Instruction Manual · September 2009

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in one

pointek

CLS500

SIEMENS

Safety Guidelines: Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel: This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Unit Repair and Excluded Liability:

- The user is responsible for all changes and repairs made to the device by the user or the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

Warning: Cardboard shipping package provides limited humidity and moisture protection. This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.
This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications.

Note: Always use product in accordance with specifications.

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- For a selection of Siemens Milltronics level measurement manuals, go to: **www. siemens.com/processautomation**. Under Process Instrumentation, select *Level Measurement* and then go to the manual archive listed under the product family.
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Safety Notes

Special attention must be paid to warnings and notes highlighted from the rest of the text by grey boxes.

WARNING: relates to a caution symbol on the product, and means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.

WARNING: means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.

CAUTION: means that failure to observe the necessary precautions can result in considerable material damage.

Note: means important information about the product or that part of the operating manual.

Safety marking symbols

	Alternating Current
	Direct Current
	Earth (ground) Terminal
	Protective Earth Terminal
	Frame or Chassis Terminal
	Cathodic protection resulting in a potential difference: for example, between the ground on the instrument and the potential of the vessel or tank

The Manual

Notes:

- Please follow the installation and operating procedures for a quick, trouble-free installation and to ensure the maximum accuracy and reliability of your Pointek CLS500
- This manual applies to Pointek CLS500 only.
- This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications.

WARNING: This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

This manual will help you set up your Pointek CLS500 for optimum performance. We always welcome suggestions and comments about manual content, design, and accessibility.

Please direct your comments to techpubs.smpi@siemens.com. For other Siemens Milltronics level measurement manuals, go to: www.siemens.com/level and look under Level Measurement.

Application Examples

- General Purpose, Dust Ignition Proof, and Explosion Proof
- A wide range of applications in high pressure and temperature, chemically aggressive, and other extreme process environments
- Liquids, Solids, Quality, and Interface detection
- Viscous non-conducting and conducting liquids

Technical Support

Support is available 24 hours a day.

To find your local Siemens Automation Office address, phone number and fax number go to:

www.siemens.com/automation/partner

- Click on the tab Contacts by Product then drill down to find your product group (+Process Automation > +Process Instrumentation > Level Measuring Instruments).
- Select the team Technical Support. Click on Next.
- Click on the appropriate continent, then select the country followed by the city. Click on Next.

For on-line technical support go to:

www.siemens.com/automation/support-request

- Enter the device name (Pointek CLS500) or order number, then click on Search, and select the appropriate product type. Click on Next.
- You will be prompted to enter a keyword describing your issue. Then either browse the relevant documentation, or click on Next to email a detailed description of your issue to Siemens Technical Support staff.

Siemens A&D Technical Support Center: phone +49 180 50 50 222

fax +49 180 50 50 223+

Abbreviations and Identifications

Short form	Long Form	Description	Units
A/D	Analog to Digital		
CE / FM / CSA	Conformité Européene / Factory Mutual / Canadian Standards Association	safety approval	
D/A	Digital to Analog		
DAC	Digital Analog Converter		
DCS	Distributed Control System	Control Room apparatus	
ESD	Electrostatic Discharge		
Ex	Explosion Proof	safety approval	
Exd	Flame Proof	safety approval	
FPM	Free Programming Mode		
FSH	Fail Safe High mode		
FSL	Fail Safe Low mode		
FV	Full Vacuum		
HART	Highway Addressable Remote Transducer		
LRV	Lower Range Value	value for 0%	mA
LSL	Lower Sensor Limit	below which no PV is anticipated	
µF	micro Farads	10^{-6}	Farad
µs	micro seconds	10^{-6}	seconds
PED	Pressure Equipment Directive	safety approval	
pF	pico Farads	10^{-12}	Farad
ppm	parts per million		
PV	Primary Variable	measured value	
SV	Secondary Variable	equivalent value	
SVLRV	Secondary Variable Lower Range Value	0% equivalent value	
SVURV	Secondary Variable Upper Range Value	100% equivalent value	
TV	Transmitter Variable		
URV	Upper Range Value	value for 100%	mA
USL	Upper Sensor Limit	above which no PV is anticipated	

Pointek CLS500

Pointek CLS500 is a 2-wire capacitance point level switch for detecting interfaces, solids, liquids, slurries and viscous materials in critical conditions of extreme temperature and extreme pressure. It uses a unique frequency-based measurement system and patented Active-Shield technology to deliver highly accurate, repeatable results. The measurement is unaffected by moisture, vapors, foam, temperature and pressure variations, or material build-up around the mounting glands.

Pointek CLS500 combines a sophisticated, easy-to-adjust transmitter with a measurement electrode and process seal designed to accommodate numerous configurations. The advanced electronics and integrated local display provide for one-point calibration without interrupting the process, and the probe shield design eliminates the need for frequent recalibration.

Pointek CLS500 can be used as a pump controller, by connecting the 2-state mA output and/or the solid state switch to a relay, and activating a pump via an auxiliary power circuit.

Pointek CLS500 is equipped with:

- Smart Transmitter with patented Active Shield technology and variable frequency oscillator
- Remote adjustable commissioning / control capabilities via HART[1]
- Analog (2-wire) 4 to 20 mA or 20 to 4 mA output
- 2-state functionality (4 or 20 mA / 20 or 4 mA)
- Solid state switch
- Adjustable hystereses on/off for solid-state output and for current signal
- Damping functionality
- Signal current (measurement/detection) according to NAMUR NE 43
- Integrated local display for commissioning and services activities
- Full range of local/remote diagnostic facilities
- Polarity-insensitive current loop

1. HART® is a registered trademark of the HART Communications Foundation, Austin, Texas, USA.

Technical Specifications: Pointek CLS500

Power

Supply voltage	
• maximum	33 V DC
• minimum	12 V DC at 3.6 mA (9.5 V DC at 22 mA)
Loop current	3.6 to 22 mA / 22 to 3.6 mA (2-wire current loop)

Mounting

Location	indoor/outdoor
Altitude	2000 m max.
Ambient temperature	
• standard	-40 to +85 ^{o}C (-40 to +185 ^{o}F)
• ATEX-Explosion Proof	-40 to +70 ^{o}C (-40 to +158^{o}F) for T6 -40 to +85 ^{o}C (-40 to +185 ^{o}F) for T5 to T1
Relative humidity	suitable for outdoor (Type 4X / NEMA 4X / IP65, IP68 enclosure)
Installation category	I
Pollution degree	4

Performance

Measurement range	
Transmitter type	
• MSP-2002-1	1 to 330 pF
Minimum span	1 pF
Measurement frequency	420 kHz @ Cx = 0 pF
Accuracy	deviation <0.1% of actual measurement value
Repeatability	0.1% actual measurement
Temperature stability	0.15 pF (0pF) or <0.25% (typically <0.1%) of actual measurement value, whichever is greater over the full temperature range of the transmitter

Safety	• current signalling according to NAMUR NE 43; 3.6 to 22 mA / 22 to 3.6 mA • probe input ESD protected to 55 kV • inputs/outputs fully galvanically isolated • polarity-insensitive current loop • fully potted • integrated safety barrier
Diagnostics (includes fault alarm)	• primary variable (PV) out of limits • system failure measurement circuit • deviation between A/D and D/A converter values • check sum • watch dog • self-checking facility

Outputs

- galvanically isolated
- damping — range 1 to 10,000

Current loop

- continuous signal — 4 to 20 mA / 20 to 4 mA
- 2-state functionality — 4 or 20 mA / 20 or 4 mA, on or off
- time delay — 1 to 100 sec. activating / de-activating
- adjustable hystereses (on / off) — 0 to 100%, min. 1% of range

Solid-state switch

- time delay — 1 to 100 sec. activating / de-activating
- adjustable hystereses (on / off) — 0 to 100%, min. 1% of range
- maximum switching voltage — 30 V DC/30 V peak AC
- maximum load current — 82 mA

User Interface

Local digital display	4 1/2 digit LCD
Rotary function switch	for selecting programmable menu items
• 16 Positions	0 to 9, A to F
Push-buttons: RED (+), BLUE (–)	used in conjunction with rotary switch, for programming menu items

Communications

HART [1] Communication protocol

1. HART® is a registered trademark of the HART Communication Foundation.

Electrodes

Process connections

• threaded connection	AISI 316 L stainless steel 3/4", 1", 1-1/4", 1-1/2", 2" NPT, BSPT, JIS
• flat-faced flanges	AISI 316 L stainless steel[1]

Probe diameter

• Rod	16 mm (0.63") or 24 mm (0.95") 19 mm (0.75") High Temperature version

Probe length

• Rod version (standard)	up to 1000 mm (40") with 16 mm (0.63") dia. probe up to 1000 mm (40") with 24 mm (0.95") dia. probe
• Rod version (High Temperature)	max. active length 750 mm (29.5") with 19 mm diameter probe

Probe insulation	PFA, Enamel[2], Ceramic: max. length 750 mm (29.5")

Wetted Parts

Insulation	PFA, Enamel
Threaded Connection	AISI 316 L stainless steel
Flange	AISI 316 L stainless steel or Teflon[3] covered

Enclosure (electronic)

• construction	aluminum, epoxy-coated; diameter 160 mm (6.3")
• cable entry	2 x 1/2" NPT
• ingress protection	Type 4X / NEMA 4X / IP65, IP68

Weight

Depends on configuration.

Example:

model:	S-series
rod:	PFA insulated, 16 mm (0.63") dia., 1 m (39.4") insertion length
weight:	approx. 5 kg

1. Please see *Flange Standards* on page 93 for a table showing flange sizes.
2. Only available as Rod version, max. length 1000 mm (39").
3. Teflon® is a registered trademark of Dupont.

Process

Pressure rating[1]	50 bar standard
Temperature rating[1]	+200 °C (+392 °F) standard: max. +400 °C (+752 °F)

Approvals

CE	Complies with the following European Directives: EMC Directive 2004/108/EC, ATEX Directive 94/9/EC, and PED Directive 97/23/EC
C-TICK	
Dust Ignition Proof (DIP)	ATEX II 3GD (EEx nA [ib] IIC T4...T6) FM/CSA: Class I, Div. 2, Gr. A,B,C,D T4 Class II, Div. 1, Gr. E,F,G T4 Class III, Div. 1, Gr. E,F,G T4
Flame-proof/ Explosion-proof enclosure	ATEX II 1/2 GD (EEx d [ia] IIC T6...T1) FM: Class I, Div. 1, Gr. A,B,C,D T4
Lloyds Register of Shipping	Categories ENV1, ENV2, ENV3, ENV5

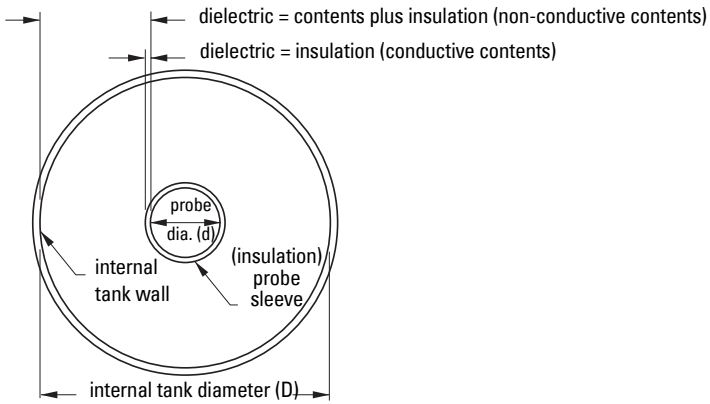
Notes:

- See *Appendix F: Approvals* on page 98 for details of certification.
- Intrinsically Safe (IS) approval [ATEX II 1 G (EEx ia IIC T4...T6),FM/CSA:Class I, Div. 1, Gr. A,B,C,D T4] no longer available. For CLS500 devices purchased prior to June 2008 with IS approval, refer to Instruction Manual 7ML19985GG01, Edition 1.0. Go to www.siemens.com/pointek. From the CLS500 product page, search the **Instructions and Manuals** archive.

1. Please refer to page 17, Temperature/ Pressure Curve chart, for specific combinations of temperature and pressure.

Operating Principles

Capacitance[1] measurement operates by forming a variable capacitor resulting from the installation of a measurement electrode in a vessel or silo. The environment (for example, the tank wall) acts as a reference electrode. Whatever material is sandwiched between the two electrodes forms the dielectric. This will be composed of the vessel contents (air, vapor, liquid, solid, or a combination) and, if the measurement electrode is insulated, the insulating layer (PFA, for example). The dielectric gives a capacitance value.



Capacitance is affected by the surface area of the electrodes, the separation distance between the electrodes, and the dielectric constant of the vessel contents. The relative dielectric constant is the measure of a material's ability to store energy. The relative dielectric constant of air (vacuum) is 1: all other materials have a higher value.

The capacitance when the probe is uncovered (capacitance in air) will be different from the capacitance when the probe is covered (for example, capacitance in water). If the product is two immiscible liquids with different relative dielectric constants, (for example, oil and water) the capacitance will change at the interface between the two liquids.

Pointek CLS500 variable frequency oscillator

The Pointek CLS500 probe is equipped with a variable frequency oscillator which responds to the capacitance. A change in capacitance is registered as a change in frequency. This technology provides high resolution and accuracy. The variable frequency maintains a constant relationship to the reading.

1. For definitions relating to capacitance, see the glossary, page 101.

Capacitance measurement in a cylindrical metal tank

In a cylindrical tank, the initial capacitance in air is calculated by factoring in the length of the probe, diameter of the probe, diameter of the tank, and the relative dielectric constant of air.

The formula[1] is: $C = \frac{K \times \varepsilon \times L}{Log(D/d)}$

where: C = capacitance
K = constant
ε = dielectric constant
L = active measurement length
D = diameter of tank
d = probe diameter

When the material inside the vessel changes, the relative dielectric constant changes, which results in a capacitance change.

The transmitter measures the capacitance of the measurement electrode relative to the environment (reference electrode). Any material that covers the probe will cause an increase in capacitance relative to an uncovered probe surrounded by air. As the product level rises the capacitance will increase. The minimum change in capacitance required to detect a change[2] in the medium is 1pF (within a range of 330 pF).

The Pointek CLS500 electrode

The Pointek CLS500 electrode, comprising a measurement section and an active shield section, is the primary sensor of the system. It supplies the electrical capacitance value of the measurement section relative to the environment.

The Pointek CLS500 patented Active-Shield Technology electrically isolates the measurement section and prevents any non-measurement capacitance from interfering with the measurement. (Capacitance changes could result from uncontrolled variations occurring in the connection cable, process connection, and non-active parts of the probe.) This gives a better ratio of initial capacitance to total capacitance, resulting in higher accuracy

1. This formula applies to a centrally mounted probe: for a probe mounted off-centre, the formula must be adjusted.
2. From absence to presence, or vice versa.

Conventional Capacitance Measurement

$$R = \frac{(C1 + C2 + C3) + Ca}{(C1 + C2 + C3) + Ca + Cm}$$

Pointek CLS500 with Active Shield

$$R = \frac{Ca}{Ca + Cm}$$

R = Ratio between initial capacitance and total capacitance

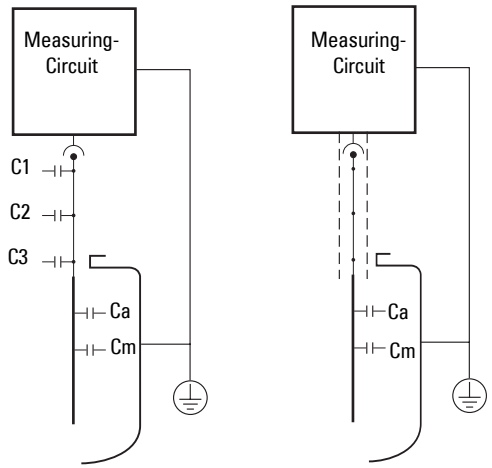
Ca = Initial capacitance (air)

Cm = Capacitance Increase (product)

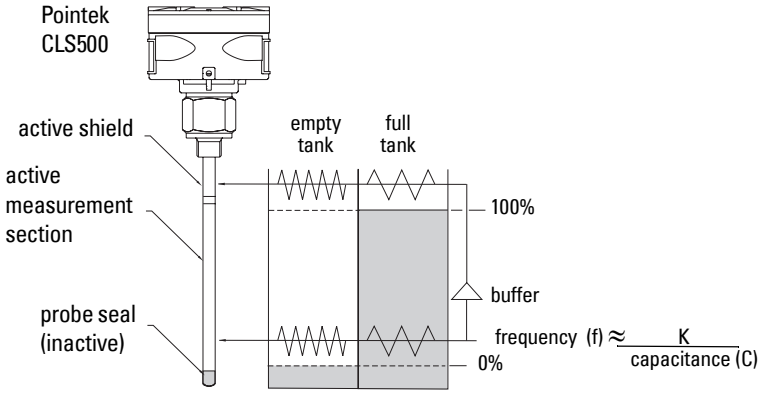
C1 = Capacitance connection point

C2 = Capacitance connection cable

C3 = Capacitance Process connection (includes active part)



The measurement is further protected from interference by a buffer, which applies the frequency signal from the measurement section to the active shield section. This effectively eliminates any electrical potential difference between the shield and the measurement section and prevents additional changes in capacitance occurring.



The relative lengths of the measurement section and active shield section can be specified to suit a particular application. If the measured range will be short relative to the total length of the electrode, specify a short measurement section. This increases the

achievable resolution of the measurement, since any change in level will be greater relative to the length of the measurement section.

The entire Pointek CLS500 transmitter is potted in epoxy resin as part of the intrinsic safety protection. The potting also protects the electronics against mechanical vibration and moisture influences.

The transmitter is connected to the electrode by a mini coaxial cable, and grounded to a connection point inside the enclosure. The external ground lug on the enclosure provides a means of connecting the instrument system ground to a grounded tank. (For more detailed information on grounding requirements, please see Grounding Examples, page 33.)

The measuring range of Pointek CLS500 is 0 to 330 pF (1.0 pF $\cong 10^{-12}$F).

Note: For safety purposes, and to ensure reliable measurement signals, the external ground lug provided on the Pointek CLS500 enclosure must be firmly connected by an adequate cable to the grounded vessel.

Application: Pointek CLS500

Pointek CLS500 has two modes of operation:

- FailSafe High or Low mode (FSH or FSL)
- Free Programming Mode (FPM)

Pointek CLS500 is most often used in FailSafe High/Low mode. This links the settings for triggering an alarm and a fault signal, so that you do not have to set each parameter individually: in effect, it acts as a shortcut.

Free Programming Mode allows each parameter to be set independently. In this mode, the continuous mA signal is available. FPM mode is less often employed with Pointek CLS 500.

Product or Interface detection

The capacitance of the electrode system is dependent on the dielectric constant of the product surrounding the probe. By comparing the capacitances resulting from different products with different dielectric constants, it is possible to determine what product is surrounding the probe.

For products that mix together:

Contamination of one product by another can be measured:

100% product A	4 mA
100% product B	20 mA

Values in between 4 and 20 mA represent the ratio of the two products[1].

For products that do not mix:

The interface between two products can be detected by the change in capacitance from one product to the other.

1. Continuous measurement is only available in Free Programming Mode.

Level Detection

The continuous 4-20 or 20-4 mA signal is proportional to the surface level of the product, with an accuracy of 0.1% of the actual measurement (for example, 1mm/m). Because the loop current is in two-state mode for fault signalling, the continuous mA signal is not available in FSH/FSL mode.

Depending on the requirements of the application, Lower Range Value (LRV - 0%) can be set to 20 mA and Upper Range Value (URV - 100%) set to 4 mA, or the reverse. The measurement takes place anywhere within that range. The LCD displays the value as mA, or pF, depending on the setting for the transmitter variable (TV). If you are using HART, you have the option to define the units (for example, meters).

2-state Switch

The mA output can be used as a 2-state switch set to either 4 or 20 mA. It can be set to go to 4 mA if the probe is covered and 20 mA if the probe is uncovered, or the reverse.

Fault Signalling

Pointek CLS500 has three signal output options:

- via the loop-current
- via the solid-state switch
- via HART

Via the loop current

When using the mA signal, Pointek CLS500 operates according to NAMUR standards[1] for fault signalling. The fault/failure signal can be triggered by a failure in the measuring system, such as:

- a checksum error
- a loss of signal caused by a defect in the module
- a short circuit in the sensor
- a process failure if the level exceeds the limit settings and if the unit is programmed to detect this

You can set the Upper and Lower Sensor Limits (menus 0B and 0C) outside the Upper and Lower Range Value settings. In this case, if the process value is outside its nominal range (the span between LRV and URV), but still not at a fault/failure level, the continuous mA output will saturate to 3.8 mA or 20.5 mA. If the process value is outside the Upper or Lower Sensor Limits, this will be registered as a fault/failure.

1. See *NAMUR recommendation NE 43* on page 98 for more details.

If you select FailSafe Mode at menu 1E, menus 08 and 18 are linked[1], and either FailSafe High or FailSafe Low can be selected. The factory setting for menu 1E is FailSafe High (FSH). Menu 08 controls the mA output, and menu 18 controls the solid-state output.

In FailSafe High mode, (FSH):

- High Signal current (20 mA) and solid-state switch closed in normal conditions when probe is uncovered.
- Low Signal current (3.6 mA) and solid-state switch open when fault/error occurs.

In FailSafe Low mode, (FSL):

- Low Signal current (4 mA) and solid-state switch open in normal conditions when probe is uncovered.
- High Signal current (22mA) and solid-state switch closed when fault/error occurs.

If you do not use communications to receive status information, we recommend utilizing analog fault signalling (menu 08) in order to be warned if a fault or failure occurs.

Via the solid-state output

The solid-state switch can be wired up to an external relay, to provide a second level of protection. It can then be used to activate a failure alarm, or a level switch. (See page 94 for details of a typical application using the analog signal in 2-state mode to provide a high alarm, and using the solid-state switch to provide a high-high alarm.)

Via HART

See page 82 for *HART Response Code Information*. Each HART message is accompanied by a response code. It is then up to the Host to decide what to do in the case of a fault situation. The Host may decide to issue Command 48, which returns more detailed information.

Adjusting alarm settings:

The adjustable hysteresis and time delay settings allow you to adjust the unit for applications with a lot of surface movement.

With a moving surface that fluctuates between 79% and 80%, if the hysteresis is set so that 80 is on and 79 is off, the alarm will constantly alternate between on and off. To prevent this, either set a time delay, or adjust the hysteresis:

- Set the time delay to10 seconds, for example: the alarm will be on only after the surface has been at 80% for at least 10 seconds.
- Reset the hysteresis: for example, set the Upper Threshold setting for 80 and the Lower Threshold setting for 70. The unit will ignore smaller surface fluctuations.

1. FailSafe Mode at menu 1E provides a shortcut, by contrast with Free Programming Mode where all menu items are completely independent. You can make the same selections in FPM, but you need to set each menu item individually.

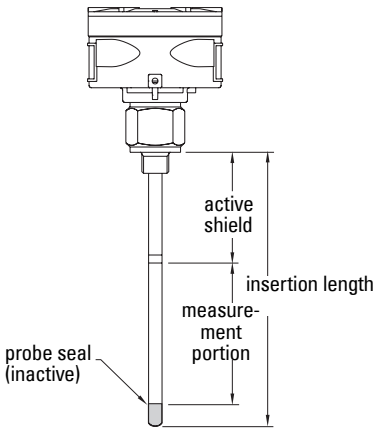
Pointek CLS500: Probe Configuration

The probe (electrode) comprises a measurement section and an active shield section. This electrode connects to the capacitance detector portion of the two-wire loop powered electronic transmitter. The transmitter module is mounted in a powder-coated aluminum enclosure which provides reliable operation in environments with dust, moisture, and high-frequency interference.

Pointek CLS500 Electrode (Probe) Characteristics

Apply to all general connection configurations:

- The standard Pointek CLS500 insulated electrode is designed for use in both conducting and non-conducting liquid applications.
- Most electrodes consist of an active shield portion and a measurement portion, which combine to form the complete electrode. (This is not the case for electrodes with ceramic/enamel insulation.)
- The sum of the active shield length and the measurement length is the total insertion length.
- The active shield design provides continuous immunity from changes in conditions at the top of the vessel where levels of vapors, dust, and condensation may be constantly changing.
- The design of the active shield isolates the starting capacitance of the electrode from the effects of changes in capacitance due to temperature and pressure fluctuations that could cause small changes in the seal geometry.
- The end seal is formed as an integral part of the electrode insulation, giving smooth and uniform characteristics (tested to 55 kV).
- Standard single cone seal



High pressure and high temperature applications

For high temperature and pressure applications (greater than 200 bar) with conductive liquids, contact your local Siemens representative.

For more details on configuration, see *Appendix E: Pointek CLS500, dimensions and application examples on* page 90.

Electrode Assembly

Pointek CLS500 electrodes come in a variety of formats to provide the necessary characteristics for correct mounting, chemical compatibility, temperature and pressure requirements, and dielectric constant of the medium. The main body of the manual discusses the standard configuration. Dimensions are shown in *Appendix E: Pointek CLS500, dimensions and application examples*, page 90.

Pointek CLS500: Standard Level Version

Available with the following features:

- Threaded flanges, welded flanges, and single-piece flanges
- HP series and HT series process seals
- Selections of standard ANSI and DIN flanges
- The most common electrode is insulated with PFA. Enamel (HP seal) is also available.
- Various process connection materials
- Rod version only

Process Connections

The standard threaded process connection with PFA insulated electrode, including the active shield, provides good results in all measurement situations within the temperature, pressure, and corrosive capabilities of the materials and seals. This remains true over a wide range of dielectric constants in both non-conducting and conducting materials.

Any standard process connection is available with Pointek CLS500, and special versions can be fabricated to match the mounting and application requirements. A wide range of threaded and flanged fittings is available. (Contact your local Siemens Milltronics representative, or check our website at www. siemens.com/processautomation).

Seal Types

The basic internal seal for Pointek CLS500 has a conical-shaped, preloaded pressure/leak resistant construction. Up to three levels of seal protection are implemented depending on the integrity requirements of the application. A single or double cone internal seal forms one or two barriers against leaking, and a third flange face gasket is also available in the D and DD seal construction. The flange face seal also provides a design with no metal wetted parts if required.

Process Connection and Seal Configuration of Pointek CLS500

Process Connection	Seal Type	Seal Description
Threaded	S	Single Cone
Welded Flange	S	Single Cone
Solid Machined Flange	S	Single Cone
	HP/HT	Primary graphite seal, and glass seal

Note: Pointek CLS500 HP (high pressure version) is only supplied with enamel insulation. A primary graphite seal plus a secondary redundant seal is provided between the electrode and the instrument body.

Pressure and Temperature Considerations

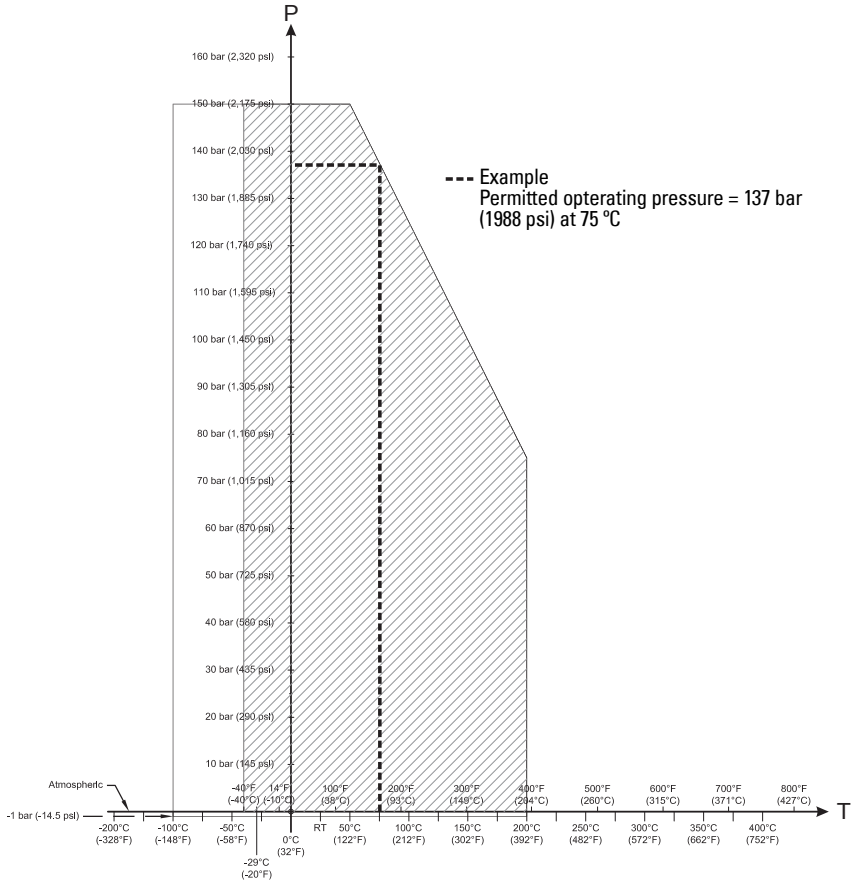
The maximum temperature and pressure of operation for the standard Pointek CLS500 level probe is 200 °C (392 °F) and 200 bar (2900 psi). Please consult the pressure curves below for qualifications that must be applied to these maximums.

Enamel probes are recommended when the process temperature exceeds 200 °C, and/or in combination with very high pressure.

Note: Consult your local Siemens representative if the material to be measured may be incompatible with the Pointek CLS500 materials of construction.

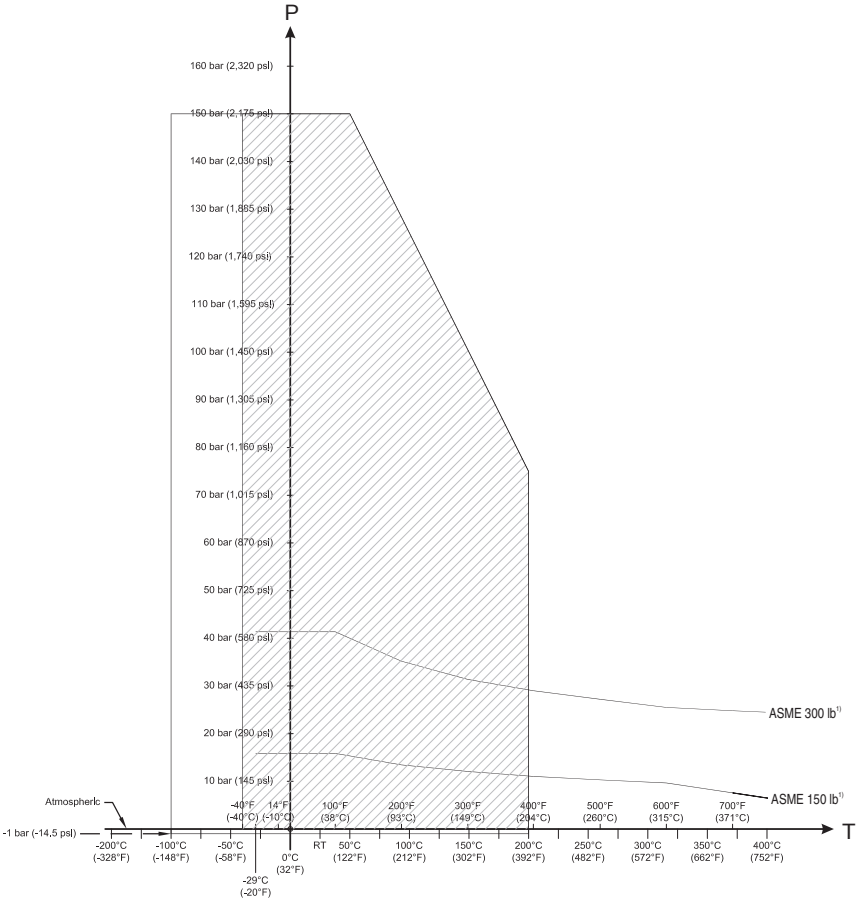
Pressure/Temperature Curves

Rod probes, threaded process connections (7ML5601)



P = Permitted Operating Pressures
T = Permitted Operating Temperature

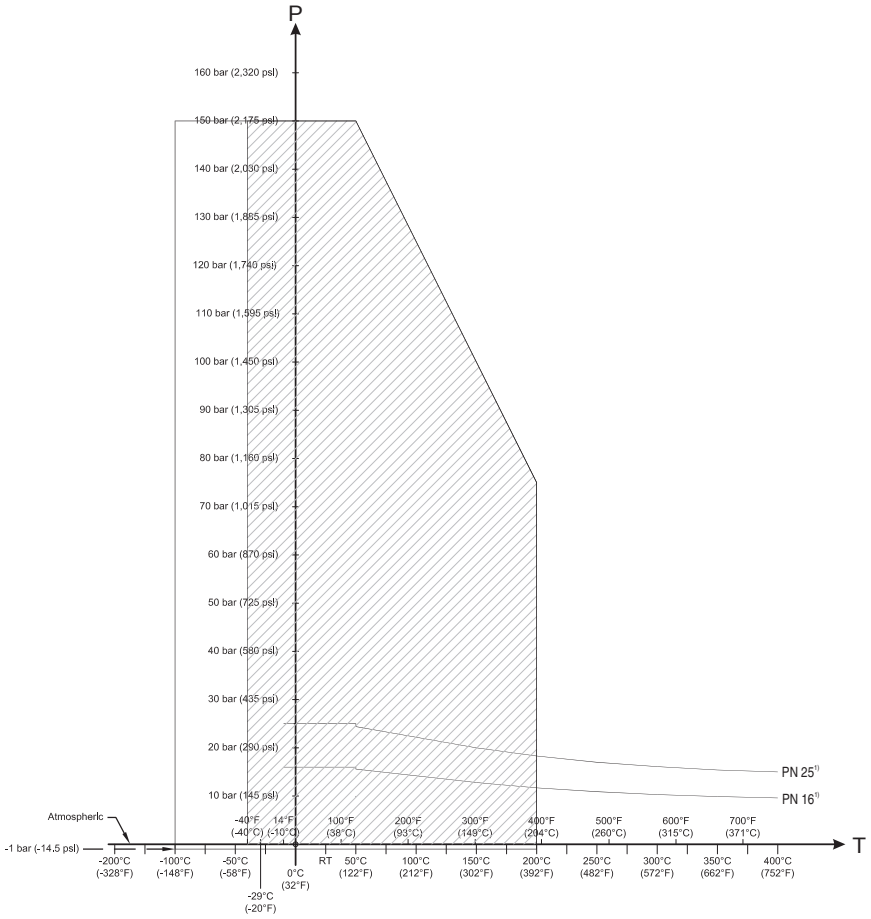
Rod probes, ASME flanged process connections (7ML5602 and 7ML5603)



P = Permitted Operating Pressures
T = Permitted Operating Temperature

1) The curve denotes the minimum allowable flange class for the shaded area below.

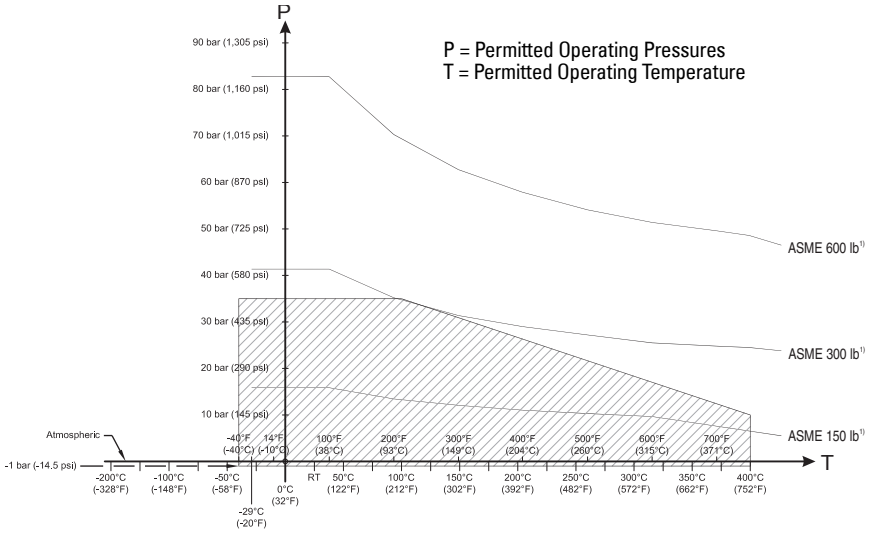
Rod probes, EN flanged process connections (7ML5602 and 7ML5603)



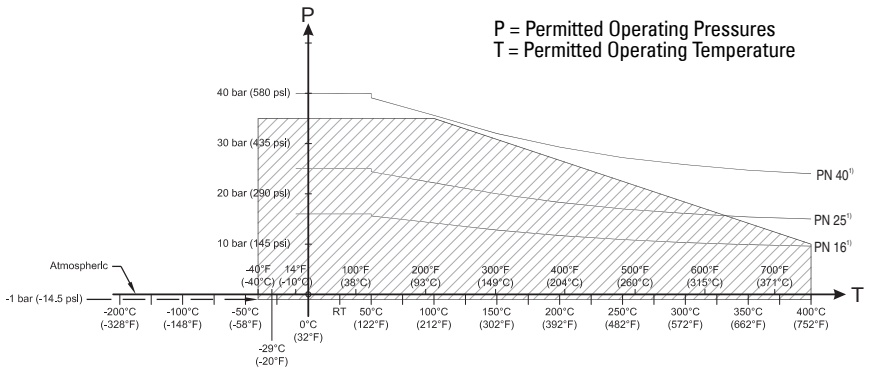
P = Permitted Operating Pressures
T = Permitted Operating Temperature

1) The curve denotes the minimum allowable flange class for the shaded area below.

High temperature (no insulation), ASME flanged process connections (7ML5604)

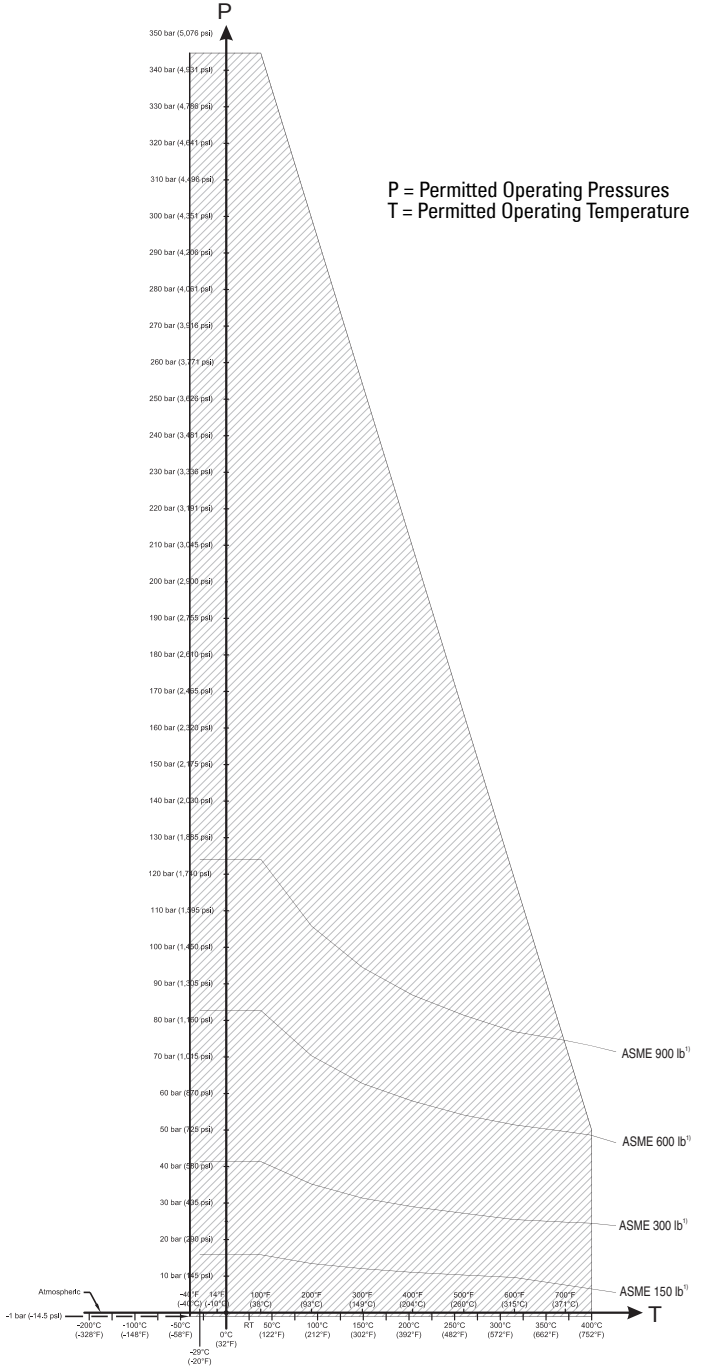


High temperature (no insulation), EN flanged process connections (7ML5604)



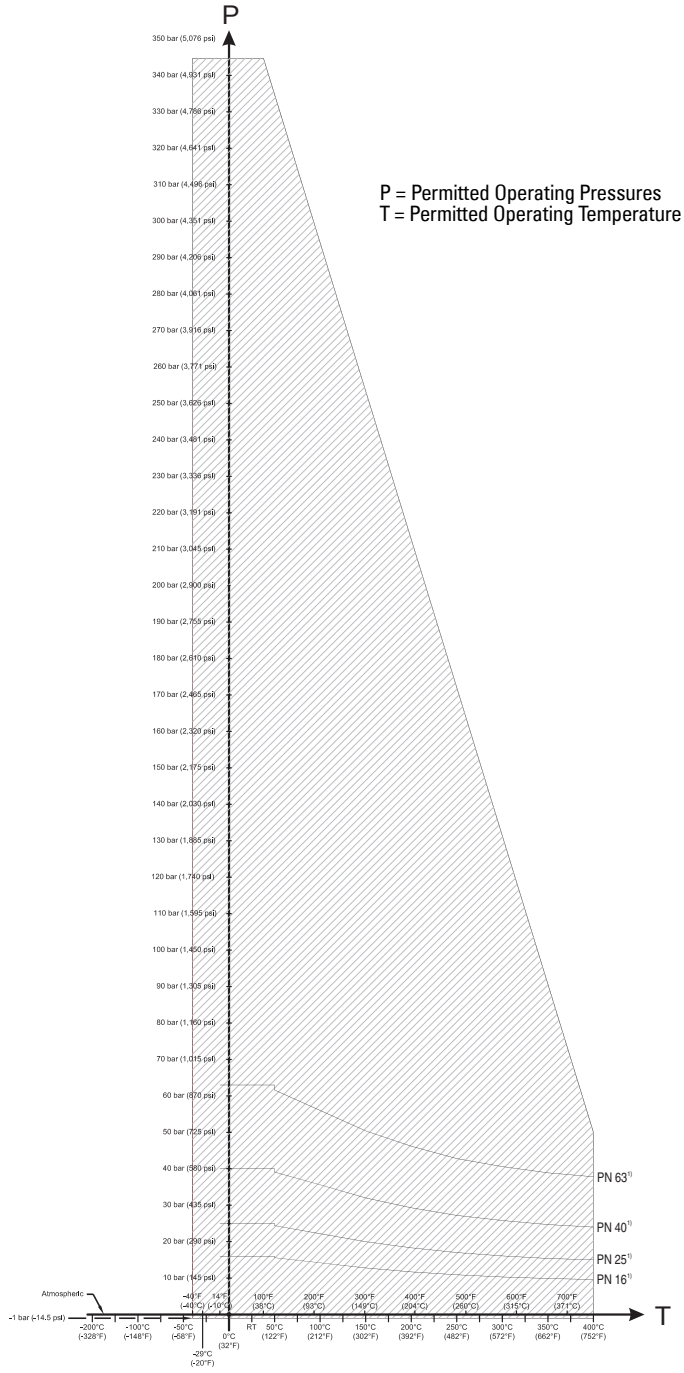
1) The curve denotes the minimum allowable flange class for the shaded area below.

High temperature, enamel rod probes, ASME flanged process connections (7ML5604)



1) The curve denotes the minimum allowable flange class for the shaded area below.

High temperature, enamel rod probes, EN flanged process connections (7ML5604)



1) The curve denotes the minimum allowable flange class for the shaded area below.

Installation: Pointek CLS500

Notes:
- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- This product is susceptible to electrostatic discharge. Follow proper grounding procedures.

! WARNINGS:
- **Disconnect the device before any welding is carried out in the vicinity of the instrument.**
- **Provide protection when the solid state switch is activating an external relay to prevent possible switch/relay damage resulting from inductive spikes generated by the relay coil. (See *Protection for solid-state switch* on page 32 for details.)**

Handling Electrodes

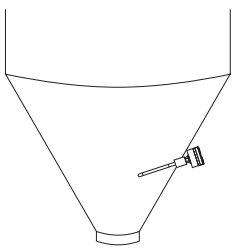
! WARNINGS:
- **Do not scratch or gouge the PFA electrode insulation since this could reduce the integrity of the insulation and the useful life of the electrode.**
- **Do not damage the insulating sleeve on the electrode during shipping, packing, and installation[1]. Any damage to the electrode can prevent proper performance.**
- **(ATEX 95): Precautions MUST be taken to avoid ignition due to hazardous electrostatic discharges:**
  a. **where an isolated probe is used in gas, vapor, or a non-conductive liquid that is potentially explosive, requiring apparatus group IIC equipment**
  b. **where the probe is used in a potentially explosive dusty atmosphere**

1. Most electrodes use PFA insulation, a very dense and reliable type of Teflon® that prevents leakage and corrosion of the metal electrode and acts as an insulator when conductive materials are being measured.

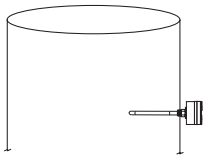
Location

Pointek CLS500 is normally mounted on the vessel top (high detection alarm) or through the tank wall at the detection level (high or low detection alarm).

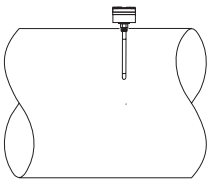
Angle



Horizontal



Vertical



Mounting Instructions

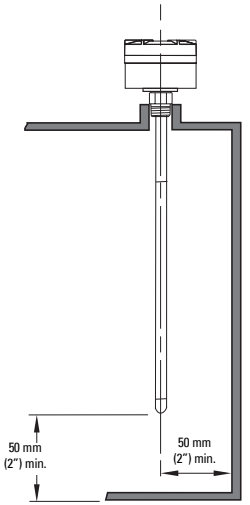
Pointek CLS500 is easily installed: simply mount the instrument on the process connection of the vessel.

Notes:

- The transmitter is specified for use at temperatures ranging from –40 °C to 85 °C (–40 °F to 185 °F): if your process temperature is outside this range, a standard option is available with a thermal isolator.
- Before mounting Pointek CLS500, check to ensure the threads are matching to avoid damaging them.

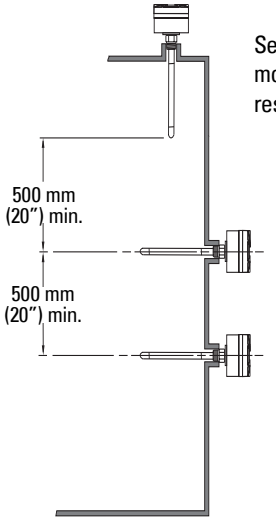
Mounting Cautions

Wall restriction

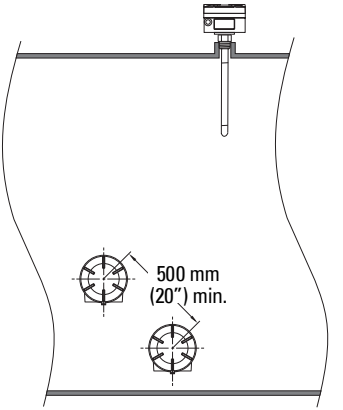


Leave at least 50 mm (2") between the probe or the probe tip and the tank wall,

Multiple units



Sensors must be at least 500 mm (20") apart: mount them diagonally if vertical space is restricted.

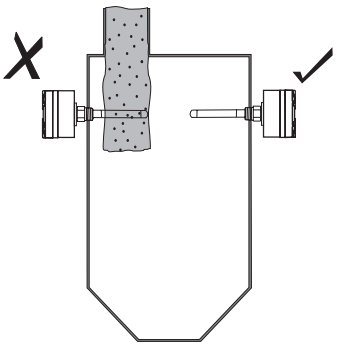


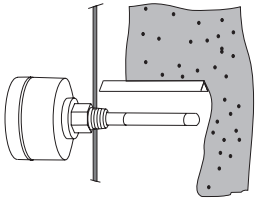
Note: These drawings are not to scale.

Process Cautions

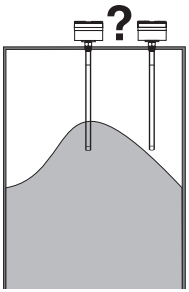
CAUTION:

- The maximum allowable torque on a rod installed horizontally is 30 Nm.
- Keep the probe out of the path of falling material, or
  Install a protective cover to protect the probe from falling material.

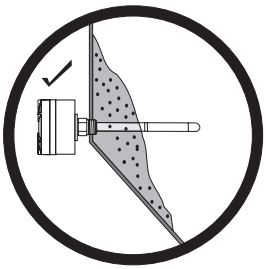


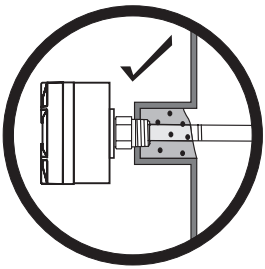


CAUTION: Consider material surface configuration when installing unit



Note: Build-up of material in Active Shield area does not adversely affect switch operation.





Interconnection: Pointek CLS500

Wiring

⚠ WARNING:

- **The DC input terminals shall be supplied from a source providing electrical isolation between the input and output, in order to meet the applicable safety requirements of IEC 61010-1.**
- **Observe the specifications of the examination certificate valid in your country.**
- **Observe the laws and regulations valid in your country for electrical installations in potentially explosive atmospheres.**
- **Ensure that the available power supply complies with the power supply specified on the product nameplate and specified in the examination certificate valid in your country.**
- **Dust-proof protection caps in the cable inlets must be replaced by suitable screw-type glands or dummy plugs, which are appropriately certified for transmitters with explosion-proof protection.**
- **The lid must not be opened in wet locations while the unit is powered. (A wet location is a location where water or another conductive fluid may be present and is likely to increase the risk of electric shock.)**

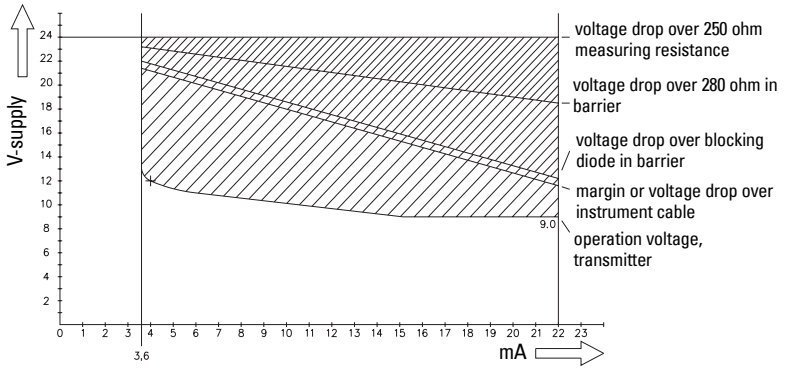
Supply

Notes:

- The transmitter is powered by the current loop and needs at least 9.5-13 Volt on the terminals: 9.5 V at 22 mA or 12 V at 3.6 mA.
- The maximum supply is 33 Volt. If the voltage is higher the device will shut down.
- The loop-circuit will withstand voltages up to 250 Vac/Vdc without any damage.

Pointek CLS500 uses a switched power supply circuit, which makes the most efficient use of the available power present on the terminals. If the signal current is low (4mA) the terminal voltage will be high, and if the signal current is high (20 mA) the terminal voltage may be low, due to all the resistive elements in the loop, such as the barrier and sense resistor.

Voltage drop versus mA for current transmitter operation



Examples:

- With a 250 Ohm sensing resistor, no barrier and negligible cable resistance, the overall supply voltage should be at least 15.0 V.
- With a 250 Ohm sensing resistor, a barrier of 280 Ohm, and 20 Ohm cable resistance (500 m), the total resistance is 550 Ohm, so the overall supply voltage should be at least 20.5 V.
- For a multi-drop application, where the measuring supply is fixed to 4 mA, the voltage on the terminals of the Pointek CLS500 should be at least 12 V.

The loop circuit is completely isolated from the measurement circuit. It is designed so that the internal capacitance and inductance on the terminals are isolated, and are not a factor in safety calculations.

Cable

Notes:

- To maintain reliable transfer of the HART modem signals, the RC[1] time constant of the connections should be less than 65 µSec.
- For output signals (from the Pointek CLS500), only the cable and barrier resistance are relevant. For input signals the measurement resistance is also relevant.
- Use twisted pair cable, screened as a pair.[2]

1. RC = Resistance * Capacitance
2. If you use a common screen over a cable containing multiple twisted pairs, do not use other pairs for signals that could interfere with HART signals.

Selecting the correct instrumentation cable

- you need to know the cable length, the barrier type (if applicable), and the measurement resistance
- select a cable that will give you a capacitance time constant of less than 65 µSec

1. Calculate the capacitance for a time constant of 65 µSec, using the following formula:
   $t = R \times C$ (time constant = Resistance * Capacitance)
   R is the sum of the load resistor and cable resistance.
   C is the sum of the cable capacitance and the capacitances of the connected device/devices.

2. Determine the cable length allowed by subtracting the capacitance value of the device (or devices) on the loop from the total capacitance, and using the maximum allowable limit of 100 pF per meter (or 1 nF per 10 meters).

Example

1. Calculate the cable capacitance which will give a time constant of 65 µSec:
   A twisted pair cable with a conductor cross-section of 1 mm^2 (AWG 18 equivalent) has a copper resistance of 73.6 Ohm/km and a capacitance of 100 pF/m (or 1 nF/10m).

   For a standard 28 V 280 Ohm barrier and a 250 Ohm measuring resistance, with a 100 meter cable:

   Resistance = 280 (barrier) + 250 (sensing device) + 7.36 (cable)= 537.36

   $$t = R \times C$$

   $$C = t/R$$

   $$65 \times 10^{-6} \text{ s} = 537.36 \times C \text{ nF}$$

   $$C = (65 \times 10^{-6}/537.36) = 121 \text{ nF}$$

2. Calculate the length of cable allowed by subtracting the capacitance value that the device presents on the loop from the total capacitance. Pointek CLS500 has no measurable capacitance value, but assume 5 nF. Then use the maximum capacitance limit (1 m /10 nF) to determine the cable length:

   $$121 - 5 = 116 \text{ nF}$$

   $$116 \times 10 = 1160 \text{ m}$$

   The maximum cable length allowed is 1160 m.

IIB type/class hazardous area applications: maximum cable length

In IIB type/class hazardous area applications the maximum allowed capacitance value is 330 nF, as long as you are not using HART. If you are using HART, the maximum cable length will be limited. Depending on cable specifications, the maximum length lies between 1 and 3 km.

Multi-drop applications: maximum cable length

In a multi-drop application, the total capacitance of all the devices must be calculated. With five devices, at 5 * 5 nF, the allowable cable length will be considerably limited.

Notes:

- If the device is part of a multi-drop setup, Pointek CLS500 sets the current to 4 mA, which inhibits analog signalling, including fault signalling.
- Multi-drop is a HART mode where devices are set to a fixed current, and the device is interrogated periodically. The maximum number of devices on one loop is 15, one of which can be an analog mode device.

Terminals

Pointek CLS500 is equipped with two terminal blocks, both insensitive to polarity.

- One terminal block connects the instrument cable (loop power).
- The second terminal block provides the solid-state switch output (solid-state relay).

Connecting Pointek CLS500

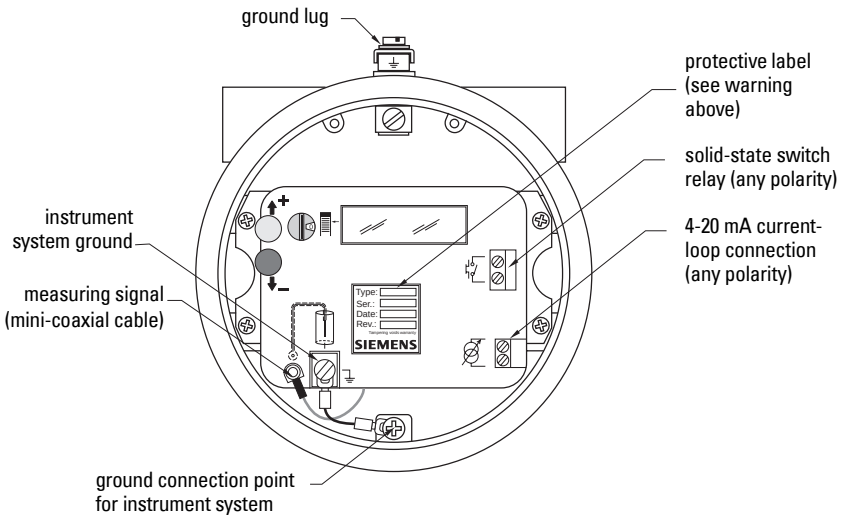
The processor integrated circuit is covered by a label which contains product information and which also acts as a protective seal against moisture.

> **! WARNING: Damage or removal of the protective label voids the warranty for the Pointek CLS500.**

1. Loosen the retaining set-screw and remove the enclosure cover.
2. Loosen the cable gland and thread the cable through it.
3. Connect the power / signal conductor wires to the current loop terminal block (any polarity).
4. Ground the enclosure (see instructions on next page for details).
5. Check to ensure all connections are good.
6. Tighten the cable gland to form a good seal.
7. Replace the enclosure cover and tighten the retaining set-screw.

Note: If you plan to calibrate the unit using push-button adjustment, do so before replacing the cover.

Connection Diagram



Protection for solid-state switch

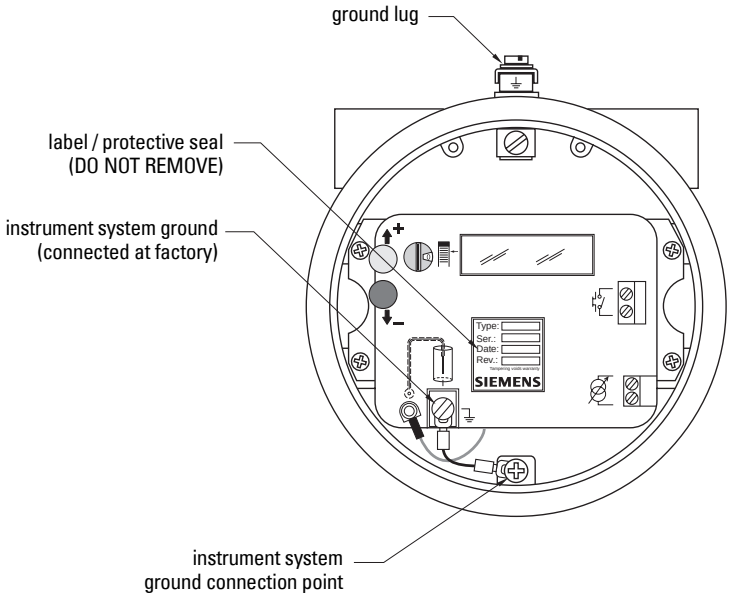
- For dc circuits: connect protection diodes in the correct polarity across the relay coil.
- For ac circuits: connect a Voltage Dependent Resistor (VDR) or other ac compatible component (such as zeners and protection diodes in combination) in the correct polarity across the relay coil.

Grounding instructions

Notes:

- Since the measurement occurs between the Measurement and Ground connections, it is important to have good, low-resistance, reliable connections in this circuit.
- Use a ground connection wire with a sufficiently large diameter relative to its length, and not less than 1mm^2.
- The Pointek CLS500 measurement circuit is completely isolated from the loop circuitry: this allows either line of the loop circuit to be grounded if requirements for Ex safety are followed and if the power supply voltage is less than 33 Vdc.

Connect the housing and the process connection with the tank wall, using the ground lug on the housing.



WARNING: When connecting the probe, do not leave moisture or metal scrap (from the cable shielding, for example) inside the housing. This could interfere with transmitter operation, or cause a short circuit.

Grounding Examples: Pointek CLS500

Grounding is important for two reasons:

1. To prevent interference to the signal: system grounding
2. For safety purposes: safety grounding

Several common applications are illustrated. They are separated into two groups: the first group illustrates System Grounding and the second illustrates Safety Grounding.

System Grounding (referencing)

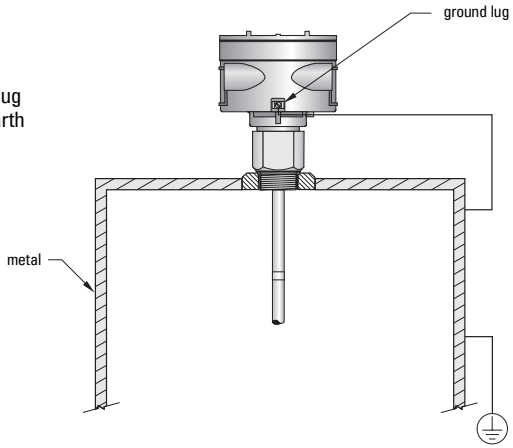
For the measuring system to function correctly, the reference electrode must be properly grounded. Make sure that there is a reliable connection from the instrument housing to the reference electrode (usually the wall of a metal tank[1]). Some common applications involving system grounding include:

- metal tanks
- metal tanks, cathodically protected
- non-conductive tanks

Metal Tanks

If the metal tank is reliably grounded, connect the ground lug on the Pointek CLS500 to the earth ground on the tank as shown.

(See page 32 for connection diagram.)



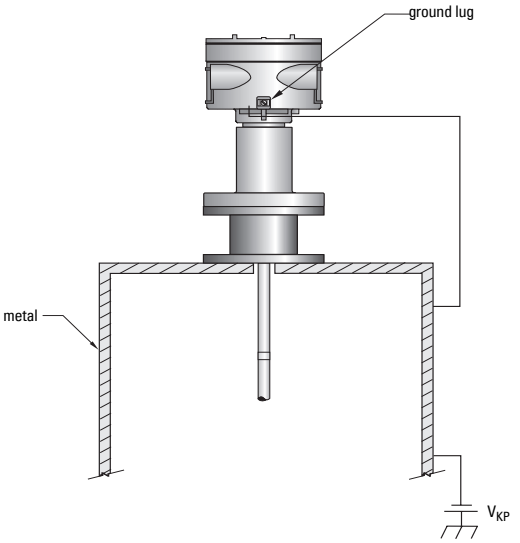
1. If the grounding reference is not the tank wall, connect the ground lug to another object that has conductive characteristics and that is reliably grounded.

Cathodically Protected Metal Tanks

Cathodically protected metal tanks are never directly grounded. However, the impedance of the supply source is so low that it will not cause any problems. The shielding of the loop cable should be grounded at one end only (the tank end) to avoid short-circuiting the cathode protection voltage.

The ground lug on Pointek CLS 500 can be connected to the tank as shown.

(See page 32 for further grounding details.)



Note: Grounding Pointek CLS500 as illustrated above provides only system grounding for referencing purposes: it does not provide safety grounding.

Non-Conductive Tanks

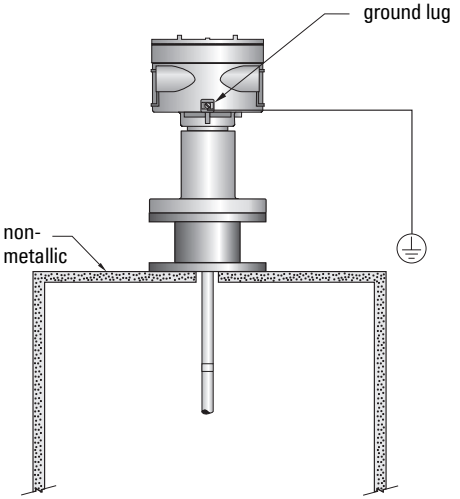
Non-metallic tanks always require a proper grounded conductive medium: connect the ground lug on the Pointek CLS 500 to earth ground.

With non-conductive contents:

- there must be a solid connection from the instrument to a grounded object in the environment (a metal tank wall, or the metal frame of a non-conductive tank).

With conductive contents:

- the vessel contents must be grounded, for example by being in contact with a grounded metal pipe.



Safety Grounding

The safety grounding requirements are determined by the application and the connected instruments. The Pointek CLS500 transmitter does not have any special requirements due to the galvanic separation between the measurement section and the loop section.

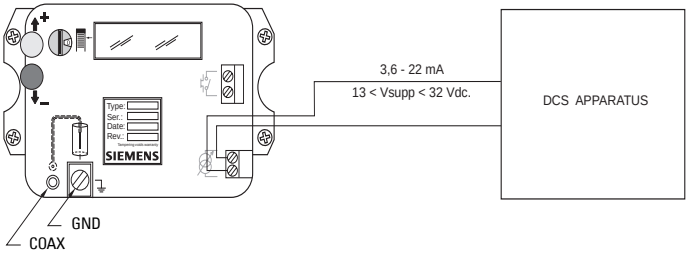
Depending on the DCS characteristics, there are three possible grounding options:

- If the DCS measures the current through the loop compared to a common zero Volt point, do not ground the negative side of the current loop because measurement inputs can be short-circuited.
- If the DCS measures the current in the positive wire or connector, the negative side of the current loop can be grounded.
- If the DCS has galvanically separated inputs for each measurement channel the grounding method can be chosen as required.

In hazardous applications a Stahl-type barrier is required, and it is typically mounted on a DIN rail inside a customer-supplied enclosure located in the non-hazardous area.

Example 1

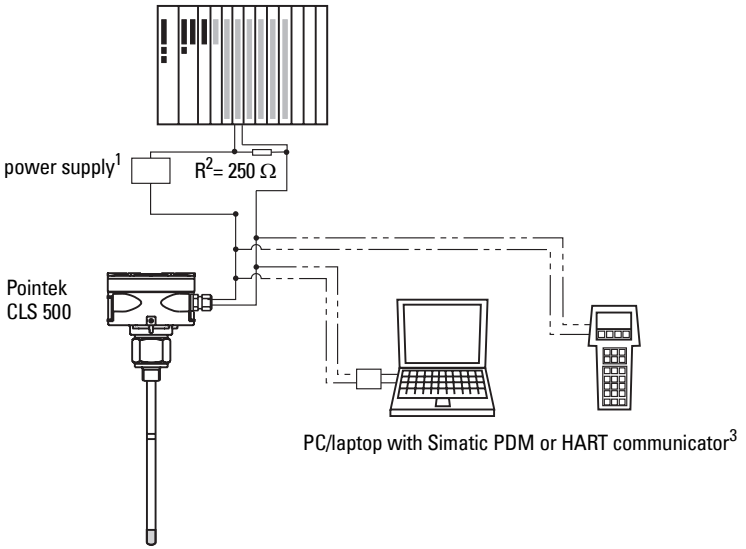
If no specific Ex conditions apply, Pointek CLS500 can be directly connected to the DCS. The supply voltage, however, should remain within the limits set by the Pointek CLS500. Connecting a Pointek CLS500 to a DCS does not influence that equipment. One of the connection cables can be grounded if desired.



Communications

Pointek CLS500 is equipped with HART communication protocol so that settings and values can be obtained and altered locally or remotely.

Typical PLC configuration with HART



Diagnostics

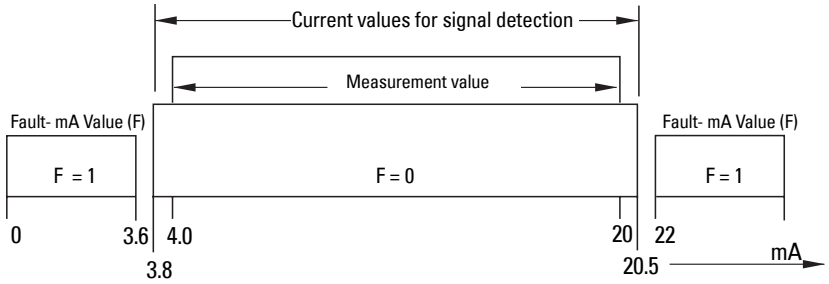
The internal diagnostic functions continuously monitor the operation of the transmitter. An error signal is generated if a failure or irregularity occurs.

Pointek CLS500 sends the signal current according to the NAMUR NE 43 recommendation. During normal operation the current remains within the range from 3.8 to 20.5 mA. If the process exceeds its normal limits but is not in a fault or failure situation, the signal current will be outside the measurement range (4 to 20 mA) but will be limited to either 3.8 or 20.5 mA.

If a fault or a failure is detected, the signal current is set to either 3.6 mA or 22 mA, depending on the settings you have chosen. This feature may be disabled by the user.

1. Depending on the system design, the power supply may be separate from the PLC, or it may be part of the PLC.
2. A 250 Ohm resistor is required only when the PLC is connected to a HART modem or a HART communicator.
3. The HART communicator and a PCL/laptop computer cannot both be connected to the 4-20 mA loop simultaneously.

Current values used as signals from digital transmitters



Whenever the local situation allows, the zero adjustment and the full scale can be set using the push-button feature and the appropriate menu selection. In most cases you can do a one-point calibration[1] by using the push-buttons to input the actual level in %.

The total isolation between the measurement circuit and the current- loop circuit provides immunity during the use of cathode protected measuring tanks. Connection to PLC equipment is possible without any difficulty.

The Upper Sensor Limit (USL) and Lower Sensor Limit (LSL) are set to 330 and 1 pF respectively, and the following conditions apply:

- The Upper Range Value (URV) and Lower Range Value (LRV) should be **within** the USL to LSL range, but can be set anywhere within that range.
- An interruption of the measuring connection will be detected: a loose or interrupted connection results in up to 0.5 pF capacitance, which is below the adjusted LSL and thus signals a FAULT condition.

Applications for Solid-State Output

The solid-state output is a polarity independent switch output. The solid-state switch has two possible functions:

- In normal process conditions, it can be activated/deactivated when the product level reaches the upper/lower threshold settings (set in menus 15 and 16).
- When a fault or failure is detected in the process or in the measurement circuit, it can signal a fault (set in menu 18).

The solid-state switch has its own parameter set: menu items 13 to 18, (see *The Two Menu Levels* tables on page 41, and *Rotary Switch Positions – Quick Reference (FSH Mode)* chart on page 46). Menu 1E provides a short-cut that sets both the current loop and the solid-state switch, to provide alarm and fault signalling in the event of an error/ failure[2]. The factory setting for menu 1E is FailSafe High.

In menu 0E and menu 0F, you set the Upper and Lower Range Values (URV and LRV) for relay operation. Within that range, the solid-state switch has independent settings for Upper and Lower Threshold, (menus 13 and 14) and the corresponding delays (menus 15 and 16).

1. See *Set up using push-buttons (for overfill protection)* on page 49.
2. See *FailSafe Mode* on page 79, for details.

When the solid-state switch is to be operated as a fault/failure output (for example, for a separate shutdown system) we recommend disabling the operation for signal output (select Free Programming Mode at menu 1E, and Disabled Mode in menu 17 on page 75). When the solid-state switch control is disabled at menu 17, the threshold delay settings are unavailable.

See page 94 for details of a typical application using Pointek CLS500 to provide a high alarm via the current loop, and a high-high alarm using the solid-state switch.

Notes:
- The solid-state output should only be used in circuits where the current is limited by a proper load.
- Due to the limited switching capabilities of the solid-state switch component, an auxiliary relay must be applied when switching high-current/high-voltage apparatus.

Switch Protection Diode

! **WARNING: When the solid state switch is activating an external relay, protection diodes must be connected in the correct polarity across the relay coil to prevent possible switch/relay damage resulting from inductive spikes generated by the relay coil.**

Factory Settings

Pointek CLS500 has a number of default factory settings. If the required settings for the application are known, the settings can be modified during final testing.

Note: To restore factory settings, use menu item 12 (see *Factory Settings* on page 78 for details).

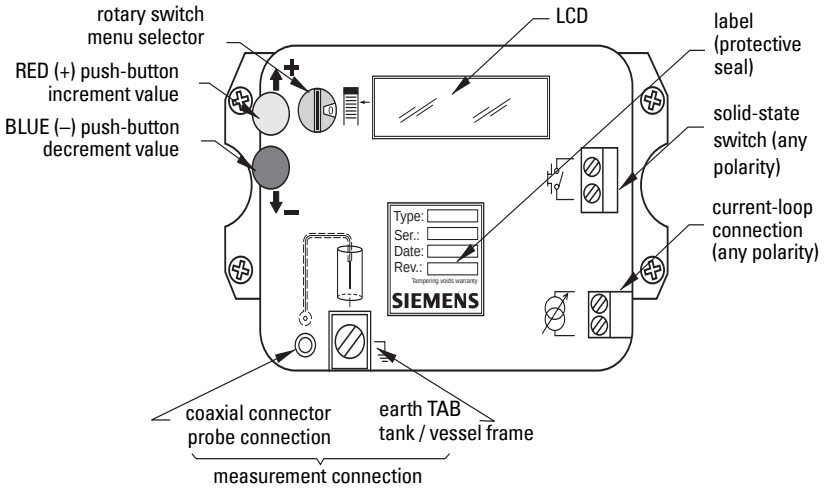
Settings:

Setting	Description
ID	Has a unique serial number
TV0 Units	pF
TV0 USL	330 pF [switch position (0)C]
TV0 LSL	1.0 pF [switch position (0)B]
TV0 URV	330 pF [switch Position (0)F]
TV0 LRV	0.00 pF [switch Position (0)E]
AO1	4-20 mA is 0-100% [position (0)8]
TAG	"customer input data via HART"
DESCRIPTOR	"customer input data via HART"
MESSAGE	"Siemens Milltronics P I"
DATE	"customer input data via HART"
SENSOR SERIAL NUMBER	"customer input data via HART"

Setting	Description
FINAL ASSEMBLY NUMBER	"customer input data via HART"
TV1 Units	UNDEFINED
TV1 LRV	0 [switch position (0)E, TV1]
TV1 URV	1.0 [switch position (0)F, TV1]

User Interface: Pointek CLS500

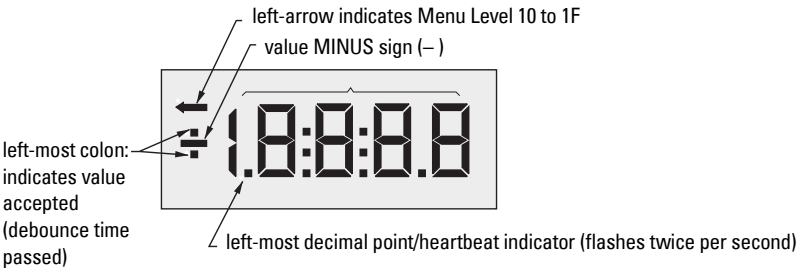
The Pointek CLS500 user interface consists of the display (LCD), the rotary switch and two push-buttons. The rotary switch enables you to select a particular item and/or variable for read-out and/or adjustment: the push-buttons allow you to select and/or alter a read-out or a value.



The integrated LCD (display)

The seven-segment LCD (display) shows the value and/or diagnostic information. It is mainly for numeric data, but there are also a number of indicators which use alphabetic characters. A list of these LCD displays, together with the associated menu items, is shown in *Appendix B: LCD display examples* on page 81.

When FailSafe mode is selected[1], the LCD blinks when the probe is uncovered; it is steady when the probe is considered covered.



The LCD will hold information for a long time even when not refreshed (for example, if there is a loss of power). The heartbeat indicator blinks continuously whenever the device is working. A still heartbeat indicator signals that the device has stopped working.

1. FailSafe High is the factory setting.

How to access the data:

Access data in the transmitter from 29 menu items divided between two menu levels: **00** to **0F** and **10** to **1F**. Use the rotary switch and push-buttons in combination to select an item and adjust the value.

The functions of the menu items are illustrated in the application example on page 94. Details on using each menu item are given in *Appendix A: Menu Groups* on page 59. (See also *Rotary Switch Positions – Quick Reference (FSH Mode)* on page 46 showing the switch position and button press combinations used to carry out different functions.)

The Two Menu Levels

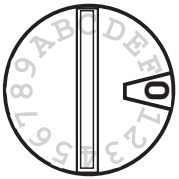
Menu 00 to 0F	Description	Menu Group	Details
00	Dynamic Value: Primary Variable (PV)	Transmitter Variable Values	64
01	Transmitter Variable select for PV		65
02	Highest/Lowest Recorded Value		65
03	Upper Threshold Delay: 2-state mode	Analog Output Signalling (loop-current in 2-state mode)	67
04	Lower Threshold Delay: 2-state mode		68
05	Upper Threshold Setting: 2-state mode		68
06	Lower Threshold Setting: 2-state mode		69
07	Analog Signalling Mode: 2-state mode		69
08	Analog Fault Signalling: 2-state mode		71
09	Stepsize Update Value	Transmitter - Variable Settings	60
0A	Damping		61
0B	Lower Sensor Limit		61
0C	Upper Sensor Limit		62
0D	Delta Range Setting		62
0E	Lower Range Value		63
0F	Upper Range Value		64

Menu 10 to 1F	Description	Menu Group	Details
10	Dynamic Value: Primary Variable (PV)	Transmitter Variable Values	64
11	Output Signal Processing Test	Miscellaneous	77
12	Factory Settings		78
13	Upper Threshold Delay: solid-state output	Digital Output Signalling (solid-state output)	72
14	Lower Threshold Delay: solid-state output		73
15	Upper Threshold Setting: solid-state output		73
16	Lower Threshold Setting: solid-state output		74
17	Digital Signalling Mode: solid-state output		75
18	Digital Fault Signalling: solid-state output		76
19	Range Inversion	Miscellaneous	78
1A	(non-operational)		
1B	(non-operational)		
1C	Transmitter Variables Dynamic Value	Transmitter Variable Values	66

Menu 10 to 1F	Description	Menu Group	Details
1D	(non-operational)		
1E	Select FailSafe High / Low (FSH/FSL) or Free Programming Mode (FPM)	Miscellaneous	79
1F	Keylock Level		80

The rotary switch

The rotary switch gives you access first to the menu level and then to the menu item[1].



The rotary switch has a small slot where the current position can be read. The positions are read clockwise, and in increasing order: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. The position wraps from F to 0.

The switch can be moved in either direction. When it is turned to a new position, the LCD displays the new menu selection for one second, followed by the data for that position.

Certain menu selections return more than one piece of information per item: in that case the display alternates between the two values, for example, PV Value / Fault status.

The push-buttons

The push-buttons allow you to change the value of a menu item. Use the RED (+) button to adjust a value up; the BLUE (–) button to adjust a value down; or press both simultaneously for special applications. For a table showing the combinations of rotary switch positions and button presses used to carry out different functions, see page 46.

Access to a menu item:

Notes:

- For a detailed description of each menu item, see *Appendix A: Menu Groups* starting page 59: the functions of the menu items are illustrated in the application example on page 94.
- Change over from Menu LEVEL 0 to Menu LEVEL 1 is only possible at position 0, from menu item 00 to 10 or vice-versa. (See page 48 for detailed instructions.)

1. First select Menu LEVEL 0 or Menu LEVEL 1.
2. Turn the rotary switch to the number of the desired item.

1. For a chart showing the rotary switch positions and related functions when Fail-Safe High or FailSafe Low mode is selected, see page 46. (If Free Programming Mode is selected, see *Rotary Switch Positions – Quick Reference (FPM Mode)* on page 109.)

Adjusting the value

Notes:
- The push buttons are preset with a delay called the debounce time.
- Keeping one or both buttons pressed continuously will trigger an auto-repeat in some menus.

1. Select a menu item.
2. Press the RED (+) or BLUE (–) push button to adjust the value up or down: acceptance is indicated when the left-most colon on the LCD appears. (You have to press longer than the debounce time to have the action accepted; the debounce time varies according to the menu item selected.)

Transmitter Variables

- Transmitter Variable 0 (TV0) is the capacitance as measured by the device.
- Transmitter Variable 1 (TV1) is a computed variable: the dynamic value is a computed derivative from the range settings for TV0.

Transmitter Variable	User-defined Functions	Units
TV0	URV, LRV, Damping, USL and LSL	Fixed to pF
TV1		Can be user-defined

Start-up: Pointek CLS500

Capacitance measurement systems require the instrument to be adjusted for a particular application. Two methods of adjustment are available:

- push-button (for instructions, see page 49)
- HART (for instructions, see page 52)

Quick Start

We strongly recommend you read the full manual to use your Pointek CLS500 to its fullest potential. However, if you can bring the product to the 0% and 100% point level, you can use the Quick Start sequence on page 45 to set up the instrument and get started. (For most applications, 0% is an uncovered probe, and 100% is a covered probe.)

Pointek CLS500 is most often used in Failsafe High or Failsafe Low mode (FSH or FSL), which sets the loop current to 4 or 20 mA 2-state mode.

Quick Start Sequence	
	For overfill protection:
1a	**Install the device with the probe uncovered.**
2a	**Power it up.**
3a	**Set the first operating point for the switch, LRV at menu 0E**
	Set value for 0% (LRV): units must be pF (Menu 01 must read Pv = 0); probe must be uncovered. a Turn the rotary switch to E (Empty). b Press both buttons and hold for about 1 second: the 0% point is now set. (In FailSafe mode, the LCD blinks to indicate the probe is uncovered.)
4a	**Set the second switch point: use menu 0D to generate URV**
	Set value for 100% (URV): probe must be uncovered. a Turn the rotary switch to D (Delta Range). b Press and hold both buttons for about 1 second: this takes the minimum span and adds it to the value for LRV to generate the value for URV. (This guarantees the device will switch if the product approaches or touches the probe.) c If the device is over-sensitive, use the RED (+) button to increase the Delta Range setting. (This will increase the value for URV and increase the span between LRV and URV.) (The LCD will stop blinking when the probe is covered.)
	For dry-run (underfill) protection
1b	**Install the device with the probe covered.**
2b	**Power it up.**
3b	**Set the first operating point for the switch, URV at menu 0F**
	Set value for 100% (URV): units must be pF (Menu 01 must read Pv = 0); probe must be covered. a Turn the rotary switch to F (Full). b Press both buttons and hold for about 1 second: the100% point is now set. (The LCD stops blinking when the probe is covered.)
4b	**Set the second switch point: use menu 0D to generate LRV**
	Set value for 0% (URV): probe must be covered. a Turn the rotary switch to D (Delta Range). b Press both buttons and hold for about 1 second: this takes the minimum span and subtracts it from the value for URV to generate the value for LRV. c For products that are conductive and viscous, use the RED (+) button to increase the Delta Range setting. (This will decrease the value for LRV and increase the span between URV and LRV). (The LCD will blink if the probe is uncovered.)
	In all cases:
5	**View primary variable (PV): menu 00**
	Turn the rotary switch to 0. The LCD displays the actual pF reading.
6	**Pointek CLS500 is now ready to operate.**

Rotary Switch Positions – Quick Reference (FSH Mode)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Menu LEVEL 0 (00 to 0F) MSP2002-1 Transmitter in F(ail) S(afe) H(igh) or F(ail) S(afe) L(ow) mode															
Units	**PV Units**	Num. Selection	PV Units	Seconds	Seconds	%	%	mA	mA	Numerical	Numerical	PV Units	PV Units	PV Units	PV Units	PV Units
NO KEYS Value readout	PV Value or Fault	Show select PV variable	Highest/ Lowest PV Memory	Activation Time Delay Current signal	De-Activation Time Delay Current signal	Upper Threshold Activation Current signal	Lower Threshold De-Activation Current signal	Loop Current in mA	Show Failsafe Mode	Actual Step Size	Damping Value	LOWER limit PV	UPPER limit PV	Delta Value PV for 4 or 20 mA	LRV Value PV for 4 mA	URV Value PV for 20 mA
Up Key RED (+)	Set Menu Level 00 to 0F	Step TV0 to TVmax	Highest PV Memory Read-out	Increase Delay Time	Increase Delay Time	Increase Upper Threshold Point	Increase Lower Threshold Point	Loop Current in mA	F(ail) S(afe) H(igh)	Increase Step Size to 10000	Increase Damping Value	Increase PV LOWER limit	Increase PV UPPER limit	Increase PV Delta	Increase PV LRV	Increase PV URV
Down Key BLUE (–)	Set Menu Level 10 to 1F	Step TVmax to TV0	Lowest PV Memory Read-out	Decrease Delay Time	Decrease Delay Time	Decrease Upper Threshold Point	Decrease Lower Threshold Point	Loop Current in mA	F(ail) S(afe) L(ow)	Decrease Step Size to 0.01	Decrease Damping Value	Decrease PV LOWER limit	Decrease PV UPPER limit	Decrease PV Delta	Decrease PV LRV	Decrease PV URV
Both Keys	Show-Menu Level	Set % Mode	Reset Hi/Lo memories to actual PV	Toggle Delay Time 00 < – > 100	Toggle Delay Time 00 < – > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Loop Current in mA		Set to 1	Set to 1	Preset Lower Limit to Actual (PV)	Preset Upper Limit to Actual (PV)	URV– LRV = Min.	LRV = Actual Value (PV)	URV = Actual Value (PV)
	*	TV0	*	00	00	75%	25%	FSH	FSH	1.0	1	1.0 pF	330 pF	330 pF	0 pF	330 pF
	Menu LEVEL 1 (10 to 1F) MSP2002-1 Transmitter in F(ail) S(afe) H(igh) or F(ail) S(afe) L(ow) mode															
Units	**PV Units**	Numerical	Factory Settings	Seconds	Seconds	%	%	O/ C	O/C	nor / inv			Resp. Units		FSM	Keylock
NO KEYS Value read-out	PV Value or Fault	Display check Fault code	FAC (factory settings)	Activation Time Delay Transistor Switch	De-Activation Time Delay Transistor Switch)	Upper Threshold Activation Transistor Switch	Lower Threshold De-Activation Transistor Switch	Status Solid State Output	Show Failsafe Mode	MODE Normal / Inverse	— Spare	— Spare	Transmitter Var 0 Read-Out	— Spare	Show Failsafe Mode	Keylock Level
Up Key RED (+)	Set Menu Level 00 to 0F		FAC (factory settings)	Increase Delay Time	Increase Delay Time	Increase Upper Threshold Point	Increase Lower Threshold Point	Status Solid State Output	F(ail) S(afe) H(igh)	MODE Normal / Inverse			Transmitter Var 1 Read-Out		F(ail) S(afe) H(igh	Increase Keylock Level

Rotary Switch Positions – Quick Reference (FSH Mode)

Down Key BLUE (–)	Set Menu Level 10 to 1F		FAC (factory set-tings)	Decrease Delay Time	Decrease Delay Time	Decrease Upper Thresh-old Point	Decrease Lower Thresh-old Point	Status Solid State Output	F(ail) S(afe) L(ow)	MODE Normal / Inverse			Transmitter Var 2 Read-Out		F(ail) S(afe) L(ow)	Decrease Keylock Level
Both Keys	Show Menu Level	Invert Sig-nalling Sta-tus	do it	Toggle Delay Time 00 < - > 100	Toggle Delay Time 00 < - > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Status Solid State Output		Toggle Operating Mode			Transmitter Var 3 Read-Out		F(ree) P(rogramming) M(ode)	
	*	*	*	**00**	**00**	**75%**	**25%**	**FSH**	**FSH**	**nor**	*	*	*	*	**FSH**	**0**

Menu levels 0 and 1

Menu level 00 to 0F is the default start-up setting after power is applied or after a reset. Menu Level 10 through 1F is flagged in the LCD by an left-arrow indicator in the upper left corner of the LCD.

To change from menu 00 to menu 10:

1. Set the rotary switch to 0.
2. Press and hold the BLUE (–) button.
3. While the button is pressed, the display shows : M 10 followed by : SEL 1, indicating that the current menu level is now 10 to 1F. A left-arrow is displayed in the top left corner of the LCD.
4. When the button is released, the LCD displays PV (primary variable) and the left-arrow remains visible.

To change from menu 10 to menu 00:

1. Make sure the rotary switch is set to 0.
2. Press and hold the RED (+) button.
3. While the button is pressed, the display shows : M 00 followed by : SEL 0, indicating that the current menu level is 00 to 0F. No left-arrow is displayed in the top left corner of the LCD.
4. When the button is released, the LCD displays PV.

In menu 00 or 10, to see the current menu level selection, briefly press one of the buttons (less than a second): the current selection is momentarily displayed.

Notes:

- Check the menu level when using the rotary switch to select a menu item: the left-arrow in the top left corner of the LCD indicates menu level 1.
- The rotary switch must be set to 0, in order to change from one menu to the other.
- Hold the RED (+) or BLUE(–) buttons for longer than the preset delay, or debounce time, when altering a value: the debounce time is generally about a second, but varies from one menu item to another.
- Keylock level (menu 1F) must be set to 0 (no restrictions) to enable you to change settings.

Start up using push-button set up: (overview)

- Check that Keylock level is set to enable calibration
- Check that the transmitter variable is set to TV0: units as pF
- Set the first switch point (set the value for 0%)
- Set the overfill protection[1] (set the value for 100%)
- Set display for dynamic PV (primary variable): select values displayed as units (pF)
- Pointek CLS500 is ready to operate

1. For instructions on setting up Pointek CLS500 or dry-run protection, see page 50.

Set up using push-buttons (for overfill protection)

Notes:
- To toggle between menu level 0 and menu level 1, set rotary switch to 0, and use RED (+) or BLUE (–) push-button to select menu.
- To reset values to factory settings, select menu 12. Press and hold both buttons: the LCD displays **do it**, followed by **FAC A** when the buttons are released.
- For a complete list of menu items, see Appendix A: Menu Groups, page 59.

First install the unit with the probe uncovered, and power it up.

- Check that keylock level is set to "no restrictions": PL = 0 at menu 1F (no change is necessary if the factory setting has not been changed)

  1. Select menu 10, then set the rotary switch to F.
  2. Use the BLUE (–) push-button to decrease the value to 0: display reads PL 0.

- Check that the transmitter variable selected is TV0 (units are pF): Pv = 0 at menu 01 (no change is necessary if the factory setting has not been changed)
  1. Select menu 00, then turn the rotary switch to 1.
  2. Use the BLUE (–) button to adjust the value to 0: the display reads Pv = 0.

Set the first operating point for the switch: menu 0E

Set value for 0% (LRV): units must be pF (Menu 01 must read Pv = 0) and the probe must be uncovered.

a. Set the rotary switch to E (Empty).
b. Press both buttons and hold for about 1 second: the 0% point is now set. (The LCD blinks when the probe is uncovered.)

Set overfill protection: menu 0D

Set the value for 100% (URV). The probe must be uncovered.

a. Set the rotary switch to D (Delta Range).
b. Press both buttons and hold for about 1 second: this takes the minimum span and adds it to the value for LRV to generate the value for URV. (This guarantees the device will switch if the product approaches or touches the probe.
c. If the device is over-sensitive, turn the rotary switch to D, and use the RED (+) button to increase[1] the Delta Range setting: this will increase the value for URV. (The LCD will stop blinking if the probe is covered.)

View primary variable: menu 00

Turn the rotary switch to 0: the LCD displays the actual pF reading.

Pointek CLS500 is now ready to operate.

1. If the stepsize is too large, see page 51 for details on adjusting the stepsize.

Set-up for dry-run (underfill) protection

First install the unit with the probe covered, and power it up.

- Check that keylock level is set to 'no restrictions': **PL = 0** at menu 1F
  (no change is necessary if the factory setting has not been changed)

  1. Select menu 10, then set the rotary switch to F.
  2. Use the BLUE (–) push-button to decrease the value to 0: display reads PL 0.

- Check that the transmitter variable selected is TV0 (units are pF): Pv = 0 at menu 01
  (no change is necessary if the factory setting has not been changed)
  1. Select menu 00, then turn the rotary switch to 1.
  2. Use the BLUE (–) button to adjust the value to 0: the display reads Pv = 0.

Set the first operating point for the switch: menu 0F

Set value for 100% (URV): units must be pF (Menu 01 must read Pv = 0) and the probe must be covered.

a. Set the rotary switch to F (Full).
b. Press both buttons and hold for about 1 second: the 100% point is now set.
   (The LCD does not blink when the probe is covered).

Set the dry-run (or underfill) protection: menu 0D

Set the value for 0% (LRV): the probe must be covered.

a. Set the rotary switch to E (Empty).
b. Press both buttons and hold for about 1 second: this sets the value for 100%.
c. Set the rotary switch to D (Delta Range).
d. Press both buttons and hold for about 1 second: this takes the minimum span and subtracts it from the value for URV to generate the value for LRV.
e. For products that are conductive and viscous, use the RED (+) button to increase[1] the Delta Range setting. (This will decrease the value for LRV, and increase span between URV and LRV.)
   (The LCD will start blinking if the probe is considered uncovered.)

View primary variable: menu 00

Turn the rotary switch to 0: the LCD displays the actual pF reading.

Pointek CLS500 is now ready to operate.

Notes:

- During normal operation, the 4 and/or 20 mA point can be calibrated at any time.
- If the difference in the capacitance value between the 4 mA point and the 20 mA point is smaller than the minimum span value (1 pF), the new value will not be accepted.

1. If the stepsize is too large, see page 51 for details on adjusting the stepsize.

Changing stepsize value: menu 09

If the steps are too big or too small when you are adjusting values, you need to change the stepsize (menu 09) to a different value.

The factory setting is 1: the LCD displays U: 1.0

a. Set rotary switch to 09
b. Press BLUE (–) button to reduce stepsize: values range from 0.01 to 1,000,
   or: press RED (+) button to increase stepsize.

Example:

LCD displays 28.00 (m)
Known height = 17 m
Decrease needed is 11, but setting for stepsize is 10: menu 09 set to U: 10.
Press BLUE (–) button to reduce stepsize to 1: LCD displays U: 1.0.
Return to OF, and decrease value to 17.00 (m).

Setup using HART

You can set up Pointek CLS500 transmitter using HART, with a HART communicator; a laptop running Simatic PDM, or with the Host system (DCS). The local circumstances determine the easiest method. If you can bring the product to the 0% and 100% point level, setup is simple. (Either the probe state is uncovered at 0%, and covered at 100%, or the reverse.)

Notes:
- Use the arrow keys, up, down, forward, and back to navigate within the menus.
- Use the back arrow to return to previous screens.

Examples of set up using a Rosemount 275 hand-held communicator, fitted with the GENERIC device descriptor:

Example 1

For situations where the level of the product can be easily adjusted to 0 and 100%.

First install Pointek CLS500, then power it up: the probe must be uncovered.

1. Switch on the 275 and request connection with Pointek CLS500.
    a. Select: Online
    b. Select: Device setup
    c. Select: Diag service
    d. Select: Calibration
    e. Select: Apply values
    (Display reads: Loop should be removed from automatic control. Select: Ok)
    f. Select: 4 mA
    g. Select: Apply new 4 mA input
2. Bring the level of the product to the level which corresponds with 4 mA.
    a. Select: Read new value
    b. Select: Set as 4 mA value: the 4 mA point has now been set.
    c. Select: 20 mA
    d. Select: Apply new 20 mA input
3. Bring the level of the product to the level which corresponds with 20 mA.
    a. Select: Read new value
    b. Select: Set as 20 mA value: the 20 mA point has now been set.
    c. Select: Exit
    (Display reads: Loop may be returned to automatic control. Select: Ok)

Setup is complete.

Example 2

For situations where the capacitance values are known in advance.

1. Switch on the 275 and establish connection with Pointek CLS500.

    a. Select: Online
    b. Select: Device setup
    c. Select: Diag service
    d. Select: Calibration
    e. Select: Enter values
    f. Select: PV LRV

2. Enter required capacitance value for 0% of the range.

    a. Select: PV URV

3. Enter required capacitance value for 100% of the range.

    a. Select: Send (the values are now sent)
    b. Select: Put loop in manual
    c. Select: Return loop to auto

If the DCS and/or the 275 are fitted with the Device Descriptor for Pointek CLS500, more functions can be used.

The available functions are:

Number	Description
(48)	Read Additional Transmitter Status
(38)	Reset Configuration Changed Flag
(128)	Set Alarm Select
(129)	Adjust for Product Build-up on Sensor
(130)	Read FailSafe mode
(131)	Return device configuration info
(132)	Set Variable Upper Limit
(133)	Set Variable Lower Limit
(134)	Write keylock value
(135)	Read keylock value
(138)	Write simulation time and value
(139)	Read simulation time and value
(140)	Write TV1 Units, URV and LRV
(141)	Read TV1 Units, URV and LRV
(144)	Reset Max/Min recorded PV
(145)	Read Max/Min recorded PV
(150)	Write analog signalling mode
(151)	Read analog signalling mode
(152)	Write digital signalling mode
(153)	Read digital signalling mode

Number	Description
(154)	Write analog threshold settings
(155)	Read analog threshold settings
(156)	Write digital threshold settings
(157)	Read digital threshold settings
(160)	Write timers analog signalling
(161)	Read timers analog signalling
(162)	Write timers digital signalling
(163)	Read timers digital signalling

Maintenance

Test Function

Auto Self-testing

Pointek CLS500 continuously performs a variety of tests to verify that the device is functioning correctly. These include a test where a known capacitor is applied to the input of the device. The internal results must match the known capacitance value. If a deviation is detected the Fault/Failure can be flagged with a pre-set loop-current (user configurable) and as a status in each HART message.

Manual testing

In order to test the proper processing of signals in PLC/DCS equipment, Pointek CLS500 allows you to invert the output signal status. In Menu 11, when both buttons are pressed simultaneously, the signal outputs switch to their opposite state. When the buttons are released, the outputs revert to the initial state.

Note: If a Fault or Failure is present, its signal will take precedence over the test function.

If no Fault/Failure is present and no buttons are pressed, the display for menu 11 alternates between two test patterns which together illuminate all the segments of the display. If the loop-current control is in analog mode the loop current will hold the last value, during this test.

Inspections

Under normal circumstances, the Pointek CLS500 transmitter requires no maintenance. However, we recommend that you schedule periodic inspections of the Pointek CLS500.

The inspection can be subdivided into two parts:

1. Visual Inspection: confirm the following conditions:
    a. Inside enclosure is clean and dry.
    b. Enclosure sealing is intact and functioning properly (not hardened).
    c. All screw connections are tight.
    d. Ground connections inside the housing are solid.
    e. Ground connections outside the housing are solid.
    f. The coaxial connector is free of dirt or deposits.
    g. No cables or wires are jammed under the cover.
2. Functional Checks
    a. Check for required minimum terminal voltage (see page 28 for supply voltage requirements).

b. Confirm that Menu 08 is set to enable analog fault signalling: display should read F: Hi or F: Lo. (If there is a fault condition, it will read F= Hi or F= Lo, when buttons are released.)

c. Check that the current goes to the alarm position (3.6 or 22 mA) if the coaxial plug is unplugged: at menu 00, the LCD should display – ooL. After the test, replace the coaxial plug.

d. Confirm that Menu 18 is set to enable digital fault signalling: the LCD should display F= cc or F= co, when buttons are released.

e. Check that the solid-state output goes to the alarm position (open/close) if the coaxial plug is unplugged. After the test, replace the plug.

f. Via HART:
Check that the PV goes to 0 pF when the coaxial plug is unplugged, (±0.15 pF is allowed). If it does, switch the output current to 4 mA and check the current through the loop, then to 20 mA and check the current through the loop. After the test, replace the plug.

Troubleshooting: Pointek CLS500

If you are unable to change settings:

- Check that keylock level (menu 1F) is set to **0**: the display should read PL = 0.
- Check that menu 01 is set appropriately: If Pv = 1, changes can only be made via HART.

If you can change settings:

- Reset menu 12 to factory settings: press both buttons, and the display should read FAC A when buttons are released.

If the LCD displays a negative reading, typically around 100 pF, this often indicates a short circuit in the probe assembly:

- Check the enclosure and make sure no water has got in.
- Check that all the connections in the probe assembly are solid.

Error Messages and Error Codes

Error Messages (push-button operation)

Error Message	Description	Cause
Flt[1]	Fault/failure has been detected	• Device is faulty • Possible short circuit in the probe or the device wiring • Possible fault in the device, or lack of sufficient energy at the device terminals
ooL[1]	Output out-of-limits	The product level has risen above the Upper Sensor LImit, or fallen below the Lower Sensor Limit

1. Alternates with the primary variable (PV).

Error Codes (HART)

Error Code	Description	Cause
32	program memory checksum error	Device is faulty
16	signal error: the measurement circuitry stopped functioning	Possible short circuit in the probe or the device wiring
8	DAC drive failure: the current as set by the DAC does not match the value measured by the ADC	Possible fault in the device, or lack of sufficient energy at the device terminals
0	PV value is outside the limits set (USL and LSL)	Usually indicates a fault in the connection between the transmitter module and the probe (the coaxial connector is off)

Appendix A: Menu Groups

The data in the transmitter is accessible as 29[1] menu items divided between two menu levels: **00** to **0F** and **10** to **1F**. You can switch between the two levels at position **00** and **10**.

The menu items are grouped according to function, with a detailed description of each item. The menu groups are shown below.

Transmitter – Variable Settings						
Stepsize Update Value	Damping	Lower Sensor Limit	Upper Sensor Limit	Delta Range Setting	Lower Range Value	Upper Range Value
Menu 09	Menu 0A	Menu 0B	Menu 0C	Menu 0D	Menu 0E	Menu 0F
see page 60	see page 61	see page 61	see page 62	see page 62	see page 63	see page 64

Transmitter – Variable Values			
Dynamic Value: Primary Variable (PV)	Highest Lowest Recorded Value	Transmitter Variable – select for PV	Transmitter Variables Dynamic Value
Menus 00 and 10	Menu 02	Menu 01	Menu 1C
see page 64	see page 65	see page 65	see page 66

Analog Output Signalling (loop current in 2-state mode)					
Upper Threshold Delay	Lower Threshold Delay	Upper Threshold Setting	Lower Threshold Setting	Analog Signalling Mode	Analog Fault Signalling
Menu 03	Menu 04	Menu 05	Menu 06	Menu 07	Menu 08
see page 67	see page 68	see page 68	see page 69	see page 69	see page 71

Digital Output Signalling (solid-state output)					
Upper Threshold Delay	Lower Threshold Delay	Upper Threshold Setting	Lower Threshold Setting	Digital Signalling Mode	Digital Fault Signalling
Menu 13	Menu 14	Menu 15	Menu 16	Menu 17	Menu 18
see page 72	see page 73	see page 73	see page 74	see page 75	see page 76

Miscellaneous				
Output Signal Processing Test	Factory Settings	Range Inversion	FailSafe Mode	Keylock Level
Menu 11	Menu 12	Menu 19	Menu 1E	Menu 1F
see page 77	see page 78	see page 78	see page 79	see page 80

1. Only 29 of the possible 32 items are currently used.

Menu Items

Notes:
- Check that you are at the correct menu level before selecting a menu item.
- Hold the RED or BLUE buttons for longer than the preset delay, or debounce time to change a setting: this debounce time is generally around a second, but varies from one menu item to another.
- Protection is set at keylock level, menu 1F: make sure the setting is appropriate.
- The transmitter variable, units as pF, units user-defined, or values as percent[a], is set at menu 01; make sure the setting is appropriate.
- Reset to factory settings at menu 12.
- Factory settings are indicated with an asterisk (*) in the tables, unless explicitly described.

a. 'Values as percent' is available as an option, but not useful for Pointek CLS 500.

Transmitter: Variable Settings: menu level 0

Notes:
- You must select menu level **0** before you can access the items at that level.
- The transmitter variable must be set for units in pF to enable settings to be changed by push-button adjustment: (menu 01 must be set to **PV = 0**).

Stepsize Update Value

This menu selection controls the increment/decrement step-size for the menus 0B, 0C, 0D, 0E, 0F, and 03.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Description	Values
09	01	9	Off	Stepsize Update Value	Range: **0.01** to **1000**
				Factory setting	**U: 1**

1. Set the rotary switch to **9**.
2. Press the RED (+) or BLUE (–) button to increase or decrease this value in decades: you can step the value up to **10**, **100,** and **1000** (1E3), or down to **0.1** and **0.01**.
3. Press and hold both buttons simultaneously to restore the value to **U:1.0**

Damping

Damping slows the measurement response to a change in level, and is used to stabilize the reading[1]. The Damping Value is not in seconds but is a factor that controls the rate of change for the dynamic value of the TV currently selected.

The increment/decrement step size is subject to the setting on Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Description	Values
0A	01, 09	A	Off	Damping	Range: **1** to **10,000**
				Factory setting	**1.00**

1. Set the rotary switch to **A**.
2. Press the RED (+) or the BLUE (–) button to alter the value between **1** and **10,000**.
   or: Press and hold a button to start a repeat function,
   or: Press and hold both buttons simultaneously to reset the value back to **1.00**.

Lower Sensor Limit

The Lower Sensor Limit (LSL) is the lower of two limit settings. Whenever the PV value (Menu level 0) drops below the Lower Sensor Limit, the measurement is considered at fault and the LCD displays **ooL**, alternating with PV.

(If the display mode is in %[2], this selection is disabled and the LCD displays **- - - -**.)
The transmitter variable on which this menu selection operates is chosen in Menu 01.

The increment/decrement step size is subject to the setting from Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Description	Values
0B	01, 09	B	Off	Lower Sensor Limit	Range **0** to **330**
				Factory setting	**1.00**

1. Set the rotary switch to **B**.
2. Press the RED (+) or BLUE (–) buttons to alter this value.
   or: Press and hold a button to start a repeat function,
   or: Press and hold both buttons simultaneously to take the current PV reading as the new setting.

1. For example, in an application with an agitated surface.
2. This option is available, but not useful for Pointek CLS500.

Upper Sensor Limit

The Upper Sensor Limit (USL) is the upper of two limit settings. Whenever the PV value (Menu Level 0) rises above the upper limit setting, the measurement is considered at fault and the LCD displays **ooL**, alternating with PV.

(If the display mode is in %[1], this selection is disabled and the LCD displays **- - - -**.) The transmitter variable on which this menu selection operates is chosen in Menu 01.

The increment/decrement step size is subject to the setting from Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Description	Values
0C	01, 09	C	Off	Upper Sensor Limit	**330** to **0**
				Factory setting	**330**

1. Set the rotary switch to **C**.
2. Press the RED (+) or BLUE (–) button to increase or decrease this value.
   or: Press and hold a button to start a repeat function.
   or: Press and hold both buttons simultaneously to take the current PV reading as the new setting.

Delta Range Setting

The Delta Range Setting allows you to commission the unit for overfill or underfill protection where it is impossible to bring the product to those levels in normal process conditions. The default value is the span between URV and LRV, but when you apply Delta Range Setting, it applies the minimum span (1.0 pF).

Overfill protection is used in applications where the probe is normally uncovered. Delta Range Setting adds the minimum span to the Lower Range Value: the result is used to update the Upper Range Value. If the process level exceeds the new URV, a fault is signalled.

Underfill protection would be used in applications where the probe is normally covered. In this case, Delta Range Setting subtracts the minimum span from the Upper Range Value and uses the result to update the Lower Range Value. If the process value drops below the new LRV, a fault is signalled.

The loop-current control must be in 2-state mode[2] (Menu 07) for Menu 0D to display the Delta Range Setting. If the loop-current control is in Analog mode, Menu 0D displays **- - - -**.

1. This option is available but not useful for Pointek CLS500.
2. The default mode for Pointek CLS500 is FailSafe High (set at menu 1E): this sets menu 07 to 2-state mode, and menu 08 to FailSafe High. Only if Pointek CLS500 is used in Free Programming Mode can Analog mode be selected at menu 07.

The transmitter variable on which this selection is based is chosen in Menu 01. The increment/decrement step size is set at Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Description	Values
0D	01, 07, 09	D	Off	2-state		Delta Range Setting enabled	Span (pF)
					*		**330**
				Analog			Display shows **- - - -**

To set overfill protection[1], first set LRV at menu 0E, then:

1. Set the rotary switch to **D**.
2. Press and hold both buttons simultaneously to take the minimum span as Delta value.
   or: Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.

Lower Range Value

Lower Range Value (LRV) is the setting for 0% of the operating range, in most cases an empty vessel/tank. (If the display mode is in %[2] this selection is disabled and the LCD displays **- - - -**.)

The transmitter variable on which this menu selection operates is chosen in Menu 01. The factory setting is TV0.

The increment/decrement step size is subject to the setting from Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Description	Values
0E	01, 09, 0B, 0C	E	Off	Analog		Lower Range Value	Range: **0.00** to **330**
				2-state	*		**0.00**

1. Set the rotary switch to **E**.
2. Press and hold both buttons simultaneously to take the current PV reading as the new setting.
   or: Press the RED (+) or BLUE (–) button to step the value up or down.
   or: Press and hold a button for a prolonged time to start a repeat function.

When the new setting exceeds that of the Limit Settings (Menu 0C and 0B), the new value is rejected and the previous value remains unchanged.

1. For more details, see *Delta Range Setting application* on page 95.
2. This option is available but not useful for Pointek CLS500.

Upper Range Value

Upper Range Value (URV) is the setting for 100% of the operating range, in most cases a full vessel/tank. (If the display mode is in %[1] this selection is disabled and the LCD displays - - - -.)

The transmitter variable on which this menu selection operates is chosen in Menu 01, and the factory setting is TV0.

The increment/decrement step size is subject to the setting from Menu 09.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Description	Values
0F	01, 09, 0B, 0C	F	Off	Analog		Upper Range Value	Range: **330** to **0**
				2-state	*		**330**

1. Set the rotary switch to **F**.
2. Press and hold both buttons simultaneously to take the current PV reading as the new setting.
   or: Press the RED (+) or BLUE (–) button to step the value up or down.
   or: Press and hold a button for a prolonged time to start a repeat function.

When the new setting exceeds that of the Limit Settings (Menu 0C and 0B), the new value is rejected, and the previous value remains unchanged.

Transmitter Variable Values: menu level 0

Dynamic Value, Primary Variable (PV): menu 00 and menu 10

Note: Menus 00 and 10 are the only locations where you can change from level 1 to level 0, or vice versa.

The value for the Primary Variable is displayed as either units (or percent of range[1]) selected in menu 01. In Fail Safe mode (the factory setting) 2-state mode is selected in menu 07 and the LCD display indicates the probe status:

- blinking for an uncovered probe
- steady for a covered probe

If the internal diagnostics detect a fault or failure, the display alternates between the PV value and the fault/failure message '**Flt**'. If the product level goes outside the limit settings, then the display alternates between the PV value and '**ooL**'. Alternatively, if the simulation (SIM) function has been selected via HART, the LCD alternately displays the text **SIM** or the applied simulation value for the duration of the simulation.

1. This option is available but not useful for Pointek CLS500.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Description	Values
00	01	0	Off	Dynamic Value (PV)	Units (or % of range[a]) selected in menu 01
10			On		

a. Available but not useful for Pointek CLS500.

To change from menu 10 to menu 00:

1. Set the rotary switch to 0.
2. Press the RED (+) button for about a second. The LCD briefly displays **: M 00** followed by **: SEL 0**, to indicate that menu 00 is selected. When the button is released the LCD displays the current PV value. No left-arrow is displayed at the top left corner of the LCD in menu 00.

To change from menu 00 to menu 10:

1. Set the rotary switch to **0**.
2. Press the BLUE button for more than one second. The LCD briefly displays **: M 10** followed by **: SEL1**, to indicate that menu level 1 is selected. Then the LCD displays PV, and a left-arrow is visible in the top left corner of the LCD, indicating menu level 1.

Display the Highest / Lowest Recorded Value

Menu Item	Rotary Switch Position	Left Arrow	Description
02	2	Off	Highest / Lowest Recorded Value

1. Set the rotary switch to **2**. The Highest / Lowest recorded values for TV currently selected are displayed alternately.
2. Press the RED (+) button to select the Highest recorded value for display,
   or: Press the BLUE (–) button to select the Lowest recorded value for display,
3. Press both buttons simultaneously for more than one second to reset the recorded values back to the dynamic value of this TV. (This will also occur after a reset [power-down] of the device.)

Select the Transmitter Variable (TV) for the Primary Variable (PV).

Menu Item	Rotary Switch Position	Left Arrow	Description	Values		
01	1	Off	Transmitter Variable selection for PV	0	*	TV0 (units are pF)
				1		TV1 (units are user definable only via HART)
				P		TV0 (values displayed as %)

1. Set the rotary switch to **1**. The LCD displays **Pv = 0**, **1**, or **P**.
2. Press the RED (+) or BLUE (–) button to select a higher or lower value.
3. Press both buttons to select **Pv = P**.

Notes:
- When PV is set to **1**, settings cannot be changed using push-button adjustment.
- Many settings cannot be changed using push-button calibration when **PV = P**.

If PV = 0, TV0 is selected for PV, URV, LRV, USL, LSL, Damping, and Highest/Lowest recorded value. The units are implicitly[1] pF.

If PV = 1, TV1 is selected for PV, URV, LRV, USL, LSL, Damping, and Highest/Lowest recorded value. The units are user definable but only by HART.

If PV = P, TV0 is selected: however, the values for PV and URV are displayed in %; LRV, USL, LSL, are blanked out with ----; all other fields are identical to that of TV0.

Transmitter Variables Dynamic Value: menu level 1

This menu selection allows you to read the values of the dynamic variables TV0, TV1, TV2[2], and TV3. When no buttons are pressed, the LCD displays the dynamic value for TV0.

Menu Item	Rotary Switch Position	Left Arrow	Mode		Description	Action	Values
1C	C	On	TV0	*	Transmitter Variables Dynamic Value	No buttons pressed	Dynamic value for TV0
			TV1		Transmitter Variables Dynamic Value	Press and hold RED (+) button	Dynamic value for TV1
			TV2[2]		Transmitter Variables Dynamic Value	Press and hold BLUE(–) button	Dynamic value for TV2
			TV3[2]		Transmitter Variables Dynamic Value	Both buttons pressed simultaneously	Dynamic value for TV3
			Invalid selection				Display shows **0.00**

1. The units are pF: there is no other option.
2. TV2 and TV3 are not currently used, but are available for future development.

Analog Output Signalling (proportional or 2-state): menu level 0

Analog mode (the loop-current) can provide either:

- a 4 or 20 / 20 or 4 mA output, when 2-state mode is selected[1]

or

- a 4 to 20 / 20 to 4 mA continuous signal proportional to the percent of the range[2]

Notes:

- To set values for Upper and Lower Threshold Delay, and Upper and Lower Threshold Setting (2-state mode), the loop-current menu (07) must be in 2-state mode.
- The factory setting is FailSafe High mode, and 2-state mode is selected.
- When the loop-current control is in analog mode, the LCD displays only **- - - -** for these menu selections (only applicable in FPM mode, selected at menu 1E).

Upper Threshold Delay (2-state mode)

The Upper Threshold Delay controls the Activation delay: the amount of time that has to pass uninterrupted with the probe covered to a level above the Upper Threshold Setting before the timer expires. When the timer expires, the output signal complies with the setting from Menu 08 for a covered probe. Whenever the level drops below the Upper Threshold Setting before the timer expires, the timer is restarted.

As an extra identifier, an upward running **A** is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Added Indicator	Des-cription	Values
03	07	3	Off	2-state	*	Upward running **A** at right of value	Upper Threshold Delay	seconds
						factory setting		**0.0**
				Analog				Display shows - - - -

1. Set the loop-current control (Menu 07) to 2-state mode.
2. Set the rotary switch to **3**.
3. Press the RED (+) or BLUE(–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.
   or: Press and hold both buttons simultaneously to toggle the value between minimum (0) and maximum (100).

1. When FSH/FSL mode is selected at menu 1E, the mA signal is either 20 or 4 mA
2. The continuous mA signal is available only when FPM mode is selected at menu 1E.

Lower Threshold Delay (2-state mode)

The Lower Threshold Delay controls the Deactivation delay: the amount of time that has to pass uninterrupted with the probe covered to a level below the Lower Threshold Setting before the timer expires. When the timer expires, the output signal will comply with the setting from Menu 08 for an uncovered probe. Whenever the level rises above the Lower Threshold Setting before the timer expires, the timer is restarted.

As an extra identifier, a downward running **A** is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Added Indicator	Des-cription	Values
04	07	4	Off	2-state	*	Downward running **A** to right of value	Lower Threshold Delay	seconds
						factory setting		**0.0**
				Analog				Display shows - - - -

1. Set the loop-current control (Menu 07) to 2-state mode.
2. Set the rotary switch to **4**.
3. Press the RED (+) or BLUE(–) buttons to increase or decrease the value.
   or: Press and hold a button to start a repeat function.
   or: Press and hold both buttons simultaneously to toggle the value between minimum (0) and maximum (100).

Upper Threshold Setting (2-state mode)

The Upper Threshold Setting is the % of range above which the probe is considered covered. In order to switch the output signal, the corresponding delay time has to be met (Menu 03).

The loop-current control (Menu 07) must be in 2-state mode for this menu to display the Upper Threshold Setting in percent. As an extra identifier, an upward ramp ⌐ is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Added Indicator	Description	Values
05	07	5	Off	2-state	*	Upward ramp at right of value	Upper Threshold Setting	% of range
						factory setting		75
				Analog				Display shows - - - -

1. Set the loop-current control (Menu 07) to 2-state mode.
2. Set the rotary switch to **5**.
3. Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.

Lower Threshold Setting (2-state mode)

The Lower Threshold Setting is the % of range below which the probe is considered uncovered. In order to switch the output signal, the corresponding delay time has to be met (Menu 04).

The loop-current control (Menu 07) must be in 2-state mode for this menu to display the Upper Threshold Setting in percent. As an extra identifier, a downward ramp ↳ is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Added Indicator	Description	Values
06	07	6	Off	2-state	*	Downward ramp at right of value	Lower Threshold Setting	% of range
						factory setting		25
				Analog				Display shows - - - -

1. Set the loop-current control (Menu 07) to 2-state mode.
2. Set the rotary switch to **6**.
3. Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.

Analog Signalling Mode (2-state): menu level 0

Note: Menu 08 has precedence over the settings in Menu 07.

The factory setting is for FailSafe High mode[1] (selected at menu 1E). When no buttons are pressed, the LCD displays the current mA value. Analog Signalling Mode (a mA reading proportional to level) is not available when FailSafe High or FailSafe Low mode (FSH or FSL) is selected.

2-state Signalling Mode provides a 4 mA or 20 mA output. The settings are relative to a covered probe:

- C: Hi selects a 20 mA signal for a covered probe, which switches to 4 mA if the probe becomes uncovered.
- C: Lo selects a 4 mA signal for a covered probe, which switches to 20 mA if the probe becomes uncovered.

1. Pointek CLS500 is most often used in FSH or FSL mode: Free Programming Mode (FPM) can be selected at menu 1E. See page 70 for detailed instructions.

Menu selections 03, 04, 05, and 06 set the criteria for delay and threshold that have to be met for a change in output signal.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Description	Action	Values
07	03, 04, 05, 06, 08	7	Off	Analog[a]		Signal proportional to % of range[b]	Press both buttons simultaneously	Display shows **C: An**
				2-state	*	2-state High	Press RED (+)	Display shows **C: Hi**[c]
						2-state Low	Press BLUE (–)	Display shows **C: Lo**[d]

a. Unavailable when FSH or FSL mode is selected at menu 1E: available only if FPM (Free Programming Mode) is selected.

b. This option is available, but not useful for Pointek CLS500.

c. While button is pressed, display reads **C: Hi**. When button is released, display shows 20.00 if the probe is covered, or 4.00 if it is uncovered.

d. While button is pressed, display reads **C: Lo**. When button is released, display shows 4.00 if the probe is covered, or 20.00 if it is uncovered.

Set the rotary switch to **7.** To change the mode to 2-state High, press the RED (+) button for more than one second: the LCD displays **C: Hi.** When the button is released, the loop-current will switch to **20 mA** if the probe is covered, or **4 mA** if it is uncovered.

To change the mode to 2-state Low, press the BLUE (–) button for more than one second: the LCD displays **C: Lo**. When the button is released, the loop-current will switch to **4 mA**, and if the probe is uncovered, or **20 mA** if the probe is covered.

While the device is in either FailSafe High or FailSafe Low mode, it reads the loop current as 4 or 20 mA (no faults) or 3.6 or 22 mA (fault situation).

(Analog Mode is only available when Free Programming Mode is selected at menu 1E: in that case it may be restored at any time by pressing both buttons simultaneously for more than one second. The LCD displays **C: An** while the two buttons are pressed, and displays the current reading when the buttons are released.The loop-current will be between 3.8 and 20.5 mA, and will saturate to one of these values if the level goes beyond the Upper or Lower range settings.)

Analog Fault Signalling (2-state)

Note:
- The factory setting FSH links menu 08 and menu 07, and sets them to enable fault signalling
- 2-state mode must be selected at menu 07.
- Menu 08 controls the current-loop fault/failure signal output. This signal has precedence over the settings on Menu 07.

When 2-state fault signalling is enabled, in the case of a fault the mA output is 3.6 mA or 22 mA[1], depending on the setting. The mA output is viewed at menu 07.

Menu Item	Rotary Switch Position	Left Arrow	Description		Action	Values
08	8	Off	2-state Fault Signalling (disabled)		Press both buttons simultaneously	Display shows **F: - -**
			2-state High Fault Signalling (enabled)	*	Press RED (+)	Display shows **F: Hi**[a]
			2-state Low Fault Signalling (enabled)		Press BLUE (–)	Display shows **F: Lo**

a. If the LCD displays an equal sign (=) in place of the colon (:) this indicates that the loop-current is at fault/failure level. For example **F: Hi** becomes **F= Hi**.

Set the rotary switch to **8**.

- To change the mode to 2-state High, press the RED (+) button for more than a second: the display reads **F: Hi**. In the case of a fault/failure the loop-current goes to 22.0 mA.
- To change the mode to 2-state Low, press the BLUE (–) button for more than a second: the display reads **F: Lo**. In the case of a fault/failure the loop-current goes to 3.6 mA.

Digital Output Signalling (solid-state output): menu level 1

To set values for Upper and Lower Threshold Delay, and Upper and Lower Threshold Setting, the solid-state switch output must be enabled (menu 17). The factory setting, FSH, links menus 17 and 18, to enable digital fault signalling. (When the solid-state switch output is disabled[2] at menu 17, these menu selections display only - - - -.)

1. For detailed information, see *Fault Signalling* on page 13.
2. This option is only available if FPM is selected at menu 1E.

Upper Threshold Delay (solid-state output)

The Upper Threshold Delay controls the Activation delay: the amount of time that has to pass uninterrupted with the probe covered to a level above the Upper Threshold Setting before the timer expires. After the timer expires, the output signal will comply to the setting from Menu 18 for a covered probe. Whenever the level drops below the Upper Threshold Setting before the timer expires, the timer is restarted.

When the solid-state switch control (Menu 17) is disabled, menu 13 displays - - - -. When the solid-state switch control is enabled, menu 13 displays the Activation delay in seconds. As an extra identifier, an upward running **d** is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Identifier	Des-cription	Values
13	17	3	On	Solid-state switch control enabled	*	Upward running **d** at right of value	Upper Threshold Delay	Range: **0** to **100** (seconds)
						factory setting		**0.0**
				Solid-state switch control disabled				Display shows - - - -

First select the solid-state switch output at menu 17 (**contact open** or **contact closed**).

1. Set the rotary switch to **3**.
2. Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.
   or: Press both buttons simultaneously to toggle the value between minimum (**0**) and maximum (**100**).

Lower Threshold Delay (solid-state output)

The Lower Threshold Delay controls the Deactivation delay: the amount of time that has to pass uninterrupted with the probe covered to a level below the Lower Threshold Setting before the timer expires. After the timer expires, the output signal will comply with the setting from Menu 18 for an uncovered probe. Whenever the level rises above the Lower Threshold Setting before the timer expires, the timer is restarted.

When the solid-state switch control (Menu 17) is disabled, menu 14 displays only **- - - -**. When the solid-state switch control is enabled, this menu displays the Deactivation delay in seconds. As an extra identifier, a downward running **d** is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Identifier	Des-cription	Values
14	17	4	On	Solid-state switch control enabled	*	Downward running **d** at right of value	Lower Threshold Delay	Range: **0 to 100** (seconds)
						factory setting		**0.0**
				Solid-state switch control disabled				Display shows **- - - -**

First select the solid-state switch output at menu 17 (**contact open** or **contact closed**).

1. Set the rotary switch to **4**.
2. Press the RED (+) or BLUE(–) button to increase or decrease the value.
3. or: Press and hold a button to start a repeat function.
4. or: Press both buttons simultaneously to toggle the value between minimum (**0**) and maximum (**100**).

Upper Threshold Setting: (solid-state output)

The Upper Threshold Setting is the % of range above which the probe is considered covered. In order to switch the output signal, the corresponding delay time has to be met (Menu 13).

When the solid-state switch control (Menu 17) is disabled, menu 15 displays only **- - - -**. When the solid-state switch control is enabled, menu 15 displays the Upper Threshold setting in percent. As an extra identifier, an upward ramp  is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Identifier	Des-cription	Values
15	17	5	On	Solid-state switch control enabled	*	Upward ramp at right of value	Upper Threshold Setting	% of range
						factory setting		75
				Solid-state switch control disabled				Display shows - - - -

First select the solid-state switch output at menu 17 (**contact open** or **contact closed**).

1. Set the rotary switch to **5**.
2. Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button for a prolonged time start a repeat function.

Lower Threshold Setting: (solid-state output)

The Lower Threshold Setting is the % of range below which the probe is considered uncovered. In order to switch the output signal, the corresponding delay time has to be met (Menu 14).

If the solid-state switch control (Menu 17) is disabled, menu 16 displays **- - - -**. When the solid-state switch control is enabled, menu 16 displays the Lower Threshold Setting in percent. As an extra identifier, a downward ramp ↳. is displayed to the right of the value.

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Added indicator	Des-cription	Values
16	17	6	On	Solid-state switch control enabled		Downward ramp at right of value	Lower Threshold Setting	% of range
						factory setting		25
				Solid-state switch control disabled	*			Display shows - - - -

First select the solid-state switch output at menu 17 (**contact open** or **contact closed**).

1. Set the rotary switch to **6**.
2. Press the RED (+) or BLUE (–) button to increase or decrease the value.
   or: Press and hold a button to start a repeat function.

Digital Signalling Mode (solid-state output)

Notes:
- Factory setting FSH links menus 17 and 18, and sets them to enable digital fault signalling. (In Free Programming Mode, available at menu 1E, all menu items are independent.)
- Menu 18 has precedence over menu 17.

Controls the solid-state switch response to level settings, and allows you to set the switch to **contact open** or **contact closed**. The settings are relative to a covered probe, and the criteria are set in Upper and Lower Threshold settings (see pages 73 and 74,. menus 15 and 16). With **contact closed**, the switch is **on**: with **contact open** the switch is **off**.

While a button is pressed, the LCD displays **S: cc**[1] (contact closed) or **S: co** (contact open). When the button is released an equal sign (=) indicating status replaces the colon, and the reading depends on the status of the probe[2].

Example: S = cc is selected (contact closed with a covered probe)
- If the probe is uncovered when the button is released, the display changes from **S: cc** to **S = co**.
- If the probe is covered when the buttons are released, the display changes to **S = cc.**
- If you press either button briefly, the LCD displays the current setting, in this case, **S: cc.**

Menu Item	Affected by:	Rotary Switch Position	Left Arrow	Mode		Des-cription	Action	Values
17	18	7	On	Digital Signalling Mode	*	Contact Closed: switch 'on'	Press and hold RED (+) button	Display shows[a] **S: cc**
						Contact Open: switch 'off'	Press and hold BLUE (–) button	Display shows[a] **S: co**
						Digital Signalling Mode disabled[b]	Press and hold both buttons	Display shows **S: - -**

a. While the button is pressed: when released the display depends on the probe status.

b. This option is only available when Free Programming Mode is selected at menu 1E.

1. A colon at the extreme left of the display appears while the button is pressed to indicate when a setting is accepted, for example **: S: cc.**

2. If digital fault signalling is enabled at menu 18, it takes precedence, and no equal sign will appear in the display for menu 17 if the device is responding to a fault.

1. Set the rotary switch to **7**.
2. Press and hold the RED (+) or BLUE (–) button to select **contact open** or **contact closed**,
3. If required, adjust menu selections 13, 14, 15 and 16 which set the criteria and threshold that have to be met for a change in output signal.
   (In Free Programming Mode only, press and hold both buttons to disable Digital Signalling Mode.)

Digital Fault Signalling

Notes:
- Factory setting FSH links menus 17 and 18, and sets them to enable digital fault signalling. (In Free Programming Mode, available at menu 1E, all menu items are independent.)
- Menu 18 has precedence over the settings on Menu 17, but if no fault exists, the switch will respond to the setting in menu 17.

Controls the solid-state switch response to a fault/failure and allows you to select either FailSafe High (FSH), or FailSafe Low (FSL).

FailSafe HIgh				FailSafe Low			
no fault		**fault**		**no fault**		**fault**	
uncovered	covered	uncovered	covered	uncovered	covered	uncovered	covered
20 mA closed	4 mA open	3.6 mA open		4 mA open	20 mA closed	22 mA closed	

In FailSafe High mode in normal conditions, the switch is **on** and **contact closed,** as long as the conditions do not cause the switch to close in response to settings at menu 17. If a fault is detected the switch will be **off** and **contact open**. This setting provides no current in a fault situation, and high current (20 mA) in normal conditions

In FailSafe Low mode in normal conditions, the switch is **off** and **contact open**, as long as the conditions do not cause the switch to close in response to settings at menu 17. If a fault is detected the switch will be **on** and **contact closed.** This setting provides high current (20 mA) in a fault situation, and no current in normal conditions.

Menu Item	Rotary Switch Position	Left Arrow	Mode		Description	Action	Values
18	8	On	Digital Signalling Mode	*	FailSafe High	Press and hold RED (+) button	Display shows **FSH**
					FailSafe Low	Press and hold BLUE (–) button	Display shows **FSL**

1. Set the rotary switch to **8**.
2. Press and hold the RED (+) button for more than one second to select **FSH**, or: Press and hold the BLUE (–) button to select **FSL**.
   (In Free Programming Mode only, press and hold both buttons to disable this function).

Miscellaneous

Output Signal Processing Test

Displays the Fault/Failure information. If operation is normal, two test displays alternate, which light up all the LCD segments in a cycle. If there is a fault or failure, an error code is displayed. See the detailed list of error codes and their meanings on page 58.

Menu Item	Rotary Switch Position	Left Arrow	Description
11	1	On	Output Signal Processing Test

Set the rotary switch to **1**.

To change the state of the output signals, press and hold both buttons simultaneously: the digital mode outputs (the solid-state switch and the loop-current control in digital mode) change to their opposite state. Thus 4mA becomes 20mA and **contact open** becomes **contact closed**. This feature allows you to verify that the output signals are properly processed further on in the PLC/DCS system: if the normal state is non-alarm, changing the state should generate an alarm.

The outputs stay in the opposite state as long as both buttons are pressed.

Factory Settings

Displays whether the factory settings are still in place, or how much they have been changed, and allows you to restore the factory settings.

Menu Item	Rotary Switch Position	Left Arrow	Description	LCD Display	Meaning
12	2	On	Factory Settings	FAC A	No parameters changed from factory setting
				FAC P	Range settings altered: timers and thresholds unchanged
				FAC ?	More parameters have been changed

Set the rotary switch to **2**. To restore the factory settings, press both buttons simultaneously to change the LCD to 'do it' and hold both buttons for more than one second. When the buttons are released, the LCD displays **FAC A**.

Range Inversion

Displays whether the device is operating with a **normal** or **inverted** range setting.
A normal range setting is where LRV (Menu 0E) is lower in value than URV (Menu 0F): the LCD displays **nor.** An inverted range is where LRV (Menu 0E) is higher in value than URV (Menu 0F): the LCD displays **inv**.

Menu Item	Rotary Switch Position	Left Arrow	Description	Mode		Values
19	9	On	Range Inversion	normal	*	Display shows **nor**
				inverted		Display shows **inv**

1. Set the rotary switch to **9**.
2. Press both buttons simultaneously for more than one second to toggle between the two modes, effectively switching the values for LRV and URV.

FailSafe Mode

FailSafe High mode (FSH) is the factory default, and it links menus 07 and 17, and 08 and 18, to enable analog 2-state and digital fault signalling.[1] Either FailSafe High or FailSafe Low can be selected at menu 1E.

In FailSafe High mode (FSH):

- Highest current (20 mA), closed solid-state switch in safe condition when probe is uncovered.
- Low Signal current (3.6 mA), solid-state switch open when fault/error occurs.

In FailSafe Low mode (FSL):

- Lowest current (4 mA), open solid-state in safe conditions when probe is uncovered.
- High Signal current (22mA)/ solid-state closed when fault/error occurs.

Menu Item	Affects other menu items	Rotary Switch Position	Left Arrow	Description	Mode		Display reads
1E	07, 17, 08, 18	E	On	Select FailSafe Mode	FailSafeHigh	*	FSH
					FailSafeLow		FSL
		E	On		Free Programming Mode		

1. Set the rotary switch to **E.**
2. Press and hold the RED (+) button for FailSafe High.
   or: Press and hold the BLUE (–) button for FailSafe Low.
   or: Press and hold both buttons simultaneously to reset to Free Programming Mode.

1. FailSafe Mode at menu 1E provides a shortcut, by contrast with Free Programming Mode where all menu items are completely independent. You can make the same selections in FPM, but you need to set each menu item individually.

Keylock Level

Controls the access protection level for the device. The factory setting is a protection level of **0,** which places no restriction on modification of settings.

Notes: HART settings override local settings.
- If the HART setting is 0, there are no restrictions, and you cannot change the protection to a higher level locally.
- If the HART setting is 3, no changes can be made, and this protection level cannot be changed locally.

- Protection level **1** disables the ability to set a value by pressing two buttons simultaneously.
- Protection level **2** disables the ability to change a value by stepping it up or down.
- Protection level **3** completely disables all changing of values.

Menu Item	Rotary Switch Position	Left Arrow	Protection			Display	
			Level		Description	local settings	HART settings
1F	F	On	0	*	No restrictions	**PL 0**	
					No restrictions		**PH 0**
			1		Disables 2-button adjustments	**PL 1**	**PH 1**
			2		Disables 1-button adjustments	**PL 2**	**PH 2**
			3		Disables all changes	**PL 3**	**PH 3**

1. Set the rotary switch to **F.**
2. Press the RED (+) or BLUE (–) button to change the setting.

Appendix B: LCD display examples

LCD: alphanumeric display examples

Menu Item Indicator:

M 00

Menu Level Indicator:

SEL 1

Internal diagnostics detects anomaly:

FLt

Solid-state switch output closed when probe is covered (displayed while button pressed):

S: oc

Solid-state switch output open when probe is covered (displayed while button pressed):

S: oo

Solid-state switch output closed and probe covered, = sign indicates current probe status (displayed when button released):

S= oc

Solid-state switch, output due to switch function disabled:

S: – –

Solid-state switch, output open when Fault detected:

F: oo

Solid-state switch, output closed when Fault detected:

F: oc

Solid-state switch / current-loop, output functions due to Faults are disabled:

F: – –

Current-loop, current goes to 22 mA when Fault detected:

Hi

Current-loop, current goes to 3.6 mA when Fault detected:

Lo

Current-loop, output in Analog (proportional) mode:

An

Indicator for range operation, normal (URV > LRV):

nor

Indicator for range operation, inverted (URV < LRV):

inv

Output out of limits, PV outside Variable Limits:

ooL

Indicator for Factory Set, all parameters are original:

FAC A

Indicator for Factory Set, range settings have been changed:

FAC P

Indicator for Factory Set, other settings have been changed also:

FAC ?

Indicator for Factory Set, reset all variables back to factory setting:

do it

Function test indicator, all outputs in digital mode invert their output status:

0 = /o

Transmitter variable selected for PV:

Pv=0

Keylock protection level:

PL 0

Simulation is active. Transmitter Variable TVO driven by simulation value:

SIM

Appendix C: HART Documentation

HART[1] Communications for Pointek CLS500

Highway Addressable Remote Transducer (HART) is an industrial protocol that rides on top of a 4-20 mA signal. It is an open standard, and full details about HART can be obtained from the HART Communication Foundation at www.hartcomm.org

Pointek CLS500 can be configured over the HART network using either the HART Communicator 275 by Fisher-Rosemount, or a software package. There are a number of different software packages available.The recommended software package is the Simatic Process Device Manager (PDM) by Siemens.

HART Device Descriptor (DD)

In order to configure a HART device, the configurator must have the HART Device Descriptor for the unit in question. HART DD's are controlled by the HART Communications Foundation. The HART DD for Pointek CLS500 will be released in 2003. Please check availability with the HART Communications Foundation. Older versions of the library will have to be updated in order to use all the features in Pointek CLS500.

Simatic Process Device Manager (PDM):

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART and Profibus PA devices. The HART DD for Pointek CLS500 was written with Simatic PDM in mind and has been extensively tested with this software.

HART information

Expanded Device Type Code:

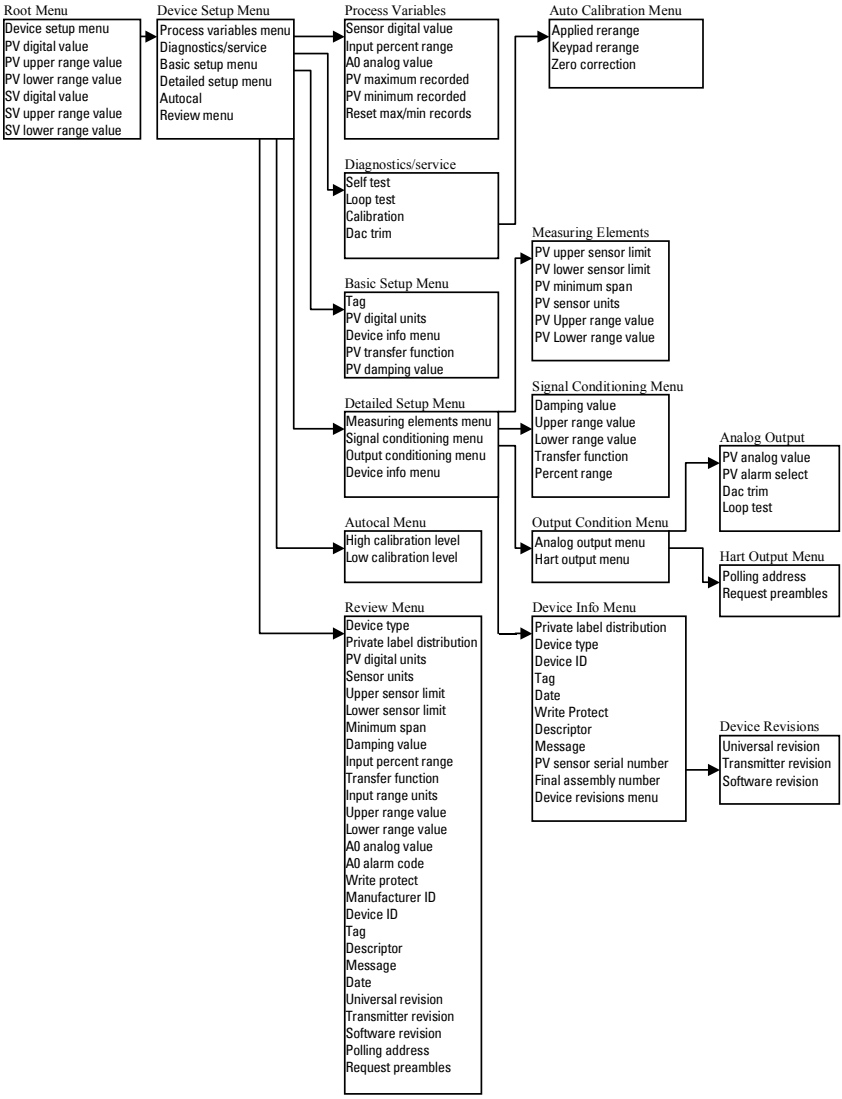
Manufacturer Identification Code	=	84
Manufacturer Device Type Code	=	248
Expanded Device Type Code	=	21752

Physical Layer Information

Field Device Category	=	A
Capacitance Number (CN)	=	1

1. HART® is a registered trademark of the HART Communication Foundation.

Pointek CLS500 DD Menu/Variable Organization



HART Response Code Information

Additional response code information, Second Byte.

Bit #7: Field Device Malfunction

When the transmitter detects a malfunction, the Analog Output will be set in a fault state.

Bit #6: Configuration Changed

When any of the settings in EEROM is changed either by a write command or by manual ZERO or SPAN adjust, this bit is set. Use command 38 to reset.

Bit #5: Cold Start

This bit is issued once after an initialisation cycle is complete; this can occur after a power loss or as a result of a (watchdog) reset.

Bit #4: Extended Status Available

When any of the extended status bits is set this flag is raised. Use command 48 to get detailed status information.

Bit #3: Output Current Fixed

This bit is set as long as the Primary Variable Analog Output is set to a fixed value.

Bit #2: Primary Variable Analog Output Saturated

Flag is set when the Primary Analog Output saturates below 3.8 mA and above 20.5 mA.

Bit #0: Primary Variable Out of Limits

This flag is set whenever the Transmitter Variable #0 (in pF), the Primary Variable exceeds the Sensor Limits returned with Command 14, Read Primary Variable Sensor Limits.

HART Conformance and Command Class

Pointek CLS500 transmitter Conformance and Command Class summary.

Command Number	Description	Usage
Conformance Class #1		
0	Return Unique Identifier	Universal
1	Read Primary Variable	

Conformance Class #1A		
0	Return Unique Identifier	Universal
2	Read PV Current and Percent of Range	

Conformance Class #2		
11	Read Unique Identifier Associated with Tag	Universal
12	Read Message	
13	Read Tag, Descriptor, and Date	
14	Read Primary Variable Sensor Information	
15	Read Primary Variable Output Information	
16	Read Final Assembly Number	

Conformance Class #3		
3	Read Dynamic Variables and PV Current	Universal
33	Read Selected Dynamic Variables	Common Practice
48	Read Additional Transmitter Status	Common Practice
50	Read Dynamic Variable Assignments	Common Practice
Conformance Class #4		
34	Write PV Damping Value	Common Practice
35	Write Primary Variable Range Values	
36	Set Primary Variable Upper Range Value	
37	Set Primary Variable Lower Range Value	
38	Reset Configuration Changed Flag	
40	Enter/Exit Fixed Primary Var. Current Mode	

Conformance Class #5		
6	Write Polling Address	Universal
17	Write Message	
18	Write Tag, Descriptor and Date	
19	Write Final Assembly Number	
44	Write Primary Variable Units	Common Practice
45	Trim Primary Variable Current DAC Zero	
46	Trim Primary Variable Current DAC Gain	
49	Write Primary Variable Sensor Serial Number	
59	Write Number of Response Preambles	

Command Number	Description	Usage
128	Set Alarm Select	Transmitter Specific
129	Adjust for Product Build-up on Sensor	
130	Read Failsafe Mode	
131	Return Device Config. Info.	
132	Write Variable Upper/Lower Limit Values	
133	Read Variable Upper/Lower Limit Values	
134	Write Keylock Value	
135	Read Keylock Value	
138	Write Simulation Timer and Value	
139	Read Simulation Timer and Value	
140	Write S.V. Units and Range Values	
141	Read S.V. Unites and Range Values	
144	Reset recorded PV min./max. values back to PV	
145	Return recorded PV min./max. values	
150	Write Analog Signalling Mode	
151	Read Analog Signalling Mode	
152	Write Digital Signalling Mode	
153	Read Digital Signalling Mode	
154	Write Analog Threshold Settings	
155	Read Analog Threshold Settings	
156	Write Digital Threshold Settings	
157	Read Digital Threshold Settings	
160	Write Delay Timers Analog Signalling	
161	Read Delay Timers Analog Signalling	
162	Write Delay Timers Digital Signalling	
163	Read Delay Timers Digital Signalling	

General Transmitter Information

Damping information

The Pointek CLS500 transmitter implements damping on most of the transmitter variables. The damping setting may vary from 1 (shortest value) to 10000 (longest value).

Non-volatile Memory Data Storage

The flags byte of Command #0 referenced in the Universal Command Specification document, will have Bit #1 (Command #39, EEPROM Control Required) set to 0, indicating that all data sent to the transmitter will be saved automatically in the non-volatile memory upon receipt of the Write or Set Command. Command #39, EEPROM Control, is not implemented.

MultiDrop operation

Pointek CLS500 transmitter supports MultiDrop Operation.

Burst mode

Pointek CLS500 transmitter does not support Burst Mode.

Units conversions

The Transmitter Variable #0 Units are in pF and cannot be changed.

The Transmitter Variable #1 Values may be set to any Units and Value with Command #140. The Transmitter Variable Range Values may be read at any time with Command #141.

The value returned as Secondary Variable (S.V.) is the result of the following calculation:

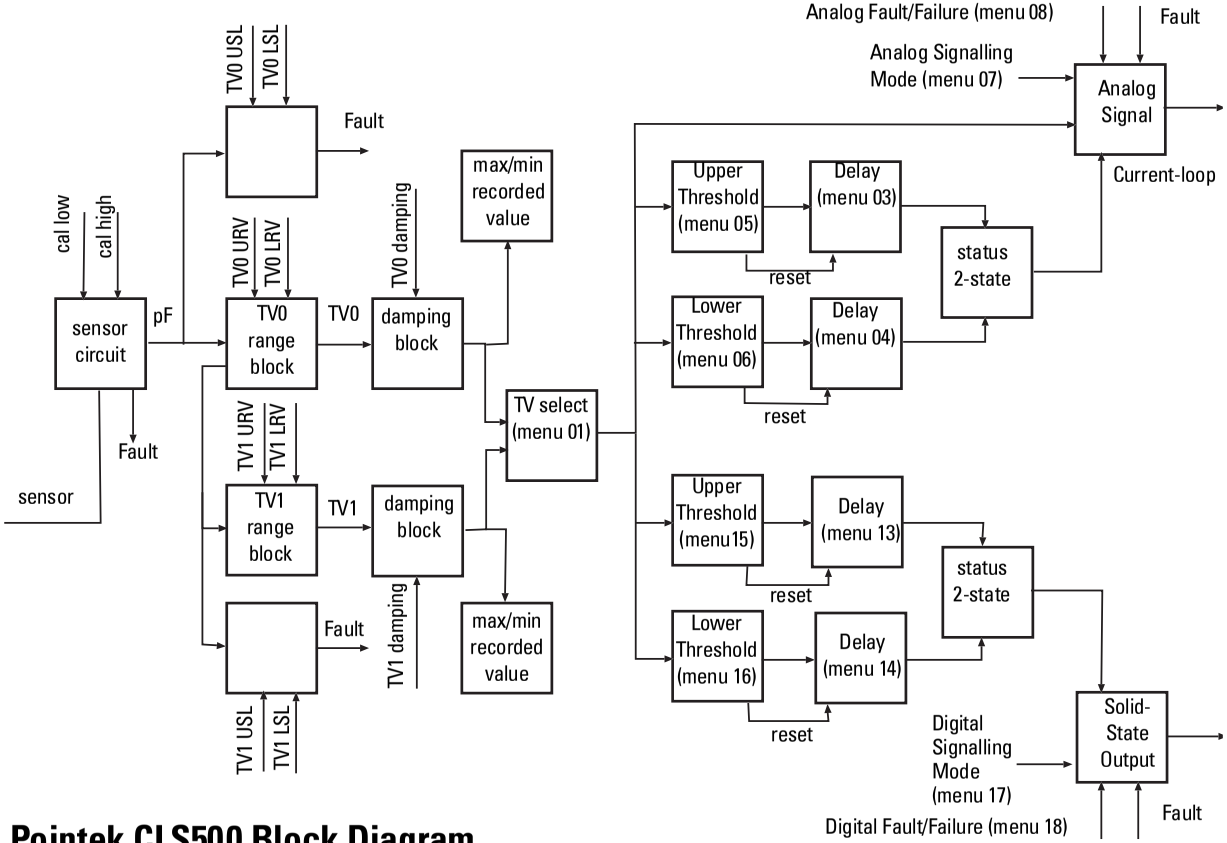
TV1 = TV0 Dynamic Range Value in percent x ({TV#1}URV – {TV#1}LRV) + {TV#1}LRV.

This method provides a means of converting TV#0 which is always in pF, to alternative units (level or volume).

Additional Universal Command Specifications

For a document listing the additional Universal Command Specifications, please contact Technical Publications at techpubs.smpi@siemens.com.

Appendix D: Block Diagram, and Correlation table, mA to %



Pointek CLS500 Block Diagram

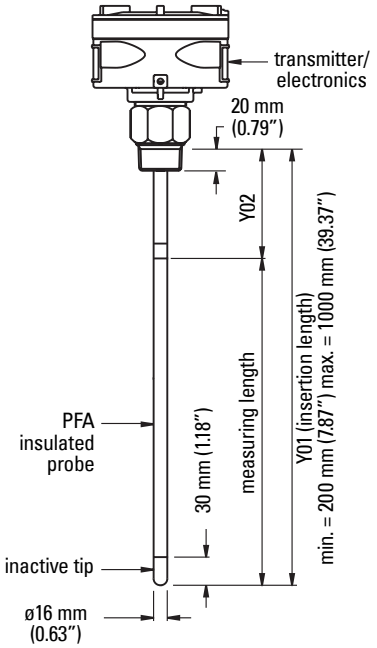
Correlation Table: 0% - 100% to 4-20 mA or 20-4 mA

Range 0 - 100 %	Current in mA	Range 100 - 0 %
0	4.0	100
5	4.8	95
10	5.6	90
15	6.4	85
20	7.2	80
25	8.0	75
30	8.8	70
35	9.6	65
40	10.4	60
45	11.2	55
50	12.0	50
55	12.8	45
60	13.6	40
65	14.4	35
70	15.2	30
75	16.0	25
80	16.8	20
85	17.6	15
90	18.4	10
95	19.2	5
100	20.0	0

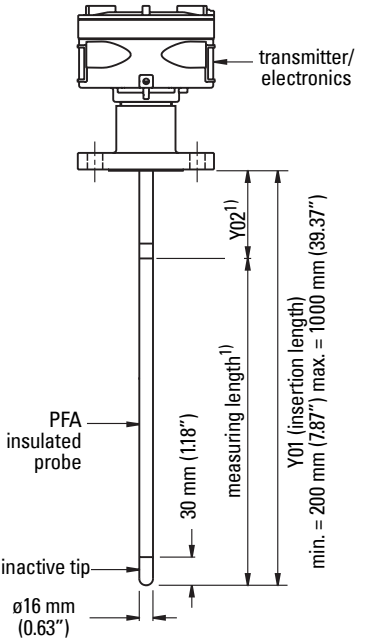
Appendix E: Pointek CLS500, dimensions and application examples

Standard rod version

Threaded



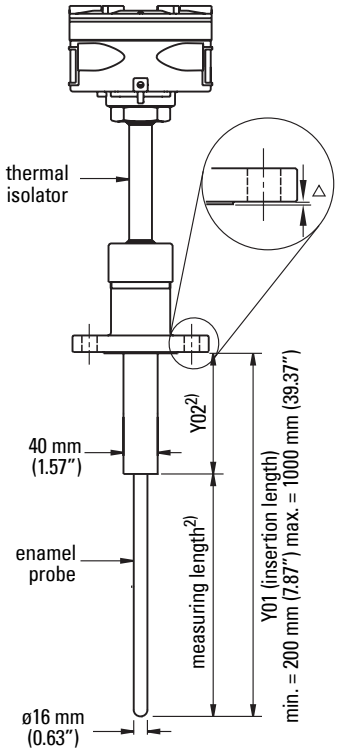
Flanged



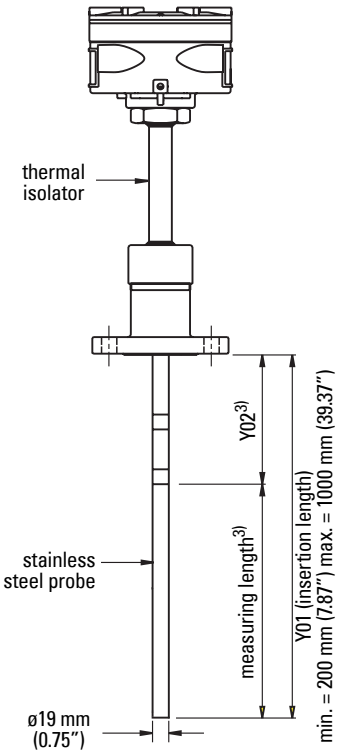
1) Minimum Y02 (active shield length) = 50 mm (1.96")

High temperature rod version

Single piece flange (7ML5604)
Stainless steel rod[1)]



Single piece flange (7ML5604)
Enamel rod

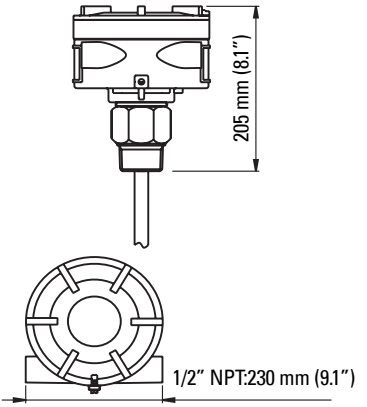


Flange Facing (raised face)	
Flange Class	Facing thickness
ASME 150/300	2 mm (0.08")
ASME 600/900	7 mm (0.28")
PN16/25/40/64	2 mm (0.08")

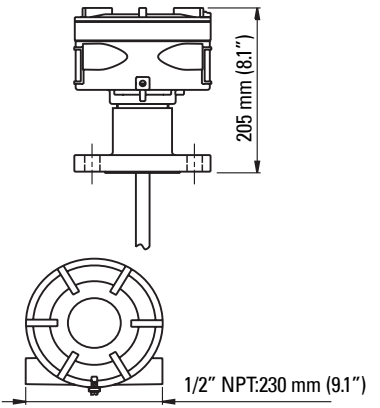
1) Non conductive materials only
2) Minimum Y02 (active shield length) = 105 mm (4.13")
3) Minimum Y02 (active shield length) = 100 mm (3.94")

Standard configuration

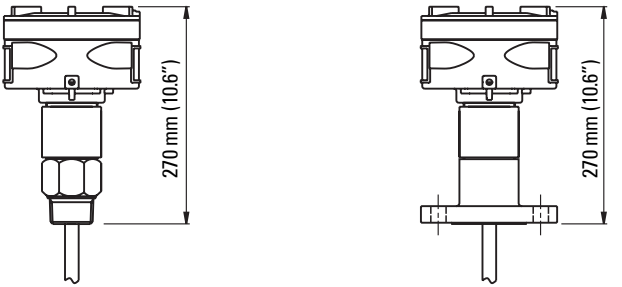
Threaded (7ML5601)



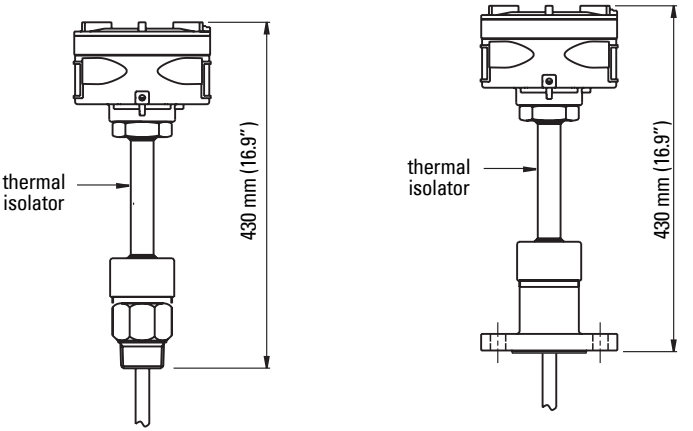
Flanged



With explosion-proof seal option

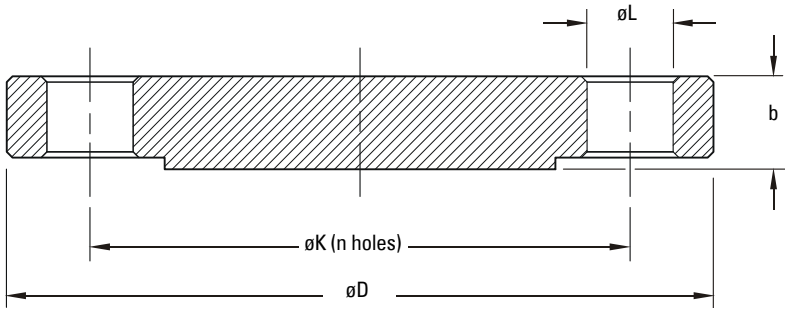


With thermal isolator option



Appendix E

Flanges



Flange Standards

Notes:

- All measurements given in mm
- One (1) inch = 25.4mm
- For details, see drawing on page 90.

FLANGES acc. ANSI standards															
	150lbs					300lbs					600lbs				
	D	k	L	b	n	D	k	L	b	n	D	k	L	b	n
2"	152.4	120.6	19	19.0	4	165.1	127.0	19	22.2	8	165.1	127.0	19	25.4	8
3"	190.5	152.4	19	23.8	4	209.6	168.3	22	28.6	8	209.6	168.3	22	31.8	8
4"	228.6	190.5	19	23.8	8	254.0	200.0	22	31.8	8	273.1	215.9	26	38.1	8
6"	279.4	241.3	22	25.4	8	317.5	269.9	22	36.5	12	355.6	292.1	29	47.6	12

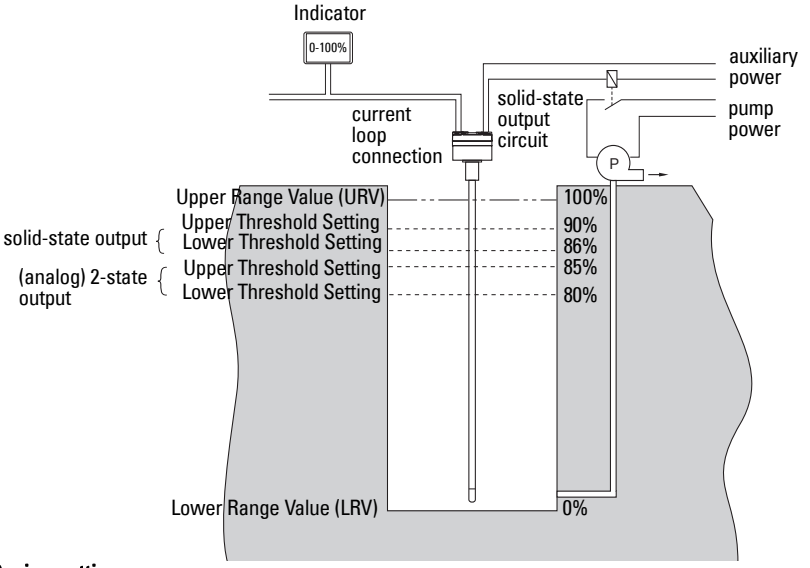
FLANGES acc. DIN standards															
	PN 10 (PN 16)					PN 25 (PN 40)					PN 64				
	D	k	L	b	n	D	k	L	b	n	D	k	L	b	n
NW50	165	125	18	18	4	165	125	18	20	4	180	135	23	26	4
NW80	200	160	18	20	8	200	160	18	24	8	215	170	23	28	8
NW100	220	180	18	20	8	235	190	23	24	8	250	200	27	30	8
NW150	285	240	23	22	8	300	250	27	28	8	345	280	33	36	8

Application Example

Pointek CLS500 can be applied to a multitude of tasks: a generic example is shown below.

Point level detection with High and High-High alarm

- The signal current provides the High alarm: it should be 4 mA below the analog switch point and toggle to 20 mA above it.
- The High alarm should be activated at or above 85% of range and deactivated at or below 80%.
- The solid-state switch provides a High-High alarm which should be activated at or above an alarm switch-point of 90% and deactivated at or below 86%.



Device settings:

Note: All values are for demonstration purposes only.

1. Reset factory settings if necessary at menu 12.
2. Select TV0 (Transmitter Variable 0 is PV) at menu 01: menu 01 reads **Pv = 0**
3. Set the High alarm:
   a. Select analog signalling mode (2-state) at menu 07.
   Press and hold the RED button for about a second: the display should read **C:Hi**. This indicates that the signal-current will switch to 20 mA when the actual range is at or above the Upper Threshold setting (menu 05) and switch back to 4 mA when the actual range is at or below the Lower Threshold setting (menu 06).
   b. Set the High alarm activation: set the reading at Menu 05 to **85**.
   c. Set the High alarm deactivation: set the reading at Menu 06 to **80**.

4. Set the solid-state output to act as a High-High alarm.
    a. Select digital signalling mode at Menu 17:
    Press the BLUE button for about a second: the display should read S:co. This indicates that the solid-state switch will open when the range value is at or above the Upper Threshold setting (menu 15).
    b. Set the High-High alarm activation: set the reading at menu 15 to 90.
    c. Set the High-High alarm deactivation: set the reading at menu 16 to 86.

This setup act as a FailSafe mode because when the range value exceeds the threshold settings, the solid-state output will open, producing the same result as a loss of power to the transmitter or faulty wiring to the solid-state output.

Delta Range Setting application

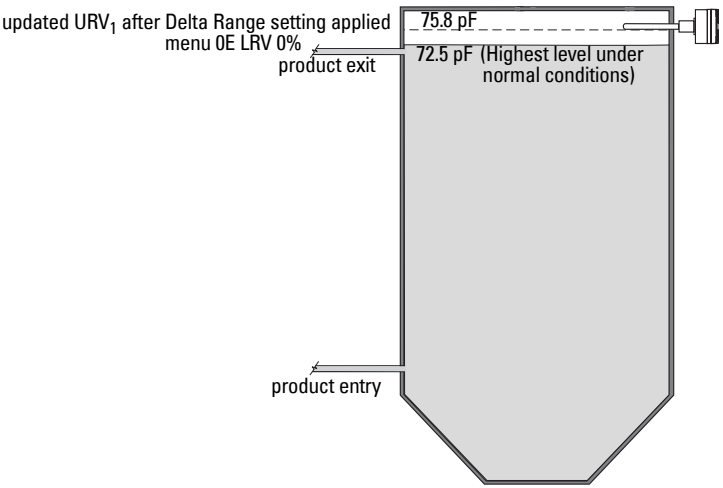
1. Setting overfill protection

Delta Range Setting can be used to set an Upper Range Value (URV) in applications where it is difficult or impossible to raise the product to that level. In this case you take the actual value for the highest normal process level as Lower Range Value (LRV), and apply Delta Range setting. This adds the minimum span to LRV, and updates URV.

Example: Normal process conditions are for the level to be at or below the level set for LRV (0%).

- It is impossible to raise the level high enough to take the actual value for URV.
- Switching must be guaranteed.

Set 2-state signalling and Upper Range Value to ensure the level never rises above the product exit opening:.



Device settings:

Reset to factory settings	Menu 12 reads	FAC A
TV0 selected: Transmitter Variable 0 is PV	Menu 01 reads	Pv = 0
Select 2-state mode: **C: Lo** (4 mA in normal conditions)	Menu 07 reads	C: Lo[1]
Lower Range Value (0% of range) is set to 72.5[2]	Menu 0E reads	72.50 pF
Apply Delta Range Settings (press both buttons)	Menu 0D reads	3.3 pF
Check Upper Range Value (100% of range)	Menu 0F reads	75.80 pF

Under normal operating conditions (level at or below LRV) the output will be 4 mA. With 2-state signalling enabled and **C: Lo** selected, the signal will switch to 20 mA in an alarm situation whenever the level reaches URV.

1. **C: Lo** appears while the button is pressed: when the button is released the display will show 4 mA as long as the level is below URV.
2. When the product is at the highest desired level, press both buttons at menu OE to take the environmental initial capacitance value as LRV (0%). (Values shown are for demonstration purposes only.)

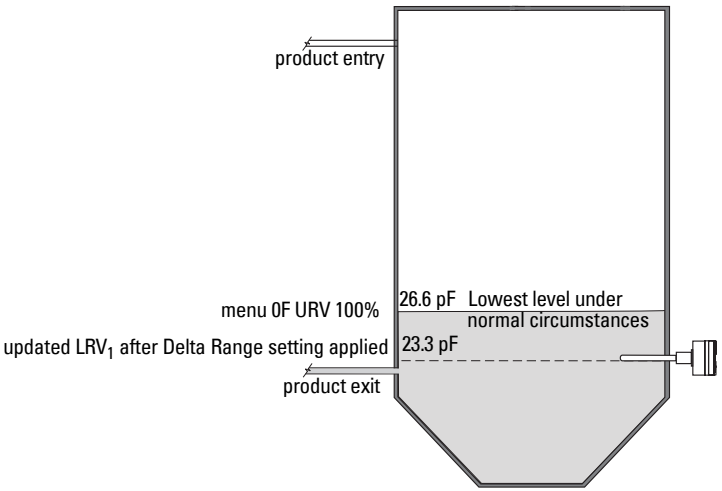
2. Setting dry run (underfill) protection

Delta Range Setting can be used to set a Lower Range Value in applications where it is difficult or impossible to lower the product to that level. In this case you take the actual value for the lowest normal process level as Upper Range Value (URV), and apply Delta Range setting. This subtracts the minimum span from URV, and updates LRV.

Example: Under normal process conditions the level never drops below the product exit opening:

- It is impossible to lower the level enough to take the actual value for LRV.
- Switching must be guaranteed.

Set 2-state signalling and Lower Range Value to ensure the level never drops below the product exit opening.



Device settings:

Reset to factory settings .....Menu 12 reads FAC A
TV0 selected: Transmitter Variable 0 is PV .....Menu 01 readsPv = 0
Select 2-state mode: **C: Lo** (4 mA in normal conditions).....Menu 07 reads C: Lo[1]
Upper Range Value (100% of range) is set to 26.6[2] .....Menu 0F reads 26.60 pF
Apply Delta Range Settings (press both buttons) .....Menu 0D reads 3.3 pF
Check Lower Range Value (0% of range) .....Menu 0E reads 23.30 pF

Under normal process conditions (level to be at or above URV) the output will be 4 mA. With 2-state signalling enabled and **C: Lo** selected, the signal will switch to 20 mA in an alarm situation, whenever the level falls to LRV.

1. **C: Lo** appears while the button is pressed: when the button is released the display will show 4 mA as long as the level is above LRV.
2. When the product is at the lowest level under normal conditions, press both buttons at menu OF to take the environmental initial capacitance value as URV (100%). (Values shown are for demonstration purposes only.)

Appendix F: Approvals

The operation of Pointek CLS500 conforms to the following:

NAMUR recommendation NE 43

This recommendation describes rules by which analog transmitters transfer their information to DCS equipment. This information can be divided into two types:

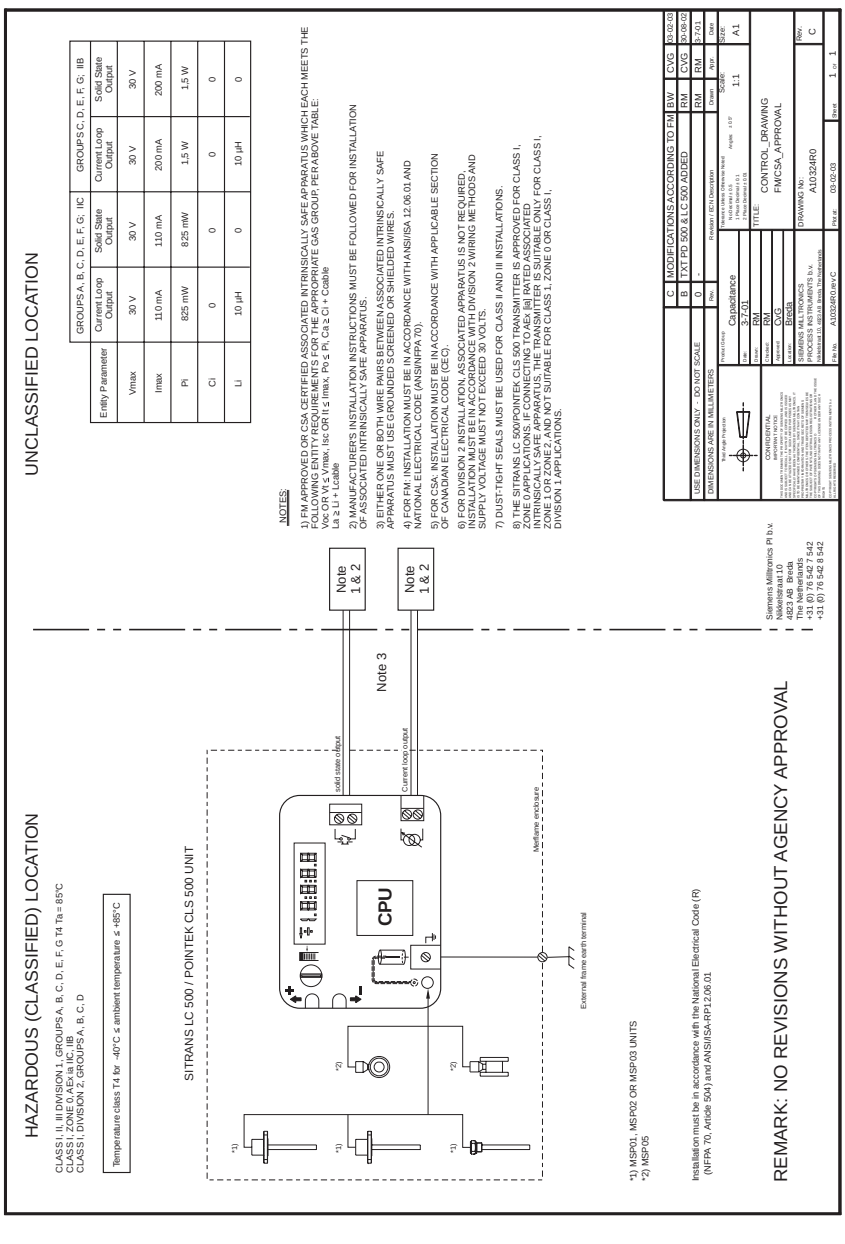
- measurement information
  For **measurement information** the current signal should be within the range of **3.8** to **20.5 mA**.
- failure signalling
  For **failure information** which indicates a failure in the measuring system[1] the current signal should be in the range of either **0** to **3.6 mA,** or **21 mA** or greater.

  The application will determine which of these two ranges is more desirable. Pointek CLS500 can be set for **3.6 mA,** or **22 mA**, as required.

1. It may also signal a process level outside the Upper and Lower Sensor Limits, if the unit has been programmed for this. For more information, see *Fault Signalling* on page 13.

Control Drawing FM/CSA Approval

Pointek CLS500



Notes

Glossary

capacitance: the property of a system of conductors and dielectrics that permits the storage of electricity when potential differences exist between the conductors. Its value is expressed as the ratio of a quantity of electricity to a potential difference, and the unit is a Farad.

capacitor: a device in a circuit that has the potential to store an electric charge. Typically a capacitor has 2 conductors or electrodes separated by a layer of a nonconducting material called a dielectric. With the conductors on opposite sides of the dielectric layer oppositely charged by a source of voltage, the electrical energy of the charged system is stored in the polarized dielectric.

derating: to decrease a rating suitable for normal conditions according to guidelines specified for different conditions.

dielectric: a nonconductor of direct electric current.[1]

dielectric constant: the ability of a dielectric to store electrical potential energy under the influence of an electric field. This is measured by the ratio of the capacitance of a condenser with the material as dielectric to its capacitance with vacuum as dielectric. The value is usually given relative to a vacuum /dry air: the dielectric constant of air is 1[1].

immiscible: incapable of mixing or attaining homogeneity.

implicit: for example in "the units are implicit in pF," the units are implied, or assumed to be pF, because there is no other option.

miscible: capable of being mixed.

repeatability: the closeness of agreement among repeated measurements of the same variable under the same conditions.

saturation: a condition in which any further change of input no longer results in a change of output. For example, "the loop-current will saturate to 3.8 or 20.5 if the level exceeds the Range settings."

solid-state device: a device whose function is performed by semi-conductors or the use of otherwise completely static components such as resistors and capacitors.

stilling-well: a grounded metal tube with openings.

1. Many conductive liquids/electrolytes exhibit dielectric properties; the relative dielectric constant of water is 80.

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Quick Reference: Pointek CLS500

Quick Start Sequence	
	For overfill protection:
1a	**Install the device with the probe uncovered.**
2a	**Power it up.**
3a	**Set the first operating point for the switch, LRV at menu 0E**
	Set value for 0% (LRV): units must be pF (Menu 01 must read Pv = 0); probe must be uncovered. a Turn the rotary switch to E (Empty). b Press both buttons and hold for about 1 second: the 0% point is now set. (In FailSafe mode, the LCD blinks to indicate the probe is uncovered.)
4a	**Set the second switch point: use menu 0D to generate URV**
	Set value for 100% (URV): probe must be uncovered. a Turn the rotary switch to D (Delta Range). b Press and hold both buttons for about 1 second: this takes the minimum span and adds it to the value for LRV to generate the value for URV. (This guarantees the device will switch if the product approaches or touches the probe.) c If the device is over-sensitive, use the RED (+) button to increase the Delta Range setting. (This will increase the value for URV and increase the span between LRV and URV.) (The LCD will stop blinking when the probe is covered.)
	For dry-run (underfill) protection
1b	**Install the device with the probe covered.**
2b	**Power it up.**
3b	**Set the first operating point for the switch, URV at menu 0F**
	Set value for 100% (URV): units must be pF (Menu 01 must read Pv = 0); probe must be covered. a Turn the rotary switch to F (Full). b Press both buttons and hold for about 1 second: the100% point is now set. (The LCD stops blinking when the probe is covered.)
4b	**Set the second switch point: use menu 0D to generate LRV**
	Set value for 0% (URV): probe must be covered. a Turn the rotary switch to D (Delta Range). b Press both buttons and hold for about 1 second: this takes the minimum span and subtracts it from the value for URV to generate the value for LRV. c For products that are conductive and viscous, use the RED (+) button to increase the Delta Range setting. (This will decrease the value for LRV and increase the span between URV and LRV). (The LCD will blink if the probe is uncovered.)
	In all cases:
5	**View primary variable (PV): menu 00**
	Turn the rotary switch to 0. The LCD displays the actual pF reading.
6	**Pointek CLS500 is now ready to operate.**

Rotary Switch Positions – Quick Reference (FSH Mode)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Menu LEVEL 0 (00 to 0F) MSP2002-1 Transmitter in F(ail) S(afe) H(igh) or F(ail) S(afe) L(ow) mode																
Units	**PV Units**	**Num. Selection**	**PV Units**	**Seconds**	**Seconds**	**%**	**%**	**mA**	**mA**	**Numeri-cal**	**Numeri-cal**	**PV Units**	**PV Units**	**PV Units**	**PV Units**	**PV Units**
NO KEYS Value read-out	PV Value or Fault	Show select PV variable	Highest/ Lowest PV Memory	Activation Time Delay Current sig-nal	De-Activation Time Delay Current signal	Upper Thresh-old Activation Current signal	Lower Thresh-old De-Activation Current signal	Loop Current in mA	Failsafe Mode	Actual Step Size	Damping Value	LOWER limit PV	UPPER limit PV	Delta Value PV for 4 or 20 mA	LRV Value PV for 4 mA	URV Value PV for 20 mA
Up Key-RED (+)	Set Menu Level 00 to 0F	Step TV0 to TVmax	Highest PV Memory Read-out	Increase Delay Time	Increase Delay Time	Increase Upper Threshold Point	Increase Lower Threshold Point	Loop Current in mA	F(ail) S(afe) H(igh)	Increase Step Size to 10000	Increase Damping Value	Increase PV LOWER limit	Increase PV UPPER limit	Increase PV Delta	Increase PV LRV	Increase PV URV
Down Key-BLUE (–)	Set Menu Level 10 to 1F	Step TVmax to TV0	Lowest PV Memory Read-out	Decrease Delay Time	Decrease Delay Time	Decrease Upper Thresh-old Point	Decrease Lower Thresh-old Point	Loop Current in mA	F(ail) S(afe) L(ow)	Decrease Step Size to 0.01	Decrease Damping Value	Decrease PV LOWER limit	Decrease PV UPPER limit	Decrease PV Delta	Decrease PV LRV	Decrease PV URV
Both Keys	Show-Menu Level	Set % Mode	Reset Hi/Lo memories to actual PV	Toggle Delay Time 00 < – > 100	Toggle Delay Time 00 < – > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Loop Current in mA		Set to 1	Set to 1	Preset Lower Limit to Actual (PV)	Preset Upper Limit to Actual (PV)	URV– LRV = Min.	LRV = Actual Value (PV)	URV = Actual Value (PV)
	*	TV0	*	00	00	75%	25%	FSH	FSH	1.0	1	1.0 pF	330 pF	330 pF	0 pF	330 pF
Menu LEVEL 1 (10 to 1F) MSP2002-1 Transmitter in F(ail) S(afe) H(igh) or F(ail) S(afe) L(ow) mode																
Units	**PV Units**	**Numerical**	**Factory Settings**	**Seconds**	**Seconds**	**%**	**%**	**O/ C**	**O/C**	**nor / inv**			**Resp. Units**		**FSM**	**Keylock**
NO KEYS Value read-out	PV Value or Fault	Display check Fault code	FAC (factory set-tings)	Activation Time Delay Transistor Switch	De-Activation Time Delay Transistor Switch)	Upper Thresh-old Activation Transistor Switch	Lower Thresh-old De-Activa-tion Transistor Switch	Status Solid State Output	Failsafe Mode	MODE Normal / Inverse	— Spare	— Spare	Transmitter Var 0 Read-Out	— Spare	Show Failsafe Mode	Keylock Level
Up Key-RED (+)	Set Menu Level 00 to 0F		FAC (factory set-tings)	Increase Delay Time	Increase Delay Time	Increase Upper Thresh-old Point	Increase Lower Thresh-old Point	Status Solid State Output	F(ail) S(afe) H(igh)	MODE Normal / Inverse			Transmitter Var 1 Read-Out		F(ail) S(afe) H(igh	Increase Keylock Level

Rotary Switch Positions – Quick Reference (FSH Mode)

Down Key- BLUE (–)	Set Menu Level 10 to 1F		FAC (factory set-tings)	Decrease Delay Time	Decrease Delay Time	Decrease Upper Thresh-old Point	Decrease Lower Thresh-old Point	Status Solid State Output	F(ail) S(afe) L(ow)	MODE Normal / Inverse			Transmitter Var 2 Read-Out		F(ail) S(afe) L(ow)	Decrease Keylock Level
Both Keys	Show Menu Level	Invert Sig-nalling Sta-tus	do it	Toggle Delay Time 00 < - > 100	Toggle Delay Time 00 < - > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Status Solid State Output		Toggle Operating Mode			Transmitter Var 3 Read-Out		F(ree) P(rogramming) M(ode)	
	*	*	*	**00**	**00**	**75%**	**25%**	**FSH**	**FSH**	**nor**	*	*	*	*	**FSH**	**0**

Free Programming Mode

Pointek CLS500 is most often used in FailSafe High or FailSafe Low mode (with linked alarm and fault signalling functions) selected at menu 1E. However, Free Programming Mode is an alternative.

In Free Programming Mode all menu items operate independently, and continuous level measurement, with a mA signal proportional to level, is available.

A chart showing the combinations of rotary switch positions and button presses for using Free Programming Mode is shown on the next page.

Rotary Switch Positions – Quick Reference (FPM Mode)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Menu LEVEL 0 (00 to 0F) MSP2002-1 Transmitter in F(ree) P(rogramming) M(ode)																
Units	**PV Units**	**Num. Selection**	**PV Units**	**Seconds**	**Seconds**	**%**	**%**	**mA**	**mA**	**Numeri-cal**	**Numeri-cal**	**PV Units**	**PV Units**	**PV Units**	**PV Units**	**PV Units**
NO KEYS Value read-out	PV Value or Fault	Show select PV variable	Highest/ Lowest PV Memory	Activation Time Delay Current sig-nal	De-Activation Time Delay Current signal	Upper Thresh-old Activation Current signal	Lower Thresh-old De-Activation Current signal	Loop Current in mA	Fault signal 22 or 3.6 mA	Actual Step Size	Damping Value	LOWER limit PV	UPPER limit PV	Delta Value PV for 4 or 20 mA	LRV Value PV for 4 mA	URV Value PV for 20 mA
Up Key-RED (+)	Set Menu Level 00 to 0F	Step TV0 to TVmax	Highest PV Memory Read-out	Increase Delay Time	Increase Delay Time	Increase Upper Threshold Point	Increase Lower Threshold Point	Set Covered: 20 mA (Hi)	Set FAULT: 22 mA	Increase Step Size to 10000	Increase Damping Value	Increase PV LOWER limit	Increase PV UPPER limit	Increase PV Delta	Increase PV LRV	Increase PV URV
Down Key-BLUE (–)	Set Menu Level 10 to 1F	Step TVmax to TV0	Lowest PV Memory Read-out	Decrease Delay Time	Decrease Delay Time	Decrease Upper Thresh-old Point	Decrease Lower Thresh-old Point	Set Covered: 4 mA (Lo)	Set FAULT: 3.6 mA	Decrease Step Size to 0.01	Decrease Damping Value	Decrease PV LOWER limit	Decrease PV UPPER limit	Decrease PV Delta	Decrease PV LRV	Decrease PV URV
Both Keys	Show-Menu Level	Set % Mode	Reset Hi/Lo memories to actual PV	Toggle Delay Time 00 < – > 100	Toggle Delay Time 00 < – > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Set Analog Range 4 to 20 mA (Anl)	Fault signal Disable	Set to 1	Set to 1	Preset Lower Limit to Actual (PV)	Preset Upper Limit to Actual (PV)	URV– LRV = Min.	LRV = Actual Value (PV)	URV = Actual Value (PV)
	*	**TV0**	*	**00**	**00**	**75%**	**25%**	**Cov.=Hi**	**Disabled**	**1.0**	**1**	**1.0 pF**	**330 pF**	**330 pF**	**0 pF**	**330 pF**
Menu LEVEL 1 (10 to 1F) MSP2002-1 Transmitter in F(ree) P(rogramming) M(ode)																
Units	**PV Units**	**Numerical**	**Factory Settings**	**Seconds**	**Seconds**	**%**	**%**	**O/ C**	**O/C**	**nor / inv**			**Resp. Units**		**FSM**	**Keylock**
NO KEYS Value read-out	PV Value or Fault	Display check Fault code	FAC (factory set-tings)	Activation Time Delay Transistor Switch	De-Activation Time Delay Transistor Switch)	Upper Thresh-old Activation Transistor Switch	Lower Thresh-old De-Activa-tion Transistor Switch	Status Solid State Output	Fault signal (Solid State Output)	MODE Normal / Inverse	— Spare	— Spare	Transmitter Var 0 Read-Out	— Spare	Show Failsafe Mode	Keylock Level
Up Key-RED (+)	Set Menu Level 00 to 0F		FAC (factory set-tings)	Increase Delay Time	Increase Delay Time	Increase Upper Thresh-old Point	Increase Lower Thresh-old Point	Set Covered = Solid State ON	Set FAULT = Solid State ON	MODE Normal / Inverse			Transmitter Var 1 Read-Out		F(ail) S(afe) H(igh)	Increase Keylock Level
Down Key-BLUE (–)	Set Menu Level 10 to 1F		FAC (factory set-tings)	Decrease Delay Time	Decrease Delay Time	Decrease Upper Thresh-old Point	Decrease Lower Thresh-old Point	Set Covered = Solid State OFF	Set FAULT = Solid State OFF	MODE Normal / Inverse			Transmitter Var 2 Read-Out		F(ail) S(afe) L(ow)	Decrease Keylock Level
Both Keys	Show Menu Level	Invert Sig-nalling Sta-tus	do it	Toggle Delay Time 00 < - > 100	Toggle Delay Time 00 < - > 100	Preset Upper Threshold Point to 75%	Preset Lower Threshold Point to 25%	Disable Switch for Solid State	Disable Fault for Solid State	Toggle Operating Mode			Transmitter Var 3 Read-Out		F(ree) P(rogramming) (M(ode)	
	*	*	*	**00**	**00**	**75%**	**25%**	**Cov.=Off**	**Disabled**	**nor**	*	*	*	*	**FSH**	**0**

Notes

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