THORNTON
Leading Pure Water Analytics

Operation Manual
450TOC Portable TOC Instrument

Total Organic Carbon Measurement



450TOC Portable TOC Instrument
58 130 472 Rev B

METTLER TOLEDO

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450TOC Portable TOC Instrument

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1 Introduction

Statement of intended use – The 450TOC is a portable Total Organic Carbon instrument designed to measure the concentration of organic substances in pure and ultra-pure water applications. The system includes a large four line backlit Liquid Crystal Display which conveys measuring and setup information. The 450TOC is designed to provide flexibility for TOC measurement to meet the needs of routine operations through periodic testing at points of use and sampling valves, to verify water system performance following maintenance, and for diagnosing potential sources or contamination within a water system.

The fully integrated and portable design allows for easy transportation and setup at any location in the water system to allow the closest possible positioning of the instrument to the sample point. Combined with continuous, real-time detection technology, the 450TOC provides the fastest response possible, making it an ideal monitoring and diagnostic tool.

450TOC

Designation	Order no.
450TOC Instrument, 110/220 VAC, 50/60 Hz	58 036 041

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2 Safety instructions

This manual includes safety information with the following designations and formats.

2.1 Definition of equipment and documentation symbols and designations



WARNING: POTENTIAL FOR PERSONAL INJURY.



CAUTION: possible instrument damage or malfunction.



NOTE: Important operating information.



When marked on the instrument or in this manual text indicates: Caution and/or other possible hazard including risk of electric shock (refer to accompanying documents).

The following is a list of general safety instructions and warnings. Failure to adhere to these instructions can result in damage to the equipment and/or personal injury to the operator.

- The 450TOC should be installed and operated only by personnel familiar with the instrument and who are qualified for such work.
- The 450TOC must only be operated under the specified operating conditions (see section titled Specifications).
- In order to meet the IP54 rating for the AC electrical connector, use only approved AC power cords and supplied AC retaining clip.
- Repair or service of the 450TOC must be performed by authorized, trained personnel only.
- With the exception of routine maintenance, cleaning procedures or fuse replacement, as described in this manual and other supporting documents, the 450TOC must not be tampered with or altered in any manner.
- Mettler-Toledo accepts no responsibility for damage caused by unauthorized modifications to the 450TOC.
- Follow all warnings, cautions, and instructions indicated on and supplied with this product.
- Install equipment as specified in this instruction manual. Follow appropriate local and national codes.
- UV Lamp access plate must be in place at all times during normal operation.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.



WARNING: Servicing of this product requires access to shock hazard voltage levels. Main power must be disconnected before servicing.

2.2 Correct disposal of the unit

When the instrument is finally removed from service, observe all local environmental regulations for proper disposal.

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3 450TOC Overview

The 450TOC is a portable Total Organic Carbon instrument designed for taking TOC measurements throughout pure and ultrapure water production facilities. The compact, portable design allows for easy installation at any measurement or sampling point within the water system. The 450TOC is configured with factory default settings to minimize measurement setup time. These default settings allow for quick operation with minimal keystrokes.

The 450TOC has more features that may require additional configuration dependent upon the operational setup. Once these parameters are set, the TOC instrument will retain these settings for future use, minimizing setup time during subsequent operation. Measurements available from the instrument include TOC, Conductivity/Resistivity (compensated and uncompensated) and Temperature.

The 450TOC is designed with four local LED indicators, five tactile-feedback control and navigation keys, and a four-line back-lit LCD display, as shown in the illustration below. The LEDs are designed to provide indication of the system status. The operation of the LEDs is synchronized with display status messages that appear in the 6-digit measurement name location.

Function	Color	Operation
Fault	Red	Flashes during Fault condition, 450TOC operation stopped
Error	Amber	Illuminates during Error condition, 450TOC remains operational
Normal Operation	Green	Illuminates whenever AC Power is on and the 450TOC is ready for normal operation.
UV Lamp On	Green	Illuminates whenever the UV Lamp is on

The instrument case consists of a rugged, two-piece molded enclosure with powder-coated metal side-plates. The two halves of the enclosure are secured with four captive Phillips-head screws accessible at the corners from the rear of the unit. A side access cover, located on the left side of the instrument and secured with four captive Phillips-head screws, provides access to the UV lamp for routine, periodic replacement.



1. **UV Lamp Access Cover**
2. **AC Power Connector**
3. **USB Port**
4. **Four-Line LCD Display**
5. **Status LED Indicators**
6. **Key Pad**
7. **UV Lamp Active LED**
8. **Sample Outlet Connection**
9. **Sample Inlet Connection**
10. **Protective Base (Optional)**

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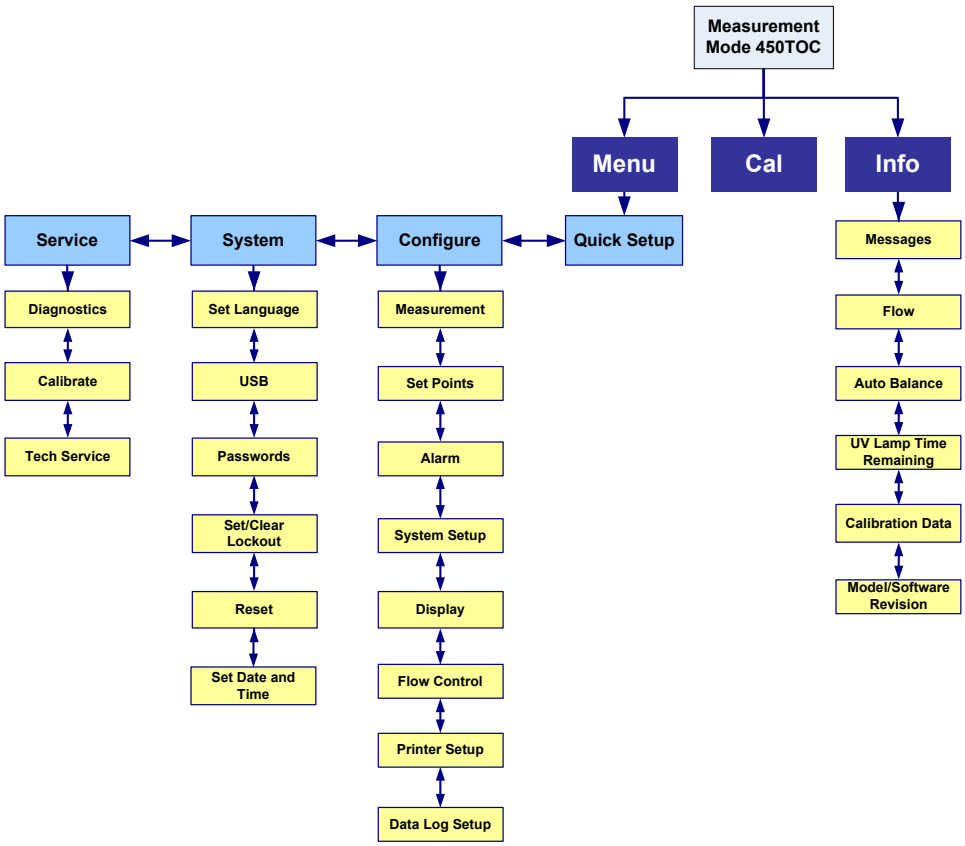
	With Base		Without Base	
Dimension	**Inches**	**MM**	**Inches**	**MM**
A	13.75	349	12.75	324
B	14.1	358	13.15	334
C	7.56	192	7.30	185

3.1 High Pressure Applications

For installations with process pressure above 85 psig (5.9 bar), a High Pressure Regulator is required to avoid damage to the 450TOC. An optional high pressure regulator, P/N 58 091 552 is available from METTLER TOLEDO Thornton.

3.1.1 Menu Structure

Below is the structure of the 450TOC menu tree:



3.1.2 Navigation keys



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3.1.2.1 Navigating the menu tree

When the system is in Measurement mode, use the desired main Menu branch with the ▶, ◀ or ▲ ▼ keys. When in Menu mode, use the ▲ and ▼ keys to navigate through the selected Menu branch.

☞ **NOTE:** In order to back up one menu page, without escaping to the measurement mode, move the cursor under the UP Arrow character ↑ at the bottom right of the display screen and press ↵ [Enter].

3.1.2.2 Escape

Press the ◀ and ▶ key simultaneously (escape) to return to the Measurement mode.

3.1.2.3 Enter/Data Log Control

Use the ↵ key to confirm action or selections. If the 450TOC is configured to display the Data Log control status on line three of the display, the [Enter] key may be used to start or stop the data log when the system is in measurement mode.

3.1.2.4 Menu

When in Measurement mode, press the ◀ key to access the main Menu.

3.1.2.5 Calibration mode

When in Measurement mode, press the ▶ key to enter Calibration Mode.

3.1.2.6 Info mode

When in Measurement mode, press the ▼ key to enter Info Mode.

3.1.2.7 Lamp Control

When in Measurement mode, Press the ▲ key to turn the UV lamp on or off. The green LED beneath the key will illuminate when the UV lamp is energized.

When in Measurement mode, the ▲ key may also be used to control purge mode. When in purge mode, the flow control valve will fully open, allowing maximum flow through the 450TOC. This mode may be used to increase flushing speed to quickly rinse the instrument prior to operation or following contamination, and also allows more quickly draining the 450TOC of liquid following use.

To activate Purge Mode, press and hold the ▲ key for 3 seconds, and then release. After releasing the key, the Green, Amber and Red status LED's will begin flashing. To return to normal operation, repeat the process described above.

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3.1.3 Navigation of data entry fields

Use the ► key to navigate forward or the ◄ key to navigate backwards within the changeable data entry fields of the display.

3.1.4 Entry of data values, selection of data entry options

Use the ▲ key to increase or the ▼ key to decrease a digit. Use the same keys to navigate within a selection of values or options of a data entry field.

NOTE: Some screens require configuring multiple values via the same data field (ex: configuring multiple setpoints). Be sure to use the ► or ◄ key to return to the primary field and the ▲ or ▼ key to toggle between all configuration options before entering to the next display screen.

3.1.5 Navigation with ↑ in Display

If a ↑ is displayed on the bottom right hand corner of the display, you can use the ► or the ◄ key to navigate to it. If you press [ENTER] you will navigate backwards through the menu (go back one screen). This can be a very useful option to move back up the menu tree without having to exit into the measuring mode and re-enter the menu.

3.1.6 "Save changes" dialog

Three options are possible for the "Save changes" dialog: Yes & Exit (Save changes and exit to measuring mode), "Yes & ↑" (Save changes and go back one screen) and "No & Exit" (Don't save changes and exit to measuring mode). The "Yes & ↑" option is very useful if you want to continue configuring without having to re-enter the menu.

3.1.7 Security Passwords

The 450TOC allows a security lock-out of various menus. If the security lock-out feature has been enabled, a security password must be entered to allow access to the menu.

3.2 Display



NOTE: In the event of an alarm or other error condition the 450TOC will display a flashing ⚠ in the upper right corner of the display. This symbol will remain until the condition that caused it has been cleared.



NOTE: During calibrations, a flashing H will appear in the upper left corner of the display to indicate that a hold state is active. This symbol will remain for 20 seconds until after the calibration or clean is completed.

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4 450TOC Setup Instructions

4.1 Unpacking and inspection of the 450TOC

Carefully unpack the 450TOC. The box should contain the following items:

- 450TOC
- 450TOC Operation Manual CD
- 450TOC Quick Start Guide
- Certificate of Calibration
- Installation Kit includes:
  - Two - 6 foot (2m) lengths of PTFE tubing, 0.125 inch (3mm) O.D.
  - Two - 0.125 inch (3mm) compression fittings
  - One - Sample Outlet Tube Adaptor
  - One - Plastic 30cc Syringe
  - One - High Capacity Inlet Filter Assembly with elbow
  - One - 2.5 M AC line cord
  - One - removable AC Line cord anchoring clip

4.2 Sample Tubing Connections

The accessory kit provided with the 450TOC includes sample tubing consisting of two 6-foot (2 m) lengths of PTFE tubing for the supply and drain connections. Two 0.25 inch (6mm) O.D. to 0.125 inch (3mm) O.D. tubing reducers are also included and can be used where applicable.

The following items are necessary to ensure proper installation:
- Sample isolation valve (not provided).
- 0.125 inch compression tube fitting for sample point (common tube fitting adapters are available from Thornton; see Section titled Accessories for details)

NOTE: The sample point should contain a shut-off valve to isolate the sample point when not in use. Proper installation guidelines should be followed when installing this valve to reduce the possibility of air entrapment or sediment in the sample line.

Remove the protective covers from the sample connections.

Prepare the sample inlet and drain connections using the PTFE tubing and fittings provided. Alternate fittings or non-TOC shedding tubing may also be used as necessary to provide a suitable connection from the 450TOC to the sample connection and sample drain point. However, the tubing and fittings selected should be appropriate for the system operating temperature and pressure.

In all cases, use small diameter tubing of the shortest length possible to ensure the fastest measurement response time. 0.125 inch tubing is recommended, and is supplied with the 450TOC. Prior to initial use, flush the sample inlet tubing to remove any particles that may be in the line or fittings before connecting it to the 450TOC.

Locate the High Capacity Inlet Filter Assembly and elbow provided in the acessory kit. The male-threaded end of the elbow assembly is screwed into the female-threaded sample inlet fitting. Hand-tighten this o-ring sealed connection to ensure the connection is tight. Do not over tighten.

Connect one length of the 0.125 inch (3mm) PTFE tubing to the high capacity inlet filter by securing the tubing in the compression fitting on the assembly. Do not over tighten.

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Connect the second length of 0.125 inch (3mm) PTFE tubing to the 450TOC sample outlet connection using the provided sample outlet tube adaptor. Place the other end of the sample drain tubing into a suitable atmospheric drain or collection sump prior to initiating sample flow.

Connect the free end of the sample inlet and sample outlet tubes to fittings or adaptors appropriate for connection to the sample point and drain collection. Two 0.125 inch (3mm) compression fittings pre provided to assist with this connection.

Important! The 450TOC drain tube must be fed to a nearby standpipe, drain sump or portable container to create an air gap and prevent siphoning. If a portable container is used, ensure the container is large enough to hold the anticipated water volume used during measurement.

4.3 AC Power Connection

The 450TOC is equipped with an IP65 rated IEC electrical connection. A removable clip is included in the accessory pack provided. To ensure the IP65 rating is maintained, install the removable clip as shown below, and use only the provided AC line cord or replacement AC line cords listed in the Accessories section of this instruction manual.



The 450TOC is equipped with a universal AC supply, and is capable of operation from 1000-240 VAC at 50-60 Hz. When ready for operation, connect supplied AC line cord to the 450TOC electrical supply connection, and then to an appropriate electrical supply. The unit will start up and begin operating immediately after connection to the AC supply.

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5 450TOC Operation

5.1 Initial Start Up

Initial start-up refers to the condition where the 450TOC is setup for the first time. Factory default settings for a 450TOC are designed to minimize setup time for this instrument and allow the instrument to measure automatically. Upon initial setup, it is recommended that the Quick Setup menu be accessed for configuration of several basic system functions. Please refer to the separate quick setup instructions provided. If desired, and before connecting the 450TOC to the water system, energize the instrument and complete the instrument Quick Setup.

5.2 Start TOC Measurement

Position the 450TOC as close to the sample point as possible. Shorter sample tubing length between the sampling point and the 450TOC will provide a faster response time. The 450TOC is designed to operate standing up-right, or lying on its back. The rear of the instrument includes two support reliefs allowing the instrument to lay flat with, or without, the optional boot.

After connecting the sample connection and drain lines to the inlet and outlet port on the 450TOC, and applying power to the 450TOC, attach the sample connection to an appropriate sample point on the water system to be tested and direct the drain line to an appropriate drain or container. Slowly open the sample isolation valve to allow water to flow to the TOC instrument. Once water begins flowing, the 450TOC will automatically control the flow rate.

The 450TOC is equipped with an Auto Start feature, which will automatically activate the UV lamp once adequate water flow is present. This feature is set to off by default. If the Auto Start feature has not been activated in the Quick Setup or Configuration menu, press the UV Lamp button on the instrument control panel to activate the UV lamp.

During the initial setup of the 450TOC, if the Auto Start function in the TOC setup menus is changed from 'No' to 'Yes', the instrument will still prompt the operator to press the key at the front panel during this initial start-up. However after this startup, the Auto Start function takes priority and the 450TOC will automatically start.

If an ERROR or FAULT condition is displayed on the measurement screen, the user can go to the Messages screen to retrieve more information regarding the cause of the condition. Refer to Section 14 of this manual for more information. If the Auto-balance function has been changed to "yes", the 450TOC will perform an auto-balance based on the interval set within the instrument setup menus.

5.3 System Suitability Testing

In many pharmaceutical water applications, System Suitability Testing is required by relevant regulating agencies such as the United States Pharmacopoeia, European Pharmacopoeia, Chinese Pharmacopeia and Japanese Pharmacopeia to qualify instruments used for total organic carbon (TOC) measurements used for validating compliance with regulatory guidelines. The System Suitability Test and TOC Calibration Kit (p/n 58 091 566) and stand (P/N 58 091 586) are available to assist in performing testing needed to meet requirements. The 450TOC System Suitability Standard Operating Procedure (p/n 58 130 475) describes the System Suitability Testing procedure in detail. System Suitability Standards (p/n 58 091 526) are also available. Contact Mettler-Toledo Thornton Customer Service for ordering information.

☞ **NOTE:** If required for pharmacopeia compliance, System Suitability Testing is recommended after each UV lamp change or after performing repairs to the 450TOC. The frequency of additional SST's should be performed according to individual user policy.

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5.4 Calibration

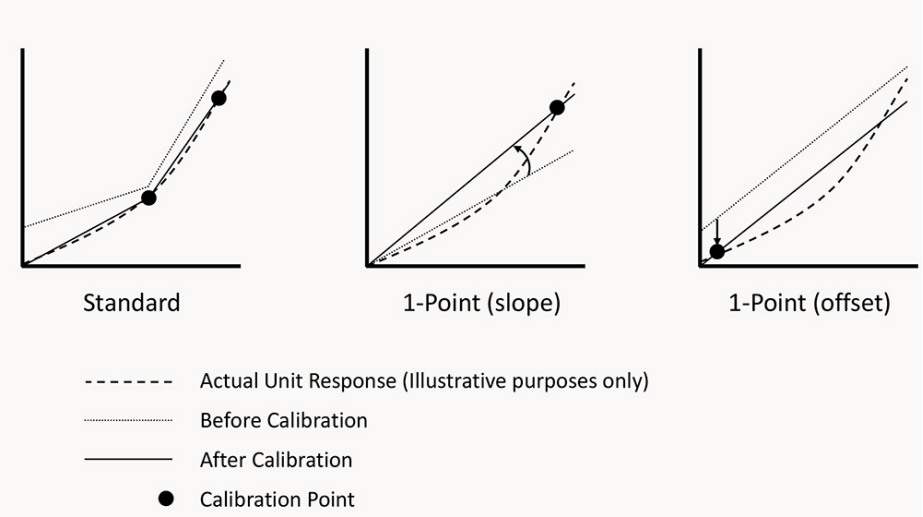
The combined System Suitability Test and TOC Calibration Kit (p/n 58 091 566) and stand (P/N 58 091 586) are available for the 450TOC. Each kit includes a Mettler-Toledo Thornton conductivity sensor, used to assist with calibration of the temperature and conductivity measurement within the TOC instrument. The 450TOC Calibration SOP (p/n 58 130 474) describes the calibration process in detail. Calibration standards (p/n 58 091 529) are also available. Contact Mettler-Toledo Thornton Customer Service for ordering information.

☞ **NOTE:** It is recommended that a TOC calibration be performed after every UV lamp change, and not to exceed 1 year. A full calibration including flow, temperature, conductivity and TOC is recommended annually.

5.4.1 TOC Calibration Methods

There are three main TOC calibration "types" available:

- Standard (multi-linear)
- 1-point slope or multiplier
- 1-point offset or adder



Standard: For most applications that operate over a wide dynamic range, the recommended TOC calibration type is Multi-Linear, referred to as "standard" in the 450TOC. A standard multi-linear calibration requires two TOC calibration solutions, typically at 250 ppb and 500 ppb. Two calibration slopes and offsets are determined in the range of 0-250 ppb TOC and 250-500 ppb TOC. The two lines intersect at 250 ppb. This calibration features provides an optimum system accuracy. This calibration type is the default calibration method with which the 450TOC is supplied, and is recommended when low and high TOC may be encountered from either the water purification process or the calibration/SST solutions.

1-point slope: A 1-point slope calibration method will adjust the TOC calibration slope. If a multi-linear calibration is being used with your 450TOC and the "1 point slope" is performed, it will over-write the "multi" calibration.

1-point offset: This method will adjust the the TOC calibration offset. If a multi-linear calibration exists and the "1 point offset" is performed, it will modify the adder on the 0 – 250 ppb range. The TOC calibration standard concentration used for the "1-point offset" must be lower than the midpoint of the "multi" calibration or 50 ppb, whichever is lower. This method is recommended for applications where low TOC is predominantly expected.

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6 Quick Setup

(PATH: Menu/Quick Setup)

Select Quick Setup and press the [ENTER] key. Enter the security code if necessary (see section titled "Passwords").

NOTE: Please find the complete description of the Quick Setup routine described in the separate booklet "Quick Setup Guide for 450TOC" enclosed in the box.

NOTE: Refer to section titled "Control/Navigation Keys" for information on menu navigation.

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7 Calibration

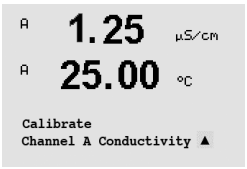
(PATH: Cal)

The calibration key ▶ allows the user one-touch access to calibration and verification features.



NOTE: During Calibration, a flashing "H" in the upper left corner of the display indicates a calibration is in process with a Hold condition active. (The hold output function need to be activated.) See also section titled "Display".

7.1 Enter Calibration Mode



While in Measurement mode press the ▶ key. If the display prompts you to enter the calibration security code, press the ▲ or ▼ key to set the calibration security code, then press the [ENTER] key to confirm the calibration security code.

Press the ▲ or ▼ key to select the type of calibration desired. The choices for each measurement type are: TOC, C1, C2, T1, T2, Flow, Edit. Press [ENTER].

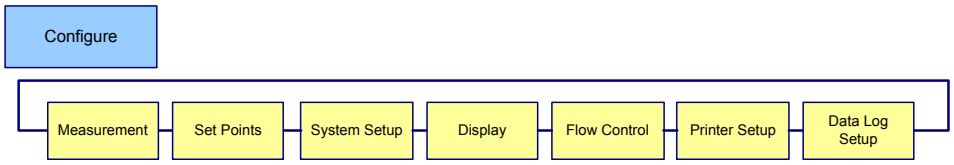
After every successful calibration, the following options are available:
Calibrate: Calibration values will be overwritten and used for the measurement. Additionally, the data will be stored in the 450TOC memory.
Abort: Calibration values will be discarded.

For a detailed explanation on how to perform a calibration in the 450TOC please refer to the Standard Operating Proceedure for calibration of the 450TOC.

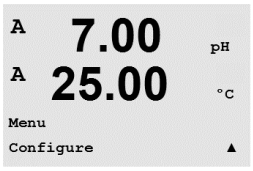
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8 Configuration

(PATH: Menu/Configure)



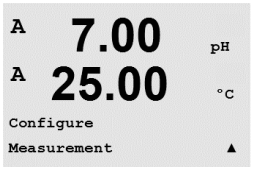
8.1 Enter Configuration Mode



While in Measurement mode, press the ◀ key. Press the ▲ or ▼ key to navigate to the Configure – Menu and press [ENTER].

8.2 Measurement

(PATH: Menu/Configure/Measurement)

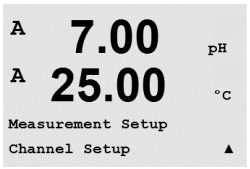


Enter configuration mode as described in Section titled "Enter Configuration Mode".

Press the [ENTER] key to select this Menu. The following sub menus can now be selected: Channel Setup, Conductivity, and Set Averaging.

8.2.1 Channel Setup

(PATH: Menu/Configure/Measurement/Channel Setup)

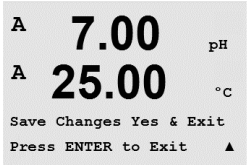


Press the [ENTER] key to select the "Channel Setup" menu to select the parameter that will be displayed on each line.

The options include: TOC in ppb, g C/L, Ω·cm, S/cm, S/m, °C, °F, Lamp Remaining, Nothing.



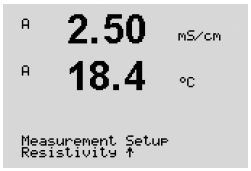
Lines a and b of the display can now be configured for each line of the display, selecting measurements and unit multipliers. Pressing the [ENTER] key will display the selection for lines c and d.



Pressing the [ENTER] key again will bring up the Save Changes dialog. Selecting No will discard the entered values and return to the measurement display screen, selecting Yes will save changes made.

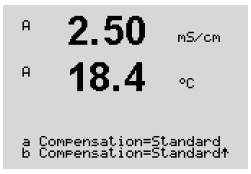
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8.2.2 Conductivity/Resistivity Temperature Compensation



(PATH: Menu/Configure/Measurement/Resistivity)

Select Resistivity and press [ENTER].



The temperature compensation mode for any of the four measurement lines configured to display conductivity can be selected. Choices are "None", and "Standard".

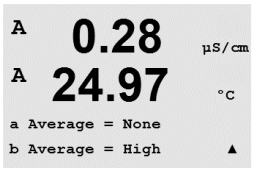
Standard compensation includes compensation for non-linear high purity effects as well as conventional neutral salt impurities and conforms to ASTM standards D1125 and D5391.

8.2.3 Set Averaging

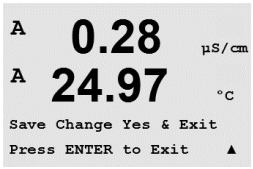
(PATH: Menu/Configure/Measurement/Set Averaging)



Press the [ENTER] key to select this Menu. The averaging method (noise filter) for each measurement line can now be selected. The options are Special (Default), None, Low, Medium and High:



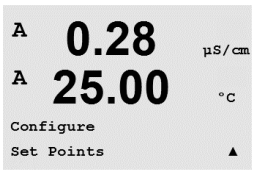
None = no averaging or filtering
Low = equivalent to a 3 point moving average
Medium = equivalent to a 6 point moving average
High = equivalent to a 10 point moving average
Special = averaging depending on signal change (normally High averaging but Low averaging for large changes in input signal)



Pressing the [ENTER] key again will bring up the Save Changes dialog. Selecting No will discard the entered values and return to the measurement display screen, selecting Yes will save changes made.

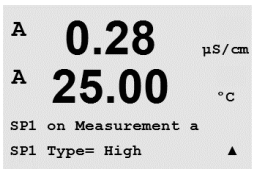
8.3 Setpoints

(PATH: Menu/Configure/Setpoints)



Enter configuration mode as described in Section titled "Enter Configuration Mode".

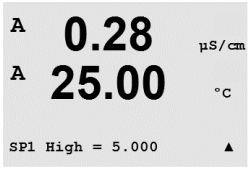
Press the [ENTER] key to select this Menu.



4 Setpoints can be configured on any of the measurements (a thru d). The possible Setpoint types are Off, High, Low, Outside and Between. Multiple setpoints can be configured for a single measurement.

An "Outside" Setpoint will cause an alarm condition whenever the measurement goes above its high limit or below its low limit. A "Between" Setpoint will cause an alarm condition to occur whenever the measurement is between its high and low limits.

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Enter the desired value(s) for the Setpoint and press [ENTER]

The next screen provides the option to configure a setpoint to be active on an over range condition. Select the setpoint and "Yes" or "No". Select the desired relay that will activate when the setpoint alarm condition is reached.

Out of Range
Once configured, warning triangle will flash in the upper right corner of the 450TOC display, a message will be accessible in the message screen informing the user of the set-point Out of Range condition, and the amber warning LED will be activated if a measurement Out of Range condition is detected on the assigned input channel.

8.4 System Setup

8.4.1 TOC General Parameters

(Path: Menu/Configure/System Setup/TOC General Para)

The 'TOC General Para' menu allows the user to configure several basic operational characteristics of the 450TOC. These functions are explained in detail below.

Auto Start
Auto Start is a feature that allows the 450TOC to automatically energize the UV lamp and start making TOC measurements when AC power is applied and adequate sample flow is detected,or when the 450TOC restarts after power is restored following a power failure. The factory default setting for the Auto Start function is 'No'. Therefore during initial start-up, the 450TOC will not start a TOC measurement. To start a TOC measurement, the user must go to the 'UV Lamp: On/Off' screen and set this mode to 'On' to turn on the UV lamp and start a TOC measurement. The user may also push the UV lamp button on the control panel to energize the UV lamp and to start a measurement. Once the 'Auto Start' mode is set to 'Yes', it is no longer necessary to set the 'UV Lamp' option to 'On' as the 'Auto Start' function will override the UV Lamp: On/Off function.

Set Auto-Start to 'Yes' to allow the 450TOC to automatically energize the UV lamp and begin making TOC measurements once AC Power is applied and adequate sample flow is detected. In the event that direct human interaction is desired to re-start measurements, this feature should be set to 'No'.

Conductivity Limit
The Conductivity Limit allows configuring the instrument so that exceeding the sepcified conductivity limit will alert the operator when the limit is exceeded by giving an error indication and message. The limits are selectable, and must be set above 0.0.

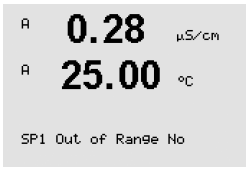
Over-ride Limit
An error message will occur if the Conductivity Limit is exceeded when 'No' is selected. The Conductivity Limit is ignored when 'Yes' is selected.

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8.4.2 Lamp Control

(Path: Menu/Configure/System Setup/Lamp Control)

UV Lamp
The 'UV Lamp' function allows the user to turn on or off the UV lamp. For initial start-up, the "UV Lamp On" key must be pressed.



Lamp Limit
The UV lamp in the 450TOC is rated for 4500 hours of normal usage. The 450TOC will display an error message when the lamp operating time has exceeded the lamp limit, which is set to 4500 hours by default. The user can adjust the Lamp Limit to any value from 400 to 9999 hours. It is the user's responsibility to assure by calibration or other means that the lamp is outputting sufficient UV light for the 450TOC to make accurate TOC measurements. Remaining lamp life as Indicated by the lamp life counter can be viewed by pressing the 'Info' key. Please refer to Section 14 for more information.

Lamp Time Reset
During normal operation, the 450TOC will automatically track the operating time of the UV Lamp. Once the set lamp limit is exceeded, an error indication will be given to alert the user that the lamp should be replaced. Following lamp replacement, the lamp life counter must be re-set by the user. To re-set the lamp life counter, enter the Lamp Control menu, select 'Lamp Time Reset = Yes and press the enter key. This will reset the counter to the Lamp Limit.

8.4.3 Autobalance

(Path: Menu/Configure/System Setup/Autobalance)

The 450TOC is capable of automatically balancing the two conductivity sensors. This step is performed to account for small differences in conductivity measurement between the two conductivity sensors. The default factory condition of the AutoBalance feature of the 450TOC is No. This will result in no AutoBalance activity being performed automatically. The user may change this attribute to 'Yes' at anytime. For applications with very low TOC (<5 ppb) AND high resistivity (>15 Mohm-cm), it is advised to set this feature to 'YES' for improved accuracy. For applications that do not meet both criteria, such as USP water production, the user may elect to remain with 'No' AutoBalance with little observable effect.

If power to the 450TOC is interrupted and restored, an Autobalance will occur if the Autobalance function is enabled. The user also has the ability to set or change settings for several functions associated with Autobalance. These additional functions will not be accessible unless Autobalance is enabled.

Autobalance
Enable (yes) or disable (no) Autobalance feature.

Autobalance Now
Perform an immediate Autobalance (AutoBal Now).

Autobalance Hold
Set a hold 'last measurement' so the analog outputs and relays are held in their current state while an Autobalance occurs.

Cycle Time
Set a time interval for the Autobalance to occur automatically. This value is selectable from 24 to 4500 hours, with a factory default setting of 4500 hours. Note that the time remaining until the next autobalance occurs can be viewed by pressing the Info key and selecting 'AutoBalace'. Please refer to Section 14 for additional information.

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Autobal Limit
Set the tolerance for balancing the sensors (limit in %). This is the percentage difference allowed between the two conductivity cell readings during an Autobalance cycle when the lamp is off.

Rinse Time
Set the length of time that the 450TOC will have sample water flowing through it before performing the Autobalance function. The Rinse Time can be set from 1 to 999 minutes. During the rinse and autobalance process, the UV lamp will be turned off, and the 450TOC will not provide a TOC indication.

8.5 Display

(PATH: Menu/Configure/Display)



Enter configuration mode as described in Section titled "Enter Configuration Mode".

This Menu allows for the configuration of the values to be displayed and also the configuration of the Display itself.

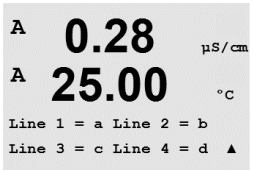
8.5.1 Measurement

The Display has 4 lines. Line 1 on top and Line 4 on the bottom.



Select the values (Measurement a, b, c or d) to be displayed on each line of the display.

The selection of the values for a, b, c, d needs to be done under Configuration/Measurement/ Channel Setup.



Select the "Error Display" mode. If this is set to "On" when an alarm has occurred, the message "Failure – Press Enter" will be displayed on Line 4 when an alarm occurs in the normal Measurement mode.

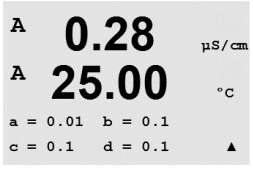


Pressing the [ENTER] key again will bring up the Save Changes dialog. Selecting No will discard the entered values, selecting Yes will make the entered values the current ones.

8.5.2 Resolution



This menu allows the setting of the resolution of each displayed value.



Possible settings are 1, 0.1, 0.01, 0.001 or Auto.

Pressing the [ENTER] key will bring up the Save Changes dialog.

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8.5.3 Backlight

This Menu allows the setting of the back light options of the display.

Possible settings are On, On 50% or Auto Off 50%. If Auto Off 50% is selected then the backlight will go to 50% after 4 minutes with no keypad activity. The backlight will automatically come back on if a key is pressed.

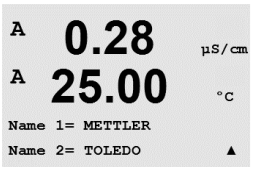
Pressing the [ENTER] key Will bring up the Save Changes dialog.

8.5.4 Name



This menu allows for the configuration of an alpha-numeric name which is displayed in the first 9 characters on Lines 3 and 4 of the Display. The default is nothing (blank).

If a name is entered on line 3 and/or 4 a measurement can be still displayed on the same line.



Use the ◀ and ▶ keys to navigate between digits to be altered. Using the ▲ and ▼ keys to change the character to be displayed. Once all digits of both display channels have been entered, press [ENTER] to bring up the Save Changes dialog.



The resulting display in the measurement mode appears on Lines 3 and 4 ahead of the measurements.

8.5.5 Display Setup

(PATH: Menu/Display Setup/Display Setup)

In place of displaying a measurement, line 3 of the instrument display can optionally be configured for one of two modes; either to provide easy access to the data log and printer function, or to display the remaining operating hours left on the UV lamp. The options available and their function are as follows:

Off: Line 3 will display measurement as configured in Measurement Setup

Lamp Status: Line 3 of the disply will indicate the operational state of the UV lamp as On or Off .

Data Log Control: When this setting is selected, the data log state and file name, or printer state will be displayed on line three of the front panel display in the following manner:

1. If neither the data log or printer function are active, line three will read "Data Log Off". In this state, press ↵ to access the Data Log set up menu.

2. If data log is active, line three will read ”Datalog On xxxxxNNN” where 'xxxxx' is the five-digit file name selected by the operator, and 'NNN' numerical extension assigned by the system. Refer to the section on Data Log for more information.

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3. If the print function is active, and data log is not active, line three will read "Printer On"

☞ **NOTE:** If both the data log and print functions are active, line three will read "Datalog On xxxxxNNN" as described in 2 above.

In all cases when Data Log Control is selected for Line 3, the ↵ key can be used to access the data log and print menus. Press and release the ↵ key to access the Data Log menu. Press and hold the ↵ for three seconds and then release, to access the Print menu. This configuration may be useful when regularly data logging measurements at several locations.



8.6 Flow Control

(PATH: Menu/Configure/Flow Control)

When the Pump Module is installed (see Accessories), or system flow rate is being controlled external to the 450TOC, set the 'Accessory Mode' to 'On'.

The Flow Control setting overrides the automated flow control feature within the 450TOC, and sets the flow control valve to fully open. For low pressure applications, a pump may be necessary to provide adequate pressure to the 450TOC in order to achieve a flow rate of 20 mL/min. Mettler-Toledo Thornton offers a metered, positive displacement Pump Module (P/N 58 091 565) as an accessory for applications where a pump is required.

8.7 Printer Setup

(PATH: Menu/Configure/Printer Setup)

The 450TOC is equipped with two USB ports, one of which can be connected to a compatible USB printer (See Accessories section in this Operating Manual). The 450TOC can be configured to print any of the four primary measurements programed on the instrument display. To set up the printer output, first connect the printer to the USB port and turn on the printer. Then, navigate to the Printer Setup menu in the Configuration section, and configure the following options:

1. Printer Output: Set the printer output to 'On' to start the printer output. The printer must be connected and energized in order to enable the printer output.

2. Lines to Print: Select a number from 1 to 4, stating the number of parameters that will be sent to the printer.

3. Print Delay: The time between each print cycle can be set from 1 to 1,440 minutes (1 day). When first activated, the system will immediately print out the selected measurements. These measurements will then print out regularly at the interval set for Print Delay.

4. Line (1 to 4): Each of the desired lines for print-out must be individually defined. First, select each individual line configured to print, and then select the parameter to be printed on that line.

8.8 Data Log Setup

(PATH: Menu/Configure/Data Log Setup)

The 450TOC is equipped with two USB ports, one of which may have any standard USB memory stick connected. The memory stick can be used to store measurement data collected by the

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450TOC or to create a file which can be used by METTLER-TOLEDO Thornton to assist with system diagnostics. To set up the data output, first connect the USB stick to either of the two USB ports on the 450TOC. Then, navigate to the Data Log Setup menu in the Configuration section, select the data mode desired and press enter to begin the configuration process. The data mode options available and the configuration requirements are described below.

Off: Set Data Mode to 'Off' to stop all data logging and deactivate the data output. No further configuration is necessary.

Data Log: Selecting Data Log will allow the 450TOC to be configured to output any of the four measurements programed on the instrument display. The file will be written in a comma separated variable format, to allow easy processing with most standard spread sheet programs. The information contained in the file will include one header row sent when the data log is first started, a date and time stamp, and the measurement data selected during the configuration process. To set up the data log output, first connect the USB memory stick to the USB port, set the data mode to Data Log, and configure the following settings:

1. File Name: Enter a 5-digit Alpha-numeric character string that will be used as part of the file name. The full file name will consist of this 5-digit string followed by a system incremented 3 digit number. The file will be saved to the memory stick with a ".log" file extension, and can be opened as a text or comma separated variable by any text editing or spread sheet software.

2. Output Delay: Select the time delay that will occur between each data point being saved to the data log file. The time between each data point can be set from 5 to 999 seconds or from 1 to 999 minutes.

3. Number of Outputs: Select a number from 1 to 4, stating the number of parameters that will be sent to the data log file.

4. Output (1 to 4): Each of the desired measurements for output must be individually selected to determine the order they will be presented in the data log file. First, select each individual output number up to the value selected in 'Number of Outputs'. Next, select the parameter desired for that position in the data file.

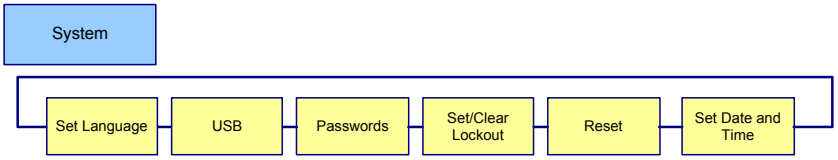
Diagnostic File: The 450TOC is capable of creating an output file containing extensive system setup information. This file is written in a proprietary format that can only be read by METTLER-TOLEDO Thornton. Under certain circumstances, you may be asked to provide this file, which can be used by METTLER-TOLEDO Thornton to assist with system diagnostics.

To create this file, ensure that a USB memory stick is connected to one of the USB ports on the 450TOC, select the 'Diagnostic File' option, and follow the on-screen prompts. This file can then be read from the memory stick, and sent to METTLER-TOLEDO Thornton by e-mail.

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9 System

(PATH: Menu/System)

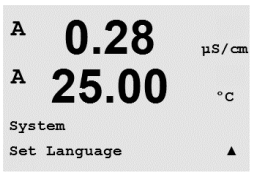




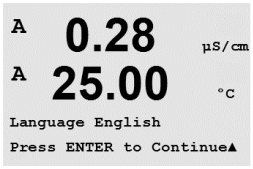
While in Measurement mode press the ◀ key. Press the ▼ or ▲ key to navigate to System Menu and press [ENTER].

9.1 Set Language

(PATH: Menu/System/Set Language)



This Menu allows the configuration of the Display language.

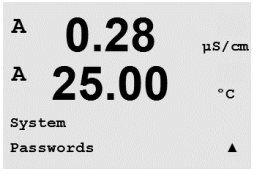


The following selections are possible:
English, French, German, Italian, Spanish, Russian, Portuguese and Japanese.

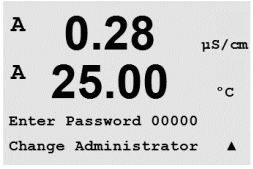
Pressing the [ENTER] key will bring up the Save Changes dialog.

9.2 Passwords

(PATH: Menu/System/Passwords)



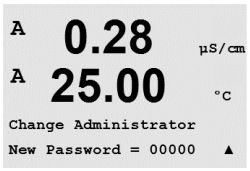
This Menu allows for the configuration of Operator and Administrator Passwords, as well as setting up a List of allowed Menus for the Operator. The Administrator has rights to access all Menus. All default passwords for new systems are "00000".



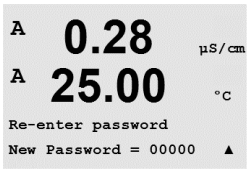
The Passwords Menu is protected: Enter the Administrator Password to enter the Menu.

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9.2.1 Changing Passwords

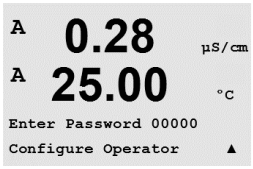


See Section titled "Passwords" how to enter the Passwords Menu. Select "Change Administrator" or "Change Operator" and set the new Password.

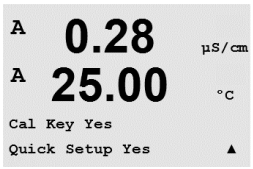


Press the [ENTER] key and confirm the new password. Press [ENTER] again to bring up the Save Changed dialog.

9.2.2 Configuring Menu Access for Operator



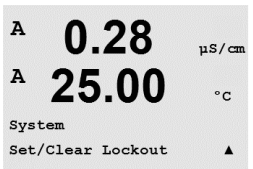
See section titled "Passwords" for information on how to enter the Passwords Menu. Select Configure Operator to configure the Access list for the Operator. It is possible to assign/deny rights to the following Menus: Cal Key, Quick Setup, Configuration, System, and Service.



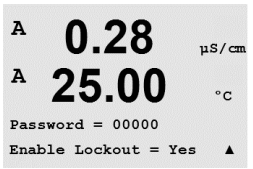
Choose either Yes or No to give/deny access to the above Menus and press [ENTER] to advance to the next items. Pressing the [ENTER] key after configuring all menus will bring up the Save Changes dialog. Selecting No will discard the entered values, selecting Yes will make the entered values the current ones.

9.3 Set/Clear Lockout

(PATH: Menu/System/Set/Clear Lockout)



This menu enables/disables the Lockout functionality of the system. The user will be asked for a password before being allowed into any menus if the Lockout functionality is enabled.



The Lockout – Menu is protected: Enter the Administrator Password and select YES to enable or NO to disable the Lockout functionality. Pressing the [ENTER] key after the selection will bring up the Save Changes dialog. Selecting No will discard the entered value, selecting Yes will make the entered value the current one.

9.4 Reset

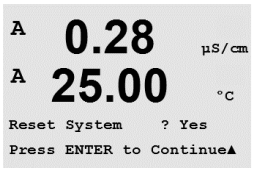
(PATH: Menu/System/Reset)



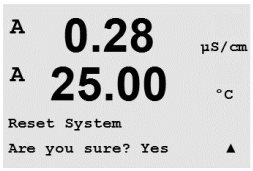
This Menu allows access to the following options:
Reset System, Reset Cal.

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9.4.1 Reset System



This Menu allows reset of the 450TOC to the factory default settings (Setpoints off, analog outputs off, etc.). The 450TOC calibration is not affected.



Pressing the [ENTER] key after the selection will bring up a confirmation screen. Selecting No will return the user to the Measurement mode with no changes. Selecting Yes will reset the 450TOC setup to the factory default condition.

9.4.2 Reset Calibration Data to Factory Settings

This menu allows the reset of the calibration data of the 450TOC to the factory settings. This includes calibration data for the TOC, conductivity, temperature and flow measurements.

Pressing the [ENTER] key after the selection will bring up a confirmation screen. Selecting No will return the user to the Measurement mode with no changes. Selecting Yes will reset the calibration data of the 450TOC to factory settings.

☞ **NOTE:** To ensure best measuring results, a new calibration of the 450TOC is recommended after a reset of the calibration data to factory settings.

9.5 Set Date and Time

(PATH: Menu/System/Set Date and Time)

Please use this menu to set the real-time-clock date & time.

The date and time are stored and displayed in the following format:

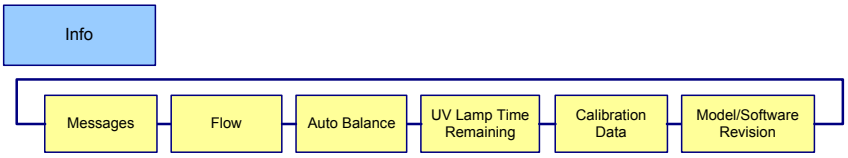
Date (YY-MM-DD)

Time (HH:MM:SS)

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10 Info

(PATH: Info)



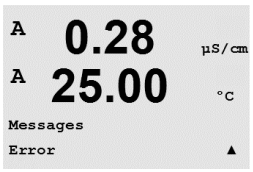
10.1 Info Menu



Pressing the ▼ key will display the Info Menu with the options Messages, Calibration Data and Model/Software Revision.

10.2 Messages

(PATH: Info/Messages)



Enter Info Menu as described in section titled "Info Menu" and press [ENTER].

The most recent message is displayed. The up and down arrow keys allow scrolling through the last four messages that have occurred.



Clear Messages clears all the messages. Messages are added to the message list when the condition that generates the message first occurs. If all messages are cleared and a message condition still exists and started before the clear then it will not appear in the list. For this message to re-occur in the list the condition must go away and then reappear.

10.3 Flow

(PATH: Info/Flow)

Enter Info Menu as described in section titled "Info Menu", select Flow, and press [ENTER].

This feature displays the current measured flow rate through the 450TOC in mL/ min, and the last flow sensor calibration date, as entered during the calibration.

10.4 Autobalance

(PATH: Info/Autobalance)

Enter Info Menu as described in section titled "Info Menu", select Autobalance, and press [ENTER].

The Autobalance menu displays the time remaining until next autobalance, and the current autobalance offset value. If the Autobalance function is turned off, the time remaining will be displayed as 'N/A'

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10.5 UV Lamp Time Remaining

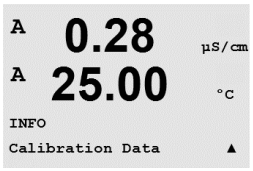
(PATH: Info/Lamp Time Remaining)

Enter Info Menu as described in section titled "Info Menu", select UV Lamp Time Remaining, and press [ENTER].

This menu displays remaining life of UV lamp in hours. The UV lamp should be replaced after 4500 hours of operation. A TOC calibration is recommended following each lamp replacement.

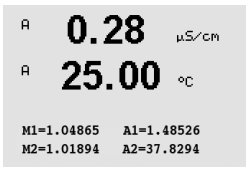
10.6 Calibration Data

(PATH: Info/Calibration Data)



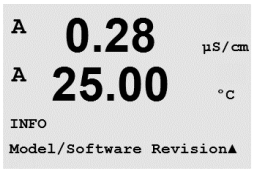
Enter Info Menu as described in section titled "Info Menu", select Calibration Data, and press [ENTER].

The menu displays the calibration constants for each parameter within the 450TOC. Use the up and down arrow keys to select TOC, Conductivity, Temperature or Flow.



Press [ESC] to exit from this display.

10.7 Model/Software Revision



Essential information for every Service call is the model and software revision number.
This menu shows the part number, model and the serial number of the 450TOC. By using the ▼ key it is possible to navigate forward through this submenu and get additional information including the current hardware and firmware versions implemented on the 450TOC.

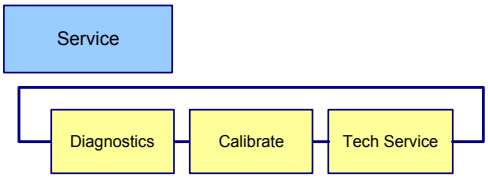


Press [ENTER] to exit from this display.

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11 Service

(PATH: Menu/Service)



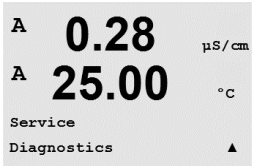
11.1 Enter Service Menu



While in Measurement mode press the ◀ key. Press the ▲ or ▼ key to navigate to the "Service" Menu and press [ENTER]. The available system configuration options are detailed below

11.2 Diagnostics

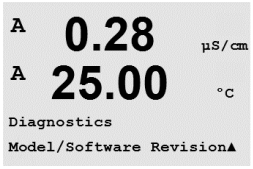
(PATH: Menu/Service/Diagnostics)



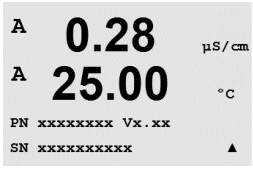
Enter Service Menu as described in section titled "Enter Service Menu" and press [ENTER] .

This Menu is a valuable tool for troubleshooting and provides diagnostic functionality for the following items: Model/Software Revision, Display, Keypad, Memory.

11.2.1 Model/Software Revision

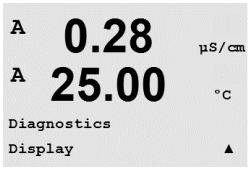


Essential information for every Service call is the model and software revision number.
This menu shows the part number, model and the serial number of the 450TOC. By using the ▼ key it is possible to navigate forward through this menu and get additional information including the current version of firmware, software and hardware implemented on the 450TOC.



Press [ENTER] to exit from this display

11.2.2 Display



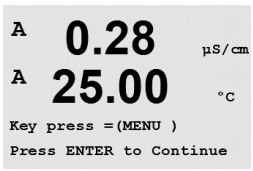
All pixels of the display will be lit for 15 seconds to allow troubleshooting of the display. After 15 seconds the 450TOC will return to the normal Measuring mode or press [ENTER] to exit sooner.

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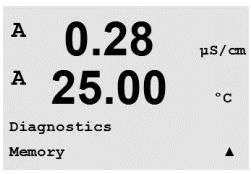
11.2.3 Keypad



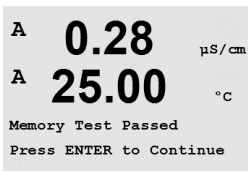
For keypad diagnostics, the display will indicate which key is pressed. Pressing [ENTER] will return the 450TOC to the normal Measuring mode.



11.2.4 Memory



If Memory is selected then the 450TOC will perform a RAM and ROM memory test. Test patterns will be written to and read from all RAM memory locations. The ROM checksum will be recalculated and compared to the value stored in the ROM.



11.3 Tech Service

(PATH: Menu/Tech Service)



NOTE: This Menu is for METTLER-TOLEDO Thornton Service personnel use only.

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12 450TOC Service Requirements

The 450TOC is designed to minimize service and maintenance. There are no moving mechanical components, therefore normal operating wear and tear is negligible. This reduces the amount of consumable components as well as the amount of time needed to maintain the 450TOC. Listed below are instructions on how to perform simple periodic maintenance, which includes UV Lamp change and filter replacement after 4500 hours of operation, and general cleaning.

12.1 UV Lamp Replacement

WARNING: UV RADIATION HAZARD
Apply power to UV lamp only when installed in housing in accordance with this instruction manual. DO NOT remove UV lamp from housing unless power is off.
Always protect eyes and skin from exposure to UV light.

METTLER-TOLEDO Thornton recommends replacement of the UV lamp inside the 450TOC after 4500 hours of operation, or 6 months of continuous use. This is a simple procedure that requires only a few minutes to complete. The following steps explain the proper procedure for the UV lamp replacement. Refer to the illustration below.

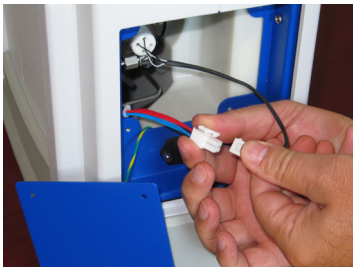
CAUTION: Use of a UV lamp other than those provided by METTLER-TOLEDO Thornton specifically for use with the 450TOC will affect performance and void the warranty of this product.

1. At the 450TOC, turn off the UV lamp by pressing the lamp control button (UV lamp ON LED will turn off) and disconnect the 450TOC from AC power.

2. Remove the UV lamp replacement side access plate on the left side of the 450TOC using a Phillips head screw driver.



3. Disconnect the power cable to the UV lamp.

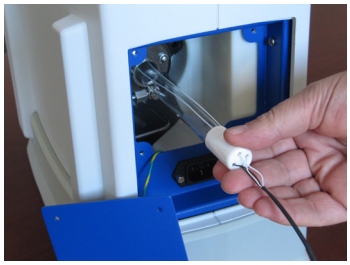


4. Loosen the UV lamp holding screw located on the left side of the oxidation chamber.



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5. Slide the cable of the UV lamp through the side opening of the enclosure and gently slide the UV lamp out of the oxidation chamber assembly (stainless steel cylinder). Be careful not to let the UV lamp hit the quartz glass tube inside the chamber.



6. Use the gloves supplied with each replacement bulb. Hold the new lamp from the ends of the lamp. Do not touch the glass of the bulb with bare hands. Slide the new UV lamp into the side opening of the enclosure and into the oxidation chamber opening until it stops. Do not use excessive force to insert the UV lamp as this may cause damage to the lamp or the internal components of the oxidation chamber.

7. Tighten the UV lamp holding screw until snug. Do not over-tighten.

8. Feed the power cable through the side opening of the enclosure. Re-connect it to the power connector.

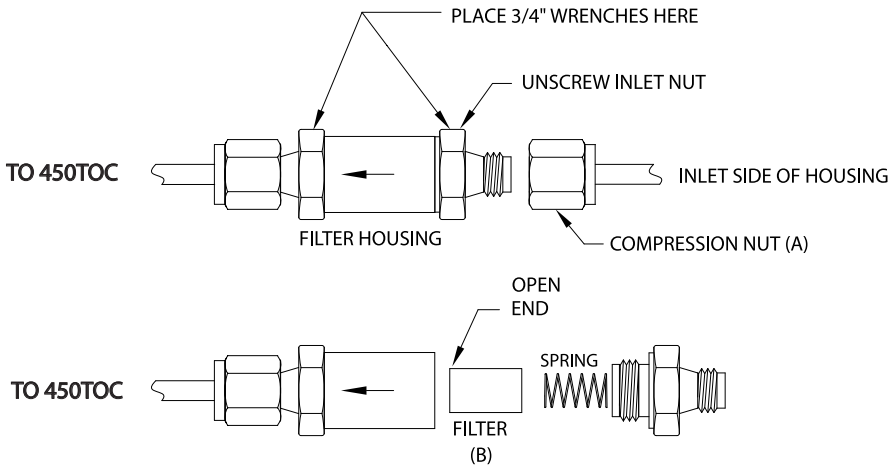
9. Install the UV lamp side access plate on the side of the enclosure and connect the 450TOC to an AC power source.

10. At the 450TOC control panel, press the 'Menu' key, and select Path: Menu/Configure/System Setup/Lamp Control. Press the 'Enter' key until 'Lamp Time Reset' is displayed. Select 'Yes', then press enter twice to confirm your selection and save the changes.

11. After the lamp replacement has been completed, a TOC calibration must be performed. In addition, a System Suitability Test is recommended in applications where compliance with Pharmacopeia regulations is necessary.

12.2 High Capacity Inlet Filter Replacement

The 450TOC includes a high capacity filter (shown below) containing a filter element that should be replaced (p/n 58 091 551, package of 2) every 6 months or sooner, depending on water quality conditions. Detailed instructions to replace this filter are included in the replacement package.

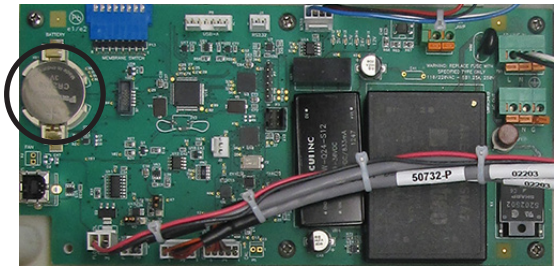


REPLACING THE FILTER ELEMENT FOR THE HIGH CAPACITY INLET FILTER

12.3 Real-Time-Clock Battery Replacement

The 450TOC is equipped with circuit board mounted battery which maintains the real-time-clock (RTC) energized when the instrument is not connected to external AC power. The battery is designed to have a five-year life before replacement is required.

To replace the battery, first disconnect the 450TOC from electrical power, remove the AC line cord from the 450TOC IEC connector, and remove the optional rubber Shock Boot if installed. Lay the 450TOC on its front side and completely loosen the four captive screws securing the two halves of the enclosure. Carefully separate the two halves. When separating the enclosure halves, the side panel with the AC connector will remain with the front half of the enclosure, and the side panel with the plumbing connections will remain with the rear half of the enclosure. Once separated, lay the two halve of the instrument enclosure flat with the base of each half facing the other.



Remove the protective splash guard covering the 450TOC electronics assemblies. Locate the battery holder, positioned on the left side of the main PCB. Using a wide-blade flat-headed screw driver, position the blade of the screwdriver between the battery and the circuit board from the left side of the instrument. Carefully rotate the screwdriver to lift the battery out of the holder.

Once the original battery has been removed, position the replacement battery over the holder and press into position until the battery snaps into place.

Reinstall the protective splash guard over the instrument electronics assemblies and secure into place. Before reassembling the two halves of the 450TOC main enclosure, inspect the u-channel gasket on each of the blue end-plates to ensure the gasket is properly in place. If the gasket has pulled away from the edges of the place, press the gasket back into place.

Caution: To avoid equipment damage when reassembling the 450TOC enclosure, carefully check between the two sections of the enclosure to ensure that no wires are out of place or pinched between the enclosure sections during assembly.

Position the front section of the enclosure over the rear section so that the end-plates are properly aligned over their respective grooves. Guide front enclosure section down into the rear section, allowing each side to evenly move into position. Carefully press the enclosure into place, making certain that no wires are trapped between the two enclosure halves. Once both sections are pressed fully back into position, tighten the four captive screws which hold the enclosure halves together.

Once the battery has been replaced, it is necessary to re-set the date and time for the RTC. Please refer to the section titled Set Date and Time for more information on how to set the RTC.

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13 Maintenance

13.1 For Technical Support

For technical support and product information for the 450TOC, contact:

Mettler-Toledo Thornton, Inc.
900 Middlesex Turnpike, Bldg. 8
Billerica, MA 01821 USA
Phone: 781-301-8600 or 800-510-PURE
Fax: 781-301-8701
Email: service@thorntoninc.com

Or: your local Mettler-Toledo Sales Office or representative. A listing can be found on the back page of this operating manual.

13.2 Front Panel Cleaning

Clean the front panel with a damp soft cloth (water only, no solvents). Gently wipe the surface and dry with a soft cloth.

13.3 Prepare Unit for Shipment or Storage

Prior to transporting or storage of the 450TOC, it is recommended that all water be drained from instrument. Transporting the unit when filled with water can result in damage to the oxidation chamber quartz coil due to freezing. Storage the 450TOC with water for long periods of time can result in the formation of biofilm within the instrument, requiring long rinse-down periods prior to use.

To drain all water from the instrument, disconnect sample and drain tubing, and connect the instrument to AC power. Activate Purge Mode to fully open the flow control valve. To activate Purge Mode, press and hold the (up arrow) key for 3 seconds, and then release. Af-ter releasing the key, the Green, Amber and Red status LED's will begin flashing.

Once the purge mode is activated, use the supplied syringe to remove any water remaining in the unit. Fully extend the syringe plunger and firmly place the tip against the Sample Inlet connection. Depress the syringe plunger to expel water from the 450TOC. Continue to re-extend the plunger and repeat this process until all water is removed from the system.

After all water has been removed from the 450TOC, press and hold the (up arrow) key for 3 seconds, and then release. The LED indications should return to normal operation, showing that purge mode has been turned off.

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14 Troubleshooting the 450TOC

Listed below are some techniques that may assist in troubleshooting this piece of equipment. Refer to the Fault Message Table on the next page for Fault and Error messages that appear in the 450TOC menus when a Fault or Error LED illuminates to signal the user that an undesirable condition exists with the TOC measurement system.

Review the table below for possible causes of common problems:

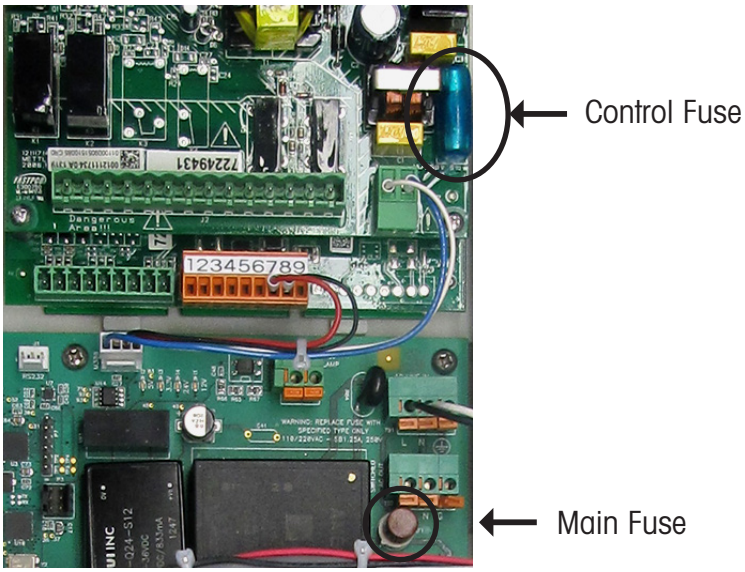
Problem	**Possible Cause**
Display is blank.	– LCD display contrast set incorrectly.
Display is blank and red LED flashes.	– Blown control fuse. – Hardware failure.
Incorrect measurement readings.	– Incorrect units multiplier entered. – Temperature compensation incorrectly set or disabled. – TOC calibration required. – Hardware failure.
Measurement readings not stable.	– Instrument is positioned too close to equipment that generates high level of electrical noise. – Averaging set too low. – Air Leak in sample line.
Displayed ⚠ is flashing.	– Setpoint is in alarm condition (setpoint exceeded). – Alarm, that has been selected (see chapter 10.6 "Alarm"), has occurred. – System fault or error condition present. See Info/ Messages for more information.
Cannot change menu settings.	– User locked out for security reasons.
None of the LEDs illuminated	– LED/Keypad failure. – Circuit board failure. – No AC Power available to 450TOC.
No Flow from sample outlet	– High capacity inlet filter clogged. – Flow control valve failure – Sample flow shut off to 450TOC inlet. – Internal component leaking. – Sample feed pressure too low.
Erratic flow through the 450TOC	– Sample outlet tubing not installed per manufacturer's instructions. – Erratic water system/sample feed pressure

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14.1 Replacing the 450TOC Fuses



To replace either of the fuses within the 450TOC, first disconnect the 450TOC from electrical power, remove the AC line cord form the 450TOC IEC connector, and remove the optional rubber Shock Boot if installed. Lay the 450TOC on its front side and completely loosen the four captive screws securing the two halves of the enclosure. Carefully separate the two halves. When separating the enclosure halves, the side panel with the AC connector will remain with the front half of the enclosure, and the side panel with the plumbing hookups will remain with the rear half of the enclosure. Once separated, lay the two halve of the instrument enclosure flat with the base of each half facing the other. Remove the protective splash guard covering the 450TOC electronics assemblies.



14.1.1 Replacing the 450TOC Main Fuse

To replace the 450TOC main fuse, first locate the fuse holder on the main PCB located at the bottom of the front section of the enclosure. The fuse is positioned at the center of the right edge on the main circuit board assembly. Grasp the end of the fuse using fingers, or an appropriate tool such as thin nosed pliers, and pull the fuse straight out from the circuit board.

Replace the fuse with spare Part Number 58 091 583, then reinstall the protective rubber shroud.

14.1.2 Replacing the 450TOC Control Fuse

To replace the 450TOC control fuse, first locate the fuse holder on the control PCB located in the center of the front section of the enclosure. The fuse is positioned at the center of the right edge on the visible circuit board assembly. Remove the protective rubber shroud covering the fuse and fuse holder, then remove the fuse from the fuse holder.

Replace the fuse with spare Part Number 58 091 326, then reinstall the protective rubber shroud.

14.2 Reassemble the 450TOC

Once fuse replacement has been completed, reinstall the protective splash guard over the instrument electronics assemblies and secure into place. Before reassembling the two halves of the 450TOC main enclosure, inspect the u-channel gasket on each of the blue end-plates to ensure

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the gasket is properly in place. If the gasket has pulled away from the edges of the place, press the gasket back into place. Also inspect the o-rings in the channels around the perimeter of the 450TOC handle, and complete enclosure to ensure they are properly seated throughout the entire channel.

Caution: To avoid equipment damage when reassembling the 450TOC enclosure, carefully check between the two sections of the enclosure to ensure that no wires are out of place or pinched between the enclosure sections during assembly.

Position the front section of the enclosure over the rear section so that the end-plates are properly aligned over their respective grooves. Guide front enclosure section down into the rear section, allowing each side to evenly move into position. Carefully press the enclosure into place, making certain that no wires are trapped between the two enclosure halves. Once both sections are pressed fully back into position, tighten the four captive screws which hold the enclosure halves together.

14.3 Warning- and Alarm indication on the display

14.3.1 Warning indication

If there are conditions, that generate a warning, the message will be recorded through the menu Messages (see section titled "Messages"; PATH: Info/Messages). If the Error Display mode is set to On, the hint "Failure – Press Enter" will be shown at line 4 of the display if a warning or alarm has occurred (see section titled "Display"; PATH: Menu/Configure/Display/Measurement).

14.3.2 Alarm indication

Alarms will be shown in the display by a flashing symbol ⚠ and recorded through the menu Messages (see section titled "Messages"; PATH: Info/Messages).

Furthermore the detection of some alarms can be activated or deactivated (see section titled "Alarm"; PATH: Menu/Configure/Alarm) for an indication on the display. If one of these alarms occurs and the detection has been activated, the flashing symbol ⚠ will be shown on the display. The message will be recorded through the menu Messages
(see section titled "Messages"; PATH: Info/Messages).

Alarms, that are caused by a violation of the limitation of a setpoint or the range (see section titled "Setpoints"; PATH: Menu/Configure/Setpoint) will be shown by a flashing symbol ⚠ and recorded through the menu Messages (see section titled "Messages"; PATH: Info/Messages).

If Error Display mode is set to On, the hint "Failure – Press Enter" will be shown at line 4 of the display if a warning or alarm has occurred (see section titled "Display";
PATH: Menu/Configure/Display/Measurement).

14.4 Fault and Error Messages

When an Error or Fault condition exists, the 450TOC will display the flashing ⚠ Alarm Status icon on the front panel display. In addition the red Fault LED or Amber Error LED on the front panel will illuminate. The Fault or Error description can be found by pressing the 'Info' key. There is an option to display the current message or the message history (last 4 messages) for any of the measurements. The messages associated with the 450TOC are listed in the following tables. The first character of the message will be an F to indicate a fault and an E to indicate an error. A Fault will turn off the UV lamp, and stop the TOC indication.

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Fault Message Table

Message Displayed	Description	Action
F-UV Lamp Failure	UV lamp not lit when powered up	– Check lamp connections or replace lamp
F-No flow detected	Flow < 12 ml/min = no flow or flow sensor failed	– Check for obstruction in water line – Replace High Capacity Inlet Filter
F-C1 shorted	C1 failure (sensor or cable)	– Replace C1
F-C2 shorted	C2 failure (sensor or cable)	– Replace C2
F-C1 open	C1 failure or no water	– Check for flow. Replace C1.
F-C2 open	C2 failure or no water	– Replace C1
F-T1 open/shorted	T1 failure (sensor or cable)	– Replace C2
F-T2 open/shorted	T2 failure (sensor or cable)	– User must correct
F-Conductivity high	Input conductivity > 100 µS/cm compensated on C1	– Water quality outside of limits for proper operation. Correct water quality.
F-Communication	Communication failure between control and sensing electronics	– Check internal signal cable – Check Main PC Board Fuse and replace if needed.

An Error is generated by a condition that may cause a problem with the proper operation of the 450TOC. Under an error condition, the 450TOC will continue to make measurements but the measured value may be in error depending upon the cause of the error message.

Error Message Table

Message Displayed	Description	Action
E-UV lamp over time	Lamp life > user limit	– Override possible Change lamp
E-Insufficient flow	Flow rate below 15 mL/min	– Check for obstruction in water line – Replace inlet filter
E-Flow too high	Flow > 25 mL/min	– 450TOC is in accessory mode. Restore flow setup to normal. – Flow Control system failure. Repair system
E-NVRAM Failure	Can't communicate or checksum invalid	– Repair 450TOC. Will work with default settings.
E-AutoBal too high	ΔC12 < user limit	– Turn lamp off. Flush system. Restart
E-Conductivity unstable	ΔC1 too noisy	– Check for air bubbles
E-Conductivity low	Input conductivity < 0.050 µS/cm compensated on C1	– User must correct
E-Temp high	Temp Over range > 70 °C at C1	– User must correct
E-Temp low	Temperature detected <2 °C at C1	– User must correct
E-TOC over range	TOC > 1 ppm	– Misapplication of 450TOC
E-Clock battery low	Real-time-Clock battery is low	– Replace real-time-clock battery

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15 450TOC Accessories, Consumable and Spare Parts

Please contact your local Mettler-Toledo Sales office or representative for details for additional accessories and spare parts.

15.1 Accessories

Description	Order no.
450TOC Protective Base	58 091 585
Kit, ISM Calibration and System Suitability Test (SST and calibration standards sold separately)	58 091 566
Stand, Calibration and System Suitability Test Kit	58 091 586
Case, 450TOC Storage and Transport, Hard Walled	58 091 587
High Pressure Regulator	58 091 552

15.1.1 Installing Optional Protective Base

To install the optional protective silicon boot, follow these instructions.

1. Place the protective base on a flat, firm surface. Lower the 450TOC into the protective base. Ensure that the support features on the back of the 450TOC align with the spaces provided in the base.
2. Firmly press the lip located on the top-inside edge of the protective base into the adjoining



grove on the front and rear of the 450TOC. The lip should fit firmly within the grove to hold the base in place.





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15.2 Consumables

Description	Order no.
Replacement UV Lamp (recommended every 4,500 hours)	58 079 513
System Suitability Standards (For use with SST KIT # 58091566)	58 091 526
Solutions, Calibration (For use with SST KIT # 58091566)	58 091 529
Combined Calibration and SST Solutions (For use with SST KIT # 58091566)	58 091 537
Filter element, High Capacity (Pkg. of 2)	58 091 551

15.3 Spares

Description	Order no.
Filter Assembly, Large capacity with Elbow	58 079 582
Kit, Replacement Fuse M300	58 091 326
Kit, Replacement Fuse, 450TOC Main Board	58 091 583
Battery, Real Time Clock	58 091 584

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16 Specifications

Measurement Range	0.05 - 1000 µgC/L (ppbC)
Accuracy	± 0.1 ppb C for TOC < 2.0 ppb (for water quality > 15 MΩ-cm) ± 0.2 ppb C for TOC > 2.0 ppb and < 10.0 ppb (for water quality > 15 MΩ-cm) ± 5% of measurement for TOC > 10.0 ppb (for water quality 0.5 to 18.2 MΩ-cm)
Repeatability	± 0.05 ppb C < 5 ppb, ± 1.0% > 5 ppb
Resolution	0.001 ppbC (µgC/L)
Analysis Time	Continuous
Update Rate	2 seconds
Initial Response Time	< 60 seconds
Limit of Detection	0.025 ppbC

Conductivity Sensor

Conductivity Accuracy	±1%, 0.02 to 20 µS/cm; ±3%, 20-100 µS/cm
Constant Accuracy	2%
Temperature Sensor	Pt1000 RTD, Class A
Temperature Accuracy	± 0.25°C

Sample Water Requirements

Temperature	0 to 70°C
Particle Size	<100 micron
Minimum Water Quality	0.5 MΩ–cm (2 µS/cm), pH < 7.5 *
Flow Rate	20 mL/min
Pressure	4 to 85 psig (0.3 bar to 5.8 bar) at sample inlet connection

General Specifications

Overall Dimensions	13.15" [334mm] W x 12.75" [324mm) H x 7.3" [185mm) D
Sample Connections	
Inlet	0.125" [3mm] O.D. (6' [2m] FDA compliant PTFE tubing supplied)
Outlet	Stainless Steel drain tube (5' [1.5m] flexible tubing provided)
Inlet Filter	316SS, inline 60 micron
Weight	5.0 lb. [2.3 kg]
Enclosure Material	Ignition Resistant Polystyrene Resin meeting UL 94 V-0
Wetted Parts	316SS/Quartz/PEEK/Titanium/PTFE/Silicone/FFKM/EPDM
Ambient Temperature/ Humidity Rating	5 to 50°C / 5 to 80% Humidity, non-condensing
Power Requirements	100 - 240VAC, 50/60 Hz, 40W Maximum
Local Indicators	Four LED lights for Fault, Error, Status and UV Lamp ON
Ratings/Approvals	CE Compliant, cULus Listed. Conductivity and temperature sensors traceable to NIST and ASTM D1125 and D5391 Meets ASTM D5173 Standard Test Method for On-Line Monitoring of Carbon Compounds in Water by UV Light Oxidation

* For power plant cycle chemistry samples, pH may be adjusted by measurement after cation exchange.

Specifications subject to change without notice

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17 Default tables

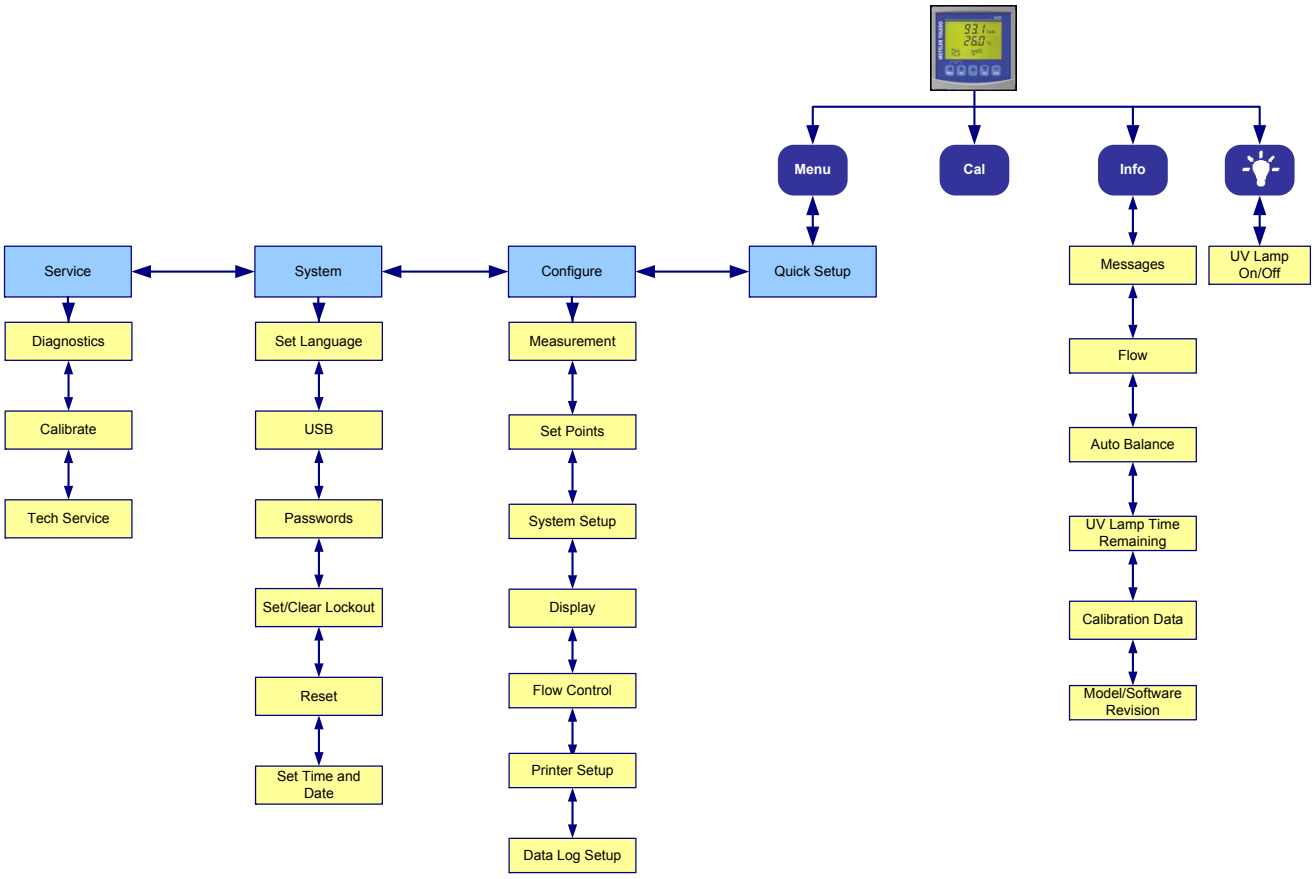
Parameter	Sub parameter	Value	Unit
Alarm			
	Power Failure	No	
	Software Failure	Yes	
	Disconnect ChA	No	
	TOC Faults	No	
	TOC Errors	No	
	Lamp Off	No	
Language		English	
Passwords	Administrator	00000	
	Operator	00000	
Lockout	Yes/No	No	
Display	Line 1	a	ppbC
	Line 2	b	S/cm
	Line 3	Datalog	
	Line 4	none	
Set Point 1	Measurement	a	
	Type	Off	
Conductivity *Resitivity*	High Value	0 *0*	µS/cm *MΩ-cm*
	Low Value	0 *0*	µS/cm *MΩ-cm*
Set Point 2	Measurement	b	
	Type	Off	
	High Value	0	°C
	Low Value	0	°C
Autobalance Parameters	Autobalance On/Off	Off	
	Autobalance Cycle Time	4500	Hours
	Autobalance Limit	15	%
	Rinse Time	15	Minutes
Lamp Parameters	Lamp Life Limit	4500	Hours
	Sensor Keypad Lock Yes/No	No	
	Overide Cond. Limit Yes/No	No	
	Conductivity Limit	2.0	µS/cm

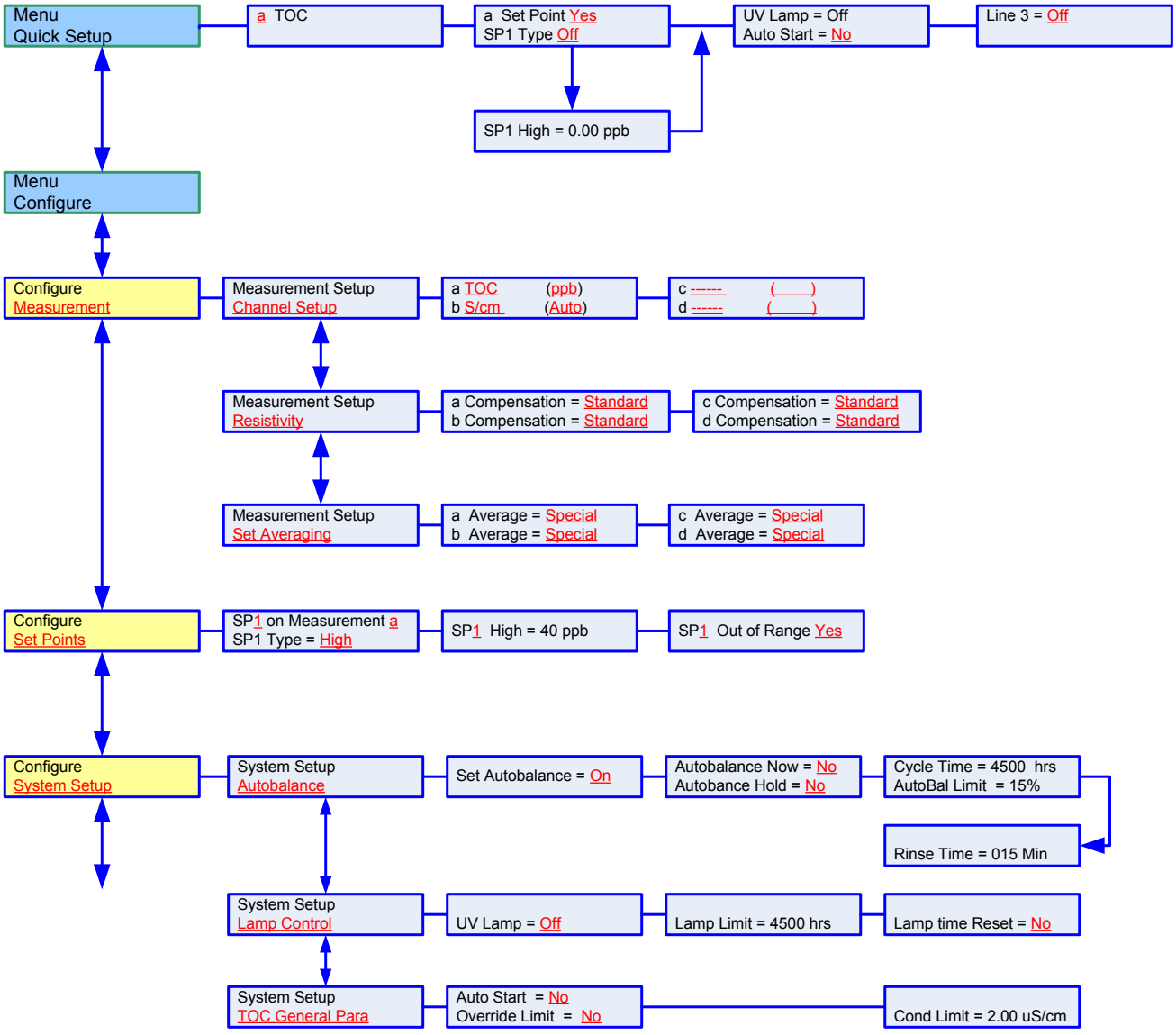
* Not adjustable

Italics = default values if resitivity instead of coductivity is chosen.

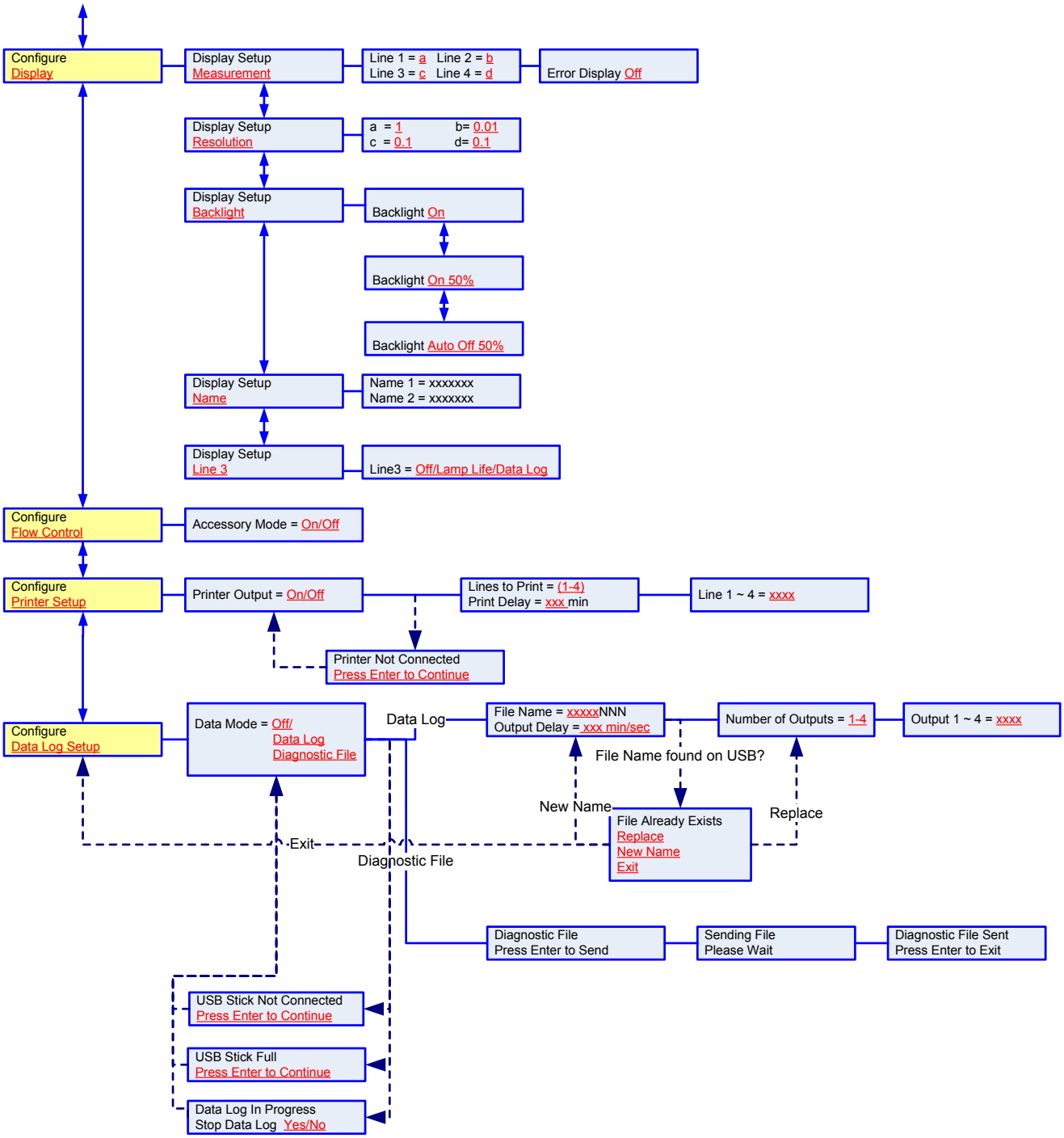
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18 Menu Tree

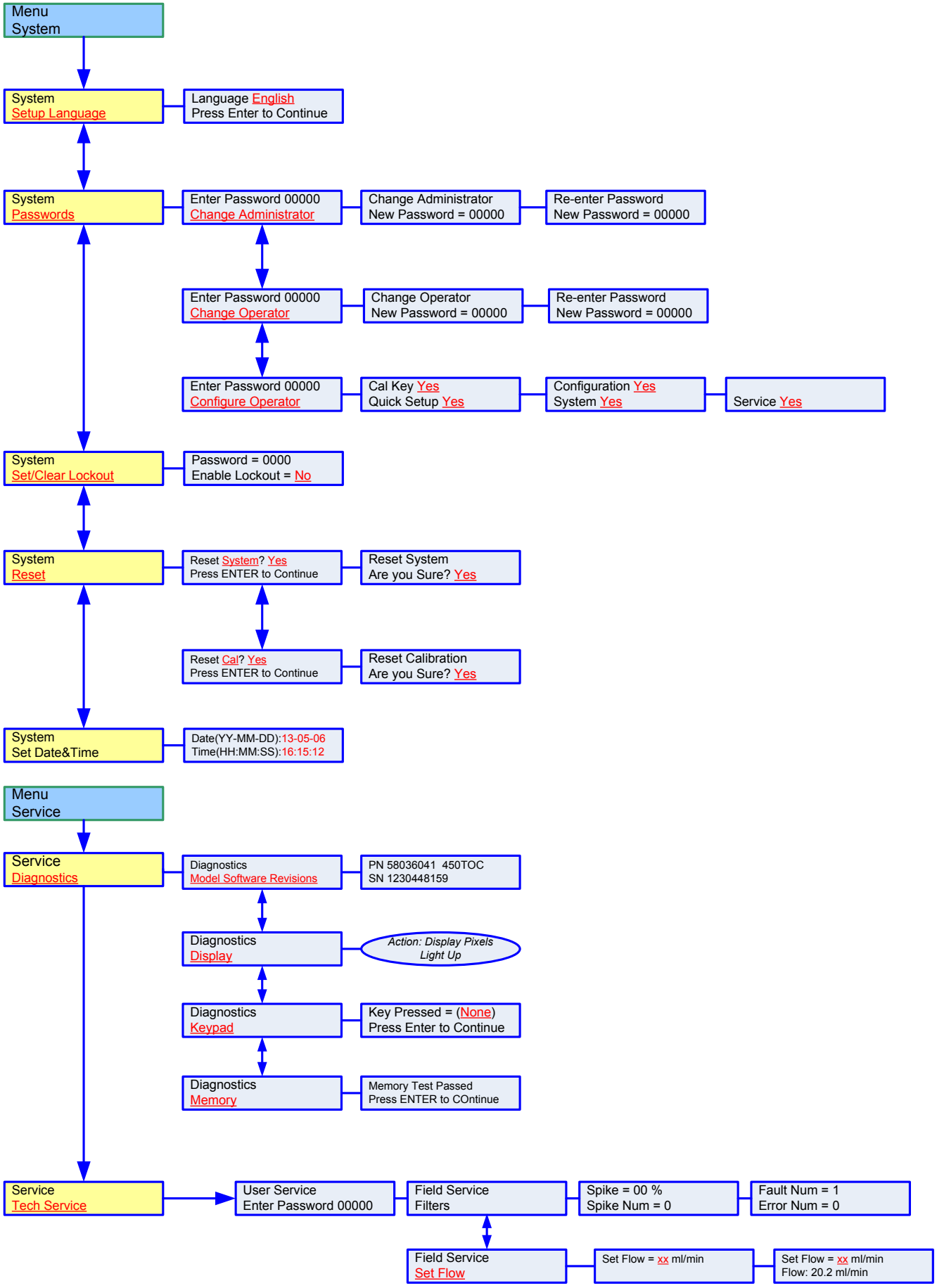

Menu
Cal
Info
Service
System
Configure
Quick Setup
Messages
UV Lamp On/Off
Diagnostics
Calibrate
Tech Service
Set Language
USB
Passwords
Set/Clear Lockout
Reset
Set Time and Date
Measurement
Set Points
System Setup
Display
Flow Control
Printer Setup
Data Log Setup
Flow
Auto Balance
UV Lamp Time Remaining
Calibration Data
Model/Software Revision



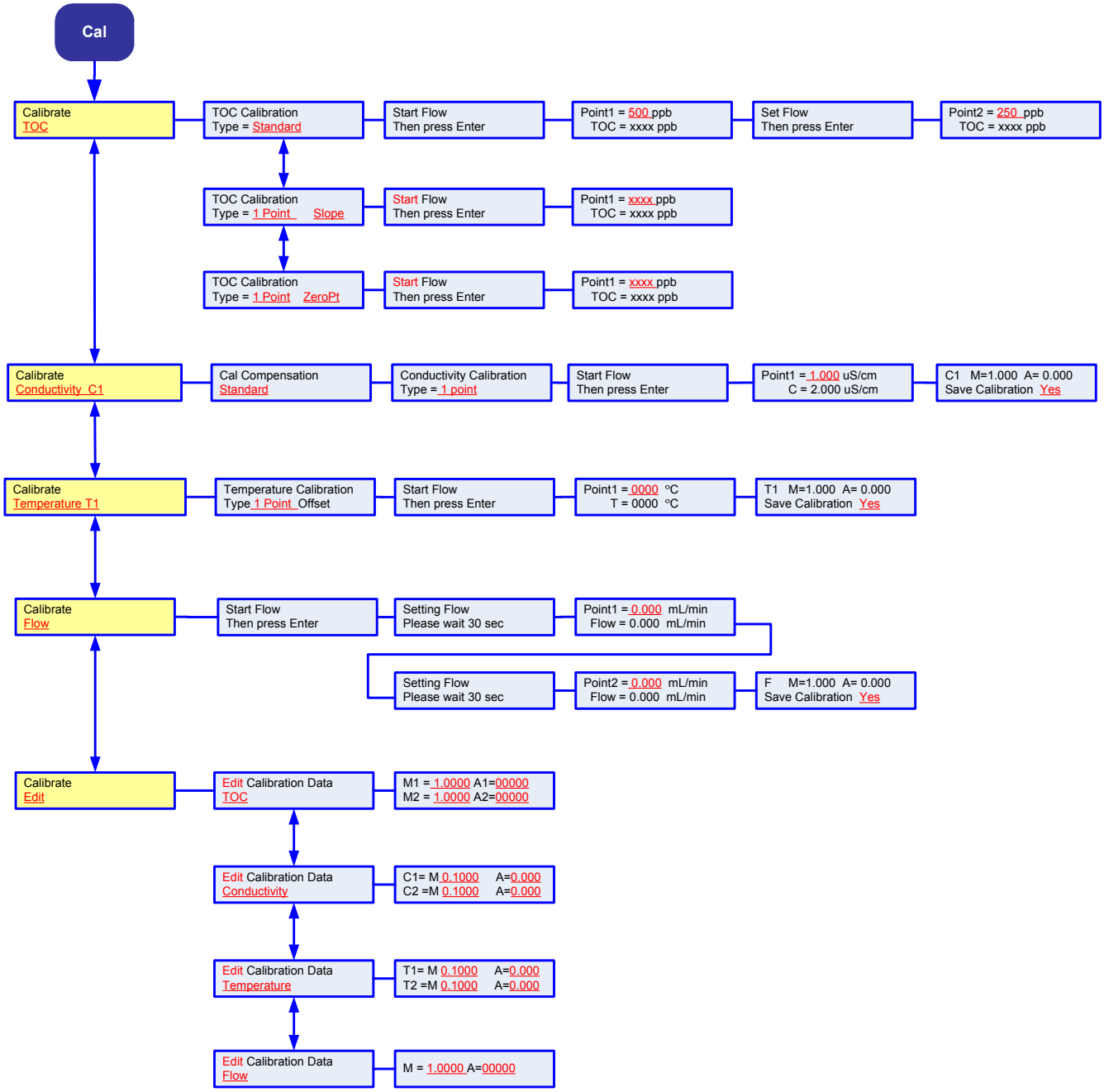
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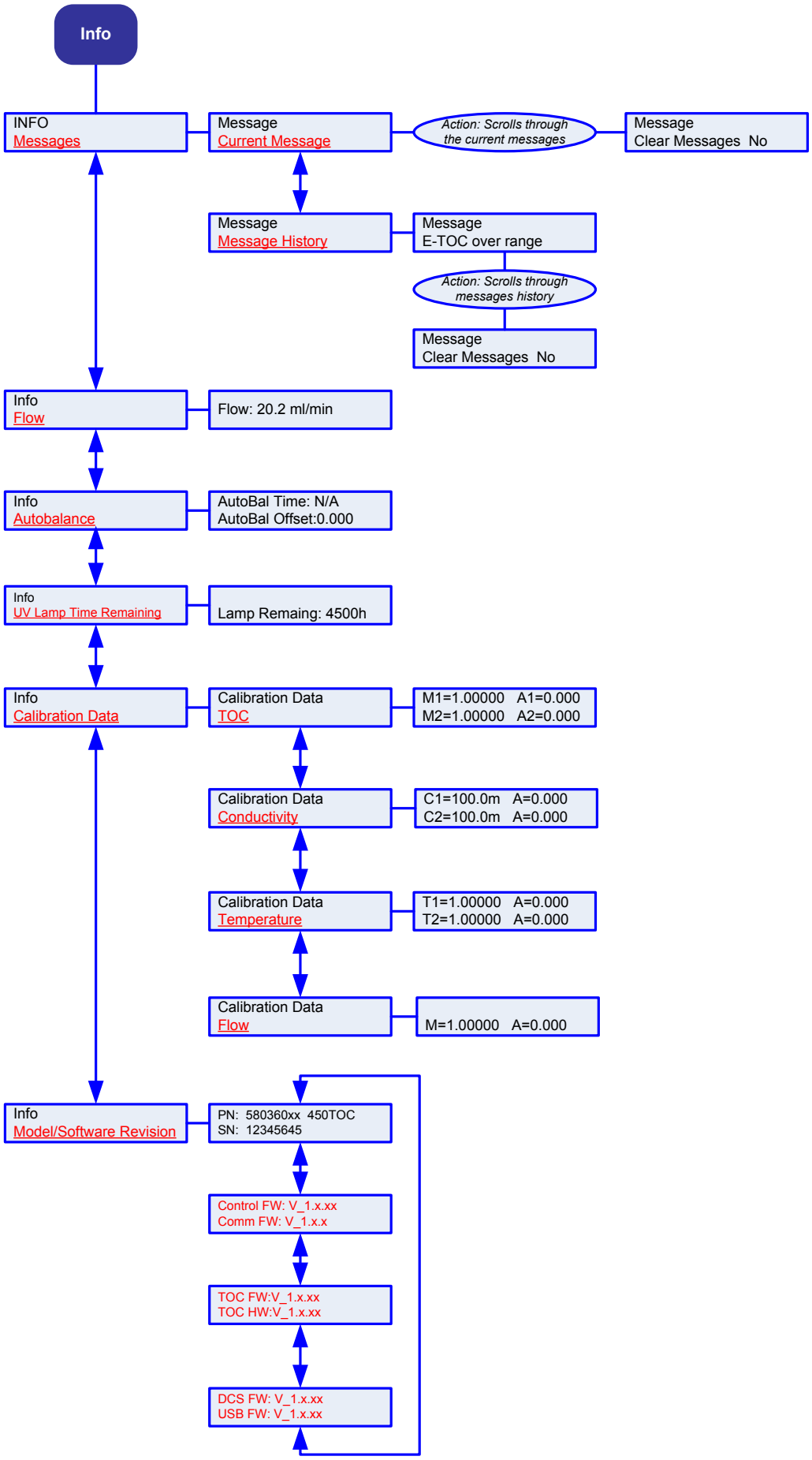


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Cal
Calibrate TOC
TOC Calibration Type = Standard
Start Flow Then press Enter
Point1 = 500 ppb TOC = xxxx ppb
Set Flow Then press Enter
Point2 = 250 ppb TOC = xxxx ppb
TOC Calibration Type = 1 Point Slope
Start Flow Then press Enter
Point1 = xxxx ppb TOC = xxxx ppb
TOC Calibration Type = 1 Point ZeroPt
Start Flow Then press Enter
Point1 = xxxx ppb TOC = xxxx ppb
Calibrate Conductivity C1
Cal Compensation Standard
Conductivity Calibration Type = 1 point
Start Flow Then press Enter
Point1 = 1.000 uS/cm C = 2.000 uS/cm
C1 M=1.000 A= 0.000 Save Calibration Yes
Calibrate Temperature T1
Temperature Calibration Type 1 Point Offset
Start Flow Then press Enter
Point1 = 0000 °C T = 0000 °C
T1 M=1.000 A= 0.000 Save Calibration Yes
Calibrate Flow
Start Flow Then press Enter
Setting Flow Please wait 30 sec
Point1 = 0.000 mL/min Flow = 0.000 mL/min
Setting Flow Please wait 30 sec
Point2 = 0.000 mL/min Flow = 0.000 mL/min
F M=1.000 A= 0.000 Save Calibration Yes
Calibrate Edit
Edit Calibration Data TOC
M1 = 1.0000 A1=00000 M2 = 1.0000 A2=00000
Edit Calibration Data Conductivity
C1= M 0.1000 A=0.000 C2 =M 0.1000 A=0.000
Edit Calibration Data Temperature
T1= M 0.1000 A=0.000 T2 =M 0.1000 A=0.000
Edit Calibration Data Flow
M = 1.0000 A=00000



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19 Certificate

Mettler-Toledo Thornton, Inc., 900 Middlesex Turnpike, Building 8, Billerica, MA 01821, USA has obtained Underwriters Laboratories' listing for the 450TOC. They bear the cULus Listed mark, signifying that the products have been evaluated to the applicable ANSI/UL and CSA Standards for use in the U.S. and Canada

Declaration of Conformity

We,
Mettler-Toledo Thornton, Inc.
900 Middlesex Turnpike, Building 8
Billerica, MA 01821, USA
Declare Under our sole responsibility that the product:

450 TOC

to which this declaration relates, in conformity with the following European, harmonized and published standards at the date of this declaration:

EMC Emissions: EN 55011 Class A

EMC Emissions and Immunity: EN 61326-1 2006, Measurement Control and Laboratory equipment EMC requirements.

Safety: EN 61010-1 2001-02, Second edition

UL LISTING

US	UL 61010-1, Third Edition Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements
CAN/CSA	CSA 22.2 No. 61010-1-12, Third Edition

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20 Warranty

METTLER TOLEDO warrants this product to be free from significant deviations in material and workmanship for a period of one year from the date of purchase. If repair is necessary and not the result of abuse or misuse within the warranty period, please return by freight pre-paid and amendment will be made without any charge. METTLER TOLEDO"s Customer Service Dept. will determine if the product problem is due to deviations or customer abuse. Out-of-warranty products will be repaired on an exchange basis at cost.

The above warranty is the only warranty made by METTLER TOLEDO and is lieu of all other warranties, expressed or implied, including, without limitation, implied warranties of merchantability and fitness for a particular purpose. METTLER TOLEDO shall not be liable for any loss, claim, expense or damage caused by, contributed to or arising out of the acts or omissions of the Buyer or Third Parties, whether negligent or otherwise. In no event shall METTLER TOLEDO's liability for any cause of action whatsoever exceed the cost of the item giving rise to the claim, whether based in contract, warranty, indemnity, or tort (including negligence).

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METTLER TOLEDO Market Organizations

Sales and Service:

Australia
Mettler-Toledo Ltd.
220 Turner Street
Port Melbourne
AUS-3207 Melbourne/VIC
Phone +61 1300 659 761
Fax +61 3 9645 3935
e-mail info.mtaus@mt.com

Austria
Mettler-Toledo Ges.m.b.H.
Südrandstraße 17
A-1230 Wien
Phone +43 1 604 19 80
Fax +43 1 604 28 80
e-mail infoprocess.mtat@mt.com

Brazil
Mettler-Toledo Ind. e Com. Ltda.
Avenida Tamboré, 418 Tamboré
BR-06460-000 Barueri/SP
Phone +55 11 4166 7400
Fax +55 11 4166 7401
e-mail mettler@mettler.com.br
service@mettler.com.br

China
Mettler-Toledo Instruments
(Shanghai) Co. Ltd.
589 Gui Ping Road
Cao He Jing
CN-200233 Shanghai
Phone +86 21 64 85 04 35
Fax +86 21 64 85 33 51
e-mail mtcs@public.sta.net.cn

Croatia
Mettler-Toledo d.o.o.
Mandlova 3
HR-10000 Zagreb
Phone +385 1 292 06 33
Fax +385 1 295 81 40
e-mail mt.zagreb@mt.com

Czech Republic
Mettler-Toledo s.r.o.
Trebohosticka 2283/2
CZ-100 00 Prague 10
Phone +420 2 72 123 150
Fax +420 2 72 123 170
e-mail sales.mtcz@mt.com

Denmark
Mettler-Toledo A/S
Naverland 8
DK-2600 Glostrup
Phone +45 43 27 08 00
Fax +45 43 27 08 28
e-mail info.mtdk@mt.com

France
Mettler-Toledo
Analyse Industrielle S.A.S.
30, Boulevard de Douaumont
BP 949
F-75829 Paris Cedex 17
Phone +33 1 47 37 06 00
Fax +33 1 47 37 46 26
e-mail mtpro-f@mt.com

Germany
Mettler-Toledo GmbH
Prozeßanalytik
Ockerweg 3
D-35396 Gießen
Phone +49 641 507 333
Fax +49 641 507 397
e-mail prozess@mt.com

Great Britain
Mettler-Toledo LTD
64 Boston Road, Beaumont Leys
GB-Leicester LE4 1AW
Phone +44 116 235 7070
Fax +44 116 236 5500
e-mail enquire.mtuk@mt.com

Hungary
Mettler-Toledo Kereskedelmi KFT
Teve u. 41
HU-1139 Budapest
Phone +36 1 288 40 40
Fax +36 1 288 40 50
e-mail mthu@axelero.hu

India
Mettler-Toledo India Private Limited
Amar Hill, Saki Vihar Road
Powai
IN-400 072 Mumbai
Phone +91 22 2857 0808
Fax +91 22 2857 5071
e-mail sales.mtin@mt.com

Italy
Mettler-Toledo S.p.A.
Via Vialba 42
I-20026 Novate Milanese
Phone +39 02 333 321
Fax +39 02 356 2973
e-mail
customercare.italia@mt.com

Japan
Mettler-Toledo K.K.
Process Division
6F Ikenohata Nisshoku Bldg.
2-9-7, Ikenohata
Taito-ku
JP-110-0008 Tokyo
Tel. +81 3 5815 5606
Fax +81 3 5815 5626
e-mail helpdesk.ing.jp@mt.com

Malaysia
Mettler-Toledo (M) Sdn Bhd
Bangunan Electroscon Holding, U 1-01
Lot 8 Jalan Astaka U8/84
Seksyen U8, Bukit Jelutong
MY-40150 Shah Alam Selangor
Phone +60 3 78 44 58 88
Fax +60 3 78 45 87 73
e-mail
MT-MY.CustomerSupport@mt.com

Mexico
Mettler-Toledo S.A. de C.V.
Ejercito Nacional #340
Col. Chapultepec Morales
Del. Miguel Hidalgo
MX-11570 México D.F.
Tel. +52 55 1946 0900
e-mail ventas.lab@mt.com

Poland
Mettler-Toledo (Poland) Sp.z.o.o.
ul. Poleczki 21
PL-02-822 Warszawa
Phone +48 22 545 06 80
Fax +48 22 545 06 88
e-mail polska@mt.com

Russia
Mettler-Toledo Vostok ZAO
Sretenskij Bulvar 6/1
Office 6
RU-101000 Moscow
Phone +7 495 621 56 66
Fax +7 495 621 63 53
e-mail inforus@mt.com

Singapore
Mettler-Toledo (S) Pte. Ltd.
Block 28
Ayer Rajah Crescent #05-01
SG-139959 Singapore
Phone +65 6890 00 11
Fax +65 6890 00 12
+65 6890 00 13
e-mail precision@mt.com

Slovakia
Mettler-Toledo s.r.o.
Hattalova 12/A
SK-831 03 Bratislava
Phone +421 2 4444 12 20-2
Fax +421 2 4444 12 23
e-mail predaj@mt.com

Slovenia
Mettler-Toledo d.o.o.
Pot heroja Trtnika 26
SI-1261 Ljubljana-Dobrunje
Phone +386 1 530 80 50
Fax +386 1 562 17 89
e-mail keith.racman@mt.com

South Korea
Mettler-Toledo (Korea) Ltd.
Yeil Building 1 & 2 F
124-5, YangJe-Dong
SeCho-Ku
KR-137-130 Seoul
Phone +82 2 3498 3500
Fax +82 2 3498 3555
e-mail Sales_MTKR@mt.com

Spain
Mettler-Toledo S.A.E.
C/Miguel Hernández, 69-71
ES-08908 L'Hospitalet de Llobregat
(Barcelona)
Phone +34 93 223 76 00
Fax +34 93 223 76 01
e-mail bcn.centralita@mt.com

Sweden
Mettler-Toledo AB
Virkesvägen 10
Box 92161
SE-12008 Stockholm
Phone +46 8 702 50 00
Fax +46 8 642 45 62
e-mail sales.mts@mt.com

Switzerland
Mettler-Toledo (Schweiz) GmbH
Im Langacher
Postfach
CH-8606 Greifensee
Phone +41 44 944 45 45
Fax +41 44 944 45 10
e-mail salesola.ch@mt.com

Thailand
Mettler-Toledo (Thailand) Ltd.
272 Soi Soonvijai 4
Rama 9 Rd., Bangkapi
Huay Kwang
TH-10320 Bangkok
Phone +66 2 723 03 00
Fax +66 2 719 64 79
e-mail
MT-TH.ProcessSupport@mt.com

USA/Canada
Mettler-Toledo Ingold, Inc.
900 Middlesex Turnpike, Bldg. 8
Billerica, MA 01821, USA
Phone +1 781 301 8800
Freephone +1 800 352 8763
Fax +1 781 271 0681
e-mail mtprous@mt.com
ingold@mt.com

Mettler-Toledo Thornton, Inc.
900 Middlesex Turnpike, Bldg. 8
Billerica, MA 01821, USA
Phone +1 781 301 8600
Toll free +1 800 510 7873
Fax +1 781 301 8701
e-mail thornton.info@mt.com

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Mettler-Toledo Thornton, Inc.
900 Middlesex Turnpike, Bldg. 8
Billerica MA, 01821
Tel. +1-781-301-8600, Fax +1-781-301-8701