



CTXIL
Inline
Consistency Sensor

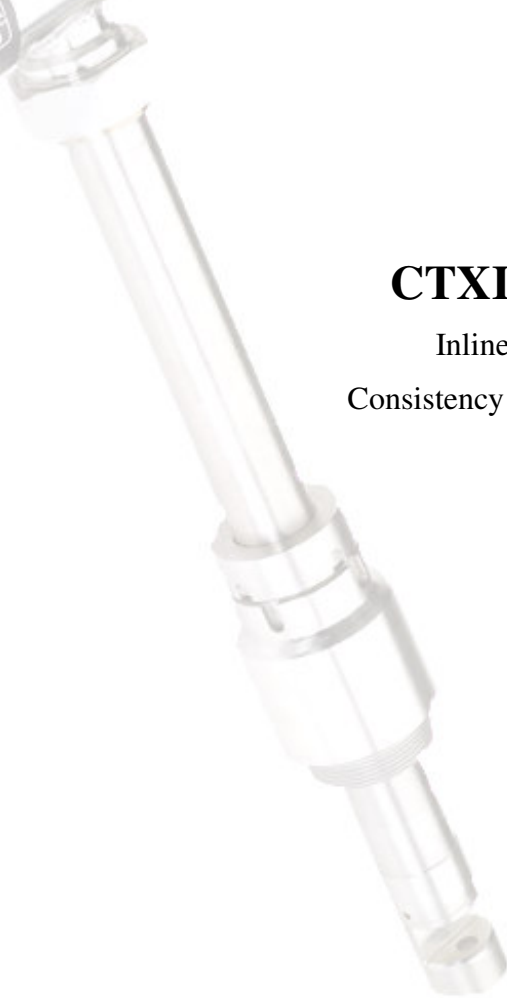


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1. Introduction

The CTXIL inline consistency sensor is used to measure suspended solids in liquids. Combined with the BB2 control box, the sensor is used to measure fiber and particle consistency in the pulp and paper industry. Examples of applications are consistency control, retention control and monitoring white water.

The sensor is also used in waste water treatment plants and other industries to measure suspended solids and maintain effluent control.

2. A few words about this manual

The manual primarily contains information about the Cerlic CTXIL sensor. Menu functions and technical data of the BB2 control box can be found in the BB2 manual.

3. Design

The CTXIL sensor is made in acid proof stainless steel and is installed directly onto the process pipe. The sensor head Ø38 mm has a self cleaning design which permits precise and reliable measurement with minimum maintenance possible, even in critical applications. The measuring lenses in the steel cell are made of sapphire glass in order to withstand abrasive liquids. Electronic and optical components are well protected within the steel enclosure to handle very demanding environments.

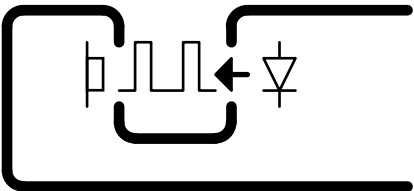
- CTXIL 20/70 is installed using a 70 mm butt weld adapter
- CTXIL 20/70 SE has a separated electronics box for applications with extreme vibrations
- CTXIL 20/38 HP is installed through a 50 mm isolation valve

A shielded 10 m (33 ft) cable is used for communication between the sensor and the BB2 control box. The cable is made of polyurethane and highly resistant to aggressive substances.

In smaller process pipes (<Ø100 mm), the CTX 20/25 or CTX 20/50 should be used.

4. Measuring principle

The CTXIL measures transmitted light through the liquid. The measuring principle is based on the suspended particles' ability to absorb and reflect light .The light source is a light emitting diode (LED) that pulses monochromatic NIR light at high power. The detected measuring signal is inversely logarithmical proportional to the consistency or suspended solids. Signal treatment is done by the BB2 control box. The temperature is measured by the transmitter to be used for temperature compensation of the measured value.



5. Unpacking sensor

The unit has been tested and approved before shipping.

Content

Please check that the content corresponds to your order and packing list.

Damages

If damages occurred during the shipment, immediately contact the carrier as well as your Cerlic representative. The shipment can be returned only after contact has been made with Cerlic.

Packaging

The original packaging is designed to protect the equipment and should be used for storage or if the goods must be returned.

Optional parts can be ordered

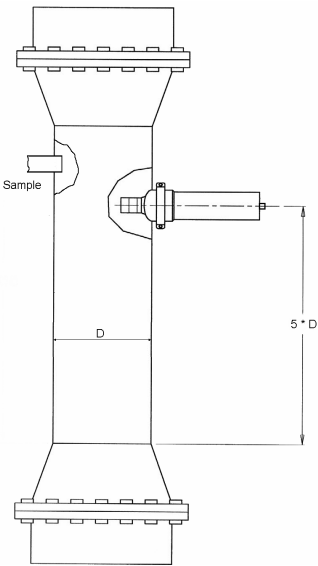
P/N

- | | |
|----------------------------------------------------------------------------------------------|----------|
| • Butt weld end for CTXIL 20/70. | 11205318 |
| • Mounting clamp for CTXIL 20/70. | 10605319 |
| • O-ring for CTXIL 20/70 (Viton 78.97 x 3.53 mm) | 11605462 |
| • Nipple weld for CTXIL 20/38 HP | 10303240 |
| • O-ring on the back of the valve CTXIL 20/38 HP (64.5 x 3) | 21650548 |
| • O-rings (2x) in the housing for CTXIL 20/38 HP (Viton 37.69 x 3.53) | 21603312 |
| • Winch incl. isolation valve and nipple weld for CTXIL 20/38 HP | 11205152 |
| • 10 m (33 ft) signal cable, max 10x10 m (10x33 ft) | 20805510 |
| • Connection box for two sensors to one BB2 control box with 1 m (3 ft) cable to connect BB2 | 11505748 |

6. Mounting inline sensor

Please carefully study these installation guidelines to reach maximum performance

- The sensor is installed where the suspension is well mixed and the flow is turbulent. Appropriate distance from a pump discharge or a pipe elbow is about five pipe diameters downstream
- Installation on a vertical pipe reduces the influence of air in the pipe and stratification of the medium.
- Turbulent flow is necessary for good performance. Depending of the consistency the flow velocity has to meet these minimum levels to reach turbulence:
 - 0 % min 0.05 m/s (0.15 fps)
 - < 1 % min 1.0 m/s (3.3 fps)
 - > 1 % min 1.5 m/s (4.9 fps)
- At low flow velocities a pipe section can be exchanged to a smaller dimension. A suitable length of this section is 1 m (≈ 40") with gradual tapers. The sensor is installed at a distance corresponding to 2/3-3/4 of the length of the section.

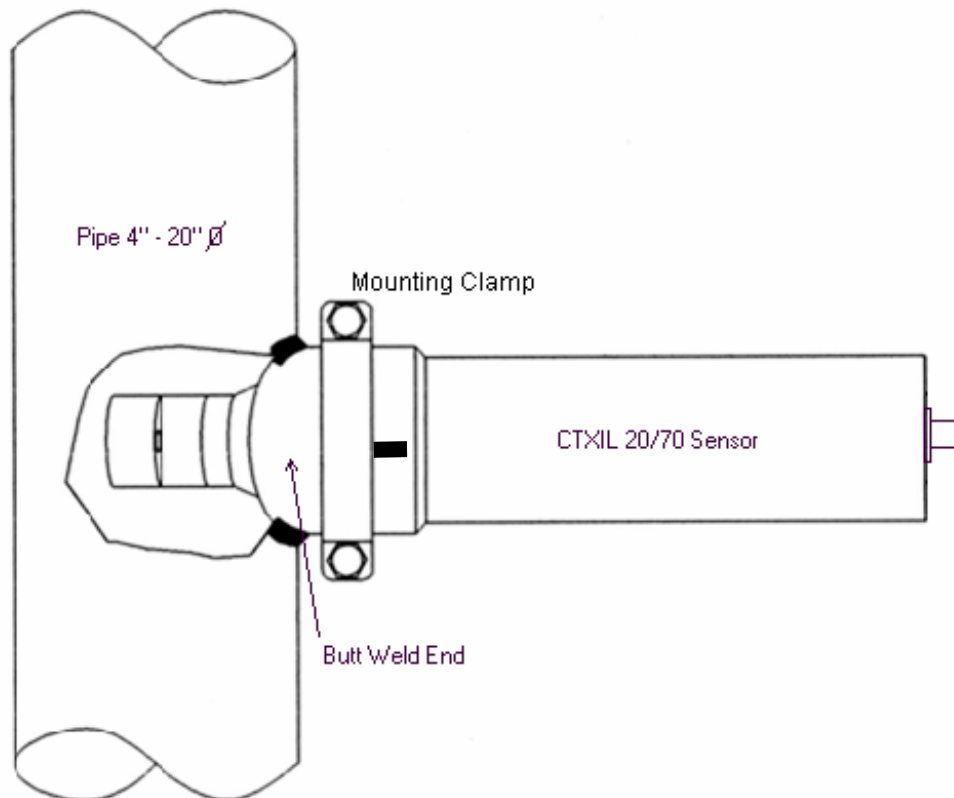


- To prevent air-bubbles from disturbing the measurement, the pressure has to meet these minimum levels:
 - 0-5 % min 1 bar (15 psi)
 - 5-10 % min 3 bar (44 psi)
 - > 10 % min 5 bar (74 psi)

- The temperature of the CTXIL 20/70 sensor must not exceed 95°C (203°F)
- The temperature of the CTXIL 20/70 SE sensor must not exceed 100°C (212°F)
- The temperature of the CTXIL 20/38 HP sensor must not exceed 100°C (212°F)
- Install the sensor to avoid exposure to considerable and fast changes in temperature
- Avoid installation where the sensor is exposed to severe cold weather or direct sunlight
- Protect the sensor from high pressure water spraying
- The sensor should never be submerged under water
- Always install the cables between sensor and control box in conduit when possible
- Install the sensor to avoid extreme vibrations
- The sensor must not be removed while still under process pressure
- The sensor must not be used as a ground point for welding
- If welding is to be done on the pipe system, the cable and the sensor should be removed
- Always remount the protective cover on the sensor connector when the cable is removed

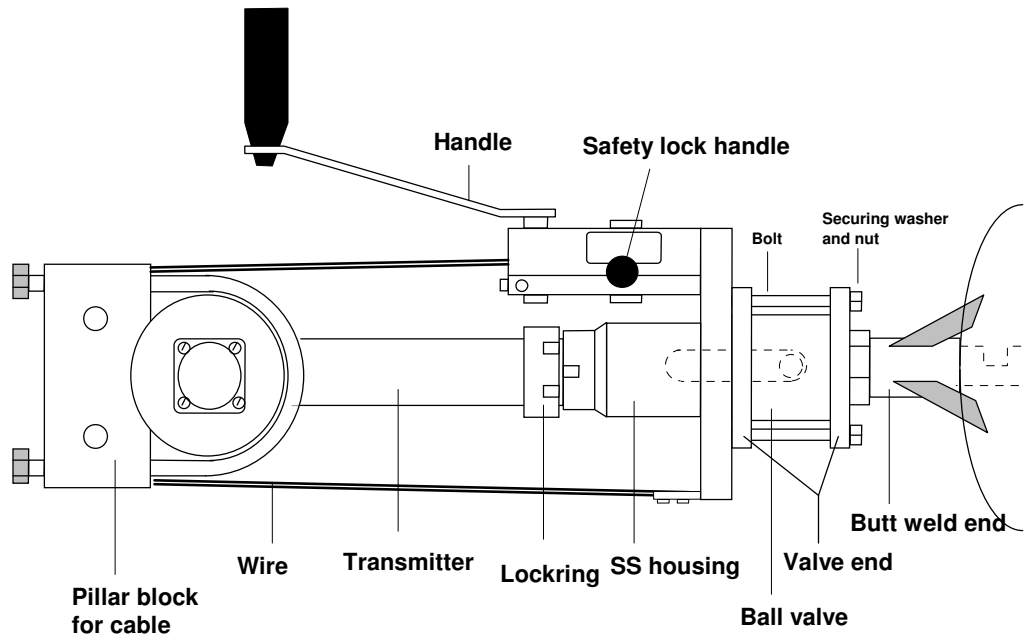
7. Mounting CTXIL 20/70 (SE)

- Make a hole in the process pipe ($\varnothing 75$ mm, ≈ 3 ") and fit the butt weld end. The sensor is mounted perpendicular to the process pipe. Minimum pipe diameter is 100 mm (≈ 4 ").
- The sensor is mounted with the measuring gap in line with the process flow. Three lines on the sensor flange indicate the orientation of the gap. The two thinner lines shall be parallel with the process flow, the thicker line indicate the position of the gap and shall be perpendicular to the flow. In some applications the measurement is improved by facing the gap a few degrees towards the flow.
- The CTXIL 20/70 SE sensor is mounted in the same way as the standard CTXIL 20/70. The only difference is that the sensor head is separated from the electronics with a 0.8 m (2.5 ft) cable. The electronic box is installed on a suitable, vibrational free location (wall, rail etc.).



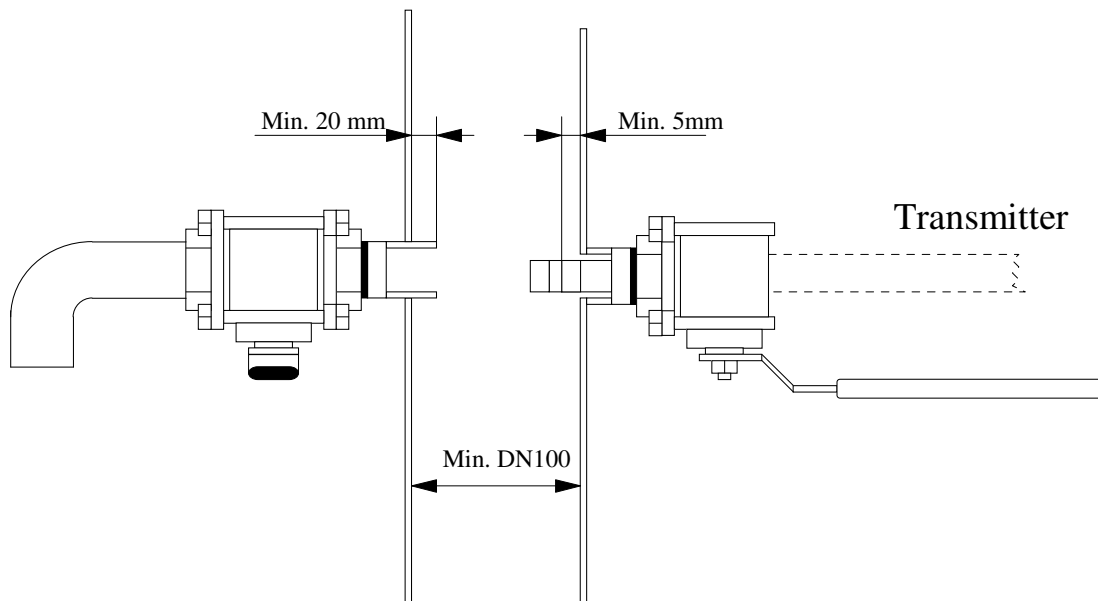
8. Mounting CTXIL 20/38 HP

To insure a safe and correct mounting, please consult the illustration for correct functionality.



Complete mounting assembly including winch for the CTXIL 20/38 HP sensor

- The sensor is mounted perpendicular to the process pipe. Minimum pipe diameter is 100 mm (≈ 4 "). The butt weld end must be cut to give a distance between the pipe wall and the sensor measuring cell of is at least 5 mm ($\approx 1/4$ ").



Mounting winch and isolation valve

- Make a hole (\varnothing 61 mm, \approx 2.4") in the process pipe and install the butt weld end. For extra strength, a piece of 3 mm (1/8") sheet metal can be used according to figure below.

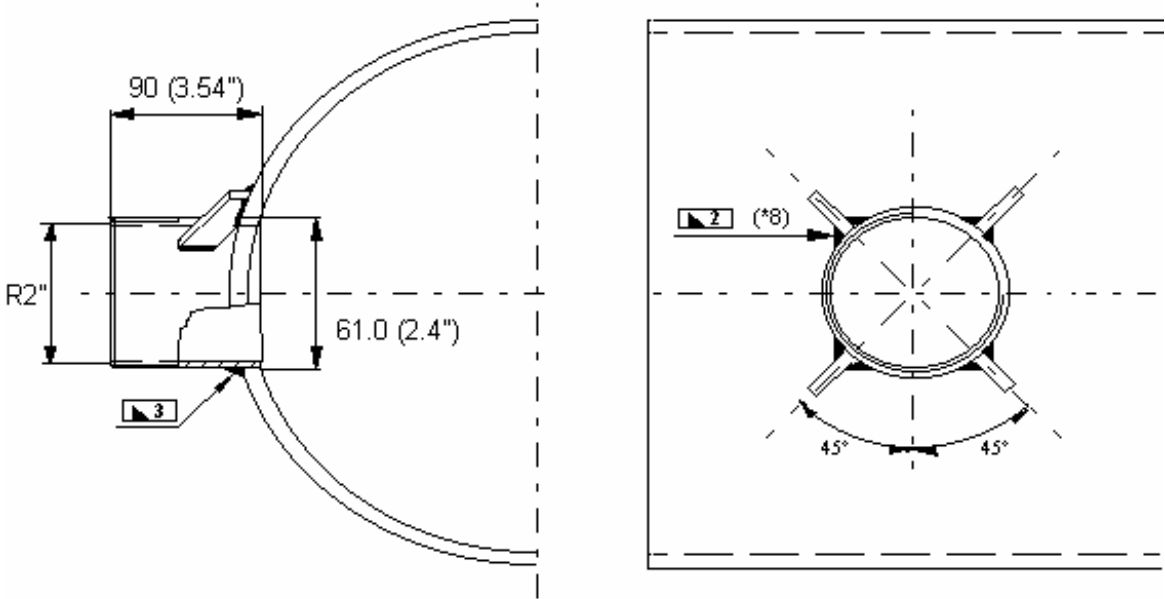


Figure. Mounting the butt weld end

- The isolation ball valve with winch is mounted onto the threaded butt weld end. Use a lot of flaxen hair and joint paste. Be aware not to pull the valve end to the bottom.

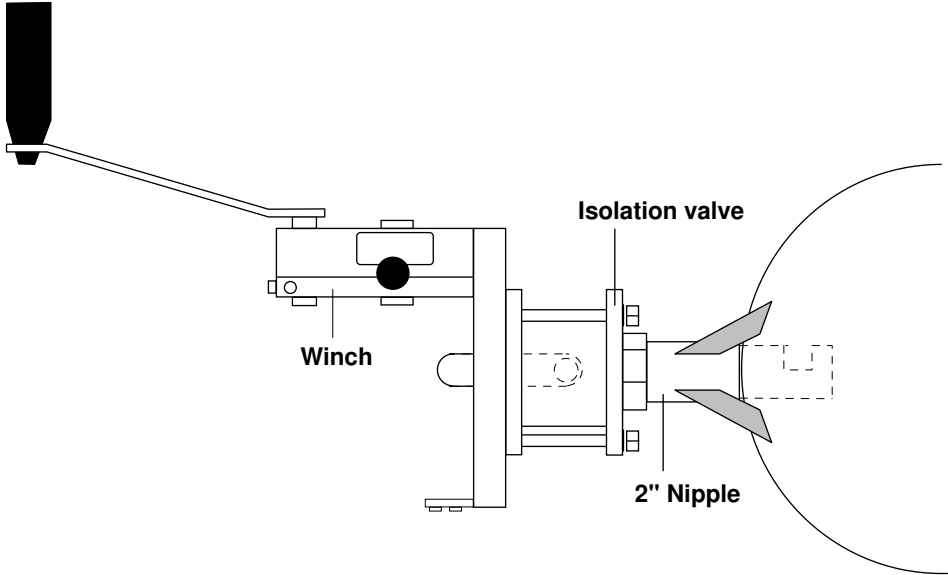


Figure. Mounting of isolation ball valve with winch

- The winch must be mounted in the correct direction. If the winch is turned, the measuring gap will be in the wrong position, giving an incorrect measuring result. With the locking ring the angle can be adjusted $\pm 25^\circ$.

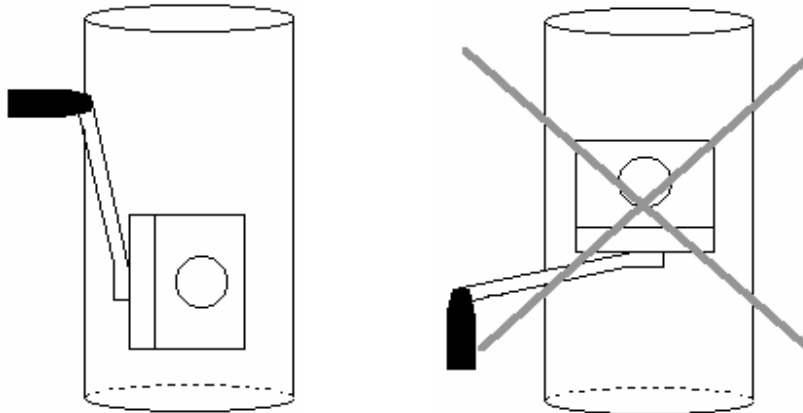


Figure. Position of the crank

- When the unit can not be mounted in one piece, it can be mounted in the following steps.
 1. Mount valve end onto the butt weld end (use plenty of sealant), make sure the handles of the valve and winch will point in the right direction.
 2. Mount the valve, valve end and winch with the bolts.
 3. Fasten the bolts using locking washer and nut.

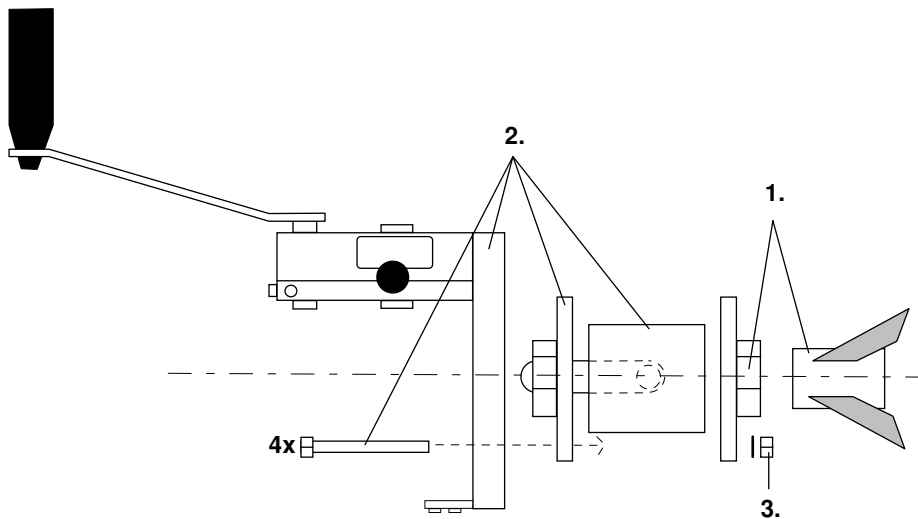


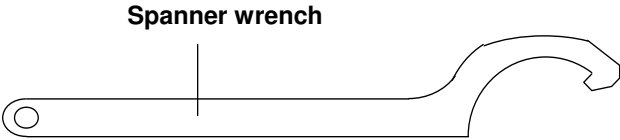
Figure. Step by step mounting of the valve and winch

WARNING!

- Make sure there is space to turn the handle of the ball valve to open and close.
- Make sure the winch is mounted in the right direction to get the measuring gap of the sensor along the direction of the flow.
- Check that the locking washers are in place and the nuts tightened before process pressure is applied.

Mounting sensor

- The sensor shall be mounted with its measure gap in line with the process flow. The sensor house is parallel to the gap, before tightening the sensor, the sensor house shall be oriented parallel to the flow. In some applications the measurement is improved by facing the gap a few degrees towards the flow. Make sure to mark on which side of the sensor the gap is located to avoid facing it away from the flow.
- The CTXIL HP is installed through a SS housing. The transmitter is stuck in the housing and cannot be removed from it. This connection unit has two functions:
 - To lock the tension ring that keeps the transmitter in position.
 - To prevent the transmitter to come off the valve.
- Always check the wire and all connections before the transmitter is mounted or dismantled. Always use the attached spanner wrenches (2 pcs) when mounting/demounting. If not, it might be a risk that the isolation valve in the nipple turns around.



- After loosening the tension ring with the spanner wrenches and opening the valve, please crank the transmitter to correct position in the pipe. It is 460 mm between the sensor tip and the nut hold.
- The sensor can, without leakage be mounted/dismounted during operation. Maximum pressure is 16 bars.

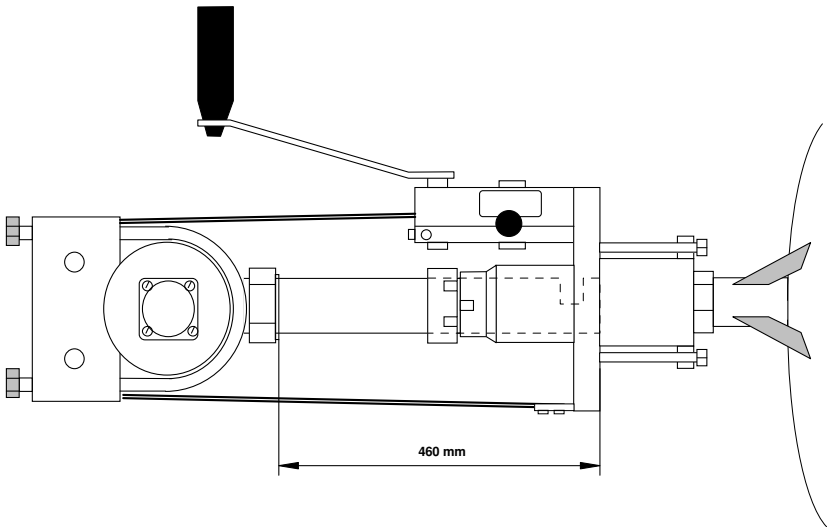


Figure. Positioning of the sensor

WARNING!

- If you mount the sensor during operation at full pressure, you must use the Cerlic winch.
- Always check the wire and the other mechanical parts before mounting/removal. When visually damaged, it should be replaced.
- This instruction must be fulfilled in all parts to avoid accidents or personal damage.
- If the instructions cannot be fulfilled in all parts, the transmitter should not be mounted or dismounted under process pressure
- Cerlic can not be responsible for accidents caused by not using this winch or that the instructions have not been followed
- To release the crank, the locking pin must be released. When this is done the crank must be held in a steady grip because the process pressure can push the sensor outwards.

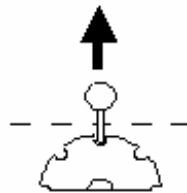


Figure. Locking pin

Open the ball valve and crank the transmitter to its measuring position. The transmitter is moved in the direction indicated with the label located under the crank. The measuring gap must be at least 5 mm inside the pipe wall. In measuring position the sensor is fixed with the locking ring.

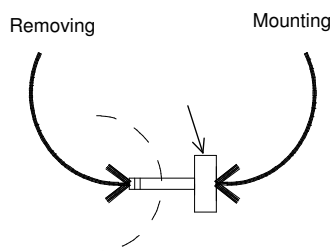


Figure. Rotation of handle

WARNING!

- Be careful mounting the sensor in straight position. If the transmitter is not cranked straight, damages on the sensor or valve can follow.
- If the sensor is hard to mount and you suspect something is stuck or that the sensor is not mounted straight, crank it out and check that everything is OK.
- The locking pin can release big forces. Do never loose the pin without holding the crank handle steady.

9. Removing CTXIL 20/70

- The sensor must never be dismantled under process pressure.
- The sensor must only be removed when the process pipe has been drained.
- Clean the measuring gap with a brush or clean cloth. Do not use a wire brush!
- Flush the sensor thoroughly.

Before the sensor is removed, pressure in the process pipe must be relieved. Make sure that no flow passes through the pipe. If the sensor is removed under process pressure this could cause serious injury or even death. Cerlic does not accept any responsibility for accidents caused when the sensor is disconnected while still under line pressure.

10. Removing the CTXIL 20/38 HP

Removal of the CTXIL 20/38HP must be done in the following steps:

- Loose the locking ring with the spanner wrenches.
- Grab the crank handle and lift up the locking pin.
- Check the direction of force from the line pressure.
- Crank out the sensor to the mechanical stop.
- Close the ball valve and open the smaller valve to reduce the pressure.
- The pillar block and the transmitter can now be removed.

WARNING!




- Removing the sensor must only be done with the Cerlic winch
- These instructions must be fulfilled in all parts to avoid the possibility of accidents and personal damage.
- In spite that the CTXIL HP has an end stop to prevent the sensor to come out of the pipe, the force from the process pressure can lead to severe damage if the sensor is let free.
- Cerlic can not be held responsible for accidents caused by not using the winch or by not following the instructions.

11. Service and maintenance

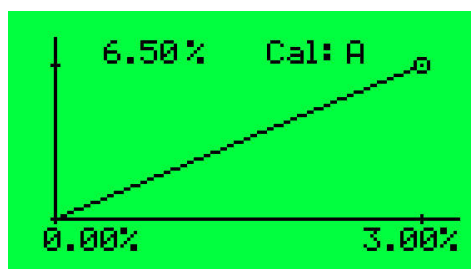
In some applications the measuring cell may need to be cleaned. Use warm water and a small bottle brush to clean the cell; do not use a metallic brush or sharp tools. An acid solution can be used to dissolve coating in the measure cell, use 5 % hydrochloric acid or sulphamic acid. Flush the cell with plenty of clean water. Repeat the treatment if necessary. If hydrochloric acid does not dissolve the coating, other chemicals may be used as long as they don't affect the O-rings made of Viton

The sensor housing may not be opened, except by Cerlic service personel. Opening the sensor housing will void all warrenty.

12. Sensor information displays

Press  and ENTER simultaneously to switch between main menu and the sensor display #1. This first display shows some additional readings to the main values (temperature, the value measured during last cleaning). Press  and ENTER simultaneously again to reach the display #2 showing the current calibration set graphically. By pressing  and ENTER simultaneously a third time you return to the main display.

```
Info Plats 1    11:09:07
CTX20/50      6.51%
Temp          22.7°C
Flush Cons    0mg/l
Signal        36650
Min: 0.00 Max: 3.00
```



13. Sensor menu

Use **↑** or **↓** to select the sensor in the main display. Press ENTER for five seconds to access the menu for the selected sensor.

Settings

Tag	Name of the sensor (10 characters) shown in the main display
Calibration	Calibration set "A"- "D" or "Extern". "Extern" will allow remote selection of calibration set from DCS.
I-Time(s)	Integration time, dampening the output signal
Unit	"%", "mg/l", "g/l" or ""ppm"
Decimals	"Std" or "Extra", number of decimals for the reading
Analog	"None", "Ch1", "Ch2", "Ch3", "Ch4", "Ch1+2" or "Ch3+4". Pick the analog output(s) to be used with sensor. Ch3-4 are optional.
Second	"Temp", "=Prim" or "Clean". If two outputs are chosen, the first will always give the primary value. The second will either give the temperature (0-100 °C), the same signal as the first or the measured value at the last flushing.

Calibrate

Selected Cal	"A"- "D" or "Ext", selection of calibration set
Used Cal	Selected calibration set (A-D)
Adjust	"No", "Store" or "Lab". "Store" stores the present reading of the sensor and after input of the corresponding lab result through "Lab" the old lab result under "Sample #1" is automatically adjusted
Take sample	"No", "Zero" or "# 1"- "# 5", see Calibration section
Cons	Actual consistency reading
Sample # 1	Lab test sample # 1
Sample # 2	Lab test sample # 2
Sample # 3	Lab test sample# 3
Sample # 4	Lab test sample # 4
Sample # 5	Lab test sample # 5

Cleaning

Cleaner	"None", "Brush" or "Flush" ("Brush" does not exist for this sensor)
Interval min	Time (minutes) between cleaning cycles
Length sec	Duration (seconds) of flushing cycle
Freeze sec	Extra freeze time of output signal after a flushing cycle
Relay	"-", "#1", "#2", "Along #1" or "Along #2". Select relay to operate solenoid for flush cycle if this sensor is a master with its own relay, or relay used by master if this sensor is a slave. These same relays can be used as "Alarm relay" below.
Next time	The next scheduled cleaning time. Pushing "Enter" on this line will set the time to current time and start a cleaning cycle. This could be used to test the "Flush" cycle.
Clean	Reading in the end of the last flushing cycle

Scale / Alarm

Max	Reading corresponding to 20 mA output signal
Min	Reading corresponding to 4 mA output signal
Hi-Alarm	Reading to activate high alarm, 0 inactivates the alarm
Low-Alarm	Reading to activate low alarm, 0 inactivates the alarm
Alarm Relay	"-", "1 and 2", "#1" or "#2". Check that it is not used for cleaning

System

Type	Type of sensor
Serial	Serial number of sensor
SoftW	Software version of sensor
Temp	Sensor temperature
MaxTemp	The highest sensor temperature recorded
Samples	Sub menu to view SA values and consistency values for this calibration set
Selected Cal	"A"- "D" or "Extern", selection of calibration set
Used Cal	Selected calibration set (A-D)
SA 0	SA value zero sample (clean water)
SA 1	SA value sample #1
Cons 1	Lab test sample #1
.....	And so on for sample #2-5
Info	<u>Menu for Cerlic internal use</u>
MS	Linearized light signal, which are SA values in calibration chart
Con	Consistency reading
SA 0	SA value for zero sample on clean water
SA 1	SA value sample #1
Cons 1	Lab test sample #1
Ch1a	Raw value channel 1 (1000-40000)
Ch1	Raw value channel 1, compensated for intensity
Intens.	Current intensity (150-25000)
Zero Int	Intensity for clean water, set during zero calibration
I-offset	Intensity offset, set during zero calibration
Temp Calib	Temperature compensation constant.
Samp/s	Samples per second
Service	Not accessible for users

14. Calibration

Overview

Calibration is made in a number of steps performed in a consecutive order. Each step is described further down. If one step is redone, all later steps have to be redone:

1. Zero calibration, made on clean water by Cerlic before shipping
 2. Calibrating consistency
 3. Adjusting calibration of consistency
- It is important that the sensor has been in operation for at least 30 minutes before calibration to have a stable operation
 - Single point calibration is recommended. In case of multiple point calibration, sample #2-5 can be calibrated when steps 1-4 above are finalized for sample #1

Zero Calibration





The sensor is zero calibrated at the factory, and does normally not need recalibration. Before doing a zero calibration make sure that it is really needed. The zero point is common for all four calibration sets. If the zero point is recalibrated it will affect all other calibration points in all calibration sets of the sensor.

Make sure the windows are clean, and use clean de-aerated water to check the meter reading. Tap water is best de-aerated in an open bucket for at least two hours.

To run a zero calibration:

- Remove the sensor from the process and clean it thoroughly
- Put the sensor head in a bucket with clean de-aerated water. Cover the bucket to avoid disturbing external light

NOTE! The sensor must not be submerged into the bucket!

- Select the sensor to be calibrated in the menu by using  or  arrows
- Press ENTER for five seconds to enter the sensor menu
- Use  and  arrows to select "Calibrate" and select "Take sample"
- Select "Zero" and press ENTER
- If you really want to destroy the existing calibrations, change "No" to "Yes", then press ENTER
- After you have filled the sensor with water, press ENTER again
- Wait for the zero calibration to finish. It will take approximately thirty seconds before the unit returns to the menu.

For more information concerning use of menu/dialogues, refer to the manual for BB2.

Calibrating consistency

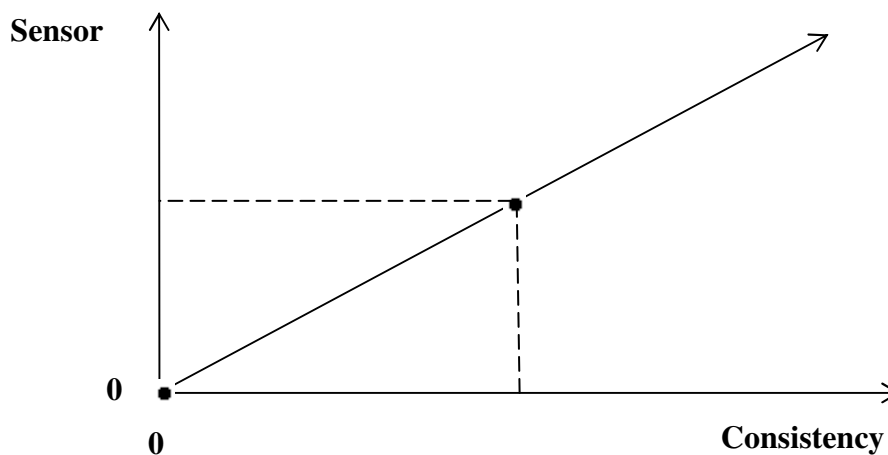
- Select “Calibrate”, “Take sample”, “#1” and press “ENTER”
- Press ”ENTER” to calibrate and take a lab sample
- Take the sample to the lab for analyzing consistency
- The lab results are entered in “Calibrate” and “Sample #1”

Adjusting calibration of consistency

Statistic adjustment of the lab sample value is a much better way to good measurement than frequent recalibration. This is done comparing the lab results with the instrument reading over time. If a systematic discrepancy is detected, the value of the lab sample used in BB2 is changed accordingly. If for example several lab results for a period of time in average shows 5 % more than the instrument, the sample value in BB2 shall be increased 5 % of its value, e.g. if the sample value is 1.00 % it shall be changed to 1.05 %. Using statistic adjustment will gradually improve the accuracy and reliability while a new calibration will restart from scratch. An Excel sheet to help doing statistical adjustment of the calibration can be downloaded from <http://www.cerlic.com>.





Calibration points

The calibration set is built up of the zero calibration point and at least one calibration point. A calibration point can be disabled by setting the consistency value to zero.



Automatic adjustment of the calibration

The function "Adjust" in the calibration menu is used to automatically adjust the calibration in an easy way. When a sample is taken for the lab, BB2 stores the reading. When the sample has been analyzed, the result is keyed into the BB2 who will compare it to the stored reading and calculate a new sample #1 value. Automatic adjustment only works for single point calibration and is primarily intended as an easy way to get started with a new sensor. Once the automatic adjustment is done, and the sensor gives a sensible reading, statistical adjustment is recommended.

- Select sensor in the menu by using  or 
- Press ENTER for five seconds to enter the sensor menu
- Select "Calibrate", "Adjust" and then "Store"
- Press ENTER when taking the lab sample
- Get the sample analyzed
- Select "Calibrate", "Adjust" and then "Lab"
- Press ENTER
- Key in the lab result, then press ENTER
- BB2 will show current and suggested new value for "Sample #1", acknowledge the change by pressing ENTER or abort using  or .

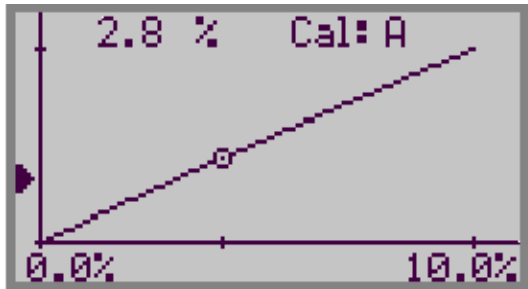
Calibration with multiple points

The only cases where multiple calibration point is useful are when the sensor signal is non linear or when the sensor has to be very accurate at widely separated consistencies.

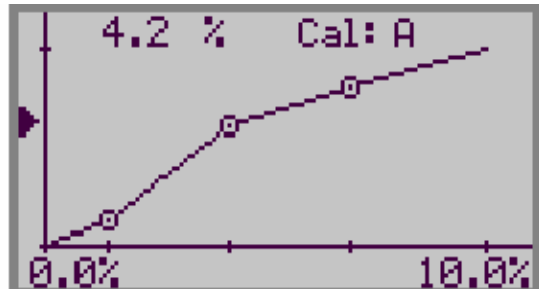
Use the same procedure described in "Calibrating total consistency and ash content (sample #1)" but select sample #2, #3, #4 or #5.

Calibration display

Press **↓** and ENTER simultaneously to switch between main menu and the sensor display #1. This first display shows some additional readings to the main value (temperature, the value measured during last cleaning, raw value of the measurement). Press **↓** and ENTER simultaneously again to reach the display #2 showing the current calibration set graphically. By pressing **↓** and ENTER simultaneously a third time you return to the main display.



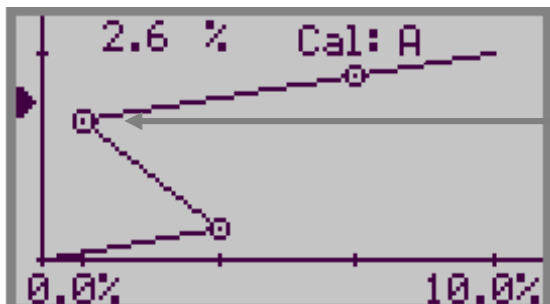
Single point calibration



Multiple point calibration

A calibration set normally consists of zero point and one consistency sample (single point calibration). Up to five samples may be used to create a calibration curve (multiple point calibration). The samples are sorted internally in order of signal intensity. The calibration display shows the calibration set in a graph:

- X-scale displays consistency, from **Min** (4 mA) to **Max** (20 mA)
- Y-scale displays the raw sensor signal
- Actual measuring value is shown in numbers and with the arrow on the Y-axis
- Samples outside the scale are not displayed but still used in the calculations. If you want to see a point outside the scale, you may temporarily change the scale in the Scale / Alarm sensor menu.

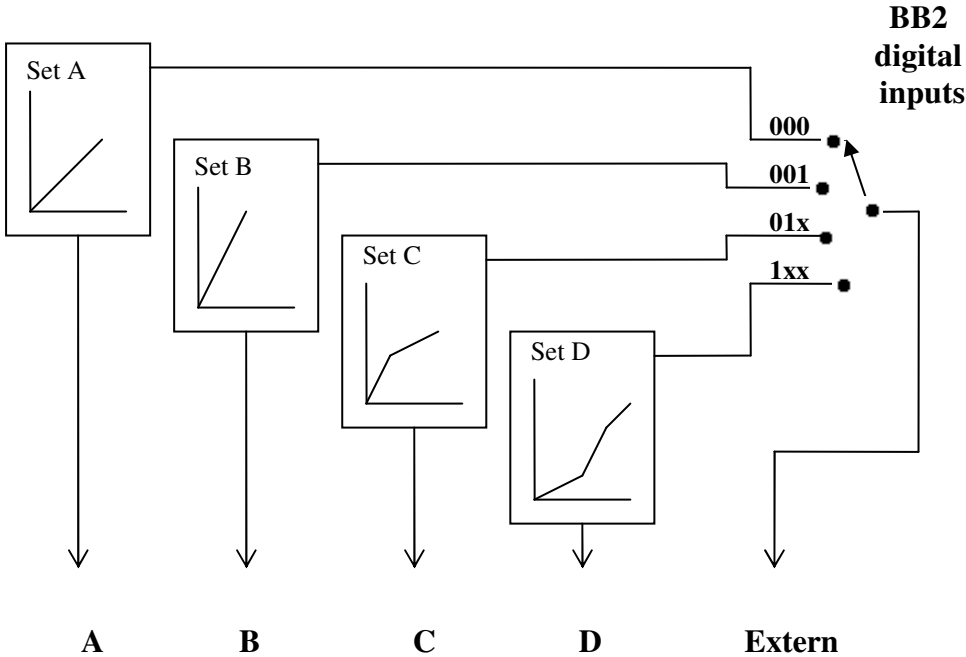


Two samples have probably been exchanged when entering the lab results. The Y-value must always increase with increasing X-value.

Multiple Calibration sets

The sensor can handle four independent calibration sets for different types and qualities of pulp. Each set has up to five calibration points. All four sets have a common zero calibration. The selection of calibration set is done in the menu for setup and calibration or from an external device (DCS). At external selection:

- The external selection overrides the manual selection
- If several sensors are connected to one common BB2, all sensors will change simultaneously to the set selected (A-D)



15. Deposits – alarm and compensation

BB2 has a choice to output the measured value during the last flushing on its second 4-20 mA output. This is useful in demanding applications where it can be used to trigger an alarm to manually clean the sensor. The signal can also be used to compensate the reading for deposits in the sensor, extending the interval between manual cleaning.

16. Scaling

On the "Scale / Alarm" menu the range of the 4-20 mA is selected, as well as alarm limits:

- Max** sets the 20 mA point output
- Min** sets the 4 mA point output
- Hi-Alarm** sets the high alarm set point; a value of zero inactivates the alarm
- Low-Alarm** sets the low alarm set point; a value of zero inactivates the alarm

17. Technical data

CTXIL 20/70 (SE)	P/N 11305556 (11305740)
Process connection	70 mm butt weld adaptor
Material	SIS2343 / 316SS
Pressure rating	PN16 / 240 psig
Enclosure	IP65 / NEMA4X
Process temperature	0 - 90°C / 32 - 194°F (0 - 100°C / 32 - 212°F)
Process pressure	Min 1 bar / 15 psig for 0-5 % Min 3 bar / 45 psig for 5-10 % Min 5 bar / 75 psig for 10-15 %
Light source	GaAs diode, 880 nm monochromatic
Measuring principle	Straight transmission, 20 mm measuring gap
Connection cable	5-pin M12 connector
Weight	3.7 kg / 8 lbs
Measuring range	Min 0 – 100 mg/l Max 15 % depending of pulp type
Flow rate	Min 1.0 m/s for consistency < 1 % Min 1.5 m/s for consistency > 1 %
CTXIL 20/38 HP	P/N 11305536
Process connection	Through ball valve Ø50 mm (≈2")
Process temperature	0 - 100°C / 32 - 212°F
Weight	5 kg / 11 lbs
Other technical data	Refer to CTXIL 20/70

Certificate of conformity

The CTX sensors along with their central unit BB2 are in conformance with the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

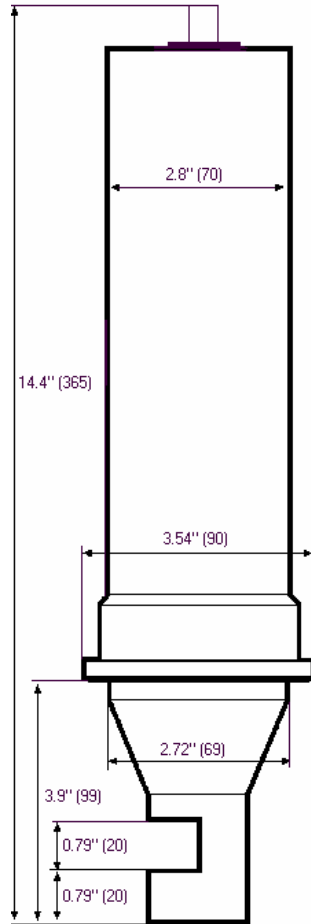
- 73/23/EEC Low Voltage Directive as amended by 93/68/EEC
- 89/336/EEC EMC Directive as amended by 92/31/EEC and 93/68/EEC

The following standards and/or technical specifications have been applied:

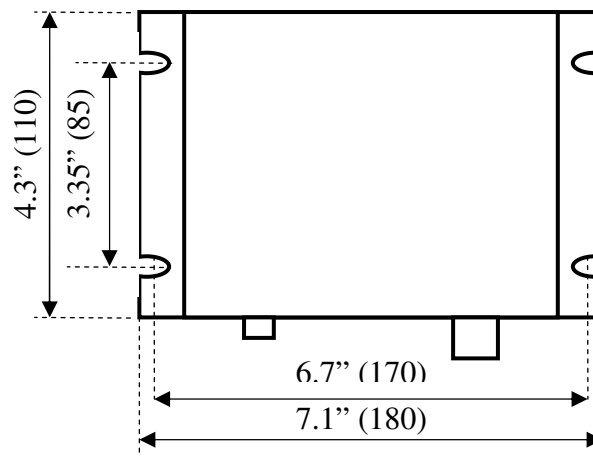
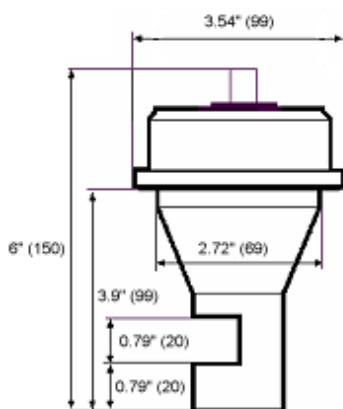
- EN 61000-6-4:2001 Electromagnetic compatibility (EMC) Part 6-4
Generic standards – Emission standard for industrial environments
- EN 61000-6-2:2001 Electromagnetic compatibility (EMC) Part 6-2
Generic standards - Immunity for industrial environments
- EN 61010-1:2001 Safety requirements for electrical equipment for measurement,
control, and laboratory use

18. Dimensions

CTXIL 20/70



CTXIL 20/70 SE



CTXIL 20/38 HP

