I/A Series System IFDC - Software
- Basic calibration via PC and Service Program Fingerprint Data Series 140 (SP 140)
  (necessary if sensor or amplifier were changed).

8.1 Calibration via local keys

Operation and function of keys
The two local keys 1 and 2 are used to set lower and upper range value, initial value of analog output and damping.



After lifting the key protection cap ***A*** insert a screw driver or pin (∅ ≤ 3 mm) into hole ***B*** and press down to second pressure point.
Both keys have two assigned functions, dependent on pressing time.

Lower range value
Setting internal zero:
For transmitter 141GP press key 2 less than 3 sec.
For transmitter 142AP this function is locked, the transmitter is adjusted to absolute pressure 0.
Setting lower range value of analog output:
The output signal is adjusted to 4 mA if the key 2 is pressed longer than 5 sec.

Upper range value
The output signal is adjusted to 20 mA if the key 1 is pressed more than 5 sec.

Damping [1)]
The damping is (electrically) set to 0 s by manufacturer.
With the local keys damping can be adjusted between 0 and 8 s (63 % time).
The local display shows the current damping value. If the key 1 is pressed less than 3 sec. Further acting of key 1 stepwise sets damping.
After damping selection, confirm by briefly pressing key 2.
Damping can be set between 0 and 32 s via Handterminal or PC.

1) Damping is only adjustable with local keys if local display is provided.

Calibration and check of lower range value and upper range value

Equipment:

- Stabilized power supply DC 24 V, 30 mA
- Local display configurated with mA resp. % or multimeter (see chapter 6, Checking of output signal)
- Screw driver (∅ ≤ 3 mm)

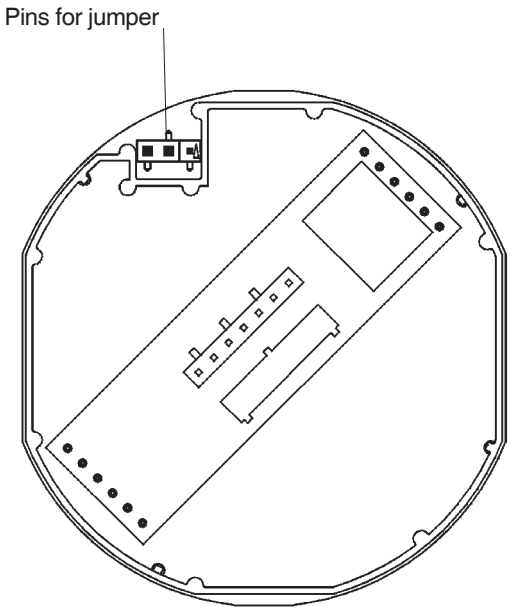
Actions:

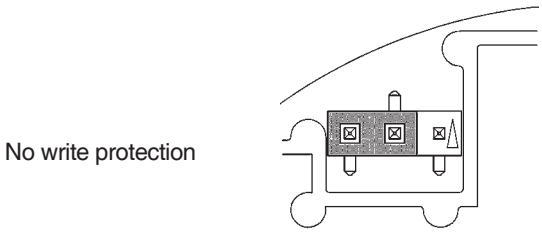
- Connect transmitter.
  See also Chapter 5, “Electrical connection”.
  If no local display is provided or the local display is configured with a physical unit, a multimeter has to be connected in series and a current measuring range 0 ... 20 mA has to be adjusted.
- Apply pressure for lower range value [1].
- Set lower range value
  (Set internal zero and lower range value of analog output).
- Apply pressure for upper range value [1]
  (upper range value = lower range value + measuring span).
- Set upper range value
- Check configured measuring range and repeat calibration if necessary [2].
- Set damping.

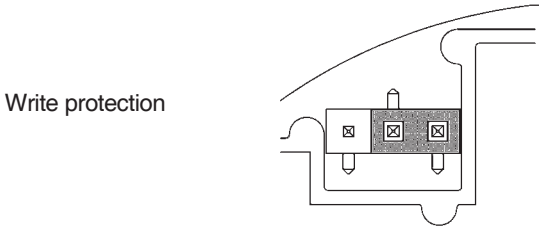
8.2. Hardware write protection (Starting Ser. No. 93/...)

The hardware write protection prevents the changing of the configuration of the transmitter. To enable writing on the transmitter, the jumper has to be plugged as shown in the figure below.

Note:
If no jumper is set, the transmitter is write protected.





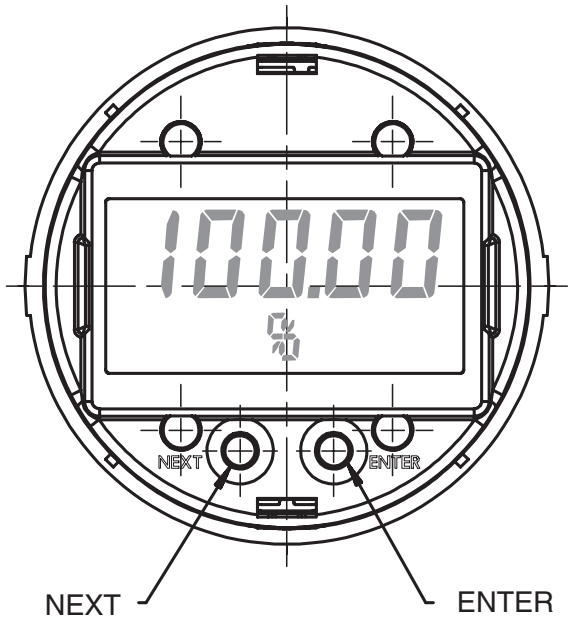


1) For reversed output signal the pressure at lower range is higher than at upper range
2) A local display configured to a physical unit may show a discrepancy within the measuring accuracy.

8.3. Calibration via Display Keys (from Serial No. 93/...)

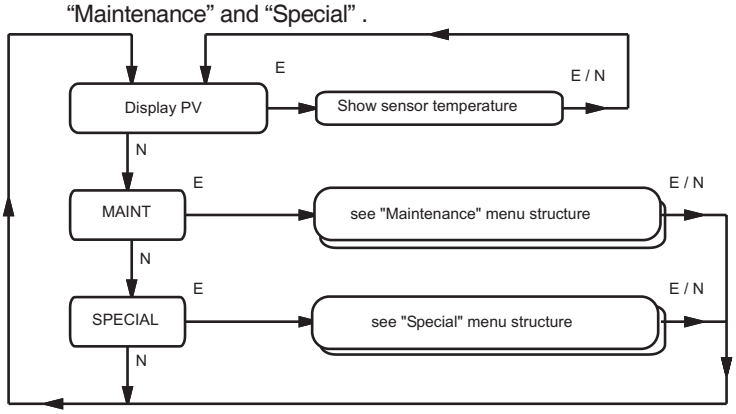
The most important configurations and calibrations can be performed as per menu directly at the transmitter via two keys (NEXT and ENTER).
(The menu structure is identical for the I/A 140 Series with either HART or FOXCOM communication protocols.)

Note:
Observe limitations for opening of housing in hazardous areas. For transmitters with additional marking “EA4" (explosion protection EEx ia IIC T4) is the openeing of housing possible without safety limitation. For all other versions of explosion protection see notes in chap. 11.2 .



Menu structure

The highest menu level offers sub-menus “ Display PV”, “Maintenance” and “Special” .



Operation differs between menus for the selection of given functions and menus for the input of numerical or alpha-numerical characters.
(see “Selection in menu", “Numerical input” and “Alpha-numerical input”)

Abbreviations used in menu structure and flow charts:

E	ENTER button
N	NEXT button (with autorepeat: i.e. long, continous actuation corresponds to multiple single actuations
LRL	Lower Range Limit
LRV	Lower Range Value
PV	Primary Variable
URL	Upper Range Limit
URV	Upper Range Value

8.3.1 Menu node “Display measurement value”

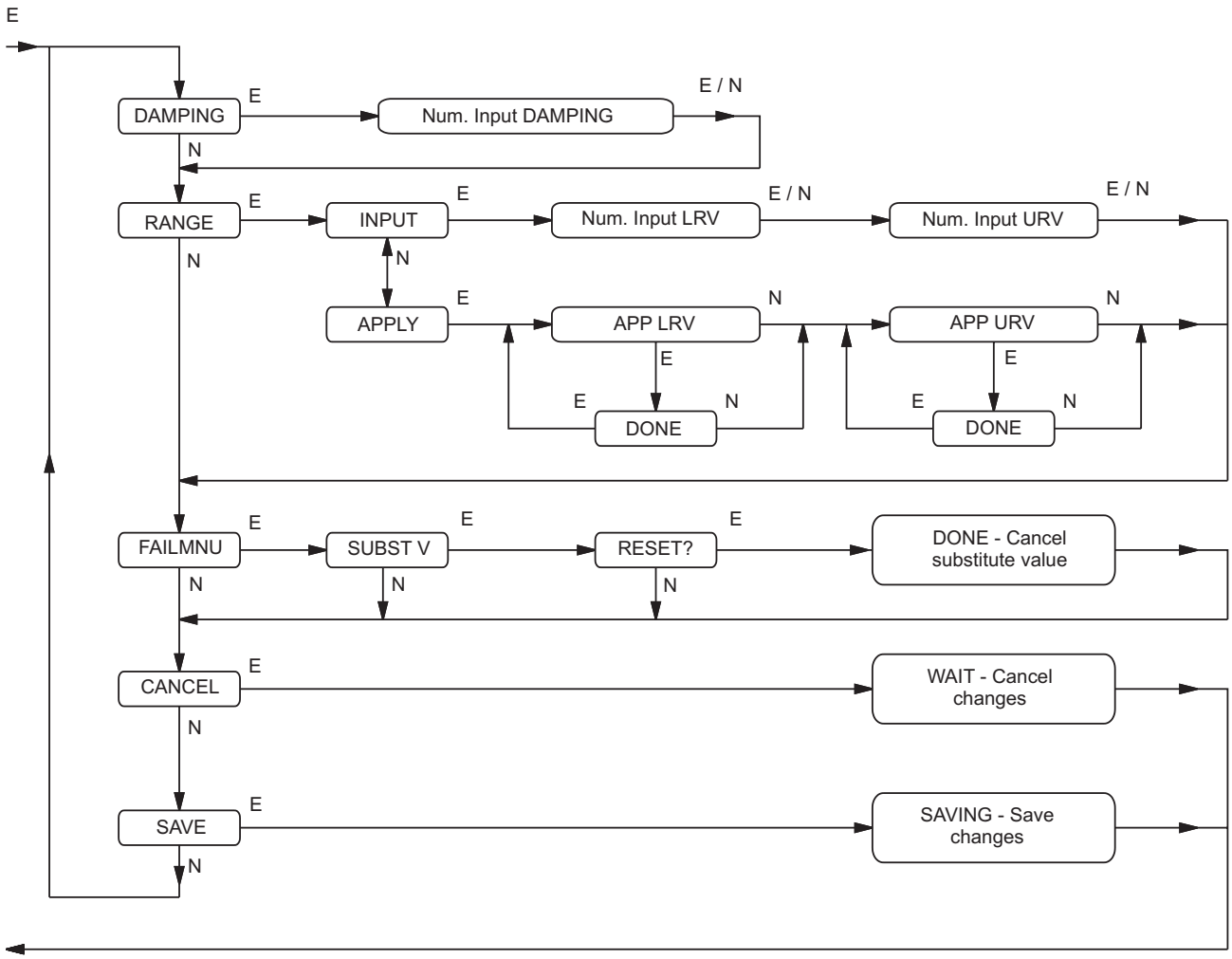
Display according to the configuration in menus “Special” - “Others”:

1. No display
2. Display of PV value and physical unit
3. Display of PV value (in %) regarding LRV and URV (in %)
4. Display PV value (in mA) regarding LRV und URV (in mA)

“Display sensor temperature”
Sensor temperature shown in °C.

8.3.2 Menu node “MAINT”

Branching to “Maintenance" menu (no protection by password).



8.3.2.1 Menu node “DAMPING”

Configuration of PV damping.

Menu node “Numerical Input DAMPING”

Display / Input of PV damping (phys. unit ‚SEC‘). The rated value range is 0 ... 32 seconds.

8.3.2.2 Menu node “RANGE”

Configuration of LRV and URV of PV. It is possible to choose between input (INPUT) or default (APPLY) of LRV and URV. The rated value range is LRL...URL.

Menu node “INPUT / Numerical input LRV”

Configuration of LRV by input.

Menu node “INPUT / Numerical input URV”

Configuration of URV by input.

Menu node “APPLY / APP LRV”

Configuration of LRV by default (current PV is indicated). LRV is taking over by pressing ENTER button.

Menu node “APPLY / APP URV”

Configuration of URV by default (current PV is indicated) URV is taking over by pressing ENTER button

.

8.3.2.3 Menu node “FAILMNU”

Branching to “Failure menu”.

Menu node “SUBST V / RESET?”

Manual take back of configured substitute value. If substitute value is taken back automatically this menu is out of operation.

8.3.2.4 Menu node “CANCEL”

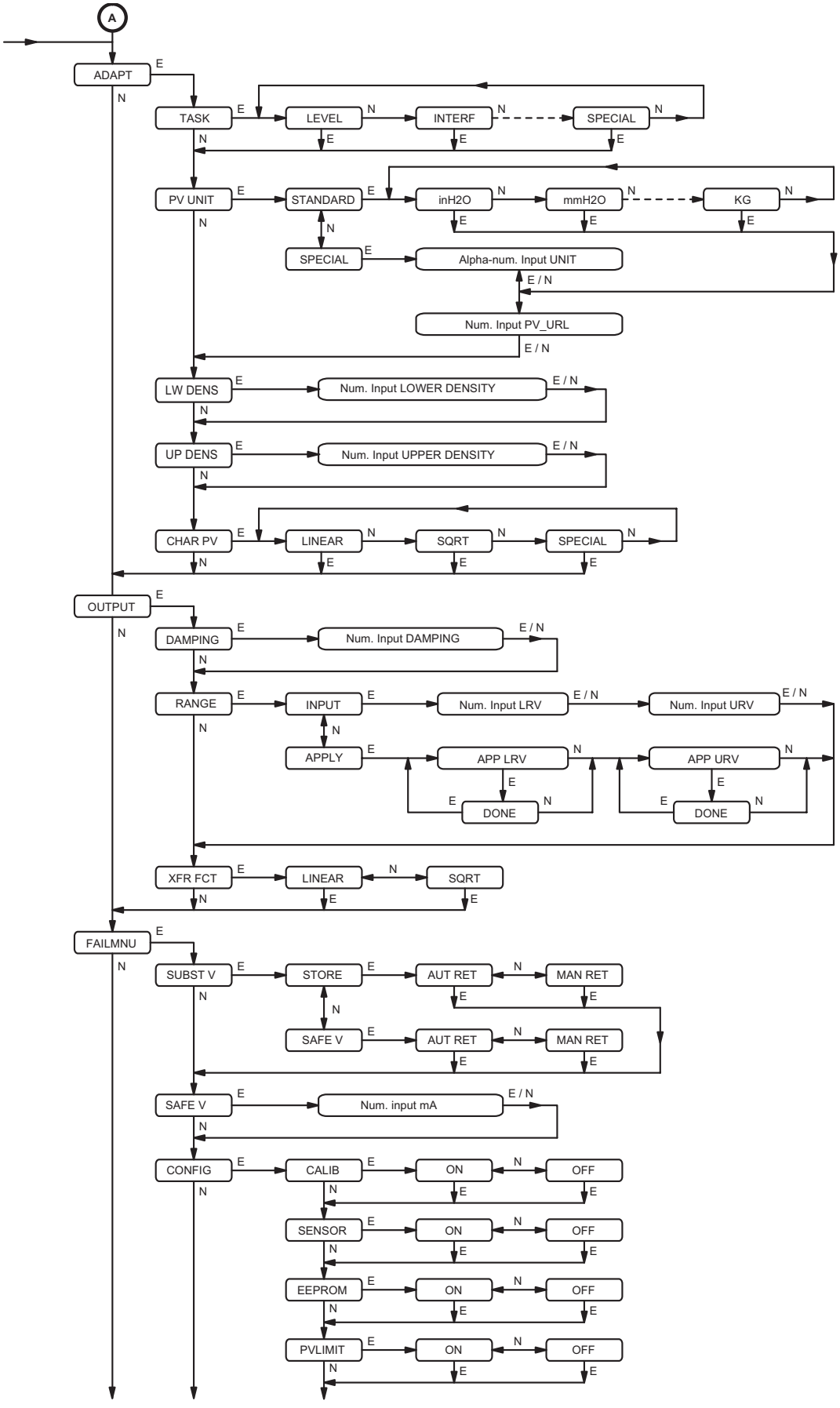
By pressing ENTER button all changes are taken back.

8.3.2.5 Menu node “SAVE”

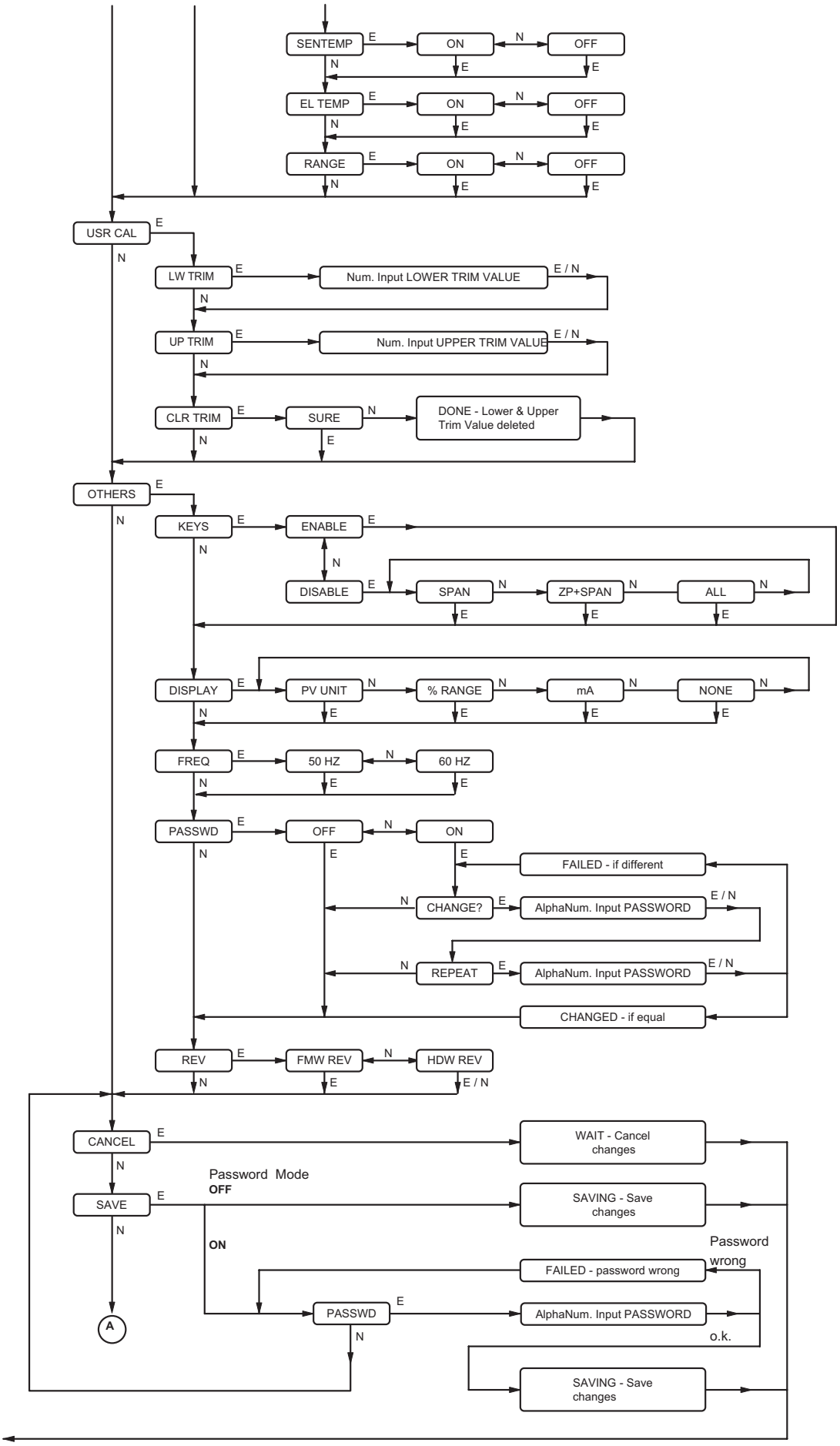
By pressing ENTER button all changes are stored.

8.3.3 Menu node “SPECIAL”

Branching to “Special" menu. In contrast to the “Maintenance" menu it is possible to make extensive configuration and calibration. Optional it is possible to configure protection by password.



Menu node "SPECIAL" (continued)



8.3.3.1 Menu node "ADAPT"

Branching to configuration for adaptation of sensor measurement value.

Menu node "TASK"

Configuration of measurement task. Selection of measuring task in menu. The configured measuring task is of a purely informative character and has no effect on the functionality of the transmitter.

Menu node "PV UNIT / STANDRD"

Configuration of standard unit for PV. Selection of the unit in menu. If the new unit can be derived from the old one (e.g. mbar to bar) or if there is a change from unit '%' to a pressure unit, an implicit conversion from LRV, URV, LRL and URL takes place. The calculated URL is displayed, but cannot be changed. In case old and new units are not identical, URL=0.0 is set and has to be entered.

Menu node "PV UNIT/ SPECIAL"

Configuration of a special unit PV. It is possible to define a unit with max. 6 charakters (see chap. "Alpha-numeric input"). If old and new units are identically, the current URL is displayed and can be changed. If old and new unit are not identically URL is setted to '0.0' and must be entered.

Menu node "LW DENS" and "UP DENS"

Configuration of density (lower density and/or upper density) of the measuring product. The configured density is in the unit 'kg/m3' and is of a purely informative nature having no effect on the functionality of the transmitter.

Menu node "CHAR PV"

Configuration of transmitting characteristic of PV. Selection of characteritic in the menu.
LINEAR – linear characteristic
SQRT – square-root extracted characteristic
SPECIAL – customized characteristic
Value pairs X/Y associated with characteristic 'SPECIAL' cannot be entered via display menu.

8.3.3.2 Menu node "OUTPUT"

Branching for configuration of current output of transmitter.

Menu node "DAMPING" and "RANGE"

see "MAINT"

Menu node "XFR FCT"

Configuration of the transfer function of the current output. Selection of transfer function in menu.

8.3.3.3 Menu node "FAILMNU"

Branching in the failure menu.

Menu node "SUBST V / STORE"

Configuration of the behavior during 'Store last Value'. In case of an error, the transmitter maintains the last valid output current until the error is eliminated (automatic return AUT RET) or until the substitute value is manually returned (MAN RET).

Menu node "SUBST V / SAFE V"

Configuration of the behavior of the substitute value. In case of an error, the transmitter changes the output current to a configured substitute value and maintains the output current until the error is eliminated (automatic return AUT RET) or until the substitute value is manually returned (MAN RET).

Menu node "SAFE V"

Configuration of the substitute value. The permissible value range is 3.6 – 23 mA. This value is of significance only if the "Substitute value" is configured instead of ' Store last value'. During an error this configured value becomes the output current of the transmitter.

Menu node "CONFIG"

Branching for configuration of malfunctions messages. There are seven areas where a malfunction signal can either be activated (ON) or supressed (OFF).

1. CALIB	Internal calibration failed
2. SENSOR	Pressure peaks of ± 150 % of nominal range
3. EEPROM	Write EEPROM impossible
4. PVLIMIT	PV ± 110 % of nominal range
5. SENTEMP	Sensor temperature out of limits
6. EL TEMP	Electronic temperature outside – 45 °... 85 °C)
7. RANGE	Configured measuring range invalid

8.3.3.4 Menu node "USR CAL"

Branching to user calibration of PV.

Menu node "LW TRIM"

Calibration of lower trimpoint. Indication of measuring value corresponding to the lower trimpoint and entry of value. Following entry of trimpoint the transmitter calculates, based on trimpoint and measuring value, a new zeropoint for its transmitting characteristics.

Menu node "UP TRIM"
Calibriation of upper trimpoint. Indicating measuring value corresponding to upper trimpoint and input of value. Following input of trimpoint transmitter calculates a new zeropoint and new end for its tranfer characteristics based on trimpoint and measuring value.

Menu node "CLRTRIM"
Delete user calibration (clear trimpoints).

8.3.3.5 Menu node "OTHERS"

Menu node "KEYS / ENABLE"
Release of all functions of external keys (1- and 2-key) of transmitter.

Menu node "KEYS / DISABLE"
Selective blocking of external keys of transmitter.

SPAN	URV configuration blocked
ZP+SPAN	LRV + URV configuration blocked
ALL	all functions blocked

Menu node "DISPLAY"
Configuration of measurement diagram in display.

PV UNIT	Display of value and unit of PV
% RANGE	Display of percent value of PV
MA	Display of mA value of PV
NONE	No display

Menu node "FREQ"
Adapt the trouble suppression to the line frequency

Menu node "PASSWD"
Branching into password administration. It is possible to secure storing of changes in the "SPECIAL" menu by a password interrogation, i.e. password interrogation may be activated (ON) or deactivated (OFF). It is possible to change the password during activated password interrogation. Dual input affects the change.

Menu node "REV"
Display of firmware and hardware revisions.

8.3.3.6 Menu node "CANCEL"

Taking back all changes by pressing ENTER.

8.3.3.7 Menu node "SAVE"

During deactivated password interrogation all changes are stored by pressing ENTER. During activated password interrogation it is necessary to enter the correct password (the old password hast to be used in the configuration of a new password) to store all changes .

8.3.4 Selection in Menu

In selecting a sub-menu the presently selected menu point will be shown first. The following menu point is selected; it is accepted by pressing ENTER.

8.3.5 Numerical Input

If the menu requests numerical input the current value and name are displayed.

By actuating key NEXT the menu position is exited without changing the value.

Following pressing ENTER the value may be changed by pressing key NEXT and upward counting of the blinking number ('1' follows '0'). ENTER switches to the following position.

Following change and/or activating of all characters (max. 5 digits) input of the decimal point is requested. Key NEXT relocates decimal point. By pressing ENTER the value has been transferred.

Upon transfer the value range is checked. In case of faulty input a blinking error signal is actuated for about 3 seconds (see " Error signals") and is branched to menu node "Cancel".

8.3.6 Alpha-numerical Input

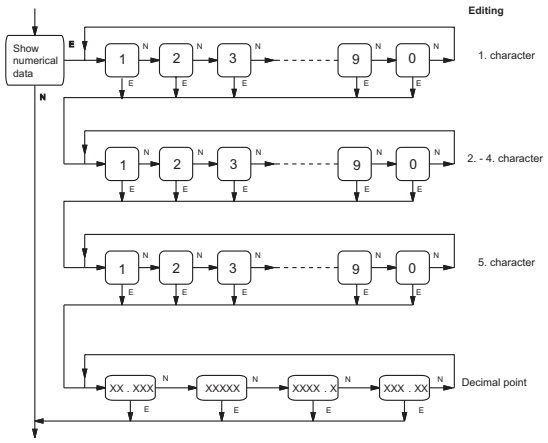
If the menu requests an alpha-numerical input, the presently selected characteristic chain is shown.

By actuating key NEXT this menu position is exited without changing the value.

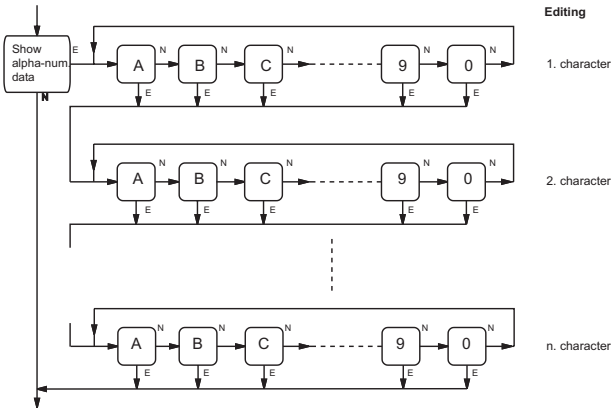
Following pressing ENTER the value may be changed by pressing key NEXT and upward counting of the blinking characteristic ('A' follows '0'). ENTER switches to the following position.

Following change and/or activation of all characters (max. 5 characters) the character chain is transferred by activating key ENTER.

Numerical Input



Alphanumerical Input



8.3.7 Error messages

The following error messages are possible:

BADDAMP	invalid range of damping
BAD LRV	invalid range of LRV
BAD URV	invalid range of URV
BADSPAN	span | upper trim point – lower trim point | < 2 % of max. admissible span of measurement
BAD PAR	invalid range of upper or lower trim point
BADPROC	invalid value of upper or lower trim point
BAD URL	invalid range of URL
BAD MA	invalid range of output current
WR PROT	transmitter is write protected

If one of this errors occurs, it will not be accepted. Break-off by activating CANCEL.

8.3.8 Warning messages

A configuration triggering a warning will be accepted and can be assumed via SAVE.

Warnings are:

WRNSPAN	observe extended technical data for turn down > 1:20 (TI EMP0600G-(en))
WRN URV-	invalid range of URV due to indirect configuration.

8.3.9 Monitoring of time

By entering menu node “MAINT” the monitoring of all keys in menus “Maintenance” and “Special” will be started for 120 seconds which will be restarted with each pressing of keys.

By exceeding the monitoring time all previous changes will be canceled and the menu is branching to menu node “Display PV”.

Only the menu steps associated to menu nodes “USR CAL” and “APPLY” are not monitored.

9 LOCAL DISPLAY

As accessory for the digital transmitter, a 5 digit LCD is available with display in %, mA or physical units.
The local display can only be activated by configuration via handterminal HT991 or PC.
See Master Instruction

for HT991:	MI EMO0110 A-(en)
for PC:	MI EMO0112 A-(en)

Starting from Series No. 93/... the PV indication can also be activated via keys at the display.

Note:
Subsequent installation or replacement of LCD display by original parts is not a repair or change as defined in ElexV, if performed by authorized personnel

9.1 Installation of local display up to Serial No. 82/.....

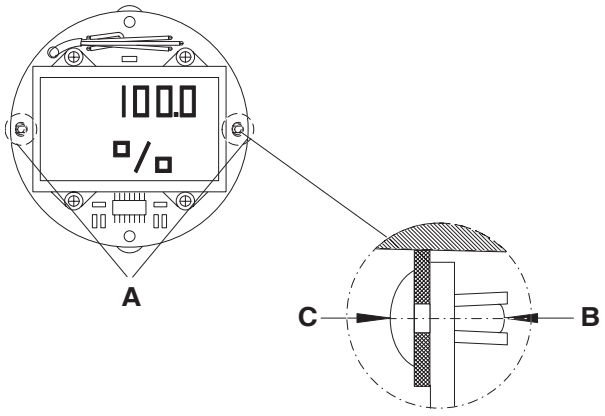
(See figure amplifier electronics in chapter 10)
For replacement or upgrading of the local display a conversion kit is available. It contains
25 front housing cover with show glass
26 O-ring seal
56 LCD display, 5 digits with
53 terminal block
Mounting is performed by exchanging front housing cover ***25*** without show glass and support plate ***58*** .

Actions:

- Unscrew housing cover ***25*** and remove support plate ***58*** .
- Connect terminal block ***53*** of LCD display to amplifier board ***59*** and screw LCD display.
  Use original parts only!
- Attach new front housing ***25*** together with O-ring ***26*** .

The local display can be twisted in 90 °-steps. For this purpose the rubber buffers **A** of the LCD display have to be shifted:

- To loosen rubber buffer, press pin in direction **B**.
- To fasten rubber buffer, press head in direction **C**.



9.2 Installation of local display from Serial No. 93/.....

(See figure amplifier electronics in chapter 10)
For replacement or upgrading of the local display a conversion kit is available. It contains
25 Front housing cover with show glass
26 O-ring seal
62 Electronic housing with display
65 O-ring seal
Installation is done by exchanging front housing cover ***25*** without show glass.

Actions:

- Unscrew housing cover ***25*** .
- Remove electronic housing ***62*** .
- Remove snap hook of electronic housing ***62*** by means of a suitable tool and take off amplifier board ***61*** . If necessary pull out terminal block ***52*** and ***54*** .
- Lock amplifier board ***61*** with display unit ***62*** in new electronic housing.
- Pull O-Ring ***65*** over electronic housing ***62*** .
- If necessary replug terminal block ***52*** and ***54***.
- Completely insert electronic housing with display unit ***62*** and level into amplifier housing ***21***. The electronic housing can be turned in 90 °-steps.
- Screw new front housing cover ***25*** with O-ring ***26*** .

10 MAINTENANCE, REPAIR

In general no maintenance is required.

Important:
Prior to any maintenance disconnect the transmitter from its control loop or power supply. Safety requirements have to be observed (see Chapter 11).

10.1 Visual inspection

As part of routine maintenance, visually inspect process connection for

- damages
- corrosion
- blocking

10.2 Sensor check

Workshop work (see figure amplifier electronics)

- Disconnect transmitter from current.
- If provided, remove cover lock ***24***.
- Unscrew front housing cover ***25***.
- Unscrew local display ***56*** resp. support plate ***58***, resp. pull out electronic housing ***62***.
- Take off terminal block ***52***.
- Resistor check [1]:

  R1 between gray and yellow = 3,6 kΩ to 4,2 kΩ
  R2 between white and brown = 3,6 kΩ to 4,2 kΩ
  R3 between gray and green = 3,6 kΩ to 4,2 kΩ
  R4 between green and brown = 3,6 kΩ to 4,2 kΩ
  R_{TK} between red and red = 50 Ω to 150 Ω

  The resistors R1, R2, R3 and R4 must be within a tolerance band of ± 10 Ω from one to another.

If the measured values deviate from these values the sensor element has to be replaced.

10.3 Amplifier check

All intelligent transmitters of the I/A 140 Series are equipped with a uniform standard amplifier.
The output signal can be checked via test sockets (see Chapter 6 “Commissioning”).

Adaptation of HART and FOXCOM amplifier electronics to sensor requires

- Service Program Fingerprint Data Series 140 (SP140) or
- PC 20 Revision higher 1.0

for adaptation of specific characteristic of the sensor to the amplifier electronics.

10.4 Replacement of amplifier electronics or sensor

Workshop activity
Sensor and / or amplifier electronics replacement by a set of original parts is no repair in the sense of Elex V if performed by authorized personnel.

Note:
Take steps to prevent the damaging of sensor and amplifier electronics when working at sensitive electrostatic components.

Make sure that sensor element and amplifier both meet the required certificate of conformity.
After replacement of amplifier or sensor element fingerprint data have to be downloaded to amplifier. Lower and upper range value have to be readjusted. (see Chapter 8).

10.4.1 Amplifier electronics up to Serial No. 82/.....

Procedure for exchange of amplifier electronics (see figure amplifier electronics)

- If provided, remove cover lock ***24***.
- Unscrew front housing cover ***25***.
- Unscrew local display ***56*** resp. support plate ***58*** and carefully take off terminal blocks ***52***, ***53*** and ***54*** from amplifier board ***59***.
- Loosen 2 screws ***60*** and unsnap electronics board ***59*** out of plastic container. Remove if necessary.(Assembly has to be done in reverse)
- Install front housing ***25*** with O-ring ***26*** and install cover lock ***24*** (if provided).

Procedure for exchange of sensor (see figure amplifier electronics)

- If provided remove cover lock ***24***.
- Unscrew front housing cover ***25***.
- Unscrew local display ***56*** resp. support plate ***58*** and carefully take off terminal blocks ***52*** and ***53*** from amplifier board ***59***.
- Before unscrewing the sensor element loosen twist lock ***36***.
- Remove sensor ***80*** from amplifier housing ***21*** and carefully pull out terminal block from housing bore.
- Install new sensor with new O-ring ***37*** and twist lock ***36*** in reverse order. Lightly grease O-ring and thread.
- Secure sensor by redressing one cog of twist lock ***36***.
- Connect terminal block ***52*** and ***53***.

1) Check with suitable test prods.

- **Attention:** Don't crush wires. Wires to terminal block ***54*** are guided between housing inner wall and plastic container below the lateral ledge.
- Install front housing cover ***25*** with O-ring ***26*** and install cover lock ***24*** (if provided).

10.4.2 Amplifier electronics from Serial No. 93/.....

Procedure for exchange of amplifier electronics (see figure amplifier electronics)

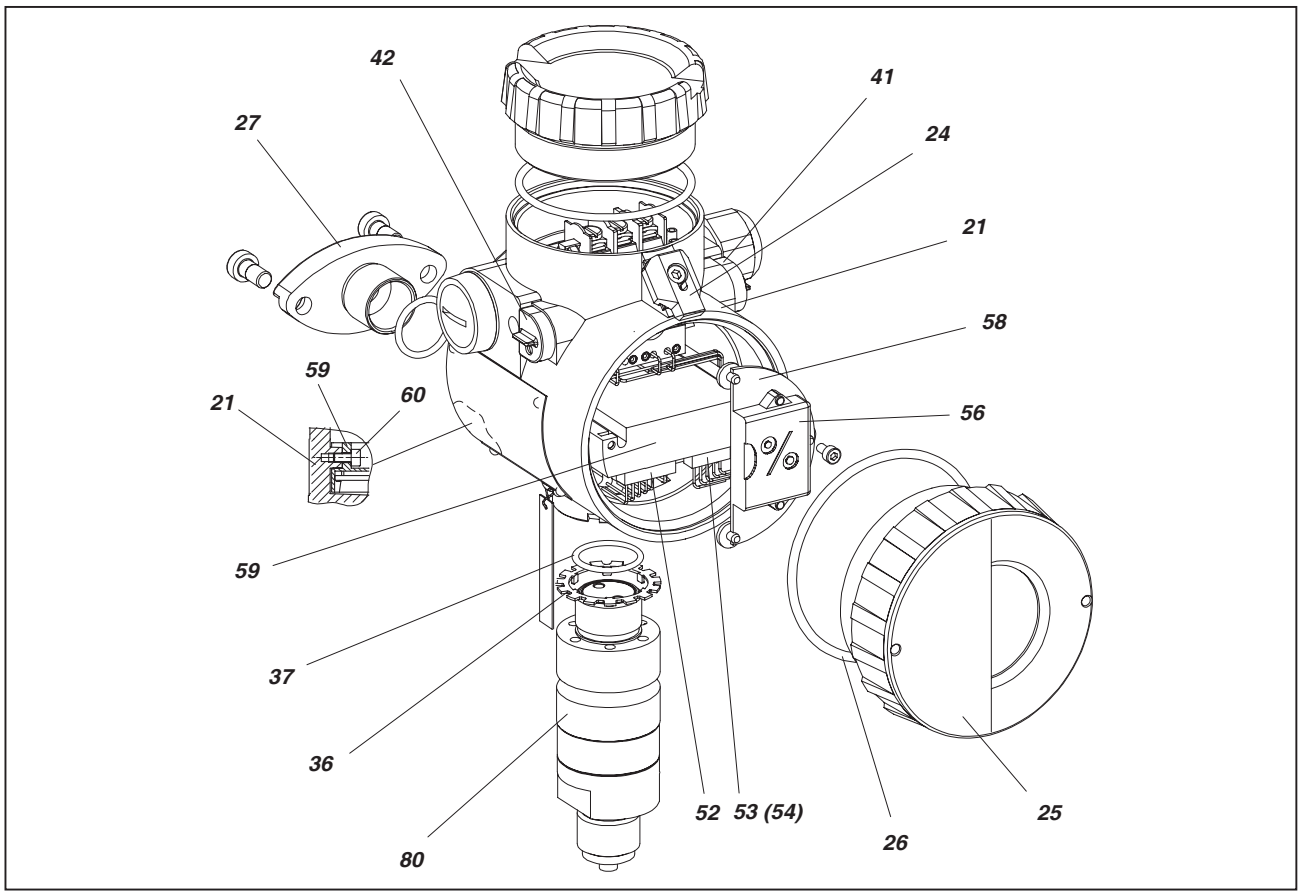
- If provided remove cover lock ***24***.
- Unscrew front housing cover ***25***.
- Pull out electronic housing ***62*** and take off terminal blocks ***52*** and ***54*** from amplifier board ***61***.
- Carefully remove snap hook of electronic housing ***62*** by means of suitable tool and take off amplifier board ***61*** .
- Lock amplifier board ***61*** in electronic housing ***62*** and replug terminal block ***52*** and ***54***.
- Return electronic housing ***62*** with hooded O-ring ***65*** and entirely flat into amplifier housing ***21***.
- Install front housing ***25*** with O-ring ***26*** and install cover lock ***24*** (if provided).

Procedure for exchange of sensor (see figure amplifier electronics)

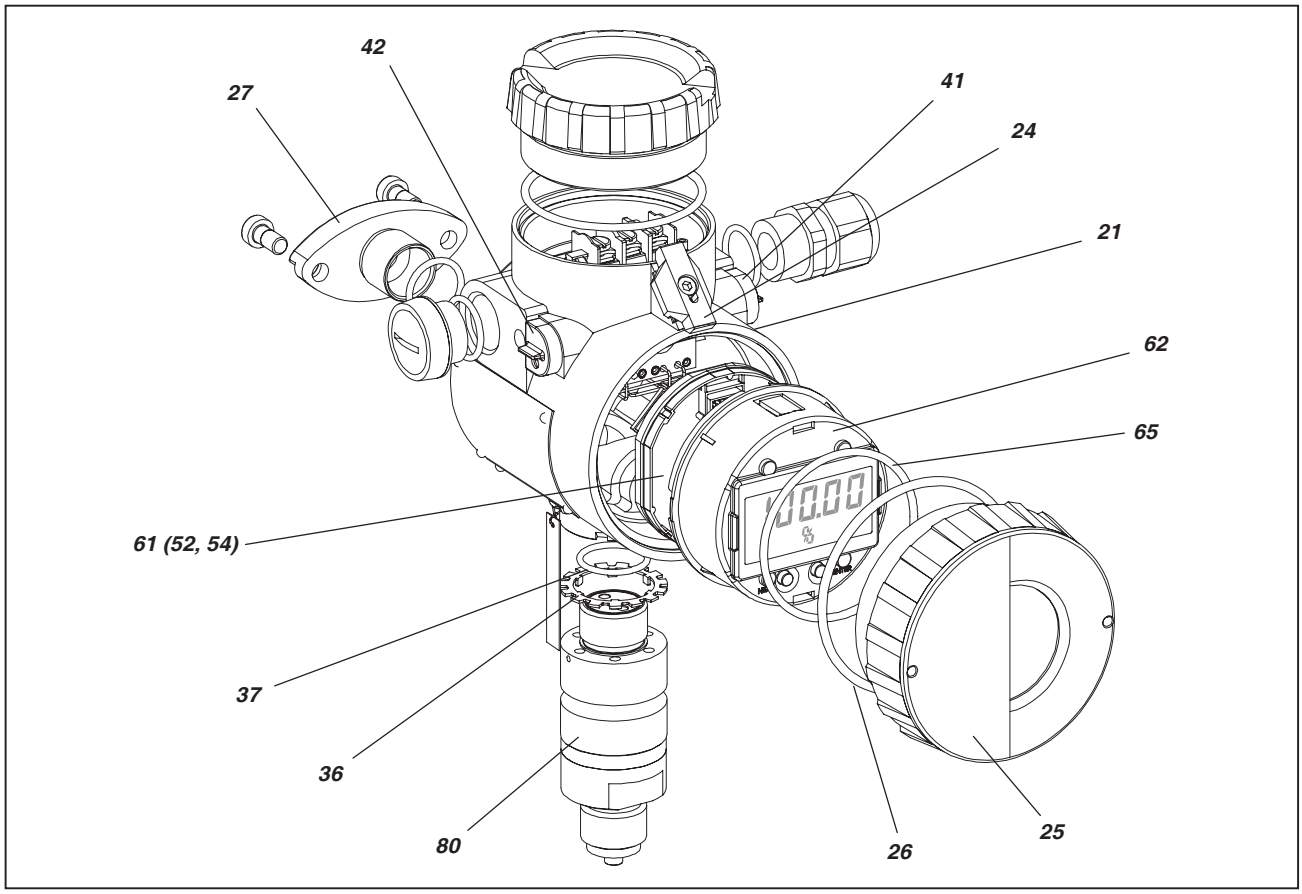
- If provided, remove cover lock ***24***.
- Unscrew front housing cover ***25***.
- Pull entirely out electronic housing ***62*** and take off terminal blocks ***52*** and ***54*** from amplifier board ***61***.
- Carefully remove hook of electronic housing ***62*** with suitable tool and take off amplifier board ***61*** .
- Before unscrewing the sensor element loosen the twist lock ***36***.
- Remove sensor ***80*** from amplifier housing ***21*** and carefully take off terminal block from housing bore.
- Mount new sensor with new O-ring ***37*** and twist lock ***36*** in reverse order. Lightly grease O-ring and thread.
- Secure sensor by redressing the twist lock ***36***.
- Connect terminal block ***52*** .
- Return electronic housing ***62*** , with hooded O-ring ***65*** completely and level into amplifier housing ***21***.
- Install front cover housing ***25*** with O-ring ***26*** and install cover lock ***24*** (if provided).

21 Amplifier housing
24 Cover lock
25 Front housing cover
26 O-ring for Pos. ***25***
27 Rear housing cover
36 Twist lock
37 O-ring
41 Cover plate for local key 2
42 Cover plate for local key 1
52 Terminal block for sensor
53 Terminal block for local display
54 Terminal block for power supply
56 Local display (up to Serial No. 82/.....)
58 Support plate (up to Serial No. 82/.....)
59 Amplifier board (up to Serial No. 82/.....)
60 Allen Screws SW 2.5 (up to Serial No. 82/.....)
61 Amplifier board (from Serial No. 93/.....)
62 Electronic housing (from serial No. 93/.....) changeable with / without display unit
65 O-ring for Pos. ***62*** (from Serial No. 93/.....)
80 Sensor

Amplifier electronics up to Serial No. 82/.....



Amplifier electronics starting from Serial No. 93/.....



11 SAFETY REQUIREMENTS

11.1 General requirements

This instrument satisfies the conditions for safety class III according to EN 61010-1 (rsp. IEC 1010-1).

Any work on electrical parts must be done by qualified personnel if any power supply is connected to the instrument.

The transmitter has to be used for its designated purpose, correctly installed and powered. National application regulations have to be observed, e.g. DIN VDE 0100 or DIN VDE 0800 in the Federal Republic of Germany.

The instrument has to be operated with safety extra-low voltage SELV or SELV-E.

Safety measures provided in the transmitter may become ineffective if the instrument is not operated in accordance with the master instructions.

Limitation of power supplies for fire protection have to be observed as per EN 61010-1, appendix F
(resp. IEC 1010-1).

Safety class IP66
To meet enclosure IP66 requirements, the screwed cable gland and all O-rings in the housing cover must be correctly installed.

Mounting location
Protect transmitter against direct and extreme sun and/or heat exposure.
Observe the permitted ambient temperatures

Process media
For dealing with process media observe the relevant safety requirements.

Caution with oxygen:
Danger of fire!
Therefore special attention has to be paid for oxygen measurement:

- Only use transmitters suitable for oxygen measurement!
- Only use equipment free of oil and grease!
- Check whether all parts in contact with oxygen are free of oil and grease.

Software
Trouble-free operation in connection wit the transmitter operating ensured only with software released by FOXBORO ECKARDT GmbH.

11.2 Explosion protection

(Only if ordered accordingly)

Technical data for explosion protection see Product Specifications PSS EMP0610 A-(en)

For installations in contact with explosive atmospheres, all relevant national regulations and installation regulations must be observed, e.g. in the Federal Republic of Germany Elex V and DIN VDE 0165.

Attention:
When repairing explosion-proof equipment, observe the national regulations.
Use only original spare parts when making repairs.

The following applies to the Federal Republic of Germany:
Repairs involving parts required for explosion-proofing must either be carried out by the manufacturer or by authorized personnel and confirmed by certificate.

Attention:
It's not allowed to open devices with certificate of conformity "EEx d", "EEx ia d IIC T6" or "explosionproof" of FM or CSA in hazardous areas. That doesn't count, if the devices are not connected to each power supply or
there is for this time no danger of explosion in the concerned area.
For devices with certificate of conformity "EEx ia dIIC T6" it is always allowed to open the cover looking from safety aspects.
The user assumes responsibility.

Cable gland
With protection type "EEx d" and instruments with certificate FM resp. CSA "explosionproof" the screw hole is
1/2 - 14 NPT or M20 x 1.5 (according to ANSI/ASME B1.20.1).

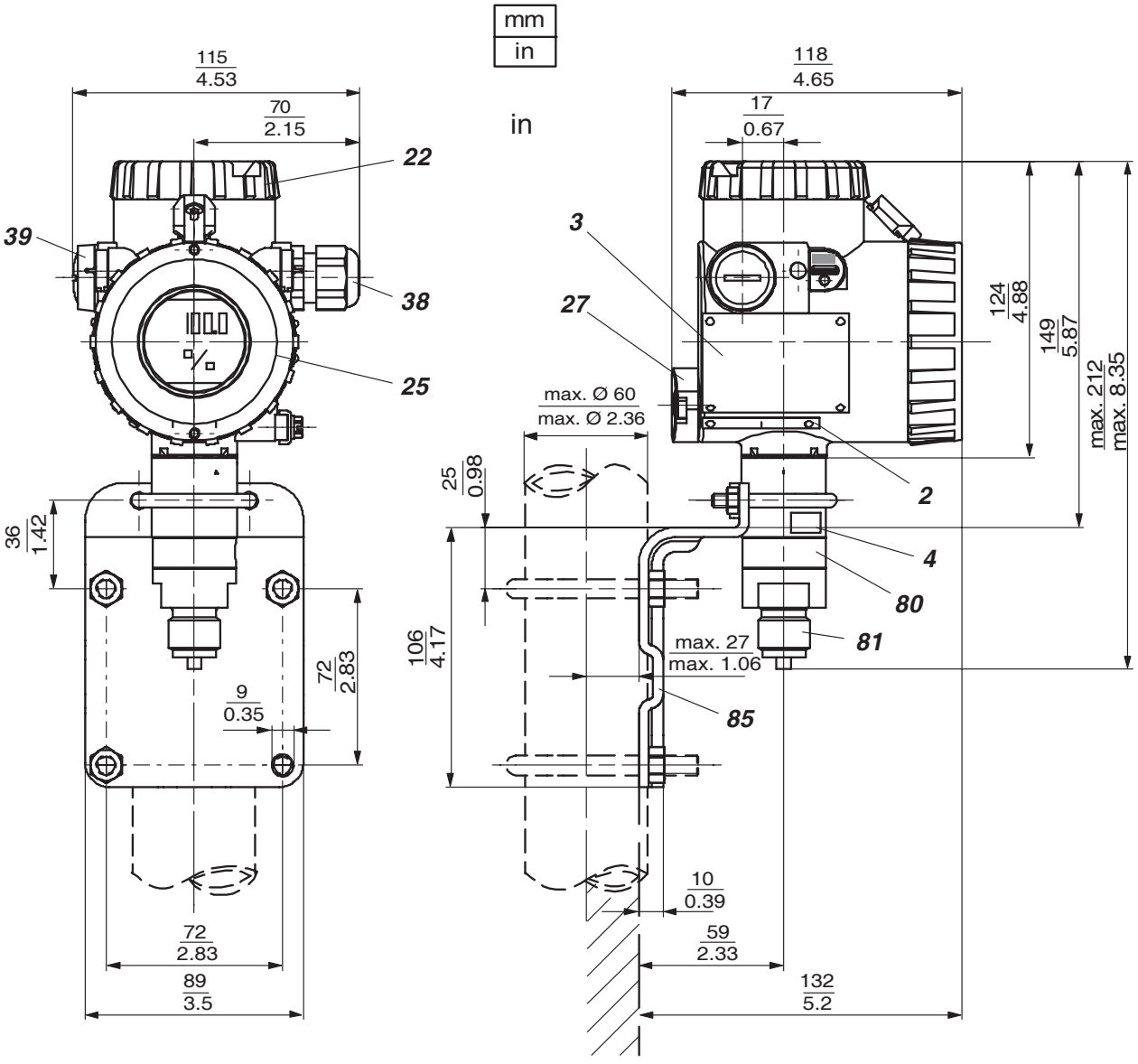
"EEx d" certified instruments must be connected via cable glands resp. tube systems which satisfy the requirements of EN 50018 (05.78) Part 12.1 and 12.2 and have a separate certification.
An opening not used must be closed according to Part 12.5 of EN 50018 (05.78).

Instruments with type of protection FM resp. CSA "explosionproof" must be connected via suitable tube and wire systems. A sealing box shall be installed within 45 cm (18 inches) of the enclosure. Openings not used have to be closed with the attached cover screw.

Cover lock
With type "EEx d" protection all housing covers have to be secured against unintentional opening.
Devices with FM or CSA "explosionproof" or "EEx d" housing covers may only be opened at disconnected power supply.

For "EEx ia d" this is required only for front and rear cover.

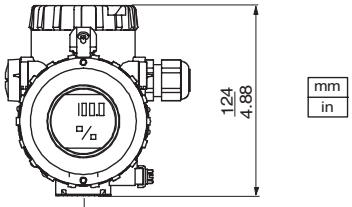
12 DIMENSIONS



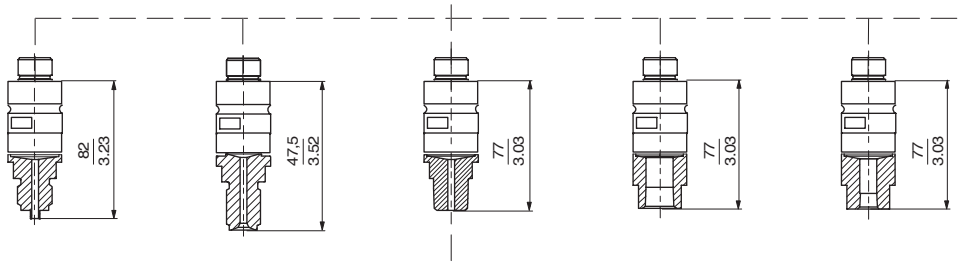
2	Tag No. label	***38***	Cable gland
3	Amplifier nameplate	***39***	Cover screw
4	Sensor marking	***80***	Sensor
22	Connecting compartment cover	***81***	Process connector
25	Amplifier with/without local display	***85***	Mounting set for pipe or wall mounting
27	Rear housing cover		

Dimensions (continued)

Process connection
141GP, 142AP

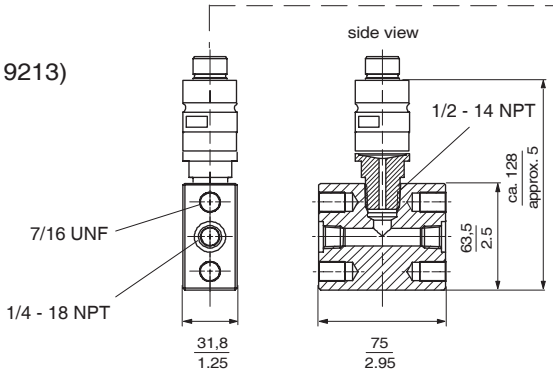


Thread



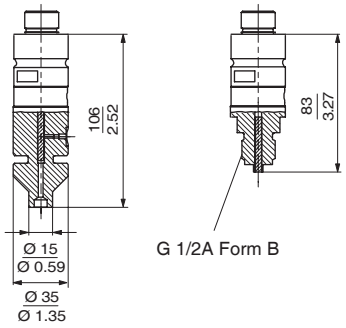
Type	G 1/2A Form B	G 1/2A Form D	1/2 - 14 NPT	1/2 - 14 NPT	1/4 - 18 NPT
Model Code	**G1**	**G2** (141GP only)	**N1**	**N2**	**N3**

Bracket Mounted
(connection according to DIN 19213)



Model Code **BM**

Prepared for pressure seal mounting



Type	welded	screwed
Model Code	**D1**	**D2**

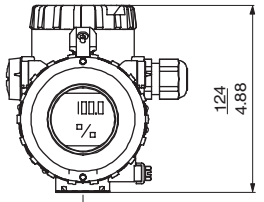
Control volume and dead volume for 141GP and 142AP prepared for mounting of diaphragm seals (screwed):

Span	Controlvolume	Deadvolume
0,25 bar	0,018 cm³	1,3 cm³
2,5 bar	0,004 cm³	1,2 cm³
25 bar	0,005 cm³	
250 bar		1,0 cm³
1600 bar		

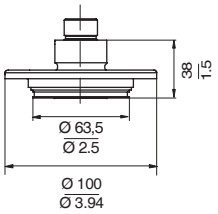
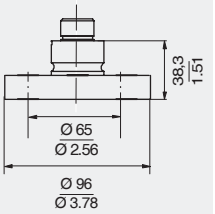
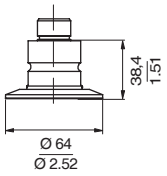
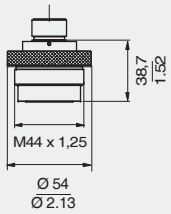
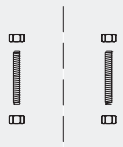
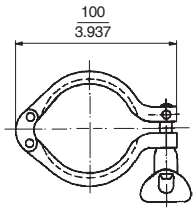
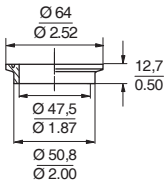
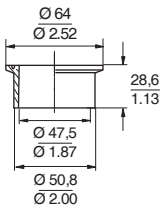
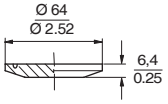
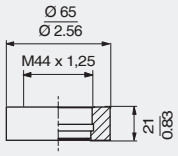
For welded version add 0.5 cm³ for dead volume (in case of missing O-rings).

Dimensions (continued)

Process connection (continued)
141GP, 142AP



Flush diaphragm

				
Type Model Code	APV Inline Flange **AP** (141GP only)	Flange DN15/PN40 **L1**	Tri Clamp 2" **L2**	M44 x 1,25 **L9**
Parts				
Type Model Code	 Profile seal EPDM **APV-1**	 U-Seal, SS/Viton **FLD-1** U-Seal, SS/NBR **FLD-2** or  O-Ring, Viton **FLD-3** O-Ring, EPDM **FLD-4** O-Ring, PTFE **FLD-5**  Mounting Set, SS (4x Screwbolts, 8x nuts) **FLD-A**	 Sealing ring, NBR, 2" **TRI-1**  Clamp ring 2", (SS-304) **TRI-A**  Welding clamp for inch pipes, (SS-316L) **TRI-B** or  Welding clamp for inch pipes, (SS-316L) **TRI-C**  Blank, (SS-316L) **TRI-D**	 Flat seal, PTFE **M44-1** Flat seal, NBR **M44-2**  Welding socket, (SS-316L) **M44-A**

13 SUPPLY OF TRANSMITTER

13.1 General

For safety requirements see chapter 11. Specialties during operation in explosion protected areas see chapter 11.2..

Depending on the transmitter application varying demands are made on the supply. The different operating modes are explained in the following chapters. The wire diagram is shown in Figures 1 to 5.

The power supply units for different applications (direct / via power supply unit of transmitters, HART / FOXCOM / without communication, intrinsically / not intrinsically) are listed in the following table.

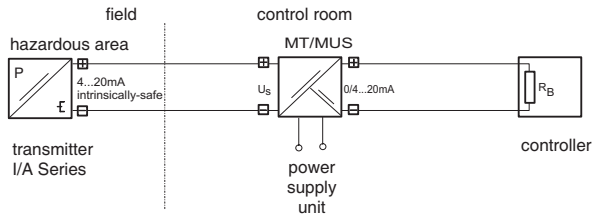
All listed supply devices are available for intrinsically-safe and/or non-intrinsically-safe application.

Application and asssociated supply

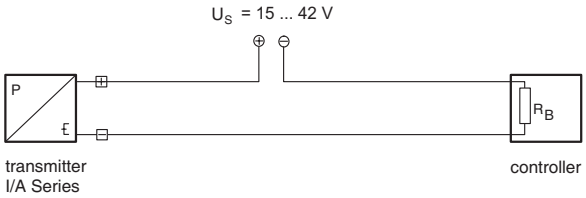
Application	Supply (**recommended)**
without communication	direct, **MT228**, MUS925, MUS80, **MUS924**
HART	direct, **MT228, MUS925**
FOXCOM analog	direct, **MT228**
FOXCOM digital	**I/A-System, MT228**

13.2 Overview of application types

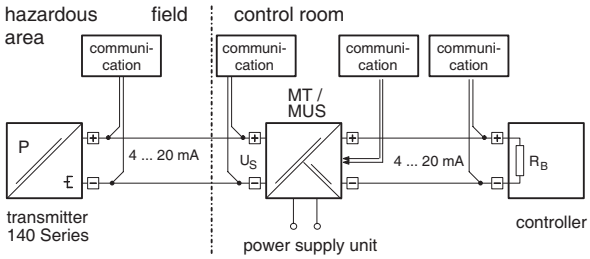
Supply via power supply unit (Fig. 1)



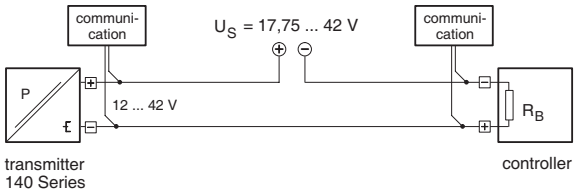
Direct supply (Fig. 2)



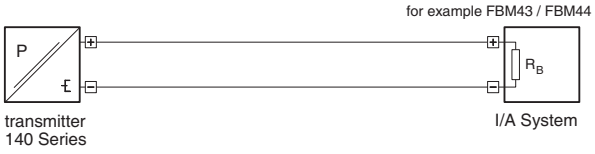
Supply via power supply unit with communication (Fig. 3)



Direct supply with communication (Fig. 4)



Direct supply via control system (Fig. 5)



13.2.1 Supply via power supply unit

This supply is the normally one used and is recommend. Interferences are prevented due galvanic separation of measurement loop, load and power supply in the power supply unit (see fig. 1)

13.2.2 Direct supply

This most simple version can be recommended only for single galvanically separated supply or measurement loops (see fig. 2)

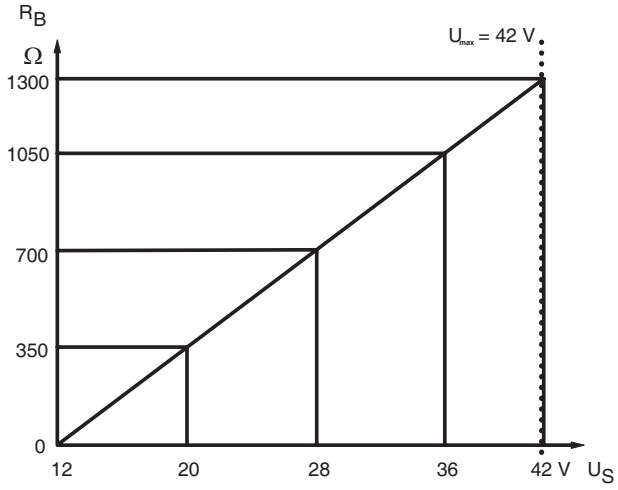
The max. load impedance is calculated per:

$R_{Bmax} = (U_{max} - 12\ V) / I_{max}$

U_{max}: max. permitted voltage (acc. to product specifications), depends on type of transmitter and explosion protection

I_{max}: 12 mA for transmitter in FOXCOM digital mode, 23 mA for all other transmitters (HART and FOXCOM)

Permissible load depending on supply voltage. Example of a non intrinsically safe 140 series HART transmitter (Fig. 6)



13.2.3 Communication

In contrast to convential operating mode in the two-wire loop **a minimal load for all communication modes** has to be available. If this load is selected too low, the communication is short-circuited.
(FOXBORO ECKARDT power supply units capable for communication (MT228, MUS925) already have respective loads).

Additionally, the line lenghts have to be limited to the max. permitted values for the respective communication

Standard values

Communication	HART	FoxCom analog	FoxCom digital
Min. load	250 Ω	200 Ω	200 Ω
Max. capacity of line	< 200 nF		
Max. length of line	ca. 3300 m	1800 m	600 m

The respective wiring diagram is shown in Figure 3.

Figure 4 shows the respective wiring diagram without power supply unit for galvanically separated loops. The operating tool - handterminal, PC with software [1] and modem [2] - can be connected to the labeled positions. Depending on the application the regulations for explosion protection have to be observed also for the operating tools!

13.3.4 Operating via I/A System

For operation via control system the devices have to be wired as shown in Figure 3 or 5. If a FBM43 or FBM44 is used in combination with a power supply unit - e.g. for intrinsically-safe applications - the non-supplying input (+ and -) of the module has to be used.

Another possibility recommended for galvanically separated single systems is shown in Figure 5. In this case the supplying input (P+ und -) of the module is used.

If the I/A System is also used for communication, additionally the marginal conditions listed in “communication” are to be observed.

13.2.5 Intrinsically-safe application

For intrinsically-safe application generally the use of a respective power supply unit is recommended. Wiring should be done as per respective national and international standards and regulations - as described in “Supply via power supply unit”. If communication is required also, the guidelines of chapter “Communication” have to be observed. In addition, the application of the operating tools and their permitted limit values are to be observed.

1) Depending on the communication protocol (HART or FOXCOM) different software tools can be used.
HART: PC20, ABO991, TSP991 or WPP991
FOXCOM: PC20, PC10
For further informations see respective documentation
2) Both communication protocols need different modems.

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