edge®
EC

INSTRUCTION MANUAL

HANNA® instruments

Dear Customer,

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using the instrument.

This manual will provide you with the necessary information for correct use of the instrument, as well as a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or view our worldwide contact list at www.hannainst.com.

TABLE OF CONTENTS

INCLUDED

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any damage, please contact your local Hanna Instruments Office.

Each instrument edge® EC (HI2003) is supplied with:
Bench cradle
Wall cradle
Electrode holder
USB cable
5 Vdc Power Adapter
Instruction Manual
Quality Certificate

HI763100: Digital four-ring conductivity probe with integrated temperature sensor
Conductivity Calibration Solution Kit

Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing.

SAFETY MEASURES

Before using this product, make sure that it is entirely suitable for your specific application and for the environment in which it is used.

Operation of this instrument may cause interference to other electronic equipment, requiring the operator to take steps to correct interference. Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid damages or burns, do not put the instrument in microwave ovens. For your and the instrument's safety, do not use or store the instrument in hazardous environments.

edge® EC enables the user to make fast, accurate measurements of commonly measured laboratory parameters using one of the Hanna Instruments edge® EC digital sensors for Conductivity. Each digital sensors has a unique serial number. Once connected to the meter, the sensor(s) are ready to measure their parameter along with temperature.

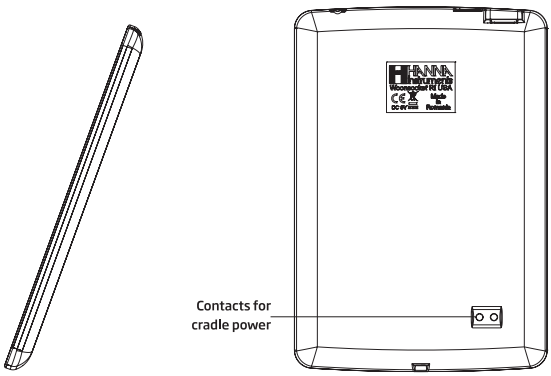
The user interface permits you to adapt edge® EC to your exact measurement requirements. The intuitive design simplifies configuration, calibration, measurement, data logging and transfer of data to a USB thumb drive or computer. edge® EC also offers a basic operation mode that streamlines measurement configuration and is useful for many routine applications. (Every feature and measurement detail is designed to give you an edge in measurement technology.)

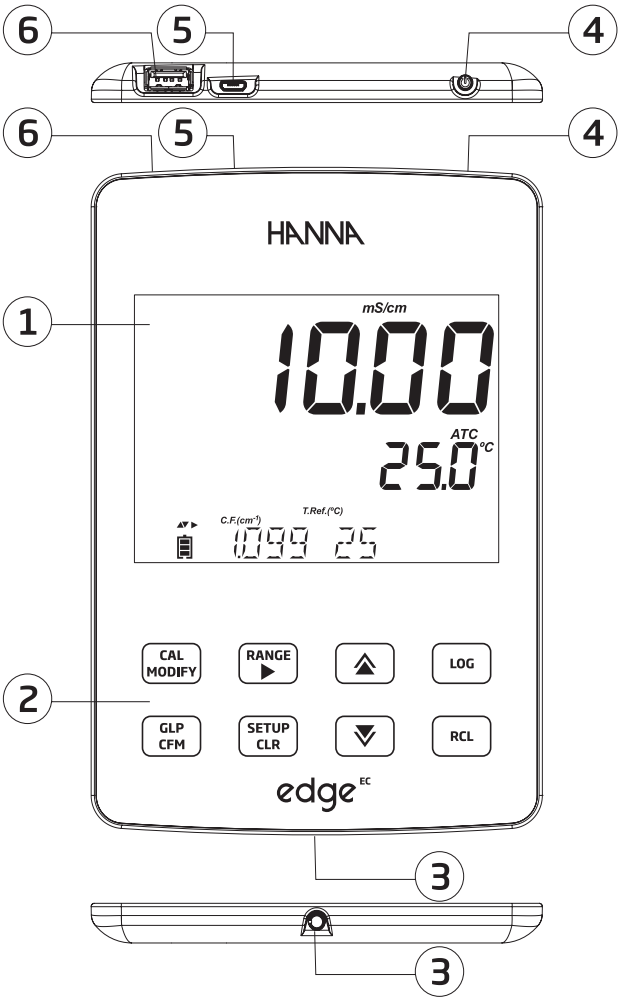
edge® EC is versatile in many ways. The slim meter and probe can be used as a portable device (using its rechargeable battery) or used in its bench or wall cradles (that also power the meter) as a line-powered laboratory instrument.

PRODUCT DIAGRAM

- Sleek, clean, intuitive design
- Internal clock and date
- Adjustable resolution
- Auto parameter recognition
- Dedicated GLP key
- GLP data included with logged data
- Basic mode for simplified operation
- Simplified data transfer to a PC
- Up to 8 hour battery life when used as a portable device

Side & Back view





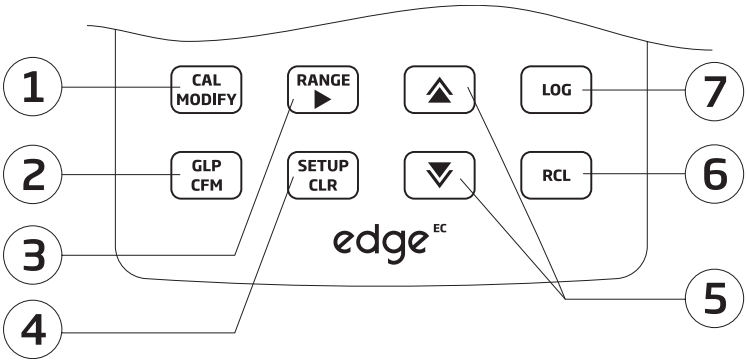
1. Liquid Crystal Display (LCD)
2. Capacitive Touch Keypad
3. 3 mm jack input for edge® EC digital probes
4. Top mounted ON/OFF button
5. Micro USB device connection for power or PC interface
6. Standard USB host connection for data transfer to a USB thumb-drive

PROBE DIAGRAM

EC Electrode

- Probes process signal directly for noise free measurements
- Auto sensor recognition
- Store calibration specific data from the last calibration
- Are built with materials suitable for use in chemical analysis
- Have integrated temperature measurement
- Incorporate a 3 mm jack termination
- Unique serial ID in every probe for traceability

KEYPAD FUNCTION



1. **CAL/MODIFY** - Used to enter and exit calibration mode. In SETUP, used to initiate changes of a configuration setting.

2. **GLP/CFM** - Used to display GLP calibration information. In SETUP, used to confirm change made. In calibration, used to accept calibration points.

3. **RANGE/▶** - Used to select measurement range. In SETUP, used to move to right in pick list. In log RCL, used to view GLP data for a data point.

4. **SETUP/CLR** - Used to enter/exit SETUP mode. During calibration, used to clear previous calibration data. In log RCL, used to clear log records.

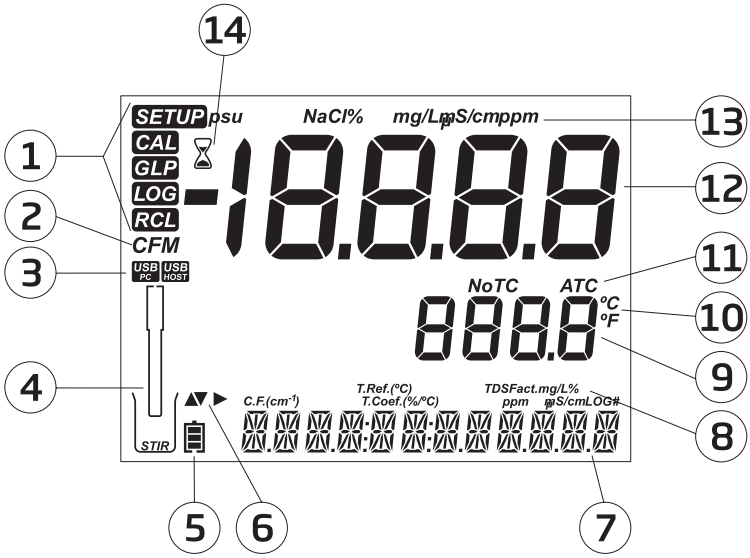
5. ⮟/⮝ - Used to scroll through SETUP menu. Used to change selection when modifying a parameter in SETUP.

6. **RCL (Recall)** - Used to view logged records or view % log memory used.

7. **LOG** - Used to log data by manual log on demand or manual log on stability or to start/stop interval logging.

Note: You can increase/decrease the speed to change the value of a parameter. Proceed as follows:
Press and hold down the ⮝ or ⮟ key, then slide the finger toward the double apex to increase the speed that a value changes.

GUIDE TO INDICATORS



1. Mode tags
2. Confirm tag
3. USB connection status
4. Probes symbol
5. Battery symbol
6. Arrow tags, displayed when they are available
7. Third LCD line, message area
8. Labels
9. Second LCD line, temperature measurement
10. Temperature units
11. Temp. Compensation status
12. Measurement line
13. Measurement units
14. Stability Indicator

The third line of the LCD (7) is a dedicated message line. During measurement the user may use the ▼ ▲ keys to select desired message. Options include date, time, calibration data, battery charge or no message. If a measurement error or log status change occurs during measurement, the third line will display a pertinent message.

SETTING UP edge® EC

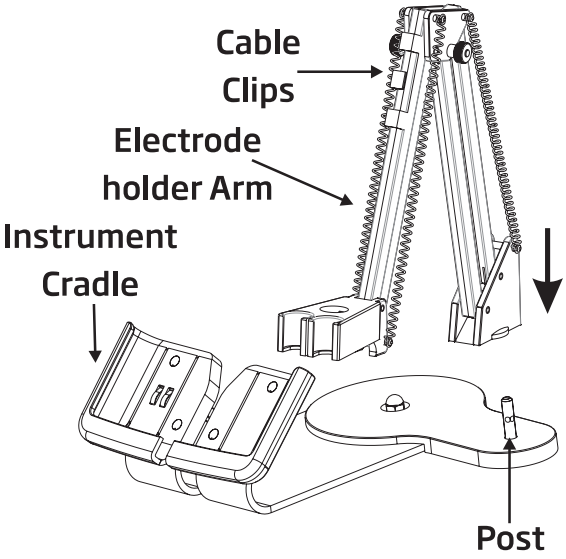
The main operating modes of edge® EC are setup, calibration, measurement, data logging, and data export. Follow this general outline of steps to get you started. The following topics are expanded upon in the sections that follow in this manual.

1. Familiarize yourself with the design features of this unique meter.
2. Decide how the meter will be used and set up the wall or bench cradle in a clean area near line power.
3. Turn edge® EC on using the ON/OFF button located on the top of the meter.
4. Plug in the probe required for measurement.
5. SETUP the measurement parameters required for the measurement you will be making.
6. Calibrate the sensor/probe.

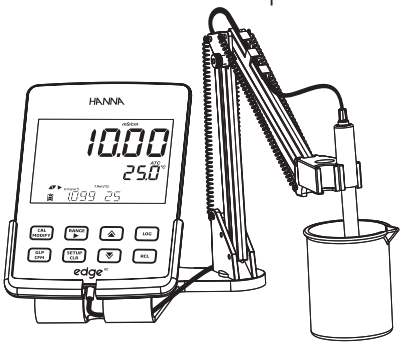
You are now ready for measurements.

Bench Cradle Setup

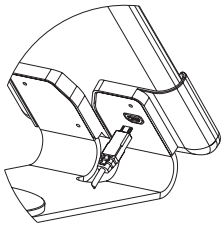
Insert electrode holder arm into the post on the pivoting base.
Connect the probe connector to the socket located at the bottom of the instrument.



Slide edge® EC into the cradle while positioning the probe cable behind the cradle. Put the probe/sensor into the electrode holder and secure cable in clips.

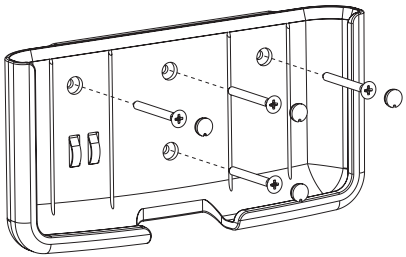


Connect the power adapter cable to the rear socket of the bench cradle. Connect the other end to the power adapter and plug into line power. Verify the battery icon indicates charging.

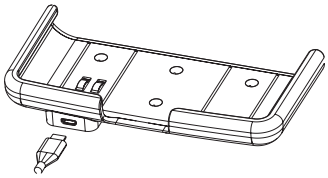


Wall Cradle Setup

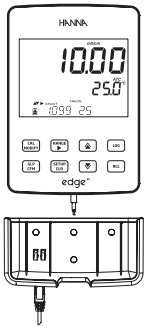
Choose suitable wall location. (Use 2.5 mm or US #3 bit). Fasten the wall cradle using the provided screws. Snap cover over screw heads.



Connect the power adapter cable to the bottom socket of the wall cradle. Connect the other end to the power adapter and plug into line power.



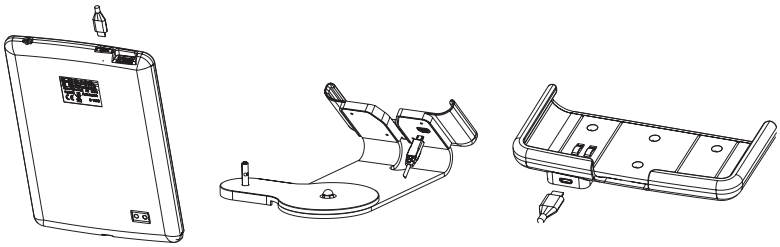
Connect 3 mm probe jack to the socket located at the bottom of edge® EC.
Slide edge® EC into the wall cradle. Verify the battery icon indicates charging.



Power Connection

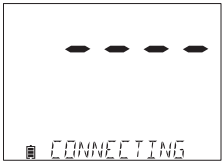
Alternatively to using the cradle for power, edge® EC can be powered by micro USB socket at the top. Plug the 5 VDC adapter into the power supply socket or by connecting directly to a PC.

Note: edge® EC is supplied with a rechargeable battery inside, which provides about 8 hours of continuous use. Whenever edge® EC is connected to the power adapter or to a PC, the battery is charging.

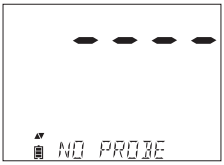


ELECTRODE & PROBE CONNECTIONS

Connect the 3 mm probe jack to the probe input located on the bottom of edge® EC. Make sure the probe is completely connected. If the probe is recognized, "CONNECTING" message is displayed along with sensor model.



If the probe is not connected or not recognized, "NO PROBE" message is displayed.



GENERAL SETUP

The following General Setup options are displayed regardless of the sensor being used. These settings remain when switching to another probe type or when no probe is attached. Options are tabulated in the table below with choices and default values. Options are accessed by pressing **SETUP/CLR** key. Loop through the options by using the ▼ ▲ keys. To modify a setting, press **CAL/MODIFY** key. The option may be modified by using **RANGE/▶**, ▲ and ▼ keys. Press **GLP/CFM** key to confirm the change. To exit SETUP press **SETUP/CLR** key.

Option	Description	Choices	Default	Basic mode
*Only seen when cable connection between micro USB and PC is made.	Select if PC is being used for charging battery (and meter will be used for logging) or if Data will be exported to the PC.	LOG ON EDGE or EXPORT TO PC	LOG ON EDGE	Available
Log	Select log type to be used from 3 types of logging: Manual log on demand Manual log on stability (3 types of stability criteria available) Timed interval lot logging	Manual Log Stability Log: Fast, Medium, Accurate; Interval Log: Seconds: 5, 10, 30; Interval Log Minutes: 1, 2, 5, 15, 30, 60, 120, 180.	Interval (5 Sec)	Manual log or Stability log: Medium
Set Calibration Expiration Warning	Meter will indicate "CAL DUE" when set time in this parameter has been exceeded.	1, 2, 3, 4, 5, 6, 7 days or OFF	7 days	Not available
Probe Specific	Parameters that are specific to a measurement type are inserted here in the SETUP list.			
Set Date	Press **CAL/MODIFY** key to Set current date, displayed in ISO format. Press **GLP/CFM** key to save changes.	YYYY/MM/DD Date	Set date	Available
Set Time	Press **CAL/MODIFY** key to Set current time, displayed in ISO format. Press **GLP/CFM** key to save changes.	24hr:MM:SS Time	Set time	Available

Option	Description	Choices	Default	Basic mode
Set Auto Off	Used to save battery life by automatically turning off when no key press is detected for time set and meter is not in active logging or calibration mode.	5, 10, 30, 60 Min or Off	10 min	Available
Sound	If enabled, a short audible tone is produced for key stroke or calibration confirmation and a longer tone for wrong key.	On or Off	On	Available
Temperature Unit	Select degree Celsius or Fahrenheit scale for displayed and logged temperatures.	°C or °F	°C	Available
LCD Contrast	Permits modification of the display contrast for various lighting conditions.	1 to 8	3	Available
Flash Format* Only seen when log errors are present.	Permits formatting the flash drive.	On or Off	Off	Available
Message Transition	User may choose how messages are displayed on third LCD line of display.	Word scroll messages or letter scroll messages	Letter scroll messages	Available
Reset Config To Default	Press the **CAL/MODIFY** key and **GLP/CFM** key (when prompted) to reset parameters.			Available: RESETS with Basic Mode OFF.
Instrument Firmware/ Probe Firmware	Displays firmware version of meter. Using the u key switches to Probe firmware (if connected) and diagnostic mode for troubleshooting.	View only	Current firmware version.	Available
Meter ID/ Meter SN/ Probe SN	User ID and Serial Number of meter and probe (if connected). Use to change between the three parameters.	Meter ID is user selectable	0000/ Serial Number	Available

**Note: Options that are seen under special conditions only.*

BASIC MODE

edge® EC offers a basic operation mode that streamlines measurement configuration for EC measurements and is useful for many routine applications. Basic EC reduces specific EC SETUP parameters to 3. The meter defaults settings to common parameters and auto ranges measurements automatically. The Basic EC meter may be used for conductivity and TDS measurements (salinity is not available). Interval logging is also eliminated. Manual and Manual medium stability Log on demand are still functional.

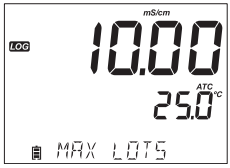
LOGGING FUNCTION

Note: If powering edge® EC through the micro USB connector to a PC, a SETUP option will require the choice "LOG ON EDGE" or "EXPORT TO PC".

1000 log records can be stored into edge® EC memory. This memory is shared between all logging types (Manual, Manual Stability, Interval logs).

The maximum number of records for an Interval lot is 600 records (provided log space is available).

A record is a stored reading and a lot is a group of records.



Each time an Interval log is initiated, a new lot is created. The maximum number of Interval lots that may be stored is 100. If a 101st lot is attempted, "MAX LOTS" will be displayed. Some lots will need to be deleted. The lot numbering is up to 999 and restarts if all lot logs are deleted. All log on demand and stability log on demand are stored in a single lot. The maximum number of records that may be stored in a Manual or Stability lot is 200 records.

If the log memory is full during any logging session, the "LOG FULL" message will be displayed on the third LCD line for a brief moment and logging will cease. The display will return to the measurement screen.

Logging type is configured in SETUP.

Types of Logging

Interval logging: A continuous log recorded using a user-selected timed period.
(This is not available in Basic mode).

Manual log on demand: Readings are logged each time **LOG** key is pressed. All of the records are stored in a single Manual lot. New records made on different days are stored in the same Manual lot.

Manual Stability log on demand: A log on demand that is made each time **LOG** key is pressed and the stability criteria is reached. Stability criteria may be set to Fast, Medium or Accurate settings.

In Setup mode, choose log parameter, press **CAL/MODIFY** key then use the **RANGE/▶** key to select between Interval, Manual, or Stability. When Interval is displayed, use the ▲ and ▼ keys to select the setting for the timed interval. When Stability is displayed, use the ▲ and ▼ keys to select the measurement stability setting.

A complete set of GLP information including date, time, range selection, temperature reading, calibration information and probe serial number is stored with each log made.

Interval Logging

Select Interval and sampling period in the SETUP menu (Not available in Basic mode). To start Interval logging, press the **LOG** key while the instrument is in measurement mode.

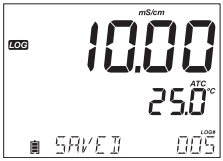
A "PLEASE WAIT" message will be displayed followed by the number of free spaces. During active interval logging, lot information is displayed on the third LCD line. The line indicates in which lot the data will be placed and keeps track of the number of logged records taken. The "LOG" tag is continuously on during active logging.

Pressing **RANGE/▶** key during an interval log will display the number of logs available.

Pressing the **LOG** key again will stop the Interval logging session. The "LOG STOPPED" message will be displayed for a few seconds.
If a sensor failure occurs during interval logging, the message "OUT OF SPEC." will alternate with logging information.

Manual Logging

Select Manual in the SETUP menu. To initiate a Manual log, press the **LOG** key while the instrument is in measurement mode. The "PLEASE WAIT" screen will be displayed briefly followed by a screen indicating the measurement has been saved and then a screen indicating the log record number.



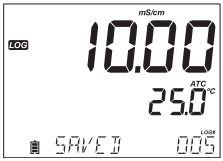
The "LOG" tag will be displayed on all 3 screens.
"PLEASE WAIT"
"SAVED" with the log record number
"FREE" with the number of free spaces available

Stability Logging

Select Stability and choose measurement stability criteria in the SETUP menu. Only Stability Medium is available in Basic mode. To initiate the Stability log, press the **LOG** key while the instrument is in measurement mode.

The "PLEASE WAIT" screen will be displayed briefly followed by a screen showing the stability tag, "LOG" tag and a "WAITING" message. The log can be stopped while the "WAITING" message is displayed by pressing **LOG** key again.

When the stability selected criteria has been met, a "SAVED" message will be displayed followed by a screen indicating how much log space is available. The "LOG" tag will be displayed on all 4 screens.

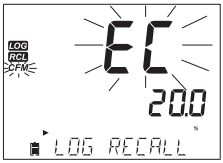


"PLEASE WAIT"
"WAITING"
"SAVED" with the log record number
"FREE" with the number of free spaces available

VIEWING LOGGED DATA

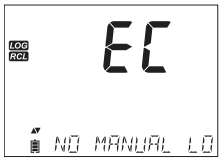
All log records stored on edge® EC may be viewed on the meter by pressing the **RCL** key. If no sensor or probe is connected, use the **RANGE/▶** key to select the desired measurement type.
Press **GLP/CFM** key to display those logs. Choices are:

- Manual log on demand lot,
- Manual log on stability lot,
- Individual Interval logging lots.



If no data was logged for the selected measurement range, the instrument displays the following messages:

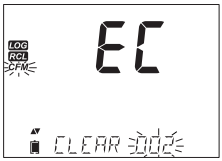
- "NO MANUAL LOGS"
- "NO STABILITY LOGS"



Press **GLP/CFM** key to enter inside lot information to view recorded data.
Use the ▲▼ keys to toggle between different records.
Use **RANGE/▶** key to display GLP data including calibration information, date, time, etc.
Press **SETUP/CLR** key then **GLP/CFM** key when deleting records or lots.
Press **RCL** key to exit the logging type.
Press **RCL** key to return to the measurement screen.

Delete Logging Type/Lot

Press **RCL** and select the parameter log.
Use the ▲▼ keys to select the Manual/Stability records or Interval lots to delete. Press **SETUP/CLR** key. The instrument will display "CLEAR MANUAL" for Manual Records, "CLEAR STAB" for Stability Records.



For Interval lots, the message "CLEAR", followed by the selected lot will be displayed with "CFM" tag blinking.
Press the ▲▼ keys to select a different lot. Press **GLP/CFM** key. The instrument will display "PLEASE WAIT".

"CLEAR DONE" is displayed for a few seconds after the selected Interval lot is deleted.

Delete Records (Manual and Stability log on demand)

To delete individual records (Manual and Stability logs only), enter Manual (Stability) log by pressing **GLP/CFM** key when Manual (Stability) is displayed. Use the ▲▼ keys to select the record to be deleted and then press **SETUP/CLR** key.

The instrument will display "CLEAR REC." and record number along with "CFM" tag blinking. Use the ▲▼ keys to select another record if necessary.

Press **GLP/CFM** key. The instrument will display "PLEASE WAIT" and then "CLEAR DONE" message. When individual logs are deleted within saved MANUAL or STABILITY logs, the logs will renumber, filling in the deleted data but staying in chronological order.
To delete all records of the MANUAL (STABILITY) log, proceed as described on page 19 for LOTS.

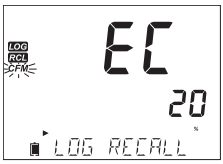
Select the Manual (Stability) lot and press **SETUP/CLR** key. The "CLEAR" message will be displayed along with "MANUAL" or "STABILITY" and CFM tag blinking on the LCD. Press the **GLP/CFM** key to confirm the deleting of the selected lot (MANUAL or STABILITY) or all records. Press **SETUP/CLR** key to exit without deleting.

The lot number is used to identify particular sets of data. The lot numbers are allocated successively until 100, even if some lots were deleted. The total number of lots that can be saved is 100. If some are deleted (for example 1-50), fifty additional logs may be stored. These will be numbered 101-150. The lots are allocated successively (provided available memory space) until 999 is reached. After this, it is necessary to delete all the LOT logs to start over the numbering.

Delete All

All logs may be deleted in a single clear. This function will delete all MANUAL, STABILITY and INTERVAL logs.

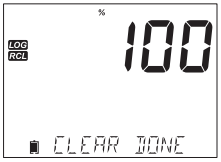
Press the **RCL** key while EC is displayed on the first LCD line, and the third LCD line message states "LOG RECALL". Press **SETUP/CLR** key.



"CLEAR ALL" will be displayed with "CFM" and "EC" tags blinking. Press **GLP/CFM** key.

"PLEASE WAIT" and the percent cleared will be displayed until completed.

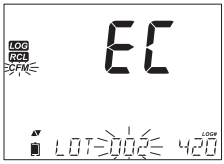
Note: If SETUP/CLR key is pressed in error, press SETUP/CLR key again to exit without deleting.



PC & STORAGE INTERFACE

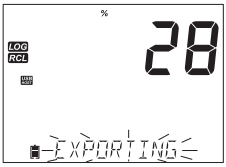
Logged data on edge® EC can be transferred from the meter to a USB flash drive by using the log recall function. The minimum requirement for the drive is USB 2.0. Select the EC record you wish to export and follow the simple steps below.

Connect USB flash drive to the USB port, located on the top of the meter. Press the **RCL** key. Press the **GLP/CFM** key. Select Manual, Stability, or interval lots by using the ▼ ▲ keys. Press the **LOG** key (not **GLP/CFM** key). The "USB HOST" tag should come on.

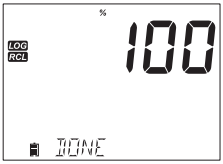


"PLEASE WAIT" message appears followed by "EXPORT".
Press **GLP/CFM** key to export the selected record or lot.
If **GLP/CFM** key is not pressed within 10 seconds, the USB host will become inactive.

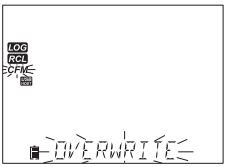
The meter will display the percentage of export.



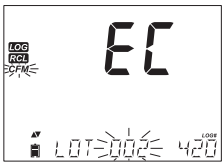
The export percentage should go to 100%. Remove USB flash drive.



If the selected file is already saved on the flash drive, edge® EC will ask for confirmation of overwriting the existing file. The message "OVERWRITE' and "CFM" tag will blink. Press **GLP/CFM** key for overwriting the existing file or **CAL/MODIFY** key to exit without exporting.



After exporting the display will return to the selected file. Press the **RCL** key twice to return to measurements.



Note: Do not remove USB flash drive during an active export transfer.

Logged data on the edge® EC can be transferred from the meter to a PC by following these simple directions. Suitable operating systems include Windows (XP minimum), OS X or Linux.

1. Connect edge® EC to the PC using the supplied micro USB cable.
2. Turn on edge® EC.
3. Press **SETUP/CLR** key and select "LOG ON EDGE".
4. Press **CAL/MODIFY** key then use ▲▼ keys to change to "EXPORT TO USB".
5. Press **GLP/CFM** key and the USB/PC Tag is displayed.
6. Press **SETUP/CLR** key to exit.

The PC should detect the USB as a removable drive. Open the drive to view the stored files. Log files are formatted as Comma separated values (*.CSV) and can be opened with any text editor or spreadsheet program.

Note: Western Europe (ISO-88859-1) character set and English language are suggested settings.
Other files may be visible depending upon computer settings. All files stored will appear in this folder.
Adjust Font or column width, appropriately. Adjust the decimal places.
All conductivity measurements will be displayed as µS/cm.

Interval logs is designated as EC Lots. ie. ECLOT001, ECLOT002, ECLOT003.
The Manual Lots are ECLOTMAN.
The Stability Lots are ECLOTSTAB. All stability logs, regardless of stability setting, are located in the same stability file for that measurement.

Click on the desired log to view data.

Note: If "°C !" appeared in log data, the electrode/probe was used beyond it's operation specifications and the data is not considered reliable.
If "°C !!" appeared in log data, the temperature sensor within the probe or electrode is broken and the device should be replaced. Logged data should not be considered reliable.

Steps To Optimize EC Measurement

Follow these steps to optimize measurement using an EC probe:

1. Determine what measurement you wish to make with the EC probe. (See below)
2. Determine if Standard or Basic mode is best for your measurement.
3. Connect the Probe and configure your measurement using the SETUP menu.
4. Calibrate the EC probe.
5. Take measurements using an EC probe.

Measurements Available With The EC Probe

The four-ring EC probe may be used for 3 different measurement applications with edge® EC.

- It may be used for temperature compensated or absolute conductivity measurements (with units of µS/cm or mS/cm).
- TDS (Total Dissolved Solids) measurements (a calculated measurement derived from the ionized particles in a sample and the conductivity measurement). This has measurement units of mg/L, ppm or g/L.
- Salinity (not available in basic mode): 3 different seawater salinity scales are supported; Practical Salinity (PSU), the Natural Seawater Scales (g/L), and the NaCl %.

The **RANGE/▶** key is used to change from conductivity to TDS (and to Salinity available in standard mode only).

BASIC VERSUS STANDARD EC MODE

Standard operation mode allows complete configuration of all options for the measurement of Conductivity, TDS or Salinity measurements. Measurement data can be logged using Manual log on demand, Manual Log on Stability or Interval logs. All logged data can be exported to a thumb drive or PC. Basic operation mode is used for conductivity and TDS measurements. Common default values are used for Cell Factor (C.F.), temperature compensation coefficient and TDS conversion factor. Measurement units are user-selectable for TDS. The meter uses continuous auto-ranging to simplify the measurement experience.

	Standard	Basic
Measurement	Conductivity, TDS, Salinity	Conductivity, TDS
Set up Parameters	Fully selectable	Default values used
Log types	Manual Log on demand Manual Log on stability (Fast, Medium, Accurate) Interval Logging	Manual Log on demand Manual Log on stability (Medium)

EC METER CONFIGURATION

EC (Electrolytic Conductivity) meter operation is configured using the **SETUP/CLR** key with an EC probe connected to the meter. The EC-specific parameters will be seen inserted into the menu. If Basic mode is "On", the EC parameter list will be simplified, limiting the options that the user can change. See Basic mode for a description of this operation before choosing how to SETUP the meter.

Option	Description	Choices	Default	Basic mode
Basic Mode		Off or On	Off	Available
Temperature Compensation	The user may select Automatic Temperature Compensation or No TC to configure absolute conductivity.	No TC or ATC	ATC	Not available. ATC is automatically used.
C.F (cm^{-1})	User may enter actual Cell factor value Manual calibration. (see page 35)	0.010 to 9.999 cm^{-1}	1.000 cm^{-1}	Not available. Automatically determined during calibration.
T.Coef. (%/ºC)	This parameter is related to the solution being measured at temperatures other than 20 or 25 ºC. It is used to correct measured conductivity to a reference temperature by applying a fixed factor for linear compensation.	0.00 to 6.00 (%/ºC) Note: Setting to 0.00 is the same as using No TC.	1.90 (%/ºC) Close for natural waters or salt solutions.	Not available. Automatically set to 1.90%/ºC.
T.Ref. (ºC)	The user may select either 20ºC or 25ºC reference temperature for temperature corrected conductivity.	20 ºC or 25 ºC	25 ºC	Available
TDS Conversion Factor.	This factor is used to mathematically convert conductivity to a TDS value.	0.40 to 0.80	0.50	Not Available. Automatically set to 0.50.

Option	Description	Choices	Default	Basic mode
View T.Ref. or T.Coef.	The user may choose whether to display the reference temperature (T.Ref) or the Temperature coeficient on the display with the measurement.	T.Ref.(ºC) or T.Coef.(%/ºC)	T.Ref (ºC)	T.Ref (ºC) automatically displayed during measurement.
EC Range	If AUTO is used, edge® EC will automatically find the correct conductivity range and unit. If a fixed value is used, measurements made outside the ranges are considered Out of Range, but units will remain fixed throughout the measurement.	AUTO, 29.99 µS/cm, 299.9 µS/cm, 2999 µS/cm, 29.99 mS/cm, 200.0 mS/cm, 500.0 mS/cm	AUTO	Not available but measurement autoranges as needed.
TDS Range	If AUTO is used, edge® EC will automatically find the correct TDS measurement range and units. If a fixed value is used, measurements made outside the ranges are considered Out of Range, but units will remain fixed throughout the measurement.	AUTO, 14.99 mg/L, 149.9 mg/L, 1499 mg/L, 14.99 g/L, 100.0 g/L, 400 g/L	AUTO	Not available but measurement autoranges as needed.
TDS Unit	Select units of measurement for TDS measurement.	mg/L or ppm	ppm	Available to select.
EC Salinity Scale	Three measurement scales are available for salinity measurement in Seawater. (Practical Salinity Scale, Percent Scale and Natural Seawater Scale).	PSU, NaCl%, g/L	NaCl%	Not available.

Cell Factor (cm^{-1}) Manual Calibration

This option may be used to perform a manual calibration in a custom standard.

1. Rinse the probe with a aliquot of standard and shake off excess solution.
2. Place the probe in the standard. The sleeve holes must be covered with solution.
3. Press **SETUP/CLR** key and use the ▲▼ keys to get to C.F. (cm^{-1})
4. Press **CAL/MODIFY** key.
5. Use the ▲▼ keys to change C.F. (cm^{-1}) until the display reads the Custom Standard value.
6. Press **GLP/CFM** key. The message "MANUAL CALIBRATION CLEARS PREVIOUS CALIBRATIONS" will be displayed on the third line LCD. "CAL" and "CFM" tags will blink. Press **GLP/CFM** key to confirm the manual calibration.

Note: GLP will display "Manual" for a standard. Using this calibration technique will erase any previous calibrations done in CAL. Log files will indicate "MANUAL" as standard.

User Selectable EC/TDS Range (Not Available In Basic Mode)

The EC and TDS measurements may be configured in SETUP as AUTO (meaning auto ranging, the measurement automatically finds the correct conductivity or TDS unit and resolution), or it may be configured with a user-selected measurement range and resolution (if you know ahead of time where your samples will fall). If AUTO is selected, the meter will select the scale with the highest possible resolution, but may change in the middle of a series of measurements changing units and displayed resolution.

Note: The selected range is only active during measurements. Auto ranging is used during calibration. If a fixed range is selected and during measurement goes beyond the range limits, the full scale value of that range will flash on the display. All log data in the CSV files will be displayed in µS/cm.

EC/TDS CALIBRATION

General Guidelines

Calibrate the instrument frequently, especially if high accuracy is required.
The instrument should be recalibrated:

- Whenever the EC probe is replaced.
- At least once a week.
- After testing aggressive chemicals.
- If "CAL DUE" is displayed on the third LCD line.

Every time you calibrate the instrument use fresh standard and perform electrode maintenance as required. It is recommended to choose a calibration standard that is close to the sample.

Preparation

Pour small quantities of the standard solutions into a beaker. If possible, use a plastic beaker to minimize any EMC interferences. For accurate calibration and to minimize cross-contamination, use two beakers for the standard solution; one for rinsing the probe and one for calibration.

Procedure

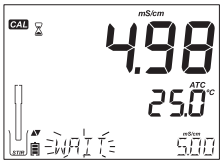
Select standard to be used for calibration. 0.00 µS (probe in air) may be used for an offset calibration.

This should be done first. Hanna Instruments Conductivity standards are available at 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm and are used for the cell factor calibration.

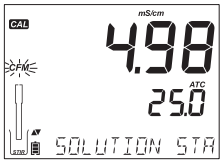
Rinse the probe with calibration solution or deionized water. Shake off excess solution. Submerse the probe in the calibration solution. The sleeve holes must be completely submersed. If possible, center the probe in the beaker away from the bottom or beaker walls.

Raise and lower the probe to refill the center cavity and tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

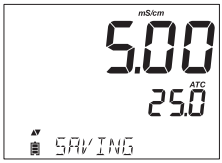
Press **CAL/MODIFY** key to enter calibration. The "CAL" tag and the recognized standard value will appear on the third LCD line. If necessary, press the ▲ ▼ keys to select a different standard value. The "⧖" along with "STIR" tag will be displayed and "WAIT" will blink on the LCD until the reading is stable.



When the reading is stable and close to the selected standard, "CFM" tag will blink, the message " SOL STD" and the value will be displayed.



Press **GLP/CFM** key to confirm calibration. The instrument displays "SAVING", stores the calibration values and returns to measurement mode.



Conductivity vs Temperature Chart

The following table lists the temperature dependence of Hanna Instruments EC calibration standards. edge® EC uses these values and their temperature coefficients during calibration.

°C	°F	HI7030 HI8030 (µS/cm)	HI7031 HI8031 (µS/cm)	HI7033 HI8033 (µS/cm)	HI7034 HI8034 (µS/cm)	HI7035 HI8035 (µS/cm)	HI7039 HI8039 (µS/cm)
0	32	7150	776	64	48300	65400	2760
5	41	8220	896	65	53500	74100	3180
10	50	9330	1020	67	59600	83200	3615
15	59	10480	1147	68	65400	92500	4063
16	60.8	10720	1173	70	67200	94400	4155
17	62.6	10950	1199	71	68500	96300	4245
18	64.4	11190	1225	73	69800	98200	4337
19	66.2	11430	1251	74	71300	100200	4429
20	68	11670	1278	76	72400	102100	4523
21	69.8	11910	1305	78	74000	104000	4617
22	71.6	12150	1332	79	75200	105900	4711
23	73.4	12390	1359	81	76500	107900	4805
24	75.2	12640	1386	82	78300	109800	4902
25	**77**	**12880**	**1413**	**84**	**80000**	**111800**	**5000**
26	78.8	13130	1440	86	81300	113800	5096
27	80.6	13370	1467	87	83000	115700	5190
28	82.4	13620	1494	89	84900	117700	5286
29	84.2	13870	1521	90	86300	119700	5383
30	86	14120	1548	92	88200	121800	5479
31	87.8	14370	1575	94	90000	123900	5575

NaCl % CALIBRATION

Preparation

Pour a small quantity of the calibration solution into a beaker. If possible, use a plastic beaker to minimize any EMC interferences.

Before pressing **CAL/MODIFY** key verify in SETUP:

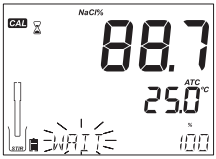
- Basic mode is off.
- Salinity Scale is set to NaCl%.

In measurement mode use the **RANGE/▶** key to select the Salinity measurement. The NaCl% tag will be on. NaCl calibration is a single point calibration at 100.0% NaCl. Use the HI7037 calibration solution (sea water solution) as a 100% NaCl calibration solution.

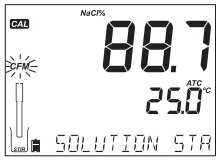
Procedure

Rinse the probe with some of the HI7037 calibration solution or deionized water. Shake off excess solution. Submerse the probe in the calibration solution. The sleeve holes must be completely submersed. If possible, center the probe in the beaker away from the bottom or beaker walls. Raise and lower the probe to refill the center cavity and tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

Press **CAL/MODIFY** key to enter calibration. The "⧖", "STIR" and "CAL" tags will turn on and the first LCD line will display the percent NaCl reading, the second LCD line will display the temperature and the third LCD line will display "WAIT" message blinking until the reading is stable.



When the reading is stable and close to the standard, "CFM" tag will blink and "SOLUTION STANDARD" message will be displayed.



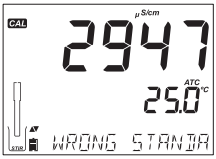
Press **GLP/CFM** key to confirm calibration.

The Instrument displays "SAVING", stores the calibration values and returns to measurement mode.

Note: If a new EC calibration is performed, the NaCl calibration is automatically cleared. A new NaCl calibration is required.

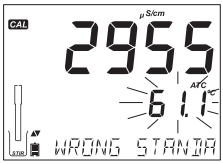
CALIBRATION MESSAGES

Wrong Standard



If the reading is too far from the expected value, the message "WRONG STANDARD" will scroll. Calibration cannot be confirmed. In this case check if the calibration solution has been used correctly or clean the probe by following the instructions for EC PROBE MAINTENANCE (see page 38).

Wrong Standard Temperature



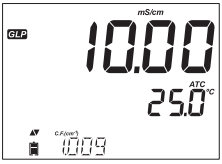
If the temperature is out of the 0.0 to 60.0 ºC range, "WRONG STANDARD TEMPERATURE" message will be displayed and the temperature value will blink.

EC/TDS GLP INFORMATION

GLP is a set of functions that allows storage and retrieval of data regarding the maintenance and status of the electrode. The following information can be viewed on the third LCD line during measurement:
TEMPERATURE SENSOR problem (if there is one)
CAL DUE or CELL FACTOR
T.Coef. or T.Ref. (User selected)
TIME
DATE
RANGE
BATTERY or CHARGE STATUS

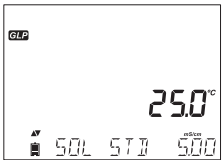
To view more information, enter GLP mode by pressing **GLP/CFM** key.
EC calibration data is stored automatically after a successful calibration.
To view the EC calibration data, press **GLP/CFM** key when the instrument is in EC measurement mode. The instrument will display the calibration standard and the temperature of the calibrated standard. Use the ▲ ▼ keys to scroll through the calibration data displayed on the third LCD line.

The cell factor in cm^{-1} determined from the calibration with the current reading.

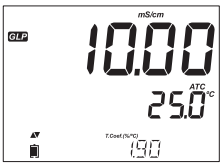


The calibration offset factor in $\mu S/cm$ together with the current reading.

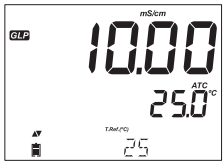
The Solution Standard and calibration temperature.



The temperature coefficient used during calibration with the current reading.



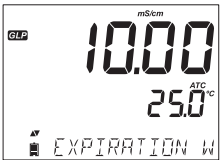
The reference temperature together with the current reading.



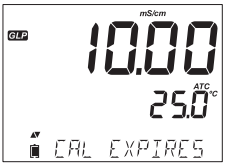
The time (hh:mm:ss) of the last calibration together with the current reading.

The date (yyyy.mm.dd) of the last calibration together with the current reading.

Calibration Expiration status together with the current reading:
If disabled, “EXPIRATION WARNING DISABLED” is displayed.

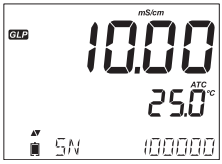


If enabled, the number of days until the calibration alarm “CAL DUE” will be displayed. (i.e. “CAL EXPIRES IN 2 DAYS”)



If enabled, the number of days since the calibration expired. (i.e. "CAL EXPIRED 2 DAYS AGO").

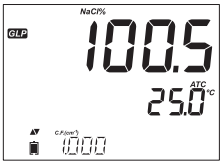
The serial number of the probe together with the current reading.



NaCl% GLP INFORMATION

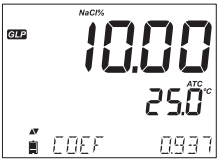
NaCl% Calibration Data in GLP

To view the NaCl% calibration data, press **GLP/CFM** key when the instrument is in NaCl% measurement mode. Use the ▲▼ keys to scroll through the calibration data. The instrument will display the calibration temperature and solution.

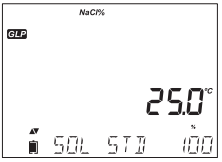


The cell factor in cm^{-1} determined from the calibration with the current reading.

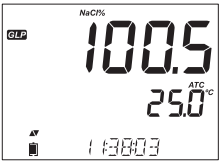
The salinity coefficient determined from the calibration together with the current reading.



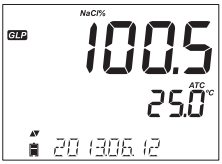
The Solution Standard together with the calibrated temperature.



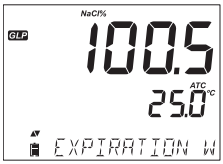
The time (hh:mm:ss) of the last calibration together with the current reading.



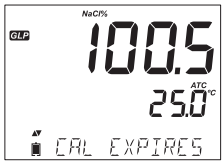
The date (yyyy.mm.dd) of the last calibration together with the current reading.



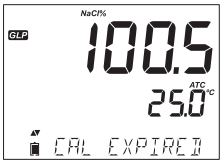
Calibration Expiration status together with the current reading:
If disabled, "EXPIRATION WARNING DISABLED" is displayed.



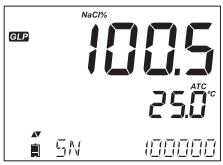
If enabled, the number of days until the calibration alarm "CAL DUE" will be displayed. (i.e. "CAL EXPIRES IN 2 DAYS")



If enabled, the number of days since the calibration expired. (i.e. "CAL EXPIRED 2 DAYS AGO").



The serial number of the probe.



Note: Press GLP/CFM key at any moment and the instrument will return to measurement mode.

The **RANGE/▶** key will change measurement from conductivity to TDS or to Salinity.

EC/TDS MEASUREMENTS

Conductivity Measurements

Connect the conductivity probe to the instrument and wait until probe parameters are loaded. When an edge® EC probe is connected, the instrument will recognize it.
Verify if the probe has been calibrated. Suspend the probe into the solution to be tested. The sleeve holes must be completely submersed. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

The conductivity value will be displayed on the first LCD line, the temperature on the second LCD line and calibration or range specific information on the third LCD line.

To toggle between information displayed on the third LCD line, use the ▲ ▼ keys.
If the reading is out of range when the range is set to automatic, the full-scale value (200.0 mS/cm for ATC mode or 500.0 mS/cm for absolute conductivity) will be displayed blinking.

Note: Temperature-compensation and absolute conductivity (NoTC) are selected in the SETUP configuration.

Automatic Temperature Compensation (ATC): The conductivity probe has a built-in temperature sensor; the temperature value is used to automatically compensate the EC/TDS reading. When this option is selected, "ATC" tag is displayed. A temperature coefficient for the sample must also be set.

No Temperature Compensation (No TC): The temperature value is displayed, but not taken into account. When this option is selected, the "NoTC" tag will be displayed. The reading displayed on the primary LCD is the uncompensated EC or TDS value.

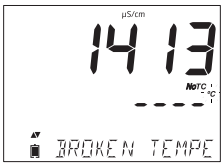
Note: The default compensation mode is ATC.
The compensation is referenced to the selected reference temperature (see SETUP for details).

If temperature compensation is selected, measurements are compensated using the temperature coefficient (default value 1.90 %/°C, is recommended for natural water samples).
To change the temperature coefficient, enter the SETUP mode and select "T.Coef.(%/°C)" (see SETUP).
The current temperature coefficient can be viewed on the third LCD line by pressing the ▲ ▼ keys until it is displayed. The value is displayed along with Cell Factor (the factor that is used to convert the measured conductance to conductivity, based on the geometry of the cell). If the temperature reading is out of range, the closest full scale value will be displayed with "°C" blinking on the second LCD line.

Error Messages During Measurement

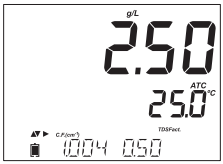
If the EC temperature exceeds the limit of the probe, the message "PROBE OUT OF SPEC" will scroll on the third LCD line. The temperature will continue to be displayed blinking. If temperature exceeds the meter specification of 120° C, then "120° C" will blink on the display. If interval logging, the message "OUT OF SPEC." will alternate with the Log specific messages in both of these cases.

The Log file will indicate a "ºC!" next to the data. In this case the temperature sensor is damaged, "BROKEN TEMPERATURE SENSOR" , "---" along with NoTC tag will be displayed and the unit tag will blink on the LCD. If logging when this occurs, the Log file will indicate "ºC!!" next to the data. Absolute conductivity (NoTC) will be marked with an "A" in the CSV files and dashes will appear in the temperature field.



TDS Measurements

Press the **RANGE/▶** key. The instrument will switch to TDS measuring range. The TDS reading will be displayed on the first LCD line and the temperature reading on the second LCD line. If the reading is out of range, the full-scale value (100.0 g/L for ATC mode or 400.0 g/L for uncompensated TDS) will be displayed blinking along with a message on the display.



SALINITY MEASUREMENTS

Salinity Measurements (Not Available In Basic Mode)

Press the **RANGE/▶** key twice to switch from conductivity to the configured Salinity scale. Verify the desired scale is configured in SETUP. The meter supports three salinity scales: Practical Scale 1978, Percent Scale %, and Natural Sea Water 1966, [g/L]. (Information on the 3 scales follows).

Note: These are for determining salinity as they relate to general oceanographic use. Practical salinity and the Natural Seawater require a conductivity calibration. NaCl % requires a calibration in HI7037 standard.

PSU - Practical Salinity Units

The practical salinity (S) of seawater relates the ratio of electrical conductivity of a normal seawater sample at 15 ºC and 1 atmosphere to a potassium chloride solution (KCl) with a mass of 32.4356 g/Kg water at the same temperature and pressure.

Under these conditions the ratio is equal to 1, and S = 35. The practical salinity scale may be applied to values to through 42.00 PSU at temperatures between -2 to 35 ºC.

According to the definition, salinity of a sample in PSU (practical salinity units) is calculated using the following formula:

$$R_T = \frac{C_T(\text{sample})}{C(35;15)\cdot r_T}$$

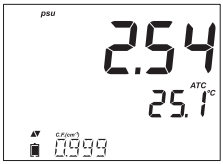
$$r_t = 1.0031\cdot 10^{-9}T^4 - 6.9698\cdot 10^{-7}T^3 + 1.104259\cdot 10^{-4}T^2 + 2.00564\cdot 10^{-2}T + 6.766097\cdot 10^{-1}$$

$$Sal = \sum_{k=0}^{5} a_k \cdot R_T^{\frac{k}{2}} + f(t)\cdot\sum_{k=0}^{5} b_k R_T^{\frac{k}{2}} - \frac{c_0}{1+1.5X+X^2} - \frac{c_1 f(t)}{1+Y^{\frac{1}{2}}+Y^{\frac{3}{2}}}$$

$$f(t) = \frac{T-15}{1+0.0162\cdot(T-15)}$$

R_T - ratio of sample conductivity to standard conductivity at Temp =(T)
C_T(sample) - uncompensated conductivity at T °C;
C(35,15) =42.914μS/cm - the corresponding conductivity of KCl solution containing a mass of 32.4356 g KCl/1 Kg solution
r_T - Temperature compensation polynomial

$a_0 = 0.008$	$b_0 = 0.0005$	$c_0 = 0.008$
$a_1 = -0.1692$	$b_1 = -0.0056$	$c_1 = 0.0005$
$a_2 = 25.3851$	$b_2 = -0.0066$	$X = 400R_T$
$a_3 = 14.0941$	$b_3 = -0.0375$	$Y = 100R_T$
$a_4 = -7.0261$	$b_4 = 0.0636$	
$a_5 = 2.7081$	$b_5 = -0.01442$	

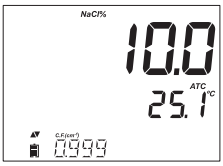


$$f(t) = \frac{T-15}{1+0.0162\cdot(T-15)}$$

NaCl% Percent Scale

The NaCl% scale is an older salinity scale used for seawater salinity. In this scale 100% salinity is equivalent to roughly 10% solids. High percentages were made by evaporation. To display NaCl in % units, enter SETUP and select NaCl% unit. Press the **RANGE/▶** key until "NaCl%" is displayed on the LCD. The instrument will display the NaCl% reading on the first LCD line and the temperature reading on the second LCD line.

If the reading is out of range, the full-scale value (400.0%) will be displayed blinking.



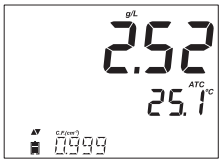
Natural Sea Water Scale

The Natural Sea Water Scale extends from 0.00 - 80.00 g/L. It determines salinity based upon a conductivity ratio of sample to "standard seawater" at 15 °C.

$$R_{15} = \frac{C_T(\text{Sample})}{C(35,15) \bullet r_T}$$

Where R_{15} is the conductivity ratio and salinity is defined by the following equation:

$$S = -0.08996 + 28.2929729R_{15} + 12.80832R_{15}^{2} - 10.67869R_{15}^{3} + 5.98624R_{15}^{4} - 1.32311R_{15}^{5}$$

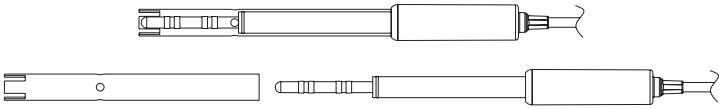


Note: The formula can be applied for temperatures between 10 °C and 31 °C.

If the reading is out of the measurement range, the display will flash the highest value possible and a warning message will be displayed. If this occurs during a log a "!" will be placed next to the measurement unit. Data found in the CSV file with a "!" should not be considered relible.

EC PROBE MAINTENANCE

Rinse the probe with clean water after measurements. If a more thorough cleaning is required, remove the probe sleeve and clean the probe with a cloth or a nonabrasive detergent. Make sure to reinsert the sleeve onto the probe properly and in the right direction. After cleaning the probe, recalibrate the instrument.



The insulator used to support the platinum rings is made of glass. Use extreme caution when handling this probe.

TROUBLESHOOTING GUIDE

Symptoms	Problems	Solution
Readings fluctuate up and down (noise).	EC probe sleeve not properly inserted; air bubbles inside sleeve.	Reinstall the sleeve. Tap the probe to remove air bubbles. Move to center of beaker. Verify top hole in sleeve is covered with solution.
The meter does not accept the standard solution for calibration.	Wrong Standard used or the EC probe is defective.	Follow the cleaning procedure. If still no results replace the probe. Verify correct standard is selected.
The display shows EC, TDS or Salinity readings blinking.	Out of range in EC, TDS or Salinity scale.	Verify the plastic shipping spacer has been removed from probe. Recalibrate the probe. Make sure the solution is in specified range. Make sure the range is not locked. (Select Auto range)
The meter does not measure temperature. "----" is displayed on second LCD line.	Broken temperature sensor.	Replace the probe.
The meter fails to calibrate Salinity.	Incorrect EC calibration.	Recalibrate the meter in EC range. Set cell constant to 1.
At startup the meter displays all LCD tags permanently.	One of the keys is stuck.	Check the keyboard or contact your local Hanna Instruments Office.
CAL "Prod" message at startup.	Instrument was not factory calibrated or lost factory calibration.	Contact your local Hanna Instruments Office.

	EC	TDS	Salinity
Range	0.00 to 29.99 µS/cm, 30.0 to 299.9 µS/cm, 300 to 2999 µS/cm, 3.00 to 29.99 mS/cm, 30.0 to 200.0 mS/cm, up to 500.0 mS/cm, absolute conductivity ‡	0.00 to 14.99 ppm (mg/L), 15.0 to 149.9 ppm (mg/L), 150 to 1499 ppm (mg/L), 1.50 to 14.99 g/L, 15.0 to 100.0 g/L, up to 400.0 g/L absolute TDS ‡ (with 0.80 factor)	0.0 to 400.0% NaCl *, 2.00 to 42.00 PSU *, 0.00 to 80.00 g/L *
Resolution	0.01 µS/cm, 00.1 µS/cm, 1 µS/cm, 0.01 mS/cm, 0.1 mS/cm	0.01 ppm, 0.1 ppm, 1 ppm, 0.01 g/L, 0.1 g/L	0.1% NaCl, 0.01 PSU, 0.01 g/L
Accuracy @ 25 °C / 77 °F	±1% of reading (±0.05 µS/cm or 1 digit, whichever is greater)	±1% of reading (±0.03 ppm or 1 digit, whichever is greater)	±1% of reading
Calibration	Single Cell Factor calibration; 6 standards available: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm, 1 point offset: 0.00 µS/cm		Single point with HI7037 Standard
Temperature compensation	Automatic -5 to 100° C (23 to 212° F) NoTC - none absolute conductivity.		
Conductivity temperature coefficient	0.00 to 6.00 %/°C (for EC and TDS only). Default value is 1.90 %/°C		
TDS factor	0.40 to 0.80 (default value is 0.50)		
EC Probe	HI763100		
Log feature	Up to 1000 * (400 basic mode) records organized in: Manual log on demand (Max. 200 logs), Manual log on stability (Max. 200 logs), Interval logging * (Max. 600 samples; 100 lots)		
Temperature Range	-20.0 to 120.0 °C ; -4.0 to 248.0 °F**		
Temperature Resolution	0.1 °C; 0.1 °F		
Temperature Accuracy	±0.5 °C; ±0.9 °F		

Additional Specifications	
PC Interface	Micro USB
Storage Interface	USB
Power Supply	5 VDC Adapter (included)
Environment	0-50 ºC (32-122 ºF) Max 95% RH non-condensing
Dimensions	202 x 140 x 12 mm (7.9 x 5.5 z 0.5")
Weight	250g (8.82 oz)

* Standard Mode Only

** Temperature limits will be reduced to actual probe limits.

‡ Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

Probes

HI763100	EC/temperature probe

EC

Conductivity Solutions

HI70030P	12880 µS/cm, 20 mL sachets (25 pcs.)
HI70031P	1413 µS/cm, 20 mL sachets (25 pcs.)
HI70039P	5000 µS/cm, 20 mL sachets (25 pcs.)
HI7030M	12880 µS/cm, 230 mL bottle
HI7031M	1413 µS/cm, 230 mL bottle
HI7033M	84 µS/cm, 230 mL bottle
HI7034M	80000 µS/cm, 230 mL bottle
HI7035M	111800 µS/cm, 230 mL bottle
HI7039M	5000 µS/cm, 230 mL bottle
HI7030L	12880 µS/cm, 500 mL bottle
HI7031L	1413 µS/cm, 500 mL bottle
HI7033L	84 µS/cm, 500 mL bottle
HI7034L	80000 µS/cm, 500 mL bottle
HI7035L	111800 µS/cm, 500 mL bottle
HI7039L	5000 µS/cm, 500 mL bottle
HI7037L	100% NaCl sea water standard solution, 500 mL bottle
HI8030L	12880 µS/cm, 500 mL FDA approved bottle
HI8031L	1413 µS/cm, 500 mL FDA approved bottle
HI8033L	84 µS/cm, 500 mL FDA approved bottle
HI8034L	80000 µS/cm, 500 mL FDA approved bottle
HI8035L	111800 µS/cm, 500 mL FDA approved bottle
HI8039L	5000 µS/cm, 500 mL FDA approved bottle

Other Accessories

HI75110/220U	Voltage adapter from 115 Vac to 5 Vdc (USA plug)
HI75110/220E	Voltage adapter from 230 Vac to 5 Vdc (European plug)
HI76404W	Electrode holder
HI2000WCW	Wall cradle
HI2000BCW	Bench cradle
HI920015	Micro USB cable

Warranty

The edge® EC is warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Electrodes and probes are warranted for six months. This warranty is limited to repair or replacement free of charge.

Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments Office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

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