Operating Instructions

Mode d'emploi

Instrucciones de manejo

SevenCompact™

S230 Conductivity meter

METTLER TOLEDO

Español | Français | English

Table of contents

1 Introduction

Thank you for purchasing this METTLER TOLEDO instrument. The SevenCompact Series is not only a new generation of intuitive and easy-to-operate bench meters for reliable measurements, they also provide extra security against mistakes and support your workflow in the laboratory.

Mistakes can be reduced to a minimum because of the following characteristics:

- New **ISM®** (Intelligent Sensor Management) technology: the meter automatically recognizes the sensor and transfers the latest set of calibration data from the sensor chip to the meter. The last five calibrations as well as the initial calibration certificate are also stored on the sensor chip. These can be reviewed, transferred and printed. ISM® provides additional security and helps eliminate mistakes.
- **Multi-language graphical user interface** on a large 4.3 inch display with intuitive menu guidance, making the operating instructions primarily a source of reference.
- **GLP and Routine mode** for the needs of any operator: in the routine mode, the deletion of data is prevented and changing those settings that would potentially jeopardize the collection of reliable results, such as measurement settings, are blocked. This provides extra security for routine daily work. Skilled workers are advised to employ the GLP mode to enjoy the instruments' powerful full functional range.

This instrument supports the workflow of a modern laboratory in all stages of the data collection and archiving process:

- **The electrode arm** can be operated with one hand and moves perfectly straight up and down to bring the electrode in the perfect position for the best measurement performance. This allows faster measurements and poses less risk to tip over the sample vessel and/or damage the head of the sensor!
- **Only one keypress required:** READ starts a measurement and CAL a calibration. It's so easy!
- **Easy switching between the normal view and the uFocus™.** The normal view has all the measurement parameters and IDs on the display to provide you an instant complete overview. In the uFocus™ only the most important information is shown in large digits, such as measurement value and temperature. This enables you to focus completely on the measurement, without getting distracted by information that is not relevant to you.
- **Easy toggling with the MODE soft key** between the various measurement parameters either before or during a measurement.
- **Versatile data archiving options**: print data, export data to a USB-stick, or send data to a PC with LabX direct software!
- **Versatile data entry procedures**: Enter sample / user and sensor IDs either directly on the instrument, or use a barcode reader or USB-Keyboard to increase efficiency.

At METTLER TOLEDO we are committed to providing you instruments of highest quality and we do all we can to support you in maximizing the lifetime of your instrument:

- **IP54 rating – water and dust protection:** we have designed our instrument in such way, that it withstands drops of aqueous solutions on the housing and connections. This not only provides extra protection, but also allows easy cleaning of the instrument with a damp cloth.
- **Rubber plugs and protective cover** provide extra security against dust and spills of aqueous solutions. Just keep the plug attached to the connections and cover the instrument with the transparent protective cover when not in use.

Have fun and many reliable measurements with our Seven Compact series of pH, Ion and conductivity meters!

2 Safety measures

Measures for your protection

Risk of explosion

- Never work in an environment subject to explosion hazards! The housing of the instrument is not gas tight (explosion hazard due to spark formation, corrosion caused by the ingress of gases).

Risk of corrosion

- When using chemicals and solvents, comply with the instructions of the producer and the general lab safety rules!

Measures for your operational safety

Caution

- Never unscrew the two halves of the housing!
- Have the meter serviced only by METTLER TOLEDO Service!
- Any spillage should be wiped off immediately! Some solvents might cause corrosion of the housing.
- Avoid the following environmental influences:
  - Powerful vibrations
  - Direct sunlight
  - Atmospheric humidity greater than 80%
  - Corrosive gas atmosphere
  - Temperatures below 5 °C and above 40 °C
  - Powerful electric or magnetic fields

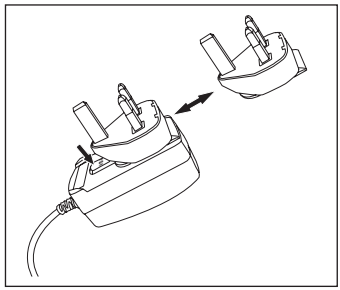
FCC Rules

This device complies with Part 15 of the FCC Rules and Radio Interference Requirements of the Canadian Department of Communications. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

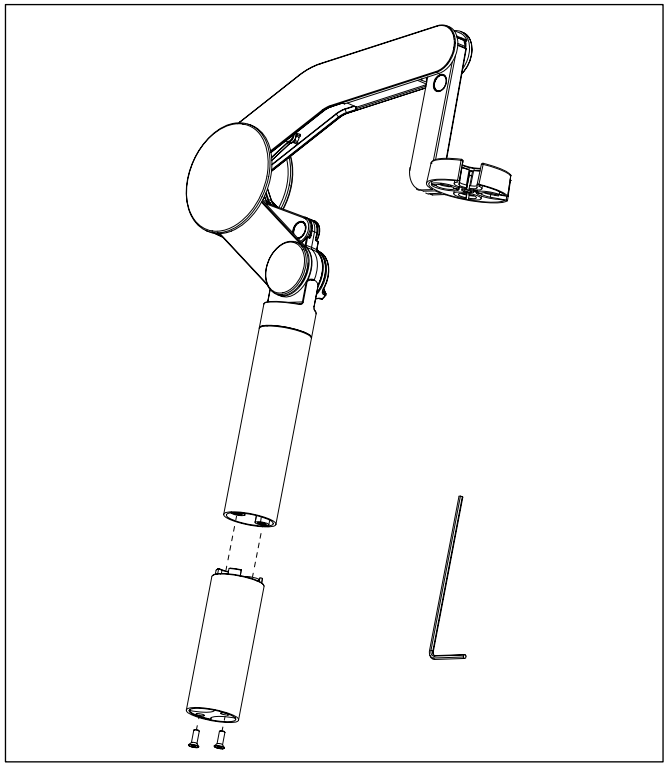
3 Installation

Carefully unpack the meter. Keep the calibration certificate in a safe place. Insert the right adapter clip into the power adapter slot:



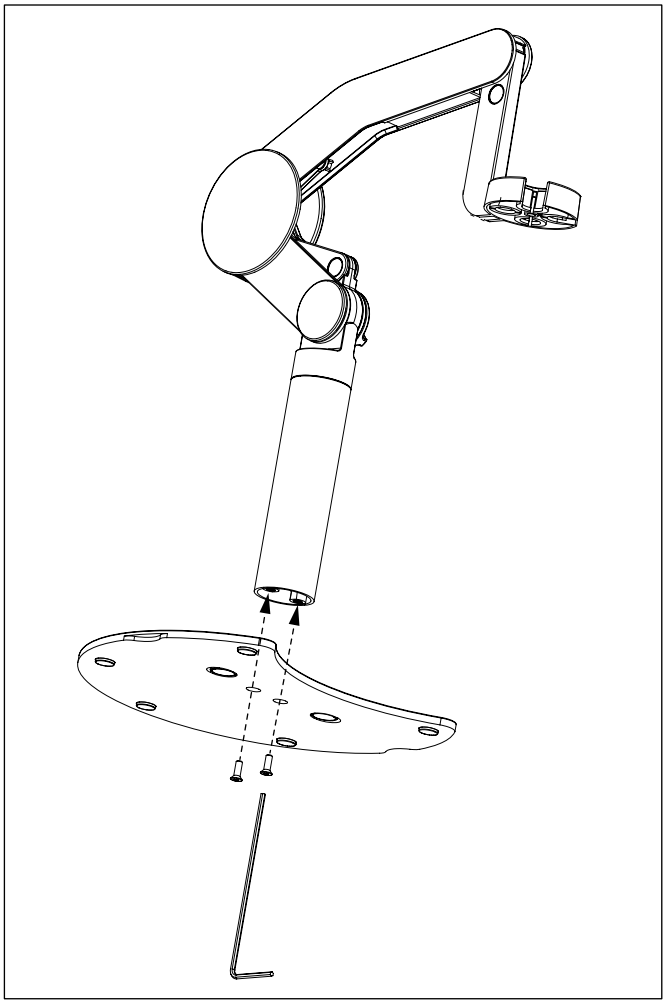
3.1 Installing the electrode arm

The electrode arm can be used as a stand alone or it can be attached to the instrument on the left or right side, according to your preferences. The height of the electrode arm can be varied by using the extension shaft part. Use the wrench to attach the extension part .

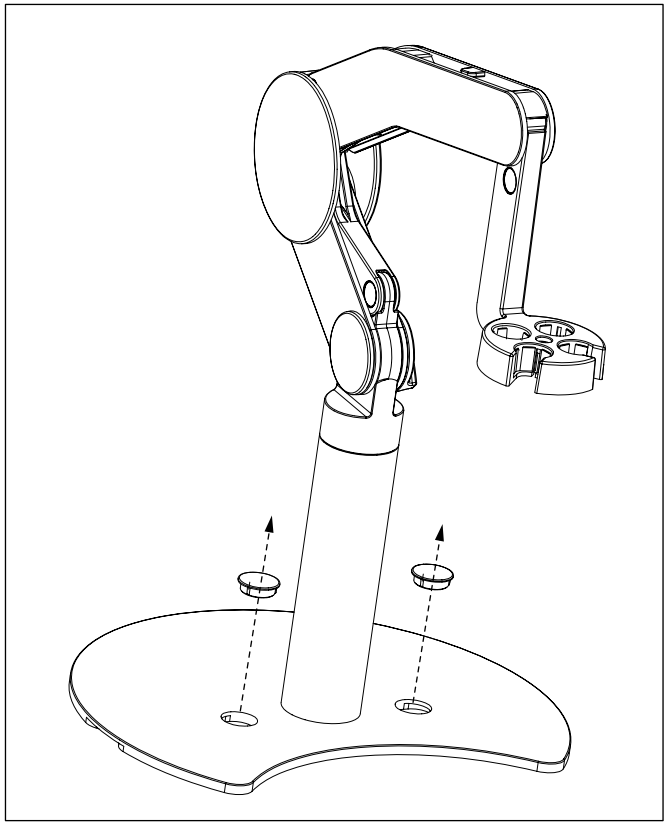


Assembly of the electrode arm

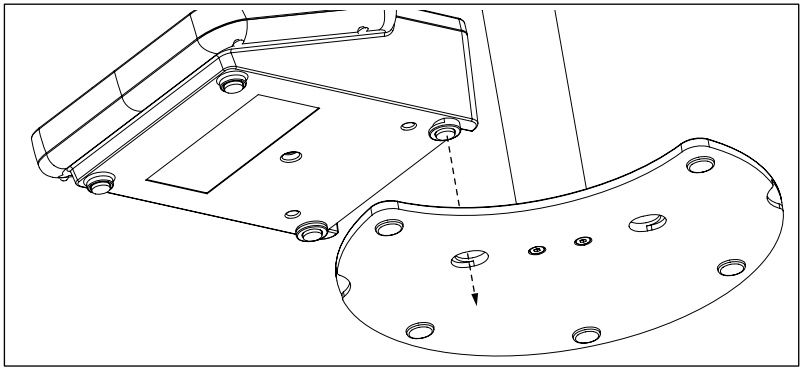
- Use the wrench to attach the base to the electrode arm by tightening the screws. The electrode arm can now be used in the stand alone mode.

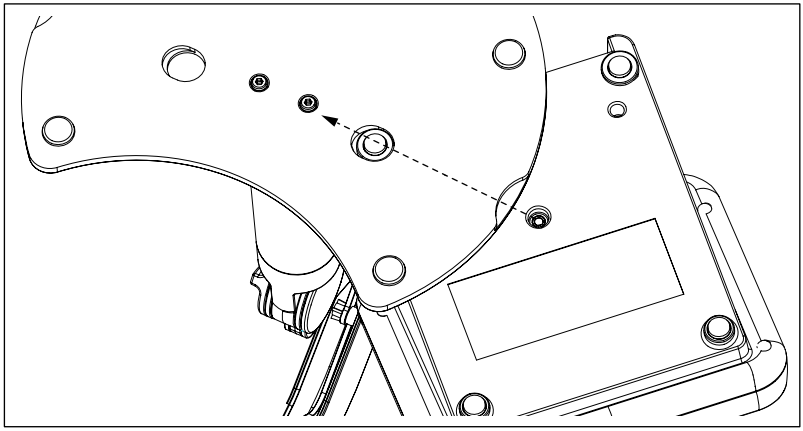


- To attach the electrode arm to the instrument, remove the plastic covers in a first step.

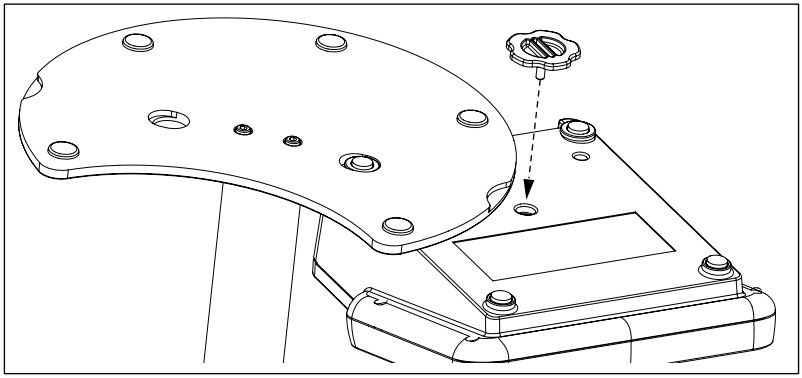


- Then insert the foot of the meter to the arm base and shift the meter in the direction of the arrow to make the foot fit.





- Use the lock screw to attach the meter to the base of the arm.



3.2 Connecting a sensor

Connect the conductivity electrode and make sure that the plugs are properly inserted.

ISM® sensor

When connecting an ISM® sensor to the meter, one of the following conditions have to be met for the calibration data to be transferred automatically from the chip of the sensor into the meter and is used for further measurements. After attaching the ISM® sensor …

- The meter must be switched on.
- (If the meter is already switched on) the **READ** key is pressed.
- (If the meter is already switched on) the **CAL** key is pressed.

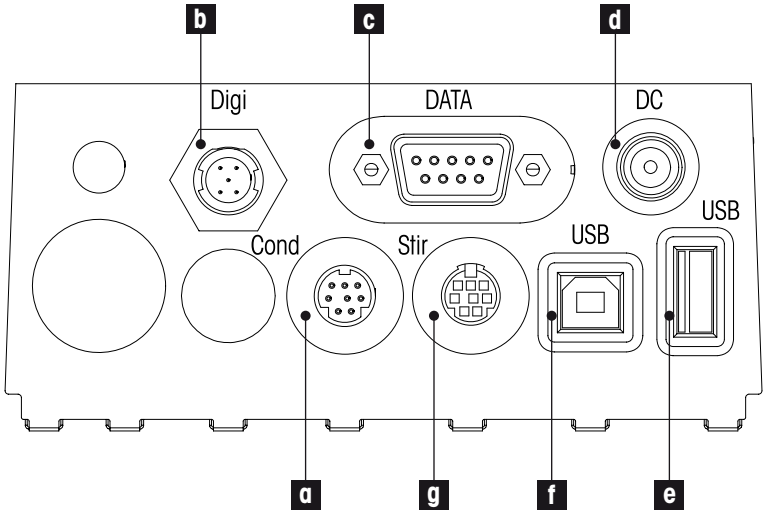
We strongly recommend you to switch off the meter when disconnecting an ISM sensor. In doing so, you make sure that the sensor is not removed while the instrument is reading data from or writing data to the ISM-chip of the sensor.

The **ISM** icon iSM appears on the display and the sensor ID of the sensor chip is registered and appears on the display.

The calibration history, the initial certificate and the maximum temperature can be reviewed and printed in the data memory.

4 Operating the meter

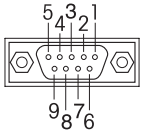
4.1 Backside layout



a	**Mini-DIN socket** for conductivity signal input
b	**Digital socket** for digital electrodes
c	**RS232 interface**
d	**DC power supply socket**
e	**USB A interface**
f	**USB B interface**
g	**Mini DIN socket** for METTLER TOLEDO stirrer

4.1.1 Pin assignments RS232 connection

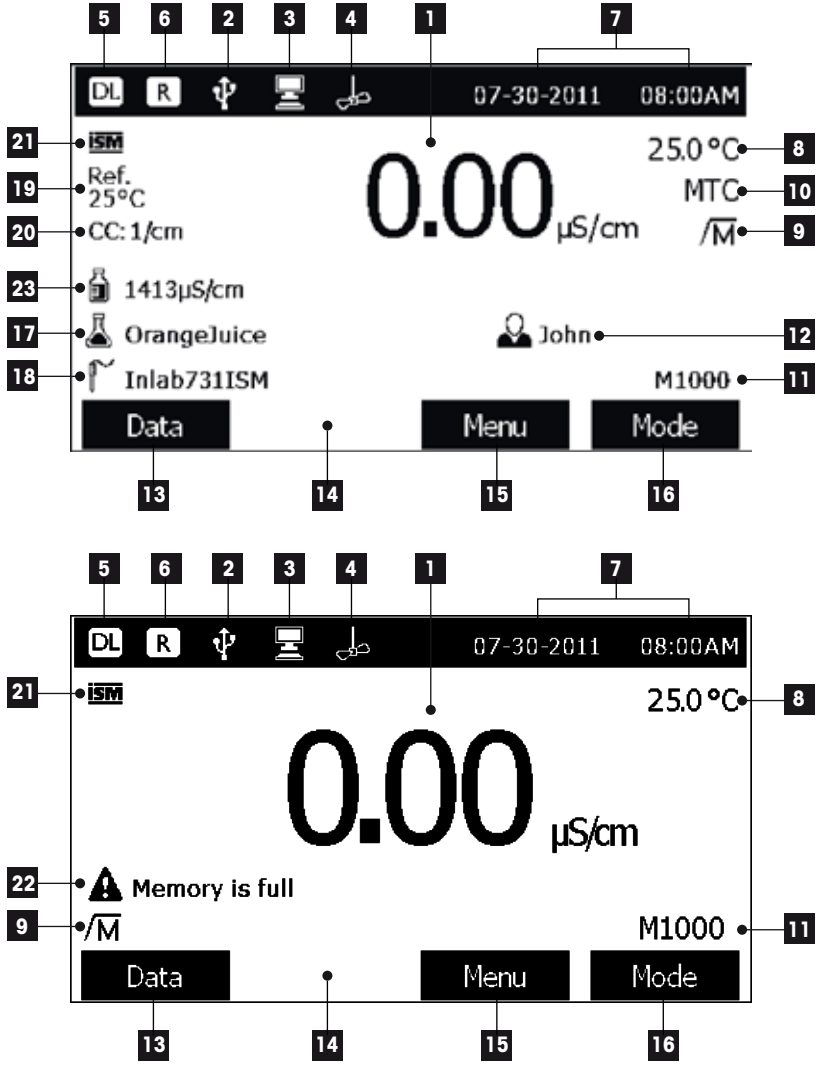
Below the PIN assigments for the RS-232 interface are shown. To this interface can be connected METTLER TOLEDO printers such as RS-P25.



Pin 1	NC	Pin 6	NC
Pin 2	TxD (out)	Pin 7	NC
Pin 3	RxD (in)	Pin 8	NC
Pin 4	NC	Pin 9	NC
Pin 5	RSGND		

4.2 The display

There are two modes for the display: the full-information screen with all the information on the display and the measurement close-up screen (superview) in which the measurement information is shown with large font. Switching between these views is possible by pressing READ for 2 s, both during a measurement or after/before a measurement.



1 Measurement value
2 USB device connected
3 PC connected (for LabX direct)

4 **Stirrer** icon (when stirring is taking place)
5 **Data logging** icon (timed interval reading)
6 **Routine mode** icon (user access rights are restricted)
7 Date and time
8 Measurement temperature
9 Endpoint format
10 Temperature compensation

ATC: Temperature sensor connected

MTC: no temperature sensor connected or detected

11 Number of data sets in memory
12 User ID
13 Softkey
14 Softkey
15 Softkey
16 Softkey
17 Sample ID
18 Sensor ID
19 Reference temperature
20 Cell constant
21 ISM® sensor connected
22 Warning messages
23 Conductivity standards

4.3 Key controls

Key	Press and release	Press and hold for 2 seconds
ON/OFF 	Switch meter on or off	Switch meter on or off
READ 	Start or end measurement (measurement screen) Confirm input or start editing a table Exit menu and go back to measurement screen	Switch between measurement close-up screen and full-information screen
CAL 	Start calibration	Review the last calibration data
Softkeys	The function of the softkeys varies from screen to screen (see "Using the softkeys")	

4.4 Using the softkeys

The meter has four softkeys. The functions assigned to them change during operation depending on the application. The assignment is shown on the bottom line of the screen.

In the measurement screen, the softkeys are assigned as follows:

Data	**Menu**	**Mode**
Access data menu	Access meter settings	Change measurement mode

The other softkey functions are:

→	Move one position to the right	**Edit**	Edit table or value
←	Move one position to the left	**End**	End calibration
↑	Scroll up in the menu	**Yes**	Confirm
↓	Scroll down in the menu	**No**	Reject
+	Increase value	**Review**	Review selected data
–	Decrease value	**Save**	Save data, setting or value
⌄⌄	Scroll to next data set in memory	**Select**	Select the highlighted function or setting
⌫	Delete letters or numbers on alphanumeric keypad	**Start**	Begin the reference measurement
Delete	Delete selected data	**Trans**	Transfer selected data

4.5 Selecting a measurement mode

Press the **MODE** softkey to switch between the different measurement modes.

The sequence of the alternating measurement modes is:

1. Conductivity
2. TDS
3. Salinity
4. Resistivity
5. Conducitivity ash

For the conductivity mode, the user can choose between the units "µS/cm & mS/cm" and "µS/m & mS/m". This setting can be made in the conductivity menu (see "Menus and settings: Conductivity measurement settings").

4.6 Navigating between menus

The meter display consists of a measurement frame, softkeys, areas for status icons and underlying menu areas.

To access the menu areas and to navigate between them, use various softkeys (see "Using the softkeys").

1 Press **Menu**.

⇨ The **Setup** menu appears and the **Cond.** tab is highlighted.

2 Press ← to highlight the **Setup** tab, or

3 Press ↓ to highlight **Sensor ID / SN**.

4 Press **EXIT** to return to the measurement screen.

4.7 Navigating within a menu

This example is based on the **Setup** menu, but the procedure applies to the other menus as well.

- Press **Menu**.

→ The **Setup** menu appears and the **Cond.** tab is highlighted.

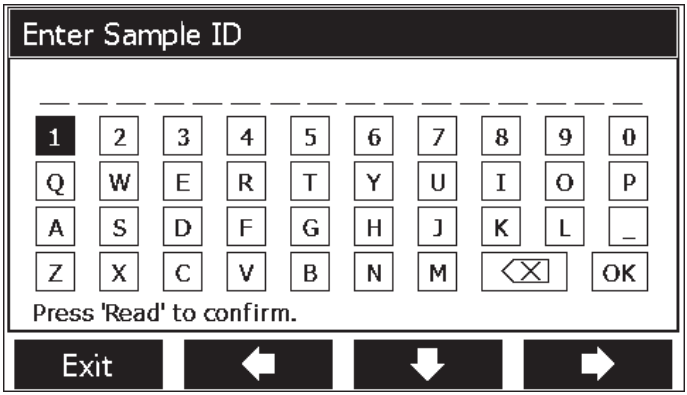
- Press ↓ as often as needed to navigate to a menu item.
- Press **Select** to move deeper in the menu for the chosen operation.
- Continue navigating with ↑, ↓ or **Select** until the final destination is reached within the menu.
- Press **MODE/EXIT** to go back to the previous menu.
  — or —
- Press **READ** to return to the measurement screen directly.

4.8 Using the alphanumeric keypad

4.8.1 Alphanumeric input

The meter has a screen keypad for entering IDs, SNs and PINs. Both numbers and letters are allowed for these entries.

When entering a PIN, each character entered will be displayed as (*).



1 Press ← to move left to highlight number or letter, use → to move right, and ↓ to move downwards.

2 Press **READ** to confirm the entry.

⇨ The line where the position of alphanumeric character is being entered blinks.

3 To end and confirm entry, use softkeys to highlight screen key **OK**, and press **READ** to save the ID.
— or —

4 To delete information, use softkeys to highlight ⌫ and press **READ** to delete the previously entered character.
— or —

5 Press **EXIT** to return to the upper level of the menu.

⇨ The entries are rejected.

4.8.2 Entering IDs / PIN

The four softkeys and **READ** key are used for navigating on the keypad and entering the ID/PIN.

Example: WATER

1 If **1** is highlighted, press ↓ once.

⇨ **Q** is highlighted.

2 Press → once.

⇨ **W** is highlighted.

3 Press **READ** to enter **W**.

4 Repositioning the highlighted bar to **A**, **T**, **E** and **R**, and press **READ** to enter each letter of sample ID in sequence as described in steps 1 - 3.

5 Reposition the highlighted bar to **OK**, and press **READ** to save the sample ID.

Instead of entering an ID with the alphanumeric keypad, one can also use a USB-keyboard or a USB-barcode scanner. In case a character is entered or scanned that is not present on the instrument keyboard it will display the entry as an underscore (_).

4.8.3 Editing values in a table

The meter has a feature, which allows the user to enter, edit or remove values in tables. (for example, temperature and buffer values for a customized buffer group). This is accomplished by using the softkeys on the display to navigate from cell to cell.

1 Press **READ** to start editing the cell in the table.

⇨ The softkeys on the display change.

2 Press + and − to enter the value and press **READ** to confirm.

⇨ The softkeys change back to ↑ and ↓.

3 Navigate to a cell and press **Delete** to remove a value.

4 To finish editing the table, navigate with the ↑ and ↓ to highlight **Save**.

5 Press **READ** to confirm the action and exit the menu.

4.9 Calibration

Calibration is only possible in the full-information screen. When starting a calibration by pressing the **CAL** key while the instrument displays the close-up screen, it will automatically switch to the full-information screen.

1 Place the electrode in a calibration standard and press **CAL**.

⇨ **Cal 1** appears on the display

2 The meter endpoints according to the preselected endpoint mode after the signal has stabilized or after pressing **READ**.

⇨ The calibration result is shown on the display.

3 Press **Save** to save the result.

— or —

4 Press **Exit** to reject the calibration and return to sample measurement.

- The second point required for the conductivity calibration curve is permanently programmed in the meter and is 0 S/m for a specific resistivity moving toward infinity. To ensure the most accurate conductivity readings, verify the cell constant with a standard solution regularly and recalibrate if necessary.

4.10 Sample measurements

- Place the sensor in the sample and press **READ** to start a measurement.
  - The display shows the readings of the sample.
  - The endpoint format blinks, indicating a measurement is in progress.

→ As soon as the measurement is stable, the **Stability** icon appears.

- If the "automatic endpoint" format is selected, the measurement stops automatically as soon as the **Stability** icon appears.
- If the "manual endpoint" format is selected, press **READ** to manually stop the measurement.
- If the "timed endpoint" format is selected, the measurement stops after the preset time.

4.11 Data transfer

It is possible to transfer either all data or a user-defined set of data from the memory to a METTLER TOLEDO printer (for example RS-P26), to a PC by using LabX direct or to a USB memory stick.

The following section describes how to proceed with the different configurations.

Data transfer from the meter to a printer

1 Connect the RS232 cable to the meter and the corresponding interface on the backside of the printer.

2 Select the interface "printer" in the data transfer settings menu (see "Setup: Data Transfer Settings").

3 Start transfer in the data menu.

For some printers (e.g. RS-P25, RS-P26 and RS-P28), the baud rate settings will be automatically synchronized with those of the instrument.

For other printers the settings for data transfer in the printer need to be adjusted as follows:

- Baud rate: 1200
- Data bits: 8
- Parity: none
- Stop bits: 1

Data transfer from the meter to LabX direct pH

1 Connect the instrument via USB B to the PC.

⇨ The icon appears on the display.

2 Select the interface "LabX direct" in the data transfer settings menu (see "Setup: Data Transfer Settings").

3 Open **LabX direct pH** and select the correct instrument.

4 Select the item and **Transfer** in the data menu to start the transfer.

Data export from the meter to a USB stick

1 Insert the USB stick into the corresponding interface of the meter.

   ⇨ The icon ♆ appears on the display.

2 Select the item and **Export to USB-Stick** in the data menu to start the transfer.

The data will be in text (extension .txt) format. The instrument will create a new folder on the USB-stick in which the name is the date in the international format, i.e. first year, then month and then the day.
Example: when the date is 25 November 2011, the name of the folder will be: 20111125.

The data will be written as a text file with a name that consists of the time in 24h format (hr min sec) with a prefix depending on what kind of data is exported. This prefix is M for measurement data and C for calibration data.
Example: when calibration data are exported at 15:12:25 (3:12:25 pm) the name of the file will be: C151225.txt

Pressing EXIT during the exporting aborts the process

4.12 Temperature compensation

We recommend the use of either a built-in or a separate temperature probe. If a temperature probe is used, **ATC** and the sample temperature are displayed. If no temperature sensor is used, **MTC** is displayed and the sample temperature should be entered manually.

In the conductivity mode, the meter uses this temperature to calculate with the entered alpha-coefficient (or with non-linear correction) the conductivity value back to the chosen reference temperature.

5 Setup

5.1 Menu structure of setup

The individual items of the menu setup are described on the pages following the list below.

1. **Sample ID**
   1. Enter Sample ID
   2. Select Sample ID
   3. Delete Sample ID
2. **User ID**
   1. Enter User ID
   2. Select User ID
   3. Delete User ID
3. **Stirrer**
   1. Stir Before Measurement
   2. Stir During Measurement
   3. Stir Speed
   4. Stirrer Voltage Settings
4. **Data Transfer Settings**
   1. Data Logging
   2. Interface
   3. Printout Format
5. **System settings**
   1. Language
   2. Time and Date
   3. Access Control
   4. Beep
   5. Routine/Expert Mode
   6. Screen Settings
6. **Service**
   1. Software Update
   2. Export Settings to USB-stick
   3. Factory Reset
7. **Instrument Self-test**

5.2 Sample ID

An alphanumeric sample ID with up to 16 characters can be **entered**. Alternatively, a previously entered sample ID can be **selected** from the list. If a sample ID has been entered, which is either purely numeric (for example, 123) or ends with a number (for example, WATER123), the following options are available:

1. <Auto Sequential> On
   Using this setting will automatically increment the sample ID by 1 for each reading.
2. <Auto Sequential> Off
   The sample ID is not incremented automatically.

A maximum of 10 sample IDs are stored in memory and listed for selection. If the maximum of 10 has already been entered, a sample ID can either be deleted manually or the oldest ID will be automatically overwritten by the new ID.

This instrument allows a special process for users that would like to enter the sample ID in a quicker way. When the homescreen is shown, while no measurement or calibration is running, typing on a USB-keyboard or scanning with a barcode reader, results in a jump in the sample ID entry screen and the entered characters are shown. In case a character is entered or scanned that is not present on the instrument keyboard (see "Operating the meter: Entering IDs/PIN"). It will display the entry as an underscore (_).

5.3 User ID

A user ID with up to 16 characters can be **entered**. Alternatively, a previously entered user ID can be **selected** from the list.

A maximum of 10 user IDs are stored in memory and listed for selection. If the maximum of 10 has already been entered, a user ID can either be deleted manually or the oldest ID will be automatically overwritten by the new ID.

5.4 Stirrer

The user can connect the METTLER-TOLEDO external magnetic stirrer to the instrument. This stirrer is powered by the instrument and will be automatically switched on/off according to the settings by the user.

1. Stir Before Measurement

- <Stir Before Measurement> On
  Using this setting will include a stirring period before the measurement starts (after pressing READ). The user can set the time between 3 s and 60 s.
- < Stir Before Measurement > Off
  No stirring before the measurement will take place.

2. Stir During Measurement

- <Stir During Measurement> On
  Using this setting will results in stirring during the measurement. When the measurement endpoints, the stirrer is automatically swiched off.
- < Stir During Measurement > Off
  No stirring during the measurement will take place.

3. Stir Speed

- The user can adjust the stir speed of the stirrer according to his preferences and the characteristics of the sample.
- A stir speed between 1 and 5 can be selected, with 5 being fastest.

To indicate that the instrument is stirring when the option "Stir Before Measurement" has been selected, the instrument will display the icon .

5.5 Data Transfer Settings

1. Data Logging

The meter stores up to 1000 sets of measurement data in the memory. The number of data sets already stored in the memory is indicated by MXXXX on the display. A message appears on the display when the memory is full. To save further measurements if the memory is full, data has to be deleted first. You can select between automatic and manual storage.

1. **Automatic storage**
   Stores/transfers every endpointed reading to the memory/interface or both automatically.
2. **Manual storage**
   If "Manual Storage" is set, **Store** appears on the display as soon as a measurement has endpointed. Press **Store** to save/transfer endpointed readings. The endpointed reading can only be stored once. When the data is stored, **Store** disappears from the measurement screen. When the Store key is shown but you go into the menu settings before saving the measurement, the Store key will not be present anymore when you exit the menu settings and return to the measurement screen.

2. Interface

Select to transfer the data in the memory to a Printer, LabX Direct or both. The meter adjusts the baud rate to the following settings in case no automatic baud rate synchronization occurs (only possible with USB and the printers RS-P25, RS-P26 and RS-P28):

1. **Printer**
   Baud rate: 1200
   Data bits: 8
   Parity: none
   Stop bits: 1
   Handshake: none
2. **LabX direct**
   The settings between the instrument and PC are adjusted automatically because USB connection is plug-and-play
3. **Printer + LabX direct**
   The settings listed above for 1. and 2. are used.

3. Printout Format

Three different printout formats are available: GLP, Normal and Short. The printouts can be printed in six different languages, depending on which language is currently selected in Setup (English, German, French, Italian, Spanish and Portuguese). For all other languages the printouts will be in English.

* If LabX direct is selected, the printout format is always GLP and English. LabX direct PC software translates the received data into the selected PC language as defined in the regional and language options.

Examples:

Conductivity printout GLP	Conductivity printout normal	Conductivity printout short
<Conductivity> GLP 22-Jul-05 10:56 AM BEER 1413 µS/cm 25.0 C MTC Ref.Temp.: 25.0 C Non-linear Manual EP Inlab730 122222222 Last cal.: 09-Jun-2010 10:56 AM Ivy Signature:_____ Outside limits!	<Conductivity> Normal 22-Jul-05 10:56 AM BEER 1413 µS/cm 25.0 C MTC Ref.Temp.: 25.0 C Non-linear Manual EP Inlab730	<Conductivity> 1413 µS/cm 25.0 C MTC Ref.Temp.: 25.0 C Non-linear Manual EP

5.6 System settings

The system settings menu is protected by a PIN. Upon delivery, the PIN is set to 000000 and is activated. Please change the PIN to prevent unauthorized access.

1. Language

The following languages are available for the system: English, German, French, Spanish, Italian, Portuguese, Chinese, Japanese, Korean and Russian.

2. Time and date

When starting the meter for the first time, the display for entering time and date appears automatically.

In the system settings, two time and four date display formats are available:

- **Time**

  24-hour format (for example, 06:56 and 18:56)

  12-hour format (for example, 06:56 AM and 06:56 PM)
- **Date**:

  28-11-2010 (day-month-year)

  11-28-2010 (month-day-year)

  28-Nov-2010 (day-month-year)

  28/11/2010 (day-month-year)

3. Access control

PIN settings are available for:

1. System settings
2. Deleting data
3. Instrument login

1 Switch PIN protection for the required access control ON. The window for entering an alphanumeric PIN appears.

2 Enter an alphanumeric PIN (max. 6 characters).

⇨ The input window for PIN verification appears.

3 Confirm PIN.

A maximum of 6 characters can be entered as PIN. In the factory default settings, the PIN for system settings and deleting data is set to 000000 and is activated, no instrument login password is set.

4. Beep

An acoustic signal can be switched on in the following three cases:

1. Key is pressed
2. Alarm/warning message appears
3. Measurement is stable and has endpointed (stability signal appears)

5. Expert/Routine modes

The meter has two working modes:

- **Expert mode**: the factory default setting enables all functions of the meter.
- **Routine mode**: some of the menu settings are blocked.

The concept of the two working modes is a GLP feature that ensures that important settings and stored data cannot be deleted cannot be unintentionally changed under routine working conditions.

The meter only allows the following functions in the routine mode:

- Calibrating and measuring
- Editing user, sample and sensor IDs
- Editing the MTC temperature
- Editing data transfer settings
- Editing system-settings (PIN-protected)
- Running the instrument self-test
- Storing, viewing, printing and exporting data
- Exporting settings to USB-stick

6. Screen settings

Screen Brightness
The screen brightness can be set from levels 1 to 16.

Screen Saver
The amount of time can be set which passes before the screen saver is activated:
5-99 minutes

If the meter is not operated during this time, the screen saver is activated. Press any key and the display is activated again, independent of the function of the key.

Screen Color
The display background color blue, grey, red or green can be selected.

The display has a limited lifetime; therefore we recommend activating the screen saver or switching off the meter when not in operation.

If an instrument login password is set, this password is required after activating the display again.

5.7 Service

1. Software Update

In case a newer software version is available, the user can perform a software update via USB-stick, by adhering to the following process:

1 Make sure that the firmware is in the root directory of the USB-stick and has a name S<xxx>v<yyy>.bin, with <xxx> being the number of the instrument type (220 for pH/Ion meter and 230 for conductivity meter) and <yyy> being the version number.

2 Connect the USB-stick to the instrument

3 Select the option "software update"

⇨ A message appears that the software update ist in progress

4 When the software update is completed you need to restart the instrument for the changes to become effective.

- After the software update the instrument is switched back to factory settings. All unsaved data will be lost and the PIN will be set back to "000000".
- In case the USB-stick is removed during the update process or the power adapter is plugged out, the instrument cannot be switched on anymore. Please contact METTLER TOLEDO service in that case.

2. Export Settings to a USB-stick

With this feature the user can export the settings. These can for example be sent via e-mail to a customer service representative in case difficulties occur, so that it is easier for the customer service representative to provide support.

1 Insert the USB stick into the corresponding interface of the meter

⇨ The ♆ icon appears on the display

2 Select the item and **Export Settings to USB-Stick** in the service menu to start the transfer

The settings will be in text (extension .txt) format. The instrument will create a new folder on the USB-stick in which the name is the date in the international format, i.e. first year, then month and then the day.

Example: when the data is 25 November 2011, the name of the folder will be: 20111125.

The data will be written as a text file with a name that consists of the time in 24h format (hr min sec) with the prefix S.

Example: when settings are exported at 15:12:25 (3:12:25 pm) the name of the file will be: S151225.txt

Pressing **EXIT** during the exporting aborts the process

3. Factory Reset

When the factory reset is performed, the instrument will revert back to the original settings when the instrument left the factory. All data will be lost and the PIN is set-back to the original PIN "000000".

5.8 Instrument self-test

The instrument self-test requires user interaction.

1 In the **Setup** menu, select "6. Instrument Self-test".

⇨ Selecting the menu item starts the self-test routine.

2 Press the function keys on the keypad one by one in any order.

⇨ The self-test result is displayed after a few seconds.

⇨ The meter returns to the system settings menu automatically.

- The user needs to finish pressing all seven keys within two minutes, otherwise "Self-test failed!" appears and the procedure has to be repeated.
- If error messages repeatedly appear, contact METTLER TOLEDO Service.

6 Menus and settings

6.1 Menu structure of conductivity

1. Sensor ID/SN

2. Calibration Settings
- 1. Calibration Standard
- 2. Calibration Reminder

3. Measurement Settings
- 1. Reference Temperature
- 2. Temperature Correction
- 3. TDS Factor
- 4. Conductivity Unit
- 5. Conductivity Ash

4. Endpoint Formats

5. Timed Interval Readings

6. Temperature Settings
- 1. Set MTC Temperature
- 2. Temperature Unit

7. Measurement Limits

6.2 Sensor ID/SN

1. Enter Sensor ID/SN

An alphanumeric sensor ID with up to 12 characters can be entered. The sensor ID will be assigned to each calibration and measurement value. This is valuable for tracing back data.

The maximum number of sensors is 30. When this number has been reached, first a sensor has to be deleted before a new sensor can be created (see the note at the end of this section how to delete a sensor).

If a new sensor ID is entered, a cell constant of 1 cm^{-1} will be used until the sensor has been calibrated.

If you enter a sensor ID which already exists in the memory and for which a valid calibration is stored, the instrument will load the specific calibration data for this sensor ID.

When connecting an **ISM® sensor** to the meter, the meter will:

- Automatically recognize the sensor when it's turned on (alternatively, when pressing **READ** or **CAL**)
- Load the stored sensor ID, sensor SN and sensor type as well as the latest calibration data of this sensor
- Use this calibration for the subsequent measurements

The sensor ID for ISM® sensors can be changed. Sensor SN and sensor type, however, are blocked for modification.

2. Select Sensor ID

Already entered sensor IDs can be selected from a list.

If a sensor ID is selected, which is already in the memory of the meter and has been calibrated before, the specific calibration data for this sensor ID will be loaded.

You can delete a sensor ID with its calibrations in the calibration data menu.

6.3 Conductivity calibration settings

Calibration standard

- Predefined conductivity standard

The following conductivity standards are available:

International:

10 µS/cm	84 µS/cm	500 µS/cm	1413 µS/cm	12.88 mS/cm	saturated NaCl

Chinese:

146.5 µS/cm	1408 µS/cm	12.85 mS/cm	111.35 mS/cm

Japanese:

1330.00 µS/cm	133.00 µS/cm	26.6 µS/cm

- Customized conductivity standard

This option is for users who would like to use their own conductivity standard for calibration of the conductivity sensor. Up to 5 temperature-dependent values (in mS/cm only) can be entered in the table. Lowest possible special standard: 0.00005 mS/cm (0.05 µS/cm). This value corresponds to the conductivity of pure water at 25°C, exclusively caused by the autoprotolysis of water.

When switching from a predefined standard to customized standard, you should always save the table even if no values have changed.

- Cell constant

If the cell constant of the conductivity cell being used is accurately known, it can be entered directly in the meter.

1 Select **Enter Cell Constant** in the menu

2 Return to the measurement display

3 Press **CAL** in the measurement display

4 The user is prompted to enter the cell constant

Calibration reminder

When the calibration reminder is "On", the user is reminded to perform a new calibration after a certain user-defined interval (maximum 9999 h) has elapsed.

- Press **READ** to save the interval and another screen appears to select calibration expiration date.

Four different time spans can be programmed. In all four cases, a warning message appears that the electrode should be calibrated.

- **Immediately**
  The meter is immediately blocked for measurement when the predefined interval has elapsed.
- **Reminder + 1h**
  The meter is blocked for measurement 1 hour after the predefined interval has elapsed.
- **Reminder + 2h**
  The meter is blocked for measurement 2 hours after the predefined interval has elapsed.
- **Continue Reading**
  The user can continue measuring when the predefined interval has elapsed.

6.4 Conductivity measurement settings

Reference Temperature

Two reference temperatures are available:
20 °C (68 °F) and 25 °C (77 °F).

Temperature Correction

There are four options:

- linear
- non-linear
- pure water
- off

With most solutions, a linear interrelationship between conductivity and temperature is given. In such cases, select the **linear correction** method.

The conductivity of natural water shows strong non-linear temperature behavior. For this reason, use the **non-linear correction** for natural water.

The option **pure water** should only be used for cases in which ultra-pure or pure water is measured.

In some cases, for example, when measuring according to USP/EP (United States/European Pharmacopoeia) you need to switch **off** the temperature correction. This can also be done by entering a linear temperature correction factor of 0 % / °C.

- Linear

When selecting linear correction, the input window for the temperature correction coefficient (0.000 – 10.000 % / °C) appears.

The measured conductivity is corrected and displayed using the following formula:

- $GT_{Ref} = GT / (1 + (\alpha (T - T_{Ref})) / 100\ \%)$

GT: conductivity measured at temperature T (mS/cm)
GT_{Ref}: conductivity (mS/cm) displayed by the instrument, calculated back to the reference temperature T_{Ref}
α : linear temperature correction coefficient (%/°C); α = 0: no temperature correction
T: measured temperature (°C)
T_{Ref}: Reference temperature (20 °C or 25 °C)

Each sample has different temperature behavior. For pure salt solutions the correct coefficient can be found in literature, otherwise you need to determine the α -coefficient by measuring the conductivity of the sample at two temperatures and calculate the coefficient by using the formula below.

- α = (GT1 - GT2) * 100% / (T1 - T2) / GT2

T1: Typical sample temperature
T2: Reference temperature
GT1: Measured conductivity at typical sample temperature
GT2: Measured conductivity at reference temperature

- Non-linear

The conductivity of natural water shows strong non-linear temperature behavior. For this reason, use the non-linear correction for natural water.

The measured conductivity is multiplied by the factor f_{25} for the measured temperature (see "Appendix") and thus corrected to the reference temperature of 25 °C:

- $G_{T25} = GT * f_{25}$

If another reference temperature is used, for example 20 °C, the conductivity corrected to 25 °C is divided by 1.116 (see f_{25} for 20.0 °C)

- $GT_{20} = (GT \cdot f_{25}) / 1.116$

Conductivity measurements of natural water can only be performed at temperatures ranging from 0 °C to 36 °C. Otherwise, the warning message "Temp. out of nLF correction range" appears.

Pure water

Similar to non-linear correction for natural water a different type of non-linear correction is used for ultra-pure and pure water. The values are compensated in the range from 0.005 to 5.00 µS/cm at temperatures (0-50°C) that differ from the reference temperature (25°C). This could for example be when checking the pure or ultra-pure water production equipment, or when checking if the cleaning-in-progress procedure for which ultra-pure water has been used had led to the removal of all soluble substances. Due to the high influence of CO2 from the air, we strongly suggest to use the flow-through-cell for this type of measurements.

- Conductivity measurements using the pure water compensation mode can only be performed at temperatures ranging from 0 °C to 50 °C. Otherwise, the warning message "Temp. out of pure water range" appears.
- In case the conductivity reading exceeds the upper limit of 5.00 µS/cm in the mode pure water, the compensation will resemble a linear compensation mode with = 2.00 %/°C.

TDS factor

TDS (Total dissolved solids) is calculated by multiplying the conductivity value with the TDS factor. A factor between 0.40 and 1.00 can be entered.

Conductivity Unit

One can choose the following conductivity units for display in the conductivity mode:

- µS/cm & mS/cm

The instrument will switch automatically between µS/cm and mS/cm depending on the measurement value. This unit is the standard for most conductivity measurements.

- µS/m & mS/m

The instrument will switch automatically between µS/m and mS/m depending on the measurement value. This unit is for example used for determination of the conductivity of ethanol according to the ABNT / ABR 10547 method.

Conductivity Ash

Conductivity Ash (%) is an important parameter that reflects the content of soluble inorganic salts in refined sugar or raw sugar/melasses. These soluble inorganic impurities directly affect the purity of the sugar. This meter can measure conductivity ash according to the following two ICUMSA methods (see "Appendix: Conductivity ash methods"):

- 28 g / 100 g solution (refined sugar - ICUMSA GS2/3-17)
- 5 g / 100 mL solution (raw sugar – ICUMSA GS1/3/4/7/8-13)

The instrument will directly convert the measured conductivity to conductivity ash % according to the selected method.

The user has the possibility to enter the conductivity of the used water for preparing the sugar solutions in µS/cm (0.0 to 100.0 µS/cm). This value is then used for correcting the measured conductivity ash values according to the formulae given in "Appendix: Conductivity ash methods".

Conductivity ash measurements are only possible in the temperature range from 15°C to 25°C

6.5 Endpoint formats

Auto

With the automatic endpoint the selected stability criterion determines the end of an individual reading depending on the behavior of the sensor used. This ensures an easy, quick and precise measurement.

1 Place sensor in the sample.

2 Press **READ**.

⇨ **A** appears on the display.

⇨ The measurement ends automatically when the measured value is stable. appears.

⇨ If **READ** is pressed before the signal is stable, the endpoint format changes to manual .

Manual

Unlike **Auto**, user interaction is required to stop the measurement reading in manual mode.

1 Place sensor in the sample.

2 Press **READ**.

⇨ **M** appears on the display.

⇨ appears on the display to signalize measurement stability.

3 Press **READ** to end the measurement. appears.

Timed

The measurement stops after the set time, which can be set between 5 s and 3600 s.

1 Place sensor in the sample.

2 Press **READ**.

⇨ **T** appears on the display.

⇨ appears on the display to signalize measurement stability.

⇨ The measurement ends automatically when the set time period expires. appears.

⇨ If **READ** is pressed before the signal is stable, the endpoint format changes to manual .

Information on the display
The following symbols appear in the display, depending on the endpoint setting.

Preselected format	Start of measurement	Signal stability	Endpointed measurement [1]
Auto endpoint	A	A	A
	A	Read ⟹	M
Manual endpoint	M	Read ⇨	M
	M	Read ⟹	M
Timed endpoint	T	🕒 ⇨	T
	T	Read ⟹	M

[1]The actual endpoint format (last column) and not the preselected is stored with the data.

6.6 Timed Interval Readings

A reading is taken every time after a certain interval (1 – 2400 s) defined in the menu has elapsed. When working in the timed-interval reading mode, the interval can be defined by entering the seconds. The measurement series stops according to the selected endpoint format or manually by pressing **READ**. When timed-interval reading is "on", the **DL** icon DL appears.

The readings can be stored in the memory, transferred to the interface or both.

6.7 Temperature settings

- **Set MTC temperature**
  If the meter does not detect a temperature probe, **MTC** appears on the display. In this case the sample temperature should be entered manually. An **MTC** value between -30 °C and 130 °C can be entered.
- **Temperature unit**
  Select the temperature unit: °C or °F. The temperature value is automatically converted between the two units.

6.8 Measurement limits

The upper and lower limits for measurement data can be defined. If a limit is either not reached or exceeded (in other words, less than or greater than a specific value), a warning is displayed on the screen and may be accompanied by an acoustic signal. The message "outside limits" also appears on the GLP printout.

7 Data management

7.1 Menu structure of data menu

1. Measurement data
1. Review
2. Transfer
3. Delete
4. Export to USB-stick

2. Calibration data
1. Review
2. Transfer
3. Delete
4. Export to USB-stick

3. ISM data
1. Initial Calibration Data
2. Calibration History
3. Maximum Temperature
4. Reset ISM

7.2 Measurement data

Review

All

All stored measurement data can be reviewed; the most recent data saved appears on the display.

- Press **Transfer** to send the measurement data (current single set) to the printer or PC.

Partial

The measurement data can be filtered according to 3 criteria.

- Memory number (from MXXXX to MXXXX)
- Sample ID
- Measurement mode

Memory number

1 Enter the memory numbers of the data and press **Select**.
   ⇨ The measurement data is displayed.
2 Scroll through the measurement data to review all measurements between the two memory numbers.
3 Press **Transfer** to send the measurement data (current single set) to the printer or PC.

Sample ID

1 Enter the sample ID and press **OK**.
   ⇨ The meter finds all stored measurements with this sample ID.
2 Scroll through the measurement data to review all measurements with the entered sample ID.
3 Press **Transfer** to send the measurement data (current single set) to the printer or PC.

Measurement mode

1 Select a measurement mode from list. The meter finds all stored measurements of the selected measurement mode.
2 Scroll through the measurement data of the selected measurement mode.
3 Press **Transfer** to send the measurement data (current single set) to the printer or PC.

Transfer

All or partially stored measurement data can be transferred by filtering the measurement data. The filter works as described above in "Review".

- Press **Select** to send the filtered measurement data to the printer or PC.

Delete

All or partially stored measurement data can be deleted by filtering the measurement data. The filter works as described above in "Review".

Deletion is protected by a PIN. Upon delivery, the PIN is set to 000000. Change the PIN code to prevent unauthorized access.

Export to USB-stick

All or partially stored measurement data can be transferred to a USB-stick. The filter works as described above in "Review". More information about the file format is given in "Operating the meter: Data transfer"

- Press **Transfer** to export the filtered measurement data to the USB-stick.

7.3 Calibration data

Calibration data can be reviewed, transferred and deleted. The latest calibration per sensor ID is stored in the memory. When using ISM-Sensors, the latest 5 calibration data can be viewed/printed (See "Data management: ISM data").

Review

1 Press **Select**.

⇨ A list of calibrated sensor IDs appears.

2 Select a sensor ID from the list.

⇨ The calibration data is shown for this sensor ID

— or —

3 Press and hold **CAL** for 3 seconds in the measurement screen.

4 Press **Transfer** to send the displayed calibration data to a printer or PC.

Transfer

1 Press **Select**.

⇨ A list of calibrated sensor IDs appears.

2 Select a sensor ID from the list.

⇨ The calibration data of the selected sensor ID is transferred to a printer or PC.

Delete

1 Press **Select**.

⇨ A list of sensor IDs appears.

2 Select a sensor ID from the list.

3 Press **Yes** when the message "Selected data will be deleted. Please confirm" appears.
— or —

4 Press **Exit** to cancel.

⇨ After deletion, the sensor ID disappears from the list in the sensor ID menu.

- An active sensor ID cannot be deleted.
- This menu is protected by a deletion PIN code. Upon delivery, the PIN code is set to 000000. Change the PIN code to prevent unauthorized access.

Export to USB-stick

Stored calibration data per sensor ID can be transferred to a USB-stick.

1 Press **Select**.

2 Select a sensor ID from the list.

3 Press **Transfer** to export the calibration data of the selected sensor ID to the USB-stick.

7.4 ISM data

SevenCompact meter incorporates Intelligent Sensor Management (ISM®) technology. This ingenious functionality provides extra security, safety and eliminates mistakes. The most important features are:

Extra security!

- After connecting the ISM® sensor, the sensor is automatically recognized and the sensor ID and serial number are transferred from the sensor chip to the meter. The data is also printed on the GLP printout.
- After calibration of the ISM® sensor, the calibration data is automatically stored from the meter to the sensor chip. The most recent data is always stored where it should be – on the sensor chip!

Extra safety!

After connecting the ISM® sensor, the five most recent calibrations are transferred to the meter. These can be reviewed to see the development of the sensor over time. This information provides an indication if the sensor should be cleaned or renewed.

Eliminate mistakes!

After connecting an ISM® sensor, the last set of calibration data is automatically used for measurements.

Additional features are described below.

Initial calibration data
When an ISM® sensor is connected, the initial calibration data in the sensor can be reviewed or transferred. The following data is included:

- Response time
- Temperature tolerance
- Cell constant
- Cell constant tolerance
- Type (and name) of electrode (for example, InLab Expert Pro ISM)
- Serial number (SN) and ordering (ME) number
- Production date

Calibration history
The last 5 calibrations data stored in ISM® sensor including current calibration can be reviewed or transferred.

Maximum temperature
The maximum temperature that the ISM® sensor has been exposed to during measurement is monitored automatically and can be reviewed for the evaluation of the electrode lifetime.

Reset ISM®
The calibration history in this menu can be deleted. This menu is protected by a deletion PIN. Upon delivery, the PIN for deletion is set to 000000. Change the PIN to prevent unauthorized access.

8 Maintenance

8.1 Meter maintenance

Never unscrew the two halves of the housing!

The meters do not require any maintenance other than an occasional wipe with a damp cloth. The housing is made of acrylonitrile butadiene styrene/polycarbonate (ABS/PC). This material is sensitive to some organic solvents, such as toluene, xylene and methyl ethyl ketone (MEK).

Any spillage should be wiped off immediately.

8.2 Disposal

In compliance with European Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), this instrument must not be disposed of together with domestic waste. This also applies to countries outside the EU, per their specific requirements.
Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.

If you have any questions, please contact the responsible authority or the distributor from which you purchased this instrument.

Should this instrument be passed on to other parties (for private or professional use), the content of this regulation must also be related.

Thank you for your contribution to environmental protection.

8.3 Error messages

Message	Description and Resolution
Conductivity/TDS/salinity/resistivity/ conductivity ash/temperature exceeds max. limit	Measurement limits are activated in the menu settings and measured value is outside these limits. • Check the sample. • Check sample temperature. • Make sure that the pH electrode wetting cap has been removed and that the electrode is properly connected and placed in the sample solution.
Conductivity/TDS/salinity/resistivity/ conductivity ash/temperature below min. limit	
Memory is full	Max. 1000 measurement data can be stored in the memory. • Delete all or partial data in the memory, otherwise you will not be able to store new measurement data.
Please calibrate electrode	Calibration reminder has been switched on in the menu settings and last calibration has expired. • Calibrate the electrode.

Message	Description and Resolution
Active sensor cannot be deleted	Deleting the calibration data of the selected sensor ID is not possible, because it is currently the active sensor ID in the meter shown on the display. • Enter new sensor ID in the menu settings. • Select another sensor ID from the list in the menu settings.
Wrong standard	Meter cannot recognize the standard. Make sure that you have the correct standard and that it is fresh.
Standard temp. out of range	The ATC measured temperature is out of calibration standard range: 5 … 35 °C for international standards and 15 … 35°C for Chinese standards Keep the standard temperature within the range. Change the temperature setting.
Temperature differs from setting	ATC measured temperature differs by more than 0.5°C from the user-defined value/temperature range. • Keep the standard temperature within the range. • Change the temperature setting.
ISM® sensor communication error	Data has not been transferred correctly between ISM® sensor and meter. Reconnect the ISM® sensor and try again.
Self-test failure	Self-test has not been completed within 2 minutes or meter is defective. • Restart self-test and finish within 2 minutes. • Contact METTLER TOLEDO service if problem persists.
Wrong settings	Entered value differs by less than 5°C from other preset values. • Enter a higher/lower value in order to get a bigger difference.
Out of range	Either entered value is out of range. • Enter a value which is within the range shown on display. or Measured value out of range. • Make sure the electrode wetting cap has been removed and that the electrode is properly connected and placed in the sample solution.

Message	Description and Resolution
Wrong password	The entered PIN is not correct. • Re-enter the PIN. • Reset to factory settings, all data and settings will be lost.
Passwords do not match	The confirmation PIN does not match with the entered PIN. • Reenter PIN.
Program memory error	Meter recognizes internal error during start-up. • Switch the meter off and back on. • Contact METTLER TOLEDO service if the problem persists.
Data memory error	The data could not be stored into memory. • Switch the meter off and back on. • Contact METTLER TOLEDO service if the problem persists.
No matching data found in memory	The entered filter criterion does not exist. • Enter a new filter criterion.
Sensor ID already exists, previous SN will be overwritten	Two sensors with the same ID but different SN are not allowed in the meter. If a different SN has been entered for this sensor ID previously, the old SN will be overwritten. • Enter a different Sensor ID in order to keep the previous ID and SN.
Standard temp out of range	Conductivity calibrations can only be performed at temperatures from 0 … 35°C. • Keep the standard temperature within the range.
Temp. out of nLF correction range	Conductivity measurements of natural water can only be performed at temperatures from 0 … 36°C. • Keep the sample temperature within the range.
Temp. out of pure water range	Conductivity measurements of pure water can only be performed at temperatures from 0 … 50°C. • Keep the sample temperature within the range.
Temp. out of conductivity ash correction range	Conductivity ash measurements can only be performed at temperatures from 15 … 25°C. • Keep the sample temperature within the range.
Update failed	The software update process failed. This could be due to the following reasons: • The USB stick is not connected or it is disconnected during the update process • The update software is not in the correct folder

Message	Description and Resolution
Export failed	The exporting process failed. This could be due to the following reasons: • The USB stick is not connected or it is disconnected during the exporting process • The USB stick is full

8.4 Error limits

Message	Range not accepted	
Out of range, determine again	Conductivity	< 0.00 µS/cm or > 1000 mS/cm
	TDS	< 0.00 mg/L or > 600 g/L
	Salinity	< 0.00 psu or > 80.0 psu
	Resistivity	< 0.00 MΩ•cm or > 100.0 MΩ•cm
	Conductivity ash	< 0.00 % or > 2022 %
Standard temp. out of range	Temperature	< 0 °C or > 35 °C
ATC measured temperature is different to the user-defined value	I tATC-Tstandard I > 1 °C	
Temperature out of range	Temperature	< -5 °C or > 105 °C
Temp. out of nLF correction range	Temperature	< 0°C or > 50C
Temp. out of pure water range	Temperature	< 0 °C or > 50 °C
Temp. out of conductivity ash correction range	Temperature	< 15 °C or > 25 °C

9 Sensors, solutions and accessories

Parts	Order No.
Solutions	
10 µS/cm conductivity standard solution, 250 mL	51300169
84 µS/cm conductivity standard solution, 250 mL	51302153
500 µS/cm conductivity standard solution, 250 mL	51300170
1413 µS/cm conductivity standard solution, 30 x 20 mL	51302049
1413 µS/cm conductivity standard solution, 6 x 250 mL	51350096
12.88 mS/cm conductivity standard solution, 30 x 20 mL	51302050
12.88 mS/cm conductivity standard solution, 6 x 250 mL	51350098

Parts	Order No.
Communication	
RS-P25 printer	11124300
RS-P26 printer	11124303
RS-P28 printer	11124304
Barcode reader	21901297
USB Cable for Barcode reader	21901309
LabX®direct pH PC software	51302876

Parts	Order No.
Guides	
Guide to conductivity and dissolved oxygen	51724716

10 Specifications

S230 conductivity meter		
Measurement range	Conductivity	0.000 µS/cm…1000 mS/cm
	TDS	0.00 mg/L...1000 g/L
	Salinity	0.00…80.00 psu
	Resistivity	0.00…100.0 MΩ•cm
	Conductivity ash	0.00…2022 %
	Conductivity ATC	-5…105 °C
	Conductivity MTC	-30…130°C
Resolution	Conductivity	Auto range
		0.000 µS/cm…1.999 µS/cm
		2.00 µS/cm…19.99 µS/cm
		20.0 µS/cm…199.9 µS/cm
		200 µS/cm…1999 µS/cm
		20.0 mS/cm…199.9 mS/cm
		200mS/cm...1000mS/cm
	TDS	Auto range, same values as conductivity
	Salinity	0.00 psu…19.99 psu
		20.0 psu…80.0 psu
	Resistivity	Ω•cm (scientific)
		0.00 Ω•cm…9.99 E +6 Ω•cm
		MΩ•cm
		1.00 MΩ•cm…99.99 MΩ•cm
		100.0 MΩ•cm
	Conductivity ash	0.001 %
	Conductivity Temperature	0.1°C
Limits of error conductivity	Conductivity	±0.5 % of measured value
	TDS	±0.5 % of measured value
	Salinity	±0.5 % of measured value
	Resistivity	±0.5 % of measured value
	Conductivity ash	±0.5 % of measured value
	Temperature	±0.1 °C
Conductivity calibration standard	5 international and 4 chinese predefined standards	1 user-defined standard
Outputs	RS232, USB A, USB B	
Power requirements	DC9-12V-10W	
Size/weight	204 x 174 x 74 mm 890 g	
Display	TFT	
Conductivity input	MiniDin	
Digital sensor input	Mini-LTW	
Ambient conditions	Temperature	5…40°C
	Relative humidity	5%...80% (non-condensing)
	Installation category	II
	Pollution degree	2
	Altitude	Up to 2000 m above sea level
Materials	Housing	ABS/PC reinforced

Window	Polymethyl methacrylate (PMMA)	
Keypad	Membrane keypad: Polyethelene terephtalate (PET)	

11 Appendix

11.1 Temperature correction factors

Temperature correction factors f_{25} for non-linear conductivity correction

°C	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	1.918	1.912	1.906	1.899	1.893	1.887	1.881	1.875	1.869	1.863
1	1.857	1.851	1.845	1.840	1.834	1.829	1.822	1.817	1.811	1.805
2	1.800	1.794	1.788	1.783	1.777	1.772	1.766	1.761	1.756	1.750
3	1.745	1.740	1.734	1.729	1.724	1.719	1.713	1.708	1.703	1.698
4	1.693	1.688	1.683	1.678	1.673	1.668	1.663	1.658	1.653	1.648
5	1.643	1.638	1.634	1.629	1.624	1.619	1.615	1.610	1.605	1.601
6	1.596	1.591	1.587	1.582	1.578	1.573	1.569	1.564	1.560	1.555
7	1.551	1.547	1.542	1.538	1.534	1.529	1.525	1.521	1.516	1.512
8	1.508	1.504	1.500	1.496	1.491	1.487	1.483	1.479	1.475	1.471
9	1.467	1.463	1.459	1.455	1.451	1.447	1.443	1.439	1.436	1.432
10	1.428	1.424	1.420	1.416	1.413	1.409	1.405	1.401	1.398	1.384
11	1.390	1.387	1.383	1.379	1.376	1.372	1.369	1.365	1.362	1.358
12	1.354	1.351	1.347	1.344	1.341	1.337	1.334	1.330	1.327	1.323
13	1.320	1.317	1.313	1.310	1.307	1.303	1.300	1.297	1.294	1.290
14	1.287	1.284	1.281	1.278	1.274	1.271	1.268	1.265	1.262	1.259
15	1.256	1.253	1.249	1.246	1.243	1.240	1.237	1.234	1.231	1.228
16	1.225	1.222	1.219	1.216	1.214	1.211	1.208	1.205	1.202	1.199
17	1.196	1.193	1.191	1.188	1.185	1.182	1.179	1.177	1.174	1.171
18	1.168	1.166	1.163	1.160	1.157	1.155	1.152	1.149	1.147	1.144
19	1.141	1.139	1.136	1.134	1.131	1.128	1.126	1.123	1.121	1.118
20	1.116	1.113	1.111	1.108	1.105	1.103	1.101	1.098	1.096	1.093
21	1.091	1.088	1.086	1.083	1.081	1.079	1.076	1.074	1.071	1.069
22	1.067	1.064	1.062	1.060	1.057	1.055	1.053	1.051	1.048	1.046
23	1.044	1.041	1.039	1.037	1.035	1.032	1.030	1.028	1.026	1.024
24	1.021	1.019	1.017	1.015	1.013	1.011	1.008	1.006	1.004	1.002
25	1.000	0.998	0.996	0.994	0.992	0.990	0.987	0.985	0.983	0.981
26	0.979	0.977	0.975	0.973	0.971	0.969	0.967	0.965	0.963	0.961
27	0.959	0.957	0.955	0.953	0.952	0.950	0.948	0.946	0.944	0.942
28	0.940	0.938	0.936	0.934	0.933	0.931	0.929	0.927	0.925	0.923
29	0.921	0.920	0.918	0.916	0.914	0.912	0.911	0.909	0.907	0.905
30	0.903	0.902	0.900	0.898	0.896	0.895	0.893	0.891	0.889	0.888
31	0.886	0.884	0.883	0.881	0.879	0.877	0.876	0.874	0.872	0.871
32	0.869	0.867	0.866	0.864	0.863	0.861	0.859	0.858	0.856	0.854
33	0.853	0.851	0.850	0.848	0.846	0.845	0.843	0.842	0.840	0.839
34	0.837	0.835	0.834	0.832	0.831	0.829	0.828	0.826	0.825	0.823
35	0.822	0.820	0.819	0.817	0.816	0.814	0.813	0.811	0.810	0.808

11.2 Conductivity standards table

International

T [°C]	10 [µS/cm]	84 [µS/cm]	500 [µS/cm]	1413 [µS/cm]	12.88 [mS/cm]	Saturated NaCl [mS/cm]
0	6.13	53.02	315.3	896	8.22	134.5
10	7.10	60.34	359.6	1020	9.33	177.9
15	7.95	67.61	402.9	1147	10.48	201.5
20	8.97	75.80	451.5	1278	11.67	226.0
25	**10.00**	**84.00**	**500.0**	**1413**	**12.88**	**251.3**
30	11.03	92.19	548.5	1552	14.12	277.4
35	12.14	100.92	602.5	1667	15.39	304.1

Chinese

T [°C]	146.5 [µS/cm]	1408 [µS/cm]	12.85 [mS/cm]	111.3 [mS/cm]
15	118.5	1141.4	10.455	92.12
18	126.7	1220.0	11.163	97.80
20	132.2	1273.7	11.644	101.70
25	**146.5**	**1408.3**	**12.852**	**111.31**
35	176.5	1687.6	15.353	131.10

Japanese

T ([°C]	1330.00 [µS/cm]	133.00 [µS/cm]	26.6 [µS/cm]
0	771.40	77.14	15.428
5	911.05	91.11	18.221
10	1050.70	105.07	21.014
15	1190.35	119.04	23.807
20	**1330.00**	**133.00**	**26.6**
25	1469.65	146.97	29.393
30	1609.30	160.93	32.186
35	1748.95	174.90	34.979

11.3 Examples of temperature coefficients (alpha-values)

Substance at 25°C	Concentration [%]	Temperature coefficient alpha [%/°C]
HCl	10	1.56
KCl	10	1.88
CH_3COOH	10	1.69
NaCl	10	2.14
H_2SO_4	10	1.28
HF	1.5	7.20

α-coefficients of conductivity standards for a calculation to reference temperature 25 °C

Standard	Measurement temp.: 15 °C	Measurement temp.: 20 °C	Measurement temp.: 30 °C	Measurement temp.: 35 °C
84 µS/cm	1.95	1.95	1.95	2.01
1413 µS/cm	1.94	1.94	1.94	1.99
12.88 mS/cm	1.90	1.89	1.91	1.95

11.4 Practical salinity scale (UNESCO 1978)

The salinity is calculated according to the official definition of UNESCO 1978. Therefore the salinity Spsu of a sample in psu (practical salinity unit) at standard atmospheric pressure is calculated as follows:

$$S = \sum_{j=0}^{5} a_j R_T^{j/2} - \frac{(T-15)}{1+k(T-15)} \sum_{j=0}^{5} b_j R_T^{j/2}$$

$a_0 = 0.0080$	$b_0 = 0.0005$	k = 0.00162
$a_1 = -0.1692$	$b_1 = -0.0056$	
$a_2 = 25.3851$	$b_2 = -0.0066$	
$a_3 = 14.0941$	$b_3 = -0.0375$	
$a_4 = -7.0261$	$b_4 = 0.0636$	
$a_5 = 2.7081$	$b_5 = -0.0144$	

$$R_T = \frac{R_{Sample}(T)}{R_{KCl}(T)}$$

(32.4356 g KCl per 1000 g of solution)

11.5 Conductivity to TDS conversion factors

Conductivity	**TDS KCl**		**TDS NaCl**	
at 25 °C	**ppm value**	**factor**	**ppm value**	**factor**
84 µS/cm	40.38	0.5048	38.04	0.4755
447 µS/cm	225.6	0.5047	215.5	0.4822
1413 µS/cm	744.7	0.527	702.1	0.4969
1500 µS/cm	757.1	0.5047	737.1	0.4914
8974 µS/cm	5101	0.5685	4487	0.5000
12.880 µS/cm	7447	0.5782	7230	0.5613
15.000 µS/cm	8759	0.5839	8532	0.5688
80 mS/cm	52.168	0.6521	48.384	0.6048

11.6 USP/EP tables

Conductivity requirements (µS/cm) for USP / EP (highly purfied water) / EP (purfied water)

Temperature [°C]	**USP [µS/cm]**	**EP (highly purfied water) [µS/cm]**	**EP (purfied water) [µS/cm]**
0	0.6	0.6	2.4
5	0.8	0.8	-
10	0.9	0.9	3.6
15	1.0	1.0	-
20	1.1	1.1	4.3
25	1.3	1.3	5.1
30	1.4	1.4	5.4
35	1.5	1.5	-
40	1.7	1.7	6.5
45	1.8	1.8	-
50	1.9	1.9	7.1

Temperature [°C]	USP [µS/cm]	EP (highly purfied water) [µS/cm]	EP (purfied water) [µS/cm]
55	2.1	2.1	-
60	2.2	2.2	8.1
65	2.42	2.42	-
70	2.5	2.5	9.1
75	2.7	2.7	9.7
80	2.7	2.7	9.7
85	2.7	2.7	-
90	2.7	2.7	9.7
95	2.9	2.9	-
100	3.1	3.1	10.2

11.7 Conductivity ash methods

The meter can measure the conductivity ash (%) according to the two ICUMSA methods:

11.7.1 1. Refined sugar (28 g / 100 g solution) ICUMSA GS2/3-17

The formula that the instrument uses is:

%(m/m)=0,0006x((C1/(1+0,026x(T-20)))-0,35x(C2/(1+0,026x(T-20)))xK)

Where,

C1 = conductivity of the sugar solution in µS/cm with cell constant = 1 cm^{-1}

C2 = conductivity of the water used in µS/cm to prepare the sugar solution with cell constant = 1 cm^{-1}

T = temperature in °C between 15°C and 25°C

K = cell constant

11.7.2 Raw sugar or melasses (5 g / 100 mL solution) ICUMSA GS 1/3/4/7/8-13

The formula that the instrument uses is:

%(m/V)=0,0018x((C1/(1+0,023x(T-20))-C2/(1+0,023x(T-20)))xK)

Where,

C1 = conductivity of the sugar solution in µS/cm with cell constant = 1 cm^{-1}

C2 = conductivity of the water used to prepare the sugar solution in µS/cm with cell constant = 1 cm^{-1}

T = temperature in °C between 15°C and 25°C

K = cell constant of the used sensor