

Martek Instruments, Inc.

Mark 25

Ultrapure Water

Conductivity Analyzer

Instruction Manual

WARRANTY POLICY

Unless otherwise stated, MARTEK INSTRUMENTS, INC. warrants this equipment to be free from defects in material and workmanship and to perform in accordance with applicable specifications for five years (one year for portable equipment) from date of shipment. All conductivity sensors are guaranteed for life.

MARTEK will provide free service at the factory, including parts, labor and transportation back to the customer, for any malfunction of its products which are returned transportation charges prepaid.

Customers desiring to return a product to MARTEK for repair should contact the Service Department by telephone at (800) 628-8834 or fax (919) 790-2375 or via our website at www.martekinstruments.com to obtain return authorization. The information required at this time will be the complete model number and serial number of the product and a brief description of the problem.

All shipments to MARTEK must be freight prepaid and addressed as follows:

***MARTEK INSTRUMENTS, INC.
2609 Discovery Drive
Raleigh, NC 27616
Attn: Repair Department***

A complete and detailed statement of the reason for return must accompany the unit. If possible, include a copy of sample reading or a printout.

Returned units must be packed as well as they were when first shipped. If possible, use the original packing. Do not return detachable cords or manuals with the unit.

MARTEK reserves the right to void this warranty if the product has been subjected to misuse, neglect, accident, improper installation or application, and for consumable items such as batteries, membranes, or solutions.

This warranty is expressly in lieu of all other obligations or liabilities on the part of MARTEK. MARTEK neither assumes nor authorizes any other person or organization to assume on behalf of Martek any other liability in connection with the sales or use of MARTEK instrumentation.

MARK 25 TABLE OF CONTENTS

	Page
1. Introduction	
1.1 Description	3
1.2 Specifications	4
2. Installation	
2.1 Panel Cutout for Monitor	5
2.2 Sensor Dimensions	5
2.3 Electrical connections to the monitor	6
3. Operation	
3.1 Keyboard & display	7
3.2 The CALIB Key.....	7
3.3 Calibrating Temperature.....	8
3.4 Calibrating Conductivity.....	9
3.5 Setting Alarms.....	9
3.6 Setting Recorder Outputs.....	10
3.7 Setting the Password.....	11
3.8 Setting the ID Number.....	11
3.9 Changing the Serial Output.....	11
3.10 Setting the Auto-Ranging Function.....	12
3.11 Troubleshooting.....	12

1. Introduction

1.1 Description

The Mark 25 Conductivity Analyzer is a simple, low cost, **4 channel**, microprocessor-based monitoring system designed for ultrapure water applications. The system consists of a readout module that can be used with up to four sensors; each sensor being incorporated into a flow-through style flow chamber.

A large 4 digit LED display indicates either **temperature**, **raw conductivity**, or **temperature-corrected conductivity** while an 8-key membrane keypad allows the operator to quickly setup and calibrate the analyzer.

The Mark 25 measures conductivity in **three ranges**; 0-1 $\mu\text{S/cm}$, 0-10 $\mu\text{S/cm}$, and 0-100 $\mu\text{S/cm}$. Calibration is accomplished quickly via automatic calibration within the Mark 25 or by comparison to a referee system (please refer to Martek's ASTM & NIST-traceable **Mark 22 In Situ Calibrator** for further information).

Four alarm set points with relay contacts are standard in addition to four isolated analog recorder outputs (0-20 mA) *and* a serial RS232 digital output for hookup to external recording equipment. For maximum flexibility, **alarm set points and analog outputs can be assigned to any range on any parameter on any channel.**

Housed in a $\frac{1}{4}$ DIN corrosion-resistant plastic case, the readout module can be panel mounted with a minimum of tools. The analyzer accepts power inputs from 97 to 240 VAC 50/60 Hz or 24 Vdc and comes with an **ON/OFF switch** located on the rear panel. Alarm and recorder wires are easily installed in removable terminal strips.

Sensors connect via a DB-9 connector located on the rear panel of the Mark 25 and the sensors mount easily to any flat surface. In addition, Martek offers **adapter plates** specifically designed to cover the space occupied by other brands of conductivity analyzers.

Sensors come standard with 10 feet (3 meters) of cable. However, longer cable lengths may be special-ordered from the factory up to lengths of 150 feet.

NOTE: If the Mark 25 is purchased as a part of the Dissolved Carbon Dioxide Analyzer, the auto-ranging function is standard and cannot be changed. For additional information, contact the factory.

1.2 Specifications

Parameter	Range	Accuracy	Resolution
Conductivity	0-1.000 $\mu\text{S/cm}$	± 0.01 $\mu\text{S/cm}$	0.001 $\mu\text{S/cm}$
	0-10.00 $\mu\text{S/cm}$	± 0.1 $\mu\text{S/cm}$	0.01 $\mu\text{S/cm}$
	0-100 $\mu\text{S/cm}$	± 1.0 $\mu\text{S/cm}$	0.1 $\mu\text{S/cm}$
Temperature	0-100 $^{\circ}\text{C}$	$\pm 0.1^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$

Power: 97-240 VAC, 50/60 Hz, 24Vdc, fuse protected

Recorder Output: Four isolated, scaleable 0-20 mA DC analog & RS232C serial ASCII digital output

Alarm Output: Four solid-state relays, 5 amp, 250 V

Weight: 2 lbs (0.9 kg) including one sensor with 10 feet (3 meters)

Construction: Readout Module Case: ABS plastic, NEMA 12 (IP65)
Sensor: Type 316 Stainless Steel and Teflon

Cabling: 8-conductor, 24 gauge, PVC jacket, shielded, 0.25 inch (0.63 cm)

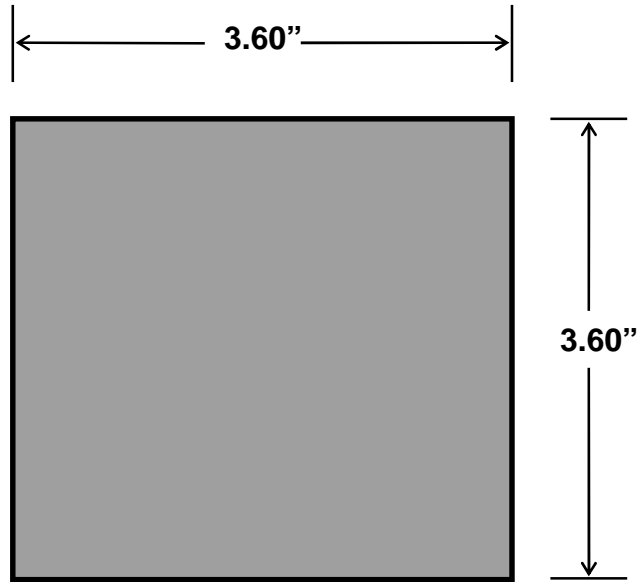
Dimensions: $\frac{1}{4}$ DIN case, 6.51 x 3.78 x 3.78 (165.5 x 96 x 96 mm) LWH

Installation: Panel mount (mounting hardware included). Recommend mounting sensor vertically with inlet at the bottom. Position of sensor cabling not a factor in mounting.

Flow rate: 45-250 ml/min

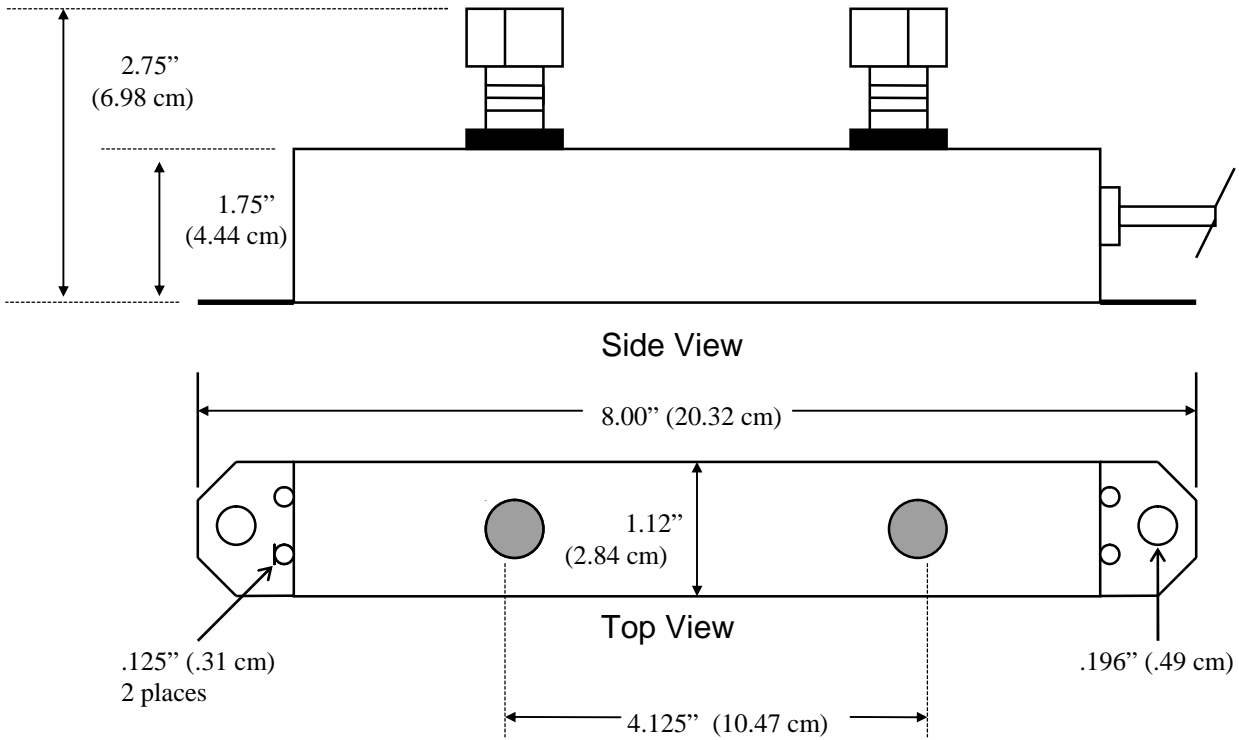
2. Installation

2.1 Panel Cutout for Monitor

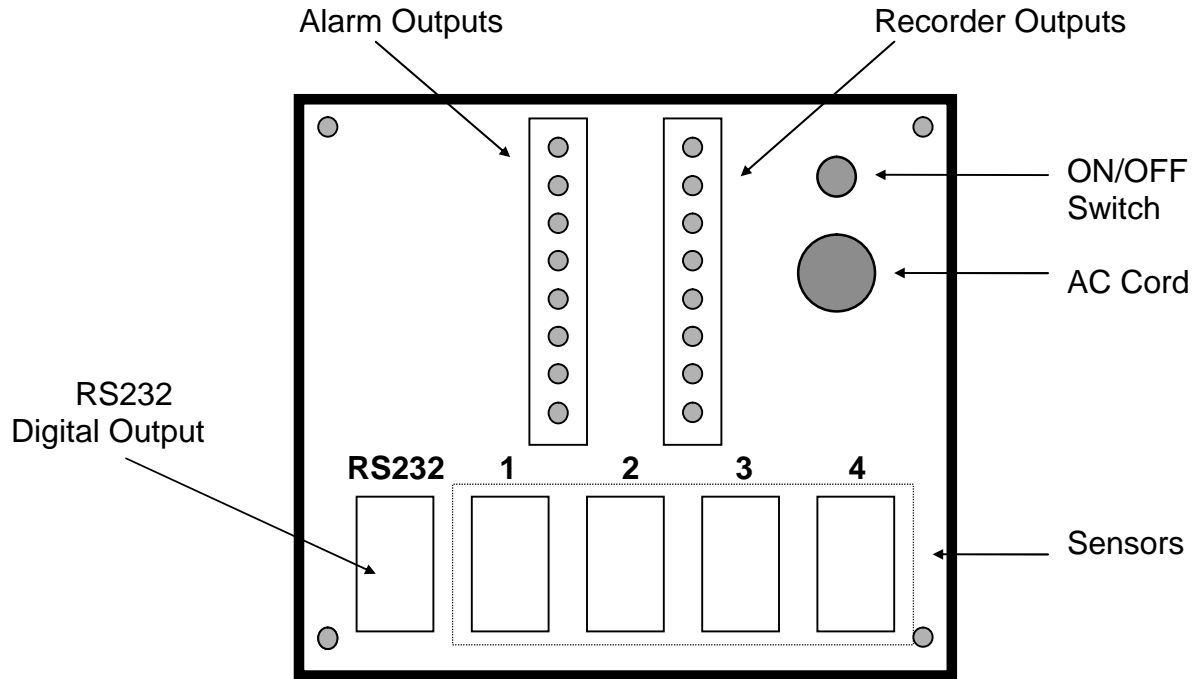


Panel Cut-out

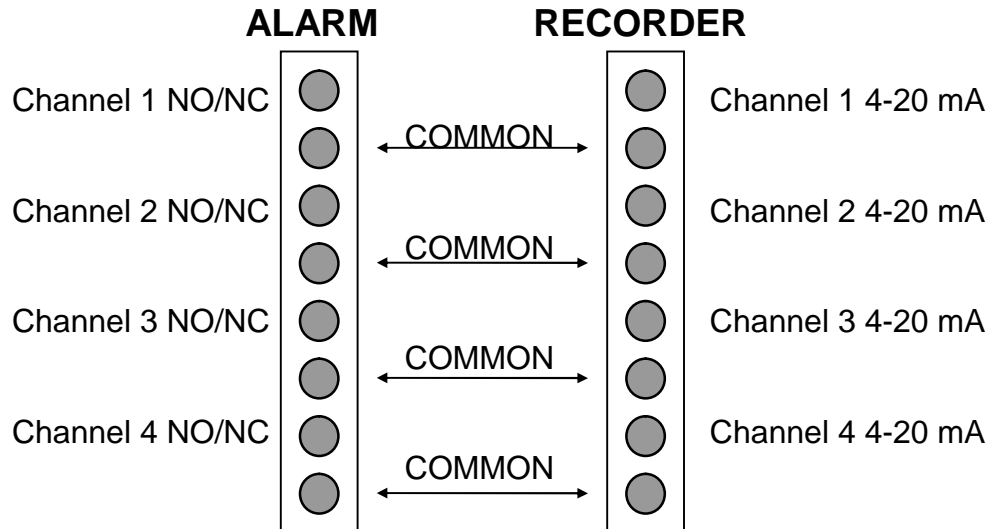
2.2 Sensor Dimensions



2.3 Electrical connections to the monitor



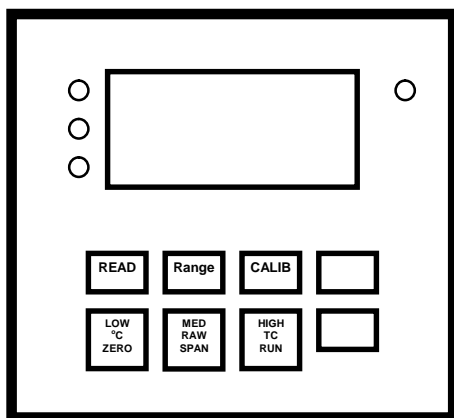
To set up the Mark 25 for operation, simply plug the sensor connector in, then plug the AC power cord into a properly grounded outlet. If recorder, digital or alarm outputs are to be used, make certain the Mark 25 is unplugged before connecting the cable to the appropriate recorder or computer. Follow the wiring diagram below for hooking up the Mark 25 alarm and analog recorder outputs:



3. Operation

3.1 Keyboard and display

The Mark 25 front panel consists of a 4 digit red LED display, 3 parameter and channel LED's, an alarm LED, and an 8-key keypad. The display is used to present all parameter measurements, operator prompts and system errors.



The keys are arranged in two rows, four keys in each row.

The **top row of keys** consist of three color-outlined *function keys* and are used to perform instrument operations such as selecting which parameter to view, what range the parameter is to be viewed in, parameter calibration and system set up.

The **bottom row of keys** are multi-colored, multi-legend keys and are used in conjunction with the function keys. The same colored legends correspond to the same colored function key.

The **arrow keys** are used to view channels, select functions during setup and calibration, and increment or decrement a displayed value.

READ key - When the <READ> key is pressed, the Mark 25 will display **rd**. If one of the bottom keys is selected, the parameter high-lighted in red will be displayed and its corresponding LED lit.

RANGE key - Range changes can be made manually for raw conductivity and temperature-corrected conductivity only. To change the range, press the <RANGE> key, then select either LOW, MED, or HIGH to display the desired range. If the Mark 25 is setup for auto-ranging, the Mark 25 will display **AUrg** as long as the <RANGE> key is pressed.

NOTE: *Manually changing the range for temperature-corrected conductivity changes the analog recorder output scaling. See Section 3.7 for details.*

Viewing a different channel is easily done by pressing the <UP> or <DOWN> arrow key. The parameter LED's to the left of the Mark 25 display also indicate which channel is being viewed. Channel ID's are as follows:

Red LED - Channel 1

Green LED - Channel 2

Red/Green LED - Channel 3

Flashing Red LED - Channel 4

3.2 The CALIB key

All setup and calibration functions are conducted via the <CALIB> key. The <CALIB> allows you to set the following:

- Calibrate temperature and conductivity
- Assign and set alarm points
- Assign and set recorder outputs
- Set a password
- Set up an analyzer ID, serial output, and auto-ranging functions

Once the sensors have been connected to the Mark 25, the power cord can be plugged into any outlet supplying 97-240 V AC 50/60 Hz power. When the Mark 25 is switched on, it will immediately start monitoring temperature.

Pressing the <CALIB> key will cause the Mark 25 to display a flashing °C.

If you continue pressing the <DOWN ARROW> key the display will flash the following prompts: **CON**, **ALA**, **rEC**, **PAS**, **uSr**. After **uSr**, the Mark 25 returns to monitoring temperature.

Here are two **basic rules** to remember when using the <CALIB> key:

1. Pressing the <UP ARROW> key will select any flashing prompt.
2. Pressing the <RUN> key will return the Mark 25 to the monitoring mode.

3.3 Calibrating Temperature

The Mark 25 can be calibrated automatically or manually for temperature.

NOTE: *Automatic, electronic calibration is a less accurate method of calibration. For best results, the Mark 25 should be calibrated to ASTM or NIST- traceable standards.*

To calibrate temperature, press the <CALIB> key. The display will flash °C.

To select temperature, press the <UP ARROW> key. The flashing will stop. Next, press the <ZERO> key. The Mark 25 will display three calibration bars and automatically zero the temperature before returning to the monitoring mode.

To span temperature, press the <CALIB> key, then the <UP ARROW> key when the temperature prompt is displayed. Next, select the key. The Mark 25 will display **Aut** which is short for Automatic.

To automatically calibrate temperature, press the <UP ARROW> key. After the calibration bars appear, the Mark 25 will briefly display a span temperature of **50.0** before returning to monitor mode.

The Mark 25 has now been calibrated for temperature.

To manually span calibrate temperature, simply press the <DOWN ARROW> key when **Aut** is displayed. The Mark 25 will momentarily display three lines, then a number indicating the input voltage will appear in the display. Once this number has stabilized, press the <CALIB> key and select the appropriate span value using the up or down arrow keys (the display defaults to 25 deg. C). When complete, press the <CALIB> key to enter the data into the Mark 25's memory.

3.4 Calibrating Conductivity

Calibrating conductivity follows the same procedure as the temperature calibration. However, if the Mark 25 is not set up for auto-ranging prior to conductivity calibration, the desired range must be selected (for information on auto-ranging, see section **3.10 Auto-ranging**).

Press the <CALIB> key, then the <DOWN ARROW> key until **CON** is flashing. Follow the same procedure for zero calibration for conductivity that was used for temperature.

To span conductivity, press the <CALIB> key and select the conductivity prompt. Next, press the <UP ARROW> key when the **Aut** prompt is displayed. The Mark 25 will display the calibration bars then briefly display **1.000** (or 10.0 or 100.0 depending on the range previously selected) before returning to the monitor mode.

NOTE: *If the auto-ranging function is OFF and the Mark 25 is monitoring raw or temperature-corrected conductivity and the measurement exceeds the current selected range, the Mark 25 will display **Err**. The decimal point will indicate the range previously selected. If an error message occurs, you must select a higher range.*

3.5 Setting Alarms

The Mark 25 has four alarm set points that can be assigned to any parameter on any channel.

Press the <CALIB> until the display indicates the alarm prompt, **ALA**. Next, press the <UP ARROW> key. The display will prompt with **AL 1** and all

parameter LED's will be lit. The <UP ARROW> key can be used to change the alarm set point to 2, 3, or 4.

To assign a particular alarm set point, press the <CALIB> key. The Mark 25 will display three bars. The bars indicate no alarm set point. Use the <UP> or <DOWN ARROW> keys to select temperature (**t**), raw conductivity (**rc**), or temperature-corrected conductivity (**tc**). Press the <CALIB> key to select the desired parameter.

The Mark 25 will then display **Lo**. To select a low set point, press the <CALIB> key. If a high alarm set point is desired, use the <UP> or <DOWN ARROW> key to change the display to **hi** then press the <CALIB> key to select.

The Mark 25 will display **.000** (if raw or temperature-corrected conductivity is selected) though the decimal point may vary depending on the range previously selected.

Use the <UP> or <DOWN ARROW> key to change the value to the desired alarm set point. When the desired set point is reached, press the <CALIB> key to set and activate alarm.

NOTE: *For convenience, pressing the <RANGE> key will advance the digit left of the decimal point.*

To disable alarm, return the set point value to **.000**.

Once an alarm set point has been assigned to a particular parameter on a channel, it cannot be assigned to another parameter or channel until it has been disabled.

When the Mark 25 reaches an alarm state, the Alarm LED will light and the alarm relay activate. The factory-set position for the alarm relays is NORMALLY OPEN. To change to a NORMALLY CLOSED position, contact Martek Instruments.

NOTE: *The Alarm LED will blink if there are active alarms that are not being viewed and will remain steady if the channel viewed is in an alarm state.*

3.6 Setting Recorder Outputs

The Mark 25 comes standard with four 4-20 mA analog recorder outputs and one RS232 digital output. Like the alarm set points, the four analog recorder outputs can be assigned to any range of any parameter on any channel. Press the <CALIB> until the display indicates the recorder prompt, **REC**. Next, press the <UP ARROW> key. The display will prompt with **ou 1** and all parameter LED's will be lit. The <UP ARROW> key can be used to change the recorder output to 2, 3, or 4.

To assign a particular analog output, press the <CALIB> key. The Mark 25 will display three bars. The bars indicate no analog output assigned. Use the <UP> or <DOWN ARROW> keys to select temperature (**t**), raw conductivity (**rc**), or temperature-corrected conductivity (**tc**).

NOTE: *A decimal point will be present for **rc** and **tc** which indicates what range these parameters are currently using. If the auto-ranging function is ON, the decimal point can be moved by pressing the <RANGE> key.*

Press the <CALIB> key to select the desired parameter.

At this point, the standard 4-20 mA output range can be changed to any value desired. In addition, a "balance" is provided to "fine-tune" each end of the recorder range.

To change the lower end of the recorder range, press the <ZERO> key. The Mark 25 will display **4.00**. Use the <UP> or <DOWN ARROW> key to change the number to the desired value. When the desired value is reached, press the <CALIB> key to set the value in memory.

At this point, the Mark 25 will then display **000**. This is the "balance". Use the <UP> or <DOWN ARROW> key to change the value in order to make the lower end of the recorder range to agree with the external recorder. When the desired balance is reached, press the <CALIB> key to set the value in memory.

The same procedure is used to change and "balance" the upper range of the recorder output.

To disable any assigned analog recorder output, select the particular output and press the <CALIB> key. Once the parameter is displayed, use the <UP> or <DOWN ARROW> keys until three bars are displayed. Press the <CALIB> key to disable the output.

Once a recorder output has been assigned to a particular parameter on a channel, it cannot be assigned to another parameter or channel until it has been disabled.

NOTE: *When the auto-ranging function is OFF, changing a conductivity range with an assigned analog output automatically changes the scaling of the*

*recorder output to the new range.
When the auto-ranging function is ON,
the assigned analog output will remain
in the range it was assigned to.*

When the RS232 digital output is used, calibration is not necessary. However, the receiving computer must be set up to accommodate the Mark 25's digital output configuration:

Baud Rate - **9600**
Parity - **Even**
Word length - **7**
Stop Bit - **1**

A communication program such as PROCOMM or Microsoft HYPERLINK can be used to write data from the Mark 25 to a computer file which can then be imported into a spreadsheet program such as EXCEL or LOTUS NOTES. The data will be displayed in the following format:

ID, Chan, Temp. Raw Cond., TC Cond.

3.7 Setting the Password

The Mark 25 can be assigned a numeric password to prevent unauthorized personnel from changing any of the settings.

Press the <CALIB> until the display indicates the password prompt, **PAS**. Next, press the <UP ARROW> key. The display will prompt with **1999** and all parameter LED's will be lit and flashing. Use the <UP> or <DOWN ARROW> keys to change the displayed value to any number other than 0. When the desired value has been reached, press the <CALIB> key to set and activate the password.

Once the password is enabled, the display will default to **1999** whenever the password prompt is selected. To gain access to any other function, you must use the arrow keys to scroll to the correct value password then press the <CALIB> key.

To disable the password, use the <UP ARROW> key to move the value to 0 then press the <CALIB> key. The password function will then be disabled.

3.8 Setting the ID Number

The Mark 25 can be assigned a three digit numeric ID number that will be displayed on the digital output.

Press the <CALIB> until the display indicates the user prompt, **uSr**. Next, press the <UP ARROW> key. The display will prompt with **id** and all parameter LED's will be lit and flashing. When the <CALIB> is pressed, the Mark 25 will display **000**. To assign an ID number, use the <UP> or <DOWN ARROW> keys to change the displayed value to any number other than 000. When the desired value has been reached, press the <CALIB> key to set the ID number.

To disable the ID number, use the <UP ARROW> key to move the value to 000 then press the <CALIB> key. The ID function will then be disabled.

3.9 Changing the Serial Output

The Mark 25 provides a standard RS232 digital output. This output can be configured in one of two ways:

1. Polling - The Mark 25 will provide the digital output only when polled by the host computer.
2. Periodic - The Mark 25 will automatically provide a digital output at a 30 second interval.

Press the <CALIB> until the display indicates the user prompt, **uSr**. Next, press the <UP ARROW> key. The display will prompt with **id** and all parameter LED's will be lit and flashing. Use the <UP> or <DOWN ARROW> key to advance to the serial prompt, **SEr**. When the <CALIB> is pressed, the Mark 25 will display **Pol**. To change the output to periodic interval, press either the <UP> or <DOWN ARROW> key until the Mark 25 displays **PEr**.

To return to the monitor mode, press the <RUN> key.

3.10 Setting the Auto-Ranging Function

The Mark 25 can be set up to automatically range between the low, medium, and high ranges for raw and temperature-corrected conductivity.

Press the <CALIB> key until the display indicates the user prompt, **uSr**. Next, press the <UP ARROW> key. The display will prompt with **id** and all parameter LED's will be lit and flashing. Use the <UP> or <DOWN ARROW> key to advance to the auto-ranging prompt, **AUrG**. When the <CALIB> key is pressed, the Mark 25 will display **OFF**. To activate the auto-ranging function, press either the <UP> or <DOWN ARROW> key until the Mark 25 displays **On**. Press the <CALIB> key

to activate the selection in the Mark 25's memory.

Pressing the <RUN> key returns the Mark 25 to monitor mode.

3.11 Troubleshooting

The Martek Mark 25 represents over thirty years of experience in conductivity measurements and, as such, has been designed to provide simple, reliable operation for many years.

To obtain optimum performance from the Mark 25, care should be taken to ensure the sensor has adequate flow and is free of obstructions. In addition, it is important to maintain correct calibration on a regular basis.

Comparison of the Mark 25 to a referee system is the preferred method of validation, however, calibration using the Mark 25's internal circuitry is also acceptable.

In the event a problem develops with the Mark 25 that cannot be resolved through calibration, contact Martek Instruments directly via telephone, fax, or e-mail located at our website, www.martekinstruments.com.