Operating Instructions

SevenCompact™ Duo S213

pH/Conductivity Meter

METTLER TOLEDO

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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:

- **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.
- **Expert 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 uPlace™ 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 soft key Mode**. Toggle 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 **EasyDirect pH** software! **EasyDirect pH** allows to store the data electronically almost unlimited and export them to Excel, or any other comma separated file for further use seamleassly and easy.
- **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 spray 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 SevenCompact series of pH, Ion and conductivity meters!

2 Safety Instructions

2.1 Definition of signal warnings and symbols

Signal words

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results.

WARNING for a hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.

CAUTION for a hazardous situation with low risk, resulting in minor or moderate injury if not avoided.

NOTICE for a hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

Attention (no symbol)
for important information about the product.

Note (no symbol)
for useful information about the product.

Warning symbols


General hazard


Electrical shock


Toxic substance


Inflammable or explosive substance


Acid / Corrosion

2.2 Product specific safety notes

The instrument has been tested for the experiments and intended purposes documented in the appropriate manual. However, this does not absolve you from the responsibility of performing your own tests of the products supplied by us regarding their suitability for the methods and purposes you intend to use them for.

Intended use

This instrument is designed to be used in analytical laboratories by qualified staff. The instrument is suitable for the processing of reagents and solvents.

Site requirements

The instrument has been developed for indoor operation in a well-ventilated area. Avoid the following environmental influences:

- Conditions outside of the ambient conditions specified in the technical data
- Powerful vibrations
- Direct sunlight
- Corrosive gas atmosphere
- Explosive atmosphere of gases, steam, fog, dust and flammable dust
- Powerful electric or magnetic fields

Staff qualification

Incorrect use of the instrument or the chemicals used in the analysis can lead to death or injury. The following qualifications are needed for operating the instrument.

- Knowledge and experience in working with toxic and caustic substances.
- Knowledge and experience in working with standard laboratory equipment.
- Knowledge and experience in working in accordance with general lab safety rules.

Responsibilities of the instrument owner

The instrument owner is the person that uses the instrument for commercial use or places the instrument at the disposal of his staff. The instrument owner is responsible for product safety and the safety of staff, user and third party.

The operator has the following responsibilities:

- Know the rules for safety at the workplace that are in effect and enforce them.
- Ensure that only qualified staff uses the instrument.
- Define the responsibilities for installation, operation, cleaning, troubleshooting and maintenance and ensure that the tasks are done.
- Train the staff in regular intervals and inform them about dangers.
- Provide the necessary protective gear for the staff.

Shut down of the instrument in emergency situations

– Pull the plug from the electrical outlet.

Protective Clothing

Wear protective clothing in the laboratory when working with hazardous or toxic substances.

Wear suitable eye protection such as goggles.

Use appropriate gloves when handling chemicals or hazardous substances and check their integrity before use.

Wear a lab coat.

Safety notes

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death.

– Keep all electrical cables and connections away from liquids.

⚠ WARNING

Danger of injuries and death due to harmful substances!

Chemicals can cause injuries if they come in contact with bare skin or are inhaled.

1 When using chemicals and solvents, comply with the instructions of the producer and the general lab safety rules.
2 Set up the instrument in a well-ventilated location.
3 Clean any spills immediately.
4 If you measure substances which form toxic gases, place the instrument in a fume hood.

⚠ WARNING

Danger of death and serious injuries due to flammable solvents!

Flammable solvents can ignite and lead to fire and explosions.

1 Keep flammable solvents away from naked flames.
2 When using chemicals and solvents, comply with the instructions of the producer and the general lab safety rules.

Any other type of use and operation beyond the limits of technical specifications without written consent from Mettler-Toledo GmbH, is considered as not intended.

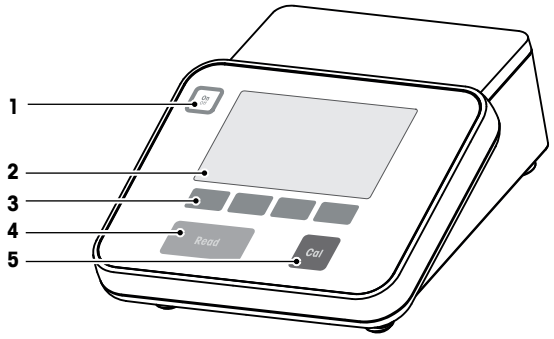
FCC Rules

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.

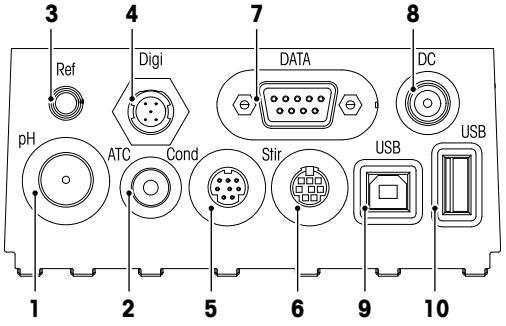
3 Design and Function

3.1 Overview



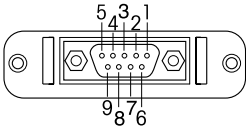
1	**On/Off** key	**2**	Display
3	Softkeys	**4**	**Read** key
5	**Cal** key		

3.2 Rear panel connections



1	BNC socket for mV/pH signal input	**2**	RCA (Cinch) socket for temperature signal input
3	Socket for reference electrodes	**4**	Socket for digital sensor (pH or Conductivity)
5	Mini-DIN socket for conductivity signal input	**6**	Mini DIN socket for METTLER TOLEDO stirrer
7	RS232 interface (Printer)	**8**	DC power supply socket
9	USB-B interface (Computer)	**10**	USB-A interface (USB-Stick, printer, barcode reader, keyboard)

PIN assignment for the RS-232 interface. METTLER TOLEDO printers such as RS-P25 can be connected to this interface.

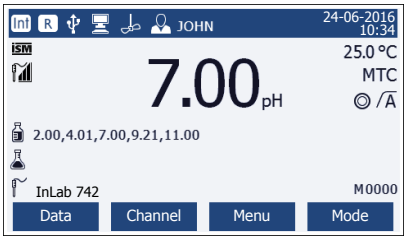


Pin 1	NC	Pin 6	NC
Pin 2	TxD (out)	Pin 7	NC
Pin 3	RxD (in)	Pin 8	NC
Pin 4	NC	Pin 9	NC
Pin 5	RSGND		

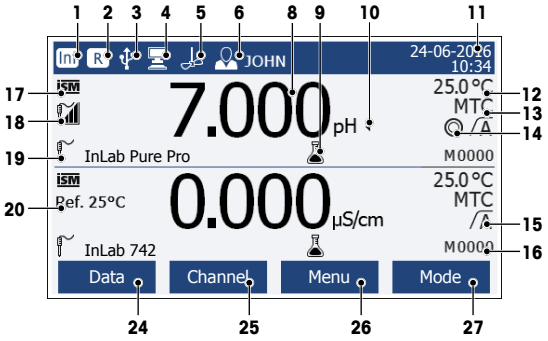
3.3 Display and icons

There are two modes available for the display representation: the full-information screen with all the information displayed, and the measurement close-up screen uFocus™, where the measurement information is shown in large font. To toggle between these views, press and hold **Read** during, after or before a measurement.

Standard view



uFocus™ view



	Icon	Description
1	Int	**Interval Readings** icon (timed interval reading)
2	R	**Routine Mode** icon (user access rights are restricted)
3		USB device connected
4		PC connected (for **EasyDirect pH**)
5		**Stirrer** icon (appears when stirring is active)
6		**User ID**
7		Calibration is running
8	**7.000 pH**	Measurement value and used measurement unit
9		**Sample ID**
10	◂	Channel selection if both channels are active
11	**24-06-2016** **10:34**	Date and time
12	**25°C**	Measurement temperature
13	**MTC**	**Temperature Correction** **ATC**: Temperature sensor connected **MTC**: no temperature sensor connected or detected
14		**Stability Criterion** (pH only) **Strict** **Standard** **Fast**

	Icon	Description
15	/A	**Endpoint Type** **A**: **Auto** measurement stops automatically when the signal is stable **M**: **Manual** to manually stop the measurement **T**: **Timed** the measurement stops after the preset time
		Stability Signal appears if the signal is stable
16	M	Number of data sets in memory
17	ISM	**ISM**® sensor connected
18		pH electrode condition Slope: 95-105% / Offset: ±(0-20) mV (Electrode is in good condition) Slope: 94-90% / Offset: ±(20-35) mV (Electrode needs cleaning) Slope: 89-85% / Offset: ±(>35) mV (Electrode is defective or too old)
19		**Sensor ID**
20	Ref.T.	**Reference Temperature**
21	CC	The cell constant of the conductivity sensor
22		Buffer groups or standards
23		Warning messages
24		Softkeys are buttons whose function changes depending on the context. See [Softkeys ▸ 9]
25		
26		
27		

3.4 Key controls

Key	Press and release	Press and hold for 2 seconds
On Off	Switch meter on	Switch meter 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	

3.5 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.

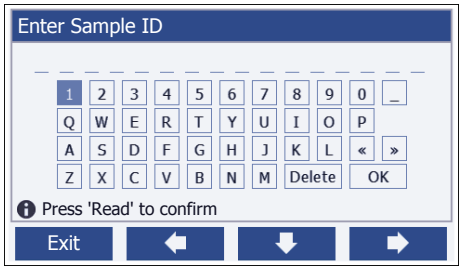
Data	Access data menu	Mode	Change measurement mode Press and hold to change the channel selection
Menu	Access meter settings	Channel	Select measuring channels
→	Move one position to the right	+	Increase value

←	Move one position to the left
↑	Scroll up in the menu
↓	Scroll down in the menu
Edit	Edit table or value
Delete	Delete selected data
Save	Save data, setting or value
Yes	Confirm an entry
No	Reject an entry
—	Decrease value
⌄⌄	Scroll to next page of results
Calculate	Calculate the calibration values
Select	Select the highlighted function or setting
Start	Start the measurement
Interface	Choose the transfer interface.
Transfer	Transfer selected data

3.6 Alphanumeric keypad

3.6.1 Entering alphanumeric characters

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 Move the cursor position using the ←, →, or ↓ keys.
2 Press **Read** to confirm an entry.
   ⇨ The position of the next character that is entered is blinking.
3 Repeat these steps to enter additional characters.
   - or -
   To delete an entry, select the character. Navigate to **Delete** and press **Read**.
4 To confirm and save the entries, navigate to **OK** and press **Read**.
   - or -
   To reject the entries, press **Exit**.

Entering IDs / PIN

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

Example text: WATER

1 If **1** is highlighted, press ↓ once.
   ⇨ **Q** is highlighted.
2 Press → once.
   ⇨ **W** is highlighted.
3 Press **Read** to enter **W**.
4 Reposition the selection to **A**, **T**, **E** and **R**, confirm each selection with **Read**.
5 Reposition the selection to **OK**, and press **Read** to save the ID.

Note

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

3.6.2 Editing values in tables

The meter allows you 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 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.

3.7 Navigating within a menu

1 Press **Menu** to enter the settings.
2 Move the selection to a menu item using the ↑ or ↓ keys and press **Select** to open the selection.
3 Apply the required settings using the navigation keys.
   - or -
   If applicable, move the selection to the next menu item in the hierarchy using the ↑ or ↓ keys.
4 Press **Exit** to return to the previous menu screen, or press **Read** to return to the measurement screen directly.

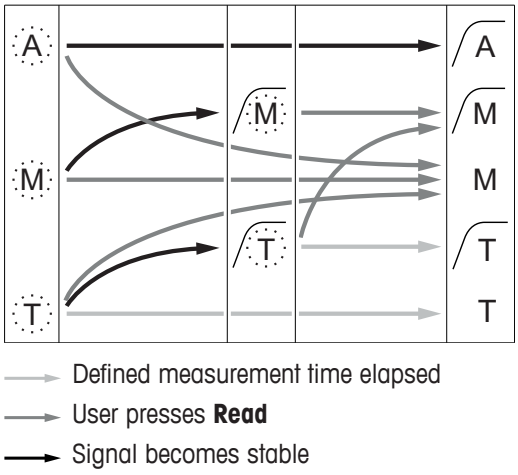
3.8 Navigating between menus

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 the softkeys.

1 Press **Menu** to enter the settings.
2 Move the selection to the top of the screen to select the tab using the ↑ or ↓ keys.
   ⇨ The navigation keys to navigate left and right are shown.
3 Move the selection to chose another tab using the ← or → keys.
4 Press **Exit** to return to the measurement screen.

3.9 Endpoint types

A general setting that defines how the endpoint of the measurement is to be determined.



Measurement stopped automatically, reading was stable

Measurement stopped manually, reading was stable

Measurement stopped manually, reading was not stable

Measurement stopped after time, reading was stable

Measurement stopped after time, reading was not stable

Defined measurement time elapsed

User presses **Read**

Signal becomes stable

4 Putting into Operation

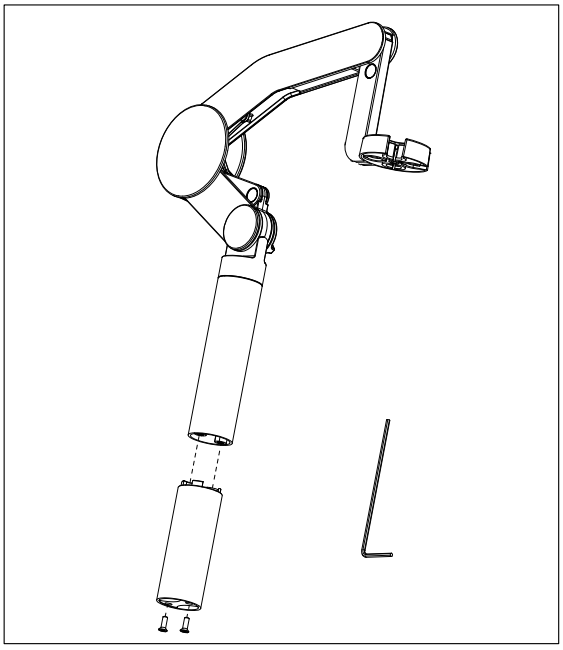
4.1 Scope of delivery

Unpack the instrument and check the scope of delivery. Keep the calibration certificate in a safe place. SevenCompact™ is delivered with:

- uPlace™ electrode arm
- Sensors (kit version or according to your order)
- Universal AC adapter
- Transparent protective cover
- CD-ROM with Operating instructions and User Manual (English, German, French, Italian, Spanish, Portuguese, Polish, Russian, Chinese, Japanese Korean, Thai)
- User Manual (print version, English, German, French, Italian, Spanish, Portuguese, Polish)
- Declaration of conformity
- Calibration certificate

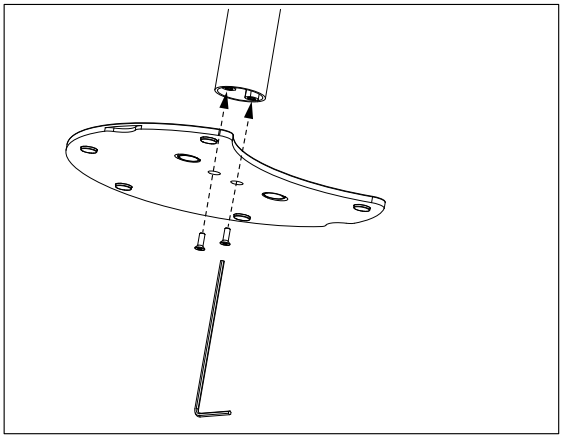
4.2 Mounting uPlace™ electrode arm

The electrode arm can be used as 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 .

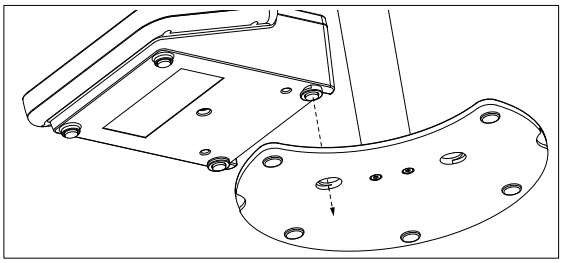


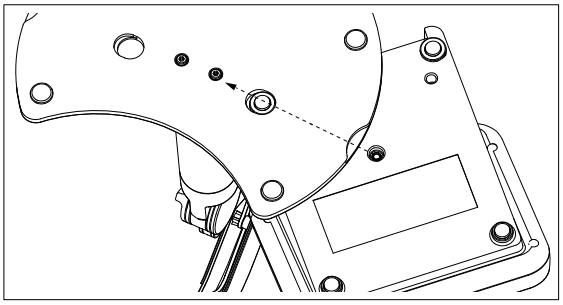
Assembly of the electrode arm

1 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.

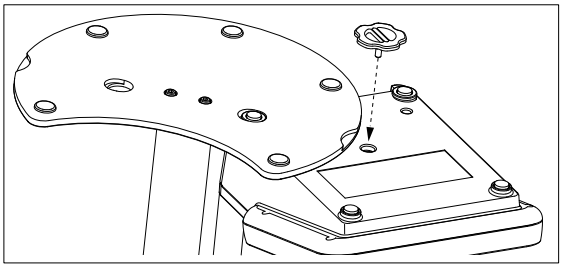


2 Then insert the foot of the meter to the arm base and shift the meter in the direction of the arrow to make the foot fit.





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



4.3 Installing power supply

⚠ WARNING

Danger of death or serious injury due to electric shock!

Contact with parts that contain a live current can lead to injury and death. If the instrument cannot be shut down in an emergency situations, people can be injured or the instrument can be damaged.

1 Check the cables and the plug for damage and replace damaged cables and plugs.
2 Ensure that the cables are arranged so that they cannot be damaged or interfere with the operation.
3 Ensure that the power plug is accessible at all times.

NOTICE

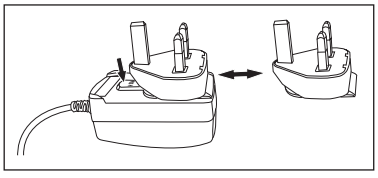
Danger of damage to the AC adapter due to overheating!

If the AC adapter is covered or in a container, it is not sufficiently cooled and overheats.

1 Do not cover the AC adapter.
2 Do not put the AC adapter in a container.

The instrument is operated using an AC adapter. The AC adapter is suitable for all supply line voltages ranging from 100...240 V AC ±10% and 50-60 Hz.

1 Insert the correct connector plug into the AC adapter until it is completely inserted.
2 Connect the cable of the AC adapter with the DC socket of the instrument.
3 Plug the AC adapter into the wall socket.



To remove the connector plug, push the release button and withdraw the connector plug.

4.4 Connecting sensors

When connecting a sensor, make sure that the plugs are properly inserted. If you are using a sensor with a built-in temperature probe or a separate temperature probe, connect the second cable to the ATC socket.

Example

– Connect a pH sensor to the BNC plug and if a temperature probe is integrated, connect the RCA (chinch) plug to the ATC input.
  - or -
  Connect a conductivity probe to the conductivity input, a temperature probe is always built in and does not need to be connected seperatly. If you have a digital sensor connect it to the digital input.

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.

4.5 Switching the instrument on and off

Switching on

– Press and release **On/Off** to switch on the instrument.
  ⇨ The firmware version, the serial number and the current date are displayed for a few seconds. After that the instrument is ready for use.

Switching off

– Press and hold the **On/Off** key until the instrument switches to standby mode.

Note

- In the standby mode, the control circuit for the **On/Off** switch is energized. The rest of the instrument is no longer energized.

4.6 Connectivity

Thanks to the plug & play capability, USB-sticks, barcode reader and printers are detected automatically.

Connection	Use
RS232 interface	RS-Printers
USB B interface	**EasyDirect pH** PC Software
USB A interface	USB-printer, USB barcode reader USB-stick with file format FAT12/FAT16/FAT32

The instrument adjusts the baud rate to the following settings in case no automatic baud rate synchronization occurs (only with printer types **RS-P25, RS-P26, RS-P28**):

Printer Baud rate:	1200
Data bits:	8
Parity:	none
Stop bits:	1
Handshake:	none

5 Configuring the Instrument

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

5.1 Sample ID

Navigation: Menu > > Sample ID

Parameter	Description	Value
Enter Sample ID	Alphanumeric sample ID with up to 16 characters can be entered. A maximum of 10 sample IDs are stored in memory and listed for selection. If the maximum number of IDs has been stored, the meter will display the message **Memory is full**.	1…16 characters
Auto Sequential	**On**: Using this setting will automatically increment the sample ID by 1 for each reading. If the last character of the sample ID is not a number, then the number 1 will be added to the sample ID with the second sample. This requires the sample ID to have less than 16 characters. **Off**: The sample ID is not incremented automatically.	**On** | **Off**
Select Sample ID	To select a sample ID out of a list of already entered sample IDs.	List of available sample IDs
Delete Sample ID	To delete an existing sample ID out of the list, select the sample ID you want to delete and press **Read**.	List of available sample IDs

5.2 User ID

Navigation: Menu > > User ID

Parameter	Description	Value
Enter User ID	Alphanumeric user IDs with up to 16 characters can be entered. A maximum of 10 user IDs are stored in memory and listed for selection. If the maximum number of IDs has been stored, the meter will display the message **Memory is full**.	1…16 characters
Select User ID	To select a user out of a list of existing users.	List of available user IDs

Delete User ID	To delete an existing user ID out of the list, select the user ID you want to delete and press **Read**.	List of available user IDs

5.3 Stirrer

You 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.

If a uMix or Compact stirrer is connected to the stirrer output, the option **Stir During Measurement** or **Stir Before Measurement** can be selected. When the stirrer is active, the symbol is displayed.

Navigation: Menu > > Stirrer

Parameter	Description	Value
Stir Before Measurement	**On**: Using this setting will include a stirring period before the measurement starts (after pressing **Read**). **Off**: No stirring before the measurement will take place.	**On** | **Off**
Enter Time	Defines the stir duration [s] if **Stir Before Measurement** is activated.	3…60
Stir During Measurement	**On**: Using this setting will results in stirring during the measurement. When the measurement is stopped, the stirrer is automatically switched off. **Off**: No stirring during the measurement will take place.	**On** | **Off**
Stir Speed	Defines the stir speed in steps, according to preferences and the characteristics of the sample.	1…5
Stirrer Voltage Settings	Defines the minimum and maximum voltages for the stirrer. **Stir Speed 1**: Defines the voltage for the lowest stirring speed. **Stir Speed 5**: Defines the voltage for the highest stirring speed.	0.5…8.0 V

5.4 Data storage

Navigation: Menu > > Data Storage

The meter stores up to 2000 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. Press **Exit** to discard the endpoint readings.

Parameter	Description	Value
Storage Mode	**Automatic Storage**: Stores/transfers every found reading to the memory/interface or both automatically. **Manual Storage**: If selected, **Save** appears on the display as soon as a measurement has found an endpoint. Press **Save** to save or transfer the endpoint readings. The readings can only be stored once. When the data is stored, **Save** disappears from the measurement screen.	**Automatic Storage** | **Manual Storage**
Storage Destination	Select to transfer the data to the memory, Printer or **PC**. **Memory**: Data will be stored in the internal memory of the instrument. **Printer**: Data will be printed to the connected printer. **PC**: Data will be transferred to the connected PC, running **EasyDirect pH**.	**Memory** | **Printer** | **PC**
Interval Readings	Activates the function to measure at intervals. The measurement series stops according to the selected endpoint format or manually by pressing **Read**.	**On** | **Off**

Interval Time	Define the time interval between the measurement points in [s] if **Interval Readings** is activated.	3…3600

5.5 System settings

5.5.1 Language

Navigation: Menu > > System Settings > Language

Parameter	Description	Value
Language	Defines the language for operation of the instrument.	English I Deutsch I French I Italian I Spanish I Portuguese I Russian I Polish I Chinese I Korean I Japanese I Thai

5.5.2 Time and Date

Navigation: Menu > > System Settings > Time and Date

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

Parameter	Description	Value
Time	Define the time and the time format for operation of the instrument. 24-hour format (for example, 06:56 and 18:56) 12-hour format (for example, 06:56 AM and 06:56 PM)	12h I 24h
Time and Date	Defines the date and the date format for operation of the instrument. **Date** 28-11-20xx (day-month-year) 11-28-20xx (month-day-year) 28-Nov-20xx (day-month-year) 28/11/20xx (day-month-year)	List of available date formats

5.5.3 Access Control

Navigation: Menu > > System Settings > Access Control

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

Parameter	Description	Value
System Settings	To enable a PIN protection for the required access control ON. When selected, the window for entering an alphanumeric PIN appears.	1…6 characters
Deletion of Data	Defines if the deletion of data is PIN protected.	**On** I **Off**
Instrument Login	Defines if the instrument login is PIN protected.	**On** I **Off**

5.5.4 Audio signal

Navigation: Menu > > System Settings > Beep

Parameter	Description	Value
Beep	Defines if an audio signal should be enabled.	**Keypress** | **Alarm Messages** | **Measurement Endpoint**

5.5.5 Operator mode

Navigation: Menu > > System Settings > Routine / Expert Mode

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

Parameter	Description	Value
Routine / Expert Mode	**Routine Mode**: Some of the menu settings are blocked. **Expert Mode**: The factory default setting enables all functions of the meter.	**Routine Mode** | **Expert Mode**

5.5.6 Screen settings

Navigation: Menu > > System Settings > Screen Settings

Parameter	Description	Value
Screen Brightness	Defines the screen brightness.	1…16
Screen Saver	Defines whether the screen saver should be used.	**On** | **Off**
Interval Time	Defines how long in [min] the system should wait after the user's last action on the terminal before activating the screen saver.	5…99
Screen Color	Defines the display background color.	**Blue** | **Grey** | **Red** | **Green**

5.6 Service

Navigation: Menu > > Service > Software Update

NOTICE

Danger of data loss due to reset!

When performing a software update, all settings will be set to default values and all data will be deleted.

You can perform a software update via USB-stick.

- 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 and <yyy> being the version number.

1 Connect the USB-stick to the instrument.

2 Select the option **Software Update**.

⇨ A message appears that the software update is in progress

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

Note

- The instrument will be reverted back to factory settings. All data will be deleted and the PIN will be set back to "000000".
- If the USB-stick is removed during the update process or the power supply is interrupted, the instrument is no longer functional. Please contact METTLER TOLEDO service for further assistance.

Export Settings to USB-stick

With this feature you can export the settings. These can for example be sent via e-mail to METTLER TOLEDO service.

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

⇨ appears on the display

2 Select **Export Settings to USB-stick** in the service menu to start the transfer.

⇨ The instrument has created a new folder on the USB-stick in which the name corresponds to the date in the international format. The date "25th November 2016" becomes "20161125".

⇨ The exported file is in text (extension .txt) format. The file name consists of the time in 24h format (hr min sec) with the prefix S. The time "15:12:25 (3:12:25 pm)" becomes "S151225.txt".

Note

- Pressing **Exit** during the export will cancel process.

Factory Reset

NOTICE

Danger of data loss due to reset!

When performing a factory reset, all settings will be set to default values and all data will be deleted.

1 Select the option **Factory Reset**.

⇨ A dialog box appears.

2 Press **Yes** to confirm the procedure.

⇨ The instrument has been reverted back to factory settings. All data has been deleted and the PIN will be set back to "000000".

5.7 Instrument Self-test

Navigation: Menu > > Service > Instrument Self-test

The instrument self-test requires user interaction.

1 Select the option **Instrument Self-test**.

⇨ A display test is performed. Subsequently, the self-test screen appears.

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.

Note

- You need to finish pressing all the keys within two minutes, otherwise **Self-test failure** appears and the procedure has to be repeated.
- If error messages repeatedly appear, contact METTLER TOLEDO Service.

6 Measuring pH

6.1 Measurement settings

Navigation: Menu > pH

1.	Sensor ID / SN		**4.**	Endpoint Type
	1. Enter Sensor ID / SN		**5.**	Temperature Settings
	2. Select Sensor ID			1. Set MTC Temperature
	2. Delete Sensor ID			2. Temperature Unit
2.	Calibration Settings			3. Temp. Sensor Recognition
	1. Buffer Group / Standard		**6.**	Measurement Limits
	2. Calibration Mode			1. pH Limit
	3. Calibration Reminder			2. mV Limit
3.	Measurement Settings			3. Rel. mV Limit
	1. Resolution			4. Temperature Limit
	2. Stability Criterion			
	3. Rel. mV Offset			

6.1.1 Sensor ID / SN

Navigation: Menu > pH > 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.

Parameter	Description	Value
Sensor ID	Enter alphanumeric IDs for sensors. A maximum of 30 sensor IDs are stored in the memory and listed for selection. If the maximum number of IDs has been stored, the meter will display the message **Memory is full**.	1…12 characters
Sensor SN	Enter alphanumeric serial numbers for sensors. Serial numbers of ISM® sensors are detected automatically.	1…12 characters

If a new sensor ID is entered, the theoretical calibration slope and offset for this type of electrode will be loaded. The sensor has to be newly calibrated.

If a sensor ID is entered, 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.

Select Sensor ID	To select a sensor out of a list of existing sensors. If a sensor ID is selected, which has been calibrated before, the specific calibration data for this sensor ID will be loaded.	List of available sensor IDs
Delete Sensor ID	To delete an existing sensor ID out of the list, select the sensor ID you want to delete and press **Read**.	List of available sensor IDs

6.1.2 Calibration Settings

Navigation: Menu > pH > Calibration Settings

Parameter	Description	Value
Buffer group	**Predefined Buffer Groups**: One of eight predefined buffer groups can be selected. **Customized Buffer Group**: A set of user-defined pH buffers with up to 5 different temperatures for each buffer can be created. The temperature difference must be at least 5 °C and the difference between the pH values must be at least 1. When switching from predefined buffer group to customized buffer group, press **Save** in the table even if no values have changed.	**Predefined Buffer Groups** | **Customized Buffer Group**

List of buffers

B1	1.68	4.01	7.00	10.01		(at 25°C)	Mettler US
B2	2.00	4.01	7.00	9.21	11.00	(at 25°C)	Mettler Europe
B3	2.00	4.00	7.00	9.00	12.00	(at 20°C)	Standard Merck buffer
B4	1.680	4.008	6.865	9.184	12.454	(at 25°C)	DIN19266:2000
B5	1.09	4.65	6.79	9.23	12.75	(at 25°C)	DIN19267
B6	1.680	4.003	6.864	9.182	12.460	(at 25°C)	Chinese
B7	2.00	4.01	7.00	10.00		(at 25°C)	Technical buffer
B8	1.679	4.008	6.865	9.180		(at 25°C)	JIS Z 8802

Temperature tables for these buffers are programmed in the meter and can be found in the "Appendix".

Parameter	Description	Value
Calibration Mode	**Segmented**: the calibration curve is made up of linear segments joining the individual calibration points. If high accuracy is required, the segment method is recommended. **Linear**: the calibration curve is determined using linear regression. This method is recommended for samples with widely varying values.	**Segmented** | **Linear**
Calibration Reminder	If activated, a reminder to perform a calibration appears after a defined time period.	**On** | **Off**

See also

Appendix [▶ 49]

6.1.3 Measurement Settings

Navigation: Menu > pH > Measurement Settings

Parameter	Description	Value
Measurement Resolution	The resolution for pH and mV needs to be set for the display. Up to 3 decimal places can be chosen depending on the unit of measurement	**pH** | **mV**

Decimal places

mV	X	no decimal places
pH, mV	X.X	one decimal place
pH	X.XX	two decimal places
pH	X.XXX	three decimal places

Parameter	Description	Value
Stability Criterion	**Strict**: The measured signal should not change by more than 0.03 mV in 8 seconds or by more than 0.1 mV in 20 seconds. **Standard**: The measured signal should not change by more than 0.1 mV in 6 seconds. **Fast** Stability-Fast icon The measured signal should not change by more than 0.6 mV in 4 seconds.	**Strict** I **Standard** I **Fast**
Rel. mV Offset	Rel. mV Offset: In the rel. mV mode the offset value is subtracted from the measured value. **Enter Offset Value**: An offset value can be entered. **Test a Reference Sample**: Determine by measuring the mV of a reference sample.	**Enter Offset Value** I **Test a Reference Sample**
Enter Offset Value	Enter an offset value in mV.	-1999.9…+1999.9

Test a Reference Sample

1 Place an electrode in the reference sample.
2 Press **Start** to begin the reference measurement and wait until the measurement display freezes.
- or-
3 Press **Read** to manually end the measurement.
4 Press **Save** to enter the measured mV value as offset into the meter.

6.1.4 Endpoint Type

Navigation: Menu > pH > Endpoint Type

Parameter	Description	Value
Endpoint Type	**Auto EP**: The meter determines when a measurement is to be stopped, based on the programmed stability criteria. **Manual EP**: The user is required to stop the measurement manually. **Timed EP**: The meter stops the measurement after a defined time.	**Auto EP** I **Manual EP** I **Timed EP**
Enter Time	Period of time [s] until the endpoint of the measurement is reached if **Endpoint Type** is set to **Timed EP**.	5…3600 s

See also

Endpoint types [▶ 11]

6.1.5 Temperature Settings

Navigation: Menu > pH > Temperature Settings

Parameter	Description	Value
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.	-30 °C…130 °C I -22 °F…266 °F
Temperature Unit	Defines the temperature unit applicable for the measurements. The temperature value is automatically converted between the two units.	°C I °F

Temp. Sensor Recognition	You can select between automatic recognition or manual selection of the temperature sensor type. For temperatures below 100 °C the instrument can reliably distinguish between NTC30 kΩ and Pt1000. At higher temperatures however, it is necessary to select the type of temperature sensor manually.	**Automatic** | **Manual**
Temp. Sensor Recognition	Defines the type of temperature sensor to be used if **Manual** is selected.	**NTC30 kOhm** | **Pt 1000**

6.1.6 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.

Navigation: Menu > pH > Measurement Limits

Parameter	Description	Value
pH Limit	Defines the upper and lower limit in [pH].	-2.000…20.000
mV Limit	Defines the upper and lower limit in [mV].	-1999.9…1999.9
Rel. mV Limit	Defines the upper and lower limit in [mV].	-1999.9…1999.9
Temperature Limit	Defines the upper and lower limit for the temperature.	-30…130 °C | -22.0…266 °F

6.2 Sensor Calibration

The meter allows you to perform calibrations with up to 5 points. 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.

Note

- The use of a temperature sensor or electrode with a built-in temperature sensor is recommended.
- If you use the **MTC** mode, you should enter the correct temperature value and keep all buffer and sample solutions at the set temperature.
- To ensure the most accurate pH readings, you should perform calibrations regularly.

6.2.1 Running a one-point pH calibration

Before performing a calibration, select the pH channel by using the **Channel** key.

- Press and hold **Read** to change the display mode (uFocus™).
- Ensure that the appropriate buffer group has been selected.

1 Place the sensor in a calibration buffer and press **Cal**.
   ⇨ **Cal 1** appears on the display and the **Endpoint Type** icon is blinking.

2 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
   - or -
   To manually stop the measurement, press **Read**.
   ⇨ Two soft buttons **Exit** and **Calculate** are shown.

3 Press **Calculate** to accept the calibration.
   ⇨ The offset value and the slope are shown on the display.

4 Press **Save** to save the result.
   - or -
   Press **Exit** to reject the calibration and return to the measurement screen.

Note

- With the one-point calibration only the offset is adjusted. If the sensor was previously calibrated with a multipoint calibration the previously stored slope will remain. Otherwise the theoretical slope (– 59.16 mV/pH) will be used.

See also

- Calibration Settings [▶ 24]
- Endpoint types [▶ 11]

6.2.2 Running a multi-point pH calibration

Before performing a calibration, select the pH channel by using the **Channel** key.

- Press and hold **Read** to change the display mode (uFocus™).
- Select the channel by using the key **Channel**.
- Ensure that the appropriate buffers have been selected.

1 Place the sensor in a buffer and press **Cal**.
   ⇨ **Cal 1** appears on the display and the **Endpoint Type** icon is blinking.
2 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
   - or -
   To manually stop the measurement, press **Read**.
3 Rinse the sensor with deionized water and place the sensor in the next calibration buffer/standard.
4 Press **Cal**.
   ⇨ **Cal 2** appears on the display and the **Endpoint Type** icon is blinking.
5 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
   - or -
   To manually stop the measurement, press **Read**.
6 Rinse the sensor with deionized water and repeat the steps with all buffers.
7 Press **Calculate** to accept the calibration procedure. The meter will end the calibration automatically when 5 calibrations are performed.
   ⇨ The offset value and slope are shown on the display.
8 Press ⬇ to scroll down to next page of result.
9 Press **Save** to accept the calibration.
   - or -
   Press **Exit** to reject the calibration and return to the measurement screen.

See also

- Calibration Settings [▶ 24]
- Endpoint types [▶ 11]

6.3 Sample Measurement

- Press and hold **Read** to change the display mode (uFocus™).
- Select the channels by using the key **Channel**.
- Press and hold **Mode** to change the channel selection if both channels are active. Then press **Mode** to change the measurement mode.

1 Place the sensor in the sample and press **Read** to start a measurement.
   ⇨ The **Endpoint Type** icon is blinking, indicating a measurement is in progress. The display shows the measurement value of the sample.

2 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
- or -
To manually stop the measurement, press **Read**.

⇨ The measurement has been stopped and the measured values are displayed.

Endpoint Type

- **Auto**: the measurement stops automatically when the signal is stable.
- **Manual**: press **Read** to manually stop the measurement.
- **Timed**: the measurement stops after the preset time.

See also

Endpoint types [▶ 11]

7 Measuring Conductivity

7.1 Measurement settings

Navigation: Menu > Cond.

1.	Sensor ID / SN		**4.**	Endpoint Type
	1. Enter Sensor ID / SN		**5.**	Temperature Settings
	2. Select Sensor ID			1. Set MTC Temperature
2.	Calibration Settings			2. Temperature Unit
	1. Calibration Standard		**6.**	Measurement Limits
	2. Calibration Reminder			1. Conductivity Limit
3.	Measurement Settings			2. TDS Limit
	1. Reference Temperature			2. Salinity Limit
	2. Temperature Correction			4. Resistivity Limit
	3. TDS Factor			5. Conductivity Ash Limit
	4. Conductivity Unit			6. Temperature Limit
	5. Conductivity Ash			
	6. Salinity Unit			

7.1.1 Sensor ID / SN

Navigation: Menu > Cond. > 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.

Parameter	Description	Value
Sensor ID	Enter alphanumeric IDs for sensors. A maximum of 30 sensor IDs are stored in the memory and listed for selection. If the maximum number of IDs has been stored, the meter will display the message **Memory is full**.	1…12 characters
Sensor SN	Enter alphanumeric serial numbers for sensors. Serial numbers of ISM® sensors are detected automatically.	1…12 characters

If a new sensor ID is entered, the theoretical calibration slope and offset for this type of electrode will be loaded. The sensor has to be newly calibrated.

If a sensor ID is entered, 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.

Select Sensor ID	To select a sensor out of a list of existing sensors. If a sensor ID is selected, which has been calibrated before, the specific calibration data for this sensor ID will be loaded.	List of available sensor IDs

7.1.2 Calibration Settings

Navigation: Menu > Cond. > Calibration Settings

Parameter	Description	Value
Calibration Standard	**Predefined Standard**: Use one of the predifend conductivity standards. **Customized Standard**: 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. **Enter Cell Constant**: If the cell constant of the conductivity cell being used is accurately known, it can be entered directly in the meter. You are prompted to enter the cell constant when calibrating the sensor.	**Predefined Standard** I **Customized Standard** I **Enter Cell Constant**

Predefined Standard

International	Chinese	Japanese
10 µS/cm	146.5 µS/cm	1330.00 µS/cm
84 µS/cm	1408 µS/cm	133.00 µS/cm
500 µS/cm	12.85 mS/cm	26.6 µS/cm
1413 µS/cm	111.35 mS/cm	
12.88 mS/cm		
Saturated NaCl		

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

Parameter	Description	Value
Calibration Reminder	If activated, a reminder to perform a calibration appears after a defined time period.	**On** I **Off**

7.1.3 Measurement Settings

7.1.3.1 Reference temperature

Navigation: Menu > Cond. > Measurement Settings > Reference Temperature

Parameter	Description	Value
Reference Temperature	Defines the reference temperature which will be used to correct the conductivity reading.	20 °C (68 °F) I 25 °C (77 °F)

7.1.3.2 Temperature correction/alpha-coefficient

Navigation: Menu > Cond. > Measurement Settings > Temperature Correction

Parameter	Description	Value
Temperature Correction	Defines the relationship between conductivity, temperature and concentration. **Linear**: Use for the temperature correction of medium and highly conductive solutions. **Non-linear**: Use for natural water (only for temperature between 0…36 °C). The measured conductivity at the sample temperature is corrected to the defined reference temperature (20 °C or 25 °C). **Pure Water**: An optimized type of temperature algorithm is used. **Off**: The conductivity value at the current temperature is displayed.	**Linear** | **Non-linear** | **Pure Water** | **Off**

Linear

The conductivity of a solution increases when the temperature rises. With most solutions, a linear interrelationship between conductivity and temperature is given.

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

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

whereras

- 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.

$\alpha = (GT1 - GT2) \cdot 100\% / (T1 - T2) / GT2$

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 and thus corrected to the reference temperature of 25 °C:

$GT_{25} = GT \cdot f_{25}$

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)

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

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 CO^2 from the air, we strongly suggest to use the flow-through-cell for this type of measurements.

Note

- 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 warer, the compensation will resemble a linear compensation mode with α = 2.00 %/°C.

7.1.3.3 TDS Factor

Navigation: Menu > Cond. > Measurement Settings > TDS Factor

Parameter	Description	Value
TDS Factor	TDS (Total dissolved solids) is calculated by multiplying the conductivity value with the TDS factor.	0.10…2.00

See also

Conductivity to TDS conversion factors [▶ 54]

7.1.3.4 Conductivity Unit

Navigation: Menu > Cond. > Measurement Settings > Conductivity Unit

Parameter	Description	Value
Conductivity Unit	**µS/cm and 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 and 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.	µS/cm and mS/cm I µS/m and mS/m

7.1.3.5 Conductivity Ash

Navigation: Menu > Cond. > Measurement Settings > 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. The instrument will directly convert the measured conductivity to conductivity ash % according to the selected method.

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

Parameter	Description	Value
ICUMSA Method	Select the method for conductivity ash measuring. **28g (Refined Sugar)**: 28 g / 100 g solution (refined sugar - ICUMSA GS2/3-17) **5g (Raw Sugar)** : 5 g / 100 mL solution (raw sugar – ICUMSA GS1/3/4/7/8-13)	**28g (Refined Sugar)** I **5g (Raw Sugar)**

Enter Cond. of Used Water	The conductivity of the used water can be entered for preparing the sugar solutions. This value is then used for correcting the measured conductivity ash values.	0.0…100.0 µS/cm

See also

Conductivity ash methods [▶ 55]

7.1.3.6 Salinity unit

Navigation: Menu > Cond. > Measurement Settings > Salinity Unit

Parameter	Description	Value
Salinity Unit	Select the unit for salinity measurement.	psu I ppt

See also

Practical salinity scale (UNESCO 1978) [▶ 54]

7.1.4 Endpoint Type

Navigation: Menu > Cond. > Endpoint Type

Parameter	Description	Value
Endpoint Type	**Auto EP**: The meter determines when a measurement is to be stopped, based on the programmed stability criteria. **Manual EP**: The user is required to stop the measurement manually. **Timed EP**: The meter stops the measurement after a defined time.	**Auto EP** I **Manual EP** I **Timed EP**
Enter Time	Period of time [s] until the endpoint of the measurement is reached if **Endpoint Type** is set to **Timed EP**.	5…3600 s

See also

Endpoint types [▶ 11]

7.1.5 Temperature Settings

Navigation: Menu > Cond. > Temperature Settings

Parameter	Description	Value
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.	-30 °C…130 °C I -22 °F…266 °F
Temperature Unit	Defines the temperature unit applicable for the measurements. The temperature value is automatically converted between the two units.	°C I °F

7.1.6 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.

Navigation: Menu > Cond. > Measurement Limits

Parameter	Description	Value
Conductivity Limit	Defines the upper and lower limit for the conductivity value in [mS/cm].	0.00001…1000.00
TDS Limit	Defines the upper and lower limit for the TDS value in [g/L].	0.00001…1000.00

Salinity Limit	Defines the upper and lower limit for the salinity value in [psu/ppt].	0.00…80.00
Resistivity Limit	Defines the upper and lower limit for the resistivity value in [MΩ · cm].	0.00…100.00
Cond. Ash Limit	Defines the upper and lower limit in [%].	0.00…2022.00
Temperature Limit	Defines the upper and lower limit for the temperature.	-30…130 °C I -22.0…266 °F

7.2 Sensor Calibration

Before performing a calibration, select the **Conductivity** channel by using the **Channel** key.

- Press and hold **Read** to change the display mode (uFocus™).
- Ensure that the appropriate calibration standard has been selected.

1 Place the sensor in a calibration standard and press **Cal**.
   ⇨ **Cal** appears on the display and the **Endpoint Type** icon is blinking.

2 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
   - or -
   To manually stop the measurement, press **Read**.
   ⇨ The calibration result is shown on the display.

3 Press **Save** to save the result.
   - or -
   Press **Exit** to reject the calibration and return to the measurement screen.

Note

- 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.

See also

- Calibration Settings [▸ 30]
- Endpoint types [▸ 11]

7.3 Sample Measurement

- Press and hold **Read** to change the display mode (uFocus™).
- Select the channels by using the key **Channel**.
- Press and hold **Mode** to change the channel selection if both channels are active. Then press **Mode** to change the measurement mode.

1 Place the sensor in the sample and press **Read** to start a measurement.
   ⇨ The **Endpoint Type** icon is blinking, indicating a measurement is in progress. The display shows the measurement value of the sample.

2 The icon ⌒ appears as soon as the signal is stable, the measurement will stop automatically if **Endpoint Type** > **Auto** is selected.
   - or -
   To manually stop the measurement, press **Read**.

⇨ The measurement has been stopped and the measured values are displayed.

Endpoint Type

- **Auto**: the measurement stops automatically when the signal is stable.
- **Manual**: press **Read** to manually stop the measurement.
- **Timed**: the measurement stops after the preset time.

See also

- Endpoint types [▶ 11]

8 Dual Channel Operation

With the thorough galvanic isolation of the electronics layout, it is possible to simultaneously measure with both measurement channels in the very same sample beaker, without interfering the measurements.

By pressing the key **Channel** the instrument can be toggled between the channels. By default the instrument is in **Dual** mode. By pressing **Channel** once, the instrument switches to **pH** mode. By pressing **Channel** a second time, the instrument switches to **Conductivity** mode.

The dual channel mode will use the settings from the respective measurement settings. Measurements can be started by pressing **Read**. Calibrations however need to be carried out in single channel mode. Changing the measurement mode is possible during dual channel operation (e.g. from **Conductivity** to **TDS**. A small arrow (◂) next to the unit indicates the selection of the unit that can be changed by pressing **Mode**. To change the channel selection, press and hold **Mode**.

You can switch between measurement close-up screen uFocus™ and full-information screen in single channel mode or in dual channel mode. Press and hold **Read** to switch.

See also

- Measurement settings [▸ 23]
- Measurement settings [▸ 29]

9 Managing data

Navigation: Data

1.	Measurement Data		**3.**	ISM Data **(**Electrode Records**)**
	1. View			1. pH
	2. Transfer			1.1 Initial Calibration Data
	3. Delete			1.2 Calibration History
2.	Calibration Data			1.3 Electrode Records
	1. pH			1.4 Reset ISM
	1.1 View			2. Conductivity
	1.2 Transfer			2.1 Initial Calibration Data
	1.3 Delete			2.2 Calibration History
	2. Conductivity			2.3 Electrode Records
	2.1 View			2.4 Reset ISM
	2.2 Transfer		**4.**	Transfer Interfaces
	2.3 Delete			

9.1 Measurement data

Navigation: Data > Measurement Data

All stored measurement data can be reviewed, transferred to selected options, or deleted. Deletion is protected by a PIN. Upon delivery, the PIN is set to 000000. Change the PIN code to prevent unauthorized access. The measurement data can be filtered according to different criteria.

1 Select the desired action **View**, **Transfer** or **Delete**.

2 Select **All** to select all the data.
- or -
Select **Partial** to apply a filter to the selection.
- or -
Select **New** to select all not yet transferred data.

⇨ The selected action will be applied to the filtered data.

Filter options

Parameter	Description
Partial by Date/Time	– Enter the time range of the data and press **Select**. ⇨ The measurement data is displayed.
Partial by Channel	– Enter the channel of the data and press **Select**.
Partial by 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.
Partial by 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.
Partial by 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.

9.2 Calibration data

Navigation: Data > Calibration Data

All stored calibration data can be reviewed, transferred to selected options, or deleted. Deletion is protected by a PIN. Upon delivery, the PIN is set to 000000. Change the PIN code to prevent unauthorized access.

1 Select channel **pH** or **Conductivity**.

2 Select the desired action **View**, **Transfer** or **Delete**.

⇨ The list of calibrated sensor IDs appears.

3 Select a sensor from the list to start the selected action.

⇨ The selected action will be applied to the sensor.

Note

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

9.3 ISM data

Navigation: Data > ISM Data

The SevenCompact meters incorporate Intelligent Sensor Management (ISM®) technology. This ingenious functionality provides extra security, safety and eliminates mistakes.

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

Initial calibration data pH sensors

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

- Response time between pH 4.01 and 7.00
- Temperature tolerance
- Membrane resistance
- Slope (calibration with pH 4.01 and 7.00) and offset
- Type (and name) of electrode (for example, InLab Expert Pro-ISM®)
- Serial number (SN) and order number
- Production date

Initial calibration data conductivity sensors

When connecting a ISM® sensor, 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 731-ISM®)
- Serial number (SN) and order number
- Production date

Options

Parameter	Description
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.

9.4 Transfer Interfaces

Navigation: Data > Transfer Interfaces

All stored measurement data can be transferred to selected interface.

Parameter	Description	Value
Interface	**USB-stick**: Data will be stored to the connected USB-stick in *.txt format. **Printer**: Data will be printed to the connected printer. **PC**: Data will be transferred to the connected PC, running **EasyDirect pH**.	**USB-stick** | **Printer** | **PC**

10 Troubleshooting

10.1 Instrument messages

Message	Description and Resolution
Temperature exceeds max. limit Temperature below min. 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.
Memory is full	Max. 2000 measurement data can be stored in the memory. Too many sensor IDs are stored. • 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.
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 buffer	Meter cannot recognize the buffer or standard/buffer. The buffers differ by less than 60 mV. • Make sure that you use the correct buffers. • Make sure that the buffers are fresh. • Make sure that the same buffer has not been used more than once during the calibration.
Slope out of range Offset out of range	The calibration result is outside the following limits: Slope < 85% or > 110%, Offset < -60 mV or > + 60 mV. • Make sure that you have the correct buffer and that it is fresh. • Check mV signal of electrode, clean or replace the electrode.
Standard temp. out of range Buffer temp. out of range	The ATC measured temperature is out of pH calibration buffer range: 5…50 °C. • Keep the buffer/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.
Standard temp. out of range	The ATC measured temperature is out of conductivity 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.
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.
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 1 pH unit/5°C from other preset values. • Enter a higher/lower value in order to get a bigger difference.

Message	Description and Resolution
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. • If no electrode is connected, put the shorting clip in the socket.
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, try again	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.
Software 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
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

10.2 Error limits

pH Channel

Message	Range not accepted	
pH exceeds max. limit	pH	< -2.000 or > 20.000
mV exceeds max. limit	mV	< -2000.0 or > 2000.0
Buffer temp. out of range/Standard temp. out of range	T (pH)	< 5 or > 50 °C
Offset out of range	Eref1-Eb > 60 mV	
Slope out of range	Slope < 85% or > 110%	
Wrong buffer	ΔEref1 < 0 mV	

Conductivity Channel

Message	Range not accepted	
Conductivity exceeds max. limit	Conductivity	< 0.00 µS/cm or > 1000 mS/cm
TDS exceeds max. limit	TDS	< 0.00 mg/L or > 1000 g/L
Salinity exceeds max. limit	Salinity	< 0.00 psu or > 80.0 psu
Resistivity exceeds max. limit	Resistivity	< 0.00 MΩ*cm or > 100.0 MΩ*cm

Message	Range not accepted	
Conductivity Ash exceeds max. limit	Conductivity ash	< 0.00% or > 2022%
Standard temp. out of range	Temperature	< 0 °C or > 35 °C
Temperature exceeds max. limit	Temperature	< -5 °C or > 105 °C
Temp. out of nLF corr.	Temperature	< 0°C or > 50 °C
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

11 Sensors, Solutions and Accessories

pH Sensors

Parts	Order No.
ISM® sensors with multi-pin head	
InLab®Micro Pro-ISM, 3-in-1 pH sensor, glass shaft, 5 mm shaft diameter, ATC, refillable	51344163
InLab®Power Pro-ISM, 3-in-1 pH sensor, glass shaft, ATC, pressurized Steady-Force™ reference system	51344211
InLab®Pure Pro-ISM, 3-in-1 pH sensor, glass shaft, immovable glass sleeve, ATC, refillable	51344172
InLab®Routine Pro-ISM, 3-in-1 pH sensor, glass shaft, ATC, refillable	51344055
InLab®Science Pro-ISM, 3-in-1 pH sensor, glass shaft, movable glass sleeve, ATC, refillable	51344072
InLab®Solids Pro-ISM, 3-in-1 pH sensor, glass shaft, open junction, sharp membrane, ATC	51344155

pH solutions

Solutions	Order No.
pH 2.00 buffer sachets, 30 x 20 mL	30111134
pH 2.00 buffer solution, 250 mL	51350002
pH 2.00 buffer solution, 6 x 250 mL	51350016
pH 4.01 buffer sachets, 30 x 20 mL	51302069
pH 4.01 buffer solution, 250 mL	51350004
pH 4.01 buffer solution, 6 x 250 mL	51350018
pH 7.00 buffer sachets, 30 x 20 mL	51302047
pH 7.00 buffer solution, 250 mL	51350006
pH 7.00 buffer solution, 6 x 250 mL	51350020
pH 9.21 buffer sachets, 30 x 20 mL	51302070
pH 9.21 buffer solution, 250 mL	51350008
pH 9.21 buffer solution, 6 x 250 mL	51350022
pH 10.01 buffer sachets, 30 x 20 mL	51302079
pH 10.00 buffer solution, 250 mL	51350010
pH 10.00 buffer solution, 6 x 250 mL	51350024
pH 11.00 buffer sachets, 30 x 20 mL	30111135
pH 11.00 buffer solution, 250 mL	51350012
pH 11.00 buffer solution, 6 x 250 mL	51350026
Rainbow sachets I (10 sachets of pH 4.01 / 7.00 / 9.21)	51302068
Rainbow sachets II (10 sachets of pH 4.01 / 7.00 / 10.01)	51302080
Rainbow bottles I (2 x 250 mL of pH 4.01 / 7.00 / 9.21)	30095312
Rainbow bottles II (2 x 250 mL of pH 4.01 / 7.00 / 10.00)	30095313
InLab storage solution (for all InLab pH and redox electrodes), 250 mL	30111142
Electrolyte 3 mol/L KCl, 25 mL	51343180
Electrolyte 3 mol/L KCl, 250 mL	51350072
Electrolyte 3 mol/L KCl, 6 x 250 mL	51350080
HCl/Pepsin solution (removes protein contamination), 250 mL	51350100
Thiourea solution (removes silver sulfide contamination), 250 mL	51350102

Solutions	Order No.
Regeneration solution for pH electrodes, 25 mL	51350104

Conductivity sensors

Parts	Order No.
InLab®731-ISM (steel)	30014092
InLab®741-ISM (steel)	30014094
InLab®710 (glass)	51302256
InLab®720 (glass)	51302255
InLab®751-4mm (narrow shaft)	51344030

Conductivity solutions

Parts	Order No.
10 µS/cm conductivity standard solution, 250 mL	51300169
10 µS/cm conductivity standard solution, 30 x 20 mL sachets	30111141
84 µS/cm conductivity standard solution, 250 mL	51302153
84 µS/cm conductivity standard solution, 30 x 20 mL sachets	30111140
500 µS/cm conductivity standard solution, 250 mL	51300170
1413 µS/cm conductivity standard solution, 30 x 20 mL sachets	51302049
1413 µS/cm conductivity standard solution, 6 x 250 mL	51350096
12.88 mS/cm conductivity standard solution, 30 x 20 mL sachets	51302050
12.88 mS/cm conductivity standard solution, 6 x 250 mL	51350098

Guides

Parts	Order No.
Guide to pH measurement	51300047
Guide to conductivity measurement	30099121

12 Technical Data

General

Screen	Color TFT	
Interfaces	RS232	9-pin male D-sub (Printer, barcode reader, PC keyboard)
	USB-A	USB-Stick (FAT12/FAT16/FAT32)/ Printer
	USB-B	Computer
Stirrer	Socket	5-pin Mini-DIN
	Voltage range	0.5…18 V ⎓
	Current	Max. 300 mA
Ambient conditions	Ambient temperature	5…40 °C
	Relative humidity	5…80% (non-condensing)
	Overvoltage category	Class II
	Pollution degree	2
	Range of application	For indoor use only
	Maximum operating altitude	Up to 2000 m
Standards for safety and EMC	See Declaration of Conformity	
Dimensions	Width	204 mm
	Depth	174 mm
	Height	74 mm
	Weight	890 g
Power rating instrument	Input voltage	9 - 12 V ⎓
	Power consumption	2.5 W
Power rating AC adapter	Line voltage	100 - 240 V ~ ±10 %
	Input frequency	50/60 Hz
	Input current	0.3 A
	Output voltage	12 V ⎓
	Output current	0.84 A
Materials	Housing	ABS/PC reinforced
	Window	Polymethyl methacrylate (PMMA)
	Keypad	Membrane keypad: Polyethelene terephtalate (PET)

pH measuring

Measurement range	pH	-2.000…20.000
	mV	-2000.0…+2000.0 mV
	Automatic temperature capture	-5…130 °C
	Manual temperature capture	-30…130 °C
Resolution	pH	0.1/0.01/0.001
	mV	1/0.1
	Temperature	0.1 °C
Limits of error	pH	± 0.002
	mV	± 0.1 mV (-1000…+1000 mV) ± 0.2 mV (> ±1000 mV)
	Temperature	± 0.1 °C (-5…100 °C) ± 0.3 °C (> 100 °C)
Isopotential point	pH 7.00	
pH input	BNC	Impedance > $3 \cdot 10^{12}$ Ω
Temperature input	RCA (Cinch)	NTC 30kΩ, Pt1000
Digital sensor input	Mini-LTW	
Calibration (pH)	Calibration points	5
	Predefined buffer groups	8
	User-defined buffer groups	1 user-defined group of 5 buffers
	Automatic buffer recognition	Yes
	Calibration methods	Linear, segmented

Conductivity measurement

Measurement range	Conductivity	0.000 µS/cm…1000 mS/cm
	TDS	0.00 mg/L...1000 g/L
	Salinity	0.00…80.00 psu
		0.00…80.00 ppt
	Resistivity	0.00…100.0 MΩ·cm
	Conductivity ash	0.00…2022%
	Automatic temperature capture	-5…130 °C
	Manual temperature capture	-30…130 °C
Resolution	Conductivity	Auto range
		0.000 µS/cm…9.999 µS/cm
		10.00 µS/cm…99.99 µS/cm
		100.0 µS/cm…999.9 µS/cm
		1000 uS/cm…9999 uS/cm
		10.00 mS/cm…99.99 mS/cm
		100.0 mS/cm…999.9 mS/cm
		1000 mS/cm
	TDS	Auto range, same values as conductivity
	Salinity	0.00…80.00 psu/ppt
	Resistivity	0.00 Ω·cm…99.99 Ω·cm
		100.0 Ω·cm…999.9 Ω·cm
		1000 Ω·cm…9999 Ω·cm
		10.00 kΩ·cm…99.99 kΩ·cm
		100.0 kΩ·cm…999.9 kΩ·cm
		1000 kΩ·cm…9999 kΩ·cm
		10.00 MΩ·cm…99.99MΩ·cm
		100.0 MΩ·cm… –
	Conductivity ash	0.000%…9.999%
		10.00%…99.99%
		100.0%…999.9%
		1000%…2020%
	Temperature	±0.1 °C
Limits of error	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 (-5…100 °C) ± 0.5 °C (> 100 °C)
Inputs	Conductivity	Mini-DIN conductivity sensors
	Digital sensor input	Mini-LTW digital sensors

Calibration	Calibration points	1
	Predefined conductivity standards	13
	User-defined conductivity standards	Yes
	Manual cell constant entry	Yes

13 Appendix

13.1 Buffers

METTLER TOLEDO USA (Ref. 25°C)

T [°C]	1.68	4.01	7.00	10.01
5	1.67	4.00	7.09	10.25
10	1.67	4.00	7.06	10.18
15	1.67	4.00	7.04	10.12
20	1.68	4.00	7.02	10.06
25	**1.68**	**4.01**	**7.00**	**10.01**
30	1.68	4.01	6.99	9.97
35	1.69	4.02	6.98	9.93
40	1.69	4.03	6.97	9.89
45	1.70	4.04	6.97	9.86
50	1.71	4.06	6.97	9.83

METTLER TOLEDO Europe (Ref. 25°C)

T [°C]	2.00	4.01	7.00	9.21	11.00
5	2.02	4.01	7.09	9.45	11.72
10	2.01	4.00	7.06	9.38	11.54
15	2.00	4.00	7.04	9.32	11.36
20	2.00	4.00	7.02	9.26	11.18
25	**2.00**	**4.01**	**7.00**	**9.21**	**11.00**
30	1.99	4.01	6.99	9.16	10.82
35	1.99	4.02	6.98	9.11	10.64
40	1.98	4.03	6.97	9.06	10.46
45	1.98	4.04	6.97	9.03	10.28
50	1.98	4.06	6.97	8.99	10.10

MERCK (Ref. 20°C)

T [°C]	2.00	4.00	7.00	9.00	12.00
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33

JIS Z 8802 (Ref. 25°C)

T [°C]	1.679	4.008	6.865	9.180
5	1.668	3.999	6.951	9.395
10	1.670	3.998	6.923	9.332
15	1.672	3.999	6.900	9.276
20	1.675	4.002	6.881	9.225
25	**1.679**	**4.008**	**6.865**	**9.180**
30	1.683	4.015	6.853	9.139
35	1.688	4.024	6.844	9.102
40	1.694	4.035	6.838	9.068
45	1.700	4.047	6.834	9.038
50	1.707	4.060	6.833	9.011

DIN(19266:2000) NIST (Ref. 25°C)

T [°C]	1.68	4.008	6.865	9.184	12.454
5	1.668	4.004	6.950	9.392	13.207
10	1.670	4.001	6.922	9.331	13.003
15	1.672	4.001	6.900	9.277	12.810
20	1.676	4.003	6.880	9.228	12.627
25	**1.680**	**4.008**	**6.865**	**9.184**	**12.454**
30	1.685	4.015	6.853	9.144	12.289
35	1.691	4.026	6.845	9.110	12.133
40	1.697	4.036	6.837	9.076	11.984
45	1.704	4.049	6.834	9.046	11.841
50	1.712	4.064	6.833	9.018	11.705

DIN(19267) (Ref. 25°C)

T [°C]	1.09	4.65	6.79	9.23	12.75
5	1.08	4.67	6.87	9.43	13.63
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	9.27	12.96
25	**1.09**	**4.65**	**6.79**	**9.23**	**12.75**
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.98

JJG119 (Ref. 25°C)

T [°C]	1.680	4.003	6.864	9.182	12.460
5	1.669	3.999	6.949	9.391	13.210
10	1.671	3.996	6.921	9.330	13.011
15	1.673	3.996	6.898	9.276	12.820
20	1.676	3.998	6.879	9.226	12.637
25	**1.680**	**4.003**	**6.864**	**9.182**	**12.460**
30	1.684	4.010	6.852	9.142	12.292
35	1.688	4.019	6.844	9.105	12.130
40	1.694	4.029	6.838	9.072	11.975
45	1.700	4.042	6.834	9.042	11.828
50	1.706	4.055	6.833	9.015	11.697

Technical (Ref. 25°C)

T [°C]	2.00	4.01	7.00	10.00
5	2.02	4.01	7.09	10.52
10	2.01	4.00	7.06	10.39
15	2.00	4.00	7.04	10.26
20	2.00	4.00	7.02	10.13
25	**2.00**	**4.01**	**7.00**	**10.00**
30	1.99	4.01	6.99	9.87
35	1.99	4.02	6.98	9.74
40	1.98	4.03	6.97	9.61
45	1.98	4.04	6.97	9.48
50	1.98	4.06	6.97	9.35

13.2 Conductivity standards

International (Ref. 25°C)

T [°C]	10 µS/cm	84 µS/cm	500 µS/cm	1413 µS/cm	12.88 mS/cm
5	6.13	53.02	315.3	896	8.22
10	7.10	60.34	359.6	1020	9.33
15	7.95	67.61	402.9	1147	10.48
20	8.97	75.80	451.5	1278	11.67
25	**10.00**	**84.00**	**500.0**	**1413**	**12.88**
30	11.03	92.19	548.5	1552	14.12
35	12.14	100.92	602.5	1696	15.39

Chinese Standards (Ref. 25°C)

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 Standards (Ref. 20°C)

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**	**26.600**
25	1469.65	146.97	29.393
30	1609.30	160.93	32.186
35	1748.95	174.90	34.979

Saturated NaCl (Ref. 25°C)

T [°C]	Saturated NaCl [mS/cm]
5	155.5
10	177.9
15	201.5
20	226.0
25	**251.3**
30	277.4
35	304.1

13.3 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

13.4 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

13.5 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)

13.6 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

13.7 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
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

13.8 Conductivity ash methods

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

13.8.1 Refined sugar (28 g/100 g solution) ICUMSA GS2/3-17

The formula that the instrument uses is:

$\%(m/m) = 0{,}0006 \cdot ((C1/(1+0{,}026 \cdot (T-20))) - 0{,}35 \cdot (C2/(1+0{,}026 \cdot (T-20))) \cdot K)$

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

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

The formula that the instrument uses is:

$\%(m/V) = 0{,}0018 \cdot ((C1/(1+0{,}023 \cdot (T-20)) - C2/(1+0{,}023 \cdot (T-20))) \cdot K)$

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

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