

VER. NO.	LC3244LD-2017
ITEM. NO.	XSBSQ-001

CATALOG

DISPLACER LEVEL(INTERFACE) TRANSMITTER LC3144LD



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LC3144LD *Levelstar* Intelligent Buoyancy Transmitter for Liquid Level, Interface and Density with Torque Tube – HART-Version



The intelligent transmitter LC3144LD *Levelstar* is designed to perform continuous measurements for liquid level, interface or density of liquids in the process of all industrial applications. The measurement is based on the proven Archimedes buoyancy principle and thus extremely robust and durable. Measuring values can be transferred analog and digital. Digital communication facilitates complete operation and configuration via PC or control system. Despite extreme temperatures, high process pressure and corrosive liquids, the LC3144LD measures with consistent reliability and high precision. It is approved for installations in contact with explosive atmospheres. The LC3144LD combines the abundant experience of FOXC with most advanced digital technology.

FEATURES

- HART Communication, 4 to 20 mA
- Back documentation of measuring point
- Configuration via FDT-DTM
- Continuous self-diagnostics, Status and diagnostic messages
- Multilingual full text graphic LCD
- Configurable safety value
- IR communication as a standard
- Local display in %, mA or physical units
- Easy adaptation to the measuring point without calibration at the workshop
- Process temperature from $-196\text{ }^{\circ}\text{C}$ to $+500\text{ }^{\circ}\text{C}$
- Linear or customized characteristic
- Materials for use with aggressive media
- 32 point linearisation for volumetric measurement
- Micro sintermetal sensor technology

TECHNICAL SPECIFICATION

Measuring range: liquid level: 0~5m
Density: 0~0.3 to 0~2.0g/cm³
 interface:
 density difference: 0~0.05 to 0~1.5g/cm³
Accuracy: A class: ±0.2%FS; B class: ±0.5%FS
Output: Analog - two wire 4~20mA DC
 Digital-HART OR FOXCOM Protocol
 FF protocol
Process temperature: -196~500°C
Ambient temperature: -40~85°C
 (with LCD: -40~70°C)

Safety class: ExiaIICT1~T4
 ExdIICT1~T5
Enclosure: IP65
Connection flange:
 External displacer: ANSI B16.5,
 HG20592~20635-97
 Internal displacer: ANSI B16.5, HG20592 ~
 20635-97, or on request
Material: Carbon steel, 304ss, 316ss, 316L,
 or on request

MODEL FORM

LC3144LD	Intelligent displacer liquid (interface) level transmitter										Model	
	1	HART			2	FF			3	FOMCOM		communication
	1	A105 carbon steel			4	316 SVS316 OOCr17Ni12Mo2 1.4401			Body material			
	2	321 SCS321			5	316L SVS316L OOCr14Ni12Mo2 1.4435						
	3	304 OCr18Ni9			6	Other material to be specified						
	H	External(side-side)			F	External top-side			G	External top-bottom		Mounting
	C	Externalside-bottom			G	External top-bottom			N	Internal top mounted		
	1	For level			2	For interfacier			3	For density		Service
	4/4A	2.5MPa/Class/150LB ANSI			7/7A	16.0MPa/Class/900LB ANSI			Pressure rating			
	5/5A	4.0MPa/Class/300LB ANSI			8/8A	32.0MPa/Class/1500LB ANSI						
	6/6A	6.3MPa/Class/600LB ANSI			9/9A	40.0MPa/Class/2500LB ANSI						
	T1	Normal temperature -40℃～150℃										Process Temp.
	T2	High temperature -60℃～500℃										
	T3	Low temperature -196℃～400℃										
	O	No requirement										Safety class
	D	Explosion proof ExdIICT1～T6										
	E	Intrinsically safe ExiaIICT1～T6										
	B	With safty barrier										
	0	Without heating jacket										Options
	J1	Heating jacket/process connection										
	J2	Heating jacket /process connectionJB/T82.1-94 DN15 PN1.0										
					-□□□□							Measure range
							-□□□□					Density
LC3144LD	1	5	H	1	5A	T2	0	J1	-2400	-1300		For example
LC3144LD Intelligent displacer liquid (interface) level transmitter, C/W HARTprotocol, 316L cage material , External(side-side) mounting, measuring Level, Pressure rating 300LB, High temperature type, No Ex-proof and no jacket requirement, measuring range 2400mm, liquid density 1300kg/m3												

1. Design

20 Amplifier housing

22 Connection compartment

121 Sensor

128 Heat sink

131 Wafer body with torque tube

133 Transmission lever

134 Torque tube

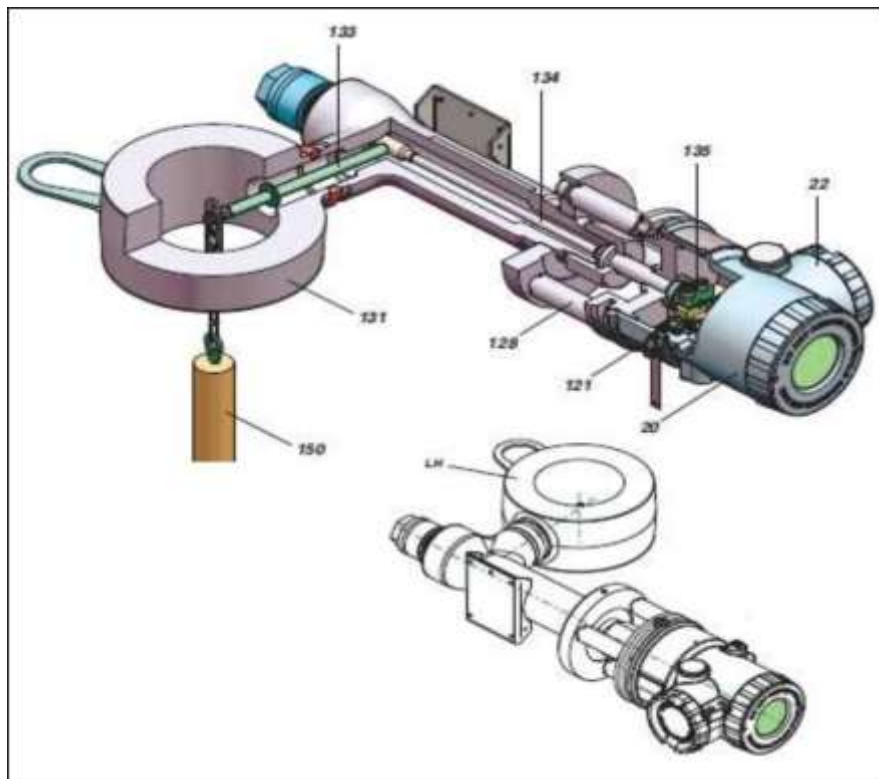
135 Clamping lever

150 Displacer with chain

LH Left-hand=mounting amplifier

to wafer body"Left hand mounted"

(Model Code L)



2. Method of Operation

The buoyancy force of the displacer 150 is transferred via transmission lever 133 and torque tube 134 to operating rod of the sensor, where it acts on free end of sensor element 121.

Four thin film metal strain gauge elements are sputtered onto sensor element, which change their resistance in the ratio of the tensile or pressure tension. These four thin film metal strain gauge elements are connected as a Wheatstone full bridge supplied from amplifier.

The voltage at the diagonal bridge section which is proportional to the effective weight is fed to the electronic amplifier as an input signal. This voltage is converted via the electronic amplifier into the 4 to 20mA or digital two-wire output single. The amplifier is supplied by the signal current circuit in two-wire mode.

3. Mounting

The 244LD LevelStar is directly built onto the vessel or alternatively on a side-mounted displacer chamber (e.g. 204DC).

During installation, the permissible static pressure and the ambient temperature range must be observed.(see Boiler label).

3.1 High medium temperatures

For some high temperature medium, the ambient temperature should be within the permitted range. If applying to the concentrated media with the high-temperature capacity (such as 300°C saturated steam) or the wafer covering with the jacket heated by the hot oil (about 300°C), the ambient temperature

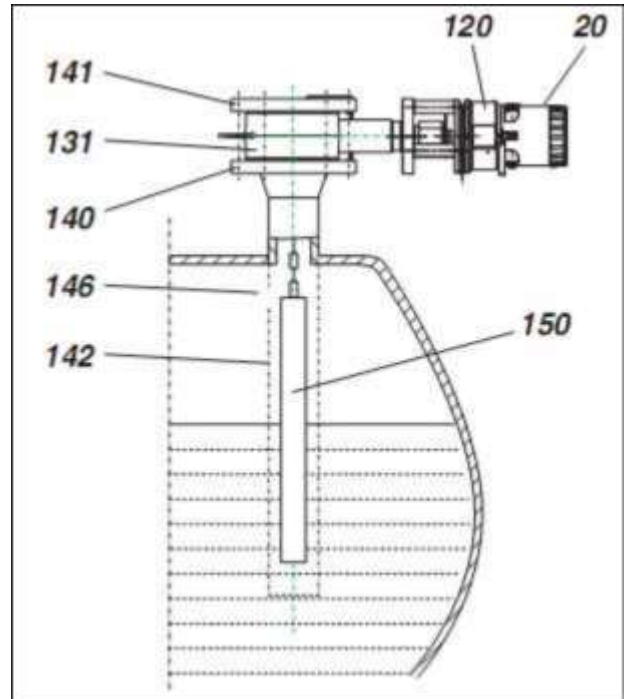
affecting directly on the sensor housing and amplifier should not surpass 50 °C.

It is important to ensure that the max. permissible temperature of the electronics housing of 85°C and that of the sensor housing of 125°C is not exceeded. Explosive devices and equipment for overfill protection are executed to WHG. And product specifications PSS EML0710 and the information in the certificate must be applied.

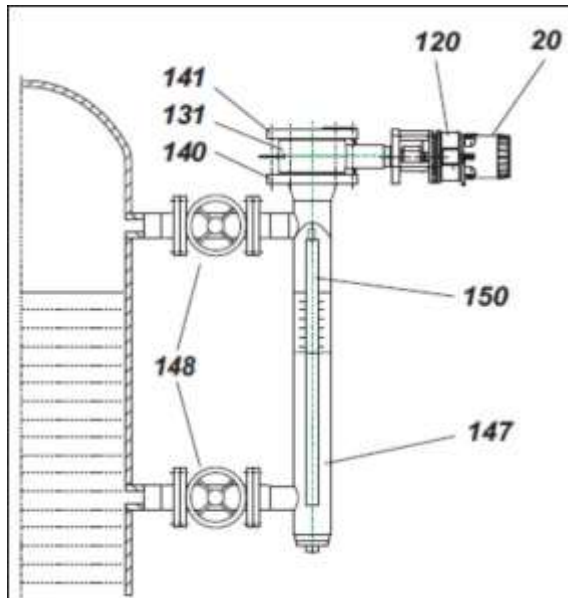
3.2 Mounting on top of the vessel

If the vessel contains a turbulent liquid, a protection cage/tube should be used. It has a venting hole 146 above the maximum liquid level. Between the protection cage/tube 142 and the displacer 150 must be a gap of 5...10 mm.

20 Amplifier	141 Blind flange
120 Sensor housing	142 Protection cage/tube
131 Wafer body	146 Venting hole
140 Connecting flange	150 Displacer 204DE



3.3 Mounting on the side of the vessel



When used in Zone 0, fittings resistant to flame penetration must be used.

If the chamber has not already been mounted by the customer, it must be mounted on the vessel with suitable bolts and seals (not included in the scope of delivery). Be sure that the displacer chamber is exactly vertical.

Between the protection cage or tube and the displacer must be a gap of 5...10mm.

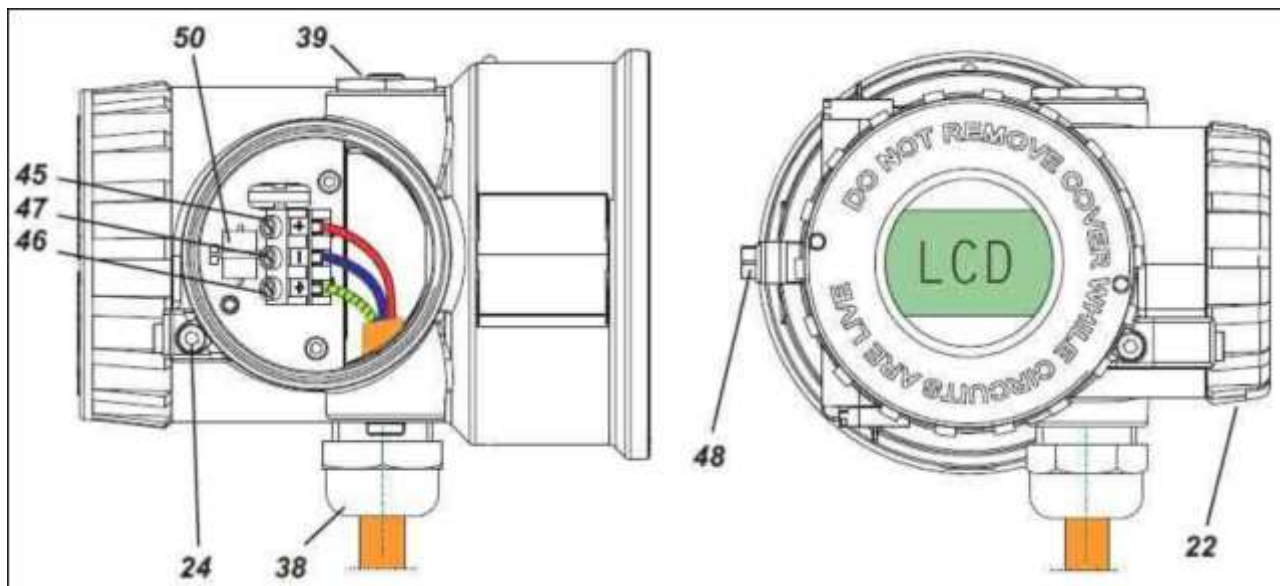
Note:

For explosion-proof devices or devices with certification as overfill protection as per WHG and /or VbF, the remarks in the product specifications PSS EML0610A and in the certificates or approvals must be observed.

147 Displacer chamber 204DC
148 Shut-off device

4. Electrical Connection

4.1 Signal wire connection



Guide cable through cable gland 38 from the bottom; observe especially the shielding.

Check before mounting cable glands if the threads are matching, otherwise housing can be damaged. Cable gland 38 and cover screw are interchangeable.

Connection input signal to terminals 45 (+) and 47 (-). The screw terminals are suitable for wire cross section of 0.3 to 2.5mm².

For section of the cable see the recommendation for cable types acc. to IEC 1158-2.

Transmitters supplied without cable gland, the cable gland used has to conform to possible Ex requirements.

This is the user's responsibility.

Note:

For explosion-proof device follow reference for cable gland and cover screw in document. "Safety Instructions 140 Series"

22 Connecting compartment cover

24 Cover lock

38 Cable gland (permitted cable diameter 6 to 12mm)

39 cover screw

45 Connection terminal "+" wire cross

46 Ground terminal max 2.5 mm²

47 Connection terminal "-" section

48 External ground terminal

50 Overvoltage protection (if present)

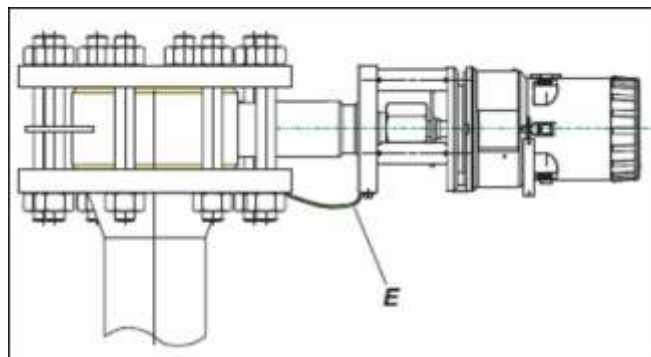
Notice:

- Tighten cover lock 24 (if provided) and unscrew cover 22
- Guide cable through cable gland and connect to terminal 45, 46 and 47
- If necessary connect external ground terminal 48.
- Screw cover 22 and install cover lock 24(if provided).

4.2 Ground

If connection to ground is necessary (e.g. potential equalization, protection of electromagnetic influence), ground terminal 46 or external ground terminal 48 must be connected.

When using an electrically non-conducting gasketing, the wafer body must be ground by wire E with the connection flange.



5. Commissioning

In any case, installation and safety regulations have to be checked prior to commissioning. See EX EML0010 A: " Safety Operating Instruction"

After correct installation and connection to power supply unit, the transmitter is ready for operation:
 $U > 12 \text{ V DC}$ (HART)

If necessary the configuration of lower range value, upper range value and damping has to be checked.
 With HART an ammeter can be attached into the output current loop for check.

6. Setting of Transmitter

Zero, lower range value, upper range value and damping of the transmitter are set by manufacture as specified in the order:

- Dimensions of displacer: length, density , weight
- Setting lower range value by weight F_0
 without zero elevation = 0
 with zero elevation = value of elevation
- Upper range value corresponding to buoyancy force of displacer
- Output range and unit

Setting via HART Protocol

- Setting with PC and FDT-DTM
- Setting with handterminal

Setting via operating push button

Setting can be done by means of the push buttons at the transmitter. See next page.

"Warm-up" before calibration

To minimize the measuring error at extremely high(or extremely low) process temperatures, it is recommended to have the transmitter reach first the operating temperature.

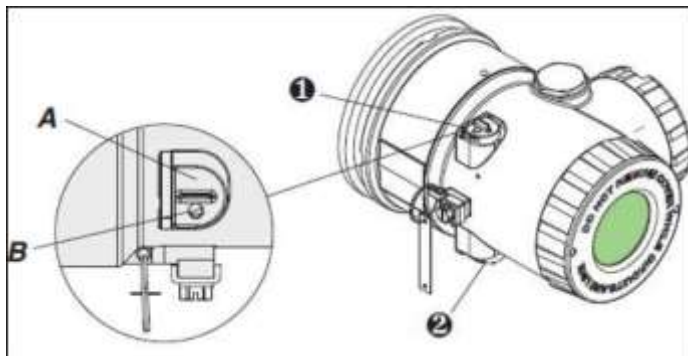
7. Starting operation

After starting (after power-on), the Logo is briefly displayed, then device information. The setting can be done by local keys and LCD display.

Setting via local keys and LCD

The operation parameters and settings can be viewed on site and in some cases changed. For local operation, a full graphic LCD is available and 2 buttons on the outside of housing. Inside the unit there are no other controls.

After shifting the key protection cap A, insert screw driver or pin ($\phi \leq 3\text{mm}$) into hole B and press down to the second pressure point.



Starting from operation view:

- the ② button switches to details of the operating values.
- the ① button switches to the menu selection

If no button is pressed within 5 minutes, the display returns automatically to the operational view.

Changing values

Liner adjustment

Is used for example in PV-offset, damping and LCD contrast:

The current value is displayed. With button ② MORE the value is increased. If the largest value is reached, starts again from beginning with the smallest value. The button has auto repeat.

Stop with button ① DONE. After that, even queried whether the change should be saved.

Numerical adjustment

Is used for example in measuring range value:

The current value is displayed and the first digit(or sign) is selected. Each time the button ① CHANGE is pressed the number is counted up, until the desired number is reached. With button ② NEXT the next number is marked and can be changed, etc. After that, even queried whether the change should be saved.

Manually or Autorange?

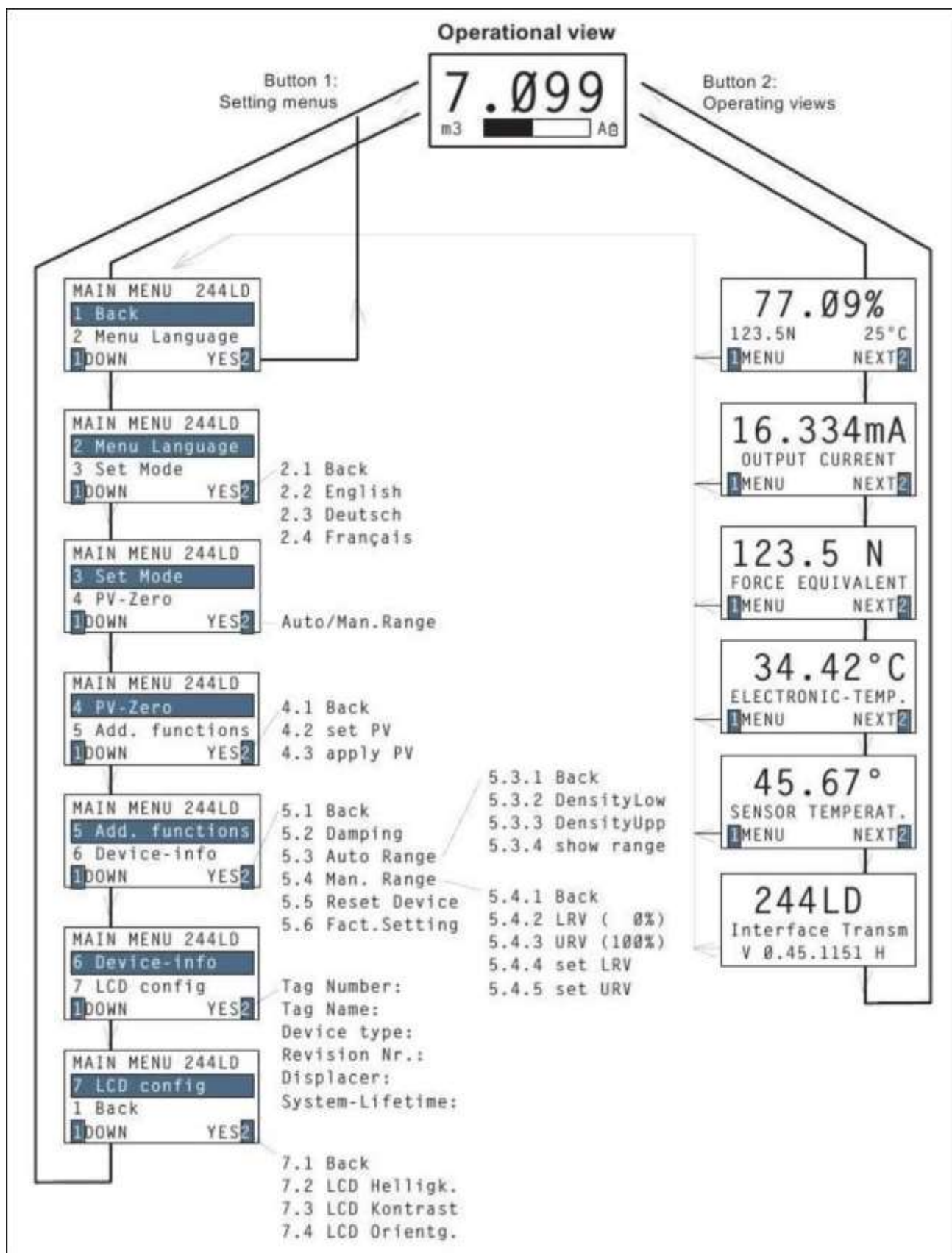
When ordering, the customer has stated range and the density of the measuring medium (or the densities of the media). From these information, the real displacer was manufactured.

On the delivery the mode is set to Autorange:

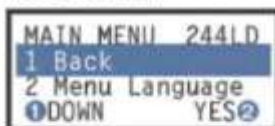
The displacer data (diameter, length, weight) and the density of the media were stored before delivery via FDT/DTM in the LC3244LD Level Star. From this data, PV-offset and upper range value URV are calculated automatically, which allows an immediate operation without any additional calibration in the

field. However, if the manual method is preferred, so the values can be entered manually.

In the manual mode, the classic method is possible to take over the respective values of the buoyancy forces with the operating conditions for 0 % (with level: empty vessel) and 100% (with level: full vessel).



Menu 1: Back

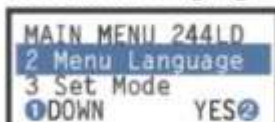


Back to Operational view.

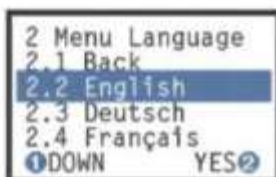
→ When selecting YES 2 it goes back to the operating view.

Note: All sub-menus start with a "back" feature that lets you come back to the previous menu. For better clarity omitted in this description.

Menu: Menu language



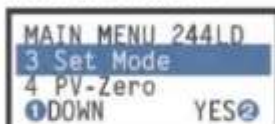
→ With YES 2 it goes to language selection:



There are 3 menu languages, standard English, German and French. From the factory, active language is always English.

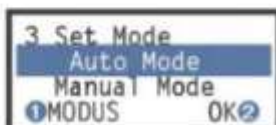
With 1 DOWN the desired language is selected and becomes active with confirming with YES 2. All texts are now displayed in the chosen language. Then it goes automatically back to the main menu.

Menu 3: Set mode



→ With YES 2 it goes to Autorange- or Manual- selection.

See also notes on page 10

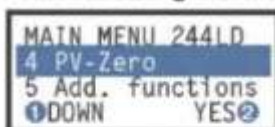


With 1 MODE you switch from Autorange- to Manual Mode. If this is to expect a change in the output value, a message appears.

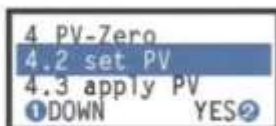
After confirming with OK 2 back to the main menu.

Switching from Manual- to Autorange Mode: Requires reset to factory settings, if manual set data allows no calculations. See menu 5.6.

Menu 4: Setting PV-Offset



→ With YES 2 it goes to setting PV-Offset:

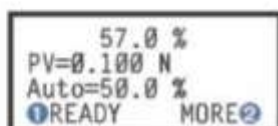


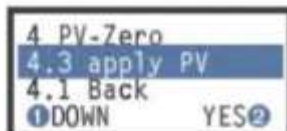
→ With YES 2 PV-Offset can be set, regardless of the mode Autorange or Manual.

Setting on Linear adjustment in 0.1% increments, see p.10

The expected impact of the change can be seen on the primary variables in the second line.

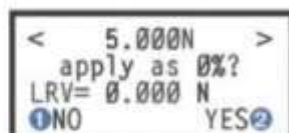
The resulting automatically calculated PV-offset is displayed on the third line to observe the change and possibly return to the former value.





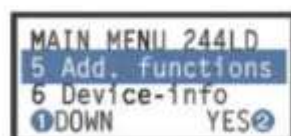
--> With YES 2 the current process value (Level: Displacer not in the medium) is taken over as the physical zero point.

This menu item is only for manual mode and therefore the auto range mode is locked (indicated by a padlock symbol).

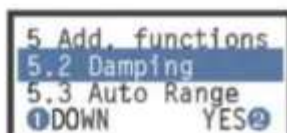


--> By confirmation with YES 2 the current value will be saved as Lower Range Value.

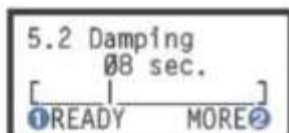
Menu 5: Additional functions



--> With YES 2 it goes to the following sub menus:

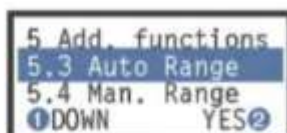


--> With YES 2 it goes to **setting the damping**.



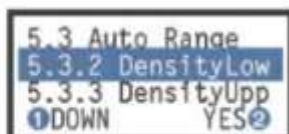
At first the current value is displayed.

The value can now be adjusted with the 2 button in steps of 1 sec. Linear adjustment, see page 10. Then back to the menu.

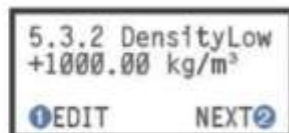


--> With YES 2 it goes to the **Range setting in the Autorange mode**.

In Autorange mode, the densities can be changed and then immediately taken into account in the automatic calculation.

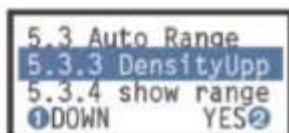


--> With YES 2 to enter the **density of the lower medium**.



The value is entered using Numerical adjustment, see page 10. Finally, the value must be confirmed and is saved.

If density of lower medium is lighter than the density of upper medium, an error message appears and the value is not stored.



--> With YES 2 to enter the **density of the upper medium**.

(Proceed as with lower density.)

Note: For Level measurement the value is 0.000.

5.3 Auto Range
5.3.4 show range
5.3.1 Back
1 DOWN YES 2

→ With YES 2 the current Measuring range is displayed:

Range=100.00 N
LRV= 0.00 N
URV= 100.00 N
BACK 2

Measuring range

Lower Range Value

Upper Range Value

→ With BACK 2 back to previous menu.

5 Add. functions
5.4 Man. Range
5.5 Reset Device
1 DOWN YES 2

→ With YES 2 it goes to the **Range setting in Manual mode.**

After setting the operating conditions for 0 % (at level: vessel empty) or 100 % (at level: vessel full) each take over the value of the buoyancy force. Or by values input at 0 % and 100 %.

Note: Feature is only available in Manual mode, Autorange mode is locked (padlock icon in the LCD).

5.4 Man. Range
5.4.2 LRV (0%)
5.4.3 URV (100%)
1 DOWN YES 2

LRV - take over the Lower Range Value (0 %)

→ With YES 2 the following display appears:

< 5.000N >
apply as 0%?
LRV= 0.000 N
1 NO YES 2

→ By confirmation with YES 2 the current value will be saved as Lower Range Value.

5.4 Man. Range
5.4.3 URV (100%)
5.4.4 set LRV
1 DOWN YES 2

URV - take over the Upper Range Value (100 %)

(Proceed as with Lower Range Value.)

5.4 Man. Range
5.4.4 set LRV
5.4.5 set URV
1 DOWN YES 2

LRV - enter the Lower Range Value (0 %)

→ With YES 2 the following display appears:

5.4.4 set LRV
+010.000 %
min= 000.000 %
1 EDIT NEXT 2

The value is entered using Numerical adjustment, see page 10.

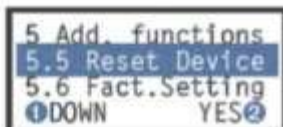
In the third line, the minimum value is displayed.

Finally, the value must be confirmed and is then stored as Lower Range Value.

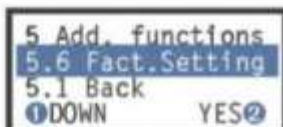
5.4 Man. Range
5.4.5 set URV
5.4.1 Back
1 DOWN YES 2

URV - enter the Upper Range Value (100 %)

(Proceed as with Lower Range Value.)

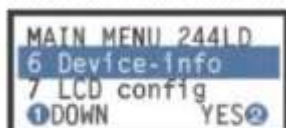


--> With YES ② it goes to function selection.
After a further confirmation the reset of electronics is running.
Same effect as Power-on.



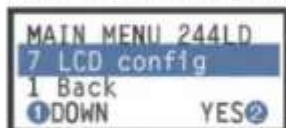
--> With YES ② it goes to function selection.
WARNING: According to a further confirmation, all custom settings are reset to the factory-defined state and will be lost.

Menu 6: Device informations

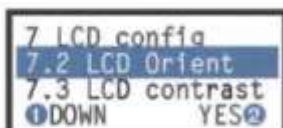


--> YES ② displays the data stored in the transmitter, such as
Tag Number
Tag Name
Device type
Revision Nr
Displacer data
System-Lifetime

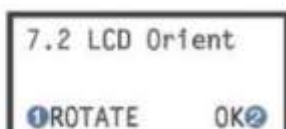
Menu 7: LCD configuration



--> With YES ② it goes to settings for the LCD:

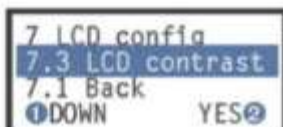
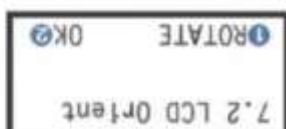


--> With YES ② it goes to selection of LCD orientation:



--> With ① ROTATE is the text "on the feet".

--> With confirming with OK ② it goes back to the menu.



--> With YES ② the LCD contrast is adjusted.
Linear adjustment, see page 10.

8. Transmitter calibrations

Zero, lower range value, upper range value and damping of the transmitter are set by manufacture as specified in the order. Therefore, under normal circumstances, the calibration is not necessary. In case the order does not include this data, the transmitter is supplied as follows:

Displacer weight = 1.500kg
 Buoyancy force = 5.884N (0.600kg)
 Indication = %
 Damping = 8s (90%time)

Set operational data and buoyancy data are stored in the transmitter. When the actual application value has deviation with the stored value, the recalibration is necessary for the transmitter.

The designed displacer maximum weight of the transmitter is 2.500kg, range 2 ~ 20N buoyancy

Transmitter calibrations has the following ways (based on the transmitters order specifications):

- Setting via operation buttons. (details see in the previous page).
- Setting via HART Protocol
 - Setting with PC and FDT-DTM
 - Setting with handterminal

Setting with handterminal

Please confirm the loop load resistance is between 250 to 1100 Ω and connect with HART handheld communicator.

1. Zero Position (level - vessel is empty; interface - the displacer immersed completely in the lighter liquid.)

Enter the menu: 2 Online→2 Diagnosis→4 Zero trim→OK→1 Trimmed→OK→2 Accept ---ENTER.

2. Full Range (level-the displacer immersed completely in the medium; interface- the displacer immersed completely in the heavier liquid.)

Enter the menu: 2 Online→3 Device Data→1 Maintenance→2 Measuring Range→1 Input→2 URV <Input new URV and delivery>;

We can also fill the liquid until full range 2-3-1-2-2 Apply URV-OK-OK-1, accept new value-enter-ok. (no calculation, the present test value is set as URV)

Note: For new URV calculation, the water is filled to the full range, enter 2 Online→1 Displays, write 1 Displays→1 PV 98% (marks as X) and 4 URV 5.88N(marks as Y), According to the following formula to calculate the value of the new URV. For example: $URV = XY = 0.98 \times 5.88 = 5.76$; URV→means Range LRV →means Zero(0.00N), if LRV is not Zero, URV value should be: URV-LRV.

9. Maintenance, reparation

Must pay attention to security requirements! Note the calibration data!

Factory calibration data are marked on each part of the transmitter. For the delivered 244LD, these values are also stored in the amplifier within the software.

- a) Replacing amplifier, these debug data can be delivered to the new amplifier. The data are available from the manufacturer.
- b) If the torque tube or sensor element is replaced, the manufacturer needs to provide new debugging data.

10. Service Warranty

Our quality system is as per ISO9001:2008 International Quality Standards. Under the condition that user adhere to the stipulated operation or storage method, if the goods are unable to work normally due to quality problem from 12 months after commissioning or 18 months after Bill of Lading, which occurs first, we can repair or replace the goods without any charge; while good damage caused by improper operation or storage, we will accordingly charge repair fees. This product is guaranteed for lifetime maintenance service.