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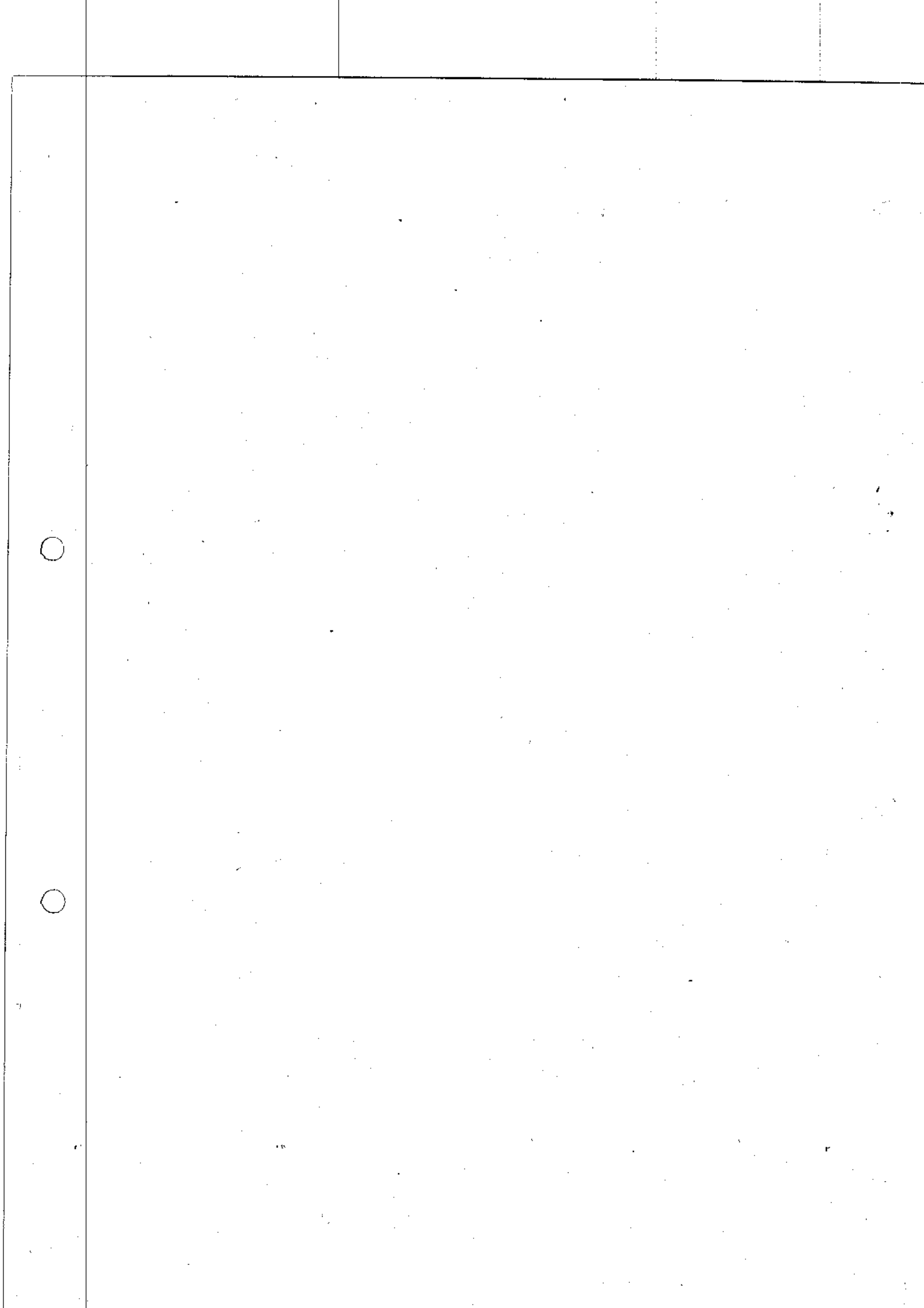
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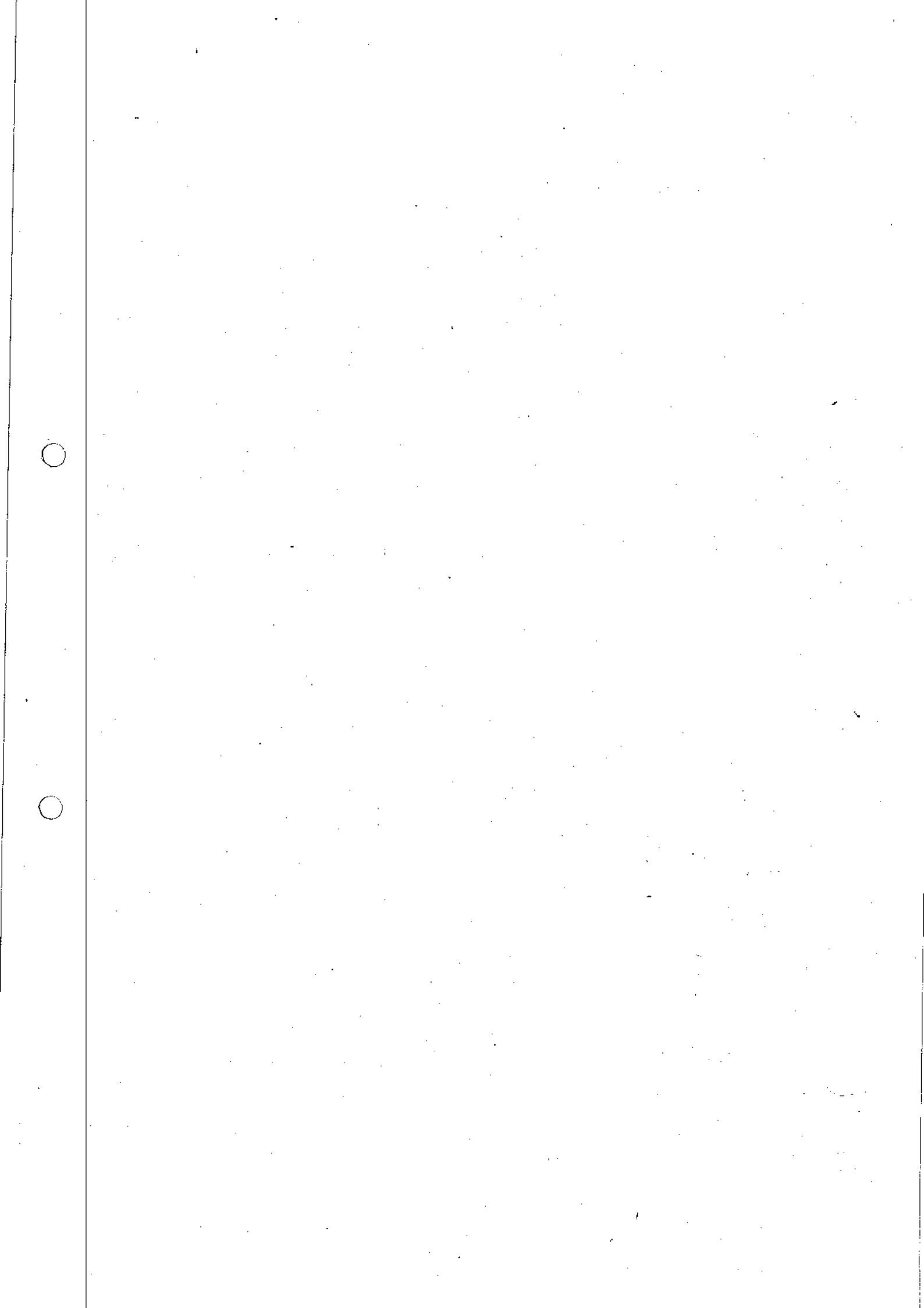
### APPENDIX A. FM5004 SOFTWARE DOWNLOAD PROCEDURE

## 1.0 INTRODUCTION

The FM5004 is a broadband electric and magnetic field monitor designed for use in radio frequency interference / electromagnetic compatibility (RFI / EMC) test system applications. It accepts inputs from up to four isotropic field probes and analyzes and displays that information on a user configurable LCD display. It provides two digital interfaces (IEEE-488 and RS-232), a switch selectable 0-5 VDC analog output, and audible user selected field strength, temperature and low probe battery alarms.

The FM5004 is compatible with all Amplifier Research FP2000 and FP5000 series "E" field or "H" field probes and has a probe dependent frequency response of 10kHz - 40GHz and a sensitivity of 0.15 V/m - 3000 V/m, 15.0 mA/m - 30 A/m (probe dependent).







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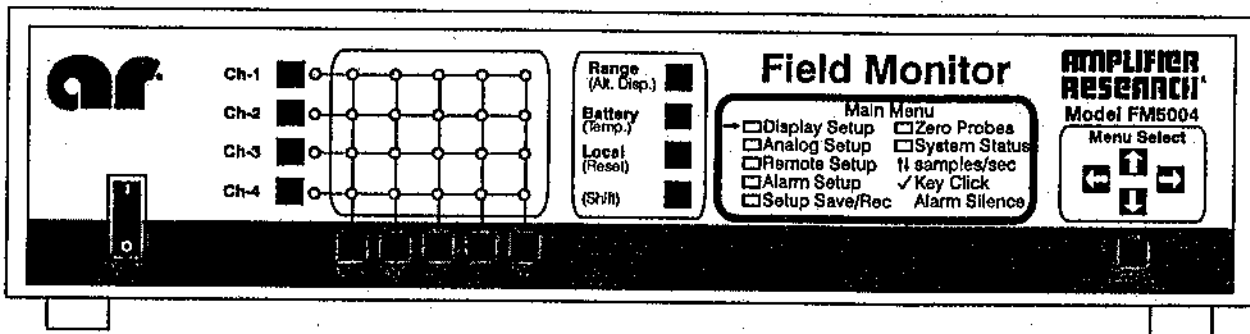
**MODEL FM5004 Field Monitor**  
**0.15 - 3000 V/m**  
**15.0 mA/m - 30 A/m Sensitivity**

The Amplifier Research Model FM5004 is a versatile electric and magnetic field monitoring system which performs all measurement display, control and alarm functions for field related testing. The FM5004 accepts inputs from up to 4 isotropic Field Probes (FPs) which are all sold separately to match the test application.

The FM5004 field monitor provides two digital interfaces (IEEE-488 and RS-232); a switch-selectable 0-5 VDC analog output; audible user selected field strength, temperature and low battery alarms; a highly readable, user configurable Liquid Crystal Display - all menu driven and controlled from the front panel. The FM5004 displays up to four probe readings simultaneously, in any combination of the five "E" field or two "H" field probes currently available or shows readings from each axis of a three axis probe\*, plus the composite reading, simultaneously. The FM5004 recognizes each FP5000 series probe (or FP2000 series probes) and automatically displays the proper decimal places and units. It is backward compatible with all glass cabled probes. Menu selection allows the user to configure and store up to four measurement set-ups and the user can choose individual ranges or implement the autoranging function. Any faults that occur will be spelled out on the screen and the unit is programmed to be self correcting when possible. As a software driven instrument, field monitor software upgrades can be made through the RS-232 port.

The seven small isotropic field probes, have an integral battery powered transceiver which communicates with the field monitor through a twin fiber optic cable. The operator can select high, low or average reading from any or all selected probes thus enjoying complete flexibility in choice of signal input and automated leveling for EMC testing. The FM5004 is CE approved.

\* all-probes except the FP5080 (or FP2080) are three axis probes.



## OUTPUT DISPLAY MODES

Batt OK		Temp OK		Fault-	
1.23	XYZ V/m	Rng 1 Ch1	12.3	XYZ V/m	Auto 2 Ch2
1.23	XYZ A/m	Rng 1 Ch3	123	XYZ V/m	Rng 4 Ch4

**4 Probe Display**

Batt OK		Temp OK		Fault-	
1.23 V/m		Min value of sample Range 1 on Chan-1			
123 V/m		Max value of sample Range 4 on Chan-4			

**2 Line Display**

Batt OK		Temp OK		Fault-	
1	1.23	Rng 1 V/m	X	0.58	V/m
Y	0.72	V/m	Z	0.81	V/m

**3 Axis Display**

### SPECIFICATIONS MODEL FM5004 SYSTEM

Sensitivity.....	0.15 - 3000 V/m 15.0 mA/m - 30 A/m
Frequency response.....	10 kHz - 40 GHz (probe dependent)
Inputs.....	Up to 4 independent probes
Overload withstand.....	Probe dependent
Output.....	LCD digital display, resolution 0.1 IEEE-488 interface RS-232 interface Analog (BNC): 0 - 5 VDC(10 mA max) proportional to % of selected range; Alarm - audible signal
<b>Power requirements</b>	
Input voltage.....	Universal input 90 - 260 VAC, 47-63 Hz
Input current.....	0.8 - 0.4 Amps
Input type.....	IEC Inlet with filter
Fuse.....	1A, 5x20 mm slow blow
Operating temperature range.....	10 - 40°C (50 - 104°F) @ 5 - 95% RH non-condensing
Weight (without case).....	3.2 kg (7 lb)
(with case).....	7.6 kg (16.75 lb)
Size (WxHxD) (without case).....	48.3 x 9.0 x 26.9 cm 19 x 3.5 x 10.1 in
(with case).....	49.8 x 12.7 x 30.5 cm 19.6 x 5.0 x 12.0 in

## 3.0 ACCEPTANCE AND BENCH TEST

### 3.1 Introduction

This section contains information on unpacking, setting up and bench testing the FM 5004 to verify proper system operation prior to field installation. The following process is recommended to help prevent the frustration of installing the system in your test environment only to discover a problem.

### 3.2 Unpacking and Acceptance

Step 1. Upon delivery of your order, inspect the shipping container(s) for evidence of damage. Record any damage on the delivery receipt before signing it. In case of concealed damage or loss, retain the packing materials for inspection by the carrier.

Step 2. Remove the field monitor from its shipping containers. Save the boxes and any protective packing materials for future use.

Step 3. Check all materials against the packing list to verify that the equipment you received matches that which was ordered. If you find any discrepancies, note them and call Customer Service for further instructions.

### 3.3 Setup Procedures

Perform the following procedures to verify system operation before installation in the test environment.

Before applying power to the system, perform steps 1-7:

Step 1. Make sure the probes are fully charged. See the user's manual for the probes being used for charging information.

Step 2. Remove the plastic caps from the appropriate RF SENSOR I/O connectors on the receiver's rear panel. Remove the protective covers from the fiber optic cable assembly. Save all protective caps and covers for future use.

Step 3. Visually inspect the tips of the fiber optic cables to ensure that they are free from dirt or other contaminants. Connect the fiber optic cable to the RF SENSOR I/O connector pair (Figure 3-1); be sure to match the cable connector colors to those on the receiver connectors (yellow to XMIT; white to RCV).

Step 4. Connect the other end of the fiber optic cable to the sensor connectors: white to XMIT; yellow to RCV.

Step 5. Connect the receiver's AC power cord to the POWER connector located on the left side of the receiver's rear panel.

Step 6. Plug the other end of the power cord into an electrical outlet.

Step 7. Set the ARM/OFF switch on all sensors to ARM (Figure 3-2).

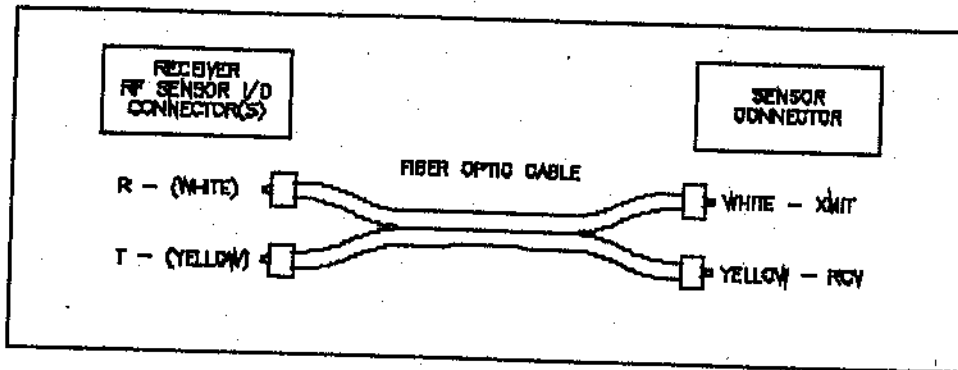


Figure 3-1  
Fiber Optic Cable Connectors

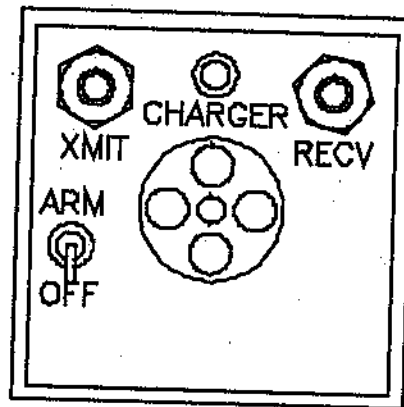


Figure 3-2  
Probe Switch Location

Step 8. Turn on the FM 5004 power via the front panel rocker switch. A tone sounds, and the receiver performs a self-test routine. If an error occurs, refer to the Troubleshooting Section of this Manual, for possible corrective actions.

### 3.4 Optional Connections

The following may also be part of your system configuration. Bench test those options present in your system, if possible, to verify proper operation prior to field installation.

Option 1. For remote-controlled operation of the FM 5004, connect the RS-232 or IEEE-488 cable to the appropriate connector.

If IEEE-488 remote control is used, set the DEVICE ADDRESS to the appropriate bus address for your installation (See the Description of Operation Section of this Manual for information on setting the device address).

Test remote operation by issuing an \*IDN? command from the remote controller (\*IDN?<LF>) and verify that the FM 5004 returns the proper response. Refer to the Remote Operation Section of this Manual, for further information.

Option 2. Connect the appropriate cable to the ANALOG OUTPUT connector. Enable the analog output system and verify proper operation. See the Description of Operation Section of this Manual for information on setting up the analog output system.



## 4.0 DESCRIPTION OF OPERATION

### 4.1 Introduction

This section contains information designed to familiarize you with your FM 5004 system. It includes definitions and operational descriptions for all controls, indicators and connectors.

For experienced users, or others who wish to begin operating the FM 5004 immediately, a quick start procedure provides the basic steps for operating the system. In addition, two examples of commonly performed measurements illustrate system operation.

#### NOTE

Before operating the FM 5004, be sure that the system has been properly installed and tested. If problems occur during operation, refer to the Troubleshooting and Error Handling Section of this Manual, or contact Customer Service for assistance.

### 4.2 Quick Start Procedure

The following procedure provides the basic steps necessary to configure the system and begin operation. Before beginning, identify the various modes and configurations you want for each channel. This will save time and improve accuracy during configuration.

- Step 1. Power up the probe(s) by setting the ARM/OFF switch to ARM. Power up the receiver by activating the POWER switch on the front panel.
- Step 2. Verify that no error codes appear on the field monitor display and there are no fault indications. If a fault is indicated or an error code appears, refer to the Troubleshooting and Error Handling Section of this Manual for information on identifying the problem and taking the necessary corrective action.
- Step 3. Select the channel to which the probe is connected by pressing the CH key followed by the DISP key for that channel number. Select the desired axes and whether the data is for display or for analog output.
- Step 4. Select the desired display mode.
- Step 5. If analog output is selected for the channel, choose the desired mode and range.
- Step 6. If more than one probe is attached, repeat this process for each channel.

#### NOTE

The configuration just entered is saved in non-volatile memory. It will remain stored unless otherwise altered, regardless of whether the receiver is powered up.

### 4.3 Controls, Indicators, and Connectors

This section contains definitions and descriptions of the controls and indicators for the front panel and connectors for the rear panel.

#### 4.4 Readout Front Panel

Functionally, the receiver front panel is divided into five sections:

- Input Power Switch
- Input selection matrix
- System Status
- Graphics Display
- Menu Select

#### 4.5 Input Power Switch

Activating the power switch causes the receiver to power up and initiate a system self-test. The power switch controls power to the FM 5004 only; it does not affect power at the probe(s).

#### 4.6 Input Selection Matrix

The input selection matrix section (Figure 4-1) contains: four switches for selecting an input channel (the *channel select* switches); five switches for defining the receiver's base operating mode for the selected channel (the *base mode* switches); and 24 LEDs to indicate the selected channel and base mode.

When the receiver is turned off, the input matrix settings are saved in non-volatile EEPROM. When the receiver is next powered up, these settings are restored.

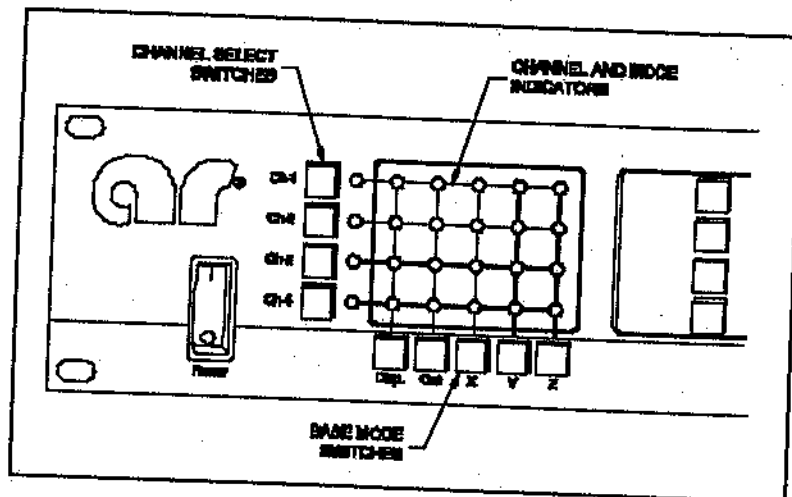


Figure 4-1  
Input Selection Matrix

#### 4.6.1 Base Mode Switches (DISP, OUT, X, Y, Z)

These switches select a probe axis (or axes) for receiver display and/or analog output. The input data for the assigned channel may be displayed on the receiver LEDs, or it may be routed to analog output. The current base mode selections for a given channel remain active until readjusted.

##### Switch    Description

- DISP**    When this LED is lit for a selected channel, that channel is 'display selected', meaning the readings from this probe will be routed to the display section. The field monitor displays the channel input as a numeric value on the display. Display mode parameters are set by entering the MENU SELECT section on the front panel.
- OUT**    When this LED is lit for a selected channel, that channel is 'analog output' selected, meaning the readings from this probe will be routed to the analog output system. Note: Any channel may be display selected, analog output selected, or both. This connects the channel input (probe signal) to the receiver's analog output. Analog mode parameters are set using the ANALOG OUTPUT section of the menu system.
- X,Y,Z**    Selects the field detected by a particular probe axis for display or analog output. Any combination of axes may be chosen. Isotropic response requires selecting all three axes. When multiple axes are selected, individual axes are combined vectorially.

#### 4.6.2 Channel Select Switches (CH-1 through CH-4)

These switches determine the channel for which the base mode settings apply. A different base mode may be set up for each channel. Up to four probes can be connected to an FM 5004.

When a channel select switch is pressed, the receiver must establish communication with the probe. During the several seconds this process requires, the base mode (DISP or OUT) LED for that channel will flash. When the connection is established, the LED glows continuously. If the receiver fails to make connection with the probe, the LED will go out.

#### 4.6.3 Input Selection LEDs

These LEDs form a matrix which signify the current channel and base mode selections. The following examples illustrate the correspondence between the LEDs and the base mode selections.

##### Example 1: Single Probe Configuration.

CH-1 pressed to select the probe attached to channel 1. X,Y, and Z pressed to provide isotropic response. DISP pressed to display the numeric value of the vectorially-combined axis values.

LED Indication: All LEDs in the top row of the matrix, except for the second from the left, are lit. All other LEDs are unlit.

##### Example 2: Dual Probe Configuration.

CH-1 set up as in Example 1. CH-2 pressed to select the probe attached to channel 2. X and Y pressed to gather the data from only those two axes. OUT pressed to provide the vectorially-combined value of X and Y reading as an analog output.

LED Indication: Channel 1; all LEDs in the top row, except for the second from the left, are lit. Channel 2; the middle three LEDs in the second row from the top are lit. All other LEDs are unlit.

#### 4.7 System Status

This section provides one button access to all selected probes for range and battery as well as enabling local control. These switches also make use of the shift key to add another function to each. Alternate display, temperature and reset are the added functions respectively. (see Figure 4-2)

#### NOTE

To perform a function on only selected probes, such as range change, battery check, etc., press the channel select button for those probes. The function will be performed only on the selected probes with selection LEDs blinking. When no channels are selected, the function will be performed for all display or analog output selected channels.

##### 4.7.1 RANGE

The range selection determines the sensitivity of the probe. With each press of the button all selected probes will increment one range, IE from 10 to 30, 30 to 100, 100 to 300, or 300 volts/meter and finally, to *auto*. If the measured signal exceeds the full-scale value for the selected range, an over-range message will appear on the display. If the selected measured signal is too low an under range indication will appear.

The FM 5004 also incorporates autoranging capability. When autorange is selected the probe will scroll up to the next higher range when the reading displayed exceeds full scale. The probe will scroll down to the next lower range when the reading displayed is less than 70 percent of full scale.

##### Range Description

AUTO Sets the selected channels to *autorange*.

1-4 Sets the selected channels to the desired range. The actual units of measure and range levels are defined in the manual for the specific probes being used.

5 Some probes may use five or more ranges. The FM5004 will allow this.

##### (Alternate Display)

Pressing the Shift button then the RANGE/(Alt. Disp.) button will change to the user selected *alternate display* mode. The alternate display is setup by entering the MAIN MENU and selecting "Alt. Disp. Format". The FM 5004 will support two display formats.

##### 4.7.2 BATTERY

Pressing the battery button will display a percentage that represents where, in the discharge curve, the battery voltage is for each selected probe. This number is derived by taking the actual voltage of the battery pack, subtracting it from the minimum voltage level for the battery (3.18 volts for a 3-cell battery pack), and dividing the result by the full range of the battery (max charge voltage minus fully discharged voltage; 4.10-3.18 volts for a 3-cell battery pack). Note: Due to the highly non-linear discharge curve of Ni-Cd batteries, the percentage displayed does not reflect the actual operation time left for a probe. It is recommended that for each probe, the approximate battery life left for a given battery voltage percent be noted. In addition, as a battery ages, the overall voltage will decrease. Note: When the battery level drops below approximately 13% (3.3 volts for a 3-cell battery pack), a low battery warning will appear on the LCD display. When this occurs, the battery should be charged as soon as

possible. When the battery voltage drops to the fully discharged level, a battery fail indication will appear on the LCD display. When this occurs, measurement accuracy will be compromised by further operation.

**(Temperature)**

Pressing Shift then BATTERY/(Temp.) will display all selected probes temperature in Fahrenheit and in Celsius.

### 4.7.3 LOCAL

Pressing LOCAL will give control of the FM 5004 to a remote device, if one is present. It can be either an RS-232 serial device or an IEEE-488 device. When the FM 5004 is in remote operation, REM will appear in the upper left hand corner of the LCD display. Pressing the Local button again will return the unit to local operation.

**(Reset)**

Pressing and releasing Shift and then pressing Reset will cause the LCD display to be redrawn and communication to be re-established with the probes. This is useful if the display malfunctions or communication to a probe is lost. It will also reset the running min, max and average readings if they are active. Pressing Reset while holding down the Shift key will cause a "hard" reset which is equivalent to cycling the power on the FM 5004.

### 4.7.4 Shift

When Shift is pressed, the items in brackets become active. Pressing a button will perform the function shown in parentheses. When Shift is active, "Shift" will appear on the LCD display. Pressing Shift again will turn off the shift.

## 4.8 Graphics Display

The display is a 240x64 graphics display with an adjustable LED back light. The display is used to indicate probe and status information as well as to display the menuing windows for system setup.

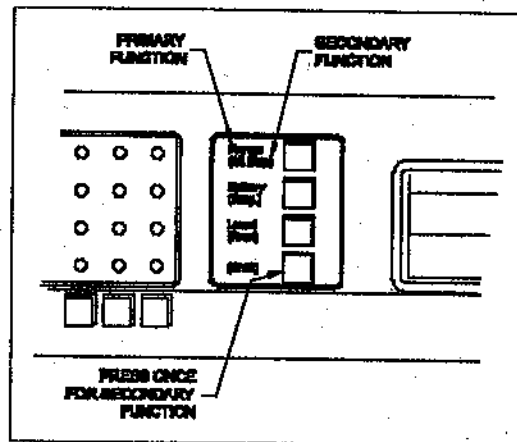


Figure 4-2  
System Status Section

## 4.9 MENU SYSTEM

### 4.9.1 Introduction

This section discusses the menu system of the FM 5004. It includes information on how to navigate through the menu system and change setup parameters. The menus appear on the graphics liquid crystal display. Five buttons control the movement through the menu system and the changing of the FM 5004 settings. The setup parameters will be saved in non-volatile memory (EEPROM) and will be loaded each time the FM 5004 is powered on.

### 4.9.2 Menu Buttons

The five buttons that control the menu navigation and data entry are located to the right of the FM 5004 liquid crystal display (Figure 4-3). The four arrow buttons are used to enter the menu system, move between selections in the menus, open sub-menus, change settings and to exit the menu system. In addition, the up and down arrows are used to increment and decrement numbers when in the numeric entry menus. The ENTER key is used to select settings from a list and to save numeric entries.

### 4.9.3 Menu Organization

The menus are organized in a tree format (Figure 4-4). For example, the MAIN MENU contains a list of sub-menus that, when selected, will call up another menu. This menu may, in turn, contain other sub-menus. Other menu types are: numeric entry, which will call up a data entry screen; item selection, which allows the operator to select a setting from a list of options; and advanced setup, which allows the operator to perform diagnostics on the FM 5004 and upgrade software.

### 4.9.4 Entering the menu system

The menu system is entered by pressing any of the arrow buttons to the right of the LCD. This will bring up the MAIN menu. An arrow will appear to the left of the first menu item. This is the cursor.

### 4.9.5 Moving through the menu system

The up and down arrows move the cursor through the menu items. When the bottom of a column is reached, pressing the down arrow will cause the cursor to wrap-around to the top of the other column, or, to the top of the same column if the menu contains only one column of selections. The reverse is true when pushing the up arrow. When the cursor is next to a sub-menu icon, pressing the right arrow button will open that sub-menu. The name of the menu item is the title of the opened menu. Pressing the left arrow button will back-up to the previous menu.

### 4.9.6 Changing settings

When the menu that contains the item to be changed is reached, position the cursor to the left of that item. If the item's icon is a check-mark, pushing the ENTER key will toggle the function on or off. A solid check mark indicates that the function is selected, a hollow check mark indicates that it is not selected. The status of the settings when the menu system is exited will be active. The FM 5004 will initialize to the same setups that were active before it was shut down previously. If the selected item contains up and down arrows to the left of it, the numeric entry screen will appear when it is selected. The name of the selected item will appear at the top of the menu and the current value for that item will appear in large type in the middle. Pressing the up or down arrows will increment or decrement the number. Only valid values will appear. Holding the button down will cause the number to change at an increasingly fast rate. When the top or bottom of the range is reached, the value will no longer change. To save the desired value, press the ENTER key. This will also return the display to the previous menu. If the left arrow is pushed without pressing enter, the value will return to the last value saved and the previous menu will be displayed.

### 4.9.7 Exiting the menu system

Pressing the left arrow button until the probe display appears closes the menu system.

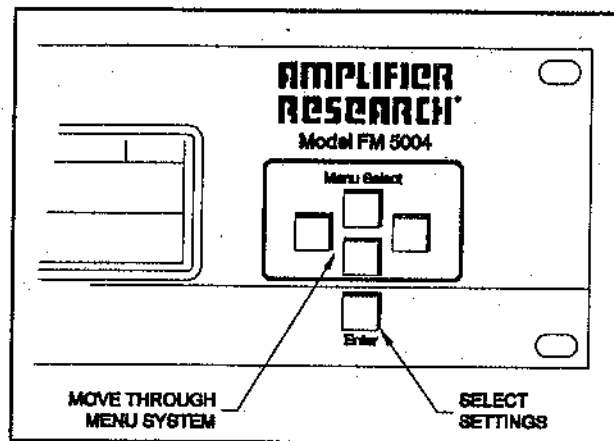


Figure 4-3  
Menu Select Section

## 4.10 MENU ITEM DESCRIPTIONS

### 4.10.1 Introduction

This section will explain, in detail, each of the menu items in the FM 5004 menu system. This section is arranged in an outline format with the MAIN menu first. Each sub-menu entry will contain a short description of the functions contained in it. These descriptions will contain a box () before the heading. When a heading contains an up and down arrow ( $\updownarrow$ ), selecting it will call up the numeric entry menu, allowing the operator to change the value for that parameter. A check-mark () indicates that this item can be enabled or disabled. A solid check-mark indicates that the item is enabled and a hollow check-mark indicates that it is disabled. Pressing the enter key will toggle the item between enabled and disabled. When several check-marks appear in one paragraph, only one of the options can be enabled at one time.

**THE FOLLOWING SECTION CONTAINS DESCRIPTIONS OF ALL OF THE MENUS IN THE FM 5004 MENU SYSTEM:**

### MAIN MENU

#### 1.0 Display Setup

This sub-menu contains all items associated with the format of the data on the liquid crystal display and display brightness and contrast controls.





**1.1  Display Fmt/Alt Disp Fmt**

These sub-menus contains the items associated with the presentation of data on the LCD when in normal and alternate display mode.

**NOTE**

For each saved setup, two display configurations are saved. This allows the operator to quickly switch between two commonly used formats. To toggle between normal and alternate display format, press the (Shift) key and then the Range/(Alt. Disp.) key on the front panel.

**1.1.1  4-Probe**

When selected, the display is divided into four sections, one for each channel. The reading from each probe is displayed in these sections. If the display is disabled for a given channel, that section of the display will be empty.

**1.1.2  2-Line**

The items in this sub-menu allow the operator to view two readings on the display at one time. The display is divided into two sections, line 1 on the top and line 2 on the bottom. The minimum, maximum or average of the display enabled probes may be shown on each line as well as the reading being sent to the analog output system. See section 2 for setting up the analog output system. Different channels may be selected for routing to the analog output and display systems. This allows the operator to display readings from different probes on each line of the display. For example, say the operator wanted to display the maximum reading from channel 1 and 2 on line one, and the maximum of the readings from channel 3 and 4 on line two. Selecting channel 1 and 2 for the display system and channel 3 and 4 for the analog output system will allow this.

Note: Only one selection may be made at one time from the Line 1 column and one from the Line 2 column.

**-Line 1-** **Min of Probe**

When selected, the minimum of the current reading and the previous samples for the display selected probes will be displayed on line 1. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

 **Max of Probe**

When selected, the maximum of the current reading and the previous samples for the display selected probes will be displayed on line 1. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

 **Avg of Probe**

When selected, the average of the current reading and the previous samples for the display selected probes will be displayed on line 1. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

**✓ Analog Out**

When selected, the readings being sent to the analog output system will be displayed on line 1 of the LCD. The number displayed will be an average of the current reading and previous readings. The number of previous readings is determined from the Filter Size setting in the Analog Output setup menu. For example, if Filter Size was set to 10, the number displayed on the LCD is an average of the current reading plus the 9 previous readings. This number will be updated at the display update rate as setup in 1.3.

**-Line 2-****✓ Min of Probe**

When selected, the minimum of the current reading and the previous samples for the display selected probes will be displayed on line 2. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

**✓ Max of Probe**

When selected, the maximum of the current reading and the previous samples for the display selected probes will be displayed on line 2. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

**✓ Avg of Probe**

When selected, the average of the current reading and the previous samples for the display selected probes will be displayed on line 2. The number of previous samples is determined from the display update rate. See 1.3 for setting the display update rate.

**✓ Analog Out**

When selected, the readings being sent to the analog output system will be displayed on line 2 of the LCD. The number displayed will be an average of the current reading and previous readings. The number of previous readings is determined from the Filter Size setting in the Analog Output setup menu. For example, if Filter Size was set to 10, the number displayed on the LCD is an average of the current reading plus the 9 previous readings. This number will be updated at the display update rate as setup in 1.3.

**1.1.3 -3-Axis-****✓ Probe - 1****✓ Probe - 2****✓ Probe - 3****✓ Probe - 4**

When selected, the readings for all enabled axes and the combined (square root of the sum of squares) reading is displayed for the selected probe. Only one probe may be selected for 3-axis display at a time. If any axes are disabled, only the enabled axes' readings are displayed and the combined reading includes only the enabled axes.

## 1.2 Display Update Rate

- ✓ 1 Update/Second
- ✓ 2 Updates/Second
- ✓ 5 Updates/Second
- ✓ 10 Updates/Second

This sub-menu contains the allowable display update rates. Only one may be selected at any time. This is the number of times per second that the LCD will be updated with new readings. If the Samples/Sec setting in the Main Menu is set greater than the display update rate, then all samples taken after the last display update will be included in the new update. The displayed reading will be an average of the previous samples. However, in 2 line display mode, with minimum or maximum of probe selected, the displayed reading will be the minimum or maximum of the previous samples. If the display update rate is set greater than the Samples/Sec setting, the display will be updated only when new samples are taken.

## 1.3 LCD Contrast

Calls up the numeric entry screen which allows the operator to adjust the contrast bias supply for the liquid crystal display. This adjustment serves to make the display more readable under different lighting conditions and viewing angles.

**Important: Improper adjustment of the LCD contrast may make the display unreadable. If the display is blank, the contrast bias may be set too low. If the display is completely black, the contrast bias may be set too high.**

## 1.4 LCD Brightness

Calls up the numeric entry screen which allows the operator to adjust the brightness of the liquid crystal display. This adjustment serves to make the display more readable under different lighting conditions and viewing angles.

## 2.0 Analog Setup

This sub-menu contains items associated with the analog output functions of the FM 5004. To select a probe for the analog output system, press the channel button for the desired probe on the front panel, then the Out button. The Out LED for that channel should be on. More than one channel may be selected for analog out at one time.

## 2.1 Full Scale Range

This item only applies to operation in auto-range mode. When operating in a fixed range, the analog output full scale range will be the upper limit of the highest range of analog output selected probes. This sub-menu contains the allowable full scale range settings for the analog output system. The field level which corresponds to a full scale output of 5 volts is the upper limit of the range selected. A zero field will create an analog output of 0 volts..

### NOTE

**If the reading being output is larger than the upper range, the output voltage will be 5 V and an analog output over-range condition will be displayed on the front panel LCD.**

- ✓ Range 1
- ✓ Range 2
- ✓ Range 3
- ✓ Range 4

**2.2**  **Min/Max/Avg**

This sub-menu contains the allowable functions to be used on the analog output data. If Minimum is selected, the minimum sample in the sample window (see 2.3 for Filter Size setup) is sent to the analog output system. If Maximum is selected, the maximum sample in the sample window is sent to the analog output system. If average is selected, the average of all samples in the sample window is calculated and sent to the analog output system.

- Min**
- Max**
- Average**

**2.3**  **Filter Size**

Calls up the numeric entry screen which allows the operator to select the number of samples to use for each analog output update. The saved samples represents a sliding window and serves as a smoothing function for the analog output signal. The analog output level is updated every sample as selected in the Samples/Sec setting in the Main Menu. If Filter Size is greater than one, the sample window contains the current sample plus the most recent samples. If Filter Size is set to 1, only the current sample is used by the analog output system. The min/max/avg setting in 2.2 will affect how the data is processed.

**2.4**  **Log Scale Output**

Selects either linear or log scale for the analog output voltage. When Log Scale Output is selected, the output will track a logarithmic curve with a zero field level being zero volts out and a full scale field level being 5 volts out. When it is deselected, the endpoints will be the same but the analog voltage out to field level ratio will be linear.

**3.0**  **Remote Setup**

This sub-menu contains items associated with setting up the FM 5004 for remote operation.

**--RS-232--**

The following are the selections for the communications baud rate between the FM 5004 and the remote controller.

- 1200 Baud**
- 2400 Baud**
- 4800 Baud**
- 9600 Baud**
- 19200 Baud**

**--GPIB--****Filter Size**

Calls up the numeric entry screen which allows the operator to select the GPIB address (0 to 31) for the FM 5004.

**4.0  Alarm Setup**

This sub-menu contains items associated with setting up the FM 5004 alarms.

**4.1  4-Probe/3-Axis Alarm Setup**

This sub-menu contains items associated with enabling the upper and lower alarms, setting up the levels which will cause an alarm and the pulse type of the alarm.

**4.1.1  Upper Enable**

When selected, the alarm will activate when the measured field is greater than the upper alarm value as selected in 4.1.2.

**4.1.2  Upper Value**

Calls up the numeric entry screen which allows the operator to enter the upper measured field value above which the alarm will activate.

**4.1.3  Lower Enable**

When selected, the alarm will activate when the measured field falls below the lower alarm value as selected in 4.1.4.

**4.1.4  Lower Value**

Calls up the numeric entry screen which allows the operator to enter the lower measured field value below which the alarm will activate.

**4.1.5  Latched**

When selected, the alarm will sound continuously when an enabled upper or lower value is crossed. Note: In this mode, when the alarm is activated, it will be latched in the on state regardless of whether the measured field returns to within the normal field level. To disable the alarm, either select Alarm Silence from the main menu or cycle the FM 5004 power.

**4.2  Line 1 Alarm Setup/Line 2 Alarm Setup**

These sub-menus contains items associated with setting up the alarm for use while in 2-Line display mode. There are separate alarm setup menus for each line in 2-line display mode. Note: Using the alarms while in two line display mode allows the use of two different upper and lower alarm values for different probes.

**4.2.1  Upper Enable**

When selected, the alarm will activate when the measured field is greater than the upper alarm value as selected in 4.2.2.

**4.2.2  Upper Value**

Calls up the numeric entry screen which allows the operator to enter the upper measured field value above which the alarm will activate.

**4.2.3 ✓ Lower Enable**

When selected, the alarm will activate when the measured field falls below the lower alarm value as selected in 4.2.4.

**4.2.4 ↑↓ Lower Value**

Calls up the numeric entry screen which allows the operator to enter the lower measured field value below which the alarm will activate.

**4.2.5 ✓ Latched**

When selected, the alarm will sound continuously when an enabled upper or lower value is crossed. Note: In this mode, when the alarm is activated, it will be latched in the on state regardless of whether the measured field returns to within the normal field level. To temporarily disable the alarm, either select Alarm Silence from the main menu or cycle the FM 5004 power. In either case, the alarm will be latched on the next time an alarm value is crossed when the LCD display exits the menu system.

**4.3 □ Temperature Alarm Setup****NOTE**

The temperature alarm will become inactive when the sample rate is set above 10 samples/second. However, taking a temperature measurement from either the front panel or by a remote temperature measurement command will cause an alarm if the alarm is enabled and the measurement causes an alarm condition.

This sub-menu contains items associated with setting up the alarm to notify the operator of an out of range temperature condition.

**4.3.1 ✓ Upper Enable**

When selected, the alarm will activate when the temperature of any active probe rises above the upper alarm value as selected in 4.3.2.

**4.3.2 ↑↓ Upper Value**

Calls up the numeric entry screen which allows the operator to enter the upper temperature level above which the alarm will activate.

**4.3.3 ✓ Lower Enable**

When selected, the alarm will activate when a probe temperature falls below the lower alarm value as selected in 4.3.4.

**4.3.4 ↑↓ Lower Value**

Calls up the numeric entry screen which allows the operator to enter the lower temperature level below which the alarm will activate.

**4.3.5 ✓ Latched**

When selected, the alarm will sound continuously when an enabled upper or lower temperature level is crossed. Note: In this mode, when the alarm is activated, it will be latched in the on state regardless of whether the measured temperature returns to within the normal field level. To disable the alarm, either select Alarm Silence from the main menu or cycle the FM 5004 power.

**4.4**  **System Alarm**

This sub-menu contains items associated with setting up the alarm to notify the operator of probe failures or system errors.

**4.4.1**  **Momentary Probe Fail**

When selected, the alarm will activate when a momentary error occurs in a probe or if an error occurs during communication with a probe.

**4.4.2**  **Hard Probe Fail**

When selected, the alarm will activate when an error condition occurs repeatably.

**4.5**  **Battery Enable****NOTE**

The battery alarm will become inactive when the sample rate is set above 10 samples/second. However, taking a battery measurement from either the front panel or by a remote battery measurement command will cause an alarm if the alarm is enabled and the measurement causes an alarm condition.

When selected, the alarm will activate when the voltage on an active probe falls below the level at which normal probe operation is guaranteed.

**5.0**  **Setup Save/Recall**

This sub-menu contains items associated with saving and recalling up to four different setup configurations. In addition, each setup may contain a separate primary display and an alternate display. To switch between primary and alternate displays, press and release the (Shift) button and then the (Alt. Disp.) button on the front panel. When the FM 5004 is powered up each time, it will be configured as it was before it was powered down previously but any changes made to a setup will not be saved permanently until it is saved in this menu. Recalling the default setup will configure the FM 5004 as it was shipped from the factory.

- Recall 1**
- Recall 2**
- Recall 3**
- Recall 4**
- Recall Default**

- Save 1**
- Save 2**
- Save 3**
- Save 4**

## 6.0 Zero Probes

This sub-menu contains items associated with zeroing the probes connected to the FM 5004. In order to zero a probe, it must be enabled for either display or analog output functions. Note: The actual zero function will not occur until the menu system is exited. "ZERO" will appear in the display window after the zero operation was performed.

- ✓ All Probes
- ✓ Probe 1
- ✓ Probe 2
- ✓ Probe 3
- ✓ Probe 4

## 7.0 Maintenance

This sub-menu contains items associated with updating the FM 5004 software and checking the system voltage levels.

### 7.1 Last Errors

When selected, a window will appear which will show detailed descriptions of the most recent errors that have occurred in the system, if any. Each error will have a time-stamp, in seconds, identifying when it occurred since the last system reset or power-up. The bottom of the screen will show the current time. Only errors that have occurred since the last system reset or power-up will appear. Pressing the up and down arrows will scroll through the errors.

### 7.2 System Status

This sub-menu contains no selections, but, when opened, will display the following information:

- Software Revision
- Software Date
- +5V Buss Voltage
- +12V Buss Voltage
- -12V Buss Voltage

Note: The acceptable values for the Buss voltages are +/-10% of nominal. If the measured voltages are outside of this range, consult the factory.

## 8.0 Samples/Sec

Calls up the numeric entry screen which will allow the operator to select the field measurement sample rate in samples per second. The minimum sample rate is one sample per second. The maximum sample rate is determined by the FM 5004 and is based on the speed of the probes connected to it. The maximum rate is limited to the slowest probe which is communicating with the FM 5004. Note: When the FM 5004 is in 3-axis mode, the actual sample rate for a complete measurement of the probe field is 1/6 of the selected sample rate.

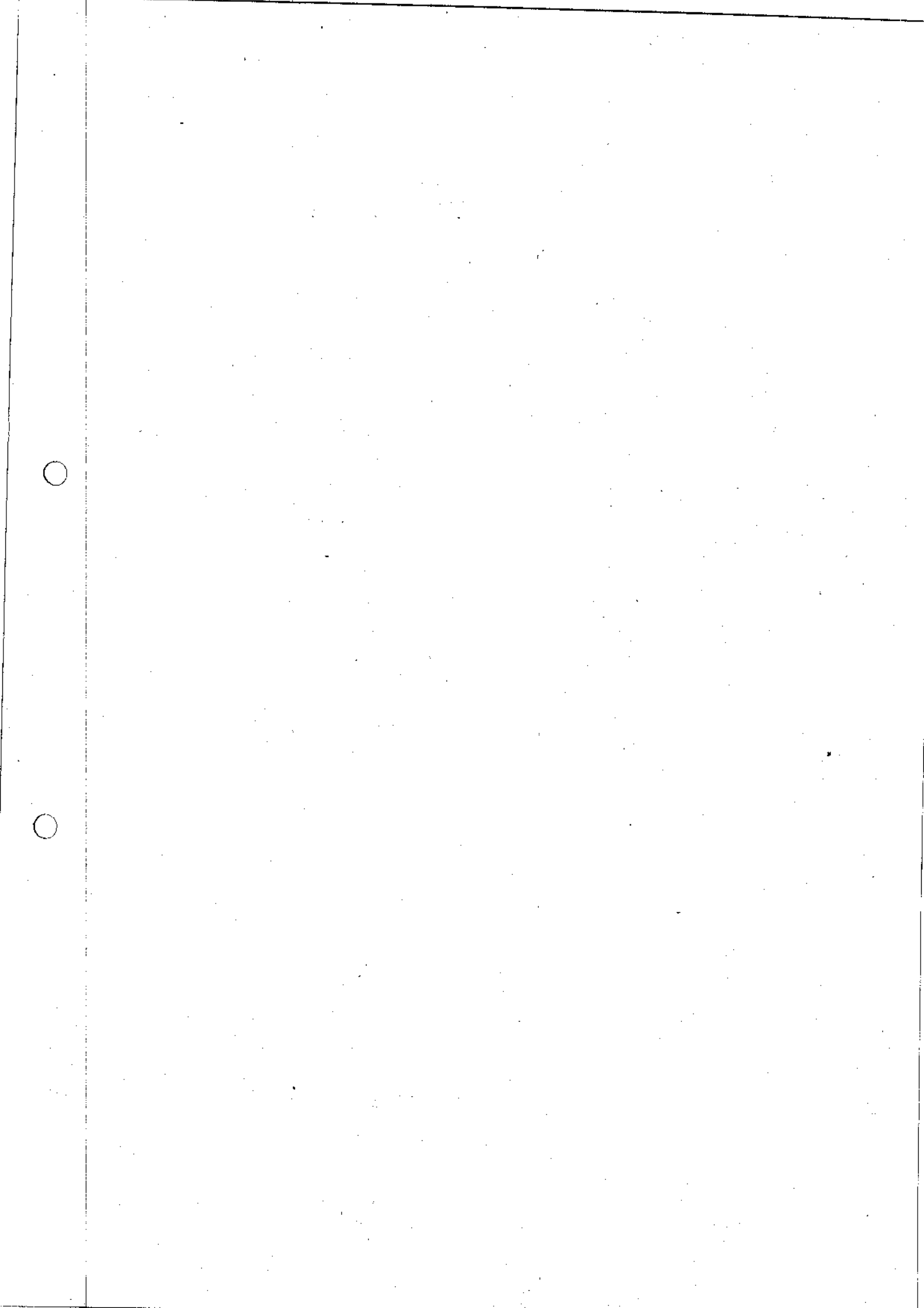


**9.0** ✓ **Key Click**

When this item is selected, the FM 5004 alarm will emit a short pulse each time a key is pressed.

**10.0** **Alarm Silence**

To silence the alarm when it is latched mode, position the arrow to the left of this item and press enter. This will silence the alarm temporarily. However, if the parameter that caused the alarm to occur is still outside of the alarm limits, the alarm will still latch on when the menu system is exited. To silence the alarm permanently, the alarm must either be disabled in the alarm setup section or the probe must be disconnected or turned off.



## 5.0 REMOTE OPERATION

### 5.1 Introduction

This section describes remote operation of the FM 5004 system using either the IEEE-488 parallel port or the RS-232 serial port connected to a remote device such as an IEEE-488 bus or a personal computer.

The IEEE-488 port on the FM 5004 is IEEE-488.2 compatible. Note: For a more detailed description on the operation of any of the remote commands, see the Description of Operation section of this manual.

### 5.2 IEEE-488 Requirements

For IEEE-488 operation, the device address is set using the menu system. See the menu system section in this manual for changing the FM 5004 device address. It is set to address 4 at the factory. If your IEEE-488 device has address 4 already assigned, reset the switch to a vacant address.

Specific IEEE-488 bus commands depend on which software package you are using. To send commands, be sure that the receiver address is set properly and that the controller also has correctly identified the receiver as a "listening" device.

### 5.3 Command Set Format

Each command code is composed of two or three alpha characters and an optional numeric parameter. If the command is sent without the numeric parameter, the instrument assumes the command is a request for status (Table 5-1). When the command is a status request, the receiver returns a string consisting of the command followed by the current setup for that command. Commands can be entered in upper or lower case (case-insensitive).

All commands are terminated by a line feed <LF>. To include several commands in a single command string, separate each command by a semi-colon (delimiter). Do not include spaces between a command and its associated numeric parameter. Data returned from the receiver will be terminated with a <CR><LF>.

### 5.4 IEEE-488 (GPIB) Communications

For General Purpose Interface Bus (GPIB) communications, the End or Identify (EOI) control line may also be used for command termination. When sending commands to the receiver via the GPIB, terminate the command with a <LF>, an EOI, or both. No characters are permitted after the <LF> or EOI; the system interprets characters following <LF> or EOI as the start of another command. When an error condition is present at the receiver, the service request (SRQ) signal is asserted. The operator can then perform a serial poll operation. The receiver error code (in binary) is contained in the lower bits of the serial poll status byte. If the receiver is addressed as a listener and the GPIB remote line is asserted, the receiver will switch to remote mode.

## 5.5 RS-232 Communications

During initialization, the receiver will test for a properly-connected RS-232 interface. In order for the receiver to recognize an RS-232 device, the DCD line (Data Carrier Detect) must be asserted. This line is sampled continuously to determine if the RS-232 connection is broken; therefore, it must remain asserted in order for the RS-232 interface to function. The CTS line (Clear To Send) is also used to gate information from the receiver; this line must be asserted in order for information to be transferred from the receiver. The CTS line can be used as a hand-shake line to inform the receiver when it is permissible to send information (there is a five second timeout error built into the receiver, resulting in an error if the timeout occurs). If the CTS line is de-asserted in the middle of a transmission, a character in the process of being transmitted will be completed; then, transmission will halt until the CTS line is asserted once again. The receiver itself asserts two lines: DTR (Data Terminal Ready) and RTS (Request To Send). These lines are asserted continuously and provide no hand-shaking function; they can simply be connected to the CTS and DCD lines at the connector. This will allow the receiver to transmit with a minimum of wires and with no hand-shaking. See Figure 5-1 and Table 5-1 for complete pin-out information.

Once the RS-232 interface is established, commands are processed in a manner very similar to that of the IEEE interface. The command structure is identical, except that there is no EOI line; therefore, all commands must be terminated by a <LF>. When a valid command is received, it is processed and the result is immediately transmitted back over the RS-232 interface. The CTS line can be used to control the flow of information from the receiver, as outlined above. The output format is identical to that of the IEEE format except, again, there is no EOI line.

## 5.6 RS-232 Settings

The RS-232 settings used to communicate with the FM 5004 are as follows:

Word Length 8 bits  
 Stop Bits 1  
 Baud Rate 1200 - 19,200 (Menu Selectable)  
 Parity None

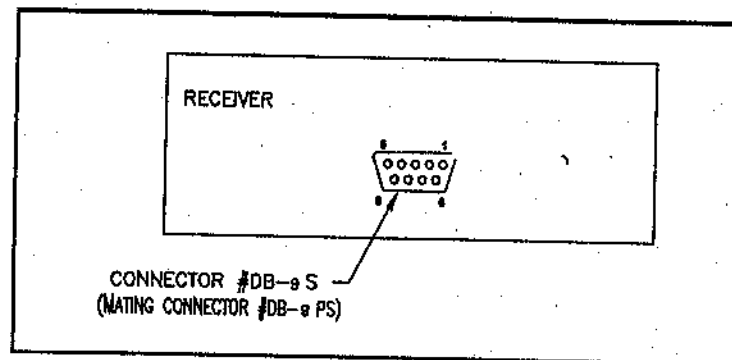


Figure 5-1  
 RS-232 Pin Detail

Table 5-1 RS-232 Port

FM 5004 Pin #	Signal	Data Direction*	Description
1	DCD	←	Device Carrier Detect
2	RD	←	Receive Data
3	TD	→	Transmit Data
4	DTR	→	Data Terminal Ready
5	GND	N/A	Ground
6	NC	N/A	No Connection
7	RTS	→	Ready To Send
8	CTS	←	Clear To Send
9	NC	N/A	No Connection

\* Note:

→ signifies Output From the FM 5004

← signifies Input To the FM 5004

**Note:** A null modem cable or adapter is required for interfacing the FM 5004 to a standard serial port on a computer.

### 5.7 Remote Commands

The commands described the succeeding pages are available to the user for remote communication with and operation of the FM 5004. In the descriptions of these commands, the following conventions are used:

1. A lower case "x" in the command or returned data syntax represents a numeric value, which may be a voltage value or a numeral associated with a functional selection.
2. A lower case "n" in the command or returned data syntax represents a channel number (1 through 4) associated with a system probe.
3. A lower case "m" in the command or returned data syntax represents a mode selection.

#### NOTE

When a numeric input is sent to the FM 5004, the base of the numbers can be decimal, binary, octal or hexadecimal. For data sent back from the FM 5004, the base is always base 10.

Example:

All of the following entries are equivalent:

AUPV,1,100  
 AUPV,1,#h64  
 AUPV,1,#b1100100  
 AUPV,1,#q144  
 AUPV,1,1e2

### Alarm Latch

Sets or clears the FM 5004 alarm latches. There is a separate alarm latch for each of the three alarms: Line 1 alarm, Line 2 alarm and 4 Probe/3 Axis alarm.

Syntax: ALAT,m,x

Parameters:

Alarm mode (m):  
0 = 4-Probe/3-Axis alarm latch  
1 = Line 1 alarm latch  
2 = Line 2 alarm latch

Numeric value (x):  
0 = latch disabled (clear)  
1 = latch enabled (set)

Examples: To set the Line 1 alarm latch, send the following command:

```
ALAT,1,1<LF>
```

To verify the latch status, send the following command:

```
ALAT,1?<LF>
```

If the latch is set, the receiver will respond with:

```
ALAT,1,1<CR><LF>
```

### Alarm Silence

Temporarily silences the FM 5004 alarm when it is latched. Note: The alarm will silence only temporarily. The alarm will become active again if the reading that caused the alarm to occur does not return to the normal range before the next measurement.

Syntax: ALSR

Parameters: None

Examples: If the alarm is latched on, to silence it, send:

```
ALSR<LF>
```

### Alternate Display Format

Sets the alternate display format for the FM 5004 display. Note: When a command is sent to enable a display format, the previous format will become disabled. If all modes are turned off, the alternate display will become inactive (blank). In the case of the 4-probe display mode, only the m and x parameters are required. When setting the alternate display to 2-line mode, a separate command is required to define each line.

Syntax:           ADFM,m,n,x

#### Parameters:

Display format (m):

1 = 2-Line, Line 1 display

2 = 2-Line, Line 2 display

3 = 3-Axis display

4 = 4-Probe display (n parameter not used)

Display mode (n):

1 = Probe 1 (3-Axis format) or Minimum of probes (2-line format)

2 = Probe 2 (3-Axis format) or Maximum of probes (2-line format)

3 = Probe 3 (3-Axis format) or Average of probes (2-line format)

4 = Probe 4 (3-Axis format) or Analog output (2-line format)

Numeric value (x):

0 = Mode disabled

1 = Mode enabled

Examples: To set the alternate display mode to 2-line format and the line 1 to average of display enabled probes and line 2 to the analog output reading, send the following two commands:

```
ADFM,1,3,1<LF>
```

```
ADFM,2,4,1<LF>
```

To verify that the Line 1 display is set to average of display selected probes, send the following command:

```
ADFM,1,3?<LF>
```

If it is enabled, the FM 5004 will respond with:

```
ADFM,1,3,1<CR><LF>
```

To set the alternate display mode to 4-Probe display format, send the following command:

```
ADFM,4,1<LF>
```

**Alarm Lower Enable**

Enables the FM 5004 line 1, line 2, 4-probe/3-axis, battery or temperature lower limit alarms. Each of these alarms must be enabled and disabled separately. Note: In the case of the low battery alarm, the level is not adjustable. See the operation section in this manual for a description of the low battery alarm operation. See the command, Alarm Lower Value, to set the alarm lower values.

Syntax: ALOE,m,x

**Parameter:**

Alarm type (m):

0 = Low temperature alarm enable

1 = Line 1 lower alarm enable

2 = Line 2 lower alarm enable

4 = 4-probe/3-axis lower alarm enable

5 = Low battery alarm enable

Numeric value (x):

0 = Lower alarm disabled

1 = Lower alarm enabled

Examples: To enable the line 1 lower alarm, issue the following command:

```
ALOE,1,1<LF>
```

To verify the line 1 lower alarm status, issue this command:

```
ALOE,1?<LF>
```

The FM 5004 will return the following information:

```
ALOE,1,1<CR><LF>
```



### Alarm Lower Value

Sets the FM 5004 lower levels for the line 1, line 2, 4-probe/3-axis and high temperature alarms. Each of the alarm levels must be set using individual commands. Note: In order for an alarm to operate, that alarm must be enabled. The data entered can contain up to five numbers and a decimal point. See the entry for each alarm type for the permissible range. See the command, Alarm Lower Enable, to enable an alarm.

Syntax:            ALOV,m,xxxxxx

Parameter:

Alarm type (m):

0 = Low temperature alarm, range: 32 - 120EF

1 = Line 1 alarm, range: 0 - Max of probe

2 = Line 2 alarm, range: 0 - Max of probe

4 = 4-Probe/3-Axis alarm, range:0 - Max of lowest range probe

Alarm level (xxxxxx):

xxxxxx = Alarm value: 0-1999.9 (see above for allowable range)

Examples: To set the line 1 lower alarm value to 150.5, issue the following command:

```
ALOV,1,150.5<LF>
```

To verify the line 1 lower alarm value, issue this command:

```
ALOV,1?<LF>
```

The FM 5004 will return the following information:

```
ALOV,1,150.5<CR><LF>
```

### Alarm Upper Enable

Enables the FM 5004 line 1, line 2, 4-probe/3-axis, battery or temperature upper limit alarms. Each of these alarms must be enabled and disabled separately. See the command, Alarm Upper Value, to set the alarm upper values.

Syntax: AUPE,m,x

Parameter:

Alarm type (m):

0 = High temperature alarm enable

1 = Line 1 upper alarm enable

2 = Line 2 upper alarm enable

4 = 4-probe/3-axis upper alarm enable

Numeric value (x):

0 = Upper alarm disabled

1 = Upper alarm enabled

Examples: To enable the line 1 upper alarm, issue the following command:

```
AUPE,1,1<LF>
```

To verify the line 1 upper alarm status, issue this command:

```
AUPE,1?<LF>
```

The FM 5004 will return the following information:

```
AUPE,1,1<CR><LF>
```

### Alarm Upper Value

Sets the FM 5004 upper levels for the line 1, line 2, 4-probe/3-axis and high temperature alarms. Each of the alarm levels must be set using individual commands. Note: In order for an alarm to operate, that alarm must be enabled. The data entered can contain up to five numbers and a decimal point. See the entry for each alarm type for the permissible range. See the command, Alarm Upper Enable, to enable an alarm.

Syntax:           AUPV,m,xxxxxx

Parameter:

Alarm type (m):

0 = High temperature alarm, range: 32 - 120EF

1 = Line 1 alarm, range: 0 - Max of probe

2 = Line 2 alarm, range: 0 - Max of probe

4 = 4-Probe/3-Axis alarm, range: 0 - Max of lowest range probe

Alarm level (xxxxxx):

xxxxxx = Alarm value: 0-1999.9 (see above for allowable range)

Examples: To set the line 1 upper alarm value to 150.5, issue the following command:

```
AUPV,1,150.5<LF>
```

To verify the line 1 upper alarm value, issue this command:

```
AUPV,1?<LF>
```

The FM 5004 will return the following information:

```
AUPV,1,150.5<CR><LF>
```

### Analog Output Mode

Sets the FM 5004 analog output mode to output either minimum, maximum or average of the analog output selected probes. Note: Selecting an analog output mode will disable the previously selected mode.

Syntax: ANAO,m

Parameter:

Mode (m):

1 = Minimum of analog output selected probes

2 = Maximum of analog output selected probes

3 = Average of analog output selected probes

Examples: To set the analog output to average mode, issue the following command:

```
ANAO,3<LF>
```

To verify that the analog output mode is average of probes, issue this command:

```
ANAO?<LF>
```

The FM 5004 will return the following information:

```
ANAO,3<CR><LF>
```

### Analog Output Range

Sets the FM 5004 analog output full-scale range to correspond to the maximum of range 1 through 4 of the analog output selected probes. Note: All analog output selected probes must use the same units of measurement and have the same ranges.

Syntax: ANAR,x

Parameter:

Range value (x):

1 = Range 1 upper limit corresponds to full scale analog output voltage

2 = Range 2 upper limit corresponds to full scale analog output voltage

3 = Range 3 upper limit corresponds to full scale analog output voltage

4 = Range 4 upper limit corresponds to full scale analog output voltage

Examples: To set the analog output full scale voltage to correspond to range 2 of the analog output selected probes, issue the following command:

```
ANAR,2<LF>
```

To verify that the analog output full scale voltage corresponds to range 2 of the analog output selected probes, issue this command:

```
ANAR?<LF>
```

The FM 5004 will return the following information:

```
ANAR,2<CR><LF>
```



Sets the baud rate used for remote communication between the FM 5004 and a controller.

Syntax: BAUD,xxxxx

Parameters:

Baud rate (xxxxx):  
1200 = 1200 Baud  
2400 = 2400 Baud  
4800 = 4800 Baud  
9600 = 9600 Baud  
19200 = 19200 Baud

Examples: To set the baud rate to 9600, send the following command:

BAUD,9600<LF>

To verify that the baud rate is set at 9600, send the following command:

BAUD?<LF>

The FM 5004 will return:

BAUD,9600<CR><LF>

### Buffer Register Enable

Sets up a command buffer from 0 to 255 bytes long.

Syntax: BFRE,xxx

Parameters:

Buffer Size (xxx):  
0 = Buffer disabled  
1 - 255 Bytes = Buffer enabled at xxx size

Examples: To enable the buffer and set it to 128 bytes, send the following command:

BFRE,128<LF>

To verify that the buffer is enabled and set to 128 bytes, send the following command:

BFRE?<LF>

If it is enabled and set to 128 bytes, the FM 5004 will return:

BFRE,128<CR><LF>

**Buss Voltage**

Measures and returns the FM 5004 buss voltages.

Syntax: BUSV?

Parameters:  
None

Examples: To check the FM 5004 buss voltages, send the following command:

BUSV?

The FM 5004 will measure the buss voltages and return:

```
+12 - +12.00<CR>
+5V - +5.00<CR>
-12 - -12.00<CR><LF>
```

**Change Range**

Change range of probe.

Syntax: CHRA,c,r

Parameters:

c = channel 1 - 4  
r = range 1 - 4 (or highest range), or A (autorange)

Example:

If command is entered with no parameters, all probe ranges will be returned. If no probe is on that channel range = 0.

If command is entered with one parameter, the current range of that probe on that channel is returned.

CHRA<LF>

```
CHRA,1,A1  Probe on channel 1 is in Autorange on range 1
CHRA,2,1   Probe on channel 2 is on range 1
CHRA,3,0   Probe on channel 3 is not on or not ready
CHRA,4,A3  Probe on channel 4 is in Autorange on range 3
```

CHRA,1<LF>

CHRA,1,A1

If command is entered with two parameters the probe on that channel will be set to that range:

```
CHRA,1,2<LF>  Set probe on channel 1 to range 2
CHRA,2,A<LF>  Set probe on channel 2 to auto range
```



## Display Format

Sets the display format for the FM 5004 display. Note: When a command is sent to enable a display format, the previous format will become disabled. If all modes are turned off, the display will become inactive (blank). In the case of the 4-probe display mode, only the m and x parameters are required. When setting the display to 2-line mode, a separate command is required to define each line.

Syntax: DSFM,m,n,x

### Parameters:

#### Display format (m):

- 1 = 2-Line, Line 1 display
- 2 = 2-Line, Line 2 display
- 3 = 3-Axis display
- 4 = 4-Probe display (n parameter not used)

#### Display mode (n):

- 1 = Probe 1 (3-Axis format) or Minimum of probes (2-line format)
- 2 = Probe 2 (3-Axis format) or Maximum of probes (2-line format)
- 3 = Probe 3 (3-Axis format) or Average of probes (2-line format)
- 4 = Probe 4 (3-Axis format) or Analog output (2-line format)

#### Numeric value (x):

- 0 = Mode disabled
- 1 = Mode enabled

Examples: To set the display mode to 2-line format and the line 1 to average of display enabled probes and line 2 to the analog output reading, send the following two commands:

```
DSFM,1,3,1<LF>  
DSFM,2,4,1<LF>
```

To verify that the Line 1 display is set to average of display selected probes, send the following command:

```
DSFM,1,3?<LF>
```

If it is enabled, the FM 5004 will respond with:

```
DSFM,1,3,1<CR><LF>
```

To set the display mode to 4-Probe display format, send the following command:

```
DSFM,4,1<LF>
```

**Display Update Rate**

Sets the rate at which the display is updated with new readings.

Syntax: DUPR,x

**Parameters:**

Display Update Rate (x):

1 = 1 Update/second

2 = 2 Updates/second

3 = 5 Updates/second

4 = 10 Updates/second

Examples: To set the display update rate to 5 times per second, send the following command:

DUPR,3<LF>

To verify that the display update rate is set to 5 times per second, send the following command:

DUPR?<LF>

The FM 5004 will respond with:

DUPR,3<CR><LF>

**EEPROM Read/Write**

Returns the contents of the EEPROM in read mode and allows new data to be stored in the EEPROM when in write mode. Warning: This command should only be used by experienced operators only as the FM 5004 setups become corrupted.

Syntax: EEPR,ddd,xx

Parameters: EEPROM address (ddd)      Decimal address to read or write to  
 Character to write (xx)      Hex character to be loaded into  
 EEPROM, blank for EEPROM read

Examples: To load the EEPROM location 12 with contents 44 hex, send following command:

EEPR,12,44<LF>

To check the contents of the EEPROM location 12, send the following command:

EEPR,12<LF>

The FM 5004 will respond with:

EEPR,12,44<CR><LF>

**Error Register Enable**

Enables the error registers used to store the errors that occur during operation.

Syntax: ERRE,xxx

Parameters: Register size (xxx):

Range 0 to 255. The number of previous error messages to save. Once the register is full, older messages will be overwritten. A zero will disable the error register and no error messages will be saved.

Examples: To enable the error register and to set it to store the previous 10 messages, send the following command:

```
ERRE,10<LF>
```

The FM 5004 will respond with:

```
ERRE,10<CR><LF>
```

**Error Register Query**

Returns a previous error which is contained in the Error Register. See IEEE-488.2 specification for description of error bits.

Syntax: ERRQ

Parameters: None

Examples: To see the most recent error message, send the following command:

```
ERRQ?<LF>
```

The FM 5004 will respond with something like:

```
ERRQ,128<LF>
```

**Filter Size**

Sets the size of the filtering to be used on the analog output readings. The number entered corresponds to how many previous readings are used to calculate the analog output voltage. This command is useful for slowing the response of the analog output voltage to sudden changes in the fields.

Syntax:            FTSZ,xx

Parameters: Filter Size (xx):

Range 0 to 16. A zero will disable the filtering function.

Examples: To set the filter size to 10 samples plus the current sample, send the following command:

FTSZ,10<LF>

To check the current filter size, send:

FTSZ?<LF>

The FM 5004 will respond with:

FTSZ,10<CR><LF>

**GPIB Address**

Sets the GPIB address used by the FM 5004.

Syntax:            GPIB,xx

Parameters: GPIB Address (xx):

Range 1 to 31

Examples: To set the GPIB address to 4, send the following command:

GPIB,4<LF>

The FM 5004 will respond with:

GPIB,4<CR><LF>

### Key Click

Enables or disables the audible key click.

Syntax: CLCK,x

Parameters:

Key click enable (x):  
0 = Key click disabled  
1 = Key click enabled

Examples: To turn on the key click, send the following command:

```
CLCK,1<LF>
```

The FM 5004 will respond with:

```
CLCK,1<CR><LF>
```

### Last Errors

Returns the code and a description of the last errors which have occurred.

Syntax: LERR,string

Parameters: Error message (string):

Up to 9 lines. The message contains the error code followed by a description of the error.

Examples: To see the last error, send the following command:

```
LERR?<LF>
```

The FM 5004 will respond with something like:

```
00:06:53,E1-PARITY ERROR<CR><LF>
```

### LCD Brightness

Sets the LCD backlight level to a specific brightness.

Syntax: LCDB,xx

Parameters: Brightness level (xx):

Range 0 to 15. A zero will turn off the LCD backlight and 15 will set it to maximum brightness.

Examples: To set the brightness to 8, send the following command:

```
LCDB,8<LF>
```

The FM 5004 will respond with:

```
LCDB,8<CR><LF>
```

**LCD Contrast**

Sets the LCD contrast level.

Syntax: LCDC,xx

Parameters: Contrast level (xx):

Range 0 to 63. 0 is minimum contrast, 63 is maximum contrast.

Examples: To set the contrast to 8, send the following command:

```
LCDC,8<LF>
```

The FM 5004 will respond with:

```
LCDC,8<CR><LF>
```

**LED Setup**

Configures the FM 5004 LED array. This command is used to select probes for display or analog output functions and to enable and disable a probe's axes. Separate commands must be sent to update each channels' LEDs.

Syntax: CLED,m,xxxxx

Parameters:

Channel number (m):

0 = All channels set the same

1 = Channel 1

2 = Channel 2

3 = Channel 3

4 = Channel 4

LED configuration (xxxxx):

This is a 5-bit binary number. A 1 corresponds to an LED being lit, and a 0 corresponds to an LED being turned off. The order of the bits is: display, out, x, y, z.

Examples: To enable channel 1 for display output with all three axes enabled, send the following command:

```
CLED,1,10111<LF>
```

The LEDs will change accordingly and the FM 5004 will respond with:

```
CLED,1,10111<CR><LF>
```

**Local Mode**

Returns the FM 5004 to local mode when it is in remote mode. Local mode allows the operator to use the front panel buttons.

Syntax: LOCL,x

**Parameters:**

Local mode enable (x):  
0 = Disabled. Stays in remote mode.  
1 = Local mode enabled

Examples: To return the FM 5004 to local mode, send the following command:

LOCL,1<LF>

The front panel buttons will become operational. The FM 5004 will respond with:

LOCL,1<CR><LF>

**Log Scale**

Enables either a logarithmic or linear scale for the analog output voltage.

Syntax: LOGS,x

**Parameters:**

Log scale enable (x):  
0 = Log scale disabled (Linear scale enabled)  
1 = Log scale enabled

Examples: To set the analog output voltage to log scale, send the following command:

LOGS,1<LF>

The scale will change to logarithmic scale. The FM 5004 will respond with:

LOGS,1<CR><LF>

**No Response Timeout**

Sets the FM 5004 no response timeout timer. The time is specified in hundredths of seconds.

Syntax: TOUT,xxxx

**Parameters:**

No response time (xxxx)

0 = No response timeout timer is disabled

1-9999 = Time to wait before initiating a no response timeout, in hundredths of seconds

Examples: To set the no response timeout timer to 2 seconds, send the following command:

TOUT,200<LF>

The FM 5004 will respond with:

TOUT,200<CR><LF>

**Read Display**

Writes the current screen contents to a remote port.

Syntax: RDIS, x

x = 0 - both lines of display (if in 2 line mode only).  
or all readings (if in 3 axis or 4 line display mode).

1 - first line of display (if in 2 line mode only)

2 - second line of display (if in 2 line mode only).

Note: If 0 is selected 4 readings will be returned. In 2 line mode  
Data corresponding to the 3rd and 4th readings will be blank lines <crlf>

Every time a reading is received from a probe an  
output will be sent out.

Output format: xx.xxxxxuuuOrc 15 character output

|||||||'---> space - normal

||||units || in 3 axis 'c' = combined reading

reading ||| 'x', 'y', 'z' = selected axis

|||

||'---> channel number or 'A' average

||

l'---> range probe is on or space average

|

'-----> 'O' = over range or space - normal



**Sample Rate**

Sets the number of times per second that enabled probes are sampled by the FM 5004. The lowest sample rate is 1 sample per second. The upper sample rate allowed is limited by the speed of the probes used on the FM 5004.

Syntax: SMPR,xx

**Parameters:**

Sample Rate (xx):

1-xx = maximum sample rate is limited by the speed of probes used

Examples: To set the sample rate to 10 samples per second, send the following command:

```
SMPR,10<LF>
```

The FM 5004 will respond with:

```
SMPR,10<CR><LF>
```

**Setup Recall**

Recalls a saved FM 5004 setup.

Syntax: RECL,x

**Parameters:**

Setup number (x):

0 = Recall default setup (factory settings).

1 = Recall setup #1

2 = Recall setup #2

3 = Recall setup #3

4 = Recall setup #4

Examples: To recall the default setup, send the following command:

```
RECL,0<LF>
```

The setup will change to the factory setup configuration. The FM 5004 will respond with:

```
RECL,0<CR><LF>
```

**Setup Save**

Saves the FM 5004 current configuration into EEPROM for recalling at a later time.

Syntax:           SAVE,x

**Parameters:**

Setup number (x):

1 = Saves to setup #1

2 = Saves to setup #2

3 = Saves to setup #3

4 = Saves to setup #4

Examples: To save the current configuration to setup #1, send the following command:

SAVE,1<LF>

The setup will be saved to EEPROM for recalling at a later time. The FM 5004 will respond with:

SAVE,1<CR><LF>

**System Alarm, Hard Probe Failure**

Enables or disables the alarm to alert the operator of a hard probe failure such as a continuous loss of communication. This alarm will activate after several attempts to restore proper function.

Syntax:           SALH,x

**Parameters:**

Alarm status (x):

0 = Alarm off

1 = Alarm on

Examples: To enable the hard probe failure alarm, send the following command:

SALH,1<LF>

The FM 5004 will respond with:

SALH,1<CR><LF>

**System Alarm, Momentary Probe Failure**

Enables or disables the alarm to alert the operator of a momentary probe failure. This alarm will sound if a probe doesn't respond for a short time but then recovers proper operation.

Syntax: SALM,x

**Parameters:**

Alarm status (x):

0 = Alarm off

1 = Alarm on

Examples: To enable the momentary probe failure alarm, send the following command:

```
SALM,1<LF>
```

The FM 5004 will respond with:

```
SALM,1<CR><LF>
```

**Software Date**

Returns the date of the current revision of the FM 5004 operating software.

Syntax: DATE

Parameters: None

Examples: To check the current date of the FM 5004 software, send the following command:

```
DATE<LF>
```

The FM 5004 will respond something like:

```
DATE,JAN 1 2000<CR><LF>
```

**Software Revision**

Returns the current revision of the FM 5004 operating software.

Syntax: SREV

Parameters: None

Examples: To check the current revision of the FM 5004 software, send the following command:

```
SREV<LF>
```

The FM 5004 will respond something like:

```
SREV,2.0<CR><LF>
```

**Timeout**

Sets the FM 5004 timeout timer in hundredths of seconds to wait when a WAIT command is sent.

Syntax: TOUT,x

Parameters: x = 0 - Timeout disabled  
1 - 9999 - Hundredths of seconds

Examples: To cause the FM 5004 to wait for a .04 second wait time, send the following command:

TOUT,40<LF>

The FM 5004 will respond with:

TOUT,40<CR><LF>

**Verbose Mode**

Causes the FM 5004 to respond to remote commands in either verbose mode or to only respond to inquiries only.

Syntax: VERB,x

Parameters: x = 0 - Verbose mode disabled.  
1 - Verbose mode on

Examples: To cause the FM 5004 to enter verbose mode, send the following command:

VERB,1<LF>

The FM 5004 will respond with:

VERB,1<CR><LF>

To disable the FM 5004 verbose mode, send the following:

VERB,0<LF>

The FM 5004 will not respond (verbose mode off).

**Wait for Timer**

Causes the FM 5004 to wait for the time specified (see Wait Timer command for setting wait time) before responding to a command.

Syntax:            **WAIT**

Parameters: None

Examples: To cause the FM 5004 to wait for the specified wait time, send the following command:

**WAIT<LF>**

No response will be sent

**Wait Timer**

Sets the FM 5004 wait timer. To enable the wait timer, a wait command must be sent. See Wait for Timer command.

Syntax:            **WTMR,xxxx**

Parameters:

Time to wait (xxxx)

0 = Wait timer is disabled

1-9999 = Time to wait in hundredths of seconds

Examples: To set the wait timer to 2 seconds, send the following command:

**WTMR,200<LF>**

The FM 5004 will respond with:

**WTMR,200<CR><LF>**

## Zero Probes

Zeros probes connected to the FM 5004. Note: The FM 5004 will respond only when the zero function has been performed.

Syntax: ZERO,x

### Parameters:

Probe number (x):

0 = Zero all probes

1 = Zero probe 1 only

2 = Zero probe 2 only

3 = Zero probe 3 only

4 = Zero probe 4 only

Examples: To zero the probe on channel 1, send the following command:

ZERO,1<LF>

When the zero function is complete, the FM 5004 will return:

ZERO<CR><LF>

The following pages contain the system level commands which are required to comply with the IEEE-488.2 specification.

### Clear Status

Clears the IEEE-488.2 Status Register

Syntax: \*CLS

Parameters: None

Examples: To clear the IEEE-488.2 status register, send the following command:

\*CLS

### Define Device Trigger

Enters a command into the define device trigger buffer. The command will be executed when a Trigger command is sent. The maximum string length for the DDT command is 80 characters. Separate the commands with A;@.

Syntax: \*DDT command or \*DDT? command

Parameters:

Command: Any IEEE-488 command in the FM 5004 command set may be sent.

Examples: To load the device trigger buffer with a Zero All Probes command, send the following command:

\*DDT;ZERO,0

To verify which command is in the device trigger buffer, send the following command:

\*DDT?

The FM 5004 will return:

\*DDT ZERO,0

**Event Status Enable**

Sets or returns the event status enable bits.

Syntax: \*ESE xxx or \*ESE?

Parameters:

Event status enable bits (xxx):

Range = 0-255; refers to the binary word that corresponds to the event status enable bits.

Examples: To set the event status enable bits to 10011111 (159 base 10), send the following command:

\*ESE 159

To check the status of the error register enable bits, send the following command:

\*ESE?

The FM 5004 will return:

\*ESE 159

**Error Status Register Query**

Returns the error status register bits.

Syntax: \*ESR?

Parameters: None

Examples: To check the status of the error status register bits, send the following command:

\*ESR?

The FM 5004 will return a number in the range of 0 to 255 which corresponds the binary representation of the error status register bits, such as:

\*ESR 255



**Identification Query**

Returns the FM 5004 identification string which includes model number and system software revision.

Syntax: \*IDN?

Parameters: None

Examples: To command a system identification, send the following command:

\*IDN?

The FM 5004 will return:

\*IDN FM 5004 Rev. 1.0

**Operation Complete**

Sets or returns the operation complete enable bit in the standard event register.

Syntax: \*OPC x or \*OPC?

Parameters:

Operation complete enable bit (x):  
0 = Disable operation complete function  
1 = Enable operation complete function

Examples: To enable the operation complete function, send the following command:

\*OPC 1

To check if the current operation is complete, send the following command:

\*OPC?

If the current operation is complete, the FM 5004 will return:

\*OPC 1

**Reset**

Causes the FM 5004 to perform a system reset.

Syntax: \*RST

Parameters: None

Examples: To cause a system reset on the FM 5004, send the following command:

\*RST

The reset will occur, but nothing will be returned. Wait at least 6 seconds before sending any more commands to the FM 5004.

**Self-Test**

Causes the FM 5004 to perform a self-test. Returns a 1 or 0 to indicate pass or fail.

Syntax: \*TST?

Parameters: None

Examples: To perform a self-test of the FM 5004, send the following command:

\*TST?

The self-test will be performed. If the test passes, a 1 will be returned, if it fails, a 0 will be returned:

\*TST 1

**Service Request Enable**

Sets or returns the service request enable bit.

Syntax: \*SRE x or \*SRE?

Parameters: Service request enable bit (x):  
0 = Service request bit disabled  
1 = Service request bit enabled

Examples: To enable the service request bit, send the following command:

\*SRE 1

To verify that the service request bit is enabled, send the following command:

\*SRE?

If it is enabled, the FM 5004 will return:

\*SRE 1

**Status Byte Query**

Returns the contents of the status byte.

Syntax:           \*STB?

Parameters: None

Examples: To check the contents of the status byte, send the following command:

\*STB?

The FM 5004 will return the contents of the status byte. The returned value is the integer value of the binary status register. For example, if the status register contains binary byte 10100001 (161 base 10), the status would be returned as follows:

\*STB 161

**Trigger**

Causes the command contained in the define device trigger buffer to be executed. The TRG command is useful when used along with a define device trigger (DDT) command to continuously execute a set of commands. Entering a TRG as the last command of the DDT string will cause the DDT command to be repeated continuously until a different command is sent to break the loop. Note: The TRG command must be the last command of the DDT string, otherwise the input buffer will overflow, causing an error.

Syntax:           \*TRG

Parameters: None

Examples: To cause the command in the define device trigger buffer to be executed, send the following command:

\*TRG

The response from the FM 5004 will be exactly the same as if the command contained in the define device trigger buffer were executed directly.

**5.8 FM2000 Compatibility**

All remote commands that work on the FM 2000 will also work on the FM 5004. Since the operational structure of the field monitors is different, issuing any of the FM 2000 commands will change the display mode to a two line mode with the display readings shown on line 1 and the analog output values shown on line 2. All FM 2000 commands must be terminated with a carriage return <CR>.

## 6.0 THEORY OF OPERATION

### 6.1 Introduction

This section discusses the theory of operation and the functionality of the FM-5004 Field Monitor. A high-level block diagram is included to aid in the description of the probes, receivers, remote communications, and overall system operation. The objective is to provide information that enhances user understanding of the design of this system. Such understanding will help improve the user's operation and maintenance of this system.

For detailed information on communications between the probes and the FM-5004 or information regarding specific circuits or components used in the probes, refer to the Users Manual for the specific probe.

### 6.2 System Theory

A complete FM-5004 Field Monitor system consists of one to four field measurement probes, coupled to the FM-5004 through fiber optic cables, and optional external devices (Figure 6-1). The FM-5004 contains fiber optic I/O cards to communicate with the probes, a main processor board, a graphics LCD to display data and system status, a keypad to allow operator control of the system and an audible alarm to alert the operator of field strengths above or below a user defined value. RS-232 and IEEE-488 ports are included for remote system operation and data collection and an analog output port is included for leveling purposes. Both probes and I/O cards employ microprocessors to provide intelligent control and operation of the system. Each has a self-contained power supply: a universal input 110-230 VAC supply for the FM-5004, and rechargeable NiCd battery packs for the probes.

When a field strength reading is requested by the Field Monitor, the I/O card for that probe sends the appropriate command to the probe through the fiber optic cable. The probe measures the signal level for each enabled axis. A vector addition is performed on these readings and the result is transmitted to the I/O card through the glass fiber optic cables. The I/O card formats the data from the probe and routes it to the main FM-5004 processor for interpretation, display, and, if desired, transmission to a remote recorder.

For detailed information on data format, baud rate, etc., refer to the Users Manual for that specific probe.

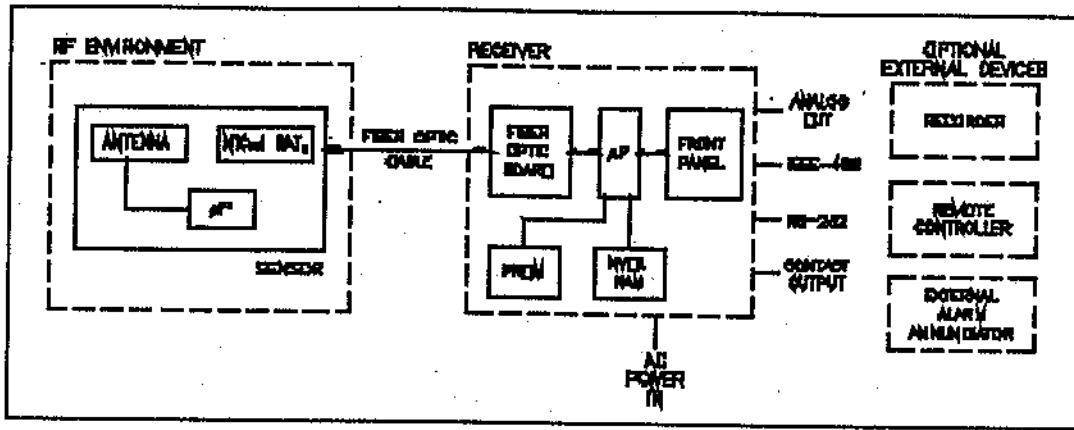


Figure 6-1  
System Block Diagram

Other commands that the probes perform consist of the following:

- Zero
- Switch range
- Enable/disable axis
- Send temperature/battery voltage

When a probe receives a command from the I/O card it performs the requested function and sends a response back to the FM-5004.

Depending on the probe used, other commands may also be available. Refer to the User's Manual for the specific probe being used for information on other commands.

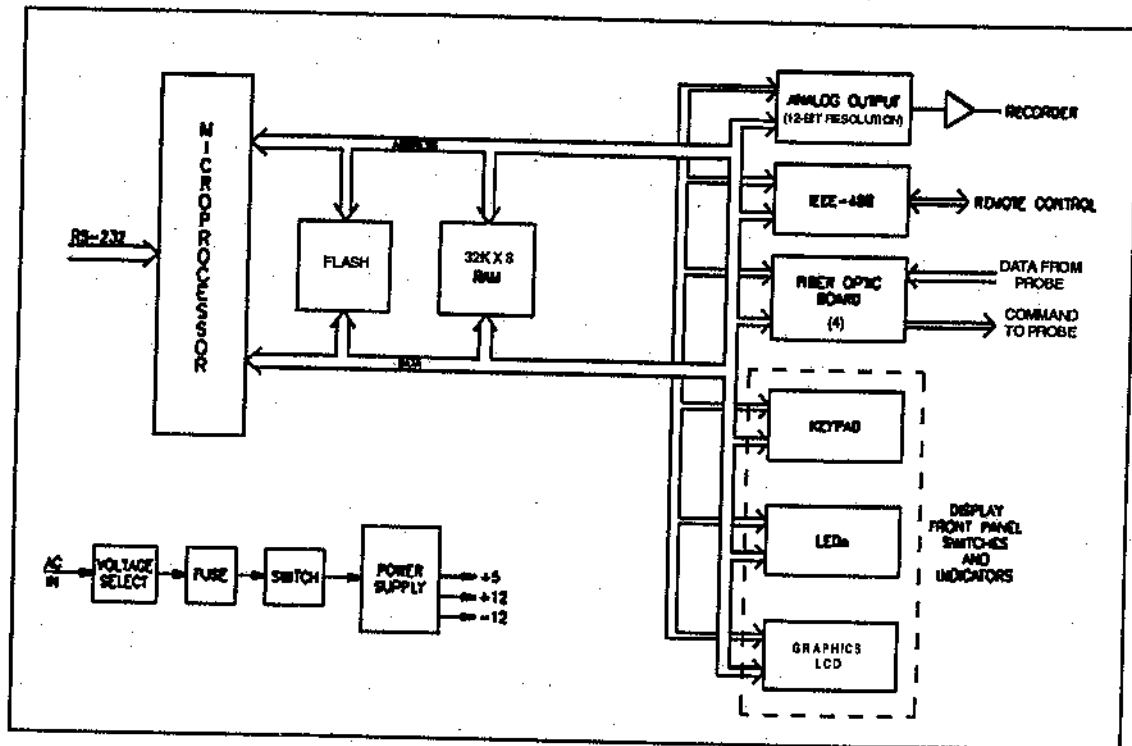


Figure 6-2  
Receiver Block Diagram

### 6.3 Receiver Theory

The FM-5004 issues commands to the I/O cards. The I/O card then issues control signals to the probe processor (Figure 6-2). It also receives the data from the probe, formats it, and relays it to the FM-5004 main processor. The sampling rate, range settings, auto-range enable/disable, display format and other setup parameters are stored in electrically erasable programmable read only memory (EEPROM). The setups are automatically restored each time the FM-5004 is powered on. Flash EEPROM memory is used to store the main program. Random access memory (RAM) is used to temporarily store measurements and settings.

Operator inputs to the FM-5004 come from either the keypad switches on the front panel or from a remote control device connected via the IEEE-488 or RS-232 ports.

Information from the probes is communicated to the operator via the front panel LEDs and the graphics LCD display. Optional receiver outputs include:

- Output to a remote receiver via the IEEE-488 or RS-232 ports
- Analog output (with 12-bit resolution) to recorders or leveling circuitry
- Programmable alarm values for driving a relay that controls a remote alarm

The FM-5004 power supply operates from a 115 to 230 VAC power source. The supply provides outputs of +5 VDC, -12 VDC, and +12 VDC.

#### 6.4 Zeroing

When the probe receives a zero command from the FM-5004 (via activation of the ZERO menu function), the probe must be in a zero field. This is because the processor directs the multiplexer to perform a normal read cycle on all axis signals. This procedure is executed for all 24 settings (four ranges, three axes per range, two antennas per axis). When the processor receives these readings, it stores them in a special register; these values are then subtracted from all subsequent measurements. Therefore, a probe which is zeroed when it is not in a zero field environment will give erroneous readings.

**Note:** The zero function will not be performed until the menu system is exited.

## 7.0 MAINTENANCE

### 7.1 Introduction

This section explains which troubleshooting and maintenance tasks can be performed by the user. It also provides information on replacement and optional parts for the FM 5004; these parts can be ordered from the manufacturer. If any questions or doubts occur concerning maintenance tasks, contact Customer Service.

### 7.2 Maintenance Recommendations

Maintenance of the FM 5004 is limited primarily to external components such as cables or connectors. Any maintenance or calibration task which requires disassembly of the field monitor should be performed at the factory. Check with Customer Service before opening the FM 5004 to avoid problems with the system's warranty.

### 7.3 Component Removal/Replacement

The sensor and the field monitor contain no user-serviceable components. Before attempting to remove or replace any components, call Customer Service.

#### NOTE

Opening the system component enclosures may void your warranty. If your system is still under warranty, contact Customer Service before performing any maintenance inside the field monitor.

### 7.4 Upgrade Policies

System upgrades are made periodically to enhance functionality. Contact Customer Service to check on the upgrade status of your measurement system(s).

### 7.5 Periodic/Preventive Maintenance

Table 7-1 contains some basic periodic maintenance tasks that help ensure accurate operation of the system and prevent future problems. Probes used with the FM 5004 require an annual calibration check to verify that they are performing within specifications. This calibration may be performed by Service Personnel at the factory. Return your probes to using the original packing materials. See your probe's User Manual for more information.

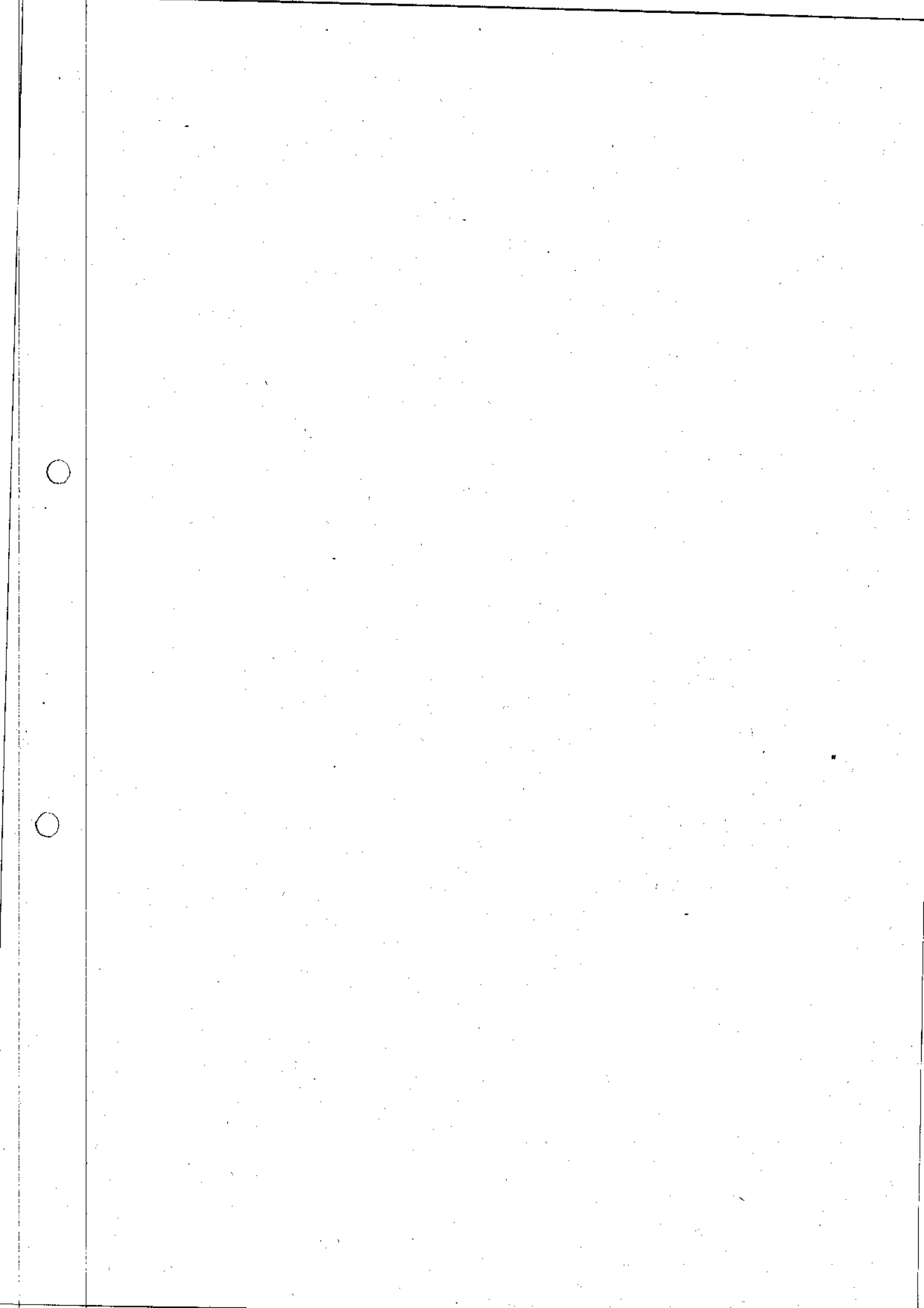
### 7.6 Cleaning Instructions

Clean using damp cloth only.

Table 7-1. Preventive Maintenance Tasks

Component / Task	Frequency	What to Do
Batteries	Weekly	Check battery status using front panel switch or remote command
System General Cleaning	Monthly	Clean contaminants from field monitor front panel. Disconnect optical fiber cables to verify that they are clean.
Cables	Monthly	Inspect for cracked or loose connectors, kinked or broken cables
System Updates / Changes	As notified by manufacturer	Follow instructions in Engineering Bulletins or upgrade notices. Call Customer Service if questions arise.





## 8.0 TROUBLESHOOTING AND ERROR HANDLING

### 8.1 Troubleshooting

This section contains some basic troubleshooting information that can define the problem and give some simple actions to verify and help correct the problem. Table 8-2 contains information to aid the user in troubleshooting the FM 5004. Table 8-2 lists general failure symptoms, the likely problem associated with the symptom, and several corrective actions. In addition, the front panel display may show error codes. For a detailed description of the cause of the error, see the section in this manual titled Error Handling.

In cases where the corrective action fails, this table and the Error Handling section will assist you in your consultation with Customer service personnel. If your symptom does not appear in Table 8-2 or the Error Handling section, contact Customer Service.

**Table 8-2. System Problem Indications**

Indication	Possible Cause	Corrective Action
FAULT indicator flashes an error code (intermittent communication error)	<ul style="list-style-type: none"> <li>• Bad cable</li> <li>• Faulty connector</li> </ul>	<ul style="list-style-type: none"> <li>• Check for dirt or contaminants, clean if needed.</li> <li>• Replace cable</li> <li>• Decrease sample rate</li> <li>• If problem persists call Customer Service</li> </ul>
Probe fails to communicate with field monitor	<ul style="list-style-type: none"> <li>• Bad cable</li> <li>• Faulty connector</li> <li>• Dead battery</li> <li>• Fiber optic cable reversed</li> </ul>	<ul style="list-style-type: none"> <li>• Check for dirt or contaminants, clean if needed.</li> <li>• Replace cable</li> <li>• Charge battery</li> <li>• If problem persists call Customer Service</li> </ul>
Field monitor fails to power up	<ul style="list-style-type: none"> <li>• Power cord unplugged or faulty</li> <li>• Fuse blown</li> </ul>	<ul style="list-style-type: none"> <li>• Connect cord properly.</li> <li>• Replace cord.</li> <li>• Replace power fuse.</li> </ul>

### 8.2 ERROR HANDLING

Any errors that occur during operation of the FM 5004 appear in the fault window located on the top line of the graphics LCD. If a specific channel caused the error, the error code will contain it's channel number. Only the most recent error will appear in the window. The last five errors and a more detailed description of the error may be seen through the menu system under "LAST ERRORS" in the "SYSTEM STATUS" sub-menu. While remotely controlling the FM 5004, the last nine errors can be sent over the IEEE-488 or RS-232 port using the LERR command.

The list of possible errors is shown below. In the fault window on the LCD, an error will appear with the channel number which caused the error first followed by the error code. Ex. "C4=O" means a channel 4 overrange error occurred. In addition to the following errors, the probes may generate errors. These appear with an "E" in front of an error number in the fault window. Ex. "C2=E6" means that the probe sent an "E6" error to the FM 5004. See the user's manual for the specific probe for a description of these errors.

**Error code A****"Alarm L1 up - line 1 upper alarm. "**

This error occurs when a field measurement causes the line 1 upper alarm to occur. For a detailed description of setting line 1 alarms, see the Description of Operation chapter in this manual.

**Error code B****"Alarm L1 lo - line 1 lower alarm."**

This error occurs when a field measurement causes the line 1 lower alarm to occur. For a detailed description of setting line 1 alarms, see the Description of Operation chapter in this manual.

**Error code C****"Alarm L2 up - line 2 upper alarm."**

This error occurs when a field measurement causes the line 2 upper alarm to occur. For a detailed description of setting line 2 alarms, see the Description of Operation chapter in this manual.

**Error code D****"Alarm L2 lo - line 2 lower alarm."**

This error occurs when a field measurement causes the line 2 lower alarm to occur. For a detailed description of setting line 2 alarms, see the Description of Operation chapter in this manual.

**Error code E****"Probe err - probe returned error."**

This error originates from a probe connected to the FM 5004. The "E" is followed by a number. See the user's manual for the specific probe for a description of the error.

**Error code F****"Batt Fail - At Fail level."**

This error occurs when a battery in a probe falls below the level at which proper probe operation is not guaranteed. Recharge the probe.

**Error code H****"Probe Fail - probe did not recover"**

This error occurs when a probe does not respond to a command sent by the FM 5004. Make sure the probe is turned on and the battery is charged. Also, make sure the fiber optic cables are connected properly.

**Error code L****"Temp lower - Temp under lower limits."**

This error occurs when a probe temperature measurement falls below the lower limit set for the probe temperature alarm. For a detailed description of setting the temperature alarm, see the Description of Operation chapter in this manual.

**Error code N****"Non support - Probe not supported."**

This error occurs when a probe that measures field strength in improper units is connected to the FM 5004.

**Error code O****"Over range error."**

This error occurs when a field strength measurement is taken that is above the upper limit for the current range on the probe being used. When in auto range mode, this error will occur if the measurement is above the allowable field strength for the highest range of the probe.

**Error code P****"Process err No time to process data."**

This error occurs when the FM 5004 processor doesn't have time to process the data from a field strength measurement before another measurement must be taken.

**Error code Q****"Sample/s -1 Process err - Rate to high"**

This error occurs when a probe is connected which doesn't support the current sample rate of the FM 5004. The sample rate can only be set to the rate at which the slowest probe will operate.

**Error code R****"Receive err Data not rec from probe."**

This error occurs when the FM 5004 sends a command to a probe and no response is received for one sample cycle.

**Error code S****"Send error Probe not ready to send."**

This error occurs when the FM 5004 is ready to send a command to a probe but the complete response hasn't been received from the previous command.

**Error code U****"Temp upper Temp over upper limits."**

This error occurs when a temperature measurement causes an upper temperature alarm to occur. For a detailed description of setting temperature alarms, see the Description of Operation chapter in this manual.

**Error code W****"Batt Warn - At Warning level."**

This error occurs when the battery voltage of a probe falls below the warning level. This indicates that the probe will operate for only a short time before a battery fail will occur. The probe should be charged as soon as possible.

**Error code Y****"Alarm upper - 4/3 display alarm."**

This error occurs when a field measurement causes the 4 probe or 3 axis upper alarm to occur. For a detailed description of setting 4 probe or 3 axis alarms, see the Description of Operation chapter in this manual.

**Error code Z****"Alarm lower - 4/3 display alarm."**

This error occurs when a field measurement causes the 4 probe or 3 axis lower alarm to occur. For a detailed description of setting 4 probe or 3 axis alarms, see the Description of Operation chapter in this manual.

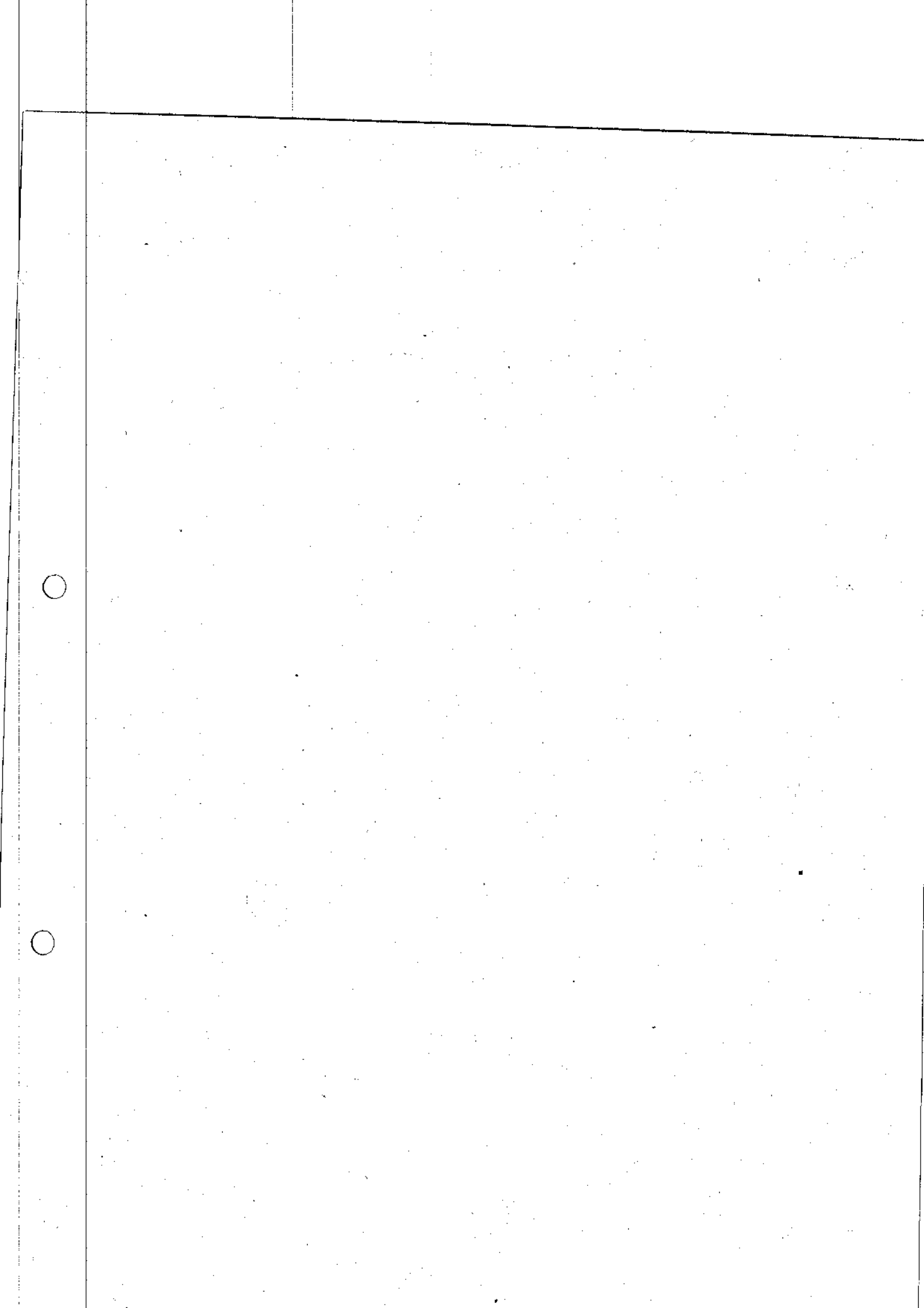
### 8.3 Return Procedures

To return a system or system component, use the following procedure.

Step 1. Contact Amplifier Research Customer Service (215-723-0275) to obtain a Return Merchandise Authorization Number (RMA).

Step 2. Briefly describe the problem in writing. Give details regarding the observed symptom(s) or error codes, and whether the problem is constant or intermittent in nature. Please include the date(s), the service representative you spoke with, and the nature of the conversation. Include the serial number of the item being returned.

Step 3. Package the system or component carefully. Use the original packing boxes and materials, if possible.



## APPENDIX A

## FM 5004 SOFTWARE DOWNLOAD PROCEDURE

**Warning:** Following the steps indicated in this section will cause the FM 5004 system software to be erased. Do not attempt to perform a software download until the FM 5004 is connected to a host computer and new software is loaded onto the computer.

Download procedure:

- 1) Load the new system software onto the hard drive of the host computer.
- 2) Connect the FM 5004 to the computer through the serial port. Note: The cable used must be a null modem cable or a null modem adapter must be used.
- 3) Start up a modem or terminal program on the host computer which is capable of sending data out a serial port. The communication settings should be 19200 baud, 8 data bits, 1 stop bit, no parity.
- 4) Power-up the FM 5004. Before entering the download procedure, it is highly recommended that the communications between the computer and FM 5004 be verified by sending a remote command to the FM 5004 and checking the response.
- 5) While holding down the Enter and right arrow keys, reset the FM 5004 by holding the Shift key and pressing the (Reset) key. Release all keys. Finally, press and release the right arrow button.
- 6) The computer screen and the FM 5004 display should show "ERASING FLASH CHIP" followed by "START DOWNLOAD NOW" after several seconds.
- 7) Send the new system software file to the FM 5004 through the serial port. "DOWNLOAD RUNNING" should appear on the FM 5004 display along with the current memory address being programmed. The download will take several minutes.
- 8) After the "DOWNLOAD COMPLETE" message appears on the display, disconnect the serial cable and reset the FM 5004. The download is now complete.

