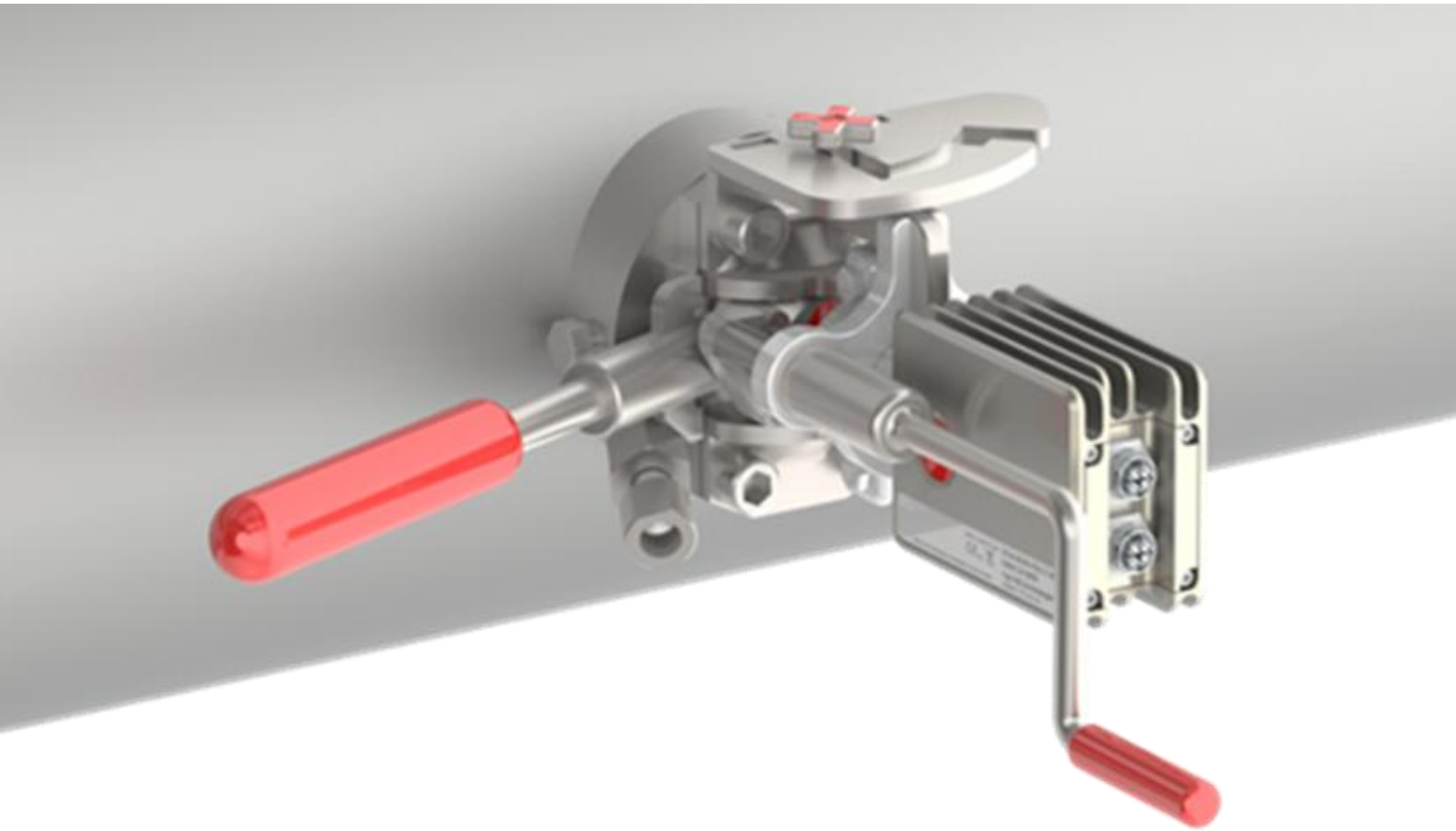


USER'S MANUAL

RETRACTABLE REFRACTOMETER DCM-20 PASVE®

KXS TECHNOLOGIES

v.5.04_2026

1. Contents

2. Important PASVE® safety precautions

⚠️ **WARNING**: If the instrument is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
• The unit is intended for indoor/outdoor use, at an altitude of less than 3000m above sea level, within an ambient temperature range of -20…65℃ and a relative humidity range of 0% to 100%. If the instrument is stored outside these ranges, it should be left to stand until it equilibrates to within the above limits.
• Do not operate the unit outside the rated power supply range specified 24VDC +/-10%.
• Before using any cleaning or decontamination method except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.
• Ensure the instrument is only connected to an earthed supply.

⚠️ **WARNING: DO NOT**
• Never open the PASVE® valve without a sensor installed in the process pipe.
• Do not remove the wash nozzle while the process is running. The wash nozzle must only be removed during process shutdown when the pipe is empty. Ensure the pipe is unpressurized.
• Do not open any screws on the PASVE® system while the process is running.
• Do not remove any wash system components unless both the wash root valve and the PASVE® wash system valve are securely closed.
• Do not use excessive force when operating PASVE® system. Excessive force can damage the system and compromise its functionality.

EU Declaration of Conformity

The PASVE® valve conforms to the following EU harmonization legislation:

- Machinery Directive (2006/42/EC) including latest amendments
- Pressure Equipment Directive (2014/68/EU)

Operator safety precautions

To ensure safe installation, operation, and maintenance of the Retractable refractometer DCM-20 PASVE® the following safety requirements must be strictly followed. These guidelines are the minimum safety standards; your organization may impose additional PPE (Personal Protective Equipment) or protocols.

⚠️ **WARNING:**

- Only authorized personnel can perform the tasks outlined in this document
- Before beginning work, familiarize yourself with the location of the nearest emergency shower and eye wash station.
- Never operate the system alone. It is recommended to have one operator perform the tasks while another reads the instructions and guides the operation. This two-person approach enhances safety and ensures accurate execution of procedures.

⚠️ **WARNING:** Hot steam and process pipes may present significant hazards. Always wear the recommended protective clothing and equipment as detailed below:

- Long-sleeved safety clothing to prevent skin exposure to potential hazards
- Protective gloves
- Safety glasses or goggles
- Ear protectors
- Hard hat or helmet
- steel-toe safety boots
- Face visor

For more information on safe operation, please refer to the following resources:

- KxS DCM-20 PASVE® sensor and nozzle insertion and removal guides.
- Instructional video on insertion and retraction available on YouTube via the KxS webpage www.kxstechnologies.com.

Before performing any maintenance or service on the DCM-20 PASVE® sensor, ensure that the sensor is fully removed from the process pipe.

High temperature

In case of hot process liquid, piping, process connection parts and DCM-20 PASVE® sensor can be hot creating a potential burn hazard. Use Personal Protection Equipment PPE (protective eyewear, clothing, gloves) to avoid burn.

Bright light source

When looking at bright light sources (e.g. LED), temporary reduction in visual acuity and afterimages can occur, leading to irritation, annoyance, visual impairment, and even accidents, depending on the situation. Avoid looking into the LED and optical measurement window in close proximity.

Electrical safety

Only licensed or authorized personnel may install or connect electrical components. Follow local and state legislation and regulations.

DCM-20 overvoltage is category I and pollution degree 2.

High pressure

Always ensure that the steam/hot water wash lines are un-pressurized before mounting/removing the optical window cleaning nozzle in/from process piping.

3. Introduction

3.1 KxS Retractable refractometer DCM-20 PASVE® systems

The KxS Retractable Process Refractometer DCM-20 PASVE® is a heavy-duty industrial instrument designed for reliable inline dry solids content measurement in kraft chemical pulp mill processes.

KxS offers three (3) specialized DCM-20 PASVE® system configurations: For black liquor, green liquor and brown stock washing, each engineered to meet the specific demands of the application.

All DCM-20 PASVE® sensors are interchangeable, covering the full R.I. range of 1.32…1.56 and all pulp mill dry solids content measurement applications up to 85 % (see Figure 1). This reduces complexity in spare unit and spare part management and stocking.

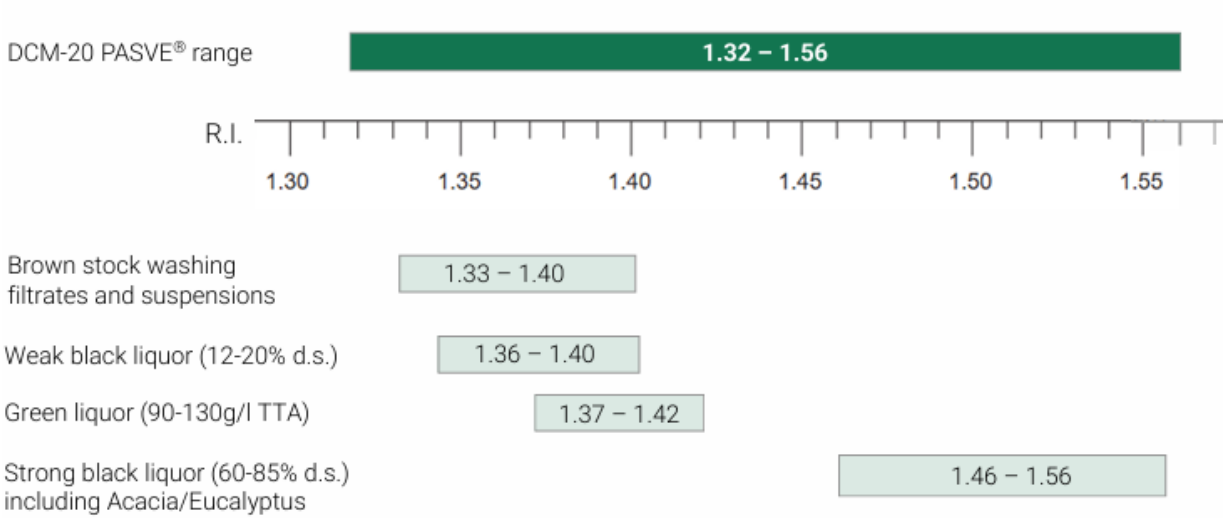


Figure 1 DCM-20 PASVE® rangeability: One sensor fits all pulp mill applications.

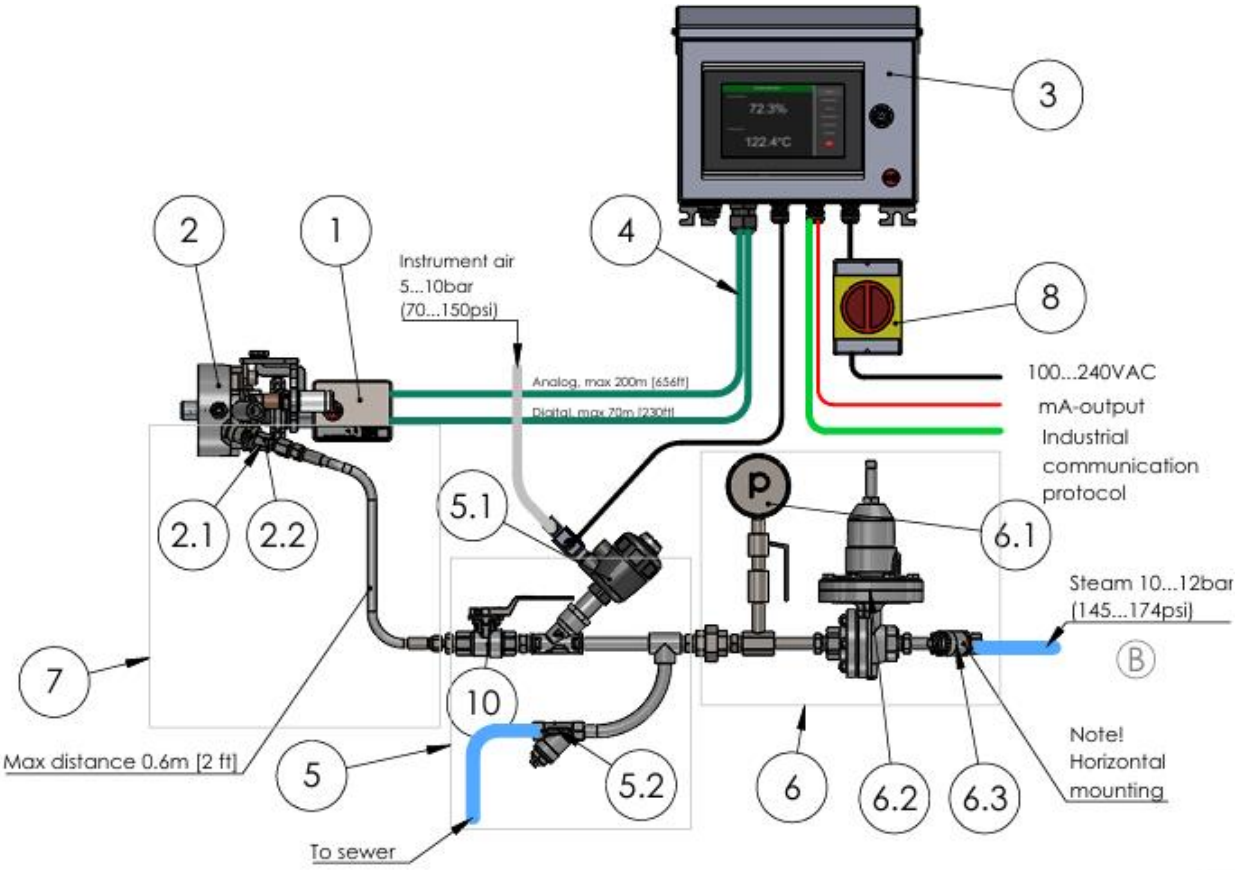
Trademarks

PASVE® is a registered trademark of SATRON® Instruments Inc.

3.1.1 Retractable refractometer DCM-20 PASVE® system for black liquor

The DCM-20 PASVE® system for black liquor dry solids measurement in evaporators and recovery boilers consists of the following (for detailed description of system components, see Fig.2):

- Retractable refractometer DCM-20 PASVE® sensor
- PASVE® Isolation valve
- Prism wash system with steam
- Modular connection unit MCU with wash relays



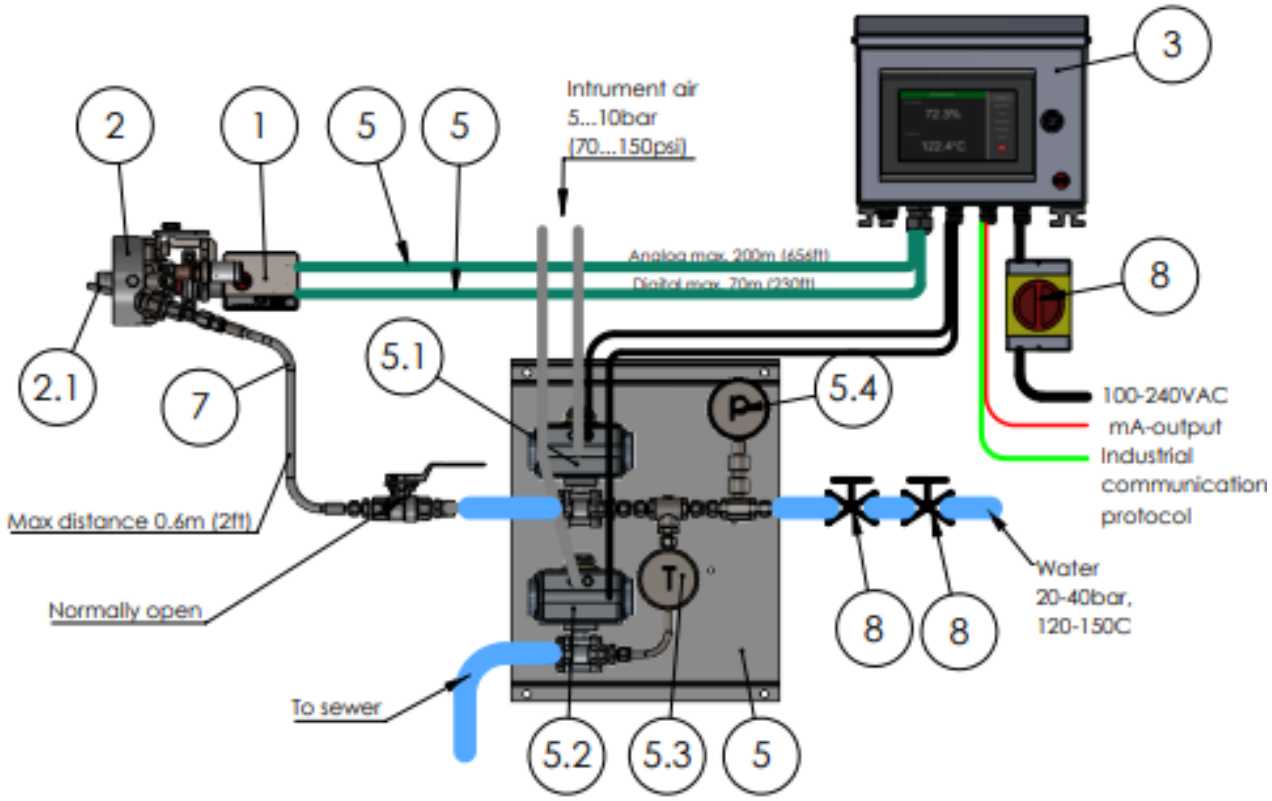
ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	Retractable Refractometer DCM-20 PASVE® Sensor	KxS	1
2	PIV PASVE® Isolation Valve assembly	KxS	1
2.1	SP-1010493 PASVE® Nozzle Steam	KxS	1
2.2	SP-7009 Check valve, SS, PTFE, 1/4" NPT	KxS	1
3	SP-8000-SSE Modular Connection Unit (MCU)	KxS	1
4	SP-9000 Sensor cable digital/analog	KxS	2
5	SP-7020 Solenoid valve assembly	KxS	1
5.1	Shut-off valve assembly DN15 (1/2") 24VDC	KxS	1
5.2	SP-7011 Steam trap	KxS	1
5.3	DN15 (1/2") Ball valve AISI 316L	KxS/Customer	1
6	SP-7030 Steam pressure reducing valve assembly	KxS/Customer	1
6.1	SP-7013 Steam gauge assembly	KxS/Customer	1
6.2	SP-7012 Pressure reducing valve	KxS/Customer	1
6.3	SP-7003 Strainer	KxS/Customer	1
7	SP-10744 PASVE wash connection set	KxS/Customer	1
8	SP-7010 Mains switch	KxS/Customer	1

Figure 2 Retractable refractometer DCM-20 PASVE® system for black liquor (Drawing 10467-B).

3.1.2 Retractable refractometer DCM-20 PASVE® system for green liquor

The DCM-20 PASVE® system for green liquor Total titratable alkali (TTA) or density g/l measurement after dissolving tank and clarifier in causticizing, is designed to resist heavy scaling and maintain accurate readings using prism wash with hot condensate water. The system consists of the following (for detailed description of system components, see Fig.3):

- Retractable refractometer DCM-20 PASVE® sensor
- PASVE® Isolation valve
- Prism wash system with hot condensate water
- Modular connection unit MCU with wash relays



ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	Retractable Refractometer DCM-20 PASVE® Sensor	KxS	1
2	PIV PASVE® Isolation Valve assembly	KxS	1
2.1	SP-10493 PASVE® Water Steam	KxS	1
2.2	SP-7009 Check valve, SS, PTFE, 1/4" NPT	KxS	1
3	SP-8000-SSE Modular Connection Unit (MCU)	KxS	1
4	SP-9000 Sensor cable digital/analog	KxS	2
5	SP-10779 Wash valve assembly for hot condesate	KxS/Customer	1
5.1	Wash valve 3/8" DN10	KxS/Customer	1
5.2	Preconditioning valve 3/8" DN10	KxS/Customer	1
5.3	Temperature gauge 0-150°C (0-302°F)	KxS/Customer	1
5.4	SP-7013 Pressure gauge 0-60bar (0-870psi)	KxS/Customer	1
6	SP-10744 Flexible wash hose assembly	KxS/Customer	1
7	SP-7010 Mains switch	KxS/Customer	1
8	Seat valve	Customer	2

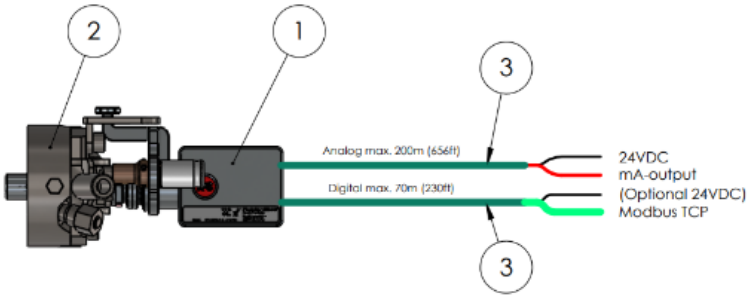
Figure 3 Retractable refractometer DCM-20 PASVE® system for green liquor (Drawing 10780).

3.1.3 Retractable refractometer DCM-20 PASVE® system for brown stock washing

The DCM-20 PASVE® system for Total dissolved solids (TDS) measurement in pulp stock lines in brown stock washing, is optimized for suspensions with abrasive content and minimal wash needs. Additionally, the same KxS DCM-20 PASVE® system can be installed in the incoming and outgoing brown stock filtrate lines. It offers flexibility in setup, allowing for initial installation as a standalone solution and if needed, the system can later be upgraded with steam wash capabilities.

The system consists of the following (for detailed description of system components, see Fig.4):

- Retractable refractometer DCM-20 PASVE® sensor, standalone and with wash nozzle connection plugged; wash can be added later if required
- PASVE® Isolation valve
- For pulp stock lines, PASVE® Isolation valve should be fitted with -PS Protective shield that safeguards prism from bark, wood chips, sand and dirt (see Fig. 5).



ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	Retractable Refractometer DCM-20 PASVE® Sensor	KxS	1
2	PIV PASVE® Isolation Valve assembly	KxS	1
3	SP-9000 Sensor cable digital/analog	KxS	2

Figure 4 Retractable refractometer DCM-20 PASVE® system for brown stock washing (Drawing 10789).

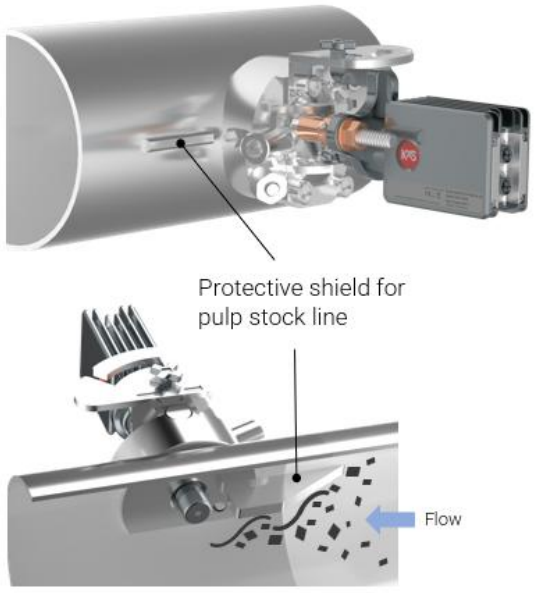


Figure 5 PASVE® Isolation Valve equipped with the -PS Protective shield when installed in pulp stock line.

3.2 Retractable refractometer DCM-20 PASVE® and PASVE® isolation valve

KxS Retractable refractometer DCM-20 PASVE® includes PASVE® isolation valve, which has been an industry standard since the 1980s. The DCM-20 PASVE® ensures a secure connection and maximum operational safety for the process and operators during inline measurements, insertion and removal in kraft pulp mill applications.

Four independent safety layers safeguard operator and prevent unintended sensor removal (Fig. 6):

1. Sensor safety stopper
2. Safety guide
3. Safety clamp
4. Safety thread

⚠ All safety functions are dependent on following KxS specific user safety instructions.

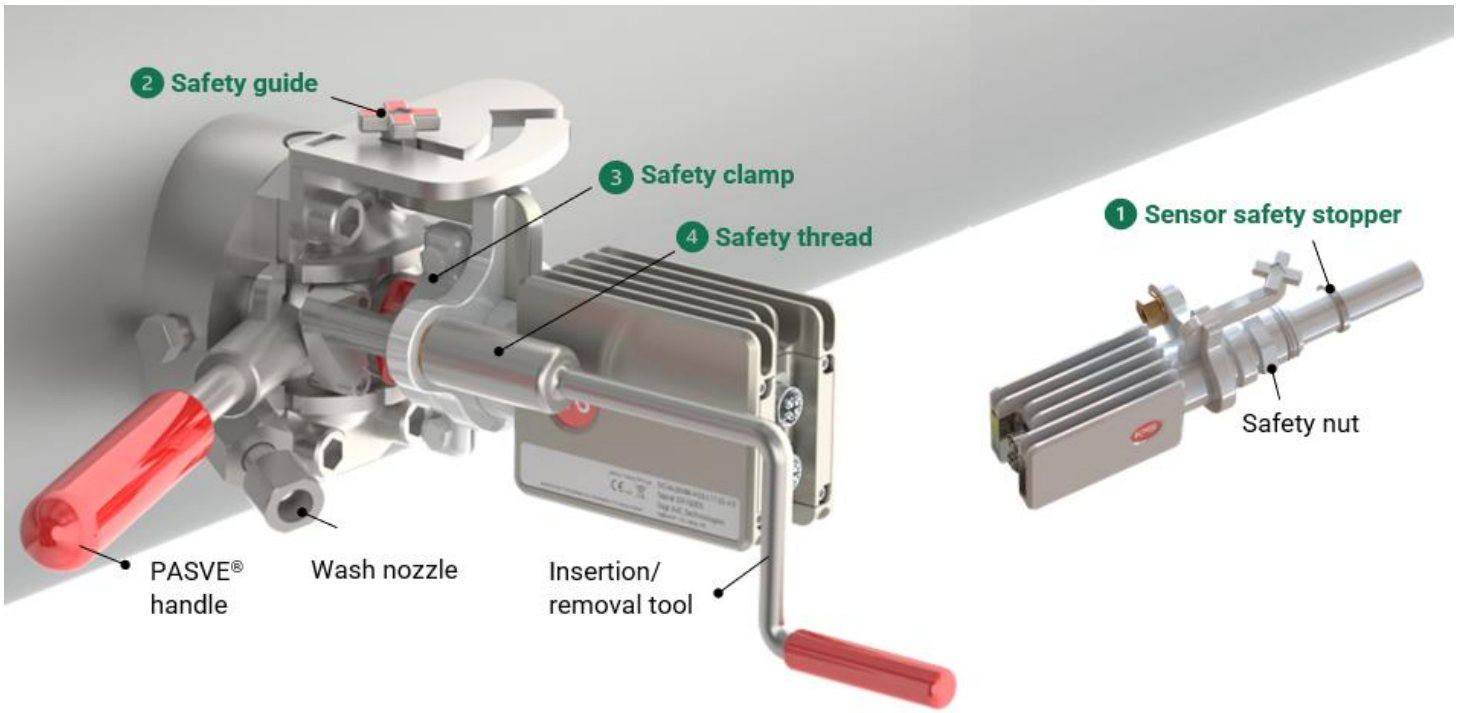


Figure 6 Retractable refractometer DCM-20 PASVE® design and safety mechanisms.

3.3 Modular Connection Unit (MCU) SP-8000

The Modular Connection Unit (MCU) SP-8000 is a vital component when using the DCM-20 PASVE® refractometer system in black liquor and green liquor measurements.

The MCU SP-8000 connects with the DCM-20 refractometer and facilitates direct, easy to use touch screen interface and displays measurement data and diagnostic information locally or to automation systems through analog 4-20 mA and digital Modbus TCP signals. The MCU also includes wash relays that are required to activate the prism wash function at specified intervals.

The power and communication modules are mounted on a DIN rail.

The MCU is housed in stainless steel (1.4301/AISI 304) enclosure with protection rating of IP66 featuring additional top cover and touch screen splatter guard for enhanced protection against dirt, rain and harsh industrial environment in outdoor and pulp mill conditions (see Fig. 7).

The MCU is delivered with mounting plates.

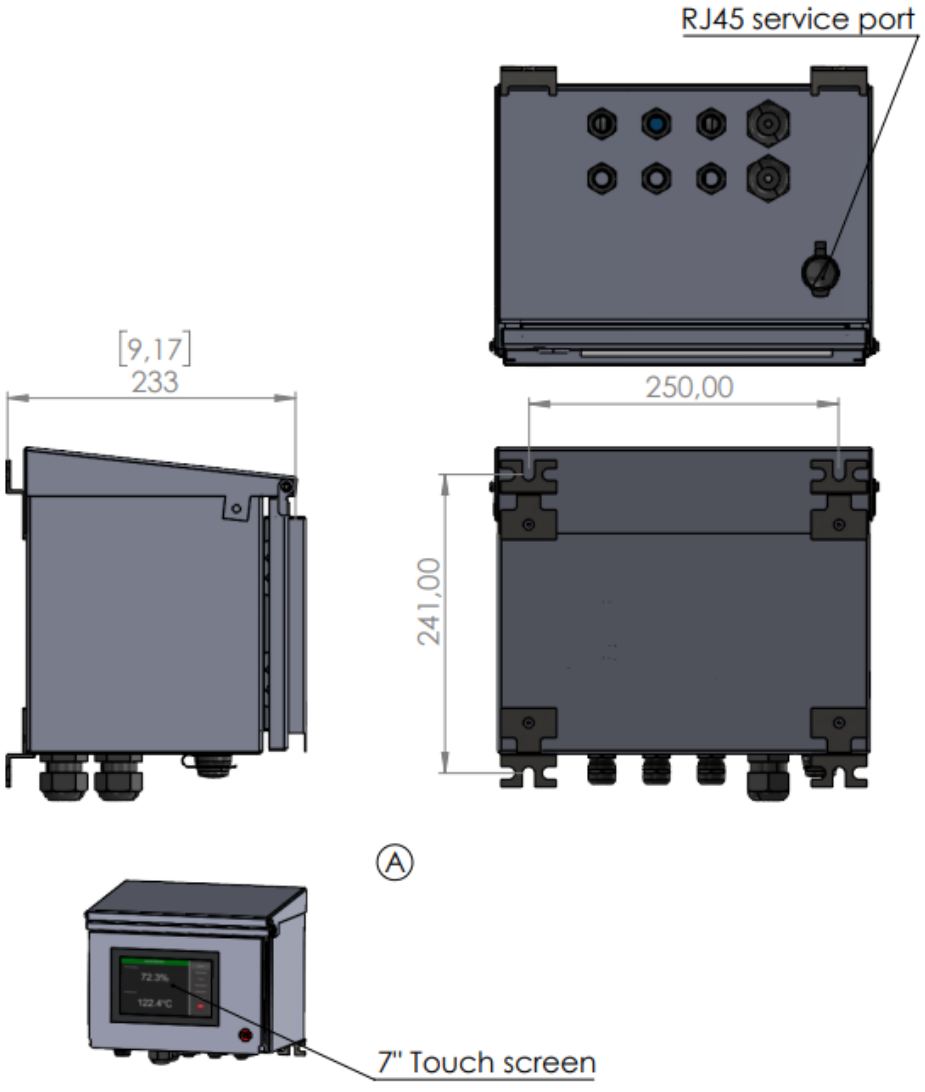


Figure 7 Dimensional drawing of Modular Connection Unit enclosure (Drawing 10528).

3.4 Display options for User Interface access

KxS Technologies offers options for user interface displays. The user interface features and functions are identical regardless of which option is chosen. Product certificates of modules and displays are available per third-party manufacturer.

3.4.1 Computer or mobile device with display and RJ45 Ethernet cable

The sensor cable is assembled to an RJ-45 connector according to the color coding given in Section 4.2 Sensor integration concept. The SP-9310 RJ-45 connector is with corresponding color coding of mode A. The cable is connected to the computer RJ-45 port, or USB-C port when a RJ-45 to USB-C adapter is used. The sensor user interface is accessed as described in Section 4.4 User interface.

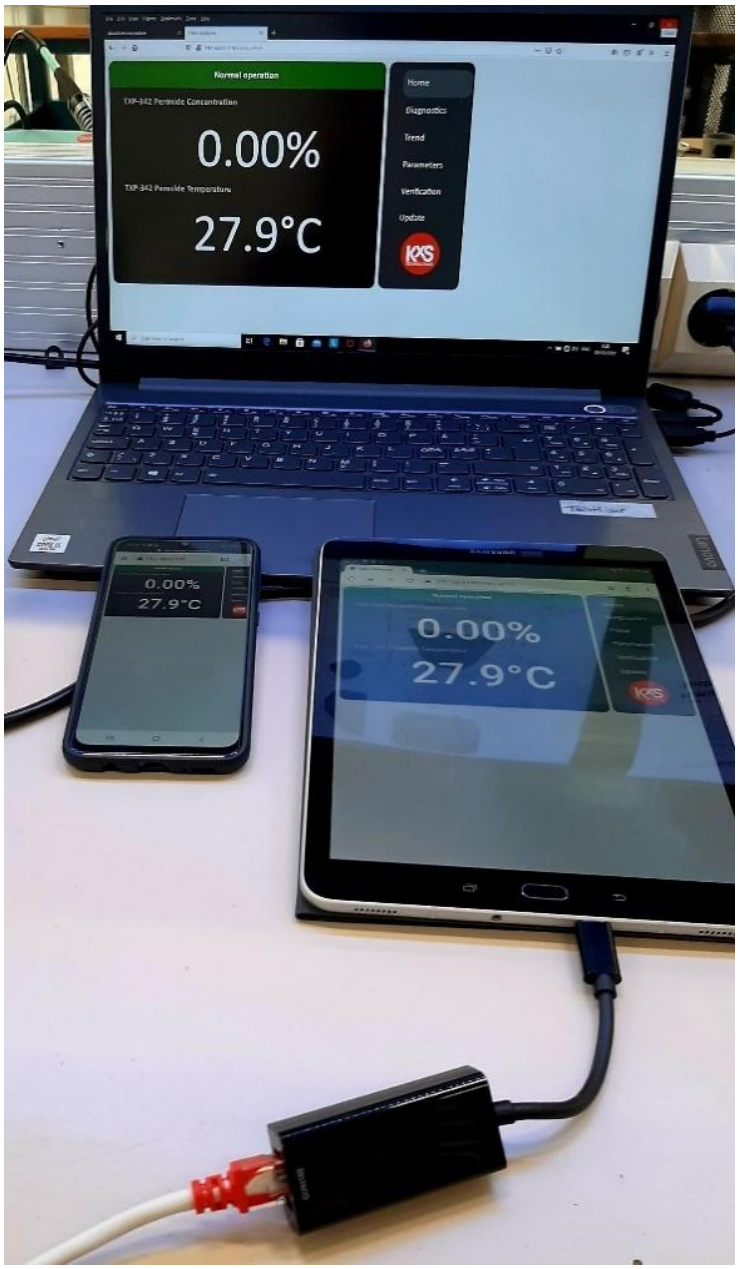


Figure 8 Computer or mobile device used as user interface.

3.5 Sensor M12 cable

Figure 9 Network cable with connector cover 10318 attached (Material 1.4404)., Ethernet CAT6A (10 Gbps), CC-Link IE CAT6A (10 Gbps), 8-position halogen-free, shielded (Advanced Shielding Technology), Plug straight M12 / IP67, coding: X, on free cable end, coding: X.

3.6 Measurement principle

KxS DCM-20 employs the physical phenomenon of Refractive Index to define liquid concentration. Optical concentration measurement is based on Snell's law and the critical angle of total reflection to provide precise readings.

Light is emitted from an LED and directed towards the interface between an optical window and the liquid being measured. As the concentration of the liquid changes, specific angles of the light are totally reflected and partially reflected back, producing light and shadow interface that is captured by a digital camera sensing element (Fig. 10).

This interface is detected by light activated camera pixels and converted into refractive index (RI). The RI values can be directly used or further translated into any concentration units, such as percentage by weight. The DCM-20 includes an integrated pT-1000 temperature element for process temperature measurement and simultaneous automatic temperature compensation of the concentration measurement.

The sensor calibration is performed with NIST traceable standard refractive index liquids and a defined process at KxS Technologies' technology center.

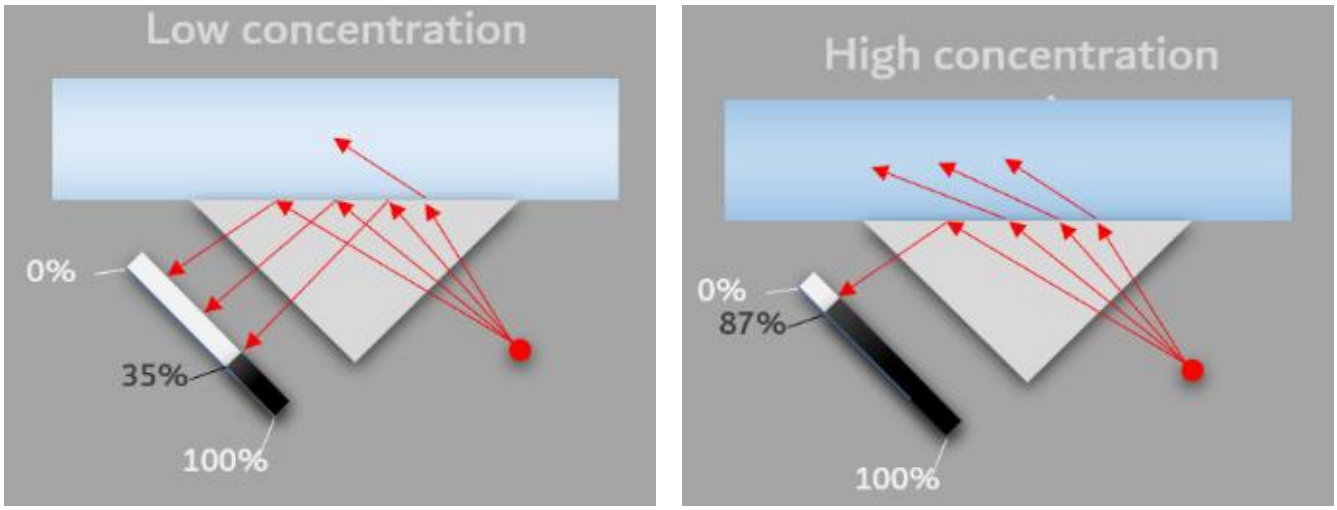


Figure 10 Optical refractive index measurement principle.

4. Connection

The KxS DCM-20 operates with 24VDC input power supply. The communication signal is transferred through either an analog 4-20mA port, or a digital Modbus TCP port. Respective shielded connector port carries a 24VDC input power supply pinout. When the analog output port is chosen, the other digital port is used as a service channel for sensor parameters and diagnostics update in the user interface on a computer web browser, external display, or mobile device. All user interface options can be used simultaneously.

4.1 Sensor connectors

Two independent sensor connectors are available. Both shielded connectors are designed with 24VDC power supply pinouts. The analog port is designed with 2x 4-20mA pinouts. The digital port is designed for Modbus TCP communication output and user interface connection (Fig. 11).

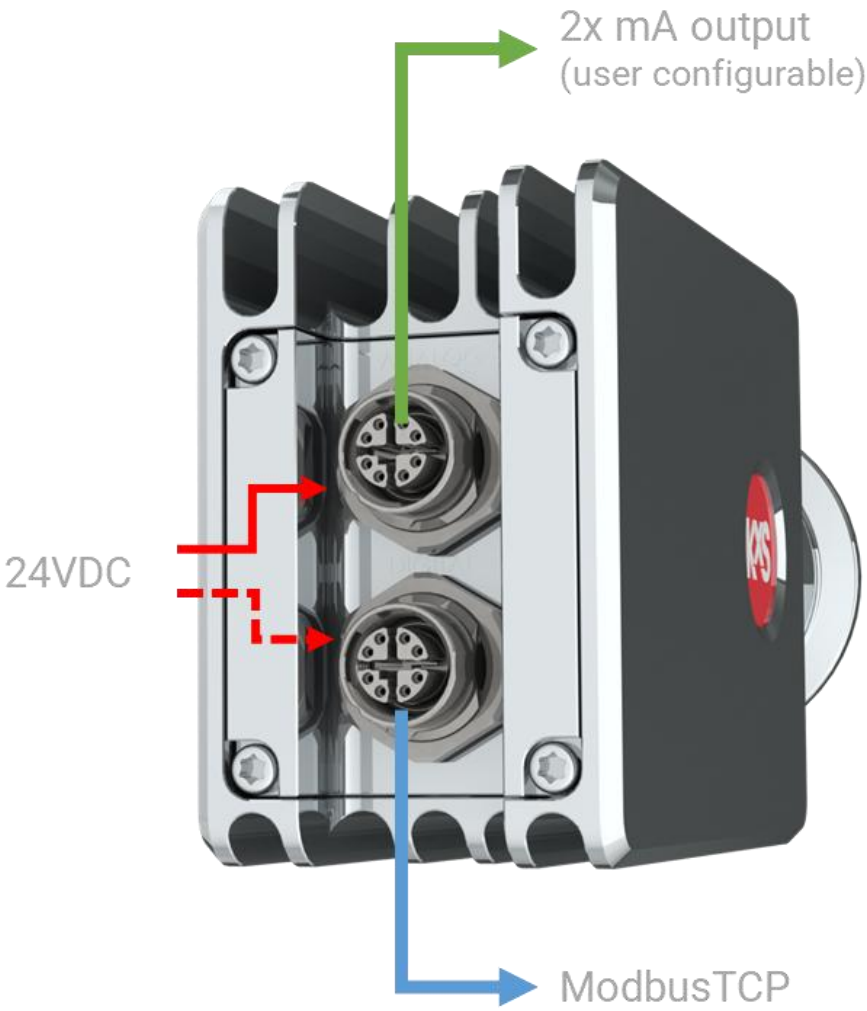


Figure 11 DCM-20 connectors.

4.2 Sensor integration concept

The sensor cable connection is with one identical M12 cable model connected either to the sensor analog or digital shielded connector port. Both sensor connectors can receive 24VDC power input. Both sensor cables can be connected when the analog output is chosen, and the digital connector serves simultaneously as access to user interfaces. A connector not in use should be covered.

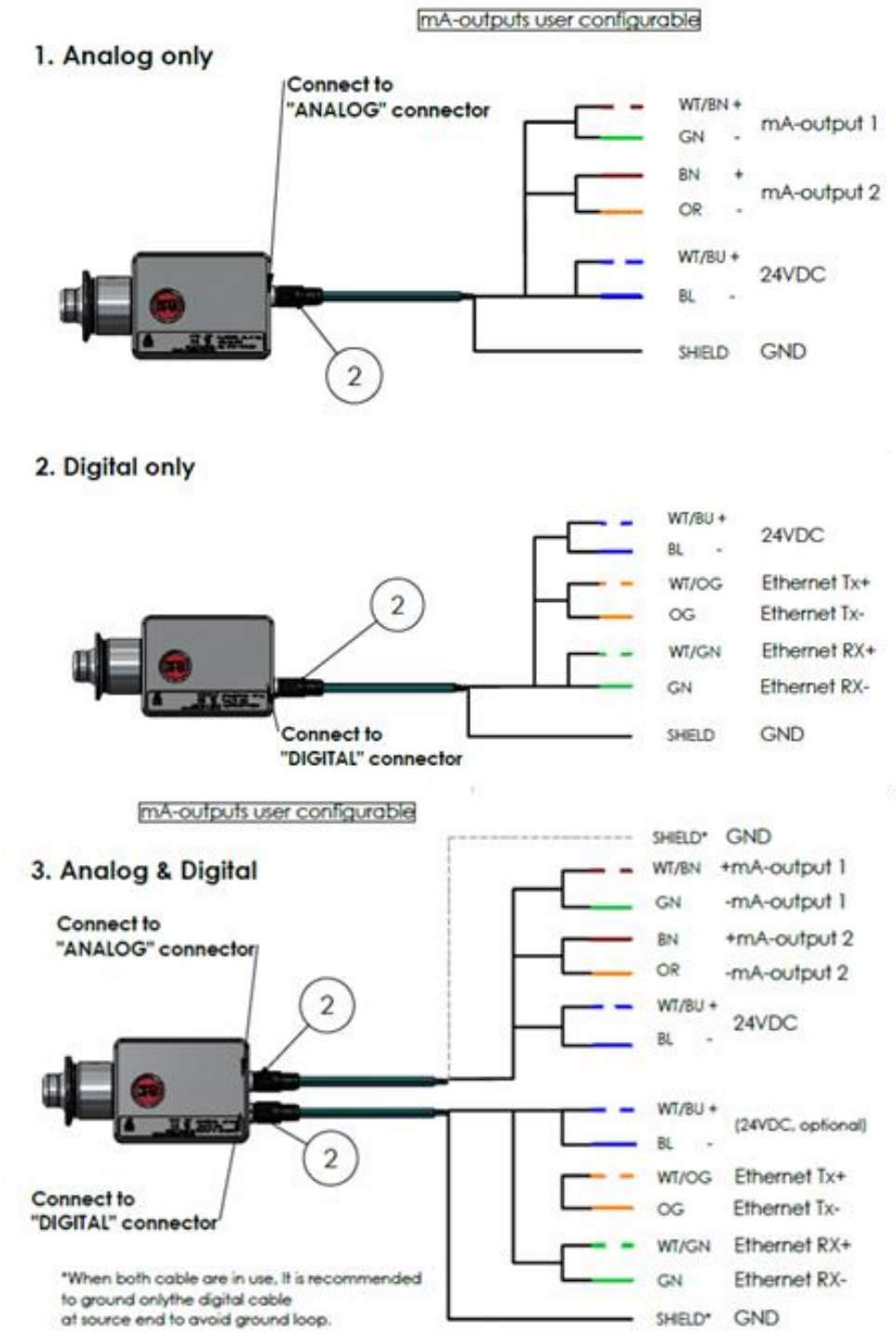


Figure 12 The DCM-20 operation concept. Drawing. 10125.

4.3 Cable connection with electrical modules

Regardless of analog or digital output port connection, one identical cable model serves both options. The shielded cable has 24VDC power supply wires, Ethernet CAT 6A communication wires, and analog communications wires for 2x 4-20mA outputs.

The SP-9000 sensor cable provided is with a M12 SPEEDCON male connector (IEC 61076-2-109) attached to the corresponding sensor female connector. The twisted pair cable structure is according to 4x2xAWG26/7; S/FTP. The outer sheath material is polyurethane PUR water blue RAL 5021.

The cable end is free with 8 wires following given pinout schedules below.

When **sensor analog output** is chosen, the 8 free-end cable wires are connected to the power supply SP-9400 according to Fig. 13. leaving 4 wires for the 2x analog mA signal connection.

Analog connector (M12 X-code)

Pin no.	Description	Wire color
1.	Not connected	WH/OG
2.	Current out 2-	OG
3.	Not connected	WH/GN
4.	Current out 1-	GN
5.	Current out 1+	WH/BN
6.	Current out 2+	BN
7.	24VDC+	WH/BU
8.	24VDC-	BU

Figure 13 Wiring pinout schedules for analog output connection

Digital connector (M12 X-code)

Pin no.	Description	Wire color
1.	Ethernet Tx+	WH/OG
2.	Ethernet Tx-	OG
3.	Ethernet Rx+	WH/GN
4.	Ethernet Rx-	GN
5.	Not connected	WH/BN
6.	Not connected	BN
7.	24VDC+	WH/BU
8.	24VDC-	BU

Figure 14 Wiring pinout schedules for digital output connection

When **sensor digital output** is chosen, the 8 free-end cable wires are connected to the power supply SP-9400 and RJ-45 connector SP-9310 according to the pinout schedule in Fig.14.

The RJ-45 connector is connected to the industrial ethernet switch SP-9320 with 4+1 available ports. The industrial ethernet switch serves connection of industrial communication protocol converter modules, external displays, and WLAN modules.

When the digital Modbus TCP signal is chosen, an additional module is available for conversion to other industrial protocols, for example Ethernet IP or ProfiNet. See separate third party user's manual for the industrial protocol converter modules.

4.4 User interface

Every sensor is delivered with the factory default IP address of 192.168.0.100. The sensor user interface is accessed through the sensor digital port when connecting the sensor to a computer with a web browser, external display, or mobile device. The sensor digital output port carries the Modbus TCP signal and connects to the user interface with a standard RJ-45 connector. The factory set sensor IP address 192.168.0.100**.** is entered in the address field of a computer web browser, external display, or mobile device. The homepage offers access to measurement values and diagnostics, configuration of parameters and verification of sensor calibrations. KxS Technologies recommends using Google Chrome or Microsoft Edge web browsers.

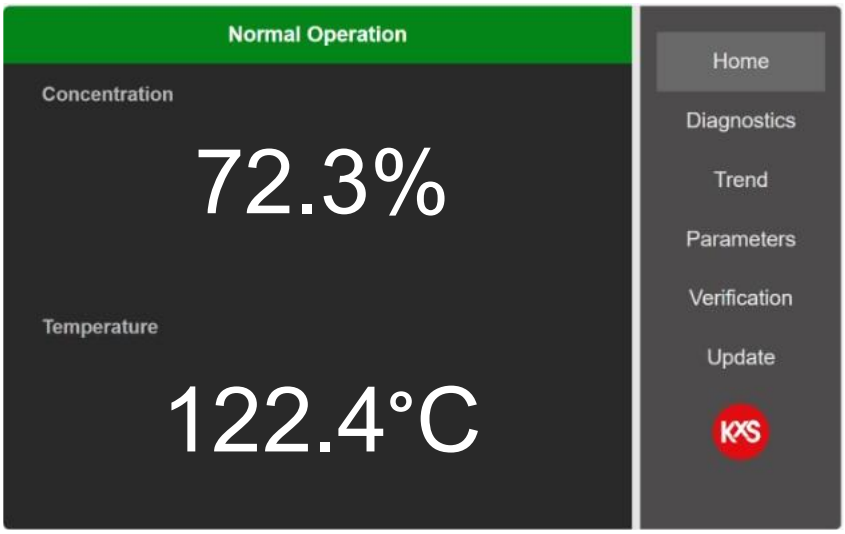


Figure 15 Sensor homepage of user interface on a computer web browser or external display SP-9500/SP-9520.

4.4.1 PC/Computer setup

Verify in the computer command prompt, (in Windows, press Start button and type *Command Prompt*) by typing *ipconfig*, that the computer IP address is set to the same 192.168.x.y network. The last two digits .x.y on the computer must not be the same as the corresponding for the sensor IP address .0.100.

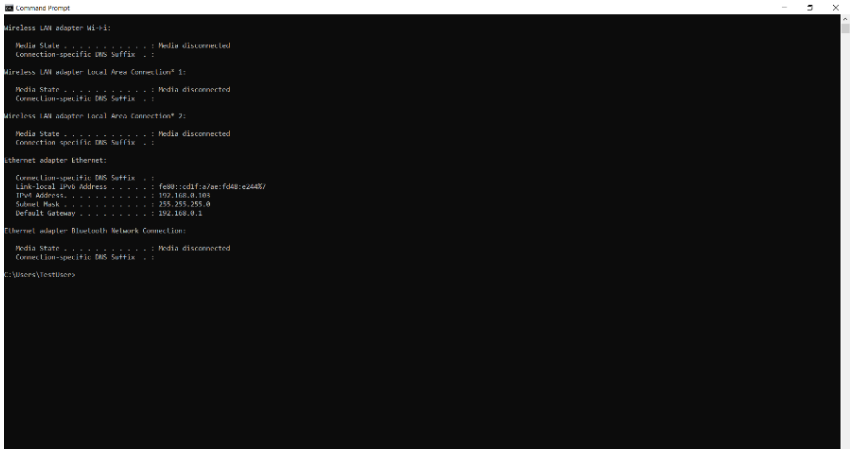
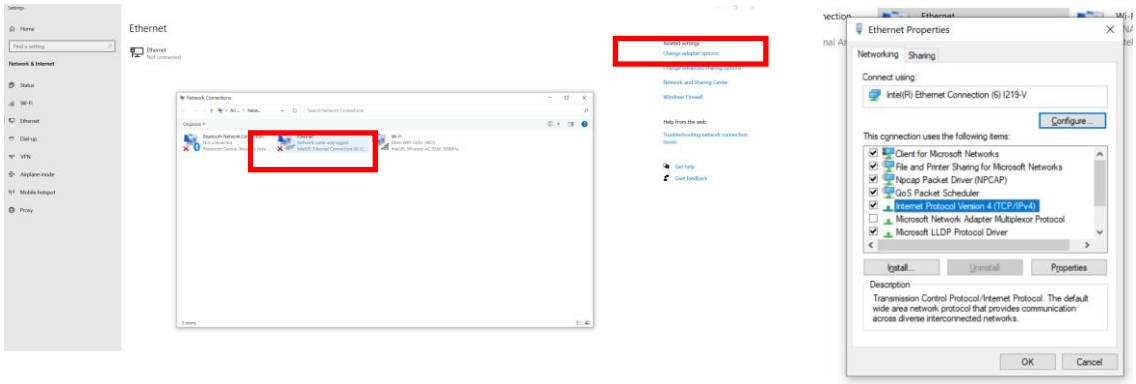
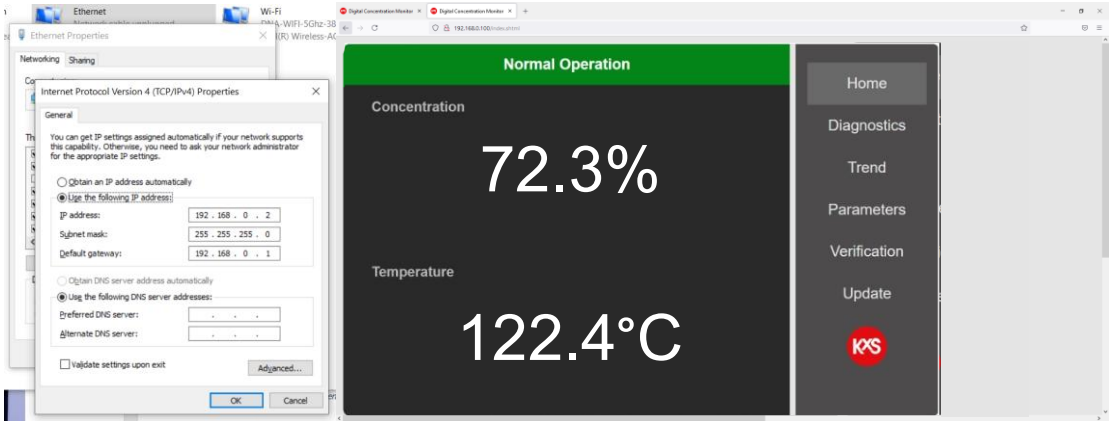


Figure 16 Command prompt on computer for IP address verification.

In the PC Start menu by typing Ethernet, the IP setting window is accessed. By going to *Change adapter settings*, a window will open where *Ethernet* is chosen. A new window for *Ethernet Properties* opens, where *Internet Protocol Version 4 (TCP/IPv4)* is double-clicked.



Unless the PC *obtains the IP address automatically* in the 192.168.x.y domain, the IP settings are changed to *Use the following IP address*. The PC IP address must not be the same as sensor default address. The PC IP address can be for example 192.168.0.2. Subnet mask: 255.255.255.0. Press OK, close, and open a web browser where the sensor IP address is entered in the address field.



4.4.2 MCU display setup

An external industrial display is available with a 7” multi touch panel mount design for user interface and displaying values and diagnostics locally. The display is powered with 24VDC. The sensor Ethernet cable is connected to the ´display with a RJ-45 port shown in Fig 17. When the display is powered up, opt for the configuration page during display start-up.

Figure 17 Cable connections to the external display and activation of configuration page during power up.

If the sensor's IP address is changed to fit the local network, the MCU display must be configured to match the new sensor IP address.

To set up the display panel's IP address go to section *Network* and dial in settings as in Fig 18. Select Static IP. IP address with 192.168.0.y where y is any other ending than the corresponding for the sensor IP. Subnet Mask 255.255.255.0. Confirm by pressing √.

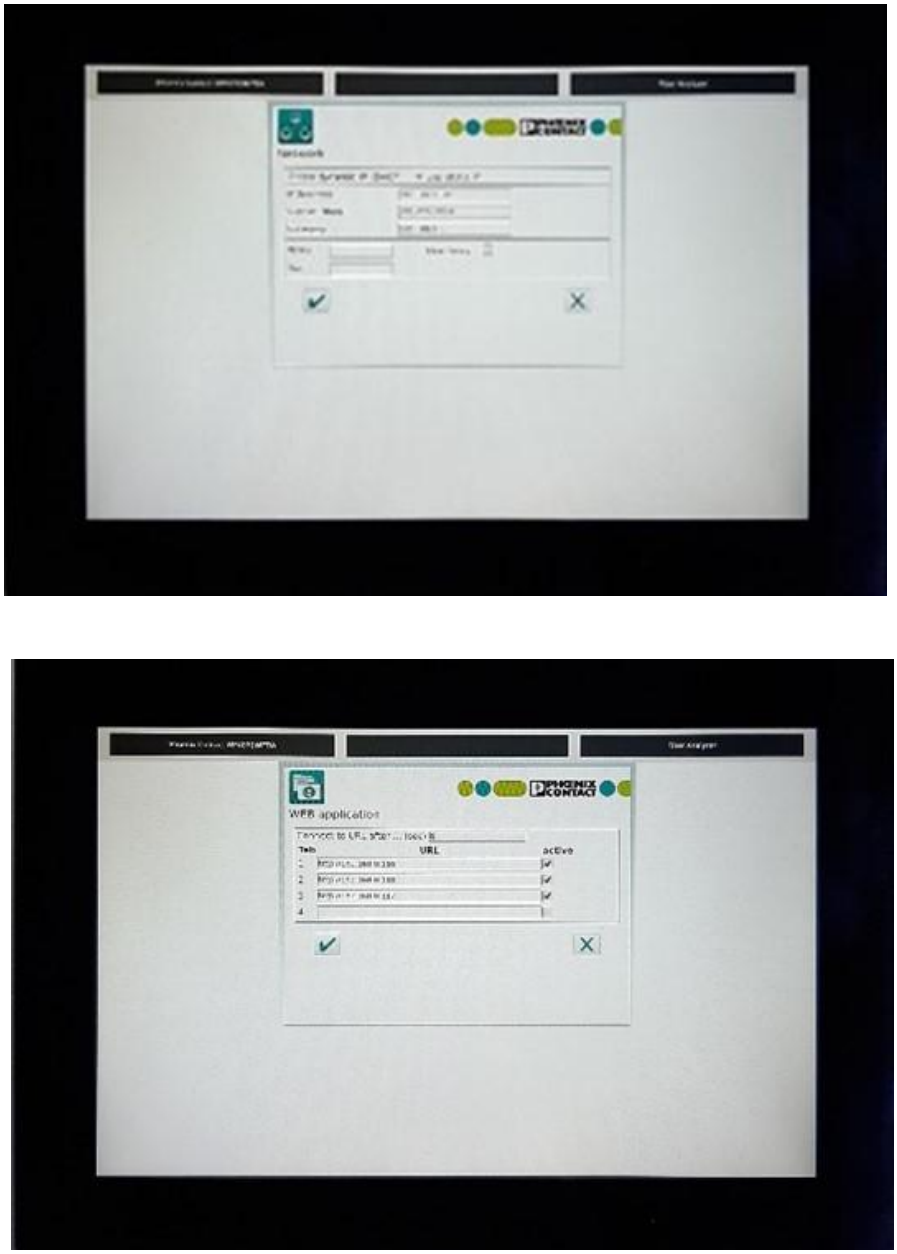


Figure 18 Display IP settings in section Network and connecting display to sensor IP in section Web application.

The touch panel unit can display four sensors by selecting respective sensor IP line ‘active’ in section *Web application* of the display user interface. Confirm by pressing ✓. The settings are applied by pressing the Restart button seen in Fig 19.

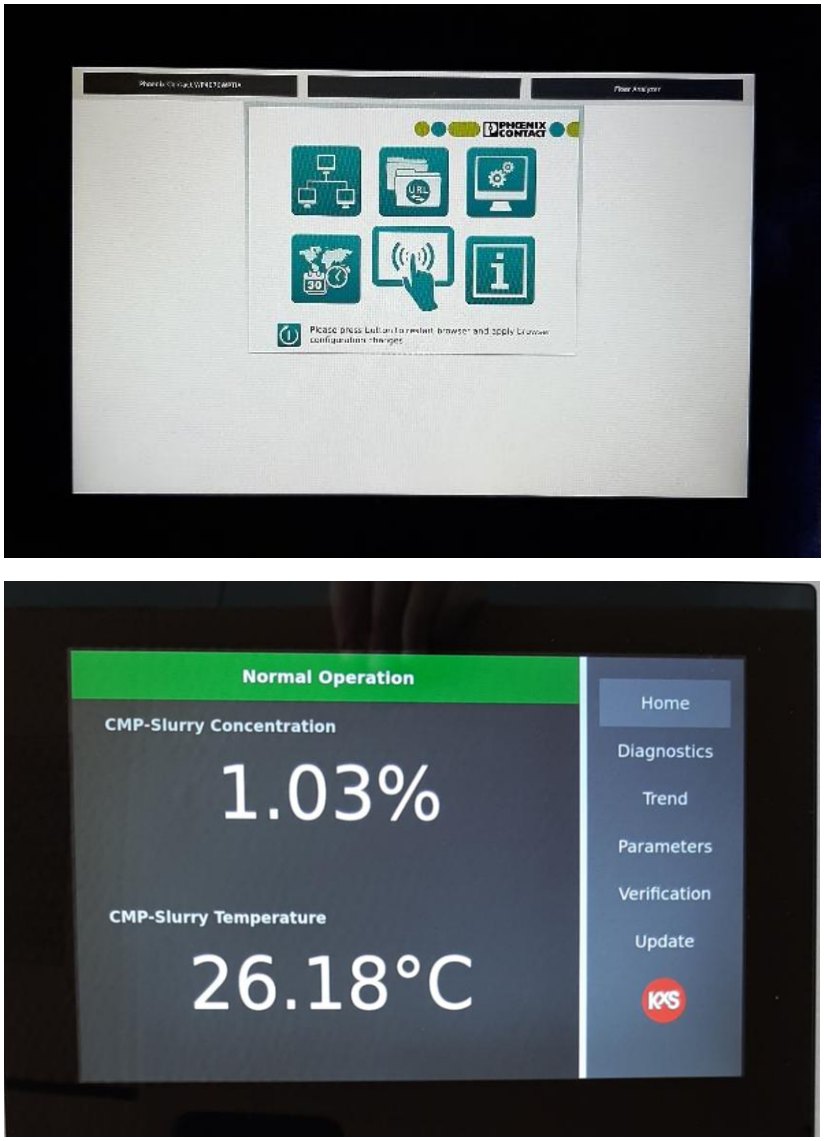


Figure 19 Restart the display by pressing the lower left button on the display to apply configuration settings and changes for activation of the sensor user interface homepage.

4.4.3 Mobile device setup

A mobile device with a USB-C port can be connected to access the user interface. An Ethernet cable from the industrial switch is connected through a standard RJ-45 to USB-C adapter. The USB-C connector is connected to the mobile device.

The mobile device is set to Airplane mode. Following the mobile device *Settings* path from left to right in Fig. 20, allows access to the sensor user interface. When the settings are done, open a web browser and type the sensor IP address in the address field (default: 192.168.0.100).

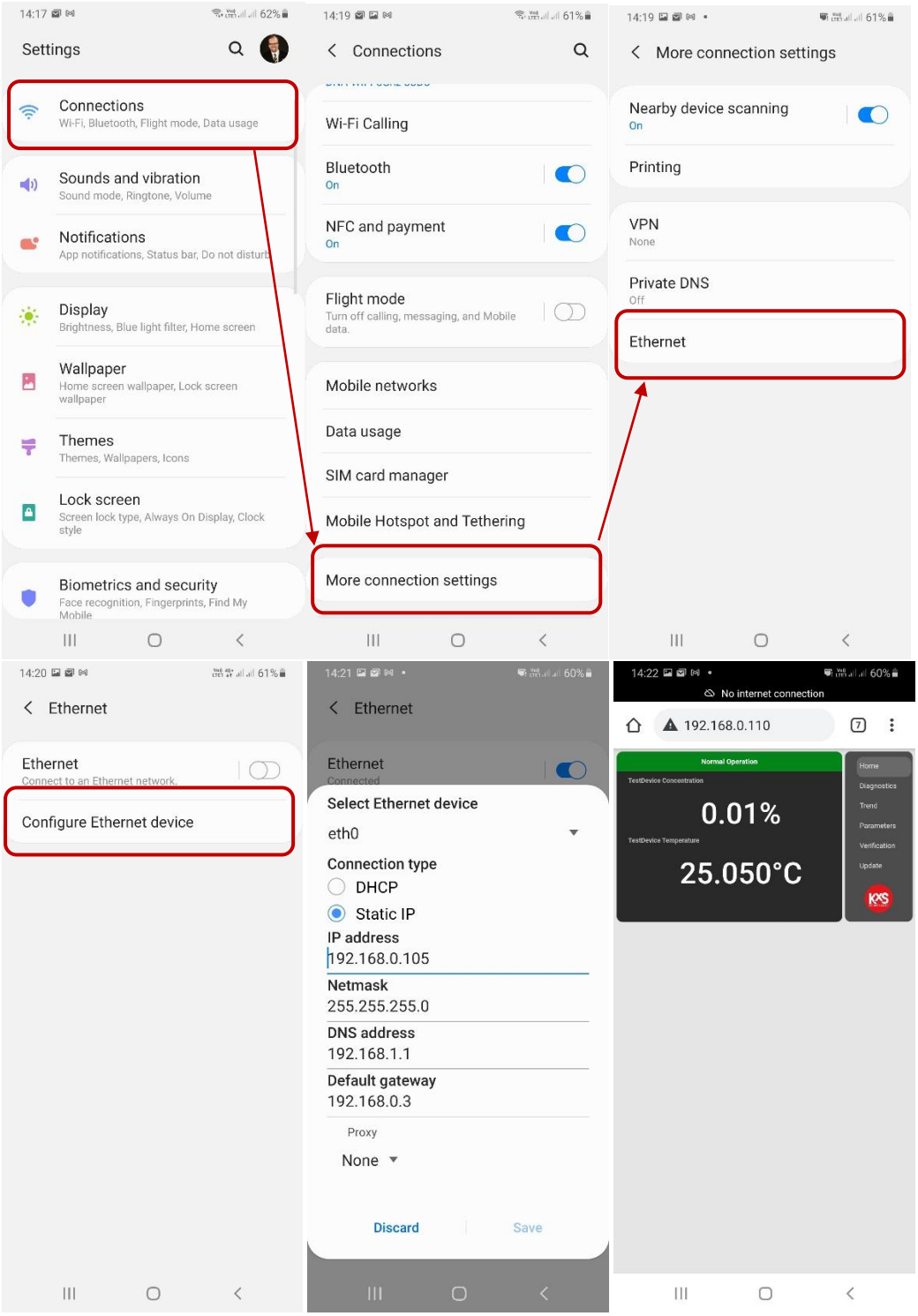


Figure 20 Mobile device setting path for IP configuration and access of sensor user interface homepage.

5. Installation, insertion and removal

5.1 Installation guidelines

The Retractable refractometer DCM-20 PASVE®, with its compact and lightweight design, offers exceptional flexibility for choosing installation points either in vertical or horizontal pipelines.

The recommended sensor mounting location is such where the sensor is accessible for cable connection, and easy insertion and removal for maintenance and service. Recommended installation height at waist level (1 m (3 ft)). Recommended free space around PASVE® system: 2 meters (minimum 1 meter).

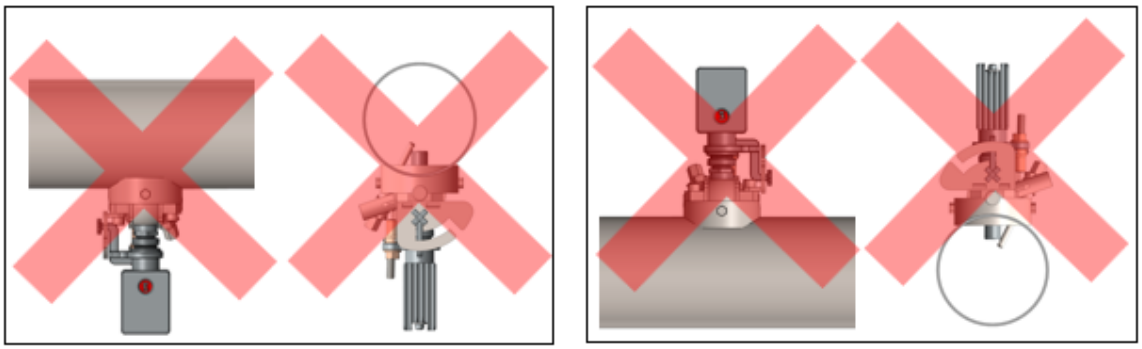
Always select a straight section of the pipe for sensor installation. Secure **at least 10 times the pipe diameter (D)** of straight pipe **before and after the installation point** to achieve laminar flow and optimal sensor performance.

⚠ **IMPORTANT: Horizontal** pipe installation: Position the sensor head in a lateral orientation (on the side of the pipe). Ensure the flow direction is from left to right.

⚠ **IMPORTANT: Vertical** pipe installation: The flow must be directed upwards to maintain a full pipe during operation.

⚠ **WARNING**: **Do not install PASVE® system above (under) or below (top) of pipe (see illustration below). Rationale:**

- **Safe operation is compromised** as insertion and removal becomes difficult
- **Measurement reliability is compromised.** Air pockets in partially filled pipes can significantly affect the reliability of refractometers installed on top.



The recommended flow velocity is 1 m/s (3 ft/s), which corresponds to a flow rate of 70 liters per minute (LPM) in a 1.5” process pipe and 270 LPM in a 3” pipe.

The installation of the Retractable refractometer DCM-20 PASVE® system involves the following key steps:

1. Disassembling PASVE® isolation valve components
2. Cutting an opening and welding PASVE® valve body to pipeline
3. Reassembling PASVE® isolation valve components
4. Installing prism wash system
5. Installing Modular connection unit MCU
6. Insulating the process pipe
7. Inserting Retractable refractometer PASVE® sensor and wash nozzle into pipeline

For more information on safe operation, please refer to the following resources:

- KxS DCM-20 PASVE® Insertion and removal guide.
- Instructional video on insertion and retraction available on YouTube via the KxS webpage www.kxstechnologies.com.

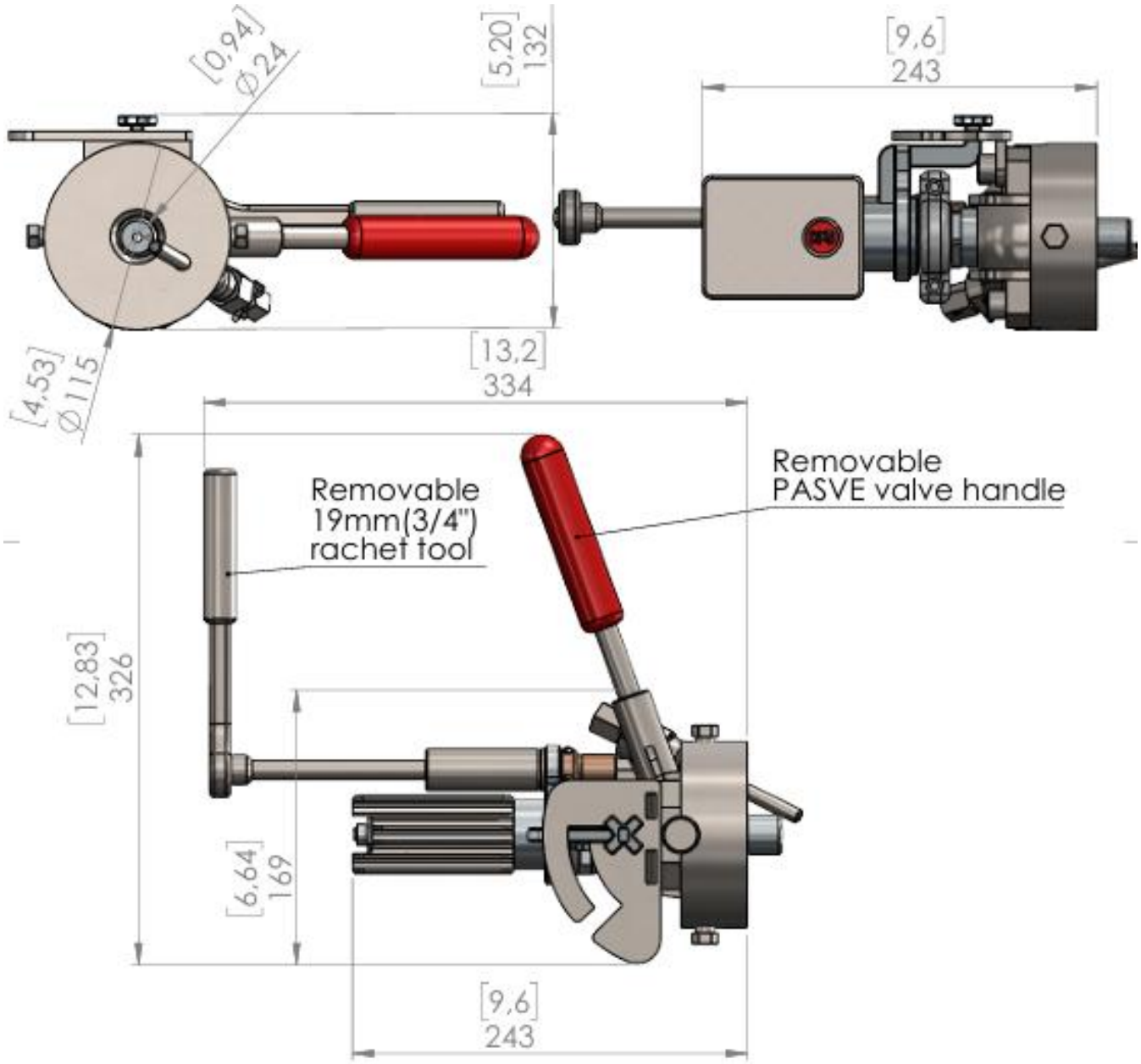


Figure 21 Retractable refractometer DCM-20 PASVE® sensor and isolation valve system (Drawing 10482-A).

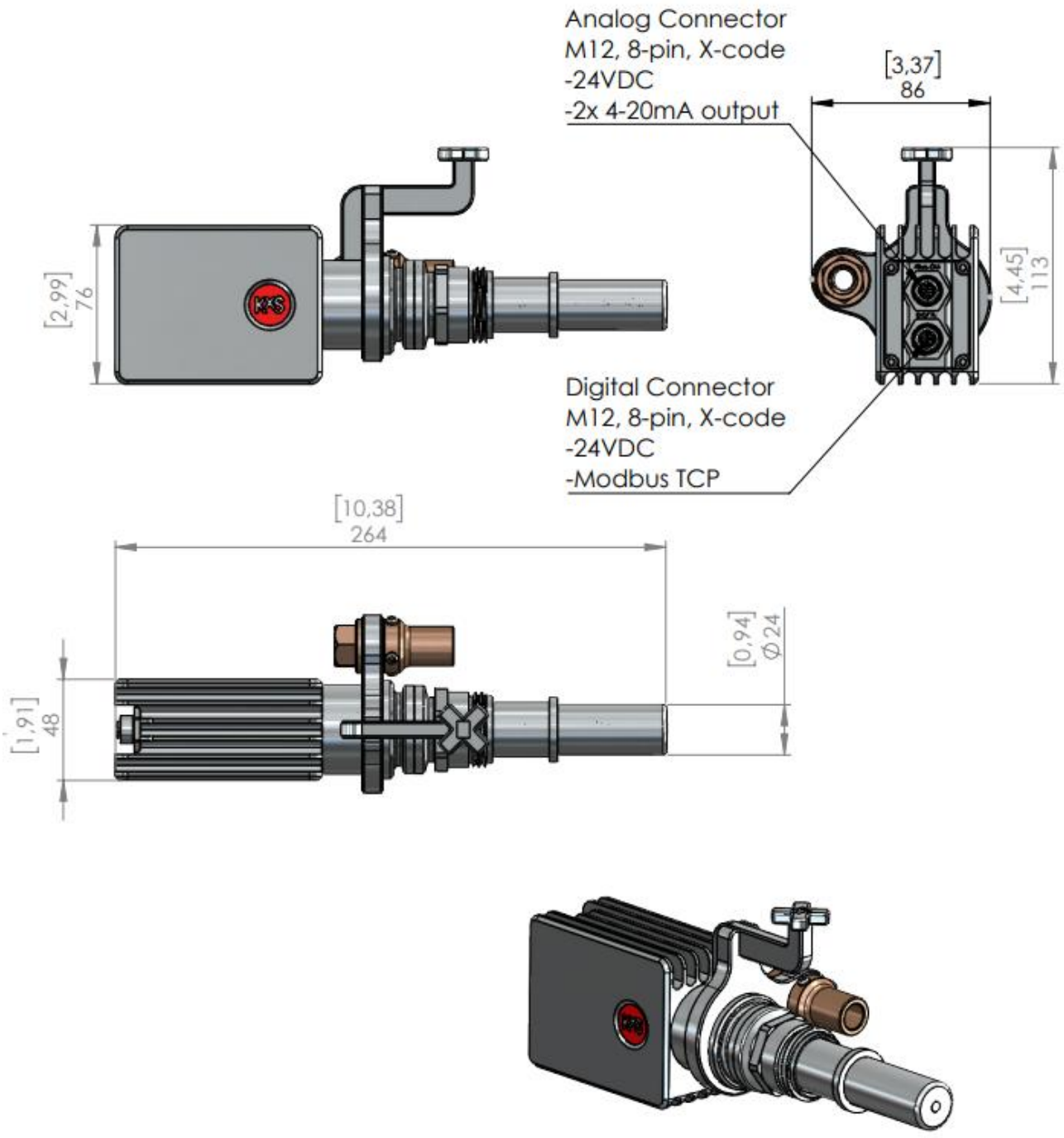


Figure 22 Retractable refractometer DCM-20 PASVE® sensor (Drawing 10526).

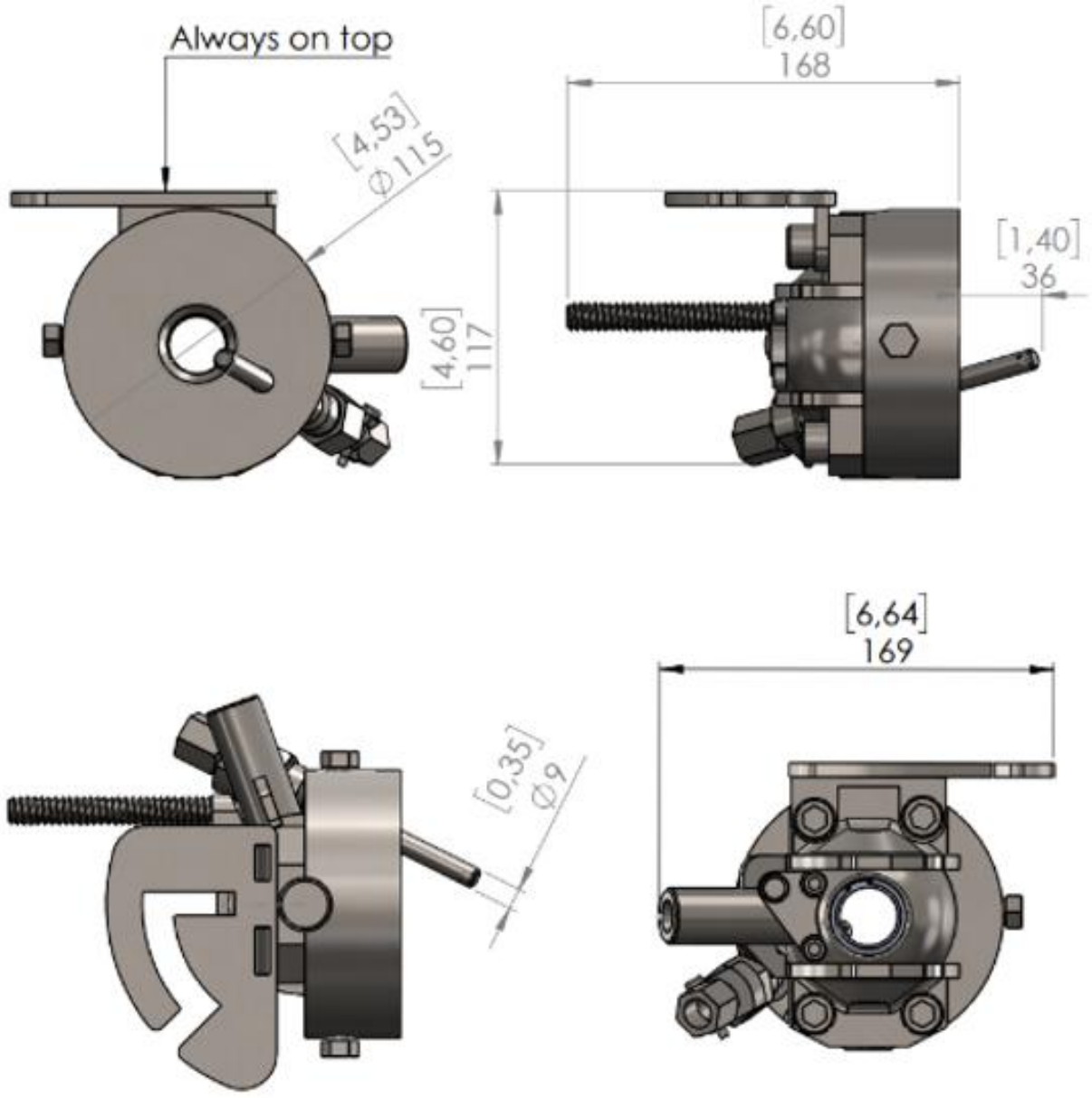


Figure 23 PASVE® isolation valve with steam or water wash nozzle (Drawing 10786).

5.2 Disassembling PASVE® isolation valve components

⚠ **IMPORTANT:** To avoid thermal damage to the isolation valve sealing, the valve body must be separated from the valve assembly and the smaller gasket be removed before welding into the process pipeline (Fig. 24).

NOTE: Be very careful not to drop or lose any parts that come loose when separating the body from the assembly.

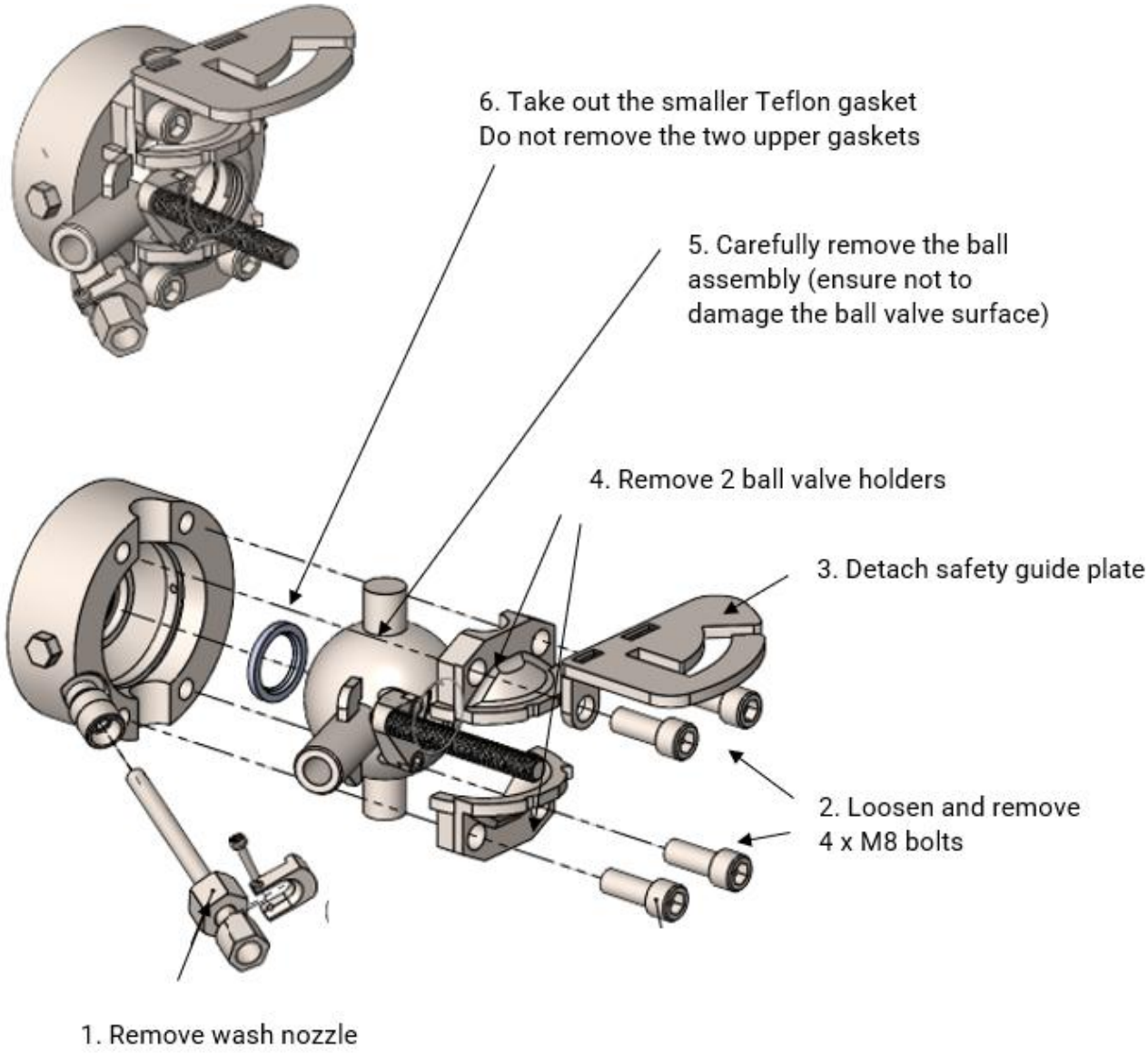


Figure 24 Disassembling the PASVE® valve components from the valve body (Drawing 10724).

5.3 Cutting an opening and welding PASVE® valve body to pipeline

⚠ **IMPORTANT:** The PASVE® isolation valve components must be disassembled, and the smallest valve body gasket and the sensor be removed before welding the PASVE® valve body in the process pipeline.

Welding precautions

- **Material specifications:** The PASVE valve body is made of SAF2205 Duplex steel (EN 1.4462, ASTM S32205/S31803). Ensure that the welding method and filler material are appropriate for this specific grade of Duplex steel to maintain the integrity and corrosion resistance of the valve.

- **Welding guidelines:** Welding must be done in 6 sequences (see Fig. 25). Refer to Fig. 27 for horizontal pipe and Fig. 28 for vertical pipe installation. These drawings provide detailed welding instructions and information on cutting opening and welding sequences, and heat input control to ensure a robust and reliable weld.

  ⚠ **IMPORTANT:** The welding must be carried so that the body temperature remains as small as possible. Additional cooling is recommended. Max. temperature for the gaskets is 250°C (482°F).

- **Regulatory compliance:** Follow all local welding codes and regulations to ensure safety and compliance. It is crucial to follow the prescribed welding standards to prevent structural weaknesses or failures.

- **Standards and recommendations:** It is strongly recommended to follow the relevant EN and ASTM standards applicable to welding SAF2205 Duplex steel.

Pre-welding preparation:

- Assess the materials and shapes of the welded components to determine the appropriate tools, cleaning methods, and any necessary preheating. Preheating is especially important in minimizing the risk of thermal cracking and ensuring a uniform weld.

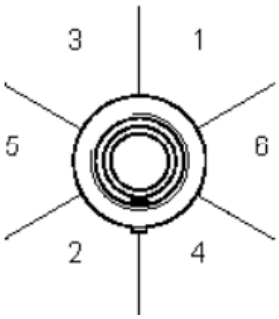


Figure 25 Welding must be done in 6 sequences as shown here.

Cut opening for pipeline connection using the installation guide sticker delivered with your package (See Figure 26). Cut the opening for welding connection into the right size according to your pipe size.

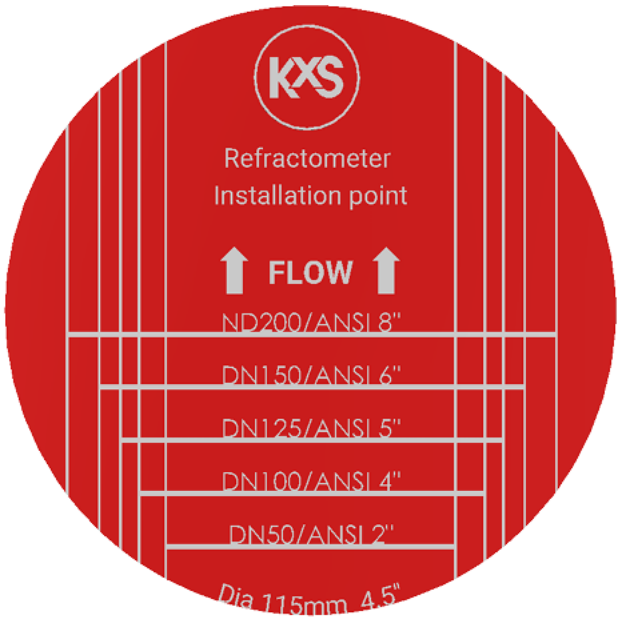
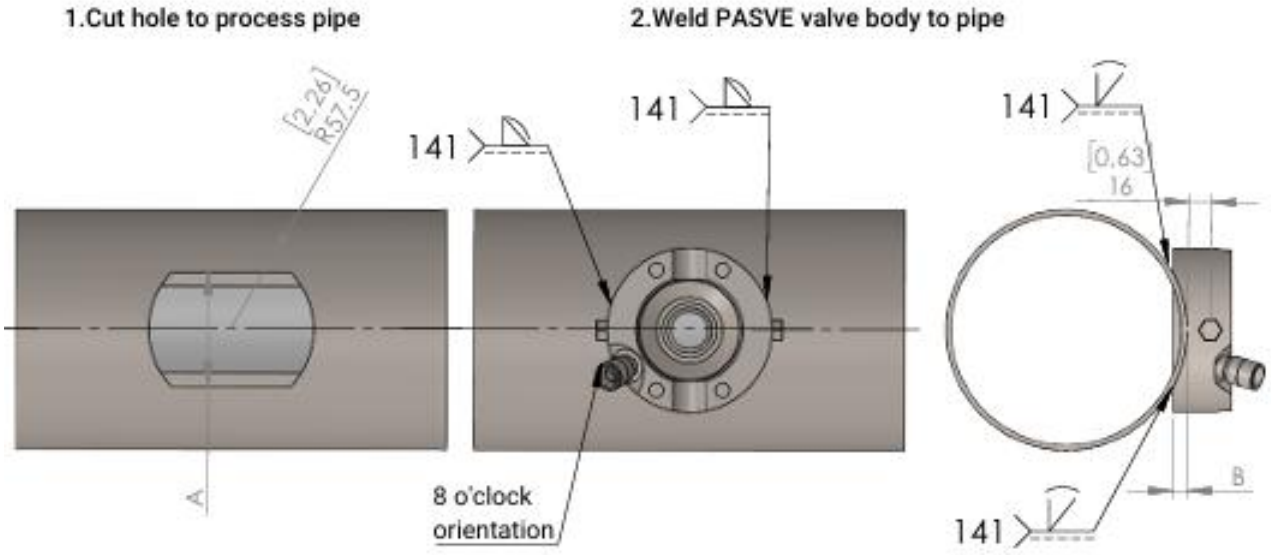


Figure 26 KxS DCM-20 PASVE® installation guide sticker (Drawing 10799).



Weld in 6 sectors and let cool down between sectors.
Seal inside the valve withstand max 250°C (480°F)

Pipe size	Cut width (A)	Cut depth (B)
DN50/ANSI 2"	54 (2.13")	17 (0.67")
DN65/ANSI 2.5"	61 (2.4")	15 (0.59")
DN80/ANSI 3"	67 (2.64")	15 (0.59")
DN100/ANSI 4"	65 (2.56")	10 (0.39")
DN125/ANSI 5"	72 (2.83")	10 (0.39")
DN150/ANSI 6"	80 (3.15")	10 (0.39")
DN200/ANSI 8"	92 (3.62")	10 (0.39")

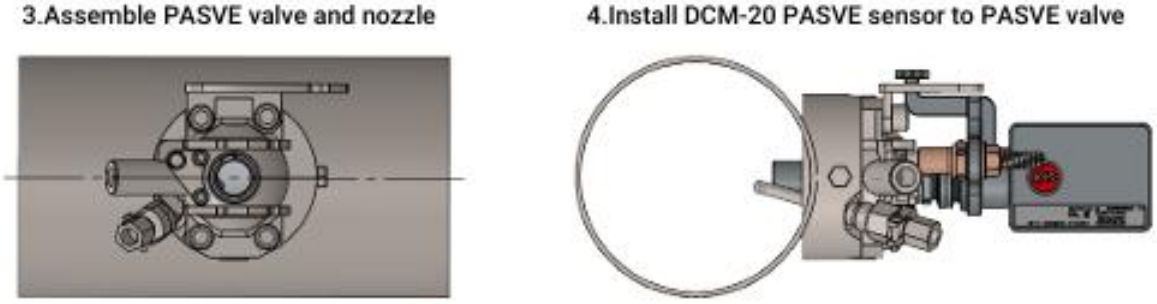
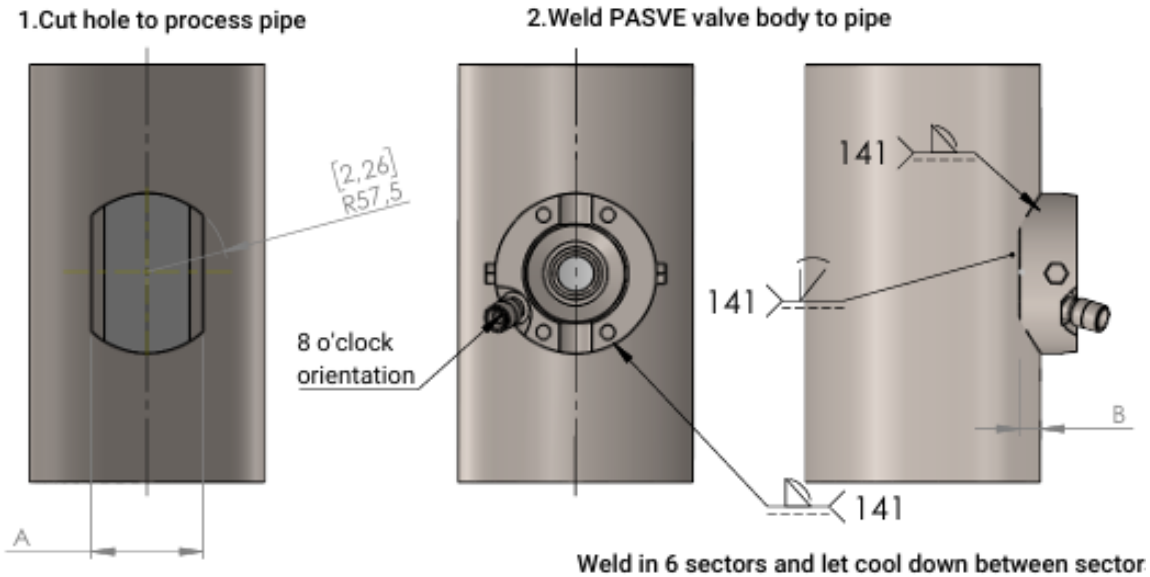


Figure 27 PASVE® installation in horizontal pipeline (Drawing. 10729).



Pipe size	Cut width (A)	Cut depth (B)
DN50/ANSI 2"	N/A	N/A
DN65/ANSI 2.5"	N/A	N/A
DN80/ANSI 3"	74 (2.91")	20 (0.79")
DN100/ANSI 4"	81 (3.19")	17 (0.67")
DN125/ANSI 5"	91 (3.58")	17 (0.67")
DN150/ANSI 6"	101 (3.98")	17 (0.67")
DN200/ANSI 8"	115 (4.53")	17 (0.67")

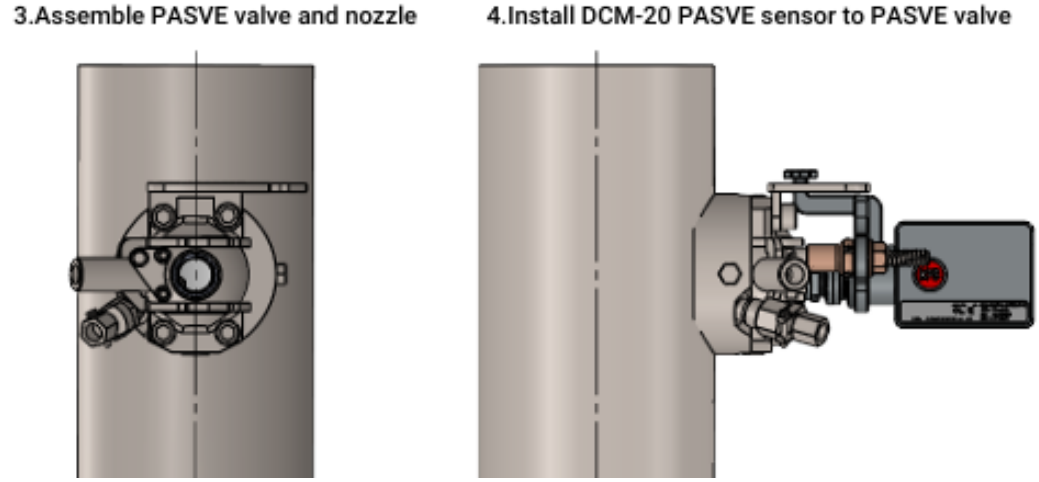


Figure 28 PASVE® installation in vertical pipeline. Drawing 10728.

Note: Vertical installation is not possible for small pipe sizes of DN50 (ANSI 2”) and DN65 (ANSI 2.5”)

Vertical installation of the DCM-20 PASVE® in small process pipe sizes of DN50 (ANSI 2”) and DN65 (ANSI 2.5”) is **not possible** because the wash nozzle body does not fit properly inside the pipe in vertical orientation. In this case, choose one of the following solutions:

- Increase the pipe diameter to DN80 (3") at the installation point using a short pipe section or adapter, or
- Install PASVE® in a horizontal position, where nozzle fit is not restricted by pipe diameter.

5.4 Reassembling PASVE® isolation valve components

After the PASVE valve body has been securely welded in place, follow the steps in Fig. 29 to reassemble the valve.

1. Place the smallest PASVE valve seal back to the valve body. Make sure that all valve seals are properly aligned.
2. ⚠ **WARNING: The safety guide plate must always be positioned on top of the valve.** This is a critical safety feature that must not be overlooked during reassembly.
3. Ensure that the wash nozzle connection is positioned at the 8 o'clock position. The nozzle fits into the hole in only one position. Ensure proper orientation when inserting the nozzle.
4. Ensure correct orientation of the ball valve mounts – pay attention to the small notches.
5. Verify that all components are correctly installed, all connections are secure, and there are no visible signs of damage or misalignment.

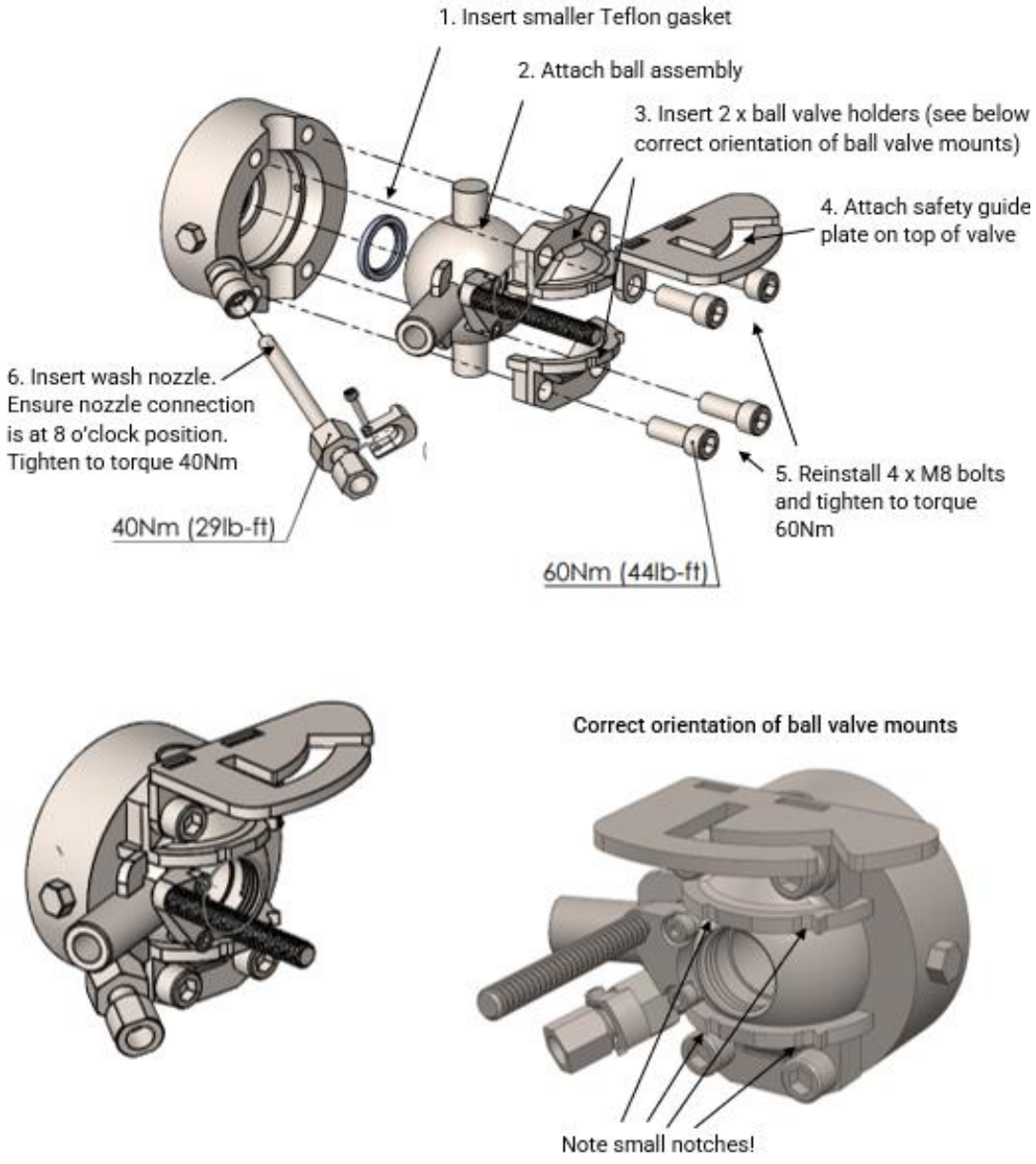


Figure 29 Reassembling the PASVE® isolation valve components.

5.5 Installing prism wash system

The wash medium needs to be specified with either steam or hot condensate water to determine the correct wash nozzle model. Typically steam wash is intended for use in black liquor applications and hot condensate water wash in green liquor applications.

5.5.1 Steam wash system

In black liquor applications material deposit, scaling or fouling may occur on the prism surface. To avoid this, install prism wash system with integral steam nozzle in the PASVE® system (Fig. 30). For steam wash system components see Fig. 31.

⚠ **IMPORTANT: Steam wash considerations**

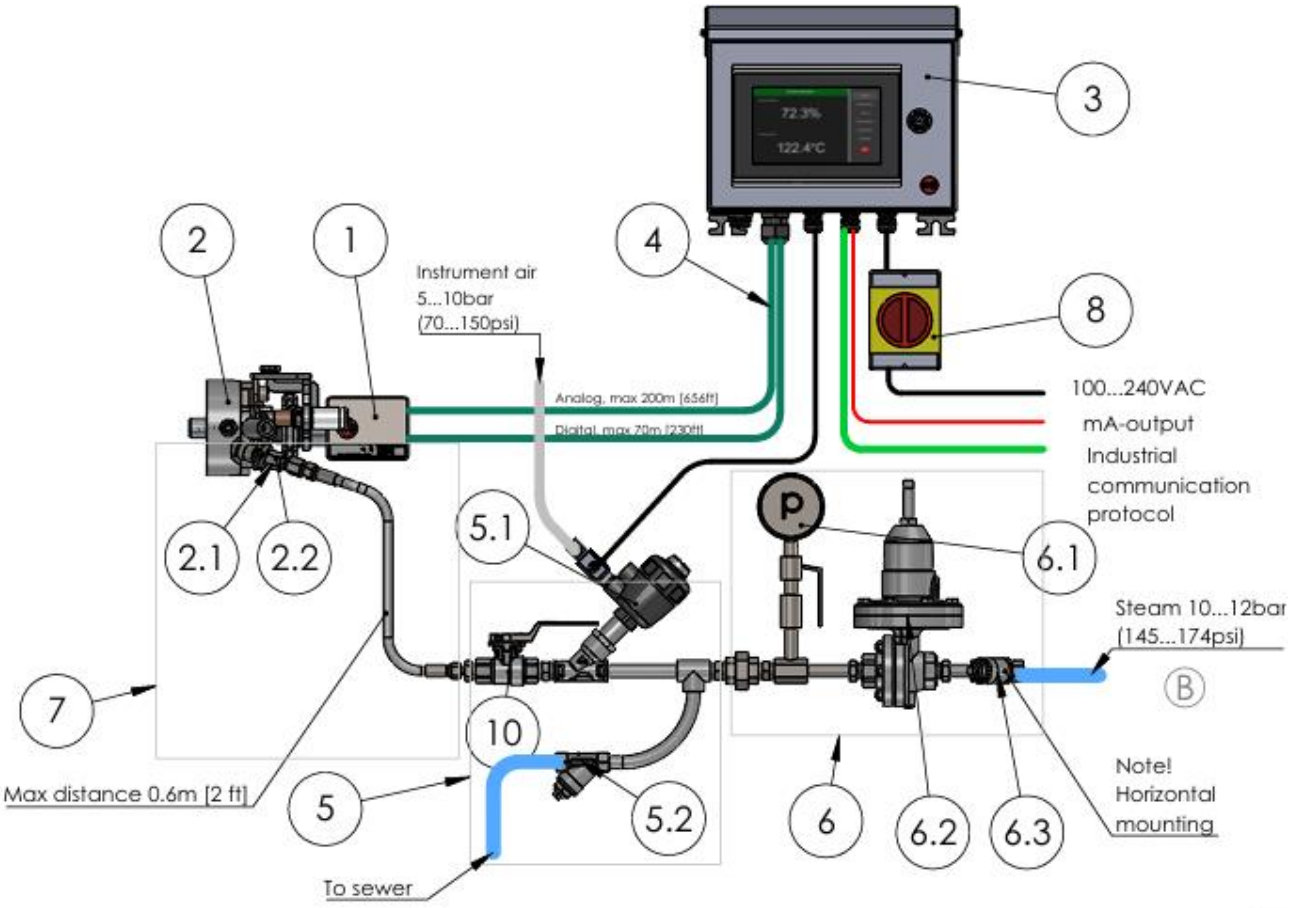
- The distance from the steam nozzle on the PASVE® valve to the steam shut-off valve should be kept as short as possible to avoid condensate. The recommended length of the distance is 0.6 m (2 ft) or less.
- Separate or isolate the power to the solenoid from the power to the Modular connection unit MCU by installing a safety switch. This enables the steam wash to be serviced without having to power down the whole PASVE® system.
- Pipe the steam trap properly to drain so that the trap is not blowing hot steam.
- Steam piping upstream of shut-off valve is ½" or larger.
- In addition to PASVE® valve steam fittings, add following components in steam wash installation:
  - steam shut-off valve
  - air-operated solenoid valve
  - steam trap
  - switch or terminal for power isolation
  - OPTIONAL, in case of contaminants (dirt, sand) in steam supply: To remove any contaminants, install a steam strainer.
- Use suitable type of steam for prism cleaning. Dry saturated steam and inlet steam pressure (before pressure reducing valve) of 12-15 bar (174-218 psi) are recommended.
- **Access to steam:** The distance between steam supply and PASVE® sensor system should be considered for the length of steam piping.
- Access to drain for steam trap condensate outlet.
- Disconnect steam valve and steam. Make sure that the steam pipe is unpressurized.

⚠ **WARNING:** Nozzle insertion and removal only during shutdown and empty pipe. Ensure process pipe is unpressurized. Nozzle fits into the hole in only one position. Ensure proper orientation when inserting nozzle.

⚠ **IMPORTANT: Ensure continuous steam wash operation and prevent nozzle blockage. Inspect periodically the operation and functionality of wash system.**

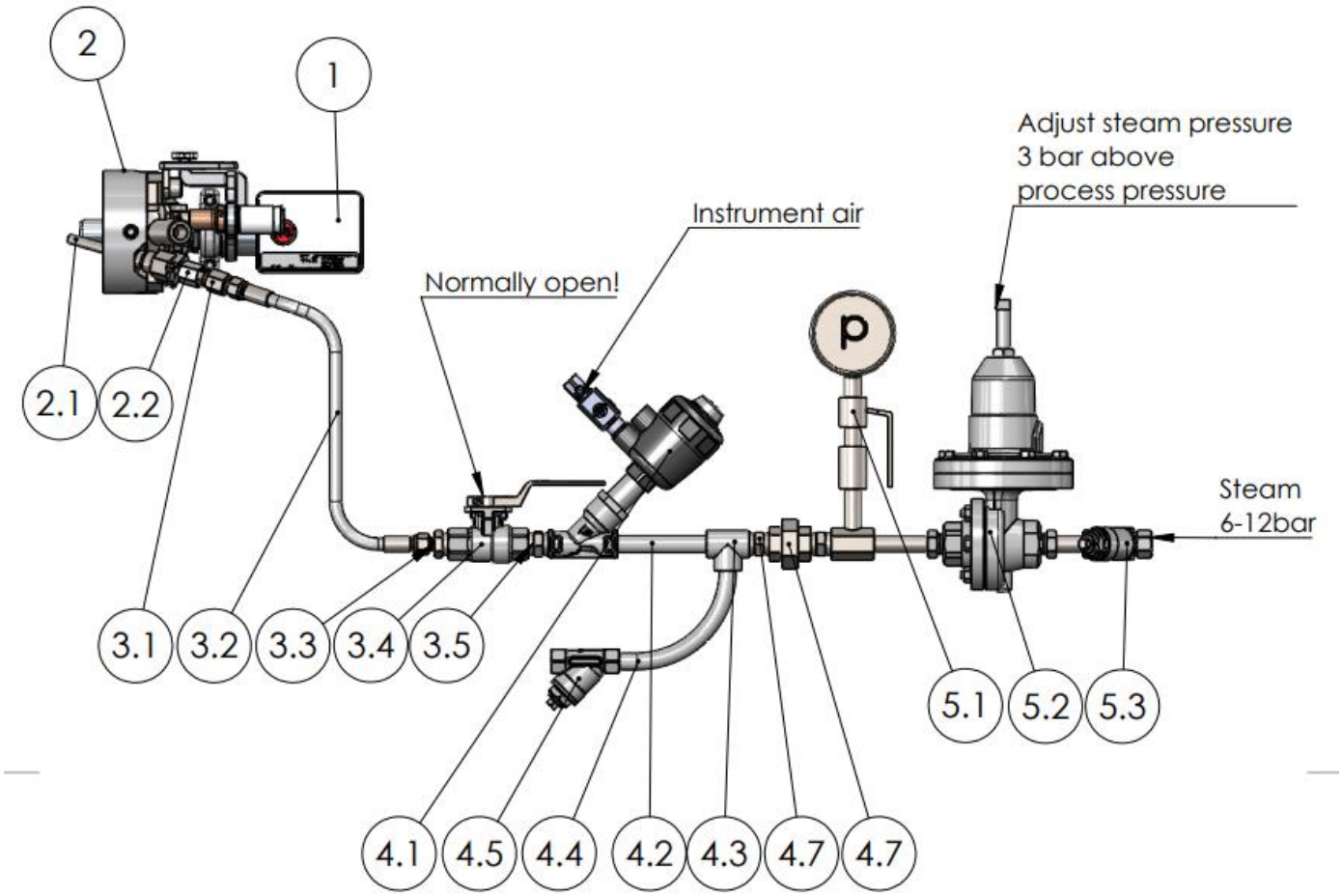
To maintain functionality of steam wash system and prevent nozzle blockages, ensure following:

1. **Timely startup:** Begin operation of the sensor and wash system as soon as possible (at least within **24 hours of liquor feed).**
2. **Steam pressure:** Maintain steam pressure at 4-5 bar above the process pressure to ensure effective cleaning.
3. **Steam valves:** Ensure **steam valves are fully open** during operation.
4. **Monitoring optical image:** Observe a noticeable change in the optical image during the steam wash cycle, indicating proper cleaning action.
5. **Monitoring process temperature:** Verify a change in process temperature during the steam wash cycle to confirm the system is functioning as intended.



ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	Retractable Refractometer DCM-20 PASVE® Sensor	KxS	1
2	PIV PASVE® Isolation Valve assembly	KxS	1
2.1	SP-1010493 PASVE® Nozzle Steam	KxS	1
2.2	SP-7009 Check valve, SS, PTFE, 1/4" NPT	KxS	1
3	SP-8000-SSE Modular Connection Unit (MCU)	KxS	1
4	SP-9000 Sensor cable digital/analog	KxS	2
5	SP-7020 Solenoid valve assembly	KxS	1
5.1	Shut-off valve assembly DN15 (1/2") 24VDC	KxS	1
5.2	SP-7011 Steam trap	KxS	1
5.3	DN15 (1/2") Ball valve AISI 316L	KxS/Customer	1
6	SP-7030 Steam pressure reducing valve assembly	KxS/Customer	1
6.1	SP-7013 Steam gauge assembly	KxS/Customer	1
6.2	SP-7012 Pressure reducing valve	KxS/Customer	1
6.3	SP-7003 Strainer	KxS/Customer	1
7	SP-10744 PASVE wash connection set	KxS/Customer	1
8	SP-7010 Mains switch	KxS/Customer	1

Figure 30 Steam wash system for the Retractable refractometer DCM-20 PASVE® (Drawing 10467).



ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	DCM-20-SR-P33-P052-SF-UC refractometer DCM-20 PASVE	KxS	1
2	PIV-115-PN40-SF-SN Pasve Isolation Valve	KxS	1
2.1	SP-10493 Pasve Nozzle Steam	KxS	1
2.2	SP-7009 Check valve, SS, PTFE, 1/4" NPT	KxS	1
3	SP-10744 Wash connection assembly with flexible hose	KxS	1
3.1	Adapter SS-600-7-4	KxS	1
3.2	Flex hose 24" SS-6BHT-24	KxS	1
3.3	Adapter SS-600-1-8RT	KxS	1
3.4	DN15(1/2") Ball valve PTFE/AISI316	KxS	1
3.5	Adapter SS-8-HN-RT	KxS	1

ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
4	SP-7020 Shut off valve assembly 24V for steam	KxS	1
4.1	Solenoid valve DN15 (1/2") 24VDC	KxS	1
4.2	1/2" tube	KxS	1
4.3	1/2" T-piece	KxS	1
4.4	1/2" curve	KxS	1
4.5	SP-7011 Steam trap	KxS	2
4.6	1/2" nipple SS-8-HN-RT	KxS/Customer	3
4.7	DN15 (1/2") Conical fitting AISI316	KxS/Customer	1
5	SP-7030 Steam pressure reducing valve assembly 1/2"	KxS/Customer	1
5.1	SP-7013 Steam gauge assembly	KxS/Customer	1
5.2	SP-7012 Pressure reducing valve 1/2"	KxS/Customer	1
5.3	SP-7003 Strainer 1/2"	KxS/Customer	1

Figure 31 Steam wash system components for the Retractable refractometer DCM-20 PASVE® (Drawing 10745).

5.5.2 Hot condensate water wash system

Green liquor applications are known for their challenging process conditions, where deposits or scaling may occur on prism surface. By equipping PASVE® system with automatic prism wash system and integral hot condensate wash nozzle, the prism remains clean, and measurements stay accurate (See Fig. 32). The wash medium needs to be specified for hot condensate water to determine the correct wash nozzle model.

⚠ **IMPORTANT: Hot condensate wash considerations**

- The distance from the water nozzle on the PASVE® valve to the water valve should be kept as short as possible to keep water as hot as possible. The recommended length of the distance is 0.6 m (2 ft) or less.
- Separate or isolate the power to the solenoid from the power to the Modular connection unit MCU by installing a safety switch. This enables the hot condensate wash to be serviced without having to power down the whole PASVE® sensor system.
- Condensate water upstream of shut-off valve is ½" or larger.
- In addition to the PASVE® valve fittings, the following components must be included in the high pressure condensate wash installation:
  - Manually operated water shut off valve
  - Wash valve assembly for hot condensate including:
    - air-operated wash valve
    - air-operated preconditioning valve
    - Pressure gauge
    - Temperature gauge
    - switch or terminal for power isolation
- Use clean 20–40 bar/ 120–150°C condensate water for prism wash
- **Preconditioning time** depends on the distance between the hot condensate supply and the PASVE® sensor system should be considered for the length of condensate piping to achieve hot condensate water for the prism wash.
- Before any mechanical adjustments on wash system components close the two seat valves and make sure that the hot condensate pipe is unpressurized.

⚠ **WARNING:** Nozzle insertion and removal only during shutdown and empty pipe. Ensure process pipe is unpressurized, de-energized and free of hazardous gases.

The nozzle fits into the hole in only one position. Ensure proper orientation when inserting the nozzle.

⚠ **IMPORTANT: Ensure continuous hot condensate wash operation and prevent nozzle blockage. Inspect periodically the operation and functionality of wash system.**

To maintain functionality of steam wash system and prevent nozzle blockages, ensure the following:

1. **Timely startup:** Begin operation of the sensor and wash system as soon as possible and latest **within 6 hours of liquor feed.**

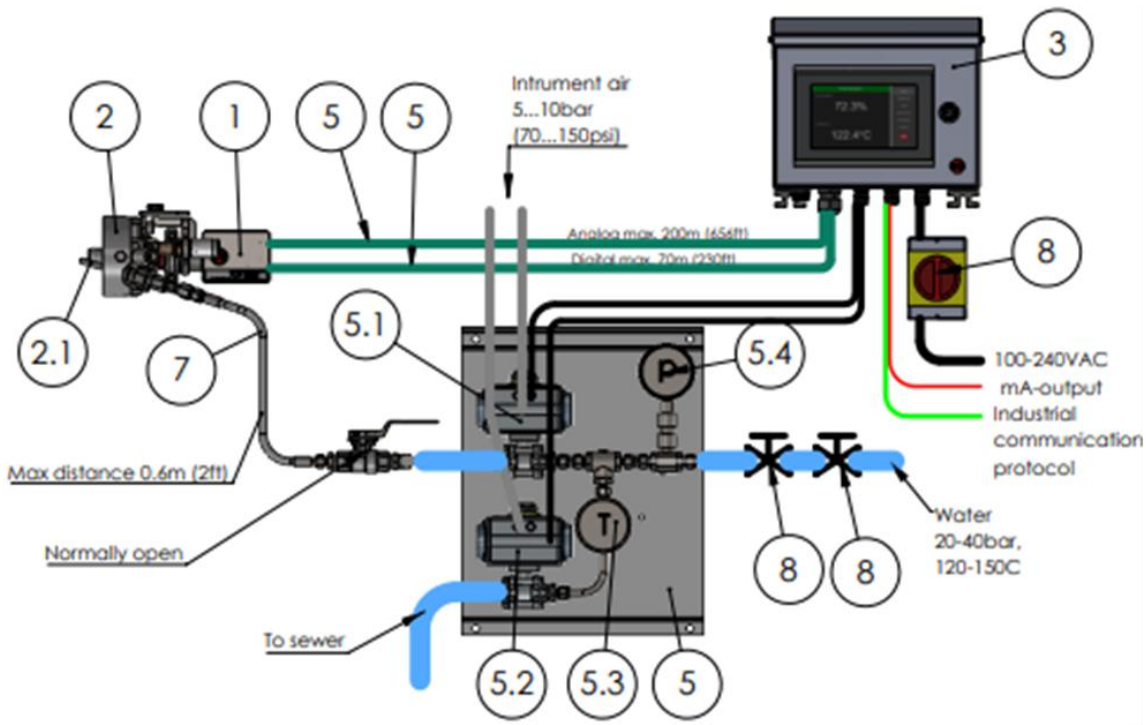
2. **Hot condensate pressure:** Maintain steam pressure at **20-30 bar above the process pressure** to ensure effective cleaning.

3. **Hot condensate supply valves:** Ensure **valves are fully open** during operation.

4. **Monitoring optical image:** Observe a noticeable **change in the optical image** during the wash cycle, indicating proper cleaning action.

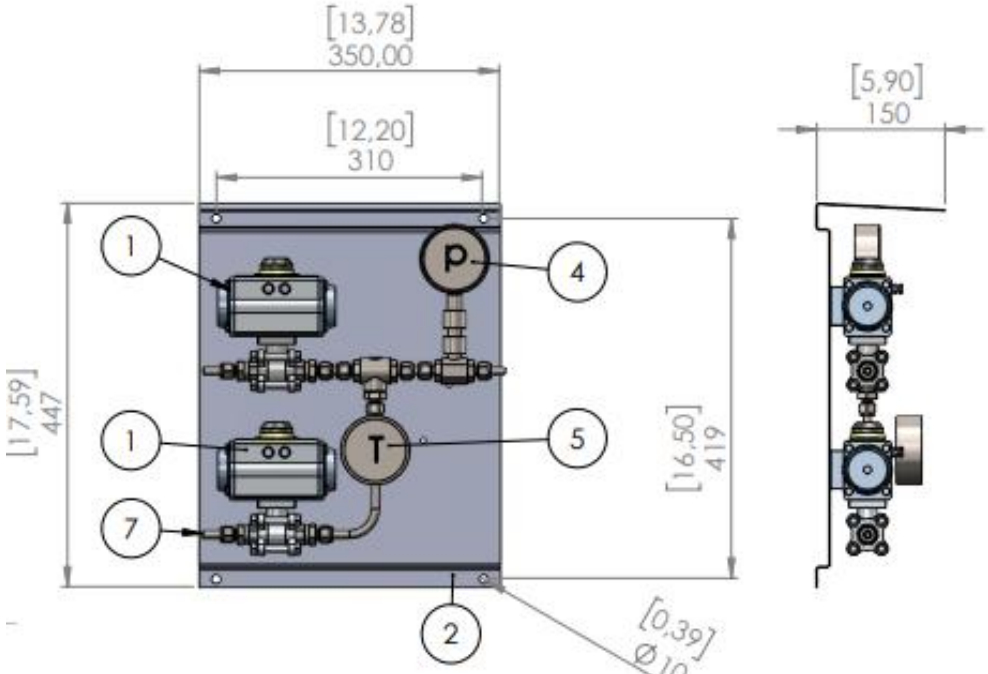
5. **Monitoring process temperature:** Verify a **change in process temperature** during the hot condensate wash cycle to confirm the system is functioning as intended.

6. **Process pipe insulation:** Proper process line insulation prevents cold spot in process line, increases solubility and decreases process liquid viscosity and possibility of scaling on the prism, see Section 5.5.



ITEM NO.	DESCRIPTION	SUPPLY BY	QTY
1	Retractable Refractometer DCM-20 PASVE® Sensor	KxS	1
2	PIV PASVE® Isolation Valve assembly	KxS	1
2.1	SP-10493 PASVE® Water Steam	KxS	1
2.2	SP-7009 Check valve, SS, PTFE, 1/4" NPT	KxS	1
3	SP-8000-SSE Modular Connection Unit (MCU)	KxS	1
4	SP-9000 Sensor cable digital/analog	KxS	2
5	SP-10779 Wash valve assembly for hot condesate	KxS/Customer	1
5.1	Wash valve 3/8" DN10	KxS/Customer	1
5.2	Preconditioning valve 3/8" DN10	KxS/Customer	1
5.3	Temperature gauge 0-150°C (0-302°F)	KxS/Customer	1
5.4	SP-7013 Pressure gauge 0-60bar (0-870psi)	KxS/Customer	1
6	SP-10744 Flexible wash hose assembly	KxS/Customer	1
7	SP-7010 Mains switch	KxS/Customer	1
8	Seat valve	Customer	2

Figure 32 Hot condensate wash system for the Retractable refractometer DCM-20 PASVE®. Drawing 10177-C.



ITEM NO.	PART NUMBER	QTY.
1	8805-217261-2_2 and 3_2-way ball valve with pneumatic rotary actuator	2
2	10778	1
3	SS-600-1-8RT-SwagelokCompany-3D-11-18-2024	9
4	Water pressure gauge	1
5	Water temp gauge	1
6	3_8 inch tube	1

Figure 33 System components for hot condensate wash for the Retractable refractometer DCM-20 PASVE® (Drawing 10779).

5.5.3 Recommended wash settings

In demanding applications, either steam or hot condensate water wash systems are available for cleaning of the prism. The recommended wash settings and times are given in Fig. 34.

Wash system parameters setting in DCM-20

Wash medium	Maximum above process	Maximum total pressure	Preconditioning time	Wash time	Recovery time	Wash interval
Steam	4-5 bar (58-73 psig) above process pressure	12-15 bar (174-218 psig)	Not required	3 sec	20-30 sec	20-30 min
Hot condensate water	30 bar (435 psig) above process pressure	70 bar (1015 psig)	10-40 sec (depending on condensate water pipe length and insulation)	10 sec	20-30 sec	10-20 min

Figure 34 Wash medium pressure and time settings.

5.6 Installing Modular connection unit MCU

5.6.1 Wiring of Modular connection unit MCU system

The wiring drawing presents all standard modules for power supply, wiring, control, and optional converter modules. Components listed from bottom to up: 60W power supply unit 110-240V in 24V out SP-9400, limit value switches with analog mA input and relay output SP-9700, wire connection unit for 100-240V input, analog signal wiring output unit, patch panel for digital communication 4 wire free-end connection SP-9330, wire connection unit for 24VDC input and output, industrial ethernet switch SP-9320. Optional digital communication protocol converters SP-9870 and SP-9860 are available depending on required protocol conversion from Modbus TCP.

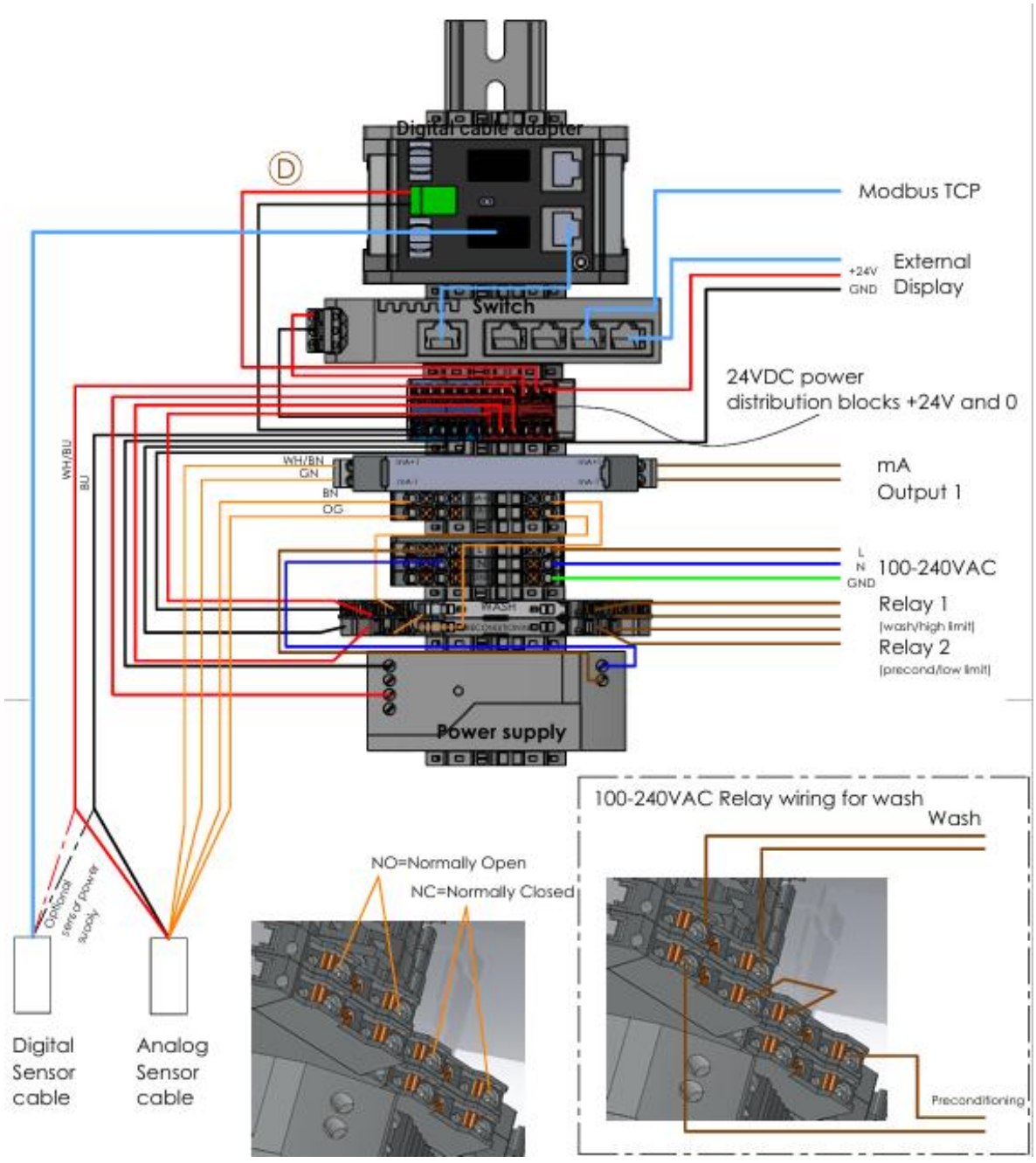


Figure 35 Wiring of modules in MCU. Drawing 10178.

5.6.2 Modular Connection Unit for Wash Systems

The prism wash is functional through one of the sensor analog 4-20mA outputs. The sensor mA wiring is connected to a Modular Connection Unit MCU for Wash Systems. The unit consists of two analog limit value switches SP-9700 and 24VDC power supply SP-9400 in a rail mounted stainless steel enclosure assembly SP-8000 with IP66, NEMA 4X category. The wiring drawing presented in Fig.36 with all components included in the SP-8000 modular connection unit.

The limit value switches SP-9700 are configured with physical DIP switches to close or open the relay per user selection while the sensor wash function is active. The chosen DIP switch schedule with corresponding sensor analog mA output for precondition and wash activation is as follows:

Precondition: Module 1 DIP switches **5, 6, 0** activated 'ON' (4.8mA).

Wash: Module 2 DIP switches **3, 7, 0** activated 'ON' (6.8mA).

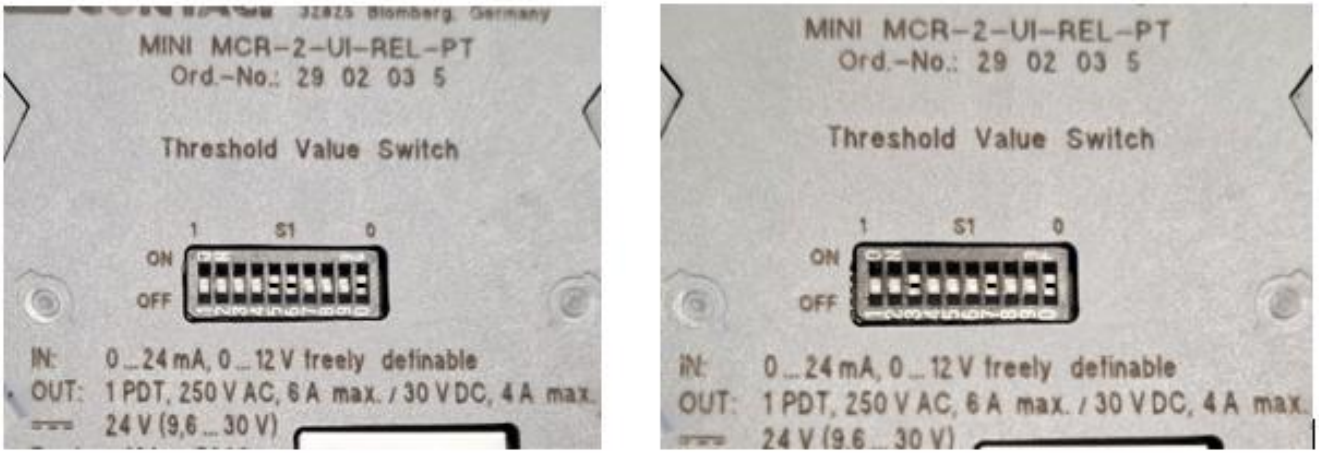


Figure 36 DIP switch configuration

Figure 37 Limit value switch with changeover relay output for monitoring analog limit values from the sensor output. The sensor wash is activated at a mA value that corresponds to the limit value switch schedule with DIP switches activated. The relay closes or opens per user selection.

5.7 Inserting wash nozzle

⚠ **IMPORTANT:** To maintain the functionality of the steam wash system and prevent nozzle blockages, ensure **timely startup:** Insert nozzle when pipe is empty. Begin operation of the sensor and wash system **within 24 hours of liquor feed.**

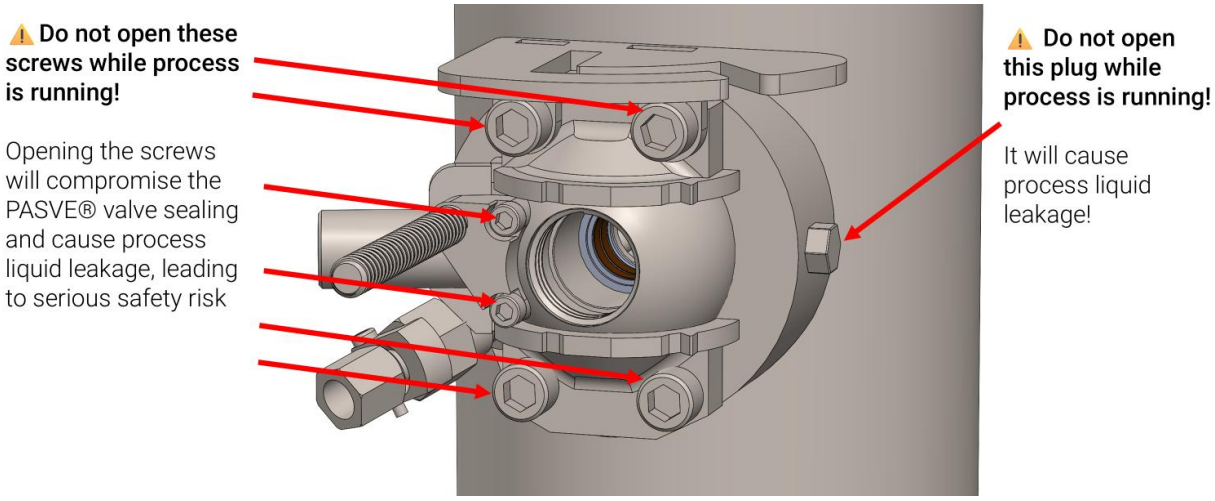
Nozzle insertion only during shutdown and when process pipe is empty. Ensure pipe is unpressurized.

1		Direct nozzle hole towards center of PASVE® valve. Nozzle fits into hole in only one position. Ensure proper orientation when inserting nozzle.
2		Insert nozzle.
3		Place nozzle nut and rotate clockwise.

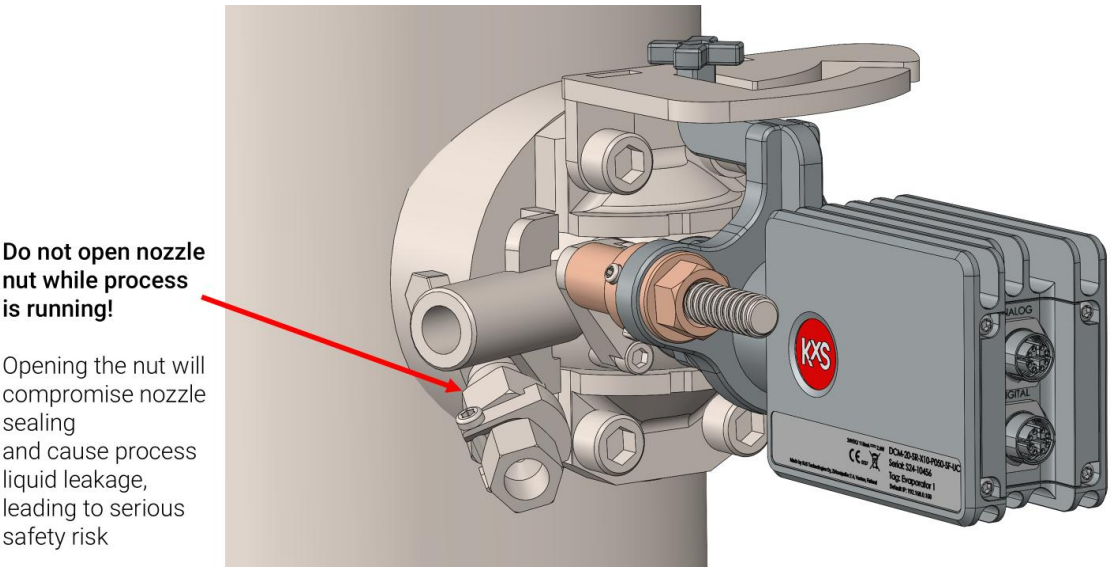
4		Tighten nozzle nut to 40Nm.
5		Place nozzle lock over nut.
6		Tighten M5 nut and bolt to 5Nm (3.7lb-ft).

5.8 Inserting Retractable refractometer PASVE® sensor into pipeline

⚠ **WARNING: Do not open any screws on PASVE® system while process is running (see illustration below)!** Opening the screws will compromise the PASVE® valve sealing and cause process liquid leakage, leading to serious safety risk.

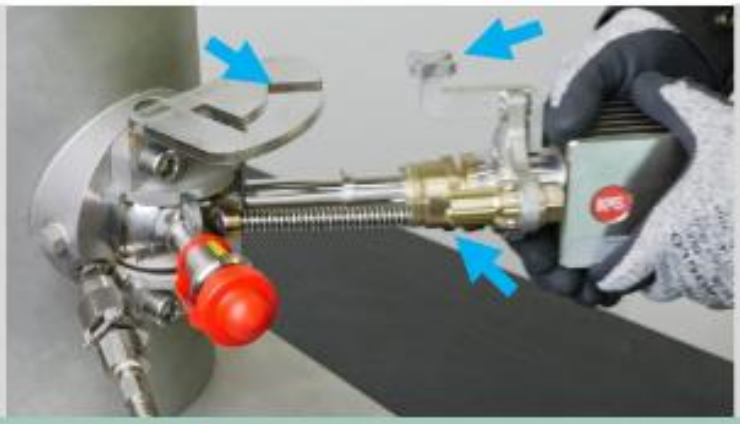
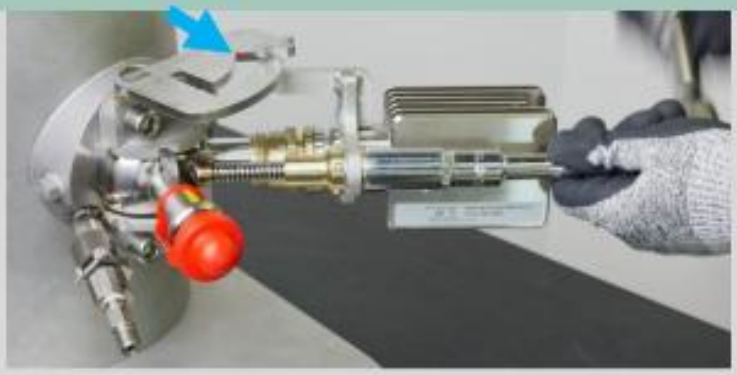


⚠ **WARNING: Do not open the wash nozzle nut while process is running (see illustration below)!** Opening the nut will compromise nozzle sealing and cause process liquid leakage, leading to serious safety risk.

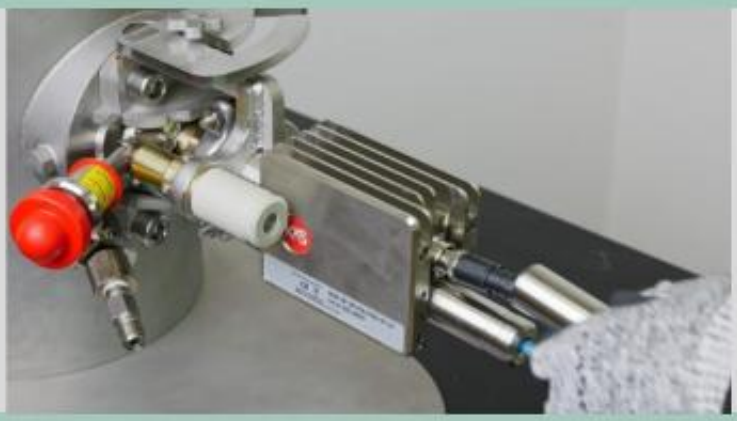
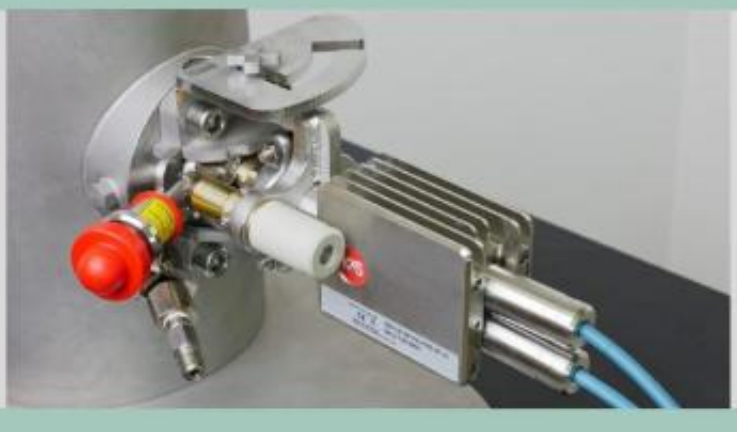


Watch the instructional video on insertion and retraction available on YouTube via the KxS webpage www.kxstechnologies.com.

⚠ **WARNING:** If you detect leaking at any point of sensor insertion or removal process, or if anything gets stuck or force is required, stop, revert immediately to the previous step and determine the cause. Do not continue insertion / removal until the reason for leakage has been cleared and fixed. Insert and remove the sensor as instructed in the following chapters.

1		Place refractometer sensor into PASVE® valve. Rotate nut in sensor clockwise to engage the threads. Ensure safety guide aligns with the safety plate groove.
2		Use 19mm (3/4") long socket with ratchet wrench clockwise to crank refractometer to PASVE® valve. Confirm guide is fully seated in safety plate slot. **Important:** Do not use power tools!
3		Attach and hand-tighten refractometer safety nut onto PASVE® valve by rotating clockwise.
4		Open PASVE® valve locking by turning PASVE® handle 4 turns counterclockwise.

5		Open PASVE® valve by pulling PASVE handle locking ring and swing PASVE® valve handle 60 degrees left until refractometer is fully aligned (straight). -
6		Lock PASVE® isolation valve by turning clockwise (4 turns) PASVE valve handle. Pull out PASVE® valve handle and plug handle hole.
7		Insert refractometer sensor into process by rotating 19mm (3/4") long socket clockwise using ratchet until guide pin is fully inserted and refractometer sensor reaches full stop.
8		Close safety clamp. Tighten the M8 screws with 13mm wrench

9		Attach PASVE® thread cover.
10		Connect digital and analog cables.
11		Refractometer is now inside process. Next: Insert wash nozzle (can be done only when empty pipe, see separate instructions).

5.9 Insulating process pipe

⚠ **WARNING:** Insulating the process pipe around the PASVE® sensor installation point is critical for maintaining accurate measurements (see Fig. 38). Proper insulation ensures that the liquid maintains its viscosity and flow velocity.

Risks of neglecting insulation

- Even a slight drop in temperature can cause the liquid to thicken (especially for viscous substances like black liquor and green liquor), **slowing flow on the prism** and resulting in inaccurate measurements
- This results in **false readings** and compromises process control.

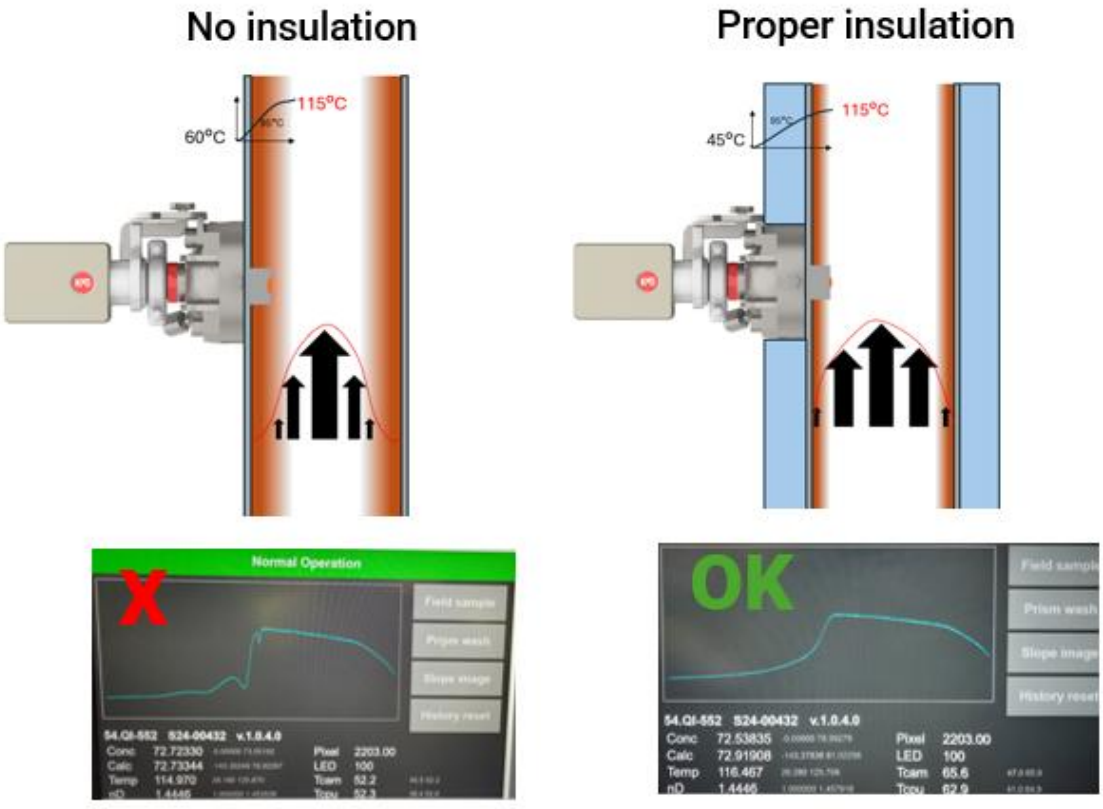


Figure 38 Neglecting to insulate the process pipe around the sensor can lead to temperature drop, significant reduction in flow velocity over the prism, and false readings (see poor optical image on the left). Proper pipe insulation ensures consistent flow over the prism for accurate readings (see good optical image on the right).

Insulation requirements (see Fig. 39):

- **Minimum length:** At least **1 meter (3 feet)** before and after the sensor installation point.
- **Material:** Use **non-flammable, heat-resistant insulation material**
- **Insulation thickness 50-100 mm (2-4 inches)**
- **Do not Insulate sensor or PASVE® valve parts**: Leave the DCM-20 sensor and PASVE® valve exposed to avoid overheating issues.

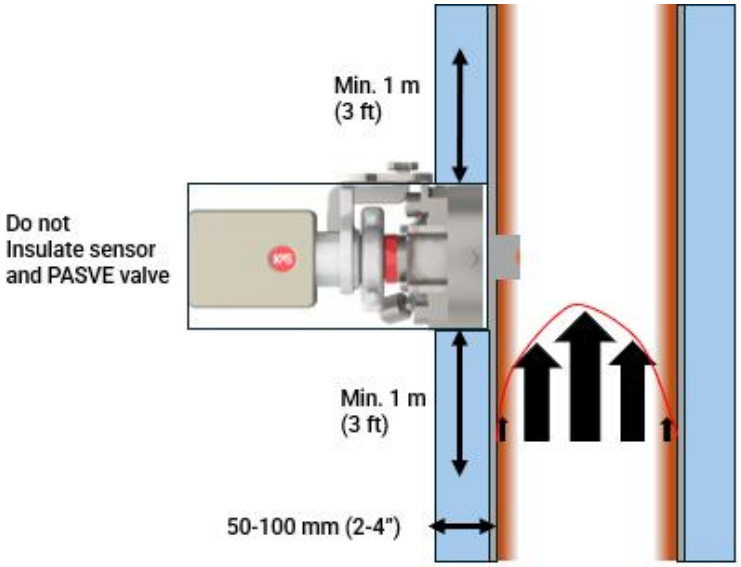


Figure 39 Neglecting to insulate the process pipe around the sensor can lead to temperature drop, significant reduction in flow velocity over the prism, and false readings! Proper pipe insulation ensures consistent flow over the prism for accurate readings.

5.5 Removing Retractable refractometer PASVE® sensor from pipeline

1		Close PASVE® system prism wash valve and wash root valve. Disconnect power from Modular connection unit MCU. Remove digital and analog cables for refractometer.
2		Remove safety clamp with two M8 bolts and nuts.
3		Remove covers from PASVE® valve handle and safety thread.
4		Unlock PASVE® valve by rotating PASVE® valve handle 4 rounds counterclockwise until full stop.

5.1

Crank out the refractometer by 19mm (3/4") long socket and ratchet by rotating counterclockwise.

5.2

Stop cranking when safety guide groove stops.

6.1

Close PASVE® valve by pulling out PASVE® handle locking ring and swing valve handle 60 degrees right according to safety plate groove.

Close PASVE® isolation valve.

6.2

Lock PASVE® valve by rotating PASVE® handle 4 turns clockwise till full stop.

7		Open refractometer safety nut by rotating it counterclockwise until its free from PASVE® valve.
8		Crank out the refractometer by rachet rotating counterclockwise from PASVE® valve completely.
9		Rinse refractometer and PASVE® valve with hot water. Cover electrical connectors. In case refractometer is removed for longer period, plug the hole in PASVE® valve with blind plug.
10		Use a padlock to increase safety when the refractometer is out of process line.

5.10 Removing wash nozzle

⚠ **WARNING:** Nozzle removal only during shutdown and empty pipe. Ensure process pipe is unpressurized.

1		Open M5 nut and bolt. Remove nozzle lock.
2		Open nozzle nut by turning counterclockwise and remove nozzle.
3		Remove nozzle by pulling out.

6. Calibration and configuration

The DCM-20 is factory calibrated for refractive index units RIU according to NIST traceable procedures.

Refractive index unit RIU and Temperature are used to convert the measurement to Conc% b.w. The factory Conc% calibration is automatically temperature compensated.

Configuration and calibration parameter changes are defined in the user interface on a web browser on a computer, external display, or mobile device. Access to the user interfaces is described in section 4.4 *User Interface*.

6.1 Calibration and configuration

The sensor user interface is accessed as described in section User interface. The homepage displays real time concentration measurement values, process temperature, and sensor serial number. In addition, the sensor status is visible: *Normal Operation* when liquid is in contact with the prism, *No Sample* when process pipe empty or no liquid on the prism *Prism Wash* when the wash system is active as user defined.

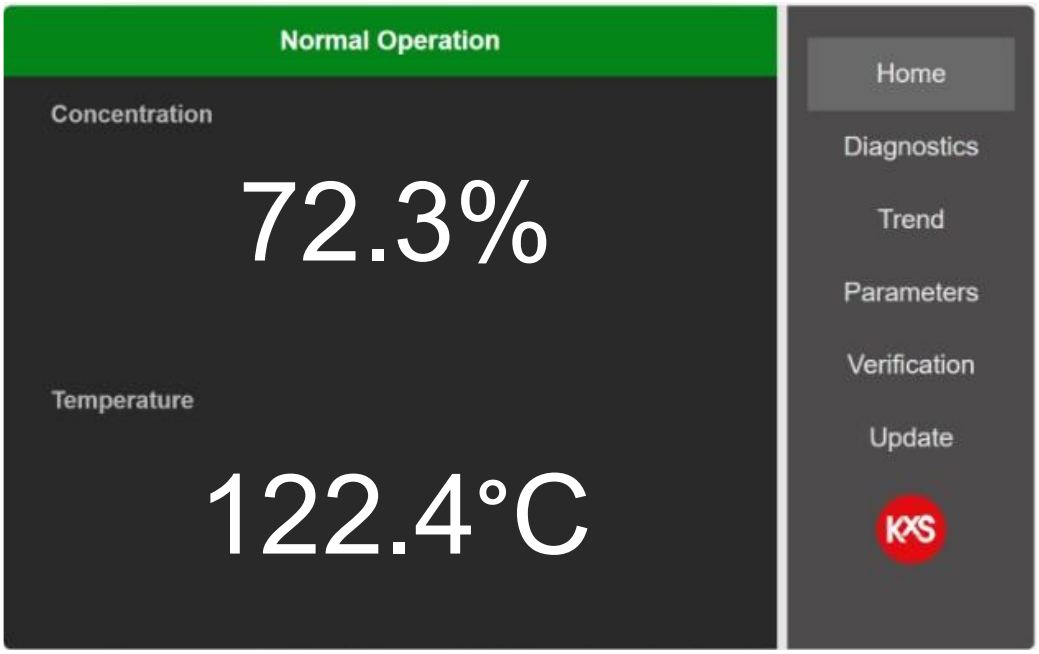


Figure 40 User interface homepage with real-time measurement values.

6.2 Diagnostics

The optical image, measurements, and sensor internal diagnostics are useful in analysing the sensor performance and application functionality. During process troubleshooting the optical image is a key indicator of measurement quality.

The 'Field sample' button activates sampling of 10 measurement data points and calculates an average for display.

Prism wash activates prism wash if one of the mA outputs have been configured for 'Wash' in section Parameters/Outputs.

'Slope image' displays the slope of the optical image border line.

History reset resets the lowest and highest measurement values during the DCM sensor power session.

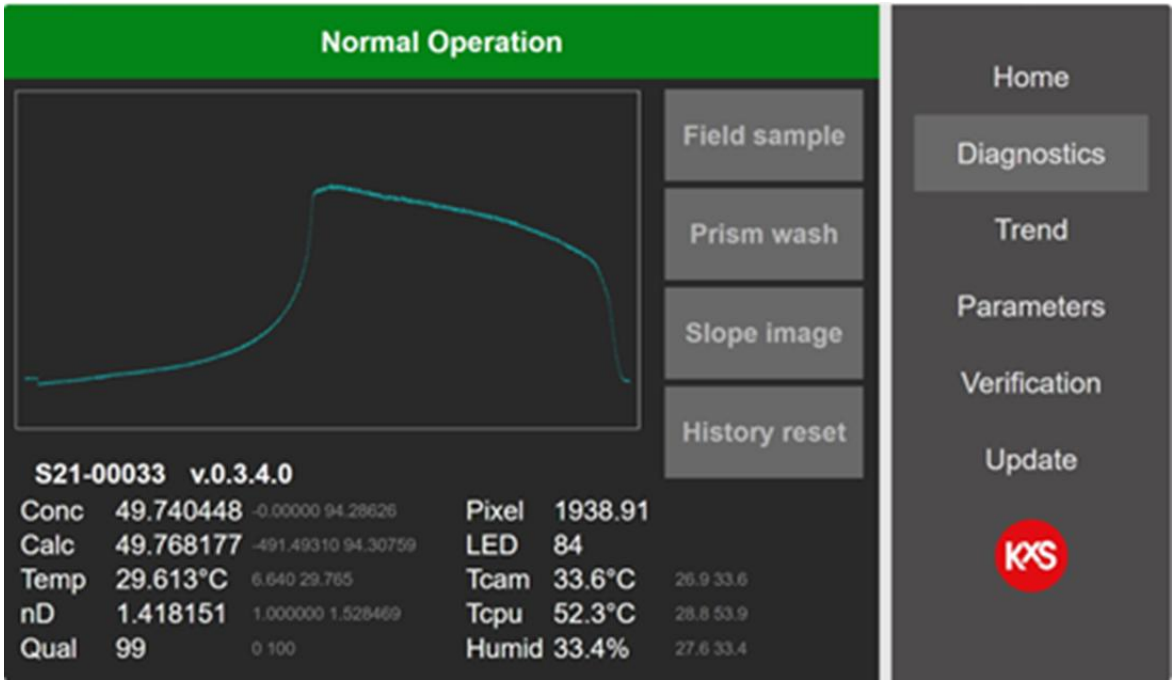


Figure 41 Diagnostics with optical image, measurements, and sensor internal diagnostics.

6.3 Trend plots

Realtime trends of user selected two measurement values (e.g., concentration and temperature) are available in page *Trend*. DCM-20 internal memory logs and stores 6000 measurement data points that can be saved in a txt file format (Fig. 27). The storage interval is user selectable in the *Trend menu* to 1, 10 or 60 seconds. When the memory is full the log continues active while old measurement points are overwritten. The txt file is written to a folder on a computer when pressing *Save trend* in the *Trend menu*. The txt file is written to the selected folder according to computer settings. For example, on a PC in folder *This PC/Downloads*.

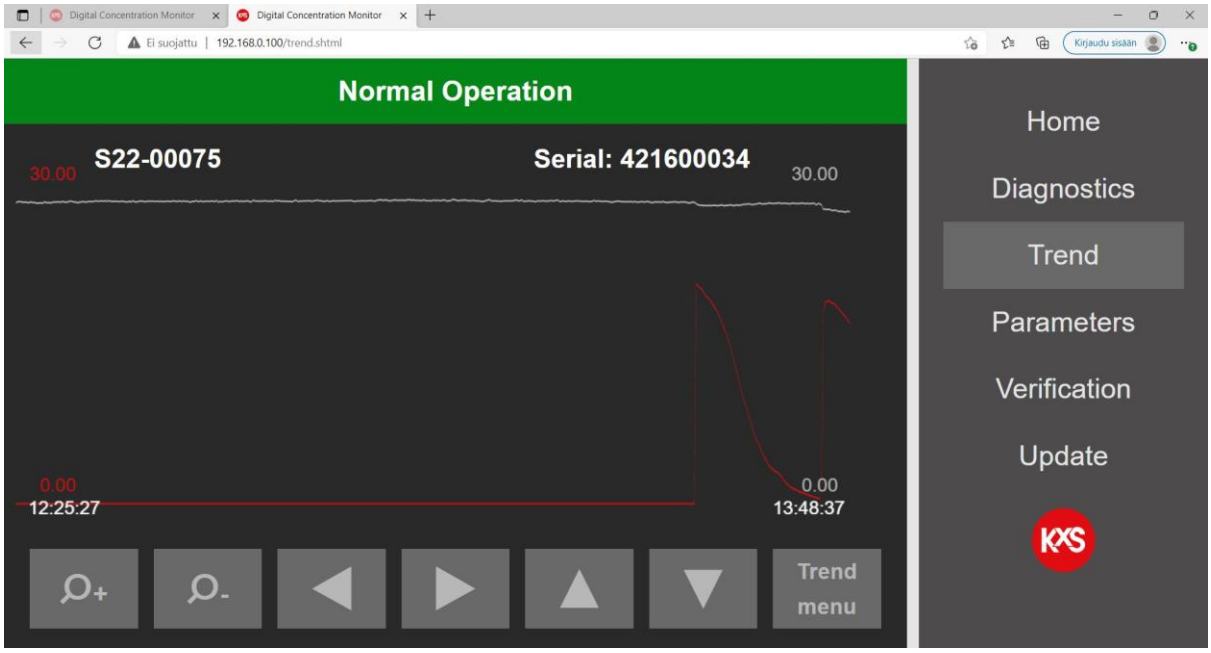


Figure 42 Continuous measurement trend.

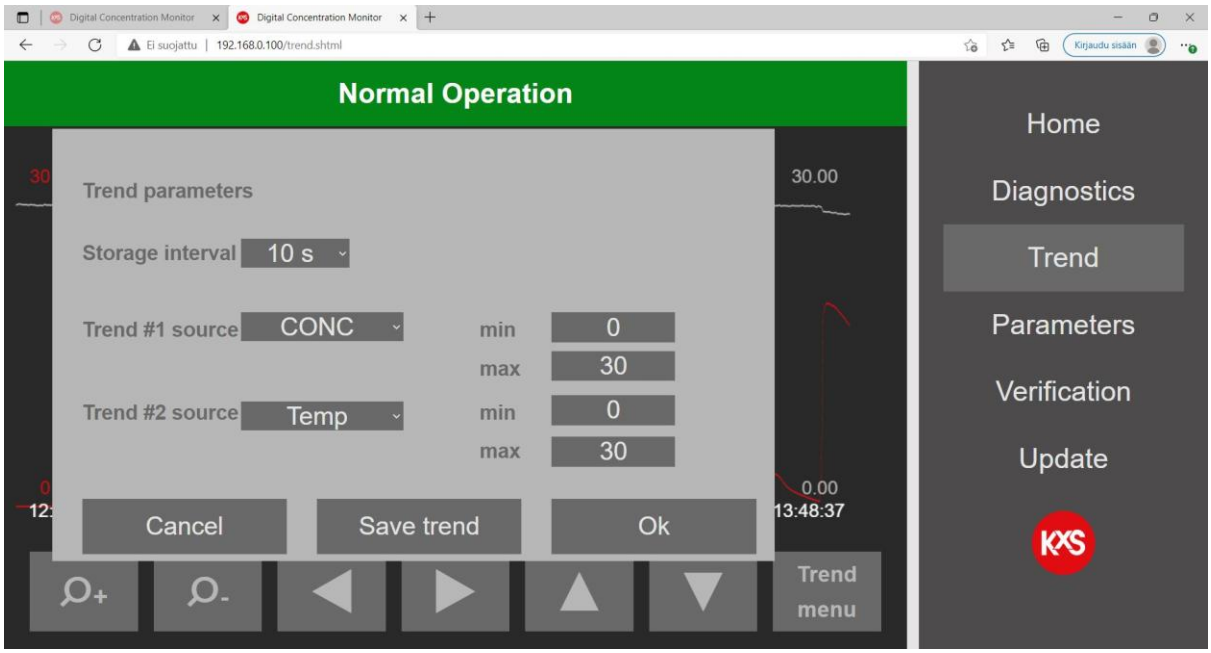


Figure 43 User selectable trend functions.

6.4 Parameters configuration

6.4.1 User interface password

Operating and changing DCM settings and parameters is password protected. The password Login is found in the user interface section Parameters/Special. Please consult KxS Technologies or its authorized local partner for the default password.

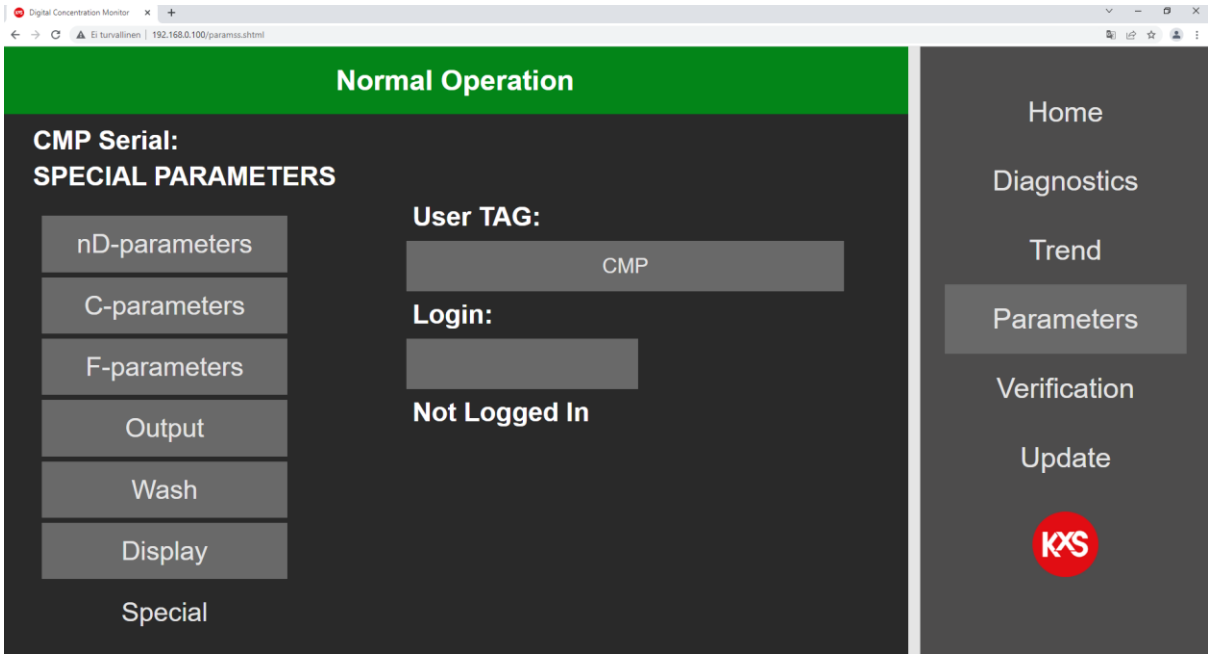


Figure 44 DCM Login with password

After the Login is activated, settings and parameters in the user interface can be changed. A user selected password can be configured.

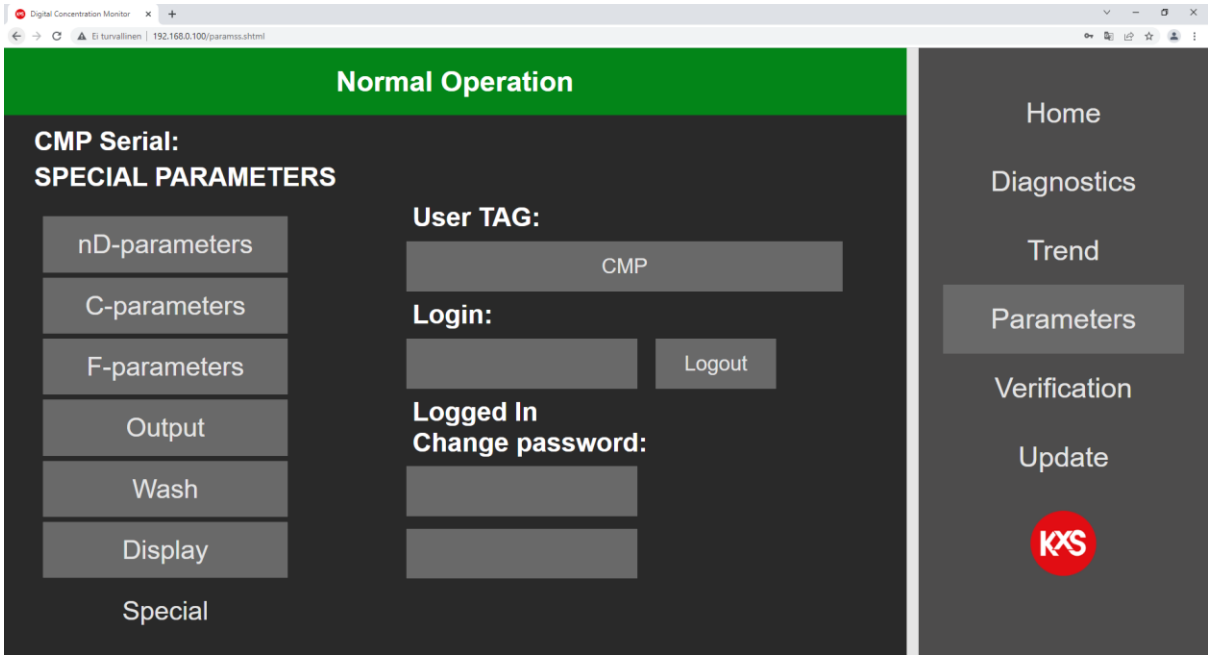


Figure 45 User selectable password

6.4.2 Calibration parameters

In the user interface the mA configuration is found on page *Parameters* and *Output*. The mA-output is user configurable for Brix, Temp, diagnostics, and Wash (of prism). The range of chosen measurement value is user configurable to correspond the analog 4-20mA range.

The sensor calibration is configured in three layers. Each layer is described by a second degree 3x3 matrix for both concentration and temperature dependency.

The factory camera pixel to refractive index unit RIU calibration is defined in page nD-parameters. The factory set a-parameters are sensor individual and must not be altered unless a sensor RIU calibration is performed.

The Chemical calibration RI to Brix/Conc% is set in page C-parameters. The 3x3 matrix describes the non-linear relationship of CONC vs RIU/Temp.

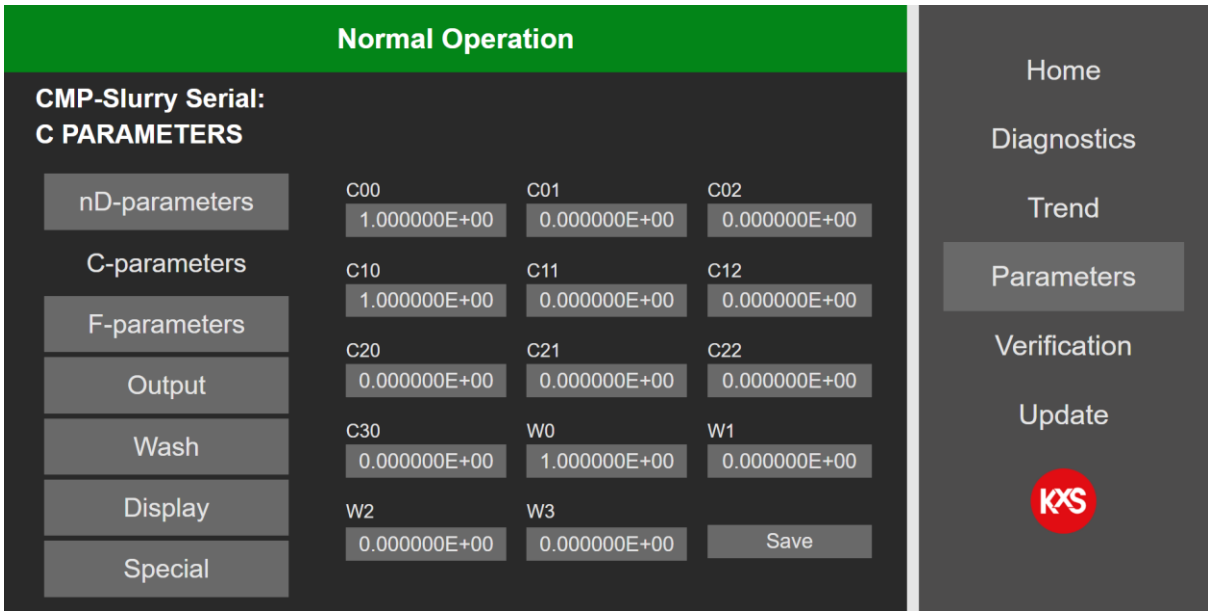


Figure 46 Sensor calibration parameter settings.

The parameter values C00-C30 are dialed by pressing respective cell. In the active cell a new parameter value is entered and confirmed by pressing *Save*.

Note! For concentration measurements the c-values are factory set and need no change. In the event the output Brix reading needs a field adjustment vs. reference measurement (laboratory), the sensor measurement is adjusted in page F-parameters with a bias adjustment. The Field adjustment matrix is defined in the F-parameters matrix.

6.4.3 Output configuration and analog signal settings

The mA output function is found in the user interface section *Parameters/Output*. Two independent mA ports are available for user configuration. In the drop-down menu the selectable output functions are Concentration, Temperature, Quality of optical image, refractive index unit nD, diagnostics, automatic Wash functions of the prism, and measurement low/high limit alarms.

The minimum and maximum measurement values are user selectable to correspond with the 4-20mA range. The selection is activated by pressing *Set*. The mA alarm limits are set in *Extras* as described in section Configuration of low and high alarms.

The final CONC (concentration) output signal can be filtered with a moving average function in *Damping*. The user selectable damping function is 0-30 sensor measurement points. In fast-changing chemical process sequences the recommendation is to keep the Damping moderate 0-10 while in slow changing process a Damping 20-30 will smooth out the CONC measurement noise.

The existing sensor IP address is found in the lower right corner of the *Output* page.

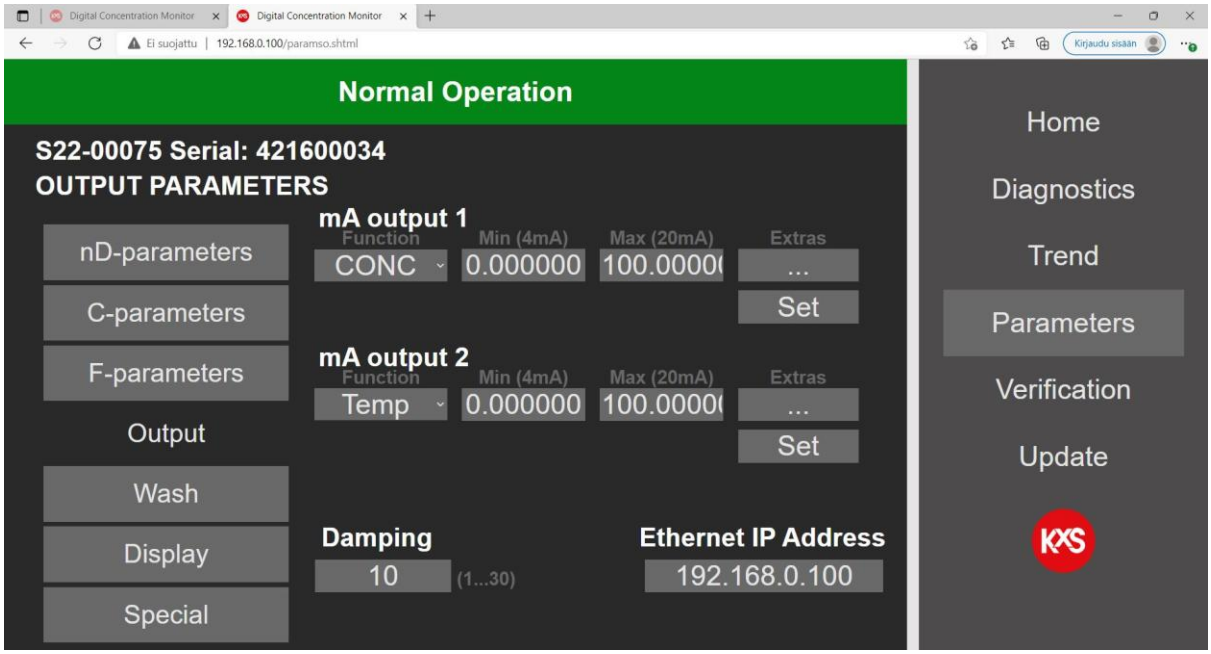


Figure 47 User configurable analog measurement output settings.

6.4.4 Configuration of low and high alarms

Low and high alarm limit values are user selectable for measurements or diagnostics. The alarm limit settings are configured in Parameters/Output/Extras.

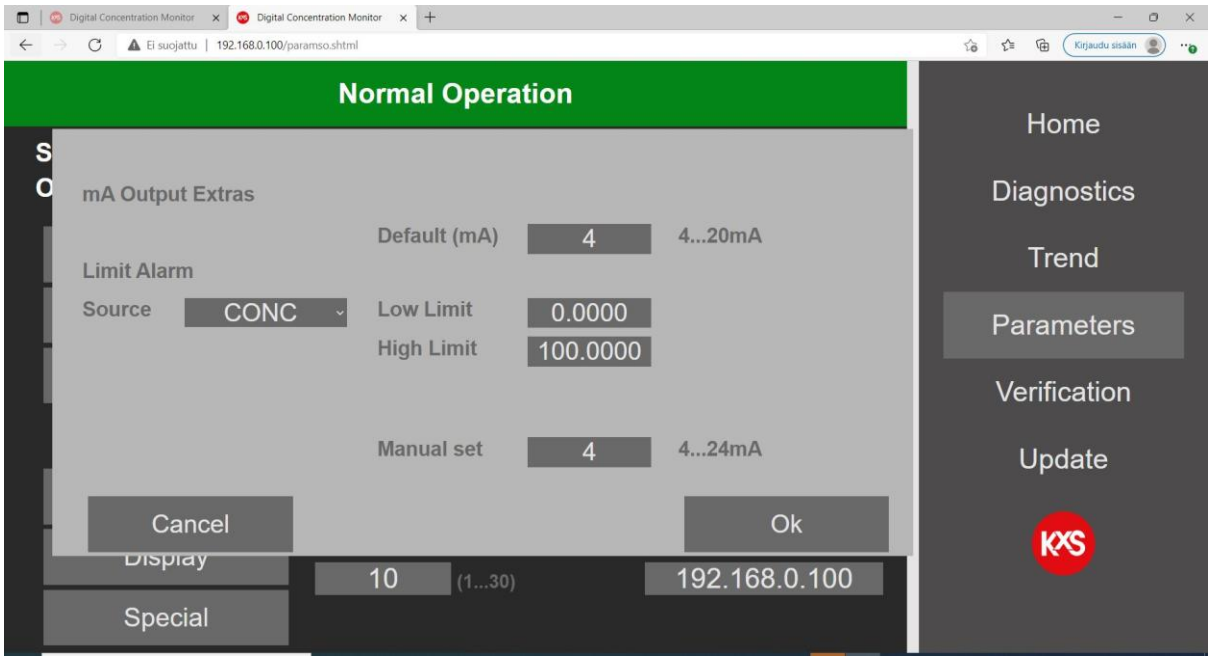


Figure 48 User selectable alarm limit function.

Simultaneously corresponding physical DIP switches are activated 'ON'. When both low and high alarms are used, 2x limit value switches SP-9700 are connected in serial per wiring drawing in section Wiring of Modular Connection Unit system.

Low alarm: Module 1 DIP switches **3, 5, 6, 9, 0** activated 'ON' (5.2mA).

High alarm: Module 2 DIP switches **3, 7, 0** activated 'ON' (6.8mA).

Figure 49 Physical DIP switch configuration for Low alarm functions. DIP switches 3, 5, 6, 9, 0 activated 'ON'

Figure 50 Physical DIP switch configuration for High alarms functions. DIP switches 3, 7, 0 activated 'ON'

6.4.5 Configuration of prism (prism) wash

The optical window wash is functional through one of the sensor analog 4-20mA outputs. Wash times can be set in the user interface and controlled by external relay units.

The configuration of wash parameters is found in the user interface on page *Parameters* and *Outputs*. For the chosen mA output (1 or 2), *Function* opens a drop-down menu where *Wash* is selected and activated by pressing *Save & Exit*.

The wash cycle is configured on page *Parameters* and *Wash*. The user selectable wash time sets the time in seconds for an open wash relay. Recommended wash cycles depending on the wash medium, see Section *Recommended wash settings*.

If you want to activate the wash manually, go to the *Diagnostics display* and press Prism Wash. This will initiate a single wash cycle.

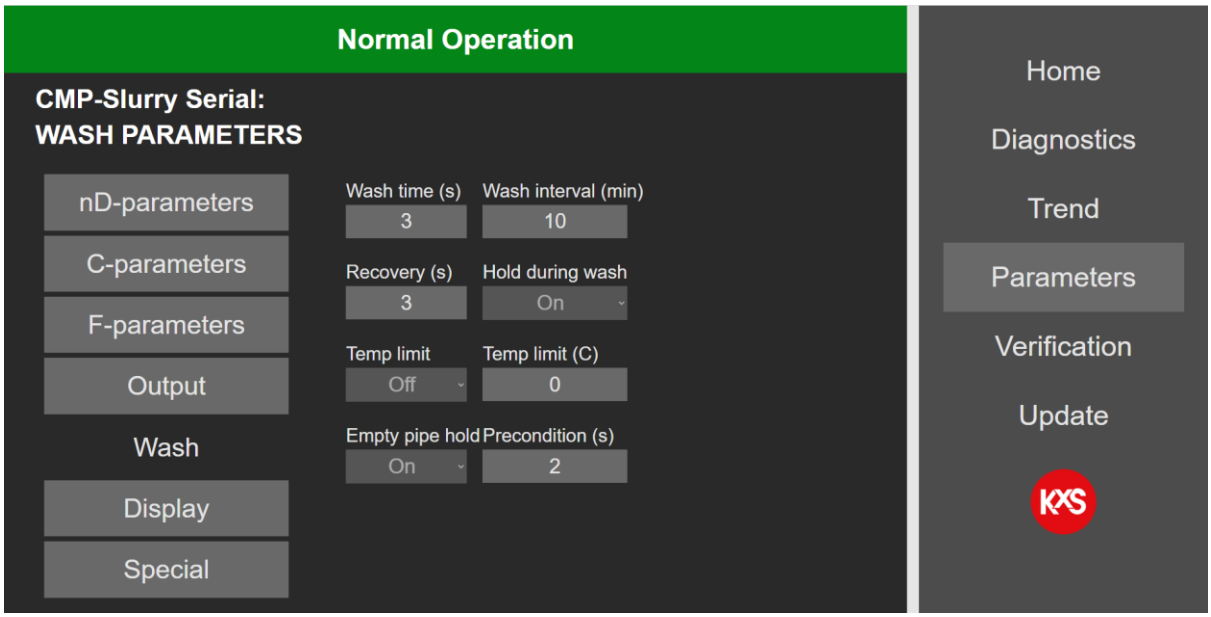


Figure 51 Optical window wash function and time settings.

The recovery time describes the time in seconds between a closed wash cycle and activation of the CONC concentration output value. The CONC concentration output value can be put on hold during wash by selecting *On* in *Hold during wash*. With an activated Hold during wash the last CONC concentration output value is held when the wash cycle begins.

6.4.6 Display

User selectable engineering units in a drop-down menu are available for display of concentration and temperature. The number of displayed decimals of the final output CONC is user selectable 1-6.

Note! The displayed CONC engineering unit is not connected to the Chemical calibration parameters as described in 3.4.2. The sensor calibration is always correlated with the C-Parameters.

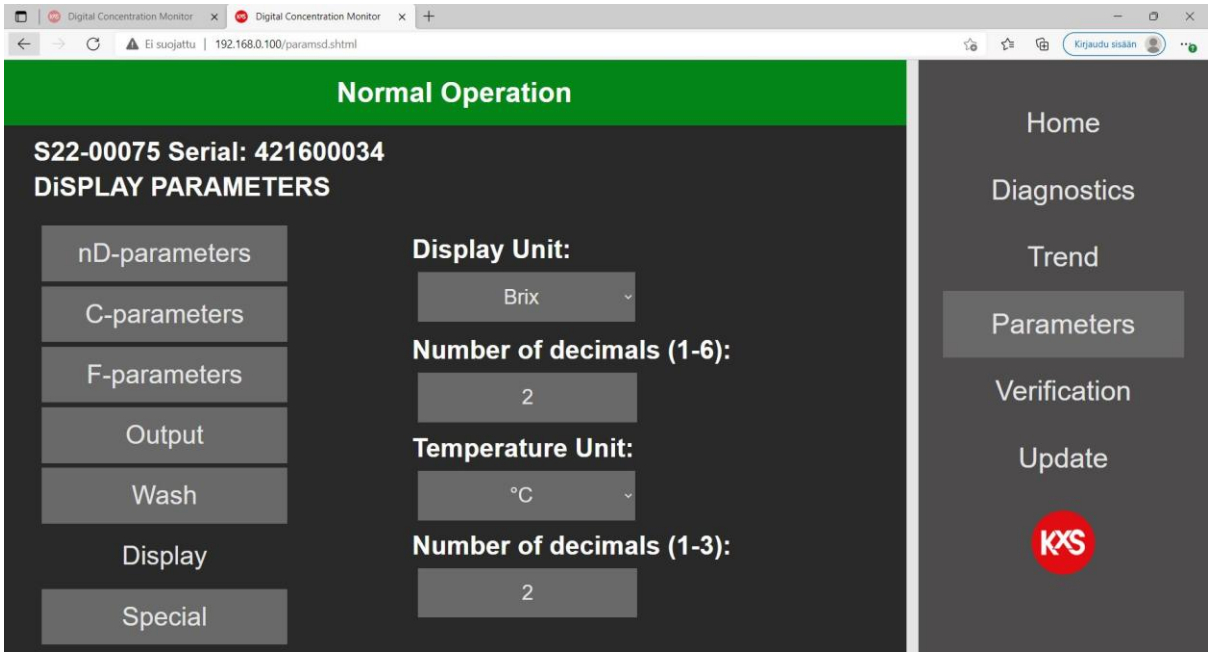


Figure 52 Displayed engineering units for concentration and temperature.

6.4.7 Software update

Sensor software is updated in the user interface in section Update. To access the sensor update function, the user interface Login must be activated. Login is activated in section Parameters/Special. Please consult KxS Technologies or its authorized distributor partner for login Password. A successful Login will allow a sensor software update function. The user interface status bar is indicated with 'Update allowed'.

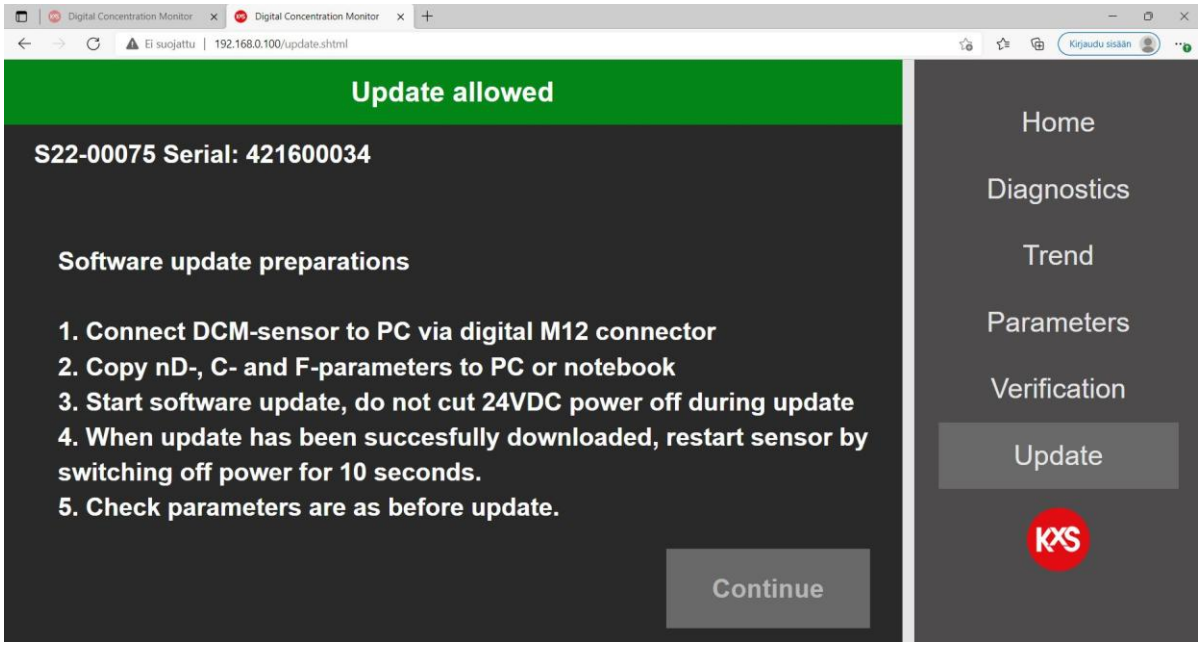


Figure 53 Guided sensor software procedure

The sensor software file is Selected and then activated by pressing 'Update. The update progress is indicated in the status bar. During the update progress the user interface should not be operated nor power to the DCM-20 interrupted. Once the update is successful, there is an indication of allowing for 10 seconds prior to rebooting the sensor through a power cycle. The sensor software version is visible in page Diagnostics.

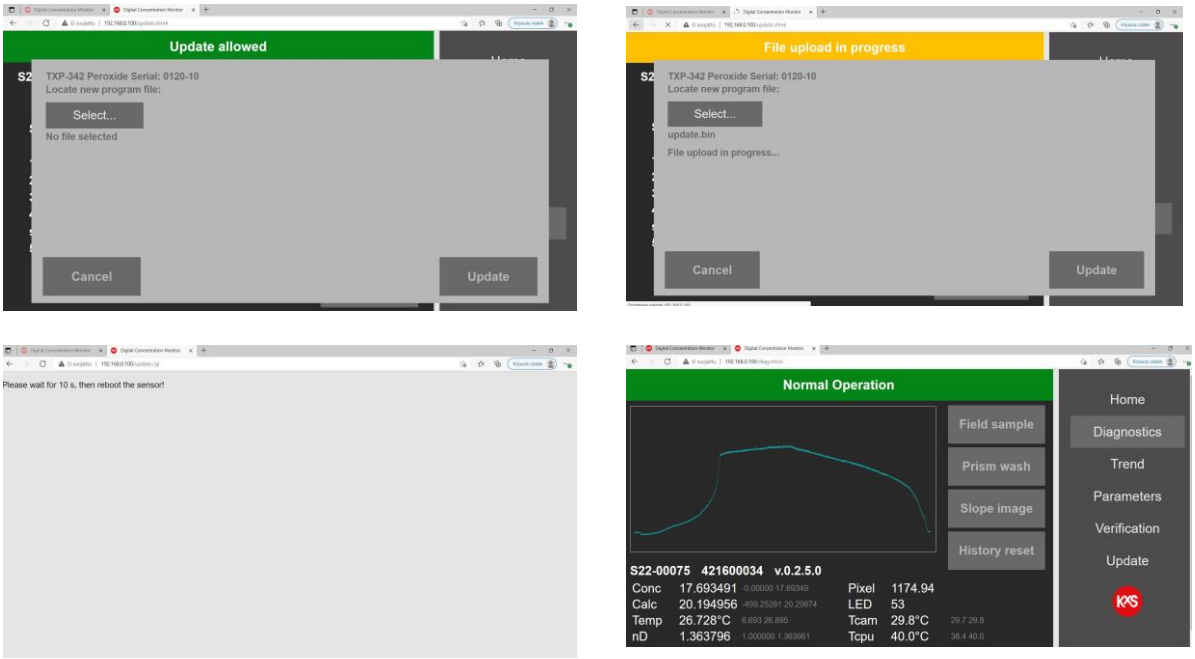


Figure 54 Sensor software update sequence

7. Digital Modbus TCP configuration

The DCM-20 digital output signal is designed with Ethernet communication in a Modbus TCP protocol. The protocol uses by default **Port 502** as local port in the server.

When configuring programmable logic controllers PLC, the DCM-20 measurement quantities are found in defined registers and addresses. The registers are defined in the Modbus Holding register with Function code 03. Sensor specific measurement quantities found in Register numbers and addresses as listed below:

Measurement quantity		Register number	Address	Data type
Status		40001	0	string32
LED		40017	16	float
RHsens	(sensor relative humidity)	40019	18	float
nD	(raw refractive index)	40021	20	float
CONC	(final concentration value)	40023	22	float
Temp	(process temperature)	40025	24	float
Tsens	(sensor internal temperature)	40027	26	float
PIX	(Pixel value)	40029	28	float
CALC	(calculated concentration)	40031	30	float
Qual	(Quality of optical image)	40033	32	float
ShortStatus		40037	36	unsigned short

ShortStatus values:

0: NORMAL_OPERATION
1: NO_SAMPLE
2: OVER_RANGE
3: OVER_RANGE_PRISM_COATED
4: NORMAL_OPERATION_LOW_LIGHT
5: NORMAL_OPERATION_LOW_QUAL
6: PRISM_COATED
7: WASH_PRECONDITION
8: WASH_ACTIVE
9: WASH_RECOVERY
10: WASH_TEMP_LIMIT
11: WASH_EMPTY_PIPE_HOLD
12: SENSOR_HUMIDITY_HIGH
13: SENSOR_TEMPERATURE_HIGH

8. Preventive maintenance

8.1 Regular wash nozzle inspection during shutdowns

To ensure the optimal performance of the steam and hot condensate wash system, it is recommended to perform the following checks **during every process shutdown:**

1. Make sure the process pipe is empty and unpressurized. **Pull out the nozzle** for inspection.
2. **Check for possible wear and damage:** Inspect the nozzle hole for signs of wear or damage. Ensure the hole retains its original shape and size to maintain effective steam or hot condensate water flow.
3. **Ensure the steam or hot condensate water hole is open:** Verify that the nozzle hole is not clogged or obstructed. The hole should remain fully open to allow unrestricted steam flow.

For removal and insertion of wash nozzle, refer to safety instructions in this manual.

Replace the wash nozzle O-ring with a new one before reinserting the nozzle into the process to ensure a proper seal and prevent potential leaks.

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