BD SENSORS®
pressure measurement

LCT 307i RS 485

Combined transmitter of level, conductivity and temperature measurement

Accurate level measurement 0.1%

Automatic selection of conductivity measure range

Integrated temperature measurement 0 ... 70 ° C

Nominal pressure

Level channel from 0…4 m H_2O to 100 m H_2O

Conductivity channel from 5 µS… 200 mS

Temperature channel: 0… 70 ° C

Output signals

digital output RS 485

Comunication protocol

HART©

Modbus RTU

Special characteristics

- compact housing- diameter 27 mm
- three quantities
- excellent accuracy
- long term stability

Optional versions

- remote or automatic adjustment range of conductivity
- selection of cable sheath material
- selection of material sealing
- selection of the cable fastening method

The LCT 307i combined transmitter is designed for continuous measurement of level, conductivity and temperature of mineral water in boreholes. It´s possible to measure water level in a borehole, pool or well by just one transmitter. Level of water, conductivity and water temperatures values are gradually sent to RS 485 bus by communication protocol Modbus RTU or HART, transmitter can handle both protocols simultaneously. For measuring the water level is used the proven semiconductor sensor with stainless steel separating diaphragm. Conductivity measurement is provided by a 4 wire sensor with platinum electrodes on ceramics. This arrangement allows accurate conductivity measurement within very wide limits. Level and conductivity channels are digitally temperature compensated. The temperature channel is fitted with a Pt 1000 sensor.

Preferred areas of use are

- mineral water resources monitoring
- water resources in general
- environmental technology

CE

BD SENSORS s.r.o.
Hradišťská 817
CZ – 687 08 Buchlovice
Tel.: +420 572 411 011
www.bdsensors.cz
info@bdsensors.cz

The company BD SENSORS s.r.o. is certified by Bureau Veritas Czech according to the standard ISO 9001.

Level channel ranges													
Level [mH_2O]	0.4	0.6	1	1.6	2.5	4	6	10	16	25	40	60	100
Permissible overpressure [bar]	0.2	0.2	0.5	0.5	1	1	3	3	6	6	20	20	20
Conductivity channel													
Conductivity channel ranges	5 µS … 100 µS				100 µS … 1 mS					1 mS … 200 mS			
Temperature channel	0…70°C												
Output signal / Supply													
Output signal RS 485	Digital output (communication RS 485 / HART© protocol) 1D Digital output (communication RS 485 / ModBus RTU protocol) 2D												
Supply	Standard 8 … 36 V_{DC}, option 3,3 V … 5 V												
Performance													
Accuracy	EN IEC 62828-2 Level … 0,1 % of span Temperature … ± 2 °C in compensated range Conductivity … range 5 µS … 100 mS … 2 % … range 100 mS … 200mS … 5% (calculated to span for ranges 5 µS … 100 µS, 100 µS … 1 mS, 1 mS … 200 mS)												
Long term stability - level	≤ ± 0.1 % span / year												
Response time - level	200 msec												
Thermal effects (Offset and Span)													
Level channel	≤ ± 0,2 in compensated range 0 ... 70 °C												
Temperature compensation	Via integrated sensor Pt1000												
Permissible temperatures	medium: 0 ... 70 °C storage: 0 ... 70 °C electronics / enviroment: 0 ... 70 °C												
Electrical protection													
Insulation resistance	> 100 MΩ												
Short-circuit protection	permanent												
Reverse polarity protection	no damage, but also no function												
Electromagnetic compatibility	emission and immunity according to EN 61326												
Electrical connection													
Cable with sheath material [1]	PVC (0 … 70 °C) grey PUR (0 … 70 °C) black FEP [2] (0 … 70 °C) black others on request												
[1] cable with integrated air tube for atmospheric pressure reference *[2] do not use freely suspended probes with an FEP cable if effects due to highly charging processes are expected*													
Materials (media wetted)													
Housing	stainless steel 1.4435 (316L)												
Diaphragm	stainless steel 1.4435 (316L)												
Seals	VITON												
Conductivity sensor	Platinum on ceramics Al_2O_3 96%												
Connecting cables (by factory)	cable capacitance: signal line/shield also signal line/signal line: 160 pF/m cable inductance:signal line/shield also signal line/signal line: 1µH/m												
Miscellaneous													
Current consumption	< 30 mA (8 V…36 V: typ. 16 mA; 3,3 V…5 V: typ. 24 mA)												
Weight	approx. 350 g (without cable)												
Ingress protection	IP 68												
CE-conformity	EMC Directive: 2004/108/EC												
Baud rate*	HART© 1200 Bd 2400 Bd 4800 Bd 9600 Bd 19200 Bd 38400 Bd ModbusRTU 1200 Bd 2400 Bd 4800 Bd 9600 Bd 19200 Bd 38400 Bd												
* *Unless otherwise specified by the customer, the communication is set as follows after delivery by the manufacturer: 8 dat. bit, 1 stop bit, 9600 Bd, even parity, address 1*													

Map of Input registers MODBUS (read only, function #4 – Read input registers)					
Address	**Register**	**Description**	**Data type**	**Example**	
0x0000	SerialNr	Serial Number	UInt32	0x0012	123456
0x0001				0xd687	
0x0002	CalDate	Date of last calibration	Date	0x07de	2014
0x0003				0x051b	27.5.
0x0004	PressUpperRange	Upper range of pressure channel	Float, IEEE754	0x4120	10,0
0x0005				0x0000	
0x0006	PressLowerRange	Lower range of pressure channel	Float, IEEE754	0x0000	0,0
0x0007				0x0000	
0x0008	Pressure	Actual pressure	Float, IEEE754	0x3f9e	1,2345
0x0009				0x0419	
0x000A	MaxPress	Maximal Pressure	Float, IEEE754	0x3f00	1,5
0x000B				0x0000	
0x000C	MinPress	Minimal Pressure	Float, IEEE754	0x3f00	0,5
0x000D				0x0000	
0x000E	TempUpperRange	Upper range of temperature channel	Float, IEEE754	0x42a0	80,0
0x000F				0x0000	
0x0010	TempLowerRange	Lower range of temperature channel	Float, IEEE754	0xc1a0	-20,0
0x0011				0x0000	
0x0012	Temperature	Actual temperature	Float, IEEE754	0x41a0	20,0
0x0013				0x0000	
0x0014	MaxTemp	Maximal temperature	Float, IEEE754	0x4270	60,0
0x0015				0x0000	
0x0016	MinTemp	Minimal temperature	Float, IEEE754	0x4170	15,0
0x0017				0x0000	
0x001E	MeasStatus	Status: 0x0001 = measurement is finished, regs. 0x0023-0x0026 contain valid measurements. Status: 0x0000 = measurement is pending; regs. 0x0023-0x0026 don´t contain valid measurements	UInt16		
0x001F	Pressure	Actual pressure (copy of regs. 0x0008-0x0009)	Float, IEEE754		
0x0020					
0x0021	Temperature	Actual temperature (copy of reg. 0x0012-0x0013)	Float, IEEE754		
0x0022					
0x0023	Conductivity	Conductivity value [S/cm]	Float, IEEE754		
0x0024					
0x0025	ConductivityTC	Conductivity value [S/cm] recalculated to reference temperature 25.0 °C	Float, IEEE754		
0x0026					
0x0027	CondCellTemperature	Temperature [°C] of conductivity cell	Float, IEEE754		
0x0028					

Map of Holding registers MODBUS (read and write, function #3 - Read Holding Registers , fce #6 - Write Single Register)					
Address	**Register**	**Description**	**Data type**	**Example**	
0x0000	PressUnitsCode	Unit of pressure channel	Uint16	0x0006	bar
0x0001	TempUnitsCode	Unit of temperature channel	Uint16	0x0000	°C
0x0002	DeviceAddress	Device address (1…247)	Uint16	0x0001	1
0x0003	Baudrate	Baud rate	Uint16	0x0005	9600
0x0004	Parity	Parity	Uint16	0x0000	PA_none
0x0005 0x0006	Pressure Offset	Value for zeroing the pressure	Float, IEEE754	0x3dcc 0xcccd	0,1
0x0007 0x0008	Temperature Offset	Value for zeroing the temperature	Float, IEEE754	0x3f80 0x0000	1
0x0009	CondOffset-Range1	Conductivity offset range 1 (5 µS…100 µS)	Float, IEEE754	0.0000000	S/cm
0x000B	CondOffset-Range2	Conductivity offset range 2 (100 µS…2 mS)	Float, IEEE754	0.0000000	S/cm
0x000D	CondOffset-Range3	Conductivity offset range 3 (2 mS…200 mS)	Float, IEEE754	0.0000000	S/cm
0x000F	CondUnitsCode	Conductivity channel unit	Unit16	0001	S/cm
0x0010	PressDamping	Pressure damping	Float, IEEE754	0,1	s
0x0012	ClearMinMaxValues	Resetting of maximum and minimum values	Unit16	0x0000	Writing 0x0000 will reset all max. and min. values
0x0013	SetCondMeasRange	Conductivity measuring range setting	Unit16	0x0007 – automatic range switching	
„SetCondMeasRange“ register values		0x0000 - Range1: range 2 mS/cm…200 mS/cm 0x0001 - Range2: range 100 uS/cm…2 mS/cm 0x0002 - Range3: range 5 uS/cm…100 uS/cm 0x0007 – automatic range switching			

Pressure unit enumeration MODBUS													
Code (Unit16)	0x0003	0x0004	0x0005	0x0006	0x0007	0x0008	0x0009	0x000A	0x000B	0x000C	0x000D	0x000E	0x000F
Unit	mmH2O @4*	mmHG @0**	psi	bar	mbar	g/cm^2	kg/cm^2	Pa	kPa	torr	atm	mH2O @4*	MPa
*millimeter of water column (4 °C)													
**millimeter of Hg column (0 °C)													

Temperature unit enumeration MODBUS			
Code (Uint16)	0x0000	0x0001	0x0002
Unit	°C	°K	°F

Baud rate enumeration MODBUS						
Code (Uint16)	0x0002	0x0003	0x0004	0x0005	0x0006	0x0007
Baud rate [Bd]	1200	2400	4800	9600	19200	38400

Conductivity enumeration MODBUS				
Code (Uint16)	0x0001	0x0002	0x0003	0x0004
Unit	S/cm	mS/cm	µS/cm	S/m
Note: 1 S/cm = 100 S/m				

Parity enumeration MODBUS			
Code (Uint16)	0x0000	0x0001	0x0002
Parity	None	Odd	Even

It is necessary to make device reset (Power supply off and on) after changing Address, Baud rate or Parity (command #6).
If reset is not performed, device uses old communication parameters.

When working with registers that are longer than 16 bits, it is necessary to read and write these registers at once, otherwise a response with the error code "Illegal data address" is returned.

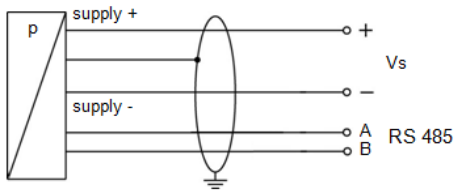
Following commands are implemented in HART protocol:	
Command #0	Read Unique Identifier
Command #1	Read Primary Variable
Command #2	Read Loop Current and Percent of Range
Command #3 Command #3 gives back 4 variables	Read Dynamic Variables and Loop Current - Primary Variable: Pressure [units below pt. 2] - Secondary Variable: PT1000 temperature unit is given by Modbus hold. register #1 (via HART only the primary variable unit can be set) - Tertiary Variable: Conductivity [mS/cm] (Temperature compensated value) - QuaternaryVariable: Conductivity [mS/cm]
Command #6	Write Polling Address
Command #7	Read Polling Address
Command #11	Read Unique Identifier Associated with Tag
Command #12	Read Message
Command #13	Read Tag, Descriptor, Date
Command #14	Read Primary Variable Transducer Information
Command #15	Read Device Information
Command #16	Read Final Assembly number
Command #17	Write Message
Command #18	Write Tag, Descriptor, Date
Command #19	Write Final Assembly Number
Command #34	Write Primary Variable Damping Value
Command #35	Write Primary Variable Range Values
Command #43	Set Primary Variable Zero
Command #44	Write Primary Variable Units
HART protocol is described in the HART standard.	

The following units of measured quantities are implemented in the HART protocol:	
HART pressure units	
Unit	Code (h)
mmH2O@4°C	0xEF
mmHg@0°C	0x05
psi	0x06
bar	0x07
mbar	0x08
g/cm2	0x09
kg/cm2	0x0A
Pa	0x0B
kPa	0x0C
torr	0x0D
atm	0x0E
mH2O@4°C	0xAB
MPa	0xED

HART temperature units	
Unit	Code (h)
Degree °C	0x20
Degree °F	0x21
Degree °K	0x23

HART conductivity units	
Unit	Code (h)
mS/cm	0x42

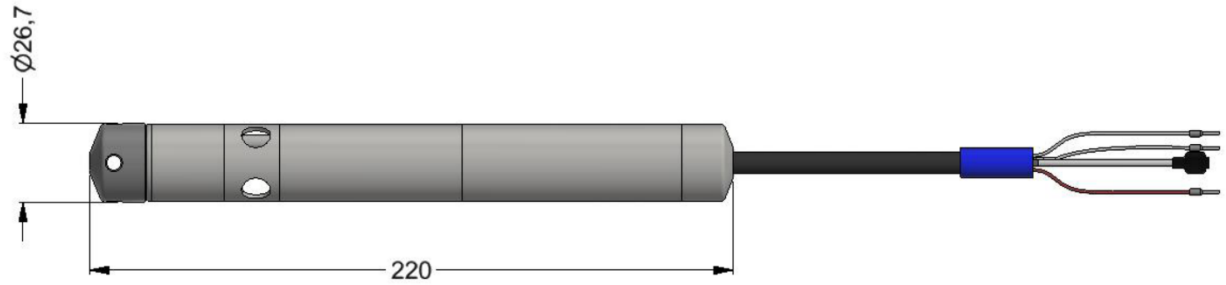
Wiring diagram / connector



Pin configuration

Electrical connection		cable colours (DIN 47100)
	Supply + Supply -	wh (white) bn (brown)
	Shield	gn/ye (green / yellow)
Communication protocol	A B	ye (yellow) pk (pink)

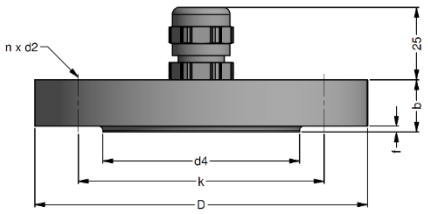
Dimensions (in mm)



Mounting flange with cable gland

Technical data		
Suitable for	all probes	
Flange material	stainless steel 1.4404 (316L)	
Material of cable gland	standard: brass, nickel plated on request: stainless steel 1.4305 (303); plastic	
Seal insert	material: TPE (ingress protection IP 68)	
Hole pattern	according to DIN 2507	
Version	**Size (in mm)**	**Weight**
DN25 / PN40	D = 115, k = 85, b = 18, n = 4, d= 14	1.4 kg
DN50 / PN40	D = 165, k = 125, b = 20, n = 4, d= 18	3.2 kg
DN80 / PN16	D = 200, k = 160, b = 20, n = 8, d= 18	4.8 kg

cable gland M16x1.5 with
seal insert (for cable-∅ 4 ... 11 mm)



Ordering type	Ordering code
DN25 / PN40 with cable gland brass, nickel plated	5000275
DN50 / PN40 with cable gland brass, nickel plated	5000278
DN80 / PN16 with cable gland brass, nickel plated	5000279

Terminal clamp

Technical data	
Suitable for	all probes with cable ∅ 5.5 ... 10.5 mm
Material	standard: steel, zinc plated optionally: stainless steel 1.4301 (304)
Weight	approx. 160 g

Ordering type	Ordering code
Terminal clamp, steel, zinc plated	1003440
Terminal clamp, stainless steel 1.4301 (304)	1000278

Display program

CIT 200
Process display with LED display

CIT 250
Process display with LED display and contacts

CIT 300
Process display with LED display, contacts and analogue output

CIT 350
Process display with LED display, bargraph, contacts and analogue output

CIT 400
Process display with LED display, contacts, analogue output and Ex-approval

CIT 600
Multichannel process display with graphics-capable LC display

CIT 650
Multichannel process display with graphics-capable LC display and datalogger

CIT 700
Multichannel process display with graphics-capable TFT monitor, touchscreen and contacts

PA 440
Field display with 4-digit LC display

For further information please contact our sales department or visit our homepage: http://www.bdsensors.cz

Tel: +420 572 411 011
www.bdsensors.com
info@bdsensors.cz

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ordering code LCT 307i RS485

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