Waltron AQUALERT® Division

Water Chemistry Measurement & Control



Aqualyzer® 3051 Hardness Analyzer
Instruction Manual

Version 3.01

WALTRON CUSTOMER COMMITMENT

This instruction manual is a technical guide to aid the customer in the set-up, operation, and maintenance of their new Waltron measuring system. Waltron provides continuous product improvement and reserves the right to make any modifications to the information contained herein without notice.

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Technical questions concerning this product should be addressed to:

Waltron Technical Service Department
Whitehouse, New Jersey
Phone: (800)-242-7353
Fax: (908)-534-5546
www.waltron.net

Please be ready to provide the following information:

- Date analyzer was purchased
- Analyzer model and serial number
- Recent maintenance history
- Calibration slope values and detailed description of problem

Waltron's technical expertise and extensive experience provides personalized solutions to the water quality industry. It is Waltron's commitment to provide the customer with timely and accurate technical service and support.

Waltron fully expects the customer to be satisfied with the quality, performance, and cost of this product.

If there are any questions or concerns regarding this product, please feel free to contact Waltron at (800)-242-7353.

Thank you for choosing Waltron!

Please note the Waltron mailing and shipping address:

Via Mail:
Waltron LLC
50 Tannery Road, P.O. Box 70
Whitehouse, NJ 08888

Via UPS/FED-EX/Motor Carrier:
Waltron LLC
50 Tannery Road
Somerville, NJ 08876

SAFETY

Please observe proper safety and handling precautions when installing, operating, maintaining, and servicing this product. The following should be noted and adhered to:

- Read and understand manual before working with analyzer.
- Pay special attention to warning labels on enclosures, containers, packages and chemicals.
- Only qualified personnel should be involved in the installation, operation, and servicing of the analyzer.
- Follow safety precautions when operating analyzer in conditions of high pressure and/or temperature.
- Keep analyzer chemicals away from heat and extreme temperatures. Reagent powders must be kept dry.
- Follow all regulations and warning labels when disposing of chemicals. Do not mix chemicals.

To obtain analyzer safety information or Material Safety Data Sheets (MSDS), please contact Waltron or logon to www.waltron.net .

WARRANTY AGREEMENT

If, within one year from the date of shipment, the customer experiences any equipment defects or is not satisfied with the analyzer manufacturing, Waltron will repair, or at its option, replace any defective part(s) free of charge. This warranty requires that the defective part(s) be returned to Waltron with shipping charges prepaid.

At Waltron discretion, a Technical Service Specialist may be sent out to repair or replace the defective part(s) on location. Traveling time and expenses of the Technical Service Specialist is at the customer's expense.

Equipment sent to Waltron must be appropriately packaged and the following information must be provided prior to returning to Waltron:

- The Return Authorization (RA) number assigned to the customer by the Waltron Technical Service Department
- Customer name, address and department
- Name and telephone number of the individual responsible for returning items for repair
- Brief problem description

Ship to Waltron service center:

Via Mail:

Waltron LLC
50 Tannery Road, P.O. Box 70
Whitehouse, NJ 08888

Via UPS/FED-EX/Motor Carrier:

Waltron LLC
50 Tannery Road
Somerville, NJ 08876

The Waltron Warranty Agreement:

- Covers expendable sensors for one month after shipment and reusable electrodes for six months after shipment.
- Does not apply to damages occurred during shipping.
- Warranty will be nullified if goods have been used for purposes other than those for which they are intended or if any seal has been removed, broken or tampered with or if the Waltron trademark or serial number has be removed, defaced, or altered.
- Does not cover expendable supply items such as reagents, tubing and electrolytes.
- Does not cover misuse or mistreatment by the user.
- Does not cover previous repair or alteration by unauthorized individuals.

Waltron does not assume responsibility for contingent liability through alleged failure or failures of products or product accessories.

CHECKLIST OF MATERIALS

- In order to ensure customer satisfaction, Waltron does its best to provide adequate and timely packaging and shipping services. Please perform the following after receiving a shipment:

- Inspect all shipping containers upon receipt and record any visible damage. If there are any outward signs of damage, please retain all containers and packages for inspection by carrier. Please retain all packing material so that it can be used for future moving and shipping needs.

- Check all items received against those on the packing list. Chemicals are usually shipped in a separate package and will be itemized accordingly.

- Verify that the number of packages received agrees with the packing list and shipping papers.

- Notify both Waltron and the carrier if any problems occur.

Important Notice:

- All analyzers are inspected and tested prior to shipment.
- In normal use, the unit should require only minor maintenance and should operate correctly and without fault over a long period of time.
- Please note that if electronic components need to be replaced, it may be necessary to adjust and/or calibrate the analyzer.
- Failure to carry out correct maintenance procedures may result in inaccurate analyzer readings.

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1 OVERVIEW

1.1 SPECIFICATIONS

1.1.1 PERFORMANCE

Sensor Classification:	Colorimetric with glass flowcell and LED source
Application:	Demineralized, boiler, potable, surface and waste water
Power Supply:	110-220Vac, 50-60 Hz 80 VA
Humidity:	Up to 90% not condensable
Ambient Temperature Range:	10-45º C analyzer (50-113º F)
Range:	0-1 ppm
Accuracy:	+/– 2% of full scale
Unit Dimensions:	Height=23.6”(60 cm), Width=15”(38 cm), Depth=8.3”(21 cm)
Positioning and Installation Details:	Wall mounting or with bench support, panel mount optional
Response Time (approximate):	<10min, batch process, programmable cycle frequency
Alarms:	2 or 4 configurable alarm relays
Reproducibility:	+/– 1 ppb or +/– 2% of reading, whichever is greater
Degree of Protection:	IP55 (NEMA 4): Wet section, IP65 (NEMA 4x): Electronics
Required Maintenance:	Once a month replenish reagents, once a year replace tubing
Reagent Consumption (approx.):	2 reagents, 2L each per month
Materials in Contact with Sample:	Glass, Silicone, Plexiglass, Stainless Steel AISI 316
CE Certification (on request):	Meets low voltage and low electromagnetic compatibility directives
Sample Conditioning Requirements:	Filtering between 10 and 60 micron, depending on the matrix, needed only
Weight:	17 kg

1.1.2 SAMPLE OPERATING CONDITIONS

Temperature Range:	5-55º C (41-131º F)
Inlet Sample:	100–500 ml/min, atmospheric, flexible tubing O.D. ¼” (6 mm)
Outlet Sample:	Atmospheric, waste tubing O.D. 3/8” (9 mm)
Turbidity:	Not applicable, sample blank correction
Color:	Not applicable, sample blank correction
PH:	3-12

1.1.3 SIGNAL OUTPUTS

Analog Outputs:	4-20mA (galvanic isolator module available as option) or 0-5V
Serial I/O for Signals:	Serial data output RS232 standard, RS485 available as option

1.1.4 OPERATIONAL CALIBRATION

Frequency/Intervals:	Recommended: 7 days
Single/Multi-Point:	Multi-Point: zero and mid-range
Matrix Corrections:	Yes, sample blank correction
Manual/Automatic:	Both

1.2 SAFETY PRECAUTIONS, INSTRUCTIONS, AND HAZARDS

1.2.1 GENERAL INFORMATION

This manual contains important information which is required for installation, start up and operation of the Waltron 3051 Hardness Analyzer. Please read this manual carefully before installing and placing the analyzer into service!

Pay attention to all caution and danger labels present on the analyzer and all caution and danger statements written on this manual.

- Waltron shall not be liable for errors contained herein and/or for an incorrect use of the analyzer. The department head and analyzer's users must be sure to read and observe the following instructions and to apply all the national and local regulations and laws regarding workers health and safety.
- Use, maintenance, and service of this analyzer is allowed only by qualified personnel who are fully trained on the analyzer's operations. This personnel is intended to be physically and mentally fit and not under effect of alcohol or/and drugs.
- When the analyzer is not used it should be protected from intentional or unintentional powering on, using a proper circuit breaker.
- Failure to do so and non-observance of hazards or dangers warnings could result in death or serious injury to the operators or damage to the analyzer.
- Before using the analyzer, it is necessary to visually check for damages to safety devices and report to your department head even if they don't cause the analyzer to stop or malfunction.
- All the analyzer's components are installed inside a metallic enclosure with a door equipped with a special key opening, only endowed to qualified maintenance personnel.

1.2.2 LIST OF WARNINGS AND POTENTIAL DANGERS

The table below is a list of hazards and dangers warning labels that may be found on the analyzer and/or in this manual. In case of these labels becoming outdated, they should be replaced with new ones by the analyzer owner.

Table 1.1: List of hazards and dangers.

	**Hazard of electrical shock** This symbol is used to present a hazard of severe electric shock or electrocution. All controls and maintenance on electrical devices labeled with this symbol should be made by qualified personnel in accordance with national or local regulations. Qualified Personnel means personnel who have been fully trained and have professional experience in avoiding electricity hazards and dangers. To avoid potentially fatal electrical shocks and/or analyzer damage always disconnect input power to analyzer before servicing.	Involved parts: · main power supply · peristaltic pump motor · input terminal
	**Hazard of chemical burns** This symbol is used to present a hazard of severe burns and serious injury for dangerous chemicals manipulation. All handling and operations maintenance on chemicals labeled with this symbol should be made by qualified personnel in accordance with national or local regulations. Qualified Personnel means personnel who have been fully trained and have professional experience in avoiding chemical hazards and dangers. Before proceeding with the handling of chemicals and service operations, read the material safety data sheets supplied with each chemical to take all the necessary precautions when handling.	Involved parts: · fluidics section · reagent container
	**Harmful** Specific indication depending on the parameter analyzed and the chemical colorimetric method used.	Involved parts: · fluidics section · reagent container
	**Warning of general hazard** This symbol means that is necessary read this manual before to proceed to any service operation to know exactly how to operate in proper way. Only qualified personnel fully trained on analyzer use and maintenance is allowed to proceed with service operations on the unit.	

1.2.3 REAGENTS

The Waltron 3051 Hardness Analyzer is based on colorimetric analysis methods, using chemical solutions.

- For the dangers and hazards regarding the chemicals used for the analysis, refer to the appendix of the specific analytic parameter and colorimetric reaction.
- Make sure that proper safety precautions are taken (e.g. using safety gloves and glasses) during handling the chemical solutions and the reagents containers / bottles.
- Read attentively the material safety data sheets of each chemical.
- The bottles of the reagents must report the specific hazards and dangers labels.

1.2.4 SAMPLE

Take the proper precautions to avoid direct contact with the sample stream. It is the responsibility of the user to collect all the information and take all the precautions regarding physical, chemical, radiation and/or biological hazards and dangers coming from sample stream and/or sample vapors. It is also the responsibility of the user to collect all the information and potential hazards regarding the chemical and physical compatibility of sample stream with analyzer materials.

Table 1.2: List of materials used in Waltron 3051 Analyzer.

Pump tubings	Silicon or Norprene
Fittings	PP
Connection tubings	Norprene / Silicon
Colorimetric cell	Glass
Mixing membrane pump	PP / EPDM
Pinch valve	Vyton / silicon tubing

1.2.5 WASTE DISPOSAL

The liquid from the drain of the colorimetric glass cell must be collected in a separate canister. Arrange removal by a disposal company. For guidelines on disposal, consult the requirements of the Local Authority chemical waste regulation.

1.2.6 ANALYZER GENERAL HAZARDS

1.2.6.1 Electrical Hazards and Precautions

General information:

- In all electrical devices that are 110-220 Vac powered, there is a hazard of electrical shock or electrocution.
- To protect all personnel involved in analyzer use and maintenance, the door of the analyzer enclosure is equipped with a special key opening.
- Service qualified personnel will receive the special key to open the analyzer's enclosure.
- Before servicing the analyzer parts that are electrically powered, turn off power to the

analyzer to avoid risks of electrocution.

- To turn off power from an electrical device, it is necessary to interrupt the power line using a circuit breaker or an isolating switch to be sure that there is no power in the area to be serviced.
- Inside the analyzer's enclosure, the lower level of protection against direct contacts is IP2X. The analyzer's enclosures are IP54.
- Protection against indirect contacts is guaranteed by efficient grounding of all isolated metal masses. Grounding screw is located inside the electrical enclosure, in the lower right position.

1.2.6.2 Operating Hazards and Precautions

HAZARD	Mechanical hazards caused by moving parts such as the peristaltic pump and the motor.

Preventive Actions:

To avoid risks, the analyzer's moving parts have been designed, built and located in closed enclosure with a special opening key. Inside the enclosure, these parts have protective covers to avoid any contact and physical injuries to users.

HAZARD	Hazard of burns and poisoning caused by contact with dangerous chemicals.

Preventive Actions:

To avoid risks, the analyzer's parts that can cause contact with chemicals have been designed, built and located in closed enclosure with a special opening key. Before servicing the liquids section, read the material safety data sheets supplied with each chemical and take all the necessary precautions when handling. Wear eye protections, gloves, mask and clothes if necessary.

HAZARD	Hazard of poisoning caused by waste gas coming out from leakages of the hydraulic parts.

Preventive Actions:

Install the analyzer in a location of adequate dimensions and ventilation.

HAZARD	Hazard of electric shock and/or electrocution in the electrical enclosure.

Preventive Actions:

The analyzer's electric equipment complies with EN 60204 requirements.
To avoid risks, the analyzer's parts that can cause hazard of electric shock and/or electrocution have been designed, built and located in closed enclosure with a special opening key. Inside the enclosure, these parts have protective covers and warning labels to avoid any contact and serious injuries or death to users.

NOTE: Electrical equipment with input power and grounding must comply with the national or local regulations and laws.

Preventive Actions:

- Check that the source voltage to be used corresponds with that requested by the analyzer.
- Check periodically the power cord grounding in addition to the analyzer grounding.

2 INTRODUCTION

2.1 ANALYZER DESCRIPTION

This manual provides general information regarding the principle of operation, proper installation and operation of the Waltron 3051 Hardness Analyzer.

The Waltron 3051 is an on-line analyzer for batch-wise analysis (sequence of sampling, analysis and result processing), using colorimetric method. The analyzer is assembled in an enclosure with lockable door. The LIQUIDS enclosure includes all the components involved in sample and reagents flows as well as their mixing and reaction stages (sampling pump, colorimetric reaction cell, reagents micropumps). The ELECTRICAL enclosure includes the main power supply, the controller PCB assembly and the touchscreen interface.



Figure 2.1: Waltron 3051 Analyzer front view.

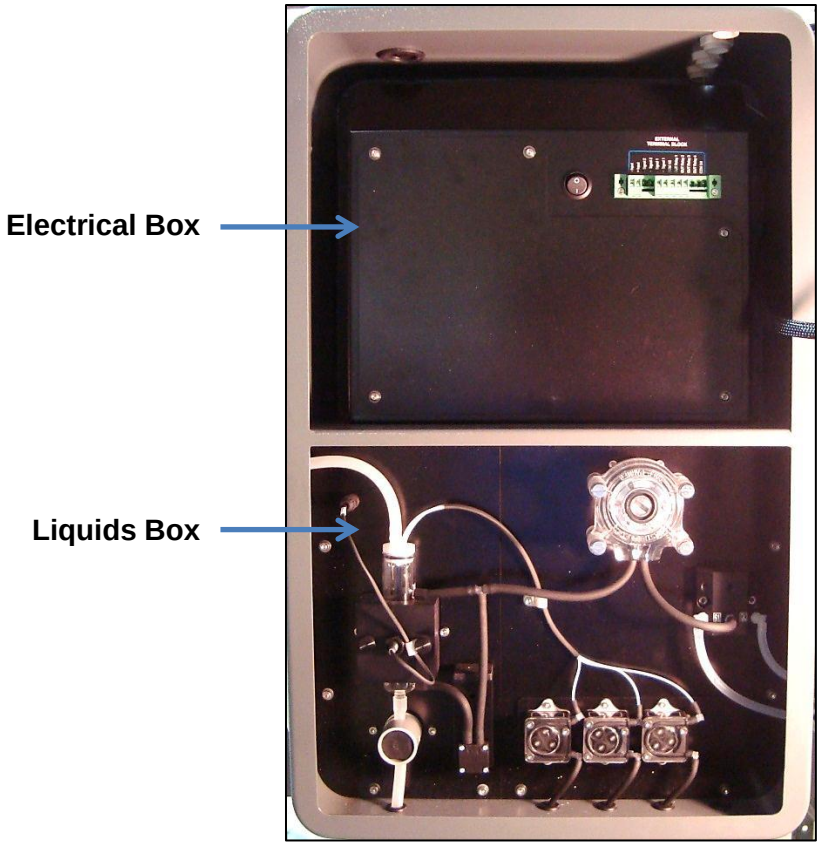


Figure 2.2: Waltron 3051 inside view with electrical box and liquids box shown.

2.2 APPLICATIONS

The application for the Waltron 3051 Analyzer is for the measurement of Hardness concentrations in high purity water.

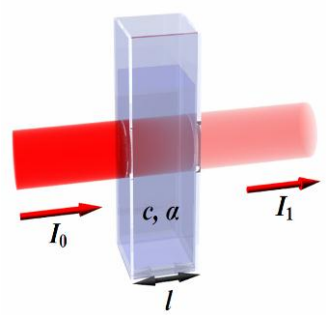
2.3 WORKING PRINCIPLE

Lambert-Beer Law

A colorimetric determination is based on the color-formation after addition of reagents. The absorbance of the solution is measured at a specific wavelength. The absorbance is related to sample concentration according to 'Beer's law'.

Lambert–Beer law is an empirical relationship that relates the absorption of light to the properties of the material through which the light is travelling.

The law states that there is a logarithmic dependence between the transmission (or transmissivity), T, of light through a substance and the product of the absorption coefficient of the substance, α, and the distance the light travels through the material (i.e. the path length), ℓ.
The transmission (or transmissivity) is expressed: $T = I_1 / I_0$



Absorbance for liquids is defined as the negative logarithm of the transmittance:

$$\mathbf{A} = -\log_{10}\mathbf{T} = \log_{10}\mathbf{1/T} = \log_{10}\mathbf{I_0/I_1}$$

$\mathbf{I_0}$ = light intensity through the sample before colorimetric reaction
$\mathbf{I_1}$ = light intensity through the sample after colorimetric reaction

In most cases the absorbance has a linear correlation with the sample concentration; for a linear calibration line just the blank and span values (i.e. concentration with zero analyte and the maximum expected concentration) are needed. Multiple analysis at each point that are averaged will provide a more accurate calibration line.

The absorbance ranges from 0 to 1, but it can go higher than that.

- An absorbance of 0 at some wavelength means that no light of that particular wavelength has been absorbed. The intensities of the sample and reference beam are both the same, so the ratio I_0/I_1 is 1. Log_{10} of 1 is zero.
- An absorbance of 1 happens when 90% of the light at that wavelength has been absorbed which means that the intensity is 10% of what it would otherwise be. In that case, I_0/ I_1 is 100/10 (=10) and $\log_{10}$ of 10 is 1.

Absorption photometry (Colorimetry):

The methods used are based on the formation of a colored complex of the analyte with a color reagent. Light with a specific wavelength is send through the reaction mixture. The absorbance of this light by the formed complex, measured by a photometer, is related to the concentration of the analyte.

$$Absorbance = \log \frac{reference}{sensor \quad reading}$$

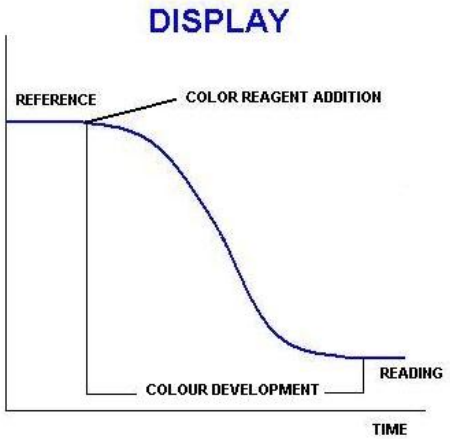


Figure 2.3: Color development.

2.4 ANALYSIS CYCLE

2.4.1 PROGRAMMING COMMANDS

An analysis time program in the Waltron 3051 Hardness Analyzer has the following structure:

1. After rinsing the reaction colorimetric cell and taking a sample, one or more miscellaneous reagents, like buffer or masking agent, may be added after which a first measurement takes place (reference); in this way interfering factors are eliminated such as sample color or turbidity, miscellaneous reagents color and refractive index variations.
2. The second measurement (reading sensor) takes place after addition of color reagent and color development, which may take a certain time period, depending on the color reaction.

Table 2.1: The run sequence of colorimetric determination.

Conditioning, rinsing and sampling *Drain, rinse and sample functions*	First the cuvette is drained and rinsed (this can also be programmed at the end of the run). In this way the hydraulic line and the colorimetric cell is rinsed as well prior to the actual sample taking. Next a sample is taken.
Addition of reagent(s) *Add reag function*	Depending on the method one or more reagents may be added before reference.
Mixing and wait *Mix and wait functions*	The mixing pump is activated and the liquid is pumped from the lower part to the upper part of the colorimetric cell. The waiting time is programmed in order to eliminate bubbles, suspensions.
First measurement *Reference function*	Regulation of the light intensity to a programmed value, in order to start from a fixed reference point and eliminate interfering factors (sample turbidity, color).
Addition of color reagent(s) *Add reag function*	Depending on the method one or more reagents may be added for the color development.
Mixing and wait *Mix and wait functions*	The mixing pump is activated and the liquid is pumped from the lower part to the upper part of the colorimetric cell; in this way reagent(s) is mixed. The waiting time is programmed in order to complete the colorimetric reaction.
Reading, absorbance and concentration calculation *Read sensor, absorbance, calculation*	Reading of the light intensity after the colorimetric reaction, calculation of the absorbance and of the concentration.
Drain, conditioning, rinsing, sampling *Drain, rinse and sample functions*	Drain and rinse of the hydraulic line and the colorimetric cell.
Waiting time (analysis frequency) *Wait function*	The wait function allows the user to set the analysis frequency.

2.4.2 FLOW DIAGRAM

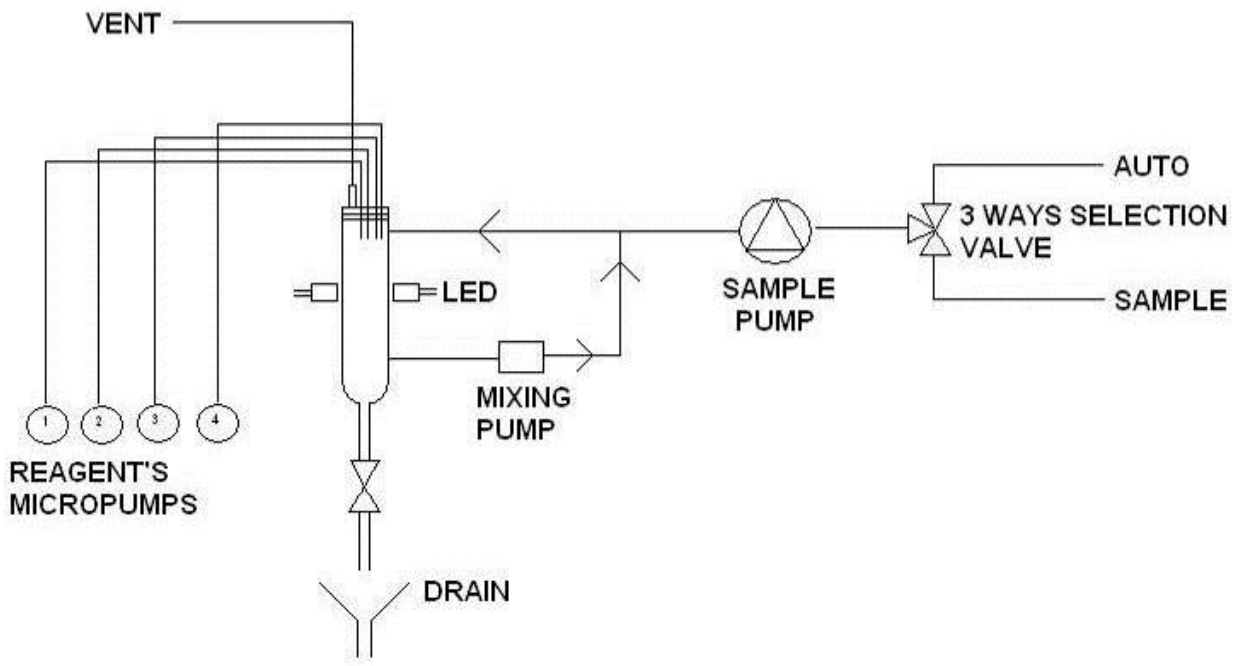


Figure 2.4: Flow diagram

2.4.3 ANALYZER OPERATIONS

The Waltron 3051 Hardness Analyzer performs several operations throughout a cycle. A list of common operations is shown below.

- Rinse #1
- Rinse #2
- Drain
- Sample #1
- Sample #2
- Add Reagent #1
- Add Reagent #2

2.5 FAST LOOP RESERVOIR

The external reservoir, required for online applications, allows a fast circulation of the sample coming from the sampling point. Inside the fast-loop reservoir the sample is at atmospheric pressure and this allows the sample pump to provide the analyzer with a constant delivery of smaple and no overpressure. In addition, the fast-loop reservoir holds a small additional quantity of sample to avoid wrong alarms in case of short loss of sample as well as to eliminate air bubbles from the sample line.

- The stainless steel drain tubing keeps a constant water level inside the container and allows a proper sample circulation to avoid suspended solids accumulation.
- The sample flow should be adjusted to have the complete sample overflow through the U-shaped stainless steel tube. A small hole at the stainless steel tubing allows the fast-loop reservoir to empty for cleaning purposes just with finger pressure.
- Inside the reservoir a level sensor checks for water presence. The loss of sample switch puts the analyzer into stand-by conditions at the end of the current cycle. When the sample flow resumes in the reservoir, the analyzer will start automatically with a new cycle.

NOTE: In the case of dual stream units, there will be two separate fast loop reservoirs, one for each of the sample streams.

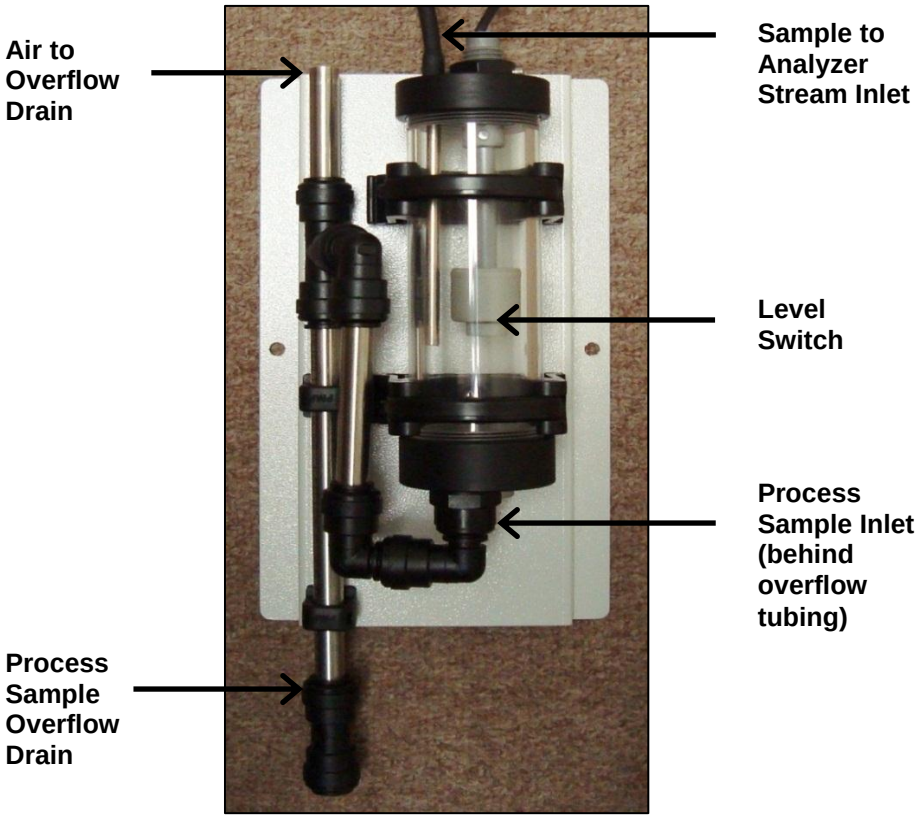


Figure 2.5: Depiction of the fast-loop reservoir.

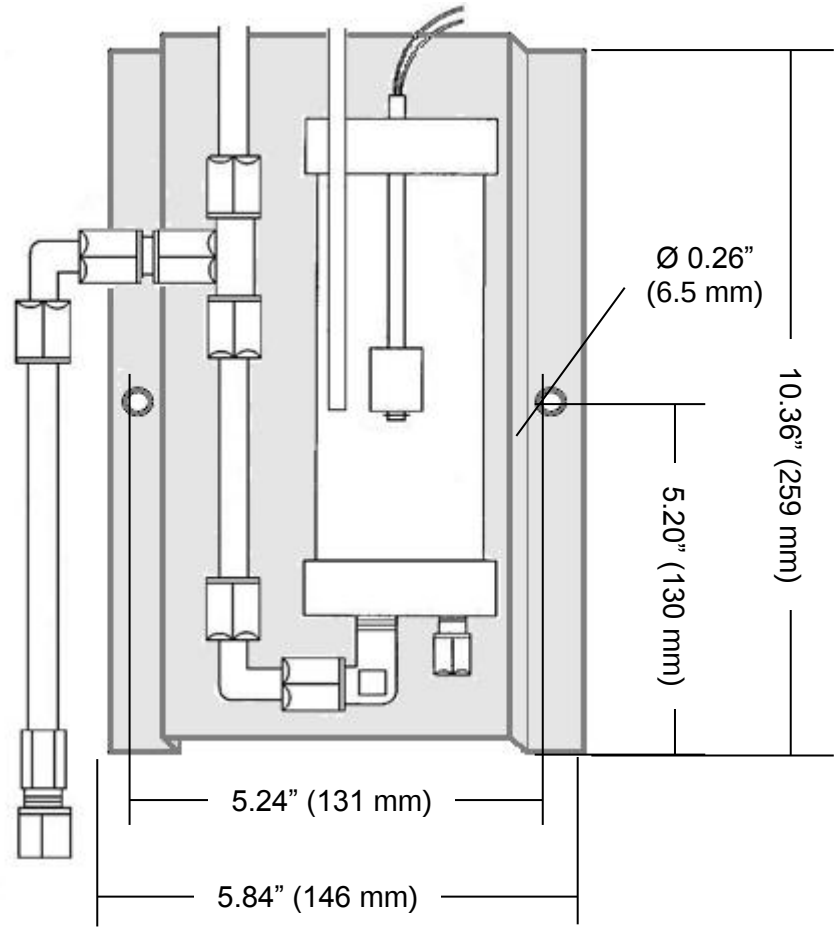


Figure 2.6: Mounting dimensions for the fast loop reservoir.

2.6 WET-SECTION BOX

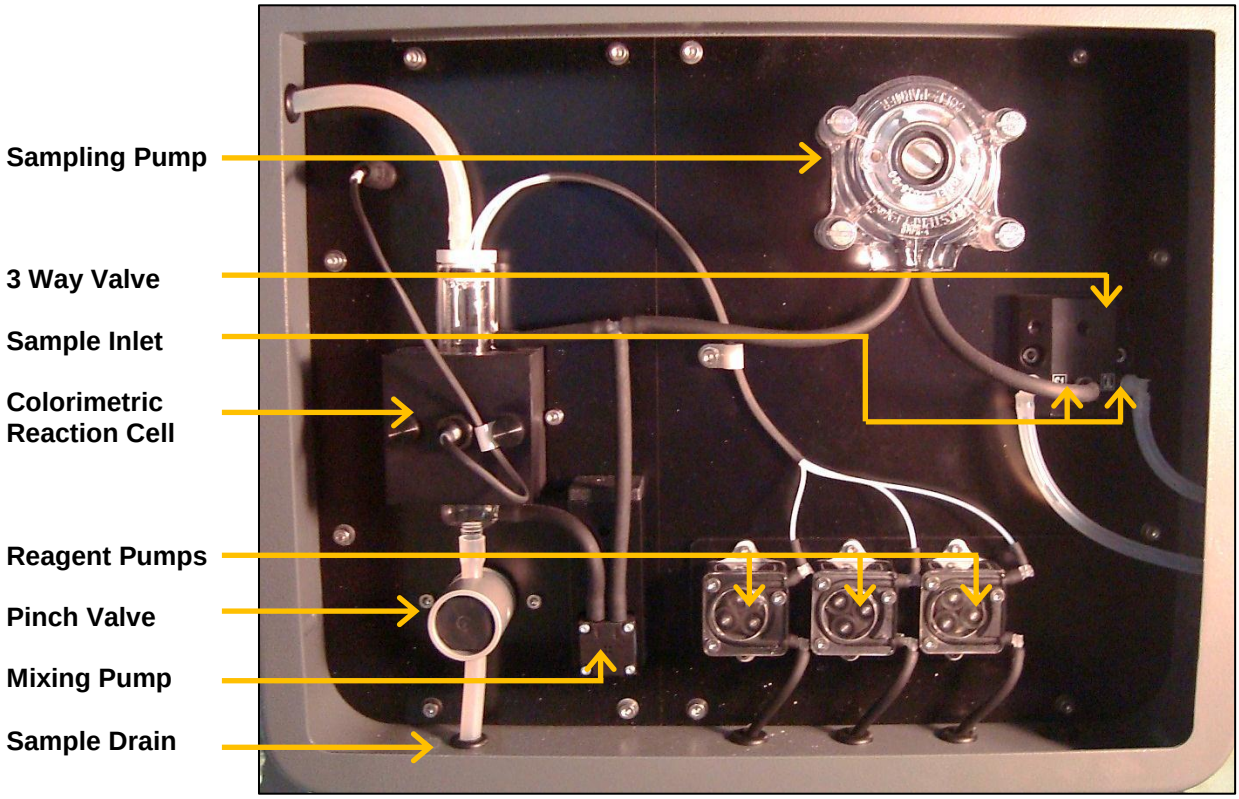


Figure 2.7: Hydraulic box with components indicated.

Sampling Pump

The analyzer uses a peristaltic pump for sampling. Pump tubing must have the proper diameter suitable for the pump. The diameter and the material of the tubing is very important; use only Waltron spare parts.

3 Way Valve

Allows the analyzer to choose between Sample Inlet 1, Sample Inlet 2 (dual stream units only), and Calibration Standard Inlet for analysis.

Sample Inlet

The tubing for the sample inlet(s) and calibration standard inlet pass through the housing enclosure on the right hand side of the unit and are connected to the 3 way valve.

Colorimetric Reaction Cell

The colorimetric reaction cell is made of glass; the diameter is 16 or 25 mm, depending on the parameter. The cell is positioned inside a thermostated block fixed with 2 screws. The block can be easily removed to allow the cleaning of the glass cell.

Reagent Pumps

The reagents are dosed with peristaltic pumps. The 3051 has two reagent pumps.

Pinch Valve

Normally-closed pinch valve to pinch or open a silicon / viton tubing O.D. ⅜ in order to close or open the drain of the colorimetric cell. The size and the material of the tubing is very important; use only Waltron spare parts.

Mixing Pump

The sample is mixed with reagents with a membrane mixing pump. The liquid is pumped from the lower part to the upper part of the colorimetric cell.
Flow direction (inlet / outlet) of the pump is indicated on it with the symbols Λ and V.

Sample Drain

The tubing for the sample drain maintains a constant level of few cm of liquid on the colorimetric cell.

2.7 ELECTRONICS

The microprocessor and its PCB assembly are located in the electronic section. It provides to control the entire analyzing system. It handles the analyzer operations, it collects all the information and data coming from the different analyzer devices and it controls all the I/O apparatus to dialogue with the user touchscreen interfaces and transfer data equipments. The connections for the external terminal block are shown in Section 3.6.2.

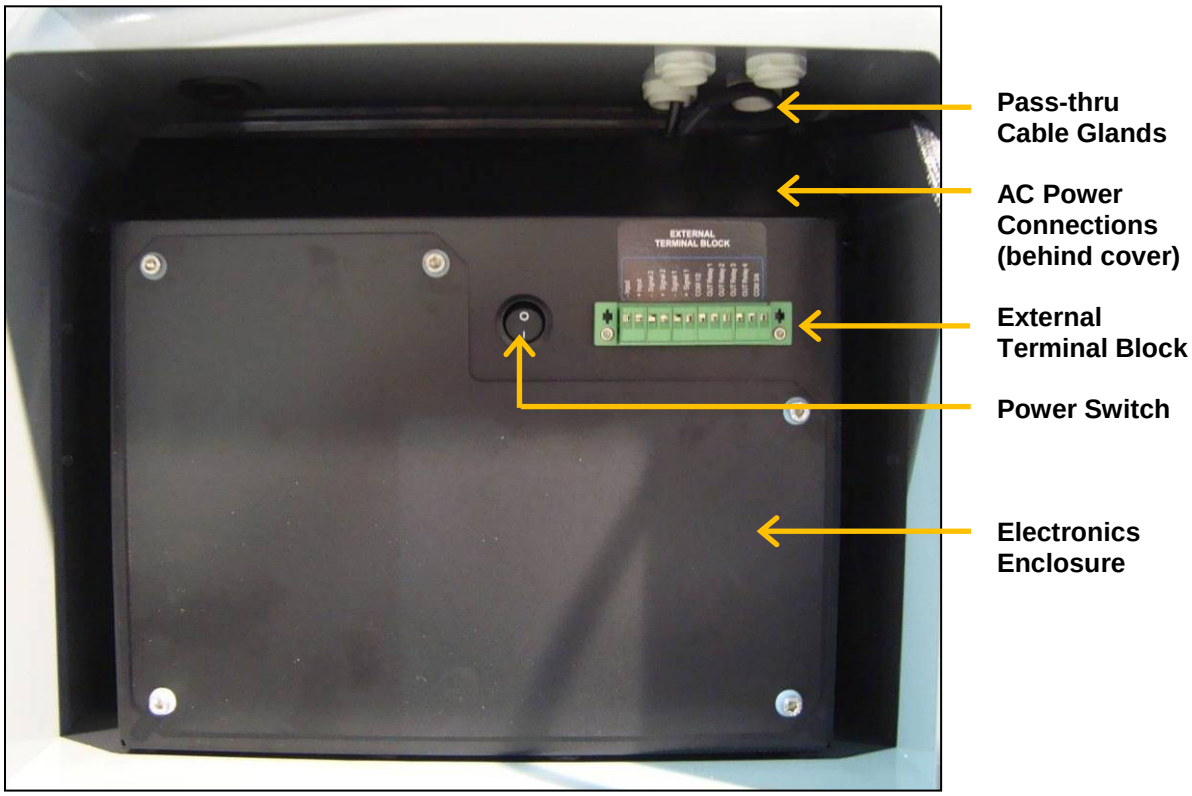


Figure 2.8: Electronics box.

3 INSTALLATION

3.1 RECEIVING

The Waltron 3051 Hardness Analyzer is assembled and fully tested for proper performance. Before proceeding with analyzer installation, it is recommended to:

- Check that the box and analyzer have not been damaged during transportation.
- Take extreme care during analyzer unpacking and moving.
- Be careful not to misplace accessories during unpacking. Refer to the packing list included.

3.2 ANALYZER HANDLING

Take extreme care when lifting or moving the analyzer. Before moving the analyzer, it is recommended to manually empty all of the hydraulic parts of any liquids.

3.3 LOCATION AND MOUNTING

It is recommended to install the analyzer in a suitable position:

- The location is to be clean, covered and properly enclosed to provide the analyzer with good ventilation and low dust concentration.
- Operating environmental conditions are: temperature between 5 and 50°C at max 80% relative humidity. If the temperature is below 5°C, the analyzer should be installed in a heated cabinet.
- Because of chemicals and waste gases it is absolutely necessary to have a well ventilated location for the analyzer.
- The analyzer is supplied with four mounting brackets for wall or stainless steel support rack installation. Use 4 screws M6 or M8 to mount the analyzer.
- Reagent bottles are supplied with the analyzer.
    - Relative position of the reagent's bottle(s) versus reagent pump(s) is very important.
    - Respect the maximum height of about 16” (40 cm) between the bottle(s) and the lowest edge of the analyzer panel.
- The fast-loop reservoir should be mounted within reach of the sample tubing (approximately 24” (60 cm) in length).

3.4 PRE-INSTALLATION

Before installing the analyzer, take the following precautions:

- Place the analyzer close to the sample point to achieve the minimum response time; the sample should be homogenous and representative.
- The drain line should be properly dimensioned and positioned at a downward slope to allow the drain of analyzed sample (by gravity) and the overflow coming from external fast-loop reservoir (if used).

WARNING!	The sample drain of the analyzer must be at ambient pressure with no restriction or counter pressure. Please verify that this condition has been strictly respected during installation.

- Clearance requirements for the analyzer should be about 8” (20 cm) on either side and about 40” (100 cm) in the front.
- Sufficient space for the reagent containers should be provided on the side or beneath the analyzer.
- The reagent containers should be positioned in the reagent bracket or a suitable basin in case of spills.

NOTE:	Respect the maximum height of 16” (40 cm) between the reagent's bottle(s) and the reagent's pump(s).

3.5 MOUTING SCHEMATICS

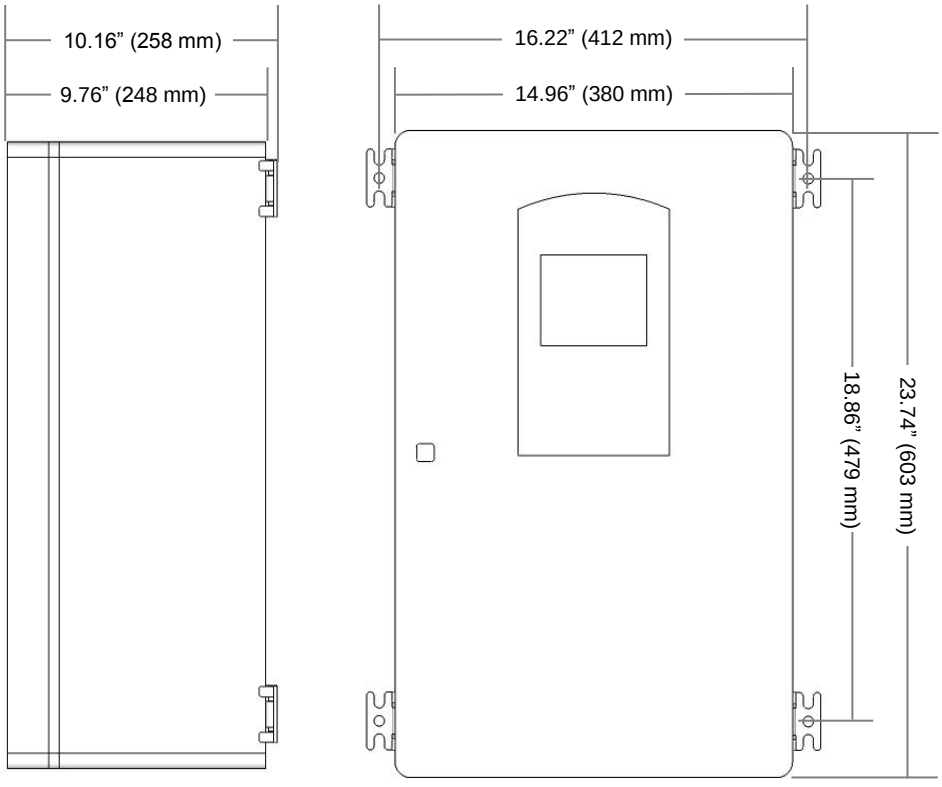


Figure 3.1: The dimensions for mounting the analyzer.

3.6 ELECTRICAL CONNECTIONS

General information:

- The electrical installation should be carried out by qualified personnel in accordance with national or local regulations. Qualified Personnel means a person who has been fully trained and has professional experience to avoid electrical hazards and dangers.
- Service qualified personnel will receive the special key to open the analyzer's enclosure.
- Before servicing the analyzer or its parts that are electrically powered, turn off power to avoid risks of electrocution.
- To turn off power from an electrical device, it is necessary to interrupt the power line using a circuit breaker or an isolating switch to be sure that there is no power in the area to be serviced.
- Protection against indirect contacts is guaranteed by efficient grounding of all isolated metal masses.
    - Grounding screw is located in the upper left position inside the electrical enclosure.
    - It will be user's task to periodically check and guarantee the efficiency of analyzer's grounding.

Users and qualified maintenance personnel must proceed as follows:

- Be careful of electrical shock and/or electrocutions labels placed on the analyzer.
- Always isolate power before servicing the analyzer.

In case of loss of power, the analyzer stops and automatically restarts into standby mode as soon as power is restored.



No maintenance should be carried out on the instrument without first switching off the power.

3.6.1 AC POWER CONNECTION

The Waltron 3051 Hardness Analyzer is designed for operation with 110-220Vac, 50 Hz power. All the connections must be made in accordance with national or local regulations. The analyzer is equipped with a thermal switch (main power switch). It is always recommended that the analyzer is connected to the mains via a circuit breaker or an isolating switch installed near the unit.

To make changes to the AC power connections, it is necessary to remove the electronics enclosure cover. The AC power connections are fed to a connector that sends the power to the ON / OFF switch before reaching the analyzer. The connections are shown below in Figure 3.2.

3.6.2 USER SIGNAL CONNECTIONS

The analyzer provides an External Terminal Block on the outside of the Electronics Enclosure. It allows the operator to connect to an external device such as a sequencer or sampler, monitor the 4-20mA ouputs and monitor alarm relays. The external terminal block can be configured from the SERVICE Screen.

Table 3.1 below shows the terminal contact labels starting with pin 1 on the left.

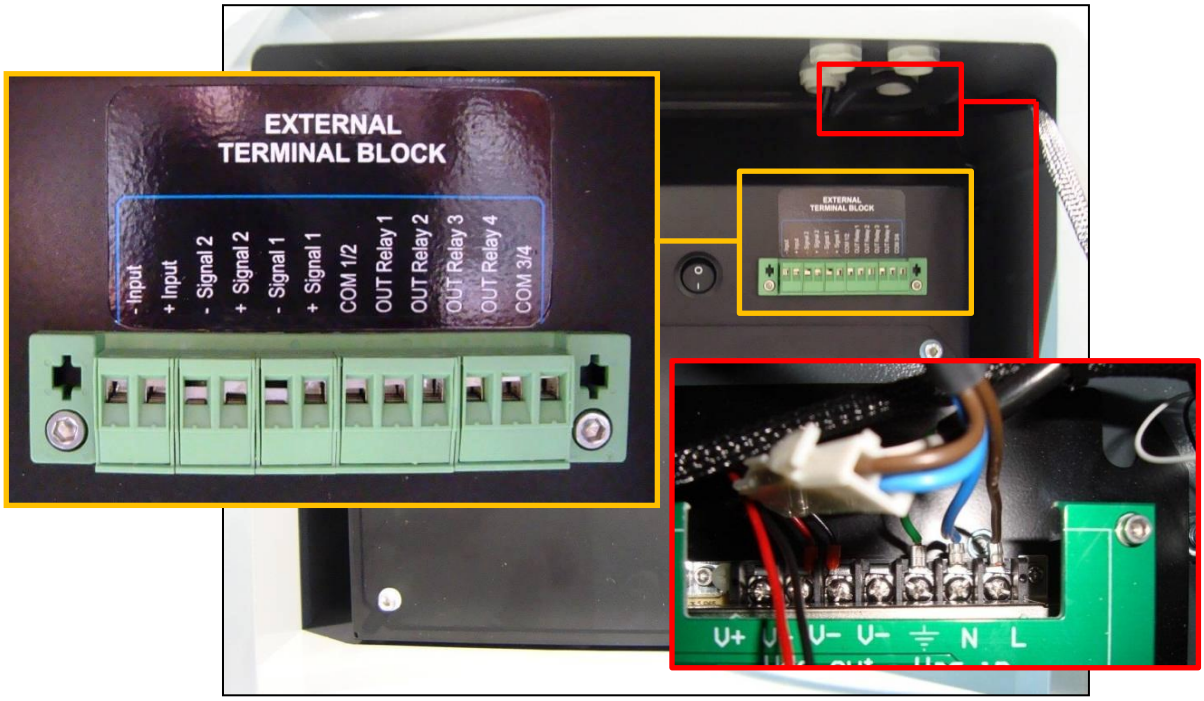


Figure 3.2: Electrical connections for user connections and power connections.

Table 3.1: Terminal block pin locations.

Pin Number	Terminal Label	Description
1	- Input	NO contact from an External Device to tell the analyzer to take a measurement.
2	+ Input	
3	- Signal 2	4-20mA output for Sample 2 Measurement
4	+ Signal 2	
5	- Signal 1	4-20mA output for Sample 1 Measurement
6	+ Signal 1	
7	COM ½	Common for Relay 1 and 2
8	OUT Relay 1	Alarm Relay 1 NO Contacts
9	OUT Relay 2	Alarm Relay 2 NO Contacts
10	OUT Relay 3	Alarm Relay 3 NO Contacts
11	OUT Relay 4	Alarm Relay 4 NO Contacts
12	COM 3/4	Common for Relay 3 and 4

3.7 REAGENT INFORMATION

The Waltron 3051 Hardness Analyzer uses 2 reagents for the colorimetric measurement.

- Reagent 1: Cresolphthalein Reagent
- Reagent 2: Ethanolamine Reagent

3.8 REAGENTS HOLDING BRACKET

Use the drawing below to mount the reagents bracket below the analyzer.

NOTE: Respect the maximum height of about 16” (40 cm) between the reagent's bottle(s) and the reagent's pump(s).

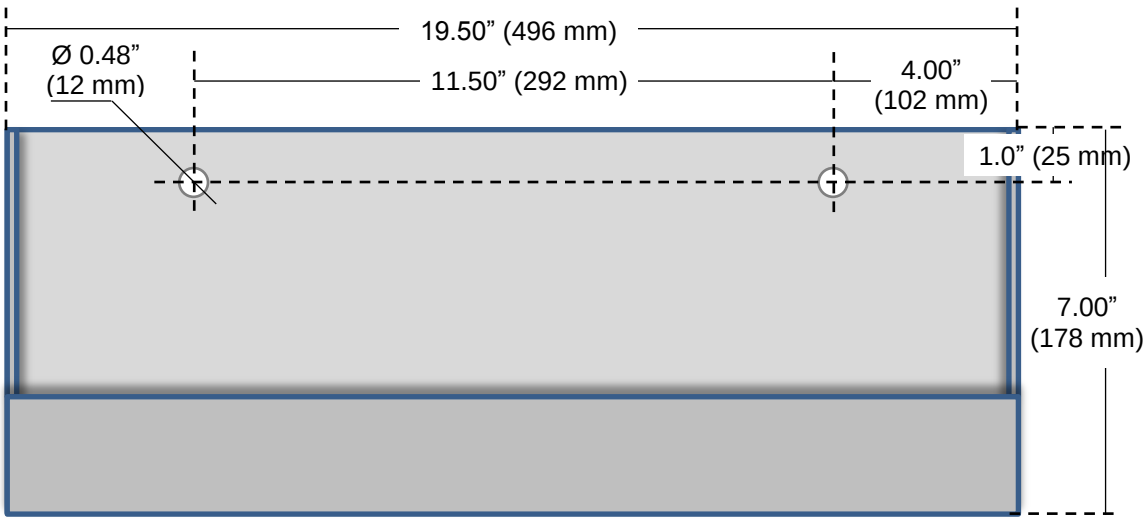


Figure 3.3: Mounting schematics for the reagent holding bracket.

4 ANALYZER INITIAL START-UP



Before proceeding with analyzer start-up it is absolutely necessary to check that all procedures for a proper installation and reagent preparation have been made. Please verify that all the suggestions and recommendations have been respected.

4.1 PREPARING THE ANALYZER FOR START-UP

Once installation is complete, proceed as follows to prepare the analyzer for online operation :

1. Connect the sample line inlet tubing (or filtered sample outlet coming from optional filtration system) to the fast-loop reservoir installed on the left side of the analyzer
2. Connect the drain fitting of the fast-loop reservoir to the waste line
3. Put the reagent inlet tubings into the appropriate reagent containers
   a. Reagent 1 = Cresolphthalein Reagent
   b. Reagent 2 = Ethanolamine Reagent
4. Put the calibration solution inlet tubing into the calibration solution positioned beneath the analyzer
5. Connect the analyzer drain tubing to waste drain line

WARNING! The drain of the analyzer must be at ambient pressure with no restriction. Please verify that this condition has been strictly respected during initial start-up procedures.

6. Check sample presence in fast-loop reservoir and adjust the sample flowrate so that there is complete reservoir discharge when a finger is covering the hole at the top of the stainless steel drain line
7. Turn the analyzer on using the switch in the electronics compartment
8. Perform reagents prime (see Section 6.1)
9. Perform calibration (see Section 6.2 & 6.3)
10. Set the analyzer to online mode (see Section 6.5)

5 USER INTERFACE

5.1 USER INSTRUCTIONS

The user's interface consists of the touchscreen located on the front panel of the analyzer enclosure. All the output/input data, information, alarms and fault conditions are shown on the display while all the commands and settings may be transferred to the analyzer simply pressing the touchscreen buttons.

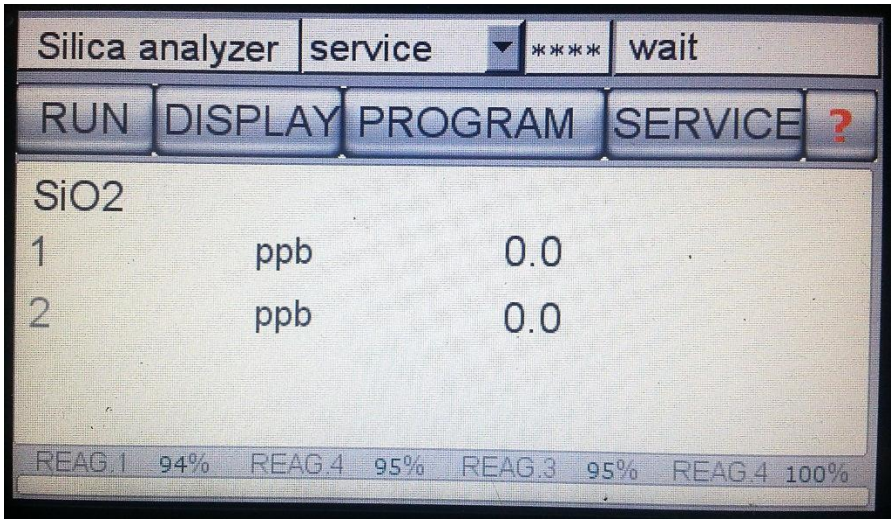


Figure 5.1: User interface main display screen.

5.2 USER PASSWORD

Table 5.1: User password.

First Level Password (service)	1111
Second Level Password (admin.)	Contact Waltron

Table 5.2 shows the menus and sub-menus that are available based on which level of password is input.

Table 5.2: Menu access level with password.

No Password	Service Password	Admin. Password
Main Menu	Display Menu – Manual Step	Program Menu – Analysis Cycle
Display Menu – Display process values	Program Menu – Calibration Menu	Program Menu – Extra Cycle
Program Menu – Settings		Service Menu
Help Menu		

5.3 MAIN SCREEN

The main screen displays:

- Name of the analysis program (Hardness Analyzer)
- Login **** window (two levels of password); pressing on **** the user can input the 4 number password
- Buttons that allow access the sub-menus (Run, Display, Program, Service and ?)
- Value (ppm or ppb) of the last analysis
- Alarms / relays
- Active step of the analysis in progress
- Reagent(s) consumption (%)

Table 5.3: Analyzer operating statuses.

ANALYZER OPERATING STATUS	
STAND-BY	The analyzer is waiting for a user's command (for example when the analyzer is switched on after a shutdown), after single cycle analysis, or when the operator has forced a stop in stand-by at the end of the current online / single cycle by pressing the button previously activated a second time.
SINGLE CYCLE	The analyzer is performing a single analysis cycle. As soon as the cycle is completed the analyzer will go into the stand-by condition.
ON-LINE	The analyzer is performing a continuous cyclic analysis based on the steps set in the PROGRAM menu (Analysis Cycle) and started when the START ON LINE button has been pressed. As soon as the analyzer completes an analysis cycle, it will restart with a new analysis. This condition is identified as the online condition.
MANUAL STOP	The analyzer has been forced to stop. A message in the main menu shows the "manual stop" and the fault alarm is initialized.

Table 5.4: Main menu button descriptions.

MAIN MENU BUTTONS	
RUN	This menu allows the user to put the analyzer into online measurement mode or run a single analysis cycle on stream 1 or stream 2. The user can also stop the analyzer with the emergency stop button.
DISPLAY	This menu displays all analysis data, the active step of the current analysis cycle with the time counter, the sensor's signal trend graph, and allows access to the manual step functions.
PROGRAM	This menu allows access to the calibration menu, enabling and disabling the loss of sample alarm, the 4-20 mA output, and settings of the analyzer.
SERVICE	Second level admin password required. This menu allows access to the analysis parameter, time, blank value, and regulation of the 4-20 mA output, led, and reference.
?	This menu shows the help user guide.

5.4 REAGENTS REFILL

The remaining reagent is shown as a percent (%) at the bottom of the main display screen.

If the reagent level falls below a value of 4%, the analyzer goes into FAULT status and stops automatically. The alarm message will be displayed in the main menu and the FAULT contact will be activated.

Every time the reagents are refilled, it is necessary to reset the value to 100%.

1. Press on the value % of each displayed reagent.
2. Bottle Reag. 1,2 Filled? YES.

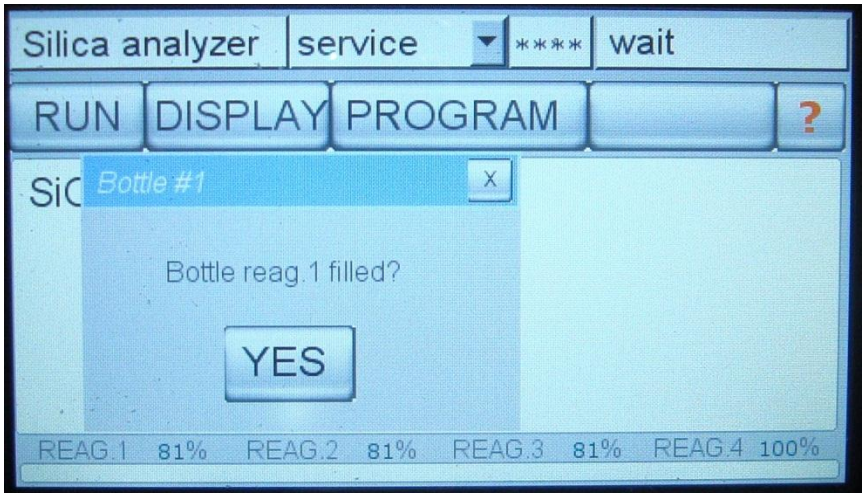


Figure 5.2: User interface screen for Reagents Refill.

5.5 RUN MENU

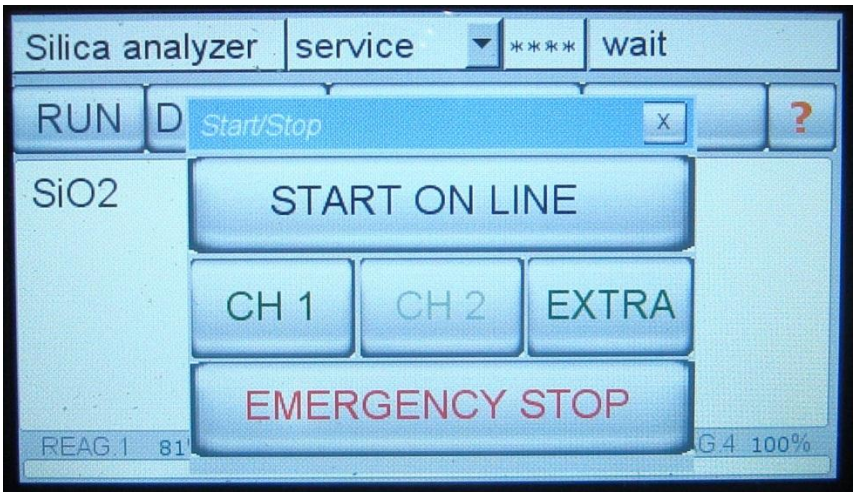


Figure 5.3: User interface after pressing the RUN Menu.

START ON-LINE:

This button puts the analyzer into continuous online operation. The analyzer will perform a continuous cyclic analysis based on the steps set in the PROGRAM menu (Analysis Cycle). This condition is identified as online and ONLINE is displayed on the button. Pressing the button again will cause the analyzer to finish the cycle in progress and put the analyzer in stand-by mode.

CH 1:

This command will perform a single analysis cycle on stream 1. At the end of the cycle, the analyzer will go into stand-by mode and wait for the user's next command.

CH 2 (available on dual stream units only)**:**

This command will perform a single analysis cycle on stream 2. At the end of the cycle, the analyzer will go into stand-by mode and wait for the user's next command.

EXTRA:

This command will perform a cycle based on the programming of the extra cycle. The default programming for the extra cycle is set to a CALIBRATION cycle.

EMERGENCY STOP:

This command will immediately stop the analyzer at the current step of the analysis in progress. The analyzer will go into the MANUAL STOP condition. On the main screen appear the message "manual stop" red coloured and the FAULT alarm contact will be activated. To restart the analyzer after an emergency stop, it is necessary to reset the fault by pressing the yellow colored RESET EM. STOP. This will force the analyzer to stand-by conditions.

5.6 DISPLAY MENU

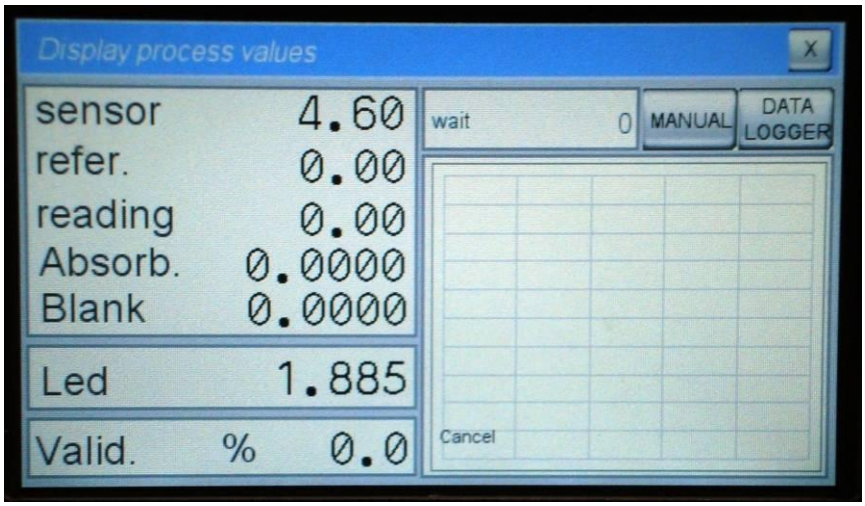


Figure 5.4: User interface in the DISPLAY Menu.

5.6.1 DISPLAY PROCESS VALUES

The following is a list of the data displayed in this menu (read-only values):

- **Sensor :** shows the current measurement of the sensor
- **Refer.:** shows the reference value (first point for the absorbance calculation)
- **Reading:** shows the reading of the sensor (second point for absorbance calculation)
- **Absorb.:** displays the last absorbance value calculated
- **Blank :** shows the most recent blank value
- **Led:** shows the led supplied
- **Valid. %:** it shows the validation value in %, compared to the calibration value
- **Current operation:** this window displays the current analysis step and the time in progress (countdown for every step programmed)

5.6.2 CHART

It displays in a graphic the sensor's signal trend during the current analysis cycle.

5.6.3 MANUAL STEP

This button allows to access to the manual commands of each programming step (see list in the Section 2.3.1) separately. The operator could decide the single operation to run (select function) and the time of the operation.

This function is protected with the 1st level of password and is available only when the analyzer is in stand-by mode.

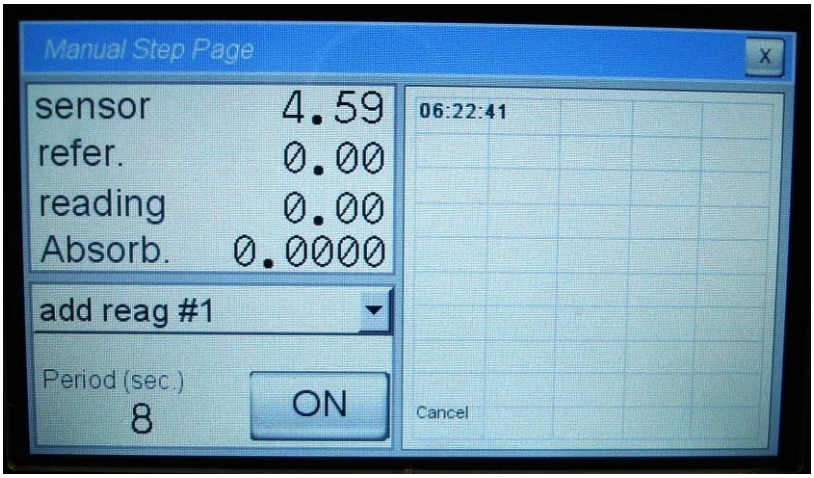
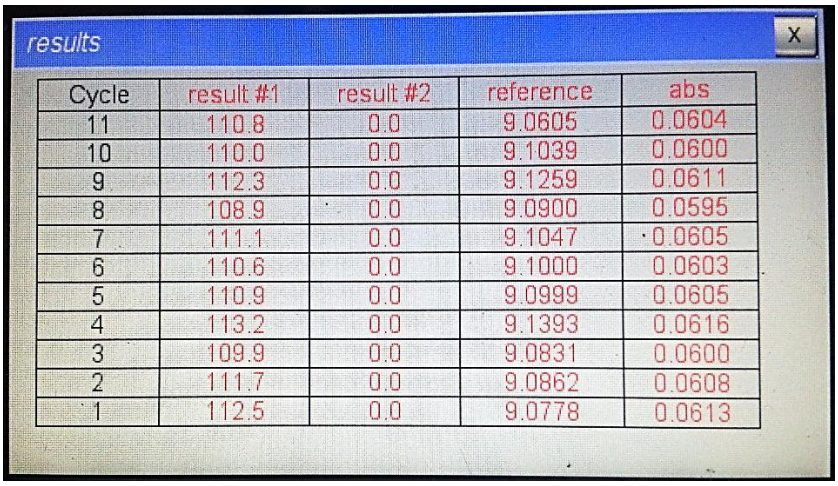


Figure 5.5: Manual step functions shown in the bottom left corner.

5.6.4 DATA LOGGER

From the DISPLAY menu, pressing the Data Logger button in the upper right hand corner will display the previous 500 results.



Cycle	result #1	result #2	reference	abs
11	110.8	0.0	9.0605	0.0604
10	110.0	0.0	9.1039	0.0600
9	112.3	0.0	9.1259	0.0611
8	108.9	0.0	9.0900	0.0595
7	111.1	0.0	9.1047	0.0605
6	110.6	0.0	9.1000	0.0603
5	110.9	0.0	9.0999	0.0605
4	113.2	0.0	9.1393	0.0616
3	109.9	0.0	9.0831	0.0600
2	111.7	0.0	9.0862	0.0608
1	112.5	0.0	9.0778	0.0613

Figure 5.6: Data logger screen of the user interface.

5.7 PROGRAM MENU

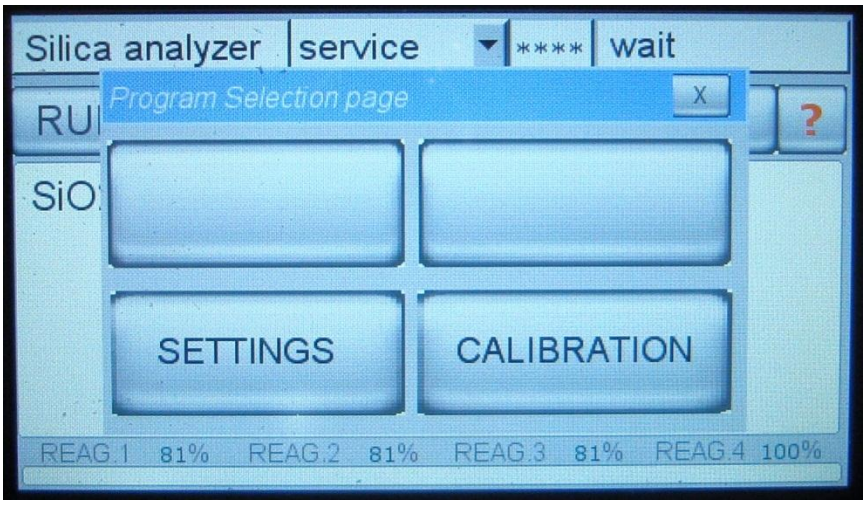


Figure 5.7: User interface after pressing the PROGRAM Menu.

The PROGRAM Menu allows access to the following operations:

SETTINGS:
Allows the user to set the ratio of the analysis cycles versus the extra cycles, the alarm value (low or high) and to enable or disable the loss of sample alarm and the 4-20 mA output.

CALIBRATION MENU:
This function is protected with the 1st level of password. Allows the user to set the value of the standard used for calibration and to perform blank and calibration cycles.

5.7.1 SETTINGS MENU



Figure 5.8: The SETTINGS Menu and options are displayed.

Cycles ratio: Programs the ratio of the analysis cycles versus the extra cycle (calibration cycle). For example, 400 analysis to 1 extra cycle means that every 400 analysis cycles the analyzer will perform 1 calibration cycle.

Cycle wait: Sets the time between analysis cycles when the analyzer is in on-line mode.

Result alarm: Programs the low / high value alarm. The alarm is expressed in % of the full scale.

Output Signal: Enables / disables the 4-20 mA output.

Datalog: Enables / disables the internal data logger.

Sample Alarm: Enables / disables the loss of sample alarm.

5.7.2 CALIBRATION MENU

Allows the user to display and set the value of the standard used for calibration and perform manual blank and calibration cycles (refer to Section 6).

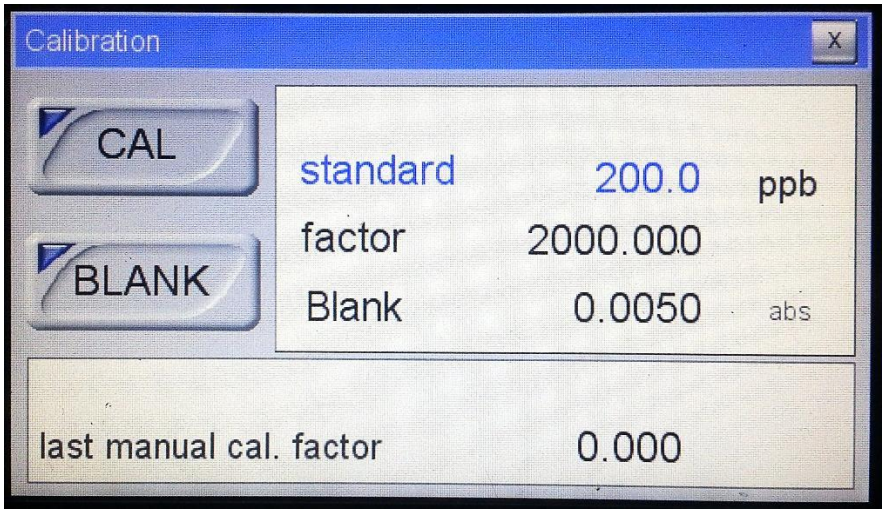


Figure 5.9: User interface at the CALIBRATION Menu.

5.8 SERVICE MENU

Acess to the SERVICE Menu requires the second level password for the admin login. The SERVICE Menu allows the user to configure the external terminal block connections.

Configure the External Control

On the Service screen change the External Input selection from NONE to either ONLINE or EXTRA CYCLE (i.e., Calibration).

Setting the range for the 4-20mA Sample 1 Output

Set the range of the 4-20mA Sample 1 Output with the F Scale1 selection. The default range is equal to the range of the analyzer.

Setting the range for the 4-20mA Sample 2 Output

Set the range of the 4-20mA Sample 2 Output with the F Scale2 selection. The default range is equal to the range of the analyzer. This setting only applies to dual stream analyzers.

Configuring Relay 1, 2, 3 and 4

There are 4 cells on the service screen to configure Relay 1, Relay 2, Relay 3 and Relay 4. Touch one of these cells and select the parameter to activate the relay:

Result Alarm – The measurement is greater than the % specified on the Settings screen. For example: If the Result Alarm on the Settings screen is set to greater than 50%, the relay will close when the measurement goes above 50% of the analyzer range.

Loss of Sample 1 – The relay will close when the flow on Sample 1 is lost.

Loss of Sample 2 – The relay will close when the flow on Sample 2 is lost.

Fault Alarm – The relay will close when a Fault Alarm occurs such as

- Pressing the EMERGENCY STOP button. Alarm is cleared by pressing RESET in the RUN window.
- Reagent went below 4%. Alarm Cleared by refilling reagent bottles and setting the level to 100%.

Cycle Command – When testing the relay, set the relay mode to "Cycle Command".

GO to the Display screen and press the Manual button.
Scroll through the options and select Relay #1.
Set the activation duration and press ON.
The Relay #1 contacts will close for the designated duration.

5.9 HELP MENU

The internal HELP Menu can be accessed by pressing the **?** on the main display screen. The help menu has the following sub-menus that can be viewed directly from the analyzer and can also be found in Appendix B.

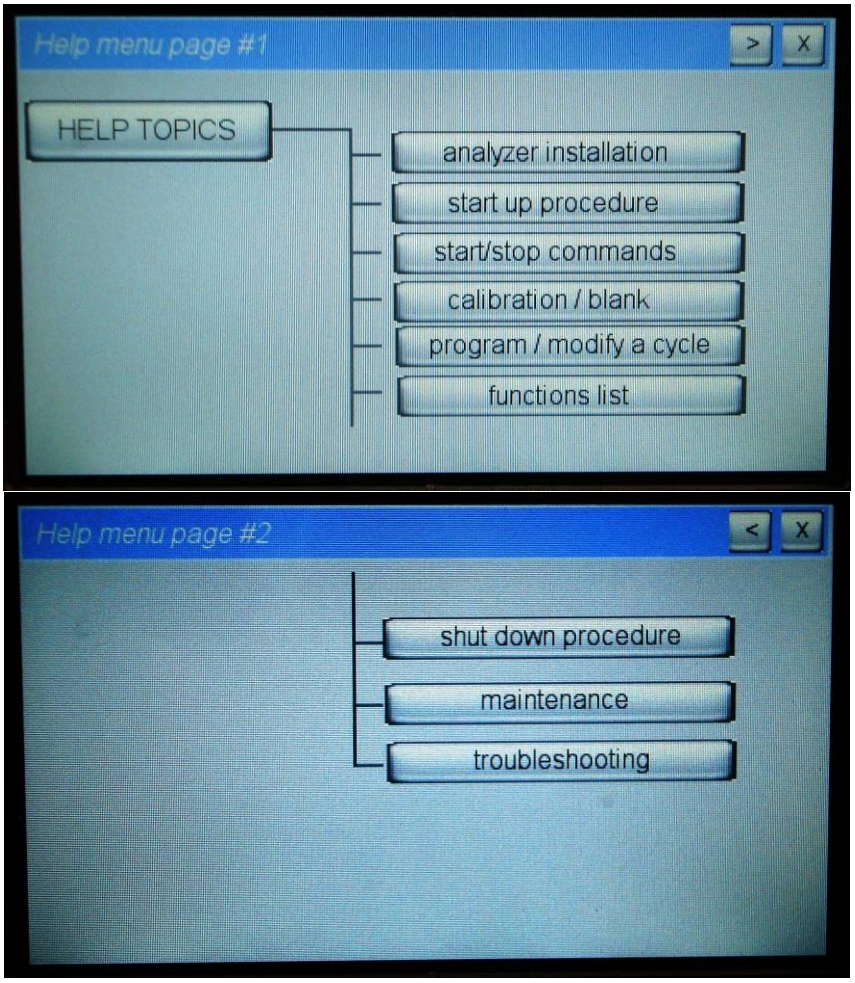


Figure 5.10: User interface showing the topics in the HELP Menu.

6 OPERATION

Colorimetry is a relative method, therefore an initial calibration is needed before measurement can be performed. This is done using standard solutions and analyzing them in the same way as the sample.

In order to ensure correct measurement performances, the analyzer should be calibrated periodically. The blank is taken with DI water. The system slope is controlled by a comparison to a standard solution of known concentration.

Calibration allows the analyzer to adjust:

- Blank of the system
- Slope of the system (factor calibration)

The calibration can be done manually or automatically.

6.1 REAGENTS PRIME

Prior to the initial calibration of the analyzer, the reagent lines must be primed. This procedure should also be performed every time the reagents are refilled or replaced.

1. Login with the 1st level service password (1111).
2. Press the DISPLAY button on the touchscreen and then press the button MANUAL STEP.
3. Select SAMPLE function for 20 seconds.
4. Select ADD REAG (1,2) functions for 40 seconds each in order to prime the three reagent lines. Visually confirm that reagent is being drawn into the lines and into the flowcell. If no reagent is seen, it may be necessary to repeat the ADD REAG function.
5. Select DRAIN function for 5 seconds.
6. Select SAMPLE function for 20 seconds.
7. Repeat steps 5 and 6 to rinse the flowcell.
8. Check the drain tube of the pinch valve is correctly positioned and select the DRAIN function for 5 seconds.

6.2 BLANK CALIBRATION

A blank calibration should be performed after reagent replacement and every time a manual calibration is required.

1. Login with the 1st level service password (1111).
2. Disconnect the sample tubing from the fast-loop reservoir and connect it to a DI water source.
3. Perform an analysis cycle by pressing the RUN Menu and selecting CH 1.
    - It is recommended to proceed with a blank refreshment after performing three analysis cycles with DI water to flush the system.
    - The absorbance detected by the analyzer is assumed to be absorbance produced by reagent(s) and DI water.
4. To store this value as the blank, from the PROGRAM menu, select the CALIBRATION

Menu.

5. Press and hold down the BLANK key.
   - This will refresh the stored BLANK value; it can be refreshed only after a completed analysis cycle with the analyzer in stand-by mode.
6. Reconnect the sample line to the fast-loop reservoir.

6.3 SLOPE (FACTOR) CALIBRATION

A manual factor (slope) calibration should be performed during the initial start-up, after reagent replacement, and after any period of extended shut-down. The recommended and default setting for automatic calibration is approximately once per week.

1. Login with the 1st level service password (1111).
2. Connect the CAL tube to the calibration standard.
3. Check that the calibration standard is the correct concentration.
   a. From the PROGRAM Menu, select CALIBRATION.
   b. The concentration of the standard is displayed in blue.
   c. To change the standard concentration, press the displayed standard value.
   d. Type the new concentration and select ENT.
4. From the RUN Menu, select EXTRA. The analyzer will perform a calibration cycle and store the new calibration factor.
5. Perform an EXTRA Cycle two to three times with the calibration standard to ensure a repeatable calibration factor.
6. To check the value of the calibration factor, from the PROGRAM Menu select CALIBRATION to open the calibration menu window.

6.4 SINGLE ANALYSIS CYCLE

The analyzer can be set to run either in continuous analysis mode or single analysis mode. Follow the steps below to perform a single analysis cycle.

NOTE: When starting the analyzer for the first time or restarting it from any period of shutdown, do not proceed to run an analysis cycle until a calibration has been performed.

1. Connect the sample tubing to the fast-loop reservoir and turn on sample flow to the fast loop reservoir.
2. Check that the sample fills the fast loop reservoir so that the float switch rises and sample is being discharged from the overflow drain.
3. Perform an analysis cycle by pressing the RUN Menu and selecting CH 1.
   - The absorbance detected by the analyzer is used along with the blank and calibration values to determine a concentration in ppb.
4. When the analyzer has finished the analysis cycle, the concentration reading will be displayed on the main screen. The result can also be found in the data logger.
5. The analysis returns to standby mode and waits for another user command.

6.5 ONLINE MEASUREMENT

In online mode, the analyzer will run perform consecutive analysis cycles until it is manually stopped or the out of sample alarm is tripped.

NOTE: When starting the analyzer for the first time or restarting it from any period of shutdown, do not proceed to put the analyzer into online operation until a calibration has been performed.

1. Connect the sample tubing to the fast-loop reservoir and turn on sample flow to the fast loop reservoir.
2. Check that the sample fills the fast loop reservoir so that the float switch rises and sample is being discharged from the overflow drain.
3. Put the analyzer into online measurement mode by pressing the RUN Menu and selecting START ON LINE.
    - The absorbance detected by the analyzer is used along with the blank and calibration values to determine a concentration in ppb.
4. When the analyzer has finished the analysis cycle, the concentration reading will be displayed on the main screen. The new result and previous results are stored in the data logger (up to 500 measurement results).
5. The analyzer will wait the user defined amount of time (see Section 5.7.1) and then proceed to run additional analysis cycles.
6. To bring the analyzer out of online operation, press the RUN Menu. The top box where START ONLINE was previously, will now be blank and dark gray. Pressing this box will tell the analyzer to complete the current analysis cycle and go into stand-by mode at its completion.

6.6 GRAB SAMPLE

The grab sample feature allows the user to measure the concentration of an external sample.

NOTE: When starting the analyzer for the first time or restarting it from any period of shutdown, do not proceed to run a grab sample analysis until a calibration has been performed.

1. If the analyzer is in online operation, it is necessary to put it into standby mode.
    - Press the RUN Menu and select the START ON LINE button (blank, dark gray box on the top of the RUN Menu).
    - The analyzer will finish the analysis cycle that is currently in progress and go into standby mode.
2. Turn off sample flow to the fast loop reservoir.
3. Disconnect the sample tubing from the fast-loop reservoir and connect it to the grab sample source.
    - The grab sample source should have at least 200 ml of sample present.
4. Perform an analysis cycle by pressing the RUN Menu and selecting CH 1.

5. When the analyzer has finished the grab sample analysis cycle, the concentration reading will be displayed on the main screen. The result can also be found in the data logger.
6. The analysis returns to standby mode and waits for another user command.
7. When the user is finished with the grab sample analysis, make sure to reconnect the sample tubiing to the fast loop resevoir.
8. Turn on sample flow to the fast loop resevoir.
9. Put the analyzer back into online operation mode by pressing the RUN Menu and selecting START ON LINE.

6.7 EMERGENCY STOP

The analyzer has an emergency stop function that will stop the analyzer immediately during any analysis cycle that it is performing.

1. Press the RUN Menu.
2. Select EMERGENCY STOP.
   - The analyzer will stop its current function and return to the main display screen.
   - The emergency stop fault alarm will be activated.
3. To put the analyzer into standby mode after an emergency stop, press the RUN Menu.
4. The menu will now show RESET in the posistion that emergency stop was listed previously.
5. Select RESET to deactivate the alarms and return the analyzer to the main display screen in standby mode.

NOTE: After initiating an emergency stop, there may be sample and reagents remaining in the analyzer. It will be necessary to flush the system before performing a new analysis cycle.

7 MAINTENANCE

7.1 SCHEDULED MAINTENANCE

Basic maintenance of the Waltron 3051 Analyzer requires that the reagent containers are refilled or replaced and that the colorimetric cell is cleaned on a regular basis. In addition, the user should perform a regular 'visual overall-check' of the wet part for immediate corrective measures, e.g. in case of leakages etc. Cleaning of the analyzer cabinet is best performed using a soft, non-aggressive cleaner.

The use of a logbook for cataloging reagent refilling, corrective measures and scheduled maintenance is strongly recommended.

During the performance of the basic maintenance work, as described in this chapter, the analyzer can not be operational. Prior to the maintenance work, all necessary precautions regarding personal safety (protective clothing, safety glasses etc.) are to be taken into consideration. Always be sure to label and rinse all connected tubing with water prior to removal.



Waltron Colorimeter is based on colorimetric analysis methods, using chemical solutions. Make sure that proper safety precautions are taken (e.g. using safety gloves and glasses) during handling the chemical solutions.

List of scheduled maintenance:

Visual check
Everytime that it is possible, visually check the following items:

- Liquid leakages
- Cell sample level (during cycle)
- Glass cell cleaness condition
- Reagent level %

Monthly

- Visual overall check
- Colorimetric cell cleaning
- Reagent(s) replacement (reset reagent counters)
- Reagent pump(s) priming
- Calibration blank with DI water, slope with calibration solution

Every 2 months

- Pinch valve drain tubing replacement

Every 4 months

- Peristaltic pumps tubing replacement

Every 6 months

- 3 ways valve cleaning, manually with a syringe
- Colorimetric cell o-ring replacement
- Fittings cleaning / replacement

Annually

- Hydraulics and sample tubing replacement
- Analyzer general inspection (for qualified personnel only)

Table 7.1: Scheduled manintenance reference chart.

OPERATION	FREQUENCY					
	Daily	Monthly	2 Mos.	4 Mos.	6 Mos.	Annually
Visual check of FAULT alarm indicator	X					
Visual check of liquids enclosures for leakages detection	X					
Visual check of reagents level	X					
Sample fast-loop reservoir cleaning		X				
Colorimetric cell cleaning		X				
Reagents replacement (reset reagent counters)		X				
Pinch valve tubing replacement			X			
Pump tubing replacement				X		
3 way valve and fittings cleaning					X	
Colorimetric cell O-ring replacement					X	
Hydraulics and sample tubing replacement						X
Analyzer general inspection (for qualified personnel only)						X

7.2 PUMP TUBING REPLACEMENT

The peristaltic pump head is located in the fluidics section. Before replacing the tubing, please read the hazards and dangers list in section 1 and health and reagents safe data sheets. It is also recommended to wear adequate clothes, gloves and eyes protection and take extreme care sample spills during tubing replacement.

Proceed as follows:

1. Stop the analyzer
2. Using the key, open the liquids enclosure
3. Manually unscrew the four wings nuts which hold the pump head in place.
4. Disconnect the pump tubing from its inlet and outlet fittings, taking extreme caution of liquid spills
5. Slide the pump head to the left and remove the pump head
6. Separate the two halves, taking care of the rotor, and remove the used tubing, taking caution of spills
7. Place the pump half containing the rotor in one hand and place the rollers in the 2, 6 and 10 o' clock positions. Place tubing in the outer port and against the two rollers as shown, keeping your thumb on the tubing to hold it in place, insert tubing key on the back of the rotor shaft and push in as far as possible. Tubing is now positioned in deep into the pump head body. With the key firmly pressed against the rotor, turn counterclockwise and push down while turning until tubing has surrounded the rotor
8. Tubing is now in place. Remove key and position other pump half into the rotor shaft and snap shut. Be careful not to pinch tubing between plastic pump halves
9. Check if the pump turns correctly using the key
10. Finger tighten the pump head slide it into the mounting screws moving the roller block with the key or with a screwdriver until the shaft aligns with the motor drive
11. Secure the four wing nuts by finger tightening until they have a firm mounting of the pump head
12. Restart the analyzer



Figure 7.1: Pump tubing replacement.

8 ANALYZER SHUT-DOWN

It is important to know that the analyzer should run continuously, if possible. For a short downtime of the 3051 analyzer (from 1 to 3 days), it is recommended to put all the inlet tubing (reagents and sample source) in a DI water source and leave the unit running in these conditions.

For long shut down period, please proceed as follows:

1. Replace the reagents in the container with distilled water and perform a priming of all the pumps with DI water.
    a. Login with the 1st level service password (1111).
    b. Press DISPLAY > MANUAL > STEP > ADD REAG 1,2 for 40 seconds.
2. Disconnect the sample line and fill the fast-loop reservoir (if present) with DI water.
3. Run the analyzer for at least 2 cycles with all of the reagent tubes placed in a DI water container.
4. Empty the hydraulic line of water.
5. Put the analyzer in stand-by mode.
6. Turn off the analyzer main power by disconnecting the plug from the power line.

9 TROUBLESHOOTING

For troubleshooting tips and solutions, refer to the HELP Menu. The HELP Menu can be found through the user interface of the analyzer and in Appendix B of this manual.

Table 9.1: Alarm descriptions.

Alarm Message	Alarm Description	Action Required
Reagent <10%	One or more reagent bottles is low	Check the level of the reagent bottles and refill as necessary
Zero Failure	The Refernce Failed	Check the water level in the sample cell
Loss of Sample 1	The sample to stream 1 is lost	Check the flow of Sample #1
Loss of Sample 2	The sample to stream 2 is lost	Check the flow of Sample #2 Dual stream analyzers only
Emergency Stop	Someone felt it was necessary to press the Emergency Stop button	Determine why Emergency Stop was pressed, correct problem and then press the RESET button on the RUN window.
Cal Error	The Calibration Factor is out of Range.	1. Check the level of the reagent bottles, 2. Make sure reagent pumps are primed 3. Check reagent pump dosage 4. Check Cal Sample level 5. Verify analyzer is draining properly
Result Alarm	Measurement is greater than the % on the Settings screen	The sample is out of range. Corrective action required.

10 SPARE PARTS

Table 10.1: Routine Maintenance Parts Listing.

Description	Part Number
Annual Consumables Kit	W3040-101
Pinch Valve Drain Tubing	W3040-055
Pump Tubing	W3040-046
Sample Line Tubing	W3040-099

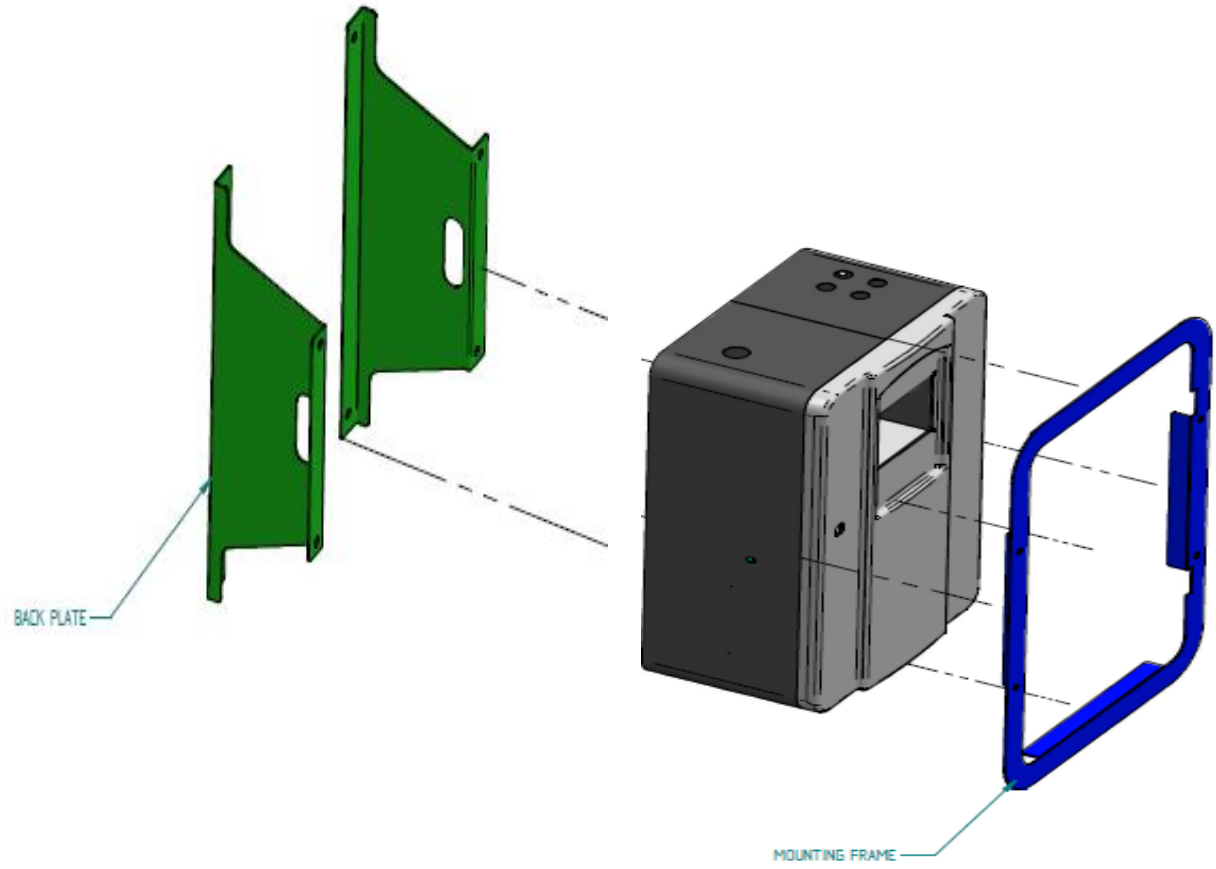
Table 10.2: Standards and Reagents Parts Listing.

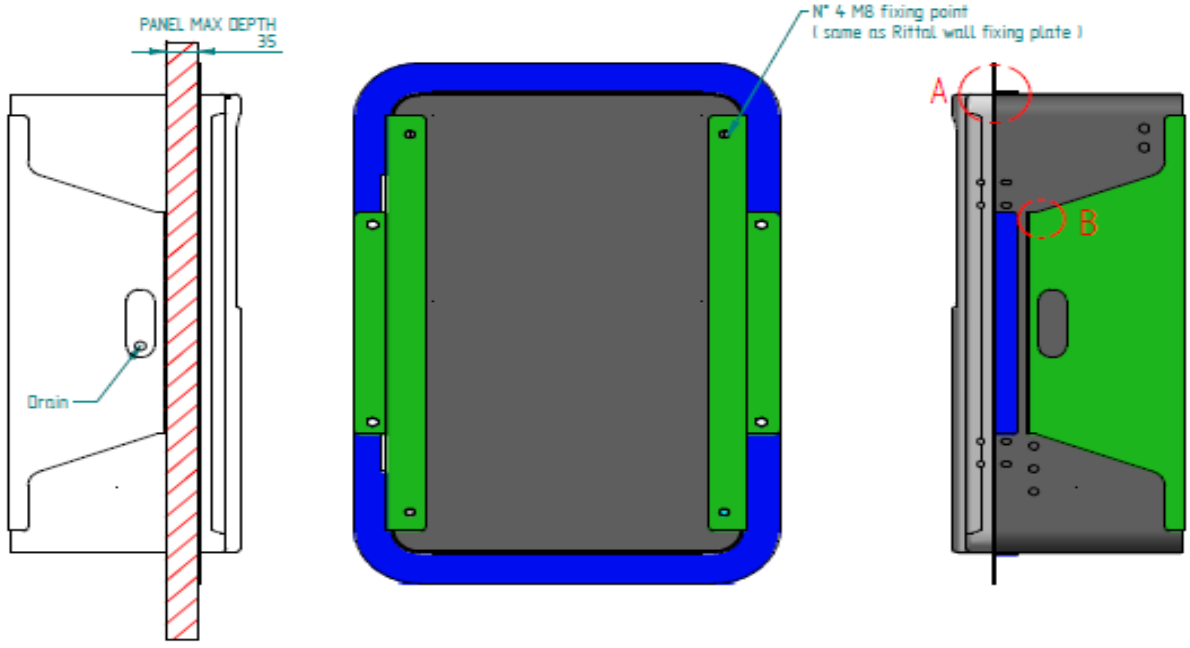
Description	Part Number
Hardness Reagent #1	W1234-091
Hardness Reagent #2	W1234-092
Hardness Calibration Standard (1 ppm)	W1234-093

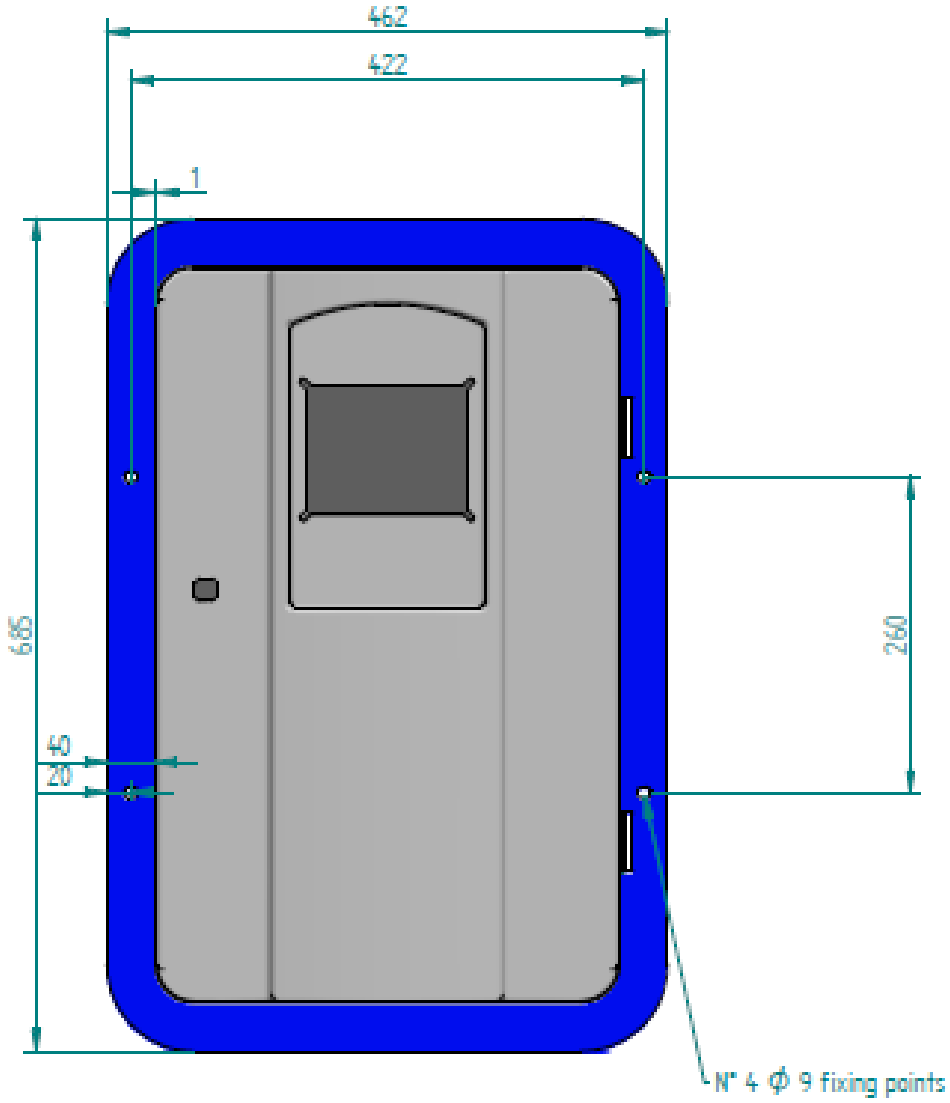
Table 10.3: Spare Parts Listing.

Description	Part Number
Pump Head 7016 – sampling pump	W9040-007
Sample level sensor	W3040-002
External reservoir - Fast loop with level switch	W3040-003
Peristaltic pump for reagents	W3040-057
Reaction quartz cell 16 mm	W3040-005
Heated block for 16 mm quartz cell	W3040-007
Heater	W3040-009
Support for 3 way valve	W3040-011
Mixing pump – PP EPDM	W3040-012
Mixing pump – PP TEFLON	W3040-013
Pinch valve	W3040-014
Pump motor 70-80 rpm 24 Vdc	W3040-015
3 ways valve	W3040-016
Power supply – 24 Vdc	W3040-021
Touchscreen	W3040-022
Extension board	W3040-023
Controller board	W3040-024
I/O board	W3040-025
Preamplifier photometer board	W3040-026
Led 565 nm with connector	W3040-032

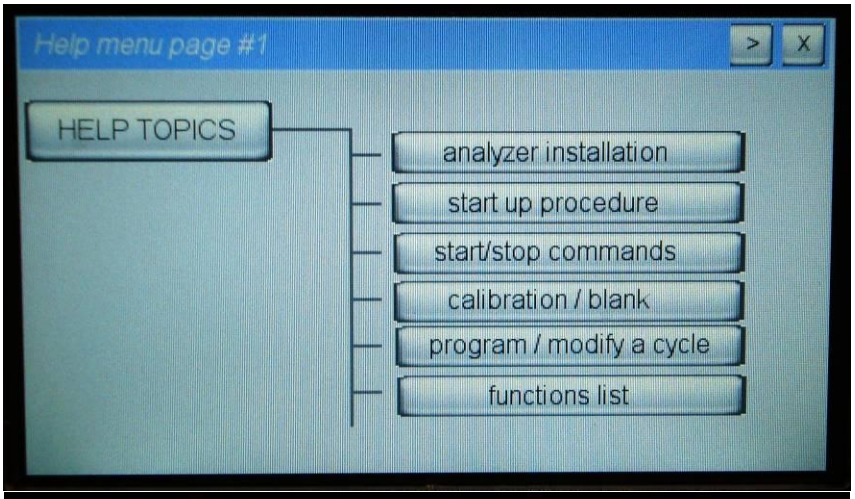
APPENDIX A – PANEL MOUNT SCHEMATICS

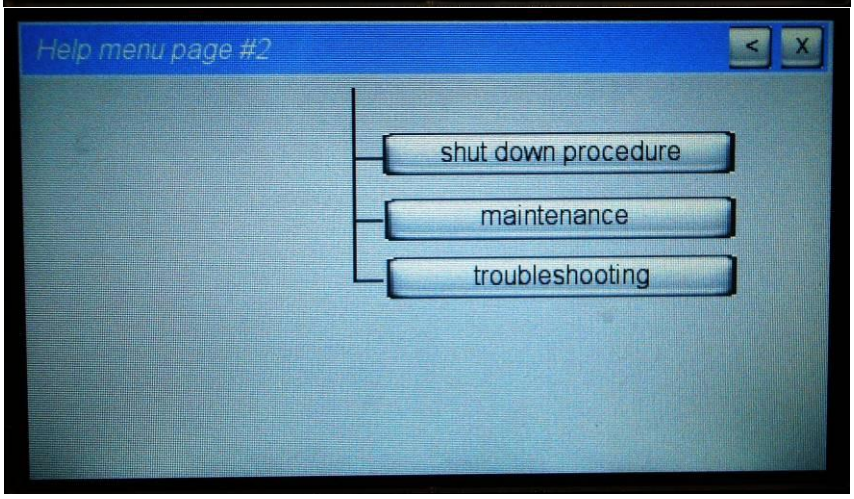


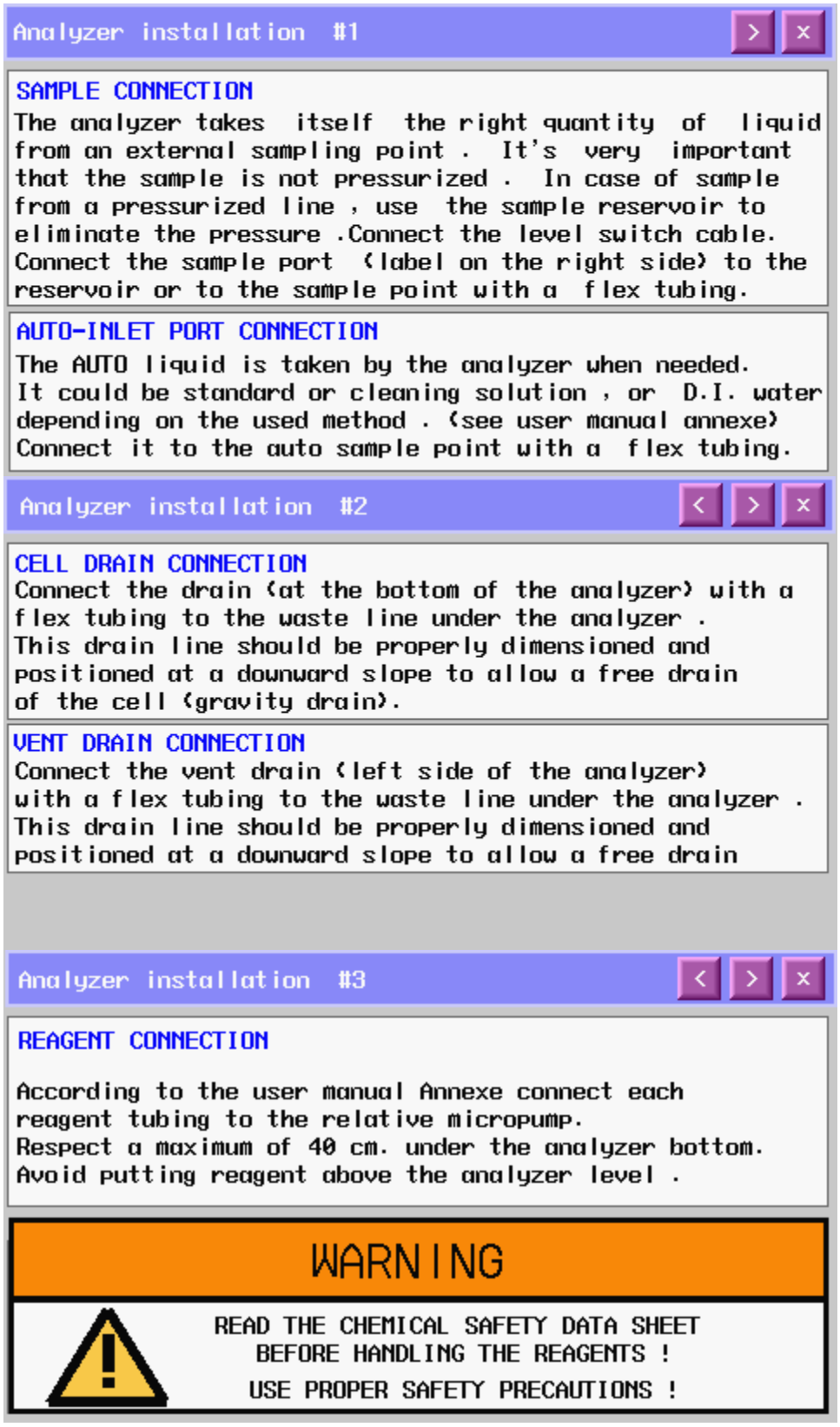


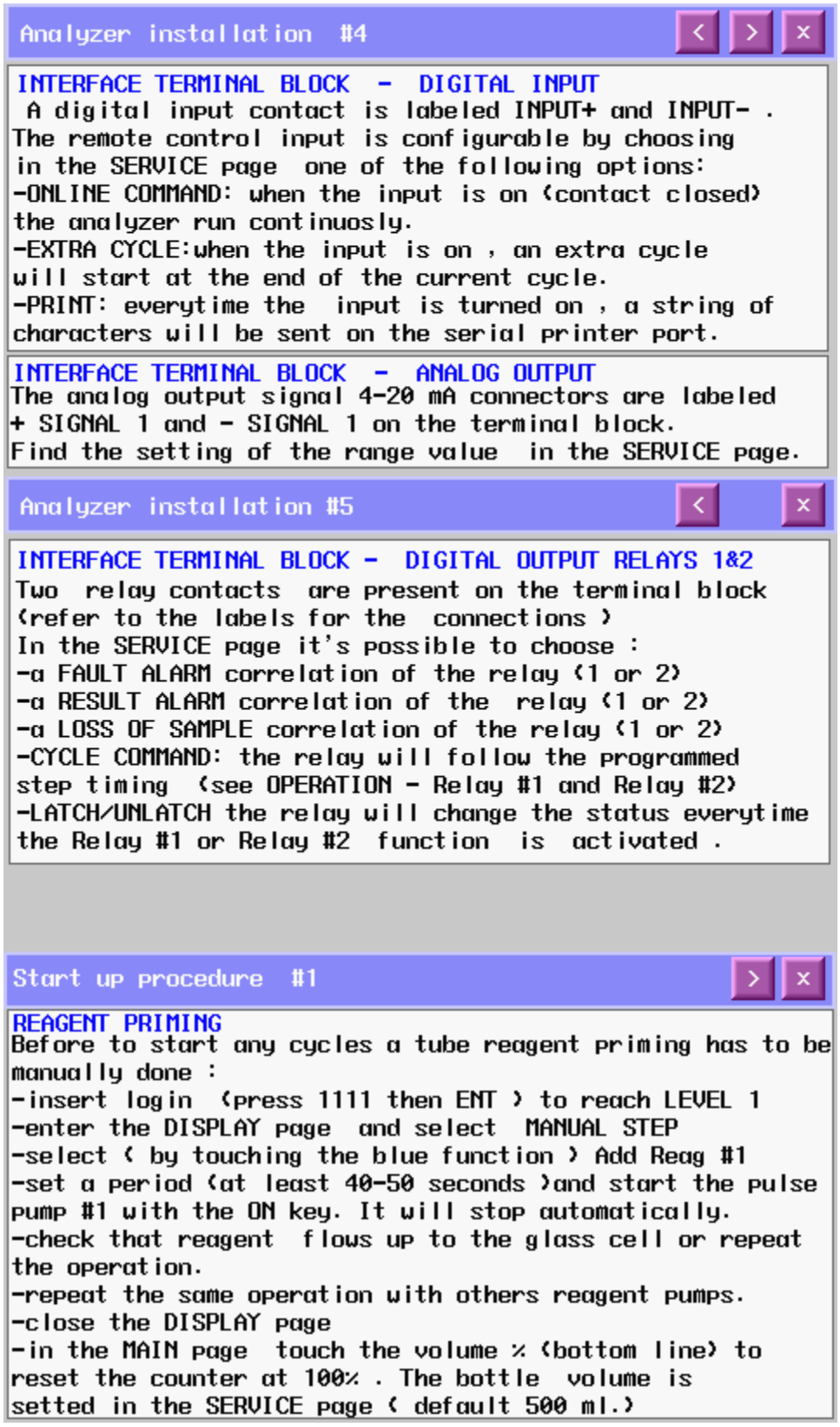

462
422
1
685
260
40
20
N° 4 Φ 9 fixing points

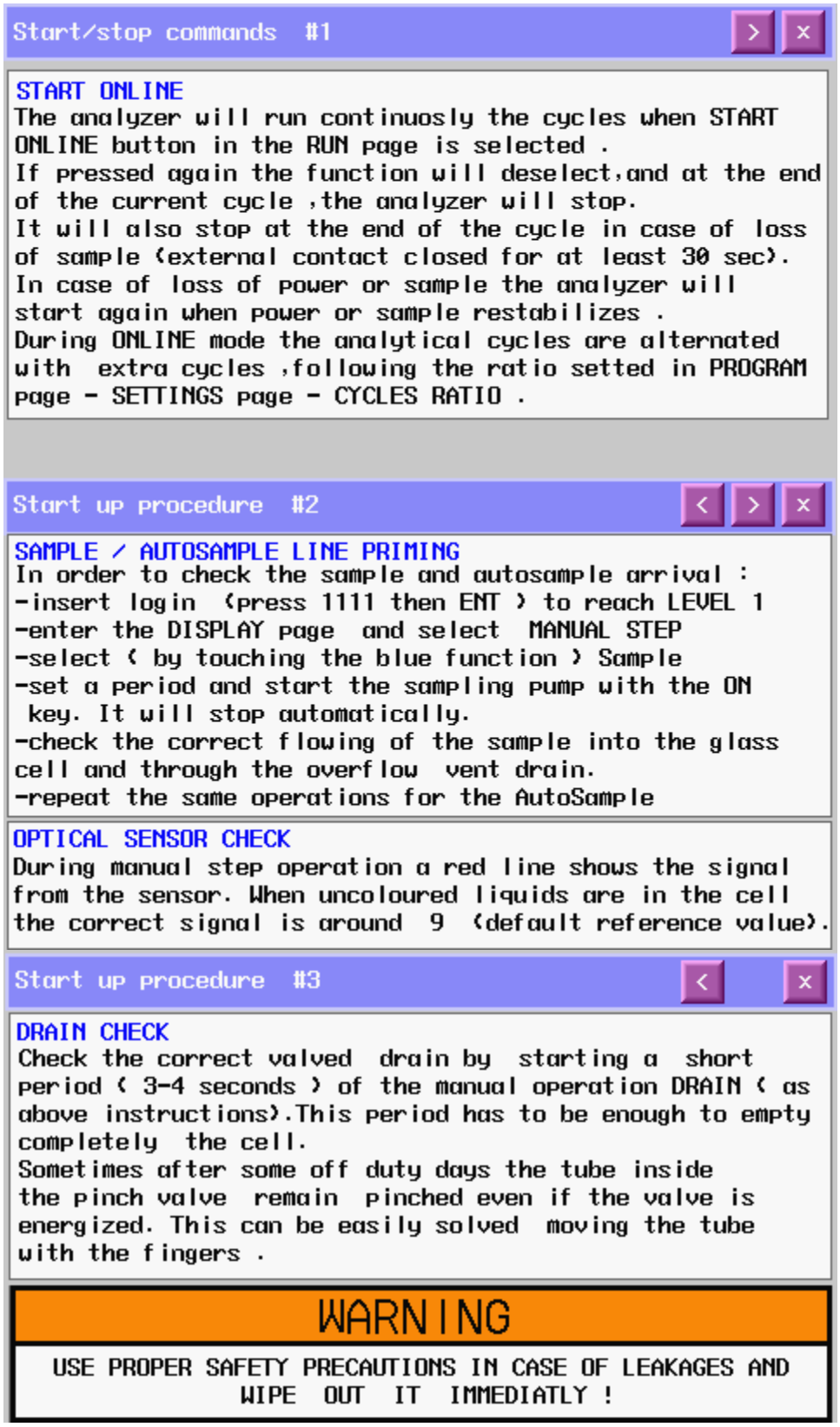
APPENDIX B – HELP MENU

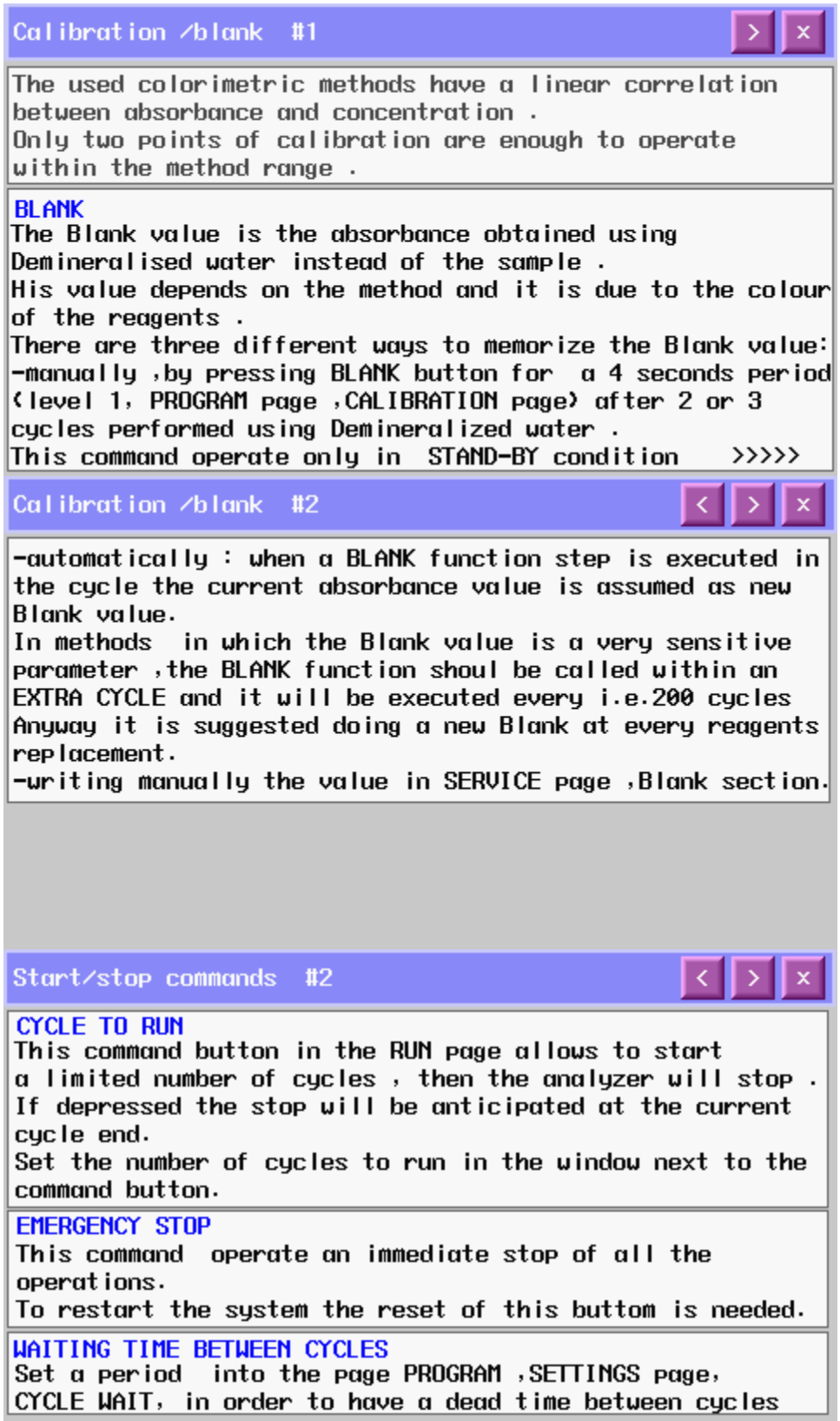


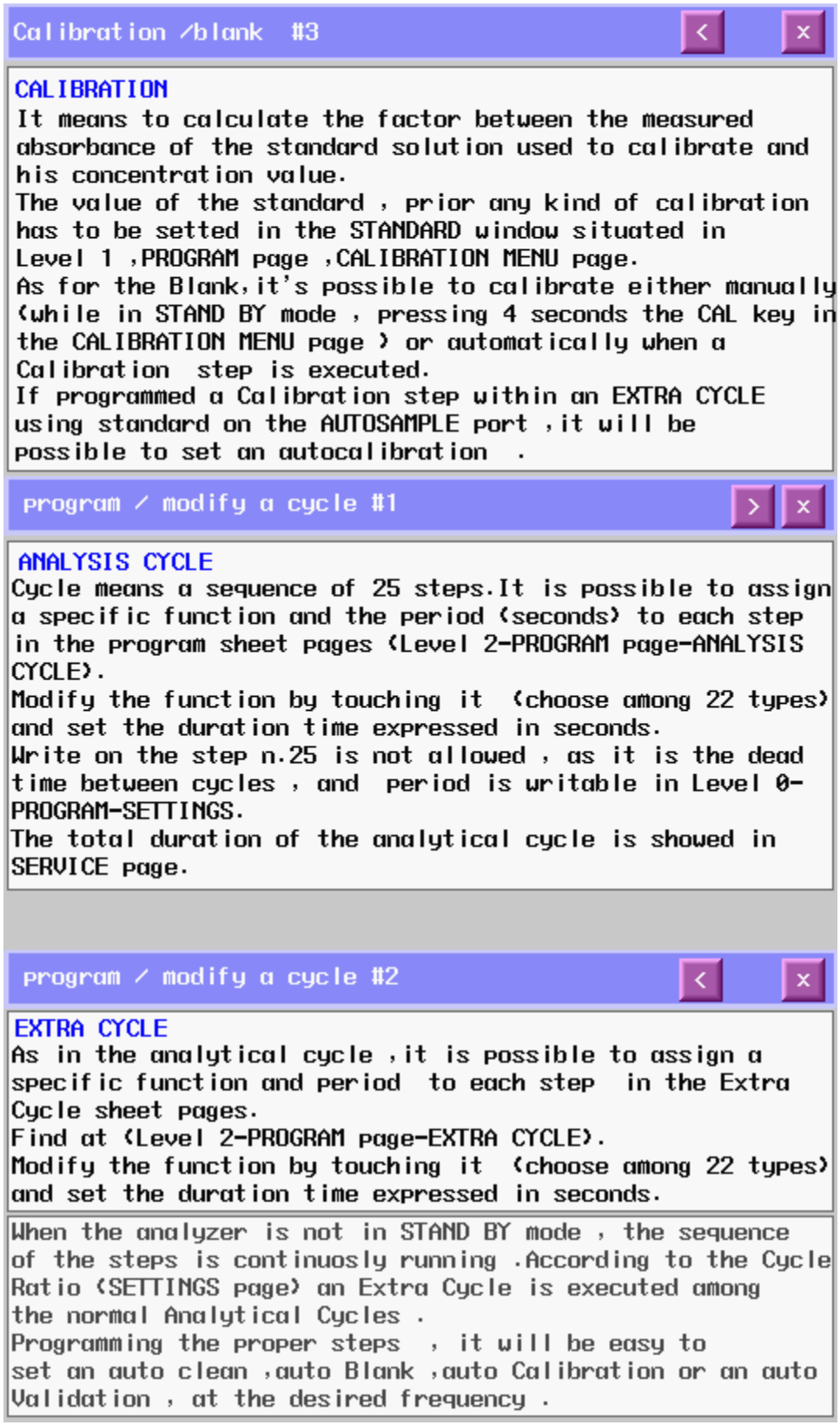



Analyzer installation #1
SAMPLE CONNECTION
The analyzer takes itself the right quantity of liquid from an external sampling point . It's very important that the sample is not pressurized . In case of sample from a pressurized line , use the sample reservoir to eliminate the pressure .Connect the level switch cable. Connect the sample port (label on the right side) to the reservoir or to the sample point with a flex tubing.
AUTO-INLET PORT CONNECTION
The AUTO liquid is taken by the analyzer when needed. It could be standard or cleaning solution , or D.I. water depending on the used method . (see user manual annexe) Connect it to the auto sample point with a flex tubing.
Analyzer installation #2
CELL DRAIN CONNECTION
Connect the drain (at the bottom of the analyzer) with a flex tubing to the waste line under the analyzer . This drain line should be properly dimensioned and positioned at a downward slope to allow a free drain of the cell (gravity drain).
VENT DRAIN CONNECTION
Connect the vent drain (left side of the analyzer) with a flex tubing to the waste line under the analyzer . This drain line should be properly dimensioned and positioned at a downward slope to allow a free drain
Analyzer installation #3
REAGENT CONNECTION
According to the user manual Annexe connect each reagent tubing to the relative micropump. Respect a maximum of 40 cm. under the analyzer bottom. Avoid putting reagent above the analyzer level .
WARNING
READ THE CHEMICAL SAFETY DATA SHEET BEFORE HANDLING THE REAGENTS !
USE PROPER SAFETY PRECAUTIONS !


Analyzer installation #4
INTERFACE TERMINAL BLOCK - DIGITAL INPUT
A digital input contact is labeled INPUT+ and INPUT- .
The remote control input is configurable by choosing
in the SERVICE page one of the following options:
-ONLINE COMMAND: when the input is on (contact closed)
the analyzer run continuosly.
-EXTRA CYCLE:when the input is on , an extra cycle
will start at the end of the current cycle.
-PRINT: everytime the input is turned on , a string of
characters will be sent on the serial printer port.
INTERFACE TERMINAL BLOCK - ANALOG OUTPUT
The analog output signal 4-20 mA connectors are labeled
+ SIGNAL 1 and - SIGNAL 1 on the terminal block.
Find the setting of the range value in the SERVICE page.
Analyzer installation #5
INTERFACE TERMINAL BLOCK - DIGITAL OUTPUT RELAYS 1&2
Two relay contacts are present on the terminal block
(refer to the labels for the connections)
In the SERVICE page it's possible to choose :
-a FAULT ALARM correlation of the relay (1 or 2)
-a RESULT ALARM correlation of the relay (1 or 2)
-a LOSS OF SAMPLE correlation of the relay (1 or 2)
-CYCLE COMMAND: the relay will follow the programmed
step timing (see OPERATION - Relay #1 and Relay #2)
-LATCH/UNLATCH the relay will change the status everytime
the Relay #1 or Relay #2 function is activated .
Start up procedure #1
REAGENT PRIMING
Before to start any cycles a tube reagent priming has to be
manually done :
-insert login (press 1111 then ENT) to reach LEVEL 1
-enter the DISPLAY page and select MANUAL STEP
-select (by touching the blue function) Add Reag #1
-set a period (at least 40-50 seconds)and start the pulse
pump #1 with the ON key. It will stop automatically.
-check that reagent flows up to the glass cell or repeat
the operation.
-repeat the same operation with others reagent pumps.
-close the DISPLAY page
-in the MAIN page touch the volume % (bottom line) to
reset the counter at 100% . The bottle volume is
setted in the SERVICE page (default 500 ml.)


Start/stop commands #1
START ONLINE
The analyzer will run continuosly the cycles when START ONLINE button in the RUN page is selected .
If pressed again the function will deselect,and at the end of the current cycle ,the analyzer will stop.
It will also stop at the end of the cycle in case of loss of sample (external contact closed for at least 30 sec).
In case of loss of power or sample the analyzer will start again when power or sample restabilizes .
During ONLINE mode the analytical cycles are alternated with extra cycles ,following the ratio setted in PROGRAM page - SETTINGS page - CYCLES RATIO .
Start up procedure #2
SAMPLE / AUTOSAMPLE LINE PRIMING
In order to check the sample and autosample arrival :
-insert login (press 1111 then ENT) to reach LEVEL 1
-enter the DISPLAY page and select MANUAL STEP
-select (by touching the blue function) Sample
-set a period and start the sampling pump with the ON key. It will stop automatically.
-check the correct flowing of the sample into the glass cell and through the overflow vent drain.
-repeat the same operations for the AutoSample
OPTICAL SENSOR CHECK
During manual step operation a red line shows the signal from the sensor. When uncoloured liquids are in the cell the correct signal is around 9 (default reference value).
Start up procedure #3
DRAIN CHECK
Check the correct valved drain by starting a short period (3-4 seconds) of the manual operation DRAIN (as above instructions).This period has to be enough to empty completely the cell.
Sometimes after some off duty days the tube inside the pinch valve remain pinched even if the valve is energized. This can be easily solved moving the tube with the fingers .
WARNING
USE PROPER SAFETY PRECAUTIONS IN CASE OF LEAKAGES AND WIPE OUT IT IMMEDIATLY !


Calibration /blank #1
The used colorimetric methods have a linear correlation between absorbance and concentration .
Only two points of calibration are enough to operate within the method range .
BLANK
The Blank value is the absorbance obtained using Demineralised water instead of the sample .
His value depends on the method and it is due to the colour of the reagents .
There are three different ways to memorize the Blank value:
-manually ,by pressing BLANK button for a 4 seconds period (level 1, PROGRAM page ,CALIBRATION page) after 2 or 3 cycles performed using Demineralized water .
This command operate only in STAND-BY condition >>>>>
Calibration /blank #2
-automatically : when a BLANK function step is executed in the cycle the current absorbance value is assumed as new Blank value.
In methods in which the Blank value is a very sensitive parameter ,the BLANK function shoul be called within an EXTRA CYCLE and it will be executed every i.e.200 cycles
Anyway it is suggested doing a new Blank at every reagents replacement.
-writing manually the value in SERVICE page ,Blank section.
Start/stop commands #2
CYCLE TO RUN
This command button in the RUN page allows to start a limited number of cycles , then the analyzer will stop .
If depressed the stop will be anticipated at the current cycle end.
Set the number of cycles to run in the window next to the command button.
EMERGENCY STOP
This command operate an immediate stop of all the operations.
To restart the system the reset of this buttom is needed.
WAITING TIME BETWEEN CYCLES
Set a period into the page PROGRAM ,SETTINGS page, CYCLE WAIT, in order to have a dead time between cycles



Calibration /blank #3

CALIBRATION
It means to calculate the factor between the measured absorbance of the standard solution used to calibrate and his concentration value.
The value of the standard , prior any kind of calibration has to be setted in the STANDARD window situated in Level 1 ,PROGRAM page ,CALIBRATION MENU page.
As for the Blank,it's possible to calibrate either manually (while in STAND BY mode , pressing 4 seconds the CAL key in the CALIBRATION MENU page) or automatically when a Calibration step is executed.
If programmed a Calibration step within an EXTRA CYCLE using standard on the AUTOSAMPLE port ,it will be possible to set an autocalibration .

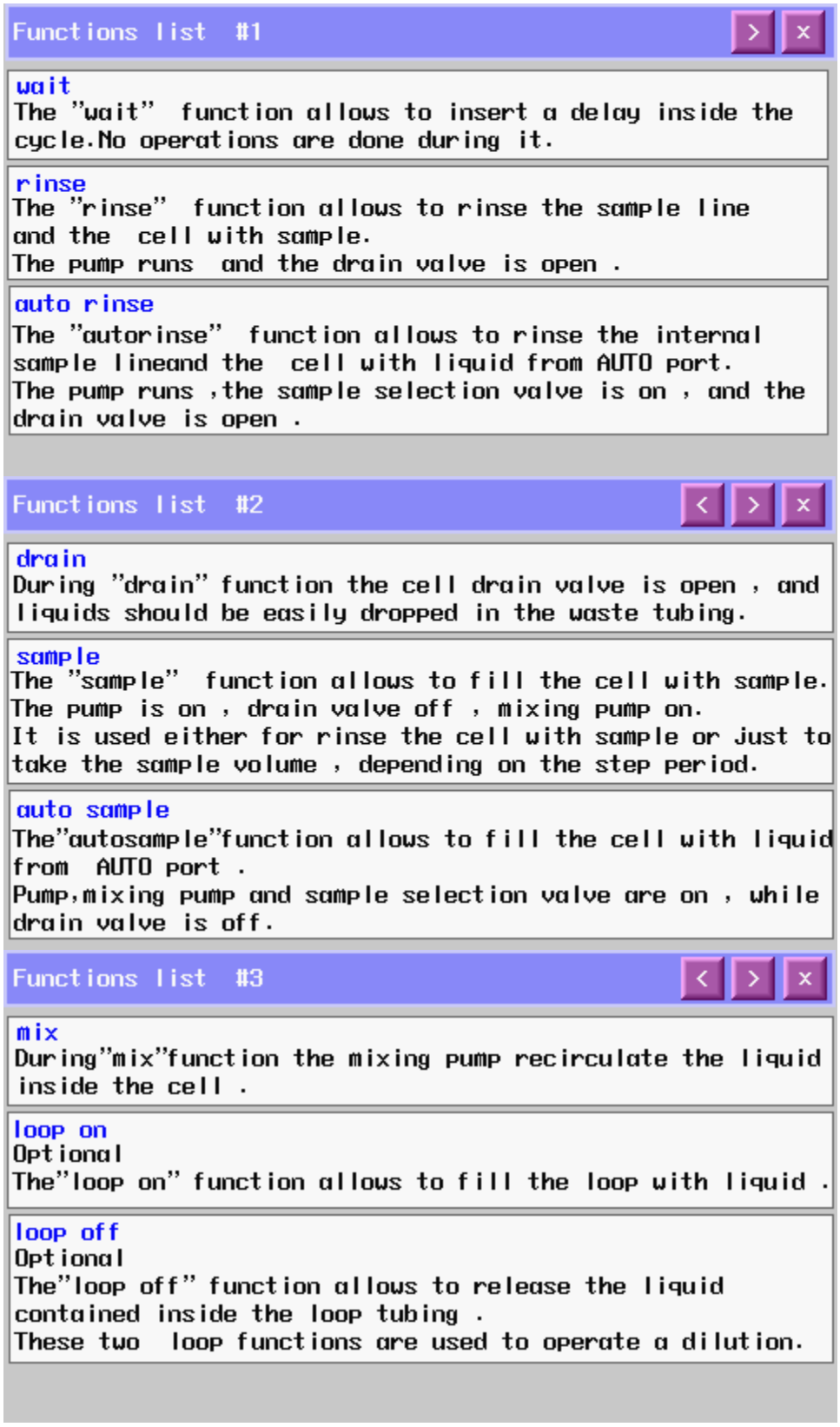
program / modify a cycle #1

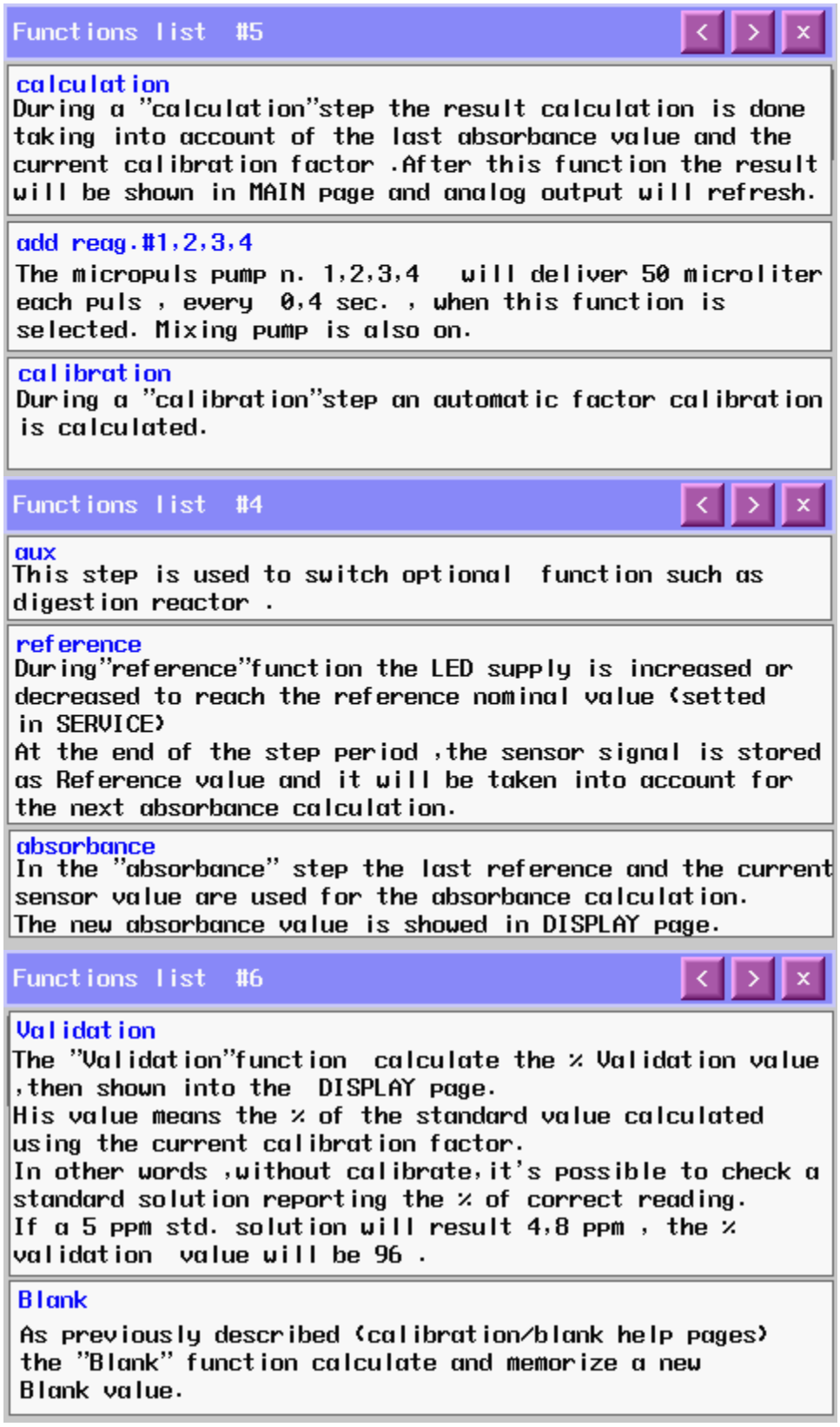
ANALYSIS CYCLE
Cycle means a sequence of 25 steps.It is possible to assign a specific function and the period (seconds) to each step in the program sheet pages (Level 2-PROGRAM page-ANALYSIS CYCLE).
Modify the function by touching it (choose among 22 types) and set the duration time expressed in seconds.
Write on the step n.25 is not allowed , as it is the dead time between cycles , and period is writable in Level 0-PROGRAM-SETTINGS.
The total duration of the analytical cycle is showed in SERVICE page.

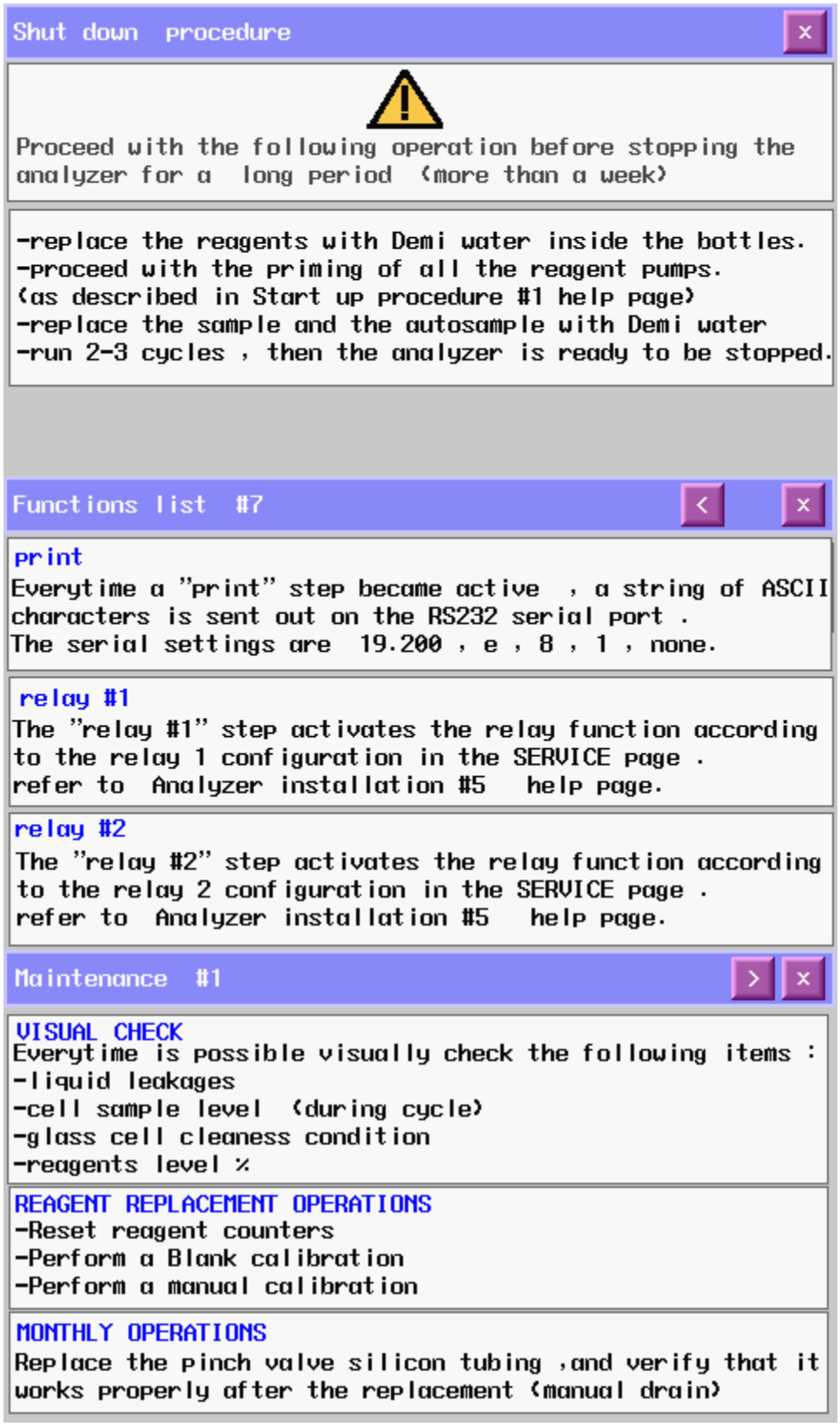
program / modify a cycle #2

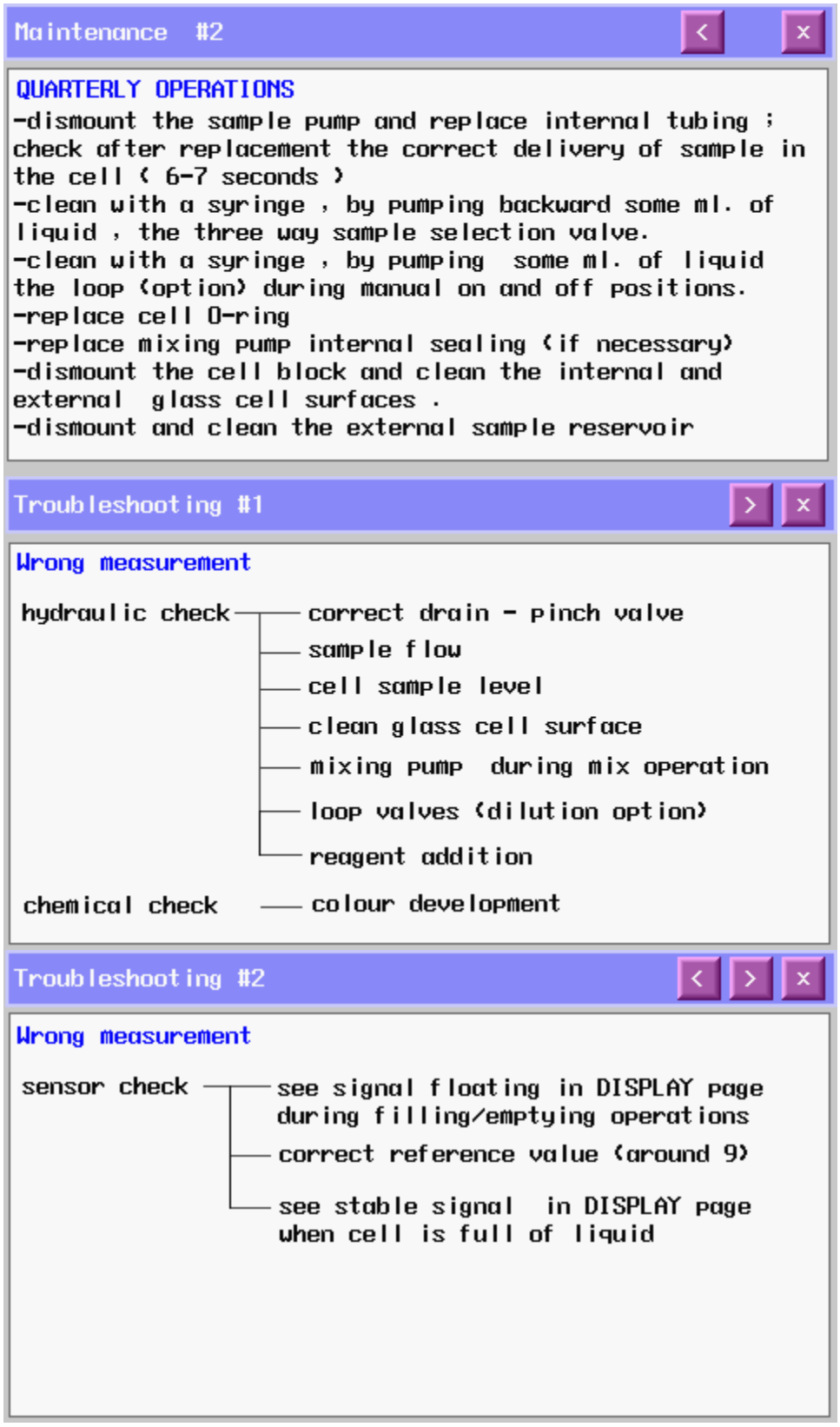
EXTRA CYCLE
As in the analytical cycle ,it is possible to assign a specific function and period to each step in the Extra Cycle sheet pages.
Find at (Level 2-PROGRAM page-EXTRA CYCLE).
Modify the function by touching it (choose among 22 types) and set the duration time expressed in seconds.

When the analyzer is not in STAND BY mode , the sequence of the steps is continuosly running .According to the Cycle Ratio (SETTINGS page) an Extra Cycle is executed among the normal Analytical Cycles .
Programming the proper steps , it will be easy to set an auto clean ,auto Blank ,auto Calibration or an auto Validation , at the desired frequency .


Functions list #1
wait
The "wait" function allows to insert a delay inside the cycle.No operations are done during it.
rinse
The "rinse" function allows to rinse the sample line and the cell with sample.
The pump runs and the drain valve is open .
auto rinse
The "autorinse" function allows to rinse the internal sample lineand the cell with liquid from AUTO port.
The pump runs ,the sample selection valve is on , and the drain valve is open .
Functions list #2
drain
During "drain" function the cell drain valve is open , and liquids should be easily dropped in the waste tubing.
sample
The "sample" function allows to fill the cell with sample.
The pump is on , drain valve off , mixing pump on.
It is used either for rinse the cell with sample or just to take the sample volume , depending on the step period.
auto sample
The"autosample"function allows to fill the cell with liquid from AUTO port .
Pump,mixing pump and sample selection valve are on , while drain valve is off.
Functions list #3
mix
During"mix"function the mixing pump recirculate the liquid inside the cell .
loop on
Optional
The"loop on" function allows to fill the loop with liquid .
loop off
Optional
The"loop off" function allows to release the liquid contained inside the loop tubing .
These two loop functions are used to operate a dilution.


Functions list #5
calculation
During a "calculation"step the result calculation is done taking into account of the last absorbance value and the current calibration factor .After this function the result will be shown in MAIN page and analog output will refresh.
add reag.#1,2,3,4
The micropuls pump n. 1,2,3,4 will deliver 50 microliter each puls , every 0,4 sec. , when this function is selected. Mixing pump is also on.
calibration
During a "calibration"step an automatic factor calibration is calculated.
Functions list #4
aux
This step is used to switch optional function such as digestion reactor .
reference
During"reference"function the LED supply is increased or decreased to reach the reference nominal value (setted in SERVICE)
At the end of the step period ,the sensor signal is stored as Reference value and it will be taken into account for the next absorbance calculation.
absorbance
In the "absorbance" step the last reference and the current sensor value are used for the absorbance calculation.
The new absorbance value is showed in DISPLAY page.
Functions list #6
Validation
The "Validation"function calculate the % Validation value ,then shown into the DISPLAY page.
His value means the % of the standard value calculated using the current calibration factor.
In other words ,without calibrate,it's possible to check a standard solution reporting the % of correct reading.
If a 5 ppm std. solution will result 4,8 ppm , the % validation value will be 96 .
Blank
As previously described (calibration/blank help pages) the "Blank" function calculate and memorize a new Blank value.


Shut down procedure
Proceed with the following operation before stopping the analyzer for a long period (more than a week)
-replace the reagents with Demi water inside the bottles.
-proceed with the priming of all the reagent pumps.
(as described in Start up procedure #1 help page)
-replace the sample and the autosample with Demi water
-run 2-3 cycles , then the analyzer is ready to be stopped.
Functions list #7
print
Everytime a "print" step became active , a string of ASCII characters is sent out on the RS232 serial port .
The serial settings are 19.200 , e , 8 , 1 , none.
relay #1
The "relay #1" step activates the relay function according to the relay 1 configuration in the SERVICE page .
refer to Analyzer installation #5 help page.
relay #2
The "relay #2" step activates the relay function according to the relay 2 configuration in the SERVICE page .
refer to Analyzer installation #5 help page.
Maintenance #1
VISUAL CHECK
Everytime is possible visually check the following items :
-liquid leakages
-cell sample level (during cycle)
-glass cell cleaness condition
-reagents level %
REAGENT REPLACEMENT OPERATIONS
-Reset reagent counters
-Perform a Blank calibration
-Perform a manual calibration
MONTHLY OPERATIONS
Replace the pinch valve silicon tubing ,and verify that it works properly after the replacement (manual drain)


Maintenance #2
QUARTERLY OPERATIONS
-dismount the sample pump and replace internal tubing ; check after replacement the correct delivery of sample in the cell (6-7 seconds)
-clean with a syringe , by pumping backward some ml. of liquid , the three way sample selection valve.
-clean with a syringe , by pumping some ml. of liquid the loop (option) during manual on and off positions.
-replace cell O-ring
-replace mixing pump internal sealing (if necessary)
-dismount the cell block and clean the internal and external glass cell surfaces .
-dismount and clean the external sample reservoir
Troubleshooting #1
Wrong measurement
hydraulic check
correct drain - pinch valve
sample flow
cell sample level
clean glass cell surface
mixing pump during mix operation
loop valves (dilution option)
reagent addition
chemical check
colour development
Troubleshooting #2
Wrong measurement
sensor check
see signal floating in DISPLAY page during filling/emptying operations
correct reference value (around 9)
see stable signal in DISPLAY page when cell is full of liquid

APPENDIX C – MULTIPLE STREAM SEQUENCER

Introduction

The Multistream Sequncer is an external accessory for the automatic, continuous multiplexing of up to four sample streams to one on-line 3040 Series colorimetric analyzer. The sequencer is connected to the analyzer via a 4 wire cable which provides communication and power supply to the external unit. Once connectted, the analyzer is linked to the sequencer and displays the process value, alarm status, channel status and time during operation for all of the active channels. Storage of event/alarm log and measurement values for all channels inside analyzer's datalogger. A sampling valves manifold is mounted on the sequencer plate and ensures sample is available for switching between streams. The fast loop reservoir with level switch is mounted on the sequencer to provide the flow alarm in case of loss of sample in any of the streams. The sequencer is factory tested and ready for installation and operation.

Specifications

Power supply: Tthe sequencer is powered by the colorimetric analyzer (voltage 100 ... 240 VAC, 50/60Hz)

Table C.1: Multistream sequencer sample conditions.

Flow Rate:	100–500 ml/min per stream
Temperature:	5-45º C (41-113º F)
Inlet Pressure Max:	0.5 bar (4 PSI)
Outlet Pressure:	Ambient pressure

Table C.2: Multistream sequencer technical specifications.

Electronics Case:	Aluminum
Protection Degree:	IP54 or IP65 upon request
Electrical Connections:	Screw clamps
Panel Dimensions:	15.75” x 7.87” x 7.91” (400mm x 200mm x 201mm)
Weight:	8.8 lbs (4 kg)

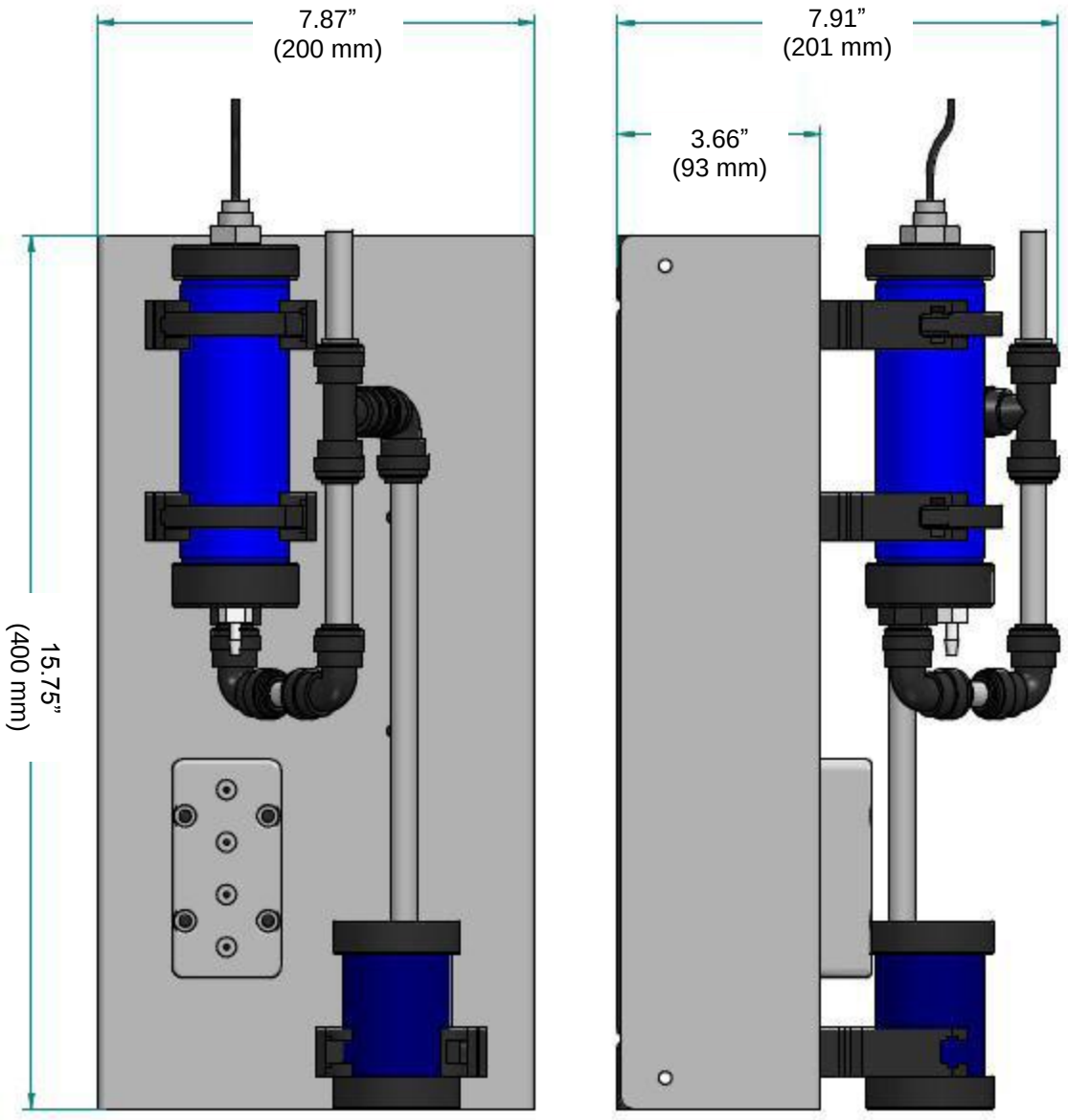


Figure C.1: Dimensons of the Multistream Sequencer.

Installation Procedure

a. Locate a wall with a suitably smooth surface to mount the sequencer for wall mounting.
b. Mark 4 holes on the wall for the position of the sequencer.
c. Drill 4 holes for M8 screws.
d. Mount the sequencer on the right side of the analyzer.
e. Ensure that the sequencer is mounted securely in place.

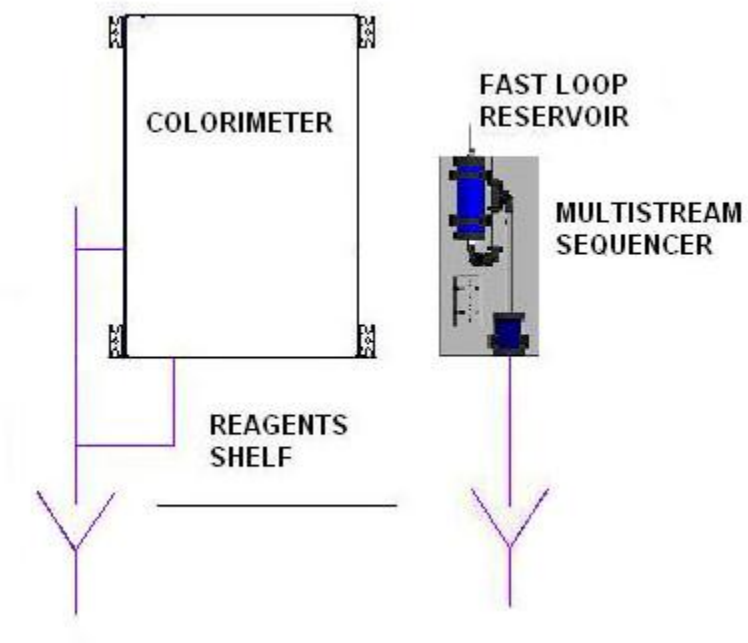


Figure C.2: Suggested installation layout of the multistream sequencer.

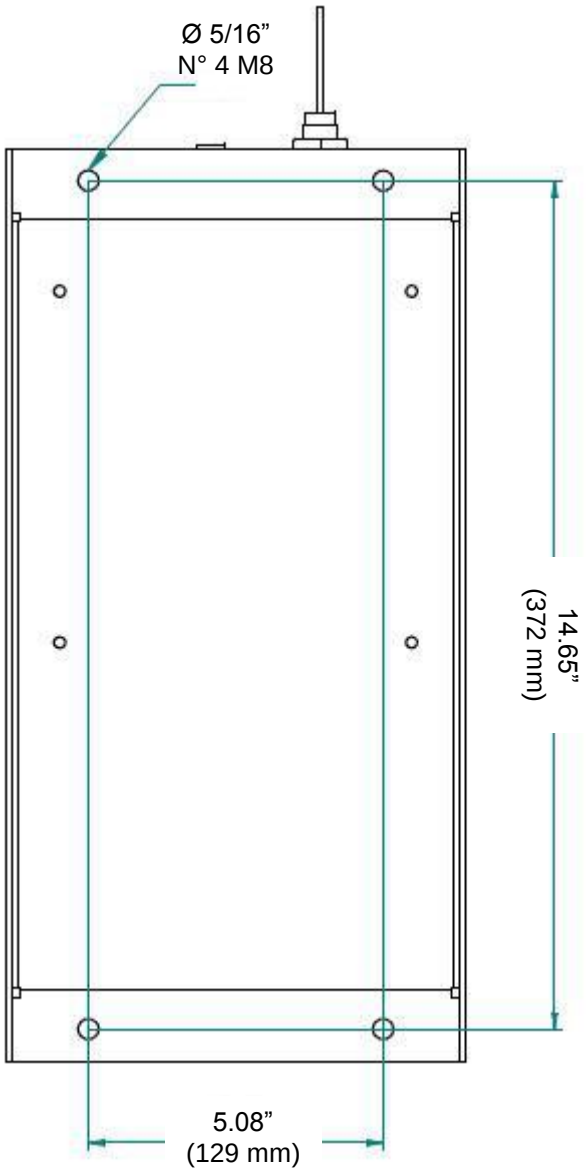


Figure C.3: Mounting Dimensions for multistream sequencer.

Electrical Connections

Connect the fast loop reservoir to the connector of the sequencer on the top of the electronic box.

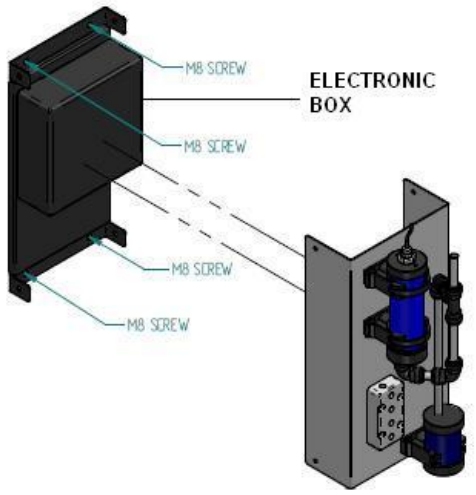


Figure C.4: Accessing the electronic box of the multistream sequencer.

Connect the 4-20 mA outputs:

1. Open the electronic box of the sequencer.
2. Connect the outputs, ensuring you get the right polarity.
3. Close the electronic box of the sequencer.

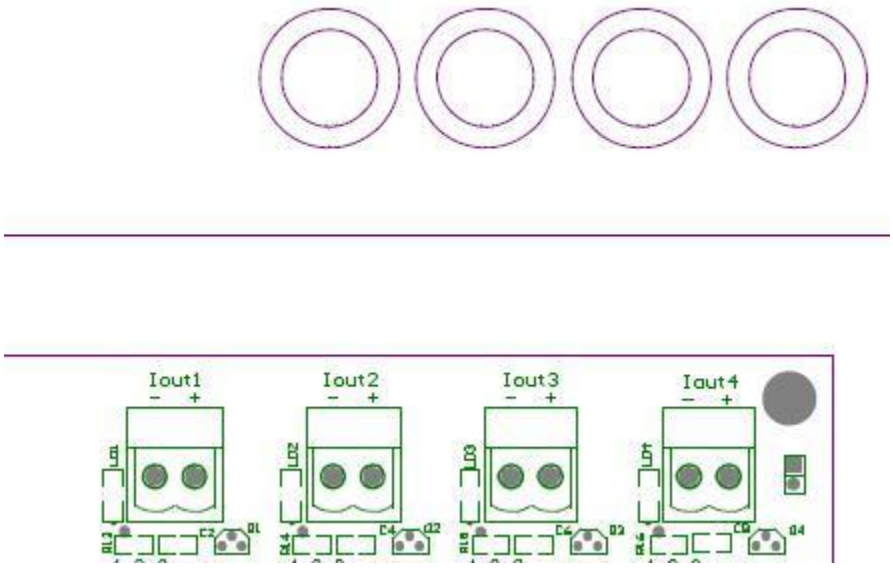


Figure C.5: 4-20mA output of the multistream sequencer.

Hydraulic Connections

- The installation site should be as near the sampling point as possible to reduce delay in response time.
- The drain line should be properly dimensioned and positioned at a downward slope to allow the drain of analyzed sample (for gravity) and the overflow coming from external fast-loop reservoir

WARNING!	The drain of the analyzer must be at ambient pressure with no restriction. Please verify that this condition has been strictly respected during installation.

Sample Connections:

1. Connect the sample line inlet tubing to the sampling valves manifold according to the labels.
2. Connect the drain of the fast-loop reservoir to the waste line.

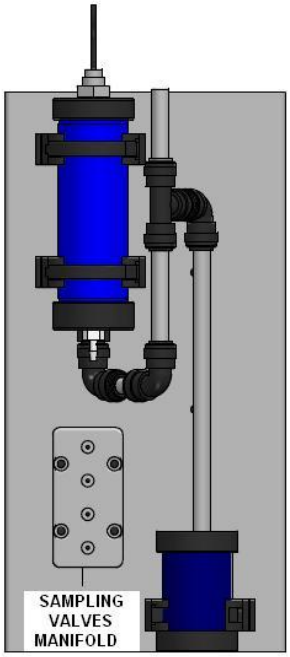


Figure C.5: Multistream sequencer hydraulic connections.

User Interface

Analyzers that are equipped with the multistream sequencer will have the following user interface screens and menus.

Main Page

The user can touch anywhere in the white part of the main page to gain access to the sequencer main page.

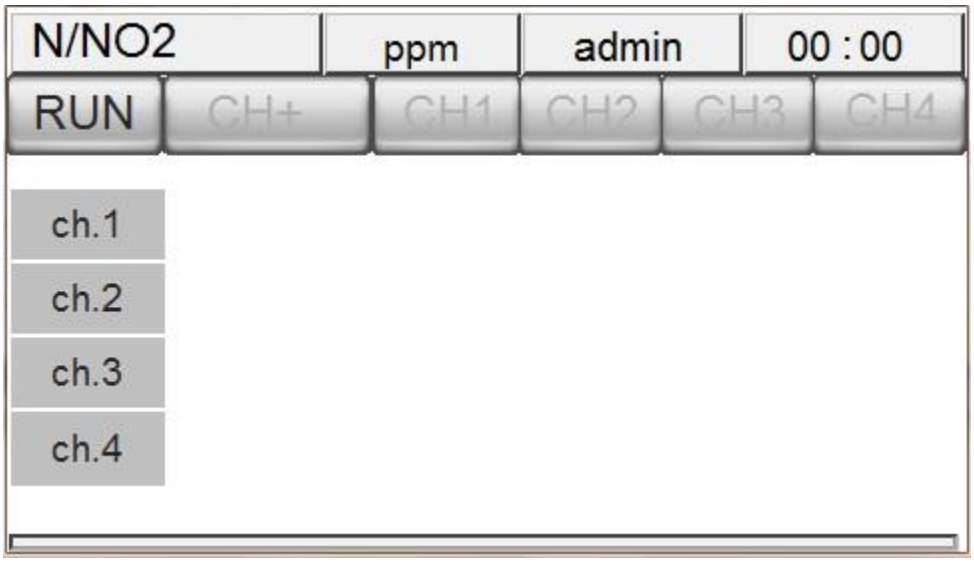


Figure C.6: Multistream sequencer main page of the user interface.

The **CH+** button will be enabled after login with the service password. This button allows the user to manually open each valve of the sequencer manifold. This function should be used with the analyzer in stand-by mode.

The **CH1**, **CH2**, **CH3**, and **CH4** buttons will be enabled after login with the admin password. These buttons allow the user to enable or disable each channel.

Pressing RUN, the following page will be displayed:

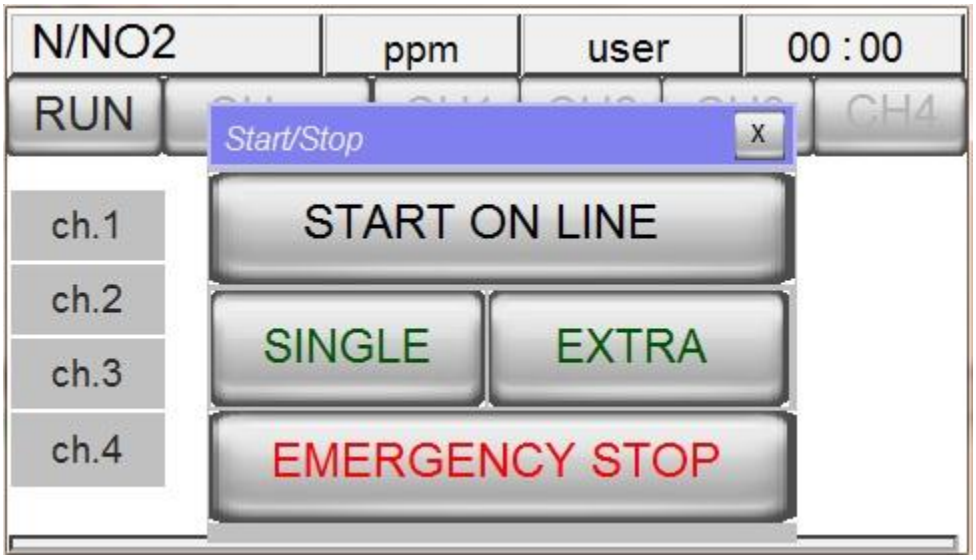


Figure C.7: Multistream sequencer RUN Menu of the user interface.

START ON-LINE:
This button puts the analyzer to online operation. The analyzer will perform a continuous cyclic analysis with the sequence CH1, CH2, CH3, CH4 of the active channels selected. This condition is identified as online and ONLINE is displayed on the button. Pressing the button again will cause the analyzer to finish the cycle in process and put the analyzer in stand-by mode.

SINGLE:
This command allows the user to perform an analysis cycle on the active channel. At the end of the cycle, the analyzer will go into stand-by mode and wait for the user's next command.

EXTRA:
This command will perform a cycle based on the programming of the extra cycle. The default programming for the extra cycle is set to a CALIBRATION cycle.

EMERGENCY STOP:
This command will immediately stop the analyzer at the current step of the analysis in progress. The analyzer will go into the MANUAL STOP condition. On the main screen appear the message "manual stop" red coloured and the FAULT alarm contact will be activated. To restart the analyzer after an emergency stop, it is necessary to reset the fault by pressing the yellow colored RESET EM. STOP. This will force the analyzer to stand-by conditions.