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*Easy*PREP *Titr*EC

User Manual

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Ordering Information

INSTRUMENT

Description	Catalog #
*Titr***EC** (110V/230V), with software	010-410-001

ITEMS INCLUDED IN THE BASIC CONFIGURATION

Description	Catalog #
Platform, 47 positions	010-450-030
Rack, for 100 ml Tubes, 47 positions	010-410-014
Temperature Probe	010-410-011
pH Probe	010-410-010
Conductivity Probe (K1.0)	010-410-012
Conductivity Probe (K0.1)	010-410-018
Blade Stirrer	010-410-016
Replacement Dispensing Tubing	010-410-021
ORP Probe	010-410-040

DISPENSING PUMPS

Description	Catalog #
*Syringe Pump, 1 ml, 5 ml, 10 ml, 25 ml	010-400-118

CORRESPONDING DISPENSERS

Description	Catalog #
Syringe, 1 ml	010-400-102
Syringe, 5 ml	010-400-104
Syringe,10 ml	010-400-108

ACCESSORIES

Description	Catalog #
Barcode reader, for rapid loading of sample identification	010-600-034
Fume Hood, protects samples from environmental contamination and vice versa when using *Titr***EC**, Inside dimensions: D 37.2 x W 31 x H 31.7, Outside dimensions: D 43 x W 32.7 x H 35.7	010-400-094
PC with Windows OS	010-400-008

ISO 17025 and ISO 8655-5 COMPLIANT

Request Instrument Certification
SYSTEM CALIBRATION OF DISPENSING ACCURACY CERTIFICATION Catalog # 010-400-050

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NF EN 61000-4-2(2009), NF EN 61000-4-3(2006,+A1:2007+A2:2010), NF EN 61000-4-4(2004,+A1:2010), NF EN 61000-4-5(2005), NF EN 61000-4-6(2009), NF EN 61000-4-11(2004).

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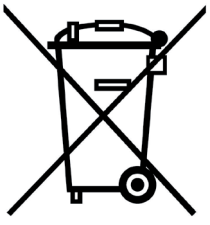

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1 Introduction

*Easy***PREP** *Titr***EC** is a multiparameter robotic platform designed for automated electrochemical measurements of large numbers of samples operating under the stringent requirements of regulated environments. The *Titr***EC** is designed for pH- Conductivity- Alkalinity/ Acidity measurements within the same vessel.

The *Titr***EC** performs pH adjustment, combined alkalinity/acidity analyses, and determines alkalinity for samples of both low and high concentrations (>1000 mg/L $CaCO_3$) within the same batch and without requiring loading of a new titrant reservoir. Smart titrant addition algorithm adds titrant volume based on the sample's response. Thus providing best throughput and accuracy in results. Alkalinity and acidity measurements are compliant with ISO 9963-1, EPA 310.1, as well as 2310 and 2320 Standard Methods.

The *Easy***PREP** *Titr***EC** accommodates 47 positions for 100 ml *Digi***TUBE** containers with a required 40 ml minimal volume.

1.1 ALKALINITY/ACIDITY METHOD

1.1.1 System Compliance

Alkalinity of a sample is its acid-neutralizing capacity, its ability to receive acidic compounds from external sources and not change its pH. The importance of alkalinity can be seen in its application in environmental monitoring. Without this capacity, any acid added to an effluent (river, lake, etc) would cause an immediate change in the water pH level, with possibly lethal effects on its living populations.

Acidity is the base-neutralizing capacity by which water can withstand addition of bases without change in pH.

The *Easy***PREP** *Titr***EC** analyses alkalinity and reports results according to US EPA 310.1 , ISO 9633-1, or APHA Standard Method 2320. It analyses acidity according to APHA Standard Method 2310.

1.1.2 EPA 310.1

Alkalinity, reported as mg/L $CaCO_3$, is measured as the amount of acid (sulfuric acid or hydrochloric acid) needed to bring the sample to a pH of 4.5.

Sample volume is defined by the user but should be ≥40 ml and <100 ml. Report the sample volume aliquotted in into the tube to the ±1 ml. Samples below 40 ml would be insufficient to immerse the sensors. Sample volumes over 100 ml may not have sufficient free space available in the tube for titrant addition. A sample volume of 40 ml is suggested for most sample types in order to optimize throughput.

Titrant and sample volume used for the EPA 310.1 method:

- 0.02 N H_2SO_4 or HCl and sample volume <100 ml for samples with expected concentrations between 20 and 1000 mg/L $CaCO_3$
- 0.10 N H_2SO_4 or HCl and sample volume of <100 ml for samples with expected concentrations above 1000 mg/L $CaCO_3$
- 0.02 N H_2SO_4 or HCl and sample volume of 100 ml for samples with expected concentrations of <20 mg/L $CaCO_3$

In the third case (expected concentrations <20 mg/L $CaCO_3$), titration end-point is 4.2.

1.1.3 ISO 9963-1

Alkalinity is reported as mmol/L. It is measured as the amount of acid (hydrochloric acid) needed to bring the water sample first to a pH of 8.3 for composite alkalinity determination (if initial pH > 8.3), then to a pH of 4.5 for total alkalinity determination.

Sample volume should be 100 ml ± 1 ml.

Titrant used for the ISO 9963-1 method:

- 0.02 N HCl for samples with expected concentrations between 0.4 and 4 mmol/L
- 0.10 N HCl for samples with expected concentrations between 4 and 20 mmol/L. ISO9963-1 is not applicable for samples with concentrations below 0.4 mmol/L.

1.1.4 APHA Standard Method 2310

Acidity, reported as mg/L $CaCO_3$, is measured as the amount of base (sodium hydroxide) needed to bring the water sample to a pH of 8.3.

Sample volume is defined by the user but should be ≥40 ml and <100 ml. Report the volume of sample poured into the tube to the ±1 ml. Samples below 40 ml would be insufficient to completely immerse the probes. Sample volumes over 100 ml may not have sufficient free volume available in the tube for titrant addition. A sample volume of 40 ml is suggested for most sample types in order to optimize throughput. The sample must be free of hydrolyzable metal ions and reduced forms of polyvalent cations.

Titrant used for the APHA Standard Method 2310 method should be:

- 0.02 N NaOH for samples with expected concentrations between 20 and 1000 mg/L $CaCO_3$ acidity.
- 0.10 N NaOH for samples with expected concentrations above 1000 mg/L $CaCO_3$ acidity.

2 Cautions, Notes and Symbols

Symbol	Description	Symbol	Description
V	Voltage	I	Mains on
~	Alternating current	0	Mains off
A	Current		Attention, consult accompanying documents
Hz	Frequency		Protective conductor terminal
F	Fast-acting fuse	W	Watts

Cautions, warnings and notes are included throughout this manual.

CAUTION

A caution is used to emphasize information pertaining to procedures that, if not strictly followed, may result in damage or destruction to the instrument or improper instrument operation.

WARNING

A warning is used to emphasize information about dangerous or hazardous conditions relating to the operation, cleaning or maintenance of the instrument that may result in personal injury.

NOTE

A note is used to emphasize procedures or conditions that may be misinterpreted or overlooked, and to clarify potentially confusing situations.

3 Warranty & Safety Information

SCP SCIENCE warrants this product free from defects in workmanship and materials for one (1) year from date of purchase.

NOTE Should the unit malfunction, please contact **SCP SCIENCE**'s Service Department or your local distributor for further instructions.

NOTE The warranty is void if the instrument shows evidence of tampering or has been subjected to excessive moisture, heat, corrosion or other misuse.

NOTE **SCP SCIENCE** shall not be responsible for any damage or losses, however caused, may be the result of improper installation or misuse of this product.

NOTE Products are supplied for laboratory use only and should not be used for any household, medical or therapeutic application. **SCP SCIENCE** presumes that only trained and qualified individuals, familiar with procedures suitable for the safe operation of these instruments, will handle them. Our customers are solely responsible for the safe operation, handling and use of these products.

MINIMUM SAFETY CONSIDERATIONS MUST BE FOLLOWED WHEN WORKING WITH *Easy*PREP *Titr*EC IN ORDER TO MAINTAIN GOOD LABORATORY PRACTICES:

3.1 MEASURES FOR YOUR PROTECTION

WARNING When using chemicals and solvents, comply with the instructions of the manufacturer and the general lab safety rules.

Always wear safety glasses when handling samples and reagents.

No User Serviceable parts inside.

3.2 MEASURES FOR YOUR OPERATIONAL SAFETY

WARNING Make sure the *Easy*PREP *Titr*EC is placed on a surface capable of supporting 45 kg.

CAUTION *Easy*PREP *Titr*EC requires a clearance of five inches (12.7 cm) on all sides.

WARNING If moving the system, always use 2 people and do not lift by the Kydex® panels. Lift by the bottom aluminum frame instead.

Keep hands and fingers free of the system when it is moving to reduce the risk of pinching.

Always plug the *Easy***PREP** *Titr***EC** in a properly grounded three-prong electrical outlet (100-240V receptacle).

Use a stabilized constant voltage AC power supply, with a voltage within +/-5% of the specified level

Always use the provided main power cord or one with the same manufacturer's specifications.

If the *Easy***PREP** *Titr***EC** is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Avoid vibrations from large machines.

4 Speci□cations

ENVIRONMENTAL

Relative Humidity	30% to 80%
Altitude	up to 2000 m
Installation	Category II
Pollution	Degree 2
Ambient Operating Temperature	15 °C to 40 °C

ELECTRICAL

Model Number	*Easy***PREP** *Titr***EC**
Voltage	115~230V
Power	125W
Frequency	50/60 Hz

pH PROBE SPECIFICATIONS

pH measuring range	0 – 14 pH units
Resolution	0.01 pH
Accuracy	1% of range
Precision	<0.5% of reading
Electrode slope	58 mV/pH units

EC PROBE SPECIFICATIONS

Measuring range (K=1.0)	5-100,000 uS/cm
Measuring Range (K=0.1)	0.1 - 20,000 uS/cm
Accuracy	10% for reading
Precision	<2%

*Titr***EC DIMENSIONS**

Width	70 cm (27” ½ in)
Depth	66 cm (26” in)
Height	69 cm (27” in)

FUME HOOD DIMENSIONS (OPTIONAL)

Width	109 cm (43” in)
Depth	83 cm (32.8” in)
Height	90 cm (35.7” in)

ORP PROBE SPECIFICATIONS

Range	-1019.9 mV to 1019.9 mV
Accuracy	± 1 mV

FUSES-RATINGS

NOTE The Power Supply has overvoltage, overload and short circuit protections.

5 Installation

5.1 BEFORE INSTALLATION

5.1.1 OVERVIEW

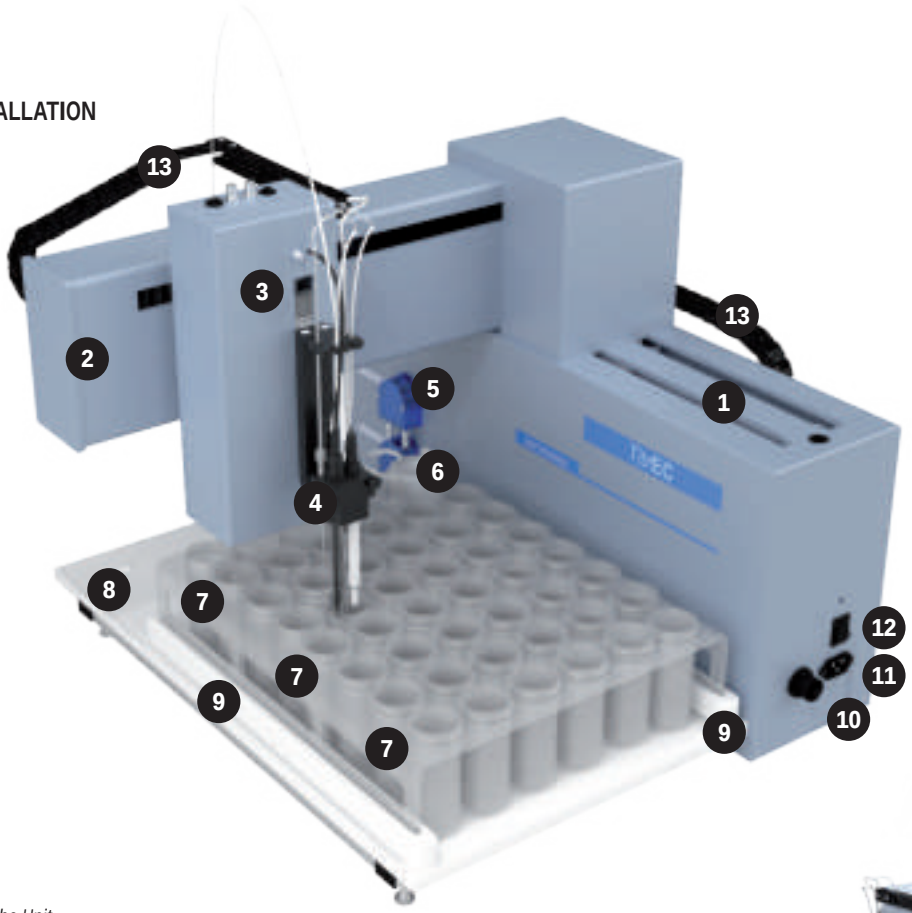

Figure 1: Front View of the Unit

Legend

Label	Description	Label	Description
1	X-arm	8	Bottom table
2	Y-arm	9.	Rack adaptors
3	Z-arm	10	USB receptacle
4	Probe Holder	11	Power receptacle
5	Peristaltic Pump	12	Power on/off button
6	Washing station	13	Cable Carrier
7	Rack		

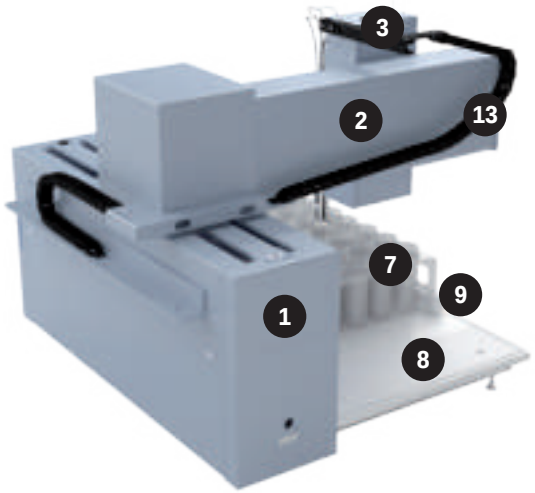

Figure 2: Rear Vew of the Unit

5.1.2 Unpacking

The system weighs approximately 45 kg (100 lbs). Use two people to lift by the bottom aluminum frame and place the system on a flat surface where it will be used. Save the packing material for future use. Ensure all parts have been delivered; some parts may be missing. When using chemicals and solvents, comply with the instructions of the manufacturer and the general lab safety rules.

Always wear safety glasses when handling samples and reagents

5.1.3 Inspection

5.2 HARDWARE INSTALLATION GUIDELINES

*Titr***EC** requires to be installed in such a way that the ON/OFF button has a minimum clearance of 8 in (20 cm)"

5.2.1 Installing The *Digi***TUBE** Rack

Place the *Digi***TUBE** rack on the platform, using the rack adapters provided on the platform. The shorter rack adapter goes to the back of the platform (item 12).

5.2.2 Installing the Syringe Pump

- The syringe pump module should be placed on the left hand side of the instrument and connected to the *Easy***PREP** *Titr***EC** with the COM2 cable supplied.
- The titrant dispensing lines are connected to the syringe pump valve on ports #1 and #2.
- The two titrant supply lines are connected to the syringe pump valve on ports #8 and #9 and will be used during titration to dispense the required titrant.

Two more pump tubings are connected to the syringe pump valve on ports #3 (outlet) and #7 (inlet). The end of the tubing on port #3 is placed in a waste container. The end of the tubing port #7 is placed in a container of clean water. These will be used to clean the syringe.

5.2.3 Installing the Probes

- Place the temperature sensor and stirrer on the Probe Holder
- Loosen the screws on the Probe Holder and insert the two probes (pH and **EC**) into the Probe Holder.
- Adjust the length to ensure that the stirrer is below all probes and can rotate freely.

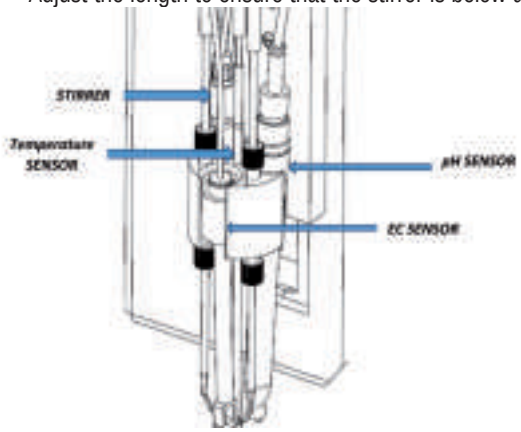

Figure 4: The Probes Installed In their Holder

5.2.4 Cable Connections

Make sure that the Power button is turned off.

- Connect the Power Cable to the receptacle located on the end of the X-arm. (Figure 5)
- Connect the USB utility cable to the receptacle located on the end of the X-arm (Figure 5).

Figure 5: Power and USB Plugs

5.3 COMPUTER SYSTEM REQUIREMENTS

- PC Processor: 1 GHz or superior
- RAM memory: 1 GB RAM
- Disk min. space: 1 GB free
- Ports: 1 USB port
- Operating System: Windows 10

5.4 SYRINGE INSTALLATION

The quick guide below will help the user in setting up the instrument and starting an application.

5.4.1 Setup and Preparation

- Start the *Easy***PREP** *Titr***EC** software. A pop up will ask if you would like to initialize the axis. Select “Yes”.
- A second pop up will ask if you would like to initialize the syringe pump. Select “Yes”.
- Make sure that the indicators representing the connected hardware components on the bottom of the screen are turned on to green.

The *Easy***PREP** *Titr***EC** comes with at least one syringe, with a choice of barrel size volumes of 5 or 10 ml. The syringe is shipped in a protective box together with the rest of the *Easy***PREP** *Titr***EC** instrument.

- To install the syringe onto the syringe pump module, go to “Admin-Tools/Syringe Pump”:

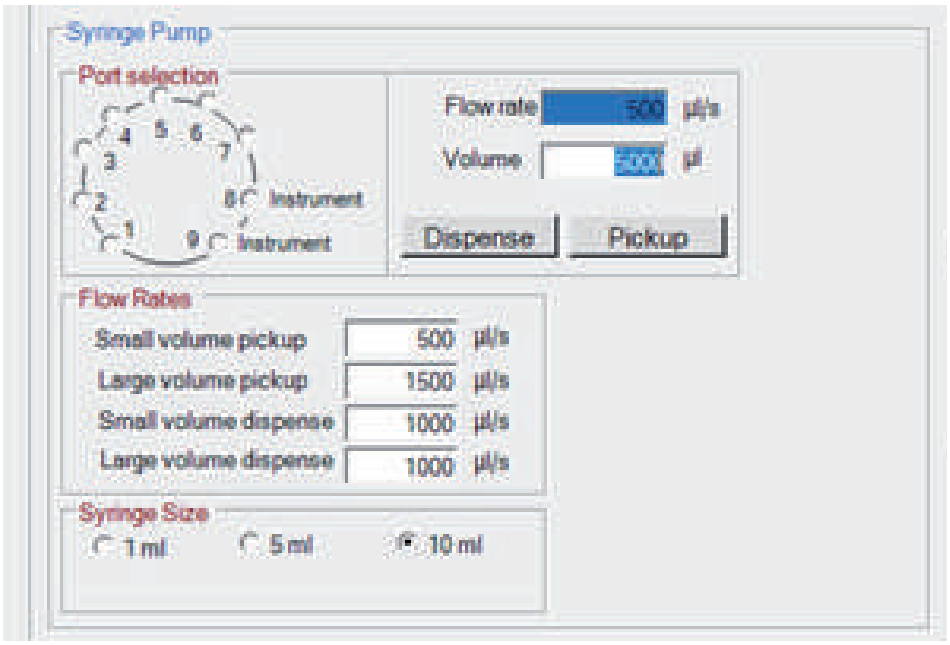

Figure 7: Admin-Tools > Syringe Pump

- Select the syringe barrel size to be installed.
- Type 50% of the total volume of the syringe into the field “Volume” (for example, if installing a 10 ml syringe, type 5000 ul), then press “Pickup”.
- The plunger is now low enough to install the new syringe.

- Remove the plunger lock screw.

- Screw the new syringe onto the syringe valve, lower the syringe plunger until the plunger lock screw can be placed through the syringe syringe plunger and screwed in.

- Once the screw has been secured, initialize the pump.

6 Software Operation

6.1 OVERVIEW OF SOFTWARE

6.1.1 Hardware Detection

Figure 10: Hardware Detectors

The five (5) indicators at the bottom of the software window indicate whether the modules have been detected by the instrument. A red indicator signifies that a module has not been detected or is faulty. A green indicator indicates the module has been detected and is ready for use.

“ROBOT” is for the robotic system.

“PUMP” is for the syringe pump module.

“pH/**EC** SENSORS” is for the pH and **EC** sensors.

"TEMPERATURE" is for the temperature sensor.

"INSTRUMENT MEMORY" is for the internal memory parameters of the system.

CAUTION If the indicator remains red after start up, go to the Troubleshooting section.

6.1.2 Software Tabs

The User Interface has four tabs: Process, Results, Settings and Admin-Tools.

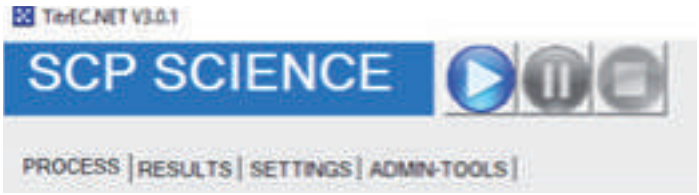

Figure 8: Software Tabs

- Process Tab: The Method is programmed and the process is visualized in real time.
- Settings Tab:

  In the “Settings” tab, sensor calibration can be manually performed. Furthermore, pump priming can also be executed in the mode.
  Results Tab: Results are displayed in process.

- Admin-Tools Tab: User defined parameter setup. This tab is password protected.

6.1.3 Operational Buttons

There are four (4) icons on the title bar.

Figure 9: Operational Tabs

-  "Run" button is blue when activated and grey when disabled.
-  "Pause" button is blue when activated and grey when disabled, it turns to "RESUME" after being pressed. When resumed the sequence will continue from the break point.
-  "Stop" button goes red when activated and grey when disabled. If the sequence is interrupted; the seqeunce will stop after the current motion (action) is finished and the result table is displayed. If the "Run" button is pressed again, the sequence will restart from the beginning.
-  "Emergency Stop" the system stops completely and immediately. The software will need to be exited and restarted prior to further use.

6.2 ADMIN-TOOLS

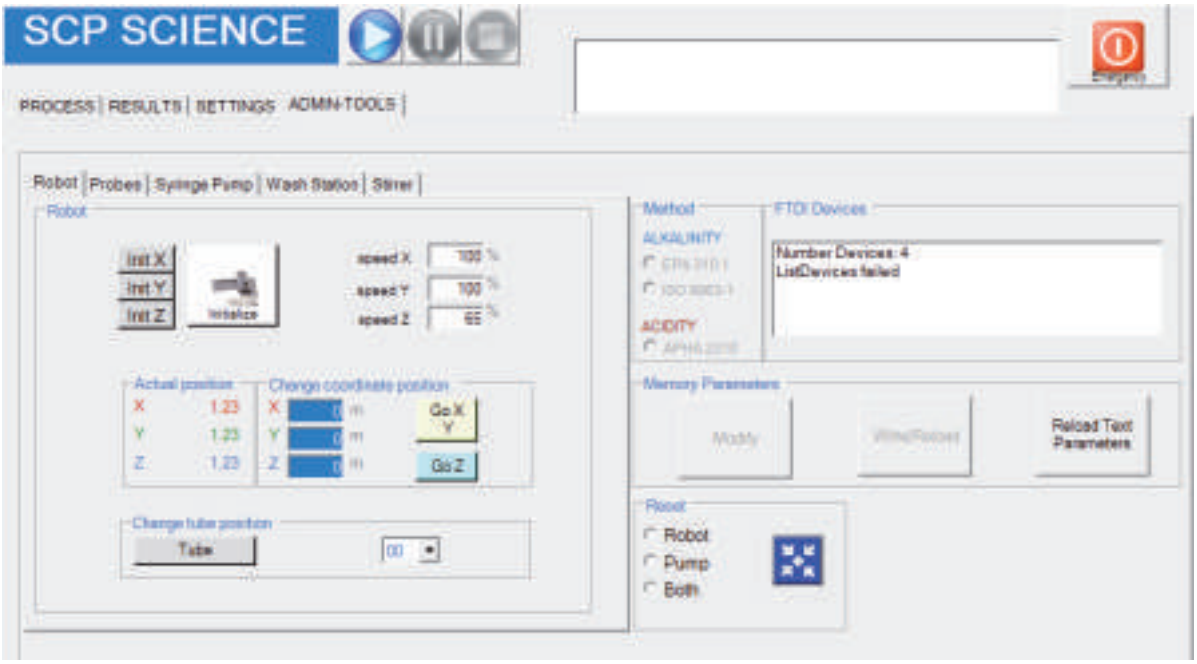

Figure 55: Screenshot of e Admin-Tools Tab

Admin-Tools is a tab where advanced parameters can be accessed and modified.

This tab is password protected. Password: scp123.

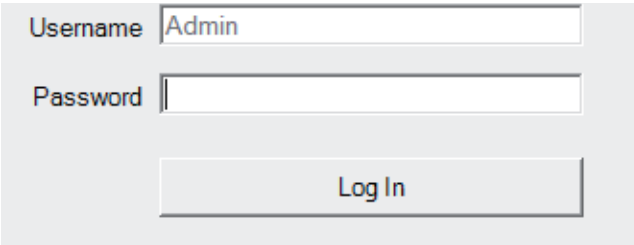

Figure 56: Admin-Tools log in

6.2.1 Robotic Arm

- "Init X": Individually initializes the X axis. The robotic arm moves the X axis to the home position (home position).
- "Init Y": Individually initializes the Y axis. The robotic arm moves the Y axis to the home position (home position).
- "Inti Z": Individually initializes the Z axis. The robotic arm moves the Z axis to the home position.
- "Initialize": Initializes each axis.
- “Axis X”: Allow for direct displacement along the X axis, based upon the value given in mm.
- “Axis Y”: Allow for direct displacement along the Y axis, based upon the value given in mm.
- "Axis Z”: Allow for direct displacement along the Z axis, based upon the value given in mm.
- “Speed X”: Allow speed adjustment on X axis (1-100-- 1 is the slowest and 100 is the fastest). The default factory setting is 100.
- “Speed Y”: Allow speed adjustment on Y axis (1-100-- 1 is the slowest and 100 is the fastest). The default factory setting is 100.
- “Speed Z”: Allow speed adjustment on Z axis (1-100-- 1 is the slowest and 100 is the fastest).
- “Change tube position”: Go to the selected position (00 is the washing station position)

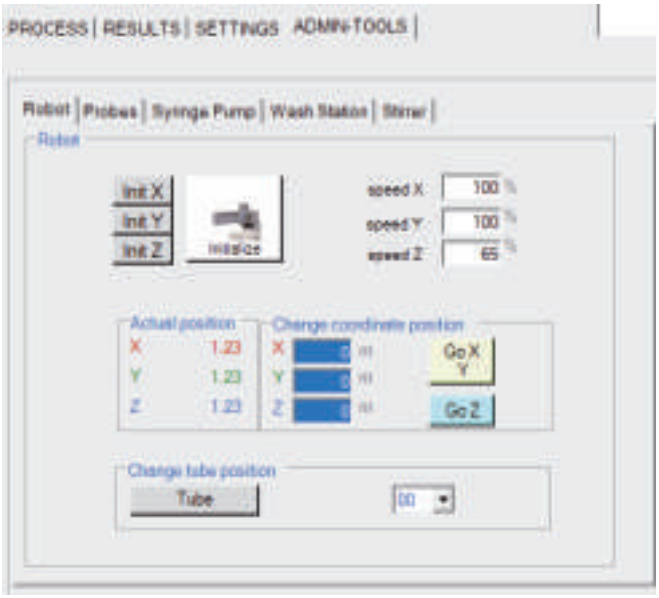

Figure 57: Robot Field

6.2.2 Pump

- "Initialization": Initializes the syringe pump module.

- "Pickup": Manually pick up selected volume from the designated source
- "SYRINGE": Selects the volume of the syringe installed on the pump.
- "Speed": Sets the pump speed for manual pickup and dispense.
- "Volume": Sets the pump volume for manual pickup and dispense (dependent on the size of the syringe installed).
- "Valve Control": Directly control of the valve. Press on a radial button to select the required valve position.
- "Dspense": Manually dipense picked up volume out of designated port.

NOTE Valves 1 and 2 are always the valve outlets towards the instrument.

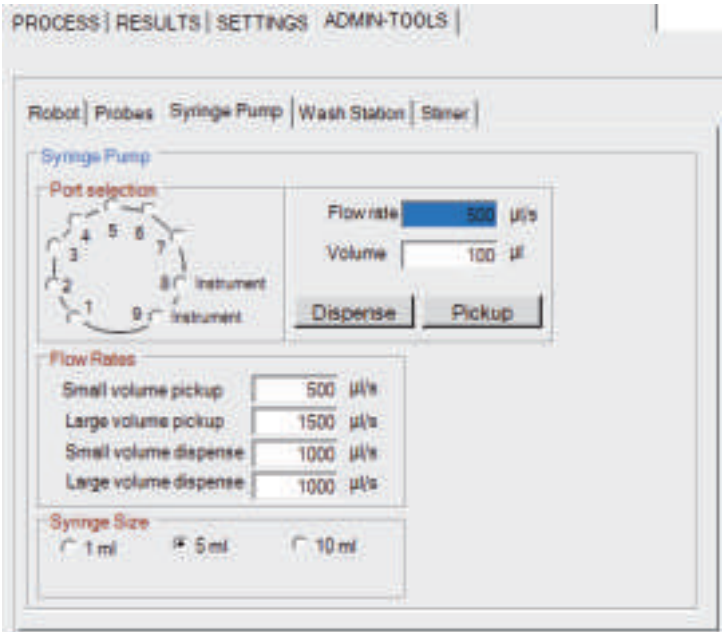

Figure 58: Syringe Pump Field

6.2.2.1 Flow Rates

- "Small volume dispense": Sets the pump flow rate for dispensing a volume below the threshold.
- "Large volume dispense": Sets the pump flow rate for dispensing a volume above the threshold.
- "Small volume pickup": Sets the pump flow rate for picking up a volume below the threshold.
- "Large volume pickup": Sets the pump flow rate for picking up a volume above the threshold.

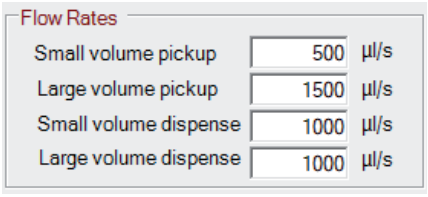

Figure 59: Flow Rates Field

6.2.3 Washing station Parameters

- “Fill”: Time of operation of the peristaltic pump needed to fill the waste station
- “Empty”: Time of operation of the peristaltic pump to empty the waste station

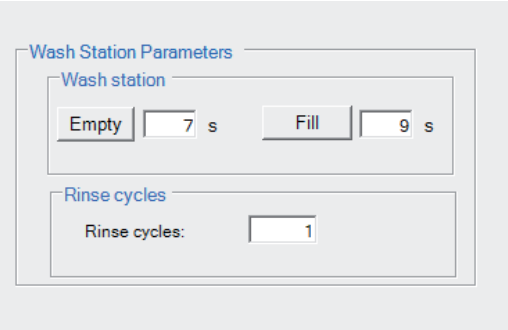

Figure 60: Wash station parameters eld

6.2.4 Stirrer

- Allows user the option to either stir or not stir the sample when measuring **EC**
- "Duration": Time between each titrant addition during alkalinity/acidity titration
- "Speed": Blade stirrer speed, in % of full power

NOTE A stirrer speed of 10% is advised for most water samples in order to avoid entraining CO_2 into the sample, which will affect sample pH.to the maintenance section.

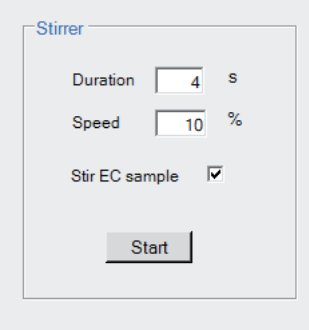

Figure 61: Stirrer Field

6.2.5 Establish Alkalinity Method

Alkalinity and Acidity concentrations will be calculated and reported according to the method selected (see sections Introduction in Section 1). Select between US EPA 310.1 and ISO 9963-1 for Alkalinity determination. Choose Standard Method APHA 2310 for Acidity determination. This is done in the Admin Tools section.

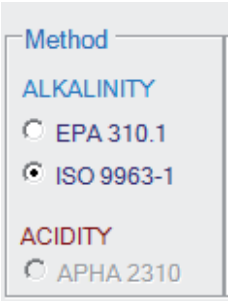

Figure 12: Method Selection

6.3 SETTINGS TAB

In the “Settings” tab, sensor calibration can be done manually. Furthermore, pump priming can also be executed in the Settings tab. Start with this section to prime the titrant dispensing lines to remove air bubbles and ensure titrant is delivered with high accuracy.

Figure 49: Settings Tab

6.3.1 Reset

- “RESET”: Initializes the *Easy***PREP** *Titr***EC** system
- “ROBOT”: Initialize the robot alone
- “PUMP”: Initialize the pump alone
- “BOTH”: Inilialize both robot and pump

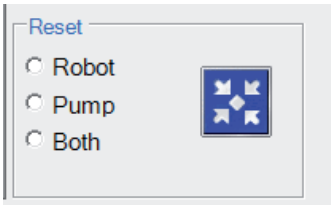

Figure 50: Reset Field

6.3.2 Priming

PRIMING is used to prime the specified titrant dispensing lines and the water rinsing line.

The valve and titrant configuration is also shown here.

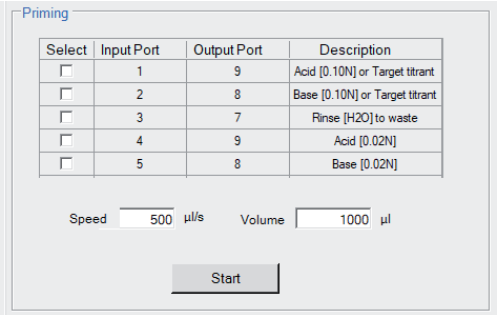

Figure 52: Priming Field

NOTE The volume required to completely fill the tubing line is 4000 µl.

6.3.3 pH/**EC** Sensors

The parameters for the **EC** and pH sensors are avaliable in Admin Tools/Probes.

The amount of attempts which the probes read the sample are specified here and the tolerance of the measurements.

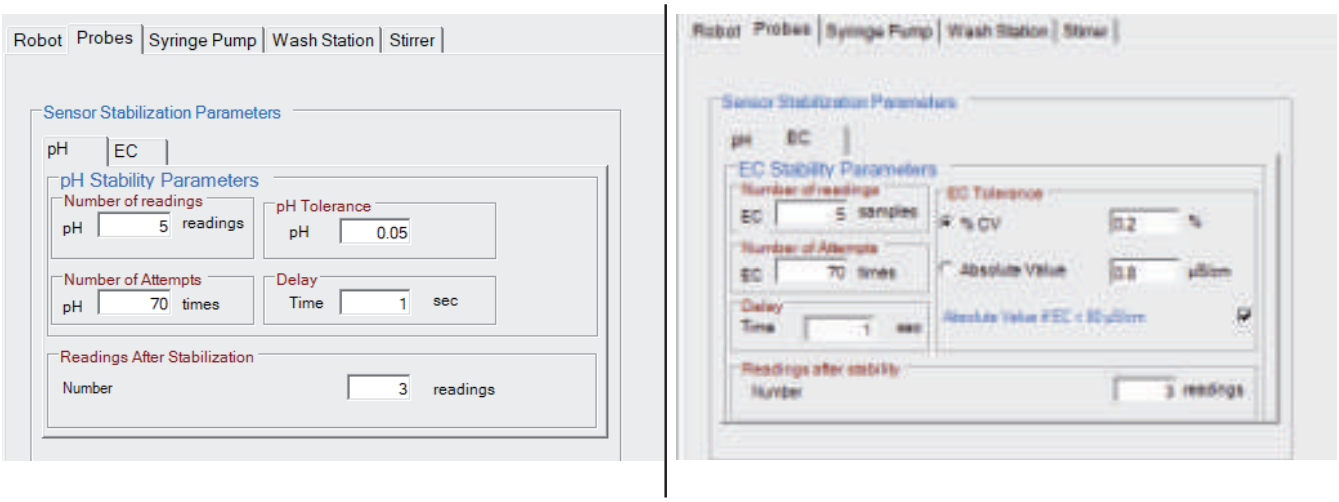

Figure 53: a) pH stabilization parameters and b) EC stabilization parameters

Stability Parameters

- Number of readings: The number of readings taken to establish if sample has stabilized.
- Number of attempts: The number of attempts to establish sample stability.
- **EC** Tolerance:
- % CV: The acceptable Coefficient of Variation between readings.
- Absolute value: The absolute acceptable diffrence between readings.
- Readings after stability: The number of readings taken after sample has stabilized.

Tolerance (pH): Tolerance on final pH accuracy during titration and pH adjustment

Number of readings: The number of readings taken for stability readings each attempt.

Number of attempts: The number of attempts to reach stabilization.

Delay: Time between readings.

Readings after stabilization: The number of readings taking after pH of the sample has stabilized,

6.3.4 Calibration

Calibrate the pH and **EC** sensors by pressing the Start button in Settings underneath Calibration.

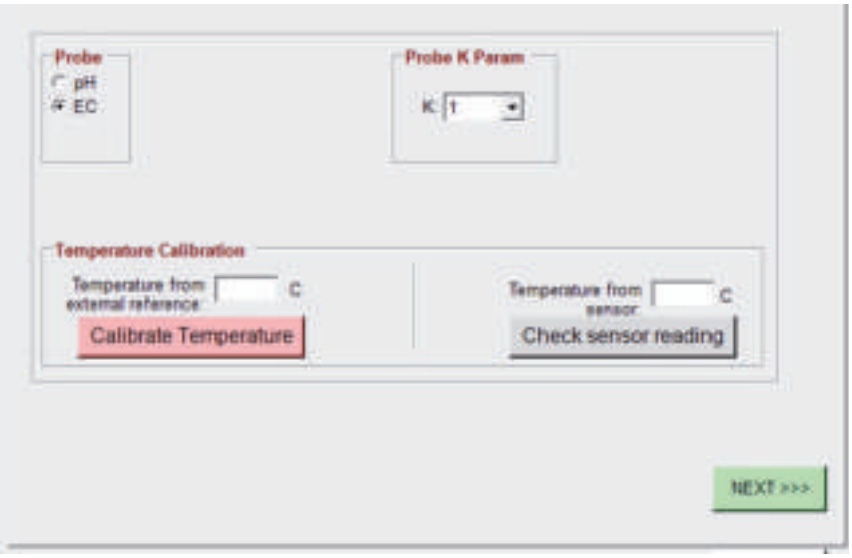

Figure 54: pH/EC Calibration Field

“Probe”: Select between calibration of the pH or **EC** sensor.

"Temperature from external source": Enter temperature from an reliable external source.

“Probe K Param": Indicates the workable range of the **EC** sensor

“Min R^2”: Minimum correlation coefficient for acceptance of the calibration curve.

“Continue the process if Min R^2 is not met”: For use with automated calibration in the Process tab. If checked, the process will continue even if the correlation coefficient of either the pH or the **EC** calibration does not meet criteria.

“CALIBRATION”: Start manual sensor calibration.

6.4 PROCESS TAB

Methods are built in the Process Tab.

Methods can be saved by pressing the save icon  or recalled by pressing the search file icon  .

Figure 11: Process Tab

6.4.1 Real-Time Process Status View

The rack visualization window is located on the top left side of the Process tab. Each sample tube is represented by its corresponding status color.

Unprocessed samples are yellow. In Process

Sample for which the analysis is completed are green. Completed

“Start time”: Records the start time of the process, from the moment that the “Run” button is pressed.

“End time”: Records the time required to reach the end of the process when the last sample has been analyzed and the probes have been cleaned.

“Tube #”: Indicates the sample tube position presently being processed.

“Sample volume”: Sample volume for the tube in process. Used in alkalinity/acidity result calculations.

“Titrant”: Indicates the titrant concentration selected for the tube in process. Used in alkalinity/acidity calculations.

“Cumul Vol”: Indicates the cumulative volume of titrant added to the processed sample.

“Dispense”: Indicates the volume of last titrant addition to the processed sample.

“**EC**”: Indicates the conductivity concentration of the processed sample.

“pH”: Indicates the initial present pH of the processed sample.

“Alkalinity”: Indicates the alkalinity concentration of the last completed sample or the Acidity of the last sample if APHA 2310 methodology is being used.

“Syringe”: Indicates the selected syringe barrel volume.

“Temperature”: Indicates the sample temperature. It is used for temperature compensation of the pH and **EC** measurements

"Method": Indicates which methodolgy is being used for Alkalinity or Acidity.

6.4.2 Input Process

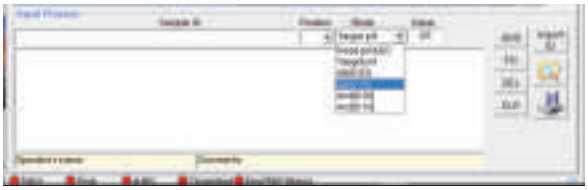

Figure 13: Input Process Field

The function and the concentration of the titrant can be selected in the drop down Mode menu.

6.4.2.1 Sequence edit definitions

- "ADD" icon: Permits to add a new line to the input process table
- “FIX” icon: Corrects the selected line.
- "DEL" icon: Deletes the last line or selected line in the input process table.
- “Recycle bin” icon: Clears the entire process table.
- “Import ID": Imports sample IDs from a text file located in any directory. The imported information fills the Sample ID column in the sequence. Used to run the same method sequence with new samples.
- “OPERATOR’S NAME” field: Stores the information about the operator of the method.
- “COMMENT" field: Stores information about the method.
- "Load ": Reload saved sequence
- "Save": Save edited sequence

Figure 14: Sequence Edit Field

6.4.2.2. Process Table Fields

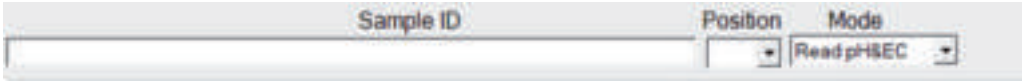

Figure 42: Input Zone To Build Test Sequences

- Sample ID: Unique ID of the sample.
- Position: Position of the sample on the rack.
- Mode: Type of analysis performed on the selected tube.
  - “Read pH&**EC**”: Consecutively read the conductivity and pH concentrations within the same sample tube.

- “Target pH”: pH adjustment of a sample. Input the target pH in the “Value” field.
- "Read pH": Reads the pH of a sample
- "Read **EC**": Reads the conductivity of the sample

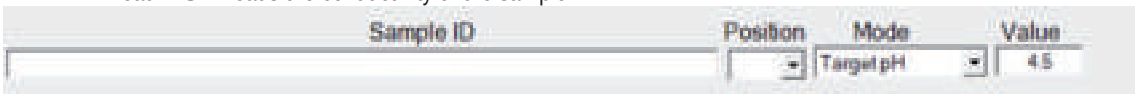

Figure 43: Input Value

- “Alk[0.02]”: Alkalinity titration of a sample using the 0.02N acid titrant and user can input standardized concentration of the titrant used for calculations in the titrant field.

Figure 44: Alkalinity Mode

- “Alk[0.1]”: Alkalinity titration of a sample using the 0.1N acid titrant and user can input standardized concentration of the titrant used for calculations in the titrant field.
- “Acd 0.02]”: Acidity titration of a sample using the 0.02N base titrant and user can input standardized concentration of the titrant used for calculations in the titrant field.
- “Acd 0.1]”: Acidity titration of a sample using the 0.1N base titrant and user can input standardized concentration of the titrant used for calculations in the titrant field.

6.5 RESULTS TAB: REAL-TIME VIEW OF RESULTS

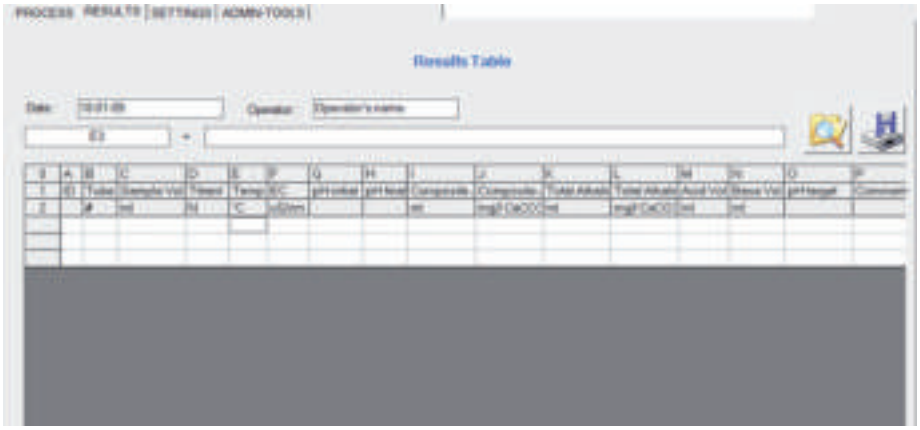

Figure 45: Screenshot Of e Results Tab

6.5.1 Results Field

- “Sample ID”: Unique sample ID.
- “Tube #”: Position of the sample tube on the rack.
- “Sample volume”: Entered volume (ml) in the process tab. This information is used to calculate alkalinity/acidity concentrations.
- “Titrant”: Titrant concentration (N) used during titration. This information is used to calculate alkalinity/acidity concentrations.

- “Temperature”: Sample temperature, in °C.
- “**EC**”: Sample conductivity concentration (mS/cm), reported at 20 °C, 25 °C, or a user-defined temperature. See Settings tab.
- “pH initial”: Initial sample pH at the start of the test.
- “pH final”: Final sample pH at the end of titration.
- “Composite alkalinity (ml)”: Volume of acid used to reach a sample pH of 8.3. Employed when calculating composite alkalinity concentration (ISO 9963-1 only).
- “Composite alkalinity (mmol/L)”: Composite alkalinity concentration of the sample, in mmol/L (ISO 9963-1).
- “Total alkalinity (ml)”: Volume of acid used to reach a sample pH of 4.5, used to calculate total alkalinity concentration (EPA 310.1 and ISO 9963-1 methods).
- “Total alkalinity”: Total alkalinity concentration of the sample, in mg/L $CaCO_3$ (EPA 310.1) or in mmol/L (ISO 9963-1).
- “Acid Volume (ml)”: Volume of acid required to reach the target pH, when using the pH adjustment mode.
- “Base Volume (ml)”: Volume of base required to reach the target pH, when using the pH adjustment mode.
- “pH target”: End-point pH of the sample when using the pH adjustment mode.
- "Comments":
- "Load": Reload saved results
- "Save": Save results

7 Guidelines to Operating the *Easy***PREP** *Titr***EC**

7.1 RINSING STATION

Place the inlet tubing of the peristaltic pump that fills the waste station (the upper pump on the left side of the instrument) inside a container of rinsing solution. Fill this container with tap water or other rinsing solution adequate for the pH electrode. Do not use deionized water. Place the outlet tubing emptying the waste station into an appropriate waste recipient.

7.2 GUIDELINES TO PRIMING OF THE TITRANT DISPENSING LINES

- Insert the Ports 9, 8 and 7 inlet tubing into the appropriate titrant or water containers (see section 7.2.3 of this manual for port allocation information).
- Select required priming ports (1&9, 2&8, 3&7).
- Selecting all three sets of ports will prime them individually and sequentially.
- Ensure the right volume for priming is typed in. Standard and minimum required is 4ml.
- Put a 100 ml *Digi***TUBE** cap (Figure 31) on top of the rinsing station in order to contain spilled titrant during the priming process.

NOTE Avoid dispensing acid or base titrant directly into the rinsing station.

- Press “Priming”.

7.3 GUIDELINES TO CALIBRATION OF THE PH AND EC SENSORS

In the Settings tab, the pH or **EC** probe can be calibrated. Follow the promts directed from the software.

NOTE Unplug the fill hole of the pH electrode to obtain a faster stabilization time.

7.4 GUIDELINES TO SELECTION OF CONDUCTIVITY. PROBE SELECTION

The *Easy***PREP** *Titr***EC** can be outfitted with two different conductivity probes: a 1.0 K conductivity probe or a 0.1 K conductivity probe.

If the conductivity of samples are < 200 µs/cm (typical tap water conductivity) increased accuracy would be obtained with a 0.1 K conductivity probe. If the conductivity of samples are > 200 µs/cm, increased accuracy would be obtained with a 1.0 K conductivity probe.

The recommended range of the conductivity probes are presented below:

- The 0.1 K probe can read accurately as low as 0.07 us/cm and as high as 50 000 us/cm
- The 1.0 K probe can read accurately as low as 5.0 us/cm and as high as 100 000 us/cm

To aid in the selection of the most appropriate conductivity probe, typical conductivity ranges of water samples are listed below.

Water sample	Typical Conductivity Range (µs/cm)
Rain water	2 to 100
Fresh water	2 to 100
Ground water	50 to 50 000
Ocean water	50 000
Landfill leachate	10 000
wetlands	50 to 50 000

**From: Sanders, L.L., 1998, A manual of Field Hydrogeology: Prentice-Hall, NJ, 381p*

7.5 TURNING OFF THE INSTRUMENT

At the end of the run:

- Empty all titrant tubing lines of liquid by removing the tubing lines from their containers and using the priming function of the software (see section 6.4.3).
- Remember to put the pH electrode back in its storage container. If the electrode is left out of storage for a prolonged period of time, refer to the maintenance section.
- Close *Easy***PREP** *Titr***EC** Software
- Shut down computer
- Power off the instrument

8 Maintenance

8.1 REFILLABLE GLASS ELECTRODE

The refillable pH glass electrode is delivered in a container filled with storage solution. The container protects and hydrates the pH electrode.

Maintenance after unpacking:

The refill insert hole is sealed during shipment in order to prevent leakage. Once the electrode is unpacked, unseal the refill hole and ensure that:

- There is enough electrolyte solution to cover the sensing portions and the reference element hasn't dried. If the bulb and/or junction are dry, soak the tip of the electrode in the storage solution, pH 7 or pH 4 buffers for at least an hour before using.
- There are no air bubbles in the glass bulb. To remove air bubbles, shake the electrode in a downward motion to force air bubbles out.
- Refill if necessary.

Regular and continuous maintenance:

Cleaning is required when:

- Time needed for stabilization increases
- Inaccurate readings are obtained
- Calibration no longer meets linearity requirements

The pH electrode should also be cleaned to remove deposits, using the following guidelines. In the heading and table X1 from the word document.

If readings appear to be drifting, soak the electrode bulb in warm (about 120 °F) pH 4 buffer for about an hour then rinse the tip with distilled or deionized water.

Never store the electrode in distilled or deionized water.

8.2 ELECTROCONDUCTIVITY CELL

The *Easy***PREP** *Titr***EC**'s conductivity cells are made of 2-pole glass/platinum.

The conductivity probe has a glass body, which allows for the probe to be used in aqueous and organic solvents.

A layer of platinum black covers the platinum electrodes of the conductivity cell, which creates a large surface area and eliminates polarization error. If this black material is dry or damaged, it will negatively affect the conductivity probe performance. To ensure that material is not dry, soak the electrode surface in clean water for at least one hour prior to use. Ensure that the water fully covers the electrodes.

Cleaning of deposits: Mechanical cleaning should be avoided to prevent scratching of the electrodes' surfaces. To remove deposits, soak the cell:

Contaminant	Cleaning Solution	Recommended Time
Water soluble contaminants	Rinse with deionized water	No limit
Lubricants and oils	Soak in warm water and liquid detergent	10 to 30 minutes
Lime or hydroxide coating (whitish coating)*	Soak in 10% acetic acid or 10% hydrochloric acid	10 TO 30 minutes

* For glass cells only

After any soaking with dilute acid, repeated rinsing with deionized or distilled water is needed to remove all traces of the acid.

2-pole glass/platinum cell: For platinized cells, the platinum black creates an effective surface for conductivity measurements. The platinum deposit is generally resistant to contamination and removal. However, replatinization of the cell may be required when measurements become slow, erratic or inconsistent. This should be done following the cell manufacturer's instructions.

At the end of the day:

Empty all titrant tubing lines of liquid by removing the tubing lines from their containers and using the priming function of the software (see section 7.3.2).

Remember to put the pH electrode back in its storage container. If the electrode is left out of storage for a prolonged period of time, refer to the maintenance section.

8.3 ACCURACY AND PRECISION VERIFICATION OF THE LIQUID DISPENSING (ISO 8655-5)

This section describes the protocol for verification of the accuracy and precision of liquid dispensing of the *Easy***PREP** *Titr***EC**. The following information is an excerpt of SCP Science internal protocol EP-WIN004-DAPP-1.0-E and can be used for internal quality control or for auditing purposes.

EQUIPMENT

- Analytical balance (Resolution = 0.1 mg, repeatability and linearity = 0.2 mg, uncertainty = 0.2 mg)
- *Easy***PREP** *Titr***EC**
- Thermometer, maximum uncertainty = 0.2°C
- Barometer, maximum uncertainty = 0.5 kPa
- Hygrometer, maximum uncertainty = 10% (%humidity in air)
- Deionized water, at equilibrium with air and at room temperature
- 30 clean and dry DigiTubes + 30 caps

TESTING CONDITIONS

- The analytical balance, *Easy***PREP** *Titr***EC** and deionized water must all be placed in the same room/testing environment for at least 2 hours before the start of testing.
- The testing environment must be free of air currents, have a maximum humidity of 50% and a constant temperature (±0.5 °C) between 15 °C and 30 °C.
- The time between dispensing of the liquid and weighing of the liquid dispensed should be minimized (<60 seconds).

NUMBER OF REPLICATE MEASUREMENTS

- To establish the conformity of the liquid dispensing to ISO 8655-5, 10 replicate measurements must be performed at the 3 volumes described below.
- For quality control purposes, the number of replicate measurements and volumes to test can be modified and adapted as long as statistically significant.

CHECK OF ACCURACY OF LIQUID DISPENSING:

- At the start and end of the test, room temperature, barometric pressure and % relative humidity must be noted.
- Weigh 30 empty Digitubes and note weight of tubes.
- Place the empty tubes on the *Easy***PREP** *Titr***EC** platform

- In the *Easy***PREP** *Titr***EC** software, prime the instrument using the prepared deionized water. Ensure that there are no air bubbles in the dispensing line and dispensing tip.
- In AdminTools, move the robot to position A01 and manually have the pump draw and dispense the indicated volumes of DI water into 10 tubes per volume (see section 6.3.2).

  i. Volumes of DI water to use depend on syringe barrel size:

Volume of Syringe:	1ml	5ml	10ml
(Check at volumes)	(0.02ml /0.5ml /1ml)	(0.05ml /2.5ml /5ml)	(0.05ml /5ml /10ml)

  ii. Perform testing on the smallest volume syringe used with the unit.

- Weigh tubes again within 60 seconds of dispensing.

	START	**END**
TEMPERATURE		
BAROMETRIC PRESSURE		
% RELATIVE HUMIDITY		

Correction factor Z =

RESULTS TABLE:

Tube #	**Wt Empty Tube (g)**	**Wt Tube + Water (g)**	**Weight of water (g)**	**Volume of water (ml)**				
	A	**B**	**C = B-A**	**D = C * Z**				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
			AVERAGE		**e_s**		**STDEV**	

- Calculate the weight of water dispensed (column C).
- Determine the density correction factor Z using the water temperature, barometric pressure and % relative humidity (see following table).
- Determine the actual volume of water dispensed: multiply the weight of water by the correction factor Z. Type in the result in column D.
- For each volume dispensed, calculate the average volume dispensed.
- For each volume dispensed, calculate the systematic error es:

  es = average volume dispensed - target volume (in ml)

- For each volume dispensed, calculate the standard deviation of the 10 measurements:

Standard deviation si: (in ml)

$$S_r = \sqrt{\frac{\sum_{i=1}^{n} (Vi - V)^2}{n-1}}$$

This standard deviation is the random error of the liquid dispensing system.

- Compare the obtained systematic error (i.e., accuracy) and standard deviation (i.e., precision) to the tolerance limits of ISO 8655-5:

SYRINGE VOLUME	Testing volume (ml)	Accuracy (SYSTEMATIC ERROR, IN ML)	Precision (STANDARD DEVIATION, IN ML)
10	10	0.060	0.020
	5		
	0.05		
5	5	0.030	0.010
	2.5		
	0.05		
1	1	0.060	0.002
	0.5		

- If the standard deviation does not meet the criteria:
  a. Verify all connections (fittings and ferrules) as well as the dispensing tubing to remove any possible air leaks.
  b. Verify and remove any air bubbles in the tubing.

9 *Easy***PREP***Titr***EC** Peristaltic Pump Service

- Empty line of liquid on the pump that needs to be serviced
- Disconnect inlet and outlet tubing
- Remove 2 screws that hold peristaltic pump
- Replace tube that is inside of the plastic cover
- Installation is reverse of removal
- After installing pump, open the software and verify if pump is working properly.

*Figure 63: Easy***PREP** *Titr***EC** *Peristaltic Pump.*

CAUTION Attention! After servicing peristaltic pump(s), waste station rinsing times need to be verified.

10 Troubleshooting

10.1. DOWNLOAD THE TEAMVIEWER SOFTWARE

TeamViewer software allows the support department to have remote access to your desktop or laptop. Download the TeamViewer software at: http://www.teamviewer.com/en/download/windows.aspx

10.2. TROUBLE SHOOTING - GENERAL CASES:

Topic	Suggestion(s)
No initialization	- Check if something is blocking one of the arms from moving back to initial position
Arms not moving	- Switch unit off and check if something is blocking the arms from moving
Software does not recognize one of the components while starting	- Verify usb cable connection - Verify probe connections
Inaccurate liquid handling	- Prime fluid lines before using - Check the fittings and tubes (cracks, leakage, kinks)
Peristaltic pump turning but does not pump liquid	- Check pump tubing and fittings - Replace peristaltic pump tubing
pH values consistently higher than expected	- Recalibrate the sensor using fresh buffers. - Calibrate from the highest point (e.g. pH 10) to the lowest point (e.g. pH 4)
Invalid Alkalinity/Acidity or Conductivity Value:	Make sure that the pH and the EC sensors were well calibrated, In the *Titr***EC** user manual, section 7.2.1 Alkalinity/Acid Method, follow the instructions of the US EPA 310.1 or ISO 9633-1 standards and the APHA 2310 standard. Then, restart the process. If the same case happens again, contact the technical support of **SCP SCIENCE**.

10.3. TROUBLE SHOOTING-- SPECIAL CASES:

10.3.1 Blade Stirrer Not Working.

- Verification of values settings in AdminTools:

The duration must be greater than 0 and speed should be 10% or 20%. The values should be similar to this:

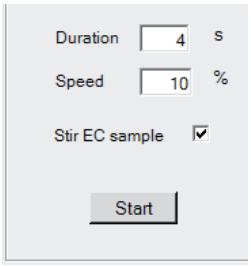

Figure 64: Blade Stirrer Field

- Mechanical inspection: See if the stirrer is touching the bottom of the container or touching one of the probes. If it is touching the bottom, decrease the Z value a bit: in ***Easy*PREP *Titr*EC** memory parameters file, modify row titled "Probe Position for Pick up Zp (mm)". This value should be 130 or less.
- Connection issue: Disconnect and reconnect the stirrer
- If none of the above fix the issue, contact **SCP SCIENCE** or your distributer for further troubleshooting guidance.

10.3.2. Multiple Symptoms Related to Memory Parameters File:

a. The robot arm is too far off to go into the wash station with all probes connected. Copy the params file received with your instrument's USB stick and replace it with your current Memory Parameters file or ask the support service to send you the right parameters file with the right positioning.

b. The params file has only 47 items compared to factory settings with 50. Copy the params file received with your instrument's USB stick and replace it with your current params file or ask the support service to send you the right parameters file with the right positioning.

To modify the parameters file:

- Enter in the new number and press enter. The cell should have changed to yellow and then save the changes
- Press Write/Reload
- Close and restart the ***Easy*PREP *Titr*EC** software to upload the new parameters.

10.3.3. The Washing Station Fills Up with Solution

When we rinse the washing station, it fills it up with solution. After rinse the pump for the drain starts but, only partially empties the station.

To fix this, go to Admin Tools. In the section Peristaltic Pump, change the Fill and Empty times to 10 seconds each. Try to fill and empty the rinsing station. If the rinsing station still fills up but does not empty, then there is something physically blocking the draining of the waste station.


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