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Instruction Manual

MANTECH Ap2000 Turbidimeter

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or mission in this manual.

The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation.

N O T I C E

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements.
Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than specified in this manual.

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1.0 Specifications

Measurement method	Ratio determination using a primary nephelometric light scatter signal (90°) to the transmitted light scatter signal.
Reading units	NTU/ EBC
Lamp Source	Tungsten Lamp
Detector	Silicon Photocell
Measuring Range	0 to1000 NTU/ 0 to 250 EBC
Resolution	0,01 on lowest range
Accuracy	± 2% of reading: 0 to 500 NTU / ± 3% 500 to 1000 NTU
Repeatability	± 1% of reading or 0,01 NTU
Automatic Reading	With user-defined intervals 0 to 250 seconds
Maximum uncertainty	± 2% of full scale
Display	LCD 2 lines / 16 characters
Response Time	Programmable 6 to 41 sec
Data Logger	Up to 1000 data
Auto ShutOff	Programmable from 1 to 60 min
Fast Cal function	Quick Calibration for single point
Software Functions	Signal averaging, "Fast Settling", results freezing, analyst and sample identification, calibration status, verification and calibration reminder, calibration history, password
Sample Required	15 ml vial with lid
Sample vials	Round borosilicate glass vial with screw and caps (Φ = 24,5 mm)
Power Supply	4 AA batteries or power supply cable
Indicator	Low battery indicator / battery exchange
Serial Output	USB
Enclosure rating	IP-67, waterproof
Storage Conditions	0 to 40°C (instrument only)
Dimensions	114 x 198 x 83 mm

Parts and Accessories - Included.

3 vials of 24,5 mm
Batteries AA e power supply cable
Instruction Manual and Carrying Case

Parts and Accessories - Optional.

Backlight Display
Silicone oil
Cleaning Cloth

2.0 Installation

2.0 Install the battery

1. With an Philips screw driver, remove the battery cover.
2. Install 4 AA alkaline or 4 AA nickel metal hydride (NiMH) batteries. Make sure that the batteries are installed in the correct orientation.
3. Replace the battery cover. (for optimal seal we recommend using torque screw driver with 4N.m)

3.0 User interface and navigation

3.1 User interface

1.**DISPLAY**: Displays readings, diagnostics and operational data.	2.**MENU:** selects options to configure the instrument, selects analysis and moves the cursor to the right.
3.**SAVE:** Store Selections and data, saves the result to be USB transfered and selects the parameters.	4.**ESC:** Powers off the unit, aborts operations, return to the previous screen.
5.**ON/Off-Read:** switches the instrument on, confirms options, sample reading, move the cursor to the left.	6. ▲**:** scroll through menus, enter numbers and letters
7. ▼**:**scroll through menus, enter numbers and letters	

4.0 Operation

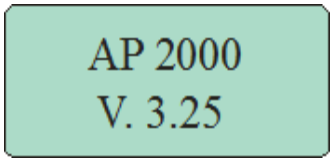
4.1 Startup

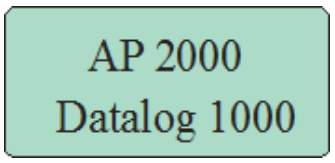
Push the ON/OFF key to turn the meter on of off.

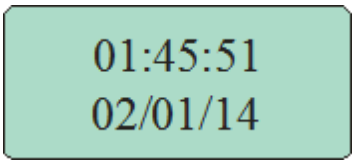
If the meter does not turn on, make sure that the batteries, or that the AC power supply is properly

connected to an electrical outlet.

The display will show, instrument version, data log and time/date.







Note: *The Auto-Shutoff option can also be used to turn off the meter.*

4.2 Navigation

The instrument Menu structure is divided in 3 main functions with submenus :

-ID – Access the user ID function

-Calibrate – Access the calibration functions

-Config – Access the confifuration functions

-Serviçe- Access the Service Functions (only for certified technicians)

Please see Menu structure in the last page of this manual.

Press and hold the **MENU** key for 3 seconds to enter the Menu Function.

You will see ID – Identification; Use the ▲ or ▼ keys select the desired function, then press **READ** to enter it.

If the menu key is pressed and released quickly the Analysis type selection will appear, select the type of measurement using ▲ or ▼.

-0-250 EBC (special measurement for food industry)
-0-1000 NTU.
-0.0-.99.9 NTU
-0.00 to 40.0: Rapid Cal Function.

-Auto NTU: Instrument choose automatcally best measuring range in NTU. RECOMMENDED.

-Sensor: Measurement of the light frequency. (to be used only by certified technician)
-User1: User calibrated courve (require full calibration of this courve).
-User2: User calibrated courve (require full calibration of this courve).

Press and release **save** to use the desired measuring range/function.

NOTE: The 0.00 to 40.0 function can only be selected for rapid single point calibration (Rapid cal function).

4.3 Sample Reading.

Before you read a sample its possible to ID the user and the Sample that will be read, If you don´t know what to please go to 5.4.2 Taking a Measurement.

4.3.1 ID

Select the Sample ID.

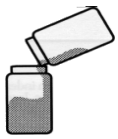
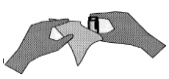
Use ▲ and ▼ to choose an sample name from the list, press and hold **SAVE** for 3 seconds to store the data.

4.3.1 USer

Select the User for the sample.

Use ▲ and ▼ to choose an user from the list, press and hold **SAVE** for 3 seconds to store the data.

4.3.2 Taking a Measurement.

For greater precision we recommend that you calibrate the 0.10 NTU point before you start your measurements. (Refer to CALIBRATION for more information)	
	Rinse the vial with the sample;
	Place sample in the vial;
	Dry the tube with a thin/absorbent paper;

	Holding the vial by the cap, gently stir the sample by inversion 3 times.
	PLACE THE VIAL IN THE READING CELL.
	Align the "I" mark of the sample vial forward with the arrow on the sample cup of the instrument and close the instrument lid;
	-If using Auto mode just wait for the reading to stabilize. -If using manual mode press **READ**;
	To turn the instrument off press and hold **ESC** until the display reads **"Off"**.

4.4 Sample Vials.

Before being use the vials should always be washed with with detergent to remove any dirt or fingerprints.

Dry the outside of the tubes with a clean, lint-free cloth. Let the tubes dry in the air, in an inverted position to prevent dust from entering the vials.

The handling of the vials has great importance. Scratch, fingerprints and water droplets in the vial or inside the light chamber can cause interference, leading to inaccurate results.

It is very important that vials and light chamber are clean and dry constantly.

The variability in the glass geometry is the predominant cause of the variability of the results. The position variation of the vial in the light chamber will greatly affect the results. To obtain accurate results, the vials must be positioned exactly,

The "I" mark in the vial must be aligned with the arrow (▲) in the instrument sample chamber.

Sample Vials calibration

The turbidimeter AP 2000 vials are factory selected for optimal precision, however in low turbidity conditions, small changes in the glass can cause different readings on the same sample.

To measure samples in the lower range, below 1NTU, for greater accuracy, a vial calibration is recommended.

1. 	Fill each vials with dilution water *.	**2.**	Complete a reading of all the vials, take note of each reading.
3. 	Mark the vials with the lowest reading with an "R", Those will be your reference vials. This tag should be near the top, close to the lid, and with permanent marker.	**4.**	The difference between the value of the reference vials "R" with the other vials is the correction factor for each of the vials. This value may be used when comparing the readings with different vials.

*** dilution water** - prepared according to Standard Methods - Method 2130 (latest edition) with membrane filtration for retention of particles ≥ 0.1 µm - generating a nominal value of 0.02 or below 0.1 NTU.

4.5 Instrument Calibration

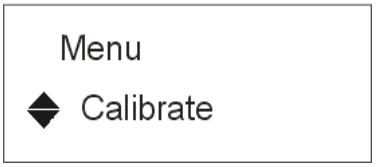
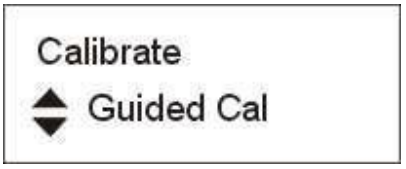
For routine work, only the blank calibration (0.10NTU) shall be performed. The complete calibration procedures, should be defined by the user, according to its quality program.

There are two calibrations options, guided and free cal, only one of those should be used to calibrate the unit, in case both are used, the last one will be saved and will be the one used for readings.

To perform a full calibration you will need diluted formazin Standards in the 0.10 NTU, 20 NTU, 100 NTU and 800 NTU, or Stabilized primary Standards in the same concentrations.

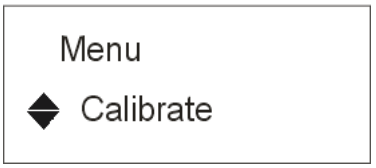
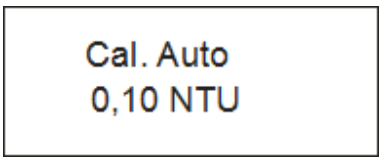
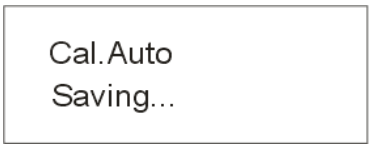
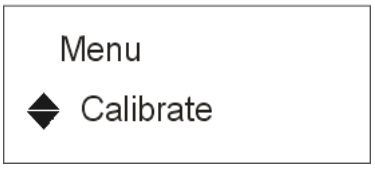
NOTE: The Standard vials must be perfectly cleaned before each measurement, using a tissue or soft absorbent equivalent paper.

4.5.1 Guided Cal

1. Press and Hold **MENU** key for 3 seconds. You will see ID – Identification; Use the ▲ or ▼ keys to select Calibrate, then press **READ** to enter it.	
2.The display will show guided cal, press **READ** to enter it.	
3.the unit will request you to insert the 0,01 NTU standard and apress **READ,** after it reads this standard and store its value, it will request you to insert the 20,0 NTU standard and so on, until the 1000,0 NTU standard is read. **If by acident you place the same standard or an standard with a close NTU value on the vial chamber, the unit will alert you with the" Same Standard?' warning. In this case, replace the standard for the correct one and proceed**.	

NOTE 1: Ailing the vial mark with the instrument arrow.
NOTE 2: After the calibration, perform standard readings for verification, and if needed repeat the calibration procedure.
NOTE 5: Storing the standards:- Do not store it in high temperature, or direct sun light.

4.5.2 Free Cal

1. Press and Hold **MENU** key for 3 seconds. You will see ID – Identification; Use the ▲ or ▼ keys to select calibrate then press **READ**, use the same ▲ or ▼ keys to select Free Cal, then press **READ** to enter it.	
2.Place 0.10 NTU Standard vial into the instrument *. Press **READ** and wait for the result;	
3. If necessary use ▲ or ▼ to change the displayed value for this standard, press and hold **SAVE** for 3 seconds. "Saving**" will be displayed**.	
4.After the value is saved, the display returns to the **"Calibrate"** menu**.**	
5.***** After calibrating the 0.1 NTU standard, perform the calibration of the other standards: 20 NTU, 100 NTU and 800 NTU.Recalibrate the 0.1 NTU for better accuracy. **If you have chosen the 0.00 to 40.0 NTU function, follow the previous step for the desired standard.**	
6.**Recalibrate the 0.1 NTU for better accuracy.**	

NOTE 1: Ailing the vial mark with the instrument arrow.
NOTE 2: If an error message displays, check the standards and repeat the previous steps.
NOTE 3: After the calibration, perform standard readings for verification, and if needed repeat the calibration procedure.
NOTE 4: After calibrating 4 points: 0,1 NTU, 20 NTU, 100 e 800 NTU. Its recommended to recalibrate the 0,1NTU point.

NOTE 5: Storing the standards:
- Do not store it in high temperature, or direct sun light.
- Avoid scratching the vial glass. This might affect the precision of the readings;
- The sample and standards vial glass should be always clean.

5.0 Configuration

The AP2000 Turbidity meter has several configuration capabilities. Its menu structure its easy and simple to operate, please folow the steps below to configurate the unit according to your needs.

Press **MENU** key for 3 seconds to enter the Menu Function. You will see ID – Identification; Use the ▲ or ▼ keys select the Config function, then press **READ** to enter it.

-ID – Acsses the user ID function

-Calibrate – Access the calibration functions

-Config – Access the configuration functions

-Service - Access the Service Functions (only for certified technicians)

Please see menu structure in the last page of this manual.

Using ▲ or ▼you can navigate between all the configurable functions. When you reach the desired function press **READ** to enter it or or **ESC** to go ack to the previous menu.

5.1 Time/Date

When inside this configuration you can change Time and Date, use ▲ or ▼ to select between the options and READ to enter it or **ESC** to go back to the previous menu.

Using ▲ , ▼ and **MENU/READ** (send the cursor to the right/left) adjust the numbers as desired, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.2 Display

When inside this configuration you can set and change Contrast, Backlight time and Backlight brightness (Time and Contrast only on instruments with backlight optional installed), use ▲ or ▼ to select between the options and **READ** to enter it or **ESC** to go back to the previous menu.

5.2.1 Contrast

Using ▲ or ▼ you can change the contrast to the desired level, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.2.2 Backlight Time

From 0 up to 60 minutes of backlight on.

Using ▲ or ▼ change the time to the desired backlight time, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.2.3 Backlight Level

From 0 up to 100 (intensity level)

Using ▲ or ▼ change the level to the desired, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.2.4 Partial Res.

Wen this mode is On, the unit will show resoults during the measurement cycle, intermediate readings.

Using ▲ or ▼ change to select yes or no, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.2.5 Big number

Using ▲ or ▼ change it from yes or no, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

If you shoose yes, the numbers will apear larger on the display

5.3 Instrument

When inside this configuration you can set Auto off, Readings, Color compensation, courves, fast settling, Sampling, ID, Calibratio interval, personalization, patrimony, use ▲ or ▼ to select between the options and **READ** to enter it or **ESC** to go gack to the previous menu.

5.3.1 Auto off

The Auto off function shall be activated to save the bateryes, iit can be configurated to turn the unit off after 0 to 60 minutes of inactivity.

Using ▲ or ▼ change the time to the desired level, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

NOTE: When the time is in 0 minutes the auto off will not be operational.

5.3.2 Auto Reading

The Auto reading function can be activated from 1 to 250 seconds,this will set the time between readings.

NOTE: If you configure the Auto reading for 5 seconds the unit will make readings every 5 seconds until it is turned off.

Using ▲ or ▼ change the desired time between readings, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.3.3 Color Compensation

The instrument can compensate for the color the sample for a more acurate reading.

Using ▲ or ▼ select yes or no, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

NOTE: When activated (Yes selected) “C” will apear in the upper right corner of the display in the reading mode screen.

5.3.4 Hab. Tests

You can define which courves will appear in the courve selection menu (when you press and release the Menu key).

Press **ESC** to remove the * icon from the courves you don´t want and **READ** to put the * icon in the ones you want.

Press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.3.5 Measuring Mode

Here you can select the type of measurent you want to take frmo, fast setling, Media or Normal.

Using ▲ or ▼ select yes or no, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

Fast Setling -When selected, instrument will take a snpshot of the sample and display the immediate reading before particles settle in the vial. (for high solids samples)

Normal - mediana

Media – calculates de media of the readings

5.3.6 Sample

This function can be used to set the number of readings the unit will take to calculate the average and present it as a measurement in the display.

5.3.7 ID

Here you can set up users names / passwords and when they shall be requested by the unit.

5.3.7.1 User ID

To create users and its passwords

5.3.7.1.1 edit

-Chose the user number between 00 and 50 , press **READ**

-Coose a name for this user using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data.

-You will see “PIN:” on the Display, use ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data.

-Press and Hold **ESC for 3 seconds** to return to the previous menu.

5.3.7.1.2 Request

To define when the user ID and password will be required

-Choose between the following options using ▲ or ▼ , when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

- ⇧ Always – ID and password will be request at every measurement.
- ⇧ On Start – ID and password will be request at Instrument Start Up.
- ⇧ MEMO – ID and password will be request when **SAVE** is pressed. (reading mode).
- ⇧ Previous – ID and password will not be request, the previous user informed will be assigned for all operations.
- ⇧ No – ID and password will not be request.

5.3.7.2 Sample ID

Here you can set up sample names / passwords and when those informations will be requested.

5.3.7.2.1 Edit

To create sample names.

-Choose the user number between 00 and 50 , press **READ**

-Choose a name for this sample using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data.

-Press and Hold **ESC for 3 seconds** to return to the previous menu.

5.3.7.2.2 Request

To define when the sample name will be required

-Choose between the following options using ▲ or ▼ , when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

- ⇧ Always – Sample name will be request at every measurement.
- ⇧ On Start – Sample name will be request at Instrument Start Up.
- ⇧ MEMO – Sample name will be request when **SAVE** is pressed. (reading mode).
- ⇧ Previous – Sample name will not be request, the previous user informed will be assigned for all operations.
- ⇧ No – Sample name will not be request.

5.3.8 Schedule Cal.

Access this funcntion to set up the time (Days/hours) before calibration is requested.

5.3.8.1 F.Scale

Choose the number of days and hours before the calibration warning graph will appear on the display using ▲ , ▼ and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data.

NOTE: When the calibration schedule is programmded, a graph will be displayed in the upper right corner during measurements, when the calibration date arrives, a bar will appear in the graph and a Calibration warning will be displayed.

5.3.9 Customize

Access this funcntion to insert an Nane for the unit, this name will show up during instrument start up and will be avaliable wen downloading the data.

-Select tha name you want to give to the unit Using ▲ to scroll to letters , ▼ to scroll to numbers (both can be used to go up or down) and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data..

5.3.10 Pat Number

Access this funcntion to insert an Nunber for the unit, this number will be avaliable wen downloading the data.

-Select tha number you want to give to the unit Using ▲ to scroll to letters , ▼ to scroll to numbers (both can be used to go up or down) and **MENU/READ** (send the cursor to the right/left), press and hold **SAVE** for 3 seconds to store the data.Language

Access this funcntion change the language of the display

Using ▲ or ▼ select from US (English) , ES (Spanish) or BR (Portuguese) when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

5.3.10 Instrument ID

Use ▲ , ▼ and **MENU/READ** (send the cursor to the right/left) to set an ID for the unit, press and hold **SAVE** for 3 seconds to store the data.

5.3.11 Pat. Number

Use ▲ , ▼ and **MENU/READ** (send the cursor to the right/left) to set an ID number for the unit, press and hold **SAVE** for 3 seconds to store the data.

5.3.12 Language

Use ▲ , ▼ to select the desired language from the list below, press and hold **SAVE** for 3 seconds to store the data.

⇧ US – English
⇧ ES – Spanish
⇧ BR – Portuguese

5.4 Communication

Use ▲ or ▼ to select between Eco Result or Log Transmit and **READ** to enter it or **ESC** to go back to the previous menu.

5.4.1 Eco Result

In this mode the measurement displayed is sent to the USB port, You can select to send all measurements only part of them.

Using ▲ or ▼ select Auto, Manual and Off, when done, press and hold **SAVE** for 3 seconds to store the data and **ESC** to return to the previous menu.

⇧ Auto – Sends all measurements to the USB (when they are performed)
⇧ Manual – Sends measurements that are selected (**SAVE** pressed during on measurement mode)
⇧ Off – No measurement will be sent to the USB

5.4.2 Log Transmit

Here you can select 4 ways to send the instrument measurement log

Using ▲ or ▼ select between , New Mark, All Mark, New, All, Press and hold SAVE for 3 seconds to store the data and ESC to return to the previous menu.

Auto - Sends all measurements to the USB (when they are performed)

Manual - Sends measurements that are selected (SAVE pressed during on measurement mode)

Off - No measurement will be sent to the USB

NOTE: When the time is in 0 minutes the instrument will not be shut off.

5.4.3 Serial Baud

Using ▲ or ▼ select between ,57600, 38400, 19200 or 9600 Press and hold SAVE for 3 seconds to store the data and ESC to return to the previous menu.

5.4.4 Header

Using ▲ or ▼ select between yes or no Press and hold SAVE for 3 seconds to store the data and ESC to return to the previous menu.

5.5 User Test

The instrument alow users to calibrate a user courve.

NOTE: When user courve is calibrated, the instrument performance might change due to standard and procedures adopted, factory calibrated courve is made with 100% tracable standards and reference materials in controlled environment, use it in order to have full confidence in instrument performance.

For more information on how to calibrate user courve please refer to the advanced operations instructions manual for the turbidity meter AP2000.

5.6 Security/Password

Here you can set up the security level and pasword for the Calibration, configuration and service functions.

On page (..) you will find the security level chart, use this as reference for the security levels you will assign to each function.

The Factory pre-saved password is 9999, if this is requires during configuration or operation use ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and MENU/READ (send the cursor to the right/left), press and hold SAVE for 3 seconds to store the data.

5.6.1 ID

Here you will assign a security level and password to aces all the ID functions.

Using ▲ or ▼ select the desired security level, when done, press and hold SAVE for 3 seconds to store the data.

5.6.1.1 Sec. Level

Choose the user number between 0 and 5, press and hold SAVE for 3 seconds to store the data.

5.6.1.2 Password

Using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and MENU/READ (send the cursor to the right/left), press and hold SAVE for 3 seconds to store the data.

5.6.2 Calibration

Here you will assign a security level and password to aces all the calibration functions.

Using ▲ or ▼ select the desired security level, when done, press and hold SAVE for 3 seconds to store the data.

5.6.2.1 Sec. Level

Choose the user number between 0 and 5, press and hold SAVE for 3 seconds to store the data.

5.6.2.2 Password

Using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and MENU/READ (send the cursor to the right/left), press and hold SAVE for 3 seconds to store the data.

5.6.3 Config.

Here you will assign a security level and password to aces all the Configurable functions.

Using ▲ or ▼ select the desired security level, when done, press and hold SAVE for 3 seconds to store the data.

5.6.3.1 Sec. Level

Choose the user number between 0 and 5, press and hold SAVE for 3 seconds to store the data.

5.6.3.2 Password

Using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and MENU/READ (send the cursor to the right/left), press and hold SAVE for 3 seconds to store the data.

5.6.4 Service.

Here you will assign a security level and password to aces all the service functions.

Using ▲ or ▼ select the desired security level, when done, press and hold SAVE for 3 seconds to store the data.

5.6.4.1 Sec. Level

Choose the user number between 0 and 5, press and hold SAVE for 3 seconds to store the data.

5.6.4.2 Password

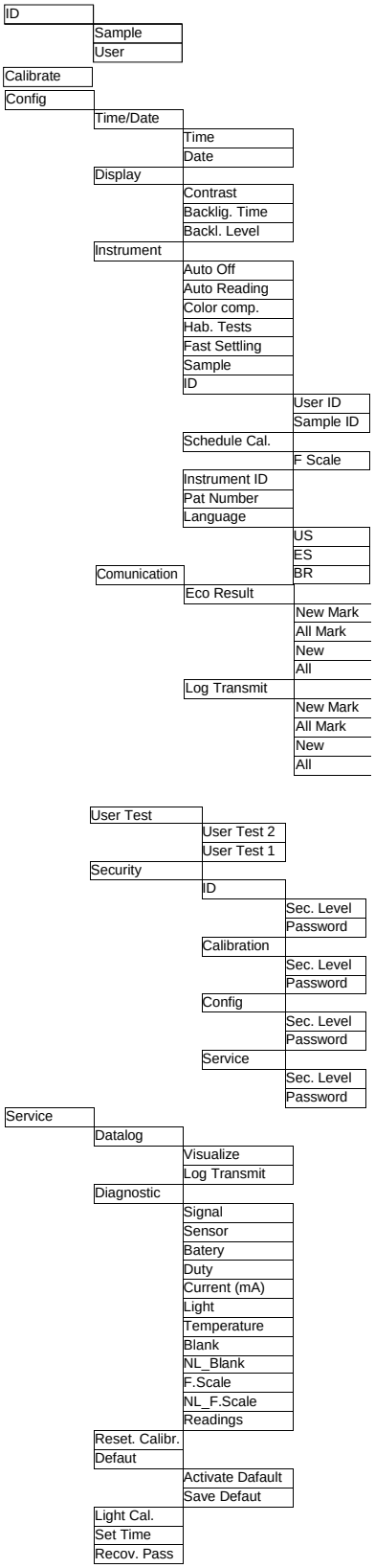
Using ▲ to scroll faster to letters , ▼ to scroll faster to numbers (both can be used to go up or down) and MENU/READ (send the cursor to the right/left), press and hold SAVE for 3 seconds to store the data.

6.0 Service

This function is to be used by factory trained technichans only,

For more information on how to calibrate user courve please refer to the advanced operations instructions manual for the turbidity meter AP2000

Menu Structure



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Version	Date	Author	Changes
1	7-Aug-2019	Laura Martin	• Document Created

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