MARTEK INSTRUMENTS, INC.

MARK 24

PROCESS ULTRAPURE WATER MONITORING SYSTEM

OPERATION MANUAL

Rev. NC(4) - 10/28/98

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 one year from date of shipment.

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 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, Suite 125
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 of MARTEK instrumentation.

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1.0 WHAT IS THE MARK 24?

The Martek Mark 24 Ultrapure Water Quality Monitoring System is a multi-channel analyzer designed to permit custom configurations for monitoring multiple process water quality parameters to include: temperature, conductivity, temperature-corrected conductivity, pH, ORP, dissolved oxygen, and % acid or caustic concentrations in applications ranging from ultrapure water to brine solutions.

The Mark 24 is especially suited for on-line ultrapure water process monitoring applications in nuclear or high performance fossil fuel power plants; semiconductor and pharmaceutical manufacturing plants; condensate polishing systems; and demineralizer, condensate and other steam processes.

These applications require empirical equations for temperature correction of the pH and conductivity measurements which are performed by the Mark 24's software and circuitry. Each sensor input provides real-time temperature measurement in addition to raw parameter data. Up to FOUR separate parameters can be hooked up to the Mark 24 and any combination of sensors can be used.

1.1 HOW CAN THE MARK 24 BENEFIT YOU?

By eliminating the need to monitor and maintain four separate analyzers, the Mark 24 allows you to add or delete sensors at will and in a matter of minutes. Another significant advantage of the Mark 24 is that it provides the operator with the option of selecting any one of four available temperature compensation factors to be used for temperature-corrected conductivity and pH measurements. Other features include a serial ASCII port that allows the Mark 24 to communicate to any personal computer accepting RS232C digital input, programmable high and low alarm set-points, and a password lock to disable the keyboard. An analog recorder output printed circuit board allows each individual channel to be configured for 0-1, 0-5 volt DC or 4-20 mA output, to facilitate interface to chart recorders.

By providing complete versatility, in addition to unparalleled accuracy and resolution, the Mark 24 allows you to detect subtle changes in water chemistry that can affect the performance of condensate polishers, resin beds, and other process systems where water purity is to be monitored and/or controlled.

1.2 HOW TO READ THIS MANUAL

Carefully review all of the material in this Manual before operating the Mark 24. Special attention should be given to the sections regarding SET UP and OPERATION. A separate instruction manual is provided for each sensor that details the CALIBRATION and TROUBLESHOOTING for that individual sensor. Since basic knowledge of process instrumentation and chemistry is required, you should already be familiar with these areas before attempting to operate the Mark 24.

We are committed to your satisfaction. If you should have any questions or comments regarding the Mark 24, its sensors, or this Manual, please contact us at **(800) 628-8834.** You can also contact us via fax at **(919) 790-2375.**

2.0 SPECIFICATIONS - PHYSICAL

Case Dimensions:

Enclosure - 6.80 x 4.42 x 9.06 inch (17.27 x 11.22 x 23.01 cm) WHD

Case Weight: 8.00 lbs. (3.64 kg)

Power Requirement:

120 OR 240 V AC, 50/60 Hz

Recorder Output:

Standard - RS 232C Serial ASCII

0-1, 0-5 volt or 4-20 mA Analog output

Mounting: Panel mount

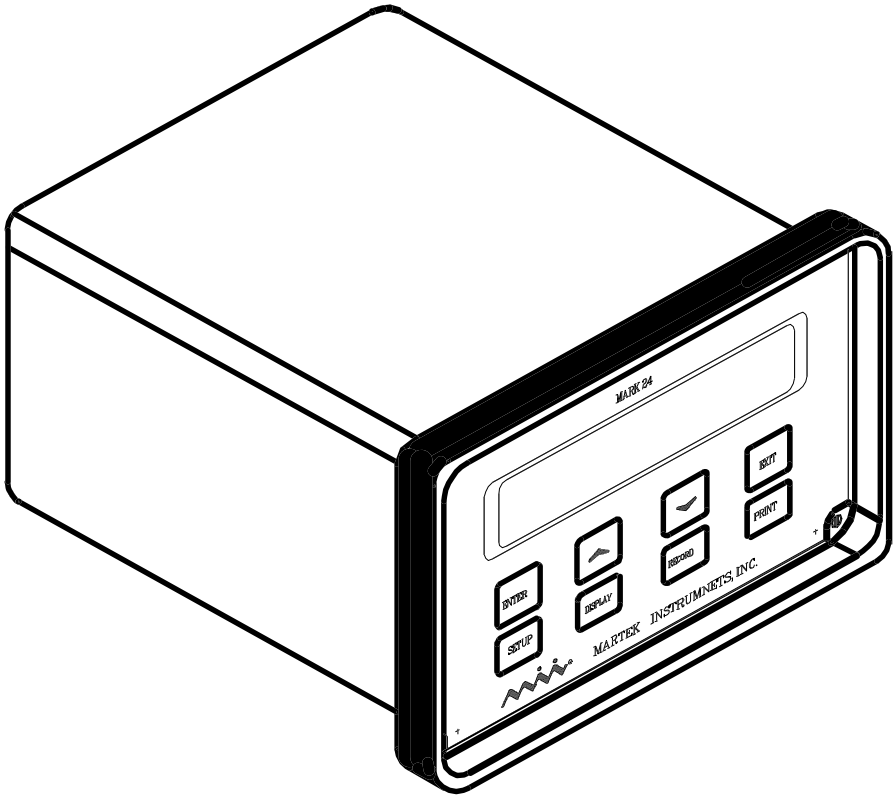


FIG 2.0

2.1 SPECIFICATIONS - MEASUREMENT

Parameter	Range	Resolution	Accuracy
Temperature	0-100° C	0.01° C	±0.15° C
Conductivity	0-2.0000 µS/cm	0.0001 µS/cm	±0.001 µS/cm
	0-20.000 µS/cm	0.001 µS/cm	±0.01 µS/cm
	0-20.000 µS/cm	0.001 µS/cm	±0.01 µS/cm
	0-200.00 µS/cm	0.01 µS/cm	±0.1 µS/cm
	0-200.00 µS/cm	0.01 µS/cm	±0.1 µS/cm
	0-2000.0 µS/cm	0.1 µS/cm	±1 µS/cm
pH	0-14 pH	0.01 pH	±0.1 pH
ORP	±1400 mV	1.0 mV	±10.0 mV
Dissolved Oxygen	0-20 ppm	0.01 ppm	±0.1 ppm
	0-2 ppm	0.001 ppm	±0.01 ppm
	0-200 ppb	0.01 ppb	±1 ppb
	0-20 ppb	0.01 ppm	±0.1 ppb
H_2SO_4, NaOH	0-10%	0.01%	±0.2%

2.2 ACCESSORIES

The Mark 24 comes complete from the factory with the following items:

- **AC Power Cord**
- **Computer Cable (p/n 400504)**
- **Mounting Bracket (p/n 820930)**

If any of these items are missing, contact the factory immediately.

NOTE: Consult the sensor instruction manual for a list of sensor accessories.

2.3 INSTALLING THE MARK 24

The Mark 24 is designed for panel mounting in any convenient location that provides protection from water, extremes in temperature, and allows access for instrument interface connections and adjustments.

Figure 2.1 illustrates the cutout dimensions for panel mounting. The panel must be no thicker than 3/8" and cutouts for adjacent Mark 24's must be no closer than 3 1/4" in all directions.

It is not necessary to drill holes in the panel. The Mark 24 is secured to the panel by a mounting bracket **(p/n 820930)** shown if Fig. 2.2. The Mark 24 is inserted into the panel cutout such that the front bezel of the Mark 24 rests against the front surface of the mounting panel. The mounting bracket is installed over the case of the Mark 24 such that the open end of the bracket rests against the back surface of the mounting panel. The bracket is then fastened securely to the rear panel of the Mark 24 case via the 8-32 screw and wing nut. See Fig. 2.3 Mark24 Panel Mounting - Side View.

NOTE: Extra care should be taken to ensure that the Mark 24 case is electrically grounded to the panel via the earth ground wire of the line cord.

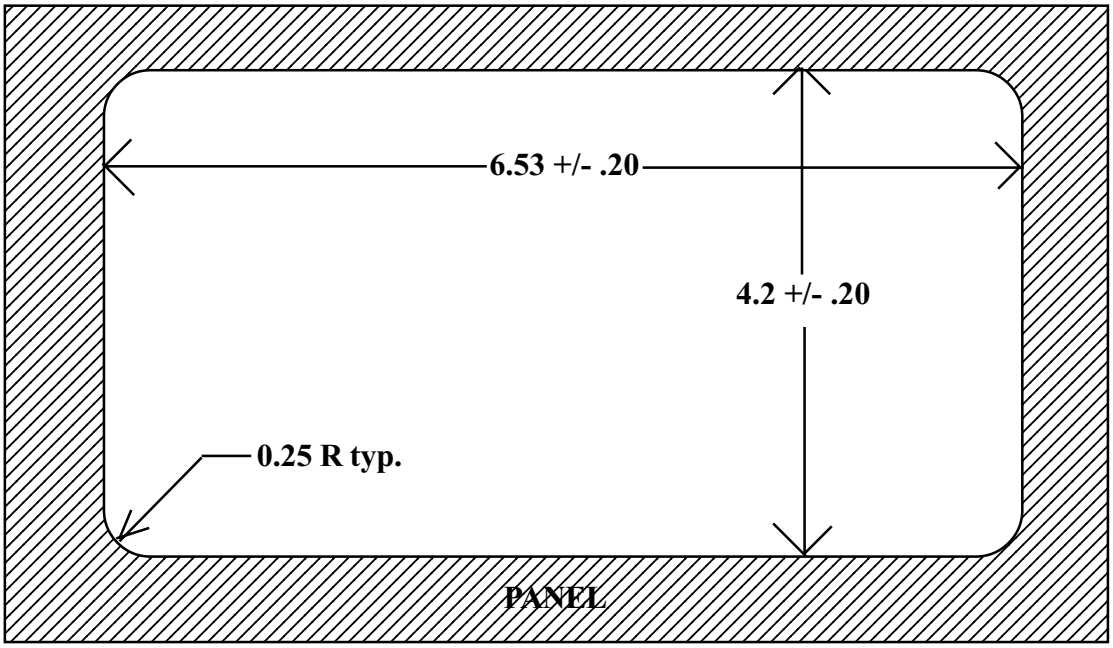


Fig. 2.1 - Mark 24 Panel Cutout

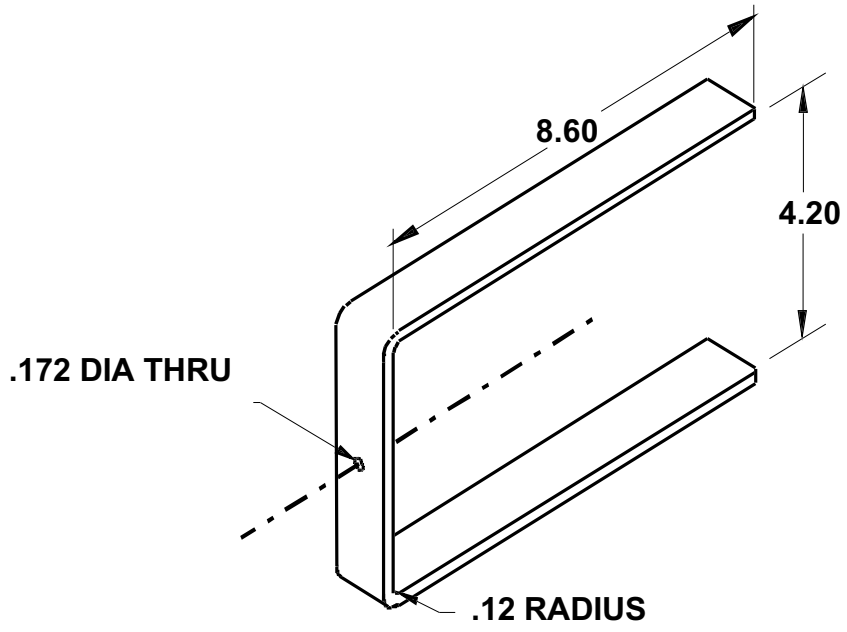


Fig 2.2 Mark 24 Panel Mounting Bracket (P/N 820930)

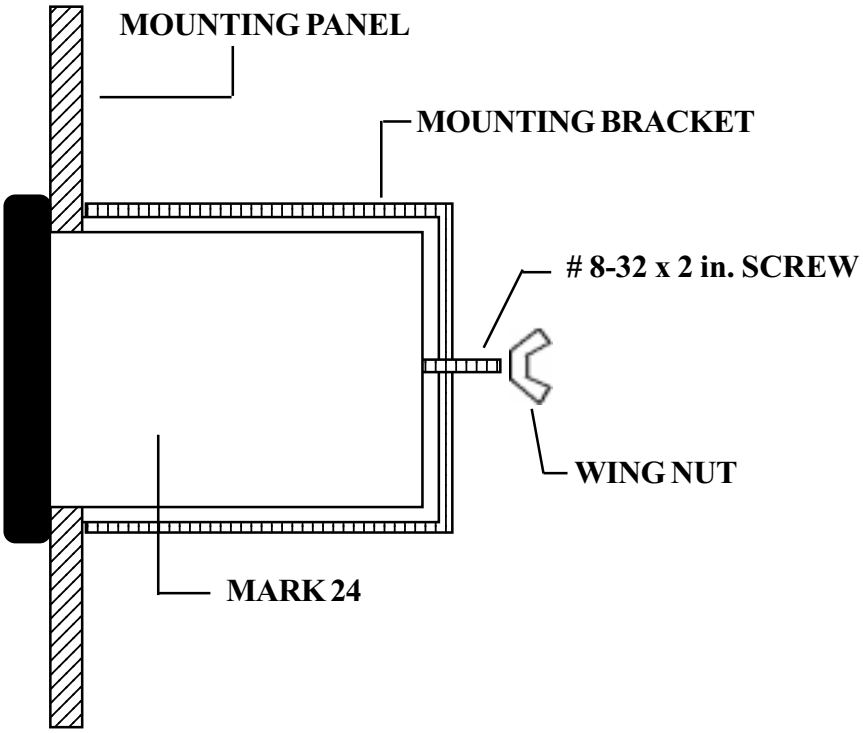


Fig 2.3 Mark 24 Panel Mounting - Side View

2.4 SET UP

The Mark 24 Analyzer is intended for use as part of a measurement system in applications in which real-time on-line measurement and recording of water parameters such as Conductivity, pH , ORP, CO_2, and Dissolved Oxygen are required. In all of these applications the measurement system consists of *(1) an analyzer, (2) a sensor with preamp, (3) a data recording device.* The components you will need to implement a monitoring system using the Mark 24 depends on the configuration of the analyzer you have selected.

2.4.1 Configuration One: 4 Parameter

System components:

- Mark 24 Analyzer
- Sensor Preamp (w/ interconnect cables)
- Sensor (w/ interconnect cables)

2.4.2 Configuration Two: 4 Channel Conductivity Sensors Only (No Preamps)

System components:

- Mark 24 Analyzer
- Sensor

2.4.3 Sensor Preamp

Martek Instruments provides the following sensors with preamps for use with the Mark 24 Analyzer.

Description	Part Number
■ Flow-thru Style Conductivity	
(0-2 & 0-20 µS)	180-21-1
(0-20 & 0-200 µS)	180-21-2
(0-200 & 0-2000 µS)	180-22
■ pH	180-24
■ ORP	180-26
■ Dissolved Oxygen	180-27
■ Insertion Style Caustic	180-28
■ Insertion Style Acid	180-29
■ Insertion Style Conductivity (0-20 & 0-200 µS)	180-31
■ Insertion Style Conductivity (0-200 & 0-2000 µS)	180-32

2.4.4 Sensor List:

Martek Instruments provides the following sensors without preamps for use with the Mark 24 Analyzer.

Description	Part Number
■ Flow-thru Style Conductivity	
(0-2 & 0-20 µS)	180-21-1C
(0-20 & 0-200 µS)	180-21-2C
(0-200 & 0-2000 µS)	180-22C

2.4.5 How To Connect The Preamp To The Mark 24

The preamp has two connection ports as shown in the following block diagram. See section 2.4.7 for individual parameter connection to the Mark 24.

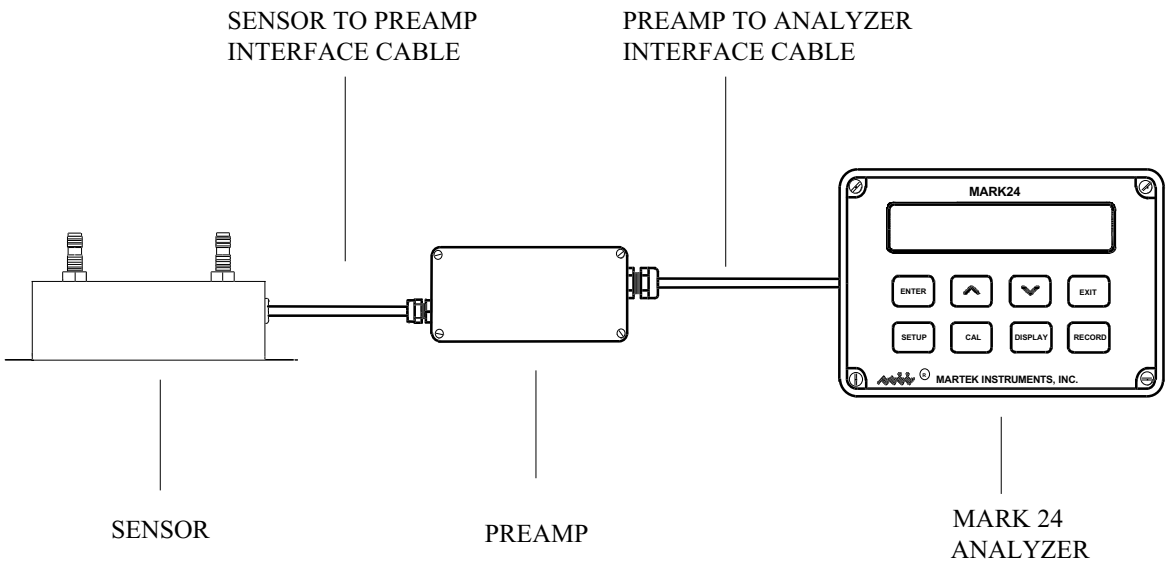


FIG. 2.4

2.4.6 Sensor To Preamp Connection

The following diagrams detail the wiring configurations for each parameter from sensor - to - preamp - to - analyzer.

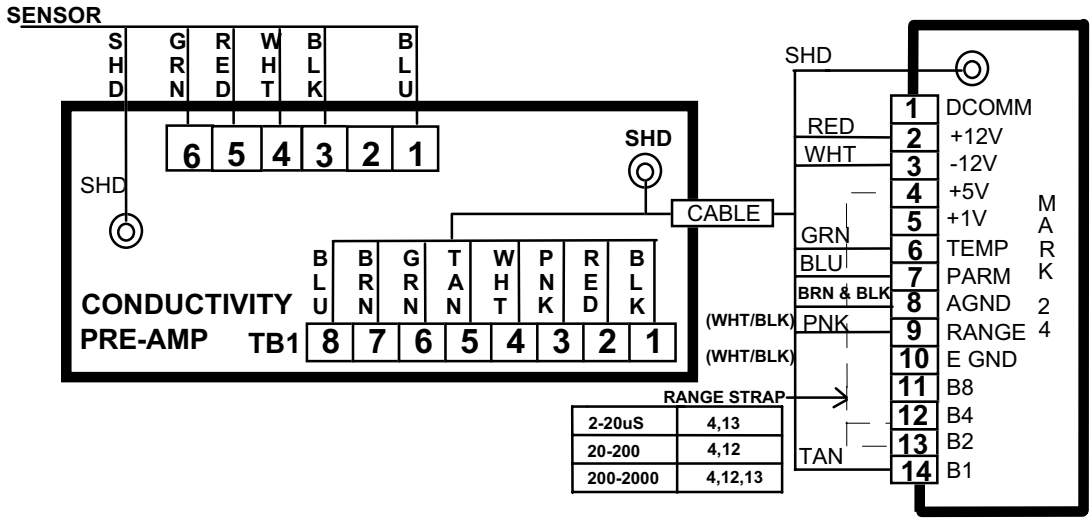


FIG. 2.5

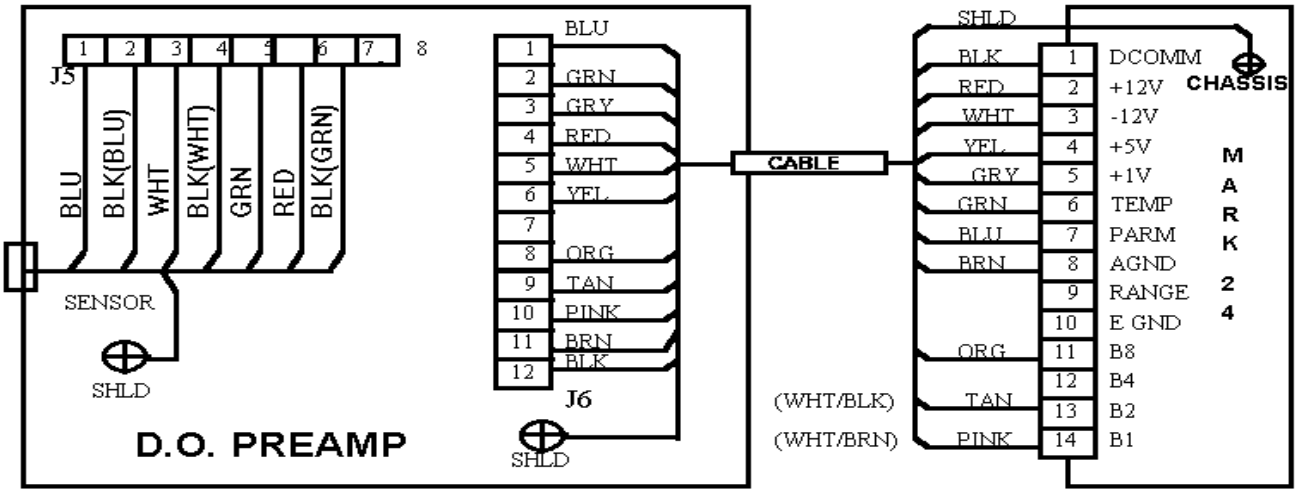

J5
1 2 3 4 5 6 7 8
BLU
BLK(BLU)
WHT
BLK(WHT)
GRN
RED
BLK(GRN)
SENSOR
SHLD
D.O. PREAMP
BLU
GRN
GRY
RED
WHT
YEL
ORG
TAN
PINK
BRN
BLK
J6
SHLD
CABLE
SHLD
BLK
RED
WHT
YEL
GRY
GRN
BLU
BRN
ORG
TAN
PINK
(WHT/BLK)
(WHT/BRN)
1 DCOMM
2 +12V
3 -12V
4 +5V
5 +1V
6 TEMP
7 PARM
8 AGND
9 RANGE
10 E GND
11 B8
12 B4
13 B2
14 B1
CHASSIS
MARK 24

FIG. 2.6

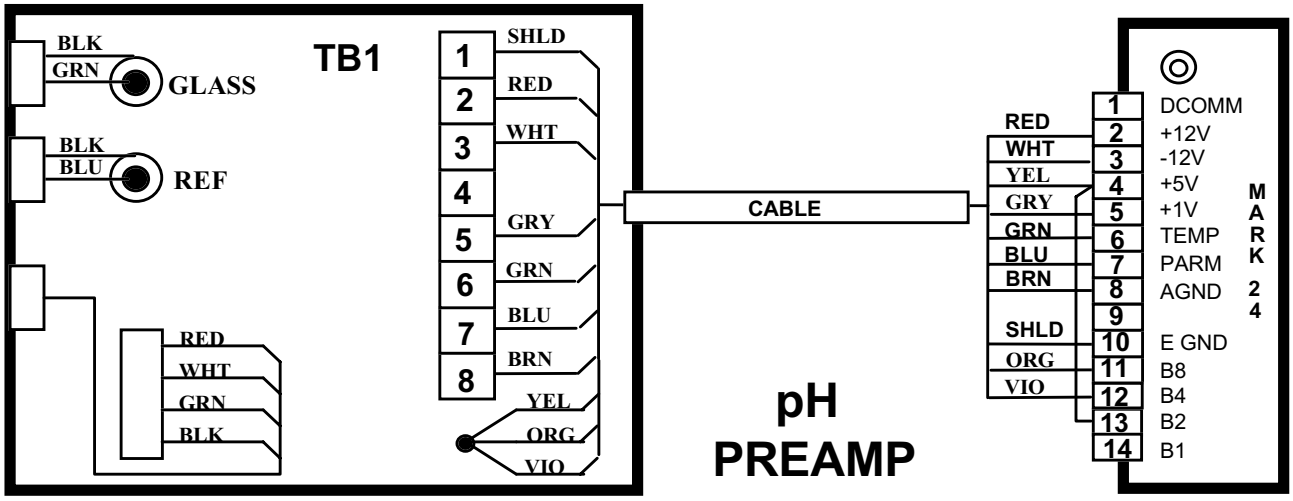

BLK
GRN
GLASS
BLK
BLU
REF
TB1
RED
WHT
GRN
BLK
1 SHLD
2 RED
3 WHT
4
5 GRY
6 GRN
7 BLU
8 BRN
YEL
ORG
VIO
CABLE
pH
PREAMP
RED
WHT
YEL
GRY
GRN
BLU
BRN
SHLD
ORG
VIO
1 DCOMM
2 +12V
3 -12V
4 +5V
5 +1V
6 TEMP
7 PARM
8 AGND
9
10 E GND
11 B8
12 B4
13 B2
14 B1
MARK 24

FIG. 2.7

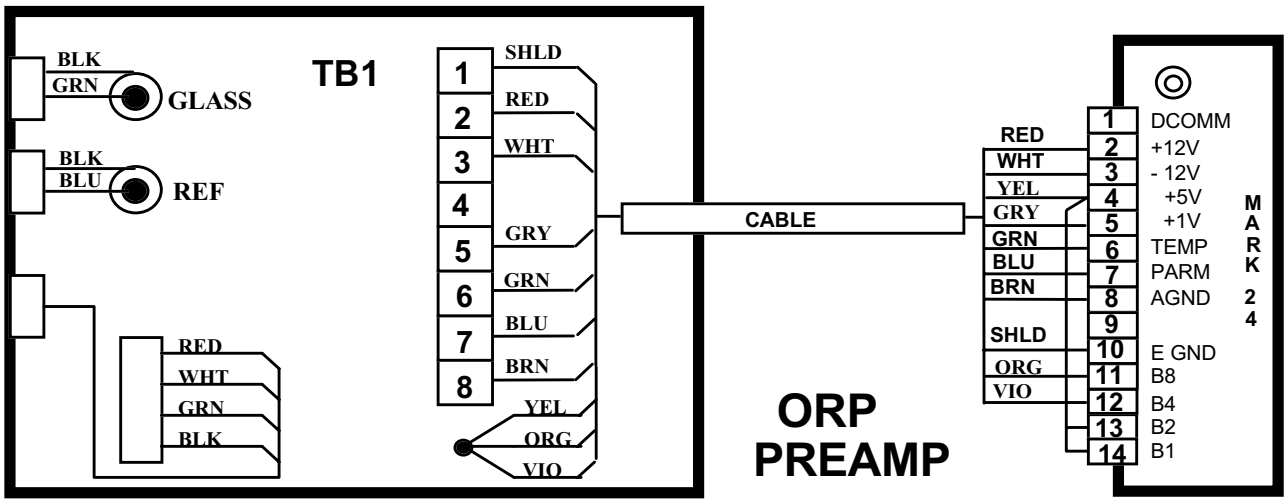


FIG. 2.8

Using a screw driver remove the top cover of the preamp case. Locate the wiring diagram in the lid of the preamp. Use this diagram to connect each preamp to the Mark 24 Analyzer. Refer to section 2.4.9 for more detailed summary of the preamp-to-Mark 24 connection.

2.4.7 Preamp To Analyzer Connection

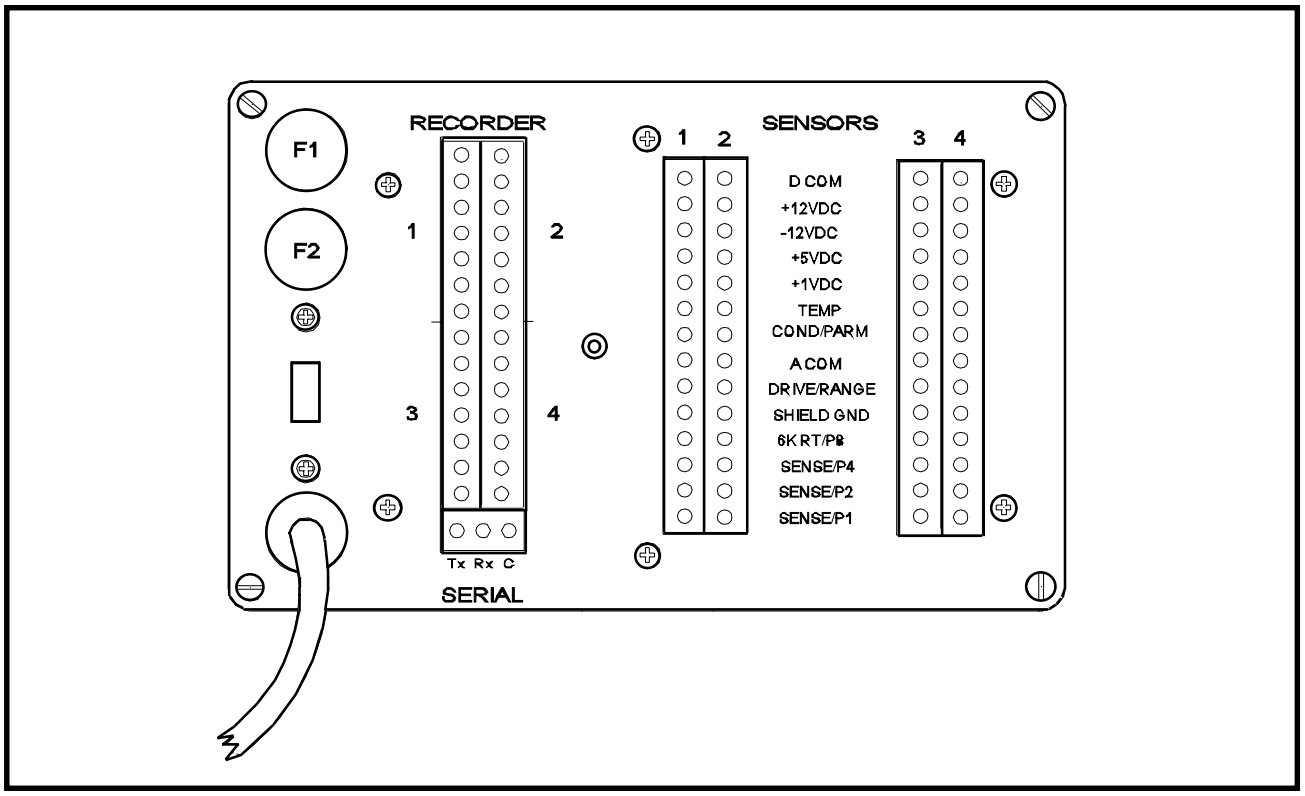


FIG. 2.9- Mark 24 Rear Panel

Locate the analyzer input channel connector you wish to connect the sensor to on the rear panel of the Mark 24. Connect the preamp as described in Section 2.4.6. The description of each input channel connection on the Mark 24 is as follows:

Pin Number	Name	Description
1	D COM	Digital Common
2	+12VDC	+12 Volt Supply to the Preamp
3	-12VDC	-12 Volt Supply to the Preamp
4	+5VDC	+5 Volt Supply to the Preamp
5	+1VDC	+1 Volt Reference Voltage to the Preamp
6	TEMP	Temperature Sense Voltage Input to the Analyzer
7	COND/PARM	Parameter Sense Voltage Input to the Analyzer

8	A COM	Analog Common between the preamp and the Analyzer
9	Drive/Range	Range Control Output from the Analyzer to the Preamp
10	SHIELD GND	Earth Ground between the preamp, sensor and the analyzer.
11	6K Rt/P8	Bit 8 of the Analyzer Channel Pcode
12	SENSE/P4	Bit 4 of the Analyzer Channel Pcode
13	SENSE/P2	Bit 2 of the Analyzer Channel Pcode
14	SENSE/P1	Bit 1 of the Analyzer Channel Pcode

2.4.8 How To Connect A Chart Recorder

The Mark 24 provides a current output (4-20 mA) or a voltage output signal (0-1 or 0-5) for each measurement channel. This signal is proportional in amplitude to the value of the parameter measured. The recorder outputs are accessible at the connector labeled ***RECORDER*** on the rear panel of the analyzer. The description of the recorder connection port for each measurement channel of the Mark 24 is as follows:

Pin Number	**Name**	**Description**
J5,1	0-1V/0-5V	CH0
J5,2	ACOMM	CH0
J5,3	5x JUMPER TO ACOMM	CH0
J5,4	4-20mA	CH0
J5,5	4-20mA RETURN	CH0
J5,6	ENABLE mA JUMPER TO +12V	CH0
J5,7	+12VDC	CH0
J6,1	0-1V/0-5V	CH1
J6,2	ACOMM	CH1
J6,3	5x JUMPER TO ACOMM	CH1
J6,4	4-20mA	CH1
J6,5	4-20mA RETURN	CH1
J6,6	ENABLE mA JUMPER TO +12V	CH1
J6,7	+12VDC	CH1

Pin Number	Name	Description
J5,8	0-1V/0-5V	CH2
J5,9	ACOMM	CH2
J5,10	5x JUMPER TO ACOMM	CH2
J5,11	4-20mA	CH2
J5,12	4-20mA RETURN	CH2
J5,13	ENABLE mA JUMPER TO +12V	CH2
J5,14	+12VDC	CH2
J6,8	0-1V/0-5V	CH3
J6,9	ACOMM	CH3
J6,10	5x JUMPER TO ACOMM	CH3
J6,11	4-20mA	CH3
J6,12	4-20mA RETURN	CH3
J6,13	ENABLE mA JUMPER TO +12V	CH3
J6,14	+12VDC	CH3

After verifying that connection of the Chart Recorder, follow the Chart Recorder Manufacture's instructions for setting the Chart Recorder's ZERO and SPAN points. Refer to figure 2.10 below for proper chart recorder cable connection.

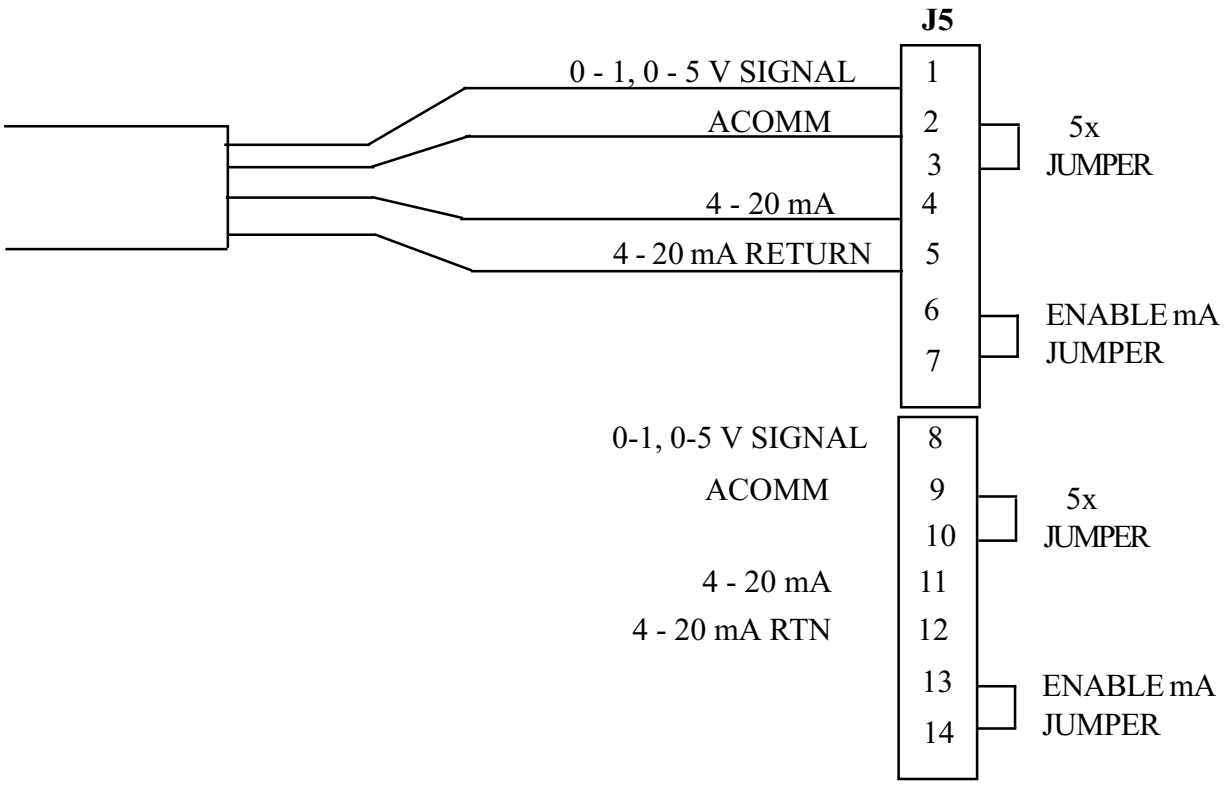


FIG. 2.10 RECORDER CABLE

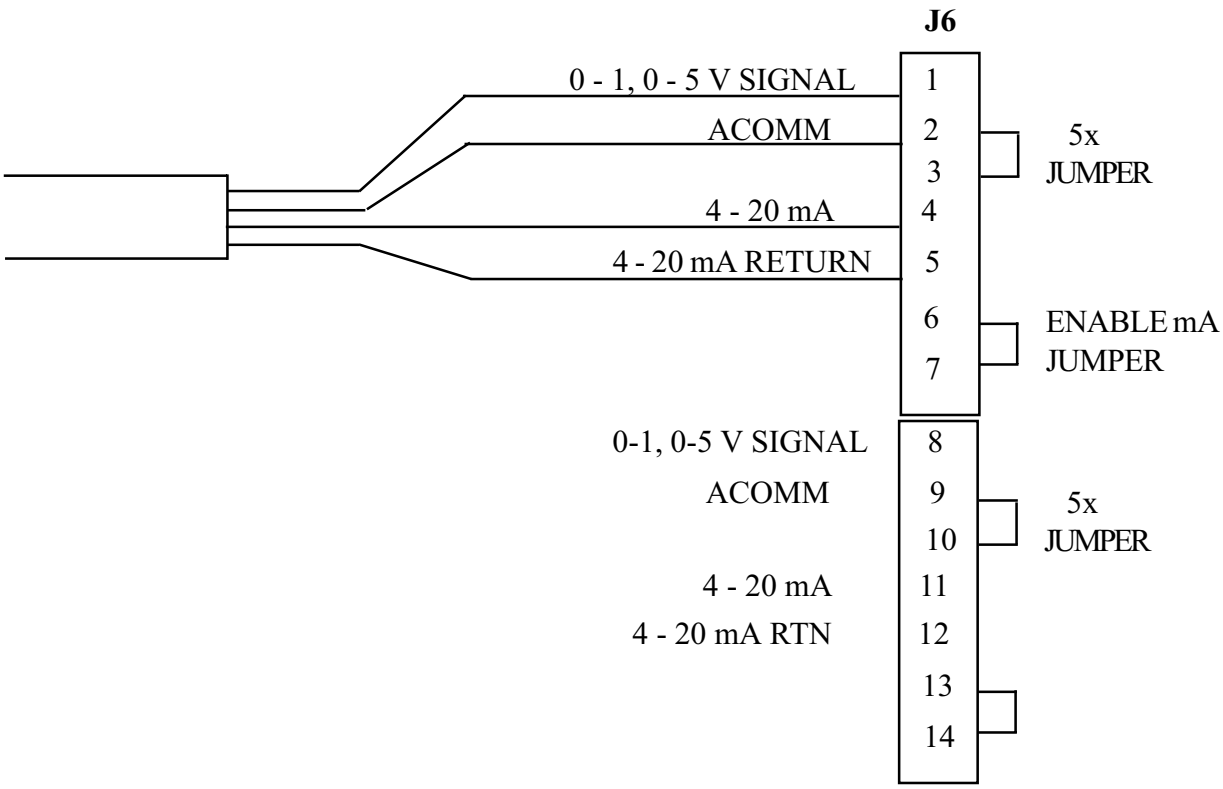


FIG. 2.11 - RECORDER CABLE

2.4.9 Data Recording Interface

The Mark 24 provides two types of data recording interfaces, hereafter referred to as paper (analog) and paper-less (digital) recording type interfaces.

Paper Recording Interface

The Mark 24 provides a paper recording interface which consists of a two-wire 4-20 mA. current loop, 0-1 volt or 0-5 volt analog output signal for each measurement channel. The amplitude of the signal is directly proportional to the measurement being made on each channel. Verify the location of this port on the rear of the Analyzer. (See Fig. 2.9). The details on how to connect a chart recorder to this port is discussed in Section 2.4.8 ***" How To Connect To A Chart Recorder "*** **.**

Paperless Recording Interface

The Mark 24 provides a paperless recording interface which consists of a three-wire serial interface port. The signal amplitude is as specified in the National RS232C Standard. The data available at this interface is in ASCII Data Format and its content is described in the Section 2.4.11 ***" How To Connect A Serial Input Device ".*** The communications configuration for the serial port (e.g. Baud Rate, Parity, number of Data Bits, and the number of Stop Bits) is software configurable. Verify the location of this port on the rear of the Analyzer (See Fig. 2.9) . The details of connecting a Serial Input/Output Device to this port is discussed in the Section 2.4.11.

Once you have verified the configuration of the Aalyzer and the location of all external connections, you are ready to proceed with the installation.

2.4.10 How To Install The Data Collection Device

The scope of this section pertains to the interface of a Chart Recorder or Serial Input Device to the Mark 24 Analyzer. You will have to consult the manufacturer's documentation in regards to the installation of the chart recorder and the data collection device components of your measurement system. When you have identified the components of your system you are ready to connect your system together.

2.4.11 How To Connect A Serial Input Device

The Mark 24 provides a digital output from the connector labeled **SERIAL** located on the rear panel. This is a THREE wire interface utilizing the TRANSMIT, RECEIVE and GROUND connections only. The Serial Interface Cable Part # is 400504. The interface connections are labeled just above the connector name. The connector pin out is as follows:

PIN NAME	DESCRIPTION
Tx	Transmit Data Output from Analyzer to the External Recording Device
Rx	Receive Data Input to the Analyzer from External Data Recording Device
COM	Common Digital Ground between the Data Recording Device and the Analyzer

After verifying connection of the Data Recording Device to the Analyzer, follow the Recording Device Manufacturer's instructions for connecting a serial output device (Mark 24) to the Recording Device's serial input port. Refer to Fig. 2.12 for RS232 interface cable description.

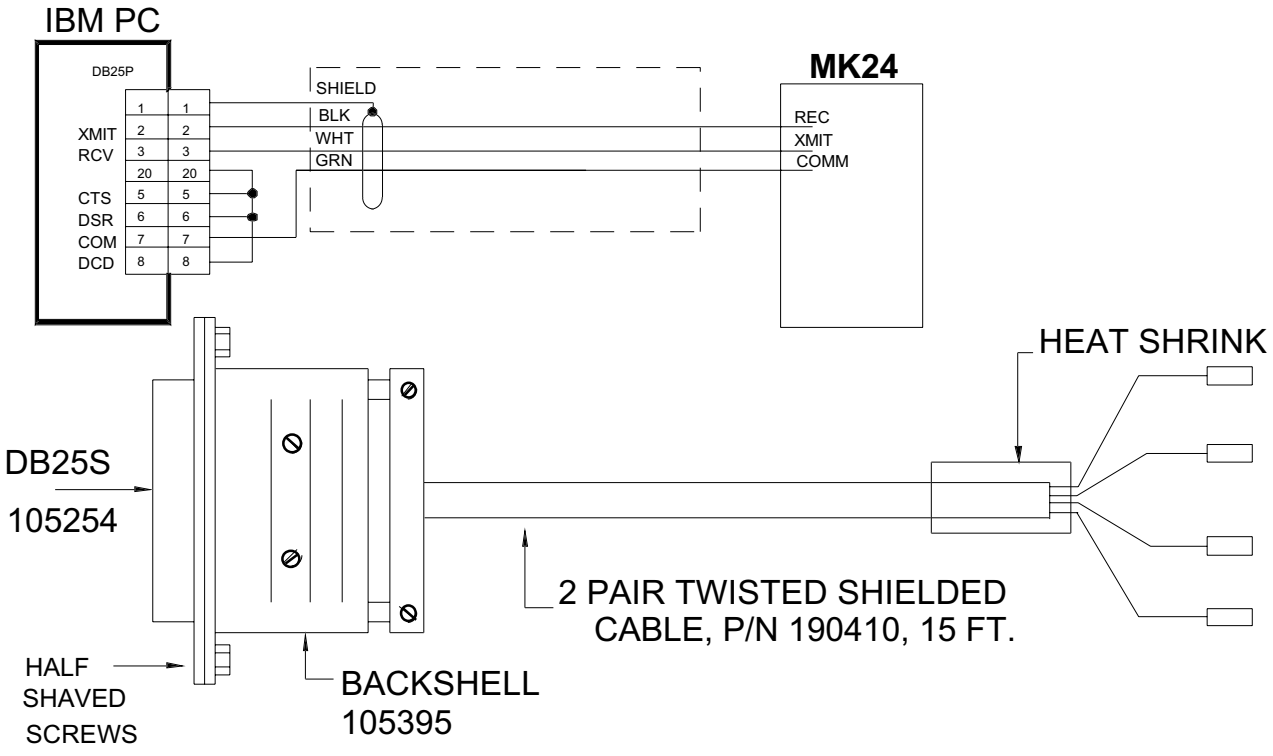


Fig. 2.12 RS232 CABLE ASSEMBLY

The software protocol needed to receive serial data from the MARK 24 requires no additional hand-shake signals other than that shown in Figure 2.12 . The Mark 24 Serial Port is a transmit ONLY protocol from the Mark 24 to the external device.

In this mode the data is transmitted from the MARK 24's serial port in DATA PACKETS. The packet period is determined by the ***programmed scan rate*** of the Mark 24 Analyzer. All data in the packet is transmitted in ascii character format. The FIELD POSITIONS and the content of the DATA FIELDS comprising the data packet is determined by the parameter being measured. See Table 1. Each message in the packet is terminated with the ascii CR **(carriage return) character. Each packet is terminated with the DATE and TIME STAMP message.**

Data Message

Each message in the data packet starts with the ***unit I.D. number and channel number byte.*** The upper nibble of this byte is the Analyzer's Unit I.D. number. The lower nibble is the analyzer channel I.D. number for the data in the message. Data in the message is preceded by the ***data field name.*** The field name may be in upper and or lower case ASCII followed by an ascii space character. Immediately following the space character is the ***parameter value.*** The parameter value consists of maximum of five ascii numeric digits . The placement of the decimal point in the value is as indicated by the position of the ascii ***decimal point*** character in the parameter value. Following the parameter value is an ascii space character. Following the space character is the ***engineering units field*** for the preceding parameter value. The units field is comprised of upper and lower case ascii text. The data message may also include ALARM or NO CAL channel status. Parameter data for any channel cannot be obtained via the serial port unless the channel has been previously calibrated. See TABLE 1 (data packet).

TABLE 1 - Data Packet

01	**Na**	**15.001**	**ppB**	**TEMP**	**025.94**	**HI ALM**	{CR}			
02	**COND**	**3.1113**	**uS**	**TEMP**	**026.10**	**DEG. C**	**RAW**	**1.5400**	**uS**	{CR}
03	**COND**	**3.1771**	**uS**	**TEMP**	**025.67**	**DEG.C**	**RAW**	**1.5729**	**uS**	{CR}
04	**NO CAL**									
08	**DATE**	**09-12-1994**	**TIME**	**17:01:48**	{CR}					

TABLE 2 - Field Names and Format

The field width consists of the field name, associated data and engineering units (including the decimal point if applicable) .

NAME	DESCRIPTION	DATA FORMAT	ENGINEERING UNITS
COND	CONDUCTIVITY	COND{SP} nnnnn	mS/µS
Na	SODIUM	Na{SP}nnnnn	ppB
TEMP	TEMPERATURE	TEMP{SP}nnn.nn	DEG. C
LO	LOW ALARM STATUS	LO ALM	
HI	HIGH ALARM STATUS	LO ALM	
Raw	RAW CONDUCTIVITY	RAW{SP}nnnnn	mS/µS
NO CAL	CHANNEL NOT CALIBRATED		
ACID	ACID CAUSTIC	ACID{SP}nnn.nn	Pct
NaOH	SODIUM HYDROXIDE	NaOH{SP}nnn.nn	Pct
D.O.	DISSOLVED OXYGEN	D.O.{SP}nnnnn	ppM/ppB
pH	pH	pH{SP}nnnnn	
ORP	OXYGEN REDUCTION POTENTIAL	ORP{SP}nnnn.n	mV
DATE	DAY/MONTH	DATE{sp}nn/nn	
TIME	HOURS/MINUTES	TIME{sp}nn/nn	
CR	CARRIAGE RETURN	{CR}	
CHECKSUM	1 BYTE CHECKSUM	nn	

Note:

1. The curly braces are not transmitted as part of the message.

3.0 THE MARK 24 FRONT PANEL

The Mark 24 Front Panel consists of a 2 line x 16 character LCD display and a eight key function keypad. The display is used to present all parameter measurements, operator prompts and system errors. The keypad is a thin membrane type made of a polycarbonate material featureing eight tactile keys with metal domes. The keys are arranged in two rows, four keys in each row. Each function key is labeled with its function name and are used to set all user-defineable operational parameters such as Date, Time, Display Scan Rate, Unit ID number, Temperature Compensation, Alarm Set Points, Recorder Output Configuration, Serial Port Configuration and Calibration. ONLY the bottom row of function keys can be password protected (e.g disabled if the correct password is not entered). Use of a password is at the user's option. Figure 3.1 illustrates the Mark 24 front panel.

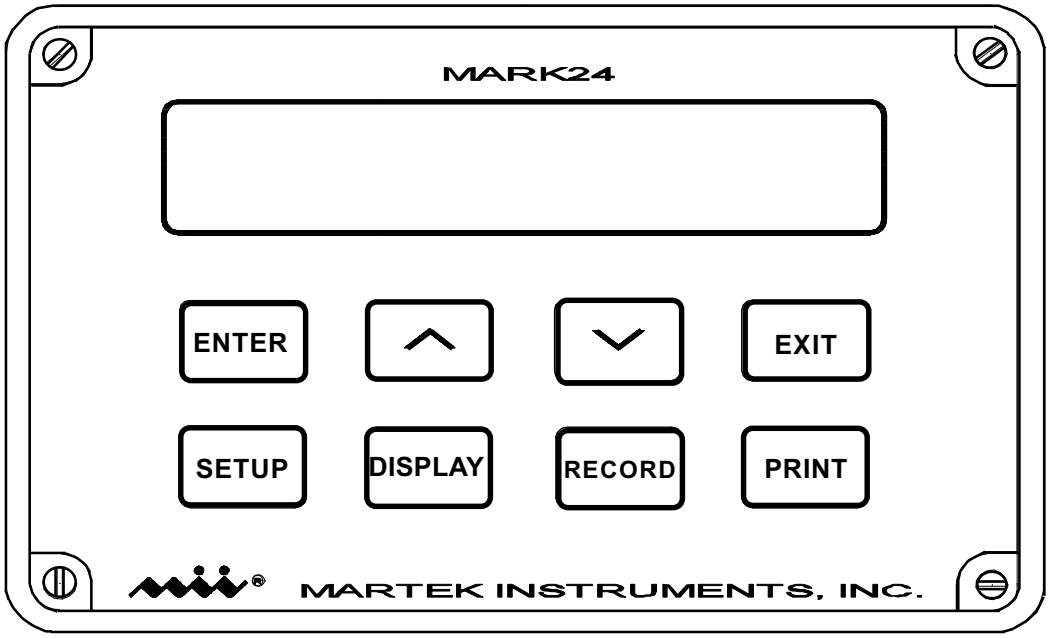


Figure 3.1 - Mark 24 Front Panel

3.1 How To Turn On The Mark 24

NOTE: Review Chapter 2 for proper connections and instrument setup before proceeding through this chapter.

The Mark 24 Analyzer comes equipped with a 120/240 VAC, 50/60 Hz line cord. Simply plug the line cord into the appropriate power outlet. The display will activate and momentarily display the Power On display screen .

After a short delay the Mark 24 displays the Software Copyright display screen. This completes the power on display sequence. The Mark 24 is now in the Monitor Mode.

In the Monitor Mode, the Mark 24 displays the measurements associated with all calibrated channels. The measurements are displayed in succession starting with the lowest channel number. After all measurements have been displayed, the Mark 24 displays the Date & Time screen. The display sequence is then repeated until a function key is depressed.

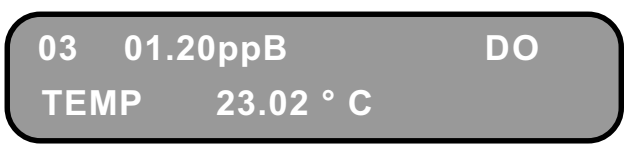
EXAMPLE:

DISPLAY SCAN CHANNEL 0

DISPLAY SCAN CHANNEL 1

DISPLAY SCAN CHANNEL 2

DISPLAY SCAN CHANNEL 3



DISPLAY DATE & TIME SCREEN

DATE: 03/11
TIME: 18.18

3.2 KEYBOARD FUNCTIONS

This section provides a description of the use and functions provided by the EIGHT keys on the front panel. The keys are arranged in two rows. The top row of keys (e.g. EDIT, UP ARROW, DOWN ARROW and EXIT) are used to; (1) edit numeric display fields, (2) move the flashing cursor within the display, (3) save configuration parameters, (4) exit or terminate a function and (5) enter & exit the the single channel scan mode of operation. The bottom row of keys provide the FOUR main user functions (SETUP, DISPLAY, RECORD and PRINT). The use of the front panel keys are discussed in more detail in the following sections.

3.2.1 Enter Key

The **ENTER Key** is used to provide the following functions:

- accept and save numeric data
- single channel scan mode
- menu selection
- advance the flashing cursor

Accept and Save Numeric Data

The **ENTER Key** is used to save the values of the user-changeable numeric data fields. A changeable numeric data field is one in which the flashing cursor is positioned on the most significant digit of the numeric field. Depress the **ENTER Key** to accept the displayed value and store it in system memory. The cursor automatically advances to the next digit.

Single Channel Scan Mode

The Single Scan Mode provides a method by which the display will lock in and display the measurement status of the parameter and temperature for any one of the calibrated channels. This function can be activated when the Mark 24 is in the Multiple Scan Mode ONLY. When all channels are being scanned and the **ENTER Key** is depressed, the Analyzer aborts its multiple channel display scan and continuously displays the channel measurement being displayed at the time the **ENTER Key** is depressed. Use the **UP ARROW** or **DOWN ARROW Keys** to view a different channel in the single channel scan mode. The Mark 24 remains in this single channel display mode until the **EXIT Key** is depressed. When the **EXIT Key** is depressed the Mark 24 reverts back to the Multiple Scan Mode.

Menu Selection

When the Mark 24 is displaying a Function Menu ***depress the ENTER Key*** to accept and execute the selected function. A function in the menu is may be selected when the function name is flashing in the display.

Advance the Cursor

When the Mark 24 is displaying user-changeable numeric data fields use the **ENTER Key** to save the digit at the current cursor position and advance the cursor to the next position. ***If the digit is a decimal point the cursor automatically skips the decimal point and advances to the next numeric digit.***

3.2.2 Up Arrow Key

The **UP ARROW Key** is a context sensitive function. That is, its operation depends on which display mode the Mark 24 is currently in. The three display modes that apply are :

- single channel scan mode
- accept and save numeric data
- menu selection

Single Channel Scan Mode

When in the Single Channel Scan Mode, use the **UP ARROW Key** to increment the scan to the next calibrated channel. Depressing the **UP ARROW Key** while the highest input channel is being displayed resets the single channel scan to channel 0 (lowest input channel number).

Accept and Save Numeric Data

When modifying a numeric data field, use the **UP ARROW Key** to increment the value at the current cursor position.

Menu Selection

When the Analyzer is displaying a menu from which the user is to select an option, use the **UP ARROW Key** to move the menu selection cursor from LEFT TO RIGHT in the display. As each menu item in the display is selected it will flash in the display.

3.2.3 Down Arrow Key

The **Down ARROW Key** is a context sensitive function. That is, its operation depends on which display mode the Analyzer is currently in. The three display modes that apply are :

- single channel scan mode
- accept and save numeric data
- menu selection

Single Channel Scan Mode

When in the Single Channel Scan Mode, use the **DOWN ARROW Key** to decrement the scan to a view a lower channel number. Depressing the **DOWN ARROW Key** after the LOWEST channel number has been displayed resets the single channel scan to channel 0.

Accept and Save Numeric Data

When modifying a numeric data field, use the **DOWN ARROW Key** to increment the value at the current cursor position.

Menu Selection

When the Mark 24 is displaying a menu from which the user is to select an option, use the **DOWN ARROW Key** to move the menu selection cursor from RIGHT TO LEFT in the display. As each menu item in the display is selected it will flash in the display.

3.2.4 Exit Key

The **EXIT Key** is a context sensitive function. That is, its operation depends on the display mode the Mark 24 is currently in. The three display modes are:

- single channel scan mode
- accept and save numeric entry
- menu selection

Single Channel Scan Mode

When in the Single Channel Scan Mode, use the **EXIT Key** to exit this mode and revert back to Multiple Channel Scan Mode.

Accept and Save Numeric Data

When modifing a numeric data field , use the **EXIT Key** to move the cursor from RIGHT TO LEFT (e.g. back space) in the display. ***If the previous digit is a decimal point the cursor automatically skips this digit and stops at the next digit.***

Menu Selection

When the Mark 24 is displaying a function menu or user prompt, use the **EXIT Key** to exit this screen and return to the previous screen. Depress the **EXIT Key** as many times as necessary to back out of the function and return to the Multiple Scan Display Mode or return to a previous menu and make an alternate selection.

3.2.5 Setup Key

The **SETUP Key** provides access to the following MENUS:

- CHANNEL
- ID/PW
- ALARMS
- CLOCK

CHANNEL FUNCTION:

The CHANNEL menu option provides access to the following functions:

- CALIB
- COMP
- RANGE
- SCAN

CALIB

Use the CALIB menu selection to perform channel calibration of ZERO and SPAN for each sensor and preamp connected to each input channel. The calibration function prompts the user through the steps necessary to calibrate the channel.

COMP

Use the COMP menu selection to set the TEMPERATURE COMPENSATION VALUE to be used in the compensated measurements of pH and CONDUCTIVITY.

Any one of three preprogrammed compensation values may be used depending on your water chemistry. The three fixed compensation values are:

- ***ETA - Ethynalamine***
- ***AVT - All Volatile Treatment***
- ***O.T. - Oxygenated Treatment***

However, if your water chemistry is not one of the above, a user-defineable value may be entered by selecting USER from the displayed menu. The format of the user entry is the same as displayed in the numeric entry field after the USER compensation has been selected.

RANGE

Use the RANGE menu selection to LOCK or UNLOCK the measurement range on a multiple range channel. If the parameter has but one range, then select the LOW range from the menu.

Select LOCK or UNLOCK from the RANGE MENU. Depress the ENTER Key. Select the channel to lock or unlock from the channel selection menu. Depress the ENTER Key. Select the range you wish to lock for the selected channel. Depress the ENTER Key.

SCAN

Use the SCAN menu selection to change/set the display measurement update rate. The scan rate affects the display rate when the Mark 24 is in the Multiple Channel Scan Mode ONLY.

Select the desired scan rate from the SCAN RATE MENU. There are three scan rates in the menu. They are as follows:

SLOW = 8 SECONDS
MEDIUM = 4 SECONDS
FAST = 2 SECONDS

ID/PW FUNCTION:

The ID/PW function provides the user with a method for setting the UNIT ID number or the SYSTEM PASSWORD. ***Select ID/PW from the SETUP MAIN MENU and depress the ENTER Key.***

PASSWORD

Use the PASSWORD menu selection to program a new system password. The password is a six digit numeric value. **The default password is always 555555** and is displayed each time the password is ***changed***. The password function may be DISABLED, ENABLED or MODIFIED. The PASSWORD ENABLE provides a method for inhibiting the use of the four function keys located on the second row of the front panel until a valid password is entered.

If the PASSWORD is lost or forgotten, power the Mark 24 OFF then ON again to reset the password to the default value.

ID

Use the ID # menu selection to program the UNIT ID # which is displayed during the displayed measurement of all channels in both single channel and multiple channel scan modes. This ID # is also transmitted as part of the output message on the serial port. The value of the ID # is from 0 - 9.

ALARM FUNCTION:

Use the ALARM menu selection to program the ALARM MODE (alarm on one channel or all channels, low alarm, hi alarm or hi hi alarm), ALARM RANGE (low or high if sensor has more than one range) and the ALARM SET POINT (the low and high alarm values within the selected range). Select ALARMS from the SETUP MAIN MENU and depress the **ENTER Key.**

The types of alarms supported are:

- ***HIGH (measurement > set point ONLY)***
- ***LO/HI (measurement < low set point or measurement > high set point)***
- ***HI/HI (measurement > low set point or measurement > high set point)***
- ***DISABLE (none)***

SETTING THE ALARM RANGE

Select RANGE from the ALARM MENU and depress the **ENTER Key**. The alarm set point is detectable ONLY in the programmed ALARM RANGE for each channel. All alarms are programmed for a LOW SET POINT and a HIGH SET POINT. An alarm set point may be set in either the LOW or the HIGH Range (if the sensor has more than one range) or both set points may be in the SAME RANGE.

SETTING THE SYSTEM CLOCK - DATE

Select CLOCK from the SETUP MAIN MENU and depress the ENTER Key. Select DATE from the CLOCK MENU and depress the **ENTER Key.** Enter the date in MM (month),DD (day) format and depress the **ENTER Key** to store the date in system memory.

SETTING THE SYSTEM CLOCK - TIME

Select CLOCK from the SETUP MAIN MENU and depress the ENTER Key. Select TIME from the CLOCK MENU and depress the **ENTER Key**.
Enter the time in Military HH (hours),MM (minutes) format and depress the **ENTER Key** to store the time in system memory.

3.2.6 Display Key

The **DISPLAY Key** provides a method by which programmed operational parameters may be viewed to verify their values. This function allows the user to view any of the following:

- compensation parameters for each channel
- alarm mode, set point and range for each channel
- record range for each channel
- serial port configuration

COMPENSATION PARAMETERS

Temperature Compensation Parameters for each channel are displayed when the **DISPLAY Key** is depressed and the COMP option is selected from the menu. An uncalibrated channel prevents the viewing of the compensation value for the channel.

ALARM PARAMETERS

The Display Alarm Parameters function is provided via the ALARM selection in the DISPLAY MAIN MENU. The alarm MODE (HI, LO/HI and HI/HI), LOW SET POINT and the HIGH SET POINT are displayed for the selected channel. The RANGE for which the alarm has been set is determined from the displayed format of the SET POINT VALUE. See the Appendix A (MARK 24 PCODE LIST) for correlation of the display value format and the sensor range.

RECORD PARAMETERS

The Display Record Parameters function is provided via the RECORD selection in the DISPLAY MAIN MENU. The parameters may be viewed for each Recorder Channel selected. The data displayed includes the recorder channel number, the operational mode for this recorder channel (manual or auto range) and the range for which the recorder output is to operate.

SERIAL PORT CONFIGURATION

The serial port configuration is user-programmable. The parameters programmed are viewed via the DISPLAY - COMM function. This function is selected from the DISPLAY MAIN MENU, COMM selection. The communications configuration is displayed on the second line of the display and in the following format:

COMM: 9600,E,7,1

where 9600 = BAUD RATE

E = EVEN PARITY

7 = # OF DATA BITS

1 = # OF STOP BITS

3.2.7 Record Key

The **RECORD Key** provides a method by which the Operational Mode for each Recorder Output may be programmed as well as a method for testing the Recorder Outputs of each channel. A recorder output voltage is available for each measurement channel. This voltage is available at the Recorder Output Connector located on the rear panel of the Mark 24 Analyzer. The maximum voltage available at these outputs is jumper selectable (refer to Chapter 2 of this manual for details).

Program Recorder Output -

To program the recorder output you must program two parameters. The first being the RECORDER RANGE. This sets the measured value (compensated) for which the Recorder Output equals 1.00 or 5.00 volts.

The second is the operational mode of the recorder output when in programmed range.

Two Operational Modes apply to the Recorder Outputs (Manual and Auto).

Manual Mode -

In the manual mode, the recorder is programmed to operate in a fixed range. As a result, any time

the measured parameter value (compensated if applicable) falls below the programmed range the recorder output is 0.00 volts. If the measured parameter value exceeds the programmed range, the recorder output is at its maximum value. This value is 1.00 volts if the 5x jumper is not installed on the recorder output connector. If the jumper is installed, the output voltage will be 5.00 volts.

Auto Mode -

In the auto range mode the recorder ouput signal is 0-1 or 0-5 volts encompassing all ranges of measurement associated with the sensor.

Span Recorder Output -

The recorder output for each channel can be set to its zero or span value from the front panel. ***You may zero or span a single recorder channel or all recorder channels.*** This function is necessary when testing the alignment of the recorder outputs of the Mark 24. The output voltage from each recorder channel should be 0.00 +/- .01 volts when the ZERO recorder option is selected and 1.00 or 5.00 +/- .01 when the SPAN recorder option is selected.

3.2.8 Print Key

The **PRINT Key** provides a method for configuring the SERIAL PORT for communication with an external device. ***You may also access the toll free Technical Support phone number by selecting HELP from the PRINT MENU***.

Use the PRINT Key to program the BAUD RATE, PARITY, # DATA BITS and # STOP BITS for the communications port. The baud rates supported are as follows:

Baud Rates List:

- 9600
- 4800
- 2400
- 1200

Parity List:

- odd
- even
- none

Data Bits:

7 or 8

Stop Bits:

1 or 2

HELP

Technical assistance may be obtained by calling the toll free number that is displayed when the HELP option is selected from the PRINT MENU.

Toll free number: 1 (800) 628 - 8834 .

3.3 MARK 24 DISPLAY

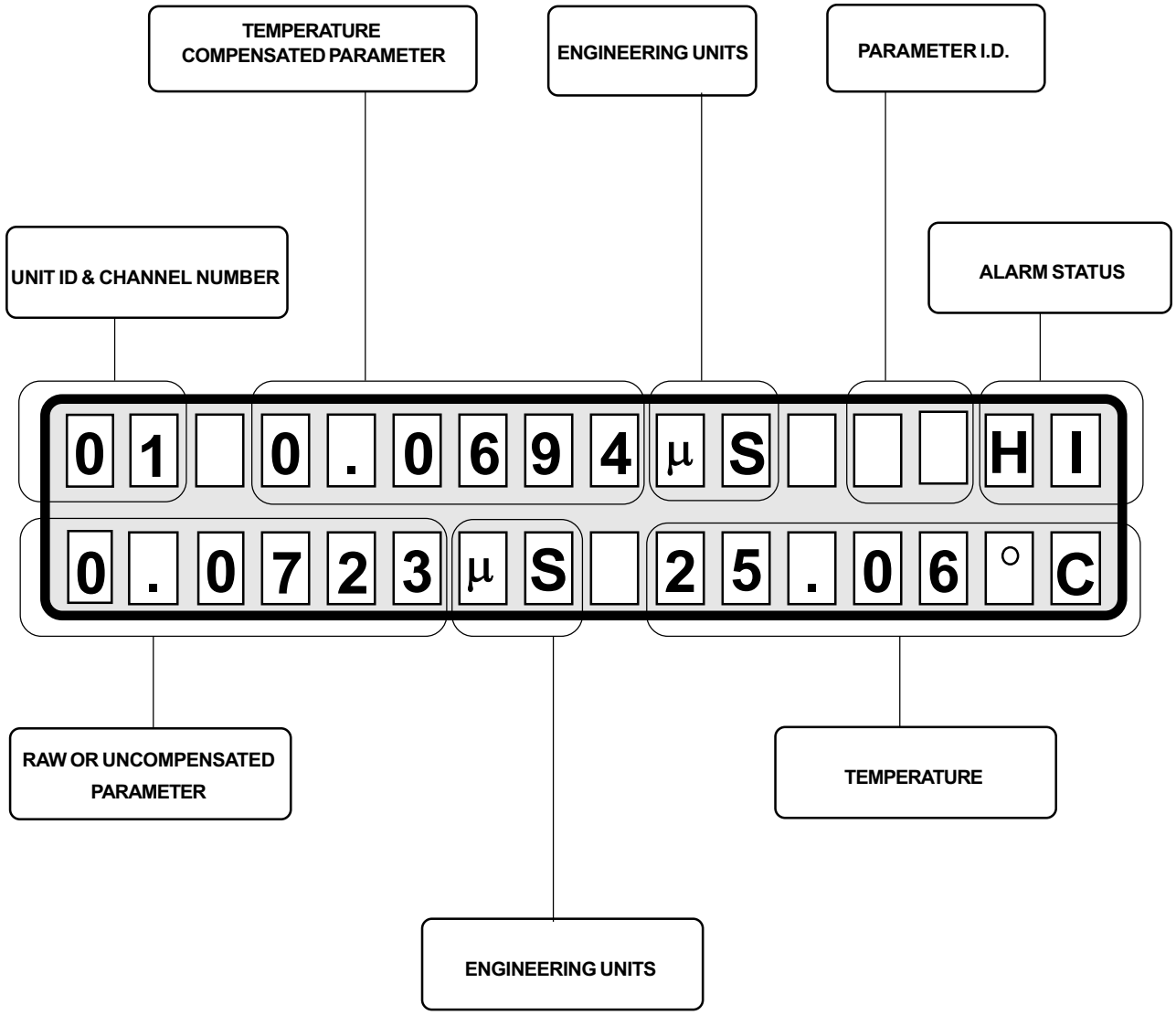


Figure 3.2 - Mark 24 DISPLAY

3.3.1 UNIT ID - This number is used to identify the measurements made by a particular analyzer. This is useful in applications where several Mark 24 Analyzers are connected to a Data Acquistion System (PC based). The range of values for the UNIT ID number is 0 - 9.

3.3.2 CHANNEL NUMBER - This number identifies the channel associated with the displayed measurement. The range of values for the channel number is 0 - 4.

3.3.3 TEMPERATURE COMPENSATED PARAMETER - This field contains the temperature compensated value of the raw measurement.

3.3.4 ENGINEERING UNITS - This field always follows compensated measurement. The size

of this field depends on the parameter measured on the displayed channel.

PARAMETER	ENGINEERING UNITS
CONDUCTIVITY	µS (MICRO SIEMENS)
	mS (MILLI SIEMENS)
DO	ppM (PARTS PER MILLION)
	ppB (PARTS PER BILLION)
ORP	mv = MILLIVOLT
ACID/CAUSTIC	% = PERCENT
pH	pH

3.3.5 PARAMETER I.D. - This field identifies the parameter measured on the displayed channel.

PARAMETER	PARAMETER I.D.
DISSOLVED OXYGEN	DO
H2SO4	ACID
NAOH	NAOH
pH	ScpH*

NOTE: ScpH = Solution Compensated pH value.

3.3.6 ALARM STATUS - This field identifies the type of alarm detected on the displayed channel. This field is always two digits wide.

ALARM STATUS	DESCRIPTION
LO	LOW ALARM
HI	HI ALARM
HH	HI - HI ALARM

3.3.7 RAW OR UNCOMPENSATED PARAMETER - This field is used to display the uncompensated parameter measurement. This applies only for conductivity measurements. For pH, the value displayed represents the standard Nernstian equation pH value.

3.3.8 TEMPERATURE - This field is used to display the current temperature on the displayed channel. This temperature is used to compute the temperature compensated parameter value.

3.4 How To Use The SETUP Key

The SETUP key is used to access the CHANNEL, ID/PW, ALARMS and CLOCK functions. With the Mark 24 turned on, press the SETUP key momentarily and release it. The Mark 24 then displays the SETUP MAIN MENU.

"How To" examples describing the use of the SETUP Key is documented in the following sections.

3.4.1 How To Calibrate

Select the CHANNEL function from the SETUP MAIN MENU. Alternate functions which may be selected from this menu are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the SETUP function you wish to perform. The default prompt is CALIB, indicated by the flashing CALIB in the display. Use the UP ARROW or DOWN ARROW key to select a different function if desired. Depress the ENTER key to use this selection.

Select the channel you wish to calibrate. The default channel is CHAN 0, indicated by flashing CHAN 0 in the display. To select a different channel, depress and release the UP ARROW or DOWN ARROW to select a another channel. Now depress the ENTER key to use this selection.

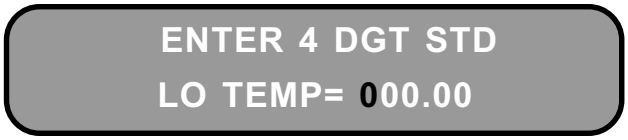
Select TEMPERATURE or PARAMETER for type of calibration to be performed. The default is TEMP and is indicated by the flashing TEMP in the display. To select PARM depress the UP ARROW or DOWN ARROW key. Now depress the ENTER key to use this selection.

Select ZERO or SPAN calibration for the channel previously selected. The default is ZERO and is indicated by the flashing ZERO in the display. To select SPAN calibration depress the UP ARROW or DOWN ARROW key. Now Depress the ENTER key to use this selection.

This prompt is displayed for a short time. This allows the user to place the TEMP - RUN jumper in the preamp in the 0 ° C position for electronic calibration or place the temperature sensor in a low temperature solution standard.

This prompt allows the user to view the calibration voltage associated with the sensor connected to the previously selected channel. Depress the ENTER key once this voltage is stable (e.g displayed value varies by no more than 10 millivolts).

This menu allows the user to enter a 4 digit standard from the previous calibration voltage. The leading zero will be flashing indicating the first digit to be modified (if necessary). To change the default value, use the UP ARROW key to increment the digit and the DOWN ARROW key to decrement the digit. Use the ENTER key to increment to the NEXT digit and the EXIT key to decrement and point at the previous digit. The current digit flashes after ENTER or EXIT key is depressed. The value entry mode is terminated after the least significant digit has been saved. To save a digit depress the ENTER key.



This menu allows the user to calibrate more channels or exit the calibration function. The default selection is yes. If no additional channels are to be calibrated, depress the UP ARROW or DOWN ARROW key to flash the EXIT prompt. When the EXIT prompt is flashing, depress the ENTER key to exit calibration. The Mark 24 then displays the MAIN SET UP MENU.

If more channels are to be calibrated, depress the ENTER key while the YES prompt is flashing. The unit will then display the Select Channel Menu allowing the user to select an alternate channel for calibration.

3.4.2 - How To Set Temperature Compensation Value

Select the CHANNEL function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the SETUP function you wish to perform. Use the UP ARROW or DOWN ARROW key to select the COMP function. When selected, the COMP prompt flashes. Now depress the ENTER key to use this selection.

Select the type of channel you wish to compensate. The default channel type is COND, indicated by the flashing COND in the display. Use the UP ARROW or DOWN ARROW to select either pH or COND type of channel. Now depress the ENTER key to use this selection.

Select the channel for which you wish to set the compensation value. The default is CHAN 0 and is indictaed by flashing CHAN 0 in the display. Use the UP ARROW or DOWN ARROW key to select a different channel. Now depress the ENTER key to use this selection.

Select the type of compensation desired depending on water chemistry. The default is ETA (ethynalamine) and is indicated by flashing ETA in the display. Use the UP ARROW or DOWN ARROW key to select a different compensation value. Compensation values for ETA, AVT, and O.T. are preprogrammed and cannot be changed.

If compensation other than ETA, AVT, or O.T. is required, select USER from the menu. This menu allows the user to set any compensation factor for additional channels or to exit the SET TEMPERATURE COMPENSATION function. Use the UP ARROW or DOWN ARROW key to make the desired selection. Depress the ENTER key to enter the selection.

If more channels are to be compensated select YES. The Mark 24 then displays the Select Type of Channel menu discussed previously.

If EXIT is selected, the Mark 24 displays the SETUP MAIN MENU. The SETUP function can then be exited from the main menu.

3.4.3 - How To Set Measurement Range

Select the CHANNEL function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the SETUP function you wish to perform. Use the UP ARROW or DOWN ARROW key to select the RANGE function. When selected, the RANGE prompt flashes. Now depress the ENTER key to use this selection.

Select MODE for the measurement channel. LOCK function locks a channel in a measurment range to be selected later. The UNLOCK function allows the Mark 24 to autorange during measurements. The default MODE is LOCK, indicated by the flashing LOCK prompt in the display. Use the UP ARROW or DOWN ARROW to select either LOCK or UNLOCK for a channel. Select LOCK and depress the ENTER key to use this selection.

Select the channel for which you wish to set the compensation value. The default is CHAN 0 and is indictaed by flashing CHAN 0 in the display. Use the UP ARROW or DOWN ARROW key to select a different channel. Now depress the ENTER key to use this selection.

This menu allows the user to select the RANGE in which to lock the channel. The default is LOW and indicated by flashing LOW in the display. Use the UP ARROW or DOWN ARROW key to select a different range. Select LOW and depress the ENTER key to lock the measurement range.

The Mark 24 then displays the SETUP MAIN MENU. The set RANGE function can then be exited from the main menu.

3.4.4 How To Set The Display Scan Rate

Select the CHANNEL function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the SETUP function you wish to perform. Use the UP ARROW or DOWN ARROW key to select the SCAN function. When selected, the SCAN prompt flashes. Now depress the ENTER key to use this selection.

Select the DISPLAY SCAN RATE for the Mark 24. The default is SLOW and is indicated by flashing SLOW in the display. Use the UP ARROW or DOWN ARROW key to select a different SCAN RATE. The scan rates for SLOW (8 sec.), MEDIUM (4 sec.) and FAST (2 sec.) are preprogrammed and cannot be changed. Now Depress the ENTER key to use this selection.

The Mark 24 now displays the SETUP MAIN MENU. The SET SCAN RATE function can be exited from the main menu.

3.4.5 How To Disable System Password

Select the ID/PW function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the ID/PW function you wish to perform. The default selection is PASSWORD and is indicated by the flashing PASSWORD prompt. Use the UP ARROW or DOWN ARROW key to select the PASSWORD function. When selected the PASSWORD prompt flashes. Now depress the ENTER key to use this selection.

The PASSWORD MENU allows the user to select the three options associated with the PASSWORD. The password may be disabled, enabled or modified (changed). For this example select DISABLE. Now depress the ENTER key to use this selection.

The Mark 24 then displays the PASSWORD DISABLED prompt, idicating that entry of the PASSWORD to access keyboard functions will no longer be necessary. This prompt is displayed for a short time ONLY. The Mark 24 then displays the PASSWORD MENU.

3.4.6 How To Enable System Password

Select the ID/PW function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the ID/PW function you wish to perform. The default selection is PASSWORD and is indicated by the flashing PASSWORD prompt. Use the UP ARROW or DOWN ARROW key to select the PASSWORD function. When selected, the PASSWORD prompt flashes. Depress the ENTER key to use this selection.

The PASSWORD MENU allows the user to select ONE of THREE options associated with the PASSWORD. The password may be disabled, enabled or modified. For this example, select ENABLE. Depress the ENTER key to use this selection.

The Mark 24 then displays the PASSWORD DISABLED prompt, idicating that entry of the PASSWORD to access keyboard functions will no longer be necessary. This prompt is displayed for a short time ONLY. The Mark 24 then displays the PASSWORD MENU. The password function can be exited from the PASSWORD menu.

3.4.7 How To Modify System Password

Select the ID/PW function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

Select the ID/PW function you wish to perform. The default selection is PASSWORD and is indicated by the flashing PASSWORD prompt. Use the UP ARROW or DOWN ARROW key to select the PASSWORD function. When selected, the PASSWORD prompt flashes. Now depress the ENTER key to use this selection.

The PASSWORD MENU allows the user to select ONE of THREE options associated with the PASSWORD. The password may be disabled, enabled or modified. For this example select MODIFY. Now depress the ENTER key to use this selection.

The Mark 24 then displays the ENTER PASSWORD prompt as well as displays the six digit default password. The most significant digit of this password flashes indicating that the password may be modified starting with the flashing digit. Use the UP ARROW and DOWN ARROW keys to increment or decrement the flashing digit. To select a digit in the left to right direction depress the ENTER key. To select the previous digit depress the EXIT key. The MODIFY PASSWORD function automatically terminates when the last digit of the password has been entered and terminated by depression of the ENTER key.

The Mark 24 then momentarily displays the PASSWORD ENTERED prompt indicating that the new password has been entered. The Mark 24 then displays the PASSWORD MENU. You can exit the ID/PW function from the PASSWORD MENU.

3.4.8 How To Set Unit I.D. Number

Select the ID/PW function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2)ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4)CLOCK - set time and date. Depress ENTER key to use this selection.

Select the ID/PW function you wish to perform. The default selection is PASSWORD and is indicated by the flashing PASSWORD prompt. Use the UP ARROW or DOWN ARROW key to select the ID # function. When selected the ID/PW prompt flashes. Now depress the ENTER key to use this selection.

The screen allows the user to enter a SINGLE DIGIT unit identification number. The current unit ID # appears in the second line of the display. This digit will be flashing indicating that this digit may be changed to any number between 0 - 9. This number may be incremented using the UP ARROW key or decremented using the DOWN ARROW key. When the ID number equals the desired value depress the ENTER key to save the value.

The Mark 24 will then momentarily display the UNIT ID ENTERED. After displaying the UNIT ID ENTERED prompt, the Mark 24 exits the SET ID/PW function and displays the SETUP MAIN MENU.

3.4.9 How To Set Channel Alarm

Select the ALARMS function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

This is the ALARM MENU. Select the ALARM function you wish to perform. The default selection is ALM MODE and is indicated by the flashing ALM MODE prompt. Now depress the ENTER key to use this selection.

The ALM MODE MENU menu allows the user to select whether he wishes to set alarms on ONE channel or ALL channels. The default is ONE channel and is indicated by the flashing ONE CHN prompt. For this example select ONE CHN by depressing the ENTER key.

The Mark 24 then displays the SELECT CHANNEL prompt. Use the UP ARROW or DOWN AR ROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The analyzer then displays ALARM TYPE menu. The default is HIGH. This is indicated by the flashing HIGH prompt in the display. Use the UP ARROW or DOWN ARROW key to select the desired alarm type. For this example select HIGH. Depress the ENTER key to use this selection.

The Mark 24 then prompts the user to set alarm parameters for additional channels. Use the UP ARROW or DOWN ARROW key to select the desired function. Depress the ENTER key to use this selection. If MORE CHS is selected, the Mark 24 displays the ALM MODE MENU. If EXIT is selected the Mark 24 displays the ALARM MENU.

3.4.10 How To Set Alarm Range

Select the ALARMS function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

This is the ALARM MENU. Select the ALARM function you wish to perform. The default selection is ALM MODE and is indicated by the flashing ALM MODE prompt. Use the UP ARROW or DOWN ARROW key to select the desired function.Now depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 then prompts the user to set the RANGE for the LOW ALARM. The default is 2 µS. This is indicated by the flashing 2 µS prompt in the display. Use the UP ARROW or DOWN ARROW key to select the desired alarm type. For this example select 2 µS. Depress the ENTER key to use this selection.

The Mark 24 then prompts the user to set the RANGE for the HIGH ALARM. The default is 2 µS and is indicated by the flashing 2 µS prompt. Use the UP ARROW or DOWN ARROW key to select the desired range. Depress the ENTER key to use this selection. The Mark 24 then displays the ALARM MENU. You can exit the ALARM function by depressing the EXIT key.

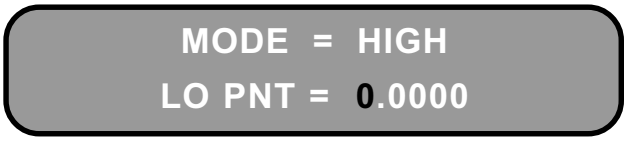
3.4.11 How To Set Alarm Set Point

Select the ALARMS function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Depress ENTER key to use this selection.

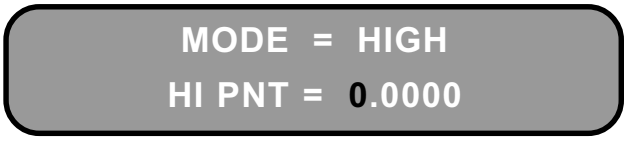
This is the ALARM MENU. Select the ALARM function you wish to perform. The default selection is ALM MODE and is indicated by the flashing ALM MODE prompt. Use the UP ARROW or DOWN ARROW keys to select the desired function. Select SET POINT and depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 then displays the alarm mode for this channel and prompts the user to enter the LO SET POINT VALUE. The most significant digit of the LO SET POINT VALUE flashes to indicate the current position to be modified. Use the UP ARROW key to increment this value or the DOWN ARROW key to decrement this number. Use the EXIT key to move the flashing cursor to the left and the ENTER key to move the cursor to the right. The LO SET POINT VALUE is saved when the least significant digit has been modified and saved by depressing the ENTER key.



The Mark 24 then displays the alarm mode for this channel and prompts the user to enter the HI SET POINT VALUE. The most significant digit of the HI



SET POINT VALUE flashes to indicate the current position to be modified. Use the UP ARROW key to increment this value or the DOWN ARROW key to decrement this number. Use the EXIT key to move the flashing cursor to the left and the ENTER key to move the cursor to the right. The HI SET POINT VALUE is saved when the least significant digit has been modified and saved by depressing the ENTER key.

The Mark 24 then displays the ALARM MENU. You can exit the ALARM SET POINT function from the ALARM MENU.

3.4.12 How To Set Clock - Date

Select the CLOCK function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2)ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4)CLOCK - set time and date. Select CLOCK from the menu and depress the ENTER key to use this selection.

This is the CLOCK MENU. Select the CLOCK function you wish to perform. The default selection is DATE and is indicated by the flashing DATE prompt. Use the UP ARROW or DOWN ARROW key to select the desired function. Now depress the ENTER key to use this selection.

The Mark 24 then displays the MONTH/DATE menu. The most significant digit of the MONTH/DATE field flashes indicating this is the current digit to be modified. Use the UP ARROW key to increment the digit or the DOWN ARROW key to decrement the digit. Use the ENTER key to save the digit and move the flashing cursor to the next digit. Use EXIT key to move the cursor backwards to the previous digit. When the least significant digit has been modified depress the ENTER key to save the new date.

The Mark 24 then displays the CLOCK menu. You can exit the SET DATE function from CLOCK menu.

3.4.13 How To Set Clock - Time

Select the CLOCK function from the SETUP MAIN MENU. From this main menu alternate functions which may be selected are (2) ID/PW - set unit I.D. or set system password, (3) ALARMS - set alarms for a measurement channel, (4) CLOCK - set time and date. Select CLOCK from the menu and depress the ENTER key to use this selection.

This is the CLOCK MENU. Select the CLOCK function you wish to perform. The default selection is DATE and is indicated by the flashing DATE prompt. Use the UP ARROW or DOWN ARROW key to select the desired function. Select TIME and depress the ENTER key to use this selection.

The Mark 24 then displays the TIME menu. The most significant digit of the TIME field flashes indicating this is the current digit to be modified. Use the UP ARROW key to increment the digit or the DOWN ARROW key to decrement the digit. Use the ENTER key to save the digit and move the flashing cursor to the next digit. Use EXIT key to move the cursor backwards to the previous digit. When the least significant digit has been modified depress the ENTER key to save the new TIME.

The Mark 24 then displays the CLOCK menu. You can exit the SET TIME function from CLOCK menu.

3.5 How To Use The DISPLAY Key

The DISPLAY key is used to view (1) temperature compensation for each channel, (2) the alarm type and alarm set point for each channel, (3) the recorder range and mode for each channel and (4) the serial port configuration parameters. With the Mark 24 turned on, press the DISPLAY key momentarily and release it. The Mark 24 then displays the DISPLAY MAIN MENU.

"How To" examples describing the use of the DISPLAY Key is documented in the following sections.

3.5.1 How To Display Channel Compensation

With the Analyzer in the normal channel scan mode depress the DISPLAY key. The Analyzer displays the DISPLAY MAIN MENU. From this main menu alternate functions which may be selected are (2)display ALARM PARAMETERS, (3) display RECORD PARAMETERS, (4)display COMM PARAMETERS. Use the UP ARROW or the DOWN ARROW keys to select the COMP function from the DISPLAY function menu and depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 then displays the compensation value for the channel selected for 6 seconds. This menu is then erased.

The Mark 24 then prompts the user to select VIEW MORE CHANNELS or EXIT the DISPLAY COMPENSATION function.

If the user selects MORE CHS, the Analyzer displays the SELECT CHANNEL menu.

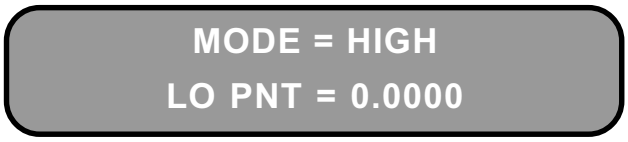
If the user selects EXIT, the Analyzer displays the MAIN DISPLAY MENU. You may exit the DISPLAY function by depressing the EXIT key when the MAIN DISPLAY MENU is displayed.

3.5.2 How To Display Channel Alarms

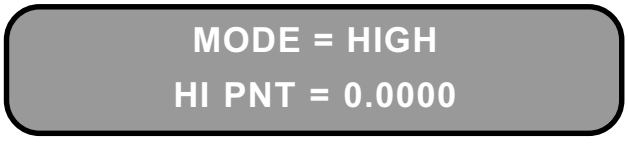
This is the DISPLAY MAIN MENU. From this main menu alternate functions which may be selected are (2)display ALARM PARAMETERS, (3) display RECORD PARAMETERS, (4)display COMM PARAMETERS. Use the UP ARROW or the DOWN ARROW keys to select the ALARM function from the DISPLAY MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 displays ALARM MODE on the first line of the display and the the LOW ALARM SET POINT on the second line of the display. The display format for the set point is by the user in the SET CHANNEL ALARM function. This display screen is displayed for 6 seconds ONLY. The analyzer then displays the HI ALARM SET POINT VALUE.



This Mark 24 displays the HI ALARM SET POINT VALUE for 6 seconds ONLY. This screen is automatically erased and the user is prompted to view more channels or exit.



The Mark 24 then prompts the user to select VIEW MORE CHANNELS or EXIT the DISPLAY COMPENSATION function. If the user selects MORE CHS, the Analyzer displays the SELECT CHANNEL menu. If the user selects EXIT, the Analyzer displays the MAIN DISPLAY MENU. You may exit the DISPLAY function by depressing the EXIT key when

3.5.3 How To Display Record Parameters

This is the DISPLAY MAIN MENU. From this main menu alternate functions which may be selected are (2) display ALARM PARAMETERS, (3) display RECORD PARAMETERS, (4) display COMM PARAMETERS. Use the UP ARROW or the DOWN ARROW keys to select the RECORD function from the DISPLAY MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 displays CHANNEL RECORD MODE for the selected channel on the first line of the display and the the RECORDER RANGE on the second line of the display. The display format for the range is defined in the SET RECORD RANGE function. This display screen is displayed for 6 seconds ONLY.

The Mark 24 then prompts the user to select VIEW MORE CHANNELS or EXIT the DISPLAY RECORD PARAMETERS function. If the user selects MORE CHS, the Analyzer displays the SELECT CHANNEL menu. If the user selects EXIT, the Analyzer displays the MAIN DISPLAY MENU. You may exit the DISPLAY function by depressing the EXIT key when the MAIN DISPLAY MENU is displayed.

3.5.4 How To Display Comm Port Parameters

This is the DISPLAY MAIN MENU. From this main menu alternate functions which may be selected are (2) display ALARM PARAMETERS, (3) display RECORD PARAMETERS, (4) display COMM PARAMETERS. Use the UP ARROW or the DOWN ARROW keys to select the COMM function from the DISPLAY MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the programmed SERIAL COMMUNICATIONS PORT settings. The display format is baud rate, parity, # of data bits and # of stop bits. These parameters are software configurable via the PRINT key function.

3.6 How To Use The RECORD Key

The RECORD key is used to (1) set the recorder range and range mode for each channel and (2) zero or span the recorder output for each channel. With the Mark 24 turned on, press the RECORD key momentarily and release it. The Mark 24 then displays the RECORD MAIN MENU.

"How To" examples describing the use of the RECORD Key is documented in the following sections.

3.6.1 How To Set Recorder Channel Range

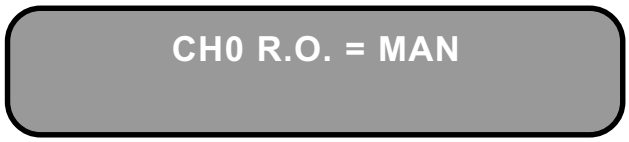
With the Mark 24 in the normal channel scan mode depress the RECORD key. The Mark 24 displays the RECORD MAIN MENU. From this main menu alternate functions which may be selected are (1) SET RECORD CHANNEL RANGE, (2) ZERO or SPAN RECORD CHANNELS. Use the UP ARROW or the DOWN ARROW keys to select the SET: function from the RECORD MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 then displays the RECORDER RANGE SELECTION MENU. The default selection is 2.000 µS and is indicated by the flashing 2.000 µS prompt. Use the UP ARROW or DOWN ARROW to select the desired RECORDER CHANNEL. For this example select 2.000 µS. Depress the ENTER key to use this selection.

The analyzer displays the SET RECORDER MODE MENU. The default selection is MANUAL (locked recorder range) and is indicated by the flashing MANUAL prompt. The AUTO (auto range) allows the recorder output to track with the range of the displayed measurement. Use the UP ARROW or the DOWN ARROW keys to select the MANUAL function from the SET RECORDER MODE MENU and depress the ENTER key to use this selection.

The Analyzer then displays the RECORDER CHANNEL and MODE selected. This prompt is displayed for 6 seconds ONLY. The Analyzer then prompts the user to set additional recorder channel modes or EXIT.



The Analyzer then prompts the user to select VIEW MORE CHANNELS or EXIT the RECORD function.

If the user selects MORE CHS, the Analyzer displays the SELECT CHANNEL menu.

If the user selects EXIT, the Analyzer displays the RECORD MAIN MENU. You may exit the RECORD function by depressing the EXIT key when the RECORD MAIN MENU is displayed.

3.6.2 How To Zero Recorder Channels

With the Mark24 in the normal channel scan mode depress the RECORD key. The Mark 24 displays the RECORD MAIN MENU. From this main menu alternate functions which may be selected are (1) SET RECORD CHANNEL RANGE, (2) ZERO or SPAN RECORD CHANNELS. Use the UP ARROW or the DOWN ARROW keys to select the SPAN: function from the RECORD MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the DRIVE RECORDER OUT selection menu. Use the UP ARROW or DOWN ARROW key to select the desired function. For this example select YES. Depress the ENTER key to use this selection.

The Mark 24 displays the drive ONE or ALL RECORDER CHANNELS selection menu. Use the UP ARROW or DOWN ARROW key to select the desired function. For this example select ONE CHN. Depress the ENTER key to use this selection.

The Mark 24 displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 prompts the user to ZERO or SPAN the selected channel or to EXIT the SPAN RECORDER CHANNEL function. The default is ZERO and is indicated by the flashing ZERO prompt. Use the UP ARROW or DOWN ARROW to select the desired function. For this example select ZERO and depress the ENTER key to use this selection. The recorder output voltage for the selected channel(s) is set to 0.00volts. The Analyzer then displays the drive ONE or ALL RECORDER CHANNELS selection menu.

3.6.3 How To Span Recorder Channels

With the Mark 24 in the normal channel scan mode depress the RECORD key. The Mark 24 displays the RECORD MAIN MENU. From this main menu alternate functions which may be selected are (1) SET RECORD CHANNEL RANGE, (2) ZERO or SPAN RECORD CHANNELS. Use the UP ARROW or the DOWN ARROW keys to select the SPAN: function from the RECORD MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the DRIVE RECORDER OUT selection menu. Use the UP ARROW or DOWN ARROW key to select the desired function. For this example select YES. Depress the ENTER key to use this selection.

The Mark 24 displays the drive ONE or ALL RECORDER CHANNELS selection menu. Use the UP ARROW or DOWN ARROW key to select the desired function. For this example select ONE CHN. Depress the ENTER key to use this selection.

The Mark 24 displays the SELECT CHANNEL menu. The default is CHAN 0 and is indicated by the flashing CHAN 0 prompt. Use the UP ARROW or DOWN ARROW to select the desired channel. For this example select CHAN 0. Depress the ENTER key to use this selection.

The Mark 24 prompts the user to ZERO or SPAN the selected channel or to EXIT the SPAN RECORDER CHANNEL function. The default is ZERO and is indicated by the flashing ZERO prompt. Use the UP ARROW or DOWN ARROW to select the desired function. For this example select SPAN and depress the ENTER key to use this selection. The recorder output voltage for the selected channel(s) is set to 1.00 or 5.00 volts (depending on the external jumper setting for the RECORDER OUTPUT CHANNEL). The Analyzer then displays the drive ONE or ALL RECORDER CHANNELS selection menu

3.7 How To Use The PRINT Key

The PRINT key is used to (1) set baud rate, parity, # data bits and the # of stop bits for the serial port and (2) display the Martek Instruments Technical Assistance telephone number. With the Mark 24 turned on, press the PRINT key momentarily and release it. The Mark 24 then displays the PRINT MAIN MENU.

"How To" examples describing the use of the PRINT Key is documented in the following sections.

3.7.1 How To Configure the Serial Port

This is the PRINT MAIN MENU. From this main menu alternate functions which may be selected are (2) HELP and (3) EXIT. The default selection is COMM. Use the UP ARROW or the DOWN ARROW keys to select the COMM function from the PRINT MAIN MENU and depress the ENTER key to use this selection.

The Mark 24 then displays the programmed SERIAL PORT PARAMETER MENU. Use the UP ARROW or the DOWN ARROW keys to select the SERIAL PORT PARAMETER you wish to modify. The default selection is BAUD and is indicated by the flashing BAUD prompt in the display. Select BAUD from the SERIAL PORT PARAMETER MENU and depress the ENTER key to use this selection.

The Mark 24 displays the list of available baud rates supported by the Analyzer. Use the UP ARROW or the DOWN ARROW keys to select the desired BAUD RATE you wish to set for the serial port. The default selection is 9600. Select 9600 and depress the ENTER key to save this selection.

The Mark 24 then displays the SERIAL PORT PARAMETER MENU. The PRINT function can be exited from the SERIAL PORT PARAMETER MENU or additional serial port settings performed.

The Mark 24 displays the programmed SERIAL PORT PARAMETER MENU. Use the UP ARROW or the DOWN ARROW keys to select the SERIAL PORT PARAMETER you wish to modify. The default selection is BAUD and is indicated by the flashing BAUD prompt in the display. Select PARITY from the SERIAL PORT PARAMETER MENU and depress the ENTER key to use this selection.

The Mark 24 displays the PARITY OPTION LIST MENU. Use the UP ARROW or the DOWN ARROW keys to select the desired PARITY you wish to set for the serial port. The default selection is NONE. Select NONE and depress the ENTER key to save this selection.

The Mark 24 then displays the SERIAL PORT PARAMETER MENU. The PRINT function can be exited from the SERIAL PORT PARAMETER MENU or additional serial port settings performed.

The Mark 24 displays the programmed SERIAL PORT PARAMETER MENU. Use the UP ARROW or the DOWN ARROW keys to select the SERIAL PORT PARAMETER you wish to modify. The default selection is BAUD and is indicated by the flashing BAUD prompt in the display. Select WORD LEN from the SERIAL PORT PARAMETER MENU and depress the ENTER key to use this selection.

The Mark 24 displays the WORD LENGTH OPTION LIST MENU. Use the UP ARROW or the DOWN ARROW keys to select the desired BAUD RATE you wish to set for the serial port. The default selection is 7 BITS. Select 7 BITS and depress the ENTER key to save this selection.

The Mark 24 then displays the SERIAL PORT PARAMETER MENU. The PRINT function can be exited from the SERIAL PORT PARAMETER MENU or additional serial port settings performed.

The Mark 24 displays the programmed SERIAL PORT PARAMETER MENU. Use the UP ARROW or the DOWN ARROW keys to select the SERIAL PORT PARAMETER you wish to modify. The default selection is BAUD and is indicated by the flashing BAUD prompt in the display. Select STOP from the SERIAL PORT PARAMETER MENU and depress the ENTER key to use this selection.

The Mark 24 displays the PARITY OPTION LIST MENU. Use the UP ARROW or the DOWN ARROW keys to select the desired PARITY you wish to set for the serial port. The default selection is 1 STOP. Select 1 STOP and depress the ENTER key to save this selection.

The Mark 24 then displays the SERIAL PORT PARAMETER MENU. The PRINT function can be EXITED(depress exit key) from the SERIAL PORT PARAMETER MENU or additional serial port settings performed.

APPENDIX A

MARK 24 PARAMETER CODES

DEC. CODE		DESCRIPTION	RANGE	FIXED/AUTO RANGE	HEX CODE
00	=	NO SENSOR			0000
01	=	SPARE			0001
02	=	COND	2.0000 uS	LOW RANGE / AUTO RANGE	0010
03	=	COND	20.000 uS	HIGH RANGE	0011
04	=	COND	20.000 uS	LOW RANGE / AUTO RANGE	0100
05	=	COND	200.00 uS	HIGH RANGE	0101
06	=	COND	200.00 uS	LOW RANGE / AUTO RANGE	0110
07	=	COND	2000.0 uS	HIGH RANGE	0111
08	=	D.O.	020.00 ppM	HIGH PPM RANGE	1000
09	=	D.O.	02.000 ppM	LOW PPM RANGE	1001
10	=	D.O.	0200.0 ppB	HIGH PPB RANGE	1010
11	=	D.O.	020.00 ppB	LOW PPB RANGE	1011
12	=	H2SO4(ACID)	010.00 pct.	430 mS COND RANGE	1100
13	=	NAOH(CAUSTIC)	010.00 pct.	430 mS COND RANGE	1101
14	=	scpH	014.00	FIXED RANGE	1110
15	=	ORP	1000.0 mV	FIXED RANGE	1111

TERMINAL DEFINITION:

PIN	DESCRIPTION
1	DCOMM
2	+12 VDC
3	-12 VDC
4	+5 VDC
5	+1 V REF
6	TEMP INPUT
7	PARAMETER INPUT
8	ACOMM
9	RANGE OUTPUT CONTROL
10	EARTH GROUND
11	B8
12	B4
13	B2
14	B1