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Instruction manual for steam boiler TDS measurement

_ control unit series 360
_ TDS probes for boilers, series 310
_ TDS probes for feed water, series 330

v. 1.19

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Instruction Manual series 360

Index

1 - Description
2 - Probe mechanical mounting
3 - Electronic control unit installation
4 - Use
5 - Alarms
6 - Use of communication software MTDS

1 - Description

Thank you for purchasing a code **360** series conductivity transmitter and a **310** or **330** series probe.

The MMT conductivity measuring systems for steam boilers are devices capable of continuously measuring the conductivity of the water inside a steam generator (boiler), or along the feed pipe.

The equipment is always composed of 2 elements

- a probe, in field (310/330 series)
- a remote electronic control unit, placed in the control cabinet (360 series)

The two items are coded as shown below for easy identification.

1.1 - Probes (310/330 series)

310-031-00	TDS probe - 3/8" thread - L=300 mm
310-051-00	TDS probe - 3/8" thread - L=500 mm
310-011-00	TDS probe - 3/8" thread - L=1000 mm
310-032-00	TDS probe - 1/2" thread - L=300 mm
310-052-00	TDS probe - 1/2" thread - L=500 mm
310-012-00	TDS probe - 1/2" thread - L=1000 mm
330-002-00	TDS probe for feedwater - 1/2” thread

Probes can operate up to maximum temperature of 239 °C and up to maximum pressure of 32 bar.

The conductivity (referred to 25°C) σ_{25med} is measured in the range 5 ÷ 10000 µS/cm, using the standard probe.

For values outside this range, call our technical department, in order to request special versions.

Inside the probe body is integrated a temperature sensor, so that the device provides the value of the conductivity automatically temperature compensated.

The series 310 are probe for direct insertion in steam boilers.

The series 330 are probes for use in feed water pipes.

The **360** series transmitters can be used indifferently with both the **310** series probes and the **330** series probes. Upon installation on the boiler, proceed as indicated in §4.2 for correct calibration.

1.1 1.2 - Electronic control unit (360 series)

360-000-18	conductivity control unit - power supply 110÷230 Vac
360-000-19	conductivity control unit - power supply 24Vac/dc

The device 360 is contained in a heat-extinguishing plastic case for easy assembly on the door of the electrical control panel of the boiler.

The device can be supplied with 2 different power supply voltages, depending on the ordering code.

The device is frontally equipped with a small terminal consisting of a keypad (6 keys) and a backlit LCD display (2 rows x 8 columns), through which it is possible to instantly read the σ_{25med} conductivity value and carry out all the normal commissioning and calibration operations.

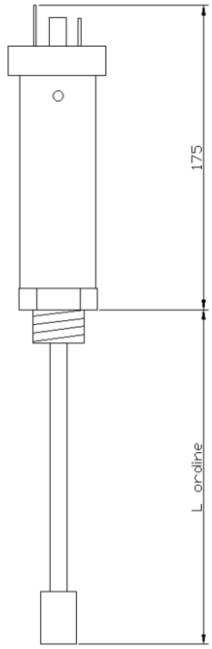
A USB serial connection is also available which, via a special software program for the Windows environment (downloadable free from MMT website), allows the user to carry out the same display and calibration operations (see §5).

The 360 outputs a normalized 4÷20 mA current analogue signal, galvanically isolated, proportional to the measured conductivity referred to 25°C, $\sigma_{25med.}$

There are 2 changeover contacts (relays) for the control of a purge valve, and for an alarm signal.

2.1 - Mounting of 310 probe

The dimensions of the TDS 310 probes are shown in the following MMT.DM.21.23 diagram.



[MMT.DM.21.23]

The measuring electrode length can be modified (shortened; see §2.2).

All the mounting and unmounting steps must be performed by qualified personnel only.

Caution: the TDS probe must be mounted and unmounted with the steam boiler cool, without pressure; in addition the water level must not exceed the level of the threaded hole of the TDS probe.

Caution: the TDS probe must be protected against the weather, if used outdoor.

The threaded connection for steam boiler mounting is 3/8" or 1/2", depending on the ordination code, and is suitable for mounting on boiler or along a feed water pipe.

To ensure pressure tightness, use the supplied copper seal; use 150Nm torque.

Don't use PTFE, to avoid electrical isolation between the thread e the boiler ground.

The mounting position inside the boiler must allow the device to measure correctly the conductivity.

The head of the probe must be at least at:

- 2 cm away from the internal heating pipes
- 5 cm projected inside the steam boiler body
- 10 cm below the minimum water level

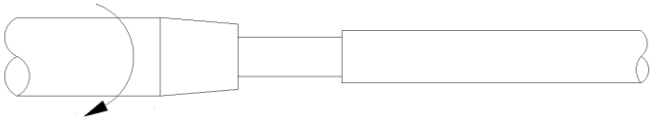
Probe 310 series horizontal mounting is always recommended.

For different mounting, please call our technical department.

2.1 - Cutting the electrode for 310 series probe

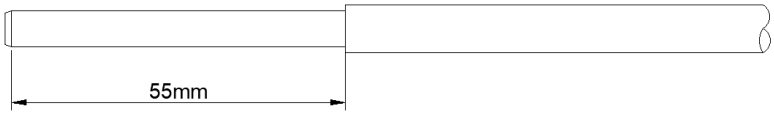
The tip of the 310 series probe must be installed no less than 20 mm from the metal parts of the boiler. Therefore, if necessary, it must be shortened by following these steps.

1 - Remove the PTFE-glass electrode protection containing the spring by turning it by hand clockwise and gently pulling it out as shown in the drawing:

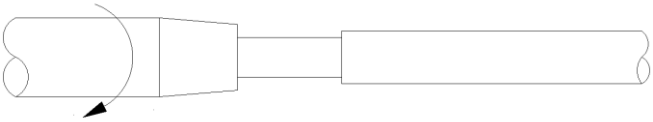


2 - Cut the electrode to the desired length, and blunt the tip.

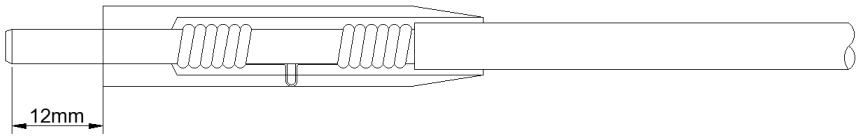
3 - Cut the PTFE coating leaving 55 mm of metal electrode uncovered.



4 - Insert the electrode protection by gently screwing it back in a clockwise direction until 12 mm of the electrode is left uncovered.

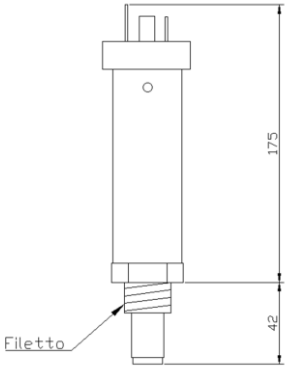


At the end of operation.



2.1 - Mounting of 330 probe

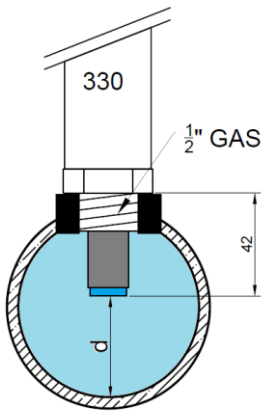
The dimensions of the TDS 330 probes are shown in the following MMT.DM.21.27 diagram.



[MMT.DM.21.27]

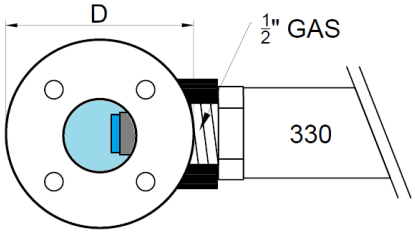
All the mounting and unmounting steps must be performed by qualified personnel only.
The probe must be mounted or unmounted with the boiler cold and without pressure.
If the probe is mounted outdoors, it must have additional protection against atmospheric agents.
The 330 series probe is designed for installation in pipes, or in flanged sockets (see following diagrams).
The probe can be installed horizontally or with a vertical inclination.
The terminal tip must be permanently immersed in water.
Ensure a constant exchange of water that touches the tip of the probe, to avoid the formation of material deposits.
Verify that the mounting location is correctly threaded ½".
Do not insulate the thread with PTFE tape or other insulating materials.
Do not apply paste or conductive grease to the threads.
To ensure pressure tightness, it is necessary to use the copper gasket supplied; tighten with a torque of 150 Nm.
Leave a distance of at least 20 mm between the terminal tip of the probe and the wall of the pipe in front of it.
Do not shorten the probe tip.

Mounting of 330 probe **[**diagram MMT.DM.23.06]



20<d<60 mm

In pipes with welded threaded connection

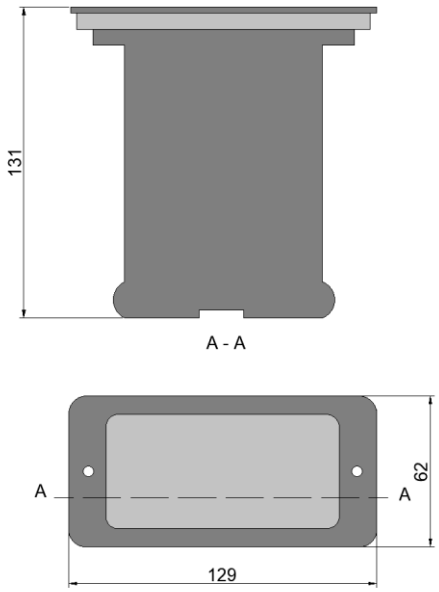


95<=D<=150 mm

In pipes with flange

3 - Electronic control unit installation

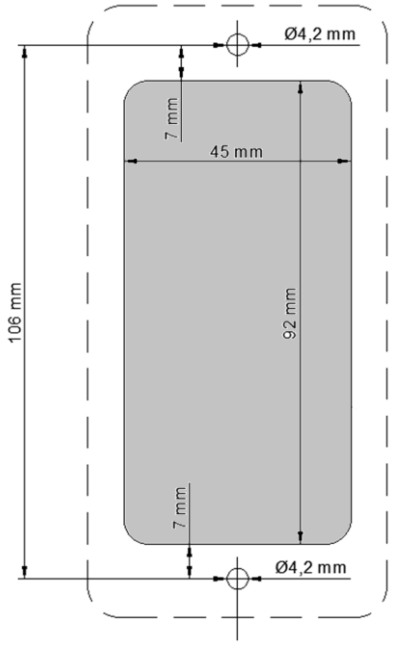
The dimension of the 360 are reported in the following image.



The transmitter 360 can be mounted on the door of the electrical control panel of the boiler, using the supplied accessory kit comprising a rubber gasket, a frame and 2 fixing screws.

A plastic clip is also supplied, for possible rear panel mounting, for DIN rail.

For mounting on the electrical panel door, use the following drilling template.

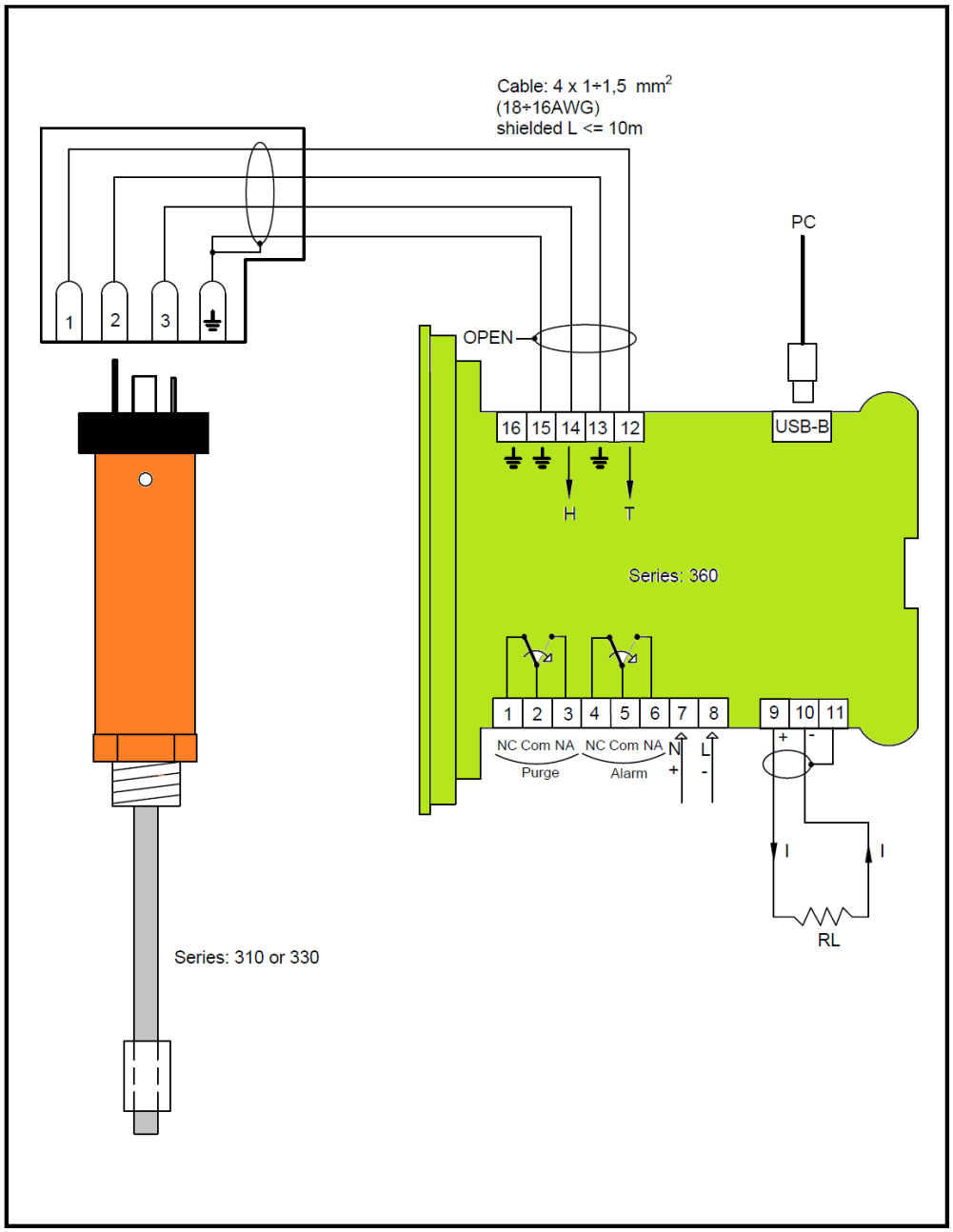


Dashed lines indicate the outline of the device.

The solid lines indicate the size of the hole.

3.01 - Wiring for 230V-AC version

For the electrical connections, refer to the following diagram (MMT.SA.23.01).



[MMT.SA.23.01]

Terminal block #1÷#8 are for power supply and relay exchange contacts (purge and alarm), with:
#7=neutral #8=line
Terminal locks #12÷#16 are for connection to probe.
Terminal blocks #9÷#11 are for current loop.
R_L stands for the input impedance of the receiving current loop.
Its value can be a maximum of 500 Ω.
Consider that the current loop receiver is often protected by active devices, which have the drawback to introduce additional R_L, effectively reducing the compliance of the 360.
The circuit is normally provided with a short circuit on the current loop in place of the resistor R_L.
In order to correctly use the current loop, remove the short circuit and connect a current reader to pin #9 and #10.

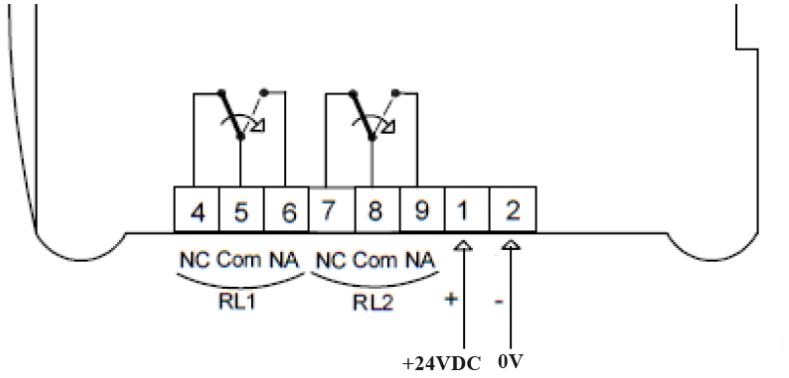
3.02 - Wiring for 24V power supply

In TDS transmitters series 360, for a regular functionality, 0V pin of supply is electrically connected to the ground of the boiler.

Therefore it is mandatory to observe some indications about the possible connection to ground of the external power supply.

3.02.1 - Wiring for 24V-DC power supply

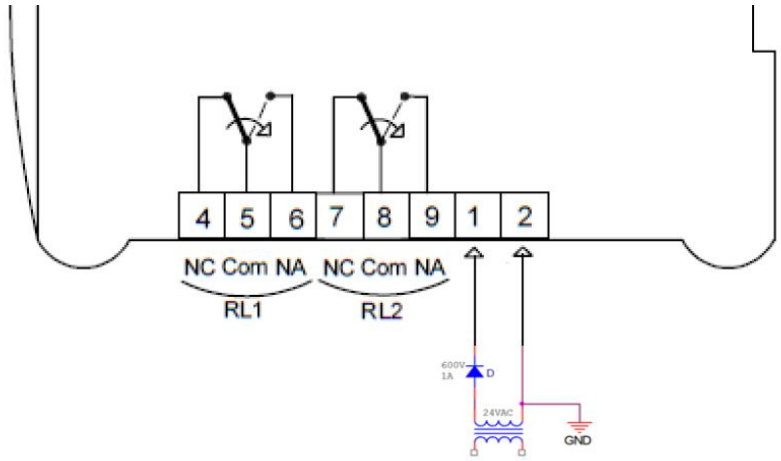
For 24V-DC supply, only the 0V pin can be connected, if required, to ground.



3.02.2 - Wiring for 24V-AC power supply

For 24V AC supply, neither of the two pins of the secondary of the supply transformer should be connected to ground, in general.

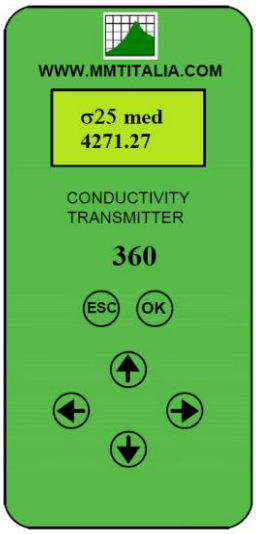
Should a connection to ground of one of the two pins be required anyway, it is necessary to interpose a diode (600V/1A) in series to the other pin, as reported in the following scheme:



4 - Use

4.1 - Standard view

The 360 conductivity meter looks like a small terminal, equipped with 6 operator keys and a 2-line x 8-character backlit LCD display, as in the following image.



Using this mini-terminal it is possible to control the operation of the device, display the information of interest, set the options to the desired values and calibrate the device.

The 360 leaves the factory programmed with reasonable default values for all parameters, so that no operator action should be required.

Once the 360 has been mounted on the electrical panel door, connected to a 310/330 series MMT probe and powered (at the correct power supply voltage as per the side plate), it will show the installed software version on the front display for 4".

This is useful information for service and maintenance.

After 4", the 360 will start showing the conductivity value referred to 25°C, called σ_{25med} in [µS/cm]

It will also generate an output current signal I_{OUT} (galvanically isolated from the power supply) proportional to the σ_{25med}, which can be connected directly to the analog input of a PLC (the maximum loadable resistance is equal to 500 Ω).

The 360 is already working, in particular:

- the output current I_{OUT} has the value that corresponds to σ_{25med}
- the purge relay is OFF if the σ_{25med} is below the purge threshold
- the alarm relay is ON if the σ_{25med} is below than the alarm threshold

Every 5" the display alternates the σ_{25med} conductivity value with the alarm code screen.

The status of the conductivity meter is displayed, where '0' indicates no alarm. Refer to §5.

If the user want to read the value of a parameter or a variable, or change the value of a parameter or carry out some calibration or setting or commissioning operations, to customize the operation of the 360, it can use the 6 keys and the LCD display as follows.

The information is organized in 28 sequential, circular menus.

The OK key is used to validate.
The ESC key is used to cancel.

The ↑ and ↓ keys are used to pass from one menu to the next or previous one or, when setting the parameters, to increase/decrease each digit.
The → and ← keys are used to move within the digits of a parameter to be modified.
The 28 menus are shown in the following table:

#m	variable/parameter	meaning	units	reading	writing	comand
1	σ_{25med}	average 25°C conductivity	µS/cm	yes	no	no
2	σ_{25ist}	instantaneous 25°C conductivity	µS/cm	yes	no	no
3	Ch0	analog channel V_{TEMP} (service)	mV	yes	no	no
4	Ch1	analog channel V_{REF} (service)	mV	yes	no	no
5	Ch2	analog cannel V_{MIS} (service)	mV	yes	no	no
6	H	water resistance	Ω	yes	no	no
7	T	temperature	°C	yes	no	no
8	I_{OUT}	output loop current	mA	yes	no	no
9	σ_{Tist}	instantaneous conductivity (T)	µS/cm	yes	no	no
10	σ_{MIN}	minimum conductivity (4mA)	µS/cm	yes	yes	no
11	σ_{MAX}	maximum conductivity (20mA)	µS/cm	yes	yes	no
12	k_{CELL}	310 probe cell constant	cm^{-1}	yes	yes	no
13	n-medie	average number	N.A.	yes	yes	no
14	purge threshold	conductivity purge threshold	µS/cm	yes	yes	no
15	purge hysteresis	hysteresis to purge threshold	%	yes	yes	no
16	alarm threshold	conductivity alarm threshold	µS/cm	yes	yes	no
17	alarm hysteresis	hysteresis to alarm threshold	%	yes	yes	no
18	time ON	ON time for purge valve	seconds	yes	yes	no
19	time OFF	OFF time for purge valve	seconds	yes	yes	no
20	I alarm	set alarm current (2 or 3) mA	mA	yes	yes	no
21	α_T	temperature coefficient	%/°C	yes	yes	no
22	set_purge	manual ON/OFF purge	N.A.			yes
23	set_alarm	manual ON/OFF alarm	N.A.			yes
24	set_I_{OUT}	manual I_{OUT} setting	N.A.			yes
25	calibration	probe calibration	N.A.			yes
26	save	parameters saving	N.A.			yes
27	recovery	default parameters recovery	N.A.			yes
28	sw_version	current software version	N.A.			yes

4.2 - Calibration

When commissioning for the first time and in any case at least once every 6 months, it is advisable to calibrate the conductivity meter.

To correctly calibrate the conductivity meter it is necessary to know the conductivity of the water on which you are working, proceeding as follows.

When you are sure that the boiler is working at full capacity, and that the conductivity meter has also been installed for a few hours of continuous operation, take a sample of water from the boiler, bring it to the reference temperature of 25°C and measure its conductivity using a reliable laboratory instrument (reference conductivity), in µS/cm.

This is the value to enter in the calibration menu.

Following confirmation of the value, using the OK button, the 360 automatically calibrates, calculating a new k_{CELL} value.

Calibration ends with the "**`Calibok!`**" message appearing on the display.

In the special menu it is possible to view the new value that has been calculated as a cell constant.

Although values in the range 0.001÷4.999 cm^{-1} are accepted, reasonable values are between 0.1÷0.5 cm^{-1}.

Warning: the value of the cell constant k_{CELL} depends on the definitive positioning of the probe inside the boiler and could also be very different from the factory one (MMT).

If there is a problem, the message "**kcnonok!**" is displayed, indicating that the 360 was unable to calculate a suitable cell constant to complete the calibration procedure.

In this case, it is probable that the probe is dirty or has encrustations, preventing the conductivity meter from carrying out correct measurements.

It is necessary to remove, with due precautions, the probe from the boiler and clean it thoroughly before repeating the calibration procedure.

If you are still unable to obtain the calibration, send the probe in MMT for a check.

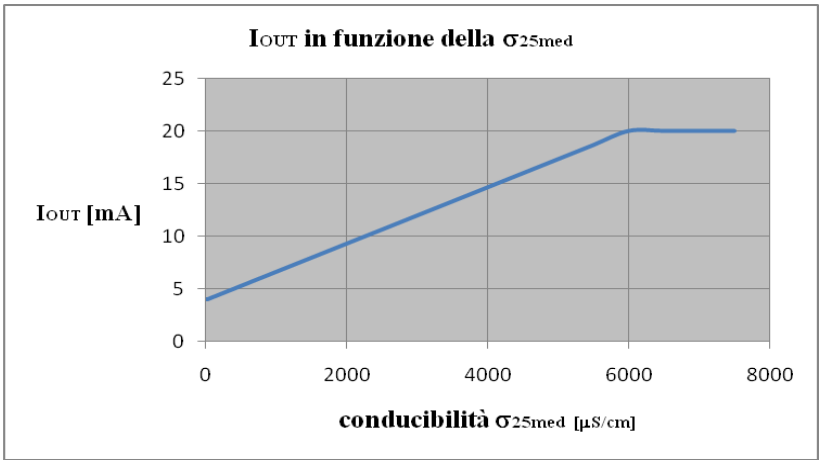
4.3 - σ_{MIN} and σ_{MAX} setting

The output current I_{OUT} is related to the value of σ_{25med} through a linear interpolation with the values of the 2 parameters, which can be set, σ_{MIN} and σ_{MAX}.

σ_{MIN} is the conductivity value σ_{25med} for which the 360 will supply I_{OUT} equal to 4mA.

σ_{MAX} is the conductivity value σ_{25med} for which the 360 will supply I_{OUT} equal to 20mA.

For example, if σ_{MIN} = 20 µS/cm and σ_{MAX} = 6000 µS/cm, then the current I_{OUT} as a function of σ_{25med} will have the trend as in the following graph:



In particular

_ for σ_{25med} = 20 µS/cm it will be I_{OUT} 4mA

_ for σ_{25med} = 6000 µS/cm it will be I_{OUT} 20mA

_ for σ_{25med} = 3010 µS/cm it will be I_{OUT} 12mA

It may be necessary to modify the values of the 2 parameters σ_{MIN} and σ_{MAX}, to adapt them to your needs.

Simply scroll through the menus until you find them, set the new values and then confirm them.

These parameters have their own acceptance limits, in particular it must always be:

$\sigma_{MAX} - \sigma_{MIN} > 100 \mu S/cm$.

4.4 - Purge relay

The 360 conductivity meter is equipped with a first internal relay for the control of an electric or pneumatic drain valve, to activate the inlet of fresh and pure water into the boiler, when the σ_{25med} conductivity is higher than a certain threshold.

Using the front keyboard of the 360 it is possible to set 4 parameters:

purge_set ***purge_hysteresis*** ***τ_ON*** ***τ_OFF***

purge_set

This is the conductivity purge threshold value referred to a temperature of 25°C, σ_{25med}, which can be set from 1µS/cm to 60000µS/cm: for example σ_{25}=2500µS/cm.

purge_hysteresis

This is the purge hysteresis value, as a percentage of the conductivity purge threshold, which can be set from 1% to 30%; for example 10%.

τ_ON (purge valve opening time)

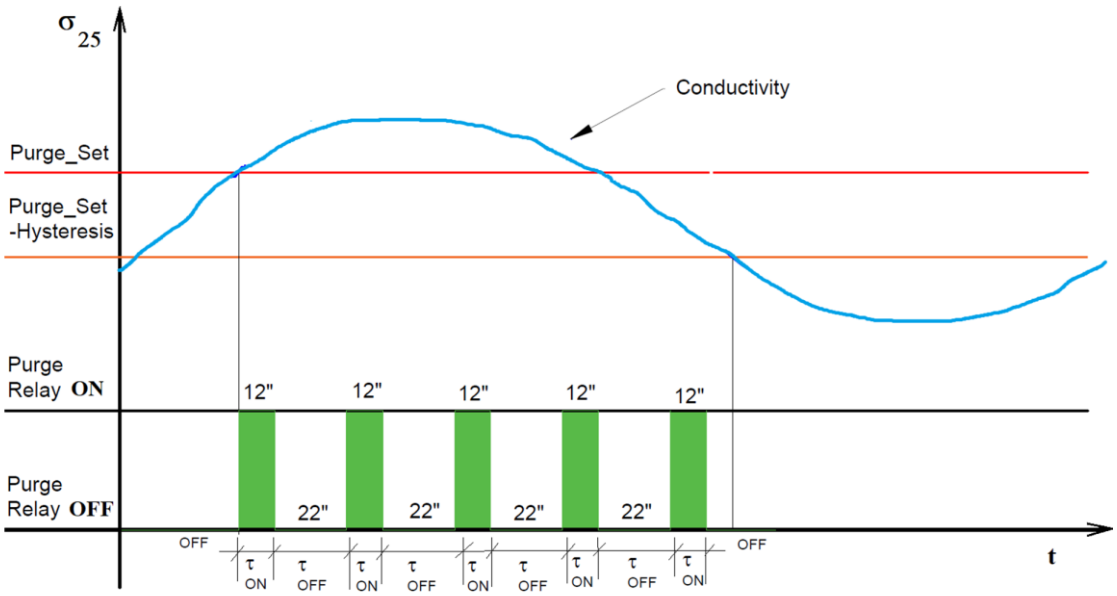
It is a time, which can be set from 1" to 99", during which the purge relay (and therefore the purge valve) is driven ON.

τ_OFF (purge valve closing time)

It is a time, which can be set from 1" to 99", during which the purge relay (and therefore the purge valve) is drived OFF.

Operation

Operation is as in the following example diagram.



As long as the measured conductivity is below the set value for the purge threshold, in our case 2500µS/cm, the purge relay is de-energized, OFF.

When the σ_{25med} exceeds the value set for the purge threshold, the purge relay is energized, ON, for a time equal to the value of the parameter τ_ON.

After this time, the relay is driven OFF for a time equal to the value of the τ_OFF parameter.

Once this time has also elapsed, the conductivity value is checked: if it has fallen below the value of the purge threshold decreased by the hysteresis, which can be set between 1% and 30% of the purge threshold, then the purge relay is driven OFF .

In our example, having chosen a hysteresis equal to 10%; this means that the purge relay will drop, OFF, only when the σ_{25med} drops below the value of 2250µS/cm.

If, on the contrary, the conductivity is still higher than the purge threshold decreased by the associated hysteresis, the cycle would restart with a new τ_ON (relay ON) followed by a new τ_OFF (relay OFF) until the conductivity drops below the value of the purge threshold decreased by the hysteresis.

4.5 - Alarm relay

The 360 has a second relay inside which can be conveniently used to give an alarm signal when the conductivity σ_{25med} is above a certain threshold, exceeded despite the action of the purge valve.

Using the front keyboard it is possible to set 2 parameters:

alarm_set ***alarm_hysteresis***

alarm_set

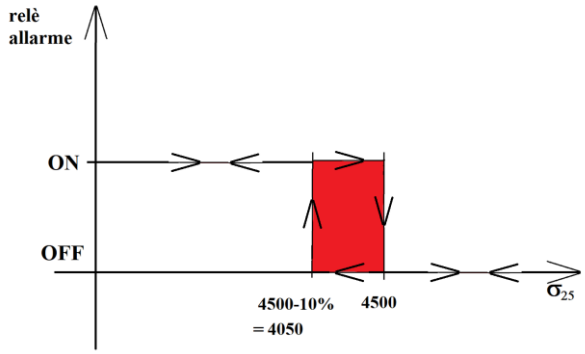
This is the alarm threshold value for the conductivity referred to the temperature of 25°C, σ_{25med}, from 10µS/cm to 9999µS/cm: for example σ_{25}=4500µS/cm.

alarm_hysteresis

This is the hysteresis value, as a percentage of the conductivity alarm threshold, from 1% to 30%; for example 10%.

Operation

Operation is as in the following example diagram.



As long as the measured conductivity σ_{25med} is below the value set for the alarm threshold, the alarm relay is energized, ON.

When the σ_{25med} exceeds the value set for the alarm threshold, in our case equal to 4500µS/cm, the alarm relay is de-energized, OFF.

The relay remains in this state until the σ_{25med} drops below the alarm threshold value decreased by a certain percentage, hysteresis, which can be set between 1% and 30% of the alarm threshold.

In our example, a hysteresis of 10% was chosen; this means that the alarm relay will drop, OFF, only when the σ_{25med} drops below the value of 4050µS/cm.

The alarm threshold must always be set higher than the purge threshold.

In case of incorrect setting, the value is not accepted.

As can be seen, an automatic reset of the alarm output is foreseen; any manual reset must be entrusted to external bodies (e.g. safety chain).

4.6 - Interdependence between purge threshold and alarm threshold

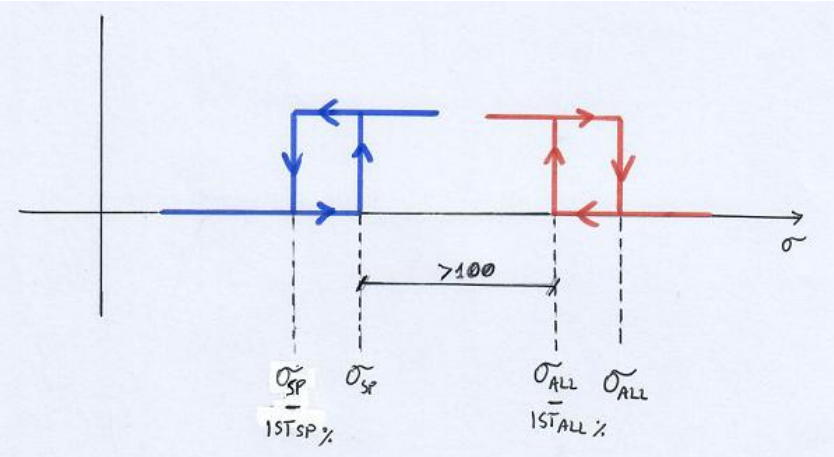
The following graph shows the reciprocal positions of the two thresholds with relative hysteresis.

When the purge threshold is exceeded (blue graph), the purge procedure begins with opening and closing of the appropriate valve according to the intervals specified in the τON and τOFF parameters.

The alarm threshold, on the other hand, is managed with a relay which drops out when the alarm threshold is exceeded (positive safety).

Thresholds must meet the following condition:

[all_threshold – all_hist%] – [purge_threshold] > 100µS/cm



4.7 - Parameter storage

Once the desired values have been assigned to the parameters, these are not immediately stored permanently, but only temporarily, to allow the user to verify their effect.

Once you are certain of the new values, they can be stored permanently (which remains even in the event of a power failure and return) using the save menu.

In this way the values will be kept in memory by the conductivity meter even if the device is switched off and on again.

The parameters that are saved are as follows (12 parameters).

parameter	units	minimum	maximum	default
σ_{MIN}	µS/cm	5	200	20
σ_{MAX}	µS/cm	201	10000	6000
k_{CELLA}	cm^{-1}	0.000	4.999	0.200
n-average	N.A.	1	200	200
purge threshold	µS/cm	1	60000	3500
purge hysteresis	%	1	30	10
alarm threshold	µS/cm	1	60000	4500
alarm hysteresis	%	1	30	10
purge τON	seconds	1	99	10
purge τOFF	seconds	1	99	20
I alarm	mA	2	3	2
α_T	1/°C	0.00	0.05	0.02

If you want to restore all the parameters to their respective factory values (MMT), use the **`recovery`** menu.

Then use the **save** menu again to ensure that the default parameters are maintained even after switching the device off and on again.

4.8 - Service

It is possible to force the value of the output current I_{OUT}, for maintenance or test reasons.
Scrolling through the menus, one reaches the I_{OUT} menu.
The I_{OUT} can be forced to 6 values:
normal/4/8/12/16/20mA.
Normal means that the I_{OUT} is related to the value of the σ_{25med}.
After 5', the I_{OUT} is automatically related to the σ_{25med}.

It is possible to force the state of the purge relay.
Scrolling through the menus, you reach the purge menu.
The purge relay can be forced into 3 states:
normal/ON-fixed/OFF-fixed.
Normal means that the purge relay is related to the value of σ_{25med}.
After 5', the purge relay is automatically related to the σ_{25med}.

It is possible to force the state of the alarm relay.
Scrolling through the menus one reaches the alarm menu.
The alarm relay can be forced into 3 states:
normal/ON-fixed/OFF-fixed.
Normal means that the alarm relay is related to the value of σ_{25med}.
After 5', the alarm relay is automatically related to the σ_{25med}.

4.9 - Menu #12 k_{CELL}

It is the value of the cell constant of the probe 310/330 placed in the boiler/pipe.
It depends on the position of the probe inside the boiler, and must be reset every time the probe has to be disassembled and reassembled in the boiler for service or maintenance reasons.
The value can be both read and set.
It is advisable to use this menu only to display the value of the k_{CELL}, instead leaving the task of calculating it automatically to menu #22 (= calibration).

4.10 - Menu #13 n-average

It is the parameter that establishes the size of the digital filter (moving average array) on the instantaneous conductivity, to calculate the average conductivity referred to 25°C, the σ_{25med}.
The moving average is updated approximately every second; therefore for n-averages = 60, a sudden variation of the instantaneous conductivity is detected in the average conductivity only after 60"; and so on for n=100 in 100"; for n=200 in 200".
It is advisable to set n-averages to low values, even =1, only in the device setup phases, in order not to have to wait too long for the adjustments.
Then, once the desired set-up has been found, it is advisable to make it possible to set this parameter to values not lower than 50.
Although it is inadvisable, it may be required to reduce this time, resulting in an increased measurement fluctuation.
The conductivity σ_{25med} is subject to this average, and consequently also the output current I_{OUT}.

4.11 - Menu #21 α_T

α_T is the temperature coefficient.

Since the probes 310/330 connected to the device 360 are all equipped with an integrated temperature sensor, the device provides for automatic temperature compensation in the conductivity measurement.

The value of the water temperature in the boiler near the probe is continuously measured and displayed.

This value is used to correct the conductivity value which is always expressed relative to the reference temperature of 25°C, σ_{25med}.

It may be necessary, in some rare cases, to modify this coefficient.

To have no correction, the α_T parameter must be set to 0.

It is normally set to 0.02 $°C^{-1}$.

5 - Alarm

If the 360 diagnoses a problem with the thermoprobe (Pt100) integrated in the 310/330 probe, it will force the I_{OUT} to the fixed value of 2[3]mA*, to give an analog alarm signal.

In this case the alarm relay would drop, regardless of the size of the σ_{25med}, to give also a digital alarm signal.

The following table summarizes the various situations.

Alarm Code	guasto/fault	IOUT	alarm relay
0	No Alarm	related to da σ_{25med}	ON
1	Pt100 in short circuit	2[3] mA*	OFF
2	Pt100 open	2[3] mA*	OFF
8	$\sigma_{25med} > \sigma_{alarm\_threshold}$	20 mA	OFF

*According to parameter #20 setting

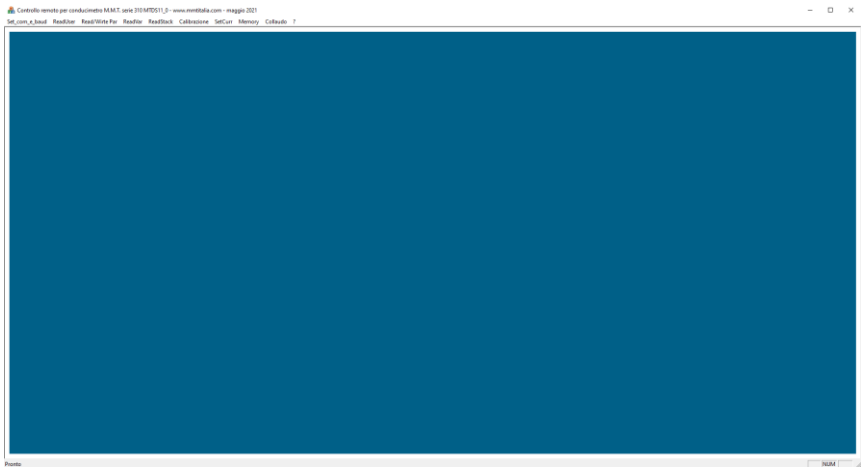
6 - MTDS software manual

Connect the USB port of the 360 to a USB port of a PC.

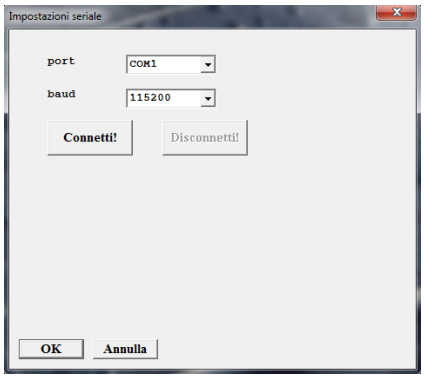
Copy on the PC the MTDS10_0 (or more recent). The software is for Widows, and is downloadable free from MMT website.

The TDS meter is programmable by the Windows based software MTDS10_0.

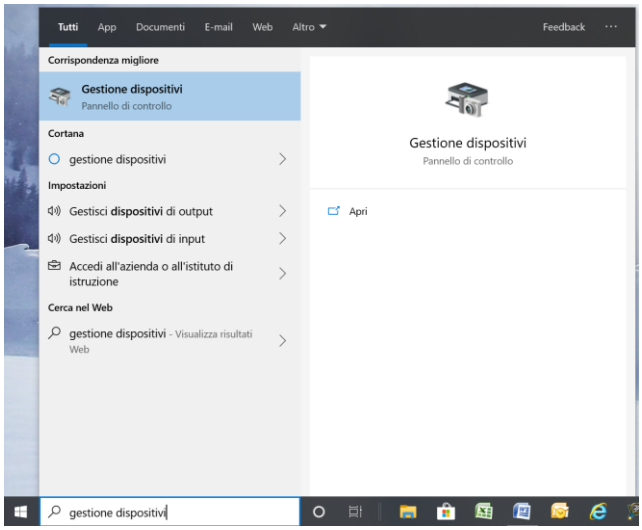
Launching the program, the personal computer screen looks like this:



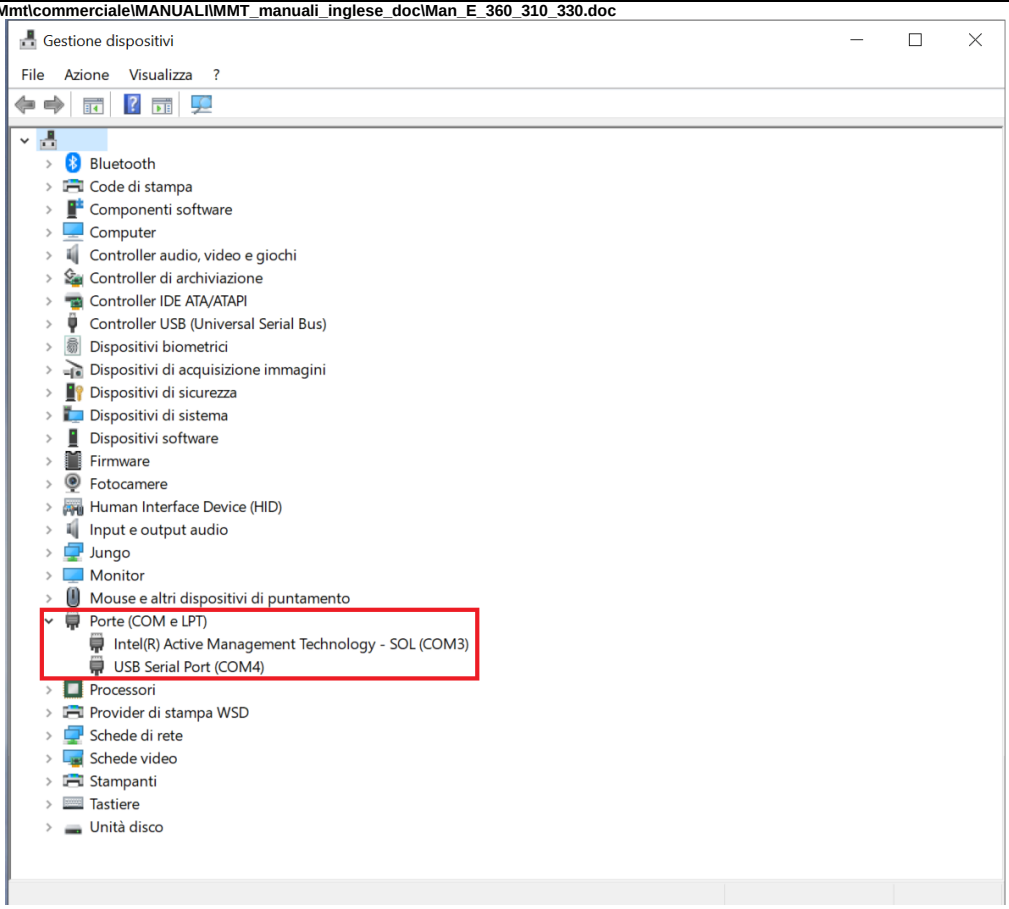
6.1 - Serial port connection by Set_com_e_baud menu:



Connect the TDS meter to some USB pc port, using USB cable.
Find the serial port to which the TDS meter is connected.
To do this, for example with Windows 10, do the following:
Open Resource Manager
It is possible to reach this section also typing in the command line:
Resource Manager.



The computer screen looks like this:

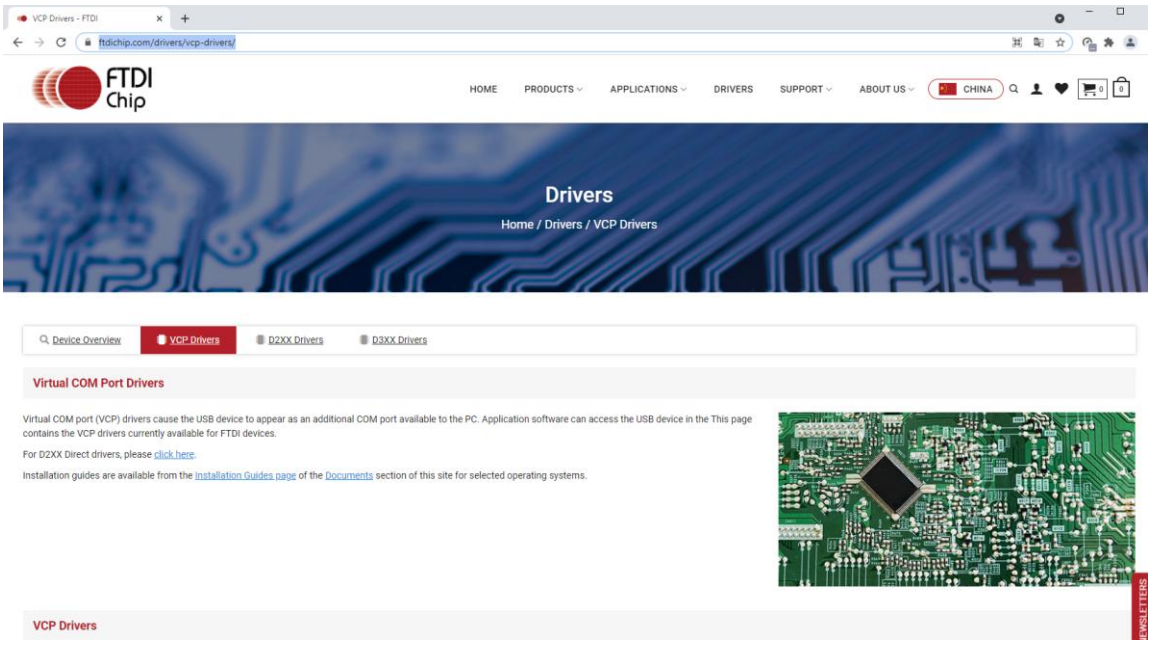


In this example, the port to be used is COM4.

In the program MTDS10_0, it is necessary to select COM4 in the dialog box "*Set_com_e_baud*".

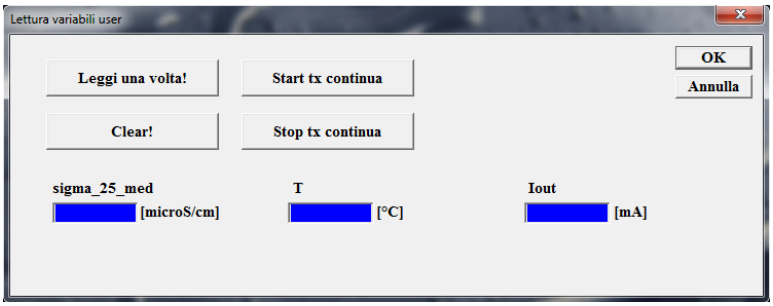
Please note: should the com port not be recognized, it could be necessary to download the appropriate driver from the internet. They are the drivers needed in order to create a virtual com port on the PC.

The internet address where these drivers are available is https://ftdichip.com/drivers/vcp-drivers/



Please note: it is important to download the correct driver, considering the operating system in which the MTDS will be running.

6.2 - Standard view by "User variables" menu



By this menu it is possible to read the conductivity referred to 25°C, the temperature in °C and the output current, in mA.

If the probe calibration has been correctly done; if the relation between the analog output current and the measured conductivity has already been set; if the thermal compensation coefficient has already been set, no operation is necessary on the TDS meter, and the device is already running correctly.

In particular, the output current is proportional to the conductivity in the 4÷20 mA range.

Pressing the key **Read once!** one single reading is done.

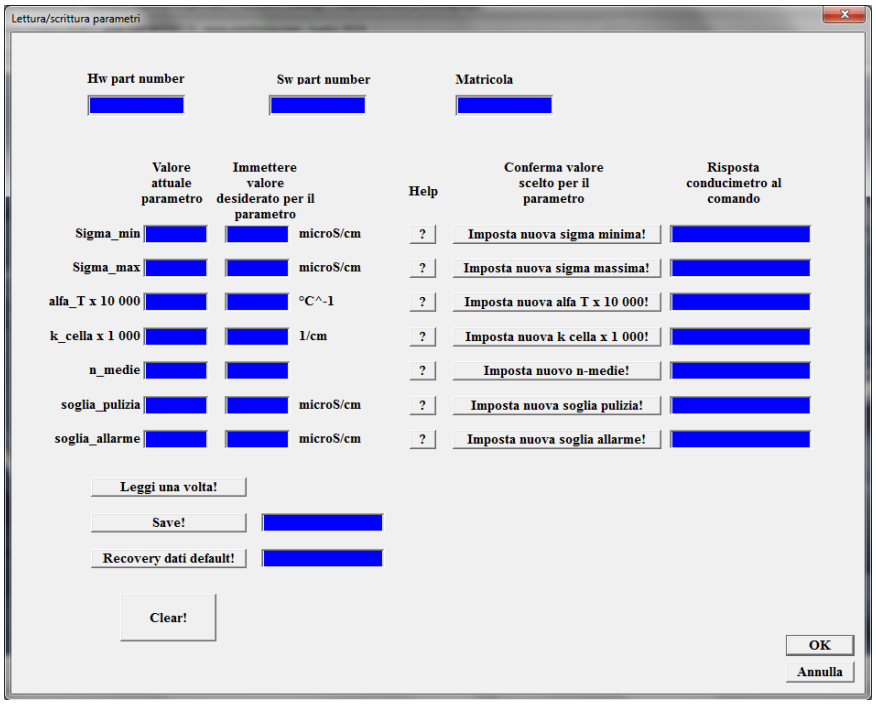
Pressing the key **Start continuous measurements!** one reading per second is done.

Pressing the key **Stop continuous measurements!**, the reading stops.

If the probe calibration, and/or the output current setting, and/or the thermal compensation coefficient has not been carried out yet, do the following, in order to set/modify the device running parameters.

6.3 - Device running parameters setting

Use the **`Read/Write Par`** menu.



By this option it is possible to verify and modify the value of each parameter, as you wish.

Each parameter must be written in the second column, and must be confirmed using the appropriate button. Only integer values are accepted.

At all times it is possible to read the parameter currently in memory, using the button:

Read once!

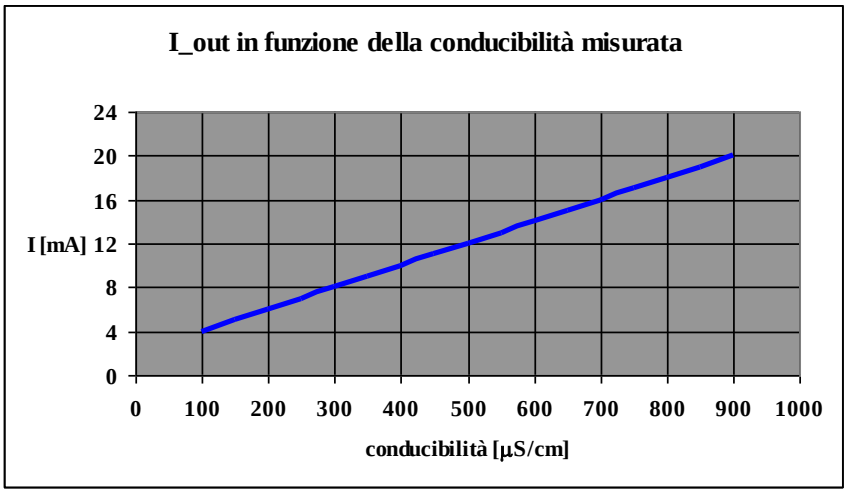
For each parameter it is possible using the help button **?** to have a short guide, about its setting.

The function of the various parameters is the following:

σ_{MIN} and σ_{MAX}

They are the conductivity values corresponding to 4mA and 20mA.

If for example σ_{MIN}=100µs/cm and σ_{MAX}=900µs/cm, the output current depending by the water conductivity will follow the diagram below:



For 300µs/cm the current will be 8mA.
For 500µs/cm the current will be 12mA.
For 700µs/cm the current will be 16mA.

Alfa T (= α_T)

It is the thermal coefficient.
The device automatically does the thermal compensation of the conductivity.
The water temperature in the steam boiler, near the probe tip, is continuously measured and displayed.
This value is used to correct the conductivity, that is always shown referred to 25°C.
It could be necessary, in some rare cases, to modify this parameter. We advise not to modify it, leaving the default value (0.02[%/°C]).
To have no correction, this parameter should be set to 0.

K_{CELL}

It is the cell constant of the TDS meter probe.
In general, this parameter should not be modified in this menu.
Its value is automatically calculated during the calibration procedure (see §4.4).

n_average

It is the number of averages done by the software.
The conductivity is updated about each second.
Typically for n_avg =200, the settling time is about 3 minutes.
n_avg less than 50 is not recommended.

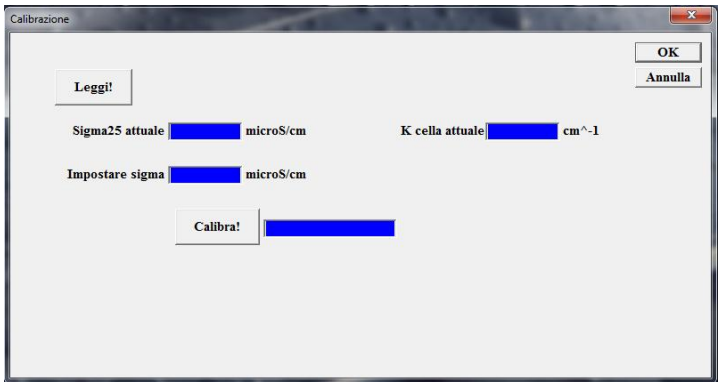
Permanent saving

Once all parameters have been correctly set, they are not saved permanently, right away.
When you are sure that the new values are correct, it is possible the permanent save them, in order to keep these values also in case of power off. This result can be obtained pressing the button **Save!**.

To recovery the parameters default values, press the button **Recovery default data!**

6.4 - TDS calibration

Open the *Calibration* menu.



Press the button **Read!** to know the current value of the conductivity and of the k_{CELL}.

To calibrate the device, it is necessary to know the conductivity of the water the TDS is measuring (referred at 25°C).

Once you are sure that the steam boiler is running normally, and also that the TDS meter is working for many hours, take a sample of water, lower its temperature to 25°C and measure its conductivity by a laboratory instrument.

The conductivity value carried out in this way, is to be inserted in the calibration menu.

Press **Calibrate!** button.

The device will calibrate automatically, computing the k_{CELL} new value.

Next to the button **Calibrate!** it will appear the message *SIGMALABOK!*, as confirmation of calibration.

Verify by pressing the button **Read!** the new value of k_{CELL}.

If there has been some problem during calibration, the calibration procedure ends with the message: "*S-LAB-ERR".*

In this case the probe could be dirty, causing wrong conductivity measurements.

It is necessary to remove the TDS meter from the steam boiler, with the proper caution, and to carefully clean the probe, before repeating the calibration procedure.

If the calibration cannot be carried out, the TDS meter should be sent to MMT for test.

Caution:

The 310-031 series TDS has not reference electrode around the measuring rod.

This means that the k_{CELL} value depends on the positioning of the probe inside the boiler, and should also differ from the MMT default value.