SATRON VO Turbidity and solids content analyzer

Installation and Setting-Up Instructions
Spare Parts List

Contents:

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Pasve™ is a trademark of Satron Instruments Inc.
Hastelloy® is the registered trademark of Haynes International.
Viton® is the registered trademark of DuPont Down Elastomers.

1. INSTALLATION

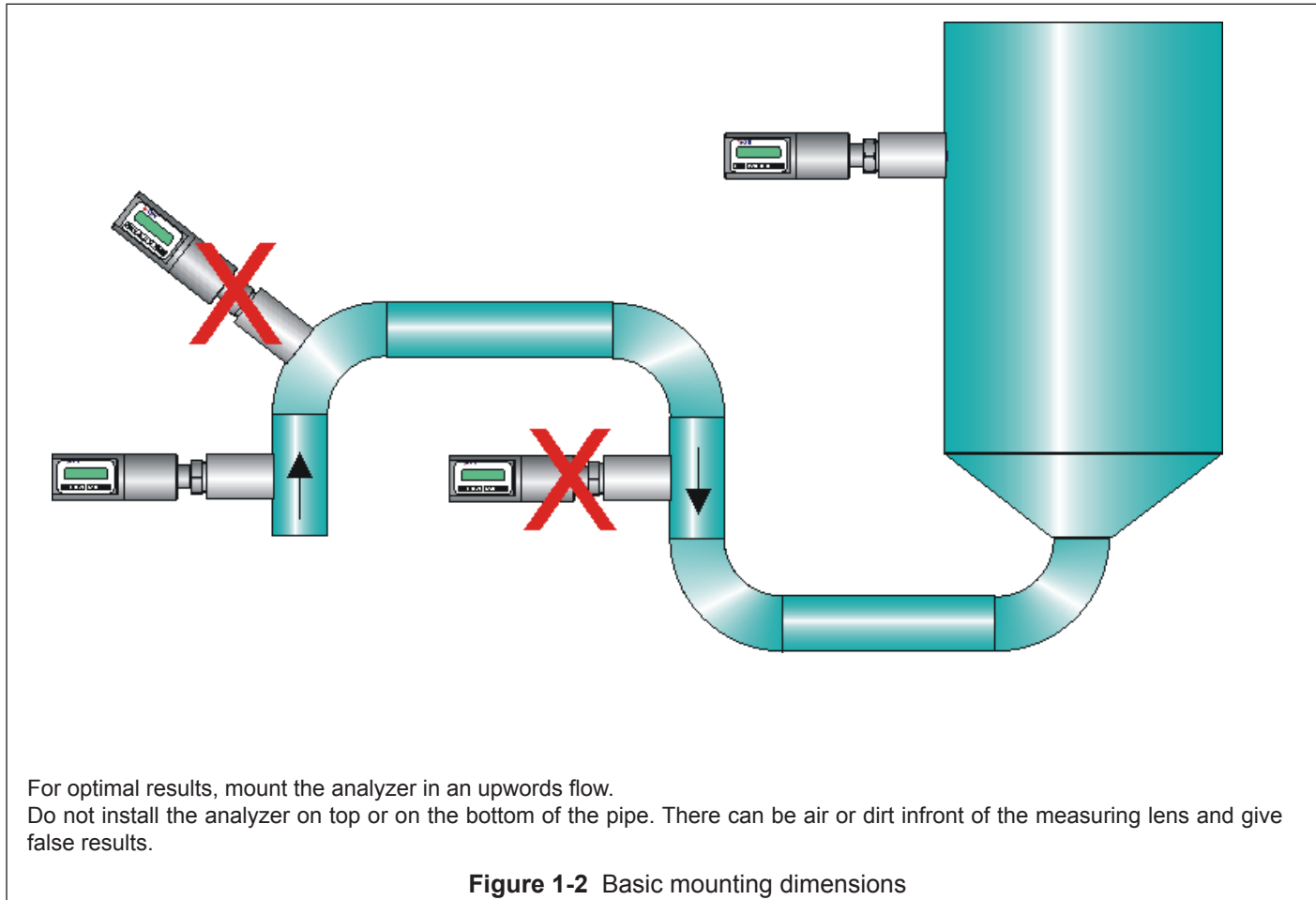## 1.1 Mechanical installation
Mounting recommendations: Fig. 1-1
• Process connection direction: horizontal
• Cable entry direction: from below
• Connector coupling direction, calibration
  direction: horizontal
• Process flow: Upwards

Figure 1-3 installation with PASVE mounting/ service valve

Figure 1-1 Recommended mounting positions

Leak port must be pointed down.

Figure 1-4 Installation with process coupling

For optimal results, mount the analyzer in an upwords flow.
Do not install the analyzer on top or on the bottom of the pipe. There can be air or dirt infront of the measuring lens and give false results.

Figure 1-2 Basic mounting dimensions

1.1.1 Installing welded process couplings.
For ⚠ installations please goto page 4.

Mounting hole for coupling
• Make a Ø 45.5 mm (+0.5/-0.2 mm) hole in the tank wall or pipe, as shown in Figure 1-5.

Welding the coupling
These instructions apply to all welded couplings; welding the G1 standard coupling is described here as an example.
• Place the coupling in the mounting hole as shown in Fig. 1-6. Then weld with several runs so as to prevent the coupling's oval distortion and tightness problems.
• The analyzer must be **out of the coupling** while the coupling is welded.You can use the shut-off plug shown in Fig. 1-7 to shut the coupling. The plug protects the coupling's sealing face and permits the starting of the process without the transmitter.
• It is always recommendable to use the welding assistant (M1050450) while welding the coupling to prevent any distortions due to heat.
• Do not make weld grounding via any analyzer's body!

1.1.2 Mounting the analyzer on the coupling

Procedure
• Make sure that the coupling's sealing face is clean.
• Remove the orange protective plug from the analyzer head.

• Insert the analyzer **in a straight line** (Fig. 1-8) into the coupling, so that the guide groove on the transmitter aligns with the stop pin on the coupling. The analyzer settles into position when the groove and pin are aligned, and will be prevented from rotating in the coupling.

When inserting the analyzer, be careful not to damage the edge of the lens on the edges of the coupling or on the end of the stop pin!

• Lock the transmitter in position by screwing the hex nut fully home. Finger tightness is sufficient to tighten the sealing faces. However, we recommend final tightening with a tool to eliminate the effect of vibration and other such factors. Apply 60±20 Nm torque.

Do not use sealing tape etc. on threaded connection!

Figure 1-5 Coupling mounting hole   10044110

Welding Sequence

Figure 1-6 Welding the coupling   1050354043

Welding assistant M1050420

79

HEX 36

1 Shut-off plug, AISI316 (Order No. M550405)
2 Shut-off screw G1
3 G1 welded process coupling

Figure 1-7 Coupling shut-off plug   10044108

Figure 1-8   10044006

1.1.3 Instructions and spare parts that are according and within the 3-A appliance

46 - 03

Welding the coupling

All couplings that are according the 3-A appliance listed in the bottom of this page.

These instructions apply to hygienic welded couplings; welding the G1 M548101A coupling is described here as an example.

• Place the coupling in the mounting hole as shown in Fig. 1-7. Make sure the leakage detection port is down. Then weld with several runs so to prevent the coupling's oval distortion and tightness problems. The inside welding must be cleaned, and polished with an end result of Ra <0,8

• The analyzer must be **out of the coupling** while the coupling is welded. You can use the shut-off plug shown in to shut the coupling.

The plug protects the coupling's sealing face and permits the starting of the process without the transmitter.

• It is always recommendable to use the welding assistant (M1050450) while welding the coupling to prevent any distortions due to heat.

• Do not make weld grounding via any analyzer's body!

Mounting the analyzer on the coupling

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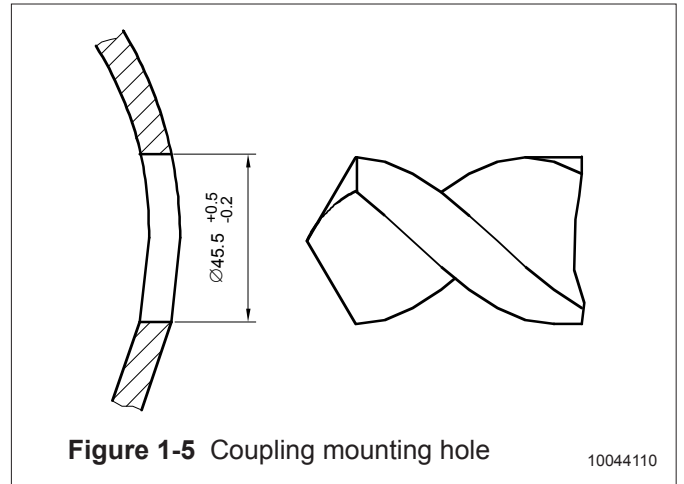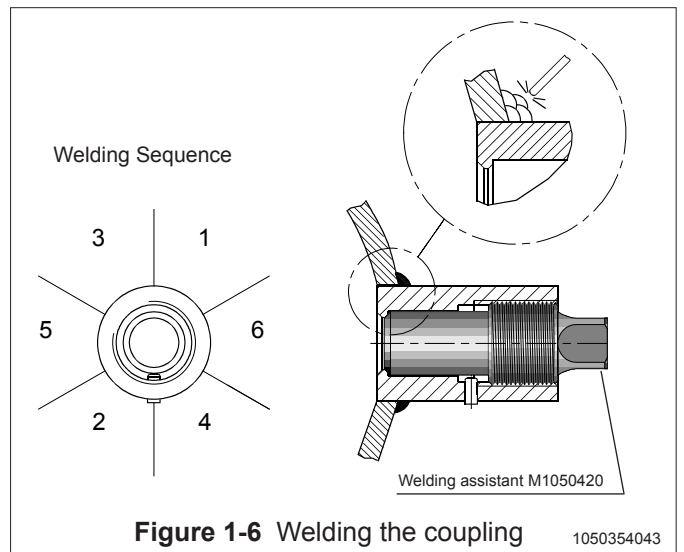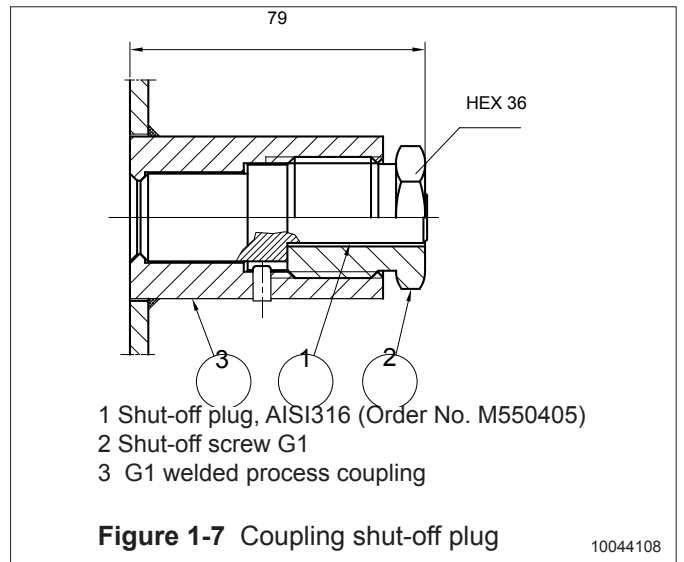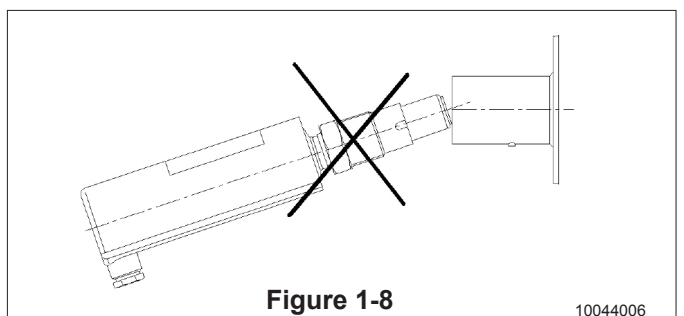**Do not use sealing tape etc. on threaded connection!**

Welding Sequence

Polished Ra <0,8

3   1

5   6

2   4

Figure 1-7

Welding assistant M1050420

Spare parts

No.	Part name			
1	O-ring EPDM	80031720	3A 18-03 Class **II**	(Do not exceed above 8% fat content).
1	O-ring FPM (Viton®)	80011720	3A 18-03 Class **I**	
2	Sticker	T1325215		
3	Plug cover DIN43650	T1325003		
4	Plug cover M12	T1325005		
5	38/G1" Welding adapter	M1050577A		
5	45/G1" Welding adapter	M548101A		
6	Tuchenhagen / Varivent DN25	M1050090A		
6	Tuchenhagen / Varivent DN50	M1050091A		
6	Tuchenhagen / Varivent DN65,5	M1050092A		
7	Tri-clover 25/38 ISO2852	M1050206A		
7	Tri-clover 40/51 ISO2852	M1050222A		
7	Tri-clover 63.5 ISO2852	M1050224A		

1.1.4 Dimensions and Housing types VOM

H0T-Housing

N0S-Housing

L-Housing

Tri-Clamp 25/38 ja 40/51
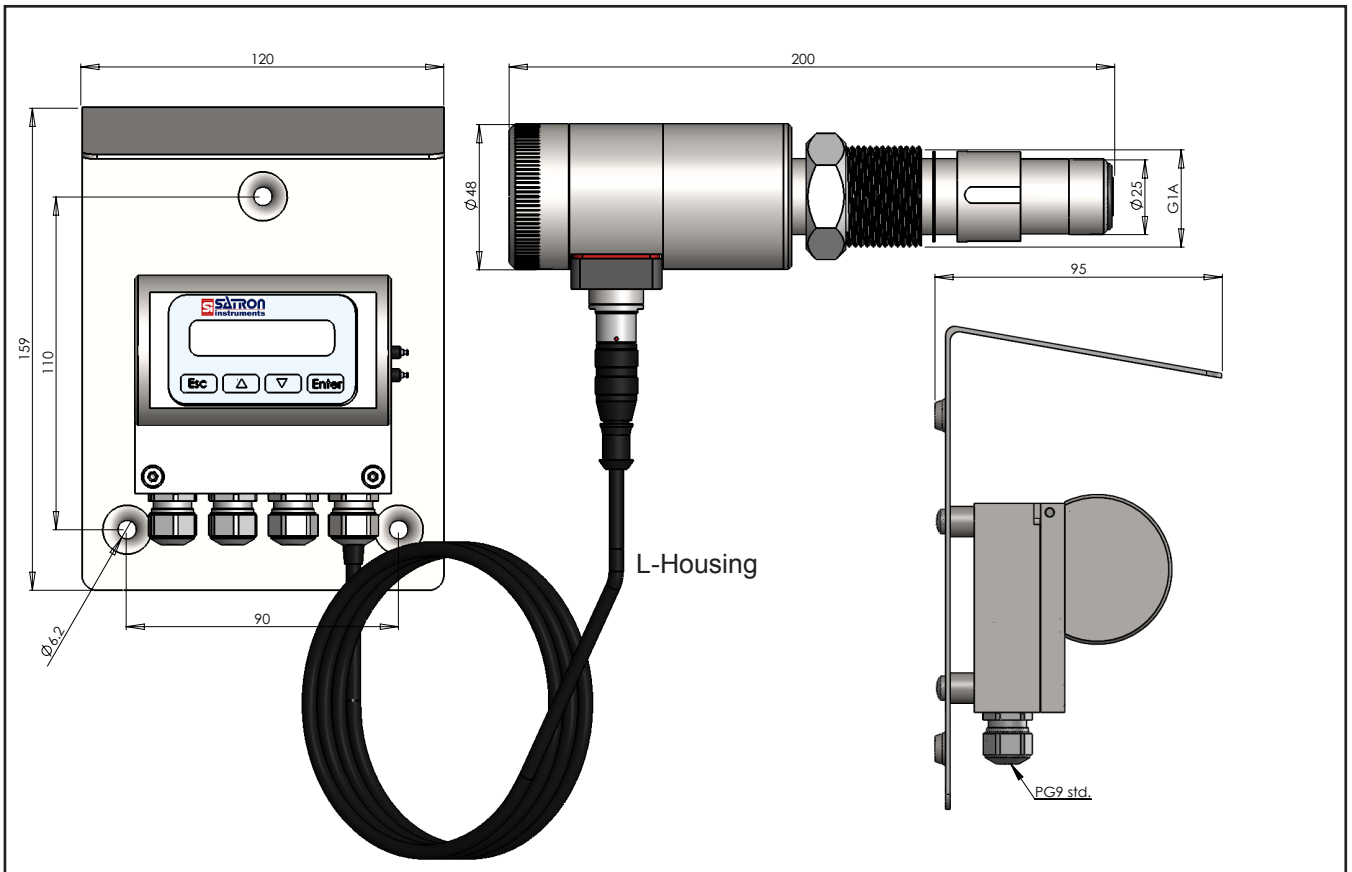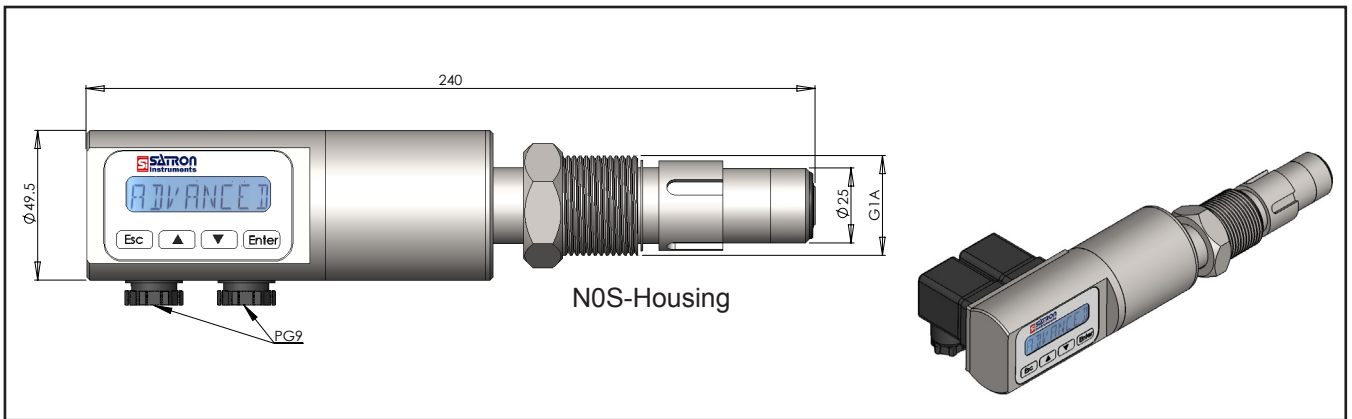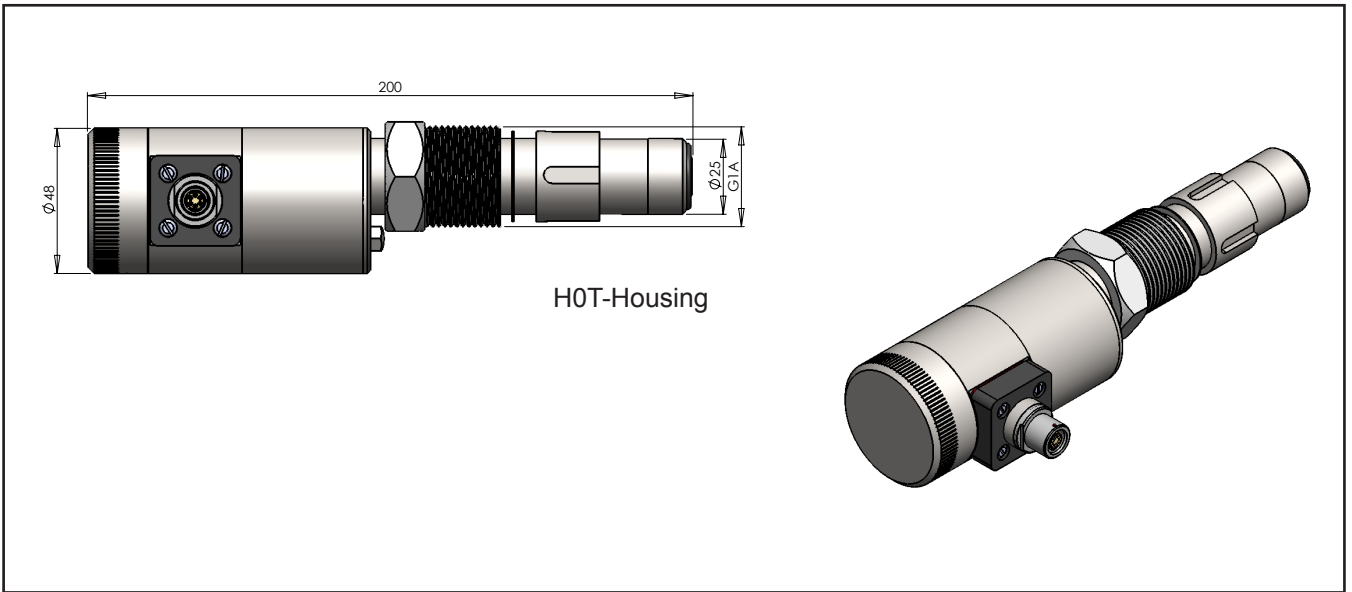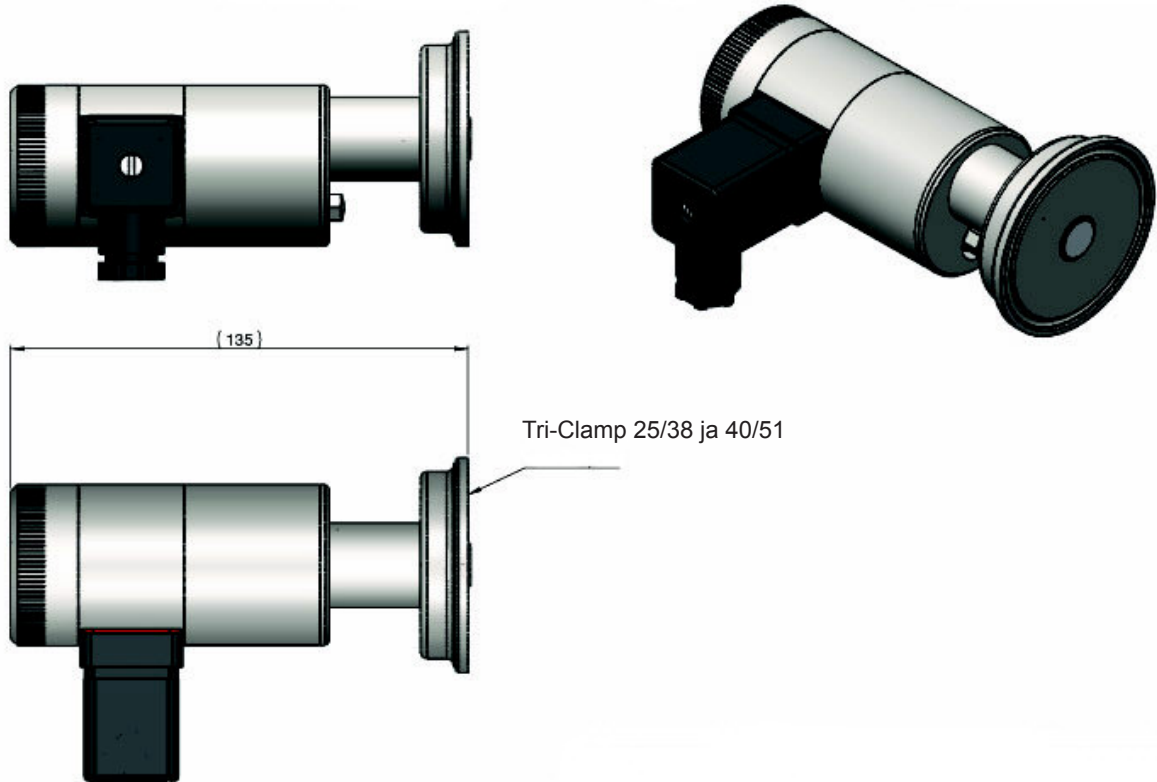
VOM with Tri-Clamp process connections, codes TA and TB
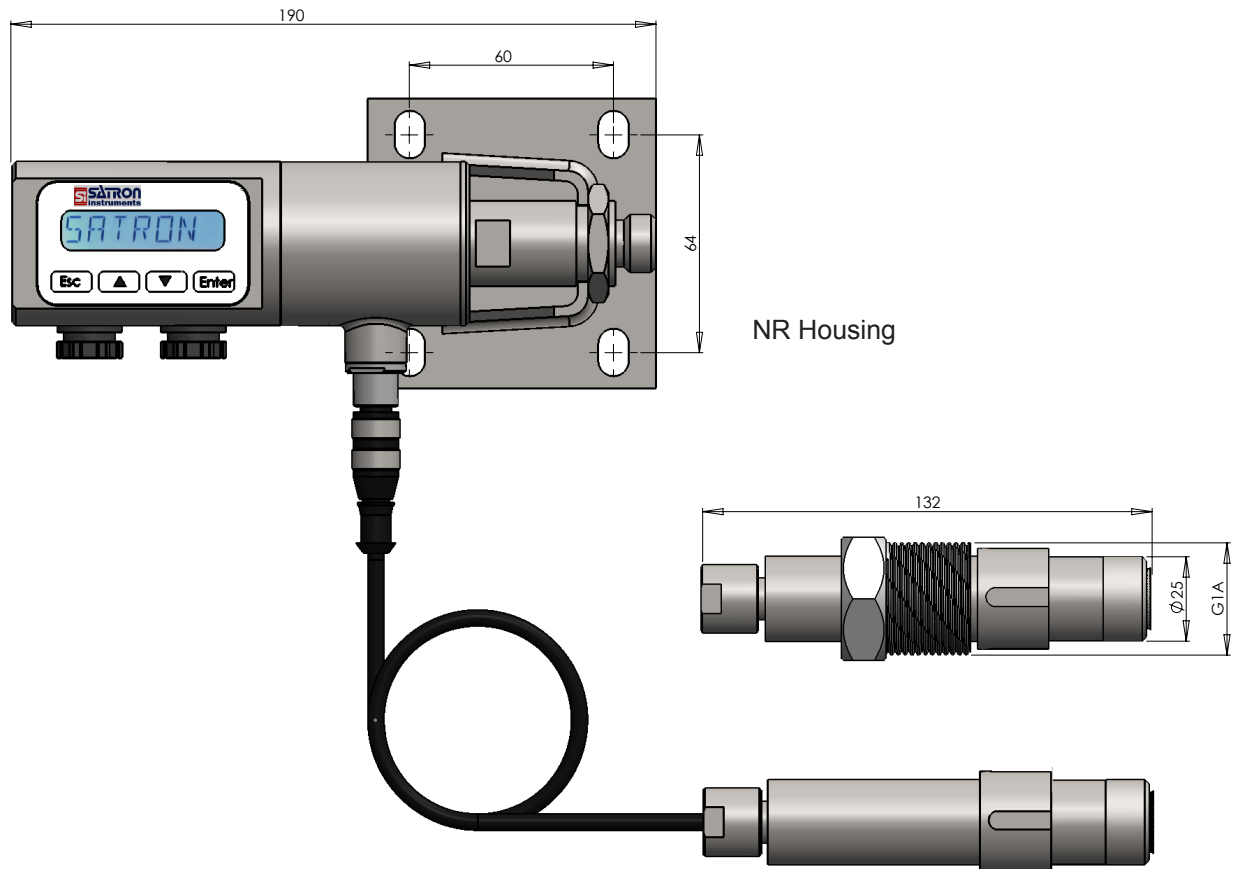
NR Housing

VOM with remote sensor, housing type code R

7

Dimensions and housing type VOF

H-housing

304

⌀ 48

G1A

⌀ 23

120

⌀ 48

304

G1A

⌀ 23

L-Housing

159

110

Esc △ ▽ Enter

⌀ 6.2

90

VOF with valve
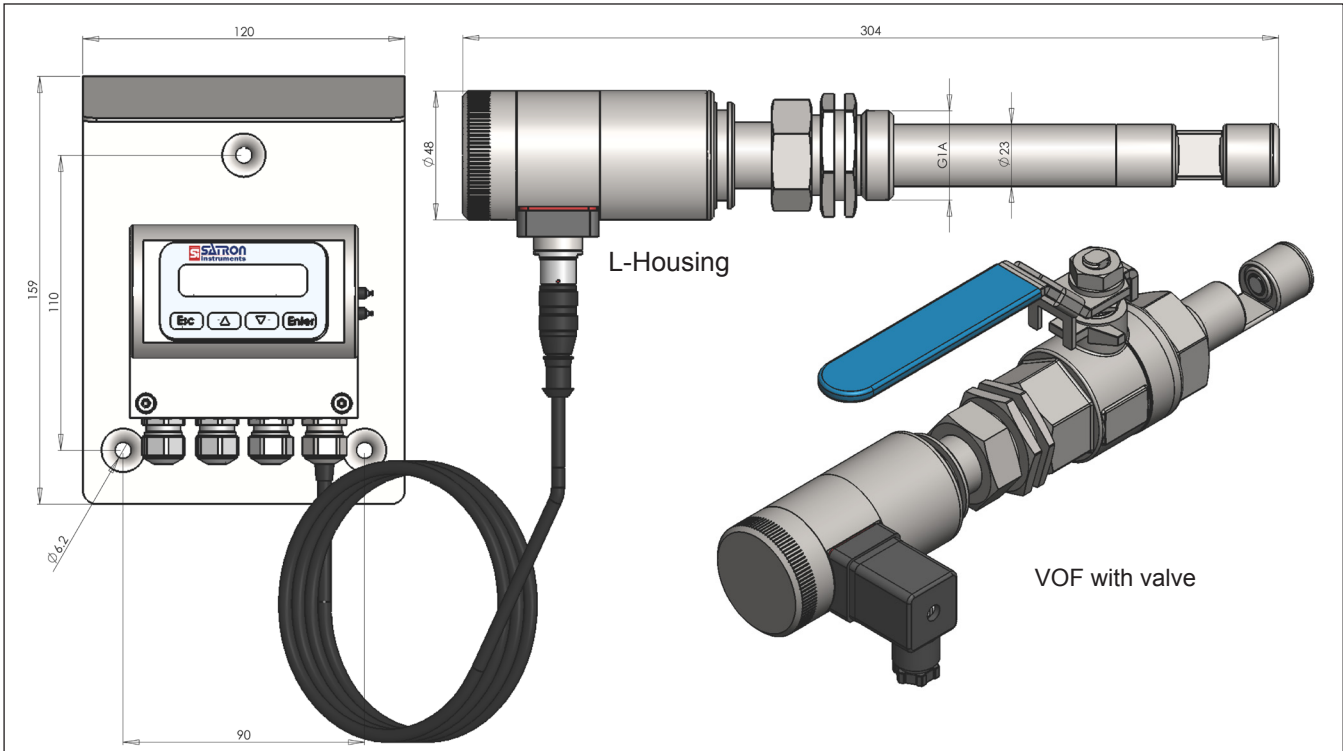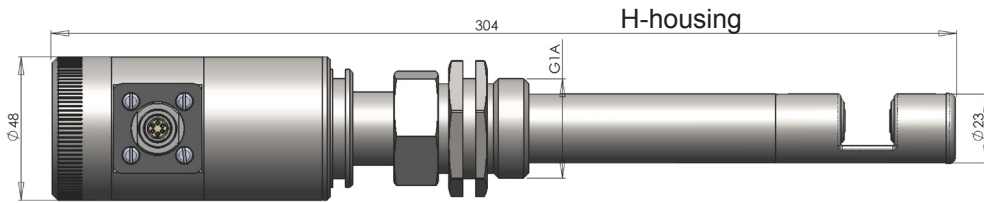
Dimensions and housing type VOD

SATRON

Esc ▲ ▼ Enter
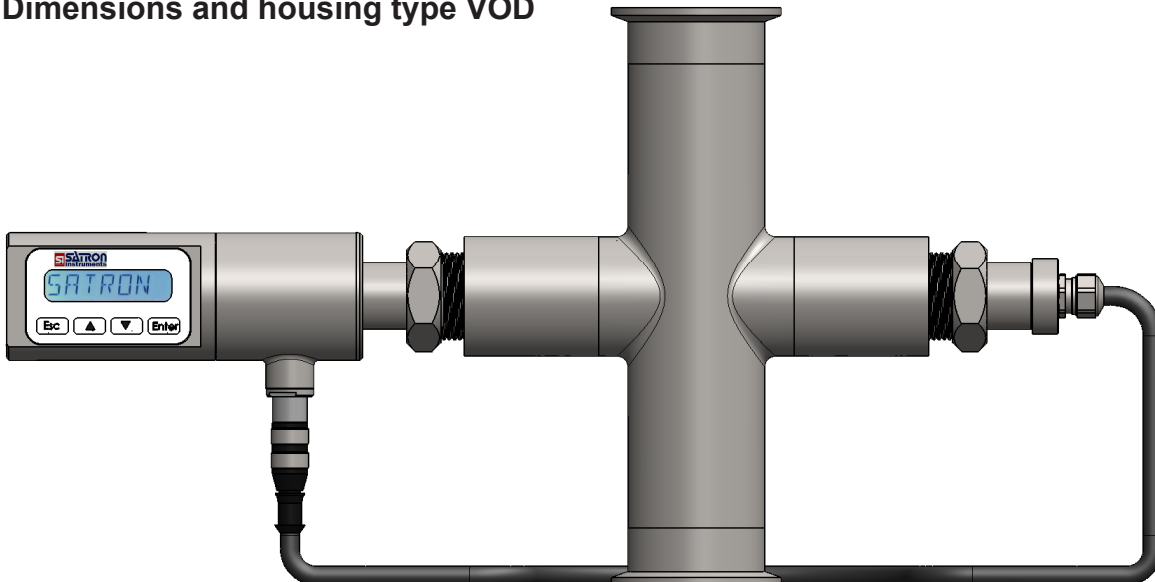
For easy installation the VOD is available with many different process connections. Such as:
DN50 PN40
DN100 PN40
Tri-Clamp DN38, DN51, DN63,5
Sandvik DN70 PN40
SMS38
SMS51
Tuchenhagen / Varivent
Contact Satron for other possibilities

1.2 Electrical connections

Supply voltage and load of the transmitter according to the figure 1-16.

We recommend shielded twisted-pair cable as signal cable.

The signal cable should not be installed near high-voltage cables, large motors or frequency converters.

The shield of the cable is grounded at the power supply end or according to the recommendations of the manufacturer of the used control system.

Position selection 3 x 90°

1. Remove screw
2. Open

Tighten the screw

Figure 1-15 Removing the PLUG junction box

Min. load using HART® – communication 250 Ω

$$R_{max} = \frac{Supply\ voltage - 5\ V}{I_{max}}$$

I_{max} = 20.5 mA using HART®-communication

I_{max} = 23 mA (when the alarm current 22,5 mA is on)
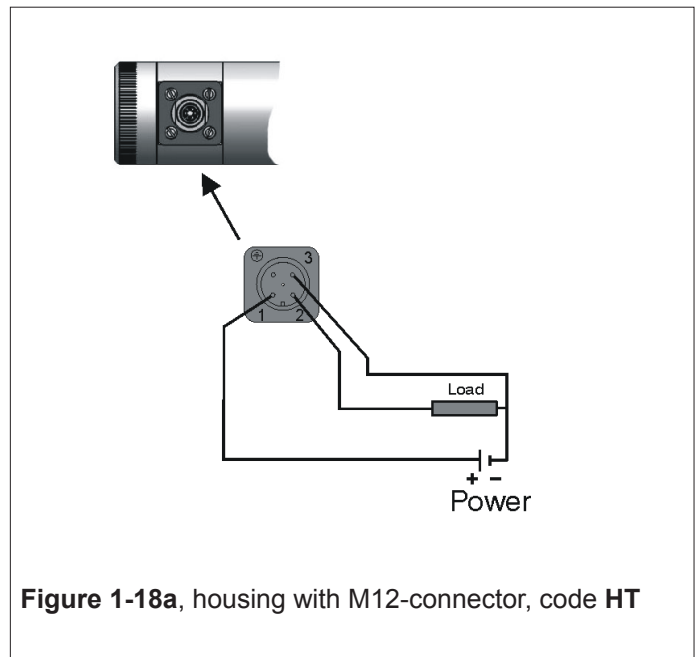
Figure 1-16

Figure 1-18a, housing with M12-connector, code **HT**
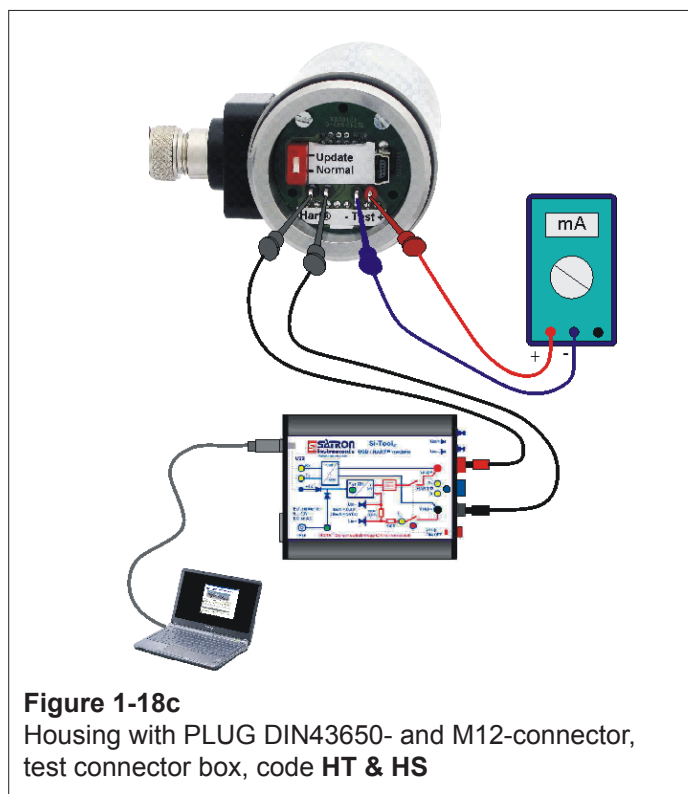
Figure 1-18c
Housing with PLUG DIN43650- and M12-connector, test connector box, code **HT & HS**
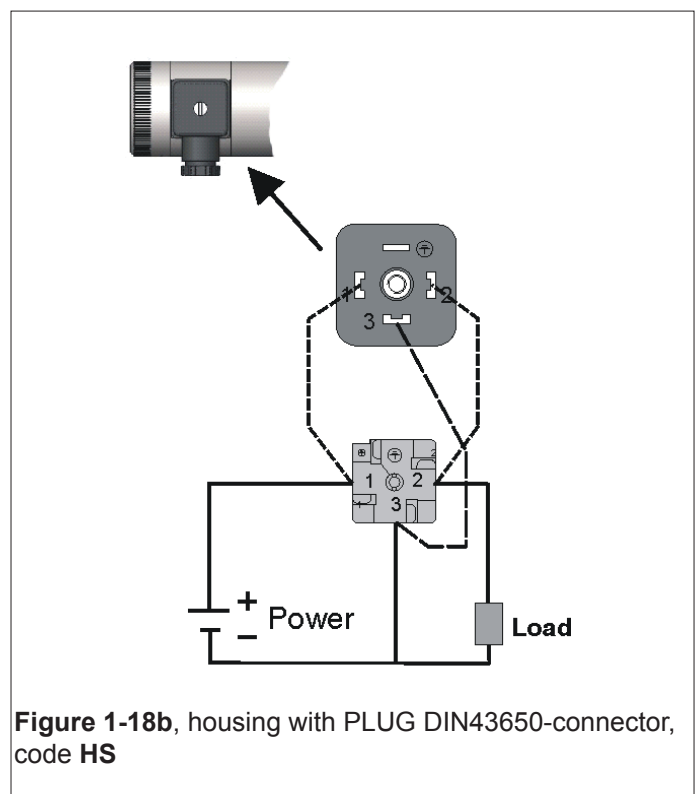
Figure 1-18b, housing with PLUG DIN43650-connector, code **HS**

Wiring
Housing with display and PLUG DIN43650-connector, code **NS**

Wiring
Housing with display and M12-connector, code **NT**

Wiring
Remote electronics housing with display, code **L**

10
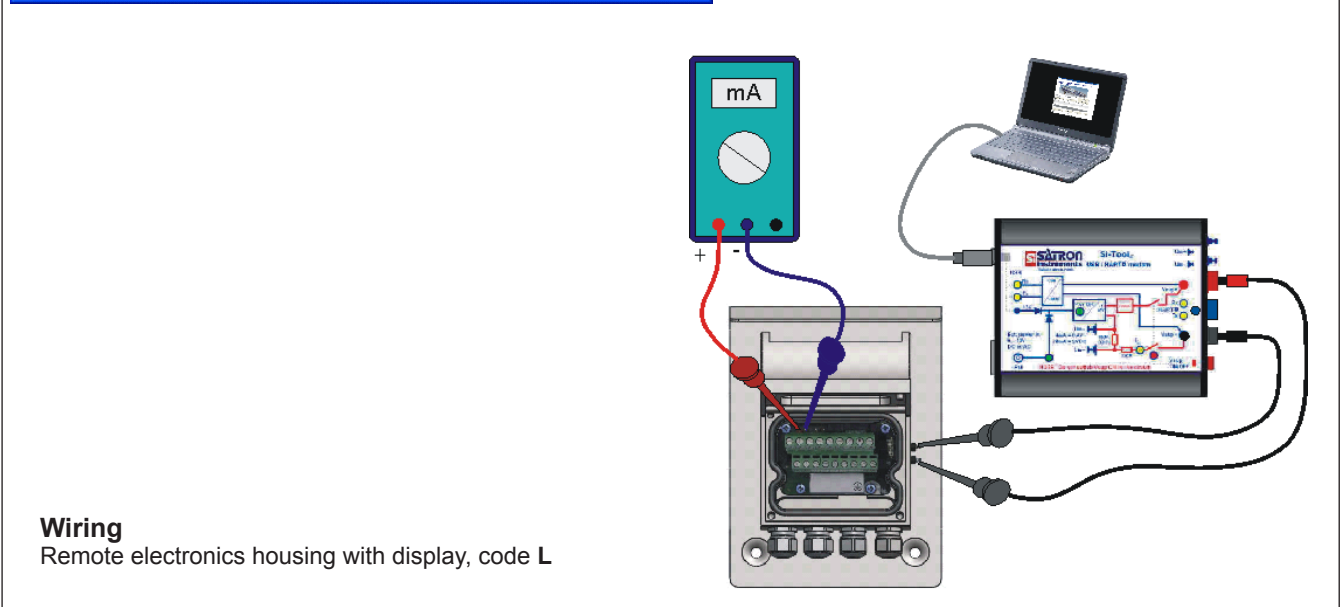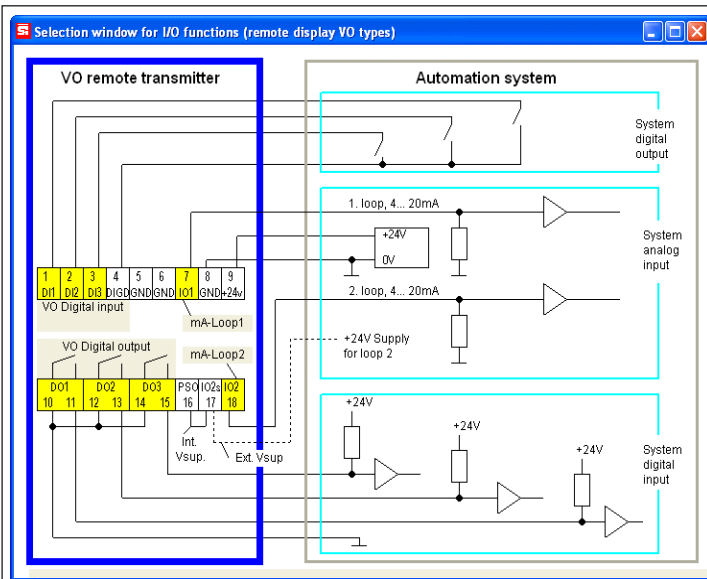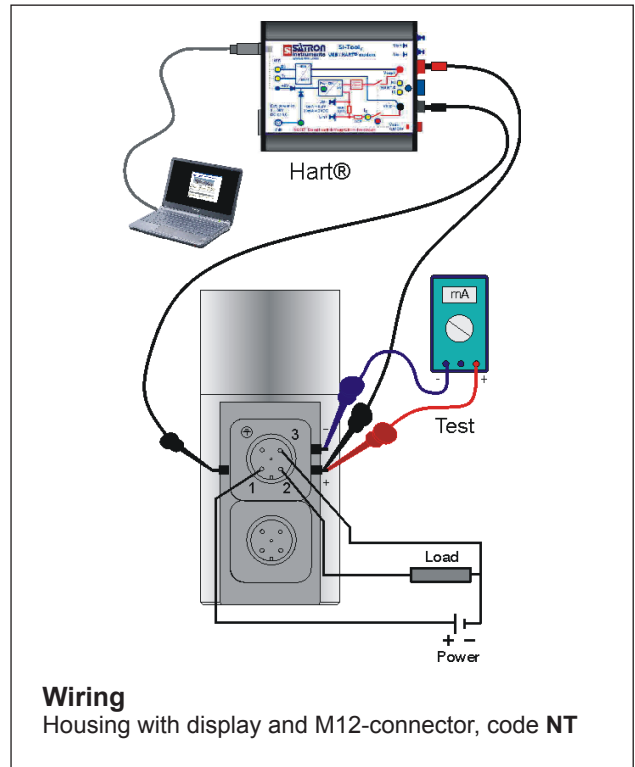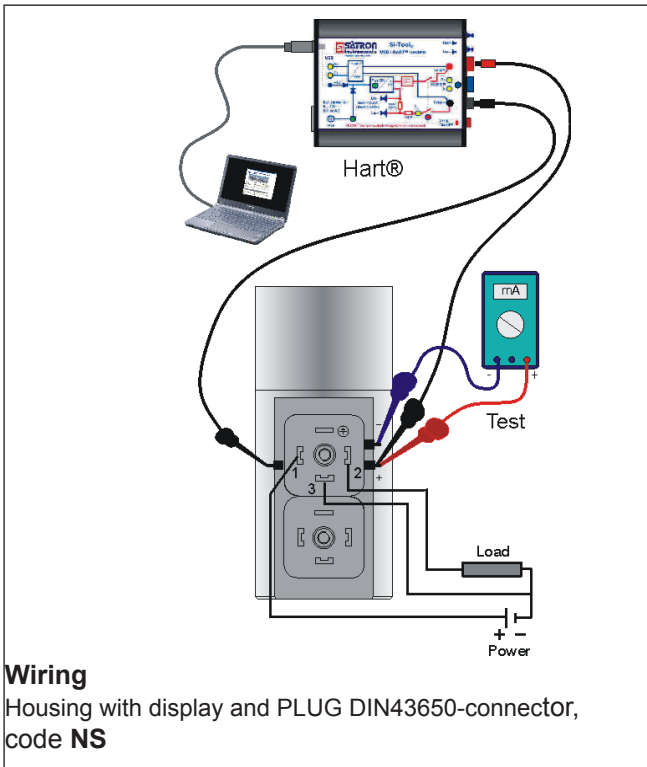
2.1 Setting-up with Satron VoAdvisor Service Software

When you want to have all the operations of the Smart transmitter, we recommend the use of Satron VoAdvisor Service Software program. Satron Instruments Inc. will deliver you the program and HART-modem.
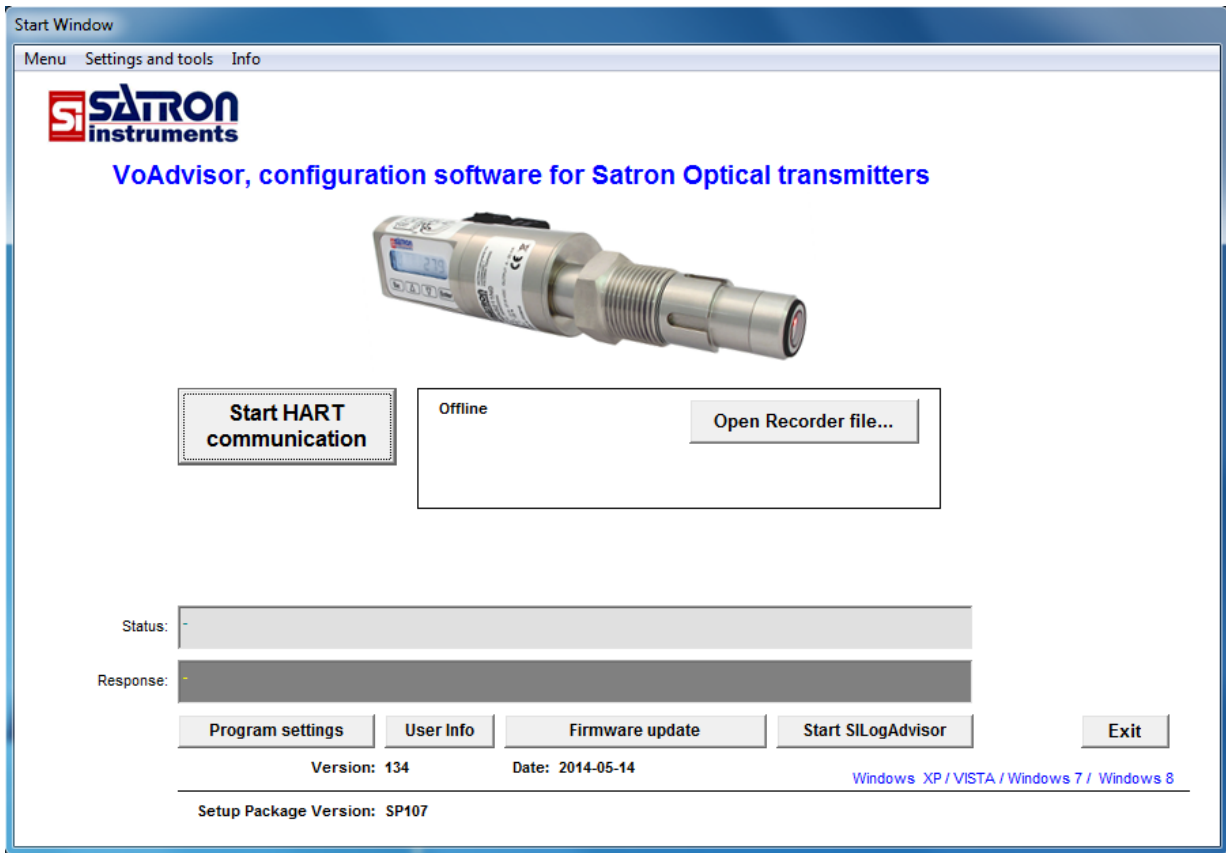
Figure 2-2   VOadvisor software

2.2 Setting-up with local switches

The additional instruction of display menus is enclosed
to this manual. See chapter 3
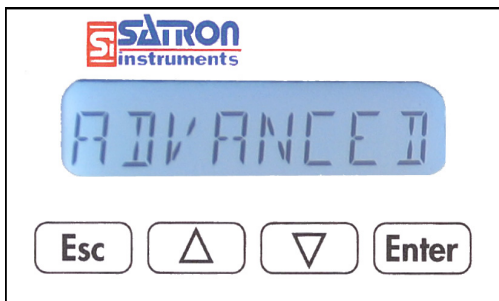
Housing with display, code N

Keyboard :

Esc   =   Press **Esc** move back towards the top of the main menu.

▲   =   Use the **UP** arrow key to move up on the current menu level
or to increase the selected parameter value.

▼   =   Use the **DOWN** arrow key to move down on the current menu
level or to decrease the selected parameter value.

Enter   =   Press **ENTER** to move to a lower level in a menu or to accept
a command or parameter valu

2.3   Setting up with VO remote unit.

The Satron VO remote can be provided with a wall box which is capable of having a 20m cable between the Sensing unit and the Display unit. Inside the Display unit is a terminal where up to 3 binary inputs, 3 relay outputs and 2 analog milliamp loops can be connected. All connections can be used simultaneously.
The signal cable between the Display unit and Sensing unit should not be installed near high-voltage cables, large motors or frequency converters.

VO Remote Connections

VO Sensing connections.
Inside the Sensing element is a dipswitch and a USB port. This is only used for updating the firmware.
DO NOT USE THE USB PORT UNLESS THERE NEEDS TO BE A NEW FIRMWARE INSTALLED.

3. USER GUIDE FOR MENUS
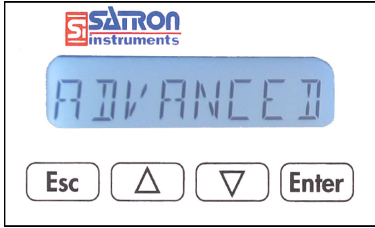
The user interface for the series VO analyzers, housing option N, consists of display and operating keys. Among other things, the user interface allows you to set process variables in the desired units on the display and to configure the analyzer e.g. by setting the lower and upper range-values.
In addition, you can perform diagnostic routines and view device information through the user interface.
The 8-character liquid crystal display (LCD) with backlight allows you to display information with letters and numbers.

OPERATING KEYS:
With the UP/DOWN arrow keys and the ENTER and ESC you can move in the menus.
ENTER:
Press ENTER to move to a lower level in a menu or to accept a command or parameter value.
UP:
Use the UP arrow key to move up on the current menu level or to increase the selected parameter value.
DOWN:
Use the DOWN arrow key to move down on the current menu level or to decrease the selected parameter value.
ESC:
Press the ESC to move back towards the top of the main menu or cancel the current action.

3.1 MEASUREMENT VALUES MENU:

When the analyzer is powered up, it immediately shows the MEASUREMENT VALUES. Use the UP/DOWN keys to move in the menu. The menu does not have any variables adjustable by the user.
Pressing DOWN shows you the following parameters in order.

U	the user calibrated information.
DIO3	the status of the digital input/output #3
DIO2	the status of the digital input/output #2
DIO1	the status of the digital input/output #1
E	the temperature of the electronics
S	the temperature of the sensor head
MA	the value of the first mA loop
MA2	the value of the second mA loop
%	the selected UNIT for the user calibrated information. (%).

3.2 MENU STRUCTURE

The VO analyzers equipped with a display and with Firmware version O120601A or later, the menu is split in to a "BASIC", and "FULL" structure. You can see the current firmware version during startup for 1 second. Or go to "INFO">"VERSION">"CPU FW", in the "FULL" structure menu.
For a quick 2 point calibration, checking the sensor status, alarms, or setting up damping for the measurement, entering the "BASIC" structure will fulfill. For more advanced settings like Language, in/out-put configuration, change of recipe, the "FULL" structure needs to be used.

4.1 Setting up with "BASIC"

To enter the "BASIC" structure menu:
Press ESC shortly, and 3 submenu´s are accessible.

"CALIB" CALIB
This is the basic calibration mode. Here the 4mA and 20mA points can be changed. The result is always a linear 2 point calibration. You can change both 4mA and 20mA, or only one of them. The analyzer needs to be teached to the new calibration, by means of having the corresponding liquid in front of the lens. the analyzer will inform that the calibration will be erased. Confirm by pressing Enter.

"# 4 MA?" *   4 MA?
Now the analyzer is asking for the 4mA value. Insert the analyzer in the corresponding liquid, wait 5 seconds and press enter.

"# 20 MA?" * 20 MA?
Now the analyzer is asking for the 20mA value. Insert the analyzer in the corresponding liquid, wait 5 seconds and press enter.
By pressing ESC. the value will be left the same, allowing to for example only change the 4mA or only the 20mA. By pressing ESC. for each value the calibration procedure will be canceled totally.

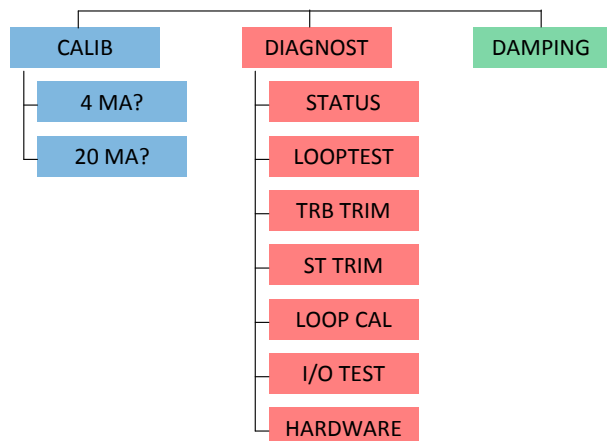### "DIAGNOST" DIAGNOST
    (see 4.2.5 for more information)
    STATUS
    LOOPTEST
    TRB TRIM
    ST TRIM
    LOOP CAL
    I/O TEST
    HARDWARE

"DAMPING" DAMPING
Time constant, in seconds for output damping. The range is 0.000s to 60s. Set the value with the **UP/DOWN** keys and accept it with **ENTER** or press **ESC** if you do not want to change the value.

4.2 Setting up with "Full"
Under the full menu are 6 submenus: System configuration, Measurement configuration, Output- configuration, Info, Diagnostics and Advanced. To enter these submenus press ESC for 3 seconds. See page 18.

4.2.1 SYSTEM CONFIGURATION `SYSTCONF`
(configure parameters that have an effect on the system like e.g. language and date.)

TAG: `TAG`
Tag code. You can enter free-format text one character at a time. When you select this option with **ENTER** the cursor will be at the left. Select characters with **ENTER** (to the right) and **ESC** (to the left). You can view the selectable characters one character at a time with the **UP/DOWN** keys until the desired character is found. When the cursor is at the right edge you can go back to the **SYSTCONF** menu either by accepting the new tag code with **ENTER** or by pressing exiting without changing the tag code by pressing the **ESC** key when asked to accept your entry. Apostrophe indicates the cursor position; at point, however, the cursor will disappear. A great deal of special characters are available besides letters and numbes.

FACTORY: `FACTORY`
Restore Factory settings. After entering this menu you will get a warning message that the configurations will be lost after this point. To cancel the procedure press **ESC**.

PASSWORD: `PASSWORD`
From this menu you can set a password (0…999) for the analyzer. If a password has been specified, you cannot set any parameters or make any other settings on the analyzer unless you enter the correct ID number in this menu. Password is not in use when **PASSWORD** is 000 after reset. You enter the **PASSWORD** in the same way as **TAG. PASSWORD** will be on when you define a value between 1 and 999. If you forget password get on to Satron Instruments Inc.

DISPLAY: `DISPLAY`
In this menu you can select the looks in which the display will be read.
BACKLGHT: Select the intensity of the backlighting from **OFF, LOW, MEDIUM** and **HIGH**.
ANGLE: lets you select the angle of the text.
NORMAL: From left to right. Transmitter mounted horizontally with process connection directed to the right.
ROTATED: Rotates the text 180 degrees from NORMAL.

HART: `HART`
Select this function with the **UP/DOWN[↑↓]** keys. In menus 1-3 you select the content of the burst message. You can view the available selections with the UP/DOWN[↑↓] keys. Available options:
In menu 1 (PV): Transmitter sends process value PV to system.
In menu 2 (PERCEN%): Transmitter sends process variable's value in per cent of specified measuring range to master.
In menu 3 (PVS/CURR): Transmitter sends all process variables and current signal's value.
In menu 5 (POLL ADR): Select the transmitter's Hart® address. The address can be set between 0 and 15. Address 0 defines current loop, in which case the transmitter will operate in two-wire system. The procedure is the same as described above.
In menu 6 (BURST ON/OFF): Select the Burst mode. First define the process variable sent by the transmitter from menus 1-3. The procedure is the same as described above.

DATE: `DATE`
From this menu you can set the date DD.MM.YYYY. You enter the DATE in the same way as TAG.
The calendar year can be selected from between 1900 and 2155. This date can be example the date of the last calibration done.

LANGUAGE: `LANGUAGE`
Select the Display language.
FINNISH, ENGLISH, SWEDISH, GERMAN, DUTCH, FRENCH.

4.2.2 MEASCONF: `MEASCONF`
(configure parameters that have an effect on the measurement.)

DAMPING: `DAMPING`
Time constant, in seconds for output damping. The range is 0.000s to 60s. Set the value with the **UP/DOWN** keys and accept it with **ENTER** or press **ESC** if you do not want to change the value.

AVERAGE: `AVERAGE`
Time constant in Hz for averaging the output. The range is 1Hz to 50Hz. . Set the value with the **UP/DOWN** keys and accept it with **ENTER** or press **ESC** if you do not want to change the value.

UNIT: `UNIT`
Here you can select what unit you want to show in the display as process value.
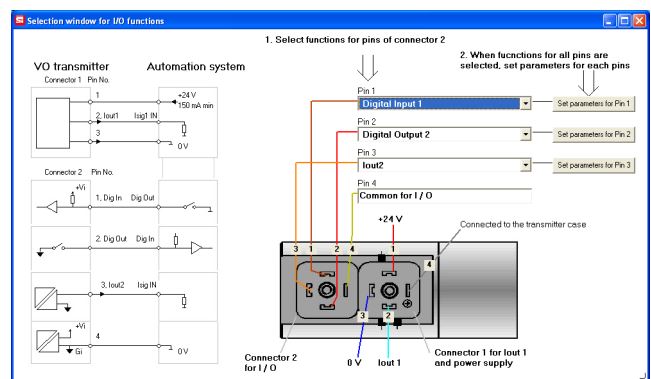FNU, FTU, NTU, %, mg/L*, ppm*
* only available in COD models.

LED CURR: Select the maximum amount of current that the LED is using in percentages.

4.2.3 I/O CONF: `I/O CONF`
(configure parameters that have an effect on the INPUT and OUTPUT relays).
Satron highly recommends the use of the
software package VoAdvisor to alter these settings!

VoAdvisor input / output configuration window

I/O 1: `I/O 1`
Settings menu for input / output PIN #1.

TYPE: `TYPE`
Select the function.
When "NONE" is selected it will be off. To use it as a digital input, select DIN1. For digital output select DOUT1.

OF TIMER: `OF TIMER`
Overfeed timer limits the time that the digital output can be continuously in ON state.
The time can be selected in seconds in the range of 1…60000s.
By default the overfeed timer is not used.
Note: overfeed timer does not function if digital output is overridden by HOLD function, when performing a I/O test in the DIAGNOST menu or with HART CPU Control/ DOOverride.

OF DELAY: `OF DELAY`
Off delays can be used to delay digital output state from ON > OFF transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

ON DELAY: `ON DELAY`
On delays can be used to delay digital output state from OFF > ON transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

DEADBAND: `DEADBAND`
Select the deadband area. In this area the state will not change to prevent fast ON/OFF switching. By default this area is 0.

LO VALUE: `LO VALUE`
Enter the lower limit value for the state transition of the digital output

HI VALUE: `HI VALUE`
Enter the upper limit value for the state transition of the digital output

SWITCH: `SWITCH`
Change the direction of the transition change of the digital output

SOURCE: `SOURCE`
Select the source to which the digital output will change its state.
  PV is the process value selected by the user. (value which is behind "U" on the display).
  MA is the 1st current loop
  ST is the sensor temperature located 5 millimeter behind the optical lens
  RANGE-% this will show a 0 to 100 % value correlating to 4…20mA.

FUNCTION: `FUNCTION`
  HI LIMIT the digital output will change its state depending on the HI VALUE
  LO LIMIT the digital output will change its state depending on the LO VALUE
  HILO LIMIT the digital output will change its state depending on the HI and LO VALUE
  ERROR AL the digital output will change its state when there is an error
  WARNG AL the digital output will change its state when there is a warning
  ERWNG AL the digital output will change its state when there is a error and/or warning
  HOLD when the digital input is ON the whole unit will be in a hold until the input is OFF.
  NONE no function.

I/O 2: `I/O 2`
Settings menu for input or output PIN #2.

TYPE: `TYPE`
When "NONE" is selected it will be off. To use it as a digital input, select DIN2. For digital output select DOUT2. When the second current loop is used with an external power supply this needs to be set at IO2EXT.

OF TIMER: `OF TIMER`
Overfeed timer limits the time that the digital output can be continuously in ON state.
The time can be selected in seconds in the range of 1…60000s.
By default the overfeed timer is not used.
Note: overfeed timer does not function if digital output is overridden by HOLD function, when performing a I/O test in the DIAGNOST menu or with HART CPU Control/ DOOverride.

OF DELAY: `OF DELAY`
Off delays can be used to delay digital output state from ON > OFF transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

ON DELAY: `ON DELAY`
On delays can be used to delay digital output state from OFF > ON transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

DEADBAND: `DEADBAND`
Select the deadband area. In this area the state will not change to prevent fast ON/OFF switching. By default this area is 0.

LO VALUE: `LO VALUE`
Enter the lower limit value for the state transition of the digital output

HI VALUE: `HI VALUE`
Enter the upper limit value for the state transition of the digital output

SWITCH: `SWITCH`
Change the direction of the transition change of the digital output

SOURCE: `SOURCE`
Select the source to which the digital output will change its state.
  PV is the process value selected by the user. (value which is behind "U" on the display).
  MA is the 1st current loop
  ST is the sensor temperature located 5 millimeter behind the optical lens
  RANGE-% this will show a 0 to 100 % value correlating to 4…20mA.

FUNCTION: `FUNCTION`
  HI LIMIT the digital output will change its state depending on the HI VALUE
  LO LIMIT the digital output will change its state depending on the LO VALUE
  HILO LIMIT the digital output will change its state depending on the HI and LO VALUE
  ERROR AL the digital output will change its state when there is an error
  WARNG AL the digital output will change its state when there is a warning
  ERWNG AL the digital output will change its state when there is a error and/or warning
  HOLD when the digital input is ON the whole unit will be in a hold until the input is OFF.
  NONE no function.

I/O 3: `I/O 3`
Settings menu for input or output PIN #3.

TYPE : `TYPE`
When "NONE" is selected it will be off. To use it as a digital input, select DIN3. For digital output select DOUT3. The enable the second miliamp loop select IO2.

OF TIMER: `OF TIMER`
Overfeed timer limits the time that the digital output can be continuously in ON state.
The time can be selected in seconds in the range of 1…60000s. By default the overfeed timer is not used.
Note: overfeed timer does not function if digital output is overridden by HOLD function, when performing a I/O test in the DIAGNOST menu or with HART CPU Control/ DOOverride.

OF DELAY: `OF DELAY`
Off delays can be used to delay digital output state from ON > OFF transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

ON DELAY: `ON DELAY`
On delays can be used to delay digital output state from OFF > ON transitions. The time can be selected in seconds in the range of 0…300s. By default the off delay is not used.

DEADBAND: `DEADBAND`
Select the deadband area. In this area the state will not change to prevent fast ON/OFF switching. By default this area is 0.

LO VALUE: `LO VALUE`
Enter the lower limit value for the state transition of the digital output

HI VALUE: `HI VALUE`
Enter the upper limit value for the state transition of the digital output

SWITCH: `SWITCH`
Change the direction of the transition change of the digital output

SOURCE: `SOURCE`
Select the source to which the digital output will change its state.
  PV is the process value selected by the user. (value which is behind "U" on the display).
  MA is the 1st current loop
  ST is the sensor temperature located 5 millimeter behind the optical lens
  RANGE-% this will show a 0 to 100 % value correlating to 4…20mA.

FUNCTION: `FUNCTION`
  HI LIMIT the digital output will change its state depending on the HI VALUE
  LO LIMIT the digital output will change its state depending on the LO VALUE
  HILO LIMIT the digital output will change its state depending on the HI and LO VALUE
  ERROR AL the digital output will change its state when is an error
  WARNG AL the digital output will change its state when there is a warning
  ERWNG AL the digital output will change its state when there is a error and/or warning
  HOLD when the digital input is ON the whole unit will be in a hold until the input is OFF.
  NONE no function.

4.2.4. OUTPCONF `OUTPCONF`
(configure parameters that have an effect on the output current loops). Change the recipe and perform new calibrations.

RECIPE `RECIPE`
Upto 4 different recipe´s can be stored in the VO. The basic factory calibration is stored standard in Recipe 1.
To perform a new calibration its recomended to use a different recipe.

LIN FUNC: `LIN FUNC`
Change the transfer function between USER and LINEAR.
 LINEAR is the standard linear transfer function using lower and upper range values. (LRV & URV)
This transfer function is used for scaling mA, it does NOT change the process value PV. The user point table is not in use.
USER is the default transfer function, in which the process value PV can be changed using 2…16 calibration point pairs.

USER.PNTS: `USERPNTS`
With the LIN FUNC selected as USER, the number of points is selected with the counter.
  POINT.CNT   Point counter for selecting the amount of calibration points. 1…16.
  POINT 1…16   By selecting SAMPLE for the corresponding point, a realtime measurement will start and when the user presses "ENTER" the unit will average the sample currently measuring and save this for the current point number. The first point corresponds to 4mA output and the last point corresponds to 20mA output.
  By using the edit function the user is able to alter the raw Please refer to the chapter CALIBRATION EXAMPLE of this manual to find more detailed information how to perform a full re-calibration.

USER MODE: `USERMODE`
Select the interpolation method between points.
  INTERPL   selects linear interpolation.
  SPLINE   selects spline interpolation.

4.2.4. INFO: `INFO`

MANUFACTURER: `MANUFCTR`
Manufacturer's name. (SATRON) Cannot be changed.

OPERATION TIME: `OP TIME`
The value of the operation time save at 1 hour intervals. When the value of the counter is < 100 hours so value save 1- minute intervals. The value of the operation time counter on the display :
HH :MM :SS when the value of counter is <100 hours
HHHH : MM when the value of counter is <100000 hours
HHHHHHHH when the value of counter is ≥100000 hours

SERIAL NUMBER: `SER NUM`
Serial number. Cannot be changed.

ASSEMBLY NUM: `ASSM NUM`
The analyzers assembly number. Press ENTER to select this item. Press ESC to exit. For instance, assembly number 0901 shows that the transmitter was made in week 01 of the year 2009.

VERSION: `VERSION`
Version numbers of the transmitter's electronics and software. Press ENTER to select this item. Press ESC to exit. With the UP/DOWN keys you can select either CPU HW, CPU SW, ADC HW, ADC SW or MAN REV (manual revision) revision number

or CPU ID-number from this submenu.

DEVICE TYPE: `DEV TYPE`
Product type code. Cannot be changed.

4.2.5. DIAGNOSTICS: `DIAGNOST`

(This submenu allows you to examine the transmitter's internal errors and faults, to set the transmitter to give out a fixed current, and to calibrate the transmitter.)

STATUS: `STATUS`
Here you can display and reset accumulated errors one at a time. The text OK will be displayed if there are no errors. Possible error messages (alarm means a serious fault/error that also puts the current signal in fault status and makes the display blink)

LOOPTEST: `LOOPTEST`
The transmitter can be set to give out a fixed current signal for testing the mA output. The first ENTER will switch the transmitter off from normal mode (AUTO OFF), the second ENTER will set it for 4 mA output, and the third ENTER for 20 mA output. The next ENTER after that will give default value 12 mA, which can be changed as desired with the UP/DOWN keys. The last ENTER will switch the transmitter back to normal mode (AUTO ON). The purpose of this test is to test the accuracy of the transmitter's current output with a reference meter.

LOOPCALIBRATION: `LOOPCAL`
Here you can calibrate the current signal given by the transmitter. The first ENTER will switch the transmitter off from normal mode (AUTO OFF). The next ENTER will make the transmitter give out a signal which it assumes to be 4 mA. Use the UP/DOWN keys to change this value in accordance with the reading on the reference meter. Then press ENTER for 20 mA output, which you must also set in accordance with the reference meter. Press ENTER to accept the new reading.
Note: Use a sufficiently accurate reference meter.

SENSOR TEMPERATURE TRIM: `ST TRIM`
Sensor Temperature Trim. Here you are able to calibrate the temperature probe which is placed in the head of the analyzer. (Maximum by 10 degrees.)
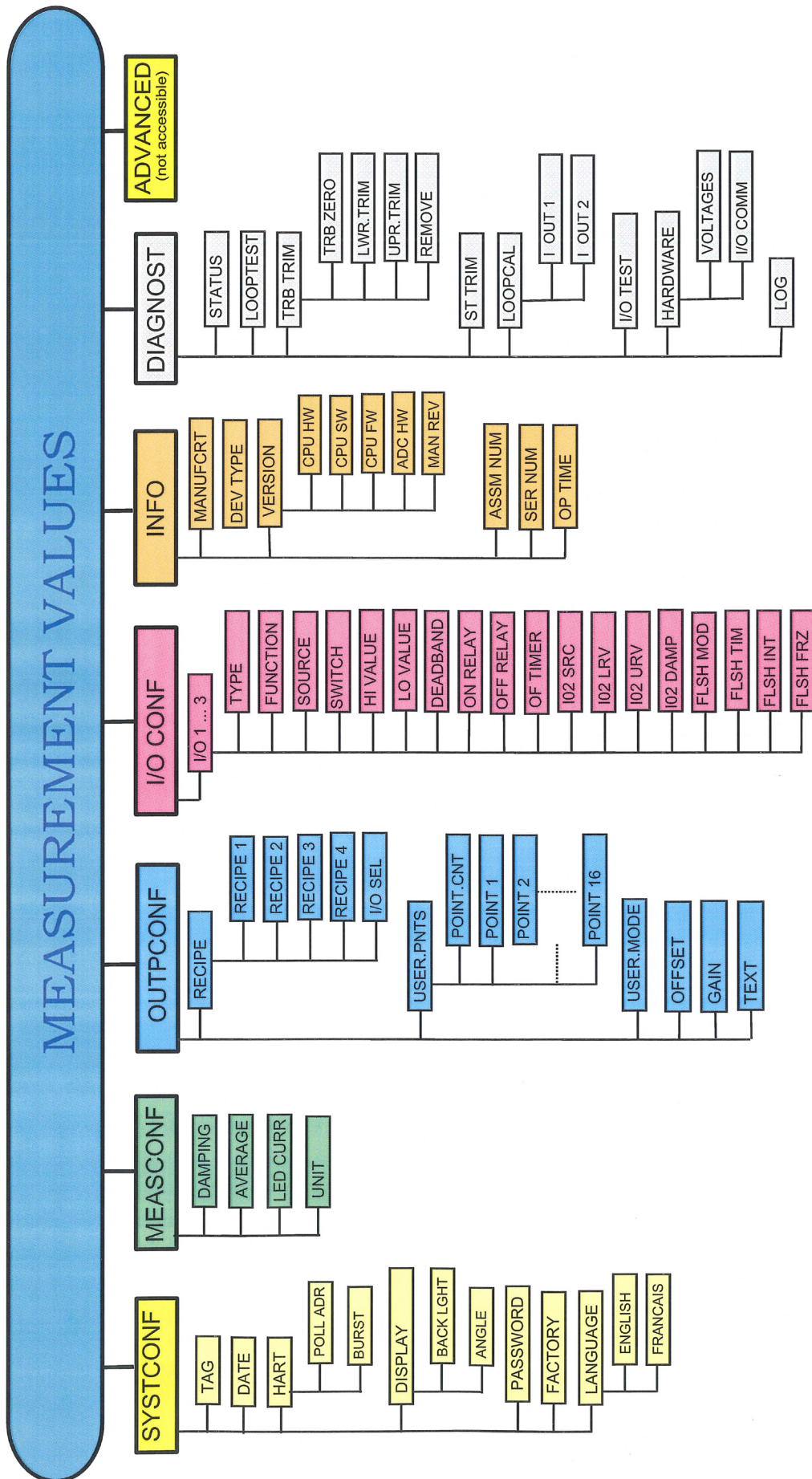
5 Set-up Calibration.

The VO series analyzer comes with a standard factory calibration.
There is space for 4 different calibrations, called recipe 1, 2, 3 and 4. The standard factory calibration is stored in recipe 1. The different recipes can be renamed and also be enabled with the binary inputs.
To change a calibration Satron recommends to use the VoAdvisor software. It is also possible to change the calibration with the use of the sensors own user interface.

Change recipe.

The current enabled recipe is shown with the down arrow when the normal user value (in measurment values) is shown.
To enable a different recipe go to `OUTPCONF` and `RECIPE`

Here you can choose between 1, 2, 3 and 4. Press enter to save.

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2 point calibration guide.

Press the ESC key for 3 seconds, to enter the "FULL" menu.

`OUTPCONF` — Esc

Use the up/down keys to enter the Output configuration window

`USERPNTS` — Enter

Use the up/down keys to enter the User Points selection.

`POINT.CNT` — Enter

Use the up/down keys to enter the point count selection

`2` — Enter

Use the up/down keys to select how many points the calibration will have.
In this example there are 2 calibration points. Point 1 equals 4mA and Point 2 equals 20mA.
Press enter to save the settings.

`SAVE ?` — Enter

Use the up/down keys to calibrate Point 1 (4mA)

`POINT   1` — Enter

Use the up/down keys change between sample mode and edit. Use sample.

`SAMPLE` — Enter

The analyzer will start showing the raw data on the display. Press enter when ready.

`*` — Enter

Enter the display value corresponding to 4mA (0.0 in this example)

`0.000000` — Enter

Press enter to save the first point of the calibration.

`SAVE ?` — Enter

Use the up/down keys to calibrate Point 2 (4mA)

`POINT   2` — Enter

Use the up/down keys change between sample mode and edit. Use sample.
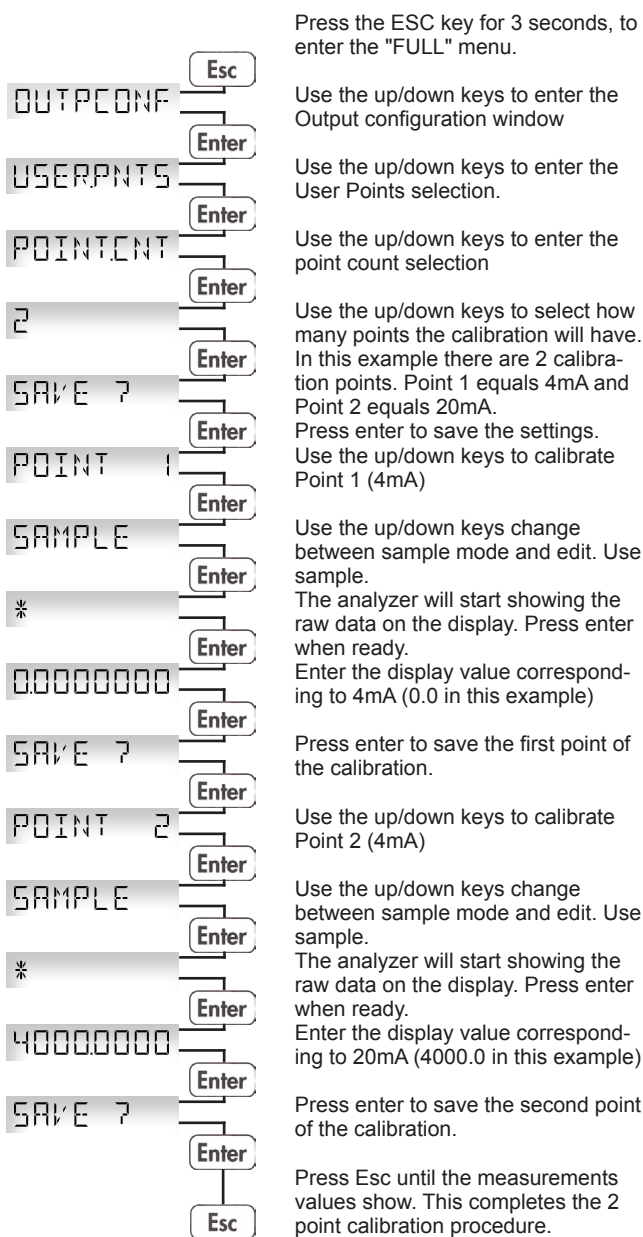
`SAMPLE` — Enter

The analyzer will start showing the raw data on the display. Press enter when ready.

`*` — Enter

Enter the display value corresponding to 20mA (4000.0 in this example)

`4000.000` — Enter

Press enter to save the second point of the calibration.

`SAVE ?` — Enter

Press Esc until the measurements values show. This completes the 2 point calibration procedure.

— Esc

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1 point calibration guide.

The unit is calibrated with 1 known sample. This is the Center point.
In this example the Center point is equal to 2000.
The 4mA value is selected as -75% from the center point (500).
The 20mA value is selected as +50% from the center point (3000).
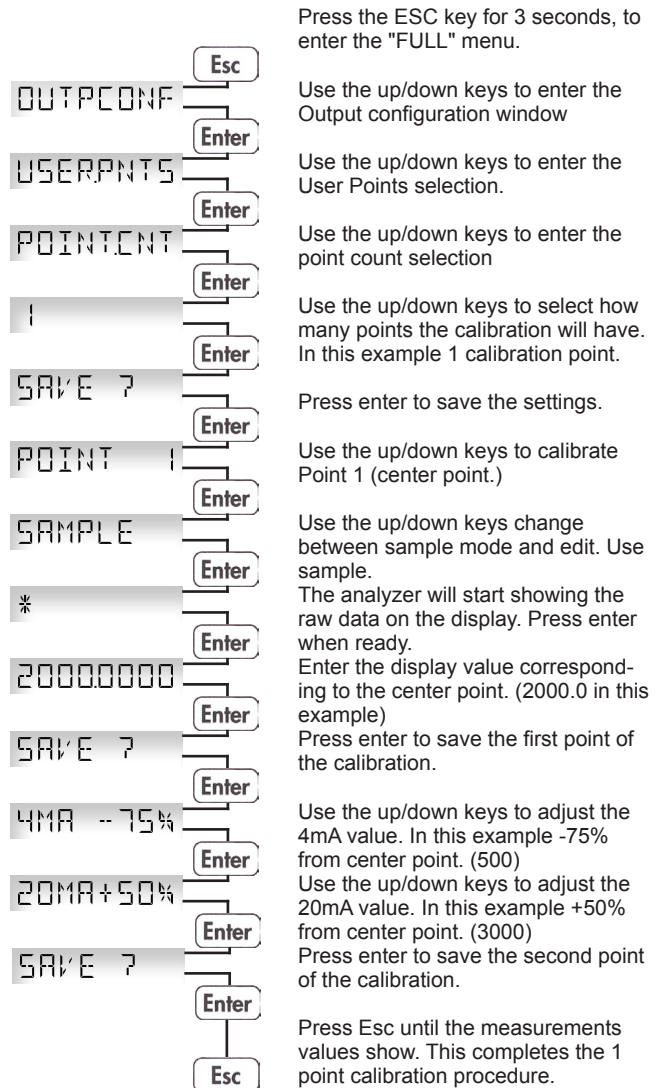Calbration is 4mA=500 20mA=3000.

Press the ESC key for 3 seconds, to enter the "FULL" menu.

`OUTPCONF` — Esc

Use the up/down keys to enter the Output configuration window

`USERPNTS` — Enter

Use the up/down keys to enter the User Points selection.

`POINT.CNT` — Enter

Use the up/down keys to enter the point count selection

`1` — Enter

Use the up/down keys to select how many points the calibration will have.
In this example 1 calibration point.

`SAVE ?` — Enter

Press enter to save the settings.

`POINT   1` — Enter

Use the up/down keys to calibrate Point 1 (center point.)

`SAMPLE` — Enter

Use the up/down keys change between sample mode and edit. Use sample.

`*` — Enter

The analyzer will start showing the raw data on the display. Press enter when ready.

`2000.000` — Enter

Enter the display value corresponding to the center point. (2000.0 in this example)

`SAVE ?` — Enter

Press enter to save the first point of the calibration.

`4MA  -75%` — Enter

Use the up/down keys to adjust the 4mA value. In this example -75% from center point. (500)

`20MA+50%` — Enter

Use the up/down keys to adjust the 20mA value. In this example +50% from center point. (3000)

`SAVE ?` — Enter

Press enter to save the second point of the calibration.

— Esc

Press Esc until the measurements values show. This completes the 1 point calibration procedure.

Table 1.
Error word.
(EW1=0…15)

Bit	Error message	Description
0	TU ER	Turbidity error
1	ST ER	Sensor temperature (ST) error
2	ET ER	Electronics temperature (ET) error
3	RANGE ER	Percentage of output under -10% or over 110% error
4	OUTSA WA	Output current saturated
5	ADCR ER	ADC converter runtime error
6		
7		
8	ADCS ER	ADC converter startup error
9	EEPRR ER	EEPROM checksum error
10	EEPRW ER	EEPROM write error
11	EECAL ER	EEPROM calibration error
12	HART ER	HART communication error
13	INTRN ER	Internal system error
14	OFTMR WA	Overfeed timer warning
15		

An example how to decipher the error word:

"EW1=0018" means 0018 (hex) = 0000 0000 0001 1000 (bin). This means that error word´s bits 3 and 4 are raised, (Error messages: RANGE ER and OUTSA WA).

CE

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