OPERATOR'S MANUAL

Model 52A
Datalogger

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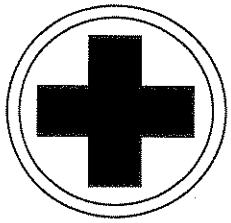
SAFETY FIRST



Protect yourself. Follow these precautions:

- Don't repair the instrument unless you are a qualified electronics technician and know how to work with hazardous voltages.
- Pay attention to the **WARNING** statements. They point out situations that can cause injury or death.
- Pay attention to the CAUTION statements. They point out situations that can cause equipment damage.

WARNINGS

The case of this unit is not connected to earth ground through the AC Adapter. The case may inductively or electrostatically float to a high voltage if used in a strong electromagnetic or electrostatic field. This presents the potential for a nasty shock. To prevent this, the case may be connected to earth ground using the uninsulated banana jack (⏚) on the rear panel.

Ground for the Digital I/O, IEEE-488, and RS-232-C cards are connected internally to the case. If one of these grounds in external equipment is connected to earth ground, this will make unnecessary the precautionary connection of the paragraph above, when the unit would have floated electrostatically.

Measurement modules "float" to approximately the input common mode voltage. The measurement modules have a shield over their midsection. This shield is connected to analog ground (measurement module input LO). With the case cover off, this shield is exposed. This shield is at input LO potential.

This instrument normally contains a lithium battery. Where lithium is prohibited, such as aboard U.S. Navy ships, verify that the lithium battery has been removed.

Do not recharge, short circuit, disassemble, or apply heat to the lithium battery. Violating this rule could release potential harmful lithium. Observe polarity when you replace the battery.

SECTION 1
INTRODUCTION

1.1 50 SERIES DATALOGGER SYSTEM

The 50 Series combines the features of a traditional datalogger with many measurement functions and datalogging modes. The use of application-specific integrated circuits and surface-mount technology to reduce circuitry size makes the 50 Series a very portable datalogger.

Model 52A. Model 52A Datalogger is configurable, half-rack-sized, with 1 to 4 installable measurement modules (Option 50-1 or 50-2), and up to 4 Digital I/O boards (Option 50-14). Each measurement module provides independent A/D (DMM-type) or counter type measurements. The system allows each measurement module to service up to 64 multiplexed inputs, giving a maximum total measurement channel count of 260 (256 multiplexer channels plus 4 front panel channels). Also, with 4 Option 50-13 Digital I/O boards, the 52A may access up to 32 bits of digital inputs, 32 bits of digital outputs, and four 8-bit-resolution analog outputs.

The 52A offers stand-alone operation, with the potential to store over 100,000 readings internally. The 52A can also function as a measurement front end for a computer. It is easily connected to any personal computer for data downloading. The 52A may also be controlled remotely (set up, programmed, started, stopped) by a computer or dumb terminal.

Multiplexer and Printer. The 52A has two companion products; the Model 53 Multiplexer/Expansion Chassis, and the Model 54 Printer/Plotter. The Model 53 accepts either 53-1 or 53-2 multiplexers. The Model 54 printer has extensive plotting capability.

1.2 WHAT THIS MANUAL COVERS

This manual covers the primary component of the 50 Series Datalogger System, the Model 52A datalogger. It describes all internal options and modules. In addition, it covers hardware setup and programming of the external self-contained Option 50-20 Multiplexer.

The companion printer/plotter, Model 54, comes with its own manual, covering only the hardware aspects of the 54. Also covered by a separate hardware manual are the optional Expansion Chassis, Model 53, and the multiplexers, Options 53-1 and 53-2, which may or may not be installed.

1.3 LEARNING TO USE THE MODEL 52A

The best way to learn to operate the Model 52A is to do the exercises. Read section 3 carefully, doing the exercises called out. Other exercises or examples are spread throughout the manual.

For definition of unfamiliar terms, use the Glossary, located before the appendices.

1.4 MODEL 52A FEATURES

Model 52A Features are summarized in table 1-1.

Table 1-1. Summary Of Model 52A Features

Feature	Summary
Power Sources	52A will run from a variety of sources. AC power is from a wall mounted transformer module. An internal, rechargeable, sealed lead acid battery option provides power for up to 50 Hrs. 52A will also run off

Table 1-1. Summary Of Model 52A Features (Continued)

Feature	Summary
	of external dc sources such as a car battery (10V-24V). 52A automatically switches over from external to internal power providing uninterrupted datalogging.
Measurement Module Measurement Functions	50-1 module implements a wide variety of measurement functions: Vdc to 320V, True RMS Vac to 320V, Temperature with 7 TC types, 2 RTD types, Cold Junction Temperature, Adc to 10A, True RMS Aac to 10A, dBm or dBW with 21 reference impedances, Frequency counting with 7 digits of resolution, Period measurement, Time Interval, Pulse Width, Events counting, Resistance to 3.2GΩ, Diode checking, Continuity, and a simple Logic function. 50-2 module is limited to Vdc and Temperature functions.
Real Time Clock	Measurement programs may be started/stopped by time. Also, a time and date "channel 9" can be used for time/date stamping.
T-channels	Text "channels" allow the entry of alphanumeric messages useful for attaching labels to measurements or providing instructions to unskilled personnel.
Math	Besides the digital and measurement channels, software driven "pseudo" channels (not associated with any hardware location) may be set up. Up to 99 Math formulas can be programmed that allow scaling, calculating interchannel relationships, table linearizations, variable passing, and variable entry. Alphanumeric labels may be assigned (e.g. "PSI") to replace the electronic unit such as Vdc.
Tracking	With the tracking feature, the readings from any measurement channel (may have a math modifier) can also be fed to an external chart recorder. (Requires a 50-14 option.)
Alarms	Up to 99 alarms can be programmed, each independent with one or two thresholds for checking in limits, out of limits, in window, outside of window, or error detection. Each alarm can be attached to any measurement channel and has an extremely versatile, user selectable, set of if-true responses. In addition, each threshold may have a unique user-programmable message associated, allowing annunciation of the alarm condition.
Alarm Responses	Alarm responses include: send a pattern of highs and lows to 1 to 8 digital output bits (50-14 option), store the alarmed reading or message, print the alarmed reading or message, sound an audible warning, display the alarm message, output to either of two communication ports either the alarmed measurement reading or an entire scan. An alarm can be used for branching to other measurement channel lists like a subroutine or GoTo function, or alternately, start another timed Program.
Communications	52A comes standard with a RS-232-C interface with 3 standard baud rates and one high-speed baud rate. Either an IEEE-488 interface or a second, fully implemented, RS-232-C interface can be added (8 baud rates, programmable parity, modem handshaking, etc.)

Table 1-1. Summary Of Model 52A Features (Continued)

Feature	Summary
Printing	The printer can give a real time print out of data with channel number, reading, and engineering units all automatically printed. Either 1 or 2 columns of data can be printed with the Model 54 (up to 4 with an 80 column serial printer). Text messages and alarm messages can also be set up to be printed by a running measurement list. Similar printing of stored data is also possible. The user may control the number of lines per page and the number of readings per line. Headers and footers are also menu selectable. A "screen dump" to the printer is available in many circumstances. This copies the current display on the 52A to the printer. The operator can also manually select a reading and print just that reading. This mode is useful for adjust-and-record calibration setups.
Plotting	The combination of the 52A and 54 Printer/Plotter has extensive plot capabilities. From 1 to 254 measurement channels can be plotted simultaneously in 1, 2, or 4 "plot windows". A single plot window is full paper width, 2 plots windows are 1/2 the paper width each, and 4 plot windows are 1/4 paper width each. There are 32 unique plot characters (could be repeated in other windows), and settable independent left-most (0%) and right-most (100%) values for each measurement channel. The plot header describes the plot character channel number, the 0% value, the 100% value, and the units for each plotted channel. By user control, the plot can be time stamped at any of 6 regular increments. The plot increment is determined by the programmed scan interval. Plot parameters are stored with individual channel lists. By combining channel lists in a Program, multiple types of data can be printed or plotted. For example, a group of thermocouples can be plotted for 10 minutes at 10 second increments, then the digital numeric data can be printed following the plotted data. Using the alarm capability, a channel list could scan the inputs until an alarm threshold is exceeded, then go temporarily to a similar channel list that plots. Therefore, plotting only on alarm conditions can easily be set up. Plotting from stored data is also possible and has the additional capability to produce X vs. Y plots. Up to 16 XY pairs of channels can be plotted. This feature, combined with the 52A versatile function set, allows plotting such relationships as voltage vs frequency, current vs resistance, voltage drift vs temperature, etc. Scatter plots and other nonlinear relationships are easily, visually, represented.
Local Display	Readings are displayed on a high contrast LCD module with 84 by 32 dot resolution. Up to four readings can be displayed simultaneously, or a single enlarged display can be selected. Bargraphs are also available on the display. The display is used for user-guided menu entry using "soft keys" for control of all aspects of 52A.

1.5 OPERATING SYSTEM PHILOSOPHY

Menus

The 52A uses a menu driven structure. The first menu you see, called the Main Menu appears upon powerup, and contains menu choices for setup and programming the 52A. Setup consists of such general things as RS-232 port setup, memory handling, calibration, and other functions only peripherally important to a data-logging task. Programming involves specifying the type of measurements and channels desired, and sometimes controls on the measurement setups (for example, start/stop conditions).

Menu Example. Where a traditional DMM has selector switches, the 52A has menus. The traditional DMM has positions on a selector switch which correspond to measurement functions (Vdc, Vac, etc.), and positions on a selector switch which correspond to ranges (3V, 30V, etc.). The 52A has selections on a menu which you choose, labelled 3V, 30V, etc. You select an item on a menu by pushing the button next to it. Where the traditional DMM is the type that has pushbuttons for each function and range, the analogy to 52A DMM operation is even closer.

Channel Numbers

"Channel" is generally synonymous for "input". Datalogger applications often require that more than one channel be measured under control of the main unit (52A). Channel numbers (as opposed to labels, for example) are used to keep track of the inputs, and to allow for orderly storage and recall of measurement data.

A 52A channel is anything that provides "measurement data" which may be displayed, stored, or transmitted.

52A channel list measurements fall into 5 basic types:

- Channels 1-4 are measurement module (A/D) front panel inputs. Channel numbers in the 100's, 200's, 300's, and 400's are assigned for multiplexer (to 52A rear) inputs. Which hundred it is (1, 2, 3, or 4) is dictated by which measurement module the multiplexer is feeding.
- Channels 5-8 are digital I/O card inputs or outputs.
- Channel 9 is assigned for time/date.
- Channels 0xx are assigned for separate Math formula entries in a measurement list (xx may be up to 99).
- Channel T's provide a means of inserting Text (words) in any channel list.

For example, each A/D measurement module installed has a unique number. Measurement modules are numbered on the front panel from left to right: channel 1, channel 2, etc. For example, entering the number "1" in the appropriate menu would select the front panel input jacks of the leftmost measurement module.

Your entry of a channel number in the "hundreds" would activate the rear panel input of the appropriate measurement module. For example, a channel entry of between 100 and 164 would activate the number one measurement module's rear panel input. And, a channel entry of 200 would activate the number two measurement module's rear panel input.

Expanding Inputs

Each A/D measurement module may be fed by one or more optional external multiplexers, to lower the cost per channel of A/D conversion. However many multiplexers are connected to a measurement module input, they route only one of the multiplexer inputs to the measurement module at a time.
A multiplexer input is activated by a channel number in the hundreds. The word "sub-channel" is often used to refer to a multiplexer input, as opposed to the front panel input of a measurement module specified by only the single digit number. In practice, only 100-164, 200-264, etc. are allowable subchannel input numbers.

When A Formula Becomes A Channel

The user-created math formulas which provide *additional* measurement data separate and distinct from analog inputs are also called channels, and referenced by the 52A according to their (channel) number. For example, a math channel "output" could be the result of multiplying channel 1's current value by 10.0. Contrast this with *scaling,* which is when a

math formula *replaces* a measurement value with the output of the formula - the channel number remains that of the original analog channel.

Measurements and Measurement Controls

Channel lists. The 52A has a hierarchical structure to its datalogging programming. Measurement tasks center around the "Channel List". The channel list is the minimum useable datalogging structure. A channel list is a user-entered list of "measurements". Each "measurement" consists of a channel number with associated function and range. Each measurement may also have "modifiers" associated. Also defined in the channel list is what to do with the acquired data (i.e., store in the internal RAM, transmit out the RS-232, plot, etc.). A channel list may be run by itself, but it takes measurements too fast for some applications. It also requires operator presence to start or stop its operation.

A channel list may specify from 1 to 255 measurements of the same or different types. A group of block consecutive channels can be entered that share functions, ranges, alarms, and modifiers. While creating channel lists, the user is prompted for every required and optional feature possible.

Some applications may require that channel lists be used with a "Program". Any channel list may be selected to run in any program.

Programs. After one or more channel lists are defined, a Program can be created to provide automatic control for channel lists. The program structure provides a start condition, channel list calls, a scan interval, a between scans mode, a stop condition, and an end condition. A powerful feature of the end condition is the ability to chain to another program or channel list. This allows mixing of different scan rates as well as adaptive datalogging.

Storage And Editing Of Setups

All user programming may be changed. Storage of channel lists and programs is under user assigned names. One measurement in a long measurement list may be changed without disturbing the others. Any parameter of a program or channel list may be changed. All user programming in the unit is unaffected by power interruptions.

SECTION 2
PHYSICAL FAMILIARIZATION

2.1 SYSTEM AND CHASSIS CONFIGURATION

Figure 2-1 illustrates the physical location of the various options associated with the Model 52A.

Not shown are the Option 50-120 and 50-220 (connected at the rear panel) and the Option 50-11 Rechargeable Battery (attached to the top cover).

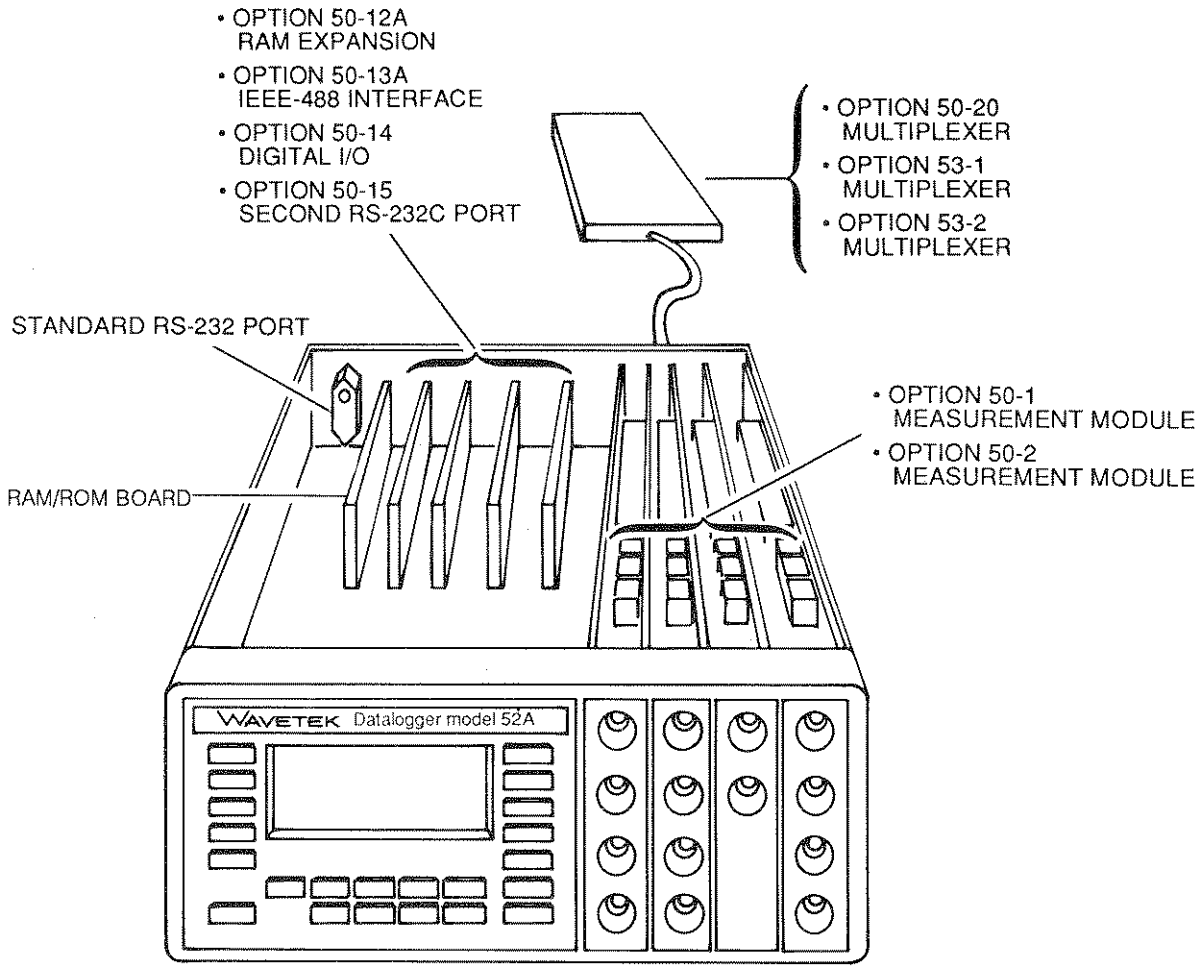


Figure 2-1. Model 52A

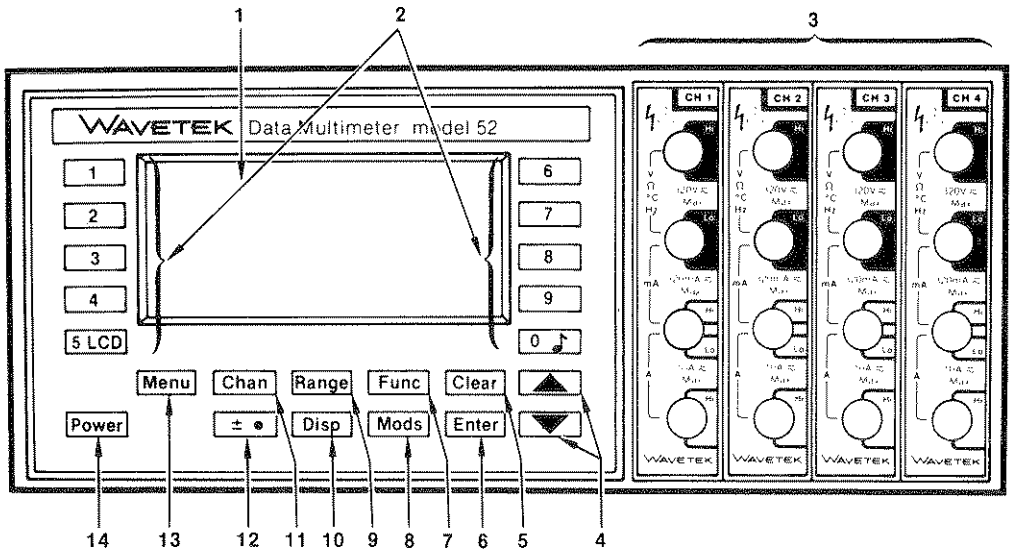


Figure 2-2. Model 52A Front Panel

2.2 THE MODEL 52A FRONT PANEL

The following paragraphs describe elements of a typical Model 52A front panel (figure 2-2). The indexed items in figure 2-2 are keyed to the following descriptions.

1 **Display** - This display, a 32 by 84 dot matrix liquid crystal graphics display (LCD), shows menus and readings which include channel number, function, and range.

2 **Numeric Keys** - These keys enter numeric value, make menu selections, control the keystroke beeper, and vary the display's viewing angle.

When menus are being displayed, keys [1] through [4] and [6] through [9] select menu items. The selection key for a given menu item is "pointed to" by the screen pointers < , >.

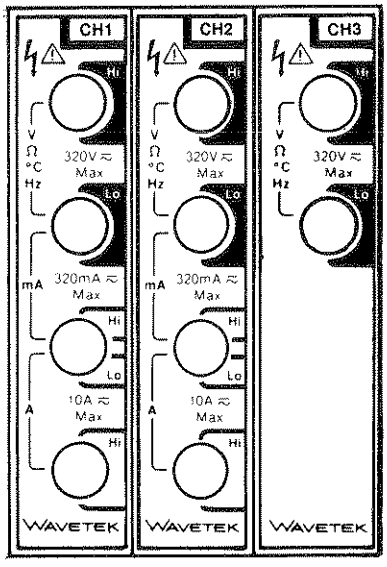
[5 LCD] and [0 ♪] perform other functions when not entering numeric values. [5 LCD] varies the "viewing angle" of the screen through eight "viewing angle" steps. [0 ♪] turns on or off the keystroke beeper.

3 **CH1 through CH4 Modules** -These modules are mix of up to four of two types of measurement modules (Options 50-1 and 50-2) that can be installed in the Model 52A.

The top two inputs (V, Ω, °C, Hz Hi and Low) provide the inputs for dc, ac, and ac+dc volts, dB, temperature (thermocouple connection), ohms, diode test, continuity, frequency, events, period, pulse width, time interval, and logic.

The second pair of inputs (mA Lo and Hi) provide the inputs for dc, ac, and ac+dc current and watts, VAac and VAac+dc below 320mA.

The third pair of inputs (A Lo and Hi) provide the inputs for dc, ac and ac+dc current and watts, VAac and VAac+dc above 320mA.



4 [▲] [▼] Cursor Keys - These keys are used to scroll menus and readings, as well as certain selectable items.

5 [Clear] - This key deletes numeric and character entries.

6 [Enter] - This key accepts a new entry.

7 [Func] - This key call a list of available functions (function menu) and steps to other groups of function menus. In the main menu, the Func key steps to groups of main menu items.

8 [Mods] - This key calls a menu which allows the selection of how the channel takes and responds to the reading (function Modifier). In the main menu, the Mods key steps to groups of main menu items.

9 [Range] - This key calls a menu which lists available ranges (range menu) for a selected function. In the main menu, the Range key steps to groups of main menu items.

10 [Disp] - This key calls a menu which allows selection of ways to display the reading (display modifier). In the main menu, the Disp key steps to groups of main menu items. In most menus, the Disp key steps to a "Help" display.

11 [Chan] - This key allows entry of a channel and subchannel number.

12 [± •] - This key changes the sign of an numeric entry. Also, it is used for placing a decimal point in a numeric entry.

13 [Menu] - This key aborts any new selection that has not been "entered" and returns to the last higher-level menu or the main menu. In the main menu, this key steps to a group of main menu items.

14 [Power] - This key instructs the microprocessor to turn Model 52A power on or off. Power is shut off by the microprocessor only after completion of its housekeeping chores. Power also can be automatically be shut off between groups of measurements in a program.

2.3 THE MODEL 52A REAR PANEL

The following paragraphs describe the elements of a typical Model 52A rear panel. The numbered items in figure 2-3 are keyed to the following descriptions.

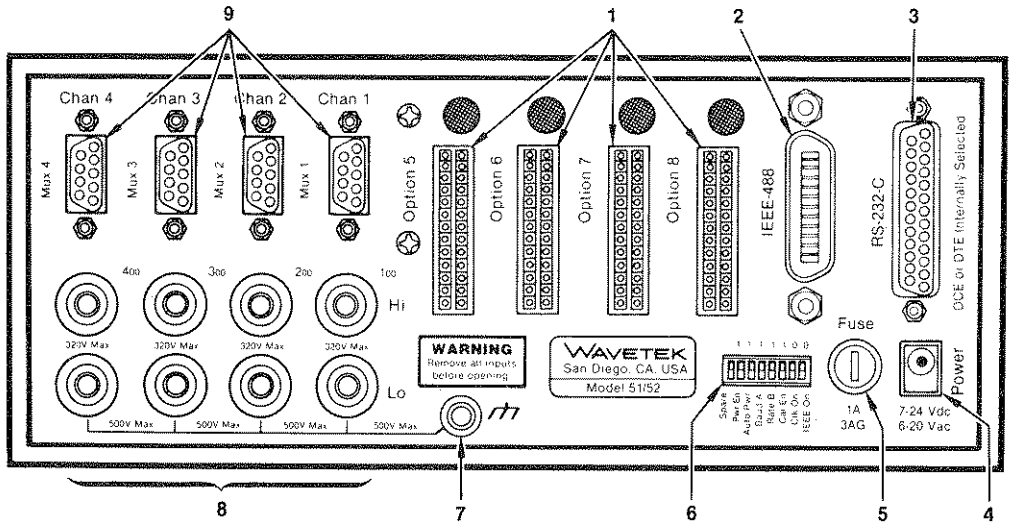


Figure 2-3. Model 52A Rear Panel

1 **Option (Positions) 5 through 8** - These option positions allow the installation of internal circuit cards (Digital I/O, Memory Expansion RAM) can be installed in various combinations.

Digital I/O Channel Card - This (Option 50-14) allows eight bits of digital input (read), eight of digital output (write), and analog output. The digital and analog outputs can be used for control applications. This card also allows the "stop" trigger input for time interval measurements. The Model 52A can contain a maximum of four Digital I/O cards.

Memory Expansion RAM Card - These memory cards expand the storage capacity of the Model 52A. There are two memory expansion options:

128K memory expansion (Option 50-12-128)

256K memory expansion (Option 50-12-256)

2 **Comm Port 2** - This position allows installation of either the optional IEEE-488 card (Option 50-13A) or the optional RS-232 card (Option 50-15).

IEEE-488 card (Option 50-13) supports the General Purpose Instrument Bus (IEEE-488 specifications) for instrument control and monitoring. The IEEE card allow talk and listen communication using IEEE-488-1978 conventions. IEEE-488 connector attached to the IEEE-488 circuit board by ribbon cable The IEEE-488 card can be installed in mother board connectors J11 (directly behind the Comm Port 2 connector) or position J10 (directly behind the Option (Position) 8 slot.The baud rate and configuration can be set up using the main menu's Comm Port 2 selection

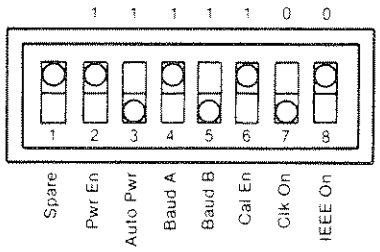
RS-232-C Serial card (Option 50-15) supports the RS-232-C standard. The baud rate and configuration can be set up using the main menu's Comm Port 2 selection.

3 **RS-232-C Serial Port** - This port is the Model 52A's standard remote interface with selectable baud rate using the rear panel switch or main menu (Comm Port 1).

4 **Power** - This is the power input for the Model 52A. The power source is a line transformer (furnished), 10 to 24 Vdc isolated source, or 8 to 18 Vac isolated source.

5 **Fuse** - Input power fuse is a 1A, 3AG type fuse.

6 **Switches**



Spare - Switch is undefined.

Pwr En - This switch disables or enables the front panel Power switch. In the closed position (switch down), this switch disables the front panel Power switch which keeps the power from accidently being turned on during shipment. In the open position (switch up), this switch enables the front panel Power switch.

Auto Pwr - This switch enables or disables automatic power. When enabled (switch up), any character sent over the RS-232-C turns power on. After receiving the character, Model 52A waits approximately 100ms before any RS-232-C data is accepted. When the switch is disabled (switch down), Auto Pwr is disabled.

Baud A and Baud B - These switches select the default RS-232-C baud rate, which the Model 52A reads at power on. The baud rate also can be set from the main menu "Comm Port 1", but resets to the rate selected by the switches at power-on.

Baud A	Baud B	Baud Rate
Up	Up	300
Down	Up	1200
Up	Down	9600
Down	Down	76.8k

Cal En - This switch enables or disables calibration. Calibration must be enabled (switch up) before calibrating the Model 52A. Calibration must be disabled (switch down) to protect from accidental calibration.

Clk On - This switch disables or enables the internal real time clock. If the unit is unused for a long period (>1 month) without external power or the Option 50-11 internal batteries, the clock should be disabled (switch up).

Turning off the clock power increases the life of the lithium RAM battery. Sliding the switch down enables the internal real time clock.

IEEE On - This switch enables or disables power for the IEEE-488 option. When enabled (switch down), and using an external power source, power is applied to the IEEE-488 board.

7 **Grounding Jack** - This jack is used to connect the Model 52A to earth ground. Maximum differential voltage between the grounding jack and any Lo connector is 500V.

8 **Hi and Lo Signal Inputs** - These are the rear panel connectors to the measurement modules. The connectors accept banana jacks. These connectors can not be used to measure current (Aac, Adc, and Aac+dc), watts (Wdc), and volt-amperes (VAac and VAac+dc).

9 **Multiplexer Control Output** - These outputs provide control for the measurement modules' external multiplexers, which expand the modules subchannels up to 64 for each module.

2.4 POWER

Power Supplies

Wavetek ships the Model 52A with a power supply to match a users specific line voltage requirements.

90 to 132 Vac, 50/60Hz,<16VA.
180 to 260 Vac, 50/60Hz,<16VA.

The Model 52A may be powered by an external ac or dc source. To connect the Model 52A to an external source, use a power connector (female plug: 2.5mm inside diameter, 5.5mm outside diameter): Electro-Mech part number 1030-4 or equivalent (available from Radio Shack).

DC source: +12 to +24 Vdc
AC source: 9 to 18 Vac (isolated only)
Typical drain: approximately 100mA
Maximum drain (all four channels running without IEEE-488): 400mA at 12Vdc.
Standby current: ~100uA
IEEE-488 current: approximately 500mA.

CAUTION

When removing or installing option boards inside the Model 52A, you must disconnect external power supplies or sources and the internal battery option, if present, otherwise the instrument could be damaged. The lithium RAM battery should not be removed.

To prevent damage to the instrument, check for proper match of line and transformer voltage and proper fuse type and rating.

Batteries

The Model 52A can be powered by an internal rechargeable battery (Option 50-11). The Option 50-11 Rechargeable Battery does not need routine replacement. If it does need replacement, refer to the Model 52A Maintenance Manual.

Battery Jumper

When the Model 52A does not contain a battery option, a battery jumper is installed in the battery socket J6. Also, the battery jumper must be used if the Model 52A came with a battery option and the batteries are not installed. Figure 2-4 shows battery jumper installation.

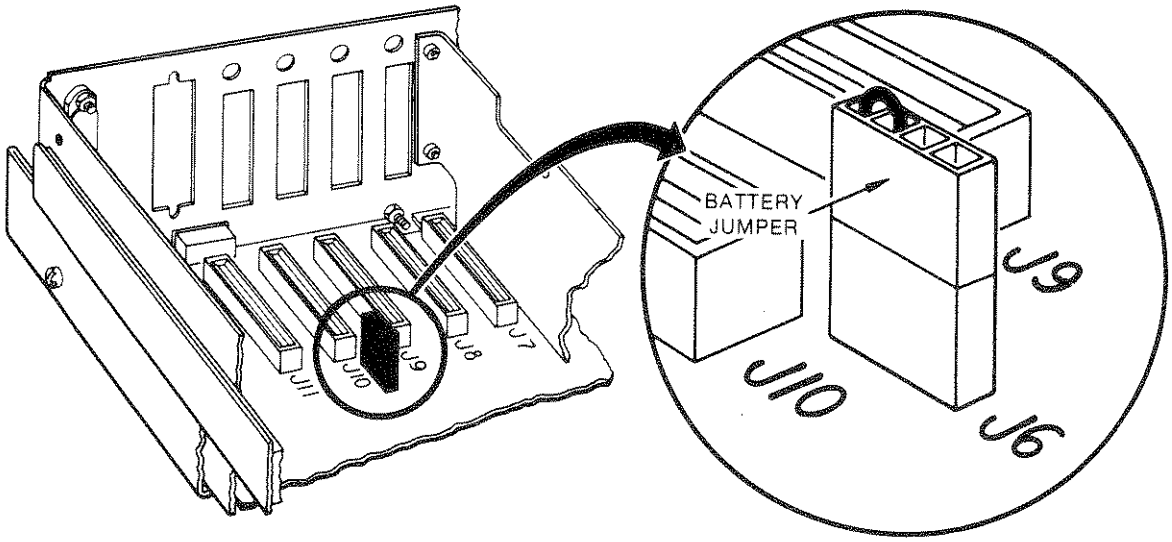


Figure 2-4 Battery Jumper

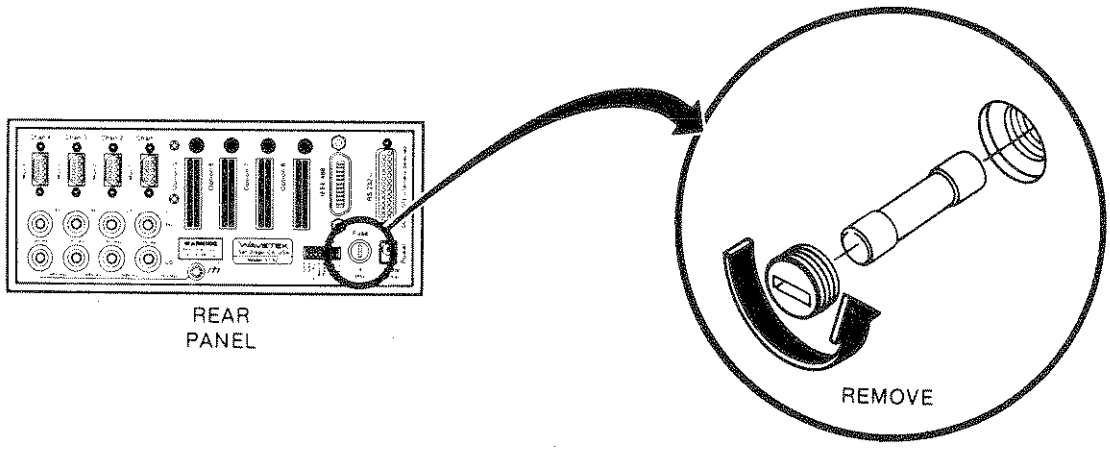


Figure 2-5. Power Fuse

2.5 FUSES

The Model 52A uses three types of fuses:

Rear panel power fuse.
Measurement module dc overload fuse.
Battery charger fuse.

Power Fuse

The power fuse, located on the rear panel, is a 1A, 3AG type fuse. Figure 2-5 illustrates the replacement of the power fuse.

DC Current Overload Fuse

The 320mA input to the Option 50-1 Measurement Module is protected by an 1A, 3AG type fuse. This fuse is accessible from the bottom of the Model 52A. Figure 2-6 illustrates replacement of one of the overload fuses.

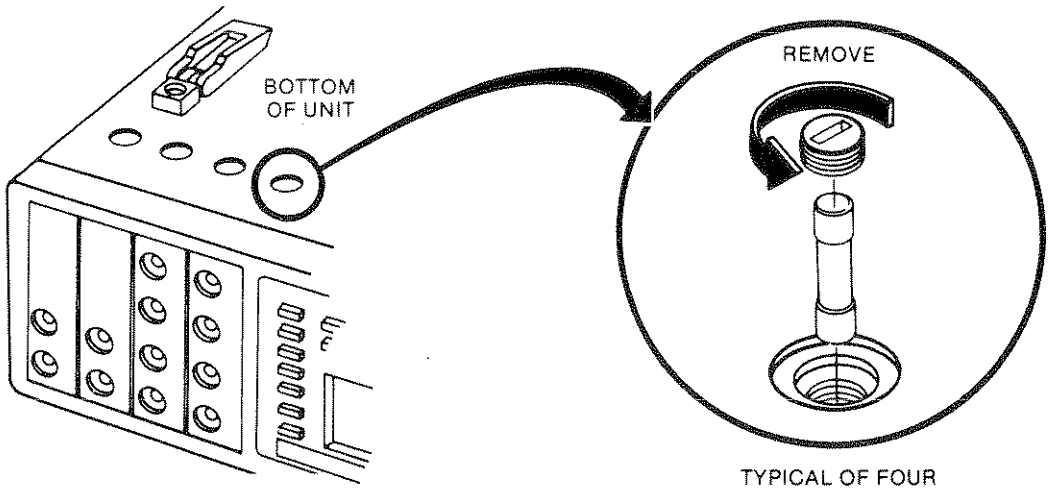


Figure 2-6. DC Current Overload Fuse.

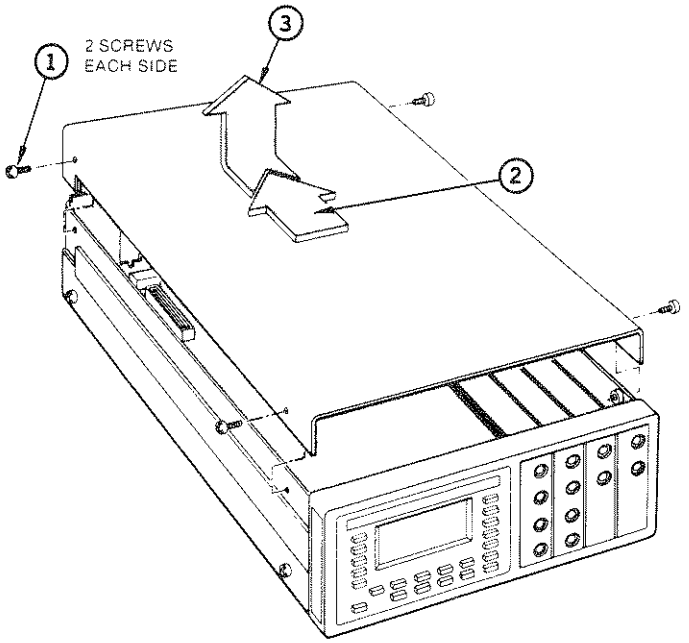


Figure 2-7. Top Cover Removal

Battery Charger Fuse

The battery charger for the Option 50-11 Rechargeable Battery is protected by a 1A, 3AG type fuse. Option 50-11 Rechargeable Battery is attached to the top cover. The following procedure describes the battery charger fuse replacement.

1. Disconnect the Model 52A from the power source.
2. Remove the top cover; see figure 2-7.
3. Disconnect the battery cable from J6; see figure 2-8.
4. Remove the battery charger fuse cover; see figure 2-9.
5. Replace the fuse with a 1A, 3AG type fuse.
6. Replace the battery charger fuse cover, connect the battery cable to the circuit board (figure 2-8) and replace the top cover (figure 2-7).

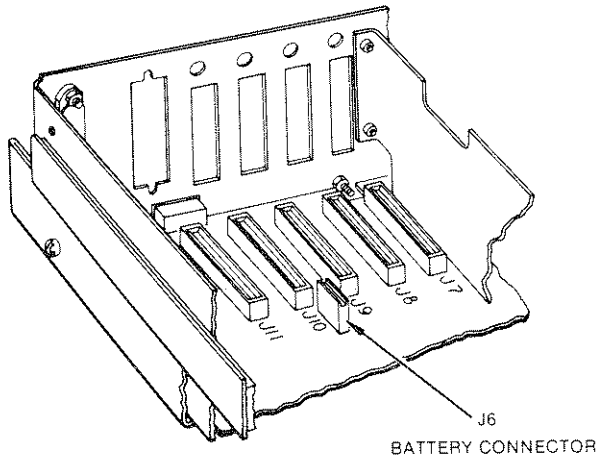


Figure 2-8. Battery Connection

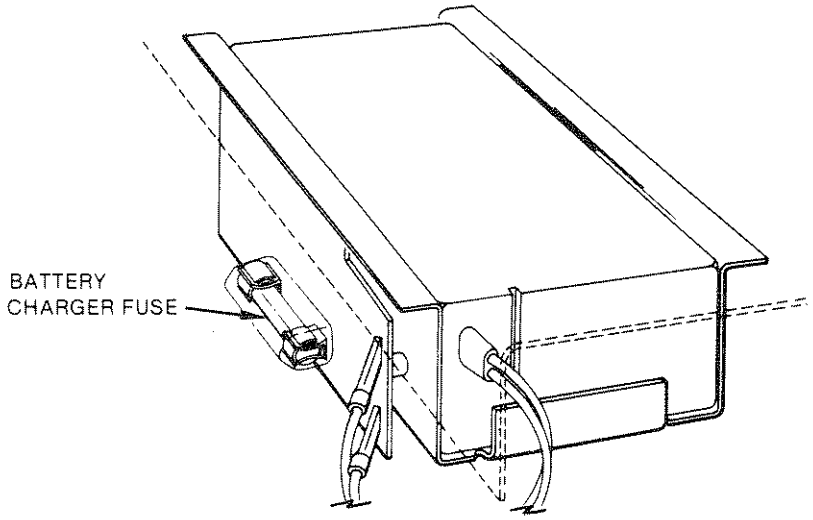


Figure 2-9. Battery Charger Fuse

SECTION 3
OPERATION OVERVIEW

3.1 TYING IT ALL TOGETHER

Section 3 gives you an overview of how features are used together to do practical applications. After you read this section thoroughly, you will understand the main issues in programming the 52A and be able to find detailed information quickly and accurately.

Section 3.2 covers general pushbutton operation. Section 3.3 introduces the main menu, and discusses the order that main menu items are typically accessed by a user:

3.3 Main Menu
3.3.1 Elements
3.3.2 Top-level Main Menu or Key Groupings:
Installation and Preliminary Setup
Operating Menus
Filing Operations
Recalling Stored Data

Section 3.4 discusses major programming concepts needed to successfully "design" practical application solutions:

3.4 Programming Concepts
3.4.1 A Shorthand Notation
3.4.2 Model 52A DMM
3.4.3 Channel (Measurement) Lists
3.4.4. Datalogging Structures Beyond Channel Lists
3.4.4.1 Introduction
3.4.4.2 Model 52A Programs
3.4.4.3 Conditional List Switching

Sections 3.5 through 3.10 discuss other major features that are used in many applications:

3.5 Math
3.6 Alarms
3.7 Controlling External Devices From Option 50-14, Digital Outputs
3.8 Chart Recorder Driving
3.9 Recalling Stored Data
3.10 Printing And Plotting

Section 3.11 discusses routing and modification of a measurement reading. It also includes a detailed "checklist" (paragraph 3.11.2) of all the suggested mental and physical steps to a successful datalogging run:

3.11 Wrapping Up
3.11.1 Real Time Data Routing
3.11.2 Get Ready To RUN

3.2 PUSHBUTTON OPERATION

Turn the 52A on by pressing the [Power] button on the front panel. Feel free to experiment by pressing a pushbutton key as it is being described.

Note
If the 52A doesn't turn on at all, try flipping the Pwr En dip switch on the rear panel; consult paragraph 2.3, item 6, if needed. If the unit displays TRAVEL MODE, then shuts off after 5 seconds, turn it on again, and press [5 LCD], [2], [Enter]. This will keep the unit on.

What you can select from a menu

Anytime there is a **<** (pointer) at the left side of the 52A screen, or, a **>** at the right side of the screen, this is a selection that you may make. Pressing the pushbutton next to the **<**, or **>**, makes the pointer go dark, showing that the selection is acknowledged by the unit. The meaning of the key is defined by what the 52A displays next to it. This is called a "soft key".

Sometimes there are more choices available in a menu than can be shown on the screen at one time. These choices can be scrolled up by using the [▼] key or the [▲] key. Usually, a ≑ symbol appears on the display to remind you when there is more material.

If you get "lost". If you get lost, a sufficient number of [Menu] key presses will get you back to a menu you recognize - completely back to the main menu, if necessary.

The [Enter] pushbutton is an example of a "hard key" - it always does what the key cap name implies. Pressing the [Enter] key brings up the next menu in a sequence, or finalizes a selection in a menu where more than one selection may be possible. It also finalizes a numeric or alphanumeric entry such as a math formula or a name you entered for a list of measurements. Pressing the [Clear] key "erases" a selection or selections that you made in a menu. Pressing the [Menu] key, *in general,* backs you up to the previous menu. When in doubt, you will refer to the Menu Navigation Map for the menu tree you are in (explained later), or read the appropriate material in the manual for the menu currently on the 52A screen.

Help information. In the main menu, to get a short summary of an item's purpose, press the pushbutton key ([6], [7], [8], or [9]) to the right of the item. In lower level menus, sometimes the right hand key is not available for the help function. In that case, try pushing either the [1] key at the upper left of the menu title currently being displayed, or, try the [Disp] key when [1] would enter the number 1 into a numeric entry screen. Help screens are not available on all menus.

3.3 Main Menu

3.3.1 Elements

The main menu, the first menu shown at power on, consists of 19 items. The 52A screen shows four items of the main menu at a time. There are "menu trees" under most of the selections on this menu, although some of the main menu selections lead only to one other menu. Main menu operation is explained in Section 4.

The Main Menu
DMM
Channel Lists
Programs
Help
Memory Status
Recall Data
Full Mem Mode
Load/Save
Scroll Speed
Keyboard Lock
Time/Date
Configuration
Math
Alarms
Tracking
Power Control
Calibrate
Comm Port 1
Comm Port 2

All items are explained in detail later; some have a complete section of the manual.

Item	Summary
DMM	For measuring a single input signal. Less complicated than a channel list, but will not automatically store or transmit measurement readings as a channel list can be set up to do.
CHANNEL LISTS	For creating a list (for one or more measurement channels) of measurement setups for measuring several input signals at the same time, or several in a particular sequence.
PROGRAMS	For creating a datalogging framework that uses existing channel lists to make measurements. Attaches start and stop conditions, intervals, repeat counts, etc.
HELP	For picking one of several general help or information screens.
MEMORY STATUS	For seeing how much memory is used up. You consult this before starting a data logging run that would store measurement readings in 52A memory. If memory is too full, you would Clear out some data before you start.
RECALL DATA	For routing previously stored measurements in the 52A to the display, or a communications port on the back.
FULL MEM MODE	For determining what the 52A will do automatically when its internal memory is full.
LOAD/SAVE	For sending or receiving setups, data, or calibration constants to or from an external computer or terminal.
SCROLL SPEED	For setting the [▲] [▼] pushbutton key response speed, as part of preliminary setup. Also for setting the speed that multichannel measurement readings are rotated vertically, or "scrolled" up through the display window.
KEYBOARD LOCK	For entering a keypad lockout code. For keeping unauthorized personnel from using the 52A, or from deleting your setups or stored data.

Item	Summary
TIME/DATE	To set the Model 52A internal clock.
CONFIGURATION	For seeing what options and what measurement modules are installed.
MATH	For creating user-defined formulas and tables for modifying real time ("as they are being taken") measurement readings.
ALARM	For setting conditions that can monitor a measurement and signal or do something when your conditions are met.
TRACKING	For setup of up to four analog (or digital) outputs which can produce an output directly proportional to measured data. Used for chart recorder driving. (Requires a 50-13 option.)
POWER CONTROL	For turning on and off Travel Mode. Also, the Power Save selection in the menu turns off measurement modules when not in use. This saves battery power when using the 50-11 rechargeable pack.
CALIBRATE	For seting the frequency of line rejection (50 or 60-Hz).
COMM PORT 1	For setting the parameters for communication port 1.
COMM PORT 2	For setting the parameters for communication port 2.

3.3.2 Top-level Main Menu or Key Groupings

There is a typical sequence that most users access the main menu items in. They fall into groups:
- Installation and preliminary setup items
- Operation items (creation and use)
- Filing operations (saving, copying, restricting access, etc.)
- Recalling stored data

Installation and Preliminary Setup

Typically, installation type items are set or checked only once.

POWER CONTROL To undo Travel Mode, if necessary, to keep the 52A on.
[SHIFT] [LCD] To set viewing angle.
CONFIGURATION
SCROLL SPEED To adjust [▲] [▼] key speed.
TIME/DATE
CALIBRATION To set the frequency of line (50 or 60 Hz) rejection.
COMM PORT 1
COMM PORT 2

Installation and preliminary setup items are covered in detail in section 4.

Operating Menus

The operating menus are set differently depending on each measurement or datalogging task.
With the exception of MEMORY STATUS and FULL MEM MODE, there is a whole section devoted to each operation menu.

Primary operating menus

DMM Overview: paragraph 3.4.2. Details: section 5.

CHANNEL LISTS Overview: paragraph 3.4.3. Details: section 6. (If the 52A is to show a multichannel display, SCROLL SPEED is used to adjust channel data scroll speed. SCROLL SPEED details: section 4. If using internal memory for storage of the measurement readings, MEMORY STATUS should be checked, and a FULL MEM MODE chosen. MEMORY STATUS and FULL MEM MODE details: section 4.)

PROGRAMS Overview: paragraph 3.4.4.2. Details: section 7.

Other operating menus

MATH Overview: paragraph 3.5. Details: section 9.

ALARMS Overview: paragraph 3.6. Details: section 8.

TRACKING Overview: paragraph 3.8. Details: section 12.

Filing Operations (Loading, Saving, Copying, etc.)

Filing operations allow lists or Programs to be loaded from a computer, copied, edited, etc. Filing is applicable once there is a channel list or Program to "file". (You created one or more from scratch, starting with selecting CHANNEL LISTS or PROGRAMS, or, loaded in one that was stored externally, using the LOAD/SAVE menu.)

LOAD/SAVE Details: paragraph 4.4.2.

Filing a Channel List

```
"Example.L"
<Clear      Run>
<List-P1  Edit>
<Copy   Rename>
```

In a filing menu is where you would actually start a datalogging run. The filing menu shows up when the creation of a channel list or Program is completed, and, when you select your creation by name, later.

For a Program

```
"Example.P"
<Lock       Run>
<List-P1  Edit
<Copy   Rename>
```

Not shown on the Program filing menu is "Clear". This choice is available - use the [Clear] hard key.

KEYBOARD LOCK For restricting access to your programming or datalogged readings. Details: paragraph 4.4.2.

Recalling Stored Data

RECALL DATA Having Run a channel list and perhaps Program, if you set up the channel list to store data (measurement readings), then you would use RECALL DATA to begin extracting the data from the 52A. Overview: paragraph 3.9. Details: section 10.

3.4 PROGRAMMING CONCEPTS

3.4.1 A Shorthand Notation

Model 52A measurement setups and programs will often be explained using a shorthand notation. The concentration is on when and how many times the 52A makes the measurement. See figure 3-1.

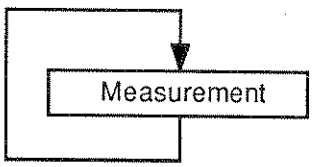


Figure 3-1. Continuous DMM Measurements

Figure 3-1 has a loop around the block called Measurement. Flowcharting is traditionally top to bottom, with blocks above performed before the blocks below. The loop around the measurement block means that the measurement is being performed continuously by the DMM.

3.4.2 Model 52A DMM

A traditional DMM setup requires you to specify the function to measure, the range, and perhaps whether or not the readings are to be averaged before being displayed (display modifier).

The Model 52A DMM mode has the same kinds of selections. In addition, the channel number must be specified. The 52A DMM has the following selectable display modifiers (found in the "Disp" menu) for analog measurements:

Max	Displays, stores, and transmits the maximum reading on the channel so far.
Min	Displays, stores, and transmits the minimum reading on the channel so far.
Average	Displays, stores, and transmits the average of the last n readings. You specify what number n is.
Delta	Displays, stores, and transmits the difference between the current measurement value, and either a number you preset or the first reading.
Resol	Selecting this item brings up another menu allowing you to change the resolution (number of digits displayed) of the reading.
Scale	Allows attaching a math function (only its function number) to the measurement. Then the raw measurement values from that channel will be the input to the function. (You set up the function separately, under MATH on the main menu, and assign the function a number.) Then the DMM will display, store, and transmit the output value of the math function, instead of the original measurement channel reading.

These "display" modifiers modify the data value before it is routed to display, storage or a comm port.

The 52A DMM also has function modifiers:

Delay	Allows a pre-delay to be set ahead of each measurement.
Alarm	Allows the number of an "alarm" to be attached to the channel.
Tracking	For attaching the number of an output setup for driving chart recorders to be attached to the channel.

52A DMM operation is covered in detail in section 5.

3.4.3 Channel (Measurement) Lists

The 52A lets you store several measurement setups in its memory, for convenient later use. This is the Channel List mode. Your measurement setups in this mode have the same ingredients as in DMM mode - plus, each setup must be given a unique name. This is so that an individual channel list may

be referred to later. The channel list mode allows several measurements with different channel, function, range, etc. parameters to be taken in sequence or in parallel.

In local operation, to enter the channel-list-setup mode, or to be able to choose from among previously made channel lists, you would select CHANNEL LISTS in the main menu. Here are the basic ingredients for a channel list.

Name your measurement list is to have
Whether measurements on different channels are to be done in parallel or serial
Where measurement readings (data) are to go (e.g., memory) and, *for each measurement:*
Channel number
Function
Range
One or more optional display modifiers (for example, MAX gives the maximum reading as the current reading)
One or more optional function modifiers (delay, alarm, and tracking)

In creating your list of measurements, the channel list menus will help you by presenting all of the choices. Note the similarity of the last five items to the DMM setup (channel, function, range, etc.). Where the 52A DMM has five parameters, each with a menu, for its one measurement, a channel list has the same five parameters for *each* analog measurement. You don't have to choose something in each menu, however - the 52A will supply default choices.

The list also has the information telling the 52A where to route the measurement data that the list generates. You may choose any or all of the items in a menu named DATA TO. The choices are:
Comm Port 1,
Comm Port 2 (both on the rear panel),
52A internal Random Access Memory ("RAM"),
Local Display.

Measurements in a list may be shown in block form as in figure 3-2, with as much detail as one requires.

A measurement is anything that generates a "reading". Each time a measurement is made, it generates one datum which may be stored, displayed, printed, and plotted. So, in figure 3-2, for each pass through the measurement list above, each measurement shown produces one reading.

The measurements in the figure have a loop around them, meaning that the list is run or "scanned" continuously. The rate of data acquisition can be slowed down somewhat by placing a "pre-delay" (up to 9.1 minutes) ahead of one or more measurements. The process of attaching a pre-delay of a certain value to a measurement begins in the "Mods" (attachments) menu.

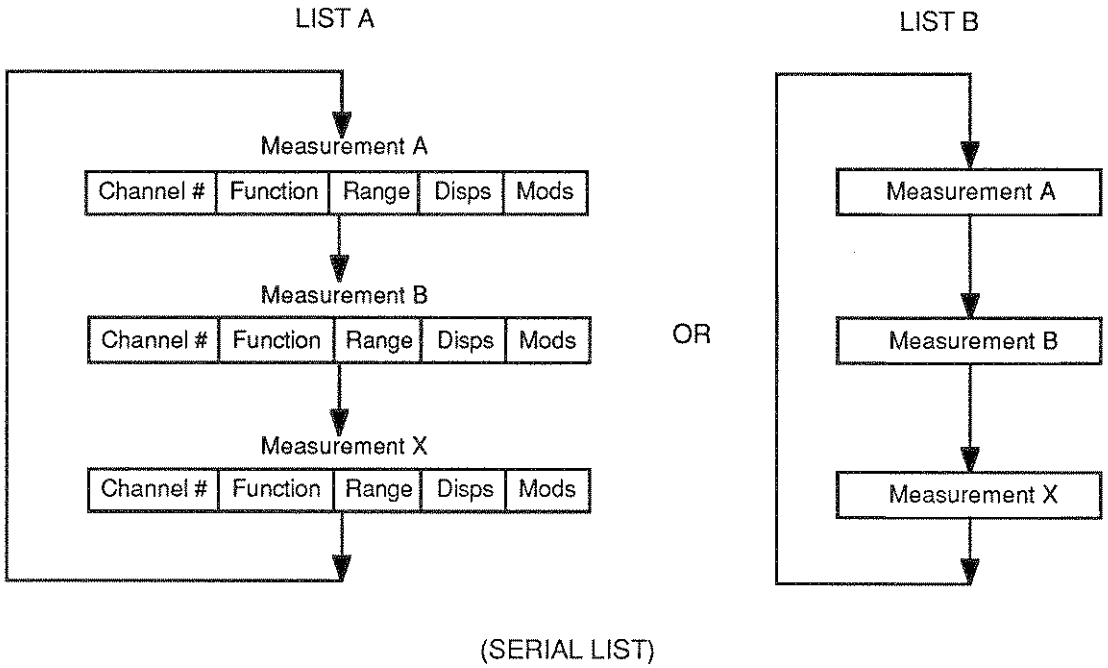


Figure 3-2. Channel Measurements

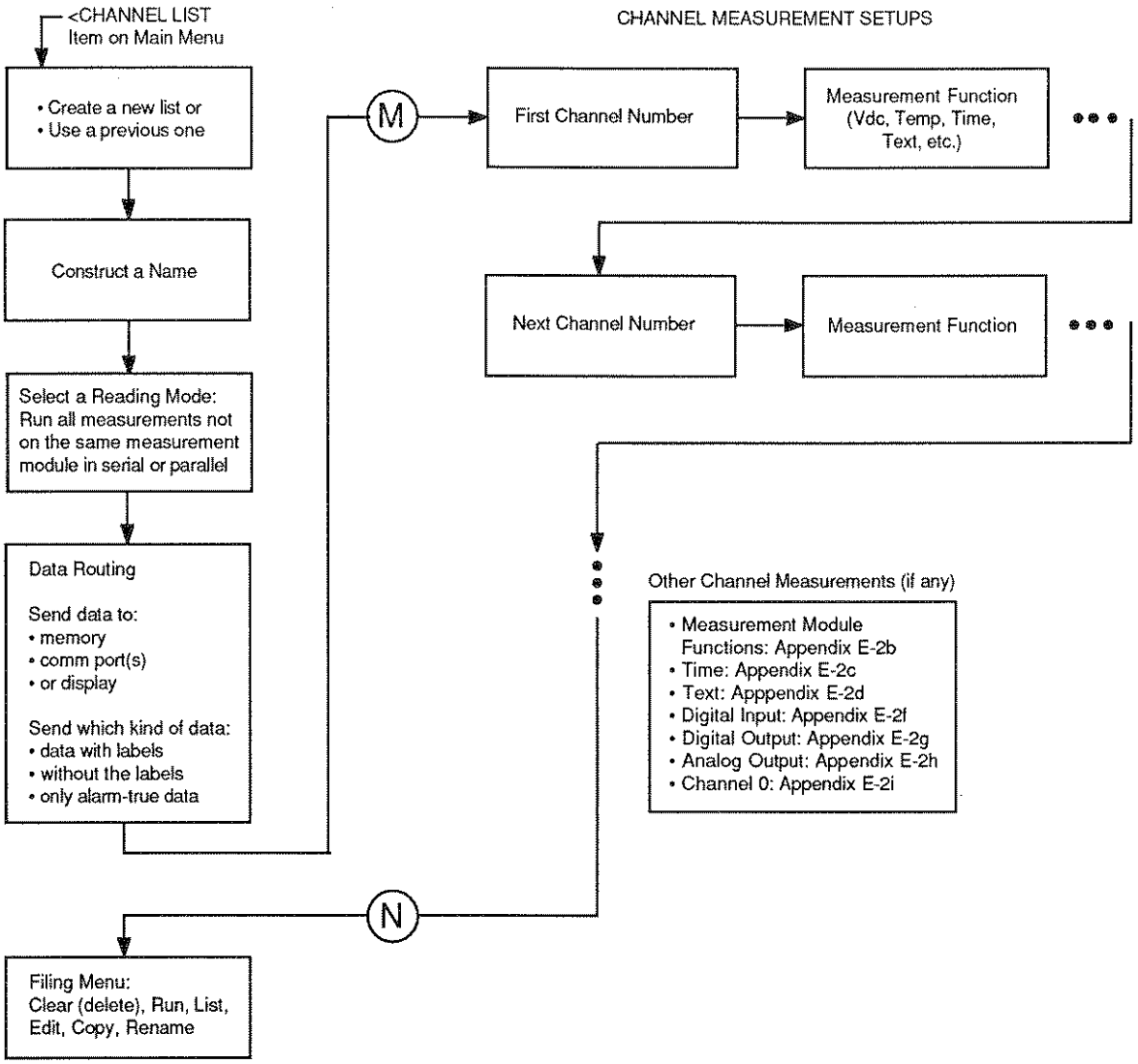
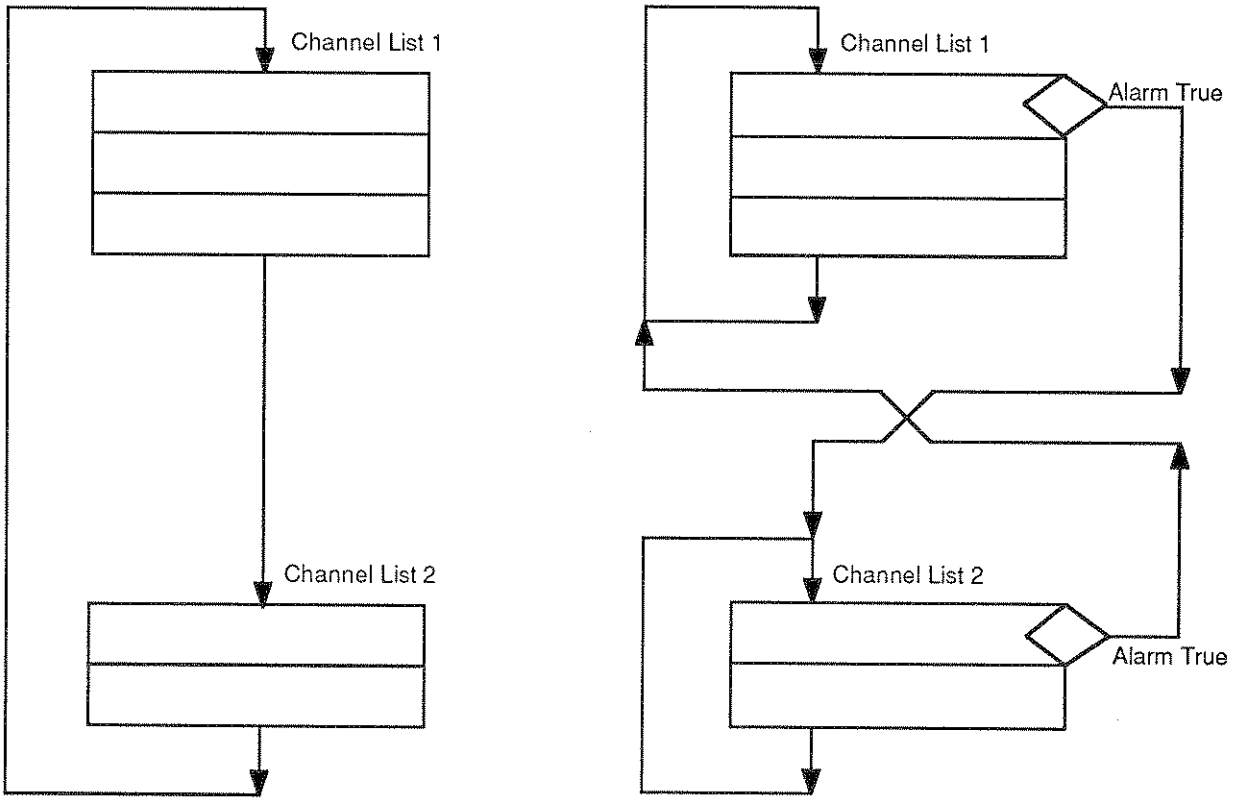


Figure 3-3. Simplified Channel List



a. Sequential Lists

b. Conditional Switching Lists

Figure 3-4. Sequential Vs. Conditional Switching Lists

In figure 3-3, the major menu groups of the channel list setup sequence are shown. From the point marked M to the point marked N, the menus are shown in the general case - the menu structure changes somewhat depending on what kind of channel is to be measured. (See the box labelled "Other Channel Measurements".)

3.4.4 Datalogging Structures Beyond Channel Lists

3.4.4.1 Introduction

A wide variety of datalogging applications require that channel lists be chained serially, or started or stopped by time. The 52A has a powerful "canned" set of menus called a Program which allows channel lists to be chained unconditionally (paragraph 3.4.4.2). Other types of datalogging applications require conditional list switching, (paragraph 3.4.4.3).

For understanding the relationship of two or more channel lists, lists may be reduced to just blocks. See figure 3-4.

In figure 3-4a, the 52A would make one scan of List 1, then make one scan of list 2. The repeat count for each list could be changed. This is unconditional serial linking of lists by Programs.

In figure 3-4b, the operation only changes from one list to another when the condition of the alarm attached to a measurement is true. As long as the alarm is false, the 52A repeatedly scans the list it is in indefinitely. The alarms are shown as the diamonds (decisions) drawn at the right side of the measurement. When one of the alarms attached to a measurement goes true, the response (preset in the alarm setup) is to jump to a named list.

3.4.4.2 Model 52A Programs

Programs are a powerful "canned" set of menus for setting up controls on when channel lists will be

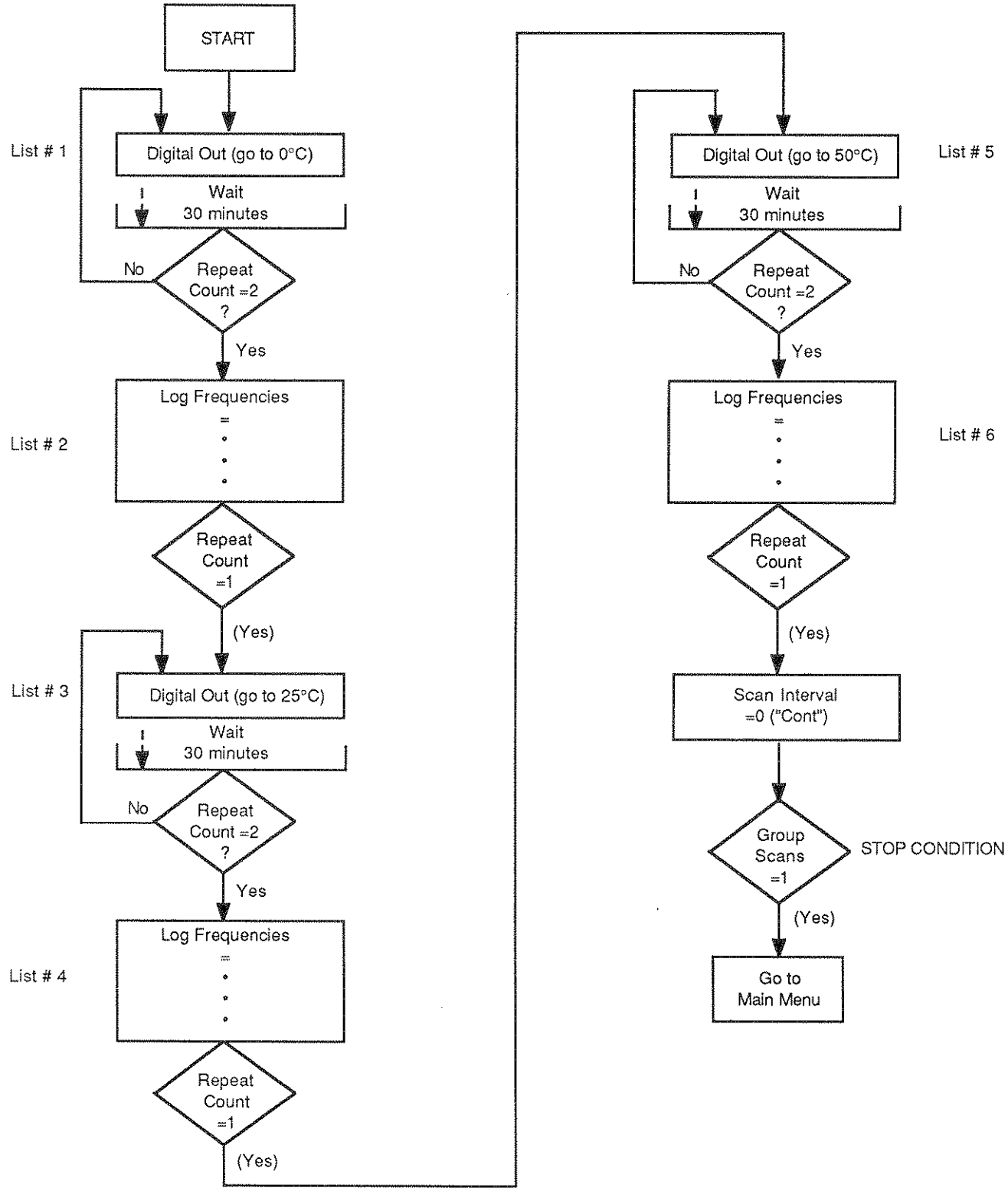


Figure 3-5. 52A Program For Oven Controller

automatically run. The Program structure provides extreme versatility in setting of automatic start and stop controls, scan intervals, repeat counts, etc.

Program creation is started by selecting PROGRAMS on the main menu. Here are the basic ingredients for a Program.

Name your Program is to have.
Storage parameters: Will the readings only be stored, or also labels, etc.
Start condition: Now, some time later, or an external input.
What channel lists are to be scanned by the Program (the "scan group").
For *each* channel list, a repeat count, and a time interval between scans of the list.
Scan interval between scans of the whole scan group.
Stop condition: A time, a number of passes through the scan group, or an external input.
What to do at the Program end: Run another channel list or Program, turn the 52A off, return to the main menu, or automatically recall stored data from memory and print or plot it.

Often, there are different sets of measurements that must be made at different times. If it is known when these measurements are to take place, a Program can be used to chain the appropriate channel lists together. For an example, diagrammed in figure 3-5, a Program will control lists which will log the frequencies of prototype VCOs when they are at certain temperatures as provided by an environmental test chamber. The 52A will control the oven temperature with the digital bit outputs of its Digital I/O board. You want to record the VCO frequencies at 0°C, 25°C, and 50°C. You don't want to record the VCO frequencies unless the oven has stabilized at each temperature for, say, 3 minutes. Filling up memory or printing out in between readings would obscure the trends or data you want to see.

The Program, using timing intervals that you would set, will allow time for the oven to reach the correct temperatures, before making the measurements of the VCO frequencies.

The timing and the measurements for this VCO logging application are summarized as follows:

1. List #1: "command" the oven to go to the first temperature, 0°C. Then wait 30 minutes (time depends on your oven). When the waiting interval is complete, run channel list #2.
2. List #2: log the frequencies of all the VCOs. Upon scanning this list once, go to list #3.
3. List #3: command the oven to go to the second temperature, 25°C. Then wait 30 minutes. When the waiting interval is complete, run channel list #4.
4. List #4: log the frequencies of all the VCOs. Upon scanning this list once, go to list #5.
5. List #5: command the oven to go to the third temperature, 50°C. Then wait 30 minutes. When the waiting interval is complete, run channel list #6.
6. List #6: log the frequencies of all the VCOs. Upon scanning this list once, end the program with no preset actions after that. The Model 52A will return to the main menu.

(A nice touch might be to have a final list which turns on an external buzzer, and displays a message from a text channel.)

Figure 3-5 illustrates this application as you might draw it to organize your thinking. It shows six lists. Lists 1, 3, and 5 are just "waiting" or monitoring lists, and there is one list (2, 4, and 6) for logging frequencies at each temperature when the oven has stabilized.

One note: the repeat count for lists 1, 3, and 5 must be set to 2 , because the time interval for a list does not become activated if the repeat count is only 1.

Data routing. In waiting lists such as 1, 3, and 5, the data values of their measurements are often irrelevant, and storage of their readings should be turned off. There are two ways this may be done:

Storage of all measurements in the list can be inhibited by deselecting RAM in the list's DATA TO: menu (located in the Overhead Menus group, see appendix E-2a).
If you want to inhibit only some measurements in the list from reaching memory, select RAM in the DATA TO: menu, then *deselect* ACTIVE in the particular measurement's Function Mods menu.

Details on Programs are in section 7.

3.4.4.3 Conditional List Switching

Sometimes the data logging has to wait for a process to reach a certain state, and it is unknown how long the process will take to reach the state. For example, you might be logging the frequencies of prototype VCOs when they are at certain temperatures as provided by an environmental test chamber. The 52A will control the oven temperature with the digital bit outputs of its Digital I/O board. You want to record the VCO frequencies at 0°C, 25°C, and 50°C. You don't want to record the VCO frequencies unless the oven has stabilized at each temperature for, say, 3 minutes. Filling up memory or printing out in between readings would obscure the trends or data you want to see.

A Program, with its set timing intervals, is not always the best programming structure for this type of application. You could allow extra time in the Program for the process to reach certain states, but the margin you must build in generally means that a Program will not finish the job in the shortest possible time.

Fortunately, with the decision-making capability of alarms, a series of channel lists handles this type of job quite nicely. The alarm decisions and responses for the above example can be summarized as follows:

1. (The oven is "commanded" to go to the first temperature, 0°C.) Is the oven at 0°C yet? *If yes*, then go to 2.

2. Log the frequencies of all the VCOs. Done with logging the first set of readings? *If yes*, Then go to 3.

3. Command the oven to go to the second temperature, 25°C. Is the oven at 25°C yet? *If yes*, then go to 4.

4. Log the VCO frequencies. Done with logging the second set of readings? *If yes*, then go to 5.

5. Command the oven to go to the third temperature, 50°C. Is the oven at 50°C yet? *If yes*, then go to 6.

6. Log the VCO frequencies. Done with logging the third set of readings? *If yes*, return to main menu.

Figure 3-6 illustrates this application as you might draw it to organize your thinking. It shows six lists. Three lists are just "waiting" or monitoring lists (1, 3, and 5), and there is one list for logging at each of the three temperatures when the oven has stabilized. Note that a short pre-delay could be put ahead of the first frequency measurement in each logging list, to allow the oven temperature to go that last 1°C.

To make the 52A jump out of a list unconditionally when the last step in a list is reached, a forced alarm (F.A.) is set up. To do this, the alarm thresholds are set to overlap so that the alarm is always true (for example, is X greater than or equal to 0, *or*, is X less than or equal to 0). This last measurement in the list could be one of time, or any other measurement to which an alarm can be attached.

3.5 MATH

Math formulas are set up starting with selecting MATH on the main menu. Each formula set up is assigned a formula number from 1 to 99. Math formulas are used to change the measurement values as they are produced (real time measurements). Math may not be used on stored data when it is being recalled from memory.

There are two general classes of usage for formulas:

Single channel *scaling*. The formula operates only upon one measurement channel, is associated (attached via the formula number) to that channel, and the output of the formula is labelled as coming from the original measurement channel (for example, channel 102, a measurement module output). The original, "raw" measurement value is thrown away. When you want to recall the data from storage later, if sorting, you would recall channel 102's data. When using a formula for scaling, it does not get its own line (an entry) in the channel list.

Interchannel calculation. The formula typically (but not necessarily) has as inputs more than one measurement channel. For example, it could subtract the current value of channel 1 from the current value of channel 2, to produce a difference. The difference is labelled as coming from "channel" 0xx, xx being the formula number you assigned. The inputs to the formula, the channels 1 and 2 data, are not thrown away. The channel list for this example would list the channel 1 measurement first, then the channel 2 measurement, then the channel 0 "measurement". For each run through the list, when operating, the Model 52A normally produces three data points that may be stored, displayed, etc.

By using interchannel calculations, indirect data such as derivatives, integrals, and anticipated values can also be generated. These could then be compared to alarm thresholds.

Tables are somewhat like scaling in their application. They are typically used when a linearization table for a particular type of sensor has not been provided in firmware by the factory. A table is a 1 to 1 look up table, having up to 255 pairs. Both columns of data are entered by the user. (Datalogging may be required under known conditions before the user can compile a set of points.) When using the sensor later, for unknown temperatures, the unit uses the table to match the measured value (for example 2.1mV) to a temperature, and display the temperature. The 52A microprocessor provides straight line interpolation between points in the table.

3.6 ALARMS

Alarms, like math, operate only upon real time measurement data. An alarm is a setup that makes one of the following threshold type decisions:

Is the channel measurement value less than a threshold?
Is the channel measurement value greater than a threshold?
Is the channel measurement value between the two thresholds?
Is the channel measurement value outside the two thresholds?

The alarm *response* to a "yes" or true can be any or all of the following:

Sound a tone on the 52A beeper.
Exit the list, return to main menu.
Send a bit or byte pattern to a digital output card.
Jump to another list or program permanently.
Jump to another list or program temporarily (Gosub).

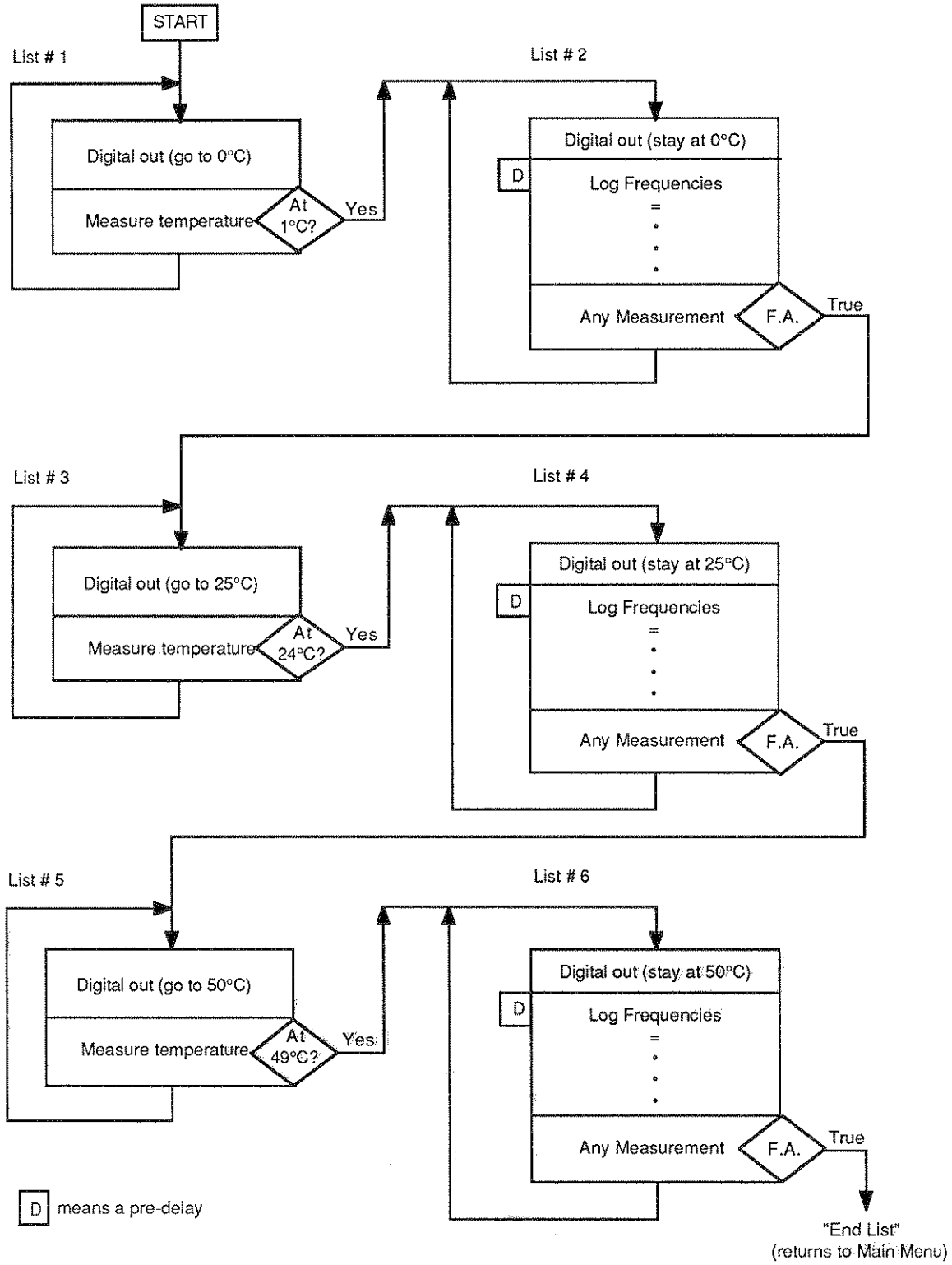


Figure 3-6. Conditional Switching Lists for Oven Controller

Transmit the measurement datum via comm port 1.
Transmit the measurement datum via comm port 2.
Show it on the display.
Store it in memory for later recall.

3.7 CONTROLLING EXTERNAL DEVICES FROM OPTION 50-14 DIGITAL OUTPUTS

Digital outputs from digital I/O boards may be caused by the following:

"Measurement" step in a running channel list.
Alarm-response output.
Tracking output.
DMM setup.

The output may take the form of one bit being set, or all eight.

For electrical considerations of using digital outputs, see appendix G.

3.8 CHART RECORDER DRIVING

The Tracking feature is used for this. It converts real time channel data to a scale within the limits of a chart recorder. Tracking setups are begun by selecting TRACKING on the main menu, and covered in detail in section 12. How a tracking setup is attached to a measurement is covered in section 6 (channel lists).

Tracking may operate only while the measurements are being made.

3.9 RECALLING STORED DATA

If the 52A internal memory (RAM) is used to store readings during a datalogging run, several options are available for how to recall the data afterward.

See appendix E-5. Retrieving data from memory begins with selecting RECALL on the main menu. This leads to the action menu named DATA TO: There are three main groups of menus. There are the Sort (setup) group, the Plot (setup) group, and the action items on the left side of the DATA TO: menu.

On the left side of the DATA TO: menu are the choices for a destination for the data upon recall:

Comm Port 1
Comm Port 2
Display.

Before actually selecting one of the above, which would send the data, you would probably want to set up a sort, so that all data that may be in memory does not come out. The Sort group of menus is used for this.

Data may be sorted or "filtered" by the:

Alarm number
Channel number
Time (when it was made)
Date
Name (of the list or Program)
Scan number (if made by a channel list running under Program control)

The "labels" on the data such as channel number, name of the list or Program, scan number, etc. may also be inhibited from being printed out.

If the data is to be plotted, then a plot setup must be created, in the Plot group of menus. Within the Plot group there are two subgroups: Setup for Y vs scan #, and Setup for X vs Y plotting. Note the similarity of the menus in each group for setting 0% Y value, and 100% Y value.

3.10 PRINTING AND PLOTTING

The menus for printing and plotting are in various menu trees, depending on the particular situation.

Communication parameters. Before printing or plotting may happen at all, the comm port to be used must be set to the appropriate communications parameters such as baud rate, etc. Use COMM PORT 1 or COMM PORT 2 on the main menu. These menus are covered in paragraph 4.4.2. The default communication settings for comm port 1 match those that the Wavetek Model 54 Printer/Plotter comes from the factory with - no change is required. Both comm port menus come with options for setting up headers, footers, and the number of lines per page.

Real time printing or plotting. You may print or plot the real time readings generated by a running channel list. The general setup menus for this, applying to all of the list's measurements, are shown in appendix E-2a. These are the Comm Port 1 and Comm Port 2 menus in the Overhead Menus group. If plotting, three menus (to pick plot character and scaling) will also appear in the measurement setup menus (appendix E-2b). If a plot character of "none" is chosen for that channel, then no plotting occurs. Using this feature, a channel list can be set up which plots only from particular measurement channels. For details, see paragraph 11.2.

Plotting X vs Y is not available when doing real time plotting.

Printing and plotting stored data (manual start). Printing and plotting of previously stored data can be set up. When printing, the communication parameters set by the comm port's main menu item (COMM PORT 1, or COMM PORT 2) apply.

Some particulars as to which channel's data is recalled and how it may be formatted are discussed in RECALLING STORED DATA, paragraph 3.9. For details, see paragraph 11.2.

Printing and plotting stored data at Program end. A Program setup may specify that at the end of a Program run, stored data will be automatically printed or plotted. See appendix E-3. Near the bottom of the menu map is a menu called PRO-

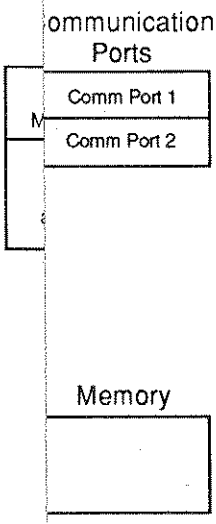


Figure 3-7. Real Time Data Flow

GRAM END: . If the RclData item is selected, then the selections in the SEND DATA TO: submenu apply. The SEND DATA TO: menu lets the data destination and the type of output (Print, Plot (X), or Plot X vs Y) be *preset.* **NOTE:** The Program goes to the plot settings in the RECALL DATA menu tree (appendix E-5) to get the particular plot setup (which channel number's data to plot, which plot character to use, etc.). However, sort parameters can not be preset for Program end recall of data. That is, *all* measurements in memory from any list or Program will be recalled.

Note the similarity of the Program's SEND DATA TO: menu, and the RECALL DATA trees' DATA TO: manual action menu:

```
SEND DATA TO:    DATA TO: Sort>
<Port 1          <Comm Port 1
<Port 2  Plot>   <Comm Port 2
<&Clr  XYPlot>   <Display Plot>
```

(The Program's SEND DATA TO: menu has no provision for displaying the data - the assumption is that the operator is not present to see it. Data may also be cleared manually when at the DATA TO menu, when the Clear key is pressed.)

Printing in response to an alarm. See appendix E-4, Alarms Creation Menus Navigation Map. At the bottom of the map is a menu called SEND DATA TO: . Assuming a comm port is selected, one or more of the following can be selected to print out when the alarm is true:

The reading (data value causing the alarm to be true)
The message associated with the alarm threshold
The present time and date
The data (all channels) for the current scan through the channel list

3.11 WRAPPING UP

3.11.1 Real Time Data Routing

This paragraph covers *where* the data may be routed, and under what conditions, while the Model 52A is performing one step of a channel list. See figure 3-7, Real Time Data Flow.

The box marked "Measurement" is the "data-maker". The channel number, function and range determine what the format of the preliminary data value will be. The preliminary value of the data may also be the final value of the data, if it is not modified by one or more of the data modifiers

This data is displayed on the display, normally. This is the default selection. Data can be inhibited from going to the display. In the Overhead Menus group (Appendix E-2a) of channel list creation, there is a menu called DATA TO:. One selection is "Disp". You would deselect it to prevent data from reaching the display.

The next box, marked "DATA TO" is the basis of the data routing. The software switches in this box are set one way or another when you make menu selections. The DATA TO: menu allows you to choose to send the data to Comm Port 1, Comm Port 2, or the RAM (memory). This is shown as the three switches in the right side of the DATA TO box in figure 3-7. Also in the DATA TO: menu is an item called FILTER. When you select FILTER, it allows you to set the other "switches" in the DATA TO box. You can choose to send the measurement value (for example, 1.999) on down the line, with or without its label (Vdc, Vac, kHz, etc.). You can also inhibit the data unless the alarm attached to the measurement is true. This is shown as the Only Alarm-True Data switch being open. In that case, the alarm must be true for the data to be passed on.

You may set the data to be transmitted or stored only if the alarm is true. To do this, you would deselect Comm Port 1, Comm Port 2, and RAM in the DATA TO: menu, and set up an alarm that is attached to the measurement. Under the alarm setup, there is a menu called SEND DATA TO:. In submenus of this menu you can set up for alarm-true transmit or storage of the data.

In the measurement's function modifier menu is an item called ACTIVE. When ACTIVE is selected (the default condition), the software switch labelled Active on figure 3-7 is closed. The ACTIVE switch provides a way to have some measurements in a list store or transmit their data, while other measurements do not.

Not shown on the figure is the software switches set by the Programs data routing menu titled "STORAGE:".

Appendix F lists what order operations are performed in within one step of a running channel list.

3.11.2 Get Ready To RUN

Any big job is easy if broken down into parts. If your datalogging application seems fairly complicated, the following sequence is suggested:

1. Connect all sensors to the Model 52A or multiplexers. Connect all necessary communication hookups and digital I/O card connections. Use the DMM mode to verify that channel hookups are correct and displaying correctly.
2. If more than one channel list is involved, use a Program, or think up a suitable programming plan of your own. Decide what types of measurements, under what conditions, how many lists, how linked (by count, by time, conditionally by one or more alarms, etc.). If a Program, or list-switching, is involved, it is *recommended* that you draw it in a form similar to the flowchart type drawings. Label alarms by numbers next to the measurements they apply

to, etc. This will avoid errors such as mis-assigned alarms, lists with the same name, etc.

3. Fill out the Program Guides for the features you are using. They provide a record of what you did later, and aid in debugging your programming. Read the appropriate section overviews (for example, channel lists overview), to be sure that the features you want can be set up in that menu group. Photocopy the blank Program Guides (appendix D), the ones you use for one application together. The Menu Navigation Maps (appendix E) are organized by menu groups and subgroups. They can help you verify that a menu you think you want is indeed in a particular section.

4. Enter the appropriate menu groups or "trees", and actually make the selections you desire, in the appropriate menus. The Menu Navigation Maps provide a quick reference for how the front panel keys operate in a particular menu group, and assure you that the menu(s) you want are ahead. If unsure as to the implications of a menu selection, then read the detailed text. Assuming the preliminary setup of the 52A has been done (comm ports, etc.), the following order is suggested:
Create the channel list(s), using the channel lists program guide.
Create any alarms, in accordance with the alarms program guide.
Create any math formulas, in accordance with the formula numbers you assigned on the math formula program guide.
Create any tracking (typically for chart recording) setup(s).
Run channel lists to test them, forcing data if necessary to test alarms (disable alarms temporarily that cause unwanted list switching, or, the alarm-tone response can be substituted.) The DMM can be set up to measure any one questionable channel with an alarm, scaling, etc. (Interchannel calculations can not be checked except by running the list.) If storing the data, check for storage by using RECALL on the main menu after running the list for a few seconds.
Create any Program(s). For testing a Program, temporarily shorten the time intervals and repeat counts, if necessary. If storing, verify by using RECALL DATA that the data gets stored in the format you want. Modify or pad the list(s) with empty text entries, if desired. Adjust headers and footers (in COMM PORT setup), if desired.

5. Reset all time intervals, repeat counts, alarm responses, etc., to their real values, clear any miscellaneous readings from memory, and RUN.

SECTION 4
MAIN MENU/SETUP

4.1 INTRODUCTION

This section discusses the main menu and its uses. The main menu, the first menu shown after power on, consists of 19 items shown four at a time.
Main menu items:

Select the unit's operating mode
- DMM
- Channel Lists
- Programs

Setup items used with measurements
- Alarms
- Math

Set up the unit for use
- Comm Port 1
- Comm Port 2
- Full Memory Mode
- Power Control
- Scroll Speed
- Tracking
- Time/Date

Provide information
- Help
- Memory Status
- Configuration

Route data and setups
- Load/Save
- Recall Data

Paragraph 4.2 lists and summarizes main menu items.
Paragraph 4.3 summarizes main menu uses.
Paragraph 4.4 provides details on main menu items.
Figure 4-1 (located in the rear of this section) is the Unit Setup Guide.
Most main menu items are covered in detail in their own sections.
- Section 5 DMM
- Section 6 Channel Lists
- Section 7 Programs
- Section 8 Alarms
- Section 9 Math
- Section 10 Recall Data

4.2 MAIN MENU ITEMS AND SUMMARY

Item	Summary
DMM	Measures a single input.
CHANNEL LISTS	Creates a channel list that measures several input signals at the same time.
PROGRAMS	Creates a program that controls channel lists which make the actual measurements.
HELP	Selects several Help or information screens.
MEMORY STATUS	Shows the available memory and how it is allocated.
RECALL DATA	Sorts stored data and selects data destination
FULL MEMORY MODE	Selects how the memory is filled.
LOAD/SAVE	Sends or receives setups, or calibration constants to or from an external computer or terminal.
SCROLL SPEED	Sets [▲][▼] key speed and channel list date scrolling rate

Item	Summary
KEYBOARD LOCK	Enter a keypad lockout code.
TIME/DATE	Set and check the time and date.
CONFIGURATION	Shows the options and measurement modules installed.
MATH	Creates user-defined formulas and tables.
ALARM	Sets conditions that can monitor a measurement and signal when the conditions are met.
TRACKING	Set up of up to four analog and four digital outputs which can produce an output directly proportional to measured data.
POWER CONTROL	Turns off all circuits that are not in use.
CALIBRATE	For choosing 50 Hz or 60 Hz interference rejection by measurement modules.
COMM PORT 1	Set up communication port 1.
COMM PORT 2	Set up communication port 2.

4.3 HOW TO USE THE MAIN MENU

The main menu is the gateway to Model 52A operation. Many of the main menu items are covered in other sections of this manual.

DMM covered in section 5.
Channel lists covered in section 6.
Programs covered in section 7.
Alarms covered in section 8.
Math covered in section 9.
Recall data covered in section 10.

4.3.1 Unit Setup

Certain main menus items are used to set up the Model 52A before use (see figure 4-1, the Unit Setup Guide).
To set up the unit,

1. Set up the communications port.
2. Set up the full memory mode.
3. Set the power control.
4. Set the scroll speed.
5. Set up the tracking output.

4.3.2 Preliminary Unit Check

Other main menu items should be checked before using the unit.

1. Check the configuration menu to identify the options installed in the unit.
2. Check the memory status for capacity and availability of memory.
3. Check the time/date menu for the correct time and date. Set if necessary.

4.4 MAIN MENU DETAILS

4.4.1 Main Menu Keys

Table 4-1 describes main menu key operation.

Table 4-1. Main Menu Keys

Key	Operation When Pushed
Power	When initially turned on, the 52A puts the main menu on the display.
Enter	Does nothing when you are at the main menu.
1	Selects the item on the screen that is currently next to it For example, assuming that you have not changed the position of the main menu with respect to the "window" since power on, pressing the 1 key will select "DMM".

Table 4-1. Main Menu Keys (continued)

Key	Operation When Pushed
[2]	Selects the item on the screen that is next to it (initially CHANNEL LISTS). Use this to get a "filing" menu that lets you start creating a list of measurements, or to pick a list to run that you previously created.
[3]	Selects the item on the screen that is next to it (initially PROGRAMS).
[4]	Selects the item on the screen that is next to it (initially HELP, which brings up choices to get general help screens other than if you pressed [6], [7], or [8]).
[5 LCD]	Adjusts the display viewing angle. There are eight angles that the display angle rotates vertically through, before repeating the first angle.
[6]	Brings up help screens which describe the Digital Multimeter mode (assuming initial main menu positioning relative to the window).
[7]	Brings up help screens which summarize the Channel (Measurement) List mode (assuming initial main menu positioning relative to the window).
[8]	Brings up help screens which summarize what a Program is (assuming initial main menu positioning relative to the window).
[9]	Operation is the same as [4], when HELP is the item. Otherwise, brings up help screens for whatever item is currently beside [4].
[▲]	Pressing one of these two keys moves the main menu items up/down [▼] past the "window" of the display screen. The window stays constant, and the menu moves. When you do this, the operation is called a "scroll".
[± •]	Brings up the following menu, so you can choose the type of [0 ♪] key operation you want. You can have a press of the [0 ♪] key give you a "dump" of the displayed information to the printer, or you can have a press of the [0 ♪] key alternately turn the audible key-click on and off. 0 KEY FUNC: <Screen Dump to Printer ◀Key Clicks
[0 ♪]	(See [± •] key) If Screen Dump was selected above, when you are looking at later screen displays, pressing the [0 ♪] key will cause a printout (it will not do this when in menus that expect an alphanumeric value to be entered). This is useful for recording DMM measurements, menu selections, etc. If Key Clicks was selected above, then when you are at the main menu, pressing the [0 ♪] key will turn the audible key "click" sound off, if on, and vice versa. The screen dump may be in graphics mode , giving a bit-mapped picture of a current display to the device connected to Comm Port 1. This Epson graphics compatible output is optimized for the Wavetek Model 54.
[Clear]	Brings up a menu which allows you to select various types of information to be deleted from the 52A memory.

4.4.2 Main Menu Items

```
<DMM
<CHANNEL LISTS
<PROGRAMS
<HELP
```

DMM

To make measurements on a single channel, select "DMM". The DMM mode presets the Model 52A into a single channel DMM (Digital Multimeter). The default Chan# is 1FP which uses the front panel banana jacks.
To change channel number, push [Chan] and enter the new Chan#.
To change functions, push [Func] and then select the desired function. More functions can be found by repeated presses of the [Func] key
The [Range], [Disp], and [Mods] keys allow further control of the DMM mode.

The DMM mode is covered in greater detail in section 5.

Channel Lists

For multiple channel measurements select "Channel List" and either create a new Channel List or choose one previously entered. A Channel List is a user entered group of channels with predefined functions, ranges, and modifiers. A list of existing Channel Lists can be scrolled through, and one selected.
New Channel Lists can be entered by selecting "Enter New" [6]. Existing Channel Lists can be run directly by pressing the key to the right of the channel list's name. Pressing the left side key allows editing, copying, renaming, locking, listing to the printer, or running the Channel List. Use the [Clear] key to delete an unwanted Channel List.

The channel list mode is covered in greater detail in section 6.

Programs

To add timing or triggering conditions to one or more predefined Channel Lists, select "Programs". A Program adds start/stop conditions and scan control attributes to one or more channel lists. A list of existing Programs can be scrolled through and selected.
New Programs can be entered by selecting "Enter New" [6].
Existing Programs can be run by pressing the key to the right of the Program name. Pressing the key to the left of the Program name allows editing, copying, renaming, locking, listing to the printer, or running the Program. Use the [Clear] key to delete an unwanted Program.

Programs are covered in greater detail in section 7.

Help

The Main Menu help provides instructions on how the various help menus function. Help menus can be displayed on the Model 52A screen or printed on the Model 54 Printer. Help is also available on most main menu selections by pressing the key to right of the main menu selection. To return to the Main Menu, press the [Enter] key. Press [Menu] key while in the main menu to jump to the following screen.

```
<MEMORY STATUS
<RECALL DATA
<FULL MEM MODE
<LOAD/SAVE
```

Memory Status

Shows in bytes available memory and how it is allocated.
To free up RAM use the [Clear] Key from the main menu or delete unneeded Channel Lists, Programs, or data.

Recall Data

Allows access to stored data collected from Channel Lists. Data can be sent to the Model 52A display, either of 2 Comm Ports, or can be printed or plotted on the Model 54 Printer via Comm Port 1.

Recall data is covered in greater detail in section 10.

Full Mem Mode

Controls memory management when the internal RAM is filled with reading data.

Load/Save

Allows archiving of user entered Programs, channel lists, alarms, and math channels; stored data; and calibration constants on a computer or controller. The information is in the form of an ASCII file which is not directly readable.

```
R Free   910098
A Data   404953
M Prgm     5069
  Total 1320230
```

Memory Status Response

Free indicates how much memory is still empty.
Data displays the space taken up by readings stored in internal RAM.
Prgm displays the space taken by user entered Programs, Channel Lists, Alarms, and Math Channels.
Total indicates amount of RAM installed.

```
WHEN MEM FULL:
<Wrap to Start
<Transmit Data
     and Clear>
```

Full Memory Mode Response

Wrap causes new data to write over the oldest data.
Transmit sends data to a communication port.
Clear erases the memory after the data is transmitted.
No selection stops storing data when the memory is filled.

```
LOAD:     SAVE:
< UserConfig >

<Calibrations>
```

Load/Save Responses

Model 52A Archiving: To use this menu assume a computer with a terminal program or equivalent is available to receive and store an ASCII file.
To save all internally stored Programs, Lists, Alarms, Math Channels, etc., push the [7] key.
To make a copy of the Calibration constants push the [9] key.
To replace the current configuration with a previously saved configuration, push [2].
To replace the current Cal Constants the "Cal Enable" dip switch must be on, (Authorized personnel only) then push the [4] key.

```
SAVE TO:

<Comm Port 1
<Comm Port 2
```

In a single Comm Port system, Comm Port 1 must be configured as a RS-232-C (see "Comm Port 1" on the Main Menu) interface in order to save a file of the Configuration or Cal Constants. If "54 Printer" is selected an ASCII file will be printed, but cannot be used for backup.

```
LOAD FROM:

<Comm Port 1
<Comm Port 2
```

Select the port interfacing to the PC with the stored Config or Cal file. When the screen "Waiting for download" appears, cause the PC to dump the file into the Model 52A. A terminal program (or equivalent) is necessary for this procedure.

<SCROLL SPEED
<KEYBOARD LOCK
<TIME/DATE
<CONFIGURATION

Scroll Speed

Allows adjusting the speed that readings auto-scroll on the Model 52A's display (does not affect actual reading rate). Also controls how fast the [▲][▼] keys operate.

Time/Date

Accesses the real-time Clock for setting the time or date.

Configuration

Shows the options and Measurement Modules installed. Also, it provides a partial operational check of the options and measurement module. Note: IEEE-488 option will not appear when operating from internal batteries or the IEEE On dip switch is in the 0 (off) position.

Scroll Speed Response

This is actually two menus in one. On the left side are selections for the speed of scrolling when you press a [▲]/[▼] key.

On the right side of the menu are speed selections for displaying multichannel measurement readings generated by a running channel list.

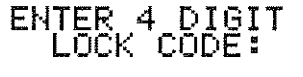
How To Change the [▲] Key And [▼] Key Speed

From the scroll speed menu, press the [2], [3], or [4] key to select the [▲]/[▼] Key speed. Press [Menu] to return to the main menu.

Whenever the 52A is reset (Poweron/Cleared), the [▲]/[▼] key speed reverts to FAST. This makes a menu (or naming-character set) scroll at top speed on the screen, when you press [▲] or [▼].

How To Change The Measured Data Scrolling Speed

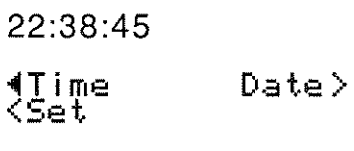
From the scroll speed menu, press the [6], [7], or [8] key to select the speed. Press [Menu] to return to the main menu.



Keyboard Lock Responses

This menu item protects the unit from unauthorized use with a 4 digit code that must be entered before access to the main menu is granted. Don't forget your lock code, as the only way around it is completely resetting the machine.

This display shows if the unit is locked. If you are an authorized user, enter the 4 digit unlock code. Should this number be lost, the only recourse is to hold down the [Clear] Key while cycling the power-on (press [Power] key). However, all user stored parameters will be lost and will have to be reentered.



Time/Date Responses

Push [3] to see time (default).
Push [8] to see date.
Push [4] to set date or time.

```
1-22-88
<Time    Date>
<Set
```

```
SET TIME:
   HH MM SS
   12:24:35
   --:--:--
```

Set Time Response

Enter new Time. Time is entered in 24 hour mode (e.g. 11 PM = 23). If no change is desired, press [Enter]. To correct an entry mistake use [Clear].

```
SET DATE:
   MM DD YY
   08/23/87
   --/--/--
```

Set Date Response

Enter new Date. Date is entered as month, date, and year. If no change is desired press [Enter]. To correct an entry mistake use [Clear].

```
<CONFIGURATION

Model 52A V5.00
CH1: 50-1   DMM
CH2: 50-1   DMM
CH3: 50-2   V+T
CH4:
OP5: 50-14  I/O
OP6: 50-14  I/O
OP7: 50-12-128
OP8: 50-13GPIB
or
 J8: 50-15 SER

BATT 50-11 RCH
or
NO INT BATTERY
```

Configuration Response

This main menu item allows the user to review the type of measurement modules and options installed in the Model 52A.

Use the [▲] [▼] keys to scroll through the configuration listing.

Configuration shows the options and Measurement Modules installed and provides an operational check of the options and module interfaces.

Note
The IEEE-488 option, 50-13 will not appear (even if installed) when operating from internal batteries or if the IEEE On dip switch is in the 0 position.

```
<MATH
<ALARMS
<TRACKING
<POWER CONTROL
```

Math

Math formulas, can be used to scale an input in engineering units, or calculate interchannel relationships such as ratio, delta readings, etc. A Math formula can be used independently in a Channel List as a math channel, or attached to any channel as a scalar using the Display Modifier menu. When used as a scalar the variable "X" must be in the formula. When attached to a measurement channel, the Model 52A will substitute the math formula's output channel data for X. X can also be used to pass a variable between Channel Lists. User entered labels can be attached to any Channel 0 for direct readout in engineering units.

Math is covered in detail in section 9.

Alarms

Up to 99 Alarms can be entered in to the Model 52A. Over, under, in window, and out of window alarm conditions can be set. Each alarm has multiple responses capability: digital output, sound, message, run Channel List or Program, print, store, and transmit. An alarm is attached to a channel by using the Function Modifier menu.

Alarms are covered in greater detail in section 8

Tracking

The Model 52A can be set up to have up to four outputs that, based on input channel data, can provide an isolated analog or digital output directly proportional to measured data. These outputs can be used for proportional feedback systems, driving chart recorders, servo loops, and so forth. To use Tracking, one or more Digital I/O card (Options 50-14) must be installed. Tracking is attached to a channel through the function modifier menu while entering a Channel List.

Tracking is covered in greater detail in section 12.

POWER CONTROL:

<Power Save
<Travel Mode

Power Control

Power control allows selection of power saver and travel mode.

Power Control Response

Power Save
[3] turns off all circuits not presently in use to maximize battery life. Use only when battery life is important and the unit is not line powered. First reading response is somewhat slower when Power Save is enabled.

Travel Mode
[4] prevents an accidental power on when there is a possibility the [Power] switch can be bumped.

<CALIBRATE
<COMM PORT 1
<COMM PORT 2

Calibrate

The Model 52A has a one year calibration cycle. The menu states the last time a scale factor calibration has been performed. Zero calibrations can be made with a shorting plug at any time. The Main Menu calibration procedure is a step by step complete cal. Individual functions and ranges can be calibrated directly using the function modifier menu.

Comm Port 1

For setting function, handshaking, and baud rate of the standard (included) RS-232-C interface. Recommended Port for the Wavetek Model 54 Printer/Plotter.

Comm Port 2

For setting function and handshaking modes of the optional COMM PORT 2. Either RS-232-C or IEEE-488 interfaces can be installed. A full implementation RS-232-C port (Option 50-15) includes parity and Modem interfacing as well as a full set of baud rates. IEEE-488 (Option 50-13) will only operate from external power. Also the rear panel dip switch "IEEE Pwr" must be in the 1 (on) position. This switch is provided for those who wish to power the Model 52A from external batteries and do not want the significant extra drain of the IEEE-488 option.

```
COMM PORT 1:
<54 Printer
<RS-232-C
          Off>
```

Comm Port 1 Setup

Select "54 Printer" [2] if a Wavetek Model 54 or a serial, 9600 baud, Xon/Xoff handshaking, Epson graphics compatible printer is attached to the selected Comm Port .
Select "RS-232-C" [3] for interfacing to a PC, terminal, or modem.
Selecting "Off" [9] will disable any communications with the Comm Port.

```
54 PRINTER:
<Rdgs/Line  __
<Lines/Pg   ___
<HeaderFooter>
```

Model 54 Printer Responses

Rdgs/Line
[2] The 54 printer can print 1 or 2 readings per line, an 80 column printer or terminal can print up to 4 readings per line. Each data field is 20 characters wide.
Lines/Pg
[3] Sets number of data lines between Header and Footer fields. A null entry equals infinite.
Header
[4] Allows entry of text or control characters at beginning of data.
Footer
[9] Allows entry of text or control characters at end of data which occurs when the Lines per page is triggered or at the end of a Program.

```
ENTER READINGS
 PER LINE:
   (0-99)
     __
```

Enter number of readings before a CR LF. The Model 52A sends out its data in 20 character wide fields. The Model 54 can print 1 or 2 columns. An 80 column printer can print 4 readings per line.

```
ENTER LINES
 PER PAGE:
   (0-255)
     ___
```

Enter number of lines before the header and footer are printed. Enter [0 ♪] if continuous data output is desired (no page breaks, no footers, header only appears once). Headers and footers can contain control characters for printer and terminal control. Also controls the length of paper between Y axis plot labels.

```
RS-232-C:
<Xmit  Format>
<Recv   Setup>
 Baud   9600 ▲▼
```

RS-232-C Responses

Xmit
[2] must be highlighted for data to be transmitted out Comm Port 1.
If control of the Model 52A will be through Port 1,
Recv
[3] must also be highlighted. If Port 2 will be the control port "Recv" here should be off.
Baud
Use the [▲][▼] keys to set Baud rate.

Format
[7] allows control of Readings per Line, Lines per Page, and entry of Headers and/or Footers.
Setup
[8] allows control of handshaking and termination characters.

```
FORMAT:
<Rdgs/Line  __
<Lines/Pg   ___
<HeaderFooter>
```

Rdgs/Line
[2] The 54 printer can print 1 or 2 readings per line, an 80 column printer or terminal can print up to 4 readings per line. Each data field is 20 characters wide.
Lines/Pg
[3] Sets number of data lines between Header and Footer fields. A null entry equals infinite.
Header
[4] Allows entry of text or control characters at beginning of data.
Footer
[9] Allows entry of text or control characters at end of data which occurs when the Lines per page is triggered or at the end of a Program.

```
HEADER=(▲):
Asc String +-.
Key switches u
pper/lower cas
```

Use the [▲] [▼] keys to enter up to 120 characters of header (or footer) which will print at the beginning (end) of any data output (including plots) and will repeat at the lines per page rate. To send a control character enter the carret (^) character with the control character immediately following.

```
FOOTER=(▲):
Asc String +-.
Key switches u
pper/lower cas
```

```
COMM PORT 2:
<54 Printer
<RS-232-C
        Off>
```

Comm Port 2 Setup

54 Printer
[2] selects the Wavetek Model 54 printer. Also, any serial printer with 9600 baud, Xon/Xoff handshaking, Epson graphics compatible can be attached to the selected Comm Port 2.
RS-232-C
[3] selects the optional RS-232-C interface for use with PC, terminal, or modem.

Off
[9] will disable any communications with the Comm Port 2.

```
RS-232-C:
<Xmit  Format>
<Recv   Setup>
  Baud   300▲
```

RS-232-C Responses

Xmit
[2] transmits data from Comm Port 2.
Recv
[3] receives control data via comm port 2. If Port 1 will be the control port "Recv" here should be off.
Baud Rate
Use the [▲] [▼] keys to set Baud rate.
Format
[7] allows control of Readings per Line, Lines per Page, and entry of Headers and/or Footers.
Setup
[8] allows control of handshaking and termination characters.

```
HANDSHAKE: LF>
◀Xon/Xoff
<CTS
Break=  None ▲▼
```

Xon/Xoff
2 selects software handshaking
CTS
3 selects hardware handshaking.
Break
▲ ▼ changes the Break character.

```
HANDSHAKE: LF>
◀Xon/Xoff DSR>
<CTS       DCD>
Break=  None ▲▼
```

Xon/Xoff
2 selects software handshaking
CTS
3 selects hardware handshaking.
Break
▲ ▼ changes the Break character.
DSR
8 enables/disables data set ready (DSR) hardware handshaking.
DCD
9 enables/disables data carrier detect (DCD) hardware handshaking.

```
PARITY:  Even>
◀Off      Odd>
<7bit    Mark>
◀8bit   Space>
```

Off
2 disables parity checking.
7bit
3 selects 7 bit data length.
8bit
4 selects 8 bit data length.
Even
6 selects even parity checking.
Odd
7 selects odd parity checking.
Mark
8 selects mark parity.
Space
9 selects space parity.

```
HANDSHAKE: LF>
◀EOI Enabled
<SRQ Enabled
Terminator=▲ ▼
```

GPIB Handshaking Response

EOI Enable
2 enables end or identify transmission termination handshaking
SRQ Enable
3 enables assertion of the Service Request line .
Terminator
▲ ▼ selects the terminator character.

4.5 OUT-OF-MEMORY DISPLAY

```
Out-of-Memory
Delete Data
  or Programs
(Push any key)
```

The display appears when you try create a new structure (channel list, alarm, math, tracking, or Program) which would use up the remaining memory space in RAM. Push Enter to proceed. To clear memory, return to the main menu and push Clear . The Clear Menu allows you the choice of clearing data or all user programming. (Should you wish to clear just individual Programs or Channel Lists, select the Channel List or Program, and from its filing menu select Clear .)

4.6 CLEARING SOME MEMORY SPACE

This appears when in the main menu, and the [Clear] key is pressed. It clears from internal memory either the communication port setups and power mode items; all Programs, channel lists, alarms and math formulas; or all previously stored measurement data.

```
CLEAR:     All>
<Setup    Data>
<Prgms/Lists/
  Alarms/Math
```

Clears from internal RAM:
Setup
[2] resets all Comm Ports and the power mode to default values.
Prgms/Lists
[3] deletes all user entered Programs, Channel Lists, Alarms, Maths, and Tracking parameters.
Data
[7] deletes all stored measurement readings.
All
[6] deletes all the above, user memory is completely cleared.
A more precise way of clearing some memory space is to clear just one list or program (use its filing menu), or clear just the stored measurement readings for one list or program (explained in RECALL DATA, section 10).

SECTION 5
DMM

5.1 INTRODUCTION

The DMM (Digital Multimeter) displays, transmits, and stores measurements taken by a single measurement setup. The DMM measurement setup consists of the channel number, function, range, display modifiers, and function modifiers.

Paragraph 5.2 lists and summarizes DMM setup items.
Paragraph 5.3 describes how to use the DMM mode.
Paragraph 5.4 gives details on unique DMM related items.

Note
Section 6 describes channel numbers, functions, ranges, display modifiers, and function modifiers in detail.

Appendix E-1 is a DMM Menu Navigation Map to guide you through the DMM menus.

5.2 DMM SETUP MENU ITEMS AND SUMMARY

Item	Summary
DMM	The main menu item that selects the single measurement setup.
CHANNEL #	Channel numbers identify the measurement inputs. Channels are 1, 2, 3, 4, 5, 6, 7, or 8 depending on the options installed plus Channels 0, 9, and T(text). Table 5-1 summarizes the channel numbers.
FUNCTION	Table 5-2 summarizes the measurement functions.
RANGE	Table 5-3 summarizes the ranges.
DISPLAY MODIFIERS	Display modifiers affect the value of the measurements. Standard display modifiers are scaled reading, minimum reading, maximum reading, resolution, averaged reading, and delta reading. Table 5-4 summarizes the display modifiers.
FUNCTION MODIFIERS	Common function modifiers are delayed measurements, alarms on measurements, and tracking outputs; some functions have unique function modifiers. Table 5-5 summarizes the function modifiers.

5.3 HOW TO USE THE DMM

5.3.1 DMM Setup

To set up the DMM mode,
1. Locate and select DMM from the main menu.
2. Press [Chan] and enter the channel number.
3. Press [Func] and select the function.
4. Press [Range] and select the range.
5. If necessary, press [Disp] and select the display modifier.
6. If necessary, press [Mods] and select the function modifier.
7. Press [Enter] to return to the DMM display.

Exercise 5-1 illustrates how to set up the DMM mode.

5.3.2 Changing the DMM Setup

To change the DMM setup,

1. If the DMM mode is not already selected, locate and select DMM from the main menu.
2. Use the following keys to jump directly to the menus.
   Use [Chan] to enter a new channel number. When a new channel number is entered, function, range, etc must be entered; see paragraph 5.3.1.
   Use [Func] to jump to the function menus; make the selection.
   Use [Range] to jump to the range menus; make the selection.
   Use [Disp] to jump to the display modifier menu; make the selection.
   Use [Mods] to jump to the function modifier menu; make the selection.
3. Press [Enter] to return to the DMM display.

5.3.3 How To Print Out The DMM Display

To print out the DMM display on the Model 54 printer,

1. When the large DMM reading is displayed, press the [± •] key which advances to the select transmit/store menu.
2. From the selective transmit/store menu, select Comm Port 1. Each time Comm Port 1 is selected, a single DMM reading is printed.
   If Comm Port 2 is selected, the Model 52A transmits a reading each time Comm Port 2 is selected.
3. Press [Enter] to return to the DMM display.

5.3.4 How To Store The DMM Measurement

To store the DMM measurement in the Model 52A's internal memory,

1. When the large DMM reading is displayed, press the [± •] key which advances to the selective transmit/store menu.
2. From the select transmit/store menu, select RAM. Each time RAM is selected, a single DMM reading is stored. The stored readings can be recalled using RECALL DATA.
3. Press [Enter] to return to the DMM display.

5.4 DMM MENU DETAILS

Pressing the key next to DMM selects the Digital Multimeter mode.

Channel Numbers
[Chan] key calls a menu to select the measurement input. Refer to paragraph 6.5.5.1.

Function
[Func] key calls a menu to select the measurement function. Refer to paragraph 6.5.5.2.

Range
[Range] key calls a menu to select the range for the measurement. Refer to paragraph 6.5.5.3.

Display Modifier
[Disp] key calls a menu to select one or more display modifiers. Refer to paragraph 6.5.5.4.

Function Modifier
[Mods] key calls a menu to selects one or more the function modifiers. Refer to paragraph 6.5.5.5.

Printout or Store
[± •] key calls the selective transmit/store menu.

Δ (Delta)
When delta is selected, the reading at that time becomes the base value. Subsequent readings are displayed as a change in value relative to the base value. A Δb indicates the reading is the change in value relative to a user-entered base value. See paragraph 6.5.5.4: Delta.

Δ% (Delta Percent)
When delta percent is selected, the reading at that time becomes the base value. Subsequent readings are displayed as the percent of change relative to the base value. A b Δ indicates the reading is the percent of change relative to a user entered base value. See paragraph 6.5.5.4: Delta.

```
1FP 0.0155  Vac
<Comm Port 1
<Comm Port 2
        RAM>
```

Select Transmit/Store Menu

Comm Port 1 (Model 54 Printer)
[2] transmits the reading shown on the first line of this menu to the device connected to communication port 1.

Comm Port 2 (Second RS-232-C, or IEEE-488 Interface)
[3] transmits the reading shown on the first line of this menu to the device connected to communication port 2

RAM
[9] stores the reading shown on the first line of this menu in the Model 52A's internal memory.

Exercise 5-1. Basic DMM Setup

Note: When you see the finger (☛), press the key pointed to by it, or the softkey pushbutton beside that item on the menu.

1.

```
☛ <DMM
  <CHANNEL LISTS
  <PROGRAMS
  <HELP
```

Having selected DMM, it is now active. It comes up with the last channel and measurement function that it was set to. For example:

```
0.0188
4FP          Vdc
<Δ           Δ%>
```

The 4FP is the channel number that the DMM was left on, for an example: channel 4 (measurement module 4, Front Panel input). At the right side of the display is shown the function (Volts, dc).

Since you want to change the channel,

2. ☛ [Chan].

```
ENTER CHAN #:

_
```

3. ☛ [2] to enter the channel number.

   ☛ [Func], and

```
2FP  0.0155 Vdc
<Vdc        TEMP>
☛ <Vac      OHMS>
<Vac+dc       dB>
```

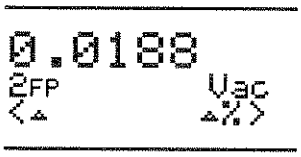
Note that the selector symbol (◀) for Vac fills in, and the function indicator in the upper righthand corner of the display changes to Vac:

```
2FP  0.0155 Vac
<Vdc        TEMP>
◀Vac        OHMS>
<Vac+dc       dB>
```

4. ☛ [Range] to bring up the range menu:

to select the 30 volt range.

This exercise uses no display or function modifiers, so ☛ [Enter] to execute the setup.



(The range selection is not shown on this display.)

You have set up the DMM on channel 2, Vac, and 30 volt range.

Table 5-1. Channel Numbers

Channels

Analog Channels
┌Channel # (1-4)
└┌Subchannel # (00-64)
101 (example)
Digital Channels
Channel # (5-8)
Time & Date
Channel 9
Math (Pseudo) Channels
Channel 0xx (01-99)
Text
Channel "T" (Up key)

Group Channel Entry
Use [±,] between Chan #s to indicate channel groups.
Example: **101-132**

Table 5-2. Functions

Functions

50-1 or 50-2		FP 50-1	
1. Vdc (default)		19. Adc	
2. Temp		20. Aac	*1
3. dBdc		21. Aac+dc	*1
4. CJTemp		22. Wdc	
50-1 Only		23. VAac	*1
5. Vac	*1	24. VAac+dc	*1
6. Vac+dc	*1	**Ch 9 Time/Date**	
7. dB (ac)	*1	25. HH:MM:SS	
8. Ohms	*2	26. M/D/Y	
9. Continuity	*2	27. M/D H:M	
10. Diode Chk	*2	28. Military	
11. Events	*3	29. D/M/Y (Eur)	
12. Frequency		**I/O Channels**	
13. Period		30. Digital Input	
14. Time Int		31. Digital Out	
15. TI...1Shot		32. Analog Out	
16. Pulse Width		**Text**	
17. PW...1Shot		Up to 10 Char's	
18. Logic			

***1. Multiplexed or mixed functions require added delay of at least 100ms to allow TRMS settleing.**
***2. FP inputs source current.**
***3. Do not switch channnels or functions when using Events.**
4. Range changing causing relay clicks should have delay added.

Table 5-3. Ranges

Ranges

1. Vdc or Vac
a. Auto b. 30mV c.300mV
d. 3V e. 30V f. 300V
2. Ohms
a. Auto b.30Ω c.300Ω
d. 3kΩ e. 30kΩ f. 300kΩ
g. 3MΩ h. 30MΩ i. AutoMΩ
j. 300MΩ k. 3000MΩ
3. Adc or Aac
a. Auto mA b. Auto A
c. 30mA d. 300mA
e. 3A f. 10A
4. Frequency
a. Auto b. 10Hz c. 100Hz
d. 1kHz e. 10kHz f. 100kHz
g. 1MHz h. 4MHz
5. Time Interval or Pulse Width
a. Auto b. 100ms c. 1000ms
d. 10s e. 100s f. 360s
6. Period
a. Auto b. 100µs c. 1000µs
d. 10ms e. 100ms f. 1000ms
7. Temperature TC or RTD type
a. R b. K c. J d. B e. E
f. T g. S
h. 100Ω 392 i. 100Ω 385
8. VA (enter a Vrng and an Arng)
a1. 30V b1. 300V
a2. 300mA b2. 3A c2. 10A

Table 5-4. Display Modifier

Display Mods

A. Scale
Enter math chan# (001-099)
B. Min/Max
1. Minimum
2. Maximum
C. Resolution
1. 32000 / 9999999
2. 3200 / 999999 (Higher spd)
3. 3200 / 99999
4. ▬ Bargraph
5. 32/99 ▬ DigiBargraph
D. Average
Value 1: # of Readings to average (1-65535)
Value 2: Delay between avg readings (.01-545.80s)
E. Delta (zero, relative, offset)
1. Delta % reading
2. Delta % number
Value 1: 0% reference
3. Delta reading
4. Delta number
Value 1: 0 reference
F. I/O Channels
1. Binary 2. Hex 3. Octal
4. Decimal 5. BCD 6. ASCII
7. Volts (analog out only).

Table 5-5. Function Modifier

Function Mods

A. Alarm: Enter Alarm #
B. Pre-Delay
Value: delay (0-545.80s)
C. Tracking Out
Value: Tracking chan# (5-8)
D. Vdc Mods: 10MΩ input Z
E. Temp Mods:
1.°C (default) 2.°F 3.°K 4.°R
F. dB Mods (enter Reference Z)
dBm: 50,75,90,93,11,125,135,150, 250,300,500,600 (default) ,600rn, 800,900,900rn,1000 (dBV),1200
dBW: 2,4,8,16
G. Counter Sensitivity
AC Coupled: 1) 3mV 2) 30mV
3) 300mV 4) 3V 5) 30V
DC Coupled: 6) TTL 7) CMOS5
8) CMOS12 9) ±40mV
10) ±400mV 11) +80 +40V
H. Time Int and Pulse Width Mods
1. AC coupled a. Rising edge ⌐
2. DC coupled b. Falling edge ¬
I. Wait for trig:
a. 200ms b. 2s c. 20s d. Indef
I. Digital and Analog Output Mods
1. Increment 2. Decrement
3. Complement
J. Digital Input Mods: Invert

SECTION 6
CHANNEL LISTS

6.1 INTRODUCTION

A channel list is a group of measurement setups (up to 254). Each channel list is identified by its unique user-defined name. This name allows storage of the setups in memory and recalling the setups when needed. A channel list can be used by itself to continuously take measurements. It can be used as the measurement portion of a program. Also, the channel list can be used as responses to alarms, monitor list in programs and program endings. The Model 52A displays (front panel), stores (internal RAM), transmits (RS-232 or IEEE-488), and prints (Model 54 printer) data taken by the channel list.

An actual channel list consists of two parts: overhead and measurement setup items. Overhead setup items affect the entire channel list: channel list name, reading mode, and data routing (Data To). Measurement setup items affect the measurement setup: channel number, function, range, display modifier, function modifiers, and measurement plotting. Each measurement setup is the same as the Model 52A's DMM mode.

Paragraph 6.2 lists the channel list menu items.
Paragraph 6.3 summarizes the channel list menu items.
Paragraph 6.4 describes how to:
Create a Channel List
Edit a Channel List — which includes:
- Change a channel list overhead item
- Change a channel list measurement item
- Add a channel list measurement item
- Delete a channel list measurement item

Delete an entire channel list
Run a channel list
Print out a channel list setup
Paragraph 6.5 gives details on the channel list menu items.
Appendix E-2 is a menu navigation map for the channel list.

Section 7 describes how to use the channel list with the program.

Section 8 describes how to use the channel list with the alarm.

6.2 CHANNEL LISTS MENU ITEMS

Below is an indented list of channel list items. These items are discussed throughout this section.

- Channel List
  - Create New
    - New Channel List Name
    - Reading Mode
      - Parallel
      - Serial
    - Data To
      - Comm Port 1
        - Print Data
        - Plot by Scan
        - & Time stamp
          - Scans Per Time Stamp
      - Comm Port 2
        - Print Data
        - Plot by Scan
        - & Time stamp
          - Scans Per Time Stamp
      - Display
        - 1-Alphanumeric
        - 4-Alphanumeric
        - Plot
        - Scroll
        - Alarms Only
        - Off
      - Filter
        - Data Only
        - Alarms Only
      - RAM
    - (Measurement Setup)
      - Enter Chan #
      - Functions
      - Ranges
      - Display Modifiers
      - Function Modifiers
      - Plot Parameters
    - (Additional Measurement Setups, if any)
  - EXAMPLE1.L
  - EXAMPLE2.L
  - EXAMPLE3.L
    - Run
    - Edit
    - Rename
      - Enter New Name
    - List-P1
    - Copy
      - Enter New Name
    - Clear

6.3 CHANNEL LISTS MENU SUMMARY

Item	Summary
	Overhead Setup
CHANNEL LISTS	Calls the channel list filing menu.
CREATE NEW	Allows creation of a new channel list.
NEW CHANNEL LIST NAME	Allows you to name the channel list.
READING MODE	Selects the order of taking measurements: *Serial* makes channel measurement in order. *Parallel* makes channel measurements simultaneously. Details: paragraph 6.5.3.
DATA TO	Selects where channel list data will be sent: *RAM* internal memory. *Disp* front panel display. *Comm Port 1* Model 54 printer port . *Comm Port 2* Optional RS-232-C or IEEE-488 port. *Filter* what data will be sent. Details: paragraph 6.5.4.
	Measurement Setup
ENTER CHAN #	Enter a channel number. Channel numbers identify the measurement input. Details: paragraph 6.5.5.1.
FUNCTIONS	Select measurement function. *Channels 1-4 - Option 50-1* measurement module provides 24 measurement functions. *Option 50-2* measurement module provides 4 measurement functions. *Channel 5-8 - Option 50-14 Digital I/O card* function menu selects either the input or output format. *Channel 9* - the time channel function menu selects the time and date format. *Channel 0* - the math channel does not use function menus. *Channel T* - the text channel's function menu allows text entry. Details: paragraph 6.5.5.2.
RANGE	Select the range for the selected function. Each function menu has its own range menu. Details: paragraph 6.5.5.3.
DISPLAY MODIFIERS	Affects how measurements are displayed, stored, or transmitted. Details: paragraph 6.5.5.4.

Item	Summary	
FUNCTION MODIFIERS	Alters how the data is taken, and how the unit responds to the measurement. Details: 6.5.5.4.	
PLOT PARAMETERS	Allows selection of the measurement's plot character and setup the 0% and 100% scale values. Details: paragraph 6.5.5.6.	
EXAMPLE 1.L EXAMPLE 2.L EXAMPLE 3.L		This is a typical sample of existing channel lists.
	Run	Runs the selected channel list.
	Edit	Allows editing of the selected channel list.
	Rename	Allows renaming the selected channel list.
	List-P1	Transmits a complete channel list setup to Comm Port 1 (Model 54 printer).
	Copy	Copies the complete channel list. The new list must be assigned a named.
	Clear	Deletes the entire channel list.

6.4 HOW TO USE CHANNEL LIST

This paragraph consists of a series of lists that describes:

Creating a Channel List.
Editing a Channel List - which includes:
Changing a channel list overhead item.
Changing a channel list measurement item.
Adding a channel list measurement item.
Deleting a channel list measurement item.
Deleting an entire channel list.
Running a channel list.
Printing out a channel list setup.

6.4.1 Creating a Channel List

To create a new channel list,

1. Locate and select CHANNEL LISTS from the main menu.
2. Select Create New.
3. Enter the channel list name.
4. Select the reading mode.
5. Select the data routing (Data To).
6. Enter the first measurement setup.
   Enter the channel number.
   Select the function.
   Select the range.
   Select the display modifier.
   Select the function modifier.
   Setup the plot parameters.
7. Repeat the channel measurement setup until all desired measurements are entered.

Exercises 6-1, 6-2, and 6-3 illustrate how to create and use channel list. These exercises are located in the rear of this section.

6.4.2 Editing a Channel List

This paragraph covers how to change various channel list items.

Changing an Overhead Items

To change an overhead item in a channel list,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list by name. If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. Changing the Overhead Items
   Reading Mode and Data To - From the "filing" menu, select Edit and use the [Enter] key to step to the reading mode and data to menus. Make selections from the appropriate menu.
   Changing Channel List Name - From the "filing" menu, select Rename and enter the new name for the channel list.
   Making a Copy of a Channel List - From the "filing" menu, select Copy to make a copy of the selected channel list. The copy of the channel list must be given a new name.

Changing a Measurement Item

To change a measurement item,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list . If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select Edit. Step through the Reading Mode and Data To menus. When the measurements are displayed, use the [▲] [▼] cursor keys to step to the desired channel measurement. Either scroll the

channel to be changed to the top of the display or press the key to the left of the desired channel measurement (channel number highlighted). Press [Func] to call the function menus. Press [Range] to call the range menus. Press [Disp] to call the display modifier menus. Press [Mods] to call the function modifier menu. Press [± •] to call the plot parameter menus.When the menu appears make the desired changes.

Adding a Measurement Item

To add a measurement item,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list . If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select Edit. Step through the reading mode and data to menus. When the measurements are displayed, use the [▲] [▼] cursor keys to step to the desired channel measurement. Either scroll the channel to be changed to the top of the display or press the key to the left of the desired channel measurement (channel number highlighted). Press [Chan] and enter the new channel number. The new channel appears right after the highlighted channel . Press [Func] to call the function menus. Press [Range] call the range menus. Press [Disp] to call the display modifier menus. Press [Mods] to call the function modifier menu. Press [± •] to call the plot parameter menus.When the menu appears make the desired changes.

Deleting a Measurement Item

To delete a measurement item from a channel list,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list . If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select Edit. Step through the reading mode and data to menus. When the measurements are displayed, use the [▲] [▼] cursor keys to step to the desired channel measurement. Either scroll the channel to be changed to the top of the display or press the key to the left of the desired channel measurement (channel number highlighted). Press the [Clear] key to delete the item.

6.4.3 Deleting an Entire Channel List

To delete an entire channel list,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list. If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select Clear to delete the entire channel list.

6.4.4 Running a Channel List

To run a channel list,

1. Locate and select CHANNEL LISTS from the main menu.
2. Locate and select the desired channel list. If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select Run to begin running the channel list
   OR, select the desired channel list by pressing the key to the right of the name: Example.L R>[7].

6.4.5 Printing Out a Channel List Setup

To printout an existing CHANNEL LISTS setup,

1 Locate and select channel list from the main menu.
2. Locate and select the desired channel list. If more than three channel lists exist, use the [▲] [▼] cursor keys to scroll through the list. Select the desired channel list by pressing the key to the left of the name: [3] <Example.L.
3. From the "filing" menu, select List-P1 to send a text printout of the channel list setup via comm port 1 to the Model 54 Printer.

6.5 CHANNEL LIST MENU DETAILS

6.5.1 Starting

```
CHANNEL LISTS
```

This main menu item calls the following menu.

```
 ▲▼ Create New>
<Example1.L  R>
<Example2.L  R>
<Example3.L  R>
```

To *create* a new channel list, select Enter New ([6]).
To scroll through the *existing channel lists*, use the [▲] [▼] keys.
To immediately *run* the channel list, press the key next to the "R".
To *edit, copy, rename, run, clear* or *print* the selected channel list, press the key to the left side of the desired channel list.

```
"Example.L" ▲▼>
<Clear    Run>
<List-Pl Edit>
<Copy  Rename>
```

"Filing" Response
This menu appears when an existing channel list is selected.

Clear
[2] deletes the entire channel list from memory - paragraph 6.4.3.

List -Pl
[3] transmits an "as programmed" listing of the channel list setup - paragraph 6.4.5.

Copy
[4] duplicates the selected channel list. The duplicate list must be given a new name - paragraph 6.4.2.

Run
[7] runs the selected channel list - paragraph 6.4.4.

Edit
[8] returns to the channel list setup menus (paragraph 6.5.3) and allows stepping through the setup menus - paragraph 6.4.2.

Rename
[9] allows renaming of the selected channel list.

6.5.2 Naming The Channel List

```
NEW CHANNEL
  LIST NAME:
 (Use ▲▼ Keys)
  --------
```

The channel list name identifies the channel list. To enter a name for the new channel list, use the [▲] [▼] keys to scroll through the character set. Press [Enter] when the desired letter is found. Finally, press [Enter] when the name is finished A name can have between 1 and 8 characters.

Character Set:
A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R,
R, S, T, U, V, W, X,Y,Z, l, \, l, ^, ■, a, b, c, d, e,
f, g, h, i, J, k, l, m, n, o, p, q, r, s, t, u, v, w,
x, y, z, <blank>, !, ", #, $, %, &, ', (,), *, +, ,, -,
., /, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, :, ;, <, =, >, ?,
@.

6.5.3 Reading Mode

```
READING MODE:
◄Parallel
<Serial
```

The reading mode determines the order measurements are taken.
Parallel lists run measurement module channels simultaneously; in other works, channels 1, 2, 3, and 4 could all make measurements at the same time. The parallel model is preferable when 1 reading may take longer (for example a 7 digit frequency resolution). Figure 6-1 illustrates the parallel mode. This mode gives the maximum reading rate

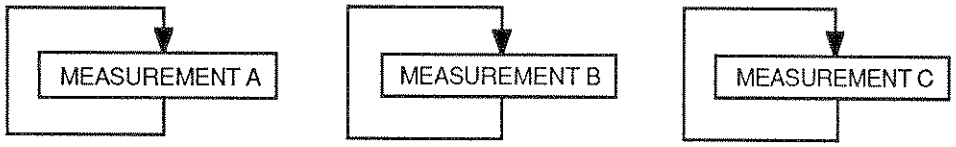


Figure 6-1. Parallel Lists

Serial list takes measurements in the exact order that they appear in the measurement setup, thus the measurement modules must wait their turn. See figure 6-2.

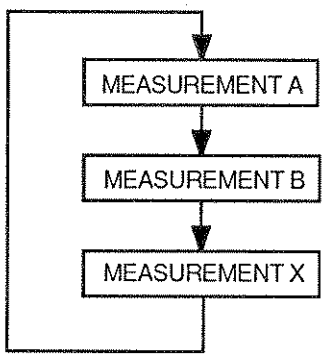


Figure 6-2. Serial Lists

Digital I/O and time channel measurements are always taken in the serial mode. The Model 52A stores data in the order entered (Serial) no matter which reading mode is selected.

6.5.4 Data Routing

```
DATA TO: RAM>
<Comm Port 1
<Comm Port 2
<Disp Filter>
```

Data generated by a channel list can be routed to any or all of four locations.
To *store* data in internal RAM, push [6].
To *view* the readings on the Model 52A display, push [4] (default).
To *output* the reading (alphanumeric or plot graphics) to the device on communication port 1, push [2].
To *transmit* the reading to the device on communication port 2 (if present), push [3].
To route specific data, select filter [9].
After making the selections, press [Enter].

Comm Port 1 Response

```
54 PRINTER:
<Print Data
<Plot by scan
 &Time stamp>
```

To *print* or *output* alphanumeric data, push [2]. To add a time stamp to channel list printout, include channel 9 in the channel list.
To *plot* (Epson graphics), push [3].
To *add a time stamp* to the plot, push [9].
Details: Section 9.

```
SCANS PER TIME
<2 STAMP: 16>
<4       32>
<8       64>
```

Select the number of scan intervals between each time stamp. A time stamp character height equals two plot positions, so there is a maximum of one time stamp per two scan plotted points.

Display Response

```
DISPLAY: Off>
<1-Alphanum-4▶
<Plot Scroll▶
<Alarms Only
```

To *display four channels* at a time, enable [7] (default).
To *display* an enlarged *single channel* reading, push [2].
To display a low resolution *plot* (1/3 the resolution of a printed plot), push [3].
For displaying only *alarm* data, push [4].
For increased scanning speed (about 25%), turn the *display off* [6].
End with [Enter].

Filter Response

```
DATA FILTER:
<Data Only
<Alarms Only
```

Data Only [2] removes the storage or transmission of scan information; program names, channel list names, and scan numbers. Selecting Data Only saves memory and prevents text strings from confusing post analysis PC programs.
Alarms Only [3] will only store or transmit the data from a channel in an alarm true condition (plus the scan information unless Data Only is enabled also).

6.5.5 Channel Measurement Setup

6.5.5.1 Channel Numbers

```
ENTER CHAN #:
(Push "Disp"
 for Help)
 101-116
```

Channel numbers identify the "measurement input connection". "Measurement connections" can be through measurement modules, digital I/O cards, or built in time channel or math. The channel number relates to the option (measurement module, digital I/O, etc.) and its slot in the Model 52A. Table 6-1 summarizes channel and subchannel numbers.

Table 6-1. Channel Numbers

Channel		How to Select	Example	Comment
1, 2, 3, 4, Measurement Module (Options 50-1 and 50-2)	Front Panel Input	Enter Channel Number only.	[Chan] [1] [Enter]	Figure 2-1 and 2-2 item 3.
	Rear Panel Input	Enter Channel Number and 00.	[Chan] [1] [0 ♪] [0 ♪] [Enter].	Figure 2-3 item 8.
	Multiplexer Inputs (Option 50-20 and Model 53)	Enter Channel Number and the multiplexer channel number (01-64)	[Chan] [1] [1] [8] [Enter]	Appendix B.
5,6,7,8 Digital I/O (Option 50-14)	Output Byte Input Byte Analog Output	Enter Channel Number only.	[Chan] [5 LCD] [Enter]	Figures 2-1 and 2-3 Section 12.
	Output Bit Input Bit	Enter Channel Number and bit position (01, 02, 03, 04, 05, 06, 07, 08)	[Chan] [5 LCD] [0 ♪] [6]	
9 Time/Date Channel	Time and Date measurement	Enter Channel Number 9 only.	[Chan] [9] [Enter]	
0 Math Channel	Math formula selection	Enter Channel Number and formula number (1-99)	[Chan] [0 ♪] [1] [4] [Enter]	Section 9

To enter a *group or block* of channels with identical setups, enter the first number, press the [± •] key then the last number of the group (e.g. 101-116: [Chan] [1] [0 ♪] [1] [± •] [1] [1] [6] [Enter]).

Function, Range, Display Modifier, Function Modifier, and Plot menus appear in turn. Table 6-2 summarizes the functions and their ranges, display modifier, and function modifiers. Following table 6-2 is a detailed description of the menus.

To *copy* the previous entry's settings into the next channel, push , [Chan] instead of [Enter].

Any time after entering the channel number, push [Menu] to skip all the the remaining measurement setup menus; default values are selected (3Vdc, all else clear).
To skip to specific menus, use the following keys:

[Func] jumps to the function menus.
[Range] jumps to the range menus.
[Disp] jumps to the display modifier menu.
[Mods] jumps to the function modifier menu.
[± •] jumps to the plot character menu.

Table 6-2. Function, Range, and Modifiers

Function	Range	Function Modifiers	Display Modifiers
Vdc	AutoRng 30mV 300m 3V 30V 300V	Cal Z=10MΩ	Scale Min Max Resol Average Delta
Vac		Cal	
Vac+dc			
dB dBdc		Z=Reference Impedance	
Temp	R K J B E T S N 392 RTD 385RTD 10CuRTD	Cal °C °F °K °R	
Ohms	Auto Rng 30 300 3k 30k 300k Auto 3M 30M AutoM 300M 3000M	Cal	
Cont			
Freq	Auto Rng 10 Hz 100 Hz 1kHz 10k Hz 100k Hz Auto 1MHz 10M Hz X10 X100 X1000	Cal AC Coupled DC Coupled	
Period	Auto Rng 100us 1000us 10ms 100ms 1000ms		

Function	Range	Function Modifiers	Display Modifiers
TI PW TI-1 Shot PW-1 Shot	Auto Rng 100ms 1000ms 10s 100s 300s	Cal Trig Wait AC Coupled DC Coupled ⌐ ¬	
CJ Temp	None	Cal	
⊣⊢CHK	1mA 100uA 10uA 1uA 100nA		
Events	None	AC Coupled DC Coupled	
Logic	None	Inv TTL CMOS 5 CMOS 12 ±40mV ± .4V + 80V	
Adc	mA Auto Rng 30mA 300mA A Auto Rng 3A 10A	Cal	
Aac		Cal	
Aac+dc			
Wdc	30V 300V		
VAac	300mA 3A		
VAac+dc	10A		

Note: All functions share the function modifiers:

Delay
Alarm
Track
Active
Reset

6.5.5.2 FUNCTIONS

Option 50-1

NOTE
A highlighted arrow indicates the current measurement function. More functions (if present) are available by pressing the [Func] key again or using the [▲] [▼] keys.

```
1FP 1.2345 Vdc
◀Vdc    Temp>
<Vac    Ohms>
<Vac+dc  dB>
```

Vdc
Vdc has 5 ranges. Input impedance is >1000 Mohms 3.2V range and below, 10Mohms on the 32 and 320 V ranges.

Vac
True rms Vac, ac coupled. Vac has 5 ranges. Input impedence is 1Mohm on all ranges. Usable bandwidth is to 1 MHz (320mV rng and above). True rms sensing with a CF(crest factor) of 3 at full scale, more CF available downscale. Vac settles slower than Vdc, therefore when multiplexing, delay should be added to any Vac channel to allow the reading to settle to accuracy. Usually a delay of 200ms suffices. By entering the same channel twice in a channel list alternate readings of Frequency and Vac can be made.

Vac+dc
Same as Vac except measures the dc component of the input signal. Don't use Vac+dc for measuring ripple as the dc component will usually swamp out any ripple.

Temp
Temperature measurement with any of 6 TC types or 2 RTD types. Cold junction compensation is provided on the front panel, or in the optional multiplexers. Do not plug TC's directly into the rear panel input as there is no CJ compensation there. TC's can be mixed types at the mux inputs. CJ compensation is automatic. RTD excitation is provided in the 53-2 mux module for 4 wire RTD's.

Ohms
Two terminal ohms only through the front panel (Chan xFP). For four terminal ohms, use Chan x00, wire source leads from the front panel inputs, sense leads from the rear panel inputs. Multiplexing is possible by 4 terminal hookups by wiring mux sourcing to the front panel and mux sensing through the rear panel. See figure 6-3. Note: the higher ranges (>=3.2M) are usually too sensitive to mux.

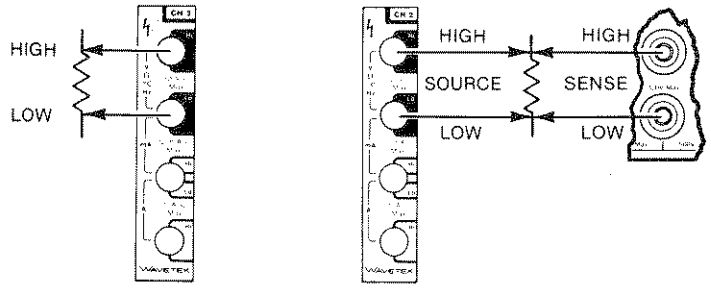


Figure 6-3. Two and Four Terminal Measurements

dB

A bridging measurement of dBm or dBW is calculated from a Vac reading. Twenty reference impedances can be selected using the function modifier menu. Relative dB measurements can be made with the Delta function. dBV measurements can be made by specifying the 1000 Ω impedance.

```
1FP 1.2345 mVdc
<Adc    Wdc>
<Aac  VAac+dc>
<Aac+dc  VAac>
```

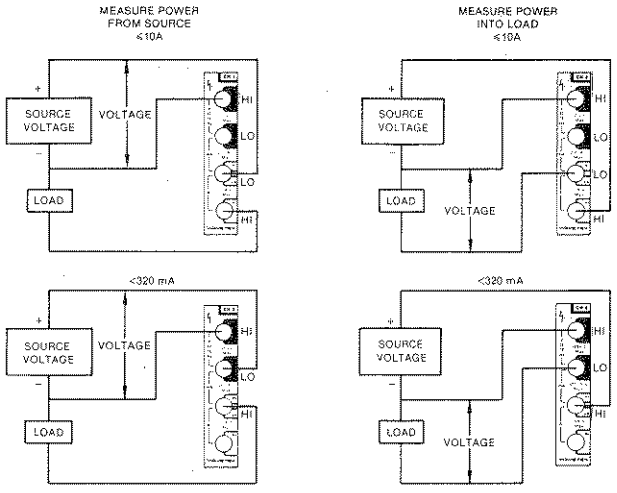
Aac, Adc, Aac+dc

Current is measured with either a 1 ohm or .01 ohm shunt in 4 ranges. The low current input is fused with a 1 amp fuse. If this fuse is blown neither input will function properly. Aac: True rms, the shunt is dc coupled, the measurement is ac coupled. See figure 6-4 for current input connections.

Figure 6-4. Current Input Connections

Wdc, VAac+dc, VAac

Alternate measurement of current and voltage yields Wdc, or Volt-Amps AC. AC measurements are wide bandwidth true rms, but as PF is not included, these are not true Wattage readings. A three wire connection is necessary. If the high side of the circuit is broken and the shunt inserted, measure voltage on the lowside. See figure 6-5 for Watt/VA input connections.



Note: Connection shown places the load in the positive leg, before the load. By reversing the polarity of the voltage source the shunt will be in the low (usually ground return) leg, after the load.

Figure 6-5. Watt/VA Input Connections.

```
1FP 1.2345 mVdc
<Cont CJTemp>
<dBdc Events>
< →+Chk Logic>
```

Continuity
Alternate ohms mode with an added display and tone feature. The continuity threshold is range dependent and set at 10% of range (i.e. 3.2 ohms in the 32 ohms range). See Ohms for additional information.

dBdc
A bridging measurement of dBm or dBW is calculated from a Vdc reading (see Vdc help). Any of 21 impedances can be selected in the Mods menu. Relative dB measurements can be made with the Delta function. dBV measurements can be made by specifying the 1000 ohm impedance. Use with RF probes or when dc volts need expressing in log functions.

Diode Test
Diode test provides a constant current source output combined with a 3.2Vdc range. 5 currents can be selected from 100nA to 1 mA. Forward biased diode voltage is easily characterized over 5 decades.

CJTemp
CJTemp provides a direct way of measuring the cold junction temperatures in the measurement module (Chan XFP) or any 50-53 series multiplexer. When reading the CJTemp from a multiplexer, any channel can be specified which is resident in the Mux. This does not preclude using the specified channel for any other purpose as the CJTemp sensor is automatically hooked up separately. Use this function to provide a reference temperature for non-52A supported TCs.

Events
Events counting with programmable sensing (Mods menu) and logic or sensitivity control. Can count to 9999999 events before overrange. Max rep rate of 800kHz, min rep rate 0. In a program the events count zeros on every pass through the scan group (but not list repetitions). In a Program, use the Math Channel variable to accumulate events counts from successive scan group passes (not necessary for Channel Lists running independently).

Logic
Provides a simple 1 (Hi) or 0 (Lo) readout of logic state. Select the Logic family in the Mods Menus.

```
1FP 1.2345 mVdc
<Freq Period>
<T-Int..1Shot>
<P-Wth..1Shot>
```

Frequency
Reciprocally calculated frequency (1Hz to 4MHz) offering high resolution with shortgate times . Resolution to .0000001 Hz. Maximum frequency is 4 MHz. Enter the same channel twice in a channel list to read both Frequency and Vac .

Period
Period measurements are based on a period average method to achieve higher resolution. From 4 to 2^18 periods are averaged.

Time Interval
Time interval measurements (1us to 360s) require at least 1 50-14 Digital I/O option. TI is measured from the rising or falling edge of the measurement module input, to the rising edge of the Trig1-4 input. Match the Trig1-4 input number to the measurement module channel number. One-shot measurements are reenabled at the start of each Scan Group, or when the Reset attribute is enabled in the [Mods] menu, or when manually reset ([± •] Menu).

Pulse Width
Positive or negative pulse widths from 1us to 360s can be measured. Control the sense from the [Mods] menu. One-shot measurements are reenabled at the start of each Scan Group (not during List repetitions), or when the Reset attribute is enabled in the [Mods] menu, or when manually reset ([± •] Menu).

```
300 1.2345 mVdc
<Vdc   CJTemp>
<dBdc  Temp>
```

Option 50-2
These functions are the same as those described under Option 50-1.

```
9 11/45 23:2
<HH:MM:SS Mil>
<M/D/Y D/M/Y>
◄MM/DD-HH:MM
```

Time - Channel 9
Select the time/date format . Channel 9 can be entered twice; once with the time displayed (always in 24 Hr mode), and once in the date mode if complete time/date information is required in the channel list.

```
5   A3  HEX
<Digital Input
<Digital Output
<Analog Output

501  1  Bit
<Digital Input
<Digital Output
```

Digital I/O
To read a digital input (Option 50-14 installed), push [2].
To write a digital output, push [3].
To write an analog output, push [4].
Single-bit I/O channels require a subchannel entry from 01-08 (LSb to MSb), or masking unwanted bits with the "X" character ([Range] menu)

```
ENTER TEXT:
 (Use ▲ keys)
 ----------
```

Text - Channel T
Allows entry of up to a 10 character text line. Use the [▲] [▼] and [Enter] keys to select each character. More text channels can be added for longer messages.

6.5.5.3 RANGES

Note
*The highlighted arrow indicates the range. If the [▲] [▼] arrow is visible on the LCD pushing the [Range] or [▲] [▼] keys will bring up subsequent range menus. Selecting "**Autorng**" can slow the reading rate while ranging and therefore fixed ranges should be used when possible.*

```
101 123.45 mVdc
◄AutoRng  3V>
<30mV    30V>
<300mV  300V>
```

Vac, Vdc, Vac+dc, dB, and dBdc
Vdc has 5 ranges: 32mV full scale with 1uV resolution, 320mV full scale with 10uV resolution, 3.2V full scale with 100uV resolution, 32V full scale with 1mV resolution, and 320V full scale 10mV resolution

Vac has 5 ranges: 32mV full scale with 1uV resolution, 320mVfs w/10uV resolution, 3.2Vfs w/100uV resolution, 32Vfs with 1mV resolution, and 320Vfs w/10mV resolution.

Ohms and Continuity

```
1FP 299.23 kΩ
◀AutoRng 3kΩ>
<30Ω ▲▼ 30kΩ>
<300Ω  300kΩ>

1FP 299.23 kΩ
◀Auto AutoMΩ>
<3MΩ ▲▼ 300MΩ>
<30MΩ 3000MΩ>
```

Aac, Adc, and Aac+dc

```
1FP 300.12 mAdc
◀mA AutoRng A>
<30mA   3A>
<300mA  10A>
```

Selecting mA (2 , 3 ,or 4) requires the use of the mA and Lo inputs. Selecting A (7 , 8 , or 9) requires the use of the A and A Lo inputs.

Frequency

```
1FP 909.909 kHz
◀AutoRng 1kHz>
<10Hz ▲▼ 10kHz>
<100Hz 100kHz>

1FP 909.909 kHz
◀AutoRng X10>
<1MHz ▲▼ X100>
<10MHz X1000>
```

The highlighted arrow indicates the range. Use X10 (7), X100 (8), or X1000 (9) when a prescaler is used in front of the Frequency Counter input.

TI, PW, TI-1Shot, and PW-1 Shot

```
1FP 909.909 ms
◀AutoRng 10s>
<100ms  100s>
<1000ms 360s>
```

Period

```
1FP 999.99  ms
◀AutoRng 10ms>
<100us 100ms>
<1000us1000ms>
```

Diode Test

```
1FP 1.6323 V⊣►
 Test I: 10uA>
◀1mA   1uA>
<100uA 100nA>
```

The Diode Test voltage range is fixed to 3.2 volts. Select the desired test current.

Temperature

```
1FP- 27.4  °C
<R    B>
◀K  TC's  E>
<J  ▲▼  T>

1FP- 27.4  °C
<S   385RTD>
<N  10CuRTD>
<392RTD
```

RTD's require the use of a 1 mA excitation current source (available in separate multiplexer modules). 100 ohm Platinum RTD's with American (392) or European (385) curves and 10Ω copper RTD's are supported.

VAac, Wdc, and Vac+dc

```
1FP 1.6323 VA≅
    300mA>
<30V    3A>
◀300V   10A>
```

VAac and Wdc require selecting both a voltage range (3 or 4) and a current range (7 , 8 ,or 9). observe proper hookup for both voltage sense and current shunt connections; see figure 6-4.

```
OUTPUT VALUE:
 (1,0,X(▲))
 X=don't care
  --------
```

Digital Output
Enter the digital output value desired (1, 0, or X). Use the [▲] key to enter a "don't care" (X). For example, to output a single bit at bit 5 position use XXX0XXXX. Note: Initially, on power up, the digital outputs are deenergized (lightly pulled up) until set by a direct digital write or an alarm.

```
MASK:(1,X(▲))
 1=Inputs
 X=don't care
  --------
```

Digital Input
When reading a digital input any or all the bits can be read. A masking value can be used to ignore unwanted bits. To read all 8 bits enter "11111111". To read just bits 1 and 2 enter "XXXXXX11".

```
OUTPUT VALUE
  IN VOLTS:
  (0-2.55)
    -.--
```

Analog Output
The 50-14 option has a D/A converter scaled to 10mV/bit. Enter the desired output value from 0-2.55V. Initial power-on value of the DAC is 0 volts.

6.5.5.4 Display Modifiers

Measurement

All display/data modifier menus share six common modifiers (Scale, Min, Max, Resol, Average, Delta) . Except those that are noted.

Use the [▲][▼] keys to display additional function modifier menus if present.

```
400-25.345 mVdc
<Scale Resol>
<Min Average>
<Max  Delta>
```

Scale
[2] allows the data to be scaled by a user math channel. A second menu will ask for the math channel number.

Min
[3] updates the data only when the current reading is lower than the lowest previous reading.

Max
[4] updates the data only when the current reading is higher than the highest previous reading.

Note
The Min/Max value remains unchanged except when the function modifier item Reset is selected.

Resol
[7] calls a menu for setting the resolution of the display and data or the bargraph modes. The resolution menu response depends on the function selected.

Average
[8] allows entering a number of readings to be averaged and an average delay. Each average will take the basic reading rate times the number of readings or'd with any added delay.

Delta
[9] takes either the current reading or a user entered base reading and subtracts it from subsequent readings. Delta or Delta% readings are calculated.

```
SCALE USING:
 0xx Label(▲▼)
(1-99) "MATH"
   --
```

Scale Response
Enter the math channel to be used for scaling this measurement channel. Pre-programmed math channels can be found by using the up/down scroll keys. Press [Enter] when the desired channel number appears. If the math channel is not yet programmed, the user is given the option of going through the math channel programming menus. In order to function as a scalar, the math channel must have a variable "X" in the formula, which will be replaced by the channels data reading when the channel is operating. Failure to include the proper variable will result in a "MATHERR" data reading.

```
MATH 01 NOT
  PROGRAMMED:
<Program Math
<OK
```

The math channel selected has not been programmed. Push [3] to program the math channel now (will return to the [Disp] menu when done), or push [4] if you plan to program the math channel from the main menu later. Failure to program the math channel at some time will result in a "MATHERR" data reading.

```
00-25.345 mVdc
<320
<3200      ▬▬>
◀32000  32▬▬>
```

Resolution Response: Vac, Vdc, Vac+dc, dB, dBdc, Temp, Ohms, Cont, CJ Temp, Diode Check, Logic, Aac, Adc, Aac, Aac+dc

Select the desired resolution. 320 counts ([2]) and 3200 counts ([3]) run at the maximum A/D rate (15 readings/s DCV, DMM mode). The 32000 count mode ([4]) runs at an average rate of 5 readings/s (DCV, DMM mode). The actual reading rate depends on a variety of factors such as function, alarms, data transmission, math operations, whether the display is on, etc.

Bargraphs: Push [8] for a 1 in 64 segment bargraph that is proportional to the digital reading in a range (i.e. 3.2v = 64 segments). Push [9] for a 1 in 50 segment bargraph that achieves much higher resolution by virtue of a 2 digit header. The first 2 digits represent the most significant digits of the digital reading. The remainder is proportionally displayed as 1-50 segments (0.5% resolution). Bargraphs of either type can be combined with the delta function for null and deviation displays.

```
400 25.34557kHz
<99999
<9999999   ▬▬>
◀9999999 99▬▬>
```

Resolution Response: Freq, Period, TI (&1-Shot), PW (&1-Shot), Events, Wdc, VAac, VAac+dc

Select the desired resolution. 99999 counts ([2]) runs at a maximum gate time of 200ms (Freq and Per functions). 999999 counts ([3]) runs at a maximum gate time of 1.3s. The 9999999 count mode ([4]) runs at an maximum gate time of 13s. The actual reading rate depends on a variety of factors such as function, alarms, data transmission, math operations, whether the display is on, etc.

Bargraphs: Push [8] for a 1 in 64 segment bargraph that is proportional to the digital reading in a range. Push [9] for a 1 in 50 segment bargraph that achieves much higher resolution by virtue of a 2 digit header. The first 2 digits represent the most significant digits of the digital reading. The remainder is proportionally displayed as 1-50 segments (0.5% resolution). Bargraphs of either type can be combined with the delta function for null and deviation displays.

```
400-25.345 mVdc
Average n Rdgs
<n=_______
<Dly ___.__ s
```

Average Response
An average is taken of n readings. With no delay entered the time required to accumulate the readings is n times the reading rate (e.g. 32000 count Vdc would take about 1 second to complete an average of 5 readings). To enter the n value push [3]. To add an average delay push [4]. This places a time delay relative to the start of each conversion and adds to the time it takes to complete an average. An average of an entire days readings can be calculated this way. Push [Clear] to remove the average.

```
AVERAGE COUNT:
 (1-65535)
  0=No Avg
  -----
```

Enter number of readings to be averaged. The Model 52A in DMM mode always runs a walking average filter of 5 readings. Enter 1 to disable the filter. Enter 0 to remove an average and restore the average filter.

```
DELAY BETWEEN
 AVG READINGS:
(0.01-545.80s)
  -----
```

Enter the delay time in 50ms increments.

```
400△ 10.000%kHz
<△Rdg  △Num>
<△%Rdg △%Num>
RL 200.000 k
```

Delta Response

"DeltaRdg" ([2] or "Delta%Rdg" ([3]) will take the currently displayed reading and store it as a delta base value. All subsequent readings will be relative to that reading expressed either in delta or delta%. "DeltaNum" ([7]) or "Delta%Num" ([8]) require a user entered delta base value. To enter a new base value push [Clear] and enter the value. To apply a multiplier (k, M, u, m) use the [▲][▼] keys. In an operating Channel List located in a Program the DeltaRdg functions reset the zero value during the first pass of the list and from that point on calculate the delta relative to the first reading. If the reset attribute is set in the Mods menu, the delta will reset on every pass through the scan group but not during a List repetition. Therefore, a list repetition of at least 2 must be applied when using reset with a DeltaRdg or the data will always equal zero. A DeltaNum setup is condition free, it is always applied.

```
500 010101010
<Binary ASCII>
<Hex Decimal>
<Octal  BCD>
```

Digital I/O

Byte wide digital I/O can be expressed in any of these data formats: "Binary" ([2]), 00000000 - 11111111. "Hex" ([3]), 00-FF. "Octal" ([4]), 0-277. "ASCII" ([7]), $20-$7F characters supported. "Decimal" ([8]), 0-255. "BCD" ([9]), upper and lower nibbles from 0-9. In all modes illegal values will be displayed as "x".

```
500 010101010
<Binary Volts>
<Hex Decimal>
<Octal  BCD>
```

Analog Output

8 bit analog outputs can be expressed in any of these data formats: "Binary" ([2]), 00000000 - 11111111. "Hex" ([3]), 00-FF. "Octal" ([4]), 0-277. "Volts" ([7]), 0-2.55V. "Decimal" ([8]), 0-255. "BCD" ([9]), upper and lower nibbles from 0-9. Any data format will be translated to its 8 bit binary equivalent and will write the D/A accordingly. Full scale D/A output equals 2.55 volts with a 10mV resolution per bit.

6.5.5.5 FUNCTION MODIFIERS

Function modifier menus share five common modifiers (delay, alarm, track, active and reset). The additional function modifiers for the different functions are covered in subsequent paragraphs. Those functions not mentioned use only the common function modifiers.

Note

Use the [▲][▼] keys to display additional function modifier menus if present.

General Modifiers

```
1FP+12.345 mVdc
<Delay Active>
<Alarm Reset>
<Track
```

Delay

[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate while multiplexing slow settling signals such as AC Volts or while waiting for a relay to close or human response time...etc..

Alarm
[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99).

Track
[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu.

Active
[7] an open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *Active* or not.

Reset
[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The *Reset* occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).

```
PRE-DELAY IN
  SECONDS:
 (0-545.80)
  ------
```

Delay Response

Enter a delay factor in seconds. Any number entered will be adjusted to a maximum resolution of 50 ms. Delay times are added to the standard conversion time and therefore cannot be used for precision timing. The Predelay is intended to allow slow settling signals a programmable time delay before conversion begins.

```
A#(1-99 or ▲):
Print the T1
msg or "Empty"
   --
```

Alarm Response

Enter the Alarm number desired (1-99). Preprogrammed Alarms and their T1 message can be found by pushing the [▲] scroll key. Any Alarm that appears has already been set up and requires no further entry.

```
ALARM 04 NOT
PROGRAMMED:
<Program Alarm
<OK
```

The requested Alarm channel has not been programmed. Push [3] to program. Push [4] if the desired alarm channel will be programmed at a later time from the main menu.

```
TRACKING OUT
 CHAN # (5-8):
◀Analog
<Digital _
```

Track Response

Select either an Analog ([3]) or Digital ([4]) tracking output. Then enter the 50-14 channel number 5-8 (option must be installed in the appropriate slot).

```
TRACK CH5 NOT
  PROGRAMMED:
<Program Track
<OK
```

The Tracking Channel selected has not been programmed. Push [3] to program the Tracking Channel now (will return to the [Mods] menu when done), or push [4] if you plan to program the Tracking Channel from the main menu later. Failure to program the Tracking Channel at some time will cause it to be ignored.

```
1FP+12.345 mVdc
<Delay Active▶
<Alarm Reset>
<Track ▲▼ CAL>
```

```
<Z=10MΩ
```

Vdc

Cal

[9] allows single module, single function calibrations. Zeros can always be cal'd with an external zero ohm short (NA on all functions). The calibrate dip switch must be enabled for calibrating the scale factor.

Z=10M

The input impedance on the 3V, 320mV, and 32 mV ranges is normally >1000 Megohms. The input impedance on the 32V and 320V is always 10 Megohms. By selecting "Z=10M" (3) the input impedance will remain a constant 10 Megohms on all ranges. Note: additional error can be caused by loading effects on multiplexers with this option enabled.

Delay, Alarm, Track, Active and Reset are described in the general case.

```
2DB 29.000 Vac
<Delay Active▶
<Alarm Reset>
<Track  Cal>
```

Vac

Delay, Alarm, Track, Active and Reset are described in the general case. Cal (calibration) is described in Vdc: "Cal".

```
1FP 12.34 dBm
<Delay Active▶
<Alarm Reset>
<Track Z= 600▲▼
```

dB and dBdc

Z=600

[9] selects the reference impedance for the dB and dBdc. Use the [▲] [▼] keys or [9] to select the dBm or dBW reference impedance.

dBW Ref Z's: 2, 4, 8, 16, 3.2, 10
dBm Ref Z's: 50, 75, 90, 93, 110, 125, 135, 150, 250, 300 500, 600, 600rn, 800, 900, 900rn, 1000 (dBV), 1200
dBV is equivalent to selecting 1000 ohms.

Delay, Alarm, Track, Active and Reset are described in the general case.

```
1FP 112.3 °C
<Delay Active▶
<Alarm Reset>
<Track ▲▼ Cal>
```

```
1FP 112.3 °C
◀°C     °R>
<°F
<°K   ▲▼
```

Temperature

Select temperature units: Centigrade, [2] ; Fahrenheit, [3] ; Kelvin, [4] ; Rankin, [7]
Delay, Alarm, Track, Active and Reset are described in the general case. Cal (calibration) is described in Vdc: "Cal".

Ohms

Ohms uses the same function modifiers as Vac.

```
┤FP 9.999999kHz
<Delay Active▶
<Alarm Reset>
<Track ▲▼ Cal>
```

```
┤FP 9.999999kHz

◀AC Coupled
<DC Coupled ▲▼
```

Frequency and Period

For repetitive fairly even duty cycle signals above 10Hz, select AC Coupled ([3] default). For logic, low frequency, or extreme duty cycle signals select DC Coupled ([4]). Use the [▲][▼] keys to switch to the sensitivity menu.

Delay, Alarm, Track, Active and Reset are described in the general case. Cal (calibration) is described in Vdc: "Cal".

```
┤FP 9.999999kHz
<Auto   300mV▶
<3mV     3V>
<30mV    30V>
```

AC Coupled Response

Select sensitivity. All ac coupled sensitivities are based on sine wave RMS voltage values. Push [2] for an automatic sensitivity setting (slower than fixed). Push [3], [4], [7], [8], or [9] for desired sensitivity.

```
┤FP 9.999999kHz
<TTL   +-40mV▶
<CMOS5 +-.4V>
<CMOS12 +80V>
```

DC Coupled Response

Select Logic Type or DC coupled threshold: Push [2] for TTL logic (.8V/2V). Push [3] for 5V CMOS logic (1.5V/3.5V). Push [4] for 12V or higher CMOS logic (4V/8V). Push [7] for a ± 40 mV sensitivity. Push [8] for a ±0.4V sensitivity. Push [9] for a +40/+80 volt sensitivity.

```
┤FP 9.999999 s
<Delay Active▶
<Alarm Reset>
<Track ▲▼
```

```
┤FP 9.999999 s
<TrigWait  ┌▶
<AC Coupled ▲▼
◀DC Coupled 1>
```

Time Interval (& 1-Shot) and Pulse Width (& 1-Shot)

For repetitive fairly even duty cycle signals above 10Hz, select AC Coupled ([3] default). For logic, low frequency, or extreme duty cycle signals select DC Coupled ([4]). Use the [▲][▼] keys to switch to the sensitivity menu.A TI or PW must be triggered during the scan. If not triggered it can hold up scan completion. To limit the time the 52A will wait for a trigger push [2]. Push [7] for a rising edge to falling edge PW measurement or to start a TI with a rising edge. Push [9] for a falling edge to rising edge PW measurement or to start a TI with a falling edge. Note: TI measurements are ended by a rising edge into the digital I/O option trigger channel input.

Delay, Alarm, Track, Active and Reset are described in the general case.

The AC Coupled Response and DC Coupled Response are described in Frequency and Period.

```
DELAY LIST AND
WAIT FOR TRIG:
◀Indef   2s>
<20s   200ms>
```

Trigger Wait Response

Select the length of time the Channel List will delay waiting for a counter function reading to trigger. Push [3] for an indefinite (as long as it takes) delay.

Cold Junction Temperature

The function modifiers for the cold junction function (CJTemp) are the same as those used for the Vac function.

```
4FP    0 EVNT
<Delay Active▶
<Alarm Reset>
<Track ▲▼
```

```
4FP    0 EVNT

◀AC Coupled
<DC Coupled ▲▼
```

Events

For repetitive fairly even duty cycle signals above 10Hz, select AC Coupled (3 default). For logic, low frequency, or extreme duty cycle signals select DC Coupled (4). Use the ▲ ▼ keys to switch to the sensitivity menu. Delay, Alarm, Track, Active and Reset are described in Vdc. The AC Coupled Response and DC Coupled Response are described in Frequency and Period.

```
1FP  1  LOGI
<Delay Active▶
<Alarm Reset>
<Track ▲▼ Inv>
```

```
1FP  1  LOGI
<TTL  +-40mV▶
<CMOS5 +-.4V>
<CMOS12 +80V>
```

Logic

Push 9 to Invert the logic sense. Select logic type or DC coupled threshold. Push 2 for TTL logic (0.8V/2V). Push 3 for 5V CMOS logic (1.5V/3.5V). Push 4 for 12V or higher CMOS logic (4V 8V). Push 7 for a +- 40 mV sensitivity. Push 8 for a ±0.4V sensitivity. Push 9 for a +40/+80 volt sensitivity.Delay, Alarm, Track, Active, and Reset are covered in Vdc.

Adc

The function modifiers for the Adc are the same as those used for the Vac.

```
500 01010101BIN
<Delay Active▶
<Alarm Reset>
<Track  Inv>
```

Digital Input

Push 9 to Invert the logic sense. Delay, Alarm, Track, Active, and Reset are the same as described in the general case.

```
510 01010101BIN
<Delay Active▶
<Alarm Reset>
<Track ▲▼
```

```
510 01010101BIN
<Increment
<Decrement
<Complement ▲▼
```

Digital and Analog Output

Each time the channel is scanned the data out can be manipulated. Push 2 to increment the data, push 3 to decrement, push 4 to complement. Delay, Alarm, Track, Active, and Reset are described in the general case.

```
001 4.6565 MATH
<Delay Active▶
<Alarm Reset>
<Track
```

Math (Channel 0)

Delay, Alarm, Track, Active, and Reset are described in the general case.

```
9   12:24:55
<Delay Active▶
<Alarm Reset>
```

Time (Channel 9)

Delay, Alarm, Active, and Reset are the same as described in the general case.

6.5.5.6 CHANNEL PLOT

```
PLOT CHAR:
<1 Window 2>
<3 Window 6>
   -    ▲▼
```

First, select which plot window the channel is to be plotted in (NA for 1 plot window), then use the ▲ ▼ keys to select a plot character. Plot window 1 is on the far left of the paper.

```
PLOT SCALING:
 0% Y value =
(▲▼for k,M,u,m)
 ________
```

Each plotted channel can have independent Y axis values. Enter the minimum (left most 0%) value . Enter a numeric value with the [0 ♪], [9], and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

```
PLOT SCALING:
100% Y value =
(▲▼for k,M,u,m)
 ________
```

Enter the maximum (right most 100%) value. Enter a numeric value with the [0 ♪], [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

6.6 CHANNEL LIST EXERCISE

The following exercises illustrate how to setup and use channel lists. Each exercise consists of step by step instructions and a filled in Channel List Creation Guide.

Exercise 6-1. Constructing a Channel List

In this exercise you will construct a list having two measurements, and then run it.

The first measurement is a measurement of time. The second measurement channel: 2; function: Vac; range: 3V. If you have only a 50-2 measurement module, make the function Vdc.

Name the list "60s", put a predelay of 60 seconds ahead of the first measurement, and make the channel list send the readings to the display and communications port number 1 which can print the measurement readings on a Model 54 Printer. Figure 6-6 Illustrates the guide for this exercise.

Note:

Everywhere you see the finger ☛ press the key shown next to it.

1.
```
 <DMM
☛<CHANNEL LISTS
 <PROGRAMS
 <HELP
```

If other lists are already stored in the 52A, the menu that comes up to the screen will look something like:

```
 ▲▼ Create New >☛
<OTHER.L     R>
<LISTS.L     R>
<etc..L      R>
```

2. Choose `Create New`. If there were no other lists stored yet, the 52A will take you immediately to:

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 _____
```

☛[6], ☛[0 ♪], observe:

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 60_____
```

☛[▲] once, observe:

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 60A____
```

Continue pressing [▲] until a lowercase "s" appears. (Use the [▼] key if you overshoot.)

☛[Enter] to execute the letter.

☛[Enter] again, to execute the name.

3.
```
 READING MODE:
 <Parallel
☛<Serial
```

(You pressed [3] for serial.) Observe the screen. The selector symbol (◀) for Serial is dark.

4. ☛ [Enter] .

```
DATA TO:  RAM>
☛<Comm Port 1
 <Comm Port 2
 <Disp  Filter>
```

Observe:

```
Comm Port 1
<Print Data
<Plot by scan
  &Time stamp>
```

Print Data is already selected (the default choice in the menu), so

☛ [▲] or [Menu] . Now you are back to:

```
DATA TO:  RAM>
<Comm Port 1
<Comm Port 2
<Disp  Filter>
```

Observe - the selector symbol (◀) for both Comm Port 1 and Disp (display) are dark. So

☛ [Enter] to exit the menu.

5. Observe:

```
FIRST CHAN #:

          _
```

☛ [9] to measure time. Observe:

```
FIRST CHAN #:

          9_
```

☛ [Enter] .

Observe the functions:

```
<HH:MM:SS Mil>
<M/D/Y  D/M/Y>
<MM/DD HH:MM
```

The default format is OK,

☛ [Mods] .

Observe:

(Attachments - "Mods" Menu)

```
<Delay Active>
<Alarm  Reset>
```

☛ [2] .

```
PRE_DELAY IN
    SECONDS

 ____________  ⇕
```

☛ [6] , ☛ [0 ♪] .

☛ [Enter] to get back up to the Mods menu.

```
<Delay Active>
<Alarm  Reset>
```

6. ☛ [Enter] to continue.

```
9FP:

 Next Ch:_
```

☛ [2] for the channel number.

Observe:

```
9FP:

 Next Ch:2_
```

☛ [Func] .

(Function Menu)

```
<Vdc       Temp>
<Vac       Ohms>
<Vac+dc ▲▼  dB>
```

☛ [3].

Observe:

```
<Vdc       Temp>
<Vac       Ohms>
<Vac+dc ▲▼  dB>
```

☛ [Enter] to sequence to the range menu.

```
<AutoRng    3V>
<30mV      30V>
<300mV    300V>
```

The 3V range is OK, so ☛ [Enter] to sequence to the next menu:

(Data Modifiers - "Disps" Menu)

```
<Scale  Resol>
<Min  Average>
<Max    Delta>
```

You are not using any of these, ☛ [Enter] to continue.

(Attachments - "Mods" Menu")

```
<Delay Active>
<Alarm  Reset>
<Track ▲▼  Cal>
```

You are not using any of these, ☛ [Enter] to continue.

7. Now there are two channels in the list:

```
9FP:2FP:

 Next Ch:_
```

There is no next channel in the measurement list, ☛ [Menu] to conclude list creation. The list is stored in memory.

8.

```
"60s.L"
                Run>
<List-P1 Edit>
<Copy  Rename>
```

If you wanted to go back to the main menu now and create some other list (for example), you would press [Menu], But you want to run 60s, so ☛ [7] to start it.

9. The first readings won't be ready for 60 seconds, so meanwhile the display shows:

```
 9  NOTRDY  HMS
2FP NOTRDY  Vac
```

At 60-second intervals, new pairs of readings are pro-duced. For example:

```
9  10:18:41 HMS
2FP 0.0033  Vac
```

If you had a Model 54 Printer connected to communications port 1, you would see:

```
9:   13:38:32 HMS2:FP 0.0033  Vac
9:   13:37:31 HMS2:FP 0.0035  Vac
9:   13:36:31 HMS2:FP 0.0036  Vac
9:   13:35:31 HMS2:FP 0.0030  Vac
9:   13:34:31 HMS2:FP 0.0029  Vac
9:   13:33:30 HMS2:FP 0.0036  Vac
9:   13:32:30 HMS2:FP 0.0034  Vac
9:   13:31:30 HMS2:FP 0.0031  Vac
9:   13:30:30 HMS2:FP 0.0029  Vac
9:   13:29:29 HMS2:FP 0.0029  Vac
9:   13:28:29 HMS2:FP 0.0028  Vac
9:   13:27:29 HMS    2:FP 0.0025  Va
"60s.L"
```

Challenge Question:
Was there any way you might have bypassed some of the Range, "Disp", and "Mods" menus, and thereby saved setup time? (Hint: consult the Channel List Menu Navigation Map, Appendix E-2b.)

WAVETEK Model 52A
Channel List Creation Guide

© 1988 Wavetek Rev 0701

Date: 6-10-88

Programmer: L. Schmitz

3) Data To:
- [X] Comm Port 1
  - [X] Print [ ] Plot
- [ ] Comm Port 2
  - [ ] Print [ ] Plot
- [ ] RAM
- [ ] Display
  - [ ] 1 Ch [X] 4 Ch
  - [ ] Scroll [ ] Plot
  - [ ] Alarms Only
- [ ] Filter Allow only:
  - [ ] Data [ ] Alarms

1) Channel List Name: 6 0 S _ _ _ _ _ L

2) Reading Mode: Serial [X] Parallel [ ]

Channel List Description: Two measurements, with one pre-delay. Prints in real time, if printer is connected.

[ ] One choice per row or column [ ] Additional or multiple choices are available

Note: Default choices are underlined (function or mode dependent)

P) Plot Setup:

Plot Windows [ ] 1 [ ] 2 [ ] 4

[ ] Time Stamp every x Scans (Optional)

[ ] 2 [ ] 4 [ ] 8 [ ] 16

Plot Symbols [ ] 32 [ ] 64

0 1 2 3 4 5 6 7 8 9 A B C D E F

4) Channels

Analog Channels
- Channel # (1-4)
- Subchannel # (00-64)

101 (example)

Digital Channels
- Channel # (5-8)

Time & Date
- Channel 9

Math (Pseudo) Channels
- Channel 0xx (01-99)

Text
- Channel "T" (Up key)

Group Channel Entry

Use [:] between Chan #s to indicate channel groups.

Example: 101:132

5) Functions

50-1 or 50-2	FP 50-1
1. Vdc (default)	19. Adc
2. Temp	20. Aac *1
3. dBdc	21. Aac+dc *1
4. CJTemp	22. Wdc
50-1 Only	23. VAac *1
5. Vac *1	24. VAac+dc *1
6. Vac+dc *1	**Ch 9 Time/Date**
7. dB (ac) *1	25. HH:MM:SS
8. Ohms *2	26. M/D/Y
9. Continuity *2	27. M/D H:M
10. Diode Chk *2	28. Military
11. Events *3	29. D/M/Y (Eur)
12. Frequency	**I/O Channels**
13. Period	30. Digital Input
14. Time Int	31. Digital Out
15. TI...1Shot	32. Analog Out
16. Pulse Width	**Text**
17. PW...1Shot	Up to 10 Char's
18. Logic	

***1. Multiplexed or mixed functions require added delay of at least 100ms to allow TRMS settleing.**
***2. FP inputs source current.**
***3. Do not switch channnels or functions when using Events.**
4. Range changing causing relay clicks should have delay added.

6) Ranges

1. Vdc or Vac
a. Auto b. 30mV c. 300mV
d. 3V e. 30V f. 300V

2. Ohms
a. Auto b. 30Ω c. 300Ω
d. 3kΩ e. 30kΩ f. 300kΩ
g. 3MΩ h. 30MΩ i. AutoMΩ
j. 300MΩ k. 3000MΩ

3. Adc or Aac
a. Auto mA b. Auto A
c. 30mA d. 300mA
e. 3A f. 10A

4. Frequency
a. Auto b. 10Hz c. 100Hz
d. 1kHz e. 10kHz f. 100kHz
g. 1MHz h. 4MHz

5. Time Interval or Pulse Width
a. Auto b. 100ns c. 1000ns
d. 10s e. 100s f. 360s

6. Period
a. Auto b. 100µs c. 1000µs
d. 10ms e. 100ms f. 1000ms

7. Temperature TC or RTD type
a. R b. K c. J d. B e. E
f. T g. S
h. 100Ω 392 i. 100Ω 385

8. VA (enter a Vrng and an Arng)
a1. 30V b1. 300V
a2. 300mA b2. 3A c2. 10A

7) Display Mods

A. Scale
Enter math chan# (001-099)

B. Min/Max
1. Minimum
2. Maximum

C. Resolution
1. 32000 / 9999999
2. 3200 / 999999 (Higher spd)
3. 3200 / 99999
4. ▮▮▮ Bargraph
5. 32/99 ▮▮▮ DigiBargraph

D. Average
Value 1: # of Readings to average (1-65535)
Value 2: Delay between avg readings (.01-545.80s)

E. Delta (zero, relative, offset)
1. Delta % reading
2. Delta % number
Value 1: 0% reference
3. Delta reading
4. Delta number
Value 1: 0 reference

F. I/O Channels
1. Binary 2. Hex 3. Octal
4. Decimal 5. BCD 6. ASCII
7. Volts (analog out only).

8) Function Mods

A. Alarm: Enter Alarm #

B. Pre-Delay
Value: delay (0-545.80s)

C. Tracking Out
Value: Tracking chan# (5-8)

D. Vdc Mods: 10MΩ input Z

E. Temp Mods:
1. °C (default) 2. °F 3. °K 4. °R

F. dB Mods (enter Reference Z)
dBm: 50,75,90,93,11,125,135,150, 250,300,500,600 (default) ,600rn, 800,900,900m,1000 (dBV),1200
dBW: 2,4,8,16

G. Counter Sensitivity
AC Coupled: 1) 3mV 2) 30mV 3) 300mV 4) 3V 5) 30V
DC Coupled: 6) TTL 7) CMOS5 8) CMOS12 9) ±40mV 10) ±400mV 11) +80 +40V

H. Time Int and Pulse Width Mods
1. AC coupled a. Rising edge ⨍
2. DC coupled b. Falling edge ⨏

I. Wait for trig:
a. 200ms b. 2s c. 20s d. Indef

I. Digital and Analog Output Mods
1. Increment 2. Decrement
3. Complement

J. Digital Input Mods: Invert

(4) Channel # or Group	(5) Function Label or Text	(6) Range Type or Value	(7A) Scale #0xx	(7B-F) Display Mods Type	Value	(8A) Alarm #Axx	(8B-J) Function Mods Type	Value	Reset	Inactive	Symbol	Window	(P) Plotting 0% Scale Factor	100% Scale Factor
9 (time)	H/M/S	—							☐	☐				
2	Vac	3V							☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				
									☐	☐				

Figure 6-6. Channel List Creation Guide for Exercise 6-1.

One limitation of a channel list, when used by itself, is that it allows a maximum pause between scans of only 545.8 seconds (about 9.1 minutes).

Exercise, 6-2 is a channel list with five different channels. The list name is "Scrolling". The measurement data will be sent to the display, and stored in memory. You will set up the display mode as 4-channel, with scroll. Exercise 6-2 is outlined in the accompanying Channel List Creation Guide Figure 6-7. In this exercise, you will use the [Menu] key in certain places, to take shortcuts. If in doubt as to key operation, consult the Channel List Menu Navigation Map, Appendix E-2.

Note

Everywhere you see the finger (☛), press the key shown next to it.

1.

```
<DMM
☛<CHANNEL LISTS
<PROGRAMS
<HELP
```

```
▲▼ Create New>☛
<60s..L      R>
<OTHER.L     R>
<LISTS.L     R>
```

2. You chose Create New.

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
```

The list name will be "Scrolling", so

☛[▲] until S shows in the first character position (Use [▼] if you overshoot.)

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 S_
```

☛[Enter] to execute the letter.

(The entry of the rest of the name letters will not be shown. You may shorten the name if you desire.)

☛[Enter] after the last letter, to execute the name.

3.

```
READING MODE:
<Parallel
☛<Serial
```

☛[Enter].

4.

```
DATA TO:  RAM>☛
<Comm Port 1
<Comm Port 2
☛<Disp  Filter>
```

Observe:

```
DISPLAY:  Off>
<1-Alphanum-4>
<Plot  Scroll>
<Alarms only
```

These are the two selections you want, so ☛[Menu]. Now you are back to:

```
DATA TO:  RAM>
<Comm Port 1
<Comm Port 2
<Disp  Filter>
```

Observe - the selector symbols (> and <) for both RAM and Disp (display) are dark. So

☛[Enter] to exit the menu.

5. Observe:

```
FIRST CHAN #:

             _
```

☛[1]. Observe:

```
FIRST CHAN #:

             1_
```

☛[Menu]. (Vdc is the default function and 3V is the default range, so they are entered by the 52A.)

```
1FP:

 Next Ch:_
```

☛[2] for the channel number.

6. Observe:

```
1FP:

 Next Ch:2_
```

☛[Menu]. 2FP:Vdc,3Vrange is entered.

```
1FP:2FP

 Next Ch:_
```

7. ☛[1]. Observe:

```
1FP:2FP

 Next Ch:1_
```

☛[Func].

(Function Menu)

```
<Vdc      Temp>
<Vac      Ohms>
<Vac+dc ▲▼  dB>
```

☛[▲] twice. (50-1 measurement module assumed.)

```
  <Cont  CJTemp>
☛<dBdc  Events>
  <⊣⊢ Chk Logic>
```

☛[Enter] to sequence through the range menu

```
<AutoRng   3V>
☛<30mV    30V>
 <300mV  300V>
```

8. ☛[Menu] to start the next channel's setup.

```
1FP: 2FP: 1FP

 Next Ch:_
```

☛[1].

☛[Func].

(Function Menu)

```
<Vdc      Temp>
<Vac      Ohms>
<Vac+dc ▲▼  dB>
```

☛[▲] twice. (50-1 measurement module assumed.)

```
<Cont  CJTemp>☛
<dBdc  Events>
<   Chk Logic>
```

Cold Junction Temperature has no range selections, so ☛[Menu] to conclude the entry.

9.

```
1FP :2FP: 1FP

 Next Ch:_
```

☛[1].

☛[Func].

```
<Vdc      Temp>☛
<Vac      Ohms>
<Vac+dc ▲▼  dB>
```

☛ [Range].

```
<R      B>
<K  TC'S E>
<J       T>
```

At this time select (☛) your thermocouple type. If no thermocouple is available, short the rear panel intput of measurement module one with a plain (copper wire) banana-type cable, and leave the selection on K (Kelvin).

☛ [Menu] to conclude the entry.

```
1FP:2FP:1FP:1FP
1FP:
 Next Ch:_
```

10. ☛ [Menu] to conclude the list creation.

```
"Scroling.L
<Clear     Run>*
<List-P1 Edit>
<Copy  Rename>
```

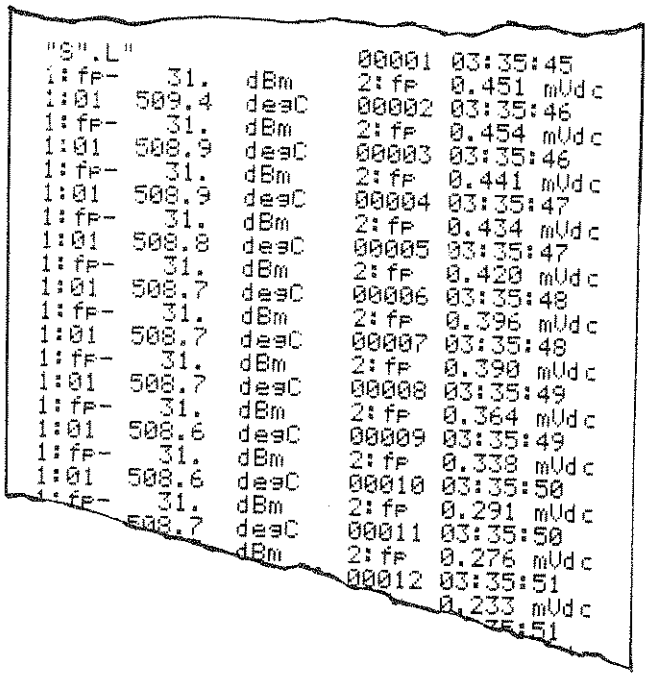
Depending on the degree of electrical noise, the display should look about like:

```
1FP 0.0001  Vdc
2FP 0.0002  Vdc
1FP-    79.  dBm
1FP  24.98 CJ°C
```

Let the list run for about 5 seconds before stopping it ([Menu] key).

You may adjust the data scrolling speed (paragraph 4.4: Scroll Speed) each time before you start the list running, and observe the effect upon the display data scrolling speed.

Use the RECALL DATA main menu item to recall and printout the data, see below.



```
"S".L"                          00001 03:35:45
1:fp-    31.   dBm              2:fp  0.451 mVdc
1:01  509.4    degC             00002 03:35:46
1:fp-    31.   dBm              2:fp  0.454 mVdc
1:01  508.9    degC             00003 03:35:46
1:fp-    31.   dBm              2:fp  0.441 mVdc
1:01  508.9    degC             00004 03:35:47
1:fp-    31.   dBm              2:fp  0.434 mVdc
1:01  508.8    degC             00005 03:35:47
1:fp-    31.   dBm              2:fp  0.420 mVdc
1:01  508.7    degC             00006 03:35:48
1:fp-    31.   dBm              2:fp  0.396 mVdc
1:01  508.7    degC             00007 03:35:48
1:fp-    31.   dBm              2:fp  0.390 mVdc
1:01  508.7    degC             00008 03:35:49
1:fp-    31.   dBm              2:fp  0.364 mVdc
1:01  508.6    degC             00009 03:35:49
1:fp-    31.   dBm              2:fp  0.338 mVdc
1:01  508.6    degC             00010 03:35:50
1:fp-    31.   dBm              2:fp  0.291 mVdc
      508.7    degC             00011 03:35:50
           dBm                  2:fp  0.276 mVdc
                                00012 03:35:51
                                      0.233 mVdc
                                      :51
```

Use the edit mode (see the last menu shown above) to add or delete one of the measurements from the list.

Identify a channel entry to be cleared by pressing the key to the left of it. The channel number will thicken or "highlight". Then press [Clear] to begin the clearing sequence. If adding an entry, it will be put after the entry that the "highlighter" is on. Once the highlighter is positioned, use the [Chan] key to start entering an additional measurement.

Also, use the Edit mode, try to turn off the display data scrolling (it is a submenuof the DATA TO: menu). Once you have scrolling turned off, you can still scroll the running list's data manually, using the [▲] and [▼] keys.

Clear the stored data, add 3 empty text channels to the end of the list, and rerun the list for about 10 seconds. Stop, and Recall to the printer. Observe the spacing provided by the empty text channels:

WAVETEK Model 52A
Channel List Creation Guide

© 1988 Wavetek Rev 0701

Date: 6-18-88

Programmer:

1) Channel List Name: scrolling&L

2) Reading Mode: Serial [X] Parallel [ ]

Channel List Description: Multiple channels with display scrolling. Also stores the data so it may be recalled later.

❒ One choice per row or column ○ Additional or multiple choices are available
Note: Default choices are underlined (function or mode dependent)

3) Data To:
- ○ Comm Port 1 ❒ Print ❒ Plot
- ○ Comm Port 2 ❒ Print ❒ Plot
- [X] RAM
- ○ Display ❒ 1 Ch [X] 4 Ch [X] Scroll ❒ Plot ○ Alarms Only
- ○ Filter Allow only: ○ Data ○ Alarms

P) Plot Setup:
Plot Windows ❒ 1 ❒ 2 ❒ 4
○ **Time Stamp every x Scans** (Optional) ❒ 2 ❒ 4 ❒ 8 ❒ 16
Plot Symbols ❒ 32 ❒ 64
0 1 2 3 4 5 6 7 8 9 A B C D E F

4) Channels
Analog Channels
Channel # (1-4)
Subchannel # (00-64)
101 (example)
Digital Channels
Channel # (5-8)
Time & Date
Channel 9
Math (Pseudo) Channels
Channel 0xx (01-99)
Text
Channel "T" (Up key)
Group Channel Entry
Use [-] between Chan #s to indicate channel groups.
Example: 101-132

5) Functions
50-1 or 50-2
1. Vdc (default)
2. Temp
3. dBdc
4. CJTemp
50-1 Only
5. Vac *1
6. Vac+dc *1
7. dB (ac) *1
8. Ohms *2
9. Continuity *2
10. Diode Chk *2
11. Events *3
12. Frequency
13. Period
14. Time Int
15. TI...1Shot
16. Pulse Width
17. PW...1Shot
18. Logic

FP 50-1
19. Adc
20. Aac *1
21. Aac+dc *1
22. Wdc
23. VAac *1
24. VAac+dc *1

Ch 9 Time/Date
25. HH:MM:SS
26. M/D/Y
27. M/D H:M
28. Military
29. D/M/Y (Eur)

I/O Channels
30. Digital Input
31. Digital Out
32. Analog Out

Text
Up to 10 Chars

*1. Multiplexed or mixed functions require added delay of at least 100ms to allow TRMS settleing.
*2. FP inputs source current.
*3. Do not switch channels or functions when using Events.
4. Range changing causing relay clicks should have delay added.

6) Ranges
1. Vdc or Vac
a. Auto b. 30mV c. 300mV
d. 3V e. 30V f. 300V
2. Ohms
a. Auto b. 30Ω c. 300Ω
d. 3kΩ e. 30kΩ f. 300kΩ
g. 3MΩ h. 30MΩ i. AutoMΩ
j. 300MΩ k. 3000MΩ
3. Adc or Aac
a. Auto mA b. Auto A
c. 30mA d. 300mA
e. 3A f. 10A
4. Frequency
a. Auto b. 10Hz c. 100Hz
d. 1kHz e. 10kHz f. 100kHz
g. 1MHz h. 4MHz
5. Time Interval or Pulse Width
a. Auto b. 100ns c. 1000ns
d. 10s e. 100s f. 360s
6. Period
a. Auto b. 100µs c. 1000µs
d. 10ms e. 100ms f. 1000ms
7. Temperature TC or RTD type
a. R b. K c. J d. B e. E
f. T g. S
h. 100Ω 392 i. 100Ω 385
8. VA (enter a Vrng and an Arng)
a1. 30V b1. 300V
a2. 300mA b2. 3A c2. 10A

7) Display Mods
A. Scale
Enter math chan# (001-099)
B. Min/Max
1. Minimum
2. Maximum
C. Resolution
1. 32000 / 9999999
2. 3200 / 999999 (Higher spd)
3. 3200 / 99999
4. ▬ Bargraph
5. 32/99 ▬ DigiBargraph
D. Average
Value 1: # of Readings to average (1-65535)
Value 2: Delay between avg readings (.01-545.80s)
E. Delta (zero, relative, offset)
1. Delta % reading
2. Delta % number
Value 1: 0% reference
3. Delta reading
4. Delta number
Value 1: 0 reference
F. I/O Channels
1. Binary 2. Hex 3. Octal
4. Decimal 5. BCD 6. ASCII
7. Volts (analog out only).

8) Function Mods
A. Alarm: Enter Alarm #
B. Pre-Delay
Value: delay (0-545.80s)
C. Tracking Out
Value: Tracking chan# (5-8)
D. Vdc Mods: 10MΩ input Z
E. Temp Mods:
1. °C (default) 2. °F 3. °K 4. °R
F. dB Mods (enter Reference Z)
dBm: 50,75,90,93,11,125,135,150, 250,300,500,600 (default) ,600rn, 800,900,900rn,1000 (dBV),1200
dBW: 2,4,8,16
G. Counter Sensitivity
AC Coupled: 1) 3mV 2) 30mV 3) 300mV 4) 3V 5) 30V
DC Coupled: 6) TTL 7) CMOS5 8) CMOS12 9) ±40mV 10) ±400mV 11) +80 +40V
H. Time Int and Pulse Width Mods
1. AC coupled a. Rising edge ⤴
2. DC coupled b. Falling edge ⤵
I. Wait for trig:
a. 200ms b. 2s c. 20s d. Indef
I. Digital and Analog Output Mods
1. Increment 2. Decrement 3. Complement
J. Digital Input Mods: Invert

(4) Channel # or Group	(5) Function Label or Text	(6) Range Type or Value	(7A) Scale #0xx	(7B-F) Display Mods Type	Value	(8A) Alarm #Axx	(8B-J) Function Mods Type	Value	Reset	Inactive	Symbol	Window	(P) Plotting 0% Scale Factor	100% Scale Factor
1 FP	Vdc	3V							❒	❒				
2 FP	Vdc	3V							❒	❒				
1 FP	dBdc	30mV							❒	❒				
1 FP	CJTEMP	—							❒	❒				
101	TEMP	(users)							❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				
									❒	❒				

Figure 6-7. Channel List Creation Guide for Exercise 6-2

In this exercise, you will set up a list, named *BlocProg*, having three different entries Each entry in the list results in several measurements, through the technique called block programming.

Two measurement modules are assumed. Each measurement module has a multiplexer ahead of it. You may use any type of Wavetek multiplexers for this exercise, and configure them as single ended, or parallel. (If you choose not to connect the multiplexers to the 52A inputs, short out the channel 1 and channel 2 multiplexer rear panel inputs.)

This exercise assumes certain conditions. If you understand the rationales for the features used, you will be able to extrapolate to your own application. Do this exercise even if you have only one measurement module, and no multiplexers - fallback instructions are provided. See figure 6-8, Creation Guide for BlocProg. If you have only one measurement module, change the second and third entries in the list to channels 101-104 and 105-108.

There are two groups of 8 thermocouples, separated by a large difference in physical location. Because of possible radio frequency interference from a nearby powerful broadcast transmitter, the two groups of thermocouples may act as the ends of an antenna. Because of the induced potential, it was decided to assign the two groups of thermocouples to different measurement modules. Each thermocouple channel will be averaged for 10 measurements before producing the actual reading.

One hypothesis is that there are only 12 thermocouples of one type available, but there are 4 thermcouples of another type. After making the one entry for the 8 channels on the first measurement module, you will copy the measurement parameters over to the first entry for the second measurement module. The first entry for the second measurement module will be for channels 201-204. These channels will also have type E thermocouples connected. But channels 205-208 have a different type TC connected, so the "range" parameter must be changed.

The measurement data will be sent to the display, and stored in memory. You will set up the display mode as 4-channel, with scroll.

Note:
Everywhere you see the finger
(☛)press the key shown next to it.

1.
```
<DMM
☛<CHANNEL LISTS
<PROGRAMS
<HELP
```

2.
```
 ▲▼ Create New>☛
<60s..L      R>
<Scrolling.L R>
<OTHER.L     R>
```

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
```

The list name will be "BlocProg", so ☛[▲] until B shows in the first character position. (Use [▼] if you overshoot.)

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 B
```

☛[Enter] to execute the letter.

(The entry of the rest of the name letters will not be shown.You may shorten the name if you desire.)

☛[Enter] after the last letter, to execute the name.

3.
```
READING MODE:
 <Parallel
☛<Serial
```

☛[Enter].

4.
```
DATA TO:  RAM>☛
 <Comm Port 1
 <Comm Port 2
☛<Disp  Filter>
```

Observe:

```
DISPLAY:  Off>
<1-Alphanum-4>
<Plot  Scroll>
<Alarms only
```

These are the two selections you want, so ☛[Menu]
Now you are back to:

```
DATA TO:  RAM>
<Comm Port 1
<Comm Port 2
<Disp  Filter>
```

Observe - the selector symbols (> and <) for both RAM and Disp (display) are dark. So

☛[Enter] to exit the menu.

5. Observe:

```
FIRST CHAN #:

              _
```

☛[1], [0 ♪], [1], [Enter]. Observe:

```
101-

 Next Ch:_
```

☛[1], [0 ♪], [8].

Observe:

```
101-

 Next Ch:108
```

☛[Enter].

(Function Menu)

```
<Vdc       Temp>☛
<Vac       Ohms>
<Vac+dc ▲▼  dB>
```

☛ [Range].

```
<R            B>
<K   TC's     E>☛
<J    ▲▼      T>
```

☛[Disp].

```
<Scale  Resol>
<Min  Average>☛
<Max    Delta>
```

```
Average n Rdgs
☛<n=  _____
<Dly _____  s
```

```
AVERAGE COUNT:
  (1-65535)
   0=No Avg
      ____
```

☛[6], [Enter].

```
Average n Rdgs
☛<n=  00006
<Dly  0.0000 s
```

☛[Enter].

```
<Scale  Resol>
<Min  Average>
<Max    Delta>
```

(Back at the display data modifiers menu.) ☛[Menu].

Now all 8 channels have been programmed for E thermocouples, and each will be averaged.

6.

```
101-108

 Next Ch:
```

☛[2], [0 ♪], [1], [± •].

```
101-108: 201-

 Next Ch:
```

☛[2], [0 ♪], [4].

```
101-108: 201-

 Next Ch:204
```

```
101-108: 201-204

 Next Ch:
```

☛ [2], [0 ♪], [5 LCD], [± •].

☛ [2], [0 ♪], [8].

☛ [Func]

```
<Vdc      Temp>☛
<Vac      Ohms>
<Vac+dc ▲▼ dB>
```

☛ [Range].

```
<R          B>
<K   TC's   E>
<J    ▲▼    T>☛
```

☛ [Disp].

```
<Scale  Resol>
<Min  Average>☛
<Max    Delta>
```

```
Average n Rdgs
☛<n=  _____
 <Dly _____  s
```

```
AVERAGE COUNT:
  (1-65535)
   0=No Avg
      ____
```

☛ [6], [Enter].

```
Average n Rdgs
☛<n=  00006
 <Dly  0.0000 s
```

☛ [Enter].

```
<Scale  Resol>
<Min  Average>
<Max    Delta>
```

(Back at the display data modifiers menu.)

☛ [Menu].

7.

```
101-108: 201-204:
205-208:

 Next Ch:
```

☛ [▲].

Observe:

```
101-108: 201-204:
205-208:

 Next Ch:T
```

☛ [Enter].

```
ENTER TEXT:
 (Use ▲▼ keys)
 ____
```

No text is to be entered, The empty text entry is to provide spacing on the printout later.

☛ [Menu].

8.

```
101-108: 201-204:
205-208: T

 Next Ch:
```

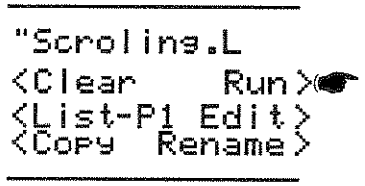
☛ [▲]. To be another empty text entry.

```
101-108: 201-204:
205-208: T

 Next Ch:T
```

☛ [Menu] which completes the empty text entry.

```
101-108: 201-204:
205-208: T : T

 Next Ch:
```

9. ☛ [Menu] which completes the channel list creation.



WAVETEK Model 52A
Channel List Creation Guide

© 1988 Wavetek Rev 0701

Date: 6-27-88

Programmer: L. Schmitz

1) Channel List Name: BlocProgL

2) Reading Mode: Serial ☐ Parallel ☐

Channel List Description: A block programming and parameter copying example.

☐ One choice per row-or column ○ Additional or multiple choices are available
Note: Default choices are underlined (function or mode dependent)

3) Data To:
- ○ Comm Port 1 ☐ Print ☐ Plot
- ○ Comm Port 2 ☐ Print ☐ Plot
- ☒ RAM
- ☒ Display ☐ 1 Ch ☒ 4 Ch ☒ Scroll ☐ Plot ○ Alarms Only
- ○ Filter Allow only: ○ Data ○ Alarms

P) Plot Setup:
Plot Windows ☐1 ☐2 ☐4

○ **Time Stamp every x Scans** (Optional) ☐2 ☐4 ☐8 ☐16

Plot Symbols ☐32 ☐64

0 1 2 3 4 5 6 7 8 9 A B C D E F

4) Channels
Analog Channels
Channel # (1-4)
Subchannel # (00-64)
101 (example)

Digital Channels
Channel # (5-8)

Time & Date
Channel 9

Math (Pseudo) Channels
Channel 0xx (01-99)

Text
Channel "T" (Up key)

Group Channel Entry
Use ± between Chan #s to indicate channel groups.
Example: 101±132

5) Functions

50-1 or 50-2	FP 50-1
1. Vdc (default)	19. Adc
2. Temp	20. Aac *1
3. dBdc	21. Aac+dc *1
4. CJTemp	22. Wdc
50-1 Only	23. VAac *1
5. Vac *1	24. VAac+dc *1
6. Vac+dc *1	
7. dB (ac) *1	**Ch 9 Time/Date**
8. Ohms *2	25. HH:MM:SS
9. Continuity *2	26. M/D/Y
10. Diode Chk *2	27. M/D H:M
11. Events *3	28. Military
12. Frequency	29. D/M/Y (Eur)
13. Period	**I/O Channels**
14. Time Int	30. Digital Input
15. TI...1Shot	31. Digital Out.
16. Pulse Width	32. Analog Out
17. PW...1Shot	**Text**
18. Logic	Up to 10 Char's

***1. Multiplexed or mixed functions require added delay of at least 100ms to allow TRMS settleing.**
***2. FP inputs source current.**
***3. Do not switch channels or functions when using Events.**
4. Range changing causing relay clicks should have delay added.

6) Ranges
1. Vdc or Vac
a. Auto b. 30mV c. 300mV
d. 3V e. 30V f. 300V

2. Ohms
a. Auto b. 30Ω c. 300Ω
d. 3kΩ e. 30kΩ f. 300kΩ
g. 3MΩ h. 30MΩ i. AutoMΩ
j. 300MΩ k. 3000MΩ

3. Adc or Aac
a. Auto mA b. Auto A
c. 30mA d. 300mA
e. 3A f. 10A

4. Frequency
a. Auto b. 10Hz c. 100Hz
d. 1kHz e. 10kHz f. 100kHz
g. 1MHz h. 4MHz

5. Time Interval or Pulse Width
a. Auto b. 100ms c. 1000ms
d. 10s e. 100s f. 360s

6. Period
a. Auto b. 100µs c. 1000µs
d. 10ms e. 100ms f. 1000ms

7. Temperature TC or RTD type
a. R b. K c. J d. B e. E
f. T g. S
h. 100Ω 392 i. 100Ω 385

8. VA (enter a Vrng and an Arng)
a1. 30V b1. 300V
a2. 300mA b2. 3A c2. 10A

7) Display Mods
A. Scale
Enter math chan# (001-099)

B. Min/Max
1. Minimum
2. Maximum

C. Resolution
1. 32000 / 9999999
2. 3200 / 999999 (Higher spd)
3. 3200 / 99999
4. ▮ Bargraph
5. 32/99 ▮ DigiBargraph

D. Average
Value 1: # of Readings to average (1-65535)
Value 2: Delay between avg readings (.01-545.80s)

E. Delta (zero, relative, offset)
1. Delta % reading
2. Delta % number
Value 1: 0% reference
3. Delta reading
4. Delta number
Value 1: 0 reference

F. I/O Channels
1. Binary 2. Hex 3. Octal
4. Decimal 5. BCD 6. ASCII
7. Volts (analog out only).

8) Function Mods
A. Alarm: Enter Alarm #

B. Pre-Delay
Value: delay (0-545.80s)

C. Tracking Out
Value: Tracking chan# (5-8)

D. Vdc Mods: 10MΩ input Z

E. Temp Mods:
1. °C (default) 2. °F 3. °K 4. °R

F. dB Mods (enter Reference Z)
dBm: 50,75,90,93,11,125,135,150, 250,300,500,600 (default) ,600rn, 800,900,900rn,1000 (dBV),1200
dBW: 2,4,8,16

G. Counter Sensitivity
AC Coupled: 1) 3mV 2) 30mV 3) 300mV 4) 3V 5) 30V
DC Coupled: 6) TTL 7) CMOS5 8) CMOS12 9) ±40mV 10) ±400mV 11) +80 +40V

H. Time Int and Pulse Width Mods
1. AC coupled a. Rising edge ⨍
2. DC coupled b. Falling edge ⨏

I. Wait for trig:
a. 200ms b. 2s c. 20s d. Indef

J. Digital and Analog Output Mods
1. Increment 2. Decrement
3. Complement

J. Digital Input Mods: Invert

(4) Channel # or Group	(5) Function Label or Text	(6) Range Type or Value	(7A) Scale #0xx	(7B-F) Display Mods Type	Value	(8A) Alarm #Axx	(8B-J) Function Mods Type	Value	(P) Plotting Reset	Inactive	Symbol Window	0% Scale Factor	100% Scale Factor
101-108	Temp								☐	☐			
201-204	Temp								☐	☐			
205-208	Temp								☐	☐			
T	(printout								☐	☐			
T	Spacing)								☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			
									☐	☐			

Figure 6-8. Channel List Creation Guide for Exercise 6-3.

SECTION 7
PROGRAMS

7.1 INTRODUCTION

Programs consist of channel lists (up to 255) that are controlled by start conditions, scan intervals, stop conditions and program end conditions. Each program, when created, is assigned an unique user-defined name. This name identifies the program when stored in the Model 52A's internal memory. A stored program can be run, edited, copied, and deleted. This section describes how to create, edit, run and delete a program. The channel list used by the program must already exist (section 6).

Paragraph 7.2 lists the program menu items.
Paragraph 7.3 summarizes the program menu items.
Paragraph 7.4 summarizes program setup.
Paragraph 7.5 gives details on program menu items.
Appendix E-3 is the programs menu navigation guide.

7.2 PROGRAMS MENU ITEMS

Below is an indented list of program menu items. These items are discussed throughout this section.

Programs
- Create New
  - New Program Name
  - Storage
    - Data
    - Lst/Pgm Names
    - Scan Numbers
  - Start
    - As Soon As Possible
    - Elapsed Time
      - Elapsed Time Till Start
    - Real Time
      - Set Start Time
    - Trigger
      - Trigger Type
        - Digital In
          - Trigger With Digital CH #
            - Trigger Value
      - IEEE-488 "GET"
      - Port1 Cntl-D
  - Lists to Scan:
    - *Select the List*
    - Repeat Count
    - T-Int Between List Repeats:
  - Scan Interval
    - Set
    - Continuous
  - Between Scans
    - Power Down
    - Next Scan Time
    - Monitor List
  - Stop:
    - Trigger
      - Digital In
      - IEEE-488 "Get"
      - Port 1 Cntl-D
    - Elapsed Time
      - Stop After Elapsed Time
    - Real Time
      - Set Stop Time
    - # of Scans
  - Program End
    - Run Prgm/ List
    - Main Menu
    - Off
    - RclData
      - Send Data To
        - Port 1
        - Port 2
        - & Clr
        - Plot
        - XY Plot

AAAAAAAA.P *(Typical program example)*
- Run
- Edit
- Rename
- Lock
- List-P1
- Copy

7.3 PROGRAMS MENU SUMMARY

Item	Summary
PROGRAMS	This main menu item allows you to create a new program, edit an existing program, or runs an existing program.
CREATE NEW	Start creation of a new program.
NEW PROGRAM NAME:	Assigns an unique user-defined name to a program.
STORAGE	Selects what data will be stored: just data.
START	Selects programs start conditions. *ASAP* - Starts the program immediately. *Elapsed Time* - Starts the program using a count down timer. *Real Time* - Starts the program at a user entered day and time. *Trigger* - Starts the program using either a digital input, IEEE-488 Group Execute Trigger, or RS-232 control D.
SCAN LIST GRP	Selects the channel list to be measured and the number of times and how often the channel list repeats. *Repeat Count* - allows entry of the number of times the channel list repeats. *T-Int Between List Repeat* - allows selection of how often the channel list repeats.
SCAN INTERVAL	Selects how often the channel list group repeats. *Contin* - Continuously repeated channel list groups. *Set* - Repeats the channel list group at an user-set time (days, hours, minutes, and seconds).
BETWEEN SCANS	Selects what the Model 52A does between scans of the channel list group. No affect when continuous is selected. *Power Down* - Model 52A powers down between channel list groups. *Next Scan Time* - Displays the time to the next channel list group. *Monitor List* - Runs a selected channel list between scans of the channel list group.
STOP	Allows selection of a programs stop conditions. *Trigger* - Stops the program using either a digital input,IEEE-488 Group Execute Trigger, or RS-232 Control D. *Elapsed Time* - Stops the program using a count down timer. *Real Time* - Stops the program at a user entered day and time. *# of Scans* - Stops the program after a number of channel list groups.
PROGRAM END:	Select what happens when the program ends. *Run Prgm/List* - Selects of a different Program or Channel List that runs after completing the original Program. *Main Menu* - Returns the Model 52A to the main menu. *Off* - Turns the power of the Model 52A off at the end of the Program. *RclData* - Recalls program data at the end of the program. The data can be routed to either communication port

Item	Summary
AAAAAAAA.P	An existing program to be run, edited, copied, or renamed. In addition, the Program can be locked out; plus the Program setup can be printed on the Model 54 Printer.
RUN	Runs the selected program.
LIST-P1	Sends the complete program setup to communication port 1 (Model 54 Printer).
COPY	Copies the selected program. The copied program must be given a new name.
LOCK	Allows the program to "locked" to prevent disruption of the program.

7.4 HOW TO USE PROGRAMS

This paragraph consists of a series of list that describes:

Creating programs

Editing programs

Deleting programs

7.4.1 Creating a Program

To create a new program,

1. Locate and select PROGRAM from the main menu.
2. Select Create New.
3. Enter the program's name.
4. Select the storage conditions.
5. Select the start conditions.
6. Select the channel list scan group along with each channel list repeat count and time interval.
7. Select the channel list scan group scan interval.
8. Select what happens between scans.
9. Select the program stop conditions.
10. Select the end of program conditions.

7.4.2 Editing a Program.

To edit a program,

1. Locate and select PROGRAMS from the main menu.
2. Locate the name of the program to be edited. Select the program by pressing the key to the left of the name.
3. Step through the program menus and change the appropriate items.

7.4.3 Deleting a Program

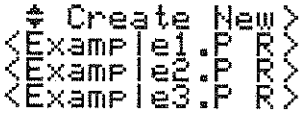
To delete an entire program,

1. Locate and select PROGRAMS from the main menu.
2. Locate the name of the program to be edited. Select the program by pressing the key to the left of the name.
3. From the "filing" menu, press the Clear key to delete the entire program.

7.5 PROGRAM MENU DETAILS

PROGRAMS

Selecting this main menu item allows the creation of a new, editing an existing, or running a program.



To create a new program, select "Create New" (2).
To scroll through the existing programs, use the ▲ ▼ keys. To immediately run a Program, press the key next to the "R".
To edit, copy, rename, lock, or print a listing, press the key to the left side of the desired program.

```
NEW PROGRAM
 NAME:
 (Use ▲▼ Keys)
   --------
```

To enter a name for a new program, use the [▲][▼] keys to scroll through the character set. Press [Enter] when desired character is found. Press [Enter] twice when name is finished (1-8 Chars).

```
STORAGE:
◀Data
◀Lst/Pgm Names
◀Scan Numbers
```

To select what data will be stored, select items from this menu. Normally (default) all items are selected (arrow filled in ◀). Deselect an item to prevent it from being stored (arrow not filled in <) *data.*
Deselect Data [2] to not store the data.
Deselect Lst/Pgm Names [3] to not store the program and channel list name.
Deselect Scan Number [4] to not store the scan numbers.

When turned off these selections override the settings of the Channel List(s) used in this program. Some PC spreadsheet programs cannot separate the names from the data, so removing the non-data related stored information can prove useful.

```
START:    ASAP>
<Elapsed Time
<Real Time
<Trigger
```

Selects the program start conditions.
ASAP [6] (Default).Starts as soon as the run key is pressed, or as soon as the program is called by another program.
To start with a time delay select "Elapsed Time" [2].
To start from a real time push [3],
To start from a digital trigger (must have Digital I/O option) select "Trigger" [4].

```
ELAPSED TIME
   TI   START:
 DD HH MM SS
 -- --:--:--
```

Elapsed Time Response

Enter the elapsed time in Delta Days (0-99), Hours (0-23), Minutes (0-59), and Seconds (0-59) using the numeric keys.

```
SET START TIME

▲DD HH:MM:SS
 -- --:--:--
```

Real Time Response

Enter the day in delta Days (0-99), and the real time in 24 hour mode: Hours (0-23), Minutes (0-59), and Seconds (0-59).

```
TRIGGER TYPE:
<Digital In
<IEEE-488"GET"
<Port1 Cntl-D▲
```

Trigger Response

Select program start trigger type.
Digital In
[2] requires at least one Digital I/O card (Option 50-14) to be present. This could detect switch closures or logic transitions.
IEEE-488"GET"
[3] (Option 50-13A required) will trigger the program start when a "Group Execute Trigger" signal is present on the IEEE-488 bus.
Port 1 (or 2) Cntl D
[4] will trigger the program start when a Cntl D is sent to the Model 52A over RS-232. The control character can be changed by selecting the Port and then using the [▲][▼] keys.

```
TRIGGER WITH
 DIGITAL CH#:
<5          7>
<6          8>
```

Select the digital input channel number. Option 50-14 must be installed in the appropriate slot on the rear panel of the Model 52A equivalent to the channel selected.

```
TRIGGER VALUE:
  1,0,X(▲)
 (X=Ignore)
  --------
```

The trigger input can be from 1 to 8 bits in any bit pattern. Enter a 1 or 0 where the input must match (MSb...LSb) and an "X" ([▲] key) for a "don't care".

```
LISTS TO SCAN:
(Chan key to
 select Lists
255 Lists max)

SCAN LIST GRP:
◀AAAAAAAAA  x001>
<BBBBBBBBB  x010>
<CCCCCCCCC  x254>
```

Channel List Scan Group

Programs operate with one or more predefined Channel Lists (Chan List Scan Group).
Push the [Chan] key to get list of available Channel Lists. From 1 to 255 lists can be accessed in a single program. If more than three lists exist, use the [▲][▼] keys to scroll through the list. Each selected list can have a repeat count multiplier which will cause the list to be scanned more than once. To modify the count, press the key to the right of the count indication ([7],[8],or [9]). If "X" is entered for the repeat count, the list will be scanned continuously (no subsequent lists will be accessed) until the stop condition occurs or an alarm occurs that has an EndList or go to List/Program response.

```
<AUKDFJSL
<AAAAAAAAA
<BBBBBBBBB
<CCCCCCCCC
```

Select a channel list for the channel list scan group by pushing the key next to the name of the desired list . Additional lists, if any, can be viewed by scrolling with the [▲][▼] keys.
Data routing codes are displayed to indicate the data output resulting from running any available list:

"s" = Store data in internal RAM.
"x" = transmit data, Comm Port 1.
"t" = transmit data, Comm Port 2.
"p" = plot data, Comm Port 1.

```
REPEAT COUNT:
(0-254orX(▲))
     ---
```

Repeat Count Response

Each channel list can be repeated up to 254 times within each scan group.
Enter the number of desired scans.
Entering "X" with the [▲] key will cause the list to scan continuously ignoring all subsequent lists until the program stop condition occurs or an alarm causes the list to abort (EndList alarm response).
Entering 0 will cause the list to be skipped altogether (used for program testing).

```
T-INT BETWEEN
 LIST REPEATS:
▲DD HH:MM:SS
  -- --:--:--
```

Repeat Count Time Interval Response

The time interval between each repetition of a Channel List can have its own independent time interval. This is timed from the beginning of the list till the next beginning of the list. The minimum time interval depends on how long it takes to finish one scan through the list.
Entering 0 or a time shorter than the minimum scan time will cause the list to run at the maximum rate it can until the repeat count is completed.

```
SCAN INTERVAL:
<Set    Contin▶
 DD HH:MM:SS
 00 01:30:30
```

Scan Interval

Scan interval is the time between each start of the Channel List Scan Group. Minimum scan interval is how long the Model 52A takes to scan all the lists in the scan group.

Set

[2] Enter the scan interval time in days (0-99), hours (0-23), minutes (0-59), and seconds (0-59) using the numeric keys.

Contin

[7] causes the Model 52A to scan as rapidly as possible the Scan Group until the stop condition is reached.

```
BETWEEN SCANS:
<Power Down
<NextScanTime
<Monitor List
```

Select what the Model 52A is to do in the time between scans.

Power Down

[2] powers down the Model 52A between scans If the stop condition is a digital input, these inputs are not monitored during power-down.

Next Scan Time

[3] displays the time to next scan (digital inputs monitored).

Monitor List

[4] runs a monitor Channel List between scans. The monitor list can be channel list in the scan group or a completely different channel list. Channel List data routing should be used during the monitor mode.

```
MONITOR:
  EXAMPLE.L
<Change
```

Monitor List Response

This screen displays the channel list that will be run between scans.
To change the monitor Channel List, push [4].

```
STOP: Trigger>
<Elapsed Time
<Real Time
<# of Scans
```

Select program stop conditions.

Elapsed Time

[2] selects a fixed, elapsed time program duration.

Real Time

[3] causes the program to end at a real time.

# of Scans

[4] selects a fixed number of Scan Group repetitions.

Trigger

[6] stops on a digital transition or a Comm Port control signal.

```
TRIGGER TYPE:
<Digital In
<IEEE-488"GET"
<Port1 Cntl-D▲▼
```

Trigger Response

Select program stop trigger type.

Digital In

[2] requires at least one Digital I/O card (Option 50-14) to be present. This could detect switch closures or logic transitions.

IEEE-488"GET" ([3]) (IEEE option installed) will trigger the program stop when a "Group Execute Trigger" signal is present on the IEEE-488 bus.

Port 1 (or 2) Cntl D ([4] or [3]) will trigger the program stop when a Cntl D is sent to the Model 52A over RS-232. The control character can be changed by selecting the Port and then using the [▲][▼] keys.

```
TRIGGER WITH
DIGITAL CH#:
<5          7>
<6          8>
```

Select the digital input option channel number. Option must be installed in the appropriate slot on the rear panel of the Model 52A.

```
TRIGGER VALUE:
  1,0,X(▲)
 (X=Ignore)
  --------
```

The trigger input can be from 1 to 8 bits in any bit pattern. Enter a 1 or 0 where the input must match (MSb...LSb) and an "X" ([▲] key) for a "don't care".

```
STOP AFTER
 ELAPSED TIME:
 DD HH MM SS
 -- --:--:--
```

Elapsed Time and Real Time Response

Enter the elapsed time in Delta Days (0-99), Hours (0-23), Minutes (0-59), and Seconds (0-59).

Enter the day in delta Days (0-99), and the real time in 24 hour mode: Hours (0-23), Minutes (0-59), and Seconds (0-59). To use a "wildcard" push the [▲] key to place an "X" in the desired position. For example, an entry of 00 0X:00:00 would start the program on the next hour.

```
# OF SCANS:
(1-65535 or X▲
 X=Continuous)
    00001
```

# of Scans Response

Enter desired number of Scan Group executions from 1 to 65535 or push the [▲] key (X) for continuous scanning. When continuous scanning is selected only an Alarm (Run Program/List or EndList response) or the Program stop condition will cause the Channel List to quit.

```
PROGRAM END:
<Run Prgm/List
<Main Menu
<Off  RclData>
```

Select what happens at the end of the program,
Run Prgm/List
[2] runs a different program or a channel list.
Main Menu
[3] returns to the main menu at program end.
Off
[4] turns the power off at program end.
RclData
[9] automatically recall data before the end .

```
<EXAMPLE1.L
<EXAMPLE2.L
<TEST1.P
<REST2.P
```

Run Prgm/List Response

Select a program or channel list by highlighting the arrow next to the desired program (.P) or channel list (.L) then pushing [Enter].

```
RUN PROGRAM OR
 CHANNEL LIST:
  EXAMPLE.L
<Change
```

"EXAMPLE.L", a typical list, indicates the selected Channel List or Program to run at the end of this Program.
To change the selection push [4] .

RclData Response

```
SEND DATA TO:
<Port1
<Port2     Plot>
<&Clr   XYPlot>
```

To Select where the data is sent.
Port 1
[2] outputs all scan data to the device on Comm Port 1 (or Printer).
Port 2
[3] output all scan data to the device on Comm Port 2.
&Clr

[4] clears the memory after transmission.

Plot

[8] starts a "Y vs Scan#" plot to the printer on Comm Port 1 .

XYPlot

[9] outputs an XY Plot to the printer on Comm Port 1. The plot parameters must be set up previously from the Main Menu level "Recall Data" menus.

```
EX-PRGM  00001
▲t=00 00:59:46
RT=00 13:07:28
<Stop Monitor>
```

"EX-PRGM 00001" gives the name of the current Program and the next-to-run scan number.

Δt=00 00:59:46 shows the elapsed time until the next scan will take place.

RT=00 13:07:28 indicates the real time the next scan will take place.

Stop

[4] stops the current program

Monitor

[8] changes the monitor mode .

```
"AAAAAAAA.P" ▲▼
<Lock      Run>
<List-P1 Edit>
<Copy  Rename>
```

Use the [▲] [▼] keys to scroll through the Programs. Then select the program by pressing the key to the left of the program name.

Run

[7] starts the selected program.

List

[3] outputs to Comm Port 1 an "as-programmed" text listing.

Edit"

[8] modifies the Program.

Copy

[4] duplicates the selected program with a new name.

Lock

[2] provides a software lock preventing disruption of the program.

Rename

[9] changes the name of the selected program.

```
COPY:
Enter New Name
 (Use ▲▼ keys)
 --------
```

Copy Response

Duplicates of the selected Program which must be renamed
Using the [▲] [▼] keys, scroll through the available character set. Press [Enter] when desired character is found.
Press [Enter] when name is finished (1-8 Chars).

```
RENAME:
Enter New Name
 (Use ▲▼ keys)
 --------
```

Changes the name of the selected Program.
Using the [▲] [▼] keys, scroll through the available character set. Press [Enter] when desired letter is found. Press [Enter] when name is finished (1-8 Chars).

SECTION 8
ALARMS

8.1 INTRODUCTION

Alarms are decision processes which ask the question: Has the measurement reached some predefined conditions and limits, and if so, what is going to happen?

Alarms make decisions based on several different conditions:

- Is the measurement less than a threshold?
- Is the measurement greater than a threshold?
- Is the measurement between two thresholds?
- Is the measurement outside two thresholds?

Alarms respond by

- Alerting the operator with a tone.
- Producing a digital output.
- Running other channel list or programs.
- Ending a channel list or jumping to another channel list in a program.
- Transmitting data over a communication port.
- Printing data on the Model 54 Printer.

Using alarms

- Create alarms using the main menu item: "Alarms". An alarm consists of an alarm number, conditions, and responses. This section covers alarm setup.
- Use alarms by attaching them to a channel measurement using the function modifier: Alarm.
- Change an alarm setup by using the main menu item "Alarms" and selecting Edit.

Paragraph 8.2 lists alarms menus items.
Paragraph 8.3. summarizes the Alarm menu items.
Paragraph 8.4 summarizes alarm setup.
Paragraph 8.5 provides details on the Alarm menus.
Appendix E-4 is an Alarms Menu Navigation Map.

8.2 ALARMS MENU ITEMS

Below is an indented list of alarms items. These items are discussed throughout this section.

- Alarms
  - Program/Edit
    - Alarm #
      - Enable
      - On Transition
      - When True
      - OnError
      - Latch
    - Alarm True if
      - X>T1
      - X<T2
      - X<T1 OR X>T2
      - T1<X<T2
      - Threshold:
        - T1
        - T2
        - Hys
        - Enter Value
        - T1 or T2 Message
    - Response
      - Tone
        - Test
        - LowF (Low Frequency)
        - MidF (Middle Frequency)
        - HighF (High Frequency)
        - Warble
        - Pulse
        - 20s
      - End List
      - Go To Program/List
      - Gosub Channel List
      - Digital Output
        - Digital Output
    - Send Data to:
      - Comm Port 1
        - Reading
        - MSG (Message)
        - Time/Date
        - 1Scan of List
      - Comm Port 2
        - Reading
        - MSG (Message)
        - Time/Date
        - 1Scan of List
      - Display
        - Message Hold
        - Message (20S)
      - RAM
        - Store in RAM
          - Reading
          - Msg (Message)
          - Time/Date
          - 1Scan of List
  - Copy
    - Copy From
    - Copy to
  - Enable All
  - Disable All

8.3 ALARM SUMMARY

Item	Summary
ALARMS	This main menu item allows the setup of alarm condition.
PROGRAM/EDIT #	Allows creation of a new alarm setup or modification of an existing alarm setup
ALARM #	Allows selection of the alarm number (1 through 99).
Axx	Allows selection of trigger conditions when alarms are true . Alarms can respond to transitions through threshold levels (*On Transition*), to true conditions (*When True*), and to channel errors (*On Err*). Plus the alarm can latch on (*Latch*). In addition, the entire alarm can be selected or deselected (*Enabled*).
ALARM TRUE IF:	Allows selection of alarm trigger conditions. Alarms can trigger when data is greater than a threshold level (*X>T1*), when data are less than a threshold level (*X<T1*), when data is outside a threshold "window" (*X<T1 or X>T2*), and when the data is inside the threshold "window" (*T1<X<T2*).
THRESHOLDS:	Allows entry of threshold values (*T1* and *T2*) which are absolute values and multiplier; for example, a threshold of 70 can represent 70 volts, 70 degrees, or 70 ohms. In addition, a dead band (*Hys*) and message (*T1 MESSAGE*) can be added to any threshold.
RESPONSE:	Allows selection of the alarm's response which can be audible alarm (*TONE*), digital output (*DigO*), another channel list or program without returning (*GotoPrgm/List*), running another channel list (*Gosub Ch List*), or stopping the channel list which, if in a program, jumps to the next channel lost or stop condition or, if in an independently running channel list, returns to the Main Menu (*EndList*).
SEND DATA TO:	Allows selection of where the data, message, or time will be sent: *Comm Port 1* transmits data to the Model 54 Printer, *Comm Port 2* transmits data either the optional RS232 or IEEE-488 port, *Display* shows the data on the front panel display *RAM* stores the data in internal memory.
COPY	Allows copying an existing alarms setup.
ENABLE ALL	Enables all alarm setups.
DISABLE ALL	Disables all alarm setups.

8.4 HOW TO USE ALARMS

This paragraph summarizes :

Creating alarms.
Alarms for time.
Alarms for a date.
Alarms for digital inputs.
Changing alarm setups.
Using alarms.
Disabling alarm setups from the channel measurement.
Deleting entire alarm setups.

8.4.1 Creating Alarms

Before creating alarms, use the "Alarm Creation Guide" (Appendix D) to identify the alarm parameters you want. Paragraph 8.4 provides details on the alarm menus.

To create alarms,

1. Locate an select Alarms from the main menu.
2. Select Program/Edit.
3. Enter the alarm number.
4. Select the alarm conditions.
5. Select the limits and thresholds.
6. Select the alarm response.
7. Select where the alarm data is to be sent.

8.4.2 Alarms For Time

For alarms on time (Time/Date - Channel 9), enter the threshold limit value (T1 and T2) in seconds from midnight.

For example: To sound an alarm a 8:00 a.m., enter the value as 28800 (60*60*8) for 28,800 seconds from midnight.

8.4.3 Alarms For a Date

For alarms on the date (Time/Date - Channel 9), enter the threshold limit value (T1 and T2) as the Julian date. In entering the Julian date remember to take into account whether or not it is a Leap year.

For example: to sound an alarm on January 26th, enter the value as 026.

8.4.4 Alarms Digital Inputs

For alarms on a digital input byte (channel 5, 6, 7, and 8), enter the threshold value (T1 and T2) as a decimal value.

For example: to sound an alarm when the input byte is 00100011, enter the decimal value as 35.

8.4.5 Changing Alarm Setups

To change alarm setups,

1. Locate and select Alarms from the main menu.
2. Select the alarm number. Use the [▲] [▼] cursor keys to step through the existing alarms numbers.
3. Select Program/Edit.
4. Step through the alarm menus. Locate and change the desired alarm conditions.

8.4.6 Using Alarms

To use an alarm attach it to a channel measurement in a channel list (section 6). Only one alarm can be attached to a measurement. When an alarm number is selected, its parameters are not displayed; so it is important to record the alarm parameters on your "Alarm Creation Guide" Alarm threshold limits are functionless values; that is, a value of 1000k can represent 1000 kΩ or 1000 kHz.

To use alarms,

1. Set up the channel list and the channel measurement: channel list, channel number, function, etc.
2. Select the function modifier: Alarm.
3. Select the alarm number (use either the numeric keys or the [▲] [▼] cursor keys).

8.4.7 Disabling Alarms In a Channel Measurement

To disable alarms that have been attached to a channel measurement.

1. Select the channel measurement in the channel list (see Channel List - Editing).
2. Press the [Mods] key to bring up the menu with Alarm on it; < Alarm will be highlighted when the alarm is selected.
3. Press [Clear] to deselect the alarm.
4. Press [Enter] to return to the measurement display.

Or,

1. Locate and select Alarms from the main menu.
2. Locate the alarm number used in channel measurement.
3. Step to the "alarm type" menu and deselect Enable (not highlighted: Enabled >).

8.4.8 Deleting An Entire Alarm Setup

To delete an entire alarm setup

1. Locate and select Alarms in the main menu.
2. Locate and select the alarm number to be deleted.
3. Delete the setup by pressing the [Clear] key.

8.5 ALARM MENU DETAILS

This paragraph provides reference material on the alarm menu structure. In general if selecting an item from a menu does not advance automatically to the next menu, press the [Enter] key. Usually, the [Menu] backs up a menu in some cases directly to the main menu.

```
ALARMS:  Copy>
<Program/Edit
<Enable All
<Disable All
```

Alarm Setup

To create a new alarm or edit an existing alarm, push [2]
For a copy of any alarm, push [6].
To disable all alarms (useful for testing Channel Lists without alarm responses), push [4]. To enable all alarms, push [3].

```
ALARM # (▲):
Print the T1
msg or "Empty"
A#(1-99) __
```

Alarm Number

Complete alarm setups are identified by their alarm numbers. There are 99 possible alarm number (1 through 99). Enter new alarm number using the numeric keys. Existing alarms can be found using the [▲] scroll key. Any displayed alarm number can be edited by pushing [Enter]. Unneeded alarms can be deleted by pushing [Clear].

```
A04:  Enable▶
<On Transition
◀When True
<OnErr  Latch>
```

Alarm Type

This menu selects the types of alarms.
On transition alarms (push [2]) responds when the "input" passes through the alarm threshold conditions.
When true alarms (push [3]) respond as long as the input meets alarm threshold conditions.
On Err alarms (push [4]) respond to channel measurement errors . Applicable errors include: overload/overrange, underrange or trigger time out (counter functions), and Math Channel calculation errors.
Enable (push [6]) is required for the alarm to operate.
Latch ([8]) will cause the alarm response to operate continuously until the Channel List is terminated or manually reset ([±•] key while the List is running).

```
ALARM TRUE IF:
<X>T1
<X<T1  T1≤X≤T2>
<X<T1  or  X>T2
```

When True Response

For Alarm true when the data is greater than a threshold level, push [2].
For Alarm true when the data is less than a threshold level, push [3].
For Alarm true when data is outside a window, push [4].
For Alarm true when data is inside a window, push [8].

```
THRESHOLDS:
<T1  -------
<T2  -------
<Hys -------
```

Threshold values are entered using either the numeric keys or the [▲] [▼] cursor keys. Threshold values are functionless, that is, 800k can represent 800kΩ or 800kHz.
Enter the alarm thresholds by selecting T1 ([2]) for single threshold alarms.
Select T2 ([3]) for dual (window) threshold alarms.
Hysteresis (dead zone) can be added to any threshold by pushing [4].

```
ENTER VALUE:
(Use ▲▼for
  k,M,u,m)
  ---------
```

Enter a numeric value using the [0 ♪]-[9] and [±•] keys.
To enter a negative number, push the [±•] key before entering the number.
To enter a value less than zero, first enter a zero ,then add the decimal point.
Use the [▲] scroll key to enter multipliers (k,M,u,m).
To clear a number, use the [Clear] key

```
T1  MESSAGE ▲▼:
T2  MESSAGE ▲▼:
```

After the threshold is set a message can be entered that appears when the alarm conditions are true.
Using the [▲] [▼] scroll keys to step through the character set, enter a 1 to 3 line message (42 characters maximum). Push [Enter] to accept the message.

```
RESPONSE:Tone>
<EndList Dig0>
<GotoPrgm/List
<Gosub Ch List
```

Alarm Response

This menu selects what happens when alarm conditions are met.
For an audible Alarm, push [6] .
For a digital output (digital I/O option) suitable for driving logic, lamps, or relays, push [7] .
Push [3] to jump to a new channel list or start a new program (no return).
Pushing [4] allows a subroutine running of a Channel List (returns).
Selecting "EndList" ([2]) will stop the current Channel List and go on to the next list or the Stop condition if in a Program, or will return to the Main Menu if the Channel List is running independently. When no menu items are selected, the channel list continues to run after the alarm conditions are met.

```
TONE:     Test>
<LowF   Warble>
<MidF   Pulsed>
<HighF     20s>
```

Tone Response

Set the tone, push [2] (low frequency), [3] (mid frequency),or [4] (high frequency) to select the base frequency.
Push [7] (warble),or [8] (pulsed)to modulate the tone.
Push [6] (test) to preview the tone selection.
Push [9] (20s) to limit the tone output to 20 seconds regardless of the alarm remaining true or if it is latched.

```
DIGITAL OUTPUT
 CHANNEL #:
<5           7>
<6           8>
```

Digital Output Response

Select the digital I/O channel number. Option must be installed in the appropriate slot on the rear panel of the Model 52A equivalent to the channel selected.

```
OUTPUT VALUE:
  (1,0,X(▲))
(X=don't care)
   --------
```

Enter the desired digital output value (binary) using the [1] or [0 ♪] numeric keys. Use the [▲] key to enter a "don't care" (X). When the alarm is true this pattern will appear at the digital output port selected ("don't care" outputs remain unchanged). When the alarm is not true the pattern will be complemented. Note: Initially, on power up, the digital outputs are deenergized (lightly pulled up) until set by a direct digital write or an alarm.

```
SEND DATA TO:
<Comm Port 1
<Comm Port 2
<Display  RAM>
```

Alarm Data Routing

A true Alarm will send data, messages, or time to any or all data ports, internal RAM, and/or the display.
Push [2] to send to the device on Comm Port 1.
Push [3] for Comm Port 2 (IEEE-488 or RS-232 if installed).
Push [4] to send the Alarm messages to the Model 52A LCD (default).
Push [9] to store in internal memory (RAM).

```
COMM PORT 1:
<Reading  Msg>
<Time/Date
<1Scan of List

COMM PORT 2:
<Reading  Msg>
<Time/Date
<1Scan of List
```

Comm Port 1 and 2 Response

These two menus select what will by sent to the communication ports.
Pushing [2] transmits just the alarm reading.
Pushing [3] transmits the time and date.
Pushing [7] transmits the alarm message.
Pushing [4] transmits the entire Channel List. This response will be ignored if the Channel List data is already being transmitted to the selected Comm Port.
Any or all responses can be selected.

```
DISPLAY:
<Message Hold
<Message  (5s)
<Message (20s)
```

Display Response

The LCD will display the reading if enabled by the channel list independent of this menu.
If the message is also desired on the display, push [2], [3], or [4].
When [2] is selected, remains on the display until acknowledged by a push of the [Enter] key.
When [3] or [4] is selected, a temporary message (5 or 20 seconds) will be displayed then the normal display mode will resume.

```
STORE IN RAM:
<Reading  Msg>
<Time/Date
<1Scan of List
```

RAM Response

This menu selects what will be stored it the Model 52A's internal memory.
Push [2] to store just the alarmed reading.
Push [3] to store the time and date.
Push [7] to store the alarm message.
Push [4] to store 1 scan through the entire Channel List. Any or all responses can be selected.

SECTION 9
MATH

9.1 INTRODUCTION

A math channel takes real-time channel list measurements, processes them, and displays, transmits, or stores the results. A math channel uses either a user entered function (formula) or table. The function can be used for either interchannel calculations or scaling.

Interchannel calculations use a function (formula) which processes measurements from several measurement channels. In this case, the math channel is inserted in a channel list just like any other channel measurement. An example of an interchannel calculation would be calculating power supply efficiency by measuring both the input and output power and using the math channel (Channel 0) to calculate the efficiency.

Scaled measurements use a function (formula) which serves as a constant. Scaled measurements are used with an individual channel list measurement. An example of a scaled measurement would be converting the current from a pressure transducer to PSI (pounds per square inch).

The *table* is a look up table with from 2 to 65535 pairs (X, Y) of points; the Model 52A interpolates between points. A table, like the scaled measurement, is used with an individual channel measurement. Each point consists of two values: the X (measured) value and the Y (desired) reading. When creating the table, the user must enter both values. An example of a table would be thermocouple linearization table for a thermocouple type not included in the Model 52A's internal tables.

Paragraph 9.2 lists the math channel menu items.
Paragraph 9.3 summarizes the math channel menu items.
Paragraph 9.4 summarizes math channel setups and use.
Paragraph 9.5 gives details on math channel menu items.
Paragraph 9.6 provides a table example.

9.2 MATH CHANNEL MENU ITEMS

Below is an indented list of items. These items are discussed throughout the section.

Math
- 0xx Math
  - Function
    - 0XX= *(Enter function)*
    - Enter Label
    - Initial Variable
      - Set
      - Scaled
      - Prompt Once
      - Prompt Always
  - Table
    - 0xx Enter X,Y
    - Enter X Value
    - Enter Y Value
  - Copy
    - Copy to Math Channel #:
  - Relabel
    - Enter Label

9.3 MATH MENU SUMMARY

Item	Summary
MATH	This main menu item allows creation and editing a math formula.
MATH CHANNEL	This menu allows entry of the math channel number. It allows creation of a new math formula, and modification of an existing math formula. If a math formula already exists, the math channel number is displayed.

Item		Summary
0xx	MATH	This menu selects the math channel type.. *Function* - Allows entry of a simple math formula for scaling or interchannel calculations. The formula may contain a variable X which can be obtained from the first measurement, set to an initial value, or prompted for user input *Table* - Allows creation of a linearizing table with up to 65535 XY pairs. *Copy* - Copies the selected math channel formula or table with a new math channel number. *Relabel* - Allows the selected math formula or table to be relabeled without reprogramming.
ENTER LABEL:		Allows the formula or table to be assigned an unique name.

9.4 HOW TO USE THE MATH CHANNEL

This paragraph consists of a series of list the describes:

Creating a Math Channel Function
Creating a Table
Editing a Math Channel Function
Editing a Math Channel Table
Deleting a Math Formula
Deleting an Entire Table
Using the Math Channel for Interchannel Calculations
Using the Math Channel for scaling
Using the Math Table

9.4.1 Create a Math Channel Function (Interchannel Calculations or Scale)

To create a formula,

1. Locate and select Math from the main menu.
2. Assign the math channel number.
3. Select the math channel type: Function
4. Enter the function (formula).
   If the formula is used for interchannel calculations, enter the channel numbers, constants, and functions.
   If the the formula is used for scaling, enter the variable X (scaled value), constants and functions.
5. Assign the label.

9.4.2 Create a Table

To create a table,

1. Locate and select Math from the main menu.
2. Assign the math channel number.
3. Select the math channel type: Table.
4. Enter the X and Y values for the table. Enter each pair of values until all desired XY points are entered.
5. Assign the label.

9.4.3 Editing a Math Channel Function

To edit a math function (formula),

1. Locate and select Math from the main menu.
2. Use the [▲] [▼] keys to locate the desired math channel number.
3. Use the [Enter] key to step through the math channel type menu.
4. Press [Enter] key. A blinking cursor appears at the end of the formula.
5. Keep pressing [Clear] key until the item to changed is cleared. All items in the formula will be deleted.
6. Enter the new item followed by the rest of the formula.

9.4.4 Editing a Math Channel Table

To edit a math table,

1. Locate and select Math from the main menu.
2. Use the [▲] [▼] keys to locate the desired math channel number.
3. Use the [Enter] key to step through the math channel type menu.
4. Use the [▲] [▼] keys to step through the XY points.
5. To change a XY pair, locate the XY pair and select them by pressing the key to the left. Enter the new values.
   To delete a XY pair, locate the XY pair and press [Clear] key.
   To insert a XY pair, locate the XY pair, press the [Range] key, and enter the value.

9.4.5 Deleting a Math Formula

Method 1 To delete a math formula,

1. Locate and select Math from the main menu.
2. Use the [▲] [▼] to locate the desired math channel number.
3. Next the math channel type (function highlighted) menu appears.

4. Press [Clear] key and delete the entire formula.

Method 2 To delete a math formula,

1. Locate and select Math from the main menu.
2. Use the [▲][▼] to locate the desired math channel number.
3. Use the [Enter] key to step through the math channel type menu.
3. Press [Enter] key and blinking cursor appears.
4. Press [± •] key to stop the blinking cursor.
5. Press [Clear] key and delete the entire formula.

9.4.6 Deleting an Entire Table

To delete a math table,

1. Locate and select Math from the main menu.
2. Use the [▲][▼] to locate the desired math channel number.
3. Next the math channel type (table highlighted) menu appears.
4. Press [Clear] key and delete the entire table.

9.4.7 Using the Math Channel For Interchannel Calculations

To make interchannel calculations,

1. Create the math channel formula.
2. Create the channel list using the channel measurements used in the math channel. Measurements must precede the math channel.

9.4.8 Using the Math Channel For Scaling

To make scaled measurements,

1. Create the math formula - include the variable X.
2. Create a channel list with a channel measurement using the display modifier: Scaled.

9.4.9 Using the Math Channel Table

To use the table,

1. Create the math table.
2. Create a channel list with a channel measurement using the display modifier: Scaled.

9.5 MATH CHANNEL DETAILS

```
MATH CHANNEL:
Oxx  Label(⇕)
(1-99) "MATH"
       01
```

Math Channel Number

Begin by selecting or entering the math channel number. Valid numbers are 1 to 99.
Use the [▲][▼] keys to scroll through the existing Math Channels, or use the numeric key to enter the number.
Use the [Clear] key to delete unwanted Math Channels.

```
001          MATH
◀Function
<Table
<Copy Relabel>
```

Math Channel Type

Select the type of math channel operation.
Function
[2] enters a simple formula for scaling or calculating interchannel relationships..
Table
[3] enters a linearizing table of up to 65535 XY pairs with interpolation between the points.
Copy
[4] duplicates the selected math channel and requires the entry of a new math channel number.
Relabel
[9] changes the channel label without reprogramming the function or table.

```
01=((1:+2:00)+
3:)*100
```

Function Response

This menu is used to create the math formula for interchannel calculations and scaling.

Number keys

[0 ♪] - [9] enter constants. Numbers less than 1 must be preceded with a 0 (for example: 0.2345).

Negative Numbers

Use the [± •] key to enter negative numbers.

Formula Functions

[▲] key, [▼] key, or [Func] key steps through the functions :

- \+ addition
- \- subtraction
- * multiply
- ( ) Parentheses
- / divide
- √ square root
- X scaling variable

Press [Enter] to accept the function.

Channel Numbers

[Chan] allows entry of a channel and subchannel as part of the formula.

For a front panel input, enter only the channel number. For example: [Chan] [2] [Enter] which is displayed as 2:.

For a rear panel input, enter the channel number and 00. For example: [Chan] [2] [0 ♪] [0 ♪] [Enter] which is displayed as 2:00.

For a multiplexer input, enter the channel and subchannel number. For example: [Chan] [2] [1] [8] which is displayed as 2:18.

To specify a specific reading of a channel, use the [Range] key and enter the reading number. For example: [Chan] [2] [1] [8] [Range] [4] which is displayed as 2:18#4. This example will use the fourth entry in the channel list of multiplexer input 18 on channel 2.

Change Formula

To change a formula ,use [Clear]. When finished push [Enter].

Delete the Entire Formula

To delete the entire formula push [Menu] which will go back one menu, then [Clear].

```
ENTER LABEL:
 (Use ▲▼ Keys)
    "MATH"
     ____
```

Use the [▲] [▼] keys to assign up to a four character label to the formula or table. Anytime this math channel is used this label will appear. This same menu appears when *Relabel* is selected.

```
VARIABLE INIT:
<Set    Scaled>
<Prompt Once
<Prompt Always
```

Scale Response

If the formula contains a scaling X,

Set

[2] presets the variable X in a formula.

Prompt Once

[3] prompts the user to enter the X value on only the first pass through the channel list.

Prompt Always

[4] prompts the user to enter the X value on every pass through the channel list.

Scaled

[7] scales one or more scaled channels.

```
INITIAL/RESET
  VALUE OF X:
(▲for k,M,u,m)
```

Set Response

Numeric Entry
Use the numeric keys to assign the initial value for X in the formula.
Negative Numbers
To enter a negative number, push the [± •] key.
Numbers Less Than Zero
To enter a value less than zero, enter the zero first then the decimal point.
Multipliers
Use the [▲] scroll key to locate and enter multipliers (k,M,u,m).
Reset
If the Reset is selected in the [Mods] menu of the channel list, X will return to this value.
Defaults to 0.

```
1▯1 NOTRDY Math
Enter X Value:
(▲for k,M,u,m)
```

Prompt Once and Always Response

This menu appears during a channel list when *Prompt Once* or *Always* is selected.
Numeric Entry
Use the numeric keys to enter the value.
Negative Numbers
To enter a negative number, push the [± •] key.
Numbers Less Than Zero
To enter a value less than zero, enter a zero first then the decimal point.
Multipliers
Use the [▲] scroll key to enter multipliers (k,M,u,m).

```
▯▯1 ENTER X,Y:
Point 000001
<X= 1.5000
<Y=
```

Table Response

To create a table,
X
[3] allows entry of the X value. The X value is the measured reading.
Y
[4] allows entry of the Y value. The Y value is the desired or displayed reading.
Order of Values
Start with the smallest value in ascending order.

Up to 65535 XY pairs can be entered. The Model 52A will interpolate between points. When finished entering the last pair push [Enter] to end.

```
ENTER VALUE:
(▲for k,M,u,m)
```

Table X/Y Value Response

Numeric Values
Enter the numeric value using the [0 ♪], through [9] and [± •] keys.
Negative Values
To enter a negative number, push the [± •] key first.
Values Less Than Zero
To enter a value less than zero, enter a zero first then the decimal point [± •] key
Multipliers
To select a value multiplier, use the [▲] key the select and enter multipliers (k, M, u, m).

```
COPY TO MATH
 CHANNEL #:
 (1-99 or ▲▼)
      01
```

Copy Response

Enter an unused Math Channel number (1-99) or use the [▲] [▼] keys to find empty Math Channels.

9.6. MATH CHANNEL EXAMPLE

The following example illustrates how to setup and use a math channel table. This example consists of step by step instructions on creating the math channel table, on creating a channel list to use the math channel table, on connecting the device used in the example, and on running the channel list which uses the math channel table.

Example 9-1 Temperature Sensor Linearization Using a Math Table

This example uses the math channel's table to linearize a cryogenic silicon diode temperature sensor (Omega Engineering CY7 series) over a 1.4 °K to 100 °K (degrees Kelvin) temperature range. Example 9-1 illustrates how to create a math channel table, how to use the table in a channel list, how to connect the sensor to the Model 52A, and how to take the measurements.

The solid arrows ➡ and ⬅ point to menu items or keys that must be selected or pressed.

CREATING THE MATH CHANNEL TABLE

The following provides a step by step example of how to create a table. This table will be used in the channel list which will be created later in this example.

1. Press [Power] to turn on the Model 52A and select MATH from the main menu.

```
  <CONFIGURATION
➡ <MATH
  <ALARMS
  <TRACKING
```

2. Enter the Math Channel Number.

```
MATH CHANNEL:
  07xx Label(▲▼)
(1-99) "MATH" t
      02
```

   Press [7] to enter the math channel number (7); then press [Enter].

3. Select table.

```
07            MATH
 Function
➡<Table  Delete>
 <Copy  Relabel>
```

4. Press [Enter] and begin entering the table's values.

   Select X and enter the value.

```
07   ENTER X,Y
Point 0001
➡ <X=
 <Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Next enter the value:
   [1], [±•], [6], [9], [8], [1], and [2].

   To correct an entry error, use the [Clear] key to back up over the error and then use the numeric keys to enter the correct value.

   Press [Enter] to accept the X value.

   Select Y and enter the value.

```
07   ENTER X,Y
Point 0001
 <X=  1.698120
➡ <Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Enter the value:
   [1], [±•], [4], and [0 ♪].

   Press [Enter] to accept the value.

```
07   ENTER x,y
Point 0001
<X=   1.698120
<Y=   1.400000
```

The X or Y point can be changed by selecting X or Y and entering the new value.

Press [Enter] to advance to the next pair of points.

5. Enter the next pair of points.

   Select X and enter the value.

```
07   ENTER x,y
Point 0002
➡<X=
 <Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Enter the value:
   [1], [±•], [6], [9], [5 LCD], [2], and [1]

   Press [Enter] to accept the X value.

   Select Y and enter the value.

```
07   ENTER x,y
Point 0002
 <X=   1.6952100
➡<Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Enter the value:
   [1], [±•], [6], and [0 ♪].

   Press [Enter] to accept the Y value.

```
07   ENTER x,y
Point 0002
<X=   1.69521
<Y=   1.60000
```

   Press [Enter] to advance to the next set of points.

6. Enter the next pair of points.

   Select X and enter the X value.

```
07   ENTER x,y
Point 0003
➡<X=
 <Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Enter the value:
   [1], [±•], [6], [9], [1], [7], and [7].

   Press [Enter] to accept the X value.

   Select Y and enter the value.

```
07   ENTER x,y
Point 0003
 <X=   1.691770
➡<Y=

ENTER TABLE
VALUE:

---------- ▲▼
```

   Enter the value:
   [1], [±•], [8], and [0 ♪].

   Press [Enter] to accept the Y value.

```
07   ENTER x,y
Point 0003
<X=   1.691770
<Y=   1.800000
```

   Press [Enter] to advance to the next pair of points.

7. Continue adding the X and Y values for points 4 through 82 (see table 9-1) using the steps demonstrated in item 4, 5, or 6.

Table 9-1. X and Y Points

Point	X Value	Y Value
4	1.68786	2.00
5	1.68352	2.20
6	1.67880	2.40
7	1.67376	2.60
8	1.66845	2.80
9	1.66292	3.00
10	1.65721	3.20
11	1.65134	3.40
12	1.64529	3.60
13	1.63905	3.80
14	1.63263	4.00
15	1.62602	4.20

Table 9-1. X and Y Points (Continued)

Point	X Value	Y Value
16	1.61920	4.40
17	1.61220	4.60
18	1.60506	4.80
19	1.59782	5.00
20	1.57928	5.50
21	1.56027	6.00
22	1.54097	6.50
23	1.52166	7.00
24	1.50272	7.50
25	1.48443	8.00
26	1.46700	8.50
27	1.45048	9.00
28	1.43488	9.00
29	1.42013	10.0
30	1.40615	10.5
31	1.39287	11.0
32	1.38021	11.5
33	1.36809	12.0
34	1.35647	12.5
35	1.34530	13.0
36	1.33453	13.5
37	1.32412	14.0
38	1.31403	14.5
39	1.30422	15.0
40	1.29464	15.5
41	1.28527	16.0
42	1.27607	16.5
43	1.26702	17.0
44	1.25810	17.5
45	1.24928	18.0
46	1.24053	18.5
47	1.23184	19.0
48	1.22314	19.5
49	1.21440	20.0
50	1.19645	21.0
51	1.17705	22.0
52	1.15558	23.0
53	1.13598	24.0
54	1.12463	25.0
55	1.11896	26.0
56	1.11517	27.0
57	1.11212	28.0
58	1.10945	29.0
59	1.10702	30.0
60	1.10263	32.0
61	1.09864	34.0
62	1.09490	36.0
63	1.09131	38.0
64	1.08781	40.0
65	1.08436	42.0
66	1.08093	44.0
67	1.07748	46.0

Table 9-1. X and Y Points (Continued)

Point	X Value	Y Value
68	1.07402	48.0
69	1.07053	50.0
70	1.06700	52.0
71	1.06346	54.0
72	1.05988	56.0
73	1.05629	58.0
74	1.05267	60.0
75	1.04353	65.0
76	1.03425	70.0
77	1.02482	75.0
78	1.01525	80.0
79	1.00552	85.0
80	0.99565	90.0
81	0.98564	95.0
82	0.97550	100.0

8. After all the points have been entered, press Enter twice.

```
VARIABLE INIT
<Set          Scaled▶ ←
<Prompt Once
<Prompt Always
```

Press Enter once.

9. Enter the Math Channel's label.

```
ENTER LABEL:
(Use ▲▼ Keys)
   "MATH"
      ____
```

Use ▲ or ▼ key to locate the first letter "d".

```
ENTER LABEL:
(Use ▲▼ Keys)
   "MATH"
      d___
```

Press Enter to accept the letter d and to move on to the next character.

Use ▲ or ▼ key to locate the letter "e".

```
ENTER LABEL:
(Use ▲▼ Keys)
   "MATH"
      de__
```

Press Enter to accept the letter e and to move on to the next character.

Use ▲ or ▼ key to locate the letter "g".

```
ENTER LABEL:
(Use ▲▼ Keys)
  "MATH"
   deg_
```

Press [Enter] to accept the letter g and to move on to the next character.

Use [▲] or [▼] key to locate the letter "K".

```
ENTER LABEL:
(Use ▲▼ Keys)
  "MATH"
   degK

MATH CHANNEL:
  0xx Label(▲▼)
(1-99)  "degK"t
      07
```

10. Press [Menu] to return to the main menu.

CREATING THE CHANNEL LIST

This portion of example 9-1 illustrates how to set up a channel list to take the measurements needed to use the math channel table created in the previous portion of this example. This example assumes that the Model 52A used contains an Option 50-1 measurement module in channel 1 and an Option 50-1 or 50-2 measurement module in channel 2.

1 Press [Power] to turn on the Model 52A and select CHANNEL LISTS from the main menu.

```
  <DMM
➡ ◀CHANNEL LISTS
  <PROGRAMS
  <HELP
```

2. Enter the name of the new channel list (degK).

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 --------
```

Use the [▲] or [▼] key to locate "d" and press [Enter] to accept the character.

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 d-------
```

Use the [▲] or [▼] key to locate "e" and press [Enter] to accept the character.

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 de------
```

Use the [▲] or [▼] key to locate "g" and press [Enter] to accept the character.

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 deg-----
```

Use the [▲] or [▼] key to locate "K" and press [Enter] to accept the character.

```
NEW CHANNEL
   LIST NAME:
 (USE ▲▼ KEYS)
 degK----
```

Press [Enter] to advance to the next menu.

To correct an entry error, use the [Clear] key to back up over the error and then use the [▲] [▼] and [Enter] keys to enter the correct characters.

3. Select the parallel Reading Mode (default).

```
  READING MODE:
➡ ◀Parallel
  <Serial
```

Press [Enter] to advance to the next menu.

4. Select the data routing destination: display.

```
  DATA TO:  RAM>
  <Comm Port 1

➡ ◀Disp  Filter>
```

Select the display options.

```
DISPLAY:  Off>
<1-Alphanum-4▶ ←
<Plot  Scroll>
<Alarms Only
```

Press [Enter] to advance to the next menu.

5. Enter the first channel setup.

```
FIRST CHAN #:
(Push "Disp"
   for Help)
        -
```

Press [1] to select the first channel number.

```
FIRST CHAN #:
(Push "Disp"
   for Help)
1_
```

Press [Func] to advance to the next menu.
Select the function: Ohms.

```
<Vdc   ⇕  Temp>
<Vac      Ohms▶ ⇐
<Vac+dc     dB>
```

Press [Range] to select a range.
Select the range: 300kΩ.

```
<AutoRng  3kΩ>
<30Ω     30kΩ>
<300Ω   300kΩ▶ ⇐
```

Press [Mods] to call the function modifier menu.
Deactivate Active; the arrow will not be highlighted. With active not selected, the Model 52A will not store the data taken by this channel.

```
<Delay Active>⇐
<Alarm  Reset>
<Track    Cal>
```

Press [Enter] to accept the first channel's setup and advance to the next channel's setup.

6. Enter the second channel's setup.

```
1FP

 Next Ch:_
```

Press [2] to select the second channel number.

```
1FP:

 Next Ch:2_
```

Press [Func] to advance to the next menu.
Select the function: Vdc.

```
➡<Vdc   ⇕  Temp>
 <Vac      Ohms>
 <Vac+dc     dB>
```

Press [Range] to select a range.
Select the range: 3V

```
<AutoRng   3V▶ ⇐
<30V       30V>
<300V     300V>
```

Press [Disp] to advance to the display modifier menu.
Select Scale.

```
➡<Scale  Resol>
 <Min  Average>
 <Min    Delta>

 SCALE USING:
   0xx  Label(⇕)
 (1-99)  "  "
         --
```

Press [7] to use math channel number 7; then press [Enter].

```
➡◀Scale  Resol>
 <Min  Average>
 <Min    Delta>
```

Press [Enter].twice.

```
1FP:2FP:

 Next Ch:_
```

Press [Enter].

```
"degK.L"
<Clear    Run▶
<List-P1 Edit>
<Copy  Rename>
```

Press [Enter] to return to the main menu.

CONNECTING THE SENSOR TO THE MODEL 52A

Before running the channel list "degK", connect the cryogenic silicon diode temperature sensor (Omega Engineering CY7 series) to the Model 52A as shown in figure 9-1.

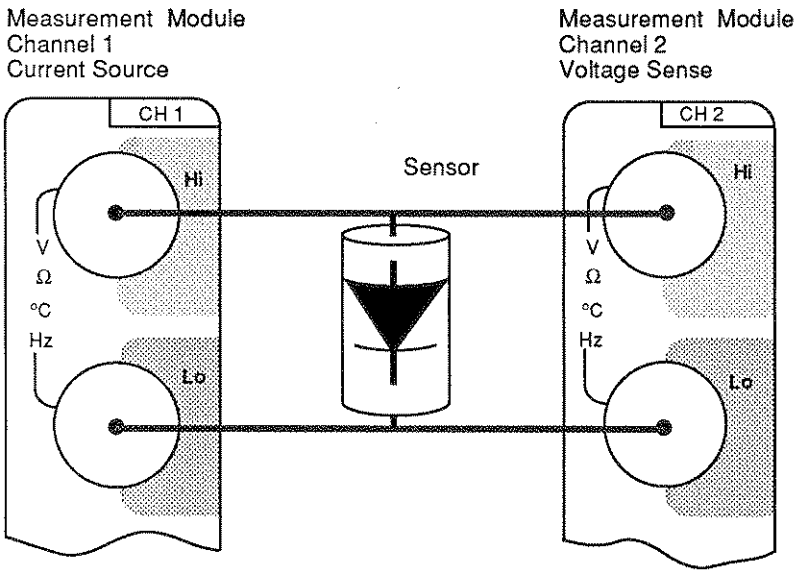


Figure 9-1. Sensor Connections

TAKING THE MEASUREMENT

After creating the math channel's table, creating the channel list, and connecting the sensor, the actual measurements can be taken.

1. Press [Power] to turn the Model 52A on; the main menu is displayed.

```
  <DMM
➡ ◀CHANNEL LISTS
  <PROGRAMS
  <HELP
```

Select CHANNEL LISTS.

```
  ⬍ Create New>
<degK.L      R>⬅
```

Select "R" to run the channel list "degK.L. Pressing the key to the left of degK.L allows editing of the channel list.

```
1FP 110.702 KΩ
2FP 30.0    degK
```

Press [Menu] to stop the channel list and return to the menu.

SECTION 10
RECALL DATA

10.1 INTRODUCTION

Recall data, a main menu item, allows the recalling of data stored in the Model 52A's memory. The recalled data can be sent to the front panel display, communication port 1 (Model 54 Printer) or communication port 2. Stored data can be sorted by time, date, channel list name, scan number, alarm number, and channel number. Data sent to the Model 54 printer can be printed or plotted. This section covers the Recall Data menu.To send data as it is taken, use the channel list item: Data To (section 6). This method prints or plots (relative to scan only) the channel lists data.

To send data at the end of a program, us the program item: Program End (section 7). This method prints and plots (relative to scans and XY plot) the data. Appendix E-5 is the Recall Data Menu Map.

Printing and plotting is covered in section 11 in detail.

10.2 RECALL DATA MENU ITEMS

Below is an indented list or recall data items. These items are discussed throughout this section.

Recall Data
- Data To
  - Comm Port 1
  - Comm Port 2
  - Display
- Sort
  - Sort By
    - Time
    - Date
    - Name
    - Scan #
    - - Labels
    - Alarm #
    - Chan #
- Plot
  - Plot Setup
    - Y Vs Scan#
      - Plot Windows
        - 1
        - 2
        - 4
      - Channel Number To Plot
      - Plot Character
      - Plot Scaling 0% Y Value
      - Plot Scaling 100% Y Value
    - X Vs Y
      - X Vs Y Plot N Points N= 1 - 65535
      - Channel Number To Plot As X
      - Channel Number To Plot As Y
      - Plot Character
      - 0% X Value
      - 100% X Value
      - 0% Y Value
      - 100% Y Value
  - Start Plot

10.3 RECALL DATA MENU SUMMARY

Item	Summary
RECALL DATA	Accesses data collected by channel lists.
DATA TO	Allows selection of where data will be routed to. *Comm Port 1* - routes data to communication port 1 (Model 54 Printer). *Comm port 2* - routes data to communication port 2 (Optional RS-232 or IEEE-488). *Display* - routes data to the Model 52A's front panel display.

Item	Summary
SORT / SORT BY	Allows selection of the sort parameters. *Time* - processes data starting after a specific time or between two time periods. Date - processes data starting after a specific date or between two dates. *Name* - processes only the data from a specific channel list or program. Scan# - processes data for a specific scan or between two scans. - *Label* - strips off channel list names and other nondata items. *Alarm#* - process data from a specific alarm number, a range of alarm numbers, or all alarms. *Chan#* - processes data from a specific channel number or a range of channel numbers.
PLOT	Allows setup of plot parameters and plotting of stored data.
PLOT SETUP	Allows selection of the type of plot and setup of plotting parameters. *Y Vs SCAN* - plots data relative to the scan number. Data can be plotted in 1, 2, or 4 windows with up to 16 channel numbers (plotted with individual characters) per plot. *X Vs Y* - plots data of one channel relative to another channel.

10.4 RECALL DATA MENU DETAILS

```
DATA TO: Sort>
<Comm Port 1
<Comm Port 2
<Display Plot>
```

To recall data first select where to send the data:
Push [2] for Comm Port 1 (usually the Model 54 Printer).
Push [3] for Comm Port 2 (if present).
Push [4] to send the data to the front panel display.
Push "Sort" ([6]) to process only selected data; for example data from just one channel.
Push "Plot" ([9]) to plot from stored data to the selected (highlighted) device. Plot files are Epson compatible graphics optimized for the Wavetek Model 54 Printer, but useable with other printers. The display gives a limited representation of the plot (1/3 of the printed resolution).To delete all data push [Clear]. Plot can not be selected when "Display" is selected.
To delete selected data push "Sort" first, then after selecting the sort parameters, push [Clear]. To execute chosen operations push [Enter].

```
PLOT      START
SETUP:    PLOT:
< Y vs scan# >
<   X vs Y   >
```

To setup plot parameters, use the keys on the left side . To run a previously user entered plot routine using stored data, push the keys on the right side.

To preset plot parameters for "End of Program" plot.
Set up the plot type needed ([3] or [4]) making sure that the channels called are present in the Program that plots as an end condition.
When returned to the "Plot Setup" menu, push [Menu] to return to the Main Menu. Now the Program can be run.

```
SORT BY: Time>
<-Labels Date>
<Alarm#  Name>
<Chan#   Scan#>
```

Select type of sort parameter.
-Labels ([2]) strips off list names and other nondata labels.
Alarm# ([3]) sorts all alarm data or from an entered alarm number.
Chan# ([4] sort for all data obtained from a Channel #.
Time ([6]) sorts for all data after the entered time.
Date ([7]) sort for all data after a date.
Name ([8]) sort for all data obtained from a List or Program
Scan# ([9]) sort for all data from a scan #.

```
TIME:
(Use - for a
  time range)
   --:--:--
```

Time Responses

Processes all data by time.
If only one time is entered, only the data after that time is used.
If a time range is entered ("time" [± •] "time") only the data taken between those times are used.

```
DATE:
(Use - for a
  date range)
   --/--/--
```

Date Response

Processes all data by date.
If only one date is entered, only the data stored after that date is used.
If a date range ("date" [± •] "date") only the data taken between those dates are used.

```
ALARM #:
(Use - for an
 alarm range)
      All
```

Alarm Response

Processes all data by alarm number.
If only one alarm number is entered, only the data for that alarm will be used.
If an alarm range ("alarm number" [± •] "alarm number) is entered, only the data taken between those alarms will be used.
If a "0" is entered, all alarm data will be used.

```
<AAAAAAAA.L
<EXAMPLE.L
<EXAMPLE.P
<TEST1.P
```

Name Response

Processes data taken by the selected Channel List or Program; all other data.will be ignored.
Use the [▲] [▼] keys to scroll through existing Programs and Channel Lists.
Select the desired Channel List or Program by pressing the key to the left of the name (1 - 4).

```
CHANNEL #:
(Use - for a
  Chan range)
      ---
```

Chan # Response

Processes all data by channel number.
By using the [± •] key all data from a range of channels can be viewed (e.g. 101-116).

```
SCAN #:
(Use - for a
  scan range)
     ----
```

Scan # Response

Processes all data by scan#.
If a scan range is entered (Scan# [± •] Scan#) only the data taken between those scans are used.

SECTION 11
PRINTING AND PLOTTING DATA

11.1 INTRODUCTION

The printing and plotting menus allow the user to select methods of printing or plotting on the Model 54 Printer data from the Model 52A. The Model 52A can print or plot data as it is taken or data stored in memory.

Data can be printed in the same format as it was taken; see figure 11-1.

Model 52A data can be plotted by scan number; see figure 11-2. Data can also be plotted by scan with a time stamp; see figure 11-3. These formats can plot up to 16 channels per plot Each plot can be divided into 1, 2, or 4 windows with each window having its own 0 and 100% scale value. Channels are identified on the plot by an unique character. Figure 11-4 shows a 1 window, 2 channel each plot.

CAUTION

When attempting to send data to either Comm Port 1 or the 54 Printer with the printer disconnected, the Model 52A will lock up.

```
Wavetek 52A Demo    Standard Data:
"D6.L"
1FP 1.0519  Vdc      10:17:56 HMS
2FP   33.5  °C       22Jul88  DMY
1FP 2.0518  Vdc      10:18:07 HMS
2FP   33.9  °C       22Jul88  DMY
1FP 2.0520  Vdc      10:18:17 HMS
2FP   34.1  °C       22Jul88  DMY
1FP 2.0520  Vdc      10:18:28 HMS
2FP   28.5  °C       22Jul88  DMY
1FP 2.0520  Vdc      10:18:38 HMS
2FP   25.1  °C       22Jul88  DMY
1FP 0.0517  Vdc      10:18:48 HMS
2FP   23.1  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:18:59 HMS
2FP   22.9  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:19:09 HMS
2FP   21.6  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:19:19 HMS
2FP   21.2  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:19:30 HMS
2FP   20.8  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:19:40 HMS
2FP   20.6  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:19:51 HMS
2FP   20.3  °C       22Jul88  DMY
1FP 1.0519  Vdc      10:20:01 HMS
2FP   20.5  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:20:11 HMS
2FP   20.5  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:20:21 HMS
2FP   20.5  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:20:32 HMS
2FP   20.3  °C       22Jul88  DMY
1FP 1.0518  Vdc      10:20:42
2FP   20.6  °C
1FP 1.0518  Vdc
2FP   20.3  °C
1FP 1
```

Figure 11-1. Print Data

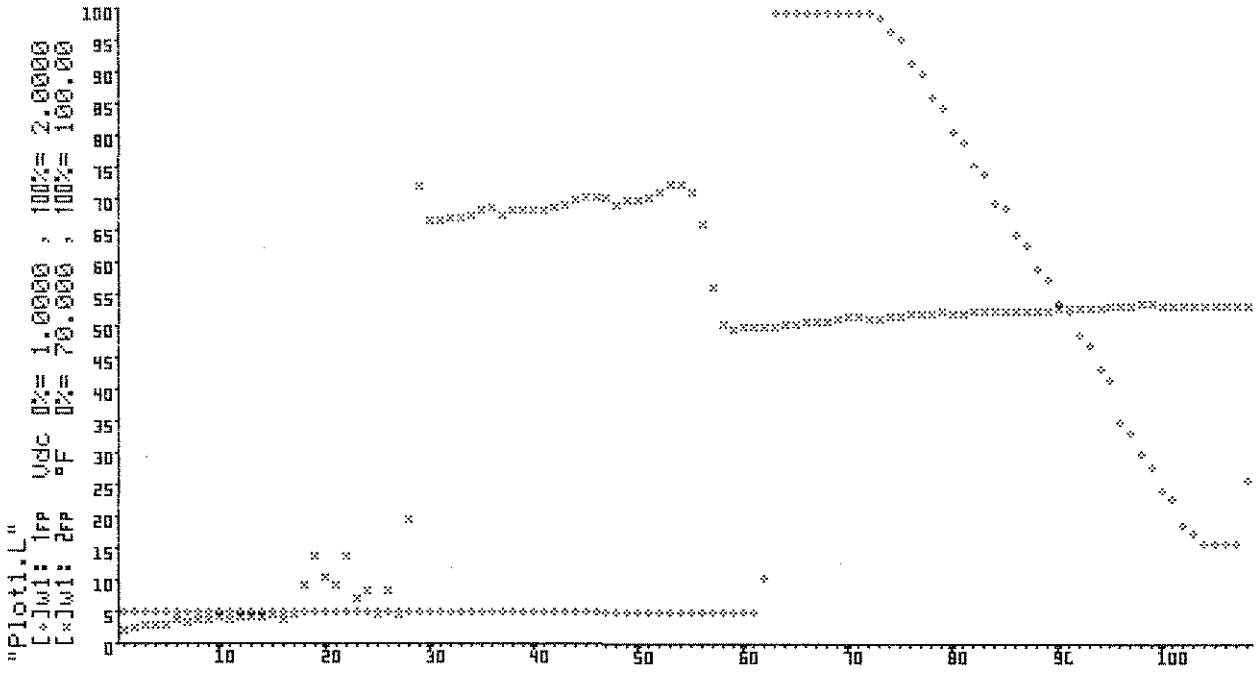


Figure 11-2. Plotting By Scan

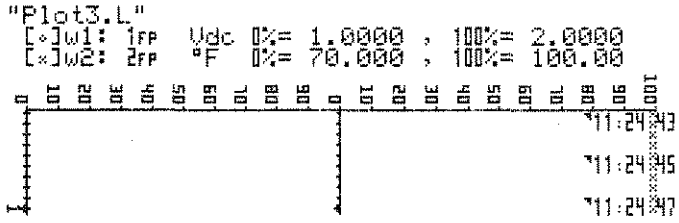


Figure 11-3. Plot By Scan With Time Stamp

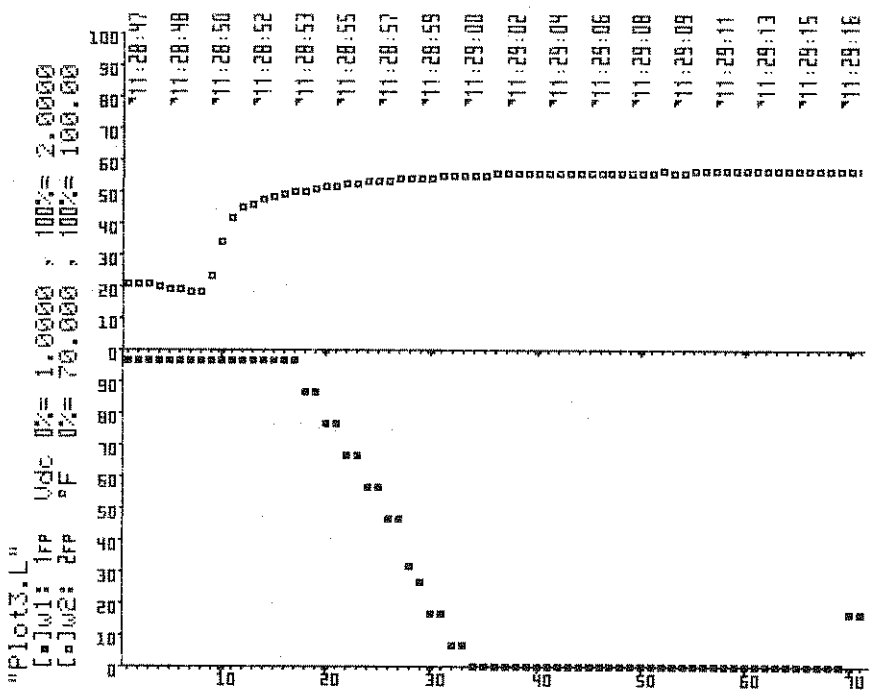


Figure 11-4. 2 Window, 1 Channel Plot

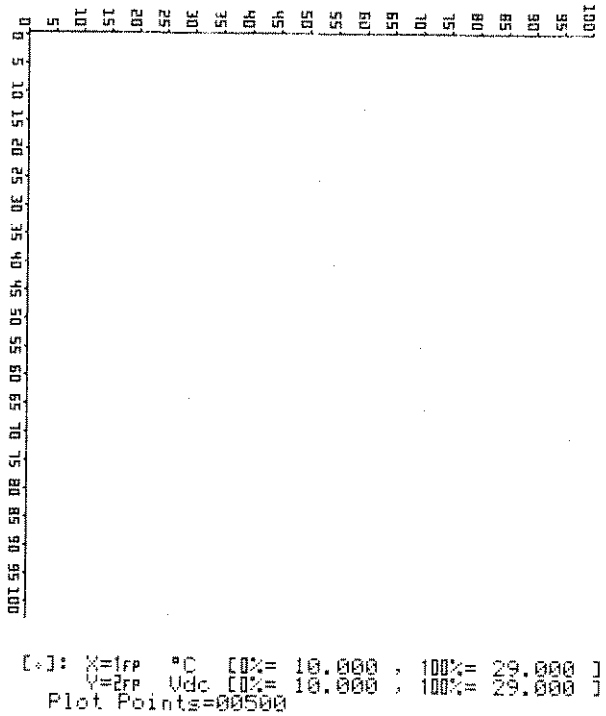


Figure 11-5. XY Plot

XY plotting plots data from pairs of channels using one channel as the X axis and the other channel as the Y axis. Each axis has its own set of 0% and 100% scale values. See figure 11-5.

11.1.1 Bargraphs

Bargraphs are the analog representations of a measurement. The Model 52A uses two types of bargraphs: full scale and high resolution.

Full scale bargraphs represent 100% of the selected range. The high resolution bargraph displays the two most significant digits as number and the remaining digits as a bargraph. Bargraphs are primarily for relative measurements.

Bargraphs are *Display Modifier* items for a channel list measurement. Also, refer to paragraph 6.5.5.4.

11.1.2 ASCII Vs Graphics Printing

The Model 52A sends data from its communication port number 1 in either ASCII (default) or Graphic format. In the ASCII mode the Model 52A sends data as ASCII characters to the printer. In the Graphic mode, the Model 52A sends the data exactly as shown on the front panel display. To receive the data in graphic format, the printer must be Epson graphic compatible (such as the Model 54 Printer). Also, in the graphics mode the data transfer is much slower.

To select the ASCII/Graphic data format,
- Locate and select COMM PORT 1 from the main menu.
- Select 54 Printer.
- Select ASCII (default) or Graphic.

Setting up Comm Port 1 is also covered in section 4.

11.2 PRINTING AND PLOTTING ITEMS AND SUMMARY

This paragraph lists and summarizes the menus for
- Printing in real time
- Printing stored data
- Printing at the end of a program
- Printing from alarms
- Plotting in real time
- Plotting stored data
- Plotting at the end of program

Only those menus for the specific task are shown.

11.2.1 Printing In Real Time

Channel Lists
- •
- •
- •

Data To
- Filter
- Comm Port 1
- Print Data

NOTE
The Model 54 Printer default conditions: readings per line, 66 lines per page. To change the printer parameters, use Comm Port 1 on the main menu.

CHANNEL LISTS
Allows creation of a new channel list, editing an existing channel list, or running an existing channel list.

DATA TO
Allows selection of where channel list data will be sent.

FILTER
Sorts the data to be printed.
Data Only sends only data to the printer, scan information, program names, channel list names, and scan numbers are not printed.
Alarms Only prints only true alarm data.

COMM PORT 1
Sends the data to the Model 54 Printer.

PRINT DATA
Prints alphanumeric data.

11.2.2 Printing Stored Data

Recall Data
  Data To
    Sort
    Comm Port 1

NOTE
The Model 54 Printer default conditions: 2 readings per line 66 lines per page. To change the printer parameters, use Comm Port 1 on the main menu.

RECALL DATA
Allows recalling of stored data.

DATA TO
Allows selection of where stored data will be sent.

SORT
Allows selection of the type of data to be printed.
-Labels strips off all names and nondata labels.
Alarm# prints data for a specific alarm number or a range of alarm numbers.
Chan# prints data for a specific channel number or range of channel numbers.
Time prints all data after a specific time or between two times.
Name presents a list of existing channel lists and programs. When one is selected, data from that channel list or program is printed.
Scan # prints all data after a specific scan number or between two scan numbers.

COMM PORT 1
Allows the data to be sent to the Model 54 Printer (Comm Port 1).

11.2.3 Printing At The End Of A Program

Programs
  •
  •
  •
  Program End
    Recall Data
      Send Data To
        Comm Port 1

NOTE
The Model 54 Printer default conditions: 2 readings per line 66 lines per page. To change the printer parameters, use Comm Port 1 on the main menu.

PROGRAMS
Allows creation of a new program, editing an existing program, or running an existing program.

PROGRAM END
Allows selection of how the program ends.

RECALL DATA
This program ends item allows the data to be sent at the end of the program.

SEND DATA TO
Allows selection where the data is sent. To print the data, select Comm Port 1.

11.2.4 Printing From Alarms

Alarms
- •
- •
- •

Send Data To
  Comm Port 1
    Reading
    Time/Date
    1 Scan Of List
    MSG

ALARMS
Allows true alarm data to be sent to the Model 54 Printer.

SEND DATA TO
Allows selection of where the data is sent.

COMM PORT 1
This "Send Data To" item routes the alarm data to Comm Port 1 (Model 54 Printer). This menu allows some sorting.
Reading prints just the alarm reading.
Time/Date prints the time and date.
1 Scan of List prints the channel list.
Msg prints the alarm message.

11.2.5 Plotting In Real Time

Channel Lists
- •
- •
- •

Filter
Comm Port 1
  Plot By Scan
  Plot By Scan & Time Stamp
    Scans Per Time
  Plot Window
- •
- •
- •

Plot Character
Plot Scaling
  0% Y Value
  100% Y Value

CHANNEL LISTS
Allows creation of a new channel list, editing an existing channel list, or running an existing channel list.

FILTER
Sorts the data to be plotted.
Data Only sends only data to the printer for plotting, scan information, program names, channel list names, and scan numbers are not plotted.
Alarms Only plots only true alarm data.

COMM PORT 1
Sends the plot data to Comm Port 1 (Model 54 Printer). Data can be plotted by scan number or plotted by scan number with a time stamp.

PLOT WINDOW
Allows selection of the number of windows per plot: 1, 2, or 4.

PLOT CHARACTER
Allows selection of the plot character. Each plot channel can have its own character.

PLOT SCALING
Allows setting of the 0% value (leftmost) and 100% value (rightmost) of Y axis of the plot. Each window can have its own set of 0% and 100% values.

11.2.6 Plotting Stored Data

- Recall Data
  - Data To
    - Sort
  - Comm Port 1
  - Plot
    - Plot Setup
      - Y Vs Scan#
        - Plot Windows
          - 1
          - 2
          - 4
        - Channel Number
          - To Plot
        - Plot Char
        - Plot Scaling
          - 0% Y Value
          - 100% Y Value
      - X Vs Y
        - Plot N Points
        - Channe Number
          - To Plot As X
        - Channel Number
          - To Plot As Y
        - Plot Char
        - 0% X Value
        - 100% X Value
        - 0% Y Value
        - 100% Y Value
    - Start Plot
      - Y Vs Scan#
      - X Vs Y

RECALL DATA
Recalls data stored in the Model 52A's internal RAM.

DATA TO
Allows selection of where stored data will be sent.

SORT
Allows selection of the type of data that will be plotted.
-Labels strips off all names and nondata labels.
Alarm# plots data for a specific alarm number or a range of alarm numbers.
Chan# plots data for a specific channel number or range of channel numbers.
Time plots all data after a specific time or between two times.
Name presents a list of existing channel lists and programs. When one is selected, data from that channel list or program is plotted.
Scan # plots all data after a specific scan number or between two scan numbers.

COMM PORT 1
Allows the data to be sent to the Model 54 Printer (Comm Port 1).

PLOT SETUP
Allows setup of Y vs scan number and X vs Y plot parameters.

Y VS SCAN#
Plots data relative to the scan number.

PLOT WINDOW
Allows selection of the number of windows per plot: 1, 2, or 4.

CHANNEL NUMBER TO PLOT
Enter the channel number for the data stored in RAM.

PLOT CHARACTER
Allows selection of the plot character. Each plot channel can have its own character.

PLOT SCALING
Allows setting of the 0% value (leftmost) and 100% value (rightmost) of Y axis of the plot. Each window can have its own set of 0% and 100% values.

X VS Y
Plots one channel relative to another channel.

PLOT N POINTS
Select the number of XY pairs to be plotted. Maximum number is 65535 pairs.

CHANNEL NUMBER TO PLOT AS X
Select the channel number for the data stored in RAM to be plotted on the X axis.

CHANNEL NUMBER TO PLOT AS Y
Select the channel number for the data stored in RAM to be plotted on the Y axis.

PLOT CHAR
Select the plot character.

0% X VALUE/100% X VALUE
Enter the 0% and 100% scaling values for the X axis.

0% Y VALUE/100% Y VALUE
Enter the 0% and 100% scaling values for the Y axis.

START PLOT
Selecting either "Y vs scan#" or "X vs Y" starts the plot routine.

11.2.7 Plot At The End of A Program

Programs
- •
- •
- •

Program End
Rcl Data
Send Data To
Port 1
Plot
XYPlot

PROGRAMS
Allows creation of a new program, editing an existing program, or running an existing program.

PROGRAM END
Allows selection of what happens at the end of the program.

RECALL DATA
This Program End item transmits data at the end of the program.

SEND DATA TO
Allows selection where the data is sent. To plot the data, select Comm Port 1.

PLOT/XYPLOT
Plots the data at the end of the program. Plot parameter must be preset using the Recall Data main menu item.

11.3 PRINTING AND PLOTTING MENU DETAILS

The menus in the list and the summary (paragraph 11.2) are grouped by function. Thus, some of the items on a menu are omitted. For example, the listing and summary for "Printing in Real Time" shows only the items required for printing from a channel list. In reality, the channel list menus contains both printing and plotting items. This paragraph details the complete menus and is organized as follows:

Channel Lists: printing and plotting in real time.
Recall Data: printing and plotting stored data.
Programs: printing and plotting at the end of a program.
Alarms: printing from alarms.
Comm Port 1 (Model 54 Printer) Setup.

11.3.1 Printing And Plotting In Real Time

```
 ▲  Enter New▶
<Examp|e1.L  R>
<Examp|e2.L  R>
<Examp|e3.L  R>
```

Channel Lists

Printing and plotting parameters must be entered as part of the channel list as it is created. Plot character and plot scaling are part of the channel measurement setup. For details on channel lists, see section 6.

```
DATA TO:  RAM>
◀Comm Port 1
<Comm Port 2
<Disp  Filter>
```

Data generated by this channel list can be routed to any or all of four locations.
Comm Port 1
[2] sends data to communication port 1. This port usually connects to the Model 54 Printer. Data can be alphanumeric printing or plotting or graphics
Comm Port 2
[3] sends data to the optional RS232 port or IEEE 488 port.
All other items are covered in section 6.
After all selections have been made, end with [Enter].

```
54 PRINTER:
<Print Data
<Plot by scan
  &Time stamp>
```

Comm Port 1 Response

To print or output alphanumeric data, push [2]. To plot (Epson graphics), push [3]. To add a time stamp to the plot, push [9]. Note: Add Channel 9 to the Channel List to time stamp standard data.

```
NUMBER OF
 PLOT WINDOWS:
<1
<2          4>
```

Plot by Scan Response

Plotting can be in 1, 2, or 4 separate windows on the paper. Any of 16 variables can individually assigned Y axis scaling. The resolution is: 1 window, 240 pixels; 2 windows, 120 pixels; 4 windows, 60 pixels.

```
SCANS PER TIME
<2   STAMP: 16>
<4          32>
<8          64>
```

Time Stamp Response

Select the number of scan intervals between each time stamp. A time stamp character height is equal to two plot positions, so there is a maximum of one time stamp per two scan plotted points.

```
DATA FILTER:
<Data Only
<Alarms Only
```

Filter Response

Data Only
[2] removes the storage or transmission of scan information, Program names, Channel List names, and scan numbers. Selecting Data Only saves memory, or prevent text strings from confusing post analysis PC programs.
Alarms Only
[3] will only store or transmit the data from a channel in an alarm true condition (plus the scan information unless *Data Only* is enabled also).

PLOT CHAR

None ⇕

Channel Measurement Plot Setup

If only one window is selected, this menu appears. Select the plot character for the channel measurement. Use the [▲] [▼] keys to step through the character set. Press [Enter] to accept the plot character.

PLOT CHAR:
<1 Window 2>
<3 Window 4>
⇕
-

If more than one window is selected, this menu appears. First select which plot window the channel is to be plotted in (NA for 1 plot window), then use the [▲] [▼] keys to select a plot character. Plot window 1 is to the left of the paper.

PLOT SCALING:
0% Y value =
(⇕for k,M,u,m)

Each plotted channel can have independent Y axis values. Enter the minimum (left most 0%) value . Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

PLOT SCALING:
100% Y value =
(⇕for k,M,u,m)

Enter the maximum (right most 100%) value. Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

11.3.2 Printing And Plotting Stored Data

RECALL DATA

This main menu item provides access to stored data collected from channel lists. Data can be sent to the Model 52A display, Model 54 Printer, either of the two communication ports, or plotted to the device on comm port 1.

DATA TO: Sort>
<Comm Port 1
<Comm Port 2
<Display Plot>

To recall data , select where data should be sent:
[2] for the device on Comm Port 1,
[3] for the device on Comm Port 2 (if present),
[4] to send the data to the LCD.

Sort
[6] if only selected data is desired such as data from just 1 channel.

Plot
[9] will plot from stored data to the selected (highlighted) device. Plot files are Epson compatible graphics optimized for the Wavetek Model 54 Printer, but useable with other printers. The display gives a limited representation of the plot (1/3 of the printed resolution).To delete all data push [Clear].
To delete selected data push "*Sort*" first, then after selecting the sort parameters, push [Clear].
To execute chosen operations push [Enter].

```
PLOT      START
SETUP:    PLOT:
< Y vs scan# >
<    X vs Y   >
```

To set plot parameters push the left side key. To immediately run a previously user entered plot routine using stored data push the right side key.

To preset plot parameters for the "End of Program" plot, set up the plot type needed (3 or 4) making sure that the channels called are present in the Program that plots as an end condition.

When returned to the "Plot Setup" menu push Menu to return to the Main Menu. Now the Program can be run.

```
NUMBER OF
 PLOT WINDOWS:
<1
<2            4>
```

Y Vs Scan# Setup

Plotting can be in 1, 2, or 4 separate windows on the paper. Any of 16 variables can individually assigned Y axis scaling. The resolution is: 1 window, 240 pixels; 2 windows, 120 pixels; 4 windows, 60 pixels.

```
CHANNEL NUMBER
 TO PLOT:

     ---
```

Enter a channel number that corresponds to data stored in memory (e.g. for Ch 1FP push 1 Enter).

```
PLOT CHAR:
<1  Window  2>
<3  Window  4>
    -       ▲▼
```

First select which plot window the channel is to be plotted in (NA for 1 plot window), then use the ▲ ▼ keys to select a plot character. Plot window 1 is to the left of the paper.

```
PLOT SCALING:
 0% Y value =
(▲▼for k,M,u,m)
  --------
```

Each plotted channel can have independent Y axis values. Enter the minimum (leftmost 0%) value desired. Enter a numeric value with the 0 ♪ - 9 and ± • keys. To enter a negative number, push the ± • key first.To enter a value less than zero, enter a zero first then the decimal point. Use the ▲ scroll key to enter multipliers (k,M,u,m).

```
PLOT SCALING:
100% Y value =
(▲▼for k,M,u,m)
  --------
```

Enter the maximum (rightmost 100%) value desired. Enter a numeric value with the 0 ♪ - 9 and ± • keys. To enter a negative number, push the ± • key first.To enter a value less than zero, enter a zero first then the decimal point. Use the ▲ scroll key to enter multipliers (k,M,u,m).

```
X vs Y:
Plot n Points
 n = 1-65535
    -----
```

X Vs Y Response

Enter the number of XY pairs to be plotted.

```
0 , X vs Y:
Channel number
to plot as X:
     ---
```

Enter the channel number to be plotted as the X coordinate of an XY pair. Data from the entered channel must be stored in RAM.

```
0 , X vs Y:
Channel number
to plot as Y:
     ---
```

Enter the channel number to be plotted as the Y coordinate of an XY pair. Data from the entered channel must be stored in RAM.

```
PLOT CHAR:
```

Use the [▲][▼] key to select a plot character for each plotted XY pair.

```
  _      ⇕
```

```
▯ , X vs Y:
 0% X value =
(⇕for k,M,u,m)
  --------
```

Enter the minimum value (0%) that X will plot. Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

```
▯ , X vs Y:
100% X value =
(⇕for k,M,u,m)
  --------
```

Enter the maximum value that X will plot. Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

```
▯ , X vs Y:
 0% Y value =
(⇕for k,M,u,m)
  --------
```

Enter the minimum value that Y will plot. Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first.To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

```
▯ , X vs Y:
100% Y value =
(⇕for k,M,u,m)
  --------
```

Enter the maximum value that Y will plot. Enter a numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first. To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] scroll key to enter multipliers (k,M,u,m).

11.3.3 Printing And Plotting At The End Of A Program

```
Programs

 ⇕  Enter New>
<Example1.P R>
<Example2.P R>
<Example3.P R>
        .
        .
        .
```

Printing and plotting parameters must be entered as part of the program as it is created.

```
PROGRAM END:
<Run Prgm/List
<Main Menu
<Off  RclData>
```

At this point the program is over. Specify the next operation: Push [2] to run a different Program or a Channel List. Push [3] to return to the Main Menu at Program end. Push [4] to power off at Program end. To automatically recall data before the end operation, push [9].

```
SEND DATA TO:
<Port1
<Port2   Plot>
<&Clr  XYPlot>
```

To output all scan data to the device on Comm Port 1 (or Printer) push [2]. For Comm Port 2 (or Printer or GPIB) push [3] . To clear the memory after transmission select "&Clr" ([4]). To output a "Y vs Scan#" plot to the printer on Comm Port 1 push [8]. For an XY Plot push [9]. The plot parameters must be set up previously from the Main Menu level "Recall Data" menus.

11.3.4 Printing From Alarms

```
ALARMS:  Copy>
<Program/Edit
<Enable All
<Disable All
```

Printing parameters must be entered as part of the alarm as it is created.

```
SEND DATA TO:
<Comm Port 1
<Comm Port 2
<Display  RAM>
```

A true Alarm will send data, messages, or time to any or all data ports, internal RAM, and/or the display.
Push [2] to send to the device on Comm Port 1.
Push [3] for Comm Port 2 (IEEE-488 or RS-232 if installed).
Push [4] to send the Alarm messages to the Model 52A LCD (this step is unnecessary for data as it is on the display by default).
Push [9] to store in internal memory.

```
COMM PORT 1:
<Reading  Msg>
<Time/Date
<1Scan of List

COMM PORT 2:
<Reading  Msg>
<Time/Date
<1Scan of List
```

These two menus select what will by sent to the communication ports.
Pushing [2] transmits just the alarm reading.
Pushing [3] transmits the time and date.
Pushing [7] transmits the alarm message.
Pushing [4] transmits the entire Channel List. This response will be ignored if the Channel List data is already being transmitted to the selected Comm Port.
Any or all responses can be selected.

SECTION 12
DIGITAL I/O AND TRACKING

12.1 INTRODUCTION

Digital I/O (Option 50-14 required) reads digital input bits and digital input bytes, writes digital output bits and digital output bytes. Plus, it can supply an analog output, as well as, a digital and analog tracking outputs. Valid digital I/O channels are 5, 6, 7, and 8 which relates to rear panel option slots. See figure 2-3 item 1 shows the location of the digital I/O slots connectors. Figure 12-1 shows the digital I/O connector along with its pins and functions. Digtal ouputs can also be addressed using alarms; Section 8.

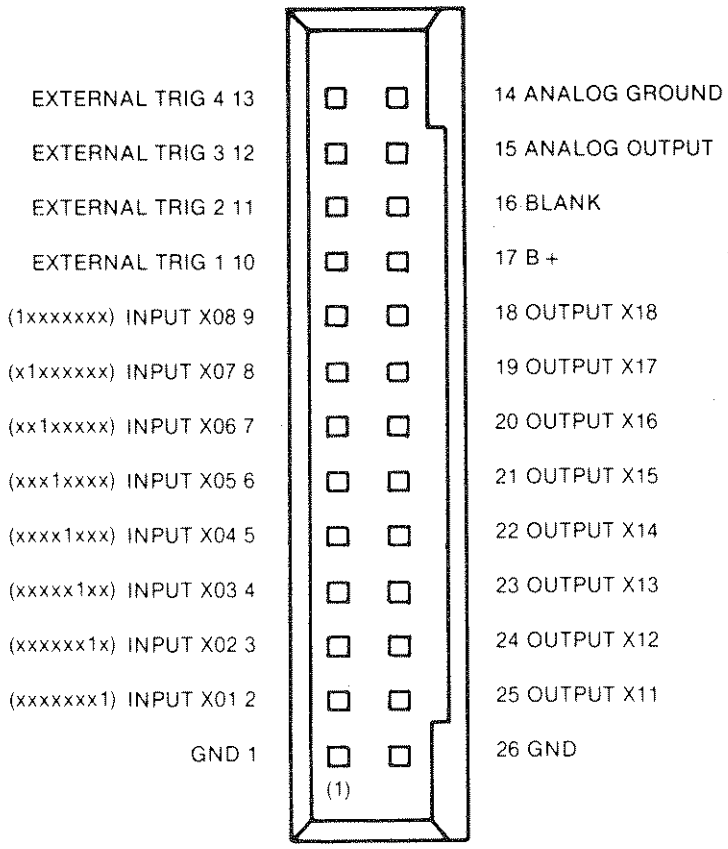


Figure 12-1. Digital I/O Connector.

Digital Input Byte

The digital input byte reads an eight-bit byte that can be displayed, stored, transmitted, or printed. The byte is read as a binary number, but the Model 52A can process all or part of the input byte as a binary, hexadecimal, octal, and binary coded decimal number, or an ASCII character. Also the byte value can be inverted relative to the input. To read a byte, use the digital I/O channel the same as any measurement channel in a channel list.

Digital Output Byte

The digital output byte writes an eight-bit byte to the digital I/O connector. The Model 52A displays the output value as binary, hexadecimal, octal, and binary coded decimal value or ASCII character. The actual output value is always a binary value. The initial value can be preset and incremented, decremented, complemented, or unchanged with each measurement scan. The output byte default value is 11111111. To write a byte, use the digital I/O channel the same as any measurement channel in a channel list. When a channel list ends, the output byte remains at the last value, however, when the channel list is part of a Program, the output byte always resets to 11111111 at the beginning of a new Program.

Analog Output

The analog output supplies an analog (0 to +2.55V) voltage to the digital I/O connector. The Model 52A displays the analog output voltage as a binary, hexadecimal, octal, decimal, and binary coded decimal value, or voltage. The initial value can be preset and incremented, decremented, complemented, or unchanged with each measurement scan. The default output voltage is +2.55V. To produce an analog output, use the digital I/O channel the same as any measurement channel in a channel list.

Digital Input Bit

The digital input bit reads a single input of the digital I/O connector. This bit can be displayed, stored, transmitted, or printed. Plus the input bit can start or stop a Program or trigger a time interval measurement. The input bit can be displayed as the bit by itself, the bit in the byte (unwanted bits masked out), or the entire byte. To read an input bit, use the digital I/O channel the same as any measurement channel in a channel list.

Digital Output Bit

The digital output bit controls an individual output bit that can control, for example, a single relay or toggle an external device. This bit can be displayed, stored, transmitted, or printed. The output bit can be displayed as an individual bit, a bit in the byte (unwanted bits masked out), or an entire byte. The initial bit value is "1" and incremented, decremented, complemented, or remains unchanged with each measurement scan. To produce a digital output bit, use the digital I/O channel the same as any measurement channel in a channel list.

Tracking (Chart Recorder Output)

Tracking produces an analog level (0 to +2.55V) or a digital byte (00000000 to 11111111) that is proportional to a channel measurement. A digital I/O card (Option 50-14) is required. Tracking conditions are set up as part of a channel measurement setup in a channel list.

The output, analog or digital, can be single ended (SE) or bipolar. Single ended output levels vary linearly between a 0 value (0V or 00000000) and a full scale value (+2.55v or 11111111); see figure 12-2.

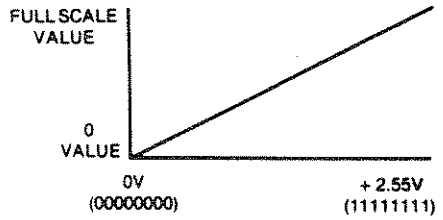


Figure 12-2. Single Ended Outputs

Bipolar outputs vary linearly around a center value (+1.28V or 10000000) and a full scale value (+2.55V or 11111111). The deviation is the full scale value minus the center value; see figure 12-3.

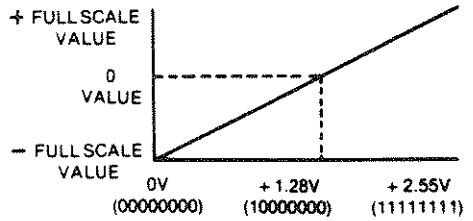


Figure 12-3. Bipolar Outputs

12.2 DIGITAL I/O MENU ITEMS

Below is an indented list of digital I/O menu items. It lists the items by function:

Reading a *digital input byte*
Writing a *digital output byte*
Generating an *analog output voltage*
Reading a *digital input bit*
Writing a *digital output bit*
Tracking a channel measurement

Under each function are the items related to the function. All items listed are discussed throughout this section.

- Channel List
  - •
  - •
  - •
  - Enter Chan # (5, 6, 7, and 8)
    - Digital Input *(BYTE)*
      - (Range)
        - Mask
      - (Display Modifiers)
        - Binary
        - Hex
        - Octal
        - ASCII
        - Decimal
        - BCD
      - (Function Modifiers)
        - Delay
        - Alarm
        - Track
        - Active
        - Reset
        - Invert
    - Digital Output *(BYTE)*
      - (Range)
        - Output Value
      - (Display Modifiers)
        - Binary
        - Hex
        - Octal
        - ASCII
        - Decimal
        - BCD
      - (Function Modifiers)
        - Delay
        - Alarm
        - Track
        - Active
        - Reset
        - Increment
        - Decrement
        - Complement
    - Analog Output
      - (Range)
        - Output Value
      - (Display Modifiers)
        - Binary
        - Hex
        - Octal
        - Volts
        - Decimal
        - BCD
      - (Function Modifiers)
        - Delay
        - Alarm
        - Track
        - Active
        - Reset
        - Increment
        - Decrement
        - Complement
    - Digital Input *(BIT)*
      - (Display Modifiers)
        - Bit
        - Mask
        - Byte
      - (Function Modifiers)
        - Delay
        - Alarm
        - Track
        - Active
        - Reset
        - Invert
    - Digital Output *(BIT)*
      - (Range)
        - Output Value
      - (Display Modifiers)
        - Bit
        - Mask
        - Byte
      - (Function Modifiers)
        - Delay
        - Alarm
        - Track
        - Active
        - Reset
        - Increment
        - Decrement
        - Complement
  - Enter Chan #
    - •
    - •
    - •
      - (Function Modifiers)
        - Track
          - Analog
          - Digital
          - Program Track
            - Bipolar
            - Single Ended
            - 0 Value
            - Full Scale Value

12.3 DIGITAL I/O ITEM SUMMARY

Item	Summary
CHANNEL LISTS	Allows creation of a now channel list, editing an existing channel list, or running an existing channel list. Digital inputs and outputs as well as tracking are part of the measurement setups of the channel list.
CHAN#	Allows entry of the digital I/O channel number. Acceptable channel numbers for Digital I/O channels are channels 5, 6, 7, and 8.
DIGITAL INPUT (BYTE)	Allows the Model 52A to read a digital input byte. *Range* item MASK specifies which bits (all or some) will be displayed. *Display Modifiers* specify the byte format: Binary number, Hexadecimal number, Octal number, ASCII character, Decimal number, or Binary Coded Decimal number. *Function Modifiers* allow delaying the measurement before its taken, attaching an alarm to the measurement, tracking the measurement, activating data routing parameters, resetting minimum or maximum readings, and inverting the input byte.
DIGITAL OUTPUT (BYTE)	Allows the Model 52A to write a digital output byte. *Range* item Output Value allows setting of the initial output byte. *Display Modifiers* specify the byte format: Binary number, Hexadecimal number, Octal number, ASCII character, Decimal number, or Binary Coded Decimal number. *Function Modifiers* allow delaying the measurement before its taken, attaching an alarm to the measurement, tracking the measurement, activating data routing parameters, resetting minimum or maximum readings, and incrementing or decrementing the output value with each measurement.
ANALOG OUTPUT	Allows the Model 52A to produce an analog output voltage. *Range* menu item Output Value allow setting the output level (0 to +2.55 volts). *Range* item Output Value allows setting of the initial output byte. *Display Modifiers* specify the byte format: Binary number, Hexadecimal number, Octal number, Volts, Decimal number, or Binary Coded Decimal number. *Function Modifiers* allow delaying the measurement before its taken, attaching an alarm to the measurement, tracking the measurement, activating data routing parameters, resetting minimum or maximum readings, and incrementing or decrementing the output value with each measurement.
DIGITAL INPUT (BIT)	Allows the Model 52A to read a digital input bit. *Display Modifier* specifies the bit format: display only the bit (1 or 0), display the bit with the unwanted bits masked out, and display the entire byte. *Function Modifiers* allow delaying the measurement before its taken, attaching an alarm to the measurement, tracking the measurement, activating data routing parameters, resetting minimum or maximum readings, and inverting the input byte.

Item	Summary
DIGITAL OUTPUT (BIT)	Allows the Model 52A to write a digital output bit. *Range* menu item Output Value allows setting the initial output bit. *Display Modifier* specifies the bit format: display only the bit (1 or 0), display the bit with the unwanted bits masked out, and display the entire byte. *Function Modifiers* allow delaying the measurement before its taken, attaching an alarm to the measurement, tracking the measurement, activating data routing parameters, resetting minimum or maximum readings, and incrementing or decrementing the output value with each measurement.
TRACK	This function modifier item allows the Model 52A to produce an analog or digital output that varies proportionally with the measurement. *Bipolar* selects an output that varies linearly about a zero (0) value. *SE* (single ended) selects an output that varies linearly between the 0 value and the full scale value *0 Value* sets the low end or center reading. Zero value output is 0.00V or 000000000 for single ended and +1.28V or 10000000 for bipolar. *Full Scale sets* the high end reading. Full scale output is always +2.55 V or 11111111.

12.4 HOW TO SETUP THE DIGITAL I/O

The following steps summarize the setups for the digital I/O functions.

12.4.1 Reading the Digital Input Byte

To read a digital input byte

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number: 5, 6, 7, or 8.
5. Select the Function: Digital Input
6. Select the Range: Mask.
7. Select the Display Modifier.
8. Select the Function Modifier.

12.4.2 Writing the Digital Output Byte

To write a digital output byte

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number: 5, 6, 7, or 8.
5. Select the Function: Digital Output
6. Select the Range: Set the initial output value.
7. Select the Display Modifier.
8. Select the Function Modifier.

12.4.3 Generating an Analog Output

To generate an analog output

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number: 5, 6, 7, or 8.
5. Select the Function: Analog Output
6. Select the Range: Set the initial output voltage.
7. Select the Display Modifier.
8. Select the Function Modifier.

12.4.4 Reading the Digital Input Bit

To read a digital input bit

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number: 5, 6, 7, or 8.and the bit position 01, 02, 03, 04, 05, 06, 07, or 08.
5. Select the Function: Digital Input
6. Select the Display Modifier.
7. Select the Function Modifier.

12.4.5 Writing the Digital Output Bit

To write a digital output bit

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number: 5, 6, 7, or 8.and the bit position 01, 02, 03, 04, 05, 06, 07, or 08.
5. Select the Function: Digital Output
6. Select the Range: Set the initial output bit.
7. Select the Display Modifier.
8. Select the Function Modifier.

12.4.6 Tracking a Channel Measurement

To read a digital input bit

1. Select Channel List from the main menu.
2. Select the Reading Mode.
3. Select the Data To (Routing).
4. Enter the channel number.
5. Select the Function.
6. Select the Range.
7. Select the Display Modifier
8. Select the Function Modifier: Track
9. Select the digital I/O tracking channel number 5,6,7, or 8
10. Select output type: Digital or Analog.
11. Select either Bipolar or Single Ended (SE).
12. Set the 0 Value.
13. Set the full scale value.

```
FIRST CHAN #:
(Push "Disp"
 for Help)
   101-116
```

Digital Byte and Analog Output Channel Numbers

Channel numbers identify the "measurement" input connection. To read or write a digital byte or produce an analog output, enter just the channel number (for example: [Chan] [5 LCD] [Enter]). To read or write a digital bit, enter the channel number and the bits position in the byte (for example: [Chan] [5 LCD] [0 ♪] [3] [Enter] .

```
5      A3    HEX
<Digital Input
<Digital Output
<Analog Output
```

Function Response

To read a digital input byte (50-14 option installed), push [2]. To write a digital output byte, push [3]. To write an analog output, push [4].

```
MASK:(1,X(▲))
 1=Input
 X=don't care
  --------
```

Digital Input Byte Range Response

When reading a digital input any or all the bits can be read. A masking value can be used to ignore unwanted bits. To read all 8 bits enter "11111111". To read just bits 1 and 2 enter "XXXXXX11".

```
500 0101010101
◀Binary ASCII>
<Hex  Decimal>
<Octal    BCD>
```

Digital Input Byte Display Modifier Response

Byte wide digital I/O can be expressed in any of these data formats: "Binary" ([2]), 00000000 - 11111112. "Hex" ([3]), 00-FF. "Octal" ([4]), 0-277. "ASCII" ([7]), $20-$7F characters supported. "Decimal" ([8]), 0-255. "BCD" ([9]), upper and lower nibbles from 0-9. In all modes illegal values will be displayed as "x".

```
500 01010101BIN
<Delay Active▶
<Alarm  Reset>
<Track Invert>
```

Digital Input Byte Function Modifier Response

Delay

[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate.

Alarm

[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99). Refer to section 8.

Track

[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu. "Refer to Tracking in this section.

Active

[7]) should be highlighted if the channel is to follow the data routing parameters of the Channel List. An open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *"Active"* or not.

Reset

[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The *"Reset"* occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).

Invert

[9] Inverts the logic sense.

```
OUTPUT VALUE:
  (1,0,X(▲))
 X=don't care
    --------
```

Digital Output Range Response

Enter the digital output value desired (1, 0, or X). Use the [▲] key to enter a "don't care" (X). For example, to output a single bit at bit 5 position use XXX0XXXX. Note: Initially, on power up, the digital outputs are deenergized (lightly pulled up) until set by a direct digital write or an alarm.

```
500 01010101Ø
◀Binary ASCII>
<Hex  Decimal>
<Octal    BCD>
```

Digital Output Byte Display Modifier Response

Byte wide digital I/O can be expressed in any of these data formats: "Binary" ([2]), 00000000 - 11111112. "Hex" ([3]), 00-FF. "Octal" ([4]), 0-277. "ASCII" ([7]), $20-$7F characters supported. "Decimal" ([8]), 0-255. "BCD" ([9]), upper and lower nibbles from 0-9. In all modes illegal values will be displayed as "x".

```
51Ø 01010101BIN
<Delay Active▶
<Alarm  Reset>
<Track ▲▼
```

```
51Ø 01010101BIN
<Increment
<Decrement
<Complement  ▲▼
```

Digital Output Byte Function Modifier Response

Delay
[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate.
Alarm
[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99). Refer to section 8.
Track
[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu. "Refer to Tracking in this section.
Active
[7]) should be highlighted if the channel is to follow the data routing parameters of the Channel List. An open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *"Active"* or not.
Reset
[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The *"Reset"* occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).

Second Menu

Increment
[2] increments the data each time the channel is scanned.
Decrement
[3] decrements the data each time the channel is scanned.
Complement
[4] complements the data each time the channel is scanned..

```
OUTPUT VALUE
   IN VOLTS:
   (Ø-2.55)
     -.--
```

Analog Output Range Response

The 50-14 option has a D/A converter scaled to 10mV/bit. Enter the desired output value from 0-2.55V. Default power-on value is 0 volts.

```
500 0101010101
<Binary ASCII>
<Hex  Decimal>
<Octal    BCD>
```

Analog Output Display Modifier Response

8 bit analog outputs can be expressed in any of these data formats: "Binary" ([2]), 00000000 - 11111111. "Hex" ([3], 00-FF. "Octal" ([4]), 0-277. "ASCII" ([7]), $20 -$7 F characters supported. "Decimal" ([8]), 0-255. "BCD" ([9]), upper and lower nibbles from 0-9. Any data format will be translated to its 8 bit binary equivalent and will write the D/A accordingly. Full scale D/A output equals 2.55 volts with a 10mV resolution per bit.

```
510 01010101BIN
<Delay Active
<Alarm  Reset>
<Track
```

Analog Output Function Modifier Response

Delay
[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate.
Alarm
[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99). Refer to section 8.
Track
[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu. "Refer to Tracking in this section.
Active
[7]) should be highlighted if the channel is to follow the data routing parameters of the Channel List. An open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *"Active"* or not.
Reset
[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The "*Reset*" occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).

```
510 01010101BIN
<Increment
<Decrement
<Complement
```

Second Menu

Increment
[2] increments the data each time the channel is scanned.
Decrement
[3] decrements the data each time the channel is scanned.
Complement
[4] complements the data each time the channel is scanned..

```
FIRST CHAN #:
(Push "Disp"
 for Help)
```

Digital Bit Channel Number

Channel numbers identify the "measurement" input connection. To read or write a digital bit, enter the channel number and subscript. The subscript identifies the position of the bit in the eight bit byte.For example, a subscript of 02 represents the second position (11111111)
[Chan] [5 LCD] [0 ♪] [2] [Enter].

```
501    1    Bit
<Digital Input
<Digital Output
```

Digital Bit Function Response

To read a digital input (50-14 option installed), push [2]. To write a digital output, push [3]. To write an analog output, push [4]. Single-bit I/O channels require a subchannel entry from 01-08 (LSb to MSb), or masking unwanted bits with the "X" character ([Range] menu).

```
501     1     Bit
<Bit
<Mask
<Byte
```

Digital Input Bit Display Modifier Response

Bit
[2] displays only the bit as a 1 or 0.
Mask
[3] displays the entire byte, however, the unwanted bits are masked out and only the desired bit is shown. For example: XXXX1XXX.
Byte
[4] displays the entire byte.

```
501     1     Bit
<Delay  Active▶
<Alarm  Reset>
<Track  Inv>
```

Digital Input Bit Function Modifier Response

Delay
[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate.
Alarm
[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99). Refer to section 8.
Track
[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu. "Refer to Tracking in this section.
Active
[7]) should be highlighted if the channel is to follow the data routing parameters of the Channel List. An open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *"Active"* or not.
Reset
[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The "*Reset*" occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).
Inv
[9] Inverts the logic sense.

```
OUTPUT VALUE:
  (1,0,X(▲))
 X=don't care
   --------
```

Digital Output Bit Range Response

Enter the digital output value desired (1, 0, or X). Use the [▲] key to enter a "don't care" (X). For example, to output a single bit at bit 5 position use XXX0XXXX. Note: Initially, on power up, the digital outputs are deenergized (lightly pulled up) until set by a direct digital write or an alarm.

```
501     1     Bit
<Delay  Active▶
<Alarm  Reset>
<Track ▲▼
```

```
501     1     Bit
<Increment
<Decrement
<Complement  ▲▼
```

Digital Output Bit Function Modifier Response

Delay
[2] inserts a delay in front of the measurement from 0 to 655.35 seconds with .01 second resolution. Useful for slowing down the reading rate.
Alarm
[3] attaches an Alarm to the channel currently accessed. A second menu will ask for the Alarm channel number (1-99). Refer to section 8.
Track
[4] requires a digital I/O option. A digital or analog output proportional to the channel data is generated. Track parameters are set from the Main Menu. Refer to Tracking in this section.

Active
[7]) should be highlighted if the channel is to follow the data routing parameters of the Channel List. An open arrow, will prevent this channel's data from being transmitted or stored. LCD readout, alarms and tracking will work *"Active"* or not.
Reset
[8] resets or clears accumulative data such as events, Time Intervals, and other counter functions, resets Minimums or Maximums, as well as resets to defaults the variables in Math Channels. The *"Reset"* occurs once each call of the Channel List in a Scan Group, but not during repeat count. Channel Lists running alone will always reset every pass (assuming reset enable).

Second Menu
Increment
[2] increments the data each time the channel is scanned.
Decrement
[3] decrements the data each time the channel is scanned.
Complement
[4] complements the data each time the channel is scanned..

Tracking

Tracking is a function modifier which can be attached to any measurement setup. To setup tracking
Create a channel list (section 6).
Setup the channel measurement.
Select the Function Modifier: Track.
Enter the output channel number.
Select the mode: Analog or Digital
Setup the 0 value.
Setup the full scale value.

Function Modifier Response

```
TRACKING OUT
 CHAN # (5-8):
◄Analog
<Digital   -
```

Analog
[4] produces an analog tracking output.
Digital
[5 LCD] produces a digital tracking output
CHAN #
Enter the digital I/O channel number. Channels 5, 6, ,7, and 8 are valid numbers

```
TRACKING:
◄Bipolar    SE>
<0=   0.000000
<FS=  2.54
```

Bipolar
[2] select bipolar tracking if the tracking data has positive and negative values.
SE
[7] select single ended tracking if the tracking data has unipolar values.
0=
[3] allows entry of the zero value. The output from the digital I/O card is 0V or 00000000 for single ended and +1.28V or 10000000 for bipolar.
FS
[4] allows entry of the full scale value. The output from the digital I/0 card is +2.54V or 11111111 for single ended and +2.54V or 11111111 (positive swing) to 0.00V or 00000000 (negative swing).

```
ENTER VALUE
(▲for k,M,u,m)
   --------
```

Enter the numeric value with the [0 ♪] - [9] and [± •] keys. To enter a negative number, push the [± •] key first. To enter a value less than zero, enter a zero first then the decimal point. Use the [▲] key to scroll through and select the multiplier (k, M, u, m).

12.6 ACCESSORY 50-32 BREAKOUT MODULE

Accessory 50-32 Digital I/O and Analog Output Breakout Module (figure 12-4) provides convenient terminal strip connections for Digital I/O channels.

Setting Up the Breakout Module — To set up the Breakout Module,

1. Remove the four screws from the module bottom to gain access to the modules's terminal strips.

2. Connect the wires to the appropriate terminals.

3. Replace the cover.

Connecting the Breakout Module to the Model 52 — To connect the breakout module to Model 52 (figure 12-5), connect the breakout module ribbon cable to the Model 52A Digital I/O connector.

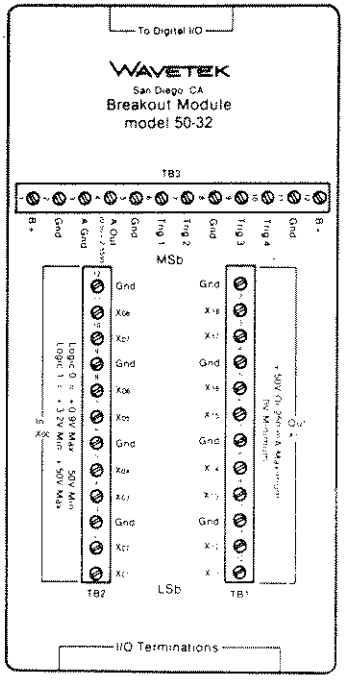


Figure 12-4. Digital I/O Breakout Module

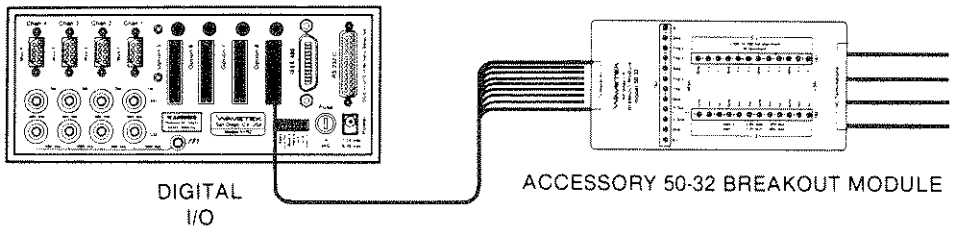


Figure 12-5. Breakout Module/Model 52A Interconnection

SECTION 13
REMOTE OPERATION

13.1 REMOTE OPERATION

13.1.1 Introduction

This section covers the remote operation of the Model 52A as it applies to the RS-232-C or IEEE-488A (GPIB) interface.

The first portion of this section describes the interface interconnection and setup:

Standard RS-232-C interface interconnection and setup – Paragraph 13.1.2.
Option 50-15 RS-232-C interface interconnection and setup – Paragraph 13.1.3.
Option 50-13A IEEE-488A interface interconnection and setup – Paragraph 13.1.4.

The second portion of this section (Paragraph 13.2) describes placing the Model 52A in remote.

The third portion of this section defined the interface protocol and syntax:

Interface protocol – Paragraph 13.3.
General command syntax – Paragraph 13.4.
Basic syntax rules – Paragraph 13.5.

The remainder of this section (Paragraph 13.6) describes the Model 52A's remote commands and their functions. While paragraph 13.6 covers every remote command, no explanations are given for how the commands interrelate; a working knowledge of the Model 52A "system" will aid in understanding command relationships. The majority of the command descriptions contain examples that illustrate the commands function and syntax. Table 13 - 4 at the end of this section summarizes the remote commands and their functions.

13.1.2 Standard RS-232-C Setup

Every Model 52A contains a built-in RS-232-C interface that can receive instrument setup commands from a controller, send data to a controller, or transmit data to a Model 54 printer in ASCII or graphics format. This full duplex interface can be set up for DCE or DTE configuration and CTS/RTS or XON/XOFF handshaking mode with programmable break character. The data format is 8-bits, no parity, one stop bit.

Connector

The standard RS-232-C connector is located on the rear panel of the Model 52A; see figure 2-3 item 3 or 13-1. For pin connections and signal names, refer to table 13-1. The rear panel connector is a DB-25 connector which connects to any standard RS-232-C cable (interface type E).

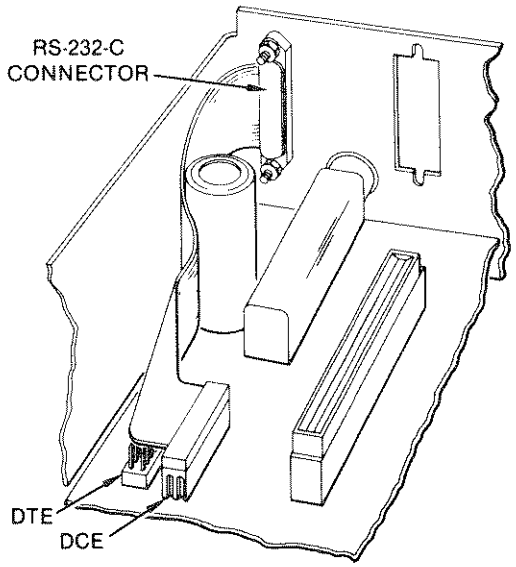


Figure 13-1. Standard RS-232-C

Table 13-1. RS-232-C Data In/Out

Pin	Name	Direction (DCE) Config-uration	Direction (DTE) Config-uration
2	TXD Transmit data	In	Out
3	RXD Receive data	Out	In
4	RTS Request to send	No conn	Out
5	CTS Clear to send)	Out	In
6	DSR Data set ready	Out	In
7	SIG GRD Signal ground	—	—
8	RLSD Receive line signal detect	Out	In
20	DTR Data Terminal Ready	In	Out

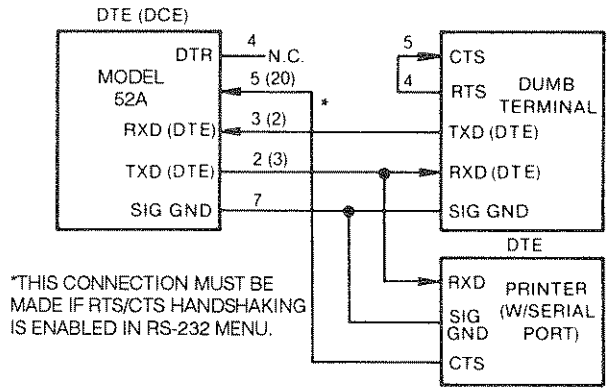
DCE/DTE Configuration

Before connecting the Model 52A RS-232-C interface, the correct device configuration (DCE or DTE) must be determined and the internal ribbon cable connected to the DCE or DTE location (figure 13-1) on the motherboard. Wavetek ships the Model 52A set up for DCE operation.

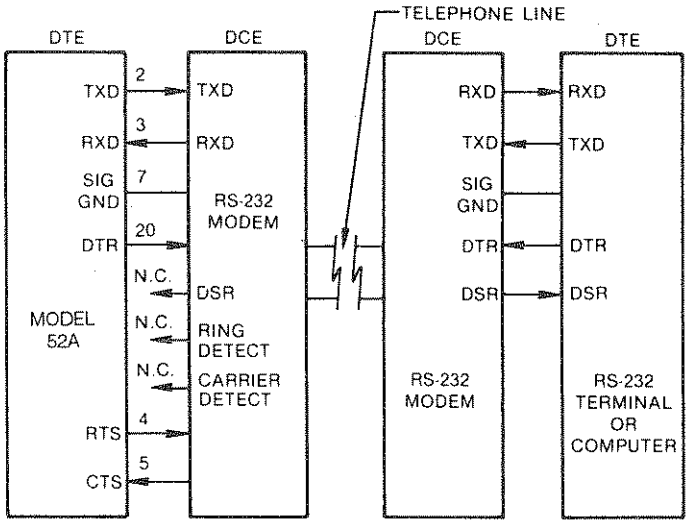
To determine the correct device configuration, refer to the following steps or the manual for your system controller/computer. The controller/computer must have a DB-25, RS-232-C connector.

1. Is the controller/computer a DCE or DTE device? If this is not explicitly spelled out in the manual you will need to look at the connector's pins. If pin 2 is the data output, the controller/computer is a DTE (most computers). If pin 3 is data output, the controller/computer is a DCE (most MODEMS). Set the Model 52A opposite to the controller/computer (for example, if the controller is DTE, set the Model 52A for DCE). To set the Model 52A remove the top cover (figure 2-7) and connect the cable to the appropriate header; see figure 13-1.

2. In most cases a straight-through cable can be used to connect the Model 52A with the other device. Model 52A requires connection of pins 2, 3, 5, 7, and 20 for CTS/DTR handshaking or pins 2, 3, and 7 for data operation (no handshaking), but the other device may require more connections. Examples of typical cable assemblies are shown in figure 13-2. However, there are many interpretations for the RS-232-C standard.

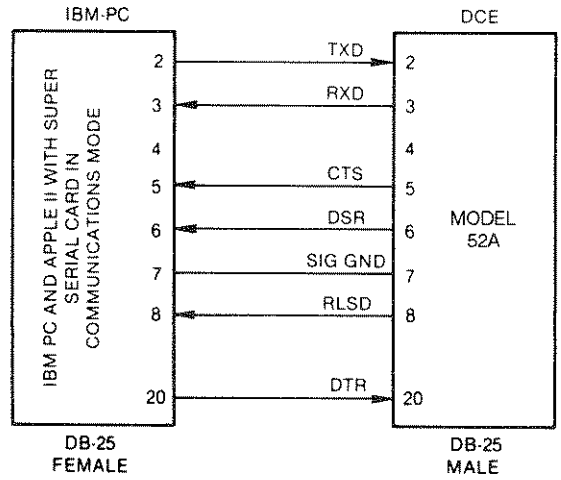


MODEL 52A TO DUMB TERMINAL WITH TEE FOR PRINTER

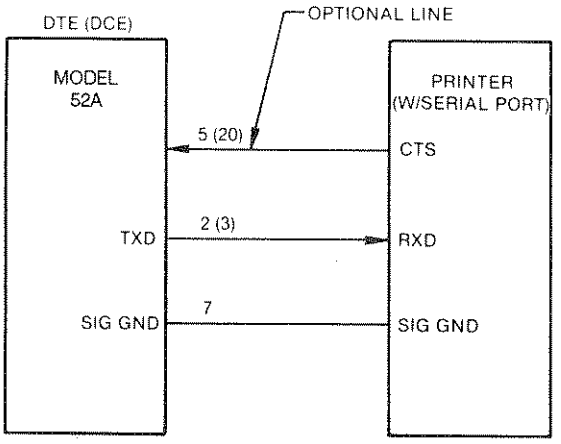


MODEL 52A TO TYPICAL MODEM CONNECTION
(SEE INDIVIDUAL MODEM MANUAL FOR HANDSHAKING LINES AVAILABLE)

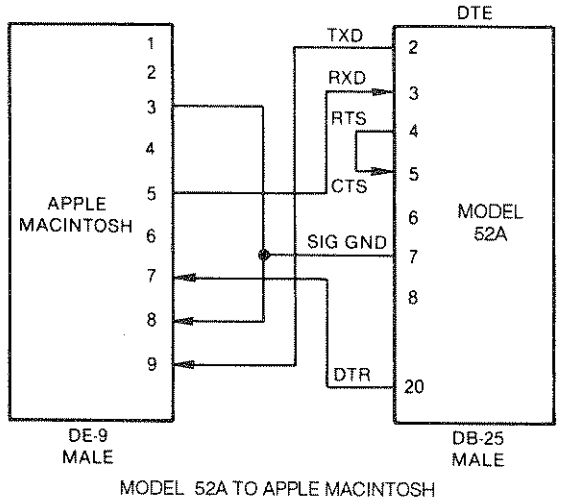
Figure 13-2. Typical Serial Cables



MODEL 52A TO IBM-PC or APPLE II



MODEL 52A TO PRINTER



MODEL 52A TO APPLE MACINTOSH

Figure 13-2. Typical Serial Cables (Continued)

Baud Rate

The BAUD rate is selected by either the rear panel DIP switch or the COMM PORT 1 main menu item. The rear panel switch is described in paragraph 2.3 item 6 - Switches. The COMM PORT 1 setup is described in paragraph 4.4.2 - RS-232-C Responses. Acceptable baud rates are 300, 1200, 9600, and 76800. The Model 52A automatically sets the baud rate to 9600 when Model 54 Printer is selected.

Handshaking and Format Setup

Set up the "Handshaking" for COMM PORT 1 by selecting the "Setup" menu; refer to paragraph 4.4.2 – RS-232-C Responses. This menu allows selection of XON/XOFF and CTS handshaking. Set up the data output format using the "Format" menu: lines per page, readings per line, headers, and footer.

13.1.3 Option 50-15

The option 50-15 provides a second RS-232-C port for the Model 52A. Option 50-15 can receive data an commands from a controller, send data to a controller, or send data to printer in ASCII or graphics format. This full duplex interface can be configured for DCE or DTE, plus setup for CTS, XON/XOFF, and modem handshaking. The data format is 7 or 8 bits, even, odd, mark, space, or parity checking, and one stop bit. The option 50-15 board plugs into option slot 8 (J10 on the motherboard); see figure 2-1 or paragraph 2.3 item 2.

Connector

The option 50-15 RS-232-C connector is located on the rear panel at option slot 8; see figure 2-1 or paragraph 2.3 item 2. For pin connections and names, refer to table 13-1. The connector is a DB-25 connector which connects to any standard RS-232-C cable (interface type E).

DCE/DTE Configuration

Before connecting the Model 52A's option 50-15 interface, the correct device configuration (DCE or DTE) must be determined and the ribbon cable connected to the DCE or DTE location (figure 13-3) on the option 50-15 board. Wavetek ships the option board set up for DCE operation.

To determine the correct device configuration, refer to paragraph 13.1.2 DCE/DTE Configuration steps 1 and 2 or the manual for your system controller/computer. The controller/computer must have a DB-25 RS-232-C connector.

Baud Rate

Select the baud rate using the main menu item COMM PORT 2 (paragraph 4.4.2 – RS-232-C Responses). Acceptable baud rates are 300, 600, 1200, 2400, 4800, 9600, 19200, and 76800.

Handshaking, Parity, and Format Setup

Set up the "Handshaking" for COMM PORT 2 by selecting the "Setup" menu; refer to paragraph 4.4.2 – RS-232-C Responses. This menu allows selection of XON/XOFF and CTS handshaking. Also from the "Setup" menu, press e to set up parity options. Set up the data output format using the "Format" menu: lines per page, readings per line, headers, and footers.

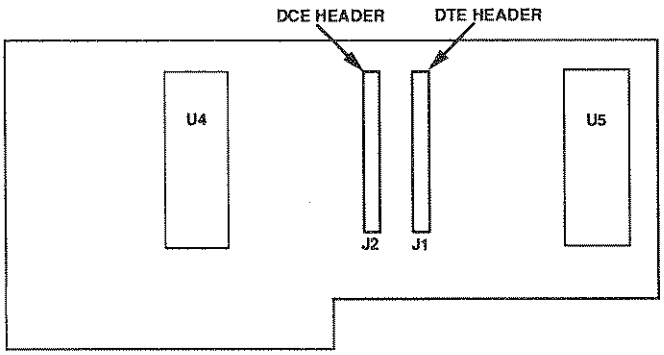


Figure 13-3. Option 50-15 Board

13.1.4 Option 50-13A

The option 50-13A provides an IEEE-488 (GPIB - General Purpose Interface Bus) I/O port for the Model 52A. The option 50-13A board plugs into option slot 8 (J10 on the motherboard); see figure 2-1 or figure 2-3 item 2.

Connector

The IEEE-488 port connections and signal names are listed in table 13-2. The rear panel connector is an Amphenol 57-10240 or equivalent connector (see figure 2-3 item 2) and connects to an IEEE-488 cable (available from Wavetek in 1 and 2 meter lengths).

Table 13-2. IEEE-488 Data In/Out

Pin	Signal	
1	DIO1	True when low
2	DIO2	True when low
3	DIO3	True when low
4	DIO4	True when low
5	EOI	True when low
6	DAV	True when low
7	NRFD	True when high
8	NDAC	True when high
9	IFC	True when low
10	SRQ	True when low
11	ATN	True when low
12	Chassis ground	
13	DIO5	True when low
14	DIO6	True when low
15	DIO7	True when low
16	DIO8	True when low
17	REN	True when low
18	Signal ground	
19	Signal ground	
20	Signal ground	
21	Signal ground	
22	Signal ground	
23	Signal ground	
24	Signal ground	

IEEE-488 Address

The IEEE-488 address of the Model 52A is set by either the COMM PORT 2 – IEEE-488 main menu item or the option 50-13A board's internal address switches. Acceptable addresses are 1 through 30.

To change the address using the main menu

1. Turn on the Power.
2. Locate the COMM PORT 2 main menu item.
3. Change the address using the [▲] [▼] keys. Valid address are 01 through 30. This address is only valid while the power remains on. If power is turned off, the unit reverts to the address set by the internal switches.

To change the IEEE-488 address using the internal address switch.

1. Disconnect the power.
2. Remove the top cover (figure 2-7).
3. Set the address using the IEEE-488 address switches located on the Option 50-13A card (figure 13-4). For switch positions refer to table 13-3. To verify the address, locate COMM PORT 2 in the main menu and check the address.

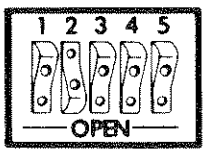


Figure 13-4 IEEE-488 Address

Table 13-3. IEEE-488 Addresses

Address	1	2	3	4	5
0	0	0	0	0	0
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	1
28	0	0	1	1	1
29	1	0	1	1	1
30	0	1	1	1	1

Handshaking and Format Setup

Set up the "Handshaking" for COMM PORT 2 – IEEE-488 by selecting the "Setup" menu; refer to paragraph 4.4.2 – IEEE-488 Handshaking Responses. This menu enables the EOI and SRQ. Set up the data output format using the "Format" menu: lines per page, readings per line, headers, and footer

13.2 ENTERING AND LEAVING REMOTE MODE

The Model 52A powers on in the local mode (front panel control). In order for remote commands to be recognized and processed the Model 52A needs to be placed in the remote mode.

The tilde character "~" places the Model 52A in remote Until the "~"character is received all incoming characters will be ignored except those for RS-232 echo control. For GPIB, the Model 52A automatically goes to remote if addressed as a talker or listener; the tilde character is not required.

The unit will then remain in remote mode until one of four conditions is met:

- It is turned off, either from front panel switch or the remote POFF command.
- A front panel button is pressed and the front panel has not been locked out or placed in remote front panel on mode.
- The remote command "GOTO LOCL" is received.
- The GPIB REN line command becomes not true.

13.3 INTERFACE PROTOCOLS

The RS-232 interface supports XON/XOFF and RTS/CTS handshaking modes in receive modes only. In the Model 52A's standard RS-232 port, RTS is always true, and XON/XOFF are optional. The option 50-15 card supports the complete handshake protocols. Two characters, when received over RS-232 only, perform special functions. They can be sent at any time, and be embedded within remote commands without altering the commands. They are:

"@" Puts the 52A into received character echo mode. This mode is active each time the unit is turned on."^"

"^" Puts the 52A into no-echo mode. Mode is retained until the unit is next powered down or "@" is received.

Generally, a transmission from the Model 52A is a single line, terminated by a carriage return-line feed combination. When more than one line is to be sent, the final line is followed by "*END" by itself. When the Model 52A has been set up to transmit data on a continuous basis, there is no terminating end message.

The GPIB interface follows several conventions. The EOI may or may not be included with each line-terminator character transmitted, based on a user-programmed setting. The Model 52A always ignores a received EOI and terminates input line with the receipt of the line-terminator character only. When the Model 52A needs to transmit data either in response to a remote command or as part of preset conditions (alarm response, etc), it will wait approximately 10 milliseconds to be made a talker. At the end of that period, if the talk mode has not been entered, the Model 52A will activate the SRQ line if enabled. After the controller has serviced the SRQ, the Model 52A will wait to be addressed as a talker for another time-out period before again asserting an SRQ. When the SRQ is active from the Model 52A, the serial poll byte will contain hex 41; all other times it will be zero.

The best way to respond to the Model 52A's decision that it needs to send data is to wait for and respond to the SRQ. Other methods can tie up the bus. Also, while waiting to be made a talker, the Model 52A ceases all other activities.

13.4 GENERAL COMMAND SYNTAX

A remote command in the Model 52A is made up of one or more keywords and its argument(s). The commands can be broken up into two basic classes:

- Commands which have a single keyword or a keyword and immediate arguments. Examples of this type of command are "TIME" and "POFF". "TIME" expects a time argument to follow. "POFF", power-off, requires no arguments at all.
- Commands with keywords that signal a *series* of subsequent keywords which, when combined, fully describe the command. "ENTP", used to enter programs, is followed by keywords which cover the multitude of options available for a program.

13.5 BASIC SYNTAX RULES

1. Between keywords and arguments on a line, characters ", : = ( ) [ ] < >" and space can be used as separators. Any of these can be used in any combination, as long as at least one separates each keyword or argument from the next keyword or argument.
2. A keyword that expects parameters must have those parameters immediately following the keyword and be on the same line. Separators in rule #1 are acceptable but ignored.
3. If a keyword is not recognized as belonging to the group currently expected, higher level, previous menus are searched ("backtracking"), but never low-QUENCY" is a valid function input, since the Model 52A only searches for "FREQ". The reverse does not hold true: FRE is not the same as FREQ, and will generate an error. For common variations of a command that wouldn't fit the uniqueness rules, synonymous commands are available. So the commands "ALARM" and "ALRM" will both work and are identical, for example.
3. Any characters after an ";" on a line are ignored. The same applies for lines with a "`" character. So comments can be placed on lines if desired using this feature.
4. Completely blank lines are ignored. They will not change the "state" of the command processing.

Line-terminator characters (LTC) stop command lines. Until the characters are received, text may be deleted via back space or delete characters and reentered. The Model 52A does not begin processing the line until the line terminator character is received. A line-terminator character on a non-blank line without a preceding semicolon (;) terminates processing of that command upon completion of interpretation of the line. A complete command on a single line should not end with a semicolon (;); including a semicolon will not cause an error. A line-terminator character without a preceding semicolon will terminate most commands; for an exception see paragraph 13.6.17 - DMM.

The Model 52A ignores all control characters (decimal values less than 32) except for line terminator character, back space and delete. In addition, the Model 52A automatically subtracts 128 from all decimal values over 128.

Remote Command Error Responses

E1	BAD COMMAND OR SYNTAX
E2	BAD NUMERIC ENTRY
E3	ILLEGAL CHANNEL NUMBER
E4	LIST OR PROGRAM NAME ALREADY EXISTS
E5	CAN'T FIND LIST OR PROGRAM
E6	OUT OF MEMORY
E7	PROGRAM IN PROCESS, MUST TERMINATE BEFORE PROCEEDING
E8	DATA NOT READY, OR DATA POINT ALREADY READ
E9	LOW BATTERY

13.6 ALPHABETICAL COMMAND DESCRIPTIONS

Each command keyword and any associated subkeywords and parameters are listed below in alphabetical order. Each entry has the format:

- Command name
- Functional Description
- Any special requirements or warnings
- Command Syntax and parameter information (as appropriate)
- Keywords and explanations (as appropriate)
- Examples of use

Note:
The following characters are used in the command descriptions. They are NOT present in actual commands:

<...>	*Means required argument.*
[...]	*Means optional.*
(././.)	*Means choose 1 from the list.*
(.I.I)	*Means choose 1 or more from the list.*
{...}	*Means repeat ad lib.*
lower case	*Means replace with argument, e.g.:<func>=VDC.*
"float"	*Means a floating point number.*
*	*Signals the default used by the 52A if not specified.*

Although the following keywords and examples show uppercase commands, the Model 52A is not limited to receiving its commands in uppercase. Only text associated with the commands, such as math labels and channel list or program names, keep their case significance.

13.6.1 ~ (tilde character- HEX 7E)

Function
Puts the Model 52A into remote mode.

Notes
The Model 52A will not recognize any characters until it is in remote mode. Once it has received "~", it will stay in remote mode until either power is turned off, the "GOTO LOCL" command is received, or a front panel key is pressed when neither local lockout or front panel on modes are active. If the Model 52A is already in remote when this character is received, the effect is to place the unit in remote, display disabled, and front panel off.

13.6.1A @ (At Character - Hex 64)

Function
Places the serial port in echo-on configuration, where each input character echos back to the remote host. This command has no meaning for IEEE-488 operation, but using @ will not generate an error.

13.6.1B ^ (Caret Character - Hex 5E)

Function
Turns off serial port echo, where each input character is not echoed back to the remote host. This command has no meaning for IEEE-488 operation, but using ^ will not generate an error.

13.6.2 ALARM or ALRM

Function
Enter an alarm specification or replace an existing one. The entire alarm can be placed on one line, or split over several lines according to the general syntax rules. Alarm numbers range from 1 to 99.

Notes
Once within the 'PROG' part of this command, all items are optional and can be entered in any order desired. So, although the keywords list shows T1 before TONE, it doesn't have to be. GOTO/GOSUB allow entry of any name, existing or not. When the alarm is used, the GOTO/GOSUB will be ignored if the specified list or program cannot be found.

Keywords
ALARM / ALRM;
ALLON;
ALLOF;
COPY <src> <dest>;
PROG <num>;
*ENAB/UNEN;
ONTR/*TRUE/ONER;
LCH/*ULCH;
*GTE/LTE/IWIN/OWIN;
T1 <float> ["message"];
T2 <float> ["message"];

HYS <float>;
TONE LO/MED/HI PUL/WRB S20;
ENDL;
OUT <chan> <value>;
GOTO [Name.L or P]/GOSUB [Name.L];
COM1 RDGIMSGITIDTISCN1;
COM2 RDGIMSGITIDTISCN1;
RAM RDG / MSG / TIDT / SCN1;
DISP MSGH / MSG5 / MSG20;

Keyword Descriptions

ALLON	Enable all alarms.
ALLOF	Disable all alarms.
COPY	Copy <src> alarm number to <dest>.
PROG	<num> program alarm <num>.
ENAB	Enable the alarm.
UNEN	Disable this alarm.
LCH	Latch alarm.
ULCH	Unlatch alarm (default).
ONTR	On transition alarm.
TRUE	When true.
ONER	On error (OVRRNG,NOTRIG,etc)GTEX≥T1.
LTE	X≤T1.
IWIN	Inside window; T1≤X≤T2.
OWIN	Outside window; X≤T1 OR T2 ≤ X.
T1	<value> [<msg>] Threshold 1, float value, optional message.
T2	<value> Threshold 2, float value, optional msg.
HYS	<float> Hysteresis, float value.
RESP	Alarm responses.
TONE	
LOW	Low frequency.
MED	Medium frequency.
HI	High frequency.
WRB	Warble tone; use with tone frequency.
PUL	Pulsed tone; use with frequency.
S20	Tone 20 seconds max or until alarm becomes non-true, whichever 1st.
ENDL	End the list.
OUT	<ch> <val> Output the binary value <val> to the specified output channel <ch>. Valid channels are 5,6,7,and 8. The output value is always specified in binary, using 0,1 or X for no change.
GOTO	<name> Go to a channel list or program. Include the .L or .P extension. If not given, .L is assumed.
GOSUB	<name> Go to a channel list, make 1 scan and return.
COM1	Standard serial port.
RDG	Send reading.
MSG	Send message.
TIDT	Send time and date.
SCN1	Send 1 scan of list.
COM2	Optional serial port or GPIB interface.
RDG	Send reading.
MSG	Send message.
TIDT	Send time and date.
SCN1	Send 1 scan of list.
RAM	Internal RAM storage.
RDG	Store reading.
MSG	Store message.
TIDT	Store time and date.
SCN1	Store 1 scan of list.
DISP	Front panel display.
MSGH	Hold message until front panel key pressed.
MSG5	Hold message 5 seconds or key pressed.
MSG20	Hold message 20 seconds, or key pressed.

Examples

ALRM ALLOF *(Disable all alarms.)*
ALRM ALLON *(Enable all alarms.)*
ALRM PROG22 UNEN *(Disable alarm #22.)*

```
ALRM PROG = 1 TRUE OWIN;
HYS <0.0000>;
T1 0.0001 "LOW!!!";
T2=10.000, "HIGH!!!";
TONE ::::MEDium;
COM1 RDG MSG RAM RDG
```

```
ALRM PROG99 ONTRAN GTE;
T1 2.4140;
HYS 0.1000;
OUT 7 1101;
COM2 RDG TIDT RAM RDG
```

13.6.2A BATT?

Function

BATT? queries the state of the Model 52A internal battery.

Note

When queried, the Model 52A returns one of the three following messages followed by a line-terminator character.

OK This message indicates a charged battery.
LOW This message indicates a low battery.
NONE This message indicates the Model 52A does not contain an internal battery.

Sending the CNF? command to the Model 52A also returns information about any internal battery.

13.6.3 BLOAD

Function
Load channel list, program, alarm, math or tracking from remote. No name is required; it is contained within the loaded data.

Notes
"BLOAD" accepts an ASCII-Hex file in a compressed format. This file is typically generated via the BOUT command, but it can be created manually with a format specification available from Wavetek. The compressed file can contain a list, program, etc.— type information is contained within the file. Each line should end with a semicolon followed by the line-terminator character. The last line should have only the line-terminator character. This last line must follow one more line which contains *END and the line-terminator character. A line containing '*END' is required. This format loads a list or program in the shortest possible time. BLOAD performs no verification on the data. It's easily possible to enter the same list multiple times, for instance, something which cannot be done from the front panel. Because all remote commands that look for list/program names take the first one that matches, any such duplicate lists/programs will be inaccessible from remote! The BLOAD command works with any strings the Model 52A sends using the BOUT command.

BOUT appends the necessary' *END' line required at the end of BLOAD.

Example
BLOAD; *(This is the command.)*
00,26,05,4C,49,53,54,00,00,00;
00,00,02,01,FF,00;
04,20,20,7B,00,02,02,00,00,00,00;
00,00,09,FF,01,00,28,00,00,1B,00 *(This is the file being sent.)*
*END *(This is the last line of the file.)*

13.6.4 BOUT <NAME.L>, BOUT <NAME.P>, BOUT <NN.M>, BOUT <NN.A>, BOUT <CH.TA>, BOUT <CH.TD>

Function
Transmits an ASCII-Hex binary representation of a channel list, program, math, alarm, analog tracking, or digital tracking setup from the Model 52A.

Notes
The transmitted data is an ASCII-Hex image of the item as it exists within the Model 52A. The main use of this command is to obtain an abbreviated copy of a list or program to be later loaded with the fast BLOAD command.

Data is sent 16 entries per line, separated by commas. all except the last data line which must have a semicolon (;) after the 16th entry. Each line is terminated with the line-terminator character. A line containing '*END' is appended to the transmission to aid remote systems recognition that the operation is complete. The '*END' line can be sent back to the Model 52A as part of a 'BLOAD' without any ill effects. An error results if the name or number given does not exist.

Example
BOUT LIST.L *(This is the command.)*
00, 26, 05, 4C, 49, 53, 54, 00, 00, 00, 00, 00, 02, 01, FF, 00;
04, 20, 20, 7B, 00, 02, 02, 00, 00, 00, 00, 00, 00, 09, FF, 01;
00, 28, 00, 00, 1B, 00
*END

13.6.5 *CAL?

Function
List the last calibration date for the Model 52A

Example
*CAL?
08/08/88

13.6.6 CAL0, CAL, CALV <value> TCAL <temp>

Function
Perform remote calibration.

Notes
All the CAL words above are expected to be part of a DMM operation and use the current DMM channel and range. CAL0 applies to DCV, and OHM only. TCAL applies to temperature, thermocouple type. CALV applies a forced cal value to any function that allows CAL.

When the cal is complete, the Model 52A replies 'CALD'.

If a calibration step is not completed within 20 seconds, the Model 52A aborts the calibration procedure and returns a TOUT (time out) message.

Examples
DMM CH 1 VDC V3; *(Get into DMM, channel 1, 3 volt range.)*
CAL0; *(Perform zero cal. Sends back response.)*
CAL; *(Apply voltage, then send this over to do the cal. Get another CALD response when done.)*
VAC V300; *(Switch to volts AC, 300 volt range.)*

CALV 2.57;	*(Apply special cal value, tell 52A to cal to this value. Done when get CALD.)*
DMM CH 2 CAL;	*DMM command not required, but hurts nothing except the time it takes to reinitialize DMM operation. Then perform cal on*
TEMP TCAL 26.5	*Then go to temperature, establish cold bath, and provide the ref-temp.)*

13.6.7 CALRTD

Function
Remote calibration for temperature, RTDs

Notes
This has the same basic requirements as CAL, namely that the unit be in DMM. The function has to be TEMP, and the range one of the two RTD types (RTD392 or RTD385).

Keywords
CALRTD(INT / EXT / ICE)

Keyword Descriptions

INT	Internal cals. 52A copies volts cals to the appropriate temperature calibration. No user intervention necessary. A CALD message is returned almost immediately.
EXT	User is expected to externally adjust his current source to give 0.00 degrees. This command in the 52A does nothing. No internal cal values are altered. The keyword is present only to match what is available from the front panel. Multiple READ commands should be used to verify the 0.00 that should occur.
ICE	The Model 52A attempts to calibrate existing input for a 0.00 reading, adjusting its internal calibration value as necessary to achieve this. An input value far outside of an expected window of values will be ignored. An CALD message is returned when this cal is complete.

Examples

DMM CH 1 RTD385;	
CALRTD INT;	*(Use internal cals. No return value.)*
CALRTD ICE;	*(Cals to 0.00, 100Ohm. Returns E5 when done.)*

13.6.8 CLR

Function
Clear memory in the Model 52A. All RAM may be cleared; also setup data, reading data, programs, channel lists, alarms, math, analog tracking, and digital tracking information may be cleared separately.

Note
For more selective deletion of lists and such, see the "DEL" command. CLR cannot be undone, so be sure that what is being deleted is correct. A 'CLR ALL' also places the Model 52A back into local mode, so a new '~' will have to be sent. 'CLR ALL' is equivalent to 'INIT'. A 2-second delay is required after a CLR ALL before additional commands can be sent.

Keywords
CLR<(ALL/SET/DATA/PLAMT)>

Keyword Descriptions

ALL	Clear everything from unit except calibration.
DATA	Delete any stored data.
SET	Set default user settings (scroll speed, etc).
PLAMT	Clear out all lists, programs, alarms and tracking.

Examples:

CLR PLAMT	*(Clears Programs, Lists, Math, Alarms, and Tracking information from Model 52A memory.)*
CLR DATA	*(Clears Data memory from Model 52A.)*

13.6.9 CMDS?

Function
Gives a list of all keywords in the Model 52A remote suite.

Notes
One keyword is listed per line, indented 4 characters for each 'depth' it is within the command hierarchy. As an example, a snapshot of the output that covers the MEM command is given below. The listing terminates with an '*END' line.

Example

```
CMDS?
(Some commands)
STOP
MEM
  FILL
  WRAP
  XMIT
    COM1
```

COM2
&CLR
CLR
ALL
SET
DATA
PLAMT
(Rest of commands)
*END

13.6.10 CNF?

Function
Request configuration information from the Model 52A

Keywords
None.

Example

CNF?	*(This is the command.)*
model 52A V5.00	*(This is returned by the Model 52A.)*
CH1: 50-1 DMM	
CH2: 50-1 DMM	
CH3: 50-2 V+T	
CH4:	
OP5: 50-14 I/O	
OP6:	
OP7: 50-12 RAM	
OP8:	
NO INT BATTERY	
*END	

13.6.11 COM1

Function
Set communications parameters and page formatting for the Model 52A standard serial interface, "COMM Port 1"

Keywords
COM1;
PR54 ASC / GRF;
/RS2;
RXTX / TX / RX / OFF;
BAUD nnnn;
BR <char>;
RPL nn;
LPP nnn;
HDR "chars" FTR "chars";
XON / NXON;
CTS / NCTS;
LF/NLF;

Keyword Descriptions

PR54	Set port to operate Model 54 Printer/ Plotter.
ASC	Output data to printer in ASCII format.
GRF	Output data to printer in graphics format. For graphics outputs also select line feed (LF). NLF is the reset default, therefore it must be changed to LF.
RS2	Set port for RS-232 operation.
TX	Enable Transmit, no receive.
RX	Enable receive, no transmit.
RXTX	Enable both RX and TX.
OFF	Disable use of port.
XON	Use XON/XOFF handshaking.
NXON	Do not use XON/XOFF.
CTS	Use CTS/DTR handshaking.
NCTS	Do not use CTS handshaking.
LF	Data transmitted from the port ends with a carriage return and a line feed (CR LF). Commands received are considered incomplete until LF is received (CR will be ignored).
NLF	No line feeds. Data transmitted from the port ends with a carriage return. Commands received are considered complete when carriage return is received (LF is ignored). Do not use NLF when sending graphic from the port, because the NLF filters out the LF characters which may be part of the graphics.
BR <char>	Define BREAK character.
RPL nn	Set Readings/Line 0-99.
LPP nnn	Set Lines/Page 0-999. LPP determines how often the header and footer texts are generated. When plotting, LPP determines how often the axes are generated.
HDR "chars"	Specify Header. The header can be up to 40 characters in length. Control characters can be included by using a caret (^) followed by the control character. For example, a bell character could be placed in the header using ^G. The Model 52A produces a header at the start of each data transmission and every LPP lines. In the plot mode, plot axes are produced whenever a header should be.
FTR "chars"	Specify Footer. The footer has the same format and size as the header. The Model 52A produces a footer after each LPP line.
BAUD nnnnn	Set Baud Rate: 300, 1200, 9600, 76800.

Examples
COM1 = PR54
COM1 RS-232 RXTX RPL 4 LPP 60 HDR "Top of Page";
BAUD:9600
COM1 ;
RS-232 BAUD 1200

13.6.12 COM2

Function
Set communications parameters and page formatting for the Option 50-15 RS-232 port "COMM Port 2".

Keywords
COM2;
PR54
GRF;
ASC

/RS2;
RXTX / TX / RX / OFF;
BAUD nnnn;
BR <char>;
RPL nn;
LPP nnn;
HDR "chars" FTR "chars";
XON / NXON;
CTS / NCTS;
LF/NLF
DSR / NDSR;
DCD / NDCD;
PRTY;
BIT7;
BIT8;
OF;
EV;
OD;
MA;
SP;

Keyword Descriptions

PR54	Set port to operate model 54 Printer/ Plotter.
ASC	Output data to printer in ASCII format.
GRF	Output data to printer in graphics format. For graphics outputs, select line feed (LF). NLF is the reset default, therefore it must be changed.to LF.
RS2	Set port for RS-232 operation.
TX	Enable Transmit.
RX	Enable receive.
RXTX	Enable both RX and TX.
OFF	Disable COM2 port.
XON	Use XON/XOFF handshaking.
NXON	Do not use XON/XOFF.
CTS	Use CTS/DTR handshaking.
NCTS	Do not use CTS handshaking.
LF	Data transmitted from the port ends with a carriage return and a line feed (CR LF). Commands received are considered incomplete until LF is received (CR will be ignored).
NLF	No line feeds. Data transmitted from the port ends with a carriage return . Commands received are considered complete when carriage return is received (LF is ignored). Do not use NLF when sending graphic from the port, because the NLF filters out the LF characters which must be part of the graphics.
DSR	Enable DSR line.
NDSR	Ignore DSR line.
DCD	Enable DCD line.
NDCD	Ignore DCD line.
BREAK <char>	Define BREAK. Character. <char> is range A-].
RPL nn	Set Readings/Line.
LPP nnn	Set Lines/Page 0-999. LPP determines how often the header and footer texts are generated. When plotting, LPP determines how often the axes are generated.
HDR "chars"	Specify Header.The header can be up to 40 characters in length. Control characters can be included by using a caret (^) followed by the control character. For example, a bell character could be placed in the header using ^G. The Model 52A produces a header at the start of each data transmission and every LPP lines. In the plot mode, plot axes are produced whenever a header should be.
FTR "chars"	Specify Footer.
BAUD nnnnn	Set Baud : 300, 600, 1200, 2400, 4800, 7200, 9600, 19200, 76800.
PRTY	Specify parity information.
BIT7	7 bit parity.
BIT8	8 bit parity.
OF	Parity disabled.
EV	Even parity.
OD	Odd parity.
MA	Mark parity.
SP	Space parity.

Examples
COM2 RS-232 RXTX BREAK: K, RPL 4 LPP 60;
PRTY 8 SPAC;
HDR "TEST #1" FTR "END TEST";
BAUD:9600

13.6.13 DATE, DATE?

Function
Set the date on the Model 52A's internal clock. DATE? returns the date.

Note
All digits must be present when setting the date including any leading zeros. The "/" delimiters are not required but may be included for readability. "-" is also accepted.

Keywords
DATE mm/dd/yy

Keyword Descriptions

mm	month (1-12)
dd	day (1-31)
yy	year(00-99)

Example
DATE 04/21/88
DATE 081688

13.6.14 DEL

Function
Delete a channel list, program, math, alarm or tracking setup from memory.

Keywords
DEL <(List.L / Prog.P /NN.M / NN.A/ NN.TD / NN.TA)>

Note
The extension '.L','.P','A','M',TD','TA' is required. It tells the Model 52A what type of item to delete. 'L' is a list, 'P' a program, 'M' a math, 'A' an alarm, 'TD' a digital track, and 'TA' an analog tracking. The Model 52A does not verify that the deletion is really desired. A list or program that has been deleted cannot be recovered except through re-entry. *Use the command with caution!* Any cleared memory can be used to store future programs, lists, or data storage.

Example
DEL DAVE.P
DEL 52.M
DEL 5.TD

13.6.15 DIR [LIST | PROG | MATH | ALARM |TRA | ALL]

Function
List a directory of channel lists and programs. With optional parameters, can get list of defined , alarms and tracking, or everything. "DIR" by itself is the same as "DIR LIST PROG"

Notes
Channel lists are terminated in ".L", programs are terminated in ".P". Math entries give "M", the number, and the four-character label. Alarm entries give "A" and the number. Tracking gives "T", "A" or "D", and the channel number.

All output has the number of bytes used by the item at the end of the line.

The directory listing is terminated by "*END". The listing is from oldest to most recent time of entry.

Keyword Descriptions

LIST	All channel lists
PROG	All programs
MATH	All math channel entries
ALARM	All alarm entries
TRA	All tracking setups
ALL	All of the above

Examples

DIR ALL	*(This is the command directory returned by the 52A.)*
PROGRAM.P,77	
LIST.L,255	
LIST2.L,255	
04.A,75	
04.TD,22	
*END	
DIR LIST MATH	*(This command list the math and channel lists only)*

13.6.16 DISP ENAB / DIS

Function
Enables (ENAB) or disables (DIS) the front panel display of the Model 52A.

Notes
When enabled, the display reflects remote commands as if entered from the front panel, and all lists/programs that are run display data. In the disabled state, the LCD has a static 'REMOTE MODE' display. No readings are available unless stored and/or transmitted. The processing of remote commands and the acquisition of data is slightly speeded up when the display is disabled. The LCD is enabled at power-on and disabled when the Model 52A enters remote operation with the '~' command. It is enabled by sending a GOTO LOCL, DISP ENAB, INIT, CLR ALL, or GOTO LOCL command.

Keyword Description

ENAB	Enables display.
DIS	Disables display.

Examples:

DISP ENAB	*(Enable the Model 52A's Display.)*
DISP DIS	*(Disable the Model 52A's Display.)*

13.6.17 DMM

Function

Sets the Model 52A to function as a Digital Multimeter on a single channel.

Notes

The "DMM" keyword, if given alone, invokes the multimeter with whatever last settings it was given in terms of channel, function, range and all modifiers. The command can be followed by other keywords to alter and specify all multimeter parameters. Refer to the "ENTL" command, paragraph 13.6.18, for a full listing of available settings.

The order of entry for settings is arbitrary, but operational restrictions apply. In particular, when a channel # is read, function, range and all else assume default values, so the channel number should be first. For a similar reason, the function should either be first, or directly after the channel number (if present).

If the line containing the DMM command terminates with a semicolon, then settings can continue to be entered and altered on subsequent lines, as long as each also ends with a semicolon. For example then, the DMM could be set to channel 1, VDC, then the range changed until readings are proper, and then a MIN/MAX applied. If the DMM command is the last command on a line, except for its options (function, range,etc.), the semicolon (;) is not required.

The standard display for DMM is the large-number type: a large-digit reading that covers the upper two lines and two lines of status information. During processing of the function, range and so on, this display will be replaced with that appropriate for the associated operation. The VIEW keyword can be used within the DMM setup to restore the standard display.

The VIEW keyword also serves to notify the Model 52A that the DMM display should be retained even if no semicolon terminates the setup lines(s). Otherwise the Model 52A assumes that the DMM command has performed a **setup** of the DMM mode, but that execution of the setup is **not** required. Therefore, either terminate DMM lines with a semicolon to indicate that the mode should remain (the command is 'not yet done'), or append a 'VIEW' at the end of the last DMM line to tell the unit that the DMM view is to be retained.

Once the DMM specification has been noted as complete (a line without a semicolon), most of the keywords listed in ENTL are no longer available. Changing channel, function anything else then requires a new DMM command to be sent. However, you *can* still use READ and WR commands. READ (paragraph 13.6.32) allows the extraction of the latest reading on the DMM, and WR (paragraph 13.6.42) writes directly to the digital I/O options, if installed. All 'top-level' remote commands, such as ENTL, terminate the DMM as part of their processing.

The STOP command can be used to terminate DMM operation. Also, other top level command such as DIR, DATE, etc. will terminate DMM operation.

Keywords

DMM [ch#[fcn][rng][disp][mod]etc]

Keyword Descriptions

VIEW; Restore big reading display.
See ENTL for other arguments.

Examples

DMM CH1 OHM R300K DLY:12 RES, LOW DBAR VIEW	
DMM CH 2 VAC;	*(30 volts range, avg 10 reads, delay 2.3 sec.)*
V30 AVG CNT 10 DLY 2.3;	*(Add a delay, any time later.)*
ALRM 17 VIEW	*(Use alarm 17, restore main display, DONE.)*
READ 2;	*(Read current displayed value.)*
DIR ALL	*(Stop DMM, give directory.)*

13.6.18 ENTL <name>, ENTLC <name>

Function

The ENTL command enters a series of channels and their modifiers that, taken together, constitute a channel list. ENTL will return an error if an attempt to create a list that already exists is made. ENTLC will delete any existing list and start a new one using the same name.

Notes

This is the most complex remote Model 52A command: there are 24 functions, 10 channels and numerous options channel and function options. A channel list name should not have the '.L' extension appended when entered; it is assumed. The Model 52A terminates channel list entry when it receives a line that does not contain a semicolon (;) before the line-terminator character. Channel T text is limited to 10 characters per entry, excess is ignored. Usually more than one mods selection may be made and in some instances more than one range. These should be treated as separate arguments. Although the function, range, disp, and mods arguments can occur in any order, the context of one argument may depend on a

preceding argument. Thus, entering the function must occur before the range just as entering the output radix must occur before the output value.

When ENTL is first invoked, keywords listed below from SER through FIL can be entered in any order. As soon as the first occurrence of 'CH' is encountered, these keywords are no longer available, and those under CH become active. After a 'CH' entry, all function, range and modifier keywords entered apply to the specified channel or channel group until the next 'CH' is encountered.

A channel group can be entering by separating two valid channel number entries with a '-' character, NO SEPARATORS between the channels. The group must be either sequential subchannels on one channel, sequential front panel entries, or sequential math channels. Grouping is not possible for alarms. (Example channel groups: 101-163, 2-4).

Keywords

ENTL <list name>;
- SER / *PAR;
- RAM;
- COM1 / COM2;
  - PRT;
  - PLOT;
    - W1 / W2 / W4;
    - TS2;
    - TS4;
    - TS8;
    - TS16;
    - TS32;
    - TS64;
- DISP;
  - OFF;
  - A1;
  - *A4;
  - PLOT;
  - *SCRL;
  - AONLY;
- FIL
  - AONLY;
  - DONLY;
- CH;

Keyword Description

SER	List serially. Acquisitions in exact order listed.
PAR	List parallel. Simultaneous acquisitions, multiple. channels.
RAM	Data to internal RAM.
COM1 / COM2;	Data to comm port 1 or 2.
PRT	Print data, ASCII.
PLOT	Graphics plot data.
*W1 / W2 / W4	Number of plot windows.
TS2	2 reads / time stamp.
TS4	4 " "
TS8	8 " "
TS1	16 " "
TS3	32 " "
TS64	64 " "
	(Note: if no TS desired, enter no TS keyword).
DISP	Display settings.
OFF	No data display.
A1	Display 1 large-number, alphanumeric.
*A4	Display is 4 readings.
PLOT	Display is plotting.
*SCRL	Scroll display. (Meaningful only for A1,A4).
AONLY	Alarms only.
FIL	Data store/xmit/display filter.
AONLY	Alarms only.
DONLY;	Data only (no scan #s or list name).
CH <chan>	Advance to channel specification, set first channel #.
<chan>	Channel # (1 or 3 characters): 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, T; 1nn, 2nn, 3nn, 4nn where nn = 00 to 64; 0mm where mm=00 to 99; Channel group is 2 chan# separated by '-', no spaces.

Function Keywords

For channels 1-4:

*VDC	DC Volts
VAC	AC Volts
VDCAC	AC+dc Volts
ADC	DC current
AAC	AC current
ADCAC	AC+DC current
WATT	Watts
VADCA	Volt-Amps ac+dc
VAAC	Volt-Amps ac
OHM	Resistance
CONT	Continuity
CJT	Cold Junction Temperature
TEMP	Temperature
DBAC	DECIBELS ac
DBDC	DECIBELS dc
DIOD	Diode check
LOGI	Logic
FREQ/FRQ	Frequency
PER	Period
PULW	Pulse Width
PULW1	Pulse Width 1 Shot
TINT	Time Interval
TINT1	Time Interval 1 Shot
EVNT	Events

For channels 5-8:

DIGI	Digital input
DIGO	Digital output
ANA	Analog output

For channel 9 (Time channel):

*HMS	HH:MM:SS
MDY	MM/DD/YY
MDHM	MM/DD HH/MM format
MIL	01Jan80
DMY	DD/MM/YY

For channel T (Text channel):

TEXT	Up to 10 char. of text. Quotes only if embedded special characters.

For channel 0xx (Math Channels):

There are no 'functions' for math channels.

Range Keywords.

(Functions not listed have no ranges.)

For VDC,VAC,VADC:

AUTO	Autorange
V30M	30mV
V300M	300mV
*V3	3V
V30	30V
V300	300V

For OHMS,CONT:

*AUTO	Autorange, 30-30Meg
MAUTO	Autorange, 300M-3G
R30	30 Ohm
R300	300 Ohms
R3K	3k Ohm
R30K	30k Ohm
R300K	300k Ohm
R3M	3 MegOhm
R30M	30 MegOhm
R300M	300MegOhm
R3G	3 GigaOhm

For ADC,AAC,AADC:

*AUTO	Autorange, 30mA-300mA
AAUTO	Autorange, 3A-10A
A30M	30 milliAmps
A300M	300 milliAmps
A3	3 Amps
A10	10 Amps

For WDC,VAAC,VAAD:

(A voltages and current range must be specified)

*VA30V	30 Volts
VA300V	300 Volts
VA300MA	300 milliamps
*VA3A	3 Amps
VA10A	10 Amps

For TEMP:

*TCK	K type Thermocouple
TCJ	J type Thermocouple
TCE	E type Thermocouple
TCT	T type Thermocouple
TCR	R type Thermocouple
TCB	B type Thermocouple
TCS	S type Thermocouple
RTD392	Platinum RTD 100 Ohm, 392
RTD385	Platinum RTD 100 Ohm, 385

For DIOD:

*D1MA	1 milliAmp excitation
D100UA	100 microAmps
D10UA	10 microAmps
D1UA	1 microAmp
D100NA	100 nanoAmps

For FREQ:

*AUTO	autorange
HZ10	10Hz
HZ100	100Hz
HZ1k	1kHz
HZ10k	10kHz
HZ100k	100kHz
HZ1M	1MHz
HZ4M	4MHz
HZX10	Use with X10 Prescaler
HZX100	Use with X100 Prescaler
HZX1K	Use with X1000 Prescaler (can add X10. X100,X1000 to a range)

For PER:

*AUTO	Autorange
P100US	100 microseconds
P1KUS	1000 microseconds (1 millisecond)
P10MS	10 milliseconds
P100MS	100 milliseconds
P1KMS	1000 milliseconds (1 second)

For PWTH,P1SH,TINT,T1SH:

*AUTO	Autorange
MS100	100 milliseconds
MS1K	1000 milliseconds (1 second)
S10	10 seconds
S100	100 seconds
S360	360 seconds

For output channels 5,6,7,8 :

OUT <bbbbbbbb> where b=1 or 0, or X for don't change for input channels 5,6,7,8:

INMSK <bbbbbbbb> where b=1 for input, X for bit ignored.

Generic Range Word:

RNG <num>	Can be used for any channel and function that has a range. <num> is the key that would be pressed on the front panel to get the desired range. For VDC, for example, RNG 2 is equivalent to AUTOrange. For range menus with more than one range screens, such as the 3MΩ, add 8 to the number value. For example, the 3MΩ range value will be RNG 11.

Display Keywords:

For ch.1-4, Math ch0, 9:HMS (exceptions noted):

SCAL <nn>	Scale using math ch# nn (1..99). 0 = remove 9:HMS is converted to seconds for scaling.9:DMY,MDY to days for scaling 9:MDHM to minutes for scaling.
MIN	Keep minimum reading.
MAX	Keep maximum reading.
RES	Resolution. (not applicable for ch.9.)
HI	7 digits for freq types, 5 for A/D.
MED	6 digits for freq types, 4 for A/D.
LO	5 digits for freq types, 3 for A/D (bar types may be used with HI/MED/LO).
BAR	Set bar graph display at current res.
DBAR	Set digi-bar display at current res.
AVG	Average readings. Not for ch 5-9,T.
CNT <num>	Average <num> readings. 0-65535.
DLY <float>	Delay <float> sec between readings during average (0.05-535s).
DLT	Apply Delta.
RDG	Apply delta reading.
%RDG	Apply delta % reading.
NUM <value>	Delta reading, user input value. Floating point number except for channel 9:HMS, for which input form is HHMMSS %NUM<value> delta % reading, as NUM above.

For channels 5,6,7,8, byte:

BIN	Display as binary value.
HEX	Display as hexadecimal value.
OCT	Display as value.
ASC	Display as ASCII value.
DEC	Display as decimal value.
BCD	Display as BCD value.

For channels 5-8, bit

BIT	Display as single binary digit.
MASK	Display as single digit in byte of 'X'.
BYT	Display entire byte bit is in.

MODS keywords

For all channels ,except T (text)

DLY <float>	Delay reading <float> seconds. 0-545.0s.
ALRM <nn>	Associate alarm nn with reading.nn=0 removes alarm.
TRAK n	Associate tracking on ch <n>,5..8
ANA	Make n analog out.
*DIG	Make n digital out (default).
ACTV	Entry inactive (default is active).
RESET	Reset entry.

For Vdc:

Z10M	Reduce input Z to 10 MegOhms.

For FREQ, PER,PULW,PULW1,TINT,TINT1

*ACCP	ac coupling
V3M	3mV
V30M	30mV
*V300M	300mV
V3	3V
V30	30V
DCCP	dc coupling
TTL	0.8,2.4V TTL
CMOS5	CMOS 5V (1.5,3.5V)
CMOS12	CMOS 12V (4,8V)
V40M	±40mV
V.4	±400mV
V80	+80/+40V

For TEMP

*DEGC	degrees Celsius
DEGF	degrees Fahrenheit
DEGK	degrees Kelvin
DEGR	degrees Rankine

For DB,DBDC

REF <nn> Set reference impedance.nn=1...22

<nn>	**Value**
1	16
2	8
3	4
4	2
5	1200
6	1000
7	900rn

<nn>	Value
8	900
9	800
10	600rn
11*	600
12	500
13	300
14	250
15	150
16	135
17	125
18	110
19	93
20	90
21	75
22	50

* default reference impedances

For TINT,PWTH,T1SH,P1SH only:

RISE	Positive edge triggered.
FALL	Negative edge triggered.
TWAIT	
INDEF	Wait indefinitely for trigger.
S20	Wait 20 seconds for trigger.
S2	Wait 2 seconds for trigger.
S200M	Wait 200 milliseconds for trigger.

For LOGIC

TYPE	Logic type (sensitivity):
TTL	0.8,2.4V TTL
CMOS5	CMOS 5V (1.5,3.5V)
CMOS12	CMOS 12V (4,8V)
V40M	±40mV
V.4	±400mV
V80	±80,+40V
LNORM	Normal inputs; an input of 1 is displayed as an 1.
LINV	Inverted inputs; an input of 1 is displayed as an 0

For output Channels 5,6,7,8:

INCR	Increment output value starting at OUT:value
DECR	Decrement output value starting at OUT:value
CMPL	Complement output value starting at OUT:value

For input Channels 5,6,7,8:

*NORM	Reading shows value of input bits
INV	Reading shows complement of input bits

Plotting for any channel 0-4

PLOT <char> <wind> <ymin> <ymax> char=1..32
wind=1..4 (limited by W1,W2,W4 setting)
ymin,ymax=floating point values

Examples

```
ENTL BILL;
  PLOT TS8  DISP A4 SCRL RAM W2;
  CH 101-108 TEMP TCJ;
  SCAL:02  AVG  CNT=4,DLY=0.5;
  DLY 2.345 ALRM:20 ACTV;
  PLOT 10 1  20.0 40.0;
  CHAN 2 WDC

  ENTL  DAVE 1

  ENTL CHARLES  CH 1 VAC CH2 VAC CH 001
```

13.6.19 ENTP, ENTPC

Function

Enter a program. The program can be entered in any order and contains the following components:

1. Program Name
2. Storage Filter
3. Start Condition
4. Channel List Calls, Repeat Counts and Interval
5. Scan Interval
6. Action Between Scans
7. Stop Condition
8. Termination Action

ENTP will report an error if an attempt is made to create a program that already exists.

ENTPC will delete any such existing program and create a new one with the same name.

Keywords

```
ENTP<program name>;
    NDAT;
    NNAM;
    SASAP / SDLT <time> / SRLT <time>
    / STRIG;
        DIGI <ch> <value>;
        RS2 <char>;
        GET;

    {
    CALL <name>;
        RPT <nn>;
        SCN <time>;
    }
    CONT / SCNI <time>;
    PWRD / NXTS / MON <name>;
    EDLT <time> / ERLT <time> / ESCAN <count>;
    / ETRIG;
        DIGI <ch> <value>;
        RS2 <char>;
        GET;
    EPOFF / EMENU / ERUN <name>;
```

/ ERCL;
COM1;
COM2;
PLOT;
XYPL;
&CLR;

Keyword Descriptions

Storage Filter

NDAT	No data storage. Overrides list settings. If NDAT is unspecified, channel lists store data based only on their respective filter settings.
NNAM	No storage of program name, scan numbers or channel list names run as part of the program.

Start Condition

SASAP	Start as soon as possible.
SDLT <time>	Start delta <time> from program invoke, <ddhhmmss>.
SRLT <time>	Start time of day, <time>= ddhhmmss.
STRIG	Start upon trigger receipt DIGI <ch> <value> digital input channel <ch>, ch=5..8, <value> is 1-8 binary digits, 1,0,X.
RS2 <char>	<char>=A....Z, interpreted as ctrl A....Z.
GET	GPIB only group execute trigger.

Channel List Calls, Repeat Counts and Interval

CALL <name>	Call list. Any name can be given, but .L is assumed, regardless of input. Up to 255 CALLS can be given.
RPT <nn>	Get <nnn> readings from entries in list. nnn=0..255. 0 means skip entry, 255 means forever, exited only by alarm or program stop condition. A repeat count of 0 skips the channel lists; this is useful for testing or debugging program.
SCN <time>	Time interval between each reading set of CALL list. Default is 0, no delay.

Scan Interval

*CONT	Continuous. No pause between program scans.
SCNI <time>	Time between scans , <time>= ddhhmm.

Action Between scans.

PWRD	Between scans, turn unit off.
*NXTS	Between scans, show time to next scan.
MON <name>	Between scans, run a list <name>.

Stop Condition

EDLT <time>	End program <time>=ddhhmm after it starts.
ERLT <time>	End program <time>=ddhhmm time of day.
ESCAN <count>	End program after <count>= 1 ... 65354 scans. This is the default end program condition; the count is 0.
ETRIG	
DIGI <ch> <value>	Digital input channel <ch>, ch=5....8, <value> is 1-8 binary digits, 1,0,X.
RS2 <char>	<char>=A....Z, interpreted as ctrl A....Z.
GET	GPIB only. group execute trigger.

Termination action

ERUN <name>	After program over, run <name> list or program.
*EMENU	When program over, return to main menu.
EPOFF	Turn power to 52A off.
ERCL	Recall data. Can use with above 3 term actions.
COM1	Data to communication port 1.
COM2	Data to com 2.
PLOT	Plot to communications port..
XYPL	XY plot to communications port (note: if neither.PLOT or XYPLOT is given, print is assumed.
&CLR	Clear stored data after transmission.

Examples:

ENTP WAVETEK; *(Create program named "WAVETEK").*
ASAP; *(Start as soon as possible).*
CALL SANDIEGO.L RPT 3; *Scan the list "SANDIEGO" 3 times.)*
CALL INDY.L; *(Scan the list "INDY")*
RPT 10 SCN "00:00:00:45"; *(10 repeats, 45 seconds between.)*
CALL CORP.L ; *(scan list CORP.)*
RPT 2 SCN 00:12; *(2 times, 12 minutes between passes.)*
SCNI 00:00:12:00; *(Set scan interval for 12 Min.)*
MON INDY.L; *(Between scans, run "INDY.L".)*
EDLTA 01:00:00:00; *(Stop 1 day from start time.)*
ERCL COM2 XYPL &CLR *(At end of program, recall xyplot data to COM1 and clear after plotting.)*

Example

ENTPC TESTPROG; *(Create program, delete if already present.)*
STRIG DIGI 6 11XX; *(Start when bits 3 and 4 of digital input 6' are 1.)*
ETRIG DIGI 6 00XX; *(End when both bits go back to 0.)*

CALL CONTROL.I RPT 10; *(Call list 'control' 10 times.)*
NXTS; *(Waiting for scans, show next time.)*
SCNI "00:01"; *(1 hour between scans.)*
CALL CONTRL2.L RPT 4SCN 000001 *(Also call contrl2.l, 1 minute between.)*

13.6.20 GOTO

Function
Go to local lockout, to front panel enabled, or to local.

Notes
Local lockout prevents any front panel key from affecting the 52A .To regain front panel control, recycle the power or send another GOTO command. Going to local will restore the ability to control the 52A from the front panel. Wait two seconds after sending a GOTO LOCL (goto to local) before sending additional commands.

Keywords Description

LLO	Front panel disabled (remote).
/LOCL	Local, (local)
/FPON	Front panel enabled (remote). The Model 52A processes front panel keys without affecting the remote status. Keys should not be pressed while the Model 52A is receiving remote commands.
/FPOF	Front panel disabled. Pressing any key returns the Model 52A to local control.

Example
GOTO FPON

13.6.21 GPIB

Function
Set GPIB parameters.

Notes
This command generates an error if the optional GPIB interface is not installed or does not have power enabled to it.

Keywords
GPIB;
PR54 ASC / GRF;
RXTX / TX / RX / OFF;
ADDR <num>;
BR <char>;
RPL nn;
LPP nnn;
HDR "chars" FTR "chars";
EOI / NEOI;
SRQ / NSRQ;
LF/NLF

Keyword Descriptions

PR54	52A sends data on IEEE-488 in graphics format.
RXTX	Both transmit & receive enabled on bus.
RX	52A receives only on bus.
TX	52A transmits only on bus.
OFF	Disable IEEE. If this is the remote port, the 52A has just become inaccessible.
ADDR <num>	Set bus address. Defaults on power on to DIP switch values, can override here.
BR <char>	Set execution break char. Equiv to the STOP command.<char> is A....Z, meaning control-A to control-Z.
RPL <num>	Set readings output / line on bus to <num>, 1....99.
LPP <num>	Set lines per page before HDR / FTR. <num>=0-255.Value of 0 means never to do HDR/ FTR.
HDR <chars>	Set header strings. "" gives no header.
FTR <chars>	Set footer strings.
EOI	Enables EOI for transmitted GPIB data. The Model 52A ignores EOI on received GPIB data.
NEOI	Disable EOI on lines.
SRQ	Enable 52A generation of SRQ.
NSRQ	Disable 52A SRQ generation.
LF	Data transmitted over the GPIB end with a combination of a carriage return and line feed (CR LF). GPIB inputs are considered incomplete until a line feed is received.
NLF	No line feeds. Data transmitted over the GPIB end with a carriage return (CR) only. GPIB inputs are considered complete after receiving a CR (LF is ignored). If EOI is enabled, the EOI is added to the CR. Do not select NLF when generating graphics over the GPIB, because NLF filters LF characters which may be part of the graphics.

Example
GPIB RS2 RXTX ADDR 9 BR R;
LPP 0 RPL 1;
HDR "^LHello" SRQ EOI

13.6.22 *IDN?

Function
Request Identification string from Model 52A

Notes
Returns "Wavetek Model 52A Datalogger" and firmware revision level.

13.6.23 INIT

Function
Resets the Model 52A which clears all memory; erases all programs, lists, and stored data; and places the Model 52A into local mode. A 2 second delay is required before sending additional commands.

Notes
No confirmation-check is performed, so be sure this is what you want! For less destructive deletions, use the "DEL" or "CLR" commands. After sending INIT wait longer than 3 seconds before returning the Model 52A to remote.

13.6.24 LINE

Function
Set line frequency rejection.

Keyword Description

50	50Hz rejection
60	60Hz rejection

Examples

LINE 60	*(Set 60Hz rejection.)*
LINE 50	*(Set 50Hz rejection.)*

13.6.25 LOAD

Function
Load a user configuration or calibration set.

Notes
A user configuration is a collection of the internal Model 52A variables that establishes the display mode, scroll speeds, recall data setups and all lists, programs, alarms, math and tracking entries. A calibration set has all current calibration constants, whether defaults or truly calibrated. In any one LOAD command, only one of U or C can be specified. The port from which the load is to come must be specified (COM1,COM2) before the load will commence. The only practical way to create a file compatible with the LOAD command is with the SAVE command.

Keywords
LOAD U/C

Keyword Description

U	User configuration
	COM1
	COM2
C	Calibration data
	COM1
	COM2

Examples:

LOAD U COM1	*(Load user configuration, comm port.1.)*

13.6.26 MATH

Function
Enter a math channel.

Notes
Entering a math formula (number) that exists eliminates the old version. Although displayed here on separate lines, the entire math entry may occur on one line. Multiple math entries can be defined on the same line. When entering the formula, text is entered as it would appear on the front panel except for the square root symbol being replaced by "R" and channels numbers must be preceded by "C" or "CH". Front panel channels are CH1..CH0; subchannels are entered as CH100,CH007, etc. The nth entry of channel C is referred to by: <C#n>. i.e in a list consisting of 2:VAC,2:FREQ,2:PER, the FREQ entry would be referred to as 2#2 No spaces are permitted in the formula entry. Entering multiple EQN statements causes each new EQN to be appended to the end of the previous EQN statement.

Keywords
MATH <nn>
    COPY <to num>;
    LBL <1-4chars>;
    *FCN / TBL;
    SCAL / PR1 / PRAL / SET <float>;
    EQN <equation string>;
    PROG;
        {
        PNT <xfloat yfloat>;
        }

Keyword Description

<nn>	Math channel number (1....99).
FCN	Define Math channel to be a Function (default).
TBL	Math channel is a table.
COPY <to num>	Copy current math to math <to num>.
LBL	Change the 4-character designator. Dflt="MATH".
SCAL	If table or function with X, scaled.
PR1	If table or function with X, prompt once for value if not avail.
PRAL	If table or function with X, prompt continually for X or table src value.

EQN	For math function only , enter the function string (formula). More than one equation can be entered for a math entry. Each equation appends the end of the previous equation. EQN is the only way to enter a large equation that spans several.
PROG	For math table only, begin accepting data sets.
PNT	Enter a data set. Give X value first, then Y.

Examples

```
MATH 01 TB L;
PROG;
PNT 0.0000 0.0000;
PNT 1.2345 2.4567  PNT 4.9152 32.768;
LBL DegK

MATH 2 FCN;
EQN  = ((4/3)*3.1416*(X*X));
PR1;
VOLX

MATH 12;                    (Enter math channel and number.)
EQN (RCH1#2)*3+CH1;         (Enter formula.)
LBL "NAME"                  (Enter label up to 4 characters.)
```

13.6.27 MEM?

Function
Request memory status from the Model 52A.

Keyword
MEM?

Example

```
MEM?                        (This is the command.)

FREE      131422            (This is the 52A's
DATA           1             response.)
PRGM          20
TOTAL     131443
*END
```

13.6.28 MEM

Function
Set Memory Mode.

Notes
This covers how all readings are to be stored, and what to do when memory becomes full.

Keywords

```
MEM FILL/WRAP;
XMIT;
        COM1 / COM2;
          &CLR;
```

Keyword Descriptions

FILL	Store readings only until memory full.
WRAP	Store readings continuously, overwrite oldest data first when becomes full.
XMIT	Transmit memory data when full.
COM1	Transmit to COM1.
COM2	Transmit to COM2.
&CLR	Clear memory after transmission.

Example:

```
MEM FILL XMIT COM2 &CLR     (Transmit data to COM2 when memory becomes full, then clear and begin refill.)
```

13.6.29 PLTSET

Function
Set up recall plotting parameters, either X vs Y or Y vs Scan type.

Notes
The information entered here is used by the "RCL" command when plotting is requested. If "PLTSET" information is not present, recall plotting will not happen. Once entered, though, the setup is retained until changed by user or a INIT, CLR ALL, or CLR SET command is received.by the Model 52A. PLTSET settings have no impact on the plotting performed by a running list or program. They continue to use their own internal setups.

Keywords

```
PLTSET;
    XY;
      {
      PLOT <data>;
      }
    YSCN1;
      {
      PLOT <data>;
      }
    YSCN2;
      {
      PLOT <data>;
      }
    YSCN4;
      {
      PLOT <data>;
      }
```

Keyword Descriptions

XY <cnt>	Enter information for X vs Y plotting. Any current XY settings are removed. YSCN types are not affected. Can then enter 1....16 PLOT points.<cnt> is the number of readings meeting recall sort conditions to apply to the plot (1-65535).
YSCN1	Enter information for a Y vs scan plot, with 1 window.
YSCN2	Enter information for a Y vs scan plot, with 2 windows.
YSCN4	Enter information for a Y vs scan plot, 4 windows.
PLOT <data>	Enter a plot entry for either X vs Y or Y vs scan, whichever has been called up. All the <data> MUST be on the same line as the PLOT keyword, and all <data> MUST go in the exact order listed below. This is one of the few 52A commands to make this demand. Doing otherwise results in undesirable operational errors.

X vs Y point format for <data>:

<xchan><ychan><char><xlow><xhi><ylow>
<yhi>;

Y vs Scan point format for <data>:

<ychan><char><ylow><yhi>;

<xchan> channel #, x axis.
<ychan> channel #, y axis.
<char> plot character, 1-32.
<xlow> floating point, low value x.
<xhi> floating point, high value x.
<ylow> floating point, low value y.
<yhi> floating point, high value y.

Examples

PLTSET YSCN1; *(Yvs Scan plot, 1 window.)*

PLOT 101 10 0.0 3.2; *(Plot ch 101, character 10, min=0.0,max=3.2.)*

PLOT 2 11 30.001 30.100 *(Plot ch 2, char 11, min=30.001, max=30.100.)*

PLTSET XY 100; *(X vs Y setup, 100 points allowed.)*

PLOT 1 2 22 1.0 2.0 1.0 2.0; *(Ch 1 vs ch 2, character 22, xmin=1, xmax=2.0, ymin=1.0, ymax=2.0.)*

PLOT 101 102 21 4 4.1 8 8.1 *(Plot ch 101 vs 102, character 21, xmin=4, xmax=4.1, ymin=8, ymax=8.1.)*

13.6.30 POFF

Function

Turn power off (RS-232-C only).

Notes

POFF will shut the Model 52A's power off. Any RS-232 characters received on COM1 when power has been shut down will turn the power back on if the AUTOPWR dip switch is enabled. COM2 does not have this feature. Once turned off from COM2, there's no way to get power back on. The Model 52A accepts the POFF command over the GPIB, but does not turn off the Model 52A's power.

13.6.31 POWER

Function

Control 52A power usage.

Notes

This command controls two aspects of 52A battery operation. The PSAVE keyword handles what to do with channel cards not currently active, which includes the main menu display and running channel lists that don't use a particular channel. The TRAVL keyword controls power-on response of the unit when operating on batteries.

Keywords

PSAVE;
ON;
OFF;
TRAVL;
ON;
OFF;

Keyword Descriptions

PSAVE ON	Power save setting on main menu, all A to D channels turned off. While running list, unused channels turned off. Used channels are turned on at list start, causing a 2.5 second delay before first reading.
OFF	A to D cards are always powered, whether in use or not. Uses more power, but no 2.5 second delay when lists are started.
TRAV	Travel mode' control.
ON	If running on battery power, when unit is turned on a prompt shows up to type "52", then e key. If this is not done in 5 seconds, the unit turns itself back off. This can be used when the 52A is being transported and might accidentally have its power button pressed. Another solution is the rear-panel power enable switch. If running from external power, this option has no effect.

OFF	No special checking. The Power key always enables power.

13.6.32 READ

Function
Read data from a channel in a running list, a running list in a program, or DMM, or main menu display level.

Notes
The entry # is applicable when there is more than one entry of the same channel in a list. If there is only one channel entry or the first entry is needed, the entry number can be eliminated. Adding "CH" to the channel number causes an error.

Keywords
READ <ccc>[#n]

Keyword Descriptions

<ccc>	Any valid channel number. 0xx, 1-4,101,9,etc.
#n	Specify which of several ch <ccc> to use. The # must follow the channel with no space, and be immediately followed by the <n>, which is 1-9. So if a list is running that has ch 1,vdc and ch 1, CJT, the first is READ with a simple read 1, the second with a "READ 1#1"

Examples:
READ 2 *(Return the current reading of channel 2.)*
READ 9 *(Return the current reading of channel 9.)*
READ 001 *(Return the current reading of channel 001.)*
READ 101#3 *(Return the third entry of channel 101.)*

13.6.33 RCL

Function
Recall or clear data from memory.

Notes
All sorts except "NAME" allow a range of values. So, for instance, you can recall channels 1-4, or scan numbers 10-20.

Keywords
RCL;
SORT;
NOL;
ALRM <num>[-num];
CH <ch>[-ch];
TIM <time>[-time];
DAT <date>[-date];
SCN <num>[-num];
NAM <name>;
NON
RCOM1 / RCOM2 ;
DISP;
COM1 / COM2 ;
PLOT;
PLOTXY;

Keyword Descriptions

SORT	Enter a sort to restrict data recalled. If no sort is specified, the last sort ever entered will take effect.
ALRM	Sort by alarm. Either single number, or range of alarms separated by a dash, no separators (space, etc).
CH	Sort by channel number. Either single channel, or range of chans separated by dash and no separators.
TIM	Sort by time or range of times. All readings that fall either after time or between time range will be recalled. 52A uses any ch9 HMS stored entries, and can get time info from any stored scan numbers (they contain timing information).
DAT	Sort by date. Recall all reads that fall after given date or between range of dates. Uses ch9:MDY or DMY, or scan numbers to pick up the timing information .
SCN	Sort by scan number or scan number range. All data stored that meets the condition of the sort will be recalled. In order to use this, some scan number entries must be present in stored data.
NAM	Sort by name. Stored data is searched for a name type entry that matches the given name. All data, including this name entry, is recalled until either the end of data or a name entry that doesn't match the one given.
NOL	For all the above sorts, leave out of recalled data any scan numbers or names. Only recall actual reading data. Use this option for recall to spreadsheets and such that would be unhappy trying to interpret names as readings.

NON	Cancels SORT settings. This is similar to the Recall All command. NON is an invalid GPIB command.
RCOM1	Perform textual recall to comm port 1 with current SORT settings. Any SORT must be entered before RCOM1, since it does the recall.
RCOM2	Perform text recall to comm port 2, if present. RCOM2 is similar to RCOM1.
DISP	Perform recall to display. The data will show there until some other command is used. It will scroll if the SCRL command has enabled this.
COM1	For plotting, set destination as COM1. COM1 valid only when used with the PLOT or PLOTXY command.
COM2	For plotting, set destination COM2 if it is present. COM2 valid only when used with the PLOT or PLOTXY command.
PLOT	Perform Y vs scan plot to port set via COM1 or COM2 keyword above. Since this does the plot, must set destination via COM1 or COM2 before using this word. Plotting information uses the settings made via PLTSET YSC N, and data as filtered by SORT.
PLOTXY	Perform XY plot to port set via COM1 or COM2 keyword. Otherwise, similar to PLOT keyword.

Examples

RCL DISP	*(Recall all data to display, current sorting.)*
RCL SORT ; NAME DAVE.L RCOM2	*(Recall data from DAVE.L to COM2.)*
RCL SORT ALRM 1 RCOM1	*(Recall Alarm #1 data to COM1.)*
RCL SORT CH 1-3 RCOM1	*(Recall channels 1 through 3 data to OM1.)*
RCL DISP SORT -LAB	*(Recall all but labels to Display.)*
RCL COM1 PLOT	*(Perform y vs scan plot to communication port 1.)*

13.6.34 *RST

Function
Clears out all unprocessed Model 52A remote commands .

Example
DISP ENAB ENTL TEST1 *RST *(The list will not be entered and display will not be enabled, because *RST clears this information.)*

13.6.35 RUN

Function
Run a specified channel list or program.

Notes
Attempting to run a list while program is active, will generate an error. The program must first be "STOP"ed. The ".L" or ".P" extension is required. A new list can be RUN without stopping the previous list. When a program is running, a channel list can be run (RUN XXX.L) if the program is in the monitor mode. Running a channel list in this manner replaces any previously selected monitor list; the new channel list remains as the program's monitor channel list for the duration of the program unless the list is again changed.

Keyword
RUN List.L/Prog.P

Examples
RUN DAVE.P
RUN NAME.L
RUN PROGRAM.P

13.6.36 SAVE

Function
Save User configuration or calibration data. This is the companion command to "LOAD". Refer to that command for further information.

Keywords
SAVE U/C

Keyword Description

U;	User configuration COM1 COM2
C;	Calibration data COM1 COM2

Examples
SAVE U COM1 *(Save user configuration, comm port 1.)*

13.6.37 SCRL

Function
Set data scroll rate and key repeat rate.

Keywords
KSLOW / KMED / KFAST;
DSLOW / DMED / DFAST / DHOLD;

Keyword Description

KSLOW	Key repeat speed is slow. Applies to Up and Down arrow keys only.
KMED	Key repeat rate: medium.
KFAST	Key repeat rate: fast.
DHOLD	Data does not scroll on 4-channel display mode of list or recall data.
DSLOW	Data scrolls slowly. About 1 scroll per 2 seconds.
DMED	Data scrolls slowly. About once per 1 second.
DFAST	Data scrolls quickly. Once per half-second.

Examples:

SCRL DSLOW KFAST *(Scroll data slow, repeat arrow keys fast.)*
SCRL;
DHOLD; *(No data scroll.)*
KMED; *(Medium speed key repeat.)*

13.6.38 STOP

Function
Terminates a running program, list, DMM, or other command as well as any pending channel list, program, math, or tracking data.

Notes
If a program is running, the Model 52A will not accept most commands from either remote or the front panel until the program is terminated. This will usually be evident from remote by receiving the E7 error code when trying to enter other commands.

Keyword
STOP

Example
STOP

13.6.39 TIME, TIME?

Function
Set or read the 52A's real time clock.

Notes
The Model 52A's real time clock is based on a 24 hour cycle. Leading zeros must be included for hours, minutes or seconds. The separating colons are not necessary. If colons (:) are used, the time must be enclosed in quotation marks (" "); see the examples. The Model 52A could interpret the colons as separators which would result in a syntax error. All unentered trailing digits are assumed to be zeros.

Keyword
TIME?
TIME "hh:mm:ss"

Examples:
TIME "08:02:55" *(Set time to 08:02:55.)*
TIME 092220
TIME? *(Request time from 52A.)*

13.6.40 TRAK

Function
Set tracking out parameters, applied to channel lists with the TRAK keyword.

Keywords
TRAK <chan>
ANA / *DIG;
SE / BIP;
ZER <float> FS <float>

Keyword Description

<chan>	Tracking channel number. 5,6,7 or 8.
ANA	Analog output on selected channel.
DIG	Digital output on selected channel.
SE	Single Ended output (0-2.55 Vdc).
BIP	Bipolar output (0-1.27-2.55 Vdc).
ZER <float>	Set zero float value.
FS <float>	Set full scale float value.

Examples
TRAK 5 ANA SE,
ZERO 0.0000 FS 32.000 *(Single ended tracking channel 5, analog out. a 0 value gives 0V out, a value of 32 gives 2.55 out.)*
TRAK 7 DIG, BIP, ZERO -3.2000, FS 3.2000 *(Bipolar tracking channel 7, digital out. a -3.2 value gives 0V out, a 0 value gives 1.28V out. a 3.2 value gives 2.55 out.)*

13.6.41 *WHO?

Function
Lists the Model 52A design team.

13.6.42 WR

Function
Write a specified value directly to digital output.

Notes
Analog output expects its value in terms of volts (0-2.55); digital expect a decimal value 0-255. WR is available at the outermost menu, within a running list, or in DMM. WR is designed for use with full byte outputs, but can be used with a bit output.

Keywords
WR <chan> <value>

Keyword Description

<chan>	Output channel number. 510,610,710 or 810 (dig) 590,690,790,890 (analog).
<value>	Valid values are 0...255(dig),0-2.55 (analog).

Examples

WR 510 255	*(Write 11111111 to digital out 5.)*
WR 810 4	*(Write 00000100 to digital out 8.)*
WR 890 0.25	*(Set analog out 8 to 250 mV.)*
WR 611 1	*(Set bit 1 of digital output channel 6 to 1.)*

13.7 REMOTE COMMAND SUMMARY

Table 13-4 summarizes the Model 52A's remote commands. Included with each command is a paragraph reference. The commands are listed in alphanumeric order.

Table 13-4. Remote Command Summary

Command	Function	Paragraph Reference
~	Tilde character places unit in remote.	13.6.1
@	AT character activates Echo-On.	13.6.1A
^	Caret character turns off Echo.	13.6.1B
ALARM/ALRM	Setup or alter alarm.	13.6.2
BATT?	Queries state of internal battery.	13.6.2A
BLOAD	From remote, load channel list, program, math etc..	13.6.3
BOUT (XXX)	To remote, transmit channel list, program, etc..	13.6.4
*CAL?	Returns last calibration date.	13.6.5
CAL0, CAL, CALV, TCAL	Performs remote calibration.	13.6.6
CALRTD	Remote calibration for temperature: RTD.	13.6.7
CLR	Clears Model 52A's memory	13.6.8
CMDS?	Lists Model 52A's keywords.	13.6.9
CNF?	Requests Model 52A configuration information.	13.6.10
COM1	Sets comm port 1's parameters.	13.6.11
COM2	Sets comm port 2's parameters.	13.6.12
DATE	Sets the Model 52A's date.	13.6.13
DATE?	Returns the Model 52A's date.	13.6.13
DEL	Deletes channel list, program, etc. from memory.	13.6.14
DIR (XXX)	Returns a directory of channel lists, programs, etc..	13.6.15
DISP ENAB	Enables the front panel display.	13.6.16
DIS	Disables the front panel display.	13.6.16
DMM	Model 52A functions as single channel DMM.	13.6.17
ENTL <name>	Creates a new channel list.	13.6.18
ENTLC <name>	Delete an existing channel list.	13.6.18
ENTP <name>	Creates a new program.	13.6.19
ENTPC <name>	Delete an existing program.	13.6.19
GOTO	Enables or disables front panel control.	13.6.20
GPIB	Sets GPIB parameters.	13.6.21
*IDN?	Returns Model 52A identification string.	13.6.22
INIT	Model 52A system reset.	13.6.23
LINE	Sets line rejection frequency.	13.6.24

Table 13-4. Remote Command Summary (Continued)

Command	Function	Paragraph Reference
LOAD	Load user configuration or calibration setup.	13.6.25
MATH	Enter Math channel setup.	13.6.26
MEM?	Request memory status.	13.6.27
MEM	Setup the Model 52A's memory mode.	13.6.28
PLTSET	Sets up recall plot parameters.	13.6.29
POFF	Turns off power (RS-232-C only)	13.6.30
POWER	Controls Model 52A power.	13.6.31
READ	Reads data from channel list, program, or DMM.	13.6.32
RCL	Recall or clear data from memory.	13.6.33
*RST	Clears all unprocessed remote commands.	13.6.34
RUN	Runs specified channel list or program.	13.6.35
SAVE	Saves user configuration or calibration setup data.	13.6.36
SCRL	Sets scroll rate and key repeat rate.	13.6.37
STOP	Stops running channel list, program, or DMM.	13.6.38
TIME	Sets Model 52A's real time clock.	13.6.39
TIME?	Reads Model 52A's real time clock.	13.6.39
TRAK	Sets tracking parameters.	13.6.40
*WHO?	Lists Model 52A design team.	13.6.41
WR	Writes output value to digital I/O card.	13.6.42

APPENDIX A
DATALOGGER SYSTEM SPECIFICATIONS