Mark 12
DMS 1000
Operator's Manual

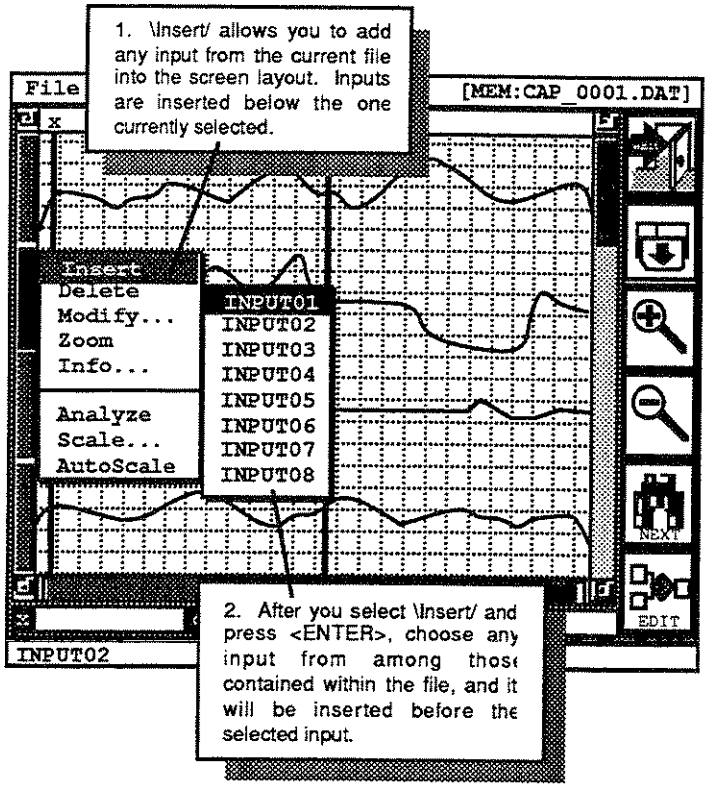
Version 5

January 1995

WESTERN GRAPHTEC INC

10.5.1 Inserting a Trace

The first menu item on the \TRACE/ menus is \Insert/. This allows you to insert a different trace after the currently selected one. You can assign each trace on the display to any of the inputs that were actually captured within the data file.



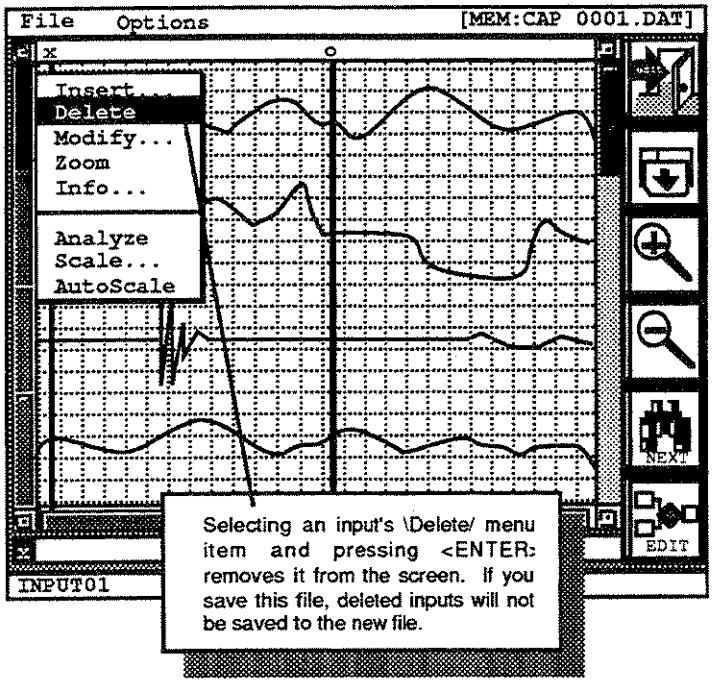
Inserting a New Trace Onto the Display

Important Notes:

- *The list that appears will contain only those inputs that were captured!*
- *The new trace will appear below/after the currently selected trace on the screen*
- *This has no effect on the hard copy output!*

10.5.2 Deleting a Trace

You may delete any trace from the screen. This process can be reversed at any time later by using the \Insert/ menu item shown in the previous pages (see 10.7.1).



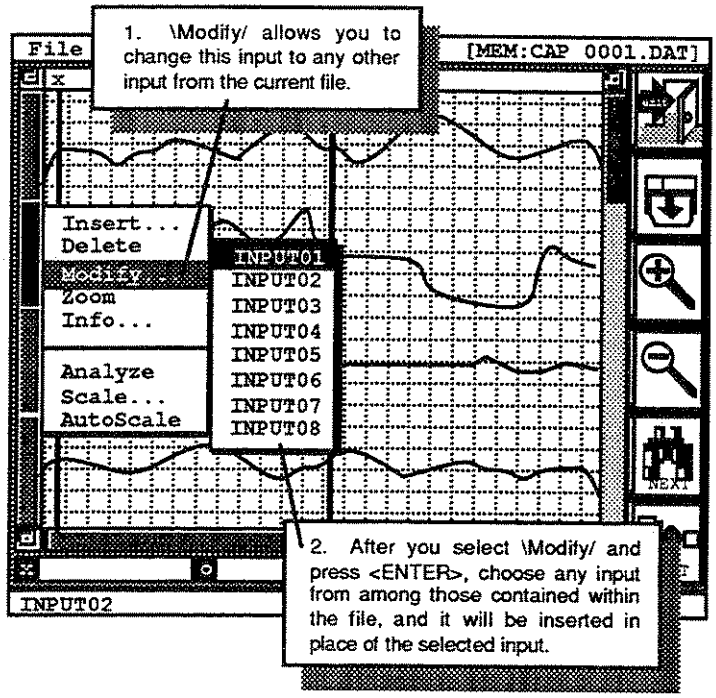
Deleting a Trace from the Display

Important Note:

- *This has no effect on the hard copy output!*

10.5.3 Modifying a Trace

Any trace on the display can be modified. This means that the input that it is assigned to can be changed to any other input contained within the capture data file. When you select this menu item you will be shown a list of all the inputs contained in this file.



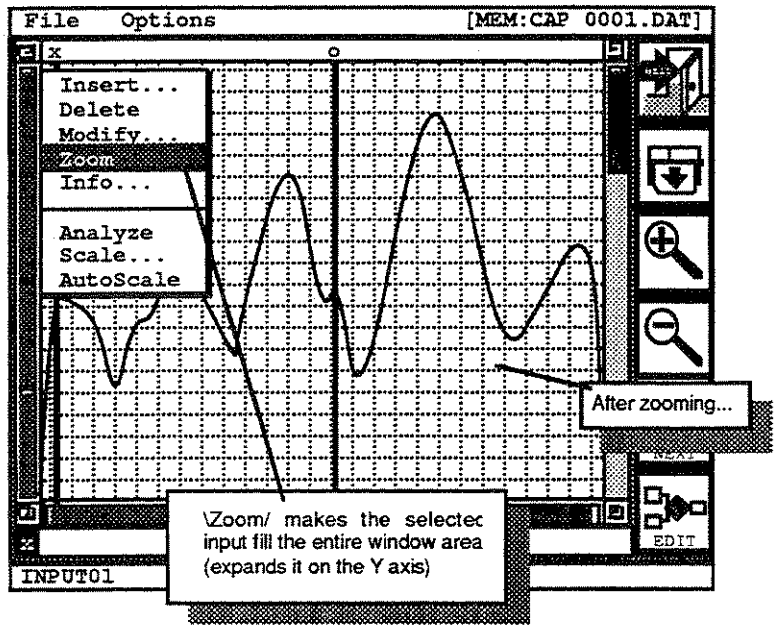
Modifying a Trace

Important Notes:

- *The same input can be assigned to as many different traces as you like. There are no limitations.*
- *This has no effect on the hard copy output!*

10.5.4 Zooming A Trace

You may "zoom" any of your traces up to the full height of the waveform area or the screen. Select this menu item to cause this trace to be zoomed. Select it again to "unzoom" this trace.



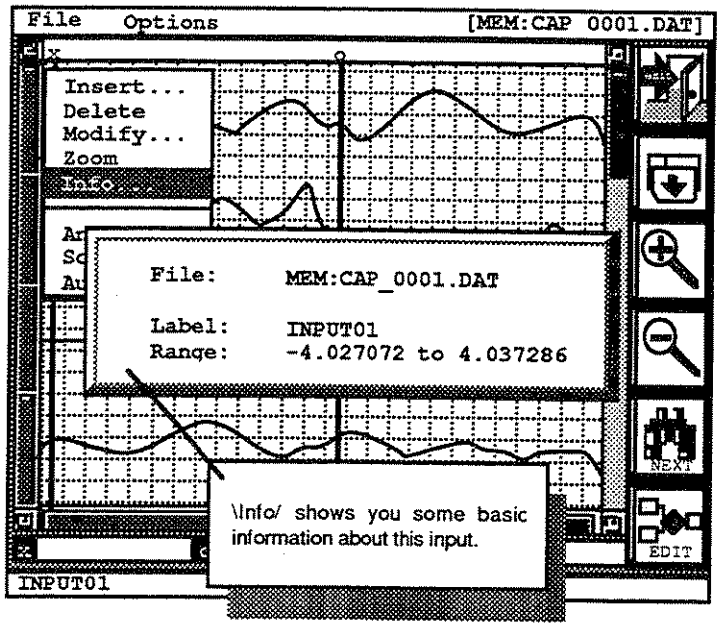
Zooming a Trace

Important Note:

- *This has no effect on the hard copy output!*

10.5.5 Getting Trace Info

You may get a text summary of the pertinent facts about this trace. Select the \Info.../ menu item and a message box will appear as shown in the illustration below:



Getting Important Information About a Trace

The file path and name are shown for reference, followed by the input that this trace is assigned to and the overall span of this input.

Important Note:

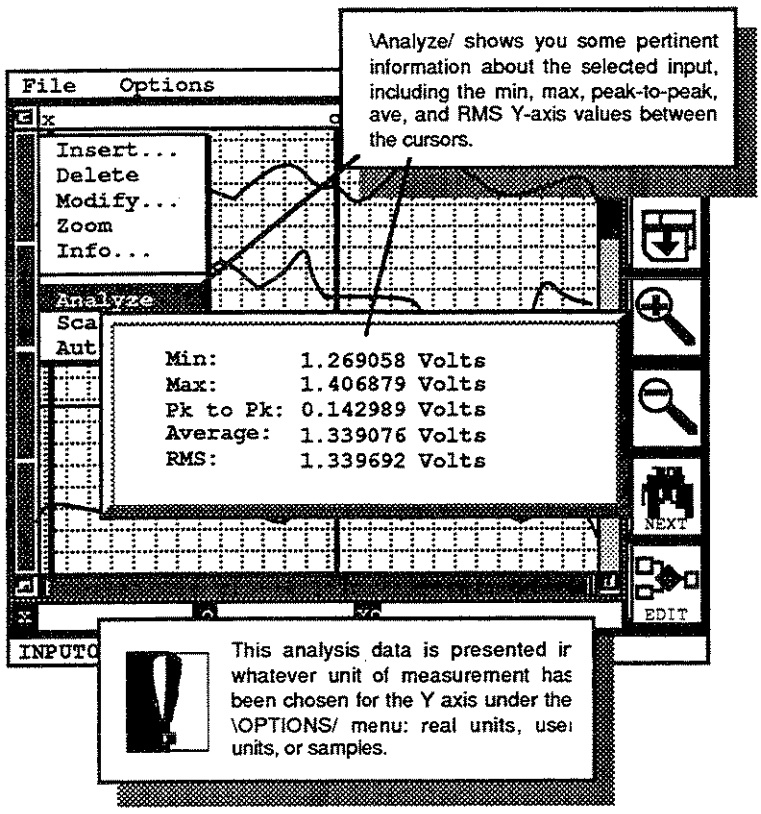
- *You may make a hard copy of this and virtually all other screens by holding down the <SHIFT> hardKey and touching the <ESC> hardKey.*

10.5.6 Analyzing a Trace

The DMS1000 can now perform some basic analysis of the selected inpu channel. It performs this analysis on the area of the waveform that is betweer the x and o cursors.

When you select \Analyze.../ from any of the \TRACE/ menus, you will see this message box on the screen containing a report about this input, including:

Min	The minimum amplitude value of this input
Max	The maximum amplitude value of this input
Pk to Pk:	The total peak-to-peak value of this input
Average:	The average value of this input
RMS:	The RMS (root mean squared) value of this input



Analyzing a Trace

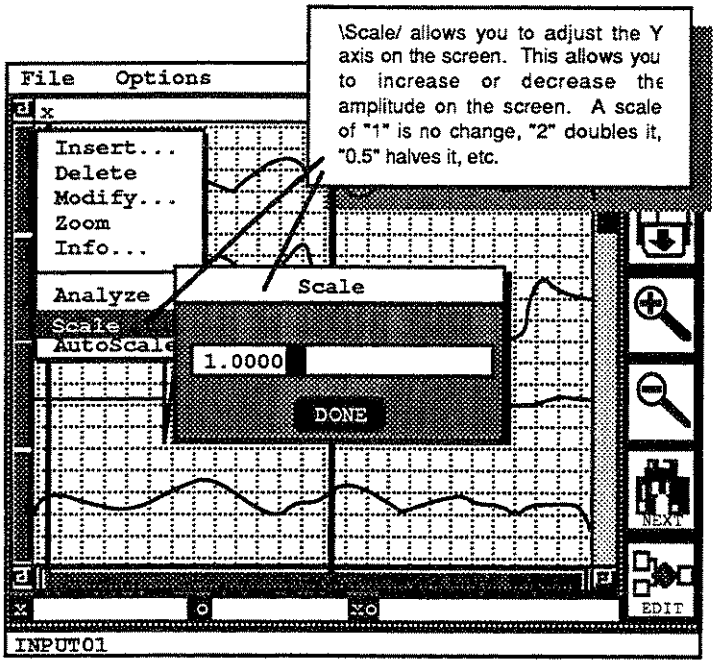
Important Notes:

- *The values are expressed in whatever the Y-axis units are set to under the \OPTIONS/ menu*
- *The values only apply to this input*

- *The values only apply to the area of this input that lies between the x and o cursors*

10.5.7 Scaling a Trace

You can scale any trace's amplitude up or down in the display. This has nc effect on the hard copy print-out. Select \Scale.../ from any input's \TRACE menu and you will be presented with the *Scale* dialog box. Here is where you can enter a scale factor. If you wanted to reduce this trace's amplitude by half you would enter a scale factor of 0.7. If you wanted to double or triple the height of a trace you would enter 2 or 3, respectively.



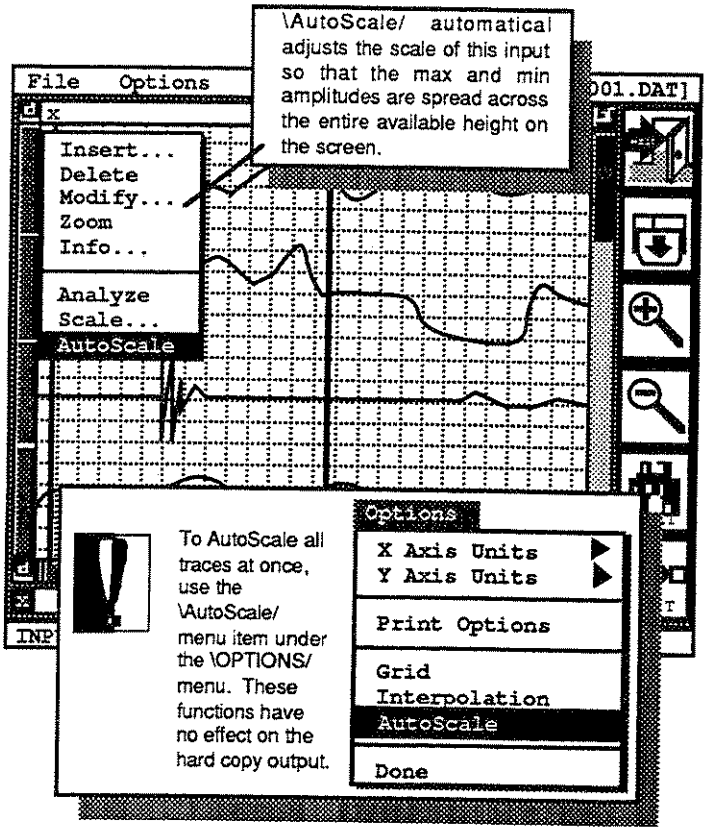
Scaling a Trace

Important Notes:

- *Scaling applies only to this input*
- *Scaling has no effect on the hard copy print out*
- *If you want to scale the trace automatically to be as large as possible, use the next menu item, called \AutoScale/*
- *If you want to apply AutoScale to all traces simultaneously, use the \AutoScale/ menu item under the \OPTIONS/ menu at the top of the screen. These are "global" controls that will affect all channels. See* 10.4.13, AutoScaling the Display.

10.5.8 AutoScaling a Trace

To AutoScale a trace so that it is as large as it can be on the display, use this menu command. If you want more control over the scaling, see 10.7.7, above.



Auto-Scaling a Trace

Important Notes:

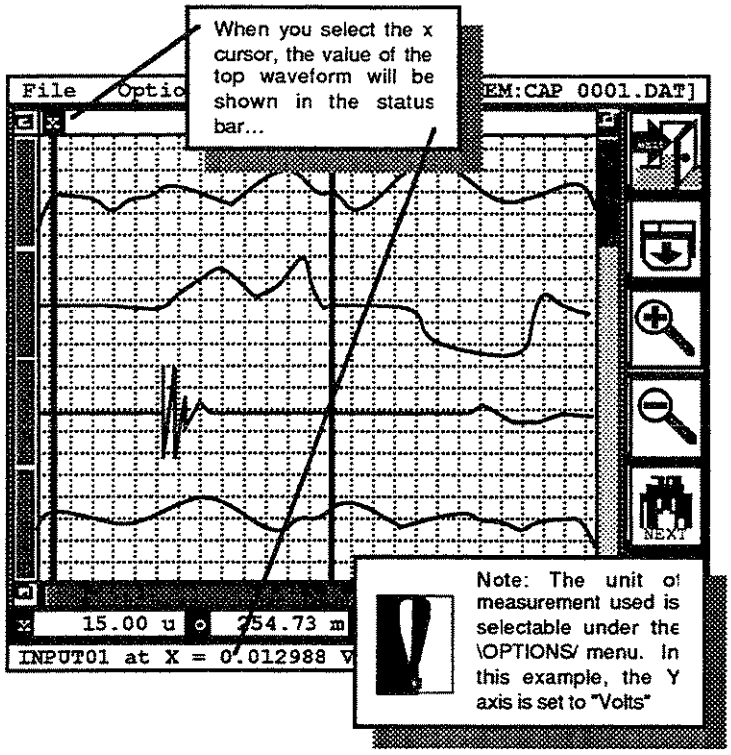
- *AutoScaling applies only to this input*
- *If you want to apply AutoScale to all traces simultaneously, use the \AutoScale/ menu item under the \OPTIONS/ menu at the top of the screen. These are "global" controls that will affect all channels. See* 10.4.13, AutoScaling the Display.
- *This has no effect on the hard copy output.*

10.6 Using the Cursors

The x and o cursors provided on this screen are some of the most important tool that you can use when analyzing, reviewing, saving, searching through, an making hard copies of your captured data files.

The cursors allow you to select, or "bracket" the area of data that will be printec analyzed, or saved to a new file.

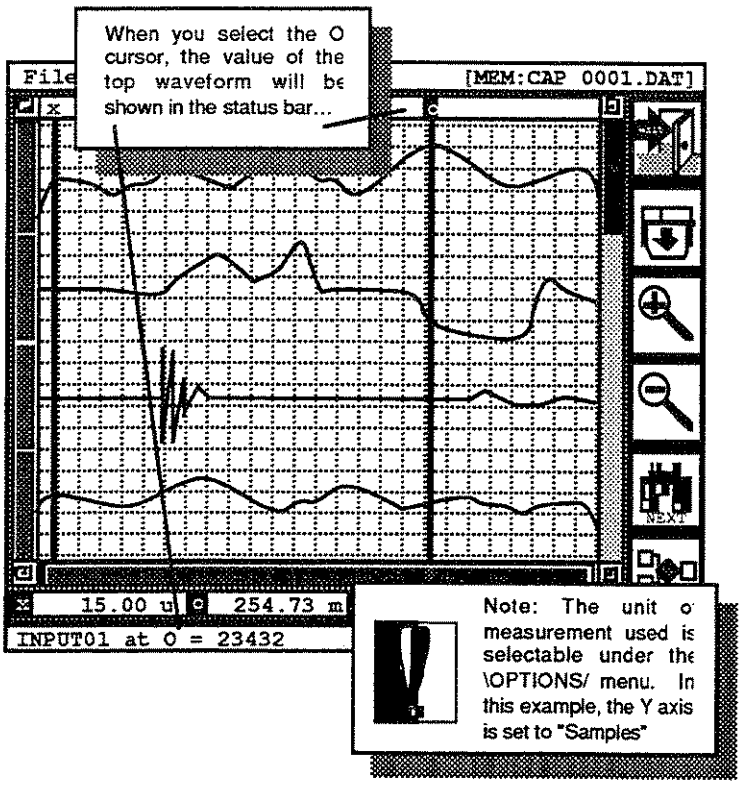
Using them is as simple as moving the highlight to the cursor of choice, and the using the jog-wheel to move it left or right. As you move each cursor, you wi notice that the information in the fields at the bottom of the screen generall changes to reflect the current location of the cursor.



Using the x and o Cursors

Note: The x cursor is also used as the starting location of all SEARCHES, but th search does not stop at the o cursor. This requires the Search Script Option M12-SCR

Now try the other cursor. Move the highlight to it (using the jog-wheel), then press <ENTER>:



Using the o cursor

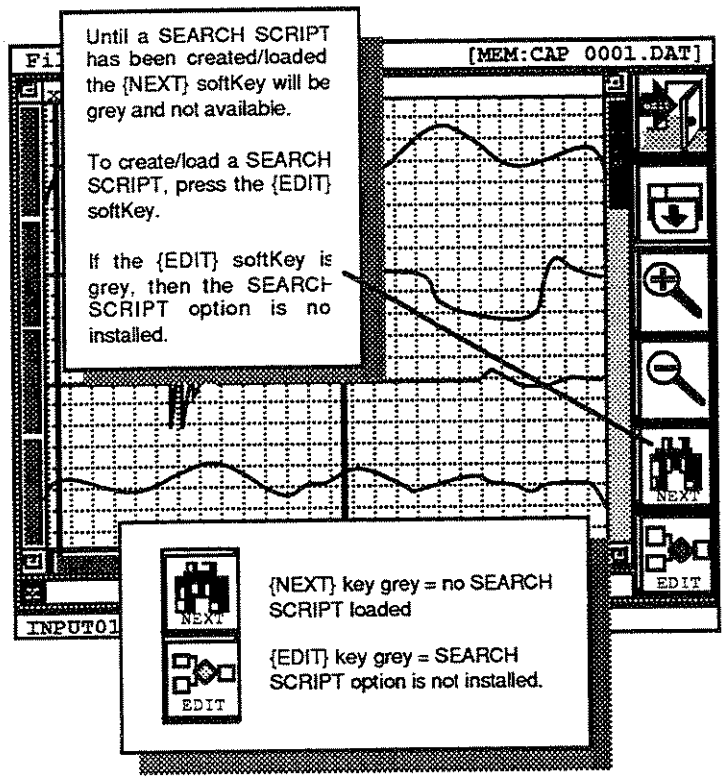
10.7 Search Script Related Functions

Please refer to the SEARCH SCRIPT section of this manual before trying to use this function for the first time.

"Search Scripts" is an optional firmware feature that was introduced in mid-1994. You can determine if your DMS1000 has this option installed by looking closely at the {EDIT} softKey at the bottom of the screen. If it is dark and active, then the Search Script option is installed. If it is gray, and nothing happens when you press it, then the Search Script option is not installed on your DMS1000.

If you do not have this option, you may wish to skip this section. Or, you may be interested in this capability and wish to learn more about it before purchasing it.

Assuming that you have the Search Script option, here is where you would access it from. Because Search Scripts are created based on a particular captured data file, you must first have one loaded on this -REPLAY- screen before attempting to create, edit, or load a Search Script.



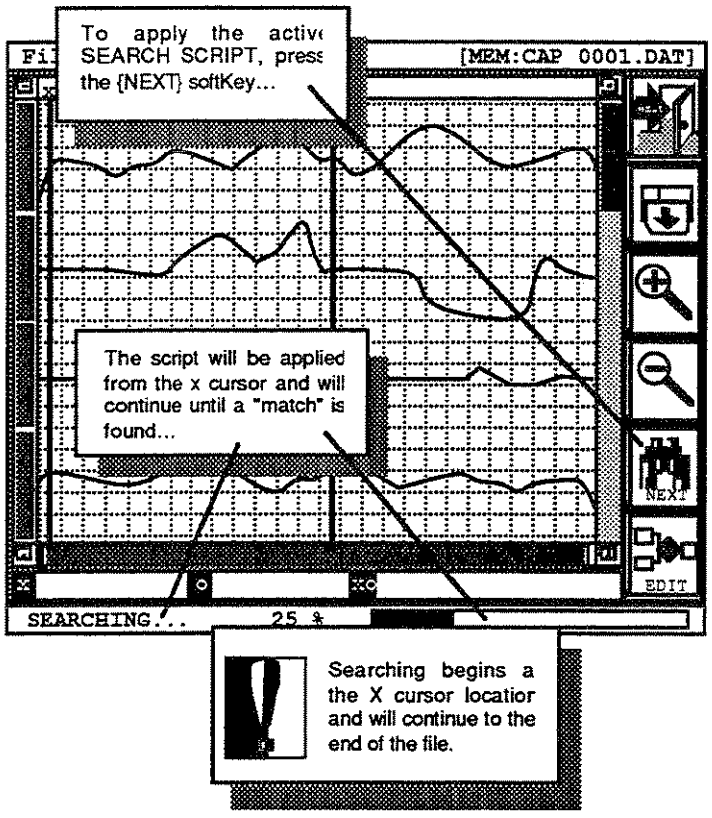
Determining if You Have Search Script Capability

Important Notes:

- *You must first load a capture data file on the -REPLAY- screen before you can load, edit, or create a new Search Script.*
- *Searching begins at the x cursor*

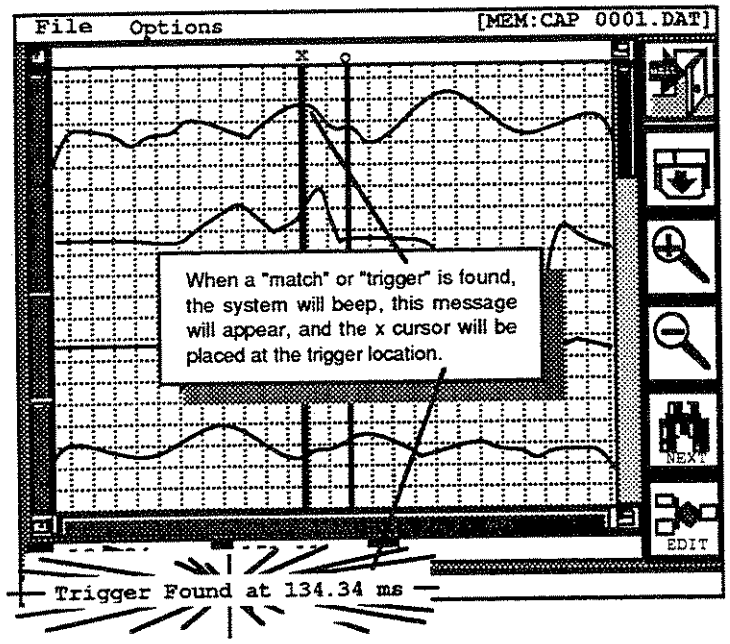
10.7.1 Applying Search Scripts

1. Go to the -REPLAY- screen
2. Load the data file that you wish to search.
3. Put the x cursor at the location from which you want the script to begin looking.
4. Press the {EDIT} softKey to access the -SEARCH SCRIPT- screen
7. On that screen, load the script that you wish to apply, or create a new one
8. Make sure that your script is saved before proceeding.
9. Press {Exit} to return to the -REPLAY- screen
10. Press the {FIND} softKey. The script will be applied to the data starting at the location of the x cursor. Each time a "true" or "trigger" is found, the system will beep and the x cursor will be moved to that place. The status bar will give the trigger location in time.
9. Press {FIND} as many more times as desired. If there are no more "triggers," then the status bar will read "No Trigger Found."



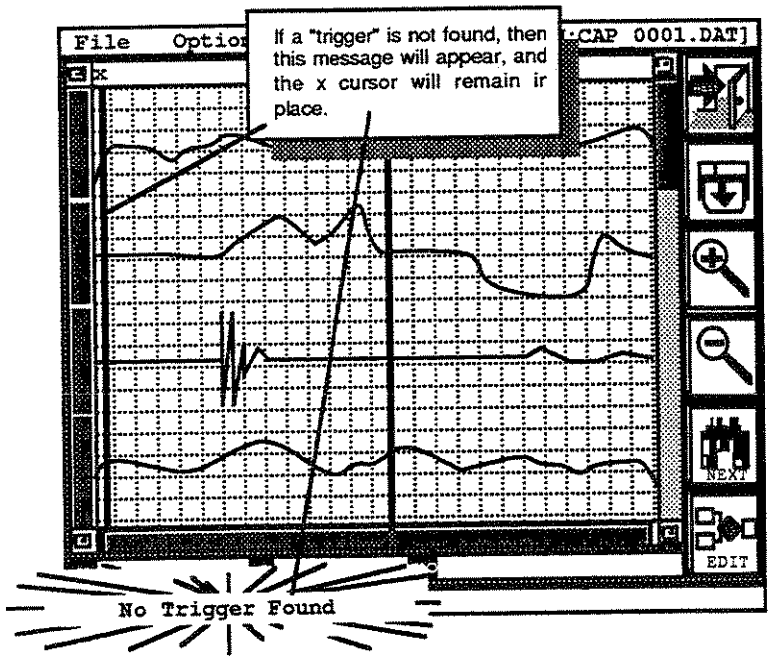
Searching Through a Capture Data File

10.7.2 Finding Valid "Trigger" Points



Search Script Has Found a Valid "Trigger" Point

Keep pressing {FIND} (the binoculars icon) until the system no longer finds a valid "trigger" point. When no more points can be located, the screen will look like this:



Search Script Has Failed to Find a Valid "Trigger" Point

10.8 Replay Screen Alphabetical Reference

Conventions:

\MENU/
\Menu Item/
\\Submenu Item//
{SoftKey}
[Screen Button/Field]
<Front Panel Key>
"caption/something printed on the screen"

{EDIT}

SoftKey 6 on -REPLAY- screen

(Search Script function—icon is a logic chart). Accesses the -SEARCH SCRIPT- screen. Same function as the \Search.../ menu item under the \FILE/ menu.

{EXIT}

SoftKey 1 on -REPLAY- screen

(Icon is an open door) Exits from this screen and returns to the previous screen.

\FILE/

Menu on -REPLAY- screen

This menu contains menu items for opening, saving and printing data files, as well as accessing the -SEARCH SCRIPT- and -CHART LAYOUT- screens.

{NEXT}

SoftKey 5 on -REPLAY- screen

(Search Script function—icon is a pair of binoculars). Applies the active Script to the current data file, starting from the x cursor. Each subsequent press resumes searching from the last trigger point found.

[o] Cursor

o cursor on the -REPLAY- screen

This on-screen cursor can be moved by selecting it with the highlight and them pressing the <ENTER> key. At this point you may use the jog-wheel to move the cursor left or right through the data file. The actual units at the intersection of the top trace and the cursor will be indicated in the Status Bar.

[o] Field

o field on the -REPLAY- screen

This field shows the x-axis value of the [o] cursor. This indicates the distance from the beginning of the file in the unit of measuremen selected by \X Axis Units >/ under the \OPTIONS/ menu.

\Open.../

Menu item under \FILE/ menu on -REPLAY- screen

Allows you to select a *.DAT captured data file for replay/review/analysis on this screen.

\OPTIONS/

Menu on -REPLAY- screen

This menu contains menu items for controlling the appearance and behavior of the on-screen cursors, the presentation of data on the screen, and the printing of data.

{Print}

SoftKey 2 on -REPLAY- screen

(Icon is DMS1000 with chart paper coming down) Exits from this screen and returns to the previous screen.

\Print.../

Menu item under \FILE/ menu on -REPLAY- screen

Allows you to print the currently loaded captured data file to the DMS1000 in whatever chart format is currently selected.

\Search.../

Menu item under \FILE/ menu on -REPLAY- screen

Allows you to select a *.DAT captured data file for replay/review/analysi on this screen.

\TRACE/

Menu on -REPLAY- screen

There are up to four \TRACE/ menus displayed at a time on the -REPLAY- screen. They do not have the word "trace" on them, but are rectangular blocks arranged vertically along the left edge of the screen. Move the highlight to the trace block desired (the Status Bar indicates which INPUT number is selected), and then press <ENTER> to see the \TRACE? menu appear.

Each \TRACE/ menu contains important menu items for inserting, deleting, and modifying the selected trace, as well as analyzing, getting information about, scaling, and zooming the selected trace.

TRACE parameters do not affect the data that is printed to the chart.

[x] Cursor

x cursor on the -REPLAY- screen

This on-screen cursor can be moved by selecting it with the highlight and them pressing the <ENTER> key. At this point you may use the jog-wheel to move the cursor left or right through the data file. The actual units at the intersection of the top trace and the cursor will be indicated in the Status Bar.

[x] Field

x field on the -REPLAY- screen

This field shows the x-axis value of the [x] cursor. This indicates the distance from the beginning of the file in the unit of measurement selected by \X Axis Units >/ under the \OPTIONS/ menu.

[xo] Field

x field on the -REPLAY- screen

This field shows the delta x-axis value of the [x] and [o] cursors. This indicates the distance between the cursors in the unit of measurement selected by \X Axis Units >/ under the \OPTIONS/ menu.

{ZOOM IN}

SoftKey 3 on -REPLAY- screen

(Icon is a magnifying glass and plus (+) sign) Expands the T-axis on the screen, making the area currently bracketed by the x and o cursors appear full-scale across the screen.

{ZOOM OUT}

SoftKey 4 on -REPLAY- screen

(Icon is a magnifying glass and minus (-) sign) Compresses the T-axis on the screen by 2:1.

Section 11 SCSI Interfacing

SCSI (Small Computer Systems Interface) is a computer interface used to connect mass storage devices like hard and floppy disk drives and tape backup drives, directly to microcomputers. It was popularized by the Apple Macintosh series of microcomputers, on which it has been a standard feature since the mid 1980's. In the 1990's, it has become a common option on IBM PC's and compatibles, particularly because so many CD-ROM drives employ SCSI as their interface.

You may add the optional M12-SCSI interface to any DMS1000 which is running firmware revision 4.0 and higher. M12-SCSI is a PC board that plugs into one of the user slots on the back of the *DMS1000*. It makes the *DMS1000* able to write data to internal or external SCSI hard disks and other similar media.

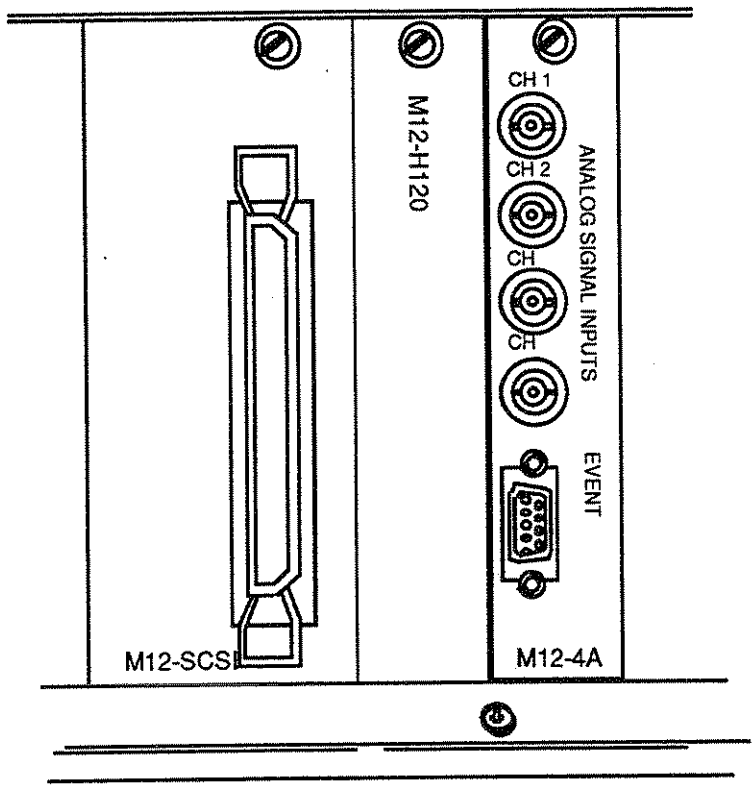
The SCSI interface supports up to seven SCSI devices, although you can only actually control one device at a time. You can easily copy files from internal memory to any SCSI drive attached, or between SCSI drives.

Many users capture data to SRAM first and then copy it to SCSI, for one or both of these reasons:

- You can write to SRAM faster than you can write to SCSI (because there are no moving parts in RAM).
- You can use the "circular memory" capabilities of SRAM to set the trigger point anywhere within the data file. This means that you can record data that occurred BEFORE the trigger. This is NOT POSSIBLE with SCSI. SCSI acquisitions are always 100% POST TRIGGER.

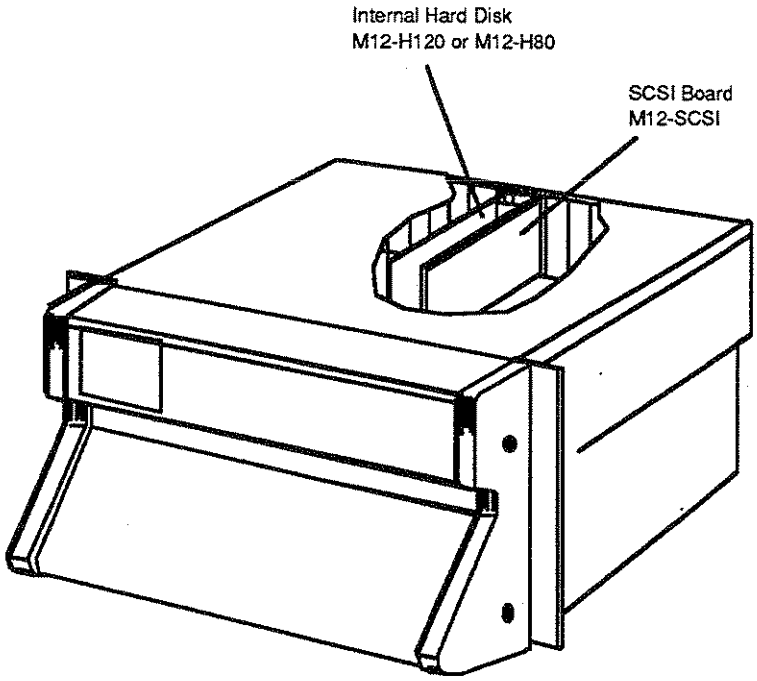
11.1 M12-SCSI Architecture

Looking at the rear panel of the *DMS1000*, we can see the M12-SCSI (option) plugged next to a M12-H120 (option):

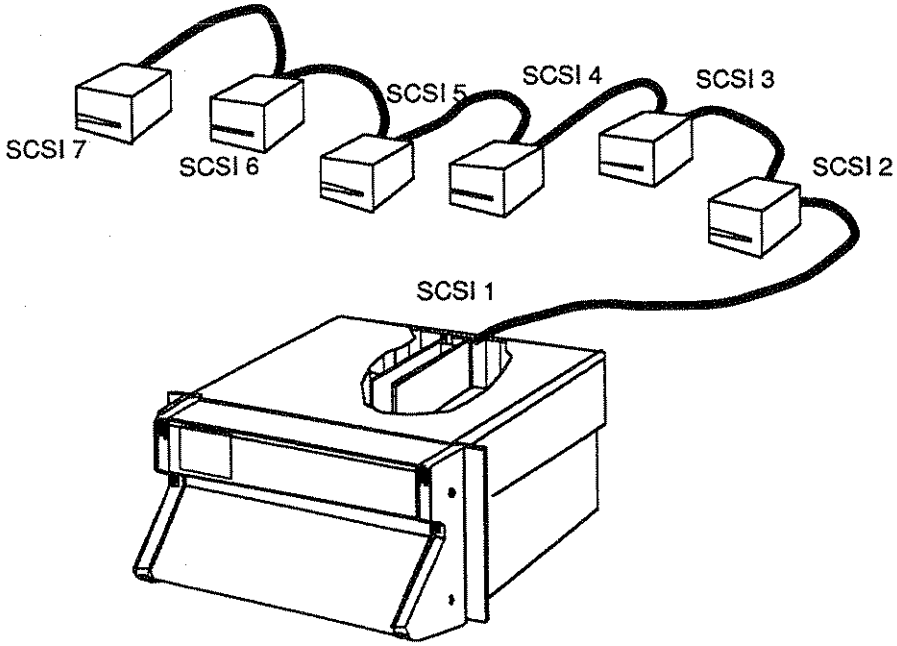


Rear Panel of DMS1000 with M12-SCSI and M12-H500 options

The M12-SCSI includes a rear panel SCSI interface connector for attaching external hard disks. The M12-H500 (or any other internal drive) is attached internally to the SCSI bus:


Internal Hard Disk
M12-H120 or M12-H80
SCSI Board
M12-SCSI

This internal connection is important, because it allows you to "daisy chain" multiple SCSI drives externally. The last drive must be terminated. Consult your SCSI documentation for more information about this.



DMS1000 with one (1) internal and up to six (6) external drives

11.2 Capturing Data

Capturing data to SCSI is no different than capturing data to SRAM (see Capture Section), with the limitations mentioned above (lower speed and lack of pre trigger capability).

Simply change the volume from "MEM" to one of your SCSI volumes in the file dialog box on the -CAPTURE- screen. The DMS1000 will capture data to the SCSI drive.

When you first power-up the DMS1000, it queries all SCSI drives and attempts to cross-reference each one to the list of drives contained in DRV.CFG, a file that is part of the operating system in FEPROM. Each drive listed in the file has been tested by Western Graphtec and proven to be able to sustain a given MTR (Maximum Transfer Rate), without interrupting the data.

If the SCSI drive is not found in this file, the DMS1000 will "mount" it anyway allowing you to use it. However, it will use the best estimate of the MTR for this device, which may be higher or lower than the device can actually support. Accordingly, it is possible *but not advisable* to attach SCSI drives that have not been tested by Western Graphtec and had drivers added to the system.

These upper limits are used on the -CAPTURE- screen, so if you try to input a sample rate that is not possible, the firmware will not let you. In all cases, if you set a sample rate and then later "turn on" more channels to be captured on the -TRIGGER- screen, the firmware will check again and warn you that it must lower the sample rate based on the number of channels selected for capturing.

11.3 Hard Disk Drives

All SCSI drives may have varying MTR's (Maximum Transfer Rates). The MTR is the hard disk's ability to write data continuously to disk.

For example, the M12-H500 has an MTR of 600 kwords/sec. This means that you can write a total of 600,000 samples to this disk per second. Divide the MTR by the number of channels you are acquiring to derive the maximum sample rate that can be set on the -CAPTURE- screen. Thus, if you are acquiring ten channels to disk, you can set the sample rate no higher than 60 kHz (per channel) when writing to this disk.

Note: *Due to the great differences among hard drives available from dozens of manufacturers, Western Graphtec cannot support hard drives that were not purchased from Western Graphtec. Non-Western Graphtec provided hard drives, or any other hardware or software, are NOT supported by Western Graphtec, nor are they covered under standard warranty provisions.*

In terms of file capacity:

b = bit

B = Byte

k = kilo = thousand

M = Mega = million

G = Giga = Billion

Therefore,

kB = kiloByte

MB = MegaByte

GB = Gigabyte

kword = thousand words

Mword = Megaword

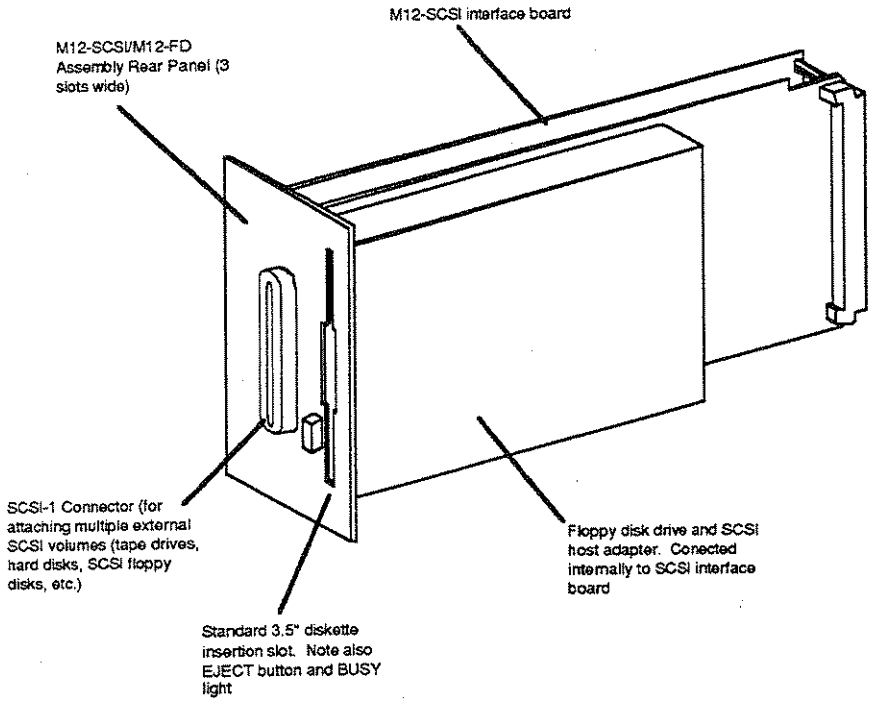
Gword = Gigaword.

Internal hard drives mount inside the *DMS1000* next to the M12-SCSI board. A direct connection between the two is made inside the *DMS1000*. Only one internal hard disk may be installed per *DMS1000*. Internal hard disks occupy one slot, and the M12-SCSI board occupies two—for a total of three slots for a SCSI interface and internal hard drive.

As of this writing, a new single-slot SCSI interface board is available for users who do not want an internal hard disk, and want the SCSI interface to occupy as few slots as possible. Due to the width of hard disk drives suitable for continuous, uninterrupted high-speed access, the hard disk and SCSI board combination still requires three rear panel slots.

However, even plugging in eight M12-4A A/D boards leaves four extra slots—so plugging in an M12-SCSI and an internal hard disk leaves you with one more slot.

11.4 SCSI Floppy Disk Drives



M12-FD & M12-SCSI Assembled Together

The optional M12-FD is an internal SCSI FDD (Floppy Disk Drive). It mounts or a common bracket with the SCSI interface board, so the entire assembly of the floppy drive and M12-SCSI interface occupy three slots.

It is possible to have an internal hard drive in a fourth slot, although this requires an auxiliary power supply for older DMS1000's (those manufactured prior to January, 1994), and a blank slot between the hard drive and internal floppy drive for clearance, so the assembly of SCSI interface, internal floppy drive and internal hard drive occupy five slots.

11.4.1 FDD Data Format

The M12-FD accepts standard 3.5" floppy disks exactly like those used in regular desktop PCAT's. The *DMS1000* formats the disks exactly like a PCAT (you can also format the disks in your PCAT if you prefer).

As with other SCSI disk volumes, the *DMS1000* has access to any files contained within the root directory of the disk. There is no capability to create, read from or write to sub directories. According to the PCAT standard under DOS, each disk volume can have up to 512 files within the root directory.

The M12-FD acts just like any other memory volume within your *DMS1000* system, with the possible exception of speed—floppy disk drives are not noted for their access times.

You can copy files to and from the floppy drive and any other valid memory volume installed within your *DMS1000* system. This includes NVR, Memory, and any other SCSI hard disk tape volume installed, whether internal or external.

You can use all of the standard commands under the `\FILE/` menu with the M12-FD, including:

\Load Setup File.../

\Save Setup File.../

\Save Setup File As.../

\Delete File.../

\Copy File.../

\Format >/

Accordingly, you may use your M12-FD for saving/loading set-ups, captured data, Macros, or any other file. You can also use the M12-FD for downloading the latest firmware update—just as the PMC can be used.

11.4.2 FDD MTR

You may even capture data directly to the floppy disk, although the MTR (Maximum Transfer Rate, i.e. "speed") is quite low compared to a hard drive. The average MTR to floppy disk is about 400 kHz (aggregate) when writing files that are less than or equal to 32 kB total, or 1.2 kB/sec when writing files that are larger than 32 kB total.

MTR is calculated the same way for floppy disks as it is for the hard disk drives. The key thing to keep in mind when reading about MTR's is that the file size mentioned is the total acquisition file size.

11.4.3 Three FDD Formats

The M12-FD accepts standard 3.5" floppy disks exactly like those used in regular desktop PCAT's, formatted either internally or via your PCAT to the standard 720 kB, 1.44 MB, and even the new 2.8 MB capacities.

There is no switch or selection for this—the M12-FD automatically senses the type of disk that you have installed and acts accordingly. There are different holes in the plastic body of the diskettes themselves that indicate to the *DMS1000* (and to your PCAT) which kind of diskette is inserted. Most readers are aware that 1.44 MB diskettes have an extra square hole that the older 720 kB diskettes lack.

If you have a diskette that has been formatted to the wrong capacity (like when you put tape over the square hole of the 1.44 MB diskette and then format it as if it were a 720 kB diskette), the *DMS1000* (and your PCAT, for that matter), could have trouble reading it. Always use the right kind of diskette.

When you format a diskette within the *DMS1000*, it will automatically be formatted to the correct capacity. There is no switch or selection that you have to make.

If you want to use the new 2.8 MB diskette format, you must purchase the correct kind of diskettes—1.44 MB diskettes will not work properly.

As stated, you can also use older 720 kB capacity diskettes.

11.4.4 Downloading New OS Code from the SCSI Floppy Disk Drive

If you have a 3.5" floppy diskette with the latest version of DMS1000 firmware on it, you may use your M12-FD FDD drive to update your DMS1000 firmware. First, your DMS1000 must have a functional version of firmware loaded (it is not possible to "boot" from a floppy disk).

Insert the disk and turn on the DMS1000. After it powers up it will prompt you about whether to download the new firmware from the diskette to FEPROM.

11.5 SCSI DAT Drives—Overview

The M12-EDAT acts just like any other memory volume within your *DMS1000* system, with the possible exception of speed—DAT drives are not noted for their access times. Also, the DMS1000 has to look for the equivalent of the FAT (File Allocation Table) from time to time, which is time consuming compared to a disk drive.

Remember that tape is a sequential access device—there is no random access as there is with disk media. If you want to replay a file that is at the end of the tape, you are going to have to wait a few minutes while the drive physically winds the tape forward or backward and locates the file.

You can copy files to and from the DAT drive and any other valid memory volume installed within your *DMS1000* system. This includes NVR, Memory, and any other SCSI hard disk tape volume installed, whether internal or external.

You can use all of the standard file handling commands under the `\FILE/` menu with the M12-DAT, including:

\Delete File.../

\Copy File.../

\Format >/

Although its primary purpose is to store captured data files, you may also use your M12-DAT to archive set-ups and macros which can later be copied back to the NVR or PMC volumes for immediate access. This is not recommended for normal use, however, because of the slow access time associated with tape media.

You may capture data directly to the DAT tape. Capturing to DAT tape, while slower than writing to RAM or disk media, have the advantage of capacity—GB's per tape. So you can record to it for a long period of time.

Some users like to capture smaller files to MEMORY or HARD DISK, then copy the file(s) to DAT tape for archival.

11.5.1 DAT Data Format

DMS1000 DAT drives accept standard DAT tapes, but the data is written to them in a unique manner. The data does not conform to any "standard," so tapes recorded on other devices cannot be replayed within the *DMS1000*. Tapes recorded by the *DMS1000* can only be replayed within another *DMS1000*.

Because tape is a sequential medium, we must write to it differently than we write to a hard disk. Therefore, if you capture data to the DAT tape to begin with, you cannot later copy it to the disk and replay it. The reason is simple: the *DMS1000* treats data on disk and DAT tape differently. It is simple: if you captured data to DAT and want to replay it, you must replay it from the DAT.

Because the *DMS1000* writes data differently to memory/SCSI and to DAT: if you capture to memory and then copy the file to SCSI, you must copy the file back to memory before replaying it.

We recommend using certified tapes. These are more expensive, but have been thoroughly tested and are certified not to have drop-outs which could adversely affect data integrity.

As with other SCSI disk volumes, the *DMS1000* has access to any files contained within the root directory of the tape. There is no capability to create, read from or write to sub directories on tape. This is also true of hard and floppy disk drives.

11.5.2 Formatting DAT Tapes

You can format your DAT tapes from the *DMS1000* just like you can format hard and floppy disks. From the \FILE/ menu, select \Format >/. When you press <ENTER> and a DAT tape is inserted, you will be able to select the SCSI DAT drive for formatting. When you format a PMC, the NVR, a floppy diskette, or a hard disk, they are wiped completely clean—all data are overwritten completely.

However, this could take hours with a DAT tape drive, so all that really happens when you format a DAT tape is that the tape is rewound, and then a short file management message is written at the beginning of the tape. The data are not really erased, but the space that they occupy is "free," and as far as the *DMS1000* is concerned, it is blank.

11.5.3 Deleting Files

Because tape is a sequential medium, you cannot delete files with the freedom enjoyed when working with non-sequential media like hard and floppy disks.

If the file that you want to delete happens to be the last one on the tape, then it can be deleted and the space reclaimed. No file other than the last one can be deleted.

If, when scanning the tape the *DMS1000* finds two files with the same file name, it will assume that the one closer to the end of the tape is the more recent one, and it will treat the other file as if it wasn't there.

11.5.4 DAT Capacity

The *DMS1000*'s DAT drives contain circuitry and intelligence for automatic data compression. This is fairly standard on DAT drives used for instrumentation applications. This is a dynamic process and is more or less effective depending on the character of the data and number of channels.

The absolute smallest amount of data possible if you fill a DAT tape up is 2 GB (yes, that's 2,000,000,000 bytes). Of course, you don;t have to fill up the tape with a single acquisition—you can freely select the file size just as you can when capturing data to disk. The big difference, of course, is that the maximum file size can be so much larger on DAT tape.

However, under the best of possible circumstances, the absolute most data that you could fit on a DAT tape is 8 GB (8,000,000 bytes).

Most *DMS1000* users will find that their average capacity per tape ranges somewhere between 2 and 4 GB.

As mentioned above, we strongly recommend that certified DAT tapes be used. Despite their higher cost, they are certified against data dropouts.

11.5.5 Using a DAT Drive

Upon power-up of the *DMS1000*, if a tape is inserted in the drive, it will be scanned to find all of the available files. This operation is rather slow (the nature of tape), and is even slower when the tape contains many files. An average amount of time is 3 minutes, but this can vary.

If there is no tape installed upon power-up, then this process is skipped. However, if a tape is inserted later, or one tape is ejected and another is inserted, when you next access a "File" dialog box, the scanning procedure will have to occur at that time.

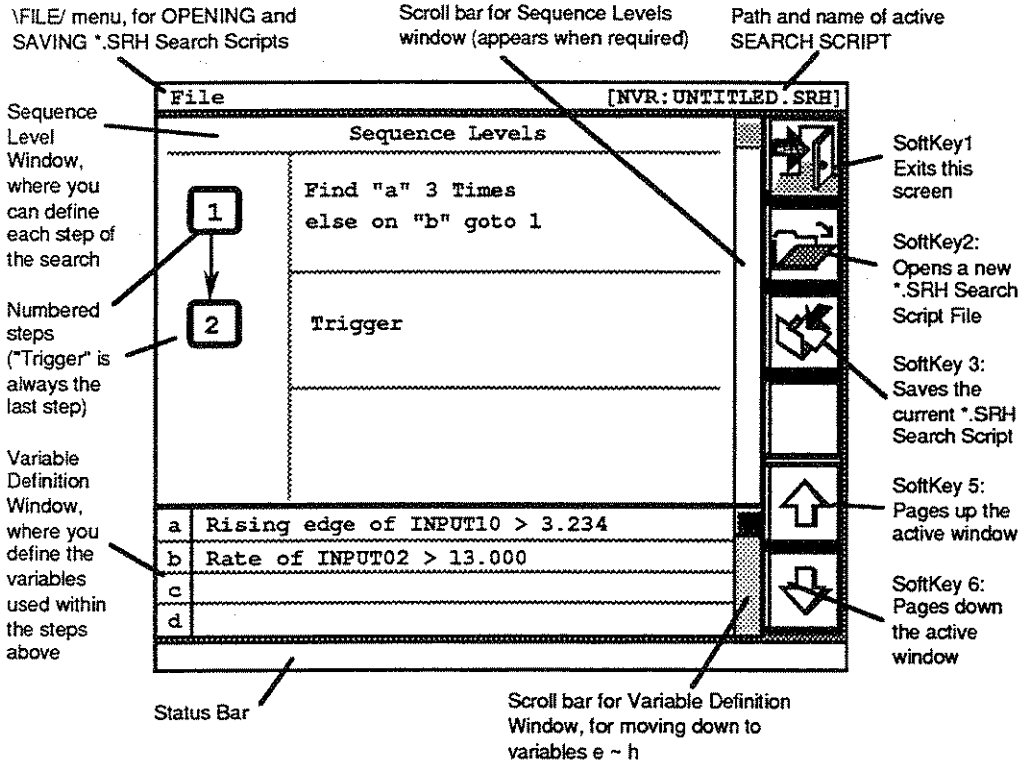
There is simply no avoiding this scanning process: the *DMS1000* has to know what files are on the tape and their locations for a variety of reasons. This also occurs with disk drives, but they are so fast in comparison that the small delay is hardly noticeable.

Aside from the relatively long time that it takes to read the directory, a tape drive acts just like a hard disk drive from the operator's point of view. You can store multiple files on each tape. There is no limitation of 512 as there is with DOS-formatted hard and floppy disk drives—the only limitation is how much tape there is left.

Section 12 Search Scripts

Search Scripts are an optional firmware capability. With Search Scripts, you can easily program powerful Boolean expressions used to search through captured data files and locate areas of interest. Due to the graphical editing screens, an in-depth knowledge of Boolean algebra is not required—just a little analytical thinking.

You may use the rising or falling edge, plus or minus level, or the rate of change (dV/dT) of any input contained within the data file within your Search Scripts. Since interchannel event markers are always captured with the data, you may also incorporate the "truth" (high/low state) of them within your Search Scripts.



The Search Script Screen

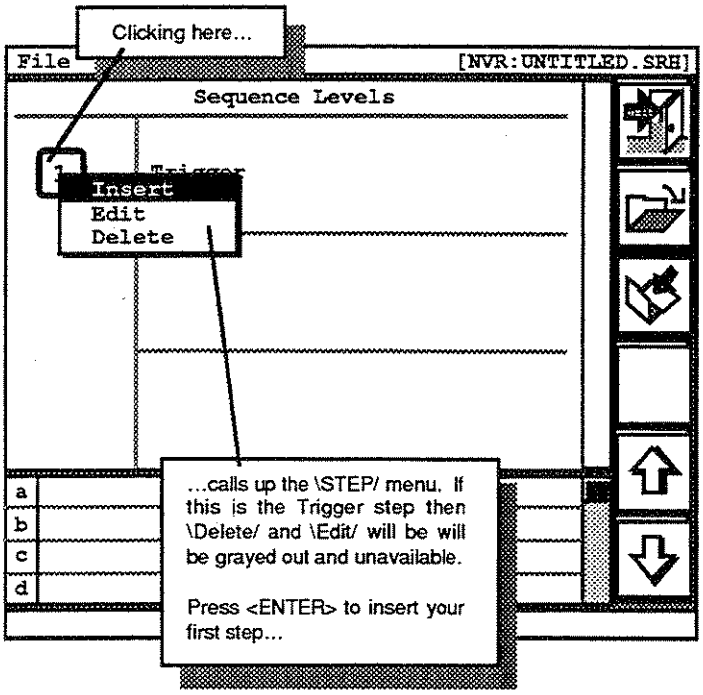
12.1 How Search Scripts Work

You must have the Search Script option installed within your DMS1000. Search Script firmware is compatible with v7.0 and higher. Consult your DMS1000 Sales and Service representative for information about how to order and install this option.

The -SEARCH SCRIPT- screen is accessed from the -REPLAY- screen. You must have already captured a data file that you wish to search through. Search Scripts can only "look" at inputs that are actually contained within your data file, therefore it is necessary to capture a file and OPEN it on the -REPLAY- screen before attempting to create a Search Script to examine it.

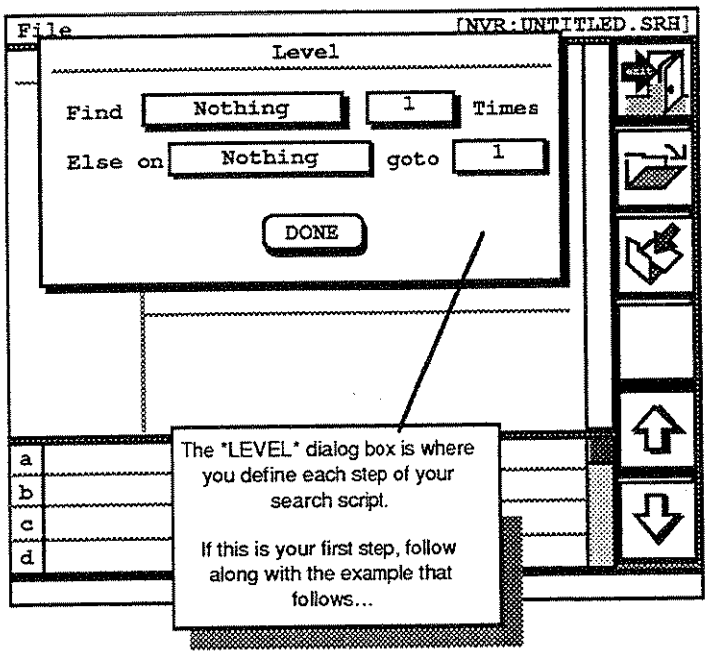
From the -REPLAY- screen, press the {EDIT} softKey (the bottom one). The Search Script screen will open. In the following pages we will learn how to create and edit a Search Script. But for the moment let's assume that we have done this. At that point you would press the {DONE} softKey at the top of the -SEARCH SCRIPT- screen, and return to the -REPLAY- screen. The Search Script is loaded into memory. Each time you press the {FIND} SoftKey (second from the bottom, with the binoculars icon), the Search Script will be applied to the captured data file, starting from the X cursor. If a "true" or "trigger" location is found, the DMS1000 will beep, the status bar will indicate "TRIGGER FOUND AT xxx ms", and the X cursor will be moved to that location. Keep pressing {FIND} until the status bar says "NO TRIGGER FOUND," indicating that all of the locations to the right of the X cursor that meet the Search Script criteria have been found.

12.2 Creating/Editing Search Scripts



Editing a Blank Search Script

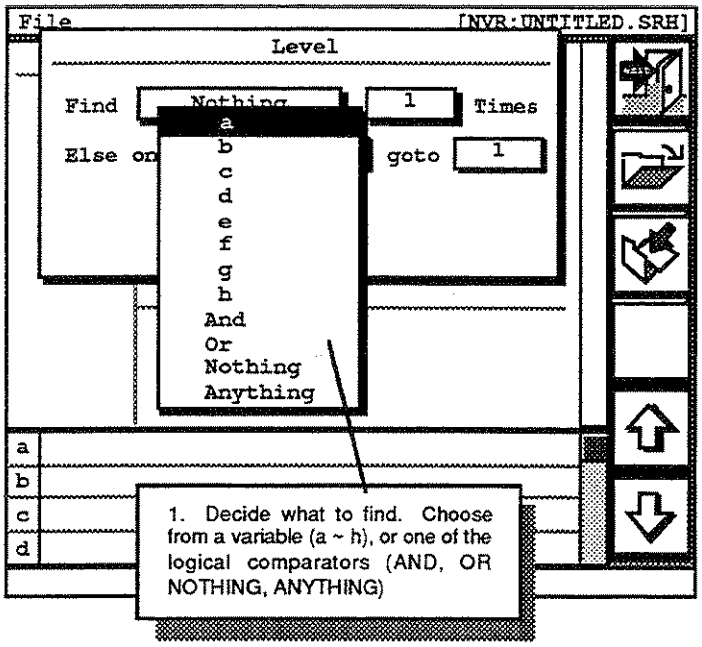
12.3 The Level Dialog Box



Setting the LEVEL

When you select a sequence number and press <ENTER>, you will see th *LEVEL* dialog box. Here is where you can define what this sequence wi search for. As you can see, this control actually provides "branching" capabilit Simply put, this means that you can also determine what happens if the conditio set in the first two fields does not occur. The "branching" path is set in the [ELS ON] and the second [GOTO] field.

12.4 Setting the Variable to FIND



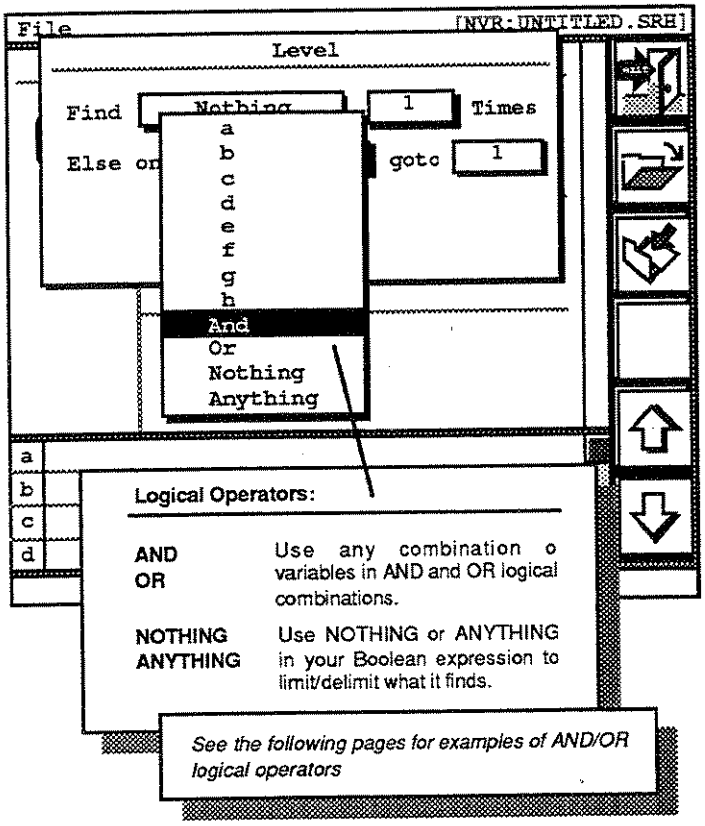
Deciding What to Find...

Choose from among the variables a ~ h, or the four logical operators at the bottom of the list.

If you choose one of the letter variables, we will see later how to set the value of each variable. Each variable can be set to the real or user units of one of the input channels. You can also choose to monitor to true/false condition of the even marker of any input (remember that interchannel event markers are also saved when you capture data!).

Or, see the next steps for how to use the logical operators.

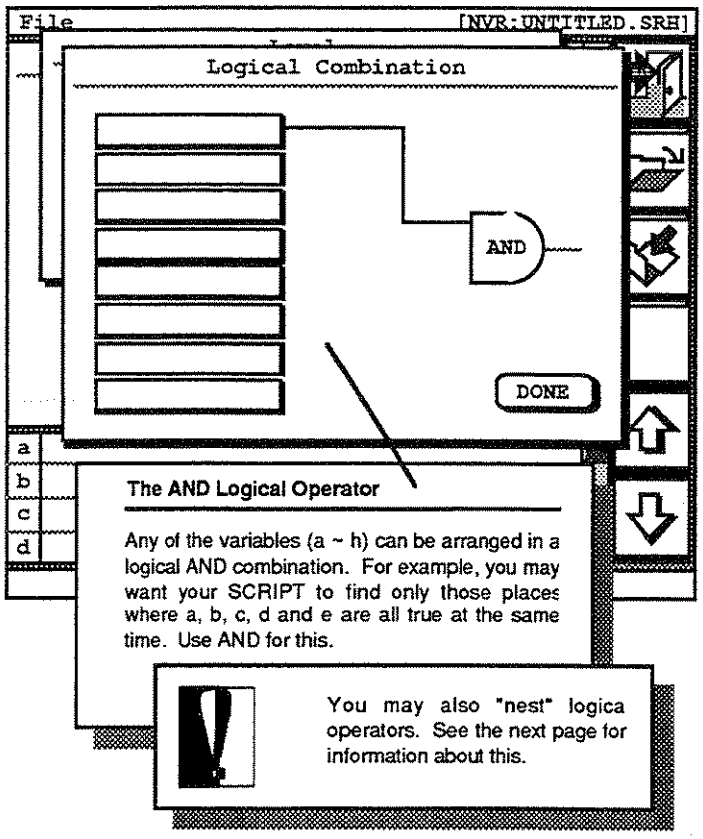
12.5 Logical Operators



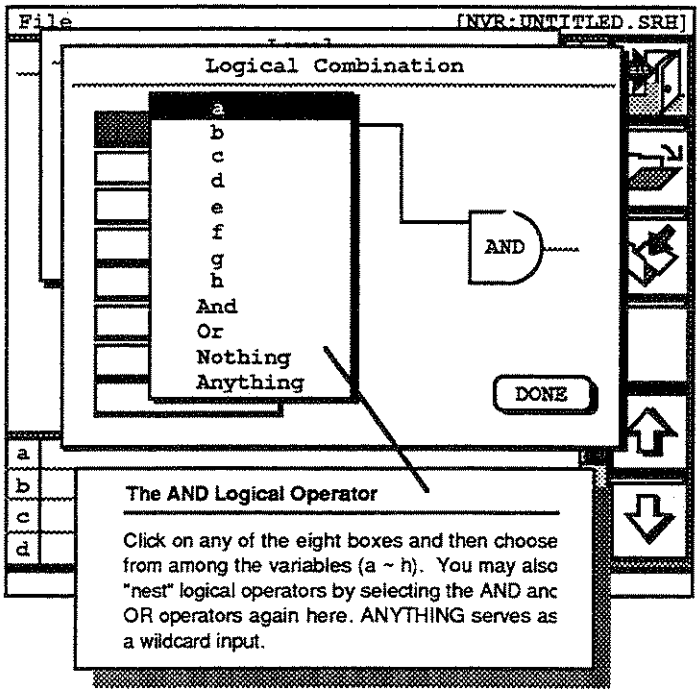
Choosing a Logical Operator

In the next pages we will review the operation of each of the logical operator available on this menu.

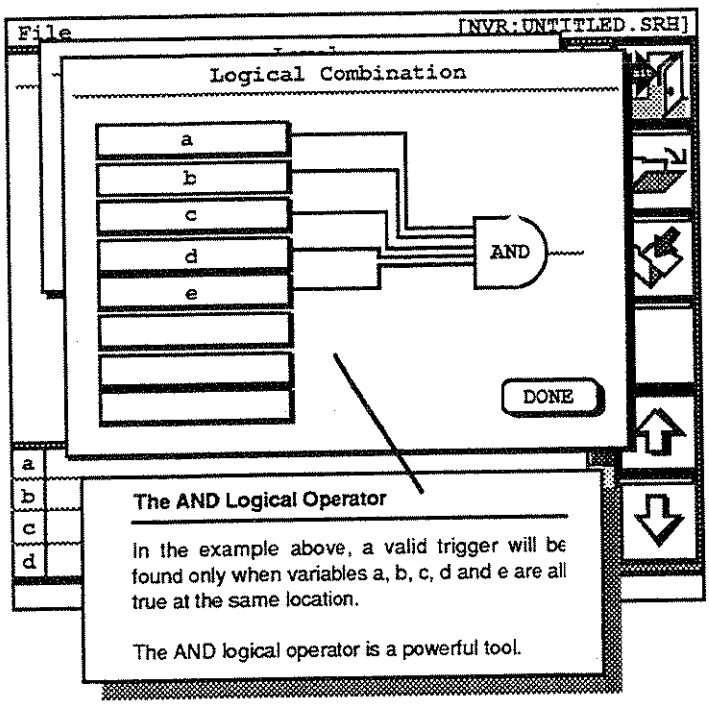
12.5.1 The AND Logical Operator



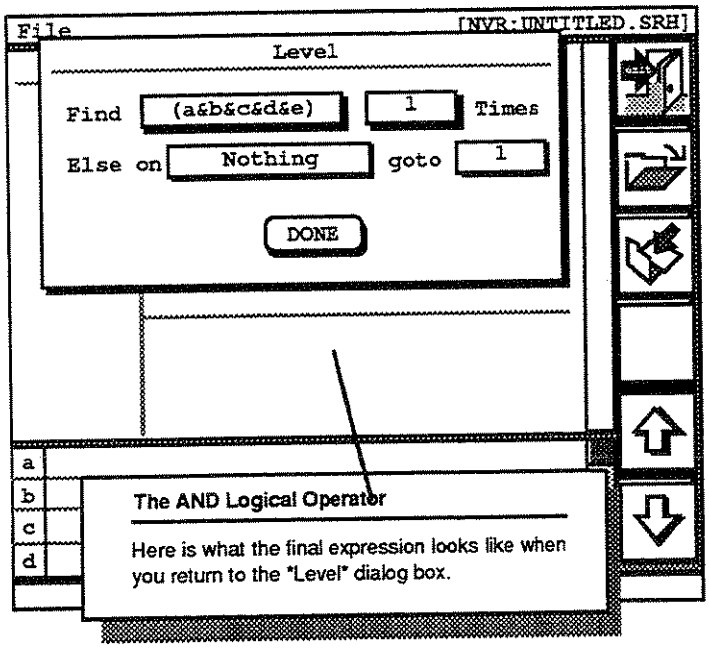
Using the AND Logical Operator



Using the AND Logical Operator

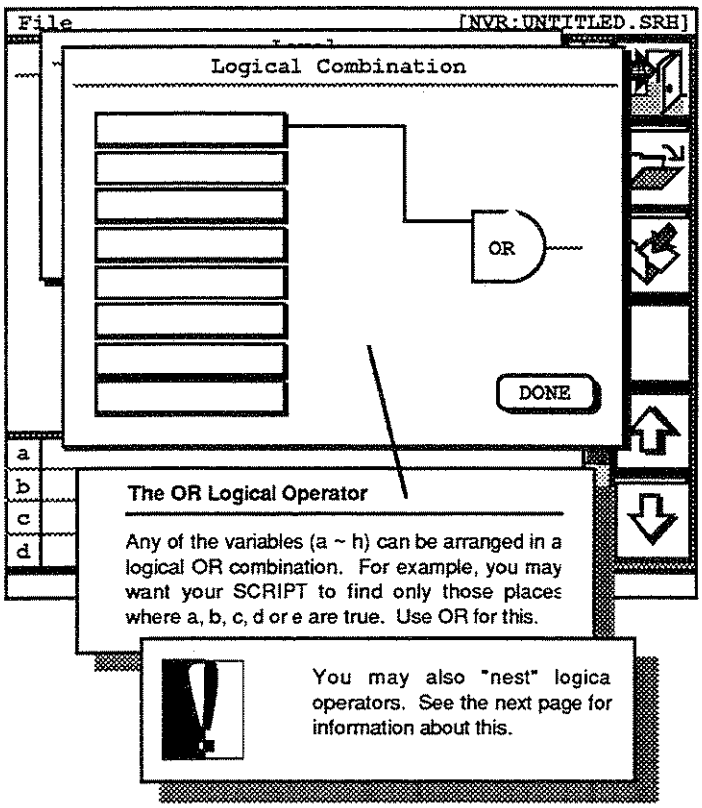


The AND Logical Operator, Ready to Go



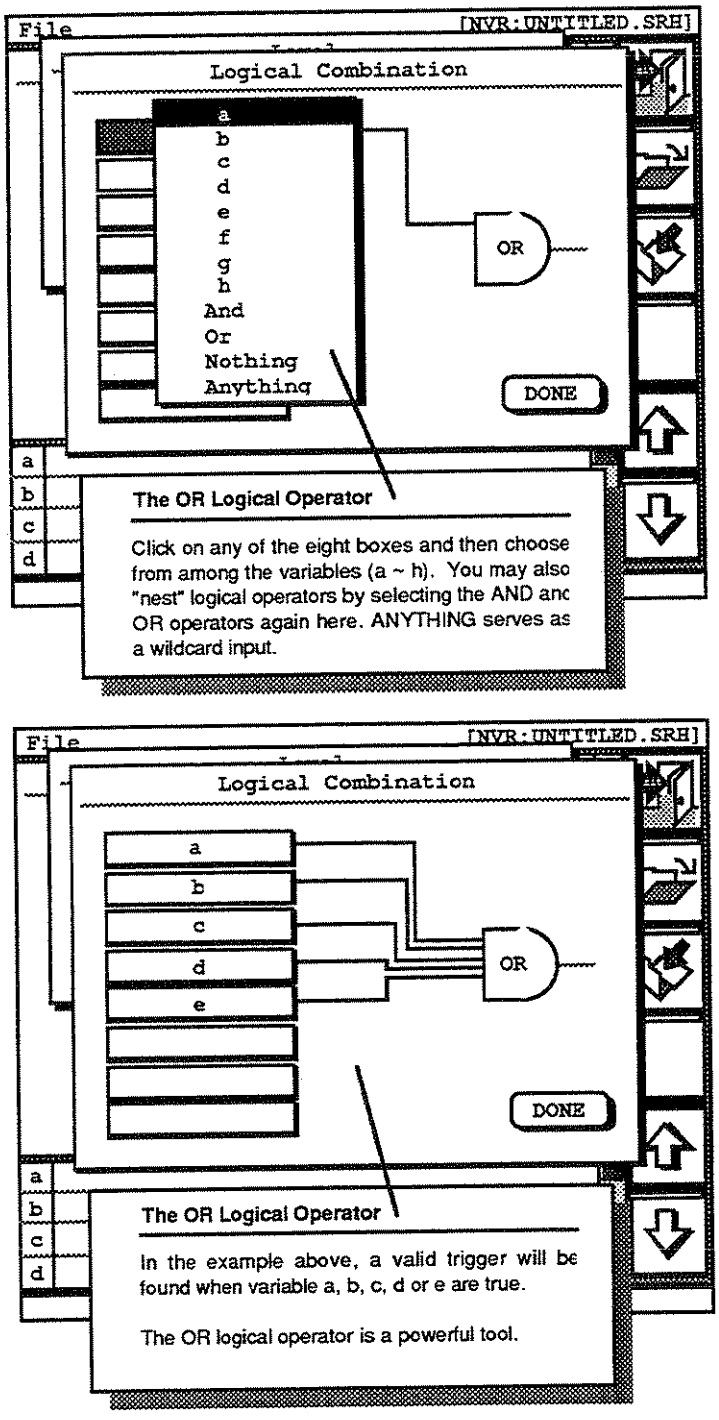
Completed AND Expression

12.5.2 The OR Logical Operator



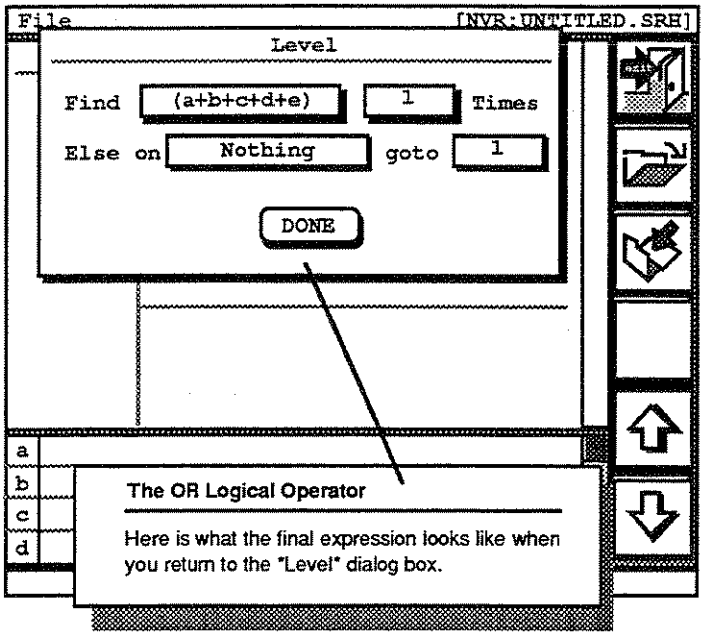
The OR Logical Operator

This operator is very similar to the AND operator described in the previous paragraph. The obvious difference, however, is that when ANY of the variables are true, then this step at the sequence will be evaluated as true. When using AND, on the other hand, ALL of the variables must be true at the same point in time before this step at the sequence will be evaluated as true.



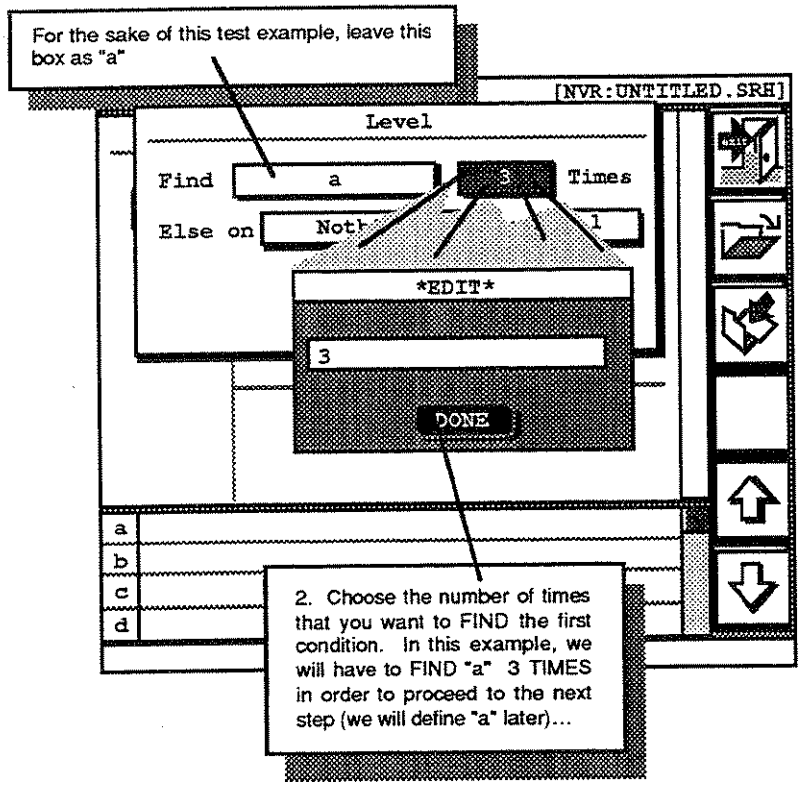
Using the OR Logical Operator

12.5.2 The OR Logical Operator, continued



Completed OR Expression

12.6 FIND Number of TIMES



Tell the Sequencer the Number of Times...

Let's say that you want to find the place in your capture data file where the signa was above or below some level for a certain length of time.

Presumably, you know the sample rate that was used when this file wa captured. If you don't remember what it was, you can always save your wor here, and then exit back to the -REPLAY- screen for a moment and check it out.

Knowing the sample rate, you can easily calculate the inverse, which is th sample interval. For example, a 1 kHz sample rate indicates a sample interval o 1 ms.

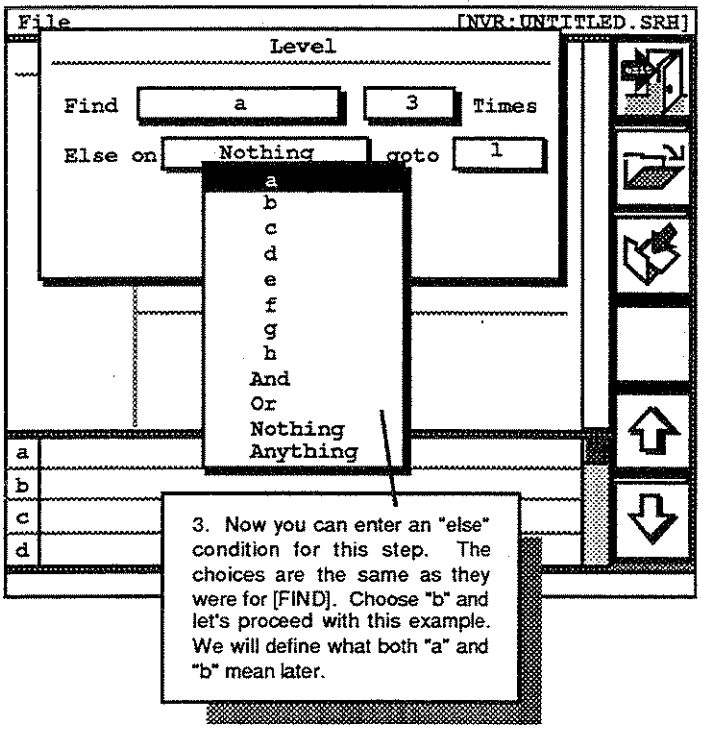
Let's say that your capture data file was sampled at 1 kHz. Let us also assum that you wish to find the place in the data where input channel 01 exceeded 1. Volts for at least one second.

This is where the [TIMES] field comes into play. Simply enter a value of "1000" i this field, and the sequencer will wait until the variable that you defined to its le has been true for at least 1000 times in a row.

Remember:

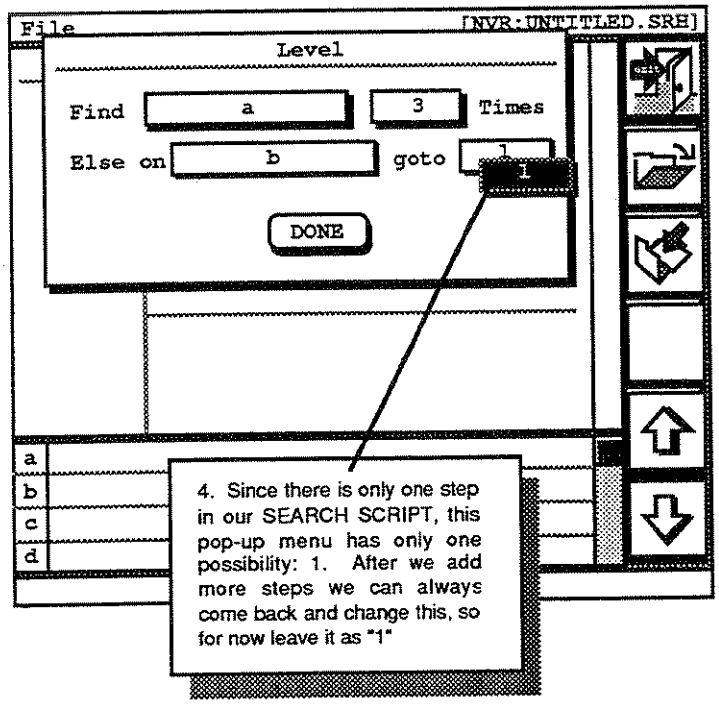
- *Because in this example your sample interval was 1 ms, 1000 samples in a ro represents one second of real-time!*

12.7 Using ELSE ON



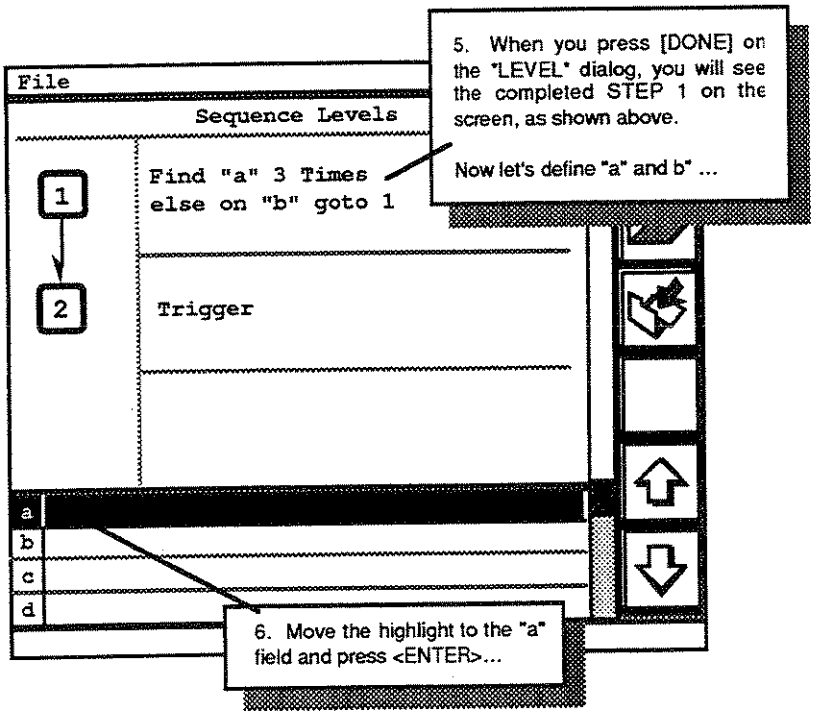
Using the [ELSE ON] field

As stated earlier, the [ELSE ON] field allows you to allow this step in the sequence to act as a "bridge" within your search script. In other words, you can determine what will happen if the top-most [FIND]/[TIMES] expression is evaluated to be false.



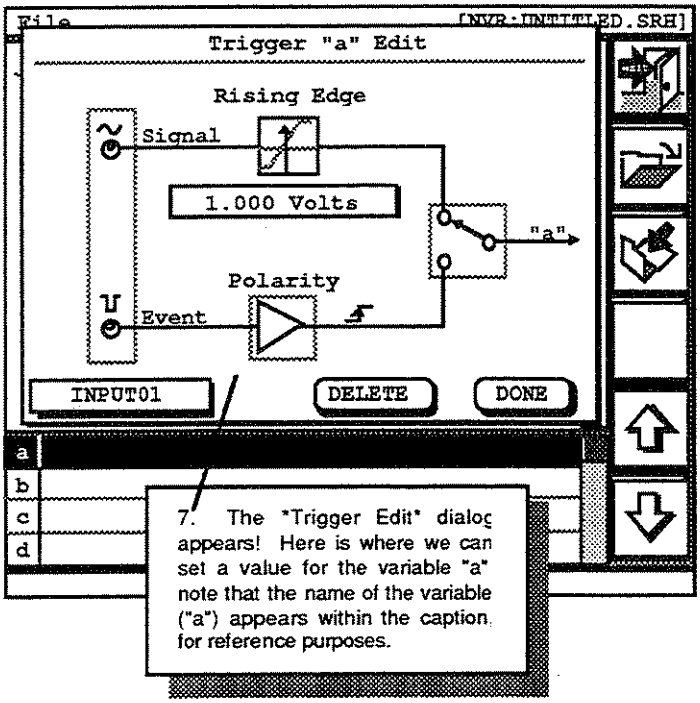
Setting the Number of Times for ELSE ON

Set the number of times that the [ELSE ON] field will be evaluated, just as you did for the top-most [FIND] field.



Completed Sequence Step

12.8 Defining the Variables

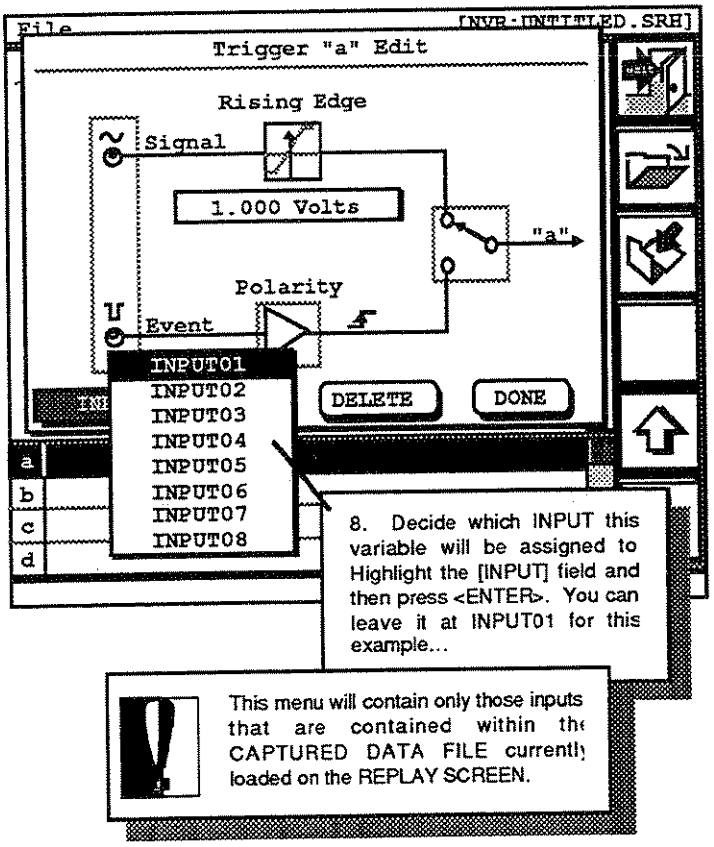


You Can Define Each Variable Separately

Move the highlight to any of the variable fields along the bottom of the screen, and press <ENTER>. This will call up the *TRIGGER (Variable) EDIT* dialog box.

Note: *You cannot define variables that are not called for within at least one of the sequence steps, above.*

12.8.1 Selecting an INPUT



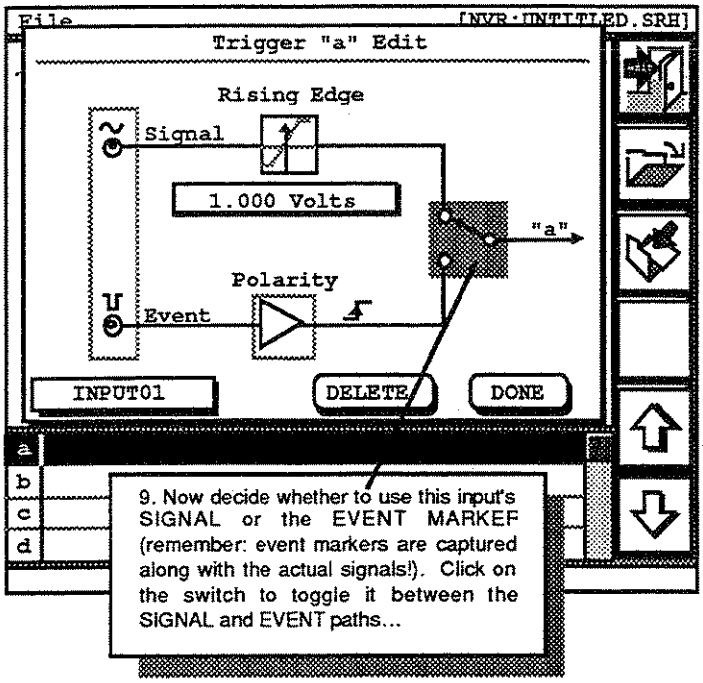
Selecting an INPUT

Any of the inputs can be assigned to this variable letter. Move the highlight to the [INPUT] field and press <ENTER>. Now, select from the menu, and press <ENTER> again.

Note: *Here's a question that we hear a lot: "My Mark 12 has 24 inputs, but they are not always shown when I select this menu. Why not?"*

Answer: Remember that a Search Script is created expressly for a particular capture data file. That is why you must first load a file on the -REPLAY- screen before coming to the Search Script screen. The Search Script engine needs to know which inputs are contained within the capture data file, and what their settings are! Therefore, only those input channels that were ACTUALLY CAPTURED within the file currently loaded on the -REPLAY- screen can be used within your script.

12.8.2 Searching By WAVEFORM or EVENT MARKER



Toggling Between WAVEFORM and EVENT MARKER

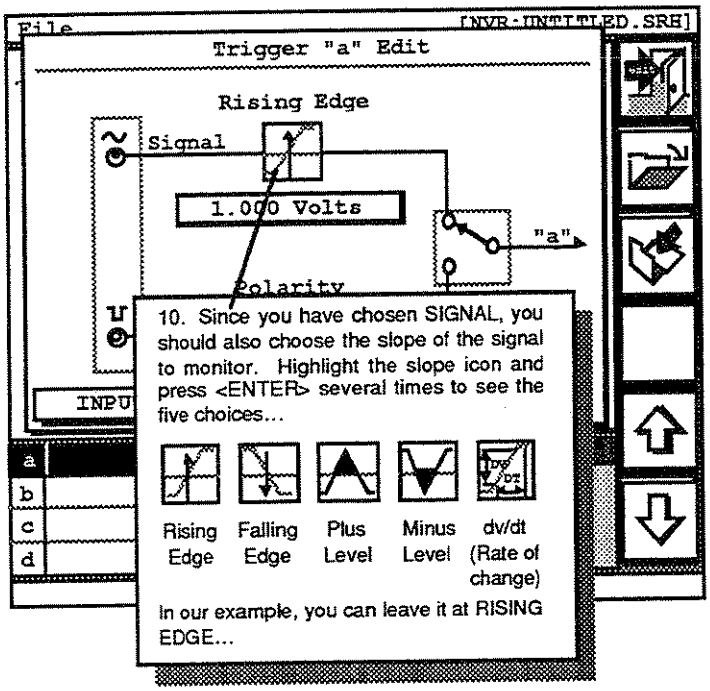
Move the highlight to the TOGGLE icon. Each time that you press <ENTER>, the switch will toggle up or down. When it is pointing down, the EVENT MARKER from this input will be used as the trigger source of this variable. When it is pointing up, the value of this input's WAVEFORM will be used.

A "waveform" can have a continuously variable amplitude and frequency.

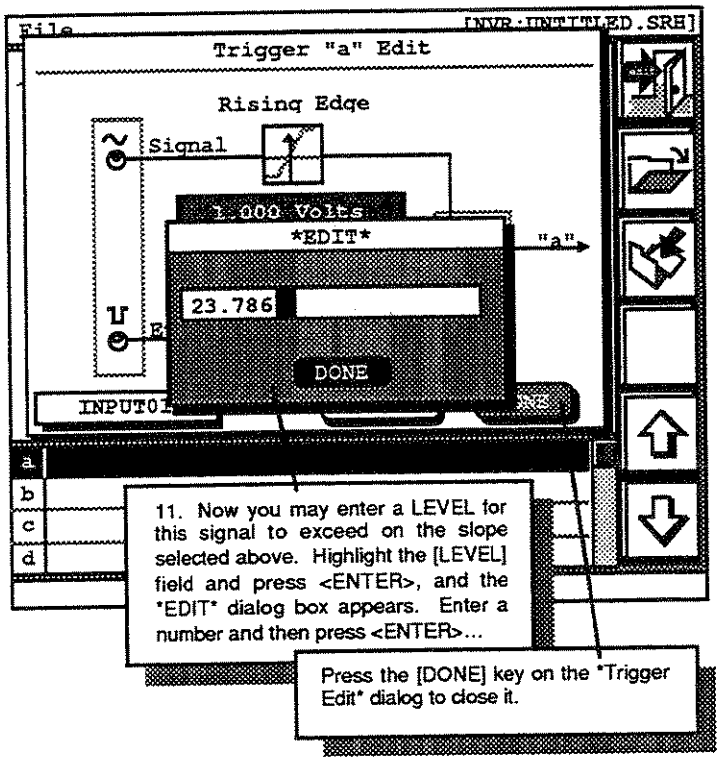
An "event marker" is a logic input: it has only two states—TRUE and FALSE. The condition of the event marker is therefore known as its TRUTH.

See the next pages to learn how to set the WAVEFORM LEVEL, or the EVENT MARKER's TRUTH

12.8.3 Setting the Waveform Slope/Level

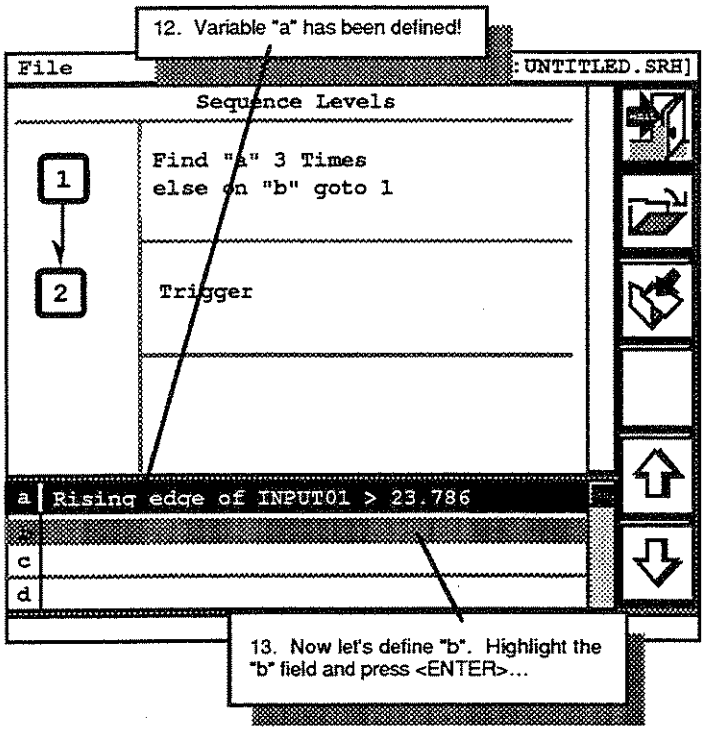


Choosing a Slope...

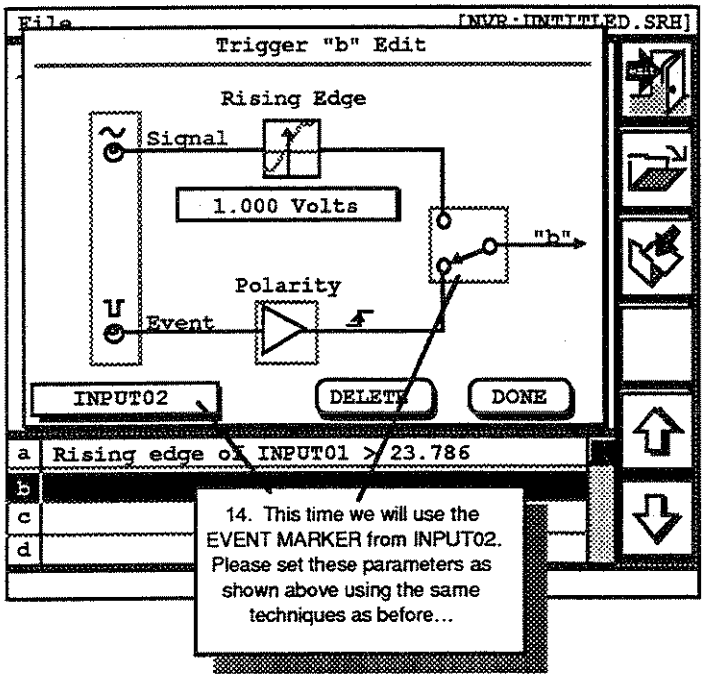


...and a Level

12.8.4 Defining the Next Variable

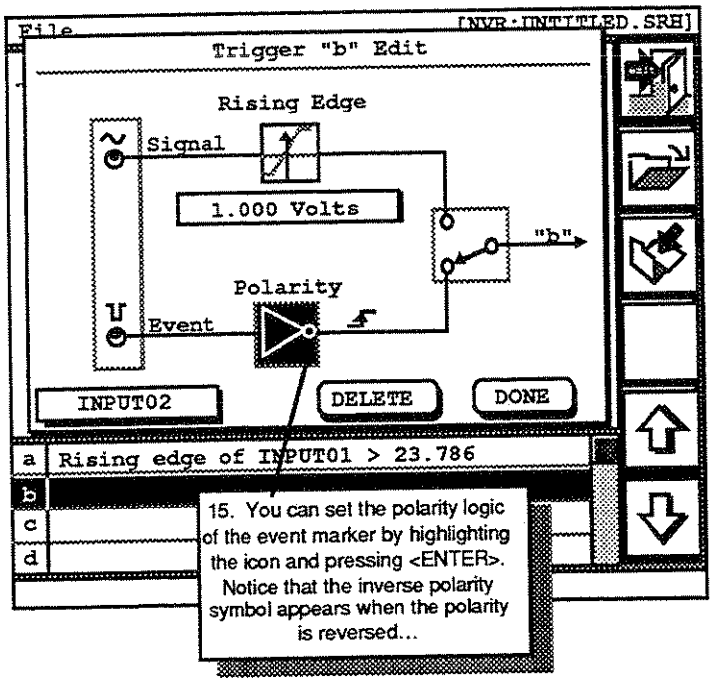


Defining the "B" Variable...

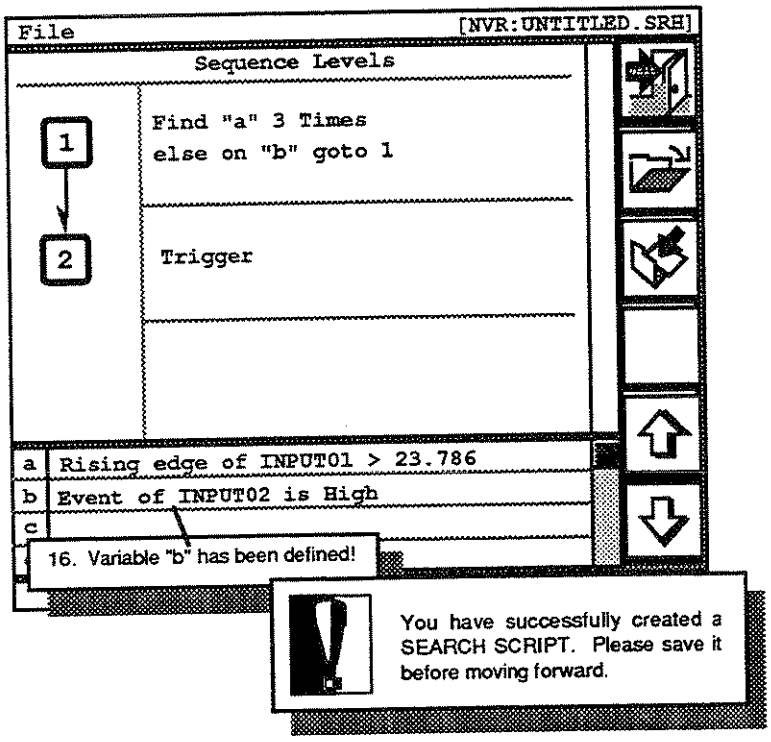


Using the EVENT MARKER as the Trigger

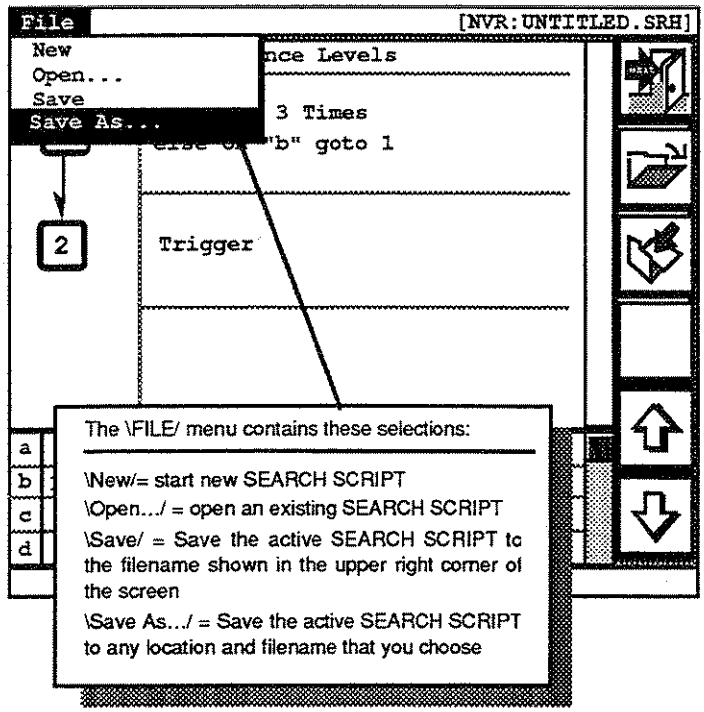
12.8.5 Setting the EVENT MARKER Polarity



Setting the EVENT MARKER Polarity



12.9 The FILE Menu

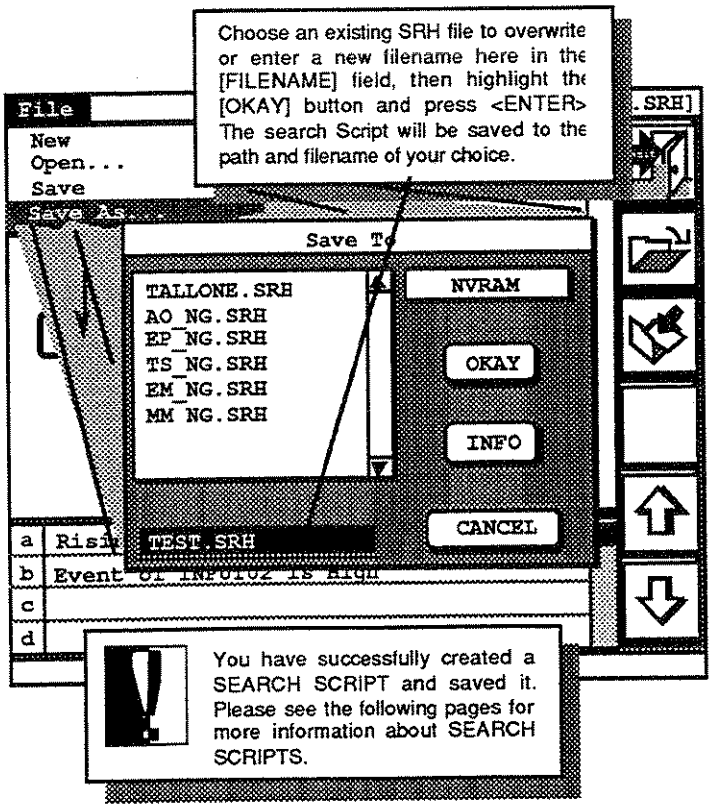


The \FILE/ Menu

Before doing anything else you should SAVE your search script. You do this using the menu items under the \FILE/ menu.

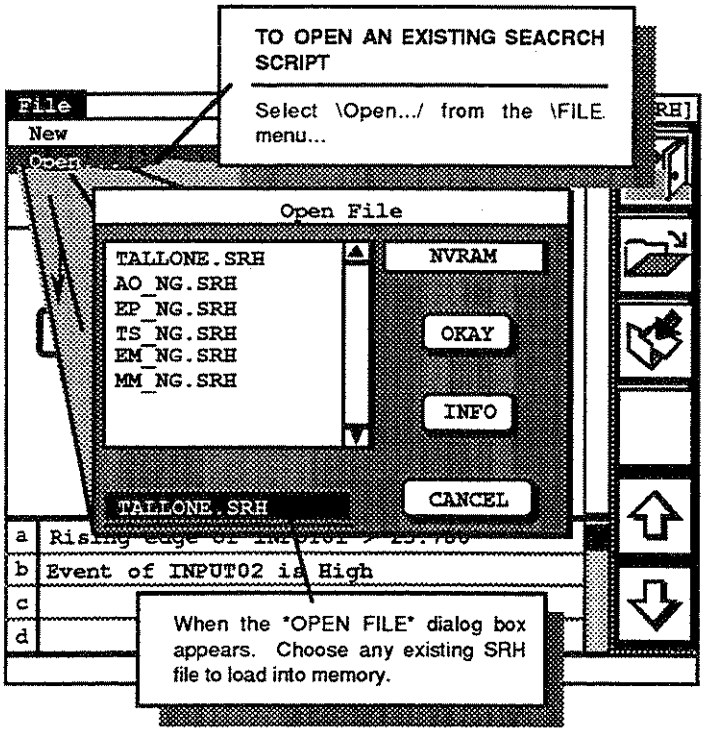
Note: *Since the search script currently in progress has never been saved before, if you simply choose \Save/, or press the {Save} softKey (the file folder with the document going into it), then it may be saved under a default filename, like UNTITLED.SRH. To prevent this from happening, use the \Save As.../ menu item. Once this search script has been given a name, you can use the \Save/ and {SAVE} methods to save it.*

12.9.1 Using \Save As.../



Use \Save As.../ the First Time that You Save a New Search Script

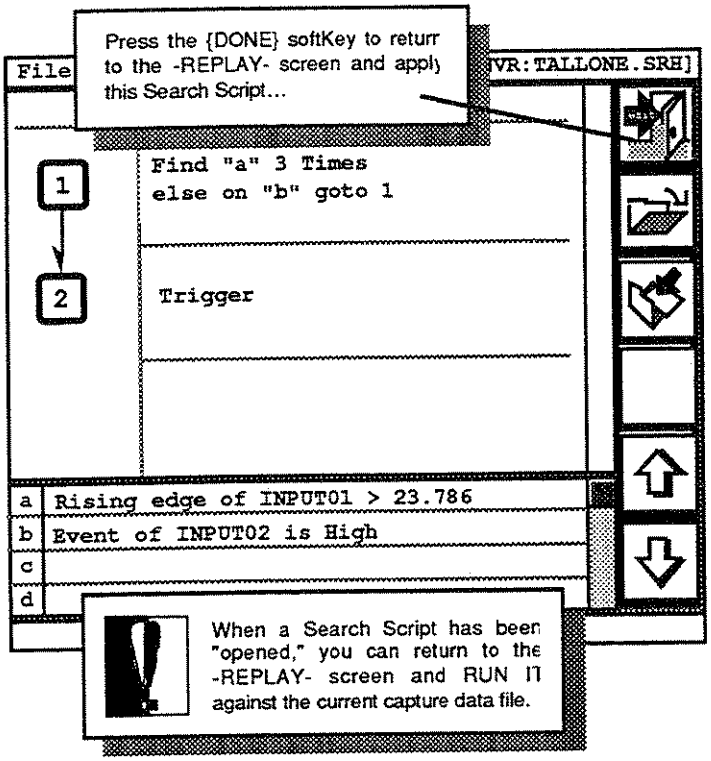
12.9.2 Using \Open.../



Opening an Existing Search Script

Note: Remember that each script applies to a particular capture data file. If your capture setup parameters are the same all of the time, however, you can apply one script to many files. Please use caution to ensure that the search script that you load and attempt to apply to a capture data file is suitable.

12.10 Applying Your Search Script



Returning to the -REPLAY- Screen

Now that your script has been saved, you are ready to apply it to the capture dat file! To do so, simply leave this screen by pressing the {EXIT/DONE} softke (always the top-most softKey). When you do so, this search script will b retained in memory, and will be available for you to apply on the -REPLAY screen.

When you return to the -REPLAY- screen, you will notice that the {SEARCH softKey (the pair of binoculars) is dark and enabled. This indicates that a searc script is loaded and ready to be applied.

Move the x cursor to the place in the file where you want to start searching. I you want the system to search the entire file, move the x cursor all the way to th beginning of the file (as far to the left as it will go).

Press {SEARCH} (the binoculars). If a valid location is found, the system wi issue an audible BEEP, and the x cursor will be moved to the "trigger" locatior Each time that you press {SEARCH}, this will happen again, until at last, no mor trigger locations can be found.

This process is shown in more detail in the Section entitled "The Replay Screen, but is summarized here for your convenience.

12.11 Search Script Screen: Alphabetical Reference

Conventions:

\MENU/
\Menu Item/
\\Submenu Item//
{SoftKey}
[Screen Button/Field]
<Front Panel Key>
"caption/something printed on the screen"

[a] ~ [h]

Fields on -SEARCH SCRIPT- screen

Each field from [a] ~ [h] can be defined as a variable within any of the steps. When a variable has been defined, it is shown within the field, otherwise, it is blank.

\And/

Menu Item under \FIND/ and \ELSE ON/ menus, on -SEARCH SCRIPT- screen

Logical Operator. Used when you wish to force more than one variable to be evaluated as TRUE at the same time before the general expression will be evaluated as true.

\Anything/

Menu Item under \FIND/ and \ELSE ON/ menus, on -SEARCH SCRIPT- screen

Logical Operator. Used when you wish to force a step to be evaluated as TRUE regardless of anything else.

\Delete/

Menu Item under \STEP/ menu, on -SEARCH SCRIPT- screen

Deletes the currently selected sequence step. Note: there is no "undo" capability—do not select this menu item unless you really mean it!

[DELETE]

*Field on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Deletes the currently selected variable definition, and closes the dialog box. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

[DONE]

Button on various dialog boxes, on -SEARCH SCRIPT- screen

General button that closes the dialog box on which it appears. Done can also be the last item in a menu. In this case, it closes the menu.

"dv/dt" 

*Slope Field Selection on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Rate of Change. Selectable from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

\Edit/

Menu Item under \STEP/ menu, on -SEARCH SCRIPT- screen

Allows you to edit the sequence step at the current location, by calling up the *LEVEL* dialog box.

[ELSE ON]

*Field on *LEVEL* dialog box, on -SEARCH SCRIPT- screen*

Where you select the variable letter (a ~ h), or one or four logical operators, to be found if the initial FIND variable is not found at this sequence step. See also the [FIND], [TIMES], and [GOTO] fields.

"Event Marker"

*Label on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Labels the waveform part of the selected INPUT as being the trigger source.

{Exit} 

SoftKey 4 on -SEARCH SCRIPT- screen

Exits from this screen and returns to the -REPLAY- screen.

"Falling Edge" 

*Slope Field Selection on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Selectable from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY] [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

\FILE/

Menu on -SEARCH SCRIPT- screen

Basic file management menu contains these menu items: \New.../, \Open.../, \Save/, and \Save As.../.

[FIND]

*Field on *LEVEL* dialog box, on -SEARCH SCRIPT- screen*

Where you select the variable letter (a ~ h), or one or four logical operators, to be found at this sequence step. See also the [TIMES], [ELSE ON], and [GOTO] fields.

[GOTO]

*Field on *LEVEL* dialog box, on -SEARCH SCRIPT- screen*

The sequence step that the sequencer will move to when the ELSE IF condition is met. See also the [FIND], [TIMES], and [ELSE IF] fields.

[INPUT]

*Field on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Selects and INPUT CHANNEL to use for the currently selected variable definition, and closes the dialog box. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

\Insert/

Menu Item under \STEP/ menu, on -SEARCH SCRIPT- screen

Inserts a new sequence step at the current location.

LEVEL

Dialog Box on -SEARCH SCRIPT- screen

Dialog box where each sequence step is configured. See also the [FIND], [TIMES], [ELSE ON], and [GOTO] fields.

[LEVEL]

*Field on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Sets the trigger level of the currently selected INPUT CHANNEL. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], "Signal", "Event."

Logical Combination

*Sub-dialog Box of *LEVEL* dialog box, on -SEARCH SCRIPT- screen*

Where you configure the AND and OR logical combinations of variables for a particular sequence step.

"Minus Level" 

*Slope Field Selection on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Selectable from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

\New/

Menu Item under \FILE/ menu, on -SEARCH SCRIPT- screen

Creates a new, blank search script. Erases the current search script, so make sure that you have saved your work before selecting this menu item.

\Nothing/

Menu Item under \FIND/ and \ELSE ON/ menus, on -SEARCH SCRIPT- screen

Logical Operator. Used when you want the search script engine to ignore a step. The default setting of the [ELSE ON] field is "Nothing."

{Open} 

SoftKey 2 on -SEARCH SCRIPT- screen

\Open.../

Menu Item under \FILE/ menu, on -SEARCH SCRIPT- screen

Opens an existing search script.

\Or/

Menu Item under \FIND/ and \ELSE ON/ menus, on -SEARCH SCRIPT- screen

Logical Operator. Used when you wish to allow a general expression to be evaluated as TRUE whenever any one of a group of variables are evaluated as TRUE.

"Plus Level" 

*Slope Field Selection on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Selectable from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

[POLARITY] 

*Field on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Toggles the polarity "TRUTH" of the currently selected EVENT MARKER. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

"Rising Edge" 

*Slope Field Selection on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

Selectable from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

{Save} 

SoftKey 3 on -SEARCH SCRIPT- screen

\Save/

Menu Item under \FILE/ menu, on -SEARCH SCRIPT- screen

Saves the currently loaded search script.

\Save As.../

Menu Item under \FILE/ menu, on -SEARCH SCRIPT- screen

Saves the currently loaded search script after allowing you to select an existing filename or input a new one. You may also set the PATH to which the file will be saved.

"Signal"

*Label on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

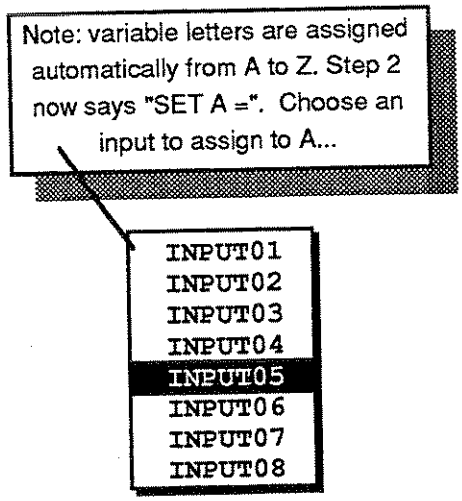
Labels the waveform part of the selected INPUT as being the trigger source.

[SLOPE]

*Field on *Trigger "(a ~ h)" Edit* dialog box, on -SEARCH SCRIPT- screen*

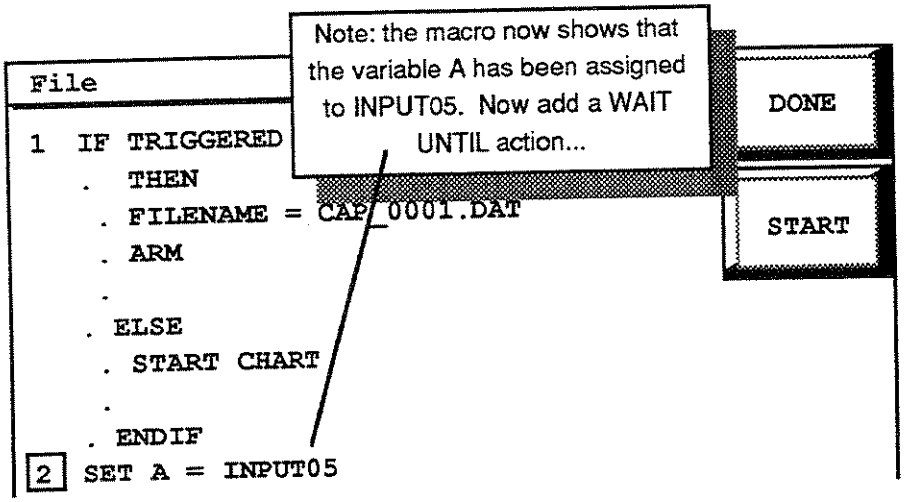
Where you select the slope, from among five choices: Rising Edge, Falling Edge, Plus Level, Minus Level, and dv/dt. See also: [INPUT], [POLARITY], [DELETE], [TOGGLE], [LEVEL], "Signal", "Event."

13.6 The INPUTS Pop-up Menu



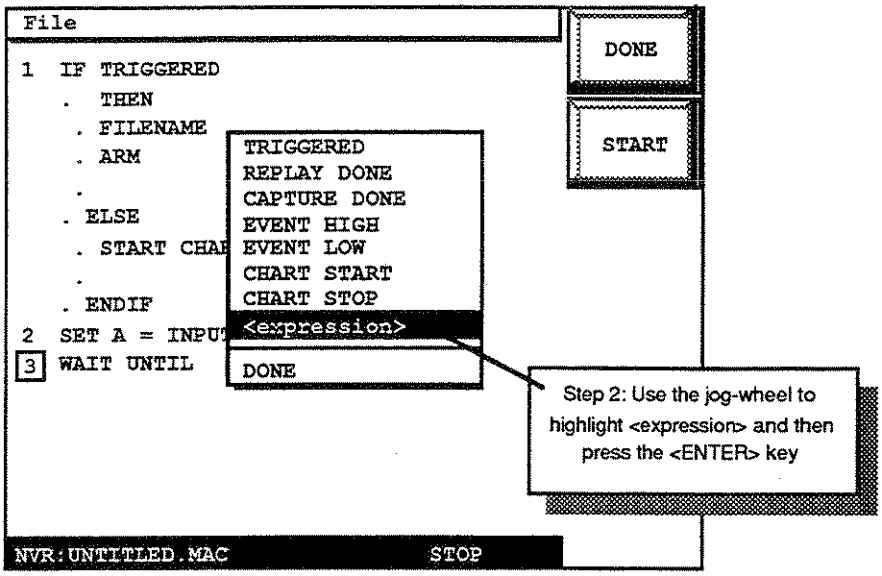
*Macro screen and *INPUTS* Pop-up menu*

The ARGUMENT to the SET VARIABLE ACTION is the INPUT that you wish monitor. A menu containing all installed inputs appears. Select one.



Macro screen after selecting an INPUT

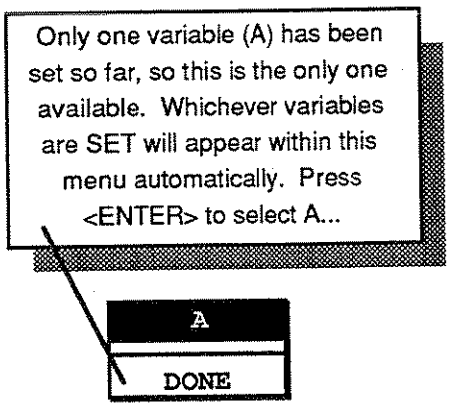
The input that you chose is automatically assigned to the variable A. When y use the SET VARIABLE ACTION more than once within a macro, each will assigned to the next available letter. You may have 52 variables: A ~Z and a ~



Setting the value for a variable

You must tell the system what the variable "A" means somewhere along the line. In the example above, we are using the WAIT UNTIL ACTION, and then selecting the <expression> ARGUMENT.

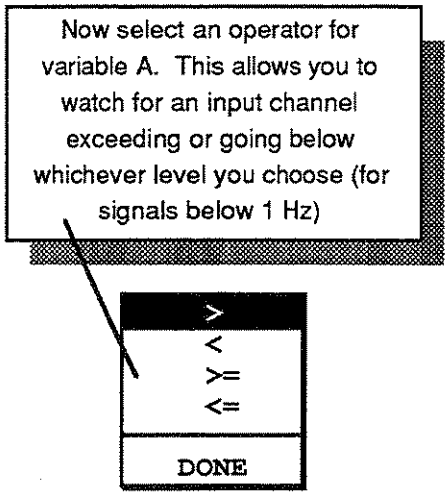
13.7 The VARIABLES Pop-up Menu



Variable selection Pop-up menu

When you select the <expression> ARGUMENT, you will be presented with Pop-up menu containing all of the variables used within the current macr sequence. In this case there is only one: "A". Select it and press <ENTER>.

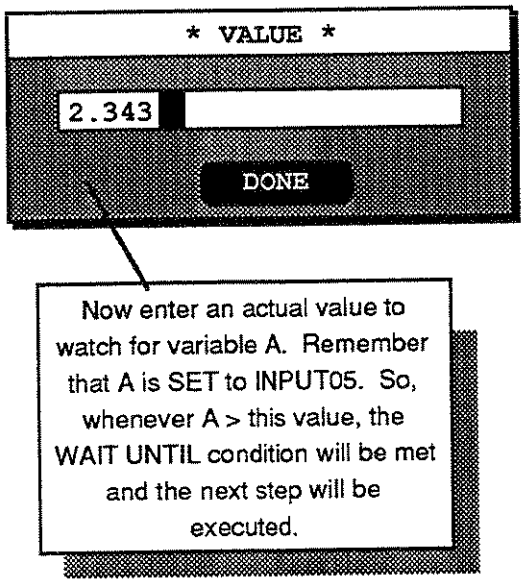
13.8 The OPERATORS Pop-up Menu



Macro screen with \OPERATORS/ Pop-up menu

Select a logical operator for the expression "A". Your choices include >, <, >=, and <=.

13.9 The VALUE Dialog Box



*Macro screen with *VALUE* dialog box*

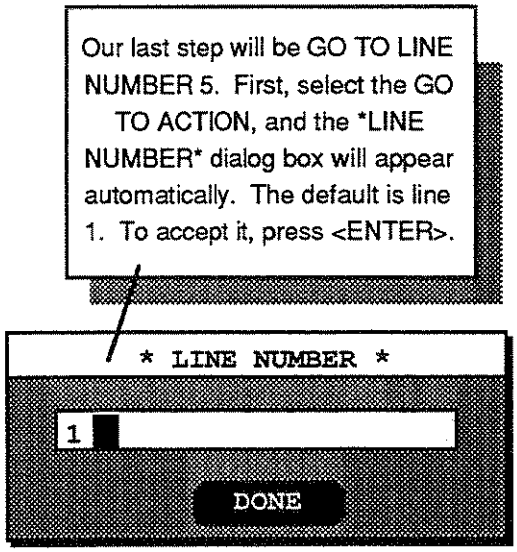
Now set a value for the expression "A". You can set any value up to the fi range of the input. The units are automatically set to match those of the inpt So, if "A" is set to INPUT01, and INPUT01 has been set to USER UNITS of 0 1000 PSI, then the value you set here will be in the same USER UNITS.

You set the units of each input on the -INPUT SETUP- screen.

So far, the macro has been told to wait at this step until "A" (INPUT05) is great than 2.343 units.

It should be noted that the expression evaluator in the macro sequencer is n particularly fast. In fact, you should not count on it to detect signal changes less than one second. If you need fast triggering, use the actual hardware trigg capabilities of the Mark 12 and its M12-TR hardware.

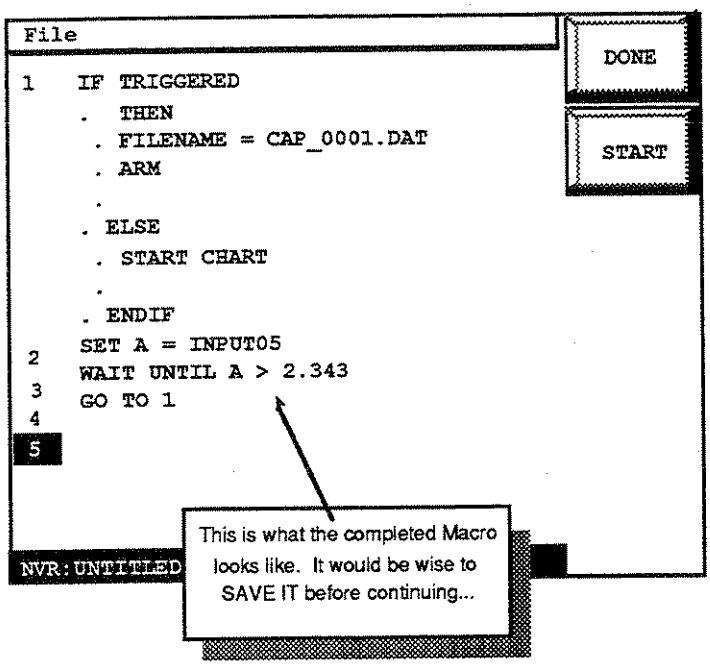
13.10 The LINE NUMBER Dialog Box



*Macro screen with *LINE NUMBER* dialog box*

You can insert a GO TO ACTION anywhere within your macro. This is useful when looping of a particular group of ACTIONS is desired, or to loop the entire macro.

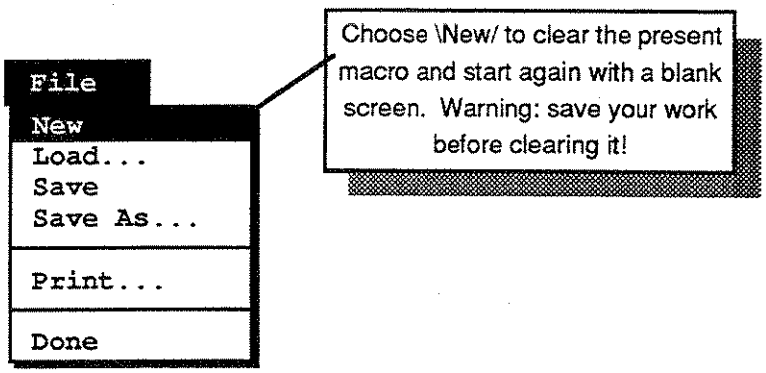
Note: if you want to loop a process a certain number of times, use the FOR/NEXT control structure.



Completed sample macro sequence

It resulting macro may not be very useful, but at least we have learned th process of getting our ideas into the macro sequencer. Now, let's learn how t save our work, recall existing macros, and run them.

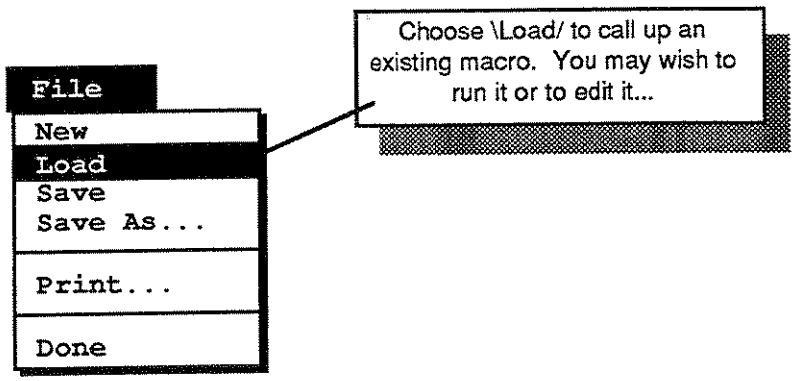
13.11 Starting a New Macro



The macro screen's \FILE/ menu

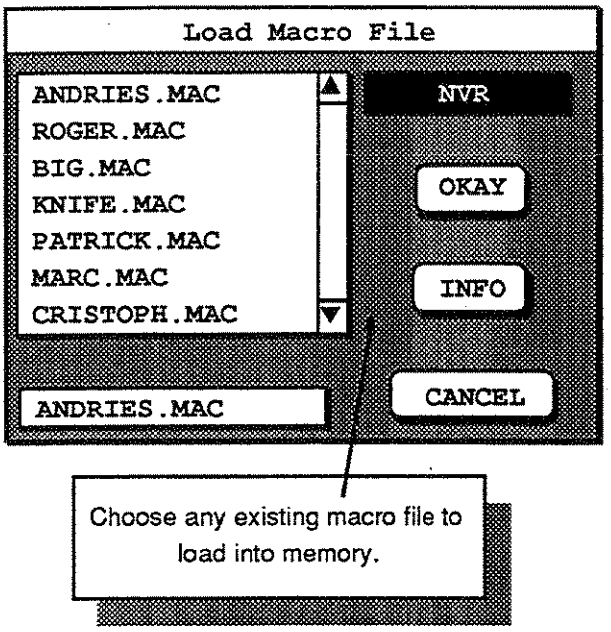
Now that you are familiar with the basic concepts of the Mark 12's macro sequencer, let us take a closer look at file management. We need to learn how to save, load, and print our completed macros.

13.12 Loading an Existing Macro



The macro screen's \FILE/ menu

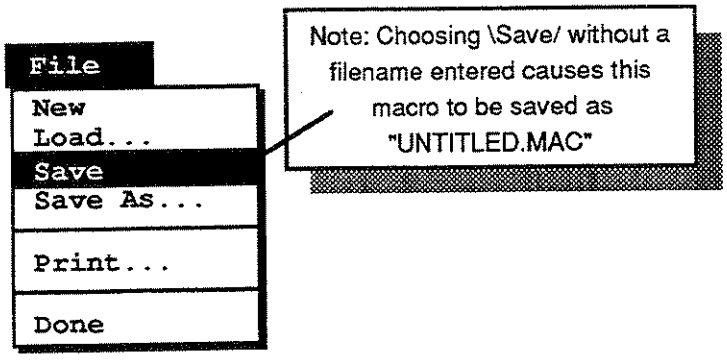
To start a new macro, select the \New/ menu item. To load an existing macro (t run it or edit it), select the \Load.../ menu item and press <ENTER>.



*The Macro screen's *Load Macro File* dialog box*

The *Load Macro File* dialog box will appear. Use conventional techniques to select any *.MAC file on your system for loading. Then move the highlight to the [OKAY] button and press <ENTER>.

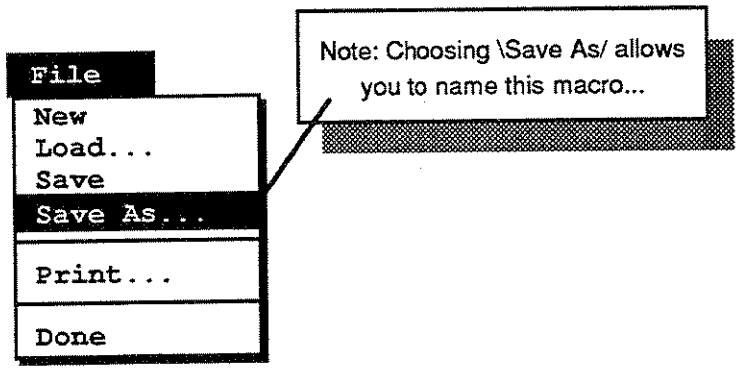
13.13 Saving a Macro



The Macro screen's \FILE/ menu

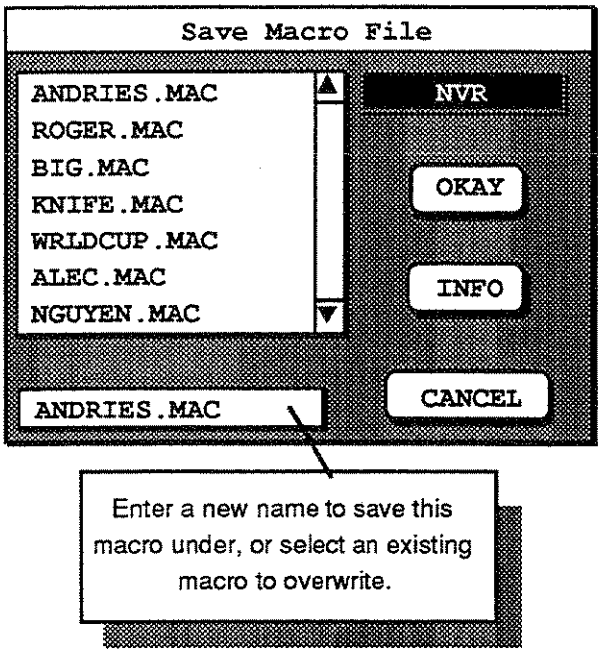
When you first start the macro sequencer, the default file name o UNTITLED.MAC is set. This also happens after you select the \New/ menu item a new, blank macro is created with the name UNTITLED.MAC.

So, be careful about selecting \Save/. If no filename has yet been set for th current macro, use the \Save As.../ menu item instead.



The macro screen's \FILE/ menu

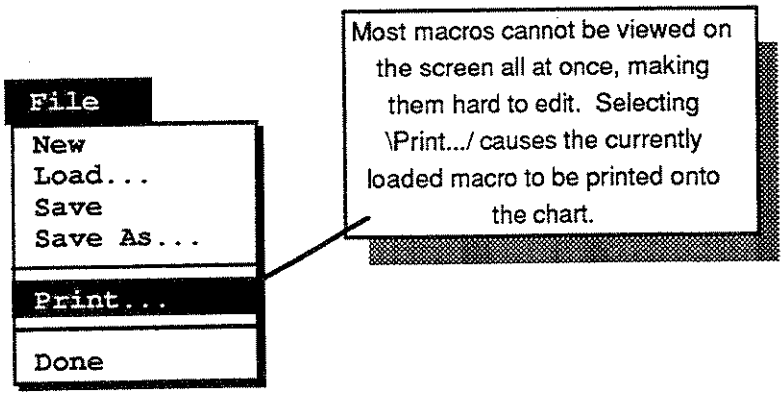
When you choose \Save As.../, the *Save Macro File* dialog box appears:



**Save Macro File* dialog box*

You can overwrite an existing macro by selecting it here. Or, enter a new name and create a new macro.

13.14 Printing a Macro



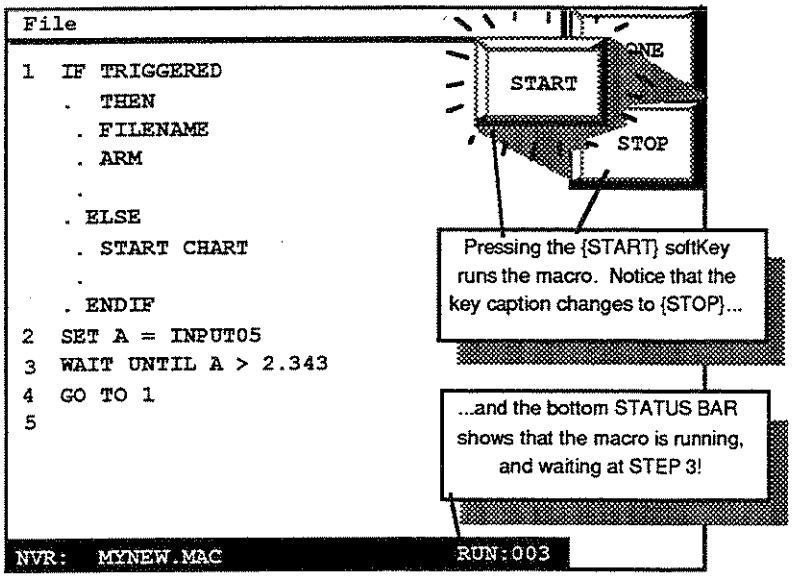
\Print.../ menu item

It is often useful to print a macro sequence. You can do a screen dump, but wha if the macro does not fit on the screen? The PRINT function allows you to prir any macro, without loading it, in a simple line printer fashion to the Mark 12 char

Select the \Print.../ menu item and then press <ENTER>. A common fil selection dialog box will appear. Use it to select any *.MAC file, the move th highlight to the [OKAY] button and press <ENTER>. The Macro will be printe on the chart.

Note: Be sure that the chart is stopped before you try to print a macro!

13.15 Running a Macro



The macro sequencer's START/STOP softKey

Once a macro has been loaded, running it is as simple as pressing the {START} softKey. The bottom of the screen indicates at which step the macro is currently on. To stop a macro, press the {STOP} softKey.

Be aware that once a macro is running, you are free to leave this screen and do anything else that you choose. Take care, of course, depending on what your macro is doing. For example, if your macro is arming the trigger and controlling data capturing, you will probably want to avoid interfering with it by operating these controls manually. You will not harm the Mark 12, but you may not get the results that you wanted from your macro.

\>/, \</, \>=/, and \<=/

Menu items on the \OPERATOR/ pop-up menu, Macro Sequencer Screen

These mathematical operators are used in the comparison of an input's current value with the value you set into a variable. For example, you may wish to let INPUT01 equal the variable "A," and let the Macro Sequencer watch for when "A" exceeds 12.444 Volts. You would use this:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 12.444
3  BEEP
4  START CHART
5
```

Notice how the ">" (greater than) operator is used within the expressio at line 2.

\A/, \B/, \C/ ... \Z/ and \a/, \b/, \c/ ... \z/

Menu item on the \VARIABLES/ pop-up menu, Macro Sequencer Screen

You can assign each DMS1000 input to a variable. Variables ar compared to the actual value of the input to the Macro Sequencer. Fc example, you may wish to let INPUT01 equal the variable "A," and let th Macro Sequencer watch for when "A" exceeds 12.444 Volts. You woul use this:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 12.444
3  BEEP
4  START CHART
5
```

The first time that you access this pop-up menu it will contain only "A However, as you use letters the list will get longer and longer, so tha each time you access this pop-up menu it will contain the previousl used letters as well as the next available variable letter.

See also: \</, \>/, \<=/, \>=/, \OPERATOR/, \Set Variable/, \<expression>

\ARGUMENTS/

Pop-up Menu, Macro Sequencer Screen

Contains a list of arguments for IF/THEN and WAIT UNTIL action Items on this pop-up menu include: \Triggered/, \Replay Done/, \Captu Done/, \Chart Start/, \Chart Stop/, \Event High/, \Event Low \<Expression>/

\Arm/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Arms the trigger circuitry. No arguments required.

\Beep/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Causes the DMS1000 beeper to sound. No arguments required.

[CANCEL]

*Button on the *SELECT FILE TO CAPTURE* dialog box, Macro Sequencer Screen*

Closes this dialog box.

\Capture Done/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the capture to be completed before moving on the next line:

```
1  ARM
2  WAIT UNTIL CAPTURE DONE
3  START CHART
4
```

\Chart Start/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Starts the DMS1000 chart. No arguments required.

\Chart Start/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the chart to be started before moving on the next line:

```
1  ARM
2  WAIT UNTIL CHART START
3  BEEP
4
```

\Chart Stop/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the chart to be stopped before moving on the next line:

```
1  ARM
2  WAIT UNTIL CHART STOP
3  BEEP
4
```

\Delay For/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Causes the Macro to suspend execution for a user-programmable perioc of time. For example, you may wish to wait at a certain line for 1/5 minutes:

```
1  START CHART
2  DELAY FOR 000 00:01:30
3  ARM
4
```

You can program delays of up to 31 days. You can set the days, hours minutes, and seconds independently.

\Delete/

Menu item on the \Insert/Delete/ pop-up menu, Macro Sequencer Screen

Deletes the current line of the Macro Sequence. Select the line numbe that you wish to delete and press <ENTER>. When this pop-up menu appears, select \Delete/ and press <ENTER> again.

Note: If you delete the first line of a control structure (IF/THEN/ELSE o FOR/NEXT), the entire structure will be deleted.

\Do Command/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

One of the most powerful commands that the Macro Sequencer has. DO COMMAND allows you to execute any of the DMS1000's remote interface commands! For example, to program and then print the second line of on-the-fly annotation 66 millimeters from the left edge of the chart

```
1  DO 'CH:TE:OT 2, 'Hello, my friend',66'
2  DO 'CH:TE:OX 2'
3
```

The entire DMS1000 remote interface command set can be used within your Macros this way.

\Done/

Menu item on the \FILE/ menu, Macro Sequencer Screen

Closes the menu.

{DONE}

SoftKey 1, Macro Sequencer Screen

Exits the Macro Sequencer screen. Be sure that you have either STARTED or STOPPED your Macro before leaving the screen. If you START your Macro, you are free to leave the screen, and the Macro will continue running according to however it is programmed.

\Else/

If/Then Control Structure Statement, on \ELSE/ENDIF/ pop-up menu, Macro Sequencer Screen

See \If/Then/Else/.

\End If/

If/Then Control Structure Statement, on \ELSE/ENDIF/ pop-up menu, Macro Sequencer Screen

See \If/Then/Else/.

\Event High/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the event to go high before moving on the next line:

```
1  ARM
2  WAIT UNTIL EVENT HIGH
3  BEEP
4
```

\Event Low/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the event to go low before moving on the next line:

```
1  ARM
2  WAIT UNTIL EVENT LOW
3  BEEP
4
```

\<Expression>/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used to set the value of a variable. For an example, see \A/, \B/...

See also: \</, \>/, \<=/, \>=/, \OPERATOR/, \Set Variable/.

\FILE/

Menu, Macro Sequencer Screen

This menu contains these important menu items: \New/, \Load/, \Save/ Save As.../, and \Print.../.

\For/Next/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

A control structure that allows you to program a "loop" with a specifi number of passes. For example, you may want to arm the trigger exactl 10 times, and then stop or move on to some other step. Use th FOR/NEXT structure for that application.

To rearm the trigger and capture exactly ten sequentially named file (like "JOE_0001.DAT, JOE_0002.DAT, etc.), see the following example:

```
1  FOR 10 TIMES
   -  SET FILENAME MEM:JOE_xxxx.DAT"
   -  ARM
   -  WAIT UNTIL CAPTURE DONE
   -  NEXT
2
```

\Go To/

Menu item on \ACTION/ pop-up menu, Macro Sequencer Screen

Causes the Macro Sequencer to go to a specific line number.

See also *LINE NUMBER*

\If/Then/Else/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Allows you to create "conditional" expressions that test something before executing. For example, you can program the Macro Sequencer to test if the chart is already running. If it is already running, the DMS1000 will beep, otherwise it will start the chart:

```
1  IF CHART STOP
   -  THEN
      -  START CHART
      -
   -  ELSE
      -  BEEP
   -  ENDIF
2
```

The "Else" argument is optional. A simpler version of the above would be to eliminate the BEEP statement:

```
1  IF CHART STOP
   -  THEN
      -  START CHART
      -
   -  ENDIF
2
```

In the second example, the IF/THEN control structure simply tests if the chart is running, and if not, starts the chart.

[INFO]

*Button on the *SELECT FILE TO CAPTURE* dialog box, Macro Sequencer Screen*

Shows the file size, date saved, and free space on the selected volume.

\Input01/ ... \INPUTxx/

Menu item on the \INPUTS/ pop-up menu, Macro Sequencer Screen

See \INPUTS/, below.

\INPUTS/

Pop-up Menu, Macro Sequencer Screen

Contains a list of all of your INPUTS. These are used when you assign a variable to an input. For example, you may wish to let INPUT01 equa the variable "A," and let the Macro Sequencer watch for when "A exceeds 12.444 Volts. You would use this:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 12.444
3  BEEP
4  START CHART
5
```

\Insert/

Menu item on the \Insert/Delete/ pop-up menu, Macro Sequencer Screen

Inserts a new line at the cursor location.

LINE NUMBER

Dialog Box, Macro Sequencer Screen

Used as an argument to the \Go To/ macro command. The resulting lin is like this:

```
2  GO TO 2
```

\Load/

Menu item on the \FILE/ menu, Macro Sequencer Screen

Allows you to load a previously saved Macro Sequence.

[MEM]

*Button on the *SELECT FILE TO CAPTURE* dialog box, Macro Sequence Screen*

Allows you to change the volume from among those currently installec All DMS1000's have these volumes: NVR (non-volatile RAM where set ups, macros, and search scripts are normally kept), MEM (SRAM captur memory, standard after 11/93), and PMC (Personal Memory Card, if on is plugged in on the front panel). There may also be one or more SCS devices (optional). Move the highlight to this button and pres <ENTER>, then select from the list that appears and press <ENTER again.

\New/

Menu item on the \FILE/ menu, Macro Sequencer Screen

Clears the current Macro Sequence and starts a new, blank one.

"NVR:UNTITLED.MAC"

Caption on the Status Bar, Macro Sequencer Screen

This is the default path (NVR) and filename (UNTITLED.MAC) when you start a new Macro Sequence.

[OKAY]

*Button on the *SELECT FILE TO CAPTURE* dialog box, Macro Sequencer Screen*

Confirms the filename currently entered and closes this dialog box.

\OPERATORS/

Pop-up Menu, Macro Sequencer Screen

Contains these mathematical operators:

>, <, >=, and <=

Operators are used within expressions to compare an input to a variable value that you set in advance. For example, the following commands cause the system to beep when INPUT01 exceeds 4.555 Volts:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 4.555
3  BEEP
4
```

See also \Set Variable/, \<expression>/, \A/

\Print.../

Menu item on the \FILE/ menu, Macro Sequencer Screen

Prints the current Macro Sequence to the chart paper. This is useful when a Macro is too long to be viewed on the screen at once. It also serves as a "hard copy backup" of your Macros.

\Replay Done/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the replay to the chart to be completed before moving on the next line:

```
1  ARM
2  WAIT UNTIL REPLAY DONE
3  SET SPEED TO 5 mm/sec
4
```

\Run For Length/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

You can program the DMS1000 chart to run for an exact distance. Fc example, you may want to run the chart at a slow trending speed unt INPUT01 exceeds 12.444 Volts, then increase the speed and run abou for 10 seconds before reducing the speed and repeating the process:

```
1  SET A = INPUT01
2  START CHART
3  SET SPEED TO 5 mm/sec
4  WAIT UNTIL A > 12.444
5  SET SPEED TO 100 mm/sec
6  DELAY FOR 000 00:00:10
7  GO TO 3
8
```

In a simpler example, we can program the chart to run for 250 mm at mm/sec and then stop:

```
1  SET SPEED TO 5 mm/sec
2  START CHART
3  RUN FOR LENGTH 250 mm
4  STOP CHART
5
```

Notice that a STOP CHART command is required after the RUN FO LENGTH xx command. The DMS1000 will not automatically stop aft the correct distance has been run. You must either stop the chart change the speed in subsequent lines of code.

\Save/

Menu item on the \FILE/ menu, Macro Sequencer Screen

Saves the current Macro Sequence to the same path and filename a shown on the left side of the STATUS BAR (the black area at the botto of the screen).

\Save As.../

Menu item on the \FILE/ menu, Macro Sequencer Screen

Opens the *SAVE FILE AS* dialog box so that you can save the curre Macro Sequence to a new path and filename of your choosing.

SELECT FILE TO CAPTURE

Dialog Box, Macro Sequencer Screen

Allows you to select the path and filename that will be used for the next acquisition. For example, you may want to arm the trigger exactly 10 times, and then stop or move on to some other step. Use the FOR/NEXT structure for that application.

To rearm the trigger and capture exactly ten sequentially named files (like "JOE_0001.DAT, JOE_0002.DAT, etc.), see the following example:

```
1  FOR 10 TIMES
   -  SET FILENAME MEM:JOE_xxxx.DAT"
   -  ARM
   -  WAIT UNTIL CAPTURE DONE
   -  NEXT
2
```

\Set Speed/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Allows you to set the chart speed to anything from 1 to 200 mm/sec. For example, you may want to run the chart at a slow trending speed until INPUT01 exceeds 12.444 Volts, then increase the speed and run for about 10 seconds before reducing the speed and repeating the process:

```
1  SET A = INPUT01
2  START CHART
3  SET SPEED TO 5 mm/sec
4  WAIT UNTIL A > 12.444
5  SET SPEED TO 100 mm/sec
6  DELAY FOR 000:00:00:10
7  GO TO 3
8
```

\Set Variable/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

You can assign each DMS1000 input to a variable. Variables are compared to the actual value of the input to the Macro Sequencer. For example, you may wish to let INPUT01 equal the variable "A," and let the Macro Sequencer watch for when "A" exceeds 12.444 Volts. You would use this:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 12.444
3  BEEP
4  START CHART
5
```

The first time that you access this pop-up menu it will contain only "A." However, as you use letters the list will get longer and longer, so that each time you access this pop-up menu it will contain the previously used letters as well as the next available variable letter.

See also: \</, \>/, \<=/, \>=/, \OPERATOR/, \A/, \<expression>/

{START} / {STOP}

softKey 2, Macro Sequencer Screen

Starts or stops execution of the current Macro Sequence. The execution status is also shown in right side of the STATUS BAR (the black area at the bottom of the screen).

\Stop Chart/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Stops the DMS1000 chart. No arguments required.

\Triggered/

Menu item on the \ARGUMENTS/ pop-up menu, Macro Sequencer Screen

Used as a "test argument" within a WAIT UNTIL or IF/THEN expression. For example, you may want to write a macro that waits for the DMS1000 to be triggered before moving on the next line:

```
1  ARM
2  WAIT UNTIL TRIGGERED
3  BEEP
4
```

VALUE

Dialog Box, Macro Sequencer Screen

The *VALUE* dialog is where you assign a value to the variable "A".

See \Set Variable/ for an example.

See also \A/, \OPERATORS/, \<expression>/

\Wait For Time/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

You can program the Macro execution to halt until a specific time is reached. For example, you may want to start evaluating variables after a certain machine turns on at 10:30 PM. You can actually set the date (day of the month number), too. Assuming that today is the 20th of the month and you want to have the Macro wait until 10:30 PM tonight:

```
1  SET A = INPUT01
2  WAIT FOR TIME 020 20:30:00
3  WAIT UNTIL A > 12.444
5  START CHART
6  RUN FOR LENGTH 250 mm
7  STOP CHART
8
```

See also \Delay For/ and \Wait Until/.

\Wait Until/

Menu item on the \ACTION/ pop-up menu, Macro Sequencer Screen

Allows you to halt execution of the Macro until a particular conditio occurs. When you select this menu item and press <ENTER>, th \ARGUMENTS/ menu will appear. At this point you may select fro among: \TRIGGERED/, \REPLAY DONE/, \CAPTURE DONE/, \EVEN HIGH/, \EVENT LOW/, \CHART START/, \CHART STOP/, an \<expression>/.

Each of these menu items is described separately within this sectio However, here are a few typical examples of how the WAIT UNTIL actio can be applied.

The example below shows WAIT UNTIL being used with the \Triggere argument to start the chart when a trigger has occurred:

```
1  FILENAME SCSI1A:MYTEST.DAT
2  ARM
3  WAIT UNTIL TRIGGERED
4  START CHART
5
```

The next example shows WAIT UNTIL being used with th \<expression>/ argument to sound the beeper when INPUT01 is greate than or equal to 24.500 Volts:

```
1  SET A = INPUT01
2  WAIT UNTIL A >= 24.500
3  BEEP
4  GO TO 2
5
```

The next example shows WAIT UNTIL being used with the \EVEN HIGH/ argument to sound the beeper when system event marker goe high:

```
1  WAIT UNTIL EVENT HIGH
2  BEEP
3  GO TO 1
4
```

13.16 Common Questions About *Macros*

Here are some questions commonly asked about *Macros*. Many of them have been covered in the preceding pages, but a few have not.

Can I copy Macros using the \Copy File.../ command under the \FILE/ menu of the -MAIN- screen?

Yes. *Macros* are just like any other file. They may be copied to and from any valid memory volume within your *DMS1000.* They may be deleted, too, using the \Delete File.../ command under the \FILE/ menu of the -MAIN- screen.

How many Macros can I store in my DMS1000?

This is sort of like asking "how many documents can I store on my 40 MB hard disk?", because so much depends on how large the documents are. *Macros* can vary widely in size. Another factor is that SETUP files also occupy the NVR, so they will compete for space if you have a lot of SETUPS (SETUPS also vary widely in size depending on how many INPUT and TRACE channels they contain, and other factors).

The good news is that Macros are generally much smaller than SETUP files. The average SETUP file is about 5 kB, whereas the average Macro is only 100 B or so. So, the average DMS1000 user should find that he or she can store about 8-12 SETUPS and 20-30 Macros in their NVRAM, and about the same amount on the standard 64 kB PMC that comes with each DMS1000. Mark 12's shipped after October of 1994 probably contain the Phase II CPU board, which has four times as much NVR space as earlier models, so they will be able to store many more macros than the examples commonly given in this manual.

In which file format are Macros stored?

They are stored in a compressed binary format.

Can I edit Macros in my word processor?

No, they can only be edited on the DMS1000 front panel.

Do Macros "take over" control of my DMS1000

Yes and no. The best way to imagine what kind of control they have is to picture that there is an invisible person in front of your DMS1000 pressing buttons for you. A Macro is a sequence of events that are acted out in the order you chose. You remain free to override any of the sequences by pressing buttons yourself. For example, let's say that the DMS1000 gets to a sequence in a Macro that changes the chart speed to 50 mm/sec. You are still perfectly free to reach out and change the speed again yourself by pressing the regular chart speed hardKeys. The Macro has already moved on to the next sequence, so it doesn't "care" what you do, really—it's not going to prevent you from operating the *DMS1000* as you see fit. If your question is "will the *Macro* Sequencer block me from operating the recorder?," the answer is no.

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"care" what you do, really—it's not going to prevent you from operating
DMS1000 as you see fit. If your question is "will the *Macro* Sequencer block
from operating the recorder?," the answer is no.

Will my Macros only work with the SETUP that was active when I created them?

No—*Macros* are not associated with SETUPs in any way—they are stand-alone "programs" that can be run with any SETUP. Of course, you could easily create a *Macro* that didn't make any sense with a particular setup. In one of our sample *Macros* , a sequence ZOOM'ed trace #1 on the EL display. What if you had a Macro that ZOOM'ed trace #4, but the SETUP only had two traces on the display? The *DMS1000* will not crash—this ZOOM sequence will simply have no effect, and the sequencer will move on to the next sequence

How many sequences long can a single Macro be?

9913.

Is the macro sequencer in version 5.0x software (and higher) compatible with macros creating using the 4.0x version?

No, sorry. The earlier macro sequencer did not have most of the capabilities of the current version, so its file format is completely different and not interchangeable.

Can I run more than one Macro at a time?

No.

My IF/THEN condition is never found "true" ... but I know that it is happening!

The condition that you specify is evaluated immediately by the IF/THEN control structure. For example:

```
1  SET A = INPUT01
2  IF A > 2.000 THEN
      -  BEEP
      -
   -  END IF
3
```

The instant that the Macro Sequencer executes line #2 it checks the value of A (INPUT01). If it is not greater than 2.000, then it moves to the next step. It does NOT "wait" at this line until the condition becomes true! This is a common error for people to make.

If you want the Macro Sequencer to wait at a certain line UNTIL A CONDITION BECOMES TRUE, then use the WAIT UNTIL command, like this:

```
1  SET A = INPUT01
2  WAIT UNTIL A > 2.000
3  BEEP
4
```

In the example above, the Macro Sequencer waits at line #2 until A (INPUT01) exceeds 2.000.

What is the frequency response of the Macro Sequencer? I have been trying to have catch a 20 microsecond glitch, without success.

The frequency response of the Macro Sequencer is quite low, on the order perhaps 1 Hz. Accordingly, its software "triggering" capabilities cannot be use to detect high-frequency or short duration events. If you want to detect an eve faster than about 1 second, use the M12-TR trigger board, which can dete amplitude events as short at 5 µs.

How can I make a macro load and run automatically whenever the Mark 12 is power up?

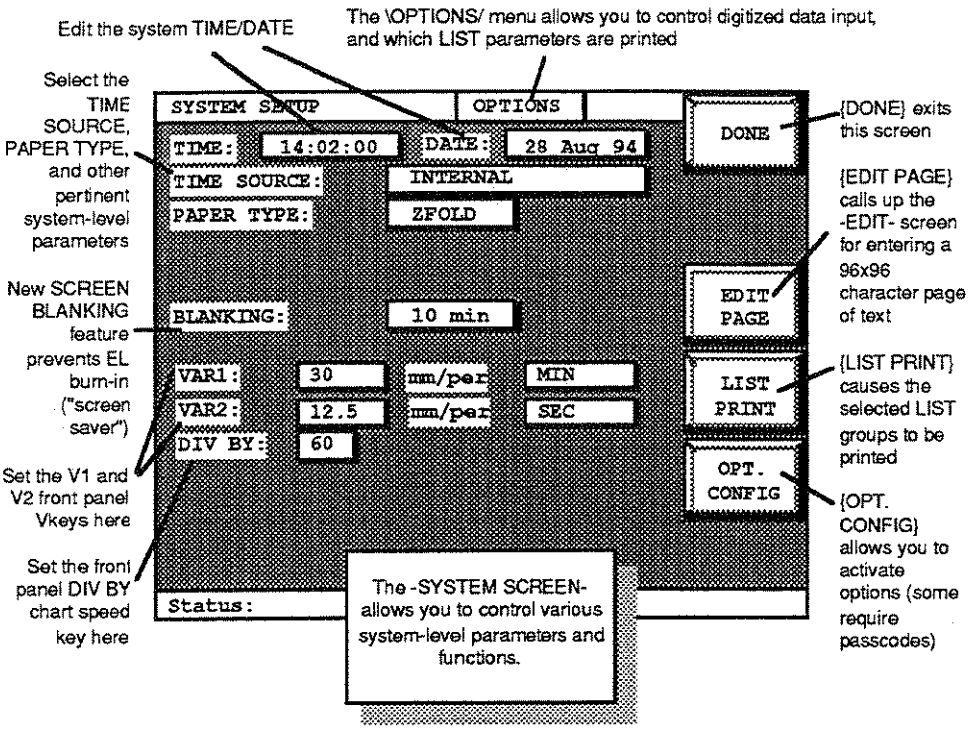
The Mark 12 will automatically load and run any macro called AUTORUN.MAC.

Do I have to load a macro before printing it?

No. In fact, you could be running a completely different macro, or none at a Simply go to the macro screen, and select \Print.../ from the \FILE/ menu, th choose the macro that you wish to print out. Make sure that the chart is stopp before trying to do this.

Section 14 The SYSTEM Screen

From the -MAIN- screen, pull down the \FILE/ menu then highlight \System.../ and press <ENTER> . The DMS1000 takes you to the –SYSTEM SETUP– screen:

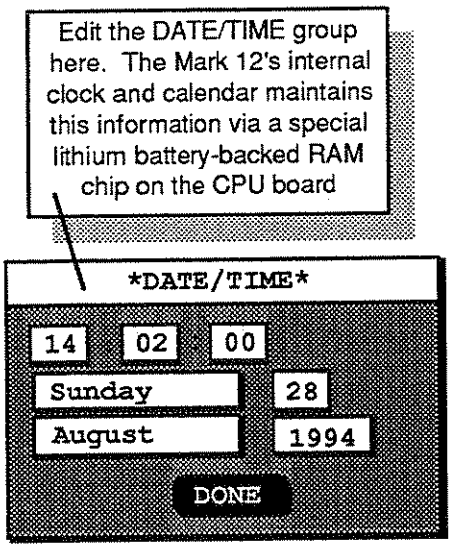


The -SYSTEM- screen

This screen is used to set global parameters, i.e., those that are not linked to any specific mode of operation, and which affect the system as a whole. It is analogous to the "User Preferences" section of many software applications.

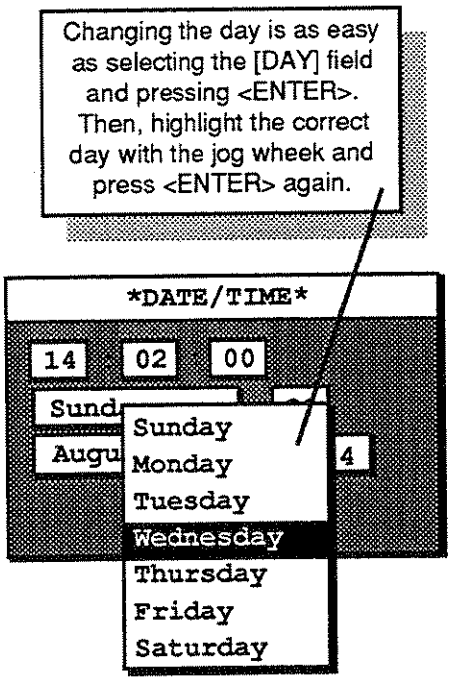
For instance, it is here that you program the two VARI speed keys, as well as the 100 characters of text that can be printed within the system channel. You choose the type of chart paper (roll or Z-fold), and the time source (internal or IRIG). There are some other parameters, too. Let us look at each of them on the following pages.

14.1 Setting the Date/Time



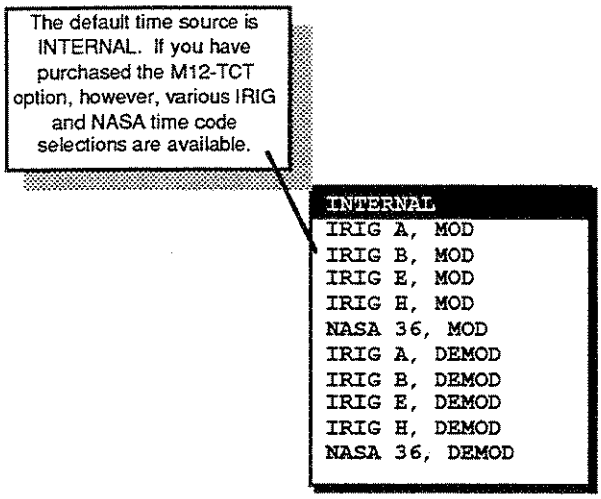
*The *DATE/TIME* dialog box*

Select the [DATE] or [TIME] field (it does not matter which), and press <ENTER> The *DATE/TIME* dialog box will appear. Move the highlight to the desire parameter and press the <ENTER> key to edit it.



Changing the day of the week

14.2 Setting the Time Source



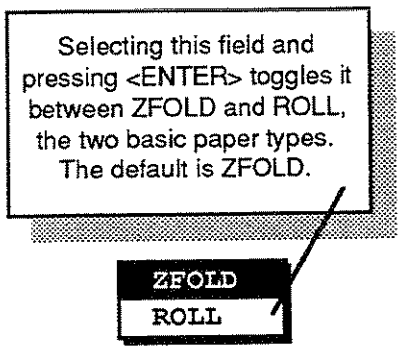
The \TIME SOURCE/ Pull-down menu

The default time source is INTERNAL. However, if you have purchased the M12-TCT option and have an external time code source, you may input it and select it here. The rear panel of the Mark 12 contains an IRIG INPUT BNC connector. In fact, there are two connectors: one for modulated IRIG and another for demodulated IRIG. Input your signal properly, and then select the corresponding IRIG type here, in this menu.

In addition to the military's IRIG (Inter-Range Instrumentation Group) time code, the Mark 12 supports NASA code 36.

When the time code is detected at the input, the Mark 12 will lock on to it and begin using it in place of the internal time/calendar. IRIG also contains an integer from 1 to 365 that represents the Julian day number (January is 001, December 31 is 365). IRIG day and time information is printed on the chart, displayed on the front panel (-MAIN- screen), and captured into memory in place of internally generated time/date information.

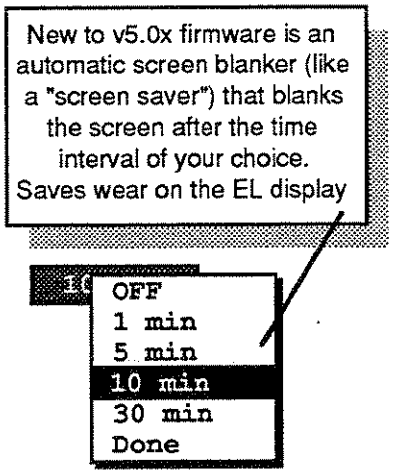
14.3 Setting the Paper Type



The \PAPER TYPE/ Pull-down menu

Select the kind of paper that you are using. This is important, because the Mar 12 will behave differently based on whether it believes you are using Z-fold or rc chart paper. For example, there are times that it wants to advance to the ne: even sheet of paper. But it will only try to detect a TOF (Top of Form) mark if believes that Z-fold paper is installed. Otherwise, it will simply advance a prese distance. So, for best results, always set this properly. The default is Z-fol This setting is stored with each setup file.

14.4 Setting the SCREEN SAVER ("BLANKING")

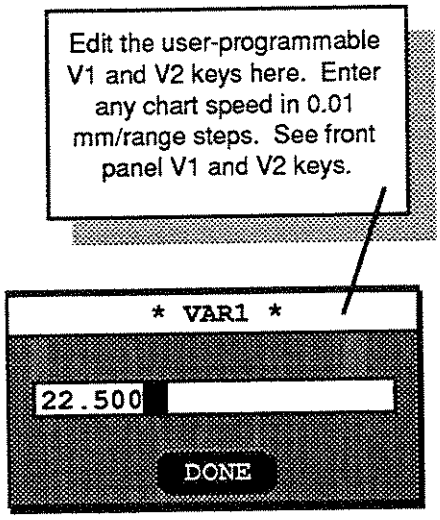


\BLANKING/ Pull-down menu

Select the amount of time that you would like to elapse before the automatic "screen saver" takes effect. Selecting \Off/ deactivates this feature. The default setting is OFF.

Note: When the BLANKING, or "screen saver" takes effect, the Mark 12's screen will go completely dark, except for a message that floats up and down the screen slowly, telling you that the screen saver has engaged. This prevents you from wondering whether the machine is turned on or not.

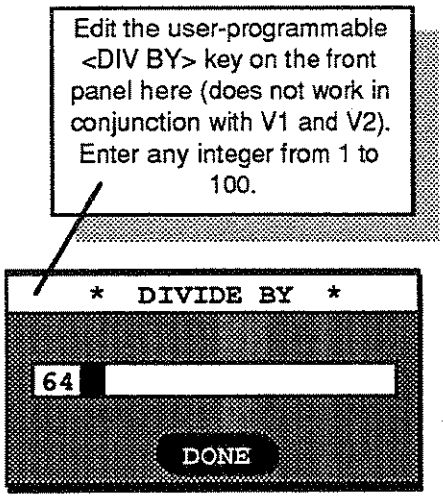
14.5 Setting the VAR1 and VAR2 Keys



*The *VAR1* dialog box*

Select either [VAR] field and press <ENTER>, and the *VAR1* or *VAR2* dialc box will appear. Enter any chart speed from 1 to 100, in 0.01 mm steps. Use th next dialog to set the range: mm/hour, /min, /sec.

14.6 Setting the DIVIDE BY Key

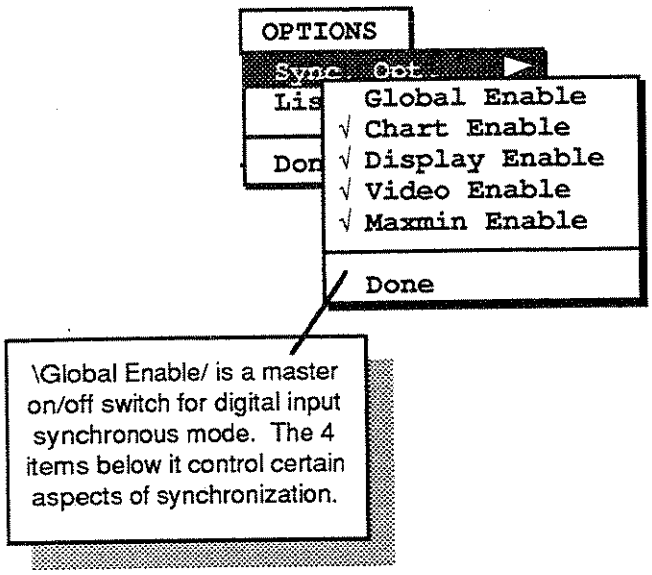


*The *DIVIDE BY* dialog box*

Select either [DIV BY] field and press <ENTER>, and the *DIVIDE BY* dialog box will appear. Enter any divisor from 1 to 100, in integer steps. When you press the <DIVIDE BY> key on the front panel, the current panel speed will be divided by this number.

Note: *The DIVIDE BY function applies only to panel speeds. It has no effect on VARI speeds.*

14.7 Setting the Sync Options



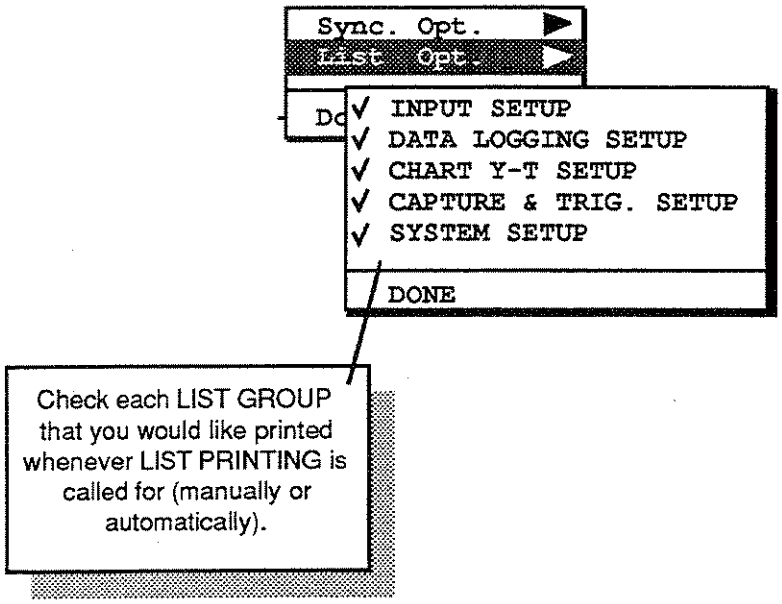
The \\SYNC OPTIONS// sub-menu

The \\Global Enable// menu item is like a "master switch" that turns this functi on or off. The other menu items toggle on or off only their specific area of t mode.

Note: *SYNC MODE applies only when digitized data are being input via the RS-23 and//or GPIB interfaces. If you are inputting digitized inputs, then you can ha the entire Mark 12 "synchronized" to incoming data stream. For example, your data are coming from a server at an inconsistent rate, using SYNC produce a chart record that appears to have been recorded contiguously, w a consistent, linear time base.*

Sub-menu Item	Description
Chart Enable	Synchronizes the chart movement to the incoming da stream
Display Enable	Synchronizes the front panel waveform display to the incoming data stream
Video Enable	Synchronizes the remote video output (requires optio M12-VDM) to the incoming data stream
Maxmin Enable	Synchronizes the rate at which the Mark 12 extrapolates max/min data points to the incoming dat stream

14.8 Setting the List Options



The \\LIST OPTIONS// sub-menu

Check on or off whichever LIST GROUPS you wish to be printed whenever a LIST PRINT is invoked. There are several ways to invoke a LIST PRINT:

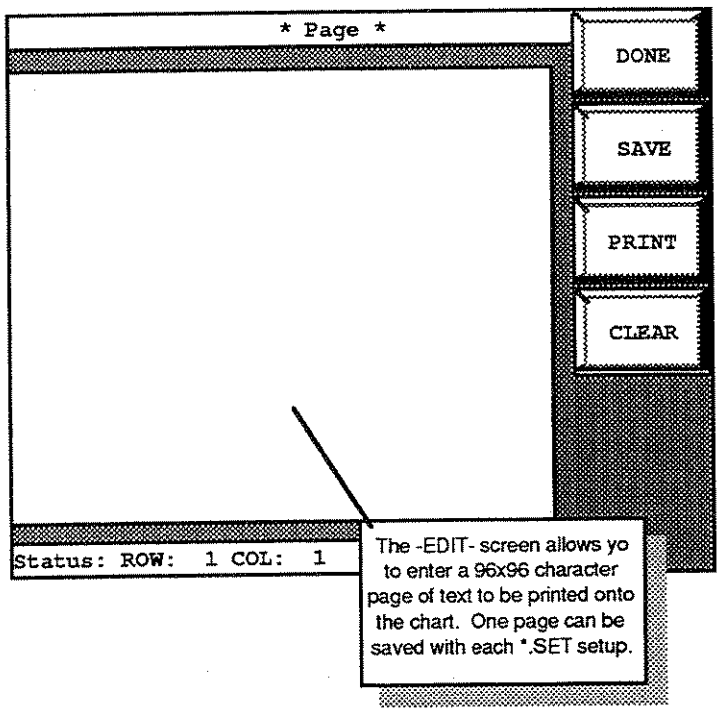
- Pressing the {LIST PRINT} softKey on the -SYSTEM- screen
- Activating the automatic LIST PRINTING option on the -Y-T CHART LAYOUT- screen (and then stopping the chart)
- Via command in the macro sequencer
- Via remote interface command

14.9 EDIT PAGE Function

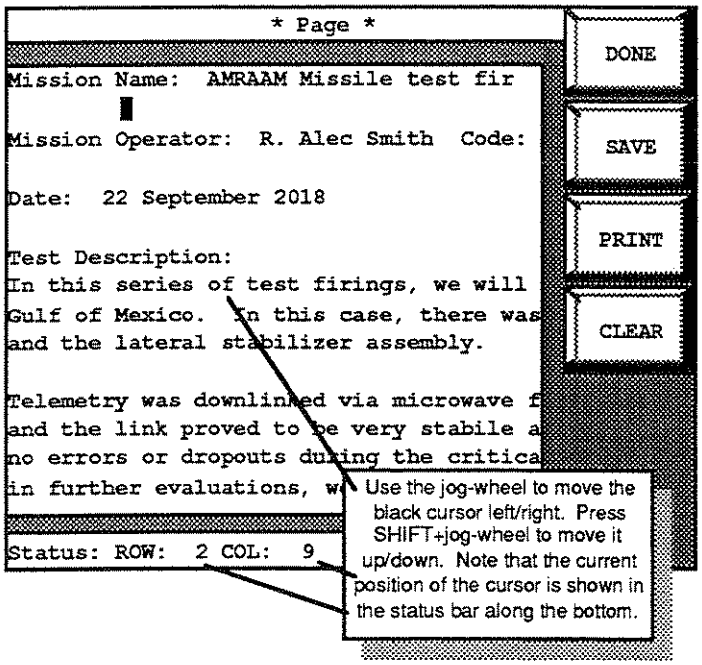
Each setup can contain a 96 x 96 character page of text, that can be printe upon demand. You enter the page of text by first pressing the {EDIT PAGE softKey...

The {EDIT PAGE} SoftKey

...and then entering the text on the *Page* full-screen dialog box:



*The *Page* full-screen dialog box*



**Page* dialog box*

Sample screen showing a large page of text entered. You cannot see the entire 96 x 96 array, of course, so you can scroll the window in all four directions.

You can move the cursor in all four directions by using the jog-wheel, and the jog-wheel and <SHIFT> hardKey at the same time. As you move the cursor, the screen will scroll as required to keep the cursor in view. Here is how to navigate:

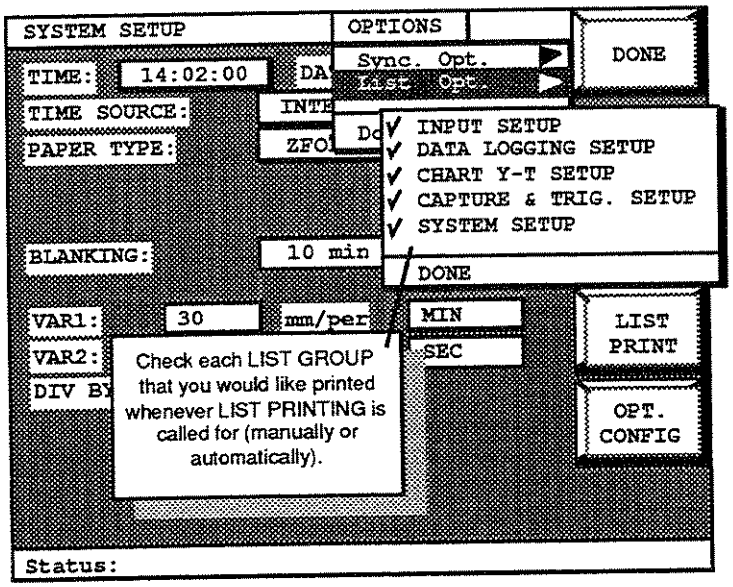
Direction	Action
RIGHT	Turn Jog-wheel clockwise
LEFT	Turn jog-wheel counter-clockwise
UP	Holding down <SHIFT>, turn jog-wheel counter-clockwise
DOWN	Holding down <SHIFT>, turn jog-wheel clockwise

14.10 LIST PRINT Function

To invoke a list printing, press the {LIST PRINT} softKey. Those LIST groups that you have selected under the \OPTIONS/, \List >/ sub-menu will be printed or the chart.

The {LIST PRINT} SoftKey

Note: The chart must be stopped before attempting to invoke a LIST PRINT.



The \OPTIONS/ menu, with the \\List Opt.// sub-menu open

You select which list sections are going to print by checking or unchecking ther here. By default, all list sections are checked and enabled. The contents of eac section are obvious from their titles. For example, the "Input Setup" sectio contains information pertaining to the INPUT's, as defined on the -INPU SELECTION- and -INPUT SETUP- screens.

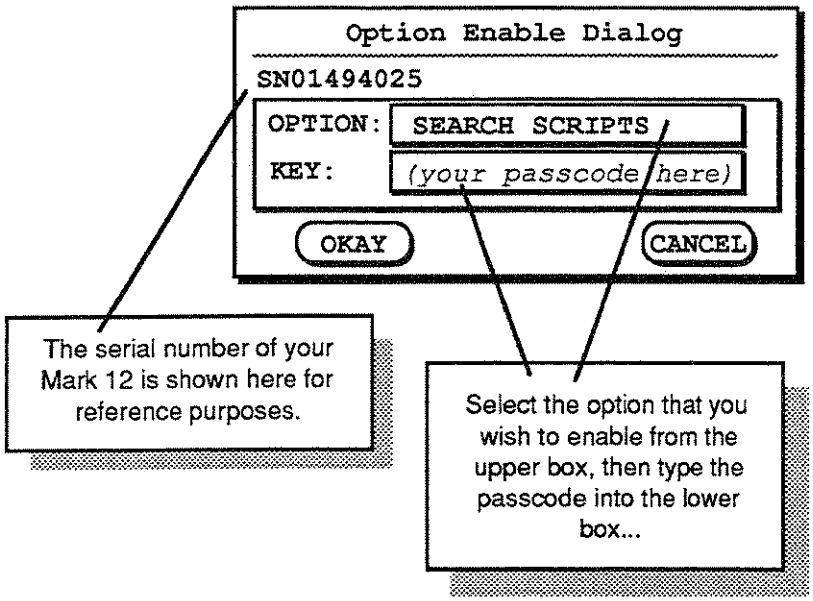
Note: Automatic LIST PRINTING itself is NOT enabled by default. You can turn it o under the \OPTIONS/ menu on the -Y-T Chart Layout- menu

14.11 OPT CONFIG Setup

At times it may be necessary to activate or deactivate a firmware option. To do so, press the {OPT CONFIG} softKey...

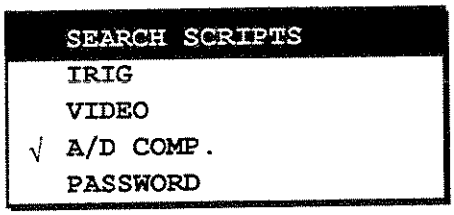
The {OPT CONFIG} softKey

...and the *Option Enable* dialog will appear:



*The *Option Enable Dialog**

To see which options are currently activated, move the highlight to the [OPTION field and press <ENTER>:



The \OPTIONS/ Pull-down menu

Options that are CHECKED are activated, or "ON." Here is a listing of thes options, what they are for, and whether they require a passcode to activate c not:

Option	Description	Need Passcode?	Option Name
Search Scripts	Graphical Boolean expression editor, allows you to search through capture data files of any size for particular events.	Yes	M12-SCI
IRIG	IRIG/NASA36 time code translator	Yes	M12-TC1
VIDEO	Outputs waveform data in real time via the RS-232C connector. Requires a PC 486 running the M12-VDM software to interpret and display the data in a variety of formats.	Yes	M12-VDI
A/D Comp	Tells the system what kind of ADC input cards are installed. If you have anything EXCEPT for the original M12-4A, -4B, -4C, -4D series (part numbers ending in -70x), then this must be turned on. If this is not activated when it should be, then the Mark 12 will not capture input channels higher than INPUT04 (real-time operations will be unaffected). Rule of thumb: if your WG.CFG file used to say "CHANNELS_PER_CARD = 16", then this option should be activated.	No	
Password	Allows you to globally turn on/off the PASSWORD PROTECTION feature found under the -MAIN- screen's \FILE/ menu.		

Appendix A DMS1000 Specifications

General Specifications

Number of Analog Waveform Channels:
4 to 52[1], in increments of 4

Number of Digitized Waveform Channels:
4 to 52, in increments of 4

Maximum Analog/Digitized Waveform Channels:
Up to 52 waveforms plus up to 53 event markers can be printed on the chart at once

Number of Event Markers:
One per analog and digitized input channel, plus one system event marker

Total Event Markers:
Up to 53 on the chart at once

Recording Method:
Thermal array printhead

Printhead Type:
Single 15.3" wide printhead—no gap running down the center of the chart as with 300 dpi dual-head systems

Dot Redundancy:
Each dot has a back-up dot printing the same data

Maximum Recording Width:
384 mm

Effective Recording Density:
Y-axis: 8 dots/mm; T-axis: 64 dots/mm max.

Total Resolution:
330,322 dots/sq. in. max.

Front Panel Display:
Electroluminescent (EL) display provides bright waveform monitor plus a graphical user interface similar to Macintosh™ or Windows™ operating systems

Front Panel Display Resolution:
256 H x 320 W (pixels)

Time Code Specifications

Time Code Capabilities:
Using M12-TCT option, Mark 12 can accept IRIG codes A, B, C, E, H and NASA 36; modulated or demodulated

IRIG Accuracy:
When recorded to memory, IRIG time code message replayed to the chart is presented with the following accuracies: IRIG A: ±0.5 ms; IRIG B: ±5 ms.

Text Entry Methods:
Text may be typed in locally via front panel keyboard, or via standard PC-AT keyboard (requires M12-TCT option), or via RS-232C and GPIB interfaces.

---

1 Increasing your inputs channels from 48 to 52 requires removing the standard Remote Control Interface from slot 13 on the rear panel. This will allow you to add a 13th 4-channel analog input card, but will eliminate RS-232C, GPIB, IRIG (optional), keyboard input jack, external trigger in/out, etc.

Analog Input Specifications

Waveform Input Type:
Analog Voltage, floating, both sides floating and isolated from each other and ground

Isolation:
M12-4A/B/C/D: 750 VAC channel-to-channel and channel-to-ground.
M12-4E: 1000 VAC channel-to-channel and channel-to-ground

Analog Inputs per M12-4 Series Card:
Four analog waveforms plus four TTL-level/switch-closure event markers per M12-4 series card

Max. Event Marker Input Voltage:
M12-4A/B/C/D: 12 VDC
M12-4E: 100 VDC

Internal Noise Floor:
M12-4E: -59 dB ±1 dB

Max. M12-4 Series Cards per Mark 12:
13—one per slot. Provides a max. total of 52 analog waveform channels plus 52 event marker channels (plus 1 system event marker)

Quantization:
M12-4E: 14-bit ADC's
All Others: 16-bit analog-to-digital converters (ADC's) are used.
Note: LSB is used to sample each channel's event marker.

Bandwidth
d.c. to 20 kHz -3 dB (without filtering)

ADC Multiplexing:
None—there is one ADC per analog input channel

Max. Analog Input Voltage:
M12-4A/B/C/D: 250 VAC
M12-4E: 500 VAC

Input Span:
M12-4A: ±50 mV to ±50 V, full-scale
(0–100 mV to 0–100 V, full-scale)
M12-4B: ±5 mV to ±5 V, full-scale
(0–10 mV to 0–10 V, full-scale)
M12-4C: ±100 mV to ±100 V, full-scale
(0–200 mV to 0–200 V, full-scale)
M12-4D: ±250 mV to ±250 V, full-scale
(0–500 mV to 0–500 V, full-scale)
M12-4E: ±50 mV to ±500 V, full-scale
(0–100 mV to 0–500 V, full-scale)

Span Accuracy:
M12-4E: (Measured accuracy) ±0.1% of full-span (no anti-aliasing filter installed)

Span Resolution:
0.001 mV steps throughout entire range

Offset Capability:
±20:1 selected span, (as long as span + offset are within the card's maximum span capability)

Start-up Drift:
M12-4E: 0.2% / 15 minutes

Zero Suppression Capability:
M12-4E: ±1000 % on most ranges (see table)
All others: None

Range	Suppression
50 mV	±250 mV
100 mV	±500 mV
250 mV	±1.25 V
500 mV	±2.5 V
1 V	±5 V
2.5 V	±6.25 V
5 V	±25 V
10 V	±50 V
25 V	±125 V
50 V	±250 V
100 V	±350 V
250 V	±275 V
500	±150 V

Zero Suppression Resolution:
M12-4E: 0.0015% of selected ADC range

Zero Suppression Setting Accuracy:
M12-4E: 0.5% of selected ADC range

Baseline Thermal Sensitivity:
M12-4E: 0.031% of full-span / °C (after warm-up)

RMS Capability:
M12-4E: Analog signal can be converted to RMS equivalent.
All others: None

Filtering Capability:
M12-4E: Programmable low-pass and high-pass filters, plus pre-programmed notch filters at 50, 60, 75 and 400 Hz.
All others: None

Data Processing Capability:
M12-4E: Filtering and RMS conversion, as shown above. Note that the unprocessed version of the data is sent to memory/SCSI, and the processed version is sent to the CPU for display/hard copy recording.
All others: None

Input Impedance:
M12-4A: 100 kΩ
M12-4B: 100 kΩ
M12-4C: 200 kΩ
M12-4D: 500 kΩ
M12-4E: 1 MΩ

Signal Polarity:
Plus or minus polarity selectable per channel (reverse polarity is printed beside the channel)

Non-linearity:
M12-4E: 0.03% of full-span (no anti-aliasing filter installed)
0.06% of full-span (with anti-aliasing filter installed)
All others: 0.1% of full-scale

Crosstalk:
-65 dB minimum

Common Mode Rejection Ratio:
M12-4E: 100 dB minimum @ 60 Hz
50 dB minimum @ 1 kHz

Anti-Aliasing Specifications (M12-4E Only):

M12-4E: There are four filters to choose from, each with unique characteristics. You may also ele to have NONE installed.

1. None
2. Bessell Option Kit 79000-511
3. Butterworth Option Kit 79000-512
4. Elliptic Option Kit 79000-513

Anti-Aliasing Filter Performance Comparison	Poles	Freq. Corner	Roll-Off	Stop-Band Performance (roll-off rate)	Step-Respons Performance ("Ringing")[2]
Bessell Option (opt. 79000-511)	8	44 kHz	< 0.8 dB @ 20 kHz; -54 dB @ 187 kHz	Worst	Best (Least)
Butterworth Option 79000-512	8	25 kHz	< 0.7 dB @ 20 kHz; -54 dB @ 58 kHz	Average	Average
Elliptic Option 79000-513	8	25 kHz	< 0.3 dB @ 20 kHz; -54 dB @ 30 kHz	Best	Worst (Most)

2 Please ask for WGI Flyer #M12-4E, which includes detailed roll-off a performance charts for each of the anti-aliasing filter choices.

Signal Processing Specifications

Filter Types:
M12-4E: Butterworth; low-pass, high-pass, and notch
All others: None

User-programmable Filters:
M12-4E: 2-pole high-pass @ 200 k (400 to 25 kHz)
2-pole low-pass @ 200 k (400 to 25 kHz)
8-pole low-pass @ 12.5 k (40 to 1.25 kHz)
8-pole low-pass @ 1.5 k (4 to 15 0 Hz)
All others: None

Pre-Programmed Filters:
M12-4E: Notch; 50 Hz, 60 Hz, 75 Hz, 400 Hz
All others: None

RMS Conversion:
M12-4E: 12.5 kHz effective sample rate
All others: None

Processing Limitations:
M12-4E: See Table 1 for the effects that various filter choices have on adjacent input channels
All others: None

INPUT 1

INPUT 2	[DIR200] None 200 kHz	[DIR200] User LP, HP 2-pole 200 kHz	[DSP10K8] Fixed LP, HP, BR 8-pole 12.5 kHz	[DSP10K8] User LP 8-pole 12 kHz	[RMS] RMS 12.5 kHz	[DSP1K8] User LP 8-pole 1.5 kHz
[DIR200] None 200 kHz	**yes**	**yes**	no	no	no	no
[DIR200] User LP, HP 2-pole 200 kHz	**yes**	**yes**	no	no	no	no
[DSP10K8] Fixed LP, HP, BR 8-pole 12.5 kHz	no	no	**yes**	**yes**	no	no
[DSP10K8] User LP 8-pole 12 kHz	no	no	**yes**	**yes**	no	no
[RMS] RMS 12.5 kHz	no	no	no	no	**yes**	no
[DSP1K8] User LP 8-pole 1.5 kHz	no	no	no	no	no	**yes**

Table 1.

Table 1 shows the valid combinations of processing types on adjacent input channels on each M12-4E series analog input card. These dependencies are a results of input channels 1 & 2 being processed b a single DSP chip, and input channels 3 & 4 being processed by a single DSP chip (there are two DSF chips per M12-4E card).

Across the top of the table are the possibilities for input 1. Choose one of the selections. Now, look directly down that column: wherever a "yes" is shown is also a valid selection for input 2.

For example, let's say that you select [User LP & HP/2-pole/200 kHz] for input 1. Looking down this column you can see that there is a "yes" in the first two rows, but there is a "no" in the last four rows. This means that if input 1 is set to this filter type, then input 2 can be set to either [None/200 kHz], or [User-Defined LP & HP/2-pole/200 kHz].

Setting input 2 to any other selection (where it says "no"), will cause input 1 to be changed to a differer filter module. However, you will be warned on the screen that this has happened.

Table 1 also indicates when a subdivision of the Mark 12's raw 200 kHz sample rate will be used. It is not always necessary to sample at that high rate. For example, if you want a 500 Hz low-pass filter, there is no reason to sample at 200 kHz to begin with.

Event Marker Specifications

Analog Event Markers
One per analog input channel, for a maximum of 53 (one per channel plus 1 system event marker).

Analog Event Marker Input Type:
Isolated TTL-low or switch-closure, via 'D' shell connector

Analog Event Marker Input Range:

M12-4E:	TTL-level to 100 V, or switch-closure.
All others:	TTL-low to 15 V, or switch-closure.
Note:	All events share a single common.

Digitized Waveform Event Marker
LSB (bit 0) is used as event marker

Digitized Input Specifications

Max. Number of Channels:
52, plus 52 event markers (1 per channel)

Analog/Digitized Mixing:
Any combination of up to 52 total analog and digitized input channels, plus up to 52 event markers (or per analog and digitized input channel), plus one system event marker.

Input Bit Resolution:
7 or 15 bits, selectable. LSB is used as the event marker

Max. Input Rate—GPIB:
20 kwords/sec., aggregate

Max. Input Rate—RS-232C:
4 kwords/sec., aggregate

Multiple Interface Input Capability:
Up to four RS-232C and four GPIB interface s may be installed within a single Mark 12. Each interfac can be set up and used independently for control or data input.

Digitized Waveform Input Type:
7- or 15-bit, selectable

Input Calibration Specifications

Automatic Calibration
Calibrates any or all channels to "live" signal ("AC CAL"), or to calibrated left & right grid edge values ("DC CAL"). When using DC CAL, left and right edges may be set independently. Employs Western Graphtec's exclusive "ASC™" (patent pending) calibration technique.

User Engineering Units:
Programmable units of measurement for left and right grid edge values. Can automatically "track" real span/offset, or "float," user selectable. When user units are activated, the input setup screen displays a "live" signal level directly in user units.

Chart Layout Specifications

Max. Signal Amplitude:
374 mm

Channel Widths:
2 to 374 mm, in 1 mm steps

Channel Positions:
Anywhere across chart in 1 mm steps

Grid Patterns:
9 selections: OFF, 10 x 10 mm; 10 x 10 mm with fine divisions; 5 x 5 mm; 5 x 5 mm with fine divisions; 5 x 4 mm; 5 x 4 with fine divisions; 50 divisions; 1 x 1 mm

Event Position:
Anywhere across chart in 1 mm steps

Text Position:
Anywhere across chart in 1 mm steps

Input Source:
Any input can be assigned to any trace on the chart

Duplicate Inputs
The same input source can be assigned to any trace on the chart any number of times (up to 52)

Overscale:
3 selections: OFF (signal clips at grid edges); ON (signal exceeds grid edges by ±2 mm); FULL-SCALE (signal exceeds grid edges to full range of ADC—up to ±x10 grid size)

Time Line Synchronization:
7 selections: OFF (grids are dimensional); EXT TTL (user supplied signal controls grid); TIME CODE (IRIG/NASA time code on-time pulse controls grid); INTERNAL—100 ms, 1 s, 10 s, or 1 m (internal time clock controls grid)

Minimum Trace Width:
Sets a 2 mm minimum trace width regardless of chart speed or data characteristics. Selectable on or off (global)

"Virtual" Channels:
"Virtual" channels can be inserted and directed to any valid input source. Any number can be inserted as long as total of real and virtual channels does not exceed 52

Trace Expansion
SoftKey on Main Screen allows one-touch expansion of all traces. Each press doubles the amplitude axis and overlaps waveforms

Master Function:
Invoking MASTER causes a given chart layout parameter to be applied simultaneously to all channels

Text Annotation Functions

Interchannel Annotation:
Each channel is annotated with: 2-digit trace ID; 15 character user-programmable input label; preamplifier settings (left and right edge values, units/division, offset, polarity, filter condition [requires M12-4E card], zero suppression [requires M12-4E card], unit of measurement); plus 128 characters c user text.

Edge-of-Record System Annotation:
Automatically prints the time, date, chart speed, time scale, and up to 100 characters of user text alon the right chart edge.

Annotation Print Rate Control:
User may control the rate at which interchannel and Edge-of-Record printing occur, among the followi choices: OFF, or every 500, 400, 300, 200, or 100 mm.

On-the-Fly (OTF) Annotation:
Five separate 128-character "on-the-fly" user text messages can be located anywhere across the cha and printed via local push-button, built-in macro sequencer, remote TTL-low/switch-closure signal, or remote computer command

Page Print Mode:
A 96 x 96 character page of text may be entered from the front panel or remotely and printed upon demand

List Print Mode:
Tabular matrices detailing the set-up conditions of the Mark 12 can be printed upon demand or automatically when the chart is stopped. List print tables include: Input set-up; chart set-up; capture/trigger set-up; and system set-up

End-of-Record Printing:
Automatic printing of left and right grid edge values in real or user engineering units plus a zero basel caret and input ID number. Can be turned on or off.

Automatic ID Markers:
Overlapping waveforms are automatically marked with their 2-digit trace ID number at user-programmable intervals.

Recording Formats

Chart Recording Formats:
Y-T, X-Y, Data Logger, Line printer

Local Video Display Formats:
Y-T, 1–16 channels (selectable and in any order)
X-Y One X-Y plot at a time (v5.00)
X-Y 1–4 X-Y plots at once (v5.01 or higher)

Remote Video (M12-VDM) Display Formats:
Y-T, X-Y, Bar Graph, Data Logger

Set-up File Specifications

Set-up Files:
User can save a complete set-up under a DOS file name for instant recall

Set-up Files Loading Time:
User can load a complete set-up from NVRAM or PMC in less than 5 seconds

Set-up File Storage:
10 to 12 set-up files (depending on size) may be stored in internal non-volatile random access memc (NV-RAM). An additional 10 to 12 set-ups may be stored on the standard Personal Memory Card (PMC) that plugs into front panel PMC port. Cards available in larger capacities for storing more thai 100 set-ups.

Printing/Plotting Functions

Line Printing Mode:
Standard line printing via RS-232C or GPIB. User-selectable number of columns and position of page

Line printing Width:
2 to 192 columns, user-selectable in 1 column steps

Line Printing Input Data Type:
ASCII, Hex, or both—user-selectable

EL Screen Printing:
Prints the EL display in user's choice of sizes: 40, 80, 120, 160, 200, 240, 280, and 320 mm wide. Image can be positioned anywhere across the chart in 1 mm steps

SOFTEC™ A Screen Printing:
Accepts high-resolution screen printing from the SOFTEC™ A Analysis Software Program

PLOT File Printing:
Contains plot commands for accepting and printing rasterized images any size up to the full chart width

Trigger Specifications

Trigger Types:
Internal (at user-selectable slope and level); manual push-button on front panel; external TTL-low/switch-closure; computer command via RS-232C or GPIB

Trigger Channel Selection:
Any combination of acquisition channels can be used as trigger channels

Trigger Slope:
Positive or negative slope (+ or -) can be selected . Slope selection is completely independent for each channel

Trigger Threshold:
Threshold can be set in steps of 1/64 of the input range for each channel. Completely independent for each channel. Level can be set in real or user engineering units

Trigger Uses:
Trigger can be used for both real-time and data capture applications.
In real-time, triggers can be used by the MACRO SEQUENCER to start the chart, change the chart speed, run for x time or distance, and to invoke virtually any other command.
When capturing data to S-RAM memory or SCSI memory volume (DAT, hard disk, floppy disk, etc.), triggers can be used to start an acquisition

Trigger/Window Location:
Trigger can be placed anywhere within ±100 of the acquisition window. Selectable three ways: by time; percentage; or actual sample number

Window Time Calculation:
Acquisition window time is calculated and displayed on the screen during set-up. No calculation by the user is required

Trigger Location Marking:
A small "T" caret and arrow are printed near the trigger point during replay

Capture Specifications

Channel Selection:
Any combination of analog input channels may be captured within a single acquisition, up to 52 maximum. Each acquisition can consist of a different number of channels

Sample Interval:
Analog channels can be sampled at 5 Hz to 200 kHz, selectable in intervals divisible by 5 µs (approx. 30,000 selections). Each acquisition can have a separate sample rate

Sample Sizes:
256 words to 2 Mwords/channel. Each acquisition can be a different size—no pre-formatting of memc is required

Memory Segmentation:
Installed memory is freely divisible among any or all channels. Entire memory volume may be dedicated to a single channel

Record Stacking:
S-RAM: up to 128 separate acquisitions may be stacked at once
Disk: up to 512 separate acquisitions may be stacked at once

Max. Frequency Response:
10 sample points/Hz at 200 kHz/channel sample rate

S-RAM Maximum Transfer Rate (MTR):
9.6 MB/sec (allows up to 19 channels @ 200 kHz/channel sample rate). See SCSI Specifications Section for MTR's for SCSI volumes

Total S-RAM Memory:
Up to 4 MB (2 Mwords) of battery backed-up SRAM, in increments of 512 kwords. Each M12-512 module provides 512 kwords.

Memory Type:
Static Random Access Memory (SRAM) with battery back-up, retains captured data after power-dowr

Acquisition Back-up Battery
Battery recharges automatically whenever power is applied. Total recharge in four hours protects dat for a minimum of 1 week without power. 40 week data retention is possible when unit is charged fully

Event Marker Capturing:
Interchannel analog event markers are captured along with waveform data

Event Marker Sample Rate:
Same as analog waveform channels—200 kHz in real-time, and whatever selection user makes durir memory recording

Replay Specifications

Maximum Replay Time Axis Resolution:
800,000 mm/sec (1.25 µs/mm). Assumes 200 kHz sample rate, 50 samples/second replay rate, and 20 mm/sec chart speed

Replay Rate:
5 selections: 50, 100, 200, 400, 800 points/second (some hard disks cannot replay at the highest rates)

Chart Speed Control During Replay:
May be controlled manually during the replay—any speed from 1 mm/hour to 200 mm/sec. Effective chart speed and time scale are constantly recalculated and printed along the right chart edge

Condensed Output:
User can elect to have any one or two waveforms replayed in any of the following book formats, saving up to 16:1 the amount of time and chart paper required for replay: One channel on 8x40 mm grids; one channel on 16x20 mm grids; two channels on 8x40 mm grids; or two channels on 16 x 20 mm grids

Time Scale Marking:
Edge-of-record system channel automatically prints recorded time, date, effective chart speed and time scale during replay. Works also when IRIG time was originally input

From/To Replay Points Selection:
On-screen cursors allow FROM and TO points to be selected in 1% steps

Printed Header File:
Header file prints all pertinent acquisition parameters (sample rate, input channels acquired, file name, kwords/channel, from/to replay points, etc.). User selectable on/off

Trace Analysis Functions:
Calculates these values for the selected trace's area between the cursors:

- Max Amplitude Value
- Min Amplitude Value
- Average Amplitude Value
- RMS Value

SCSI Interface Specifications

Number of SCSI Drives Supported At Once:

Up to seven SCSI devices may be attached at once to the M12-SCSI interface board. Reading/writi functions may be easily selected among them by the user. This may be comprised of one internal an ≤6 external devices, or: no internal and ≤7 external

PC Connectivity

When a suitable PCAT has an Adaptec SCSI interface card and SCSI hard disk, it is possible to connect the Mark 12 and read/write data directly from/to the PCAT's disk drive

SCSI Devices Supported:

1. Internal and external hard disk drives; 80 to 535 MB
2. Internal or external 3.5" floppy disk drive; writes standard PCAT 1.44 or 2.8 MB formats
3. 14 GByte VHS tape-based drive
4. 2 GByte DAT tape-based drive

Internal SCSI Hard Drives

The following models are available as of December 1994:

- M12-H500 ~535 MB (267 Mwords)
- M12-H1000 ~1.2 GB MB (600 Mwords)

External SCSI Hard Drives

The following models are available as of December 1994:

- M12-EH500 ~535 MB (267 Mwords)
- M12-EH1000 ~1.2 GB MB (600 Mwords)

Hard Disk Drives: Maximum Transfer Rates (MTR's):

- M12-E/H500 0.6 Mwords/sec (aggregate)
- M12-E/H1000 1.4 Mwords/sec (aggregate)

Internal/External SCSI Floppy Drive

M12-FD (internal) and M12-EFD (external) models read and write standard 3.5" DOS diskettes, in the older 768 kB, standard 1.44 MB, or newer 2.8 MB format. Format is selected automatically according what kind of floppy diskette is inserted into the drive.

Other SCSI Drive Types

SCSI DAT Drive

Convenient size DAT drive stores a minimum of 1.6 GB (800 Mword) of data per DAT cassette tape. With compression, up to 8 GB (4 Mwords) can be stored per tape. Compression is automatic. Compression effectiveness varies according to the character of the data. Sustained throughput to media is as high as 200 kB (100 Mword) per second

SCSI PCM/VHS Tape Drive

Stores up to 16.2 GB (9.1 Gwords) on a single S-VHS tape. Sustained throughput-to-media rate as high as 2 MB (1 Mword) per second

Interfacing & Remote Control Specifications

Computer Interfaces:
One set of RS-232C and GPIB (IEEE-488) interfaces are included as standard with the Mark 12 mainframe

Multiple Interfaces:
Additional sets of RS-232C and GPIB interfaces may be added to the Mark 12 mainframe via M12-IFII Option. Each M12-IFII provides an additional RS-232C and GPIB interface. Multiple interfaces may be set up and used independently

Remote Control
Remote control connector allows TTL-low/switch-closure actuation of chart stop/start, remote trigger actuation, remote event marker actuation; and remote chart drive stepping

Macro Sequencer Specs

MacroScripting:
User can write "MacroScripts" up to 999 sequences long that automate the behavior of the Mark 12

Macro Script Actions & Parameters:
CHART STOP, CHART START, WAIT UNTIL (trigger, replay done, capture done, system event, chart start, chart stop), WAIT FOR TIME (time and date), ARM (the trigger circuit), DELAY FOR (x amount of time and up to 31 days), RUN FOR (x distance), SET SPEED TO (any speed), REPEAT (for looping), and DO COMMAND (any Mark 12 remote interface command). Control structures: IF/THEN/ELSE, and COUNT FOR

Macro Storage and Recall
Macros may be saved under *.MAC filenames just as setup files can be, to either NVR or PMC. Macros can be loaded and run regardless of which setup is currently active. Macros can be archived to SCSI volume just like any other file

Chart Drive Specifications

Chart Motor:
Stepper, crystal-referenced, micro-stepped @ 64 steps/mm

Chart Speed Accuracy:
±2% ±0.5 mm

Chart Speeds:
Front panel keys for 1, 2.5, 5, 10, 25, 50, 100 & 200 mm/min or mm/sec, plus user programmable DIVIDE BY key (1, 2, 3...100). In addition, VAR1 and VAR2 keys can be programmed to any speed from 1 to 200 mm/hour, /min, or /sec in 1 mm increments

Chart Paper Types:
Mark 12 mainframe accepts roll or Z-fold paper internally—no separate hardware or modifications required

Chart Paper Length:
PZ1000 Z-fold paper = 100 m pack; PZ2000 Z-fold paper = 200 m roll; PR360BN roll paper = 100 m roll

Remote Chart Stepping:
Via external TTL pulse, chart can be stepped up to 50 mm/sec chart speed.

Power & Mechanical Specifications

Power Input:
100, 117, 220 or 240 VAC; 50 or 60 Hz. 400 Hz operation available upon request

Power Consumption:
~3 A nominal; ~8 A instantaneous peak

Weight:
DMS1000 Mainframe = ~70lbs. (31 kg); Add 0.3 lbs. (136 g) per M12-4 Series input card

Size:
English Measurements:
Chassis is 19.6" wide x 10.5" high x 113.4" deep. Rack-mounting dimensions: 19" wide x 10.5" high. Depth within the rack is 19.6". Protrusion beyond rack front is 1.8".

Metric Measurements:
Chassis is 447mm wide x 267mm high x 493mm deep. Rack-mounting dimensions: 483 mm wide x 267 mm high. Depth within the rack is 448mm. Protrusion beyond rack front is 48mm.

Warranty:
Consult your local Graphtec Sales/Service office

Operating Environment:
0 to 35° C @ 5 – 75% RH, non-condensing

Operating Altitude:
25,500 ft.

Appendix B Glossary of Terms

Aspect Ratio	Used primarily to describe the ratio of a video monitor's height to its width.
Dialog Box	A small window that appears within a screen. Dialog boxes contain a logical grouping of controls, selections, vKeys, and text entry fields.
DMS	Data Management System. Describes a chart recording system based on a wide format, high speed thermal array recorder that includes local and remote video monitoring, and a SCSI interface for direct hard disk connection.
Pull-down Menu	A rectangular "menu" that appears on the video screen. Pull-down menus appear in response to a vKey "button" being selected, or when a menu title has been selected. They contain two or more choices.
DAT	Digital Audio Tape. A new tape format introduced in the 1980's, DAT was created primarily for audio/music applications, but has found widespread acceptance as an instrumentation tape drive format. DAT cassettes are slightly smaller than conventional analog audio cassettes for consumer use. Now, DAT drives with a SCSI interface make it possible to use DAT tape drives as a SCSI memory volume with the *DMS1000*.
DSP	Digital Signal Processor. The *DMS1000*'s custom DSP is largely responsible for its ability to perform many different tasks at once.
EL	Electroluminescent. A bright, monochrome display available in a variety of sizes and resolutions. Usually amber/yellow. EL displays are superior to LCD displays in terms of brightness, visibility over a wide range of viewing angles, and screen refresh speed. EL's are more power-consumptive than LCD displays, however, which is why LCD's are used in laptop computer applications. The *DMS1000* uses a 320 x 256 pixel EL display with a 60 Hz update rate.
F.S.	Full-scale. Describes a signal or input range that will be displayed across the full span of the grid. For example, a signal that is "40 V f.s." is one which is either ±20 V, or 0–40 V on the chart. See also "Peak-to-peak."
GPIB	Similar to IEEE-488, a standard multi-device parallel interface. Standard on the *DMS1000*.
HardKey	Any of the plastic keys located on the *DMS1000* front panel (except the six plastic keys located along the right side of the video screen). Called "hard" because their functions are predetermined and do not change.
Hz	Hertz, or cycles per second. A 60 Hz waveform is one whose period occurs 60 times per second of time.
kW	kilo-Word. One thousand words. See "MW," below.
MB	Megabyte. One million 8-bit bytes.

Mword	One million words (pron. "Mega-word"). We say "word" w referring to the *DMS1000*'s memory, because the *DMS1000* 16-bit system, a single byte actually requires two 8-bit bytes. when we say that the RAM memory is 2 Mwords, this means although there are really 4 million 8-bit bytes available, or million 16-bit words will fit.
Peak-to-peak	Describes the full amplitude range of a signal. For exampl signal that is "±20 V" is really 40 V peak-to-peak, since the ov range is from -20 V to +20 V.
PMC	Personal Memory Card. The *DMS1000* has a PMC interface on its front panel. PMC's are like solid-state floppy disks.
Range	The actual setting of the A/D converter. Range is typically s 2:1 of the Span, allowing offset to be introduced by the u Example: this would allow a 0–5 V signal to be offset so that was on the right grid edge, and 5 V was on the left grid e Starting with version 4.04, the range is set automatically du SPAN selection and/or during calibration.
RS-232C	A standard serial computer interface. Standard on the *DMS10*
Sample Rate	The rate in Hertz (Hz) at which an incoming analog wavefor digitized by an ADC
SCSI	Small Computer Systems Interface. This optional interface p into any of the 12 expansion slots in the rear of the *DMS1* SCSI allows the *DMS1000* to connect directly to a SCSI-compa hard disk drive, or similar mass storage device.
Screen	Any image which fills the entire *DMS1000* EL video displa called a "screen." Screens are grouped according to com function.
Setup	A complete set of user-defined parameters which cause *DMS1000* to behave in a known manner. Many set-ups ca created and stored in internal memory, on PMC, or external SCSI device or computer attached via GPIB or RS-232A.
SoftKey	One of the six plastic keys located along the right side of the v screen. Called "soft" because their functions change accordi which screen is being shown on the video display.
SPAN	The portion of the RANGE that is actually shown across the pattern on the chart. See RANGE, above.
SRAM	Static Random Access Memory. This generally refers to *DMS1000*'s internal RAM memory.
T-axis	The axis that runs parallel with time. Also: "Time Axis"
Time Base	See "Time Scale"
Time Scale	Often used to describe the time base of the chart; the inver chart speed. For example, if the chart speed is 50 mm/sec then the Time Scale is 20 ms/mm, the inverse.
vKey	A "virtual key" that appears on the video screen. Called "vi because they are just 2-dimensional screen images that ca really be pressed with a finger, but that are "pressed" by sele them with the jog-wheel then pressing <enter> .
Virtual	Something which appears to be there but really is not.
W	Word. See "MW," above.

X-Y	X-Y describes a presentation of a Waveform A's amplitude axis versus Waveform B's amplitude axis (as opposed to one waveform's amplitude axis versus time).
Y-axis	The axis that runs perpendicular to time. In a Y-T presentation, it is the axis that runs parallel with amplitude.
Y-T	Y-T describes the typical "strip chart" data presentation format: amplitude versus time.

Appendix C Multilingual Cross-reference of Terms

In this section, some of the more common words used in conjunction with the *DMS1000* operation are shown in English, French, German, Italian, and Dutch.

English	French	German	Italian	Dutch
A/D Converters	Convertisseurs A/N	A/D Wandler	Convertitori A/D	A/D Converters
Auto-Calibration	Auto Calibrage	Autom. Eichung	Autocalibrazione	Auto Calibratie
Bandwidth	Bande pasante	Bandbreite	Banda Passante	Doorlaatband
Channel	Voie	Kanal	Canale	Kanaal
Data-logging	Mode journal	Data-Logging	Data-logging	Data-logging
Hard Disk	Disque dur	Hard-Disk	Hard Disk	Hard DIsk
Input	Entrée	Eingang	Ingresso	Ingang
Input Isolation	Isolation d'entrée	Isolationsspannung	Ingresso Isolato	Isolatiespanning
kB (kilobyte)	ko	Kb	kB (kilobyte)	kB
MB	Mo	Mb	MB	MB
Math Functions	Fonctions calculs	Mathem. Funktionen	Funzioni di calcolo	Rekenfuncties
Memory Recording	Enregistrement en mode mémoire	Speicher Aufzeichung	Registrazione con memoria	Geheugen registratie
PMC (Personal Memory Card)	Cartes mémoire	Speicher-Karte	SMP (scheda di Memoria Personale)	Geheugenkaarten
Real -time	Temps réel	Echtzeit	Tempo Reale	Real time
Recorder	Enregistreur	Schreiber	Registratore	Recorder
Thermal printhead	Peigne thermique	Printkopf	Testa di stampa termica	Thermische printbalk
Video display	Ecran vidéo	Videoanzeige	Display	Video display

Appendix D Digital Input Recording

The *DMS1000* can accept digitized waveforms via its built-in GPIB and RS-232C computer interfaces.

Beginning November 1, 1993, the "standard" *DMS1000* mainframe was bundled with (among other important things), 32 digitized input channels. These can be input via either the standard RS-232C or GPIB interfaces, or in any combination (12 channels via RS-232C and 20 via GPIB, etc.).

If your DMS1000 was built prior to November 1993 and you wish to add digitized input capability, please consult Western Graphtec for price and delivery.

It is possible to input digitized waveforms into both GPIB and RS-232 at the same time. It is also possible to input analog waveforms via the analog input boards at the same time that you are inputting digitized waveforms via GPIB and/or RS-232C!

Most people use the GPIB interface for inputting digitized waveforms due to its speed, and use the serial port for controlling the *DMS1000.* If only one interface is used, commands may be mixed with data, following the protocol.

D.1 Digital Interface

Digital data is sent to the *DMS1000* through either the GPIB or the SERIAL p as a stream of data blocks interspersed with standard commands. The number bytes per sample and the number of contiguous channels per block should preset using the *DFT command.

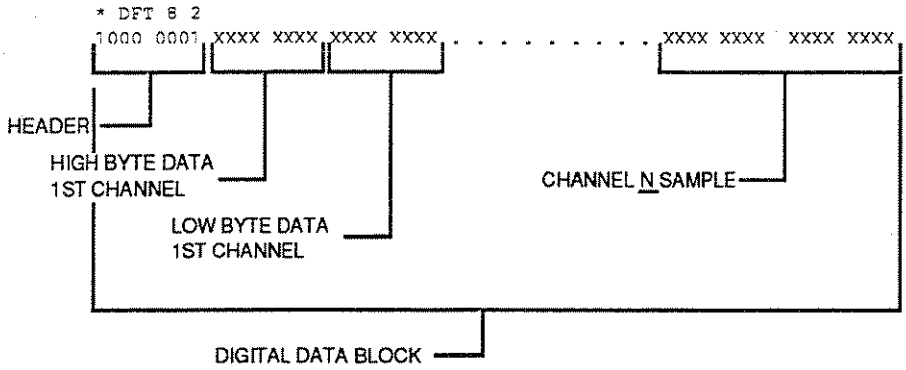
The data format is defined as follows:

Digital Data ::=	<block1><block2>...<blockn>
<block> ::=	<header><channel n sample><channel n+1 sample> ...
<channel number> ::=	integer, 0 to 127
<header> ::=	One byte 128 + <starting channel number>
<channel sample> ::=	{<one byte sample> | <two byte sample>}
<one byte sample> ::=	One 8-bit signed integer +127 = + full-scale -128 = - full-scale
<two byte sample> ::=	One 16-bit signed integer, <high byte><low byte>. +32767 = +full-scale -32768 = - full-scale Bit 0 is the event bit. 0 = Event Off, 1 = Event On

Data Format Table

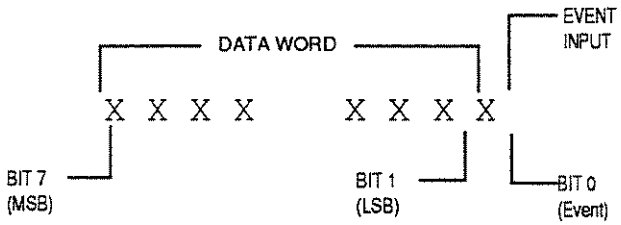
Presently, it is not possible to change the organization or arrangement of the b within bytes or byte-pairs. This is, however, under consideration as a futu software enhancement.

Example: 8 digital channels with 2-byte (16-bit) data:



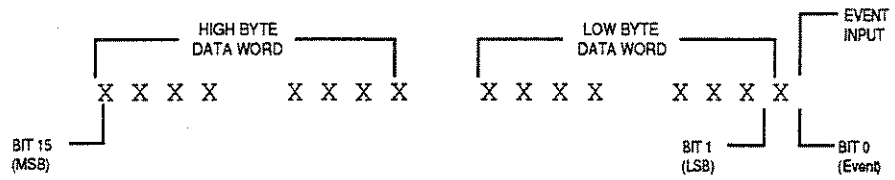
Digitized Input Data Transfer Format

When sending 1-byte (8-bit) data, the byte is arranged as follows:



1-byte Digitized Input Bit Organization

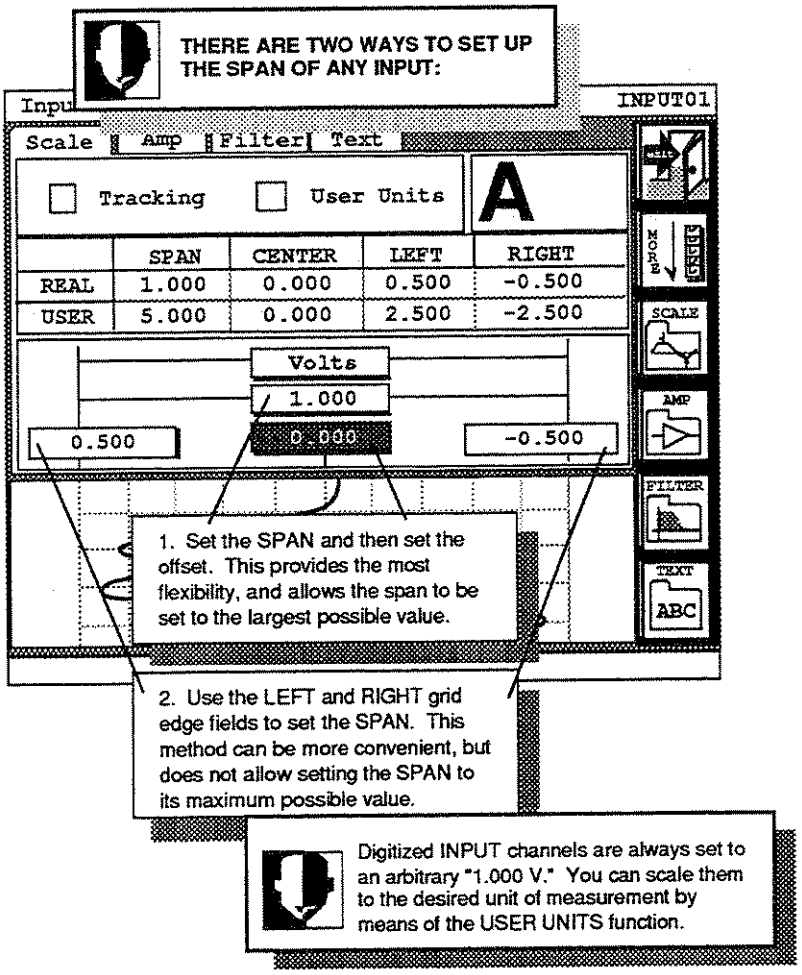
2-byte (16-bit) data:



2-byte Digitized Input Bit Organization

D.2 Adjusting the Span and Offset of Digitized Waveform Channels

You may adjust the span and offset of digitized waveform channels very much if they were analog inputs. To do so, go to the -INPUT SETUP- screen. Tl screen can be reached from the -MAIN- screen and selecting the \Setu menu item from the \INPUT/ menu:



Input Setup Screen

Make sure that the correct input channel is selected, and then make whate scaling changes are desired.

Note that the RANGE is automatically set to 1.000 V, and cannot be chang This is an arbitrary value, anyway, since the input to this channel is not an ana voltage. But it serves as a reference for the SPAN and OFFSET values, 1.000 V is a logical, easy to use number.

You can see a real-time, instantaneous representation of the incoming signa the lower white box.

Run the chart and watch this input channel. You may make real-time adjustments to the SPAN and offset by varying the SPAN and OFFSET values shown on this screen, following the standard procedures described in the -INPUT SETUP- screen section.

You may use the {EXT CAL} *(AUTO CAL)* functionality with digitized waveform channels. This saves setup time by having the *DMS1000* adjust the SPAN and OFFSET to make them some percentage of the full grid width—usually 100%. You can apply AUTO CAL to a single channel, all slave channels, or all channels.

You may also use the MASTER functionality with digitized waveform channels just as if they were analog channels.

Every attempt has been made to maintain a consistent user interface between analog and digitized waveform channels.

Appendix E Keyboard Characters

Here are the characters that can be entered from the front panel keyboard built into the Mark 12.

Chr	Description	How to Make it
A ~ Z	Upper-case English alphabet	Press the dedicated hardKey <A>, <B>, etc.
a ~ z	Lower-case English alphabet	Hold down <SHIFT>, then press the dedicated hardKey <A>, <B>, etc.
1 ~ 9	Arabic numerals	Press the dedicated hardKey <1>, <2>, etc.
:	colon	Press the dedicated hardKey <:>
,	comma	Press the dedicated hardKey <,>
.	period	Press the dedicated hardKey <.>
Other Important Characters		
–	minus sign	Hold down <SHIFT>, then press <0>
!	exclamation point	Hold down <SHIFT>, then press <1>
"	quotation marks	Hold down <SHIFT>, then press <2>
#	number sign	Hold down <SHIFT>, then press <3>
$	dollar sign	Hold down <SHIFT>, then press <4>
%	percent sign	Hold down <SHIFT>, then press <5>
&	ampersand	Hold down <SHIFT>, then press <6>
'	apostrophe	Hold down <SHIFT>, then press <7>
(	left parens	Hold down <SHIFT>, then press <8>
)	right parens	Hold down <SHIFT>, then press <9>
=	equals sign	Hold down <SHIFT>, then press <DEL>
_	underscore	Hold down <SHIFT>, then press <BKSPACE>
<	less-than	Hold down <SHIFT>, then press <,>
>	greater-than	Hold down <SHIFT>, then press <.>
*	asterisk	Hold down <SHIFT>, then press <:>
	blank space	Press <SP>

Appendix F Data Formats

This section describes the structure of the data stored in a standard DMS1000 captured data file. This format was changed in version 5.0 firmware to include more information about the input channels by default. This affected only the header portion of the data file structure. Support for the tape file format was initially added in version 4.07.

F.1 File Structure

There are two variations on the file structure depending on whether the data was captured to SCSI disk or SCSI tape media. The format can be identified by *RecordID* field in *WG Record.*

F.1.1 Disk File Structure

The data in a disk file is composed of a *Header Record* followed by a *Data Record.*

Position in File	Item
0	*Header Record*
WGRecord.RecordSize	*Data Record*

Disk File Structure

F.1.2 Tape File Structure

The data in a tape file is composed of a *Header Record* followed by a *Data Record* followed by another *Header Record.* The two *Header Records* are identical except that the *TriggerStart*, *TriggerChannel*, and *TriggerTime* fields are only valid in the second one. This is due to the nature of tape, a sequential medium.

Position in File	Item
0	*Header Record*
WGRecord.RecordSize	*Data Record*
*WGRecord.RecordSize + WGRecord.NumberOfFrames * WGRecord.NumberOfChannels*	*Header Record*

Tape File Structure

F.2 Header Record

The *Header Record* contains all of the setup information necessary to interpi the *Data Record*. There are two formats for the header record depending on t firmware version active when the data was captured. Prior to firmware versi 5.0, the header format was v1.0. Firmware 5.0 and higher use header forn 2.0.

Header format v2.0 can be identified by a *SavedSetup* field being set to zero the *WG Record*, and a *Channel Record* being found immediately following t *WG Record*.

F.2.1 Header Format v1.0

(Before v5.0 firmware) This Header Record is composed of a *WG Recc* optionally followed by a *Setup Record*.

Byte Offset	Item
0	WG Record
156	Setup Record

v1.0 Header Record

F.2.2 Header Format v2.0

(v5.0 firmware and above) This *Header Record* is composed of a *WG Recc* followed by a variable length sequence of records, which is terminated by record of type *End Record*. Aside from the *End Record*, the only record ty found will be a *Channel Record*. There will be one *Channel Record* for ea channel captured, and the order that the *Channel Records* are fou corresponds with the order in which the channels are found in a *Frame*.

Note: If an unknown record type is found it should be ignored and skipped.

Byte Offset	Item
0	*WG Record*
156	Channel 1 *Channel Record*
	Channel 2 *Channel Record*
	. . .
	Channel N *Channel Record*
	EndHeader Record

v2.0 Header Record

F.2.3 WG Record

Offset	Type	Field	Description
0	LONG	*RecordID*	'MSH1' for disk file, or 'MSH2' for tape file
4	LONG	*RecordSize*	Size of Header Record, in WORDs
8	LONG	*SamplePeriod*	Sample period, in µs
12	LONG	*NumberOfFrames*	Number of data sample frames
16	LONG	*StartFrame*	Offset from the beginning of *DataRecord* to the first Frame, in WORDs
20	LONG	*StartTrigger*	Offset from the beginning of *DataRecord* to the Frame in which the trigger occured, in WORDs.
24	WORD	*TriggerChannel*	Relative channel number that caused the trigger.
26	FLOAT	*TriggerPercent*	Trigger percent setting at the time of capture. Ranges from -1.0 to +1.0
30		*TriggerTime*	Trigger time. When IRIG is active, the month and year are set to 0.
30	LONG	*TriggerTime.Us*	Time that the trigger occured
34	WORD	*TriggerTime.Sec*	"
36	WORD	*TriggerTime.Minute*	"
38	WORD	*TriggerTIme.Hour*	"
40	WORD	*TriggerTIme.Day*	"
42	WORD	*TriggerTIme.Month*	"
44	WORD	*TriggerTIme.Year*	"
46	WORD	*TriggerTIme.WeekDay*	"
48	WORD	*NumberOfChannels*	Number of channels per Frame
50	WORD ARRAY[52]	*ChannelSource*	This array contains the location on the capture bus of each channel was captured. It is used to cross-reference the channel to the label in the setup record. Only required when using header format 1.0.
156	WORD	*SetupSaved*	not 0 = v1.0, and a *Setup Record* follows. 0 = v2.0, no *Setup Record,* but a *Channel Record* may follow.

WG Record

F.2.4 Channel Record

This record provides specific information that was in effect when the data was captured. It provides information that allows the raw capture data to be scaled in either Volts or user engineering units.

Offset	Type	Field	Description
0	LONG	*RecordType*	= 'CPRE'
4	LONG	*RecordSize*	Size of this record in Bytes, not including the *RecordType* and the *RecordSize*
8	FLOAT	*Range.Lo*	Min range setting of the channel during capture, in Volts
12	FLOAT	*Range.Hi*	Max range setting of the channel during capture, in Volts
16	FLOAT	*VoltScale.Lo*	Min chart edge setting, in Volts
20	FLOAT	*VoltScale.Hi*	Max chart edge setting, in Volts
24	FLOAT	*UserScale.Lo*	Min chart edge setting, in user units
28	FLOAT	*UserScale.Hi*	Max chart edge setting, in user units
32	WORD	*CardSlot*	Slot number of the I/O card that this channel came from
34	WORD	*CardChannel*	Channel number of the I/O card that this channel came from
36	CHAR[16]	*CardName*	Name of the I/O card that this channel came from
52	WORD	*Polarity*	Polarity setting at the time of capture. 0 = Plus !0 = Minus Please note that polarity is a software function, so the "raw" captured data does not reflect this condition.
54	CHAR[17]	*Label*	Input Label
71	CHAR[17]	*Units*	User units text
88	WORD	*Options*	This field contains the setting of various text print option flgas that were in effect at the time of capture. They are: 0x0001 Print Channel Label 0x0002 Print Channel Text 0x0004 Print Units Full-scale 0x0008 Print User Units 0x0010 Print Units/Div 0x0020 Print Suppression 0x0040 Print Filter Settings
90	BYTE[32]	*Reserved*	Not used, set to zero (0)

Channel Record

F.2.5 End Header

This record marks the end of the list of Records that follw the WG Record.

Offset	Type	Field	Description
0	LONG	*RecordType*	= 'CEND'
4	LONG	*RecordSize*	Size of this record in Bytes. For this record, the size will be zero (0), because there is no data.

End Header

F.2.6 Setup Record

This record contains the system setup data in a proprietary, compressed format. This record is only present when both of the following conditions are true:

- The DMS1000 firmware is earlier than v5.0
- The SetupSaved field of the WG Record is not zero (0). This results only in pre-v5.0 DMS1000's in which the \Save Setup File/ menu item on the -CAPTURE- screen was checked.

F.3 Data Record

This record contains all of the raw data samples. It is composed of a sequence of Frames. Each Frame represents one sample in time for all channels captured. The first Frame in the sequence is positioned randomly within the *Data Record.* Frames follow sequentially from the first one, and can wrap around from the end of the *Data Record* to the top. Note that the first Frame is located on a WORD boundary—**not** on a Frame boundary. This means that a Frame can wrap around in the middle of a Frame.

Word Offset	Frame
...	...
WGRecord.StartFrame + WGRecord.NumberOfChannels * (N)	N + 1
WGRecord.StartFrame	1
WGRecord.StartFrame + WGRecord.NumberOfChannels	2
WGRecord.StartFrame + WGRecord.NumberOfChannels * (N - 1)	N

Data Structure

F.3.1 Frame

A Frame is composed of a sequence of samples. One sample for each channel captured. The order of the samples correlates to the order of the Channel Records.

Word Offset	Description
0	Sample Channel 1
1	Sample Channel 2
2	Sample Channel 3
...	...
WGRecord.NumberOfChannels * (N - 1)	Sample Channel N

Frame

F.3.2 Sample

A sample is a 16-bit integer composed of a high Byte followed by a low Byte, with the LSB of the low Byte being the EVENT MARKER bit. The format of a sample is one's complement, such that the following applies:

+FullScale = ChannelRecord.Range.Hi = 0

-FullScale = CHannelRecord.Range.Lo = 65535

BYTE Offset	Description
0	High Byte
2	Low Byte + LSB = Event

Sample

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Mark 12
DMS 1000
Operator's Manual

Version 5

January 1995

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Mark 12
DMS1000

Operator's Manual

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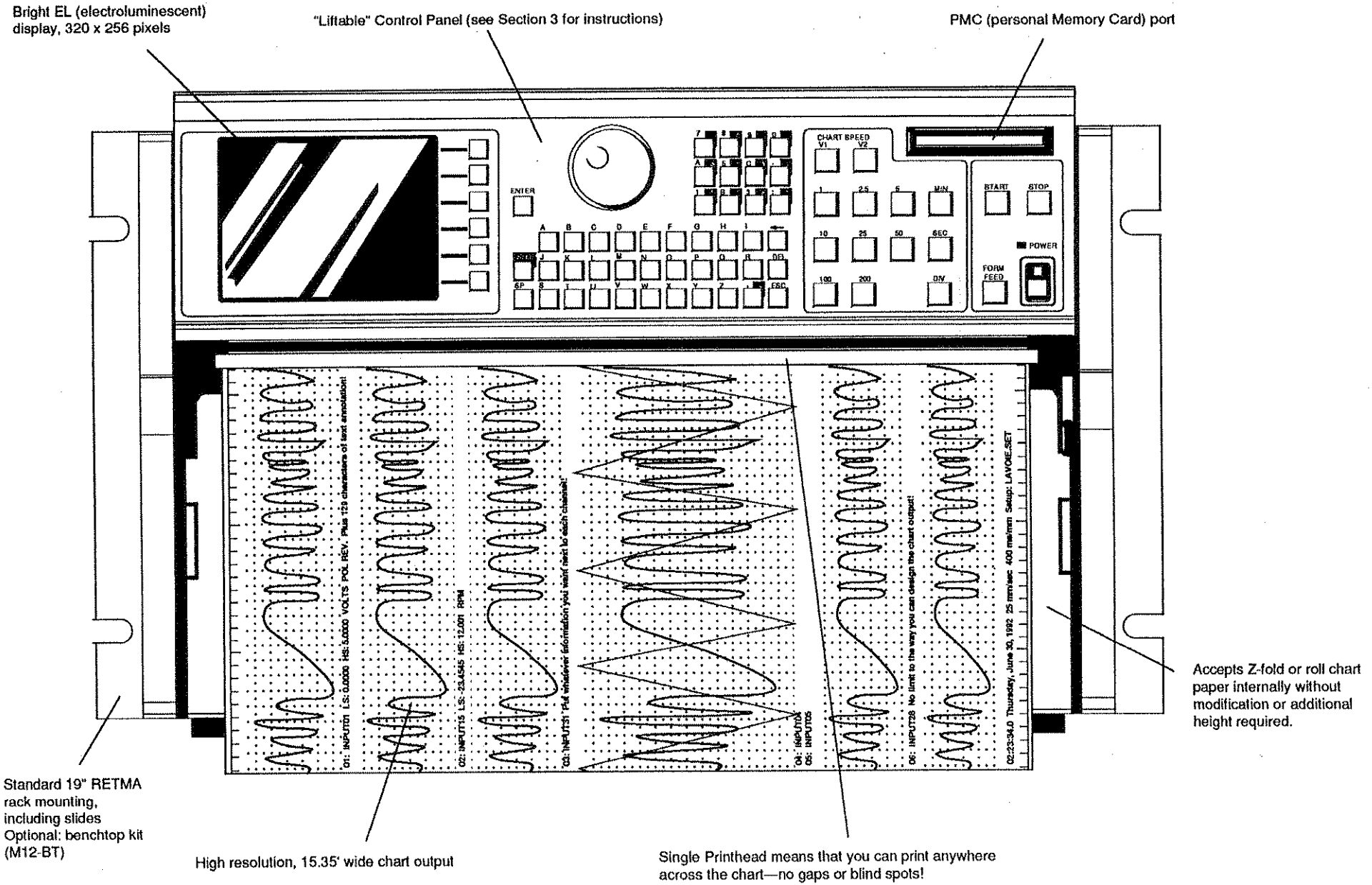
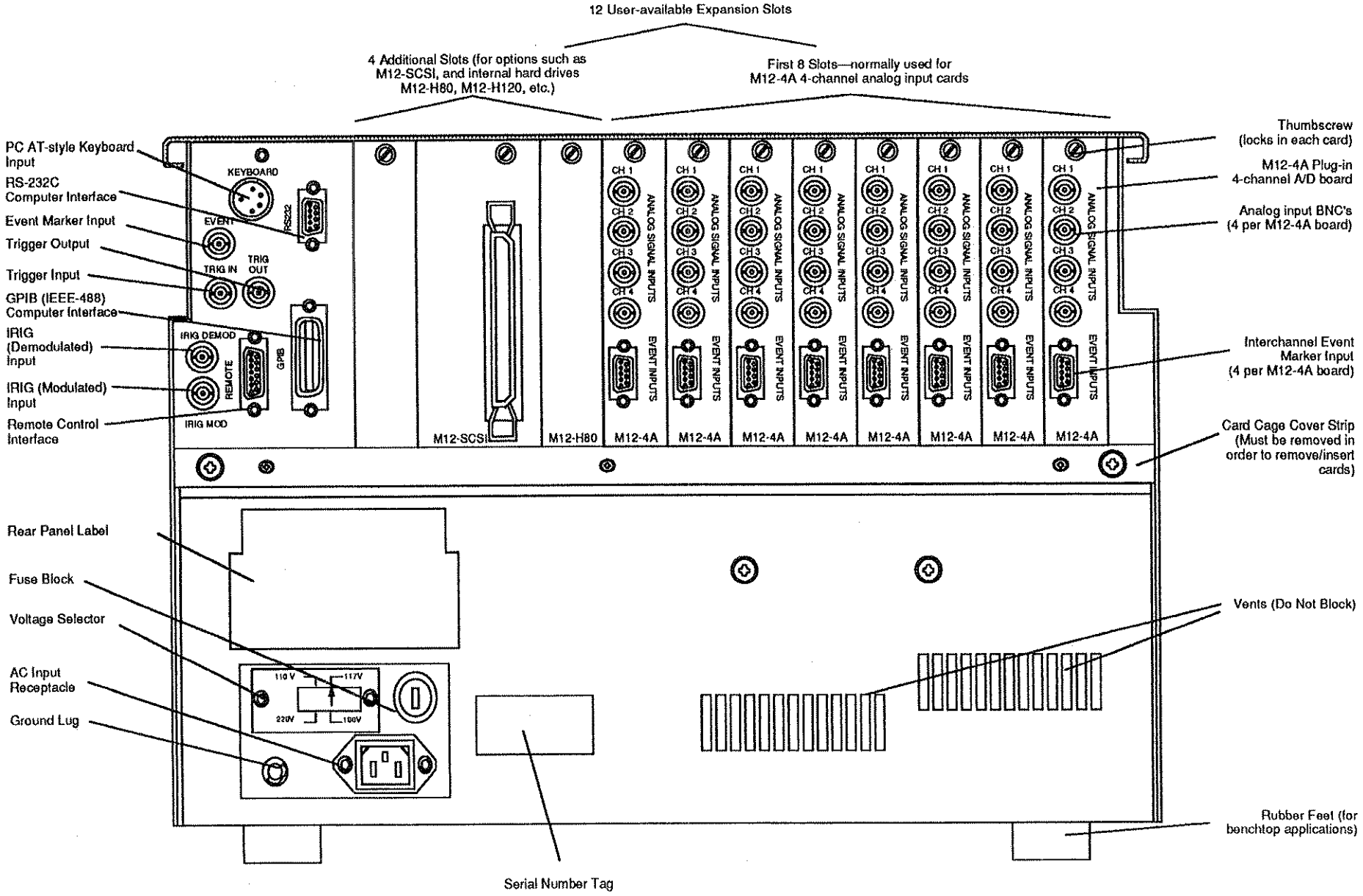

Bright EL (electroluminescent) display, 320 x 256 pixels
"Liftable" Control Panel (see Section 3 for instructions)
PMC (personal Memory Card) port
Accepts Z-fold or roll chart paper internally without modification or additional height required.
Standard 19" RETMA rack mounting, including slides
Optional: benchtop kit (M12-BT)
High resolution, 15.35' wide chart output
Single Printhead means that you can print anywhere across the chart—no gaps or blind spots!


12 User-available Expansion Slots
4 Additional Slots (for options such as M12-SCSI, and internal hard drives M12-H80, M12-H120, etc.)
First 8 Slots—normally used for M12-4A 4-channel analog input cards
PC AT-style Keyboard Input
RS-232C Computer Interface
Event Marker Input
Trigger Output
Trigger Input
GPIB (IEEE-488) Computer Interface
IRIG (Demodulated) Input
IRIG (Modulated) Input
Remote Control Interface
KEYBOARD
RS-232
EVENT
TRIG IN
TRIG OUT
GPIB
IRIG DEMOD
REMOTE
IRIG MOD
M12-SCSI
M12-H80
M12-4A
CH 1
CH 2
CH 3
CH 4
ANALOG SIGNAL INPUTS
EVENT INPUTS
Thumbscrew (locks in each card)
M12-4A Plug-in 4-channel A/D board
Analog input BNC's (4 per M12-4A board)
Interchannel Event Marker Input (4 per M12-4A board)
Card Cage Cover Strip (Must be removed in order to remove/insert cards)
Rear Panel Label
Fuse Block
Voltage Selector
AC Input Receptacle
Ground Lug
110 V
117V
220V
100V
Vents (Do Not Block)
Rubber Feet (for benchtop applications)
Serial Number Tag

softKey Label

This is on on-screen label for the actual softKeys at right. You must press the actual softKey—not the label displayed on the screen.

<ENTER> hardKey

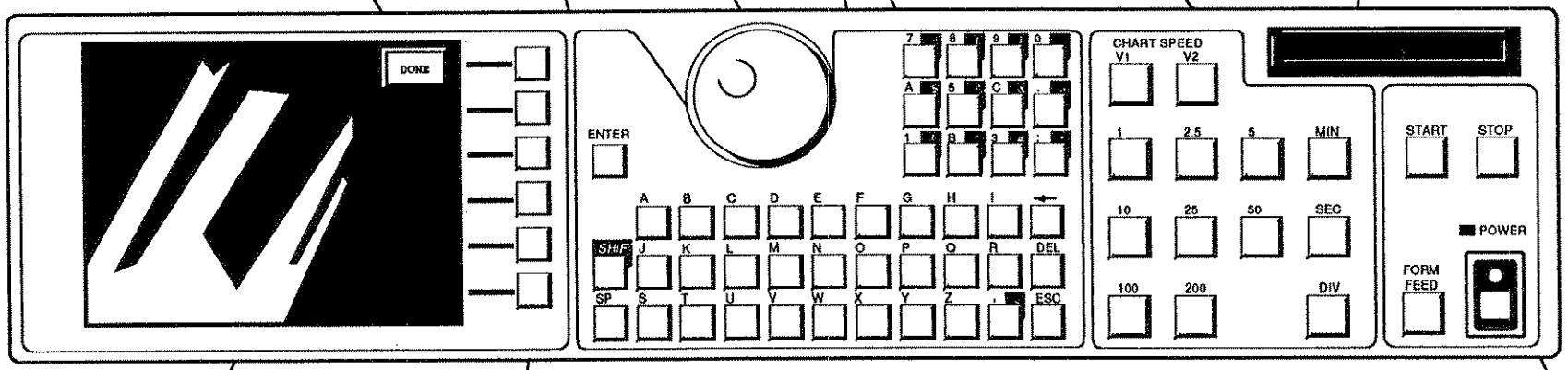
Alphanumeric and Editing hardKeys

Jog-wheel

Chart Speed hardKeys

PMC Port

This is where the Personal Memory Card (PMC) is plugged in.



EL Video Display

The Video display is the primary user interface, and can also display waveforms independently of the chart recording

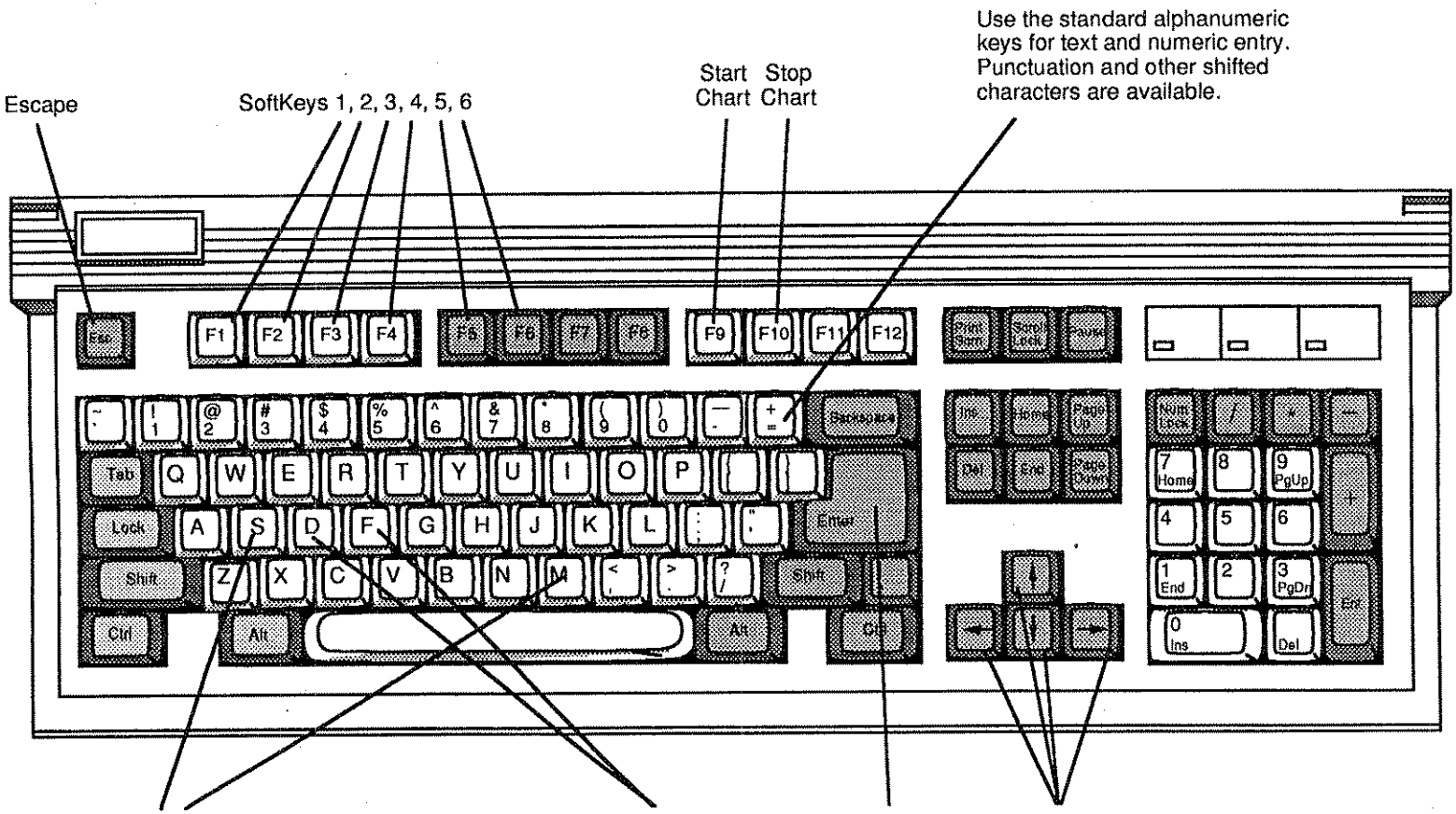
softKeys

softKeys do not have dedicated, specific functions, but instead have different functions depending on which screen is being displayed.

hardKeys

hardKeys have a dedicated, specific function.

Start/Stop/Forn Feed/Power hardKeys



Note: you may use either Alt key

IBM Keyboard Key Equivalents

Section 1 Basic Information

1.1 How to Use This Manual

The *DMS1000* Operator's Manual has been designed to make your experience with the *DMS1000* a pleasant and productive one. It is organized as both an instructional tool for *DMS1000* newcomers, and as a handy reference for the experienced Arraycorder operators, or those who need to brush up on their skills.

We suggest that *DMS1000* newcomers read the first few chapters completely before attempting to operate the recorder. Then, with this manual by your side, go for it.

Experienced *DMS1000* operators should locate this manual somewhere close to the *DMS1000* as a handy reference tool. If you are worried about this manual "walking away" and leaving you without a technical and operational reference, we suggest that you purchase a spare copy. When you receive it, lock it away.

1.2 What is the *DMS1000*?

The *DMS1000* is a whole new concept in recording. Where its predecessors Mark 10 and Mark 11 redefined what an 8-channel oscillographic chart recorder could be, the *DMS1000* goes not only farther down the path of increased performance, but encompasses an entirely new concept of what a recorder should be.

The *DMS1000* is not even called a recorder: it is a powerful Data Management System. We call it a DMS because it has several important new capabilities:

- Expandable to 32 or even 52 channels
- Video display and interfacing
- SCSI interface for direct hard drive attachment

These features bridge the gap between conventional thermal array "recorders" and PC-based data acquisition systems. The *DMS1000* is the first and only instrument to tie everything together.

At its most basic level, the *DMS1000* emulates an 8- or 16-channel oscillographic recorder with an extremely high bandwidth. Conventional recorders employing moving ink or thermal styluses are limited to a 150 Hz bandwidth, and even less when attempting to trace the waveform full-scale across a 40 mm wide span. On the other hand, the *DMS1000* can present the true amplitude envelope of waveforms as fast as *20 kHz*...more than a hundred-fold improvement!

No moving parts means less maintenance. Less calibration. Less down-time.

But this is just the beginning. Microprocessor intelligence enables the *DMS1000* to do a lot more than just be a high bandwidth oscillographic recorder. It can capture waveforms in its large RAM memory (requires memory option), then replay them in slow motion, analyze them with numerous mathematical operations, and write them to a SCSI disk drive.

And there's more. In addition to conventional amplitude vs. time (Y-T) presentations, the *DMS1000* can record incoming waveforms in user-scaleable engineering—like a data logger. Enter a page of text for printing any time, as well as descriptive annotation for each waveform channel. Each channel also includes a TTL-low/switch-closure activate event marker, increasing the number of channels to 64—unprecedented power!

You can see that there is a lot more to the *DMS1000* than meets the eye...and a lot more yet to come. We encourage you to take full advantage of its many and varied functions. Please keep this manual close at hand while operating the *DMS1000*. Read the pertinent sections closely, and browse through the others so that you will know what can be done with this powerful instrument.

And remember to send in your registration cards to be assured of receiving updated and new sections for this manual.

1.3 Uncrating

Please uncrate the *DMS1000* and its accessories carefully, following accepted procedures for the safe opening of crates, boxes, and pallets. After uncrating, perform a visual inspection and confirm that all ordered items have been received and that what you have matches the packing slip. Go through all of the boxes and packing materials one last time to ensure that no small parts or packages were missed.

If you detect any damage to the equipment, or extraordinary damage to the shipping containers, please STOP and call Western Graphtec Customer Service at (800) 854-8385, weekdays from 7 a.m. to 3:30 p.m., Pacific Time. Please retain all shipping containers and materials until the matter has been resolved.

Note *We advise that you keep all shipping containers and materials for at least 90 days.*

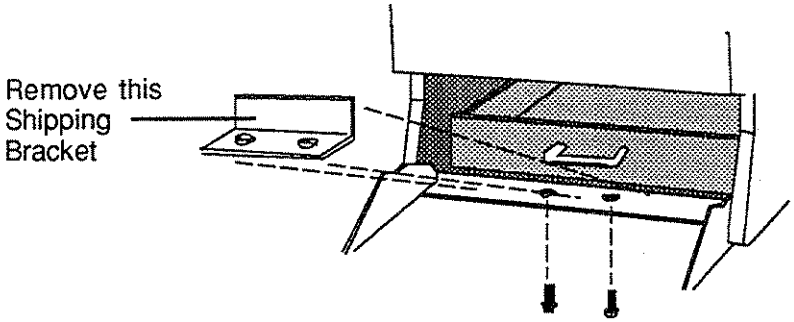
Note *We are all concerned about the environment, and we try to keep our use of non-biodegradable packing materials to a minimum. Please dispose of these materials safely.*

Effective August 1, 1994, each basic *DMS1000* mainframe should contain the following items:

Item	Name	Model	Qty
Mainframe	*DMS1000, including:* • *M12-TR Capture/Trigger Board* • *One M12-512 SRAM Memory Module* • *Rear panel jack for connecting a standard PCAT keyboard* • *Standard PC-AT keyboard (Europe Only)*	*DMS1000*	1
Accessories	Personal Memory Card—64 KB	M12-64k	1
	Power Cord		1
	Thermal Recording Paper—100 meters	PZ1000	1 pack
	DMS1000 Operator's Manual	73801-041	1
	Either: Rack-mount slides—left and right, or side-panel mounted carrying handles (this was specified at the time of ordering)		1 Pair

If you have purchased additional accessories, like rack-mounting drawers, chart take up units, and so on, please verify these against the packing slip. Keep in mind that some options are installed inside the *DMS1000* itself, and cannot be detected unless the *DMS1000* is turned on and operated. Verify that the internal options you ordered are shown on the packing slip, and then check these during actual test.

Before attaching a power cord to the *DMS1000*, please remove the chart paper drawer shipping bracket by removing the 2 screws from below, as shown in the drawing:



Note: Save this bracket! You should re-install it whenever the DMS1000 is shipped!

1.4 Installation

The *DMS1000* mainframe weighs approximately 70 lbs., so do not attempt to move it yourself. Always get help when attempting to lift and move the *DMS1000*.

If you are going to use the *DMS1000* in a bench-top configuration, you're done!

If you are going to mount the *DMS1000* in a RETMA 19" rack enclosure, you're *almost* done. Please locate the pair of rack-mount slides that come with every *DMS1000* mainframe.

Since many thousands of racks all over the USA differ so widely, we cannot provide instructions for every possible configuration. If you have not previously installed heavy equipment into your rack enclosures before, contact someone at your company who has to help you. In any case, lifting the *DMS1000* into the rack is a two-person job. The enclosed rack slides and hardware are probably all that you will need to mount the *DMS1000* successfully.

1.5 Environmental Precautions

The following adverse conditions should be avoided:

- Excessive dust, dirt, salt and corrosive gases
- Temperature and humidity conditions (see note below)

Note *When gauging temperature and humidity conditions, a good rule of thumb is: if a human being can stand it, then the DMS1000 probably can, too.*

- Excessive vibration and shock, outside the limits specified in Section 4.
- Surge voltages, electromagnetic or radio frequency interference
- When locating the *DMS1000*, take special care not to block the ventilation louvers/holes.

Note *The DMS1000 should always be kept in a normal, indoor environment. It is not designed to be stored or to operate outside or in an otherwise unprotected environment. Locating a DMS1000 in a hostile environment—even briefly—can void your warranty.*

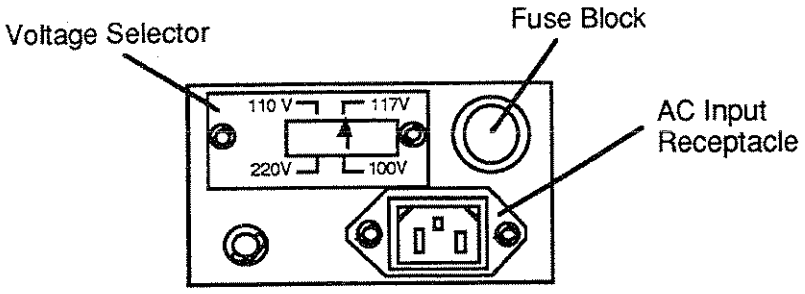
1.6 Power Requirements

Power the *DMS1000* from a power source of the desired nominal voltage (±10%), capable of supplying at least 10 A (assuming 117 VAC operation), and one with a means of providing a protective ground connection. Use the accessory power cord provided.

Warning *This recorder has a line selector to enable operation at voltages other than 117 VAC. Before attempting operation at any other voltage, be sure that this selector is set properly, and that the fuse is of the correct value. Should the DMS1000 exhibit abnormal operation after changing the voltage selector, turn off the power immediately and contact Customer Service at (800) 854-8385, weekdays from 7:00 a.m. to 4:30 p.m. Pacific Time (10:00 a.m. to 7:30 p.m. Eastern Time).*

1.7 Selecting Other Voltages

The voltage selector is located on the rear panel:



AC Input Area

Note: *Turn off the front panel power switch and unplug the power cord from the DMS1000 before attempting to remove the voltage selector. Failure to observe this precaution could result in electrical shock hazard to you.*

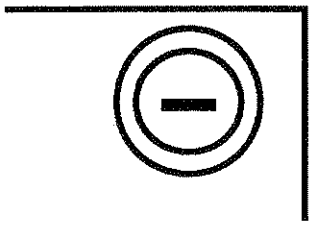
When the power cord has been unplugged, remove the voltage selector by pulling it straight away from the *DMS1000*. Re-insert it so that the arrow is pointing at the desire voltage level.

There is no need to make any adjustment for different line frequencies, since the *DMS1000* will automatically adjust to any frequency from 50 to 400 Hz.

The **fuse must be changed** when going from 100/117 V to 220/240 VAC (or vice versa), as follows:

Voltage (VAC)	Fuse	Frequency
100 or 117	8 A	Self-adjusting (50–400 Hz)
220 or 240	4 A	Self-adjusting (50–400 Hz)

Changing the fuse is easy. With the power cord still unplugged, locate the fuse block on the rear panel:



Open the fuse block by turning it counter-clockwise. Remove the cap, then the fuse itself. Replace it with a new fuse of the proper value. Replace the cap. Plug in the AC power cord, then turn on the front panel power switch.

1.8 Unlocking the "Liftable" Front Panel

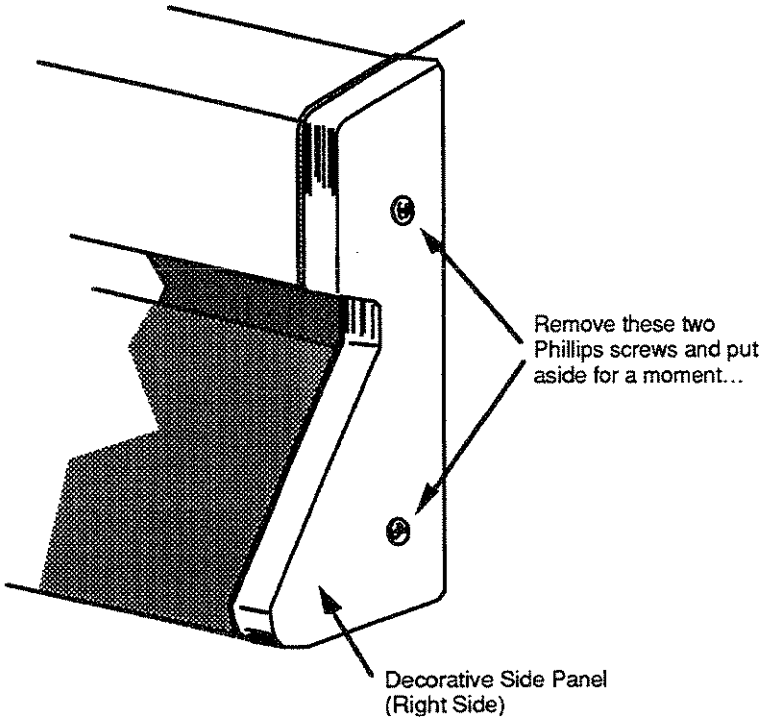
Another unique *DMS1000* feature is its "liftable" front panel. Many users have found that placing the front panel in its lifted position improves chart visibility—especially when immediate viewing of chart records is important.

The *DMS1000* is shipped in the normal locked and down position, so you will need to remove a few screws to allow it to be lifted. Once released, it is a simple matter to raise or lower it in just a few seconds, to suit the application.

Note: *Please keep these screws with the recorder, since you must replace them before shipping the DMS1000 to avoid damage to the front panel!*

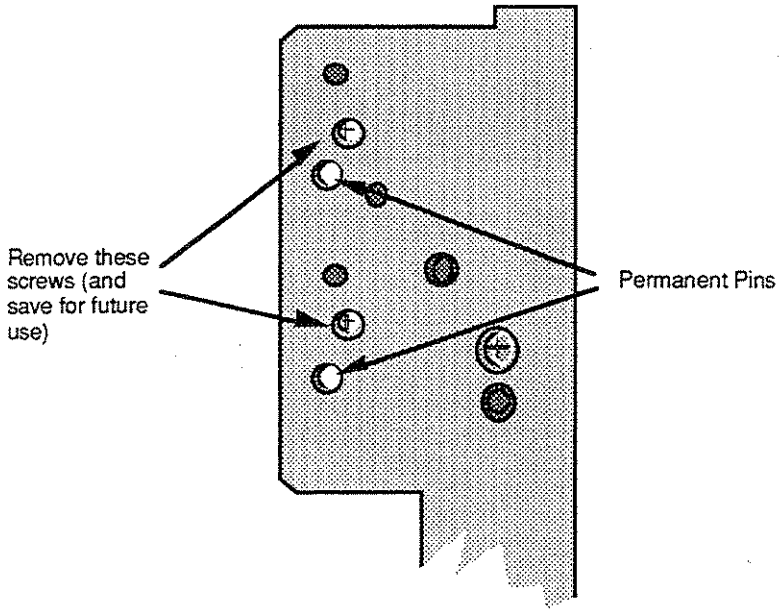
Step 1

Remove the two screws that hold each decorative (plastic) side panel in place and put them aside for a moment. Remove both decorative side panels and put them aside for a moment.



Step 2

Removing the decorative side panels reveals the permanent pins and removable screws which hold the front panel in place. Using the picture above, remove the screws identified and put them in a bag. Again, it is a good idea to hold onto these screws and this procedure permanently, as they should be replaced before the *DMS1000* is shipped anywhere.

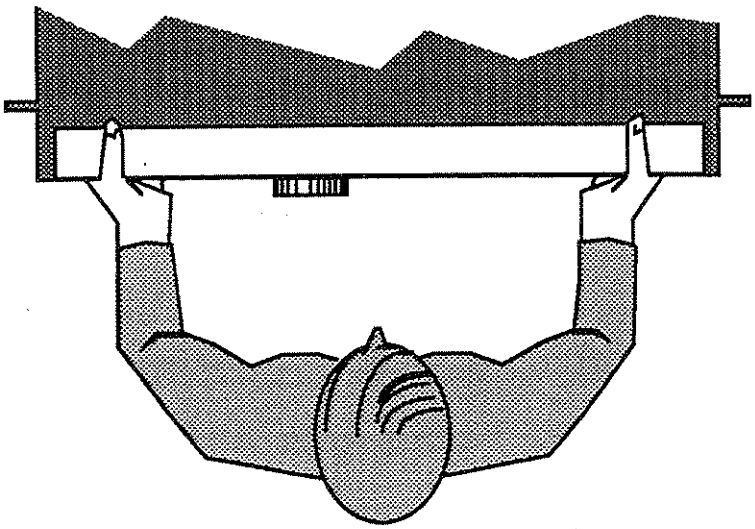


Step 3

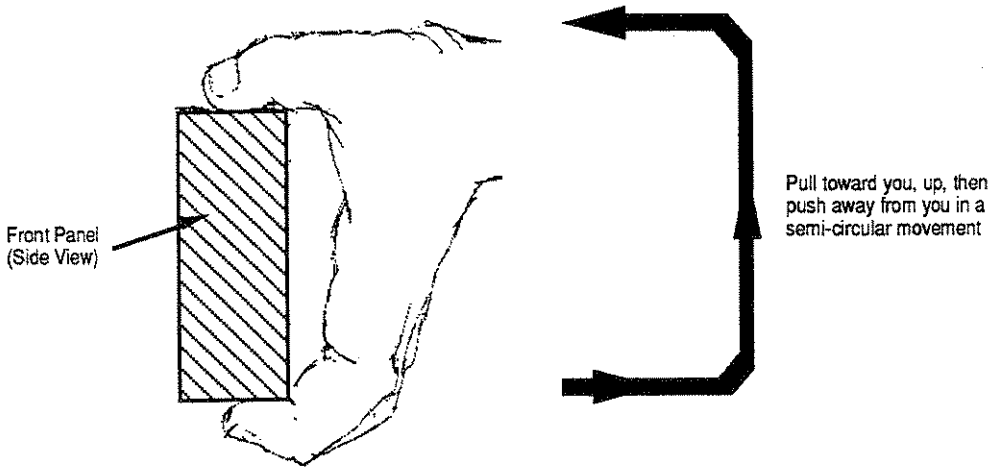
Replace the decorative side panels (reverse Step 1, above). Now you may lift the *DMS1000*'s front panel anytime you'd like. Here's how:

Step 4

Standing in front of and facing the *DMS1000* , reach out and grasp the front panel with both hands as shown. Now, pull gently toward you, lifting very slightly as you pull. You'll feel the front panel slide along two tracks on its permanent pins. Pull it toward you, then up, then push it back flush again—it will drop down snugly into the lifted position.



Top View ↑ ... side view ↓



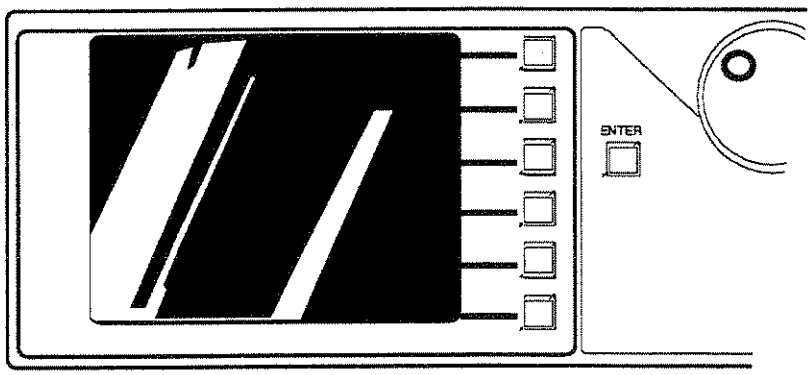
Section 2 Front & Rear Panel Controls & Connections

2.1 Front Panel Controls Identified

Note: *Please refer to the front panel drawing at the beginning of this section as you read.*

The *DMS1000* front panel has two basic sections: the **Video Interface Section**, and the **Dedicated Controls Section**:

2.1.1 Graphical User Interface Section



Front Panel—GUI Section (EL display & softKeys)

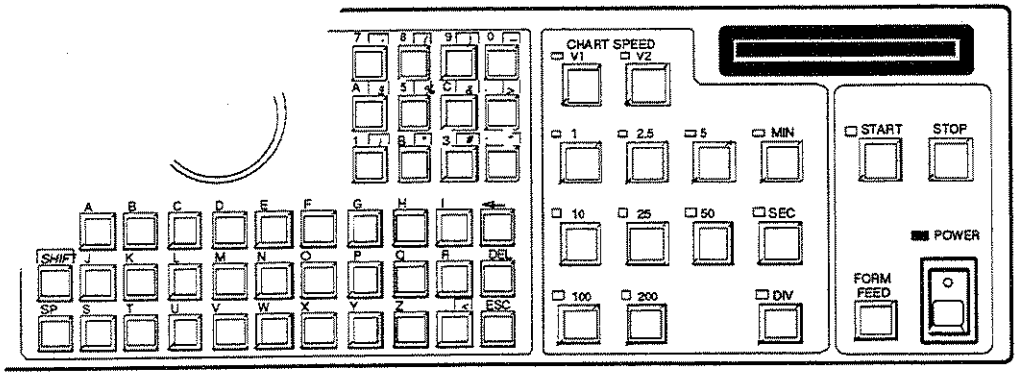
The Graphical User Interface (GUI) on the built-in Electro-Luminescent (EL) display is where most of the setup and control of the *DMS1000* is performed. Note the six *softKeys* located to the right of the screen. The menus and selections which pertain to these keys is not fixed, and will vary according to which screen is being displayed. This provides a fast, intuitive and flexible method of controlling a large number of functions with only a few buttons.

Note also the large circular jog-wheel above and to the right of the video monitor. This jog-wheel is essentially your "pointing device," and may be compared to a mouse or trackball that you may have with your home or office microcomputer.

You will quickly learn how to use the jog-wheel to move the highlight around the screen until it selects the item you want to change, then confirm your selection by pressing the <ENTER> hardKey below and to the left of the jog-wheel.

That's it! That's all you need to know to control the *DMS1000*'s video interface.

2.1.2 Dedicated Controls Section



Front Panel—Dedicated Controls Section

The **Dedicated Controls Section** is comprised of "hardKeys": a power switch and several groups of buttons which have only one function each.

The alphanumeric hardKeys include many useful punctuation and special characters. In addition to the entire upper and lower-case alphabet and numbers 0 through 9, the following characters are included:

-	(minus sign[1])	=	(equals sign[2])	%	(percent sign)
,	(comma)	_	(underscore[3])	&	(ampersand)
.	(period)	$	(dollar sign)	<	(less-than)
(	(left parentheses)	#	(number sign)	>	(greater-than)
)	(right parentheses)	:	(colon)	!	(exclamation point)
'	(apostrophe)	*	(asterisk)	"	(quotation marks)

You access uppercase letters, punctuation marks, space, and these special characters with the <SHIFT> hardKey. See Appendix E for a complete reference of all of the characters that can be entered from the front panel.

---

1 Earlier Mark 12's had two SPACE keys. You may input a dash/hyphen by pressing <SHIFT> and either <SPACE> key simultaneously. Later Mark 12's have a dedicated <SPACE> key (<SHIFT> <0>).

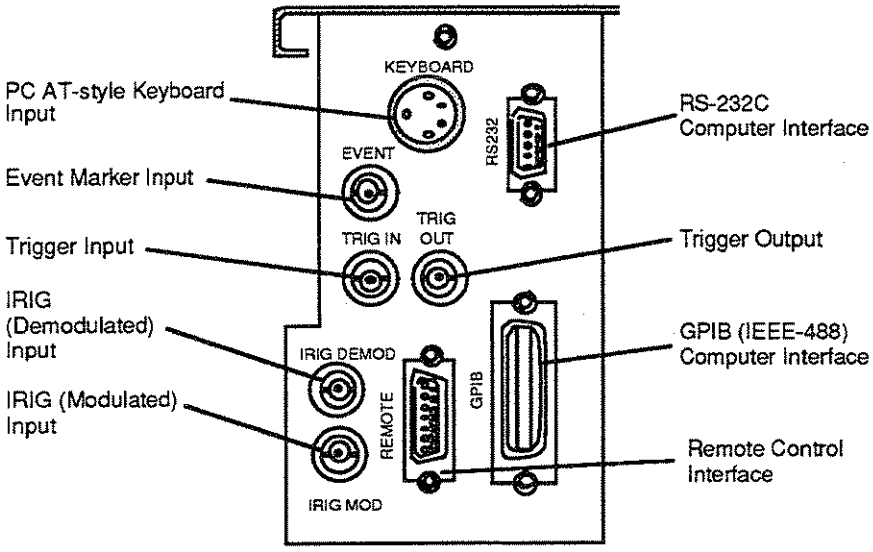
2 You input an equals sign (=) by holding down <SHIFT> then pressing the <DELETE> key

3 You input an underscore (_) by holding down <SHIFT> then pressing the <BACKSPACE> key (the key with an arrow pointing to the left)

2.2 Rear Panel Connections Identified

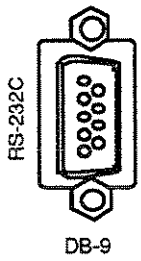
The *DMS1000* rear panel has two basic sections: the **Plug-in Card Section**, and the **Power Input Section**:

2.2.1 Plug-in Card Section—REMOTE CONTROL INTERFACE CARD

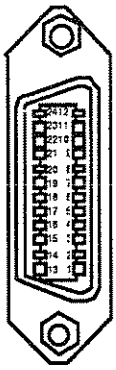


Standard Remote Interface Card

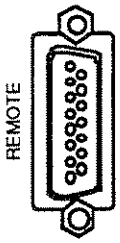
The left-most plug-in card is the Remote Interface Card (RCI), included standard with the *DMS1000*. The M12-TCT Keyboard Interface/Time Code Translator card is also attached to this card. The M12-TCT was made standard during November 1993 so that all DMS1000's came equipped with a IBM PC keyboard input connector, however the IRIG Time Code Translator function is still optional.



RS-232C A 9-pin DB-9 connector for the standard serial interface included with each *DMS1000*. RS-232C allows complete control over all functions.

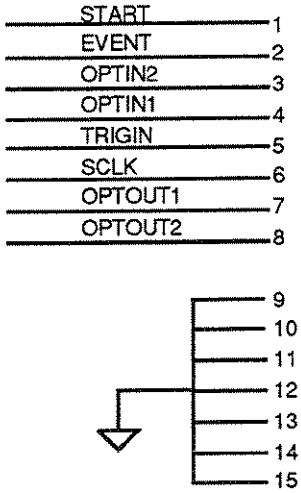


GPIB A standard IEEE-488 (GPIB) connector for the standard GPIB interface included with each *DMS1000*.. GPIB allows complete control over all functions (except power on/off).



DB-15

REMOTE Another standard item is the **Remote** control interface DB-15 connector. This connector allows the remote control of several basic functions like chart start/stop and actuation of the standard system event marker via TTL-low or switch-closure. The pin-outs of this connector:



Important Notes:

- *EVENT can be used to remotely actuate the system event marker.*
- *TRIGIN can be used to remotely trigger the DMS1000 (make sure that [EXT TRIG] is turned ON on the -TRIGGER- screen).*
- *START can be used to remotely start/stop the DMS1000 chart motor.*

- *OPTIN1, OPTIN2, OPTOUT1, OPTOUT2, and SCLK are not used and are reserved for future expansion.*

EVENT (BNC) Actuates the standard system event marker

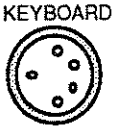
TRIG IN (BNC) Actuates the trigger remotely

TRIG OUT (BNC) Sends the trigger pulse to another device

IRIG DEMOD[4] (BNC) For inputting demodulated IRIG signals

IRIG MOD (BNC) For inputting modulated IRIG signals

KEYBOARD



KEYBOARD The circular connector marked KEYBOARD allows you to directly plug in a standard IBM PC AT keyboard to facilitate text annotation entry. The keyboard will be active only when the text entry screen is active on the video display. See the first few pages of Section 4 for a drawing of the PC-AT keyboard, and a complete listing of the key equivalents.

---

4 The two IRIG BNC connectors as well as the circular KEYBOARD input require that the M12-TCT IRIG option be installed onto the Remote Control Interface Card. Note also that the IRIG option does not occupy a plug-in slot!

2.2.2 Plug-in Card Section—GENERAL

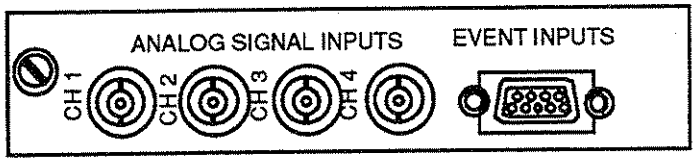
Referring to the drawing of the rear panel, you will observe that there are 12 plug-in slots available for the user. This unprecedented expansion capability means that you can plug in up to eight M12-4x Four-Channel Analog Input Cards, for a total of 32 channels, and still have four slots left over for other options.

If you have the DMS1000E model, you may plug an input card into all of the slots if you desire, for a total of 52 analog channels. Each analog channel includes an event marker. Using all thirteen slots means that you must remove the standard Remote Interface Board, so you lose external TTL/RS232C/GPIB control, remote video capability, digital input, and IRIG capability.

So, many DMS1000E users use 12 slots for input cards. This provides 48 analog channels plus 48 event markers, and they can still have external TTL/RS232C/GPIB control, remote video capability, digital input, and IRIG capability.

2.2.3 Plug-in Card Section—ANALOG INPUT CARD

Look at any one of the eight M12-4 Series Analog Input Cards shown in the rear panel drawing.



Each M12-4 (one shown above) has four BNC connectors for inputting your analog waveforms. M12-4A, -4B, -4C, and -4D card inputs provide 750 V channel-to-channel and channel-to-ground isolation. M12-4E card inputs provide 1000 V isolation. In addition, a DB-9 connector accepts four event markers (one per channel). The M12-4E card uses a DB-15 for the same purpose.

Here are the available M12-4 Series modules:

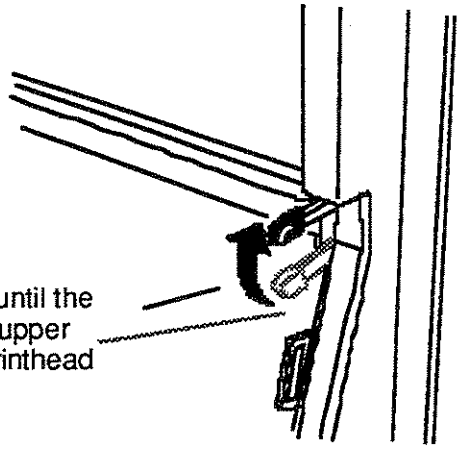
Model	Total ADC Ranges	Typical Spans (full-scale)	Input Z	Input Isolation
M12-4A	1–100 VAC	±50 mV–±50 V peak-to-peak	100 kΩ	750 VAC
M12-4B	0.1–10 VAC	±5 mV–±5 V peak-to-peak	100 kΩ	750 VAC
M12-4C	2–200 VAC	±100 mV–±100 V peak-to-peak	200 kΩ	750 VAC
M12-4D	5–500 VAC	±250 mV–±250 V peak-to-peak	500 kΩ	750 VAC
M12-4E	50 mV - 500VAC	±50 mV to ±500 V peak-to-peak	1 MΩ	1000 VAC

M12-4 Series Input Card—Basic Information

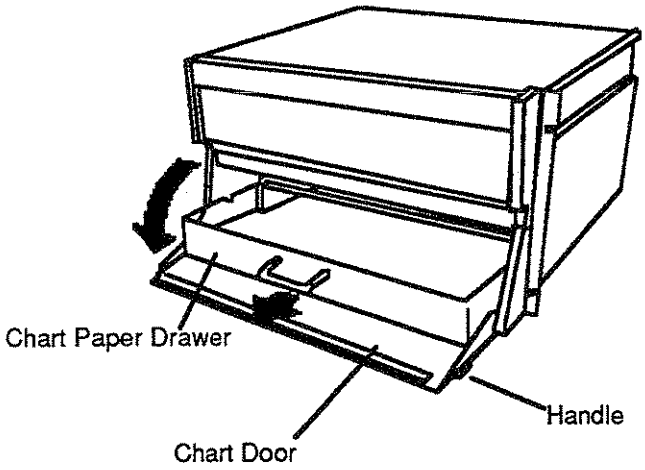
See the Specifications in the Appendices for complete technical information about the M12-4 series input cards

2.3 Loading Z-fold Chart Paper

Step 1: Lift Printhead

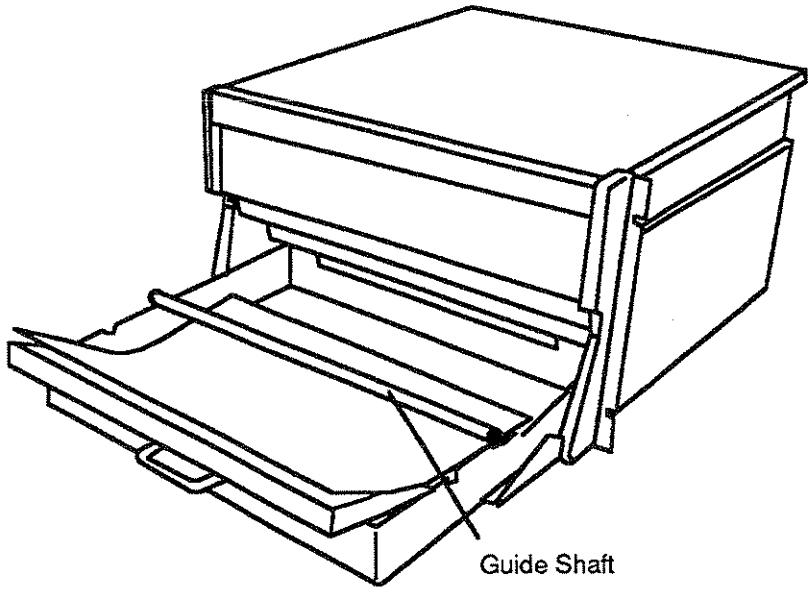


Step 2: Open Drawer



Open the chart door and slide out the chart paper drawer all the way.

Step 3: Insert Pack

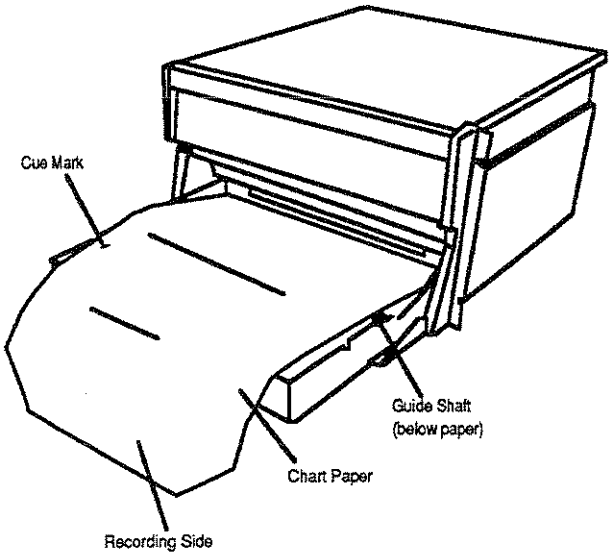


Slide the pack into the chart drawer below the guide shaft (the silver bar).

You may remove the guide shaft to make insertion easier, but remember to replace it, since it is required to maintain proper back-pressure.

Be sure that the thermal sensitive side is going to come out top-up with the top of form mark facing up and on the left side of the recorder. The red stripe marks the end of the pack, and should thus be on the bottom.

Step 4: Pull Chart OVER Silver Bar



Pass a sheet or two over the top of the silver bar and toward you.

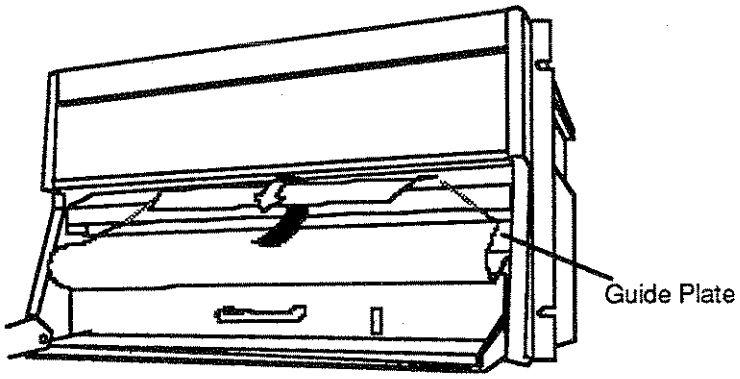
Verify that the black cue mark is on top and on the left side of the sheet.

Important Notes:

- *Chart paper is thermally sensitive only on one side. Therefore, it is critical that you insert the paper so that the top-of-form mark shows when the paper is draped as shown above. The DMS1000 cannot print on the back side of the chart.*

- *The last three feet of the chart are marked with a red warning doubt about which side of the pack is the top, remember that the red line should be on the bottom of the pack.*

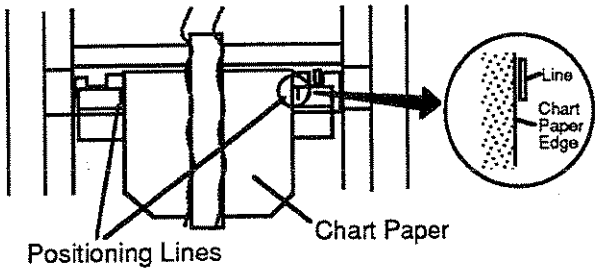
Step 5: Thread Some Paper



Slide the paper drawer most of the way closed, then feed the edge of the chart paper up behind the roller.

It may be useful to turn the roller slightly with your fingers to coax the chart paper around. This is easier when the front panel is raised. When the chart paper appears above the roller, pull it out a few feet.

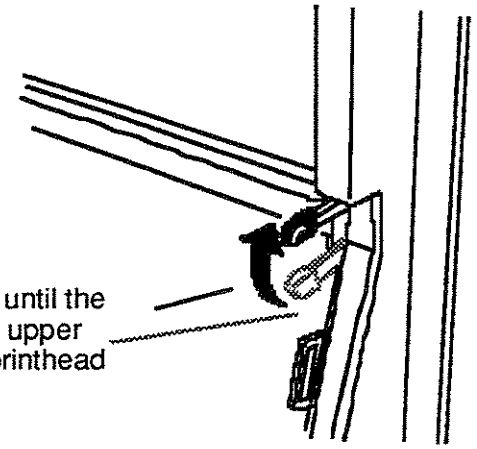
Step 6: Align Chart Paper



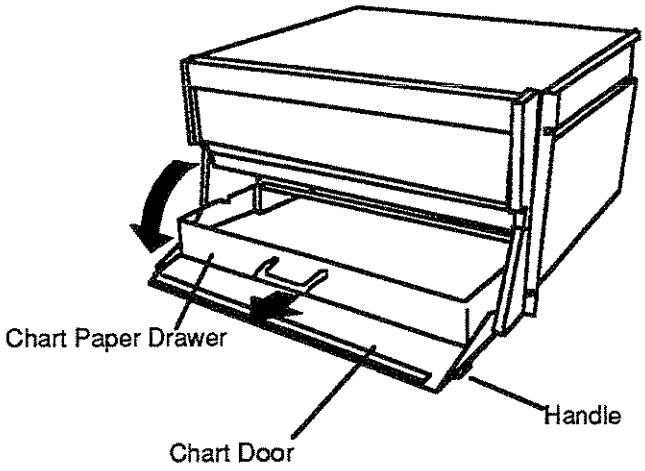
Pull the paper out and straight down, lining up the edge of the paper with the alignment mark scribed inside the Mark 12.

2.4 Loading Roll Chart Paper

Step 1: Lift Printhead



Step 2: Open Drawer



Open the chart door and slide out the chart paper drawer all the way.

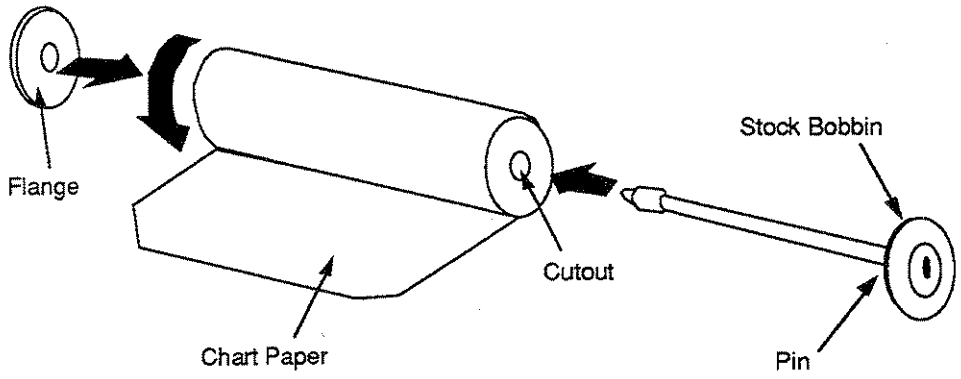
Step 3: Assemble the Roll

After removing the roll of chart paper from its container, locate the stock bobbin and screw-on flange.

Look at each cardboard end of the roll—one end has a small cut-out. This cut-out will mate with the pin in the stock bobbin.

Push the stock bobbin all the way through the roll, making sure that the pin mates with the cut-out as described above.

Finally, screw on the flange.

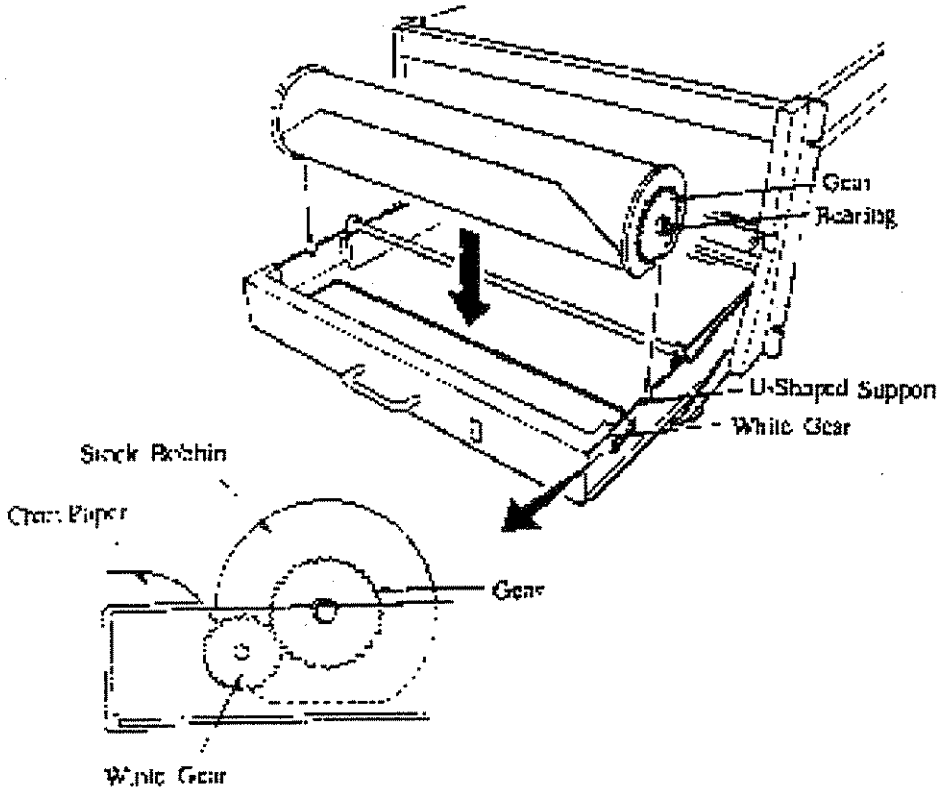


Assembling the Roll

Step 4: Place Roll into Mark 12

With the chart drawer still open, place the roll/bobbin assembly onto the U-shaped supports on either side of the drawer.

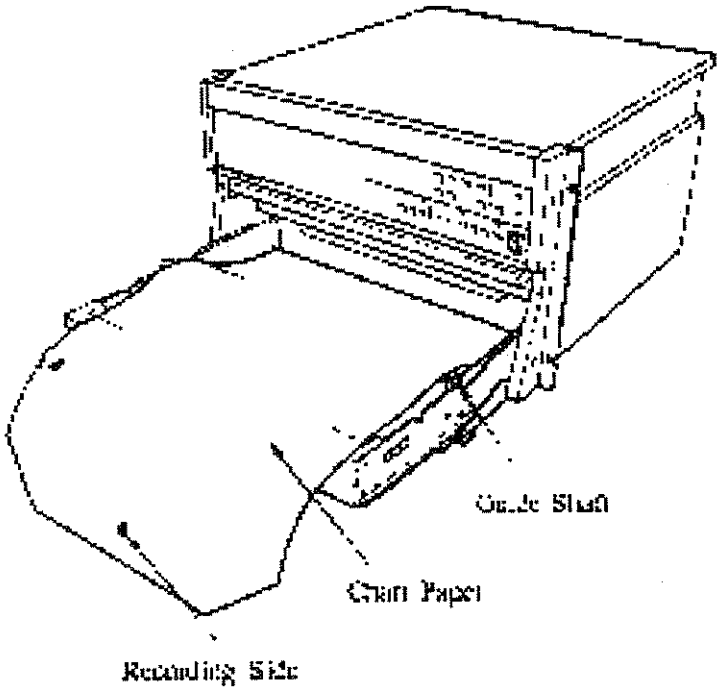
Make sure that the white gear on the stock bobbin meshes with the smaller white gear inside the drawer (on the right-hand side).



The small white gear provides the back tension required to keep the chart paper feeding smoothly and without skew or wander.

Step 5: Pull Out Some Paper

Pull about a foot of chart paper toward you as shown below:



Important Notes:

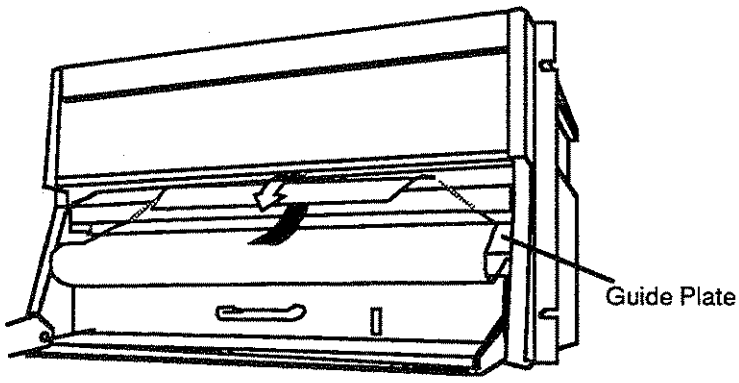
- *Chart paper is thermally sensitive only on one side. Therefore, it is critical that you insert the paper as described above. The DMS1000 cannot print on the back side of the chart.*
- *The last three feet of the chart (the part closest to the cardboard hub) are marked with a red warning line.*
- *You DO NOT USE the silver bar when using ROLL PAPER*

Step 6: Thread Paper/Close Drawer

Now, leaving a sheet of paper hanging out as shown, push the drawer most of the way back into the recorder.

Feed the end of the chart paper under the guide plate so that it pops out above the platen (the black rubber roller).

Now push the drawer back until it clicks solidly into place

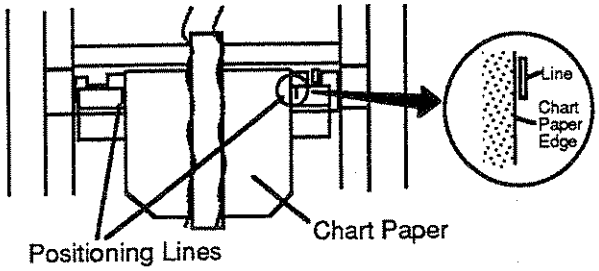


Slide the paper drawer most of the way closed, then feed the edge of the chart below the roller.

It may be useful to turn the roller slightly with your finger to help get the chart to come around. When it appears, pull it out a few feet.

Step 7: Align Paper

Pull the end of the paper straight out so that about 8–10" of paper are showing. It is important to line up the edges of the chart with the positioning lines, as shown below:



When the paper is aligned properly and seems to be set "squarely," lower the printhead lever, then close the panel. You're done!

2.5 Printing the *DMS1000* EL Display

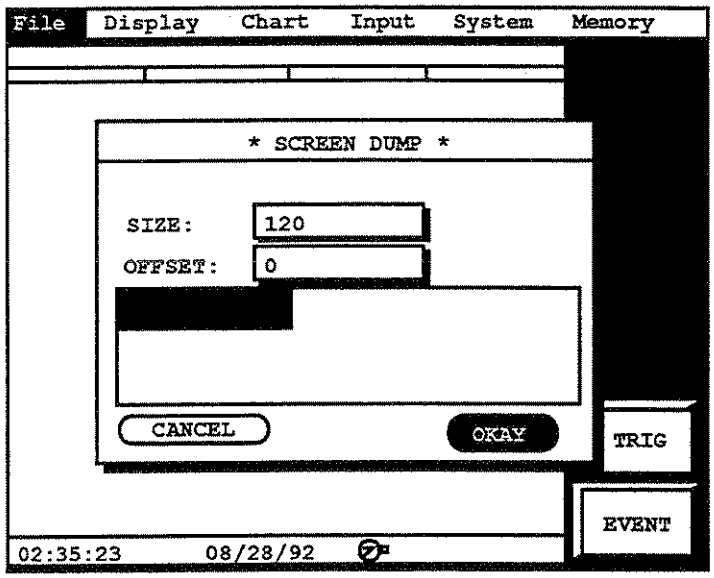
The DMS1000 can print out copies of its own video display screens via a hidden command sequence.

This is useful as a training aid for new operators, or to document set-up parameters for future reference.

To cause the current screen to be "dumped," you must first stop the chart. Make sure, however, that the chart is "enabled" under the [Chart] menu on the –MAIN– screen.

Hold down the <SHIFT> hardKey, then press <ESC> . DO NOT RELEASE <SHIFT> UNTIL AFTER YOU HAVE RELEASED <ESC>! Otherwise, the DMS1000 will recognize the <ESC> hardKey—no screen dump will occur, and you may upset some of the parameters on the screen (i.e., <ESC> causes dialog boxes and pull-down menus to go away, etc.).

When you press <SHIFT> + <ESC>, a *SCREEN DUMP* dialog box will appear:



**Screen Dump* dialog box*

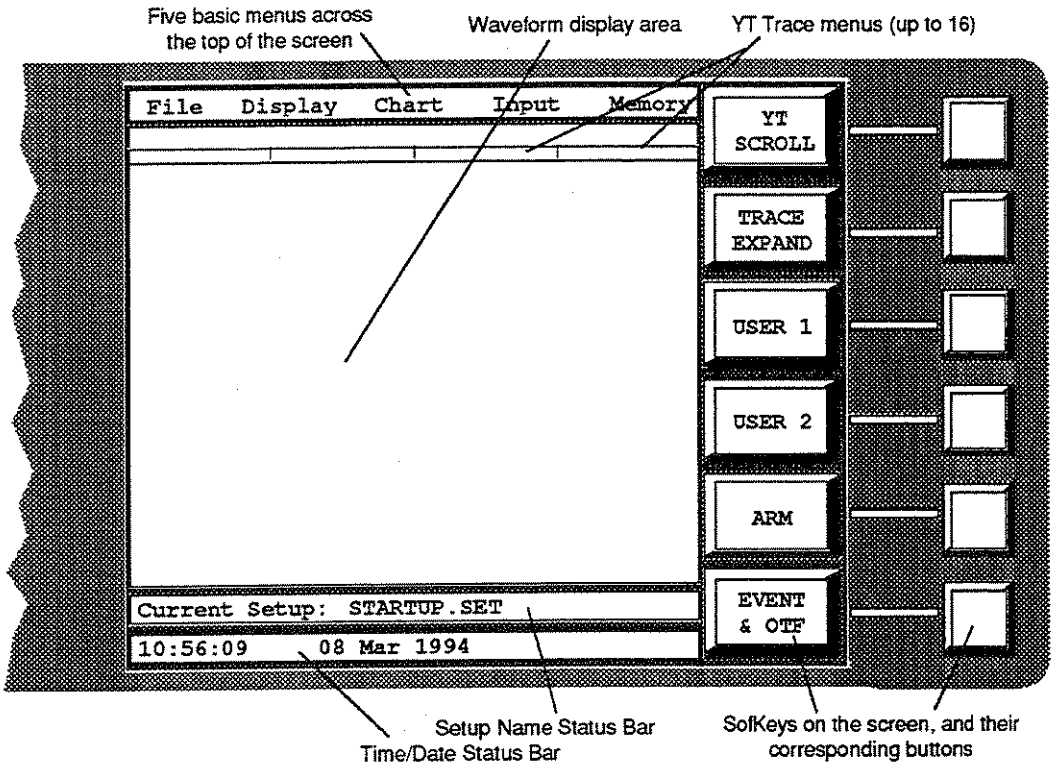
The *SCREEN DUMP* dialog box contains controls for deciding how big you want the screen printed, and where across the chart you want the image to appear. The shaded area represents the relative size and location of the printed image in relation to the chart paper. There is a [Cancel] vKey, plus the familiar [Done] vKey.

When you highlight the [Done] vKey and press <ENTER>, the dialog box will disappear, and there will a momentary lapse while the DMS1000 sends a rasterized copy of its screen electronically to the printhead. After a few seconds, the screen dump will print out on the chart. Use the <FORM FEED> hardKey to advance the chart to the next perforation if required.

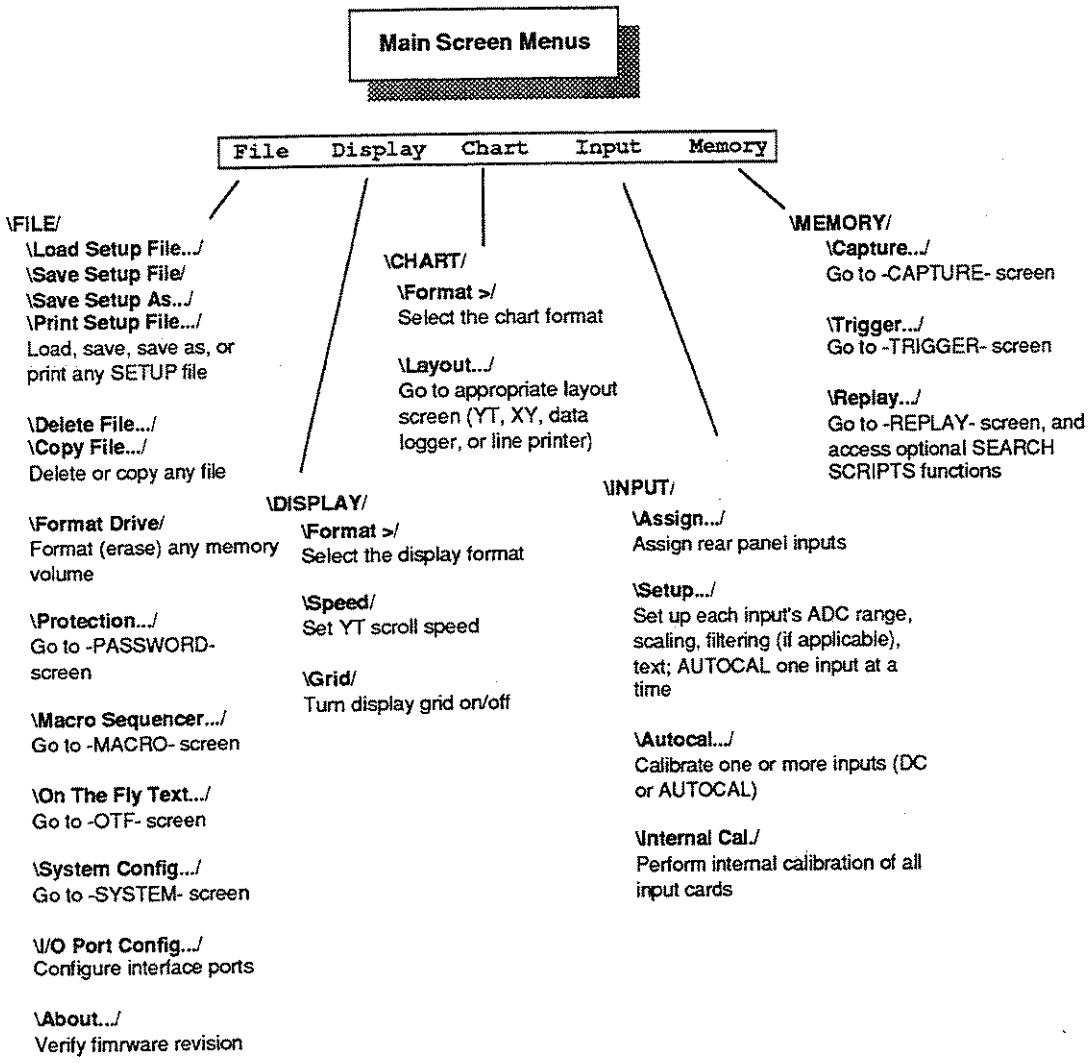
Section 3 The Main Screen

The drawing below identifies the major screen objects. The next drawing shows a hierarchy of menu commands. When you're ready, proceed by following the steps shown with your own DMS1000.

After the screens there is an alphabetical listing of the screen objects (buttons, menus, menu items, softKeys, et al), with definitions.

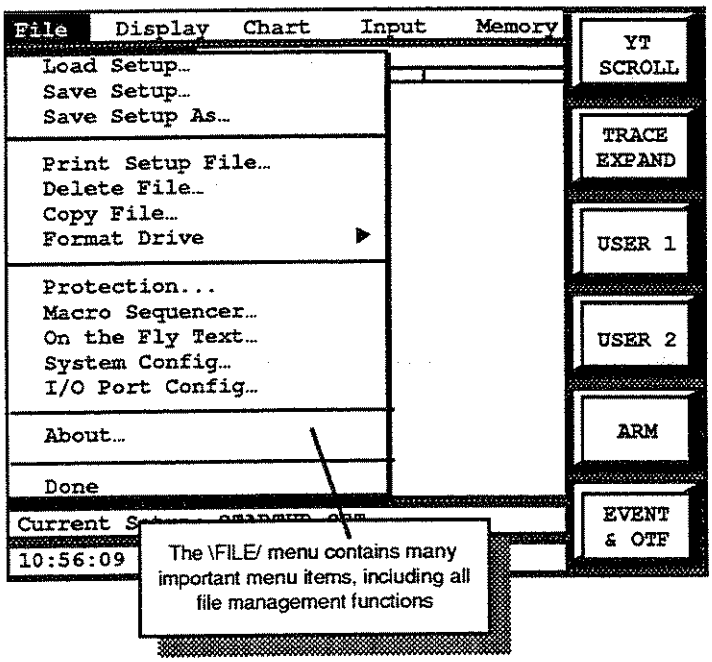


Menu Hierarchy—Main Screen



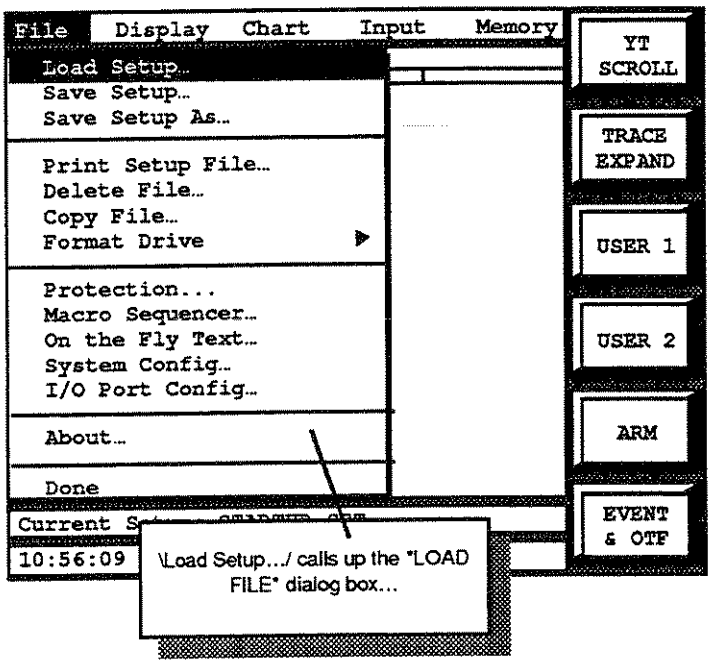
Main Screen Menu Hierarchy

3.1 The File Menu

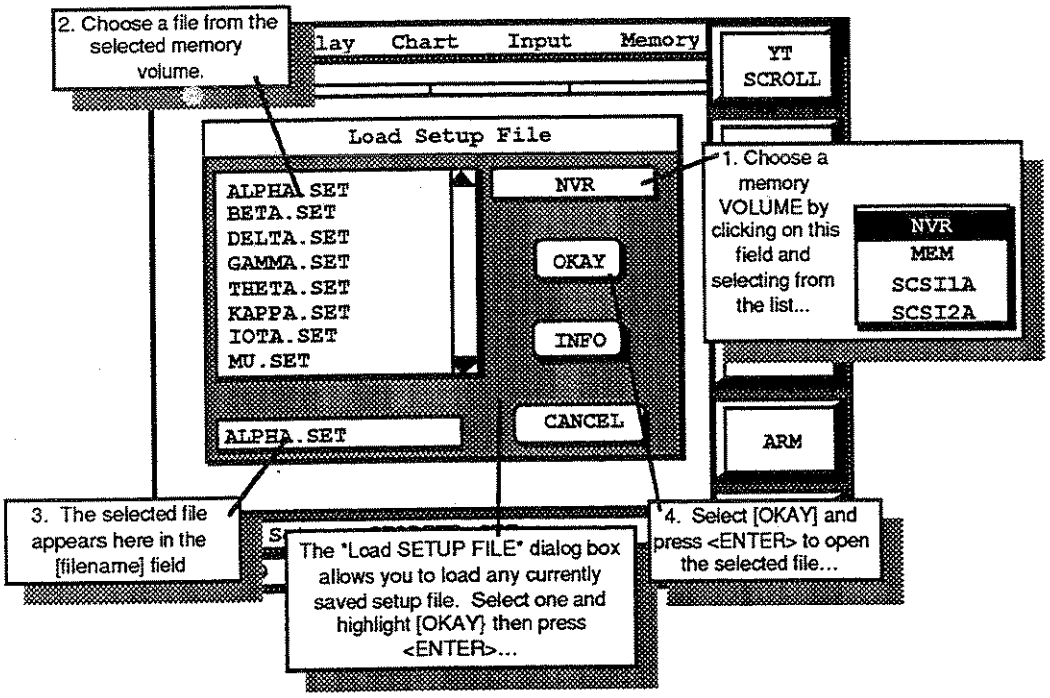


The \FILE/ menu

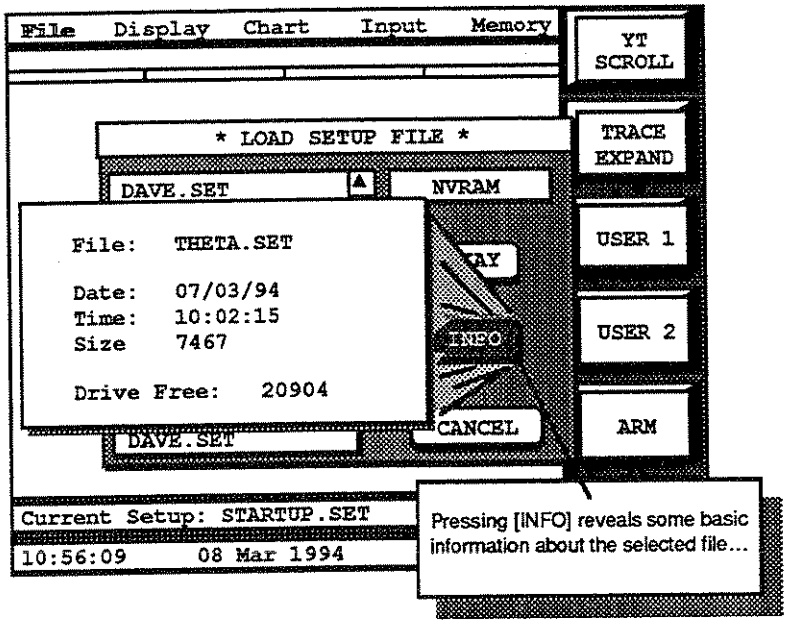
3.1.1 Load Setup...



Loading a Setup File



Select a setup file from any installed memory volume

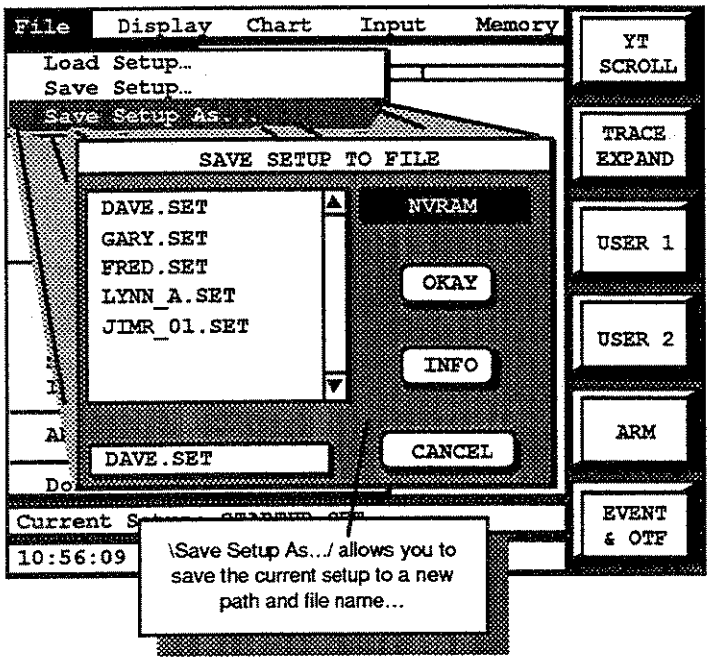


Get INFO about any file on the system

3.1.2 Save Setup...

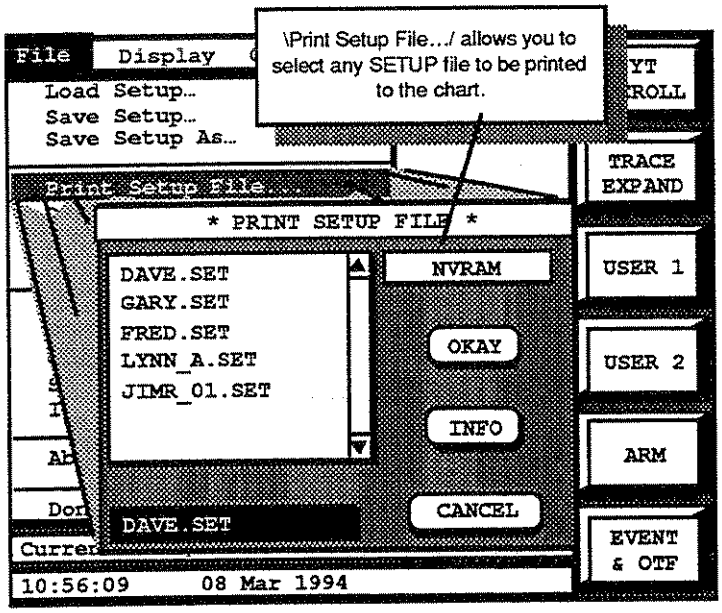
Selecting this menu item causes the currently loaded setup file to be saved to the same name and location that it was loaded from. If no setup was loaded, then this menu item will not be available: you must first load a setup in order to "save" it. Use \Save Setup As.../ to save the current setup.

3.1.3 Save Setup As...



Saving a setup to a different filename/path

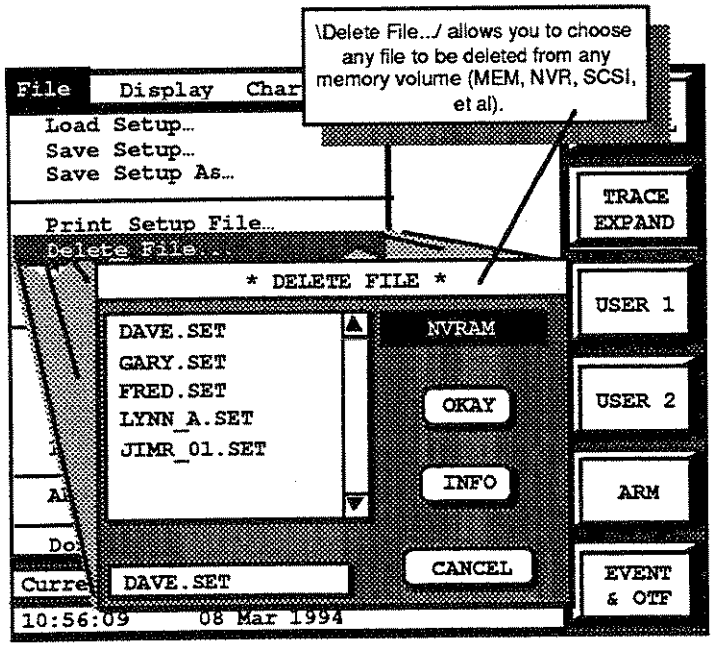
3.1.4 Print Setup File...



You can print any setup file to the Mark 12's chart

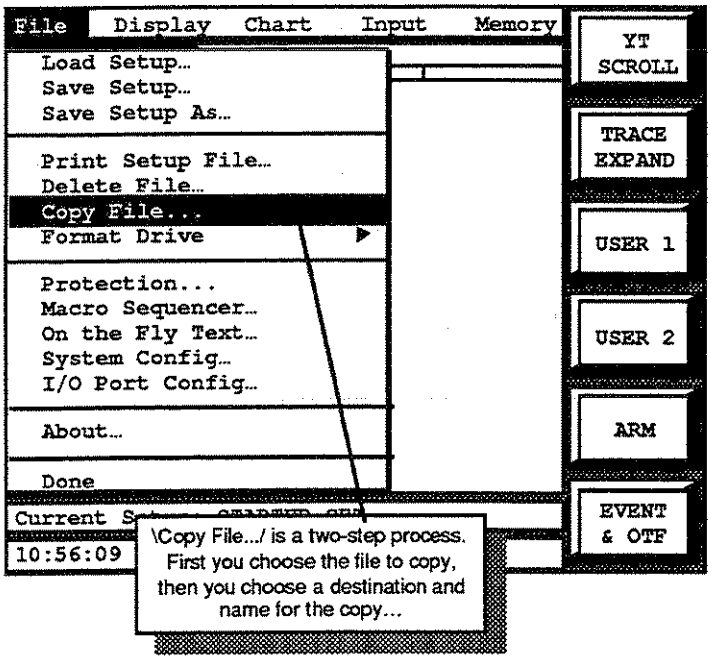
Note: Stop the chart first!

3.1.5 Delete File...

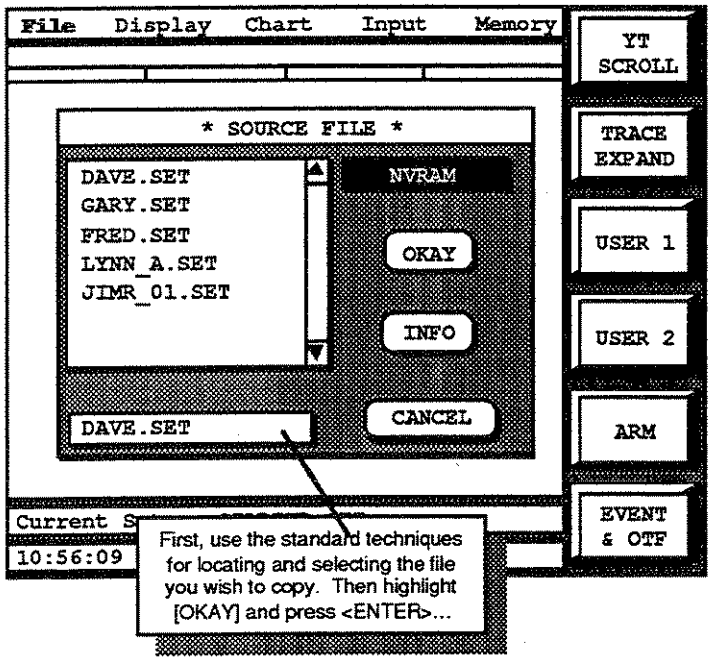


You can delete any file on the system

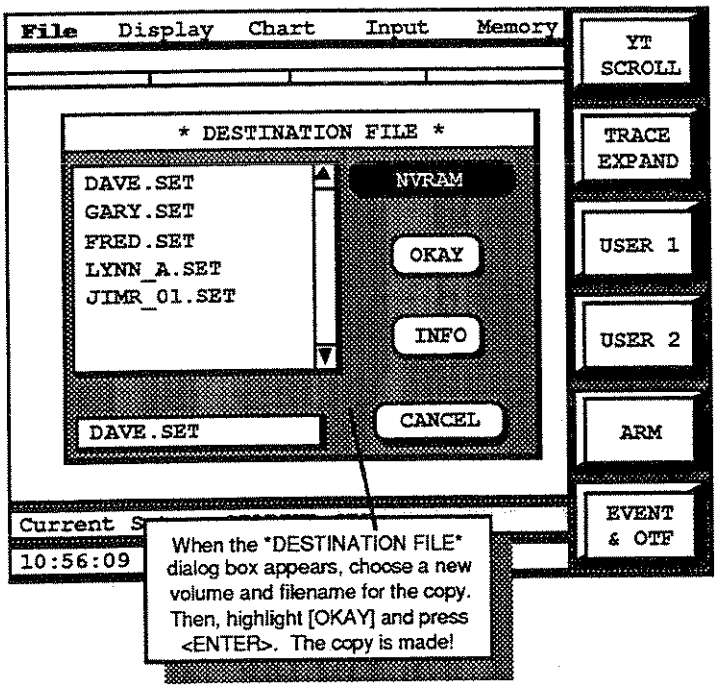
3.1.6 Copy File...



You can copy any file on the system, to any filename/volume



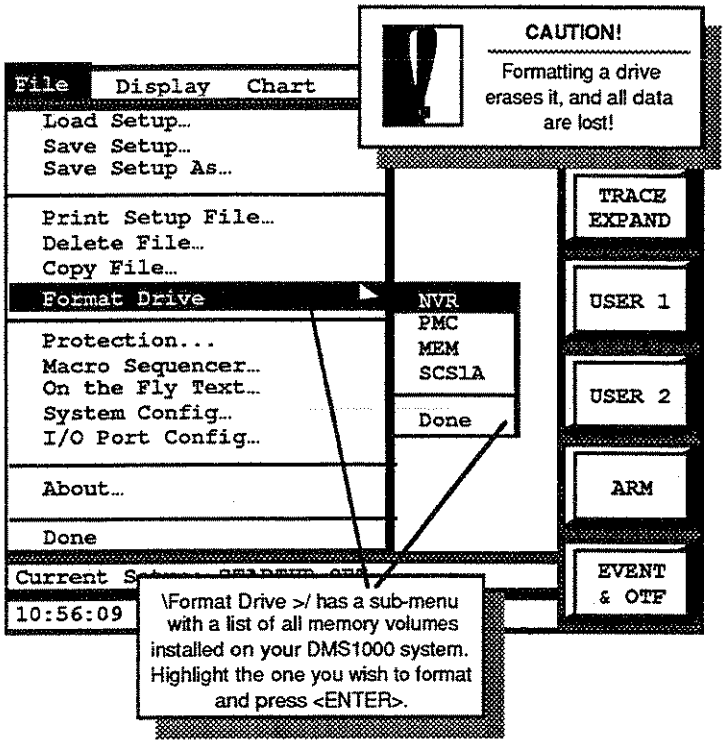
First, select the source file (the file to copy)



Then select the destination file

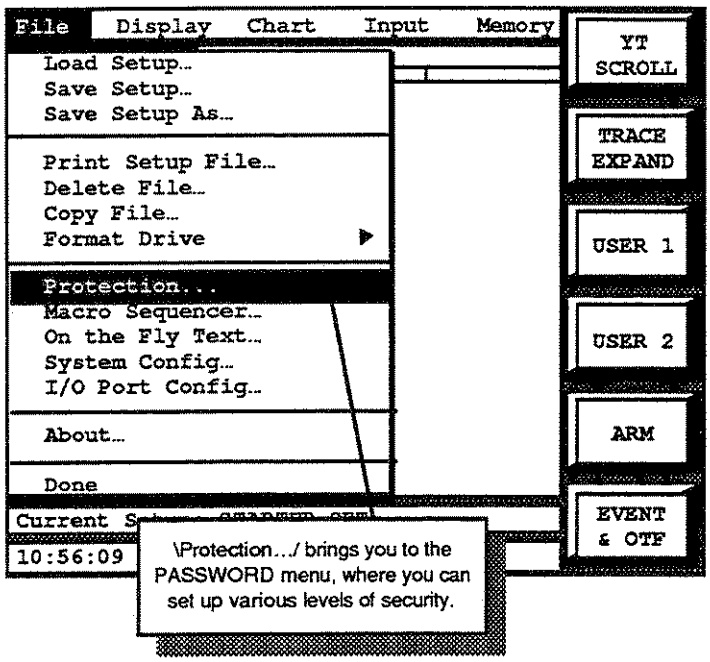
Note: *You can change the filename and volume. For example, let's say that there is a setup file called MYFILE.SET, currently located in NVRAM. You can select it as the source file, then enter a completely different destination filename and path/volume. Continuing the example, you could direct the destination file to the SCSI1A volume (assuming that you have a SCSI hard disk or some other SCSI device at that address), and enter a filename of NEWFILE.SET.*

3.1.7 Format Drive >



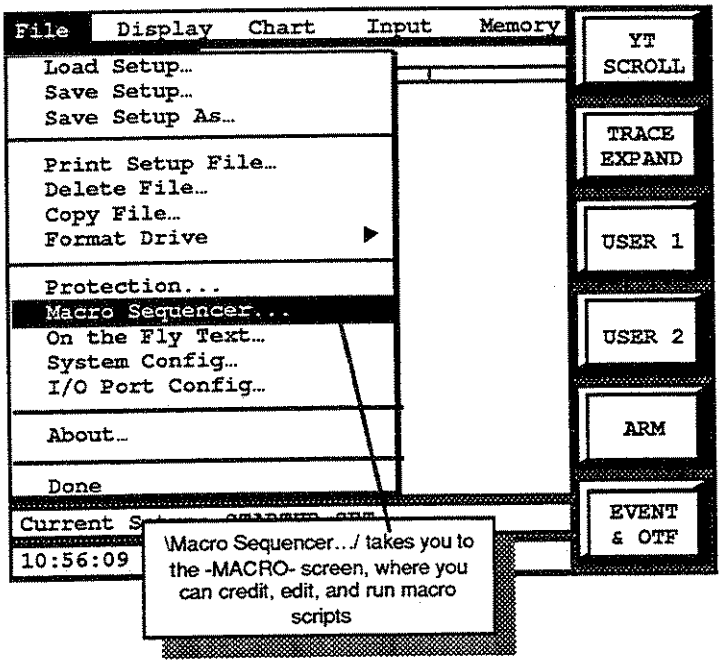
Formatting a memory volume erases it completely

3.1.8 Protection...



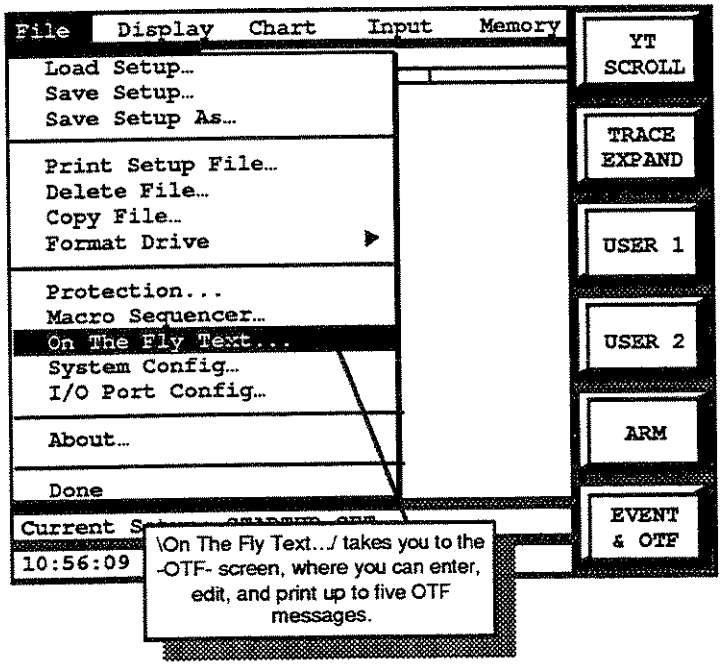
You can set the areas that others may access when using your Mark 12

3.1.9 Macro Sequencer...



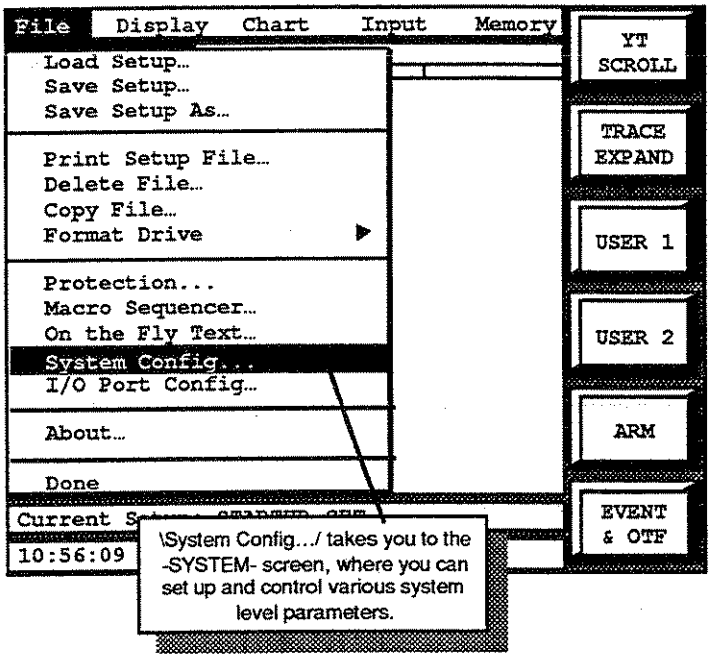
Program the Mark 12 to follow your "macro scripts"

3.1.10 On The Fly Text...



Enter up to five lines of text that can be printed anywhere across the chart

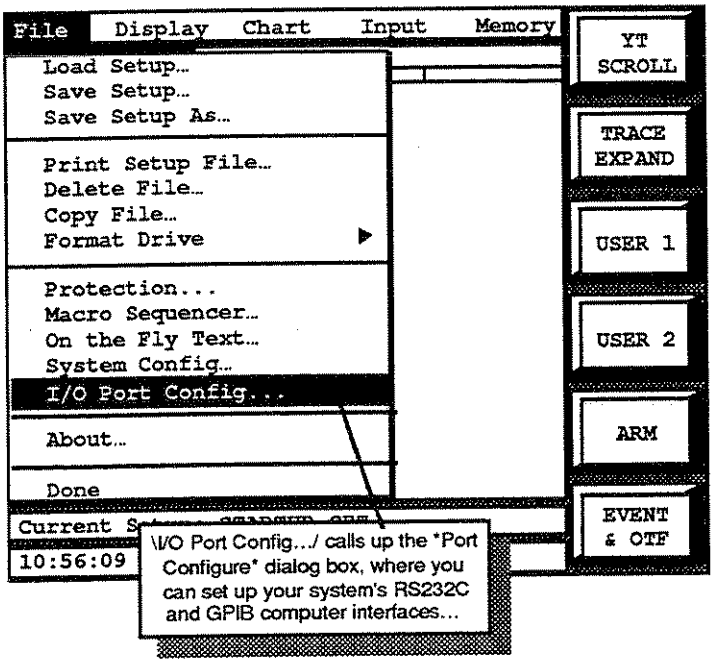
3.1.11 System Config...



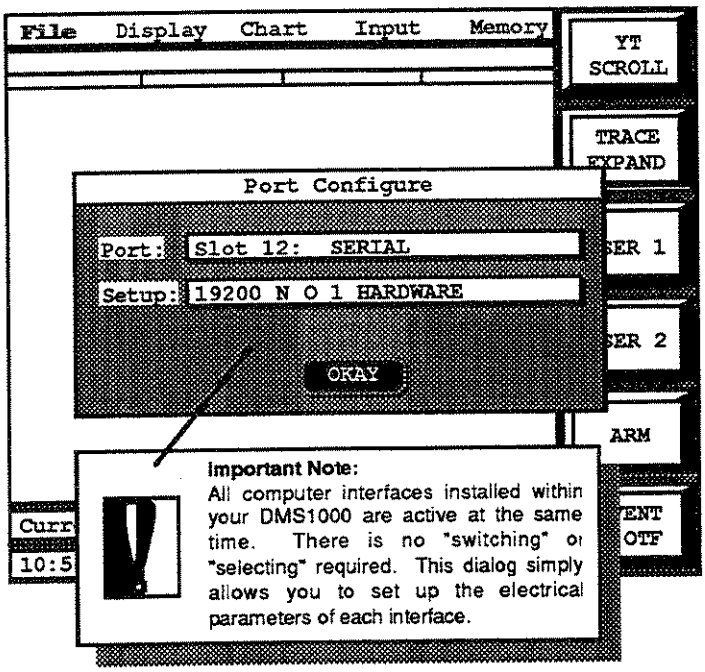
Set up global[5] parameters via the -SYSTEM- screen.

5 Global parameters are those that affect all modes of operation the same. Examples: the kind of chart paper installed, the time source, etc.

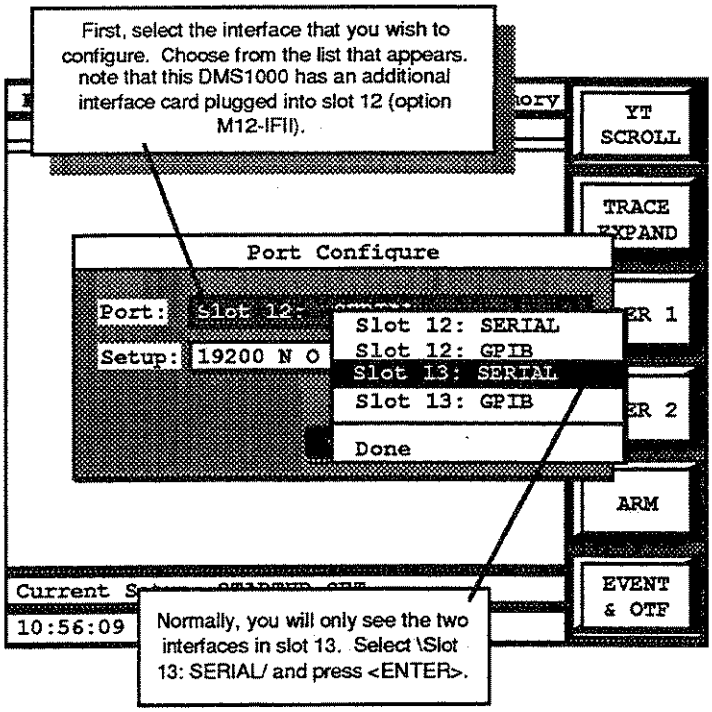
3.1.12 I/O Port Config...



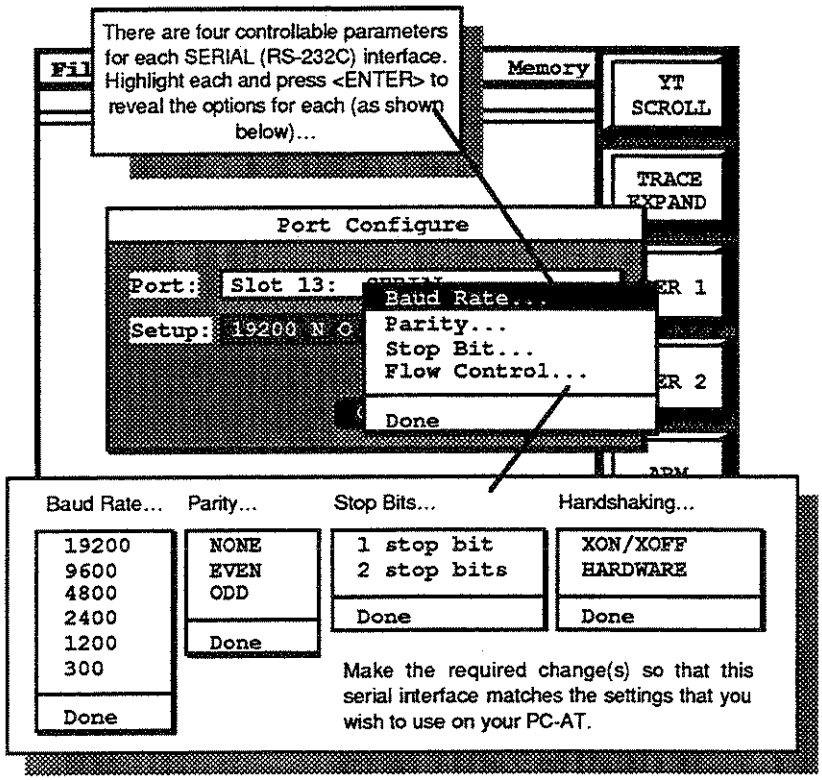
Let's set up the two standard computer interfaces: RS-232C and GPIB



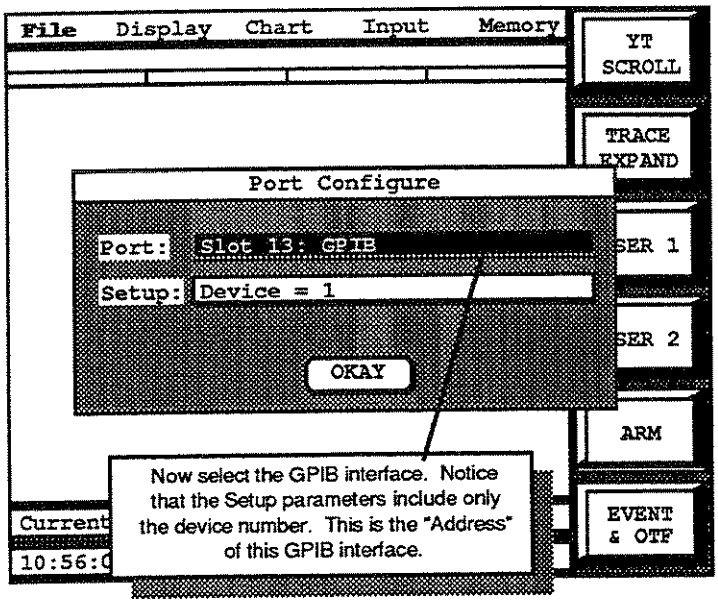
Both interfaces are active all the time



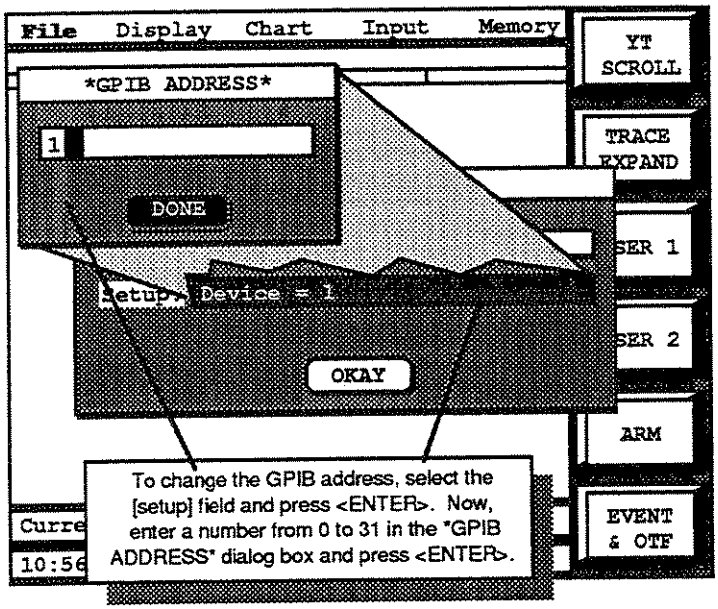
We will configure the RS232C interface first...



Configure the RS232C interface to match your PC's settings



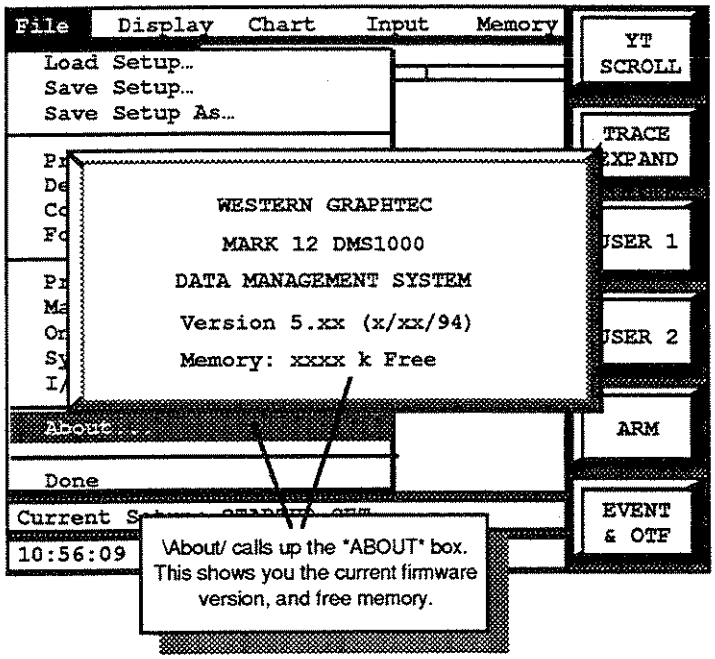
Let's set up the GPIB interface...



Choose the GPIB address, and you're done!

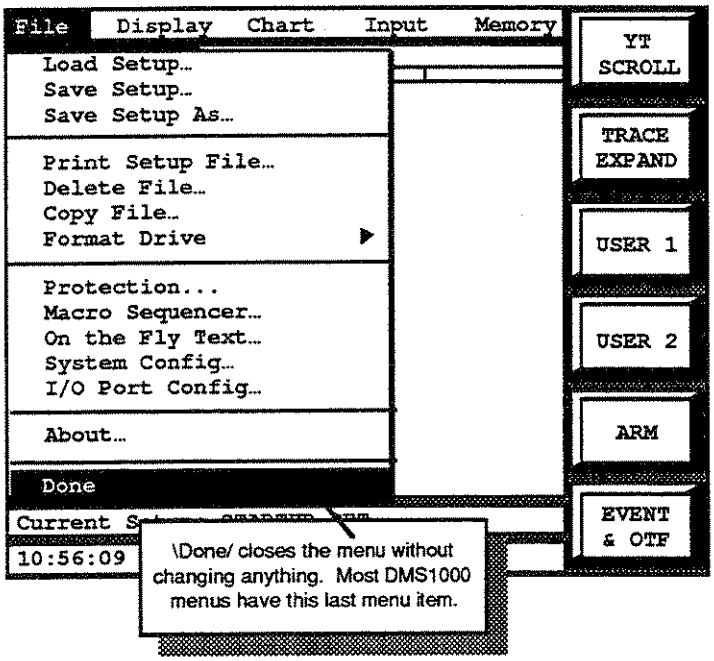
Note: If you have additional interfaces (via the M12-IFII option), you set them up exactly the same way as above

3.1.13 About...



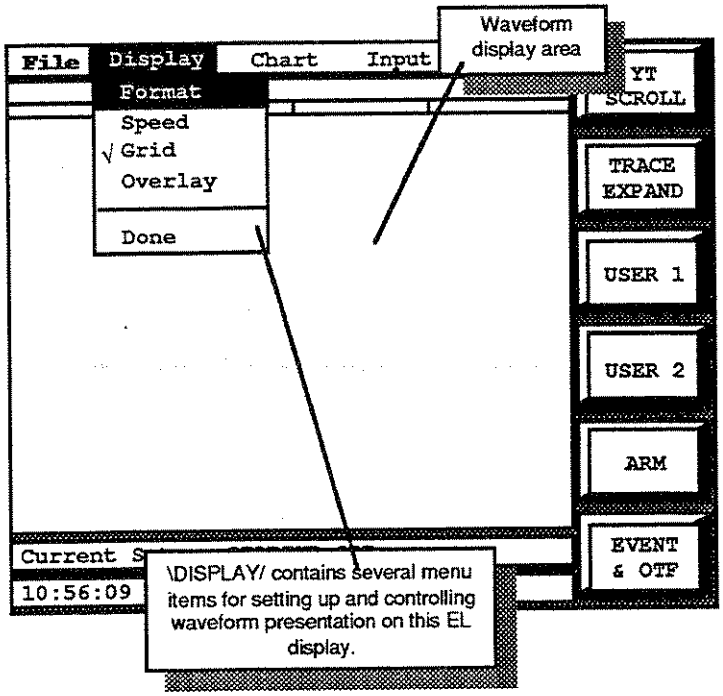
\About.../ shows basic information about this Mark 12 and its firmware

3.1.14 Done



\Done/ is used to close most menus. It is always the last menu item.

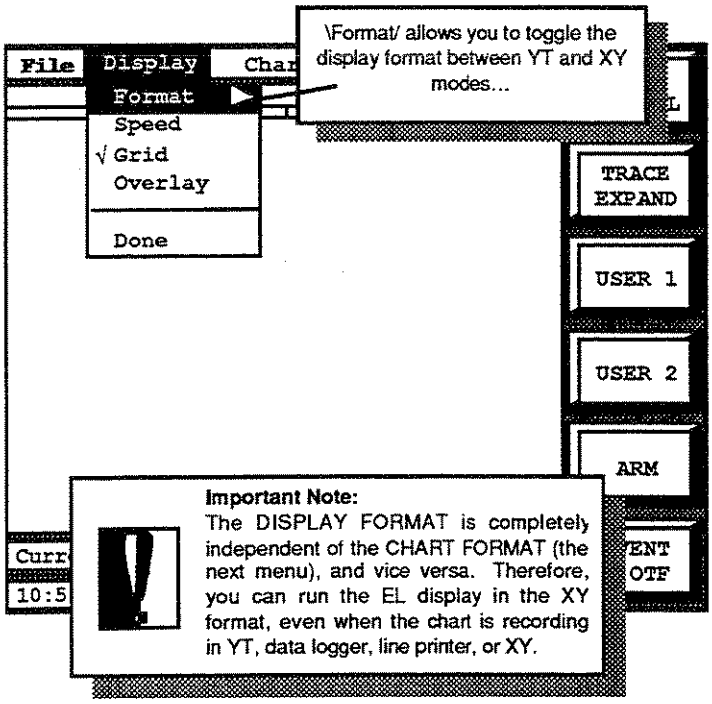
3.2 Display Menu



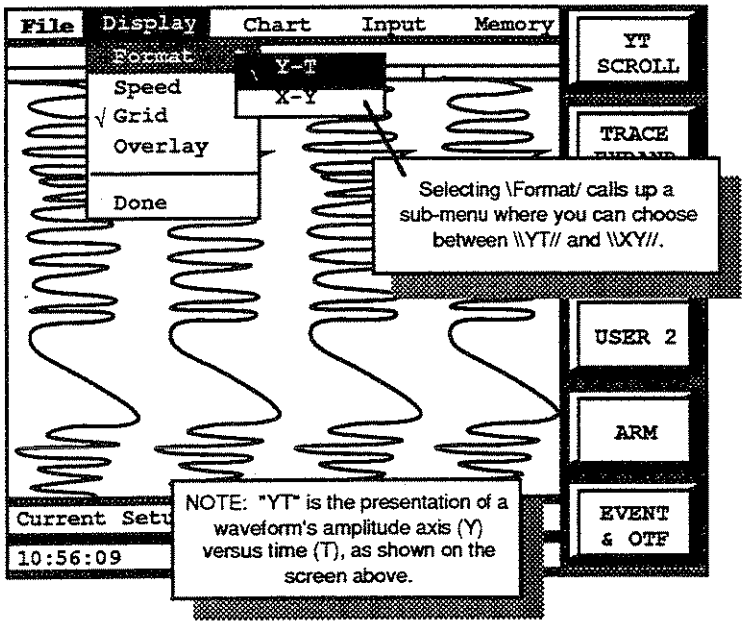
\DISPLAY/ is where you control the waveform display format

Note: The DISPLAY format has no effect on the CHART format, and vice versa. They are completely separate and independent

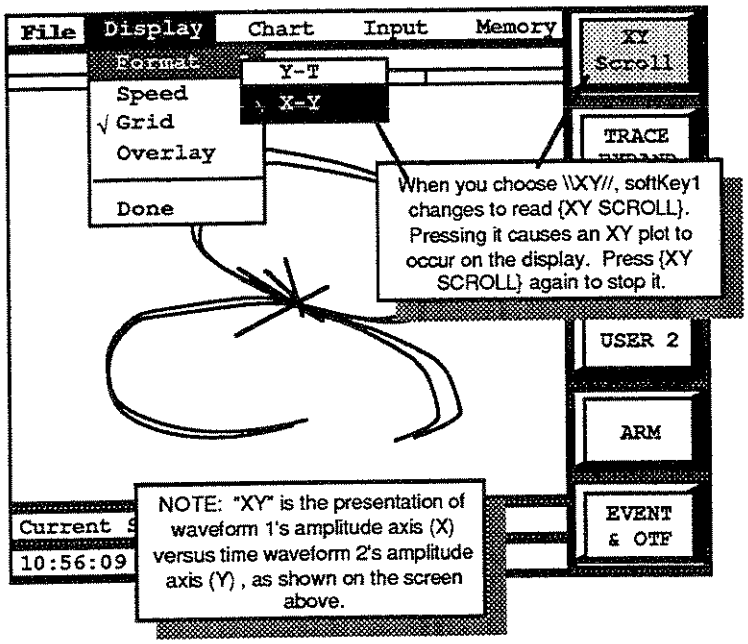
3.2.1 Format >



The DISPLAY format is independent of the CHART format

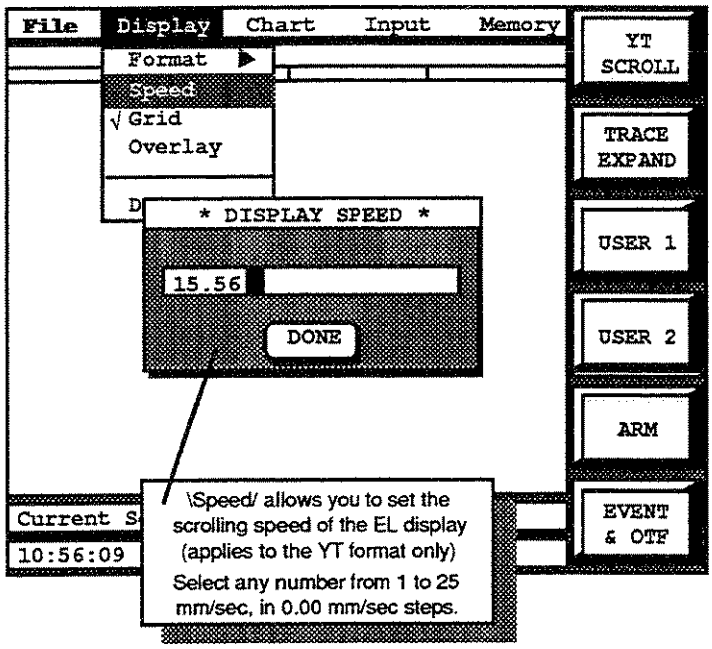


Select between Y-T and X-Y



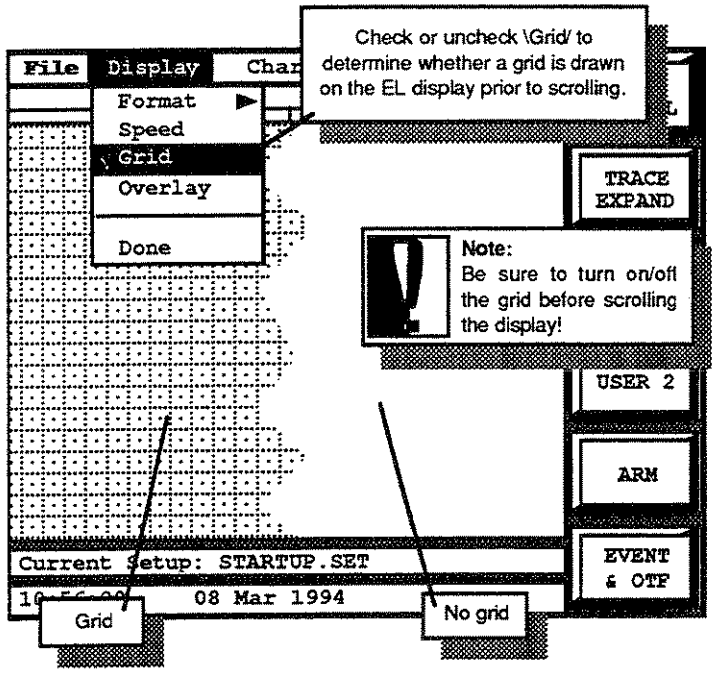
The X-Y selection changes the -MAIN- screen a little...

3.2.2 Speed



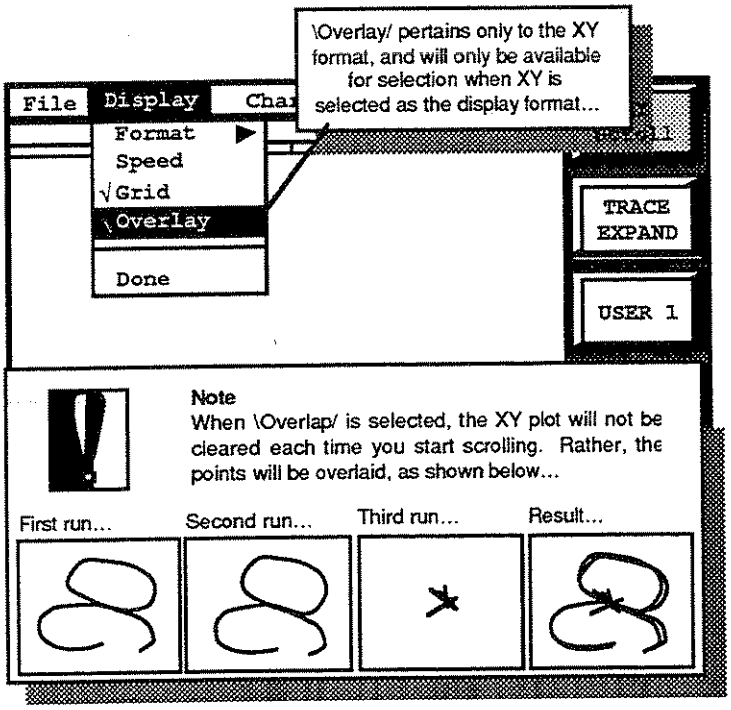
Set the Y-T DISPLAY SCROLL speed from 1 to 25 mm/sec

3.2.3 Grid



You can activate a background grid for both the Y-T and X-Y display formats

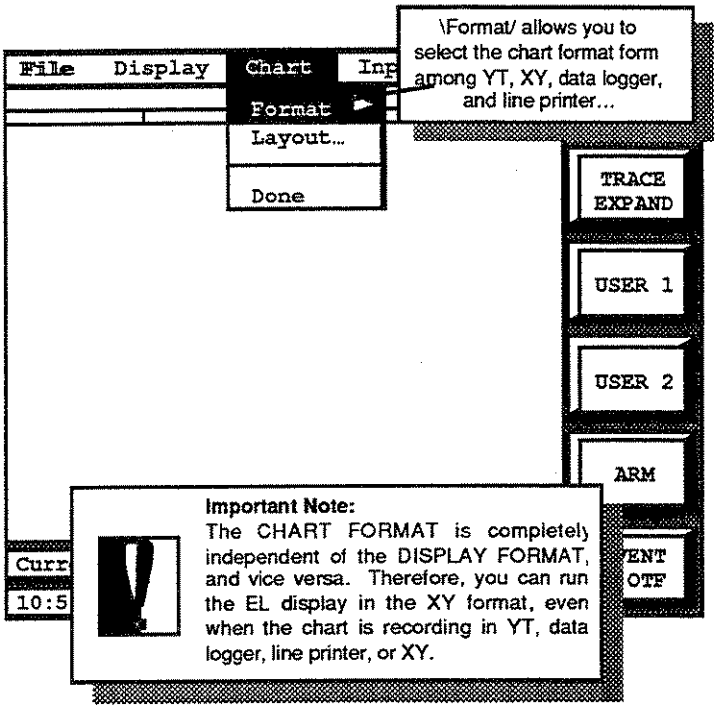
3.2.4 Overlay



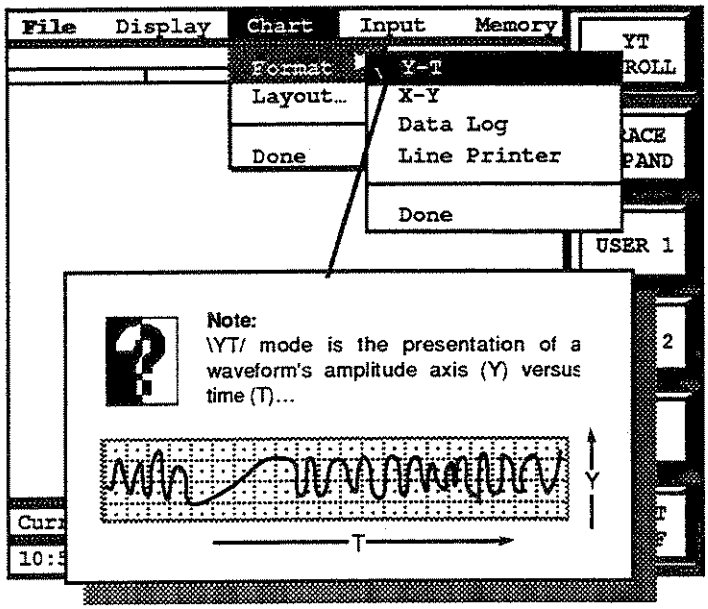
Overlay pertains to the X-Y display format only

3.3 Chart Menu

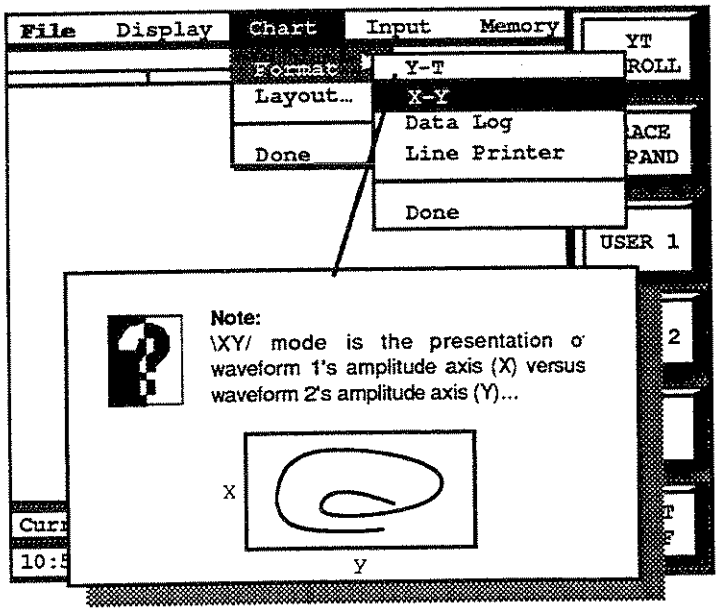
3.3.1 Format >



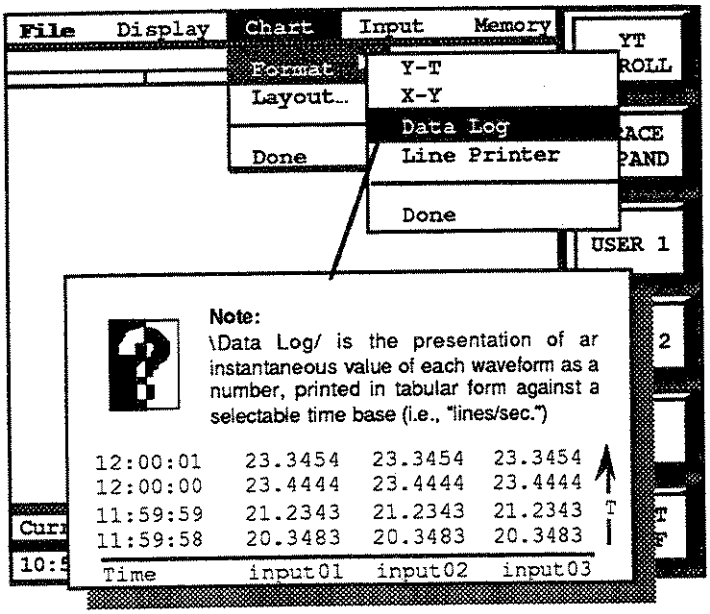
Select the desired format for the CHART



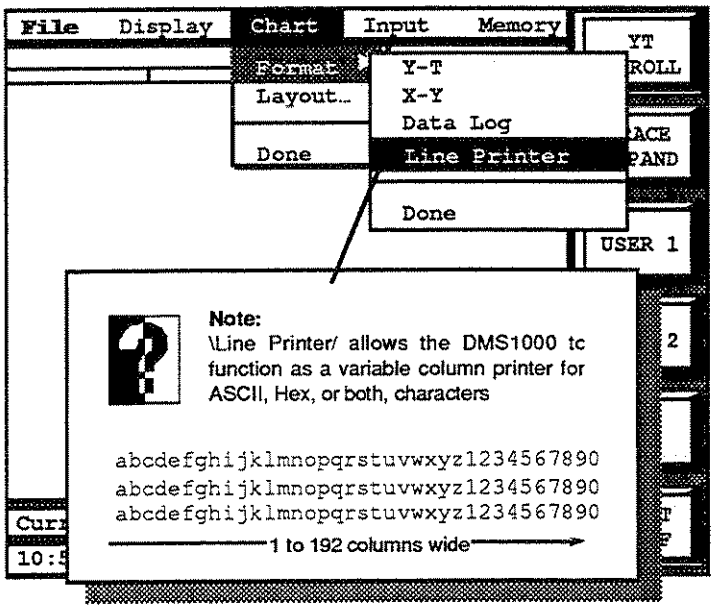
Y-T is the most popular chart format



X-Y is important when plotting one function against another (other than time)

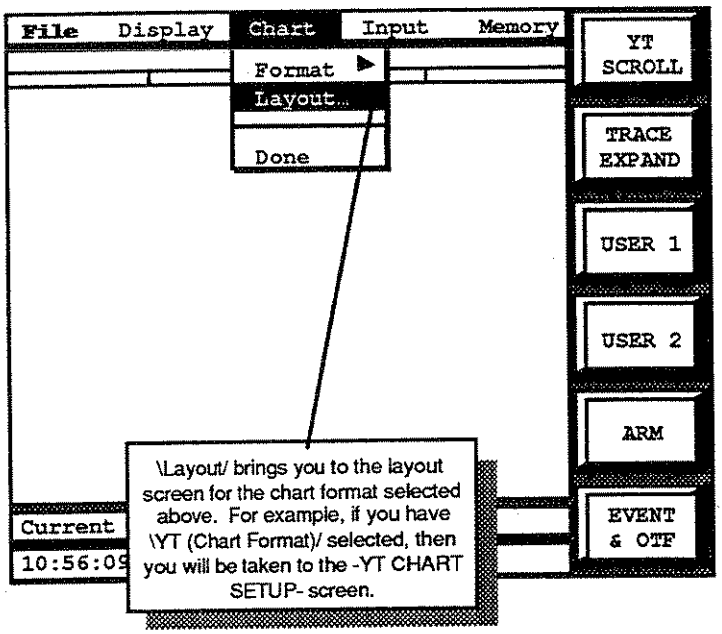


Data Logger converts incoming data to numerical values and prints them in columns



The Mark 12 can also act as an ASCII/Hex line printer

3.3.2 Layout

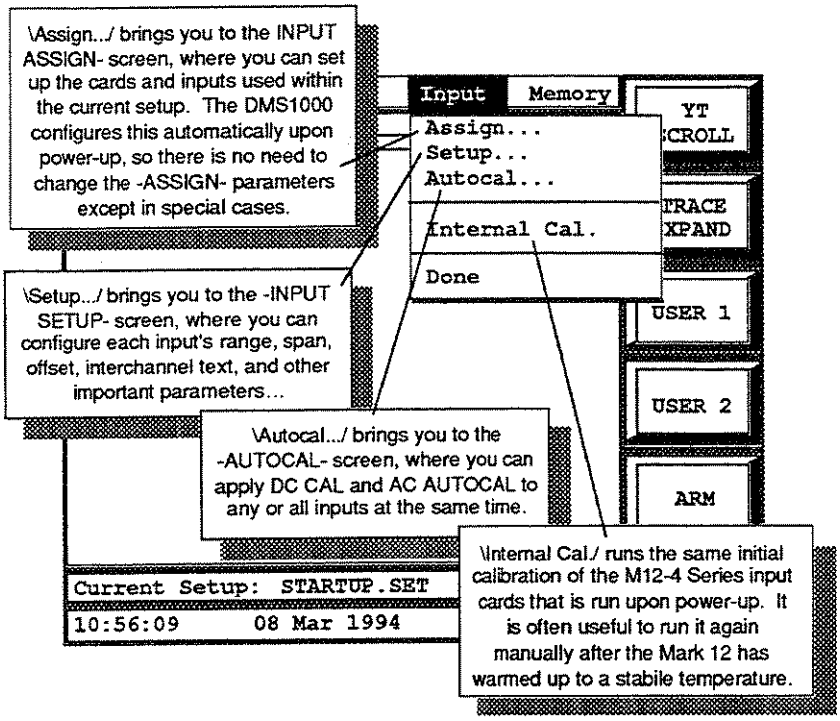


After you choose a CHART FORMAT, go to the LAYOUT screen to configure it

Note: The layout screen that you go to depends on which format is currently selected

3.4 Input Menu

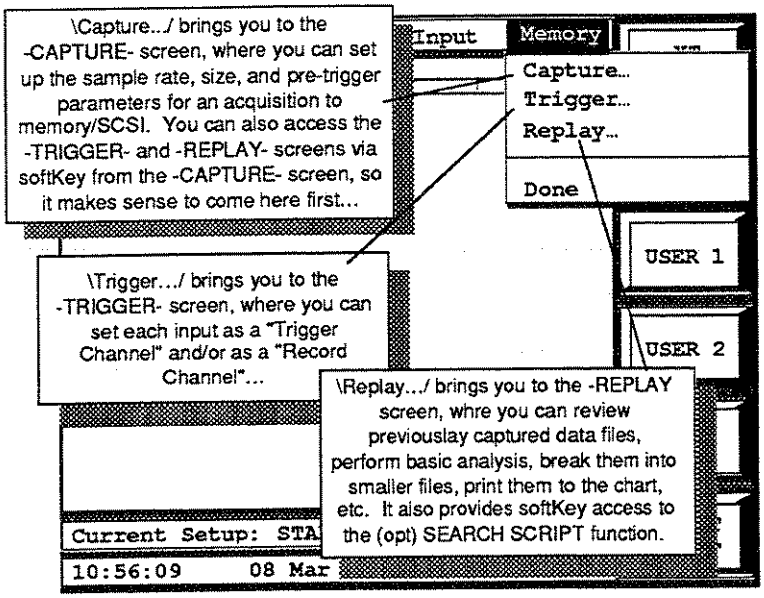
These menu items are so simple that we will show them all in this one figure. Each menu item takes you to the screen of the same name. As always, \Done/ closes the menu without making a selection.



Set up your inputs using the three INPUT related screens

3.5 Memory Menu

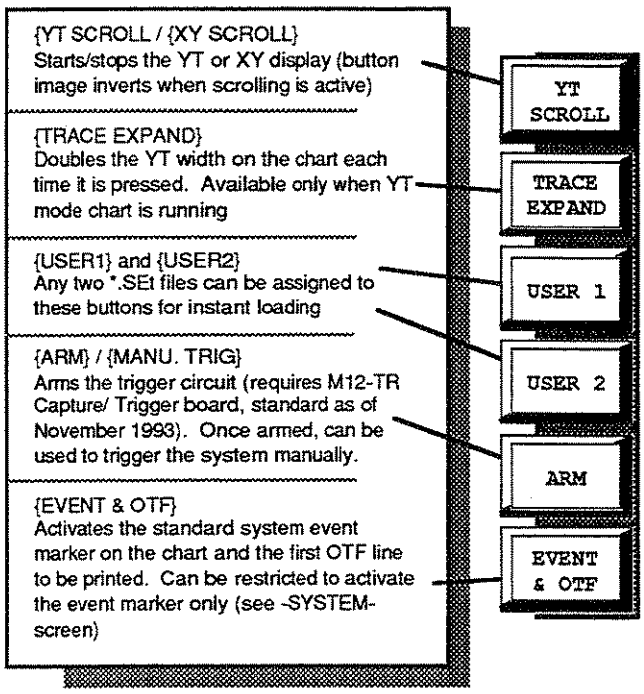
These menu items are so simple that we will show them all in this one figure. Each menu item takes you to the screen of the same name. As always, \Done/ closes the menu without making a selection.



Set up the data capture parameters using the three MEMORY screens

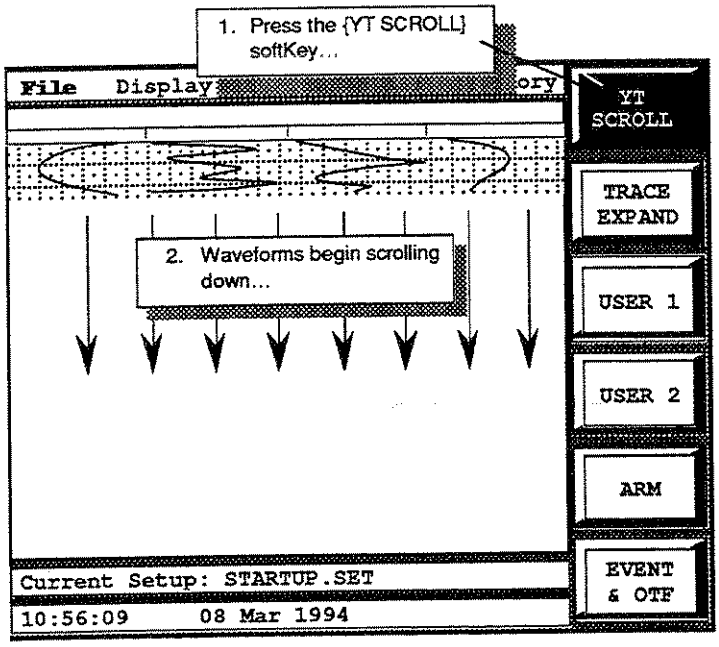
3.6 SoftKeys

Here is an overview of the six softKeys on the -MAIN- screen. This is followed by a closer look at some of them where warranted.



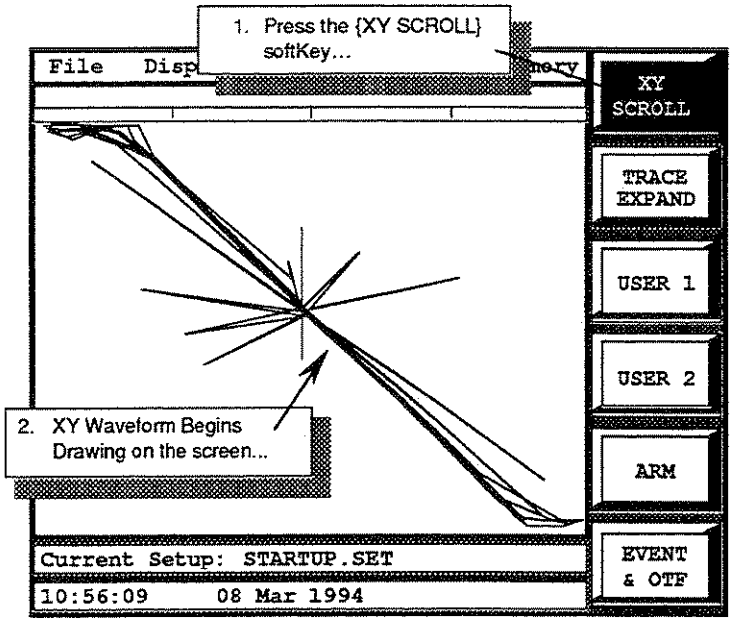
SoftKeys on the -MAIN- screen

3.6.1 Y-T Scroll



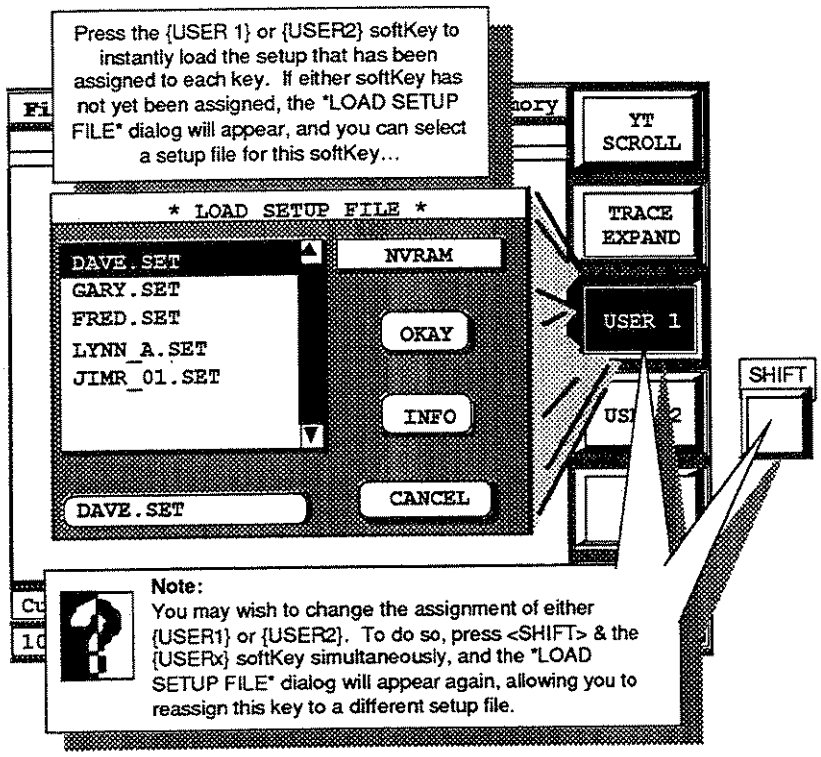
The {Y-T Scroll} softKey

3.6.2 X-Y Scroll



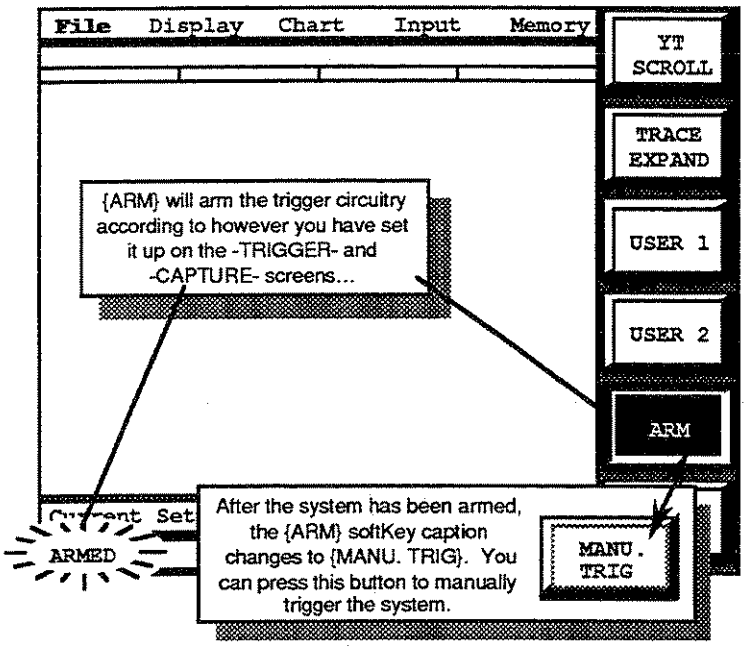
The {X-Y Scroll} softKey

3.6.3 User 1 & User 2

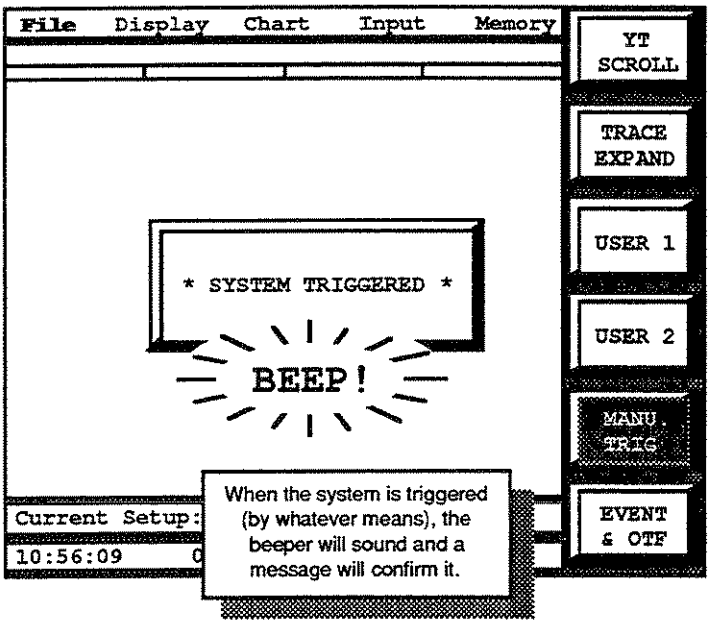


The {USER 1} & {USER 2} softKeys

3.6.4 Arm

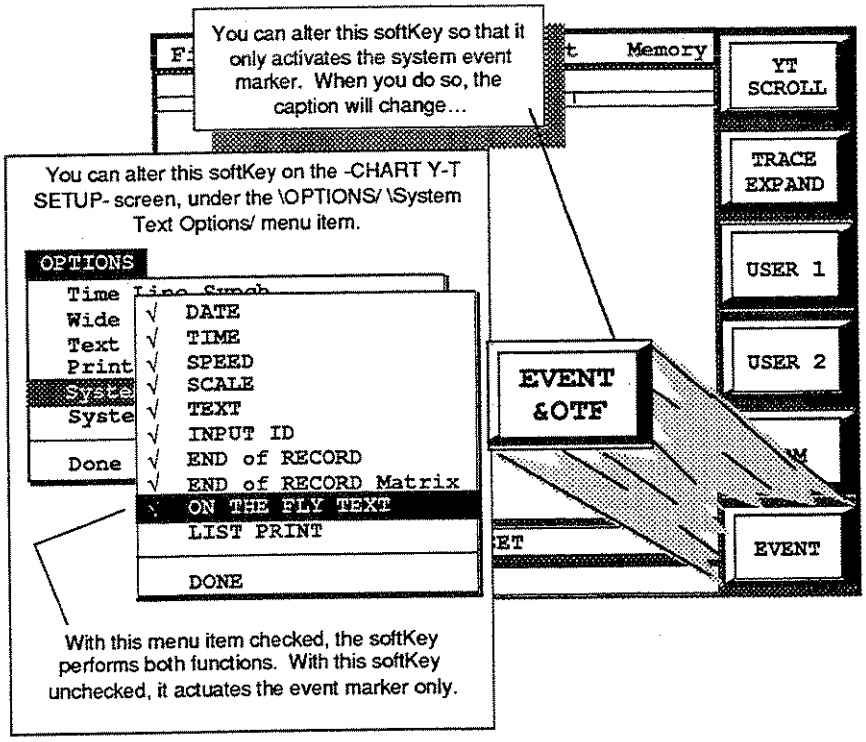


The {ARM} softKey



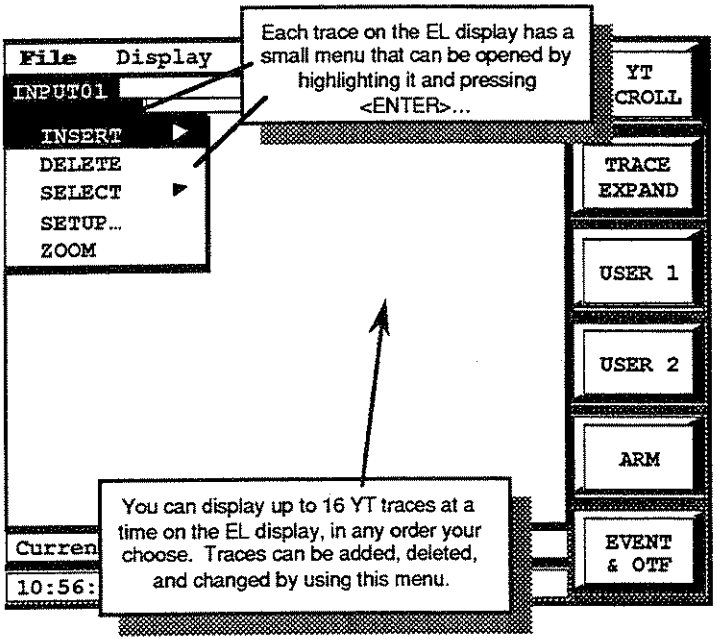
Triggering the system manually (after arming it)

3.6.5 Event & OTF



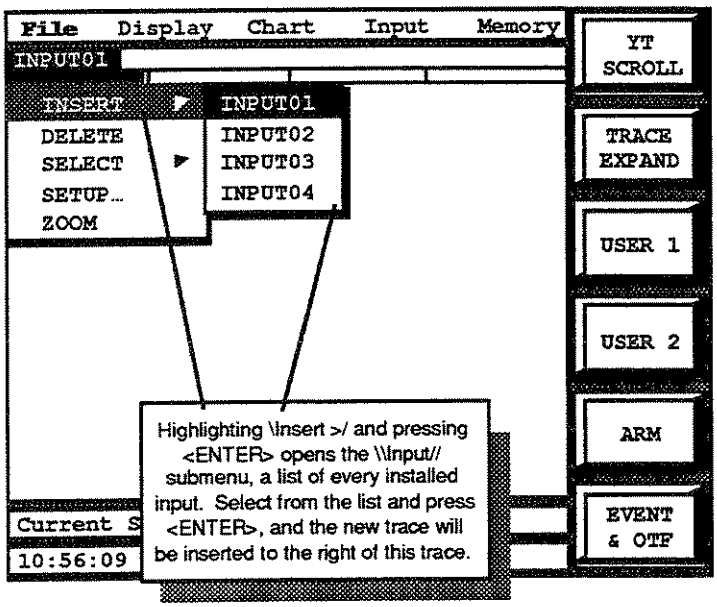
The {EVENT/OTF} softKey can be configured two different ways

3.7 Trace Menus



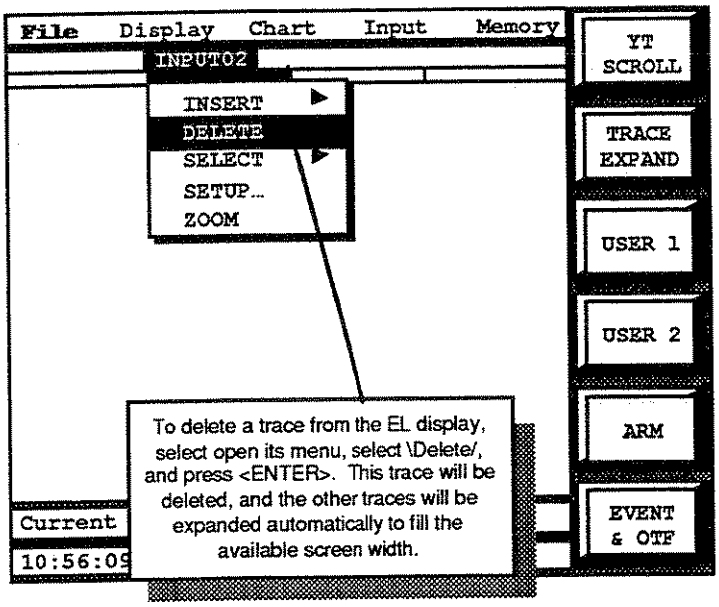
The \TRACE/ menus are unmarked, but very important

3.7.1 Insert >



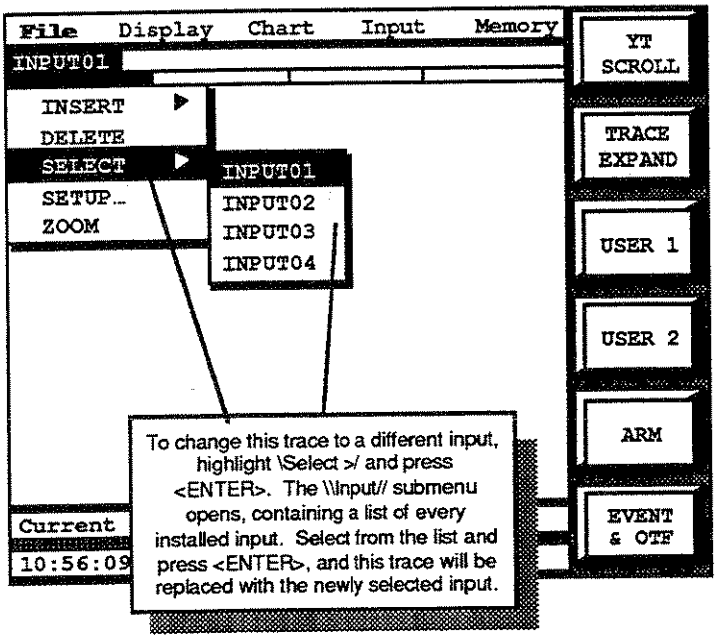
Inserting a new TRACE into the display

3.7.2 Delete



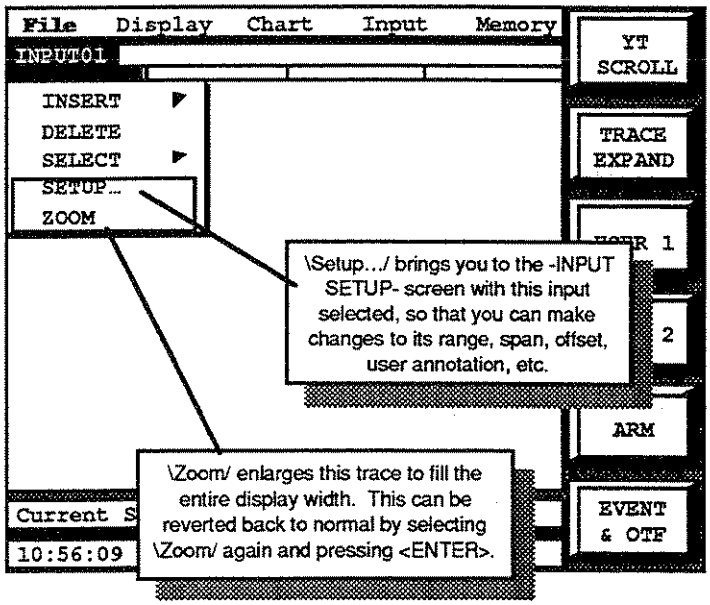
Deleting a TRACE from the display

3.7.3 Select >



Assigning a new INPUT to any TRACE on the display

3.7.4 Setup... & Zoom



\Setup.../ and \Zoom/

The \Setup.../ menu item takes you directly to the -INPUT SETUP- screen, with this input selected. This is a time-saving way to access the configuration of any input that is shown on the display.

The \ZOOM/ menu item increases the width (amplitude) of this trace to the full available area of the EL display. To undo the zoom, simply select this item again, and the original display configuration will be restored.

3.8 Main Screen Alphabetical Reference

Conventions:

\MENU/
\Menu Item/
\\Submenu Item//
{SoftKey}
[Screen Button/Field]
<Front Panel Key>
"caption/something printed on the screen"

\About.../

Menu item under \FILE/ menu

Select this menu item and press <ENTER> to call up the *ABOUT* dialog box. This dialog box simply shows you the firmware revision number currently installed within your DMS1000 system. It also contains the firmware date, and free RAM space.

{Arm}

SoftKey 4 on -MAIN- screen

Arms the DMS1000's Capture/Trigger board (standard after November 1, 1993), assuming that at least one channel has been designated as a "trigger channel" (see -TRIGGER- screen).

When the system is armed, this SoftKey's caption changes to {MANU. TRIG}, at which point it can be used to manually trigger the system.

\Assign.../

Menu item on \INPUT/ menu

Select this menu item and press <ENTER> to go to the -INPUT ASSIGN- screen, where you can set up the system's input cards, define input names, etc.

\Autocal.../

Menu item on \INPUT/ menu

Select this menu item and press <ENTER> to go to the -AUTOCAL- screen, where you can AC or DC calibrate any or all inputs at once, and define the AUTOCAL parameters.

\Baud Rate.../

Menu item on Port Configure Dialog Box

Select this menu item and press <ENTER> to call up a sub-menu of baud rate choices:

Select the desired baud rate and press <ENTER>. These controls allow you to configure the DMS1000's serial interface(s) to match the settings of your PC.

\Capture.../

Menu item on \MEMORY/ menu

Select this menu item and press <ENTER> to go to the -CAPTURE- screen. This is where you can define the sample rate, number of samples, and pre-trigger information for the next acquisition.

This requires the M12-TR Capture/Trigger board (standard after November 1, 1993).

\CHART/

Menu on -MAIN- screen

This menu contains \Format >/, where you can select the format that data will be shown on the chart (see also \\Y-T//, \\X-Y//, \\Data Log//, and \\Line Printer//). It also contains \Layout.../, which brings you to the correct layout screen according to whichever chart format has been selected.

\Copy File.../

Menu item under \FILE/ menu

Select this menu item and press <ENTER> to start the process of copying a file from one location in your DMS1000 to any other location. For example, you may have a setup file called "MYSETUP.SET" stored in NVR (non-volatile RAM) that you want to copy to the PMC (personal memory card). When you have selected this menu item and press <ENTER>, the *SOURCE FILE* dialog box will appear:

Use standard file management dialog box techniques to select the correct volume and filename, then highlight [OKAY] and press <ENTER>. When you do, this dialog will disappear and the *DESTINATION FILE* dialog box will appear:

Set the correct volume and filename and press <ENTER>. The file will be copied from the source to the destination. The source file remains intact (it is not moved, it is literally copied).

"Current Setup"

Caption on upper status bar

This provides the current setup, i.e., the *.SET file that is currently loaded. If none was loaded, then this will say "DEFAULT.SET." If you want a certain setup file to be loaded automatically each time that you turn on the DMS1000, save it under the name "STARTUP.SET." and locate it on the NVR volume.

\\Data Log//

Sub-menu item under \CHART/ menu's \Format.../ menu item

\Data Log/ is the presentation of an instantaneous value of each waveform as a number, printed in tabular form against a selectable time base (i.e., "lines/sec."). Select the \\Data Log// sub-menu item and press <ENTER> to select the DATA LOG mode. After doing this you can then use the \Layout.../ menu item to go to the *DATA LOG LAYOUT* screen, where you can choose which inputs to include within the printout, and the data log rate ("lines/sec").

"Date"

Caption on lower status bar

This provides the current date and time. In version 5.0 the date format was modified to prevent confusion around the world (for example, 5/7 means May 7 in America, but it means July 5 most other places).

If you have the M12-TCT option installed within your DMS1000, and the time source is set to something other than [INTERNAL] on the -SYSTEM- screen, then the incoming IRIG or NASA time code will be decoded and displayed here as well as on the chart.

\Delete/

Menu item under the \TRACE/ menu

To delete a trace from the EL display, select open its menu, select \Delete/, and press <ENTER>. This trace will be deleted, and the other traces will be expanded automatically to fill the available screen width.

\Delete File.../

Menu item under \FILE/ menu

\Delete File.../ allows you to choose any file to be deleted from any memory volume (MEM, NVR, SCSI, et al). When you highlight \Delete File.../ and press <ENTER>, the *DELETE FILE* dialog box will appear. Use standard file management dialog box techniques to select the file on any installed volume that you want to delete. Then highlight the [OKAY] button and press <ENTER>. The file will be deleted.

Note: when you delete files from a SCSI disk volume, the files are not actually erased, rather, the space that they consume is made available for new files, and the filename is deleted from the disk's FAT (file allocation table).

To literally delete files from a SCSI disk volume, use the \Format >/ menu item. This performs a low-level reformatting of the hard disk. All data will be overwritten and lost forever, so take care when formatting any volume.

Delete File

Dialog Box

See \Delete File.../, above.

Destination File

Dialog Box

See \Copy File.../, above

\DISPLAY/

Menu on -MAIN- screen

This menu contains menu items used for setting up the way that YT or XY data are presented here on the built-in EL display. These include \Format >/ for selecting YT or XY format, \Speed/ for setting the YT scroll rate, \Grid/ for turning on/off the background grid pattern, and \Overlay/, which turns on/off XY data overlay. See each of these objects for more information about them.

Display Speed

Dialog Box

See \Speed/, below.

\Done/

Menu item under all menus

Nearly every DMS1000 menu has a last item called \Done/. This menu items allows you to close a menu without making a selection. Simply highlight \Done/ and press <ENTER>, and the menu will be closed.

Another way to do this is by pressing <ESC>, which is located in the lower right corner of the alphanumeric keys on the DMS1000 front panel.

{Event (& OTF)}

SoftKey 6 on -MAIN- screen

Pressing this softKey while the YT chart is running causes the system event marker to actuate. This event marker is located just to the right of the left chart edge's time tick mark.

When this softKey's caption reads {Event & OTF}, then pressing it also causes the first line of on-the-fly text to be printed. You can control whether this softKey includes the "& OTF" function on the -SYSTEM- screen.

Go to the -SYSTEM- screen and highlight the \Print Opt./ menu item under the \OPTIONS/ menu, then press <ENTER>. You will be given a sub-menu containing \\On The Fly Text//. If there is a check mark next to this sub-menu item, then the softKey caption will be {Event & OTF}. If there is not, the caption will be {Event}.

\FILE/

Menu on -MAIN- screen

This menu contains may key functions, particularly those related to file management. It also provides access to other system-level screens (i.e. -ON THE FLY TEXT-, -MACRO SEQUENCER-, -SYSTEM-), and system-level functions (i.e., *(I/O) Port Configure*, *About*, etc.).

See the separate listing for each of these menu items.

\Flow Control.../

Menu item on Port Configure Dialog Box

See also \I/O Port Config.../.

Select this menu item and press <ENTER> to call up a sub-menu of baud rate choices:

Select the desired baud rate and press <ENTER>. These controls allow you to configure the DMS1000's serial interface(s) to match the settings of your PC.

\Format >/ (Chart)

Menu item on \CHART/ menu

This menu item contains several sub-menu items, each of which allows you to select a different format for data on the chart.

See also \\Y-T//, \\X-Y//, \\Data Log//, and \\Line Printer//.

\Format >/ (Display)

Menu item on \DISPLAY/ menu

\Format Drive >/

Menu item under \FILE/ menu

GPIB Address

Dialog Box within Port Configure Dialog Box

Allows you to set the GPIB address of this DMS1000.

\Grid/

Menu item on \DISPLAY/ menu

Allows you to turn on/off the grid pattern displayed behind the Y-T and/or X-Y data on the EL display.

\I/O Port Config.../

Menu item under \FILE/ menu

This menu item allows you to set up your DMS1000's computer interfaces. The DMS1000 comes standard with one RS232C and one GPIB (IEEE-488) interface. However, additional RS232C and GPIB interfaces may be added by plugging in one or more M12-IFII options.

Important Note:

All computer interfaces installed within your DMS1000 are active at the same time. There is no "switching" or "selecting" required. This dialog simply allows you to set up the electrical parameters of each interface.

To set up your interfaces, select the \I/O Port Config.../ menu item and press <ENTER>. The *Port Configure* dialog box will appear:

First, select the interface that you wish to configure. Choose from the list that appears. Note that this DMS1000 has an additional interface card plugged into slot 12 (option M12-IFII).

RS232C Setup

Unless you have purchased additional M12-IFII card(s), you will only see the two interfaces in slot 13. Select \Slot 13: Serial/ and press <ENTER>.

Now move to the [Setup] field and press <ENTER> to call up a menu of serial interface choices: \Baud Rate.../, \Parity.../, \Stop Bit.../, \Flow Control.../. Select each menu item in turn and set the parameter according to your wishes:

Baud Rate Parameters:	19200, 9600, 4800, 2400, 1200, 300
Parity Parameters:	None, Odd, Even
Stop Bit Parameters:	1 or 2
Flow Control Parameters:	Xon/Xoff (software) or hardware

GPIB Setup

To set the GPIB interface parameters, select the [PORT} field and press <ENTER>. This time, select \Slot 13: GPIB/ and press <ENTER>. Now you can select the [Setup] field and press <ENTER>. The only parameter for GPIB is the actual address.

Now, enter a number from 0 to 31 in the *GPIB ADDRESS* dialog box and press <ENTER>. You can use the jog-wheel to step from 0 to 31, or use the numeric keys on the front panel to type a number, then press <ENTER>.

[Info] button

Button on all file management dialog boxes

All file management dialog boxes (i.e., *LOAD FILE*, *SAVE FILE*, *COPY FILE*, etc.) have a button called [INFO]. Highlight this button and press <ENTER>, and a small box of information about the file will appear, as shown above.

This includes the filename, the data and time of its creation, file size (in bytes), and the remaining number of bytes on the selected volume ("drive").

\Insert >/

Menu item under the \TRACE/ menu

Highlighting \Insert >/ and pressing <ENTER> opens the \\Input// sub-menu, a list of every installed input. Select from the list and press <ENTER>, and the new trace will be inserted to the right of this trace.

\INPUT/

Menu on -MAIN- screen

\INPUT/ contains three menu items, each of which takes you to a particular screen.

\Assign.../ takes you to the -ASSIGN- screen, where you can set up the input cards, slots, and channels that are used within the current setup. You can also modify the name of each input on this screen.

\Setup.../ takes you to the -INPUT SETUP- screen, where you can set the ADC range, span, offset, and text annotation of each input channel. If you are using the M12-4E card, you can also set the zero suppression, RMS, and filtering parameters for each input channel.

\Autocal.../ takes you to the -AUTOCAL- screen, where you can perform AC or DC calibration on any or all input channels simultaneously.

\Layout/

Menu item on \CHART/ menu

Select this menu item and press <ENTER> to go to the correct layout screen according to whichever chart format has been selected (see \Format >/). For example, if you have the Y-T format select, then this menu item will take you to the -YT CHART LAYOUT- screen. However, if Data Log format is selected, this menu item will take you to the -DATA LOG- screen.

"Time"

Caption on lower status bar

This provides the current date and time. In version 5.0 the date format was modified to prevent confusion around the world (for example, 5/7 means May 7 in America, but it means July 5 most other places).

If you have the M12-TCT option installed within your DMS1000, and the time source is set to something other than [INTERNAL] on the -SYSTEM- screen, then the incoming IRIG or NASA time code will be decoded and displayed here as well as on the chart.

{Trace Expand}

SoftKey 2 on -MAIN- screen

Doubles the YT width on the chart each time it is pressed. Available only when YT mode chart is running.

\Trace/

Menu on -MAIN- screen

Each trace on the EL display's -MAIN- screen has a small menu that can be opened by highlighting the rectangle above each trace and pressing <ENTER>. When you do, the menu will open, revealing several menu items that allow control over the traces that appear here on the EL display.

See the separate entries for each of these menu items.

\Trigger.../

Menu item on \MEMORY/ menu

Select this menu item and press <ENTER> to go to the -TRIGGER- screen. This is where you can define each input as a "trigger channel," "Capture channel," or both. You can also turn on/off internal and external triggering.

This requires the M12-TR Capture/Trigger board (standard after November 1, 1993).

{User 1} and {User 2}

SoftKeys 2 & 3 on -MAIN- screen

Press the {USER 1} or {USER2} softKey to instantly load the setup that has been assigned to each key. Effective with version 5.0, the assignments made to these keys are non-volatile, and will not be lost after power-down.

If either softKey has not yet been assigned, the *LOAD SETUP FILE* dialog will appear when you press the softKey, and you can select a setup file for this softKey.

Use standard file management dialog box techniques to select the desired *.SET file.

From time to time you may wish to change the assignment of either {USER1} or {USER2}. To do so, press <SHIFT> & the {USERx} softKey simultaneously, and the *LOAD SETUP FILE* dialog will appear again, allowing you to reassign this key to a different setup file.

\\X-Y// (Chart)

Sub-menu item under \CHART/ menu's \Format.../ menu item

This is one of four choices of chart formats that are made available under the \Format >/ menu item of the \CHART/ menu. The selected format is indicated by a check mark next to it in the sub-menu. To select any format, highlight it and press <ENTER>.

\XY/ mode is the presentation of waveform 1's amplitude axis (X) versus waveform 2's amplitude axis (Y).

When the XY chart mode is checked, selecting the \Layout.../ menu item and pressing <ENTER> takes you to the -XY SETUP- screen.

The selection of a CHART format has no bearing on the DISPLAY format—the two are completely separate and independent.

\\X-Y// (Display)

Sub-menu item under \DISPLAY/ menu's \Format.../ menu item

This is one of two choices of EL display formats that are made available under the \Format >/ menu item of the \DISPLAY/ menu. The selected format is indicated by a check mark next to it in the sub menu. To select any format, highlight it and press <ENTER>.

\XY/ mode is the presentation of waveform 1's amplitude axis (X) versus waveform 2's amplitude axis (Y).

When you choose \\XY//, softKey1 changes to read {XY SCROLL}. Pressing it causes an XY plot to occur on the display. Press {XY SCROLL} again to stop it. The selection of a DISPLAY format has no bearing on the CHART format—the two are completely separate and independent.

{XY Scroll}

SoftKey 1

This softKey starts the XY plot to the EL display. The display format must be set to XY for this softkey to be available. See \Format >/ (Display) for instructions on how to select XY as the EL display format.

Press {XY Scroll} once to start recording to the EL display. The channels used for X and Y are determined on the -XY SETUP- screen (you can access this screen by selecting \\XY// under \Format >/ on the \CHART/ menu).

Press {XY Scroll} again to stop the recording.

If you want a background grid pattern, be sure to check the \Grid/ menu item under the \DISPLAY/ menu before pressing {XY Scroll}.

To print the screen to the chart, follow the procedures described under *SCREEN DUMP*, above.

To achieve a high-resolution X-Y print-out, use the actual XY Chart Format. See \\XY// (Chart), above.

\\Y-T// (Chart)

Sub-menu item under \CHART/ menu's \Format.../ menu item

This is one of four choices of chart formats that are made available under the \Format >/ menu item of the \CHART/ menu. The selected format is indicated by a check mark next to it in the sub-menu. To select any format, highlight it and press <ENTER>.

\YT/ mode is the presentation of a waveform's amplitude axis (Y) versus time (T).

When the YT chart mode is checked, selecting the \Layout.../ menu item and pressing <ENTER> takes you to the -YT CHART LAYTOUT- screen.

The selection of a CHART format has no bearing on the DISPLAY format—the two are completely separate and independent.

\\Y-T// (Display)

Sub-menu item under \DISPLAY/ menu's \Format.../ menu item

This is one of two choices of EL display formats that are made available under the \Format >/ menu item of the \DISPLAY/ menu. The selected format is indicated by a check mark next to it in the sub-menu. To select any format, highlight it and press <ENTER>.

\XY/ mode is the presentation of waveform 1's amplitude axis (X) versus waveform 2's amplitude axis (Y).

When you choose \\YT//, softKey1 changes to read {YT SCROLL}. Press {YT SCROLL} to start/stop scrolling waveforms on the EL display.

The selection of a DISPLAY format has no bearing on the CHART format—the two are completely separate and independent.

{YT Scroll}

SoftKey 1

Starts/stops the YT presentation scrolling on the built-in EL display.

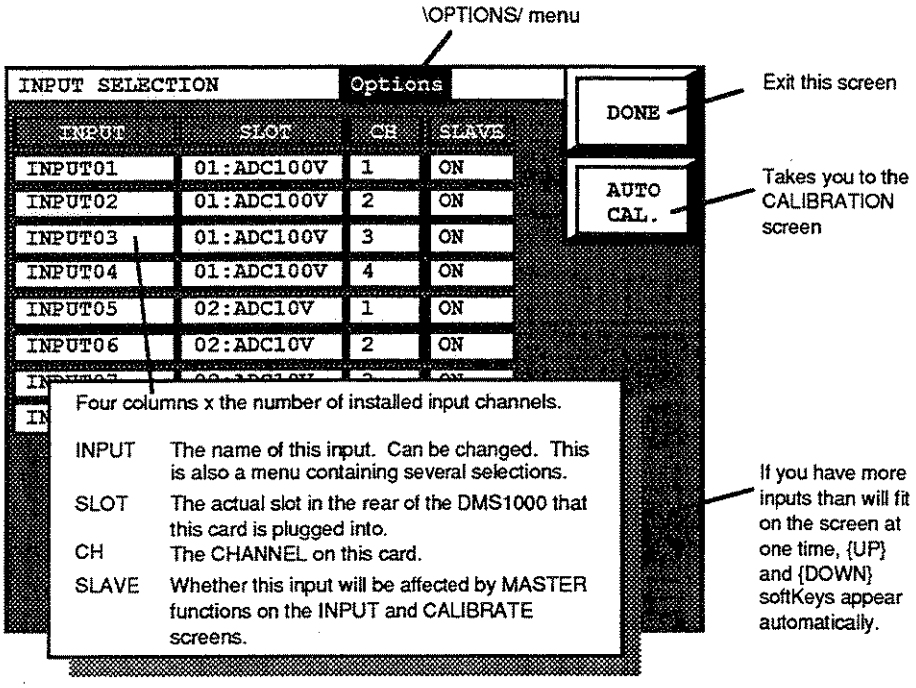
\Zoom/

Menu item under any \Trace/ menu

\Zoom/ enlarges this trace to fill the entire display width. This can be reverted back to normal by selecting \Zoom/ again and pressing <ENTER>.

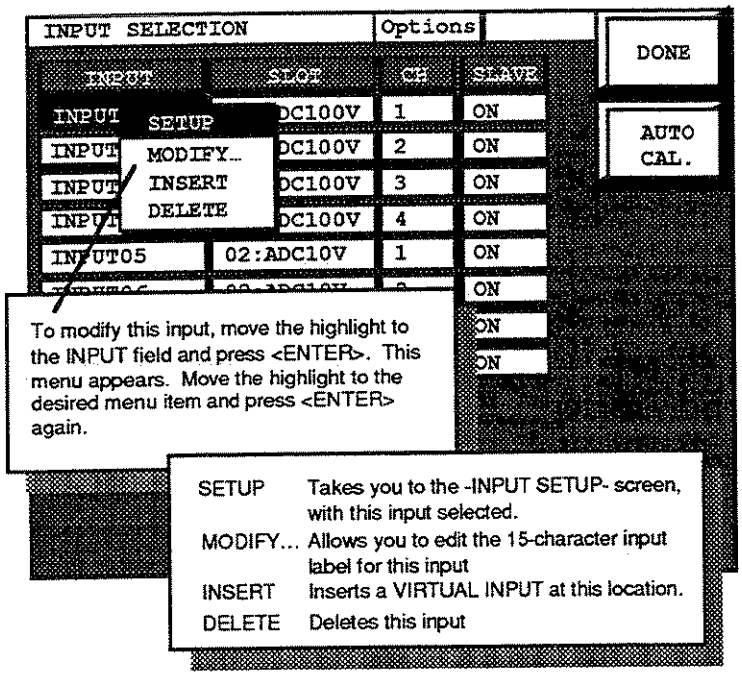
Section 4 The Input Selection Screen

This is where you can add "virtual" inputs, delete inputs from the setup, and modify the default input names ("INPUT01 ... INPUT32"). Most DMS1000 never use this screen unless they want to change these parameters. When the DMS1000 is first turned on, it determines which input cards are installed in which slots and automatically creates an input assignment in ascending order.



The -INPUT SELECTION- Screen

4.1 Modifying the INPUT

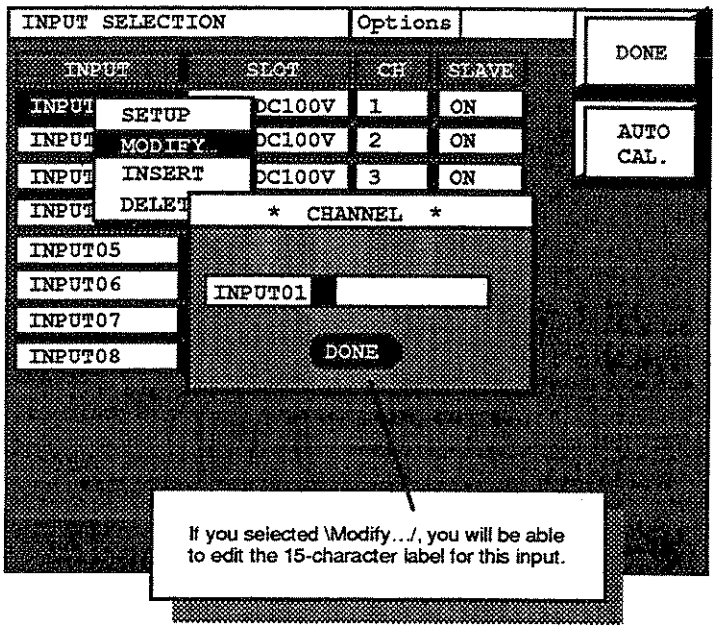


The \INPUT/ Pull-down menu

Move the highlight to the [INPUT] field and press <ENTER>. The pull-down menu will appear, as shown above. Move the highlight to your selection and press <ENTER>.

Selecting \Setup/ will take you directly to the -INPUT SETUP- screen, with this input selected. The other menu items are described in the following paragraphs.

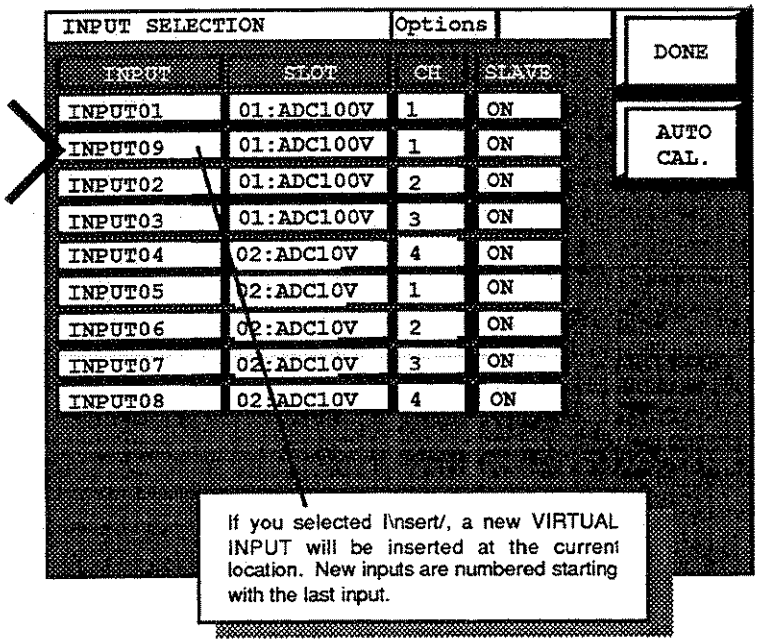
4.1.1 Modifying the Input Label



*The *CHANNEL* dialog box*

Move the highlight to the \Modify.../ menu item and press <ENTER>. The *CHANNEL* dialog box will appear, as shown above. You may now enter a new input label for this input. The new label will be shown on all of the Mark 12's screens in lieu of "INPUT01." It will also be printed on the chart in lieu of "INPUT01."

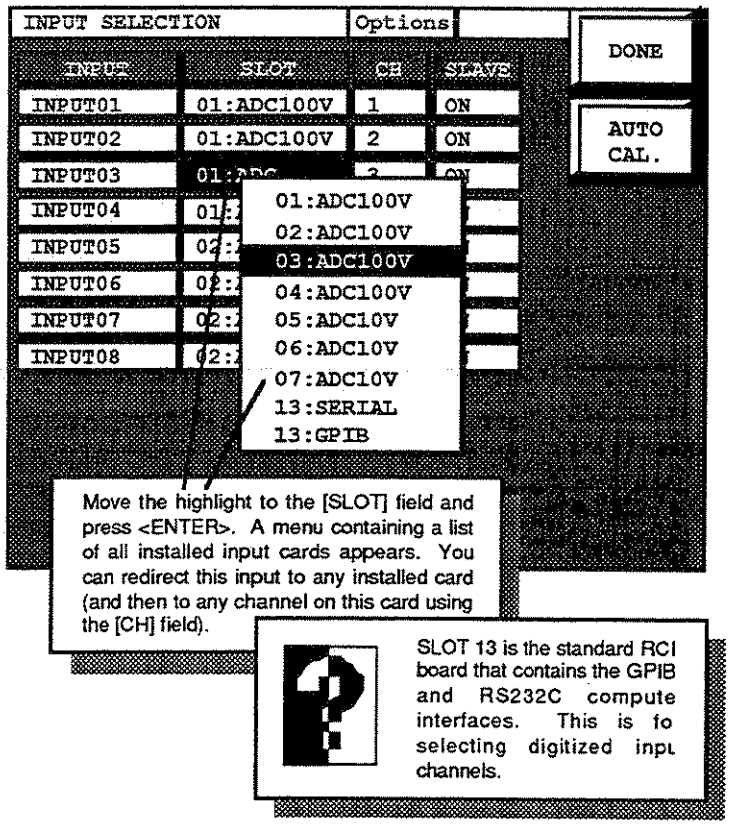
4.1.2 Inserting an Input



Inserting a new input

Move the highlight to the \Insert/ menu item and press <ENTER>. A new input will appear at the current location.

4.2 Selecting the Slot

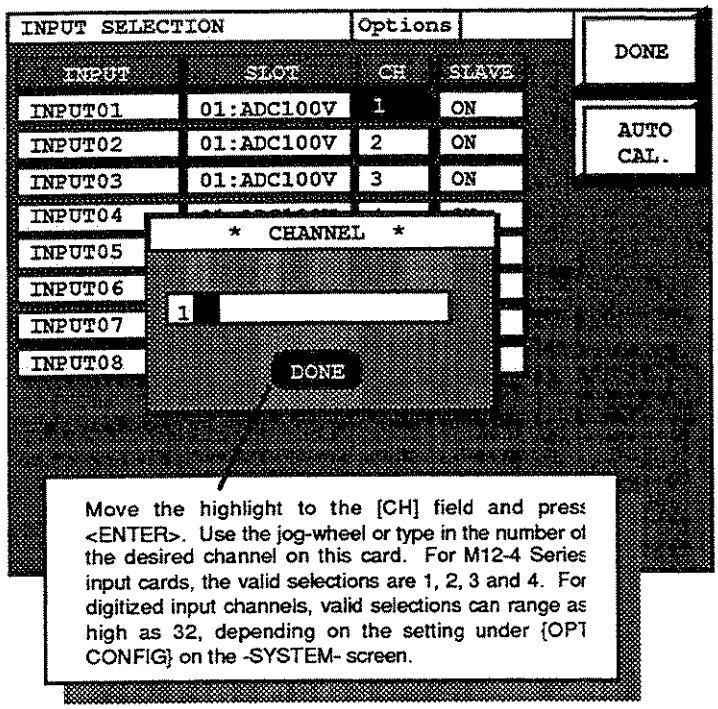


The [SLOT] field

Move the highlight to the [SLOT] field and press <ENTER>. The \SLOT/ pull-down menu will appear, upon which you may direct this input to any installed input card.

Note that you may also direct this input to any installed computer interface port. RS232C and GPIB are standard in slot 13, but you may purchase additional interface cards (M12-IFII), providing more than one of each interface.

4.3 Selecting The Channel

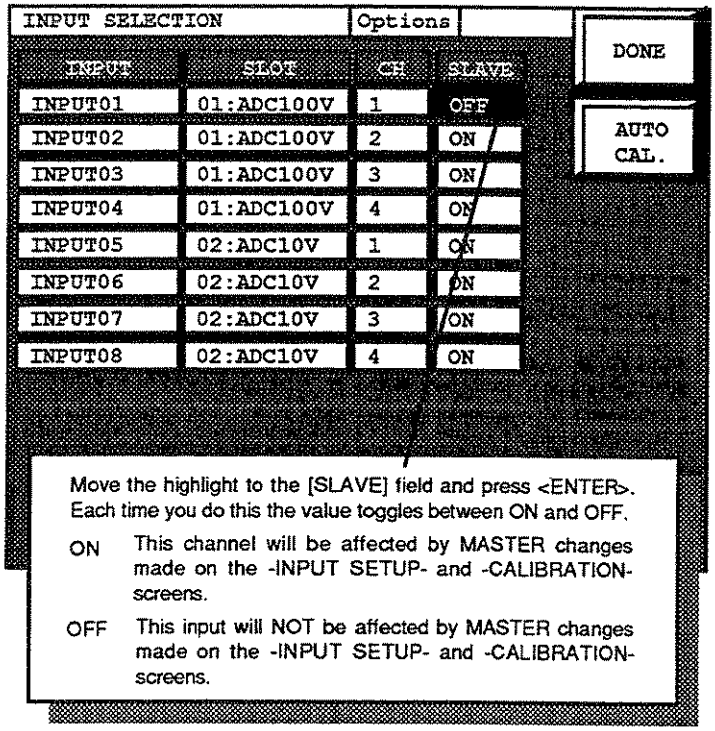


*The *CHANNEL* dialog box*

Move the highlight to the [CH] field and press <ENTER>. The *CHANNEL* dialog box will appear, in which you may assign this input to any input channel on the selected card slot..

When done, move the highlight to the [DONE] field and press <ENTER>.

4.4 Setting the Slave Parameter



The [SLAVE] field

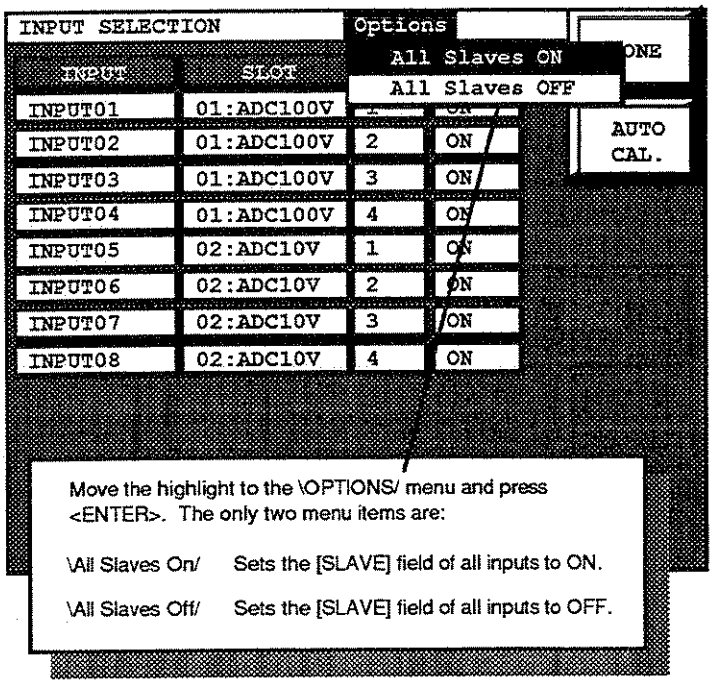
Move the highlight to the [SLAVE] field press <ENTER>. Each time you press <ENTER> this field toggles from ON to OFF.

The default setting for all inputs is ON.

When an input's SLAVE parameter is set to ON, this input will be affected by MASTER/SLAVE functions performed on the -INPUT SETUP- screen.

Note: The master/slave functionality is provided on several screens. It allows the user to make one or more changes to all of the traces or inputs at once. Please be aware that the SLAVE parameter on this screen applies only to master changes made on the -INPUT SETUP- screen. For example, if you have turned the slave parameter of INPUT01 to OFF here, and then use the master function on the -Y-T CHART LAYOUT- screen, INPUT01 will be affected just like all of the other inputs. Why? Because the chart layout screens affect only TRACES, not INPUTS! The only place you can affect inputs is on...you guessed it...one of the input screens.

4.5 The Options Menu

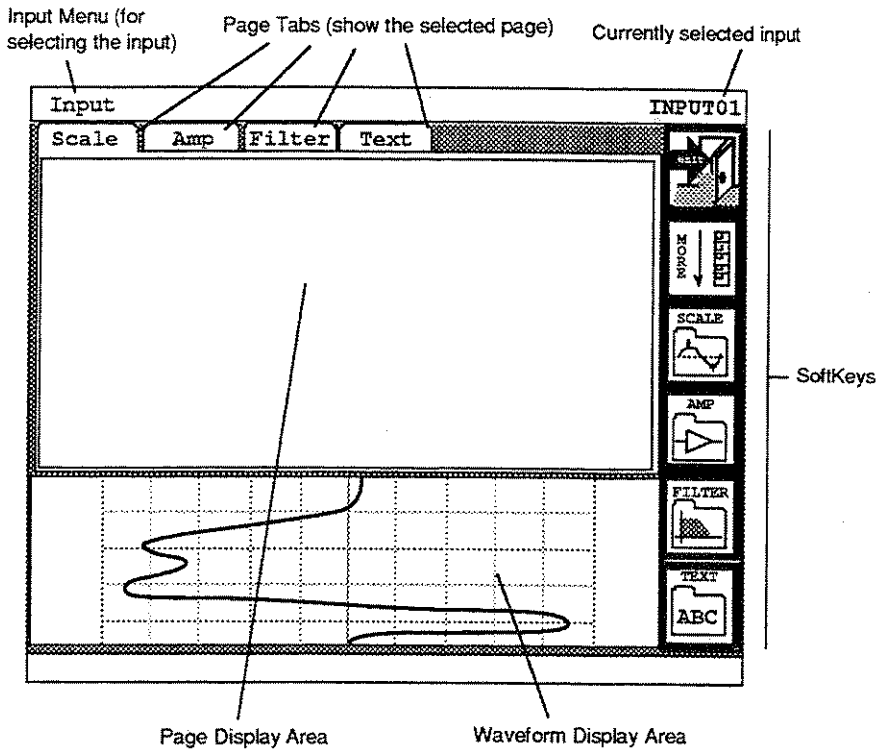


The \OPTIONS/ menu

Move the highlight to the \OPTIONS/ menu and press <ENTER>. This menu contains only two menu items: \All Slaves On/ and \All Slaves Off/. This is a simple way to toggle on/off the SLAVE parameter of all your inputs at once.

Section 5 Input Setup Screen

The –INPUT SETUP– screen is where you will configure the range and offset input characteristics of each channel, invoke automatic System Calibration (ASC™), enter interchannel annotation, turn channels on or off, calibrate your inputs, and program the engineering unit scaling parameters. If you have any M12-4E input cards, this is also where you will control the zero suppression, filtering, and RMS conversion parameters.

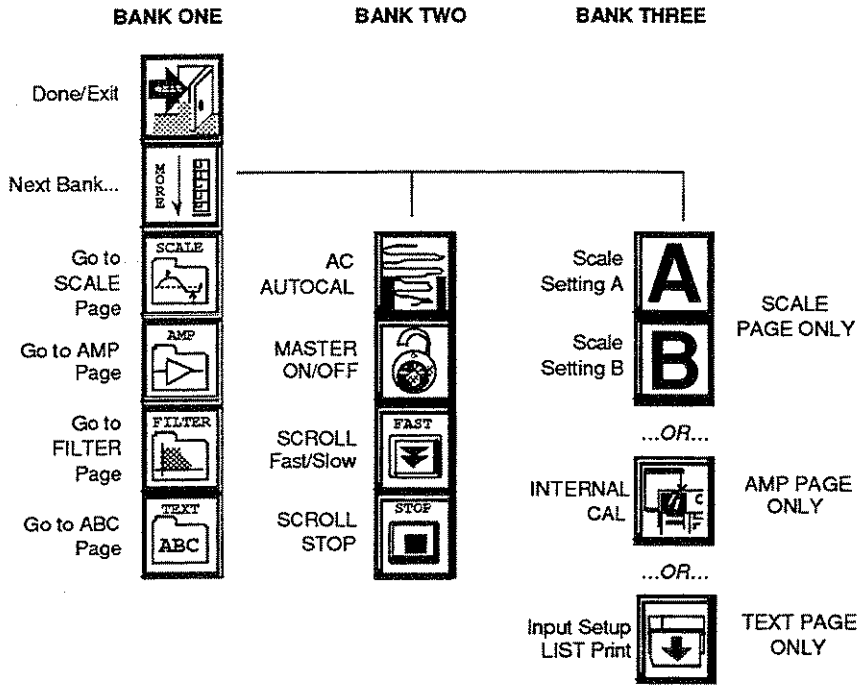


-INPUT SETUP- screen, without a page shown

Note that the "page" area in the middle of the screen is blank in the illustration above. In reality, a page is always shown.

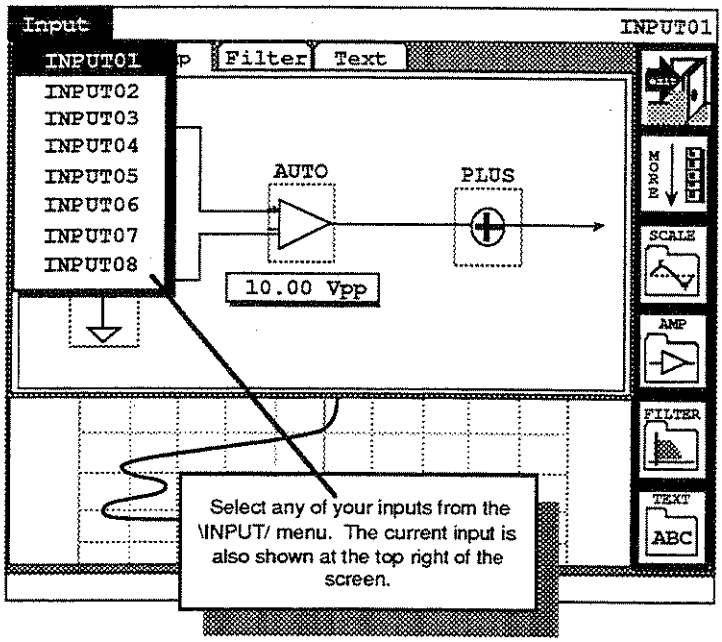
5.1 Input Setup SoftKeys

Note also the six softKey icons along the right edge of the display. One special softKey provides access to additional banks of icons. The additional banks that appear will differ depending on which page is shown. Here is a breakdown:



SoftKey banks available on the -INPUT SETUP- screen

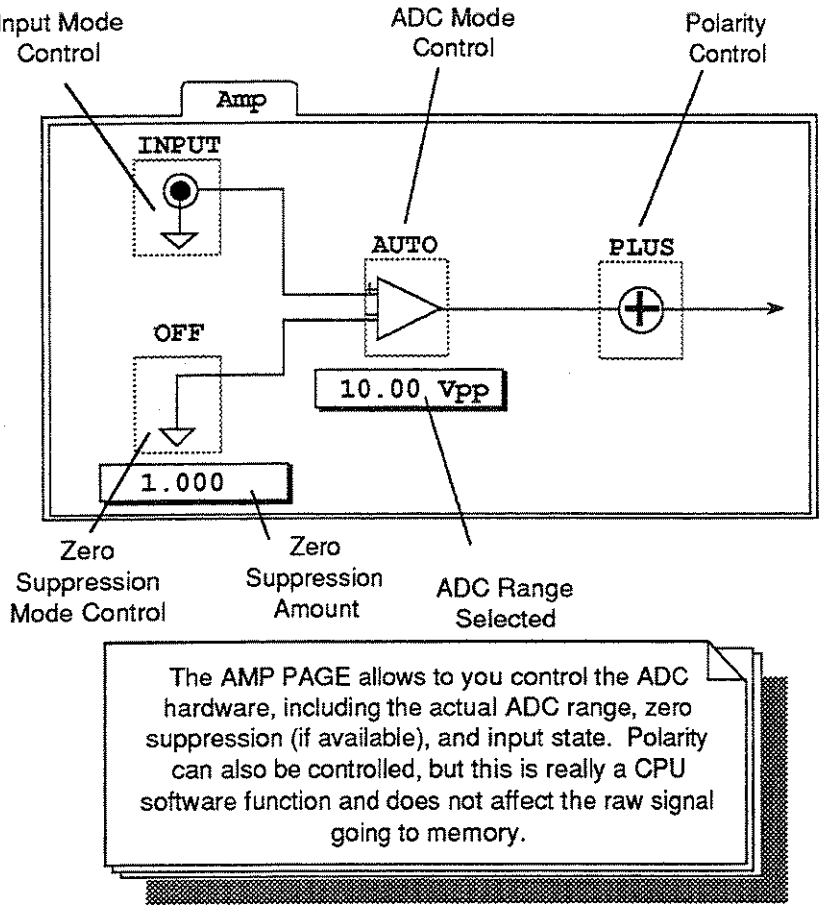
5.2 General Controls



Changing INPUTS with the \INPUT/ menu

You work on one INPUT at a time on this screen. To select any installed input, use the \INPUT/ menu. Move the highlight to the desired input and press <ENTER>.

5.3 The AMP Page

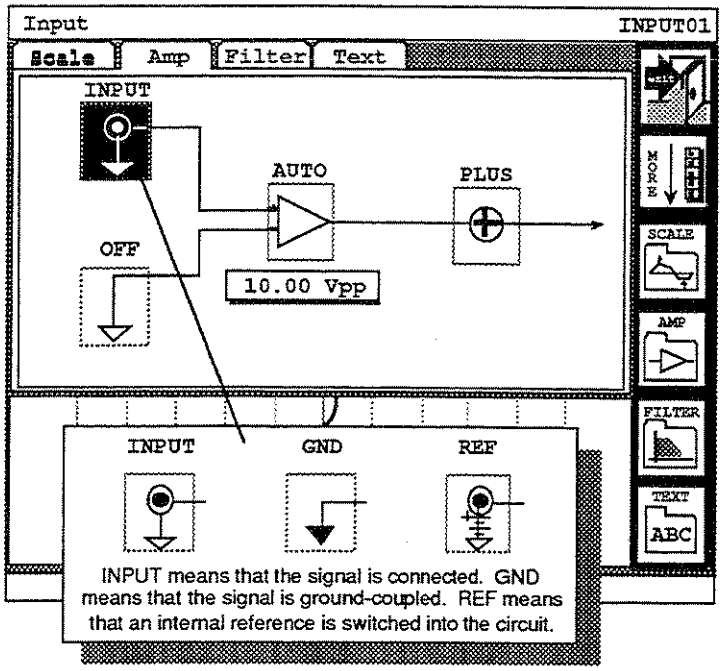


The AMP Page

We will examine each of these controls and how to use them on the following pages.

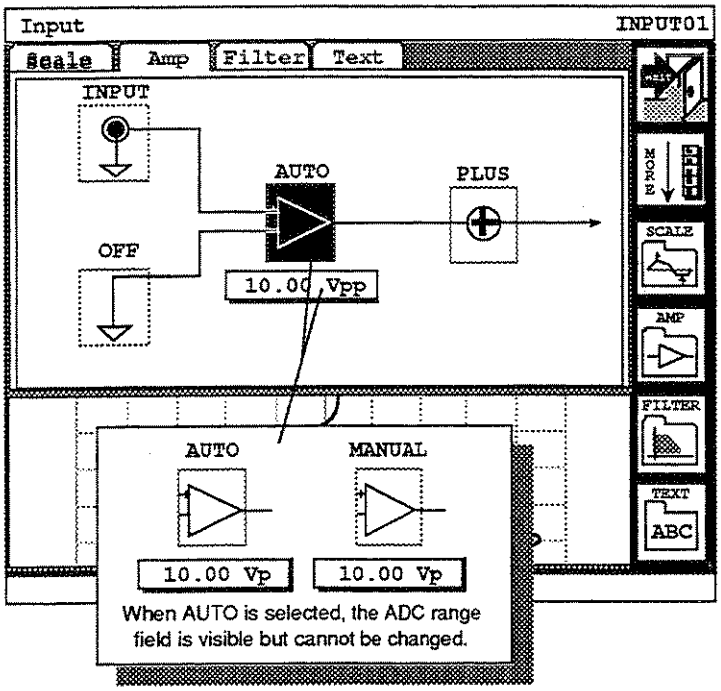
Note: Zero Suppression requires the M12-4E input card

5.3.1 Selecting the INPUT STATE



Selecting the Input State

5.3.2 Controlling AUTO-RANGING

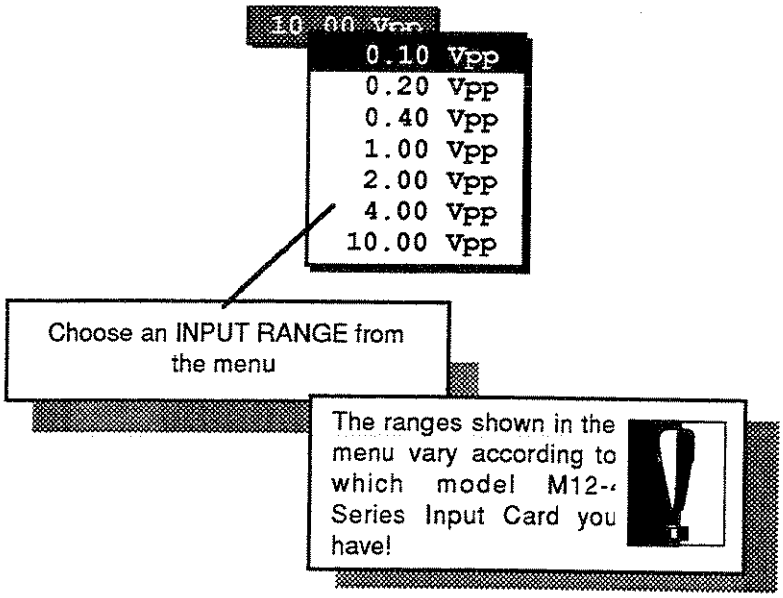


Controlling AUTO-RANGING

When AUTO-RANGING is turned ON, changes made to the scale/offset on the SCALE page will automatically cause a change to the actual hardware ADC setting, shown here.

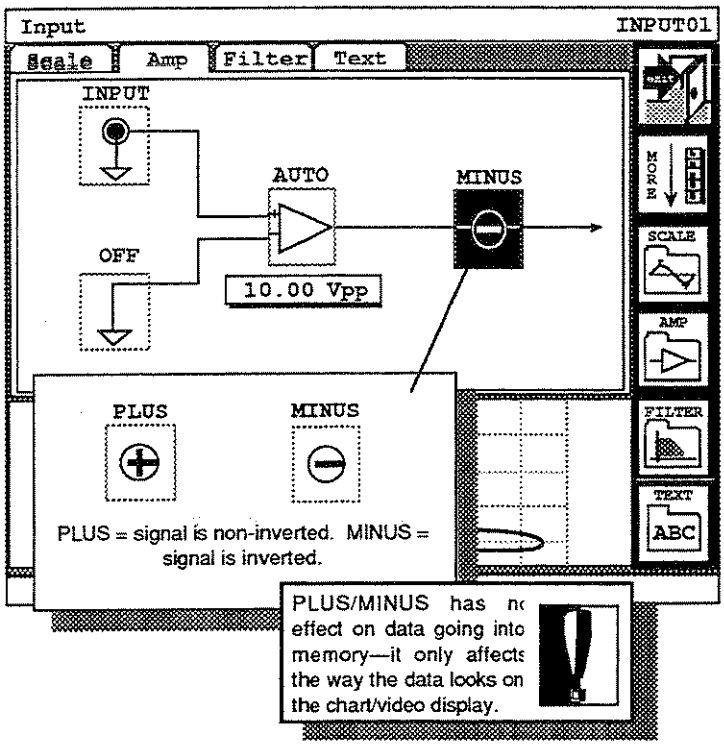
Also, when AUTO-RANGING is turned on, you may see, but not edit, the actual hardware ADC range here. On the screen above, it is currently set to 10.00 V PP (±5 VFS).

When AUTO-RANGING is turned OFF, the you will be able to select the hardware ADC setting on this page and change it:



Auto-Ranging Turned OFF

5.3.3 Setting the Input Polarity

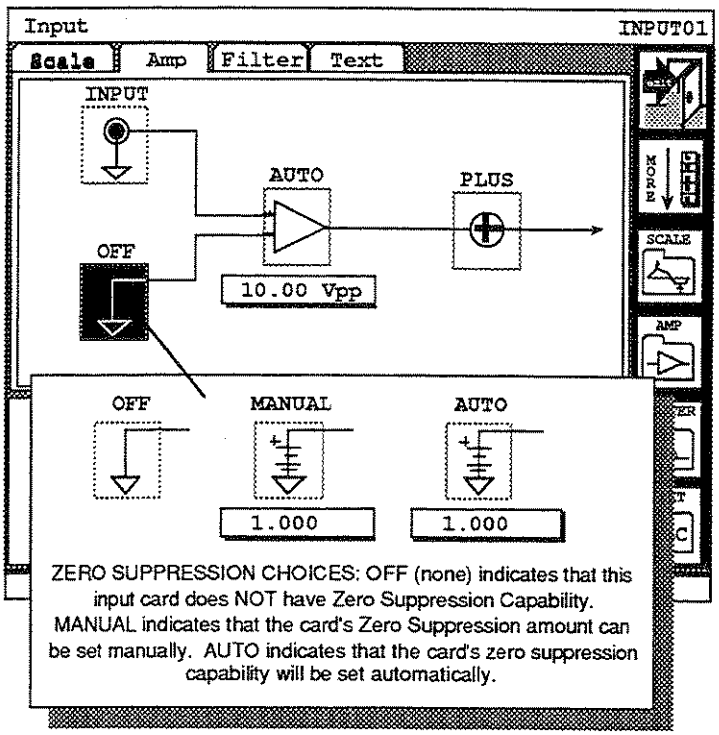


Setting the Input Polarity

Toggle this icon until the desired polarity is shown.

5.3.4 Using Zero Suppression

Note: This feature only applies to the M12-4E card.



Using Zero Suppression

Remember that when AUTO SUPPRESSION is in effect (when this control is set to AUTO), then the Mark 12 will apply zero suppression whenever you call for more than a moderate amount of offset on the SCALE page.

When Zero Suppression is left in the MANUAL mode, then it will not be applied automatically by the system. In this state, you control it manually, by selecting the zero suppression field and then inputting a voltage value.

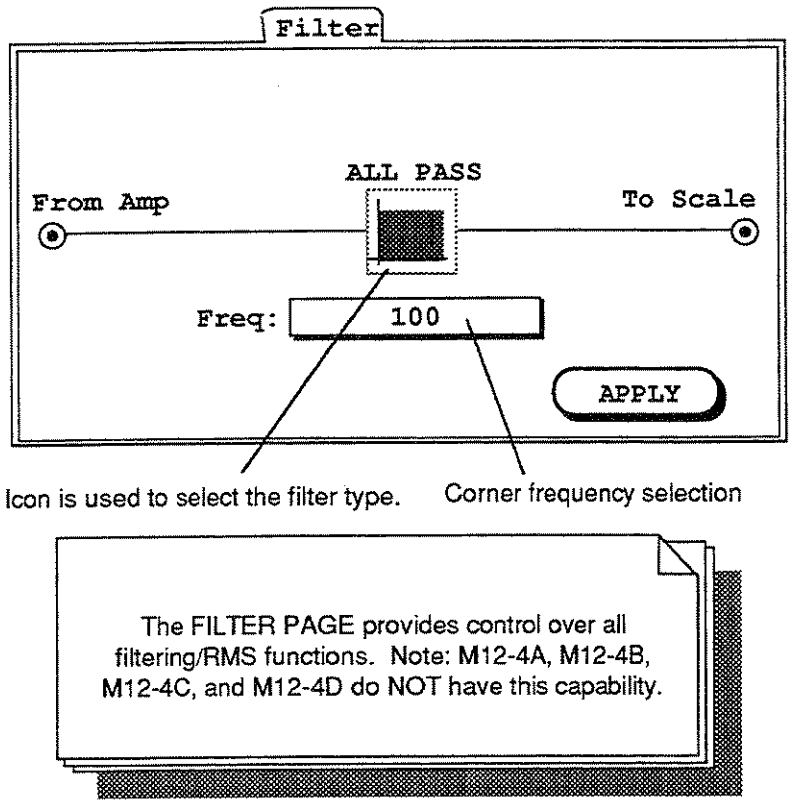
Zero suppression values are always set in Voltage—never in user or engineering units. This is because this is a direct hardware function that occurs before the signal has been digitized or digitally scaled.

A Note About Triggering and Zero Suppression:

- *When AUTO SUPPRESSION is turned on, then the trigger value that you set wil take into account the suppression amount (if any). For example, if the trigger level is set to 1.000 V, then the system will trigger when the input reaches 1.000 V, regardless of the suppression setting.*

  However, when AUTO SUPPRESSION is turned oof, the suppression value is ignored during trigger level calculations. For example, if the trigger level is set to 1.000 V, and the zero suppression is set to 1.000 V, then the system will trigger when the signal level reaches 2.000 V.

5.4 The FILTER Page

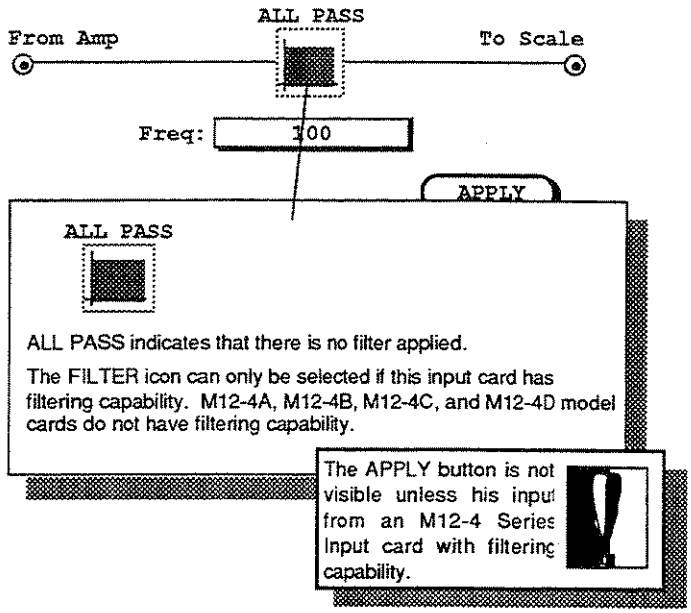


The Filter Page

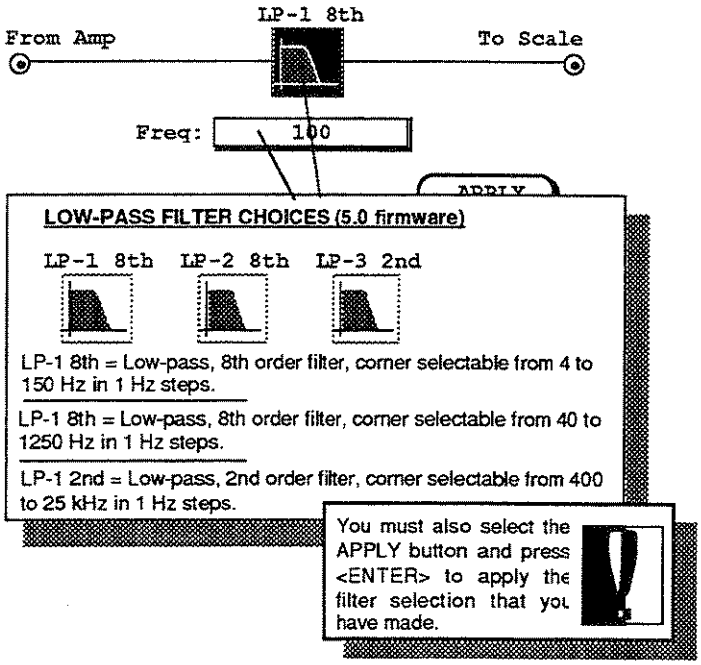
We will examine each of these controls and how to use them on the following pages.

Note: Filtering requires the M12-4E input card

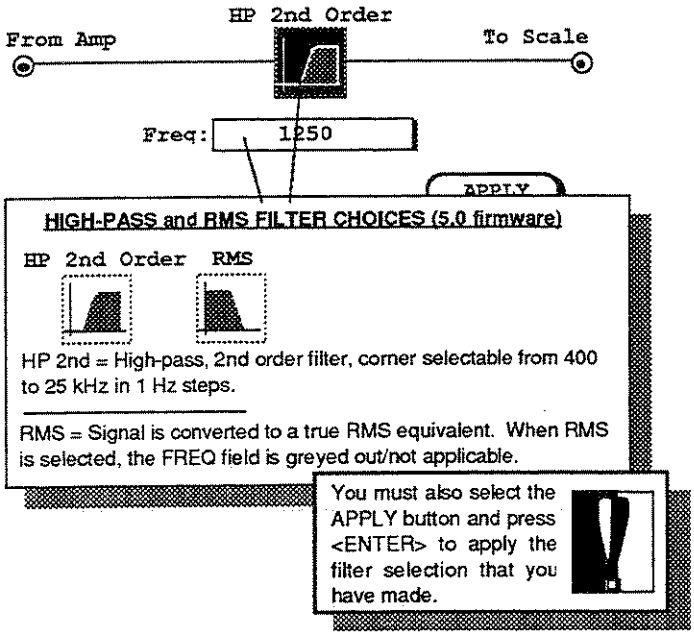
5.4.1 Setting the Filter Type



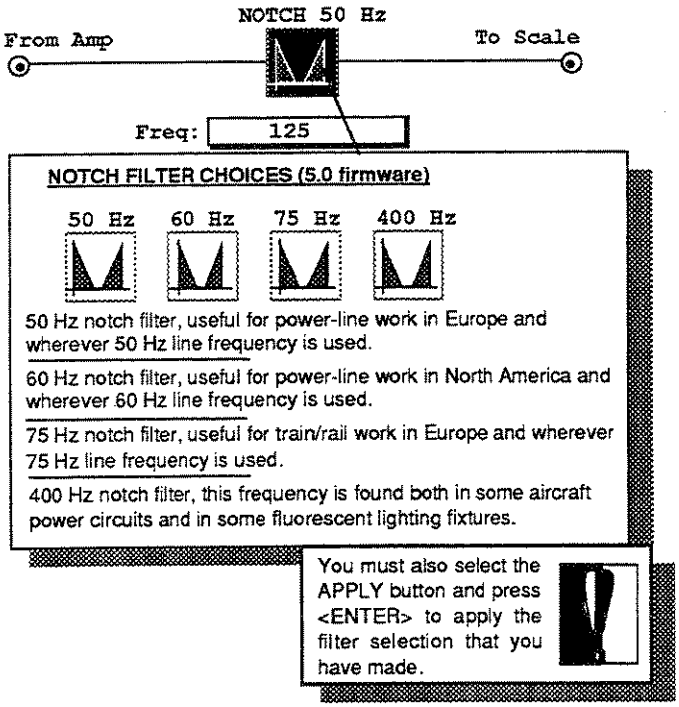
All Pass Filter (None)



Low-Pass Filter Selections

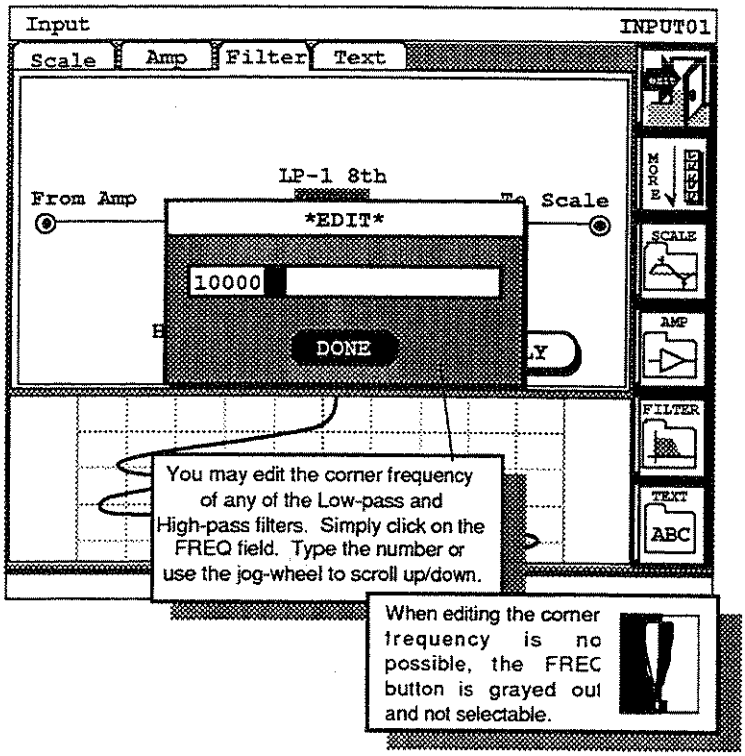


High-Pass Filter Selections



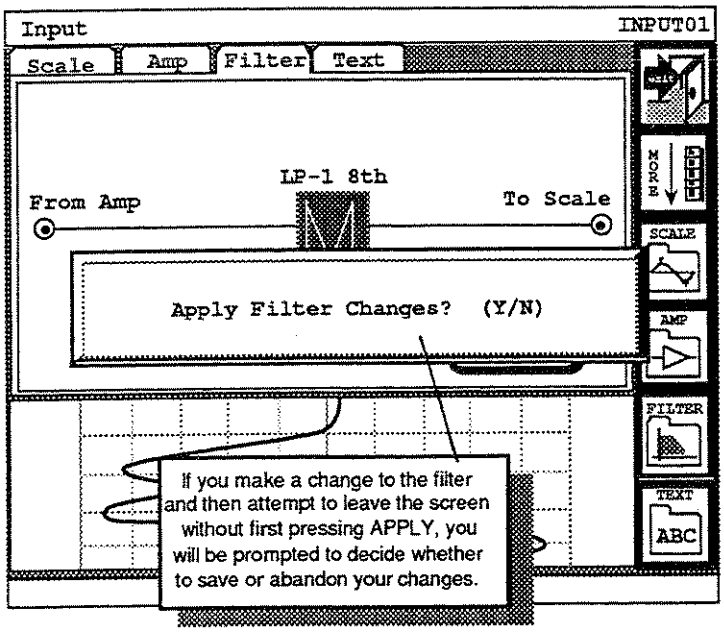
Notch Filter Selections

5.4.2 Setting the Filter Corner Frequency



Setting the corner frequency

5.4.3 Applying Filter Setting Changes



Applying Your Changes

Remember that you must press the [APPLY] button in order for filter type/value changes to take effect. If you forget to press this button, and you attempt to leave this screen or page, the system will prompt you as shown above.

At this point, you may elect to CANCEL the changes by pressing <N>, or apply them, by pressing <Y>.

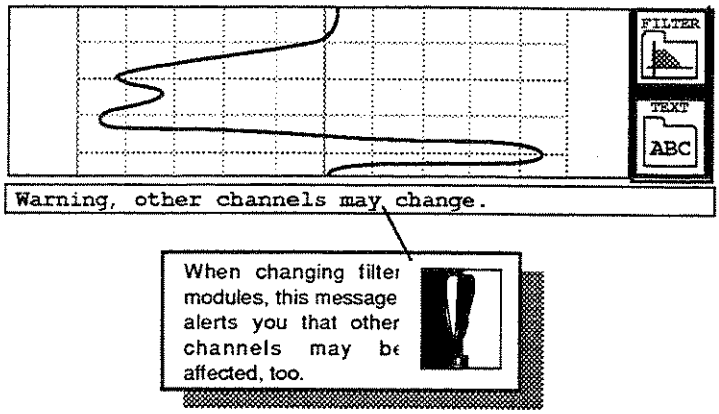
5.4.4 Watching For Filter Dependencies

On the M12-4E input card, channels 1 and 2 are processed by a single DSP, and channels 3 and 4 are processed by another DSP. This is very efficient, but can lead sometimes to filter settings from one input affecting another.

For example, let us say that you call up INPUT01, which is assigned to the channel 1 on your first M12-4E card. You wish to apply a filter to it, so you come to this page and select a 2-pole low-pass filter.

Now you move to INPUT02, which is assigned to channel 2 of your first M12-4E card. Remember: channels 1 and 2 within an M12-4E card are processed by the same DSP chip.

You select an 8-pole filter and apply it to this input. Suddenly, you see this message:



Some filter choices will affect other channels

If you proceed, the 2-pole filter that you applied to INPUT01 will be changed to an 8-pole filter.

The DSP that is processing two channels can only have one software module loaded into it at a time. Software modules contain one or more similar programs. Thus, as long as you keep INPUT01 and INPUT02 BOTH as 2-pole or 8-pole filters, then there is no problem. However, one cannot be 2-pole and the other 8-pole at the same time.

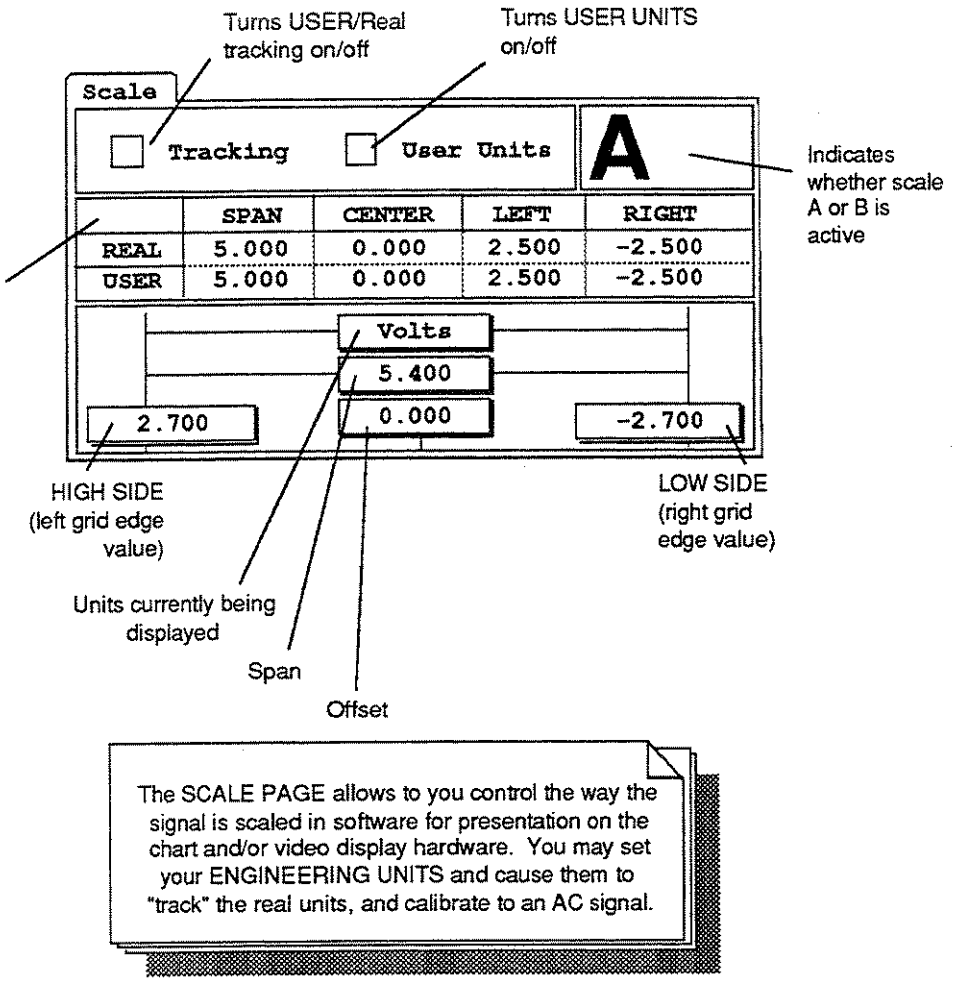
There are no restrictions if either channel is set to ALL PASS (no filtering).

When an input is set to the RMS mode, then the other input must either be set to ALL PASS or RMS mode.

Consult the latest edition of the Western Graphtec publication entitled **WGI flyer #M12-4E** for the latest information about DSP software dependencies as relate to the M12-4E card.

As long as you understand the inherent restrictions regarding DSP software module capabilities, then there should be few surprises when operating the Mark 12.

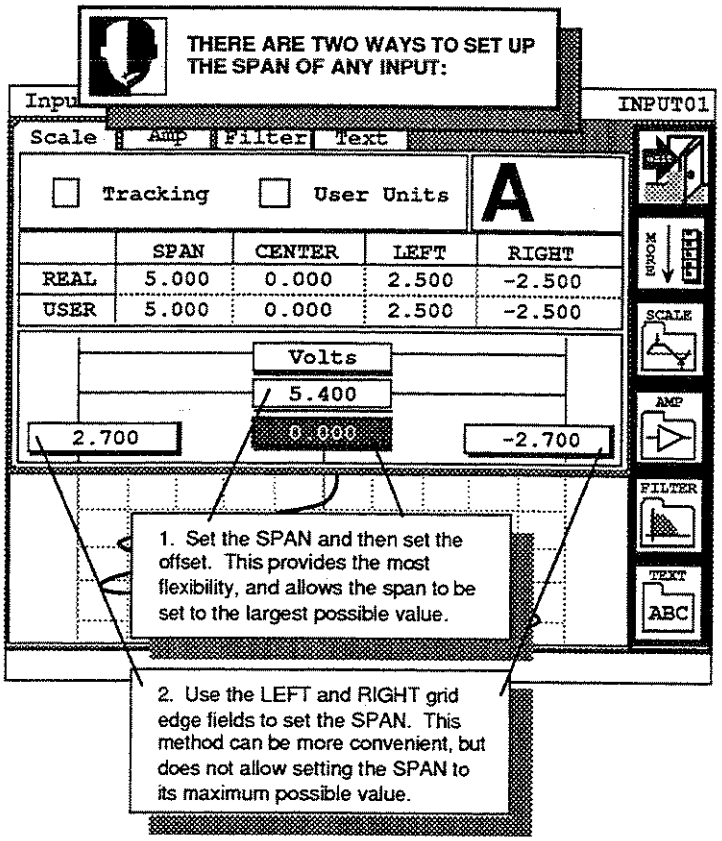
5.5 The SCALE Page



The Scale Page

We will examine each of these controls and how to use them on the following pages.

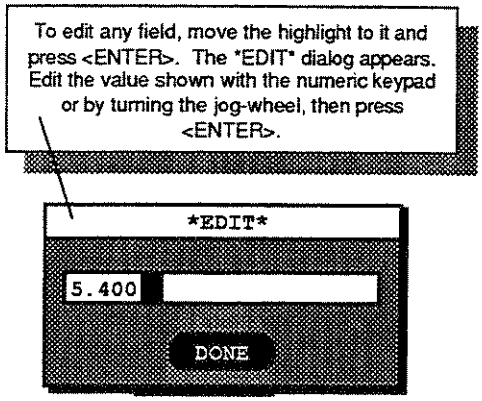
5.5.1 Setting the Span/Offset



Setting the Span and Offset

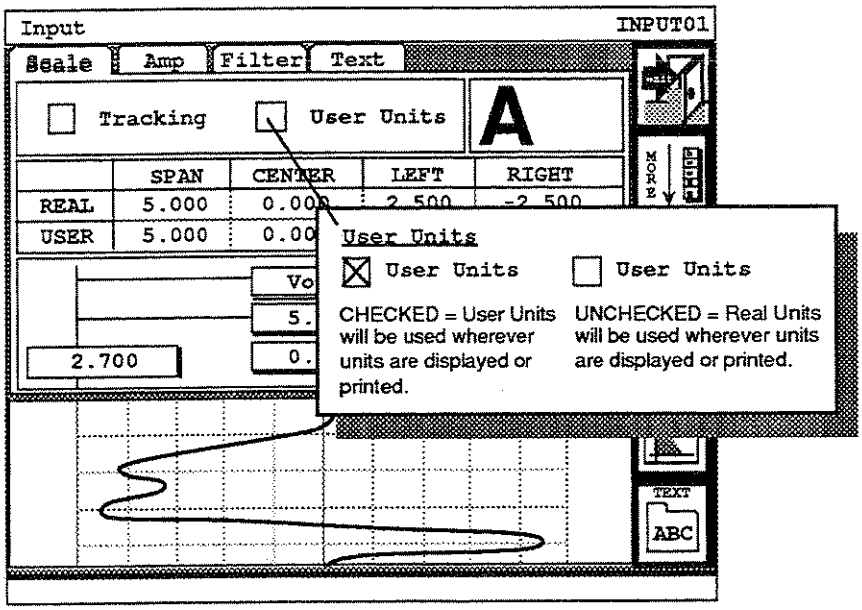
You can use the center two controls, first setting the overall SPAN, and then inputting an OFFSET value. This method provides the best overall offset capabilities, and is certainly more intuitive when recording bipolar signals.

Or, you can use the outer two controls, setting the right edge (LS) first, and then inputting a value for the left edge (HS). This method is preferred when recording unipolar signals, as you are not required to calculate span and offset values.



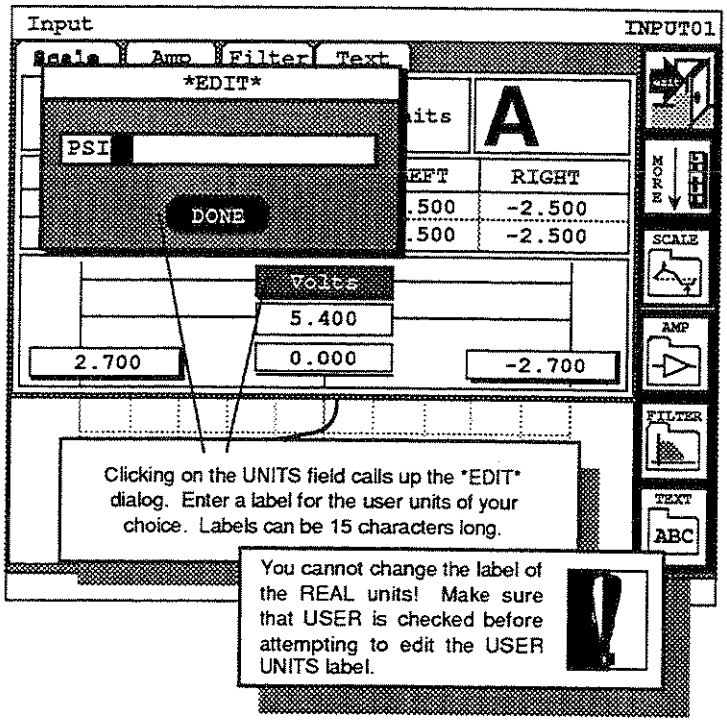
Editing numeric values

5.5.2 Activating USER UNITS



Turning on/off User Units

When you activate the USER UNITS (by checking this box), then the values in the fields just above the chart graphic, as well as the user label, can be edited!



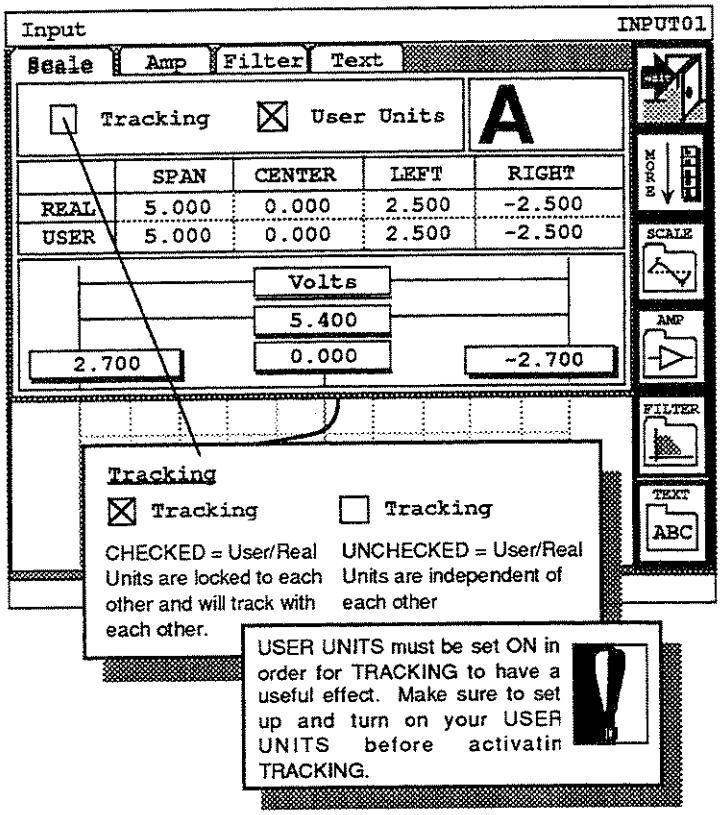
Editing the USER UNITS label

We strongly advise following these steps:

1. Calibrate your system completely using the REAL units (do not activate USER UNITS yet)
2. Activate the USER UNITS, and then edit the LS, HS, and LABEL fields to the appropriate engineering unit values. For example, set the LS to "0.000", the HS to "100.000", and the LABEL to "PSI"
3. Once both the real units are calibrated and the user units are properly set to match, then activate the TRACKING control. This will lock in a mathematical relationship between the REAL and USER units. See the next paragraph for additional information about how the Mark 12 behaves when TRACKING is activated.

5.5.3 Activating TRACKING

Note: Do not attempt to activate TRACKING until you have read the preceding paragraph regarding USER UNITS.



Turning on/off Tracking

When you activate TRACKING (by checking this box), a mathematical link is established between the REAL and USER units. At this point, you are working completely in USER UNITS.

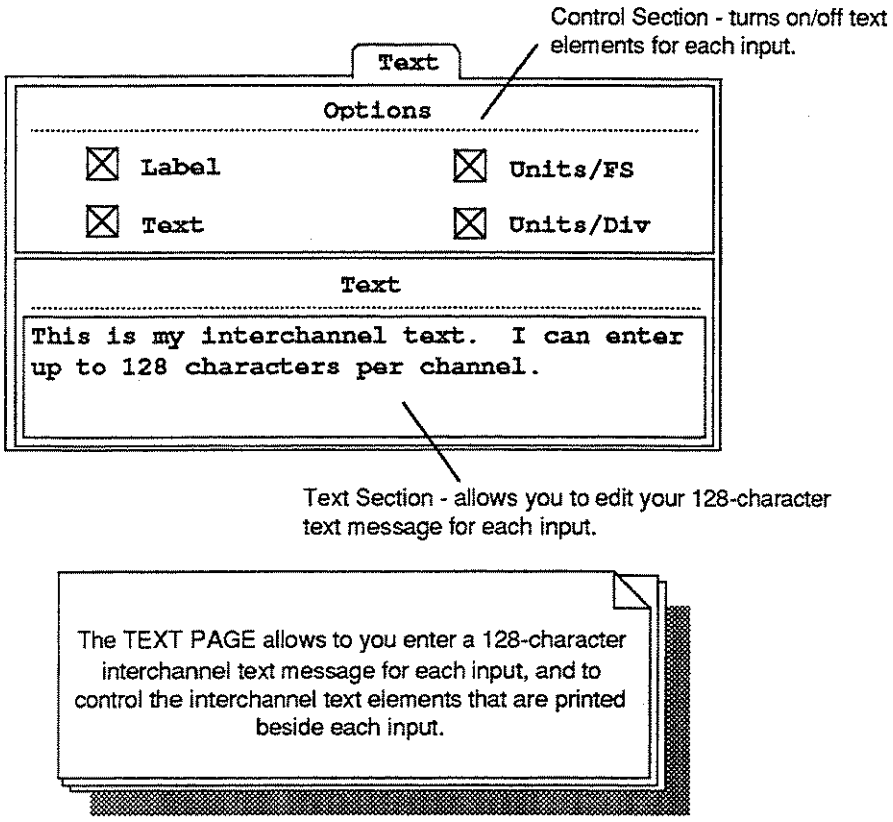
Let's say that the real input voltage is ±5 V, but you have input user units as 0 to 100 PSI. You activated the user units, so the display is now completely in PSI. All functions, including triggering, are now set in PSI.

When tracking is activated, any changes that you make to the user units will have affect the real units. So, if you suddenly decide that instead of 0 to 100 PSI, you want to see 25 to 100 PSI, the Mark 12 will make the appropriate changes to the REAL span and offset (and the ADC range and/or zero suppression, if required, and if AUTO-RANGING and/or AUTO-SUPPRESSION are turned on).

Tracking allows you to LINK the real units and user units together. Without this, you would have to do the calculations to determine what the REAL span and offset should be changed to in order to achieve 25 to 100 PSI. This probably also means calibrating all over again.

The USER UNITS and unique TRACKING capabilities of the Mark 12 eliminate this requirement completely, saving you time and money, and reducing the possibility of errors. We are only human, after all, but the computer inside the Mark 12 rarely makes a math error.

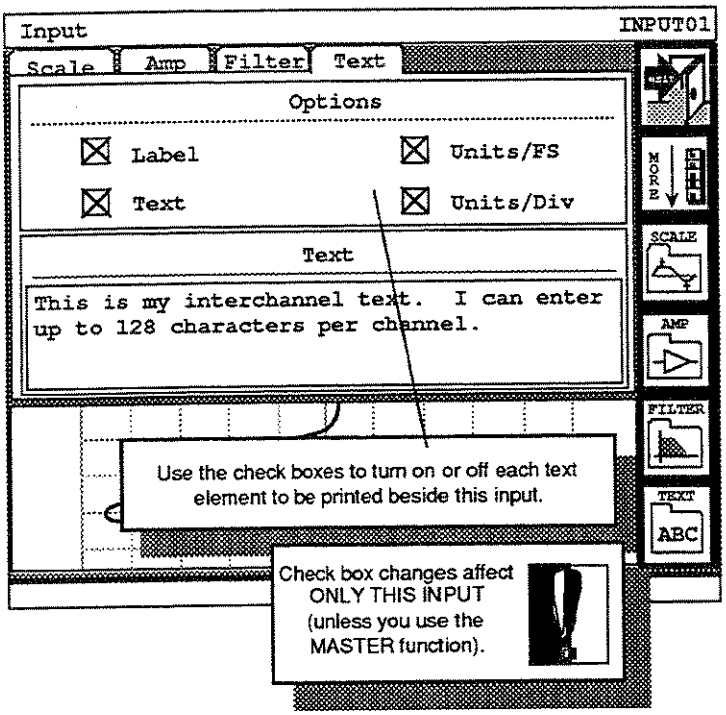
5.5.4 The TEXT Page



The TEXT Page

We will examine each of these controls and how to use them on the following pages.

5.6.1 Selecting Text Elements

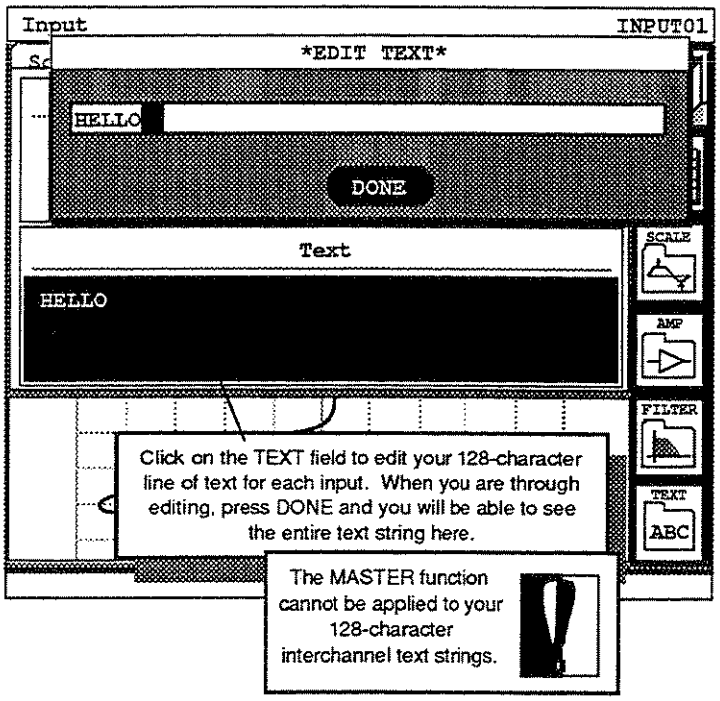


Select the interchannel text elements that you wish printed beside this input

These parameters can be set independently for each input:

Label	The actual input label, like "INPUT01", or whatever you have changed it to on the -INPUT SELECTION- screen.
Units/FS	The full-scale units, expressed as "HS: 5.000 LS: -5.000". If an M12-4E card is installed on this channel, also includes the filter and zero suppression settings
Units/Div	The units/FS divided by the number of grid divisions on this trace. Expressed like "1 V/div"
Text	Your 128-character line of text, entered on this screen

5.6.2 Entering Interchannel Text

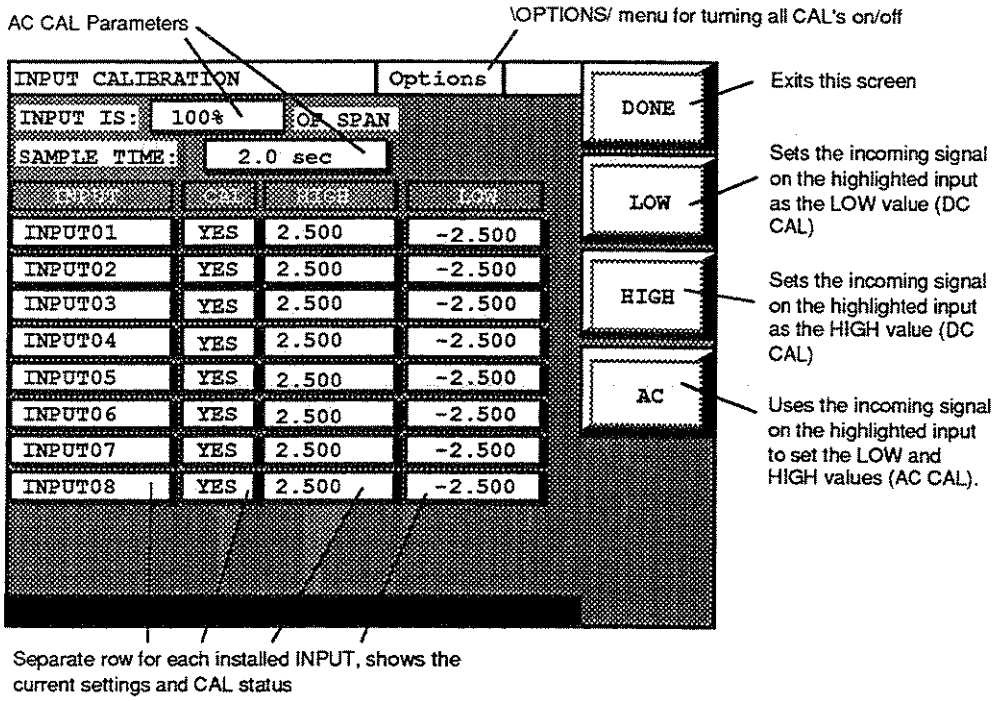


Inputting your text

You may enter up to 128 characters of text to be printed following the other parameters, beside each input.

Note: *Text is associated with the inputs, not the traces on the chart! If you create a Y-T chart layout with several traces that have the same input source, then the interchannel text will be the same for all of the traces. If you want to put the same signal on the chart BUT with different text, create several VIRTUAL INPUTS, each assigned to the same channel on the same slot (do this on the -INPUT SELECTION- screen). Then, you will have, in effect, separate inputs whose text you can edit.*

Section 6 Input Calibration Screen



The -CALIBRATION- Screen

The –CALIBRATION– screen is where you can perform AC or DC CAL on one or more inputs at a time, and set the AC CAL defaults.

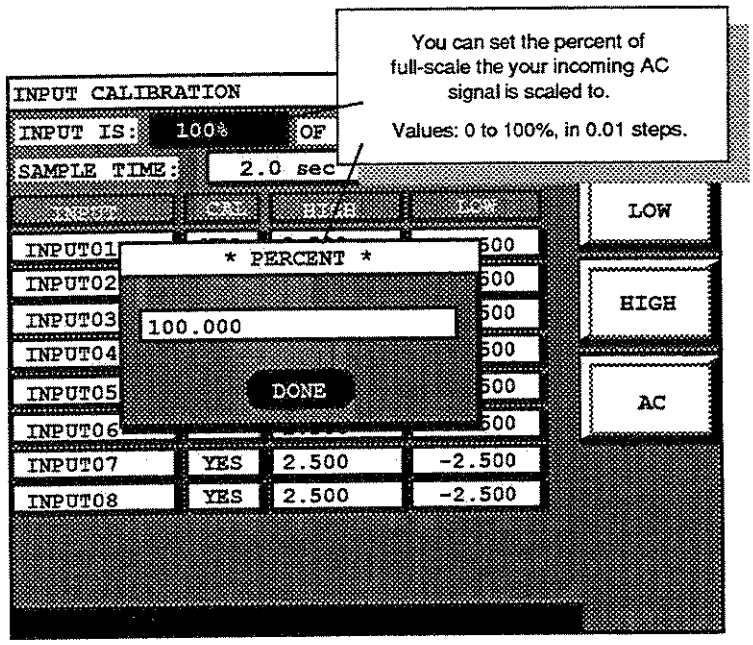
Remember that on the -INPUT SETUP- screen, you can run AC calibration on the selected input. The AC CAL parameters are global, however, and are set here.

The AC CAL parameters are shown at the top of the screen, and include:

- How long the signal is monitored for
- What percentage of full-scale the signal should be scaled to

Let's look at this screen in detail, and learn how to use it.

6.1 Setting the SCALE Parameter



*The *Percent* dialog box*

SCALE AND AC CAL

If you want to use AC CAL, you can do so here or on the -INPUT SETUP- screen. The advantage of doing it here is that you can calibrate more than one INPUT at a time. The disadvantage is that you cannot see the waveform on this screen, but you can on the -INPUT SETUP- screen.

Regardless of where you invoke it from, you set the two parameters related to AC CAL on this screen.

The first AC CAL parameter is the percentage of full-scale that the incoming AC signal will be scaled to. You can select any number from 1 to 100%, in 0.01% steps. If you enter a value with more resolution, it will be rounded.

For example, let's say that your grid pattern is 100 mm wide, and you set this parameter to "80%." When you run AC CAL, the signal will be scaled to exactly 80 mm wide, *centered* on the grid pattern.

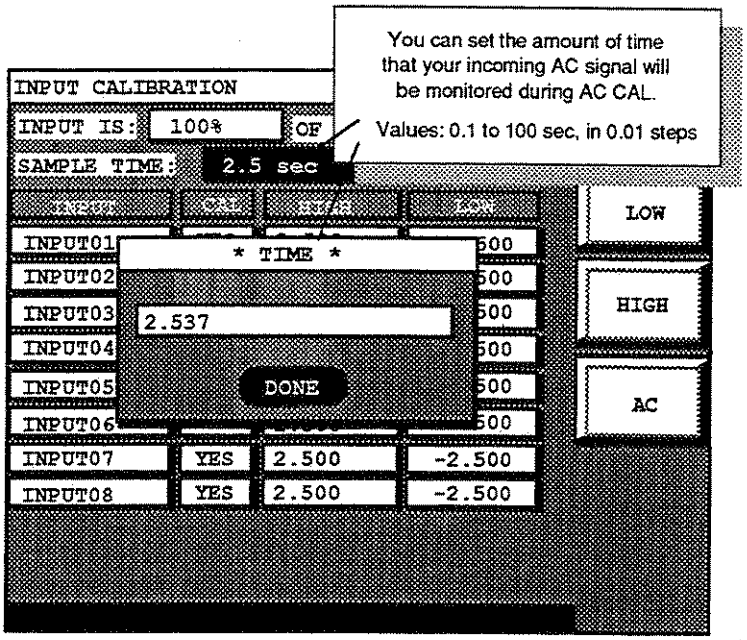
Since AC CAL is bi-polar by definition, signals will always be centered against the background grid pattern.

SCALE AND DC CAL

The scale parameter also applies to DC CAL, but in a different way. Since DC CAL is unipolar by definition, signals will always be aligned with the right edge of the grid pattern.

For example, let's say that your grid pattern is 100 mm wide, and you set this parameter to "80%." Now, you input the low side voltage and press {LOW}, then the high side voltage and press {HIGH}. The result on the chart is that low wide is aligned with the right edge of the grid, and the high side is exactly 80 mm (80%) of the way across to the left side.

6.2 Setting the TIME Parameter



*The *Time* dialog box*

If you want to use AC CAL, you can do so here or on the -INPUT SETUP- screen. The advantage of doing it here is that you can calibrate more than one INPUT at a time. The disadvantage is that you cannot see the waveform on this screen, but you can on the -INPUT SETUP- screen.

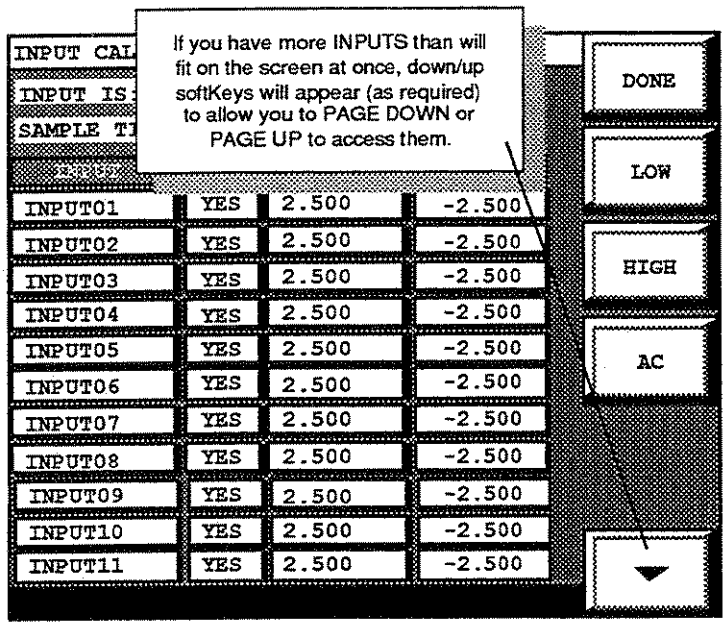
Regardless of where you invoke it from, you set the two parameters related to AC CAL on this screen.

The first AC CAL parameter is PERCENTAGE, as described in the previous paragraph.

The second AC CAL parameter is TIME, which is the amount of time your incoming signal will be monitored for during the AC CAL process. You can select any amount of time from 0.1 to 100 seconds. If you enter a value with more resolution, it will be rounded to 0.1 second.

Note: The TIME parameter does not apply to DC CAL

6.3 PAGE DOWN and PAGE UP SoftKeys

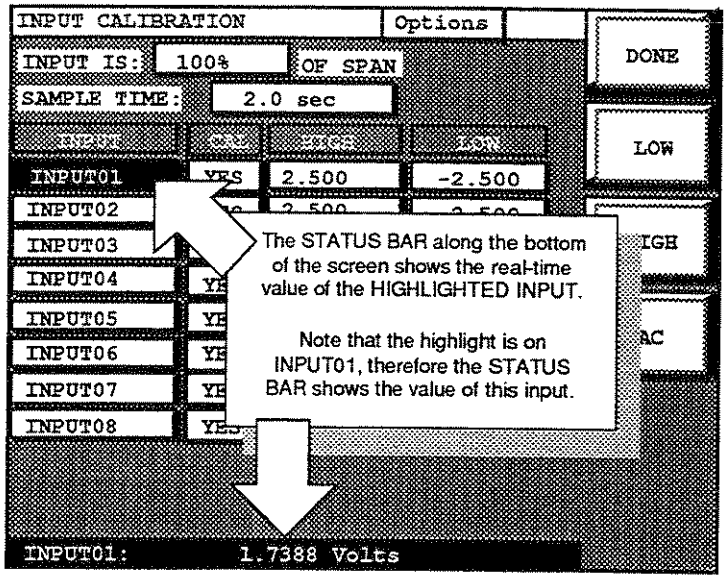


PAGE DOWN and PAGE UP SoftKeys

If you have more INPUTS than will fit on the screen at one time, PAGE DOWN and PAGE UP softKeys will appear automatically, as required, to allow you to see every input.

Note: These softKeys appear or disappear as required. For example, when the pages is scrolled UP all the way (so that INPUT01 is shown), the PAGE UP softKey will disappear. They only appear when required to allow you to navigate.

6.4 The STATUS BAR

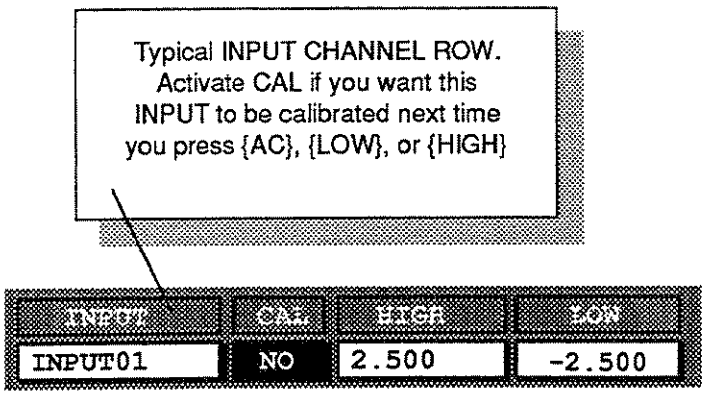


Real-time Input Reference on the STATUS BAR

It may be useful to see the actual input level of each INPUT. To do so, simply move the highlight to any of the fields in the row of the desired INPUT. Now look at the STATUS BAR: it contains a real-time "volt meter."

If an INPUT's USER UNITS are turned on, then this value will be scaled and displayed in your own engineering units, here and everywhere else.

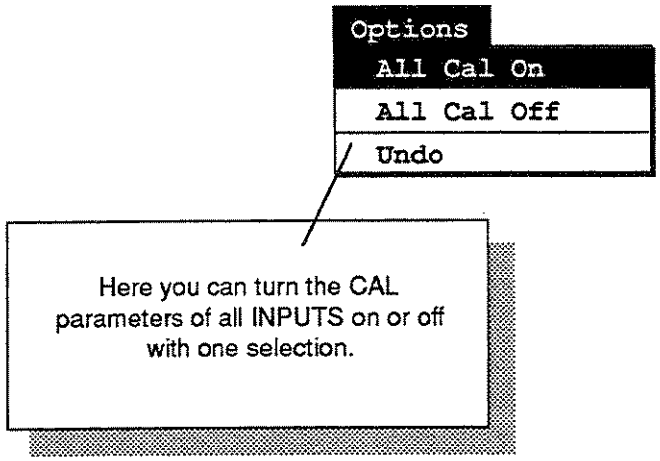
6.5 The CAL Parameter



Each INPUT has a CAL Parameter

You may selectively activate or deactivate the CAL parameter of each INPUT. When this parameter is ON (activated), then this INPUT will be calibrated the next time that you press {AC}, {LOW}, or {HIGH}.

You may wish to turn all of the INPUTS on or off at once, to save time and aggravation. We have provided a simple way to do this under the \OPTIONS/ menu:



The \OPTIONS/ menu simplifies turning the CAL parameter on/off

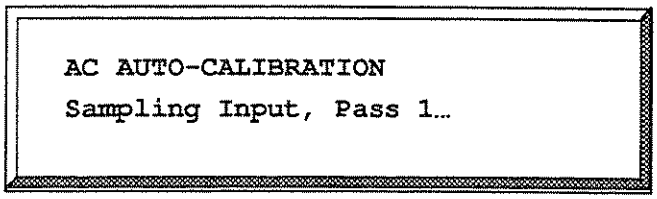
6.6 Running AC CAL

First, ensure that only those INPUTS that you wish to calibrate are set to CAL (the CAL parameter set to ON).

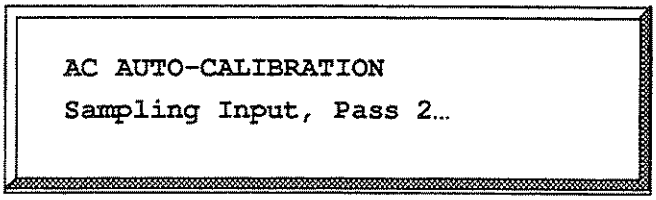
Next, make sure that the [TIME] and [PERCENT] parameters are set according to your wishes.

Next, ensure that the signal(s) that you wish to calibrate to are being input to the Mark 12 into the appropriate input channels.

Finally, press {AC}. When you do so, the Mark 12 will display several message boxes telling you what it is doing:



The first PASS...



The second PASS...

Remember that the amount of time that the Mark 12 monitors your signals is a parameter that you have control over. If the amount of time is too short or too long, you can modify it on this screen.

Each pass occurs for the length of time that you selected. So, the total time required to perform the AC CAL is actually twice as long as the selected number of seconds. This is because two passes are required to ensure accurate calibration.

6.7 Running DC CAL

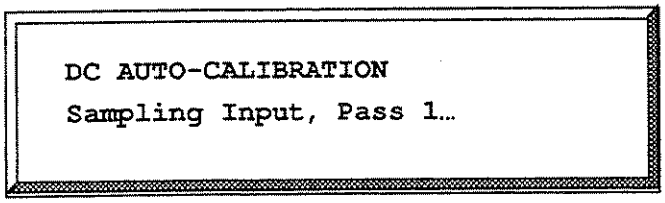
First, ensure that only those INPUTS that you wish to calibrate are set to CAL (the CAL parameter set to ON).

Next, make sure that the [PERCENT] parameter is set according to your wishes.

Next, ensure that the signal(s) that you wish to calibrate to are being input to the Mark 12 into the appropriate input channels.

INPUT THE LOW SIGNAL(s)

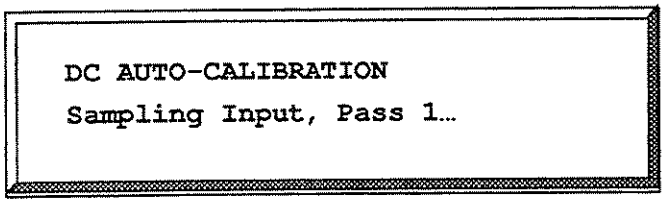
When the low signal(s) is being input to the appropriate INPUT(s), press {LOW}. When you do so, the Mark 12 will display this message box, but only for an instant. You may not even have time to read it:



Setting the LOW SIDE

INPUT THE HIGH SIGNAL(s)

When the high signal(s) is being input to the appropriate INPUT(s), press {HIGH}. When you do so, the Mark 12 will display this message box, but only for an instant. You may not even have time to read it:



Setting the HIGH SIDE

Remember that the percentage of full-scale (the grid width) that each INPUT will be scaled to depends on the PERCENT parameter that you set earlier. Also remember that during DC CAL, the low side will always be aligned with the right grid edge.

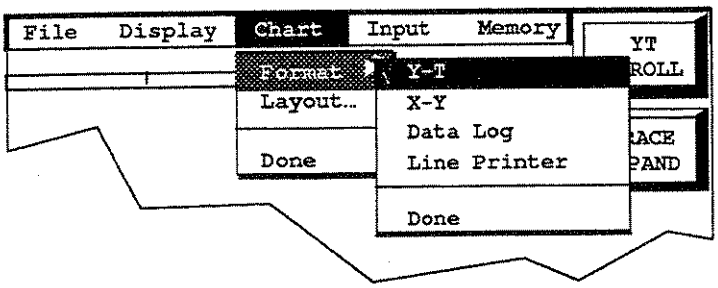
Section 7 Chart Recording/Printing Formats

The DMS1000 has four chart recording/printing formats:

Sect 7.1	Y-T	The conventional presentation of signal amplitude versus time
Sect 7.2	X-Y	The presentation of the amplitude axis of one inputs against the amplitude axis of another input
Sect 7.3	Data Log	The presentation of the numeric equivalent of one or more inputs at regular intervals
Sect 7.4	Line Print	Ability to mimic a conventional line printer, adjustable from 1 to 132 columns wide, and infinite length

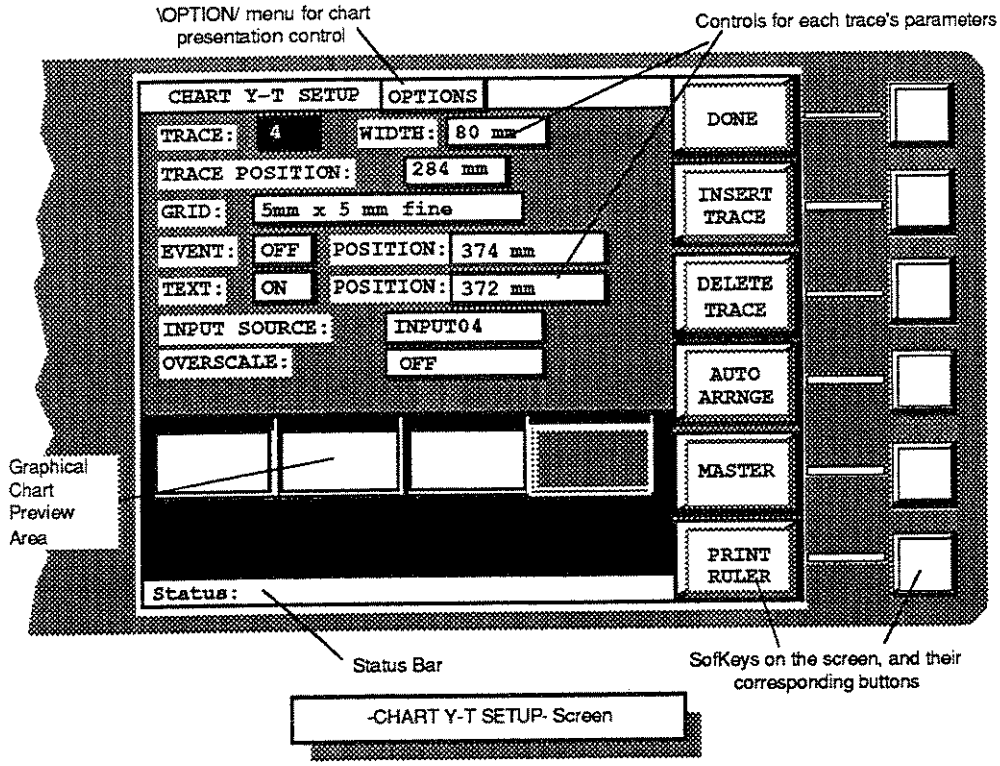
7.1 Y-T Mode

From the -MAIN- screen, set the Format to \Y-T/ under the \CHART/ menu.



Selecting Y-T on the -MAIN- screen

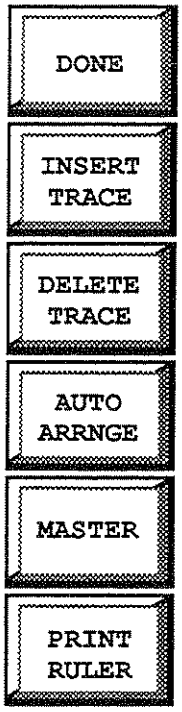
Now, move the highlight to the \Layout/ menu item and press <ENTER>:



The -Y-T CHART LAYOUT- Screen

Unlike a regular "recorder," INPUTS and TRACES are two distinct things within the Mark 12. For example, an old-fashioned pen recorder has eight inputs. Each input corresponds directly and irrevocably to one of the traces on the chart. However, this connection is completely optional within the Mark 12. You can direct any or all of the actual INPUTS in the back of the Mark 12, to any or all of the TRACES on the chart. There are no restrictions or limitations. You can assign the same INPUT to more than one trace, for example. Remember that the connection between INPUTS and TRACES is programmable!

7.1.1 SoftKeys



{DONE} exits this screen and returns you to the previous screen.

{INSERT TRACE} adds a trace to the layout, copying the parameters from the currently selected trace.

{DELETE TRACE} deletes the currently selected trace from the chart layout.

{AUTO ARRANGE} divides the chart into equally sized traces.

{MASTER} (toggle function). When activated, changes made to any trace are applied to all other traces.*

{PRINT RULER} causes a mm scale to be printed across the paper, facilitating creation of custom chart layouts.

SOFTKEYS

* Some parameters are not aplicable to the MASTER function. Master applicability is indicated on the status bar whenever a control is selected (if MASTER is ON).

SoftKeys on the Chart Layout Screen

SoftKeys located along the right edge of the screen make it fast and easy to perform several important functions, including:

INSERTING new traces

DELETING the selected trace

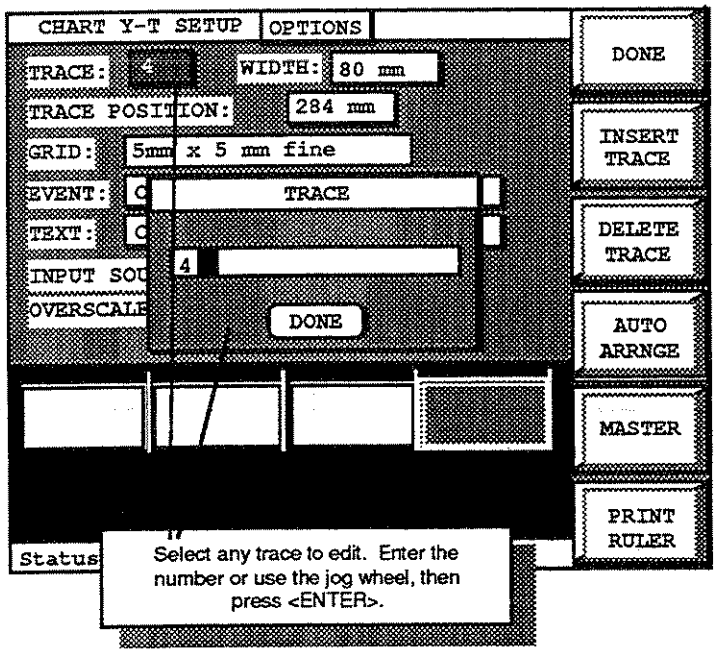
AUTO-ARRANGING all of the traces

Printing the RULER on the chart

Turning on/off the MASTER function

Let's look at this screen in detail, starting with selecting traces, editing them and their text and event markers, and overall control of the chart.

7.1.2 Selecting a TRACE



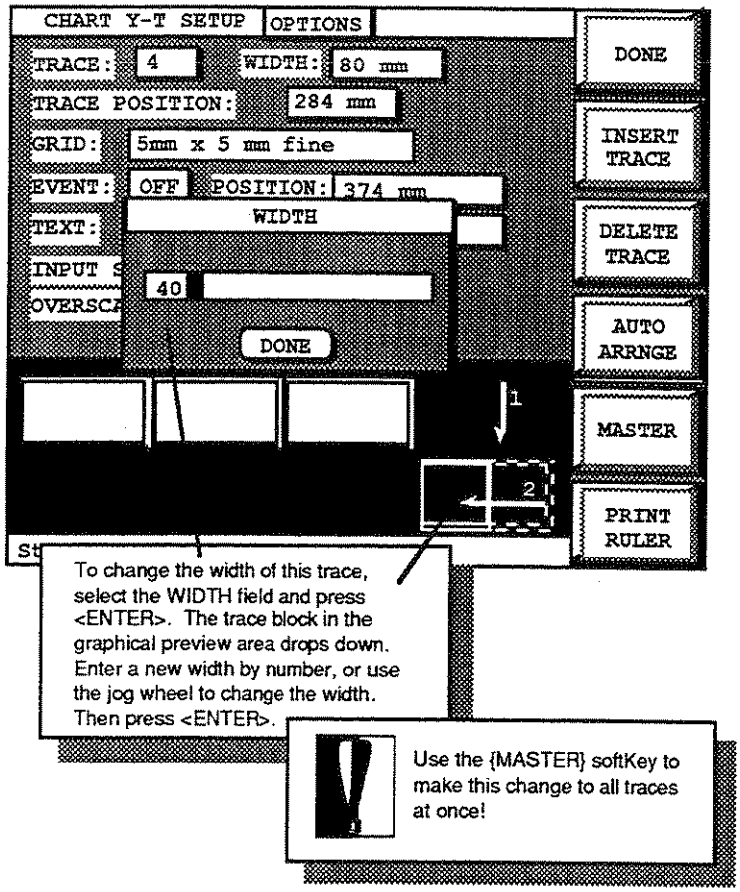
Selecting a TRACE to edit

Move the highlight to the [TRACE] field and press <ENTER>. The *TRACE* dialog box will pop up. Use the jog-wheel to increment or decrement the trace number selected, or enter a number using the numeric hardKeys.

As you change the number in this field, the appropriate trace will turn dark gray on the screen, providing a visual clue as to which is which.

When the desired trace is selected, press <ENTER>.

7.1.3 Changing the TRACE WIDTH



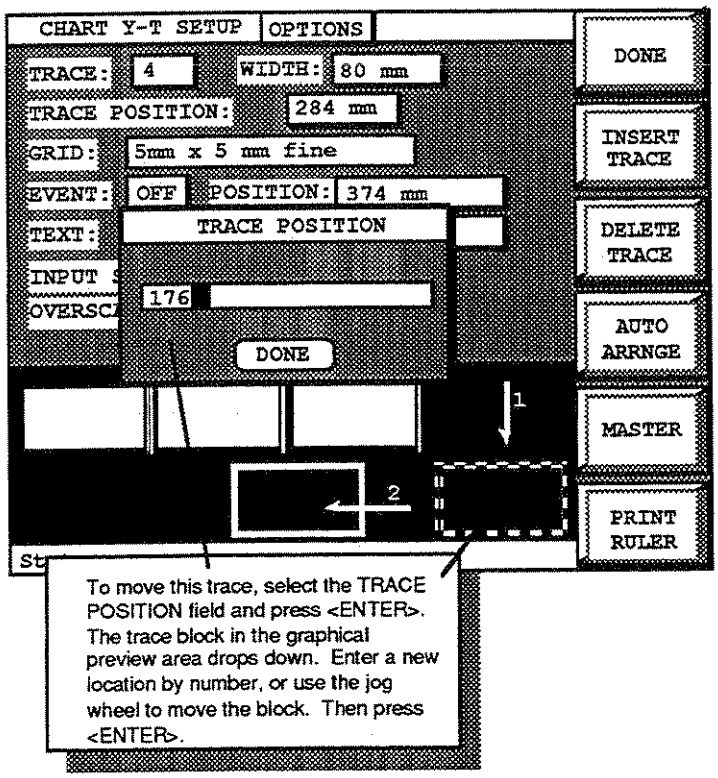
Changing the TRACE WIDTH

Move the highlight to the [WIDTH] field and press <ENTER>. The *WIDTH* dialog box will pop up. Use the jog-wheel to increment or decrement the width, or enter a number using the numeric hardKeys.

Notice that as you begin to edit the trace, that the graphical representation of it on the screen drops down into the editing area, and changes width in response to your input. This makes designing the chart nearly as easy as drawing it!

Note: *The left edge of the grid remains "anchored." Therefore, you can only increase the width until the right edge gets to the edge of the chart. To increase the width further, you must first move the TRACE POSITION farther to the left. See next paragraph.*

7.1.4 Changing the TRACE POSITION

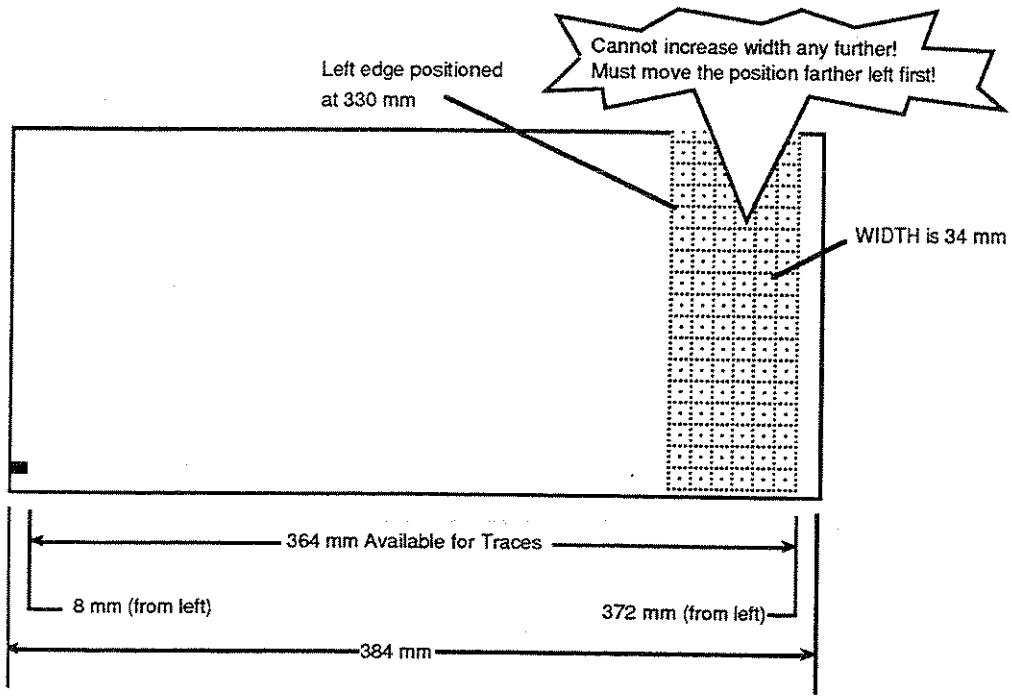


Changing the TRACE POSITION

Move the highlight to the [POSITION] field and press <ENTER>. The *TRACE POSITION* dialog box will pop up. Use the jog-wheel to increment or decrement the position, or enter a number using the numeric hardKeys.

Notice that as you begin to edit the trace, that the graphical representation of it on the screen drops down into the editing area, and changes position in response to your input. This makes designing the chart nearly as easy as drawing it!

Note: *The width remains constant. Therefore, you can only move the trace to the right until the right edge gets to the edge of the chart. To continue moving the position further to the right, you must first decrease the TRACE WIDTH. See previous paragraph.*



In the example above, a 34 mm wide trace has been positioned at 332 mm.

330 + 34 = 364

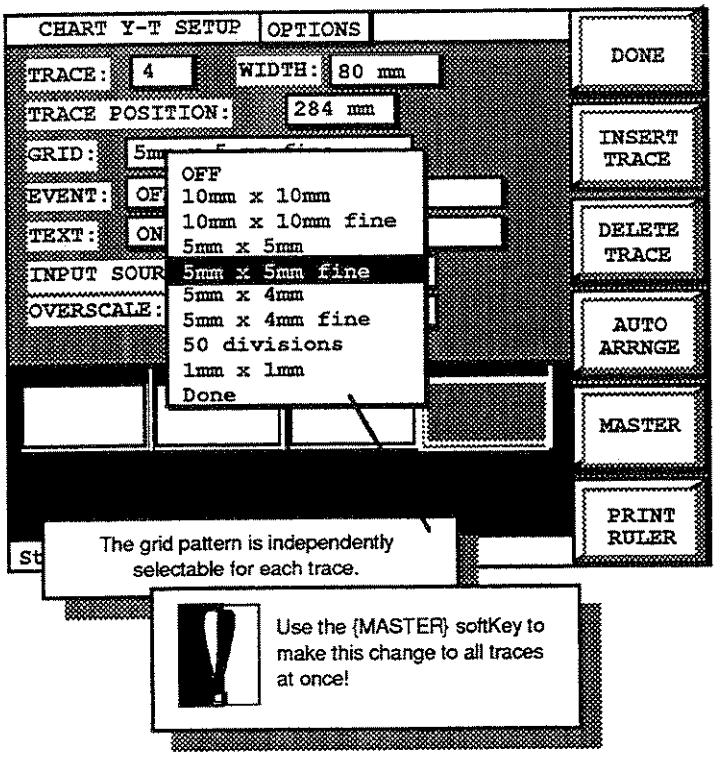
Since 364 mm is the total width of the trace area of the chart, this trace's width cannot be increased without first moving it farther to the left. If the position is changed to 30 mm, how wide can we make it?

364 mm - 30 mm = 334 mm

Following the formula above, we see that a trace positioned at 30 mm can be made up to 334 mm wide.

Illustration of the relationship between trace WIDTH and POSITION

7.1.5 Selecting the GRID PATTERN



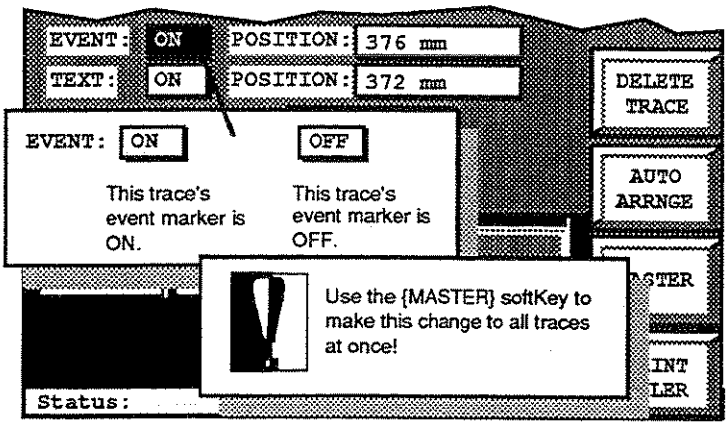
Selecting the GRID PATTERN

Move the highlight to the [GRID] field and press <ENTER>. The \GRID/ pull-down menu will appear. Use the jog-wheel to move the highlight up or down the menu, selecting any of the available grid patterns.

There are no restrictions: each trace can have a different grid pattern if you choose.

The 50 division grid pattern divides the grid, regardless of its width, into 50 divisions. Therefore, although there is nothing to stop you from doing so, it is probably not useful to use this pattern on traces that are less than 20 mm wide as the line spacing is too tight.

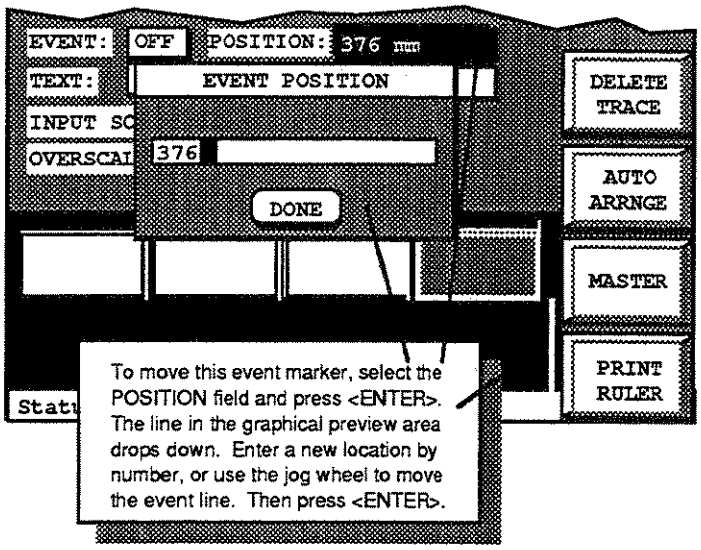
7.1.6 Event Marker Control



Turning Event Marker on/off

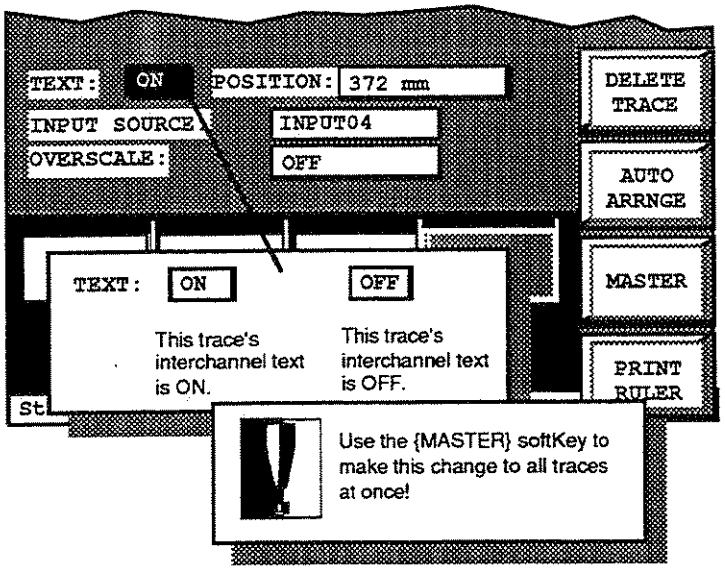
Move the highlight to the [EVENT] field and press <ENTER>. Each time you press <ENTER> this event marker toggles on or off. When an event marker is off, then it does not appear on the chart at all.

You can position the event marker manually. To do so, move the highlight to the [EVENT POSITION] field and press <ENTER>.



Positioning the Event Marker

7.1.7 Text Line Control

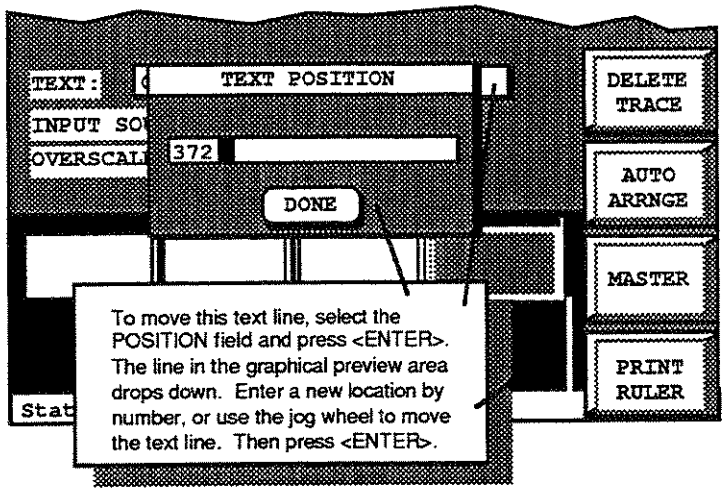


Turning Text Line on/off

Move the highlight to the [TEXT] field and press <ENTER>. Each time you press <ENTER> this text line toggles on or off. When a text line is off, then it does not appear on the chart at all.

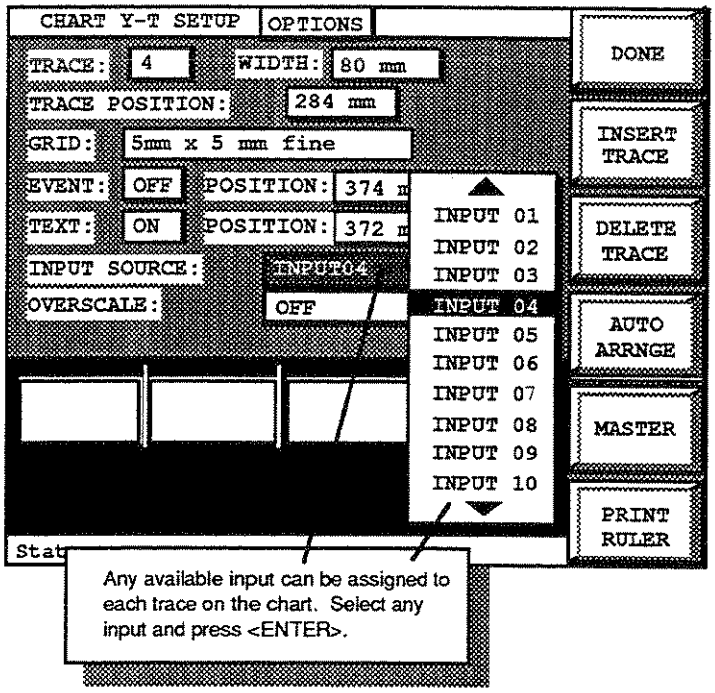
Note: *Remember that the actual interchannel text is associated with the INPUT! So, to edit the text, go to the -INPUT SETUP- screen and select the correct INPUT (the same one that this trace is assigned to)*

You can position the text line manually. To do so, move the highlight to the [TEXT POSITION] field and press <ENTER>.



Positioning the Text Line

7.1.8 Selecting in INPUT SOURCE

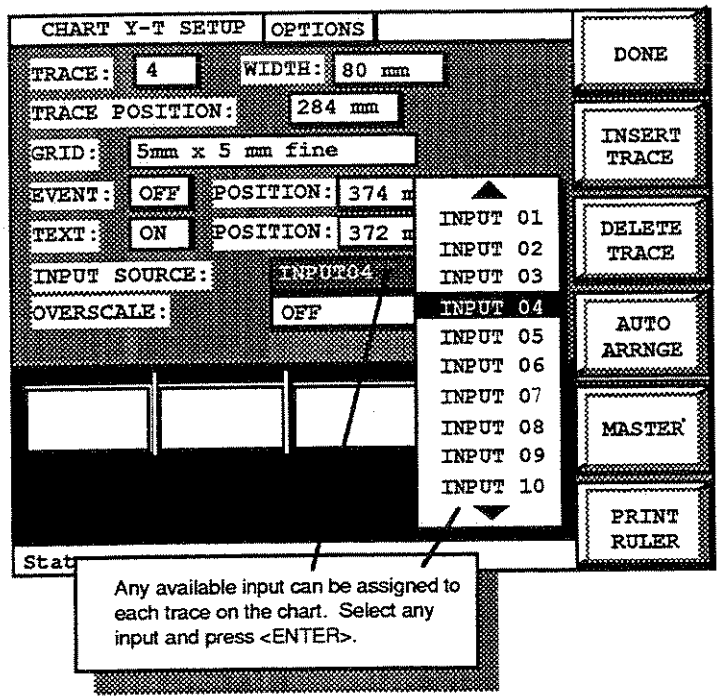


Assigning an INPUT to this TRACE

Move the highlight to the [INPUT SOURCE] field and press <ENTER>. The \INPUT SOURCE/ pull-down menu appears. Use the jog-wheel to move the highlight up or down until the desired INPUT is selected.

Note: INPUTS can be assigned to as many or few TRACES as you desire. There are no restrictions!

7.1.9 Setting the Overscale



Selecting the amount of Overscale for this TRACE

Move the highlight to the [OVERSCALE] field and press <ENTER>. The \OVERSCALE/ pull-down menu will appear. Use the jog-wheel to the move the highlight to the desired amount of overscale, then press <ENTER> again to select it.

Here is what each of the selections means:

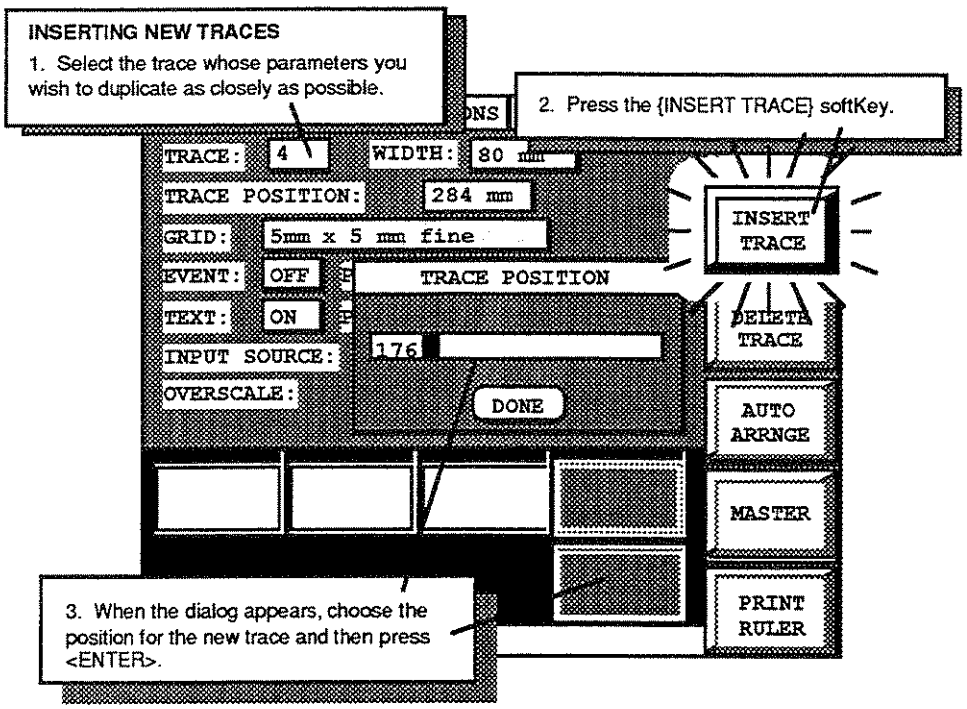
Off	No overscale. Waveforms CLIP at grid edges
Overscale	Waveforms will be allowed to exceed grid edges by ±2 mm
Full-Scale	Waveforms will be allowed to exceed grid edges up to the full amplitude capability of the A/D converter. Typical amount: ±50%.

7.1.10 Inserting a Trace

First, you should be aware that when you insert a new trace, the Mark 12 will copy the parameters of the currently selected trace. Thus, in effect, it "copies" the current trace.

So, if it matters to you what the characteristics of the new trace are, then use the [TRACE] field to select the trace that you want to "copy" before pressing the {INSERT TRACE} softKey.

Ready? Go ahead and press the {INSERT TRACE} softKey, and this dialog will appear:



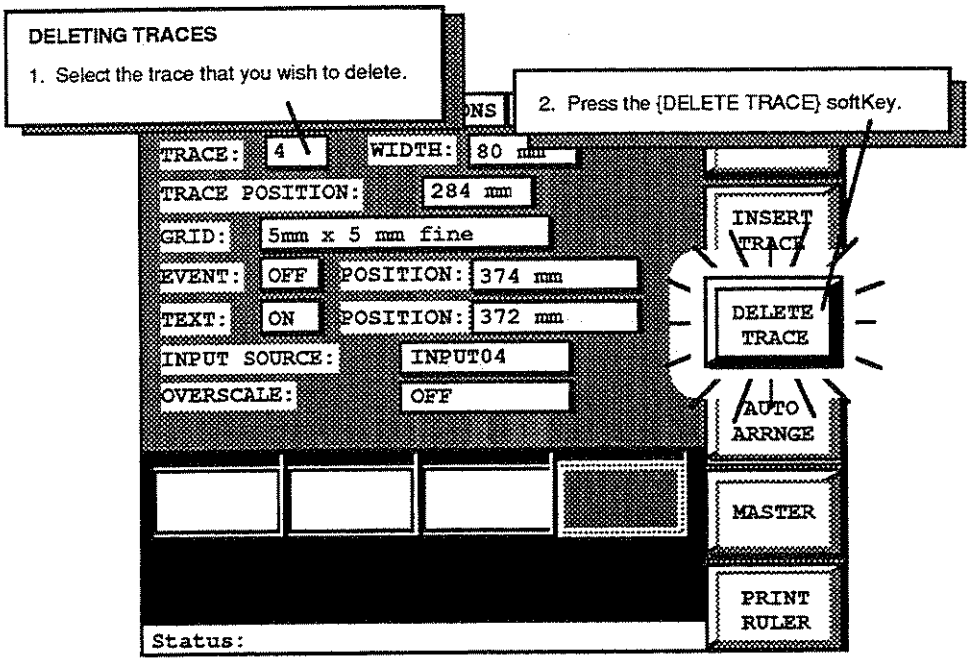
Inserting a trace starts with the {INSERT TRACE} softKey...

Use the jog-wheel (or enter a number via the numeric hardKeys) to position the new trace wherever you want it.

Note: *Remember: TRACES and INPUTS are separate things! This new trace will be assigned the same input that the previously selected trace has. If you want it to be assigned a different input, you must do it manually.*

7.1.11 Deleting a Trace

Select the trace that you wish to delete. Make sure that it is the one that is highlighted down at the bottom of the screen.

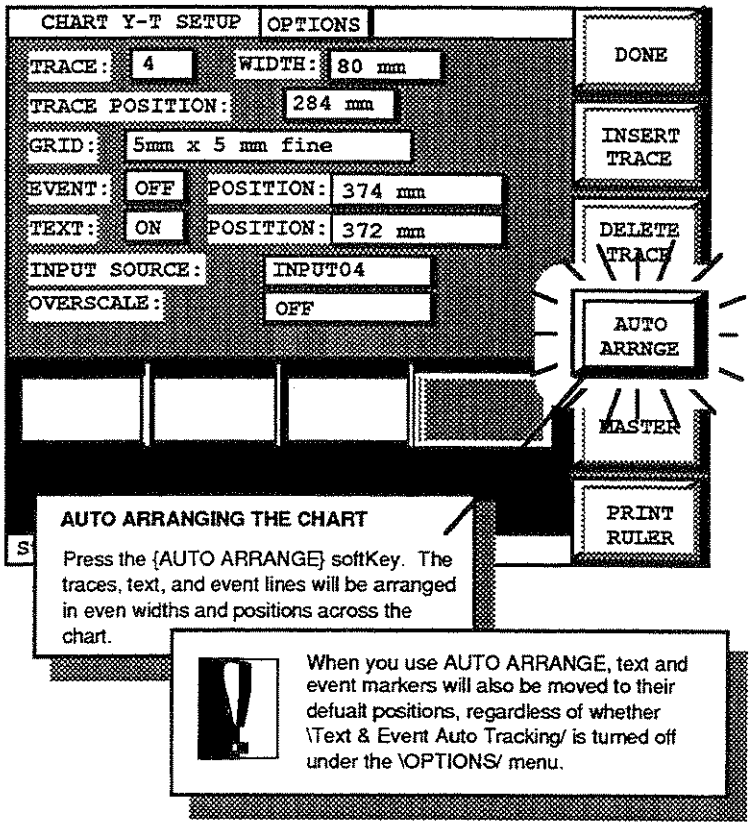


Deleting a Trace

Note: There is no "undo" capability, so be careful when deleting traces. You can always insert them back again, but if you don't remember the settings, it can mean unnecessary work for you.

7.1.12 Auto-Arranging the Chart

After you have inserted more than a few traces, the chart can become quite cluttered and hard to edit. The Mark 12 can save you a lot of time and trouble by arranging the traces on the chart for you. When you invoke this feature, it divides the available chart width among all traces evenly, and tries also to make the trace widths come out to 5 mm increments.



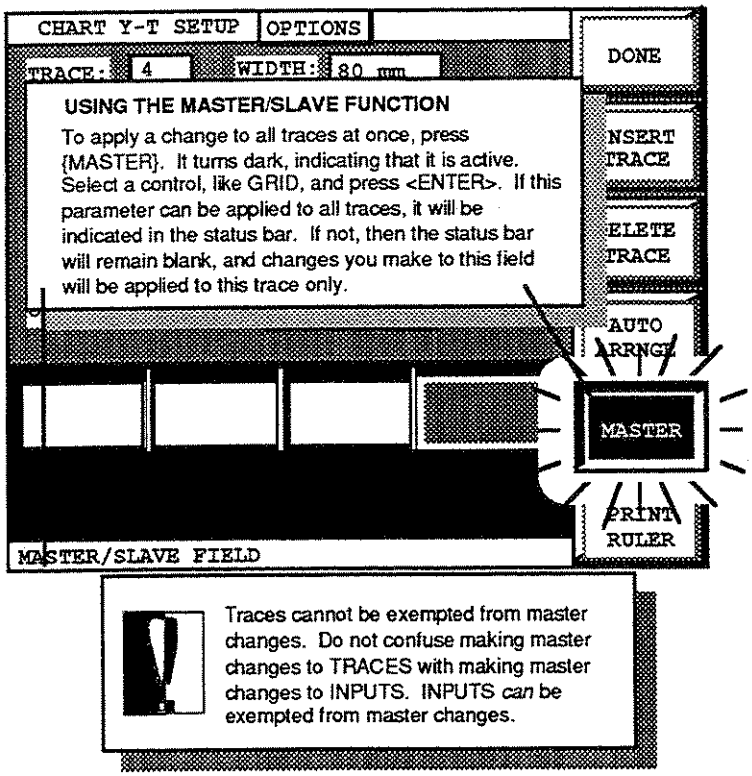
Auto-Arranging the Chart

Note: The Mark 12 will not automatically put the traces in ascending order: it orders them the same way that it encounters them.

7.1.13 Using the MASTER Function

You can easily make a single change or a series of changes to more than one trace at a time. This is done by using the MASTER feature. When you press the {MASTER} softKey, it will turn dark (inverse video), indicating that the master feature is activated.

At this point, changes made to the current trace will be applied to all traces.



The MASTER Function

As the illustration points out, please do not confuse using MASTER on this screen with the INPUT SLAVE ON/OFF parameter on the -INPUT SELECTION- screen. On that screen you may program INPUTS to ignore master changes. But this applies to INPUT changes only—it has nothing to do with TRACES or this screen.

There are certain exceptions to the master function. Here is a table showing each parameter on this screen, and whether or not it can be controlled by the master function:

TRACE	No
TRACE WIDTH	Yes
TRACE POSITION	No
GRID	Yes
EVENT ON/OFF	Yes
EVENT POSITION	No
TEXT ON/OFF	Yes
TEXT POSITION	No
INPUT SOURCE	No
OVERSCALE	Yes

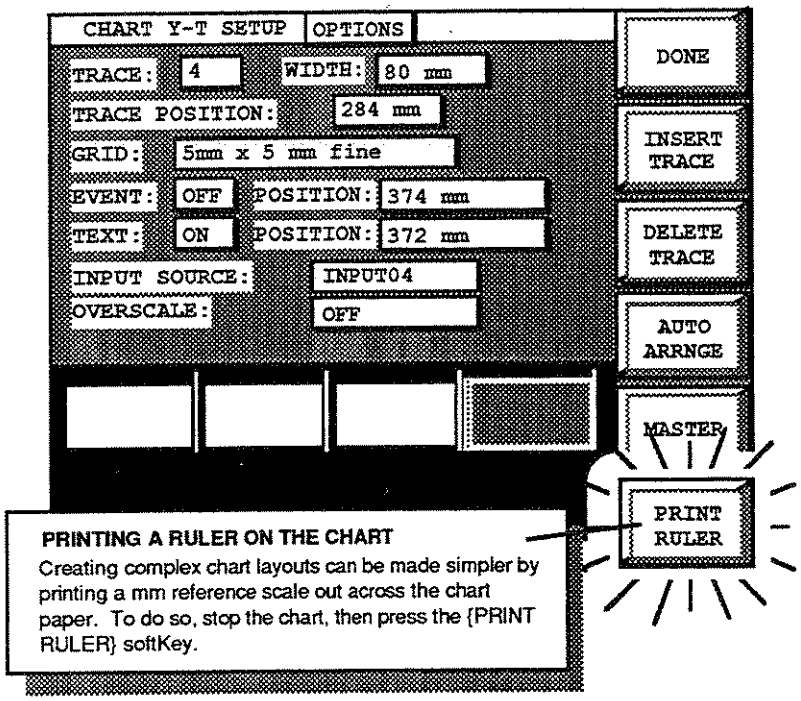
7.1.14 Printing a RULER on the Chart

You can print a ruler across the chart. This is really a millimeter scale, that car serve as a valuable reference when trying to design complex chart layouts.

If the chart is running, stop it.

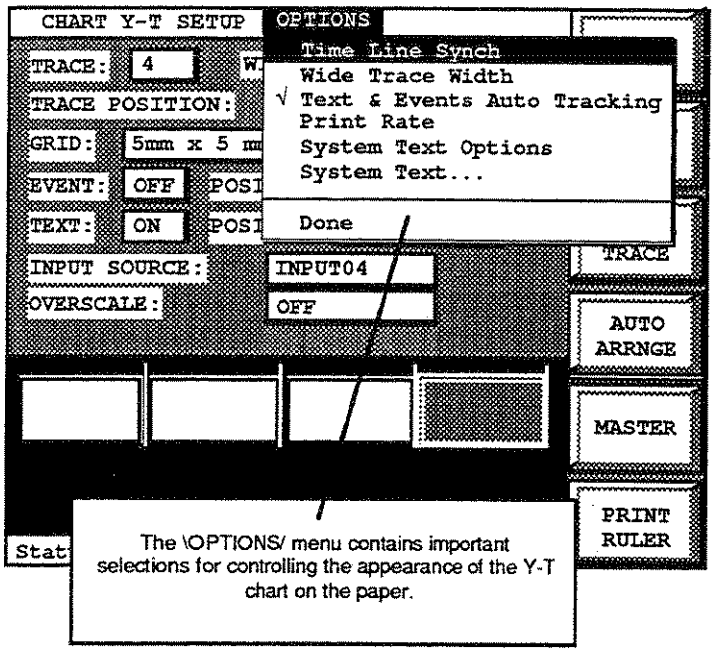
Press the {RULER} softKey.

A millimeter scale is printed across the entire width of the chart. It is marked ir the same mm units that this screen works in.



Printing a RULER on the Chart

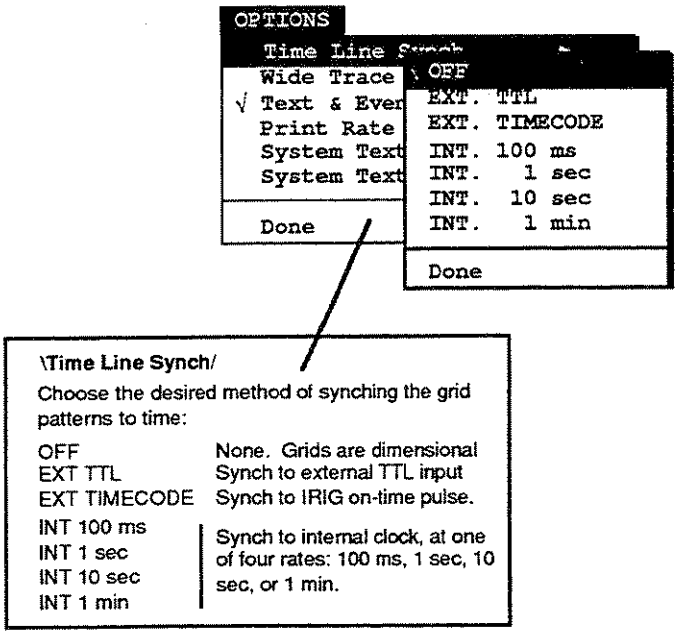
7.1.15 The \OPTIONS/ Menu



Using the \OPTIONS/ Menu

The \OPTIONS/ menu allows you to control many important aspects of the Y-T chart and its behavior. Let us examine each of these menu items, what it does, and how to use it.

7.1.16 Time Line Synch

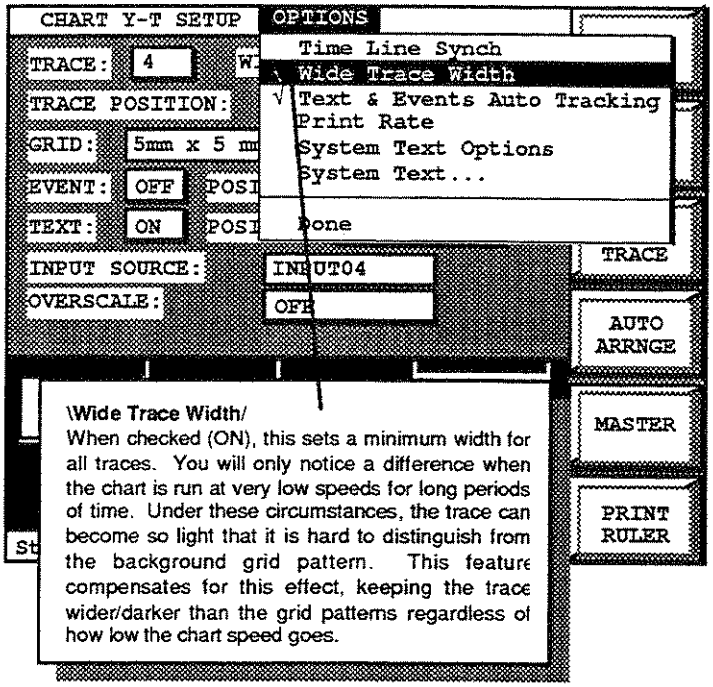


Setting the Time Line Sync

You can elect to have the horizontal grid lines (those that are printed perpendicular to the time axis) at regular time intervals, instead of the normal dimensional method.

Off	Chart grids printed in normal dimensional method
Ext TTL	Chart grids printed whenever a remote signal is received
Ext Timecode	Chart grids printed in synchronization with incoming time code on-line pulse (requires M12-TCT option, a time code source attached, and IRIG selected as the time source on the -SYSTEM- screen)
ms	Chart grids printed every 100 milliseconds
sec	Chart grids printed every 1 second
sec	Chart grids printed every 10 seconds
min	Chart grids printed every 1 minute

7.1.17 Wide Trace Width



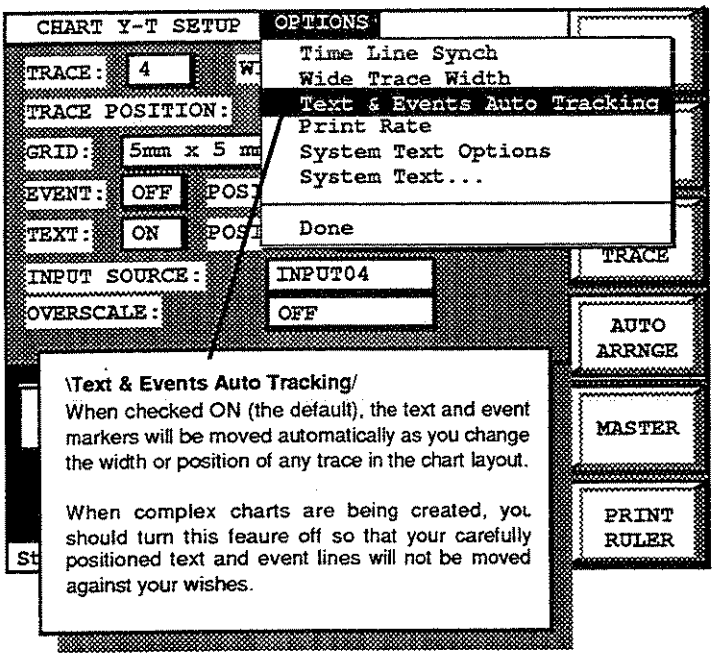
Setting a Minimum Trace Width

If you typically run the Mark 12's chart speed below 25 mm/sec, then the traces can become gray and lose contrast against the background grid patterns.

To correct this condition, you can select turn on the \Wide Trace Width/ function. This sets a minimum 2 mm trace width, regardless of the chart speed.

Note: You will probably not notice any difference at higher chart speeds. This feature only has an effect when the chart is run at low speeds for long periods of time.

7.1.18 Text/Events Auto-Tracking

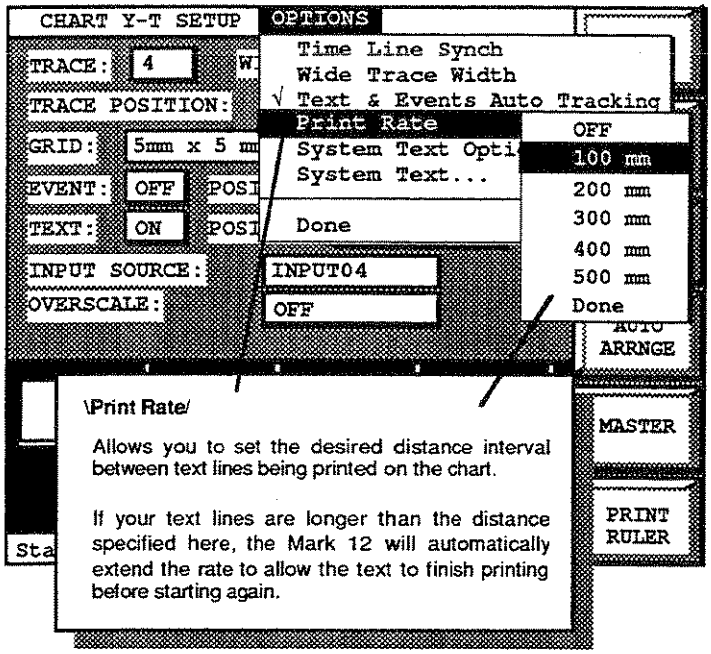


Turning On/Off Text/Events Auto-Tracking

If you typically run the Mark 12's chart speed below 25 mm/sec, then the traces can become gray and lose contrast against the background grid patterns.

To correct this condition, you can select turn on the \Wide Trace Width/ function. This sets a minimum 2 mm trace width, regardless of the chart speed.

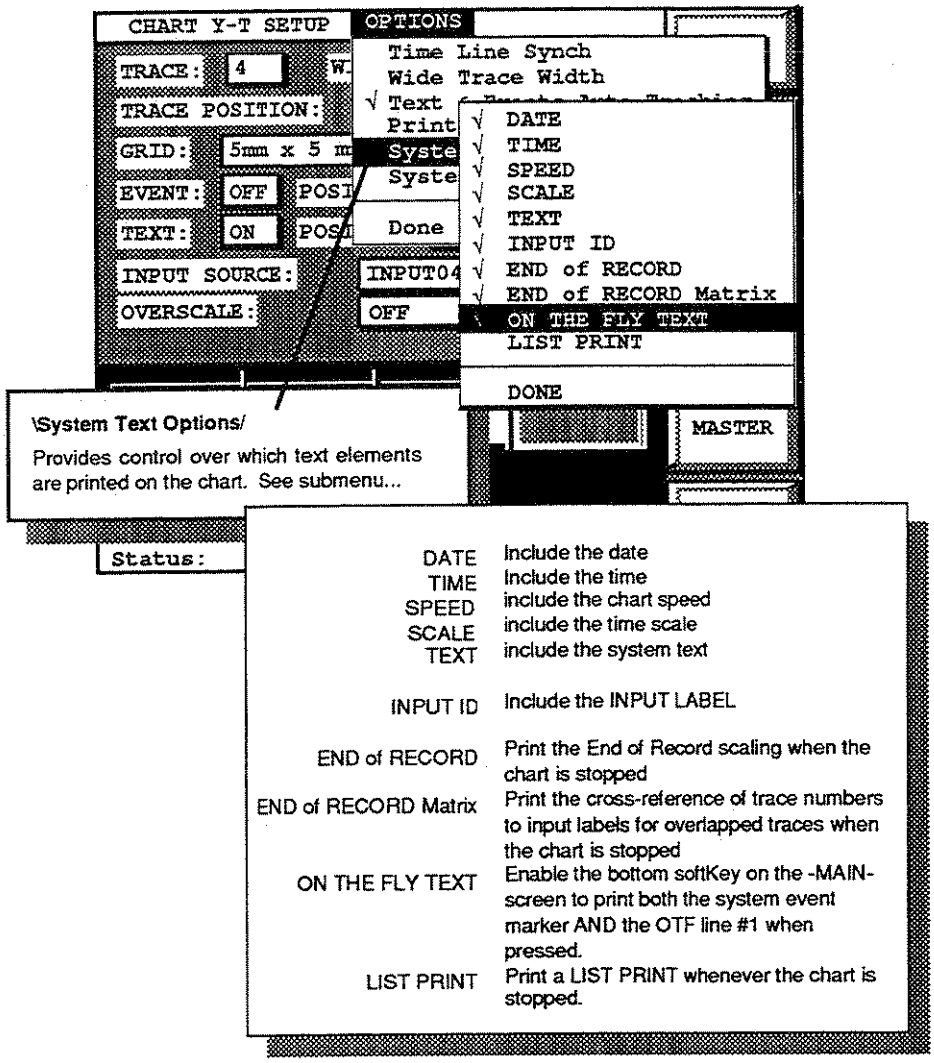
7.1.19 Print Rate



Selecting the Print Rate for Interchannel and System Text

Choose the desired print rate for your interchannel and system text lines.

7.1.20 System Text Options

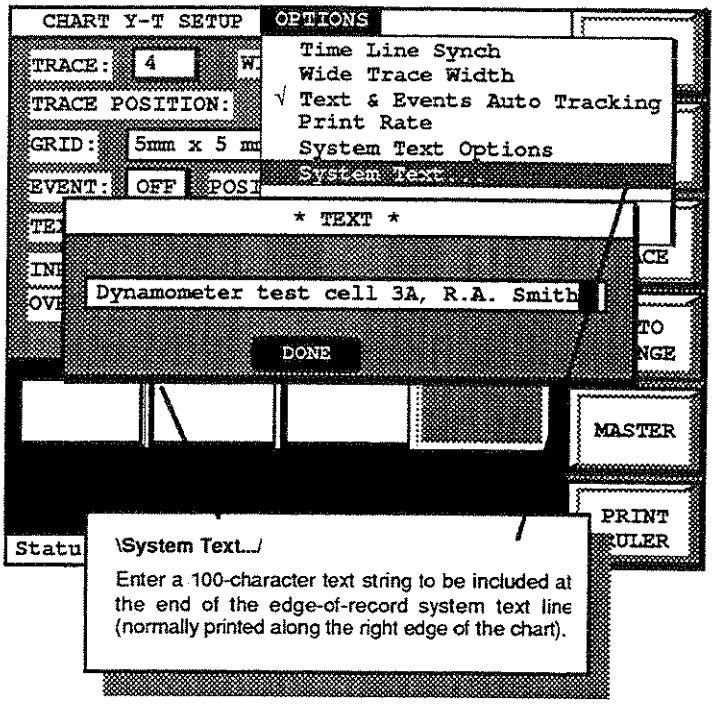


Setting the System Text Options

The default setting is ON (checked) for all of these parameters except for the las one: LIST PRINTING.

These are the system text parameters that will print, as well as the automatic printing that will occur whenever you stop the chart in the Y-T mode.

7.1.21 System Text Line



Editing the 100-character system text line

You can enter up to 100 characters of text to be printed at the end of the standard system text line.

This text is useful for annotating the entire chart, since it does not apply to any single trace.

Enter the text that you want in the *TEXT* dialog box, and then press <ENTER>.

Note: *Entering text is especially fast and easy if you attach an IBM PC-AT keyboard to your Mark 12. Prior to 11/93, this required option M12-TCT. As of 11/93, this capability (but not the IRIG translator) was made standard. If your Mark 12 has a round PC-AT keyboard connector on the rear panel, then you can take advantage of this convenience.*

7.2 X-Y Mode

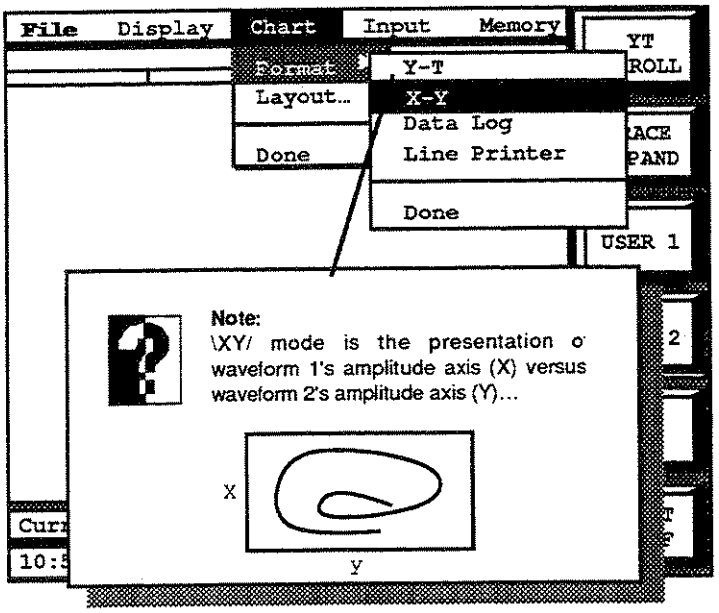
The Mark 12 has X-Y chart capabilities, as well as X-Y display capabilities.

It is important to note that these capabilities are analogous to the Y-T mode. In other words, there is Y-T recording to the chart, and Y-T display on the screen. These modes work independently of each other. It is the same with the X-Y mode of operation: there is an X-Y DISPLAY mode, and an X-Y CHART mode.

Note: Do not confuse the X-Y DISPLAY mode with the X-Y CHART mode!

If you want to display X-Y data on the front panel, use the X-Y DISPLAY mode.

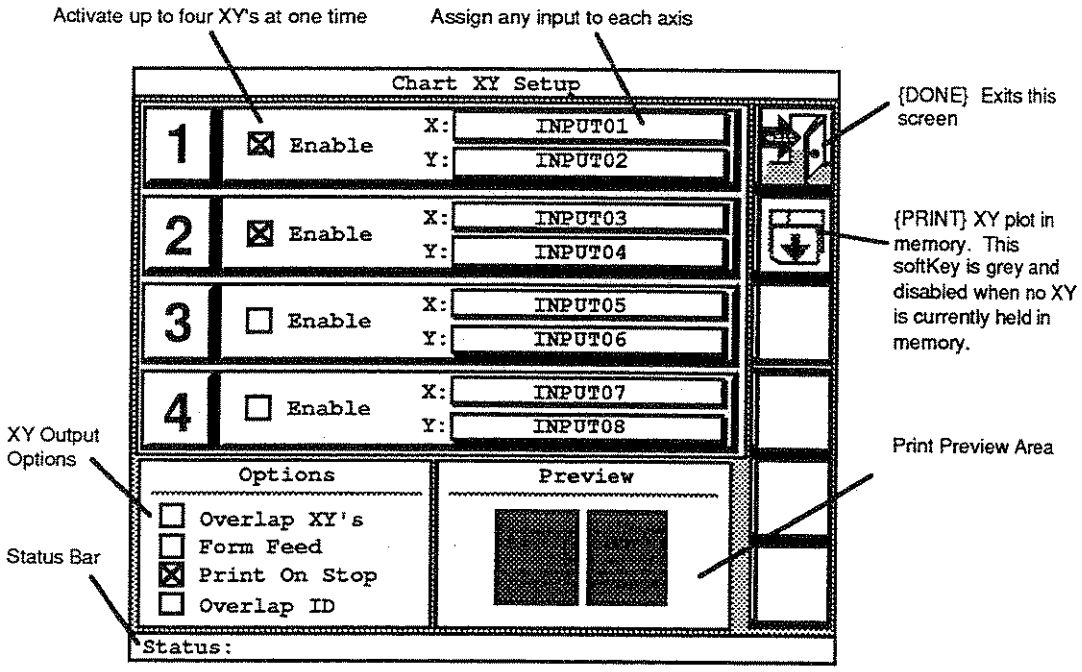
From the -MAIN- screen, set the Format to \X-Y/ under the \CHART/ menu.



Selecting X-Y on the -MAIN- screen's \CHART/ menu

Now, move the highlight to the \Layout/ menu item and press <ENTER>.

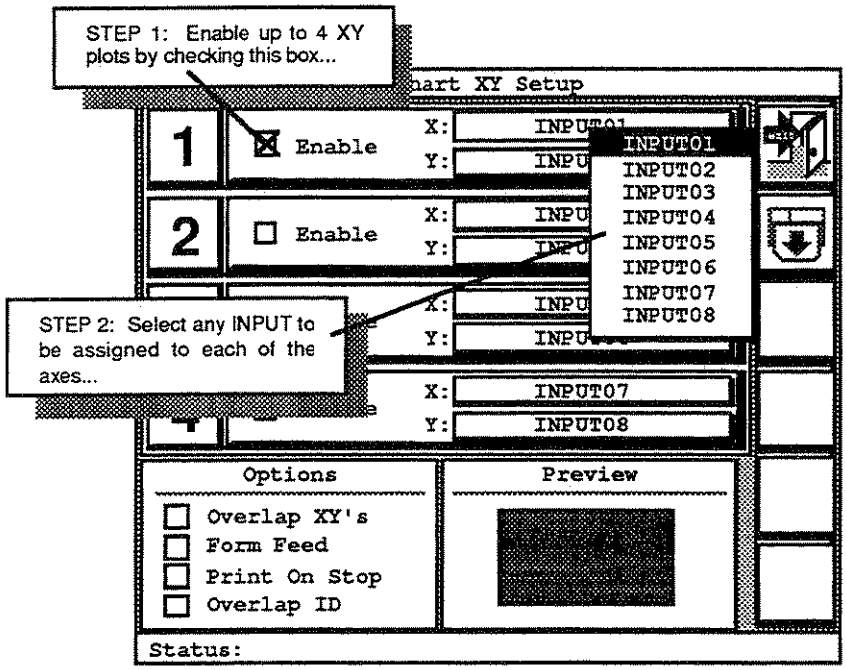
7.2.1 X-Y Setup Screen



The X-Y Setup Screen

7.2.2 Choosing the Number of Plots

7.2.3 Selecting the INPUTS for Each Plot

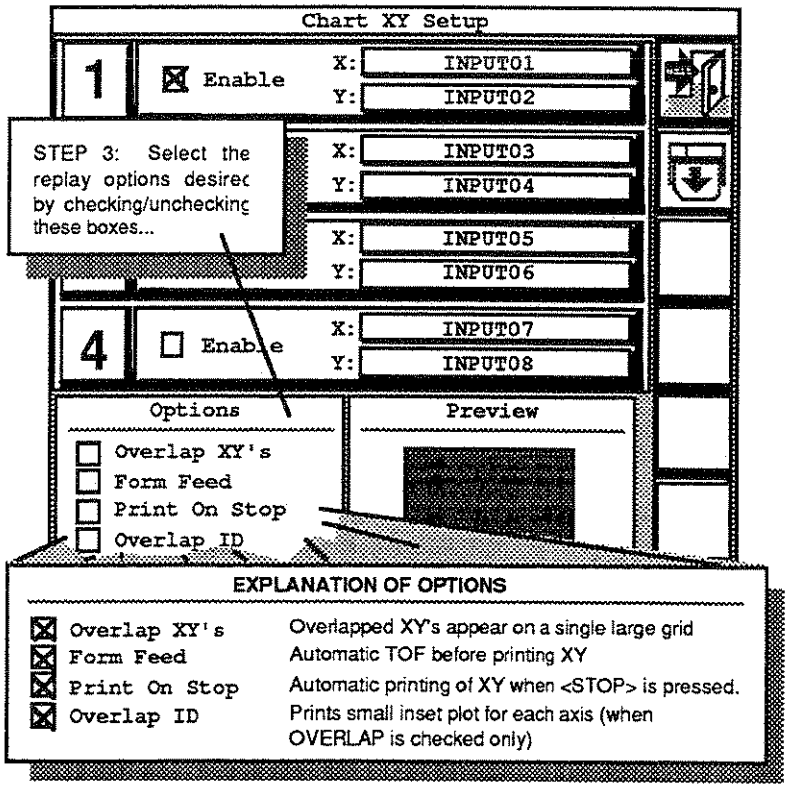


Choose the Number of Plots, and the INPUTS for Each...

Each X-Y plot can be comprised of up to four separate X-Y plots. The X and Y channels for each plot can be selected independently.

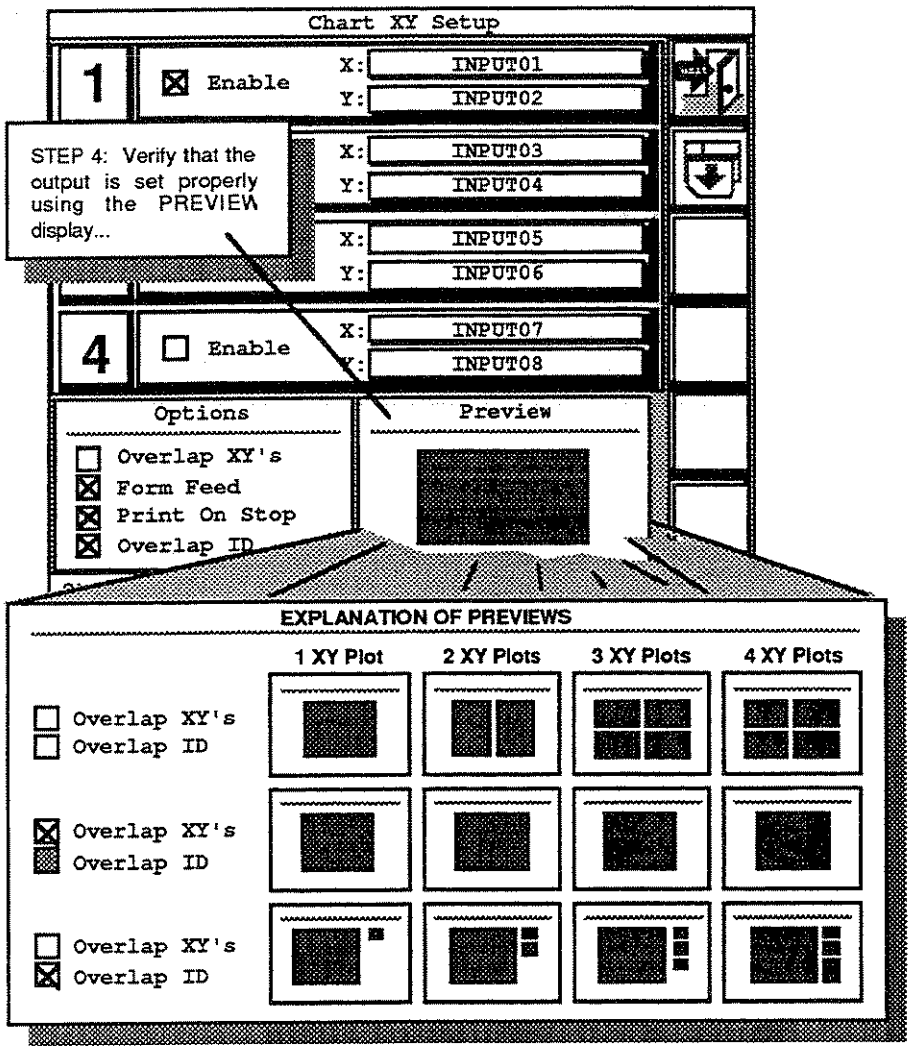
Note: You may assign the same input to more than one axis! This is useful when comparing several signals against a common reference.

7.2.4 Setting the X-Y Plot Options



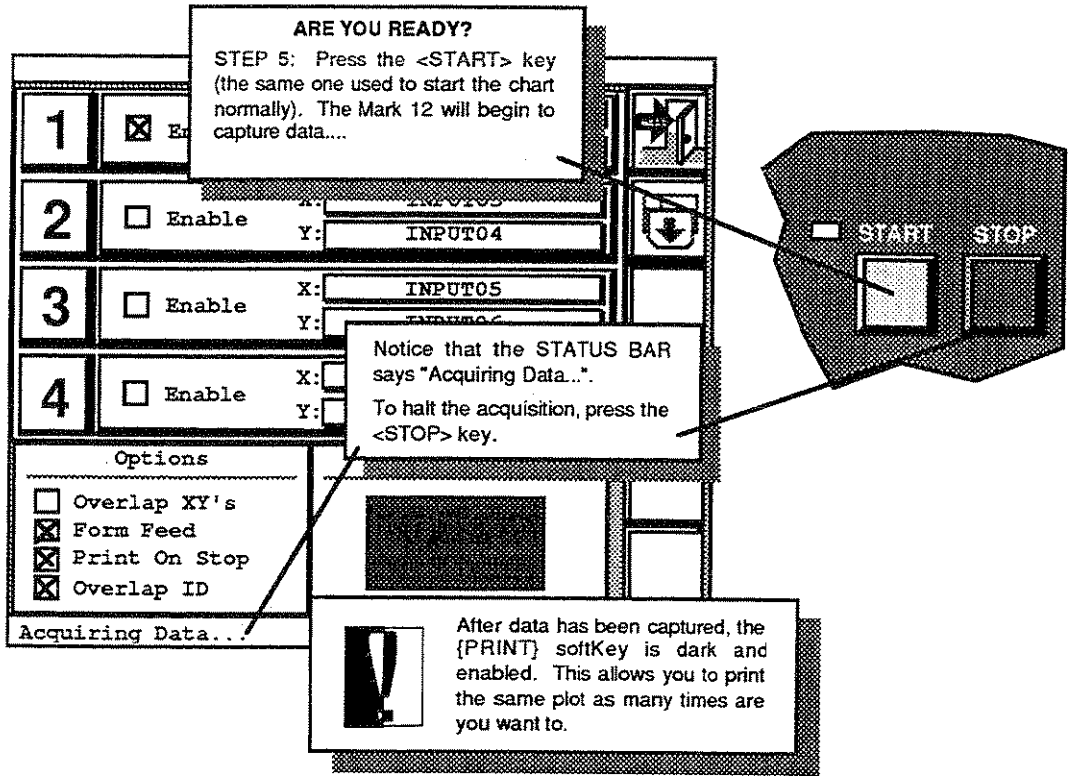
Check on or off whichever options you choose...

7.2.5 Using the Preview Section

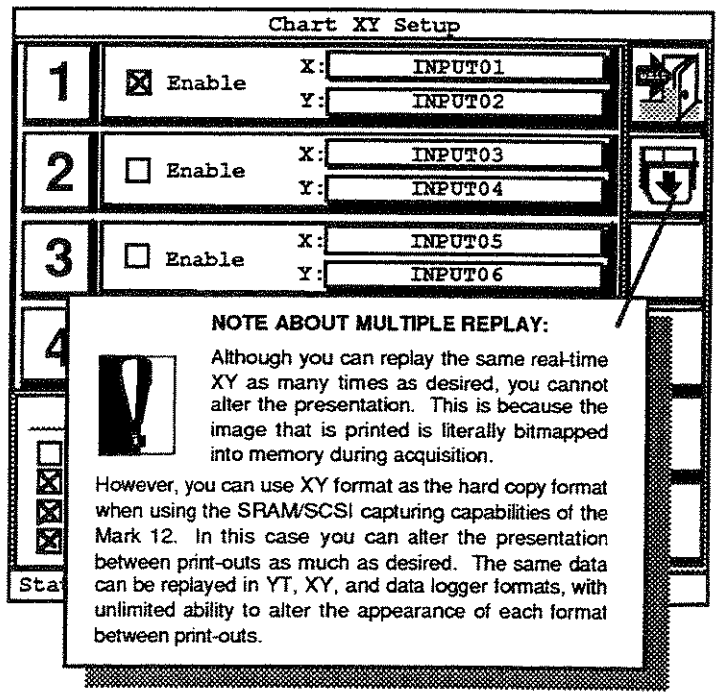


Using the Preview Section Saves Time...

7.2.6 Recording Data



Press the <START> key to Capture Data...



Replaying the Same Data

7.2.7 Sample Outputs

Sample 1: Four Overlapped XY's
(A4 size: 250 mm x 180 mm)

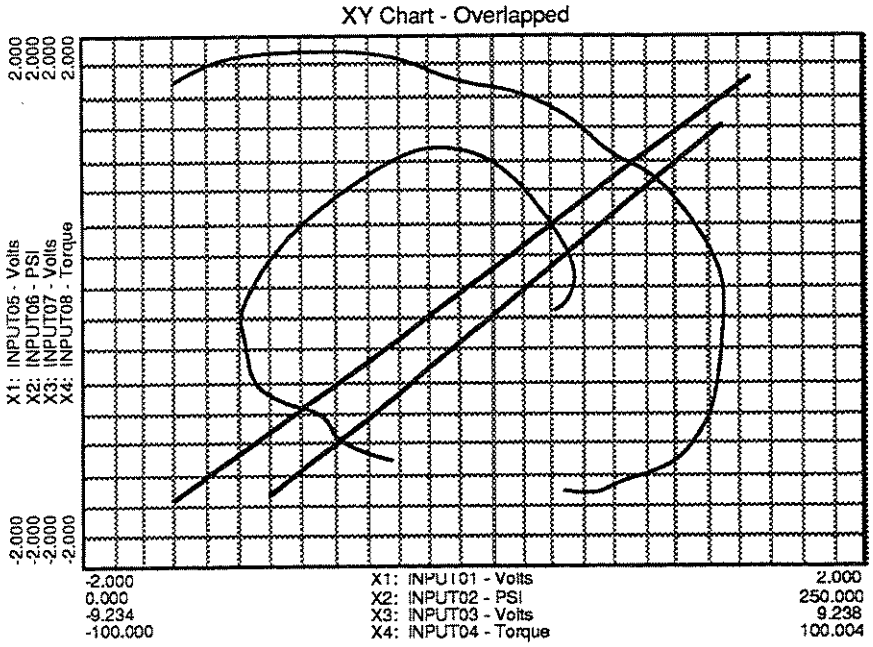


Chart Output Sample

Sample 2: Four Overlapped XY's, with Overlap ID
(Main chart size: 200 mm x 180 mm
inset chart size: 40 x 40 mm)

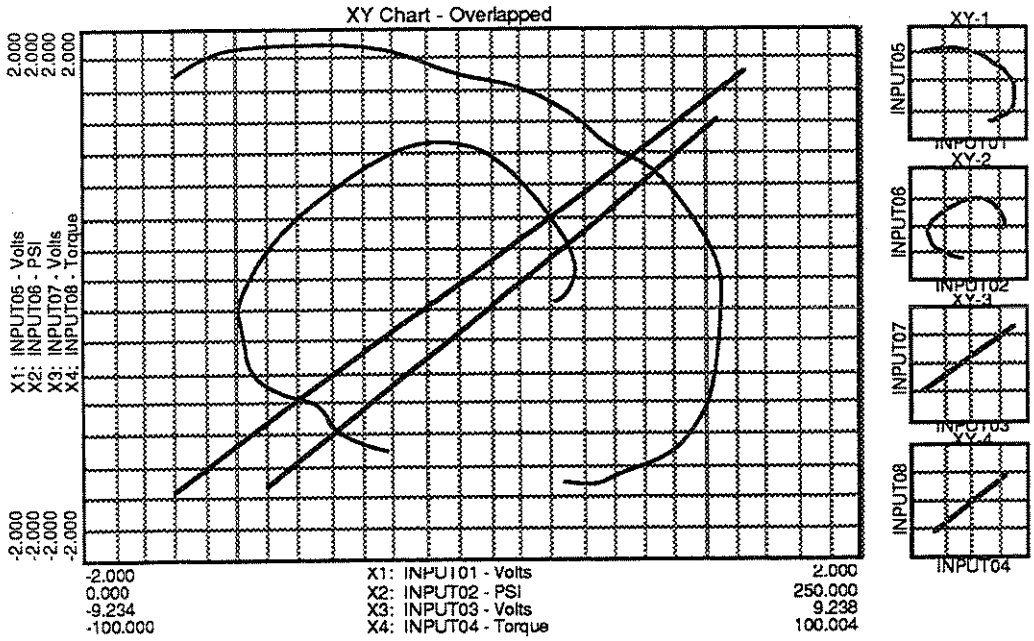


Chart Output Sample

Sample 3: Four Separate XY's
(size: 120 mm x 80 mm)

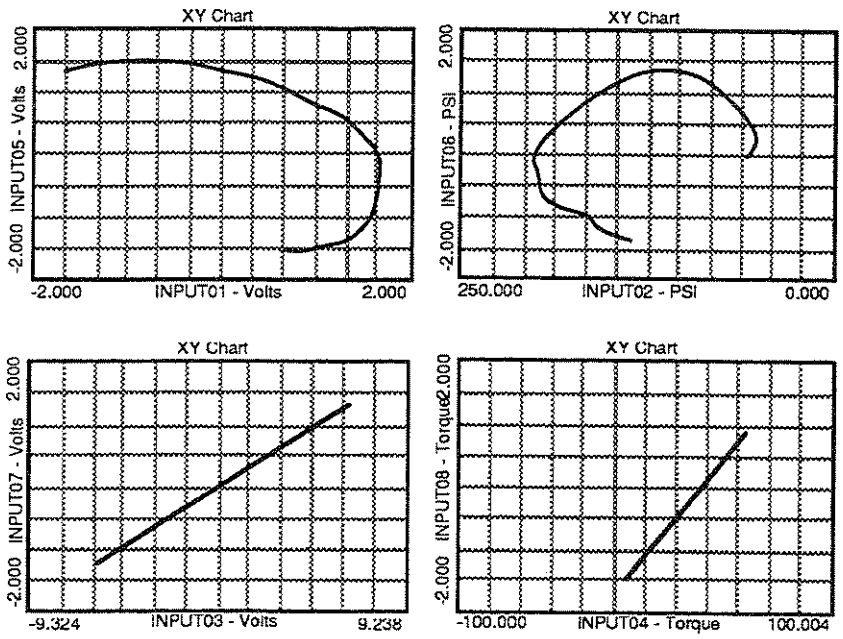


Chart Output Sample

Sample 4: Two Separate XY's
(size: 120 mm x 180 mm)

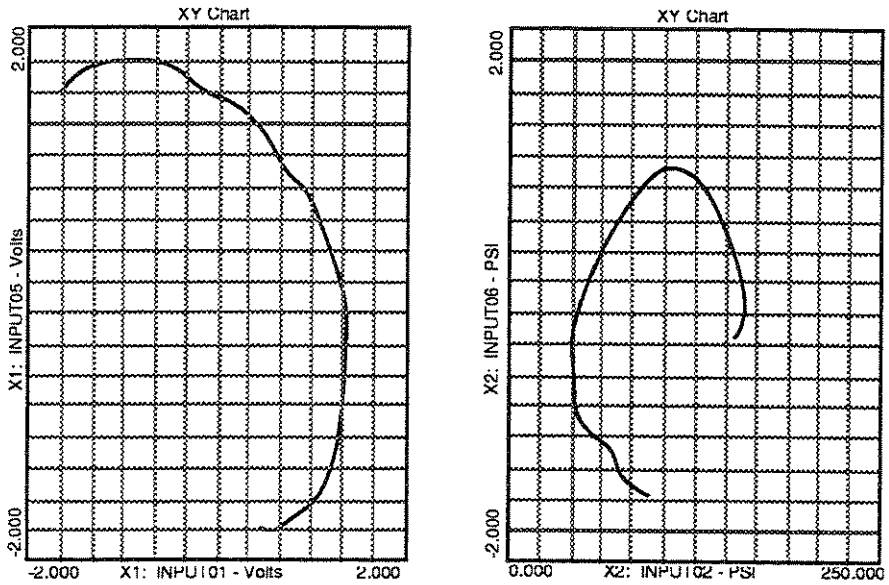


Chart Output Sample

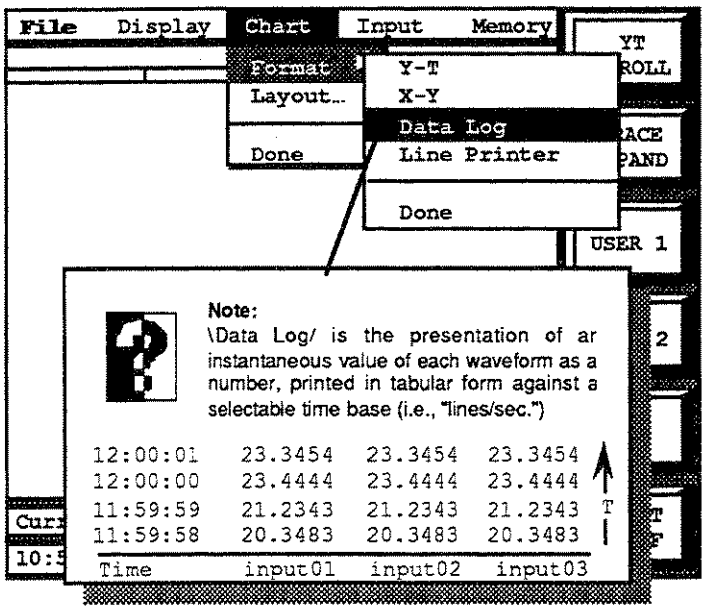
7.3 Data Logger Mode

Data Logger is a CHART mode only—there is no DISPLAY mode equivalent.

Data Logger mode records your data in numeric form on the chart. INPUTS that are being recorded in USER UNITS (according to your selection on the -INPUT SETUP- screen), will also be shown scaled in the proper units in the data logger mode.

The Data Logger mode can record up to 32 INPUTS at once on the chart. You can selectively turn on or off any input. There are no restrictions, except that you cannot go above 32 INPUTS at once.

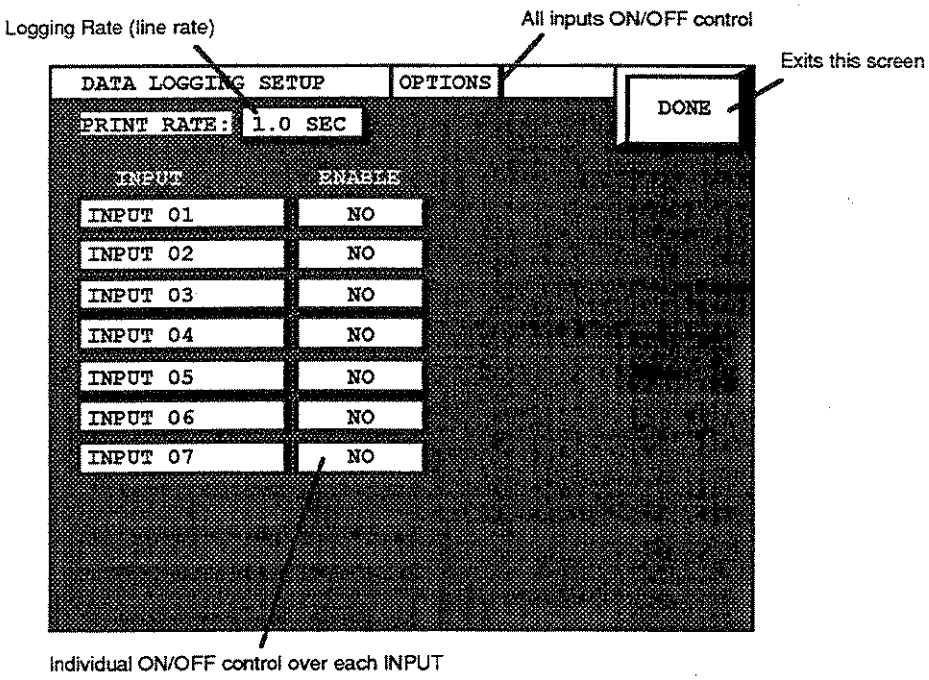
From the -MAIN- screen, set the Format to \Data Logger/ under the \CHART/ menu.



Selecting Data Logger on the -MAIN- screen

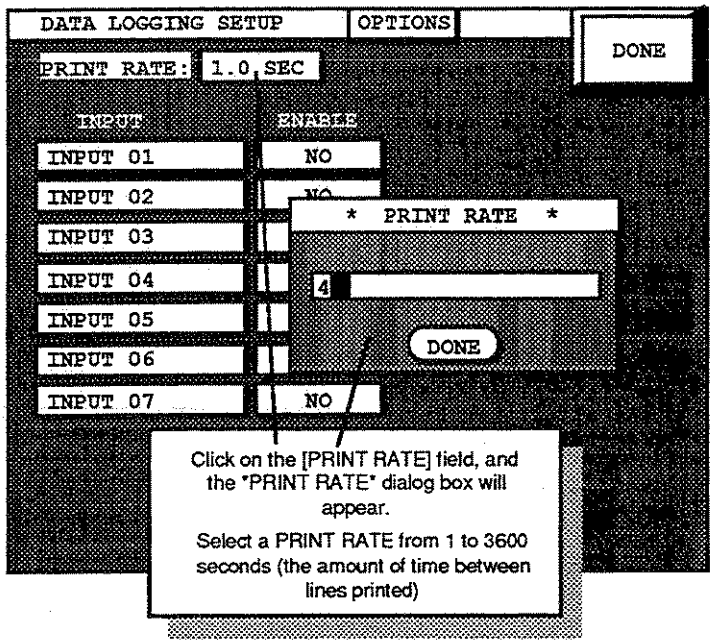
Now, move the highlight to the \Layout/ menu item and press <ENTER>. You will be taken to the -LOG SETUP- screen.

7.3.1 Data Logging Setup Screen



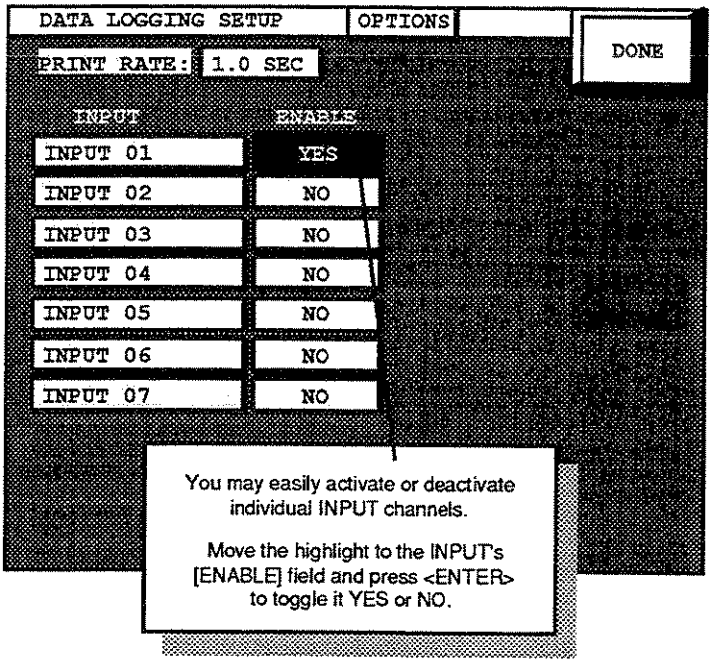
The -Data Logger Setup- Screen

7.3.2 Setting the Print Rate



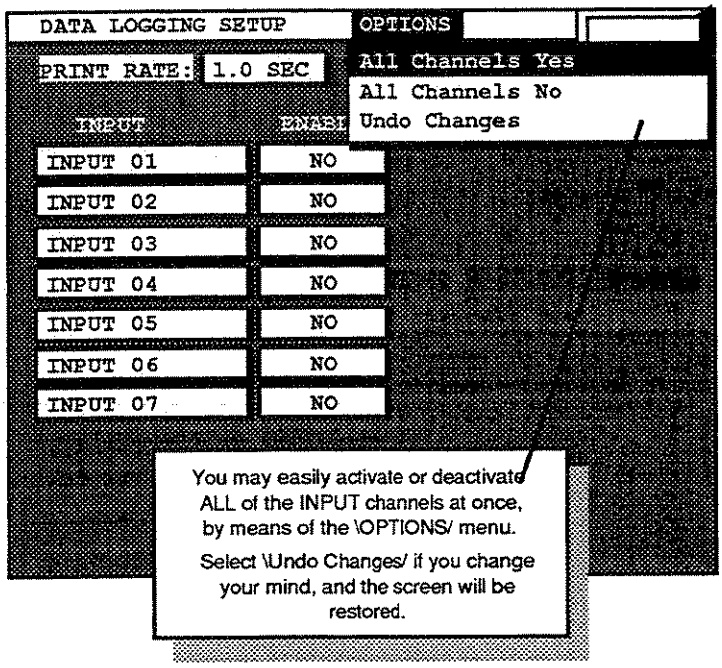
Setting the [PRINT RATE]...

7.3.3 Turning INPUTS On/Off



Turning INPUTS on/off for Logging

7.3.4 Turning ALL INPUTS On/Off at Once

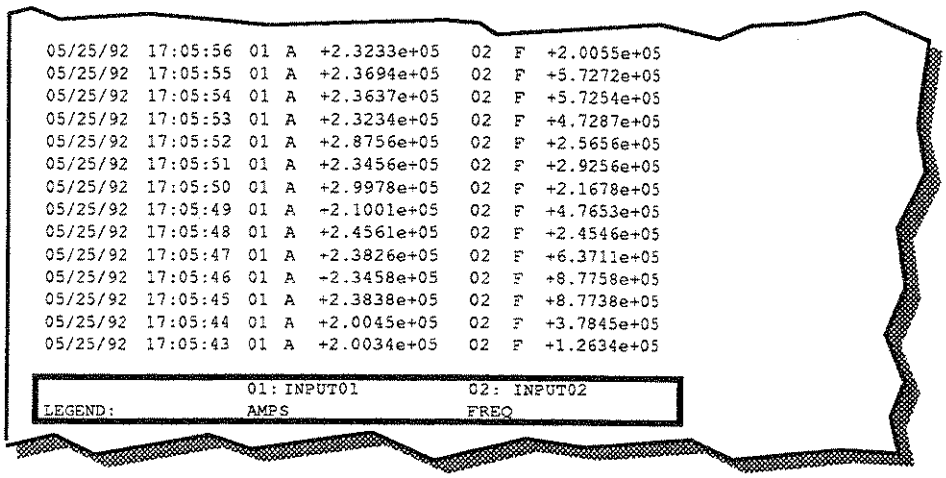


Turning All of the INPUTS on/off for Logging—At Once!

7.3.5 Sample Charts

The Data Logging chart contains only those input channels that you have selected on this screen.

Note that in the chart sample below, only two channels have been selected:

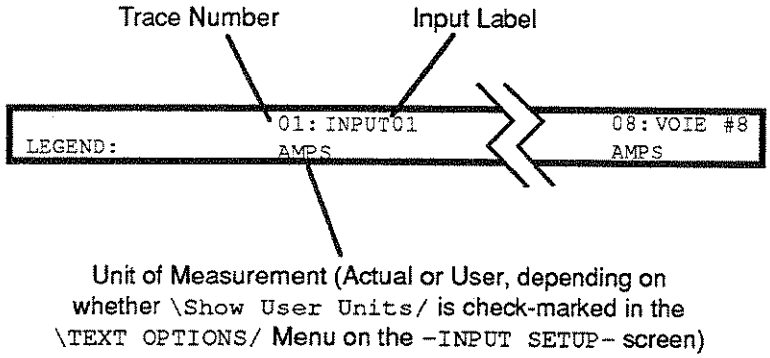


```
05/25/92  17:05:56  01  A  +2.3233e+05   02  F  +2.0055e+05
05/25/92  17:05:55  01  A  +2.3694e+05   02  F  +5.7272e+05
05/25/92  17:05:54  01  A  +2.3637e+05   02  F  +5.7254e+05
05/25/92  17:05:53  01  A  +2.3234e+05   02  F  +4.7287e+05
05/25/92  17:05:52  01  A  +2.8756e+05   02  F  +2.5656e+05
05/25/92  17:05:51  01  A  +2.3456e+05   02  F  +2.9256e+05
05/25/92  17:05:50  01  A  +2.9978e+05   02  F  +2.1678e+05
05/25/92  17:05:49  01  A  -2.1001e+05   02  F  +4.7653e+05
05/25/92  17:05:48  01  A  +2.4561e+05   02  F  +2.4546e+05
05/25/92  17:05:47  01  A  +2.3826e+05   02  F  +6.3711e+05
05/25/92  17:05:46  01  A  -2.3458e+05   02  F  +8.7758e+05
05/25/92  17:05:45  01  A  +2.3838e+05   02  F  +8.7738e+05
05/25/92  17:05:44  01  A  +2.0045e+05   02  F  +3.7845e+05
05/25/92  17:05:43  01  A  +2.0034e+05   02  F  +1.2634e+05

                    01: INPUT01          02: INPUT02
LEGEND:             AMPS                 FREQ
```

Sample Chart Output—Two INPUT Channels

Notice the header, or "legend," that is printed prior to the beginning of the logging data. It contains the INPUT LABELS and unit of measurement of the selected inputs:



Unit of Measurement (Actual or User, depending on whether \Show User Units/ is check-marked in the \TEXT OPTIONS/ Menu on the -INPUT SETUP- screen)

Data Log Legend

7.4 Line Printer Mode

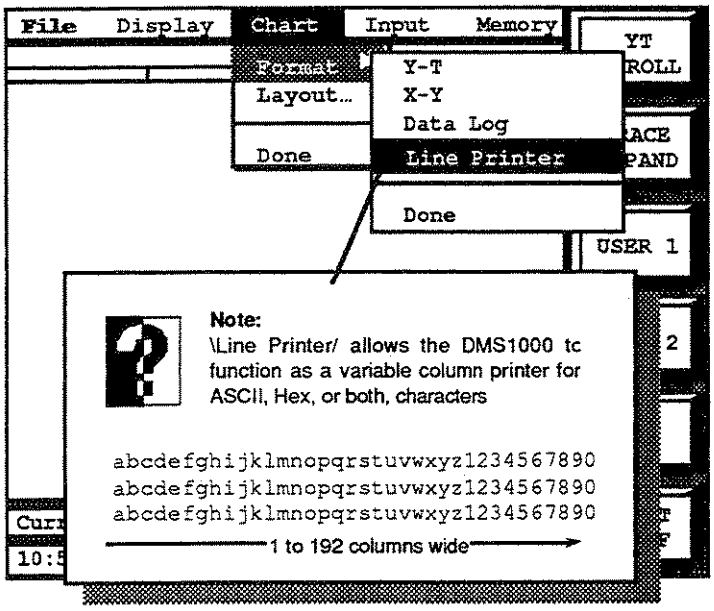
The Mark 12 can serve as a very nice line printer, with selectable row length from 1 to 192 characters. You can instruct the Mark 12 to print only ASCII characters Hex characters, or both.

The mode in which it prints both ASCII and Hex characters is especially useful to those software engineers who are writing programs for the Mark 12, as it will directly echo everything that it receives onto the chart. In this way, programmers can literally see what is being sent from their computer to the Mark 12.

Be aware, however, that when you put the Mark 12 into the ASCII/Hex mode that the only way to get it OUT of this mode is via the front panel. It makes sense: if it is going to print everything that you send it, then all remote interface commands are being ignored!

When the Mark 12 is in either the ASCII or Hex only modes, you can send ESC ETX to get it back to Y-T mode. See the software manual for details about this and all remote interface commands.

From the -MAIN- screen, set the Format to \Line Printer/ under the \CHART/ menu.

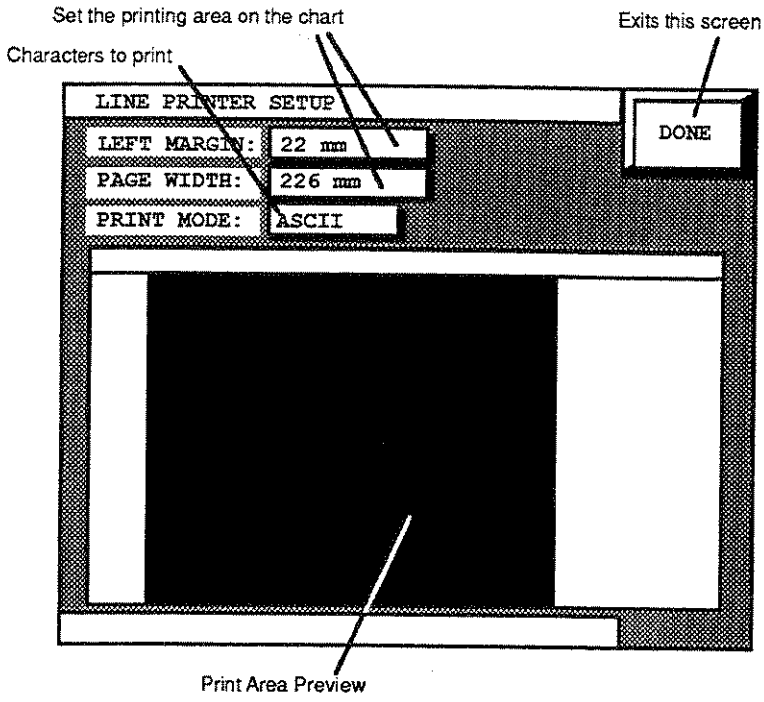


Selecting Line Printer on the -MAIN- screen

Now, move the highlight to the \Layout/ menu item and press **<ENTER>**:

7.4.1 Line Printer Setup Screen

The setup screen allows you to set the page width, position the left margin on the chart, and to select the mode of operation (ASCII, Hex, or both).



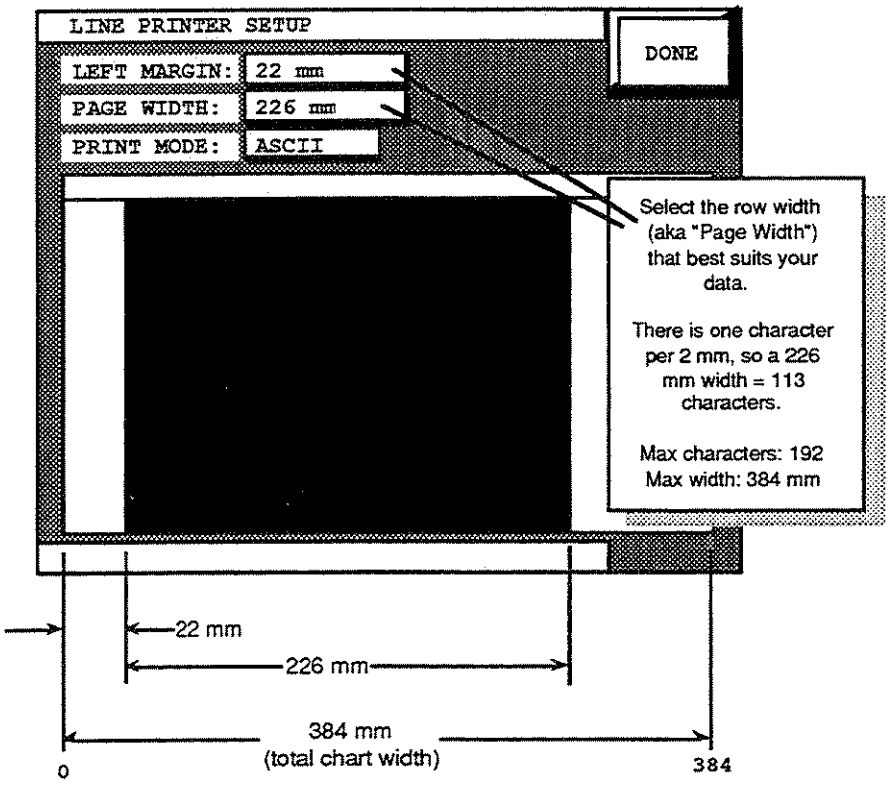
Line Printer Setup Screen

7.4.2 Setting the Page Width and Left Margin

The setup screen allows you to set the page width (2 mm per character), positio the left margin, and to select the mode of operation (ASCII, Hex, or both).

If you set the margin to 0 mm, then you can increase the width to as much as 38 mm. Since there are 2 mm per character, this means that you can print up to 19 characters per row!

This is a very wide line printer, indeed.

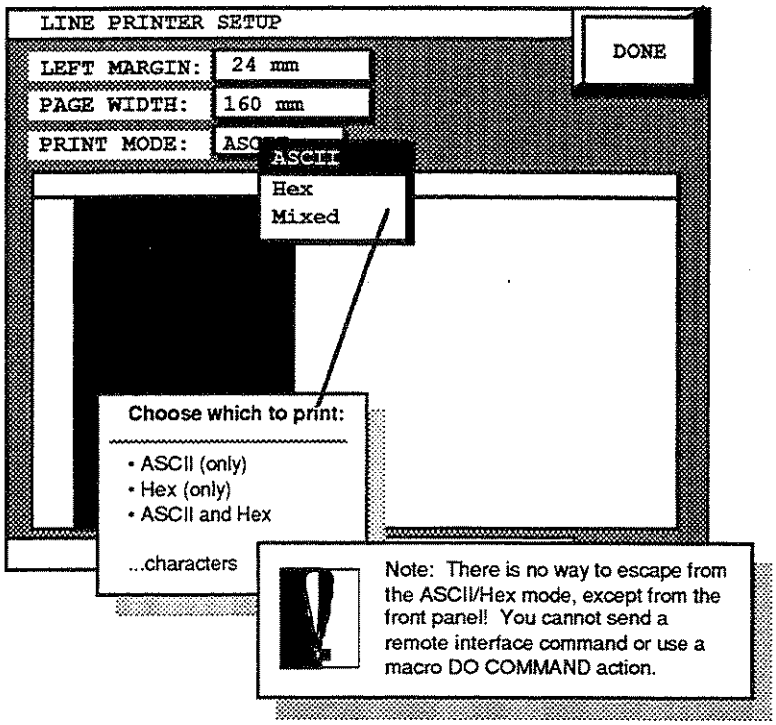


Setting up the width and margin

The illustration above should help you to visualize how this graphical scree relates to the actual output on the chart.

7.4.3 Choosing the Characters to Print

You may instruct the Mark 12 to print only ASCII characters, only Hex characters, or both.



Choosing the Characters to Print

Note: See the warning in the illustration about the ASCII/Hex mode!

Section 8 The Trigger Screen

The *DMS1000* has some very powerful capabilities when it comes to triggering from waveforms, capturing data to SRAM or SCSI drive, and replaying data to the chart. Starting the v5.0 there is even some built-in waveform analysis included with the -REPLAY- screen. Also new to v5.0 firmware is the (optional) SEARCH SCRIPT capability, which allows you to program the DMS1000 to look through any size data file and locate areas of interest for you automatically.

All of these functions require the M12-TR Trigger Board. You may use the trigger detection circuits on this board for a variety of purposes, including capturing data to SRAM memory or SCSI. But you can also use triggers to cause the *DMS1000* to perform some other action or string of actions. In these instances, you do not necessarily have to capture data to memory at all. You can use the trigger circuit(s) to control the actions of the DMS1000 within your MACRO SEQUENCES. For example, you can write a Macro that will start the chart and run it for x time or distance whenever a trigger occurs, and then rearm the trigger circuitry.

Note: The M12-TR Capture/Trigger Board was made standard during November of 1993. If you purchased a DMS1000 after that date then you have this option. An easy way to check is to observe the -MAIN- screen: if the \MEMORY/ menu is gray and disabled, then there is no trigger board installed.

There are three major screens related to triggering, capturing data, and replaying/analyzing it:

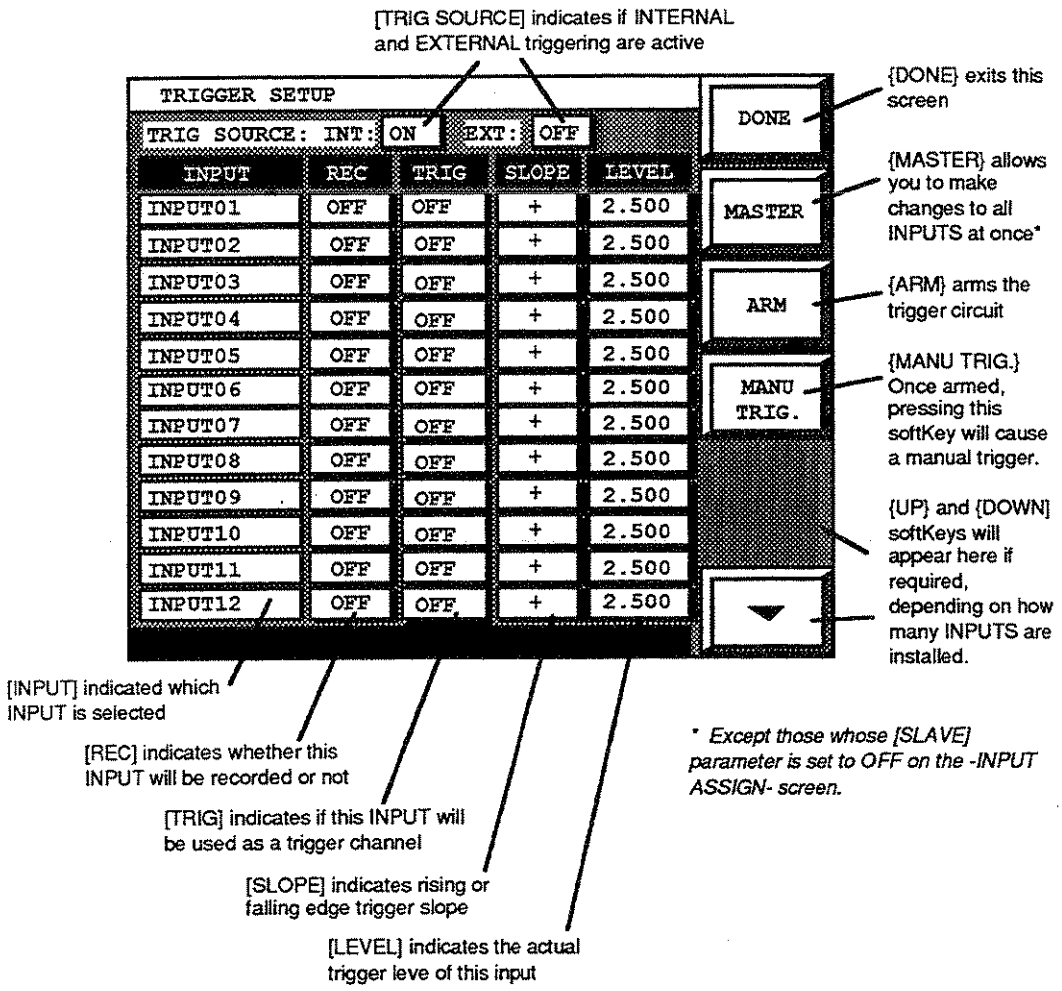
Sect 8	-TRIGGER-	This screen allows you to select which inputs will be trigger inputs, their levels and slopes, and which inputs will be recorded
Sect 9	-CAPTURE-	This screen allows you to set the sample rate, pre-trigger percentage (SRAM recording only), and number of samples/channel to acquire
Sect 10	-REPLAY-	This screen allows you to preview captured data files, "zoom in" and take measurements with cursors, perform basic analysis, select which portion or channels to replay to the chart.

Each of these sections contains a "walk" through the appropriate lay-out screen, followed by an alphanumeric listing of each screen object (menus, menu items, softKeys, screen fields and buttons).

Those interested in using the triggers to cause something other than waveform capturing to occur should also refer to *Section 8, The Macro Sequencer.* This section describes how to use triggers (and other system events) to kick off a whole series of user-programmable actions. You can make the *DMS1000* behave just like you want it to. Macros can be named, stored, and recalled.

To use any of these capabilities, however, you should be familiar with the -TRIGGER- screen, so let's get started.

With the M12-TR installed, the DMS1000 is provided with a separate, individually programmable trigger circuit for each channel. The M12-TR can also accept up to four plug-in memory modules, but these are not required for general real-time triggering operations.



High-level look at the -TRIGGER- screen

The M12-TR Trigger/Capture Board can be programmed to activate when:

- the channel exceeds a selectable level of the full-scale voltage (or whatever the unit of measurement is), and...
- the channel crosses on a positive or negative slope

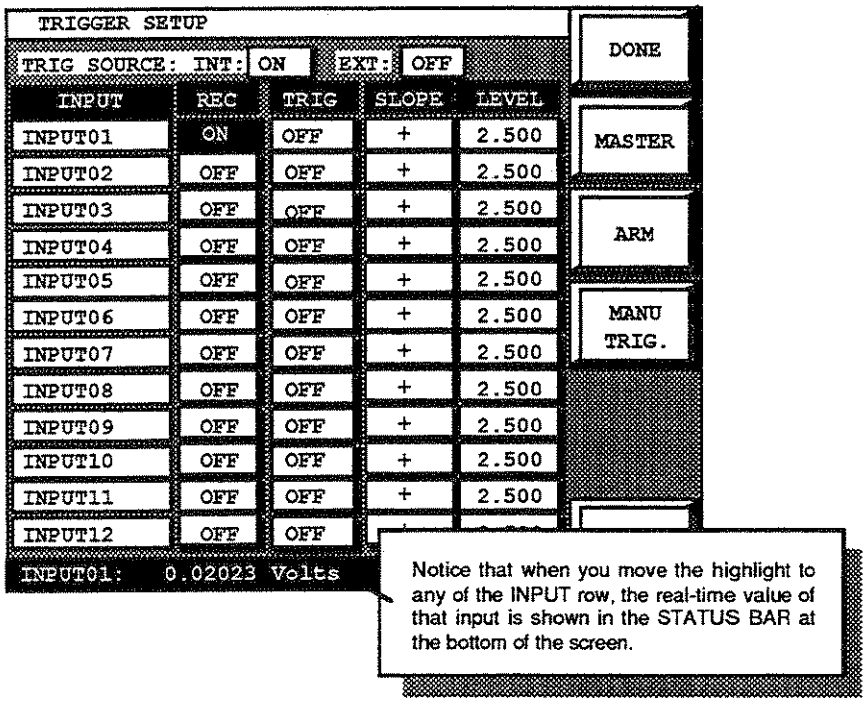
Therefore, you could program the DMS1000 to watch for a signal whose level exceeded 50% of full-scale, and that crossed this threshold with either a rising slope. When this occurred, a trigger would be sent to the main CPU of the DMS1000.

Each channel can be set up independently of all others. This is unlike conventional linear array recorders, which force you to assign a particular channel(s) to be "the trigger channel" before running the test! The DMS1000's separate, independent triggers are a valuable resource for which you will undoubtedly discover many uses over the years.

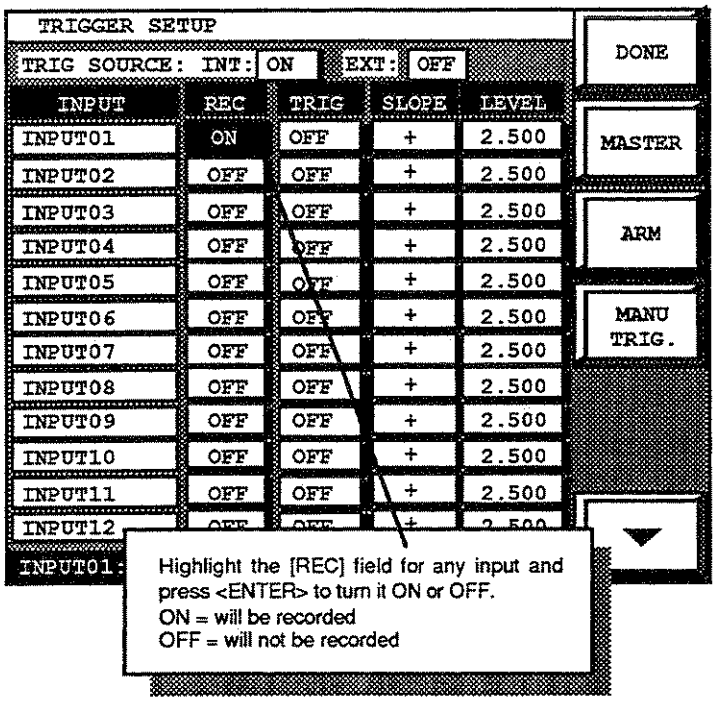
Once any one of the triggers occurs, the DMS1000 immediately performs whatever function it had been preset to do. Accordingly, subsequent trigger occurrences are ignored. However, you may program the Mark to automatically re-arm itself afterwards.

The first thing you generally need to do before acquiring data is to decide:

- Which channels will be captured
- Which channels will be trigger sources
- What the trigger slopes and levels will be



8.1 Setting INPUTS to Record

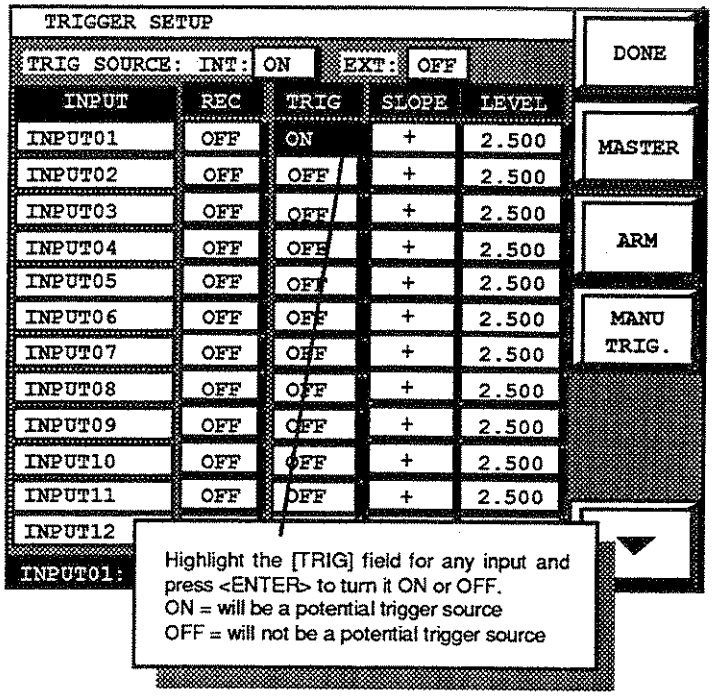


Activating the RECORD parameter

Every INPUT can be set independently to be recorded or not. This is set via the [REC] field.

Note: *Any input that is a TRIGGER input must also be recorded. This does not apply if you are not recording any inputs, i.e., if you are using the trigger circuitry for any purpose other than data capturing.*

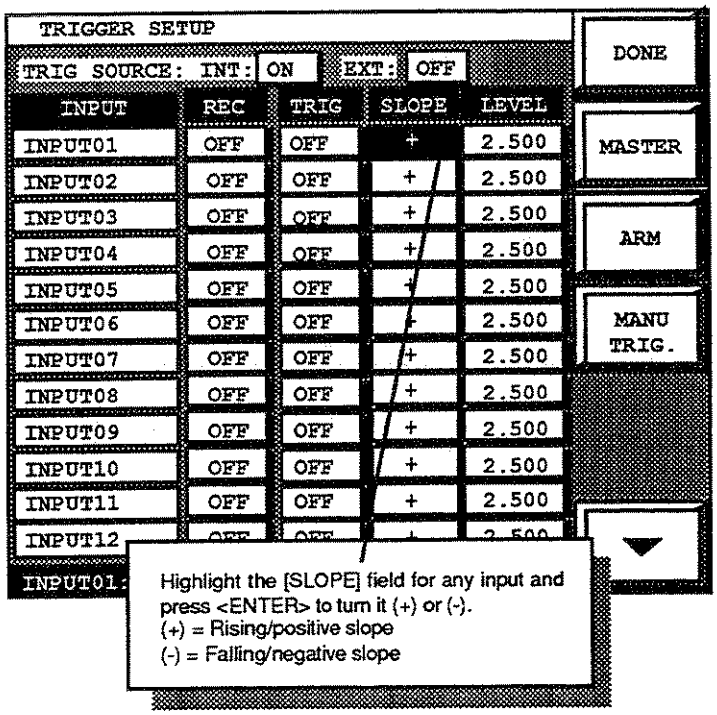
8.2 Setting the Trigger Inputs



Any input can be a trigger input!

Note: *As soon as the [REC} field of any input has been turned to ON, the DMS1000 "knows" that you are planning on capturing data to SRAM or SCSI. Therefore, turning any input's [TRIG] field to ON will result in that input's [REC] field being turn on automatically. If you are capturing data, then any input selected as a trigger source must be captured to memory.*

8.3 Setting the Trigger Slope

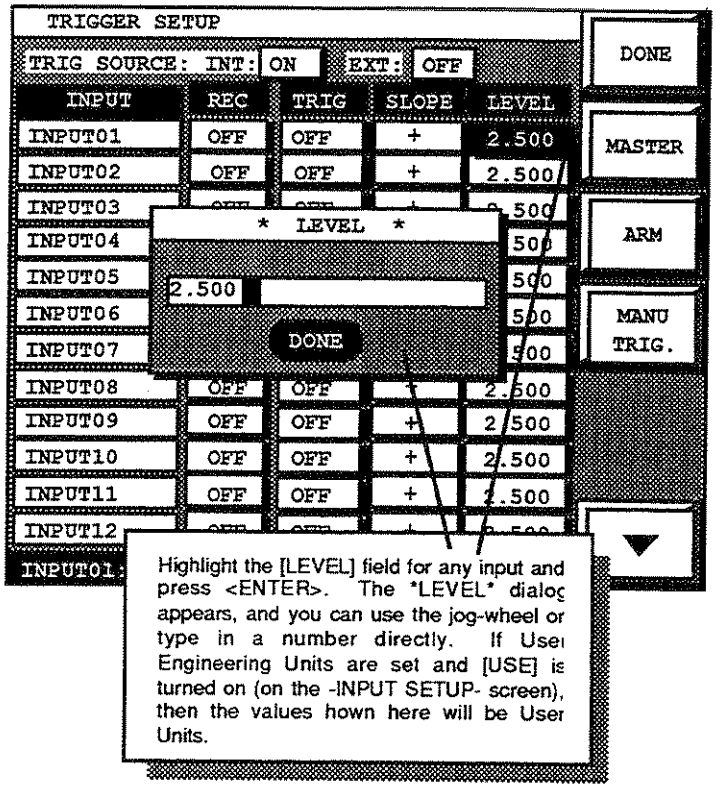


Setting the Trigger Slope

You set the trigger conditions for each input via two parameters: slope and level. Each input can have only one slope, so you cannot trigger on ±5.000, for example. But you could trigger on +5.000, or -5.000.

Set the proper slope, then move on to the next field and set the trigger level.

8.4 Setting the Trigger Level



Setting the Trigger Level for Each Input

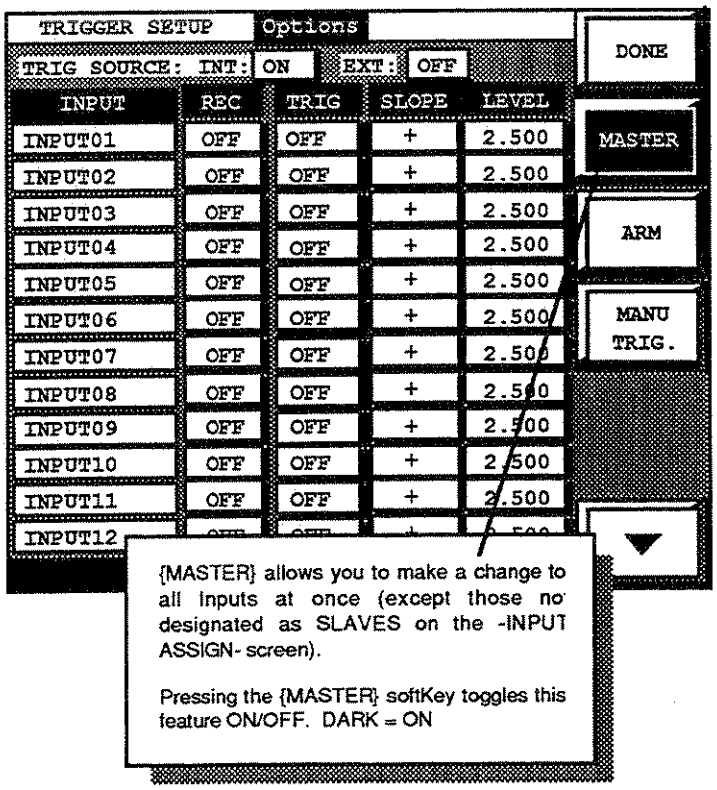
The trigger slope and level can be set completely independently for each input.

Note: The Mark 12's trigger circuitry is a logical OR. Therefore, any input whose TRIGGER parameter is set to ON can cause the system to trigger (assuming that the slope and level conditions are met). As soon as any input triggers the system, the appropriate action is taken (usually capturing the data to SRAM or SCSI volume), and then the trigger system must be reset before it can respond to another trigger. During the capture cycle, all subsequent trigger events are ignored.

Please note that as you move the highlight from one input row to the next, that the STATUS BAR along the bottom of the screen shows you what the signal level is for that input. This is very convenient when setting trigger levels, as you can see what the nominal signal level is at this moment.

Note: Any inputs whose USER parameter is turned ON on the -INPUT SETUP- screen will be shown in user units throughout the system. Thus, if you have input user units of 0 to 1000 PSI for an input and then activated USER, then the numeric value for that input will be scaled and expressed in PSI, including on this screen!

8.5 Using the {MASTER} Softkey



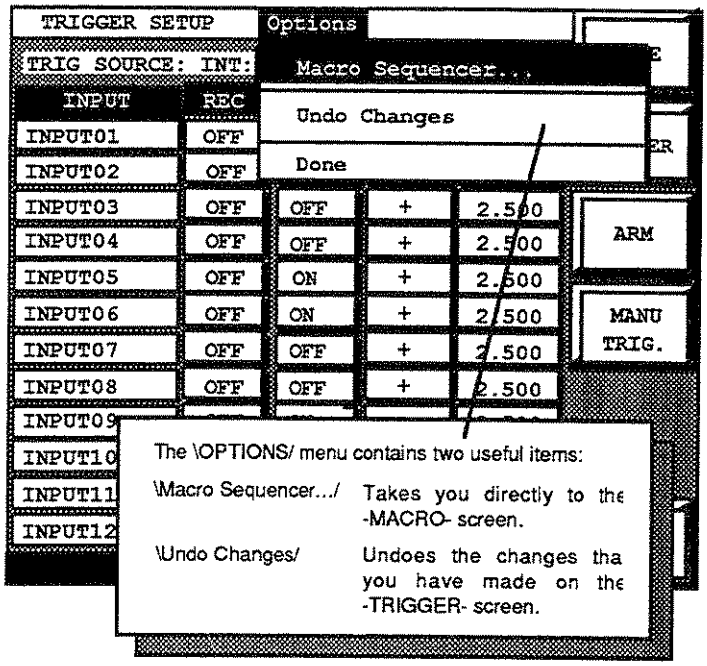
{MASTER} softKey in action...

There will be times when you wish to set all of the inputs to a certain condition at once. If your Mark 12 has 16, 20, 32...or even 48 input channels, it can be quite tedious to make changes one input at a time.

Therefore, we have provided the {MASTER} softKey and functionality on this screen, too.

Press {MASTER}. The softKey will turn black (inverse video). At this point, changes that you make to one INPUT will be made to all of them.

8.6 The Options Menu



The \OPTIONS/ menu

The \OPTIONS/ menu contains two menu items.

\Macro Sequencer.../ is a convenient way to go directly to the -Macro Sequencer- screen. Very often, when creating macros, you may need to come here to set up or verify a trigger setting. This lets you go directly back.

\Undo Changes/ resets everything to the way it was when you first came to this screen (these

8.7 Trigger Screen: Alphabetical Reference

Conventions:

\MENU/
\Menu Item/
\\Submenu Item//
{SoftKey}
[Screen Button/Field]
<Front Panel Key>
"caption/something printed on the screen"

{Arm}

SoftKey 3 on -TRIGGER- screen

Arms the DMS1000's Capture/Trigger board (standard after November 1, 1993), assuming that at least one channel has been designated as a "trigger channel" (see -TRIGGER- screen).

When the system is armed, softkey 4 {MANU. TRIG} can be used to manually trigger the system. Pressing {ARM} again will cancel/abort the arm condition.

\Done/

Menu item under the \OPTIONS/ menu on -TRIGGER- screen

Closes the \OPTIONS/ menu.

{DONE}

SoftKey 1 on -TRIGGER- screen

Exits the -TRIGGER- screen.

[EXT]

Field on -TRIGGER- screen

See also TRIG SOURCE. This field can be toggled on/off by the user. When off, the external trigger input of the DMS1000 cannot be used to trigger the system. Valid trigger inputs presented at this input connector will be ignored. This input is found on the remote interface connector.

[INPUT]

Field on -TRIGGER- screen

Contains a list of all inputs available to be used as triggers and/or to be captured.

"INPUTnn: 23.565 Volts"

Bottom caption of -TRIGGER- screen

The values shown above are just for example. When the highlight falls on the fields of any input, the value shown here on the bottom of the screen reflects the "live" value of that input. This can be useful when setting up a trigger level, because it reminds you of the nominal trigger level of this input in real-time.

[INT]

Field on -TRIGGER- screen

See also TRIG SOURCE. This field can be toggled on/off by the user. When off, the internal triggering capabilities of the DMS1000 will not trigger the system. Valid triggers, as set up on this screen, will be ignored.

[LEVEL]

Field on -TRIGGER- screen

Contains the trigger level of each input selected for triggering.

LEVEL

Dialog box of the -TRIGGER- screen

This dialog box appears after you move the highlight to the [LEVEL] field of any input and press <ENTER>. You may then use the jog-wheel or numerical hardKeys to select a valid trigger level for this input.

Note: when user units are turned ON for any input, the trigger level values shown will be expressed in USER UNITS. This is very useful, because it eliminates the need for you to convert the units yourself.

\Macro Sequencer.../

Menu item under the \OPTIONS/ menu on -TRIGGER- screen

Selecting this menu item takes you directly to the MACRO SEQUENCER, where you can program the DMS1000 to follow a sequence of events based on TRIGGER EVENTS. Access to this screen is provided here as a convenience to those who are using the trigger capability not to capture data, but as a way to start/stop the chart or activate some other sequence of events. All of this is possible with the MACRO SEQUENCER built as standard into the DMS1000..

{MASTER}

SoftKey 2 on -TRIGGER- screen

When activated, this softKey applies the change(s) that you make to a single input to all inputs. This is a handy way to turn on all of the inputs to be recorded, for example. Press [MASTER}. It will turn dark. Now, move the highlight to the [REC] field of any input and toggle it to ON. You will see that all of the inputs will change to the REC ON state.

{MANU. TRIG}

SoftKey 4 on -TRIGGER- screen

Arms the DMS1000's Capture/Trigger board (standard after November 1, 1993), assuming that at least one channel has been designated as a "trigger channel" (see -TRIGGER- screen).

\OPTIONS/

Menu on -TRIGGER- screen

This menu contains several useful menu items. These include: \Macro Sequencer.../ and \Undo Changes/. See separate descriptions for these items.

[REC]

Field on -TRIGGER- screen

This field can be toggled on/off by the user. When on, the selected input will be recorded during the next acquisition. Note: that when any of the inputs is set to be recorded,

[SLOPE]

Field on -TRIGGER- screen

Sets the slope (rising or falling) of the trigger level of this input. Used in conjunction with [LEVEL] to set the condition in which this input will cause a trigger event to be generated.

[TRIG]

Field on -TRIGGER- screen

Activates this input as a potential source of a trigger. When ON, this input will be monitored by the system. When its signal meets the [LEVEL] and [SLOPE] conditions set, a trigger event will be generated.

Note: when the [REC] field is turned ON for any of the inputs, all other input's whose [TRIG] field is turned on will also be set to be recorded. In other words, all TRIGGER INPUTS must also be RECORDED. This only takes effect when one or more inputs are set to be RECORDED.

"TRIG. SOURCE"

Field caption on -TRIGGER- screen

Caption for the [EXT] and [INT] fields. Allows you to turn off external and internal triggering independently of one another.

"TRIGGER SETUP"

Screen caption of -TRIGGER- screen

The name of this screen, shown at the top left corner of the screen.

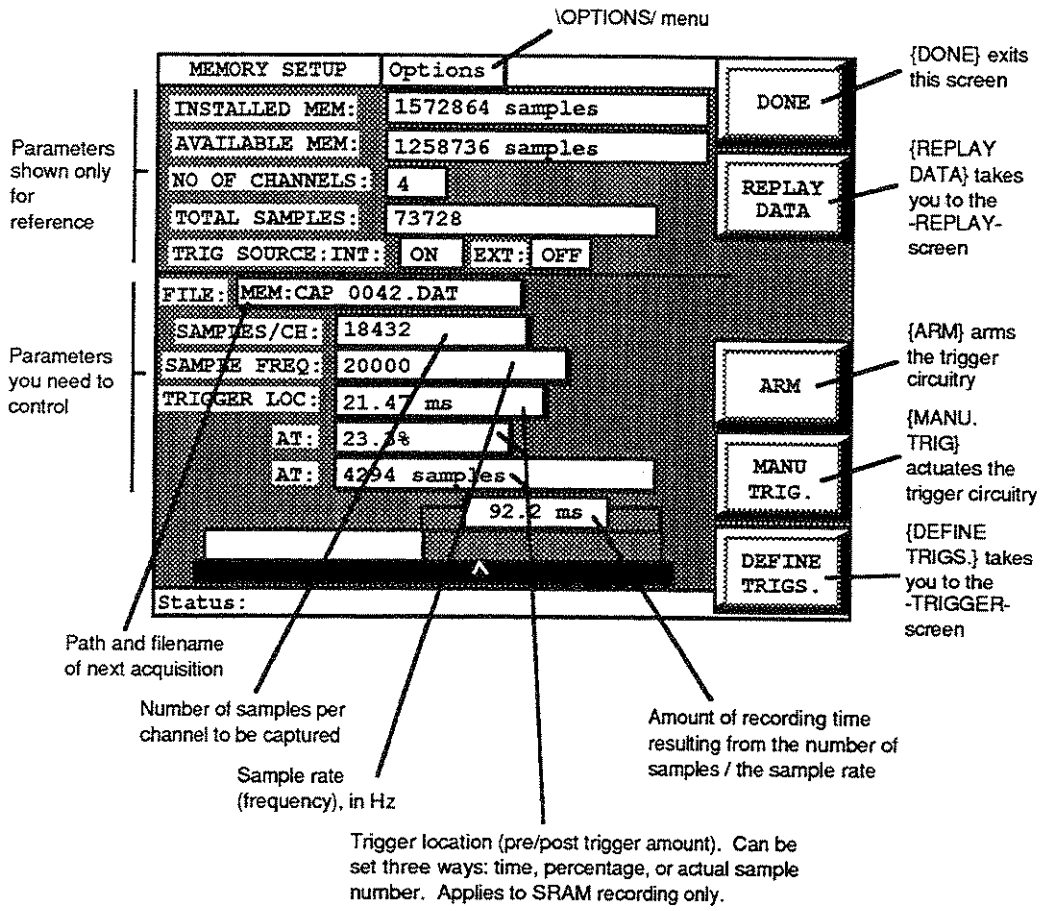
\Undo Changes/

Menu item under the \OPTIONS/ menu on -TRIGGER- screen

Reverts any changes that you have made to this screen since entering it.

Section 9 The Capture Screen

This section contains a graphical tour of the -CAPTURE- screen, followed by an alphanumeric listing of each screen object (menus, menu items, softKeys, screen fields and buttons).



The-CAPTURE- screen

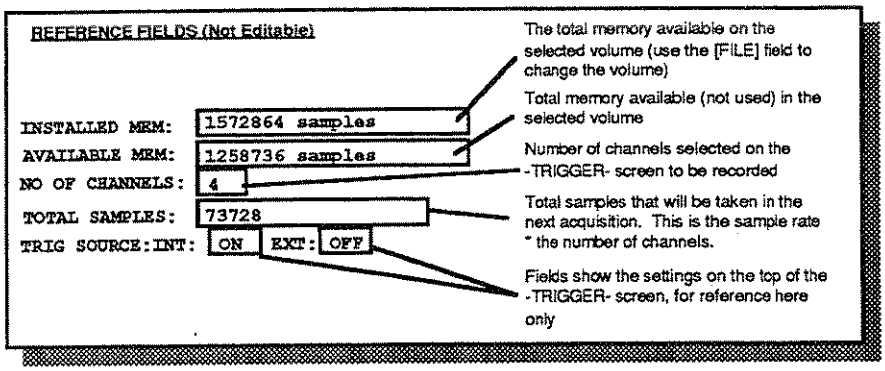
The -CAPTURE- screen is where you set up the sample rate, trigger location (SRAM capturing only), and select the filename and location of the file to be captured.

It presumes that you have already set up the trigger input channels, slopes, and levels, using the -TRIGGER- screen, as described in the previous section.

If you have not configured the triggers yet, and you wish to do so, press the bottom-most softKey, labeled {DEFINE TRIGS.}. This will take you directly to the -TRIGGER- screen. When you are done there, press {DONE} to return directly to this screen.

Assuming that the triggers are configured properly, let's proceed with finalizing the capture conditions.

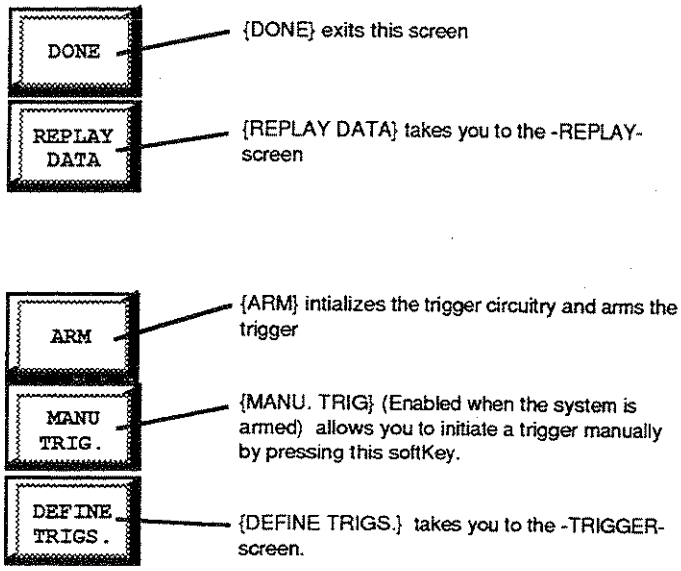
9.1 Reference Section



-CAPTURE- Screen Reference Section

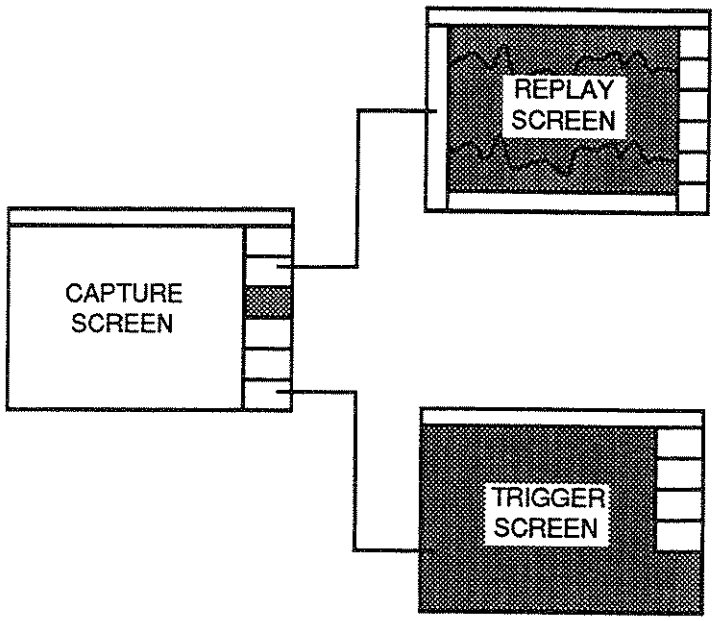
The -CAPTURE- screen is divided into halves by a thin black line. The fields above the line do not require any interaction on your part: they are simply provided for reference purposes.

These reference fields show the total capacity of the selected memory volume the available space within that capacity (how much space has not yet been used by files), the number of input channels selected to be captured on the -TRIGGER- screen, the total number of samples that will be acquired in the next acquisition, and the status of the INTERNAL and EXTERNAL trigger circuits.



There is only one bank of softKeys on this screen, as shown above. Two of them provide access to the other screens related to data capturing: the -TRIGGER- and -REPLAY- screens.

Many users find it convenient to come to the -CAPTURE- screen first, because from here you can go to either of the other two important screens:

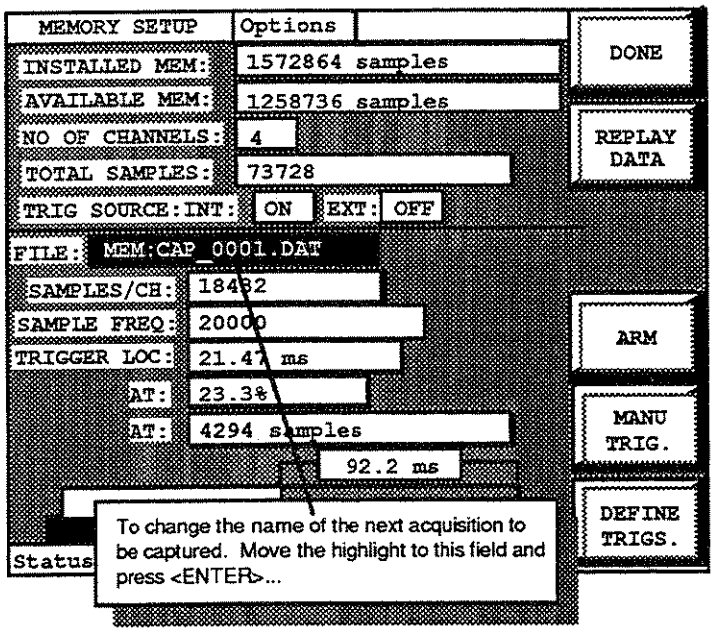


Hierarchy of Screens

9.3 Operation

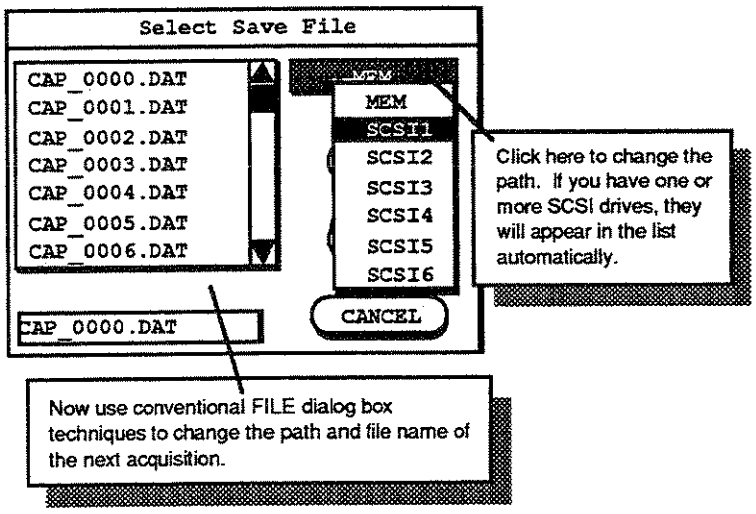
If you have not already set up the triggers, do so now by pressing the [DEFINE TRIGS.} softKey. See the preceding section for instructions for that screen.

9.3.1 Setting up An Acquisition



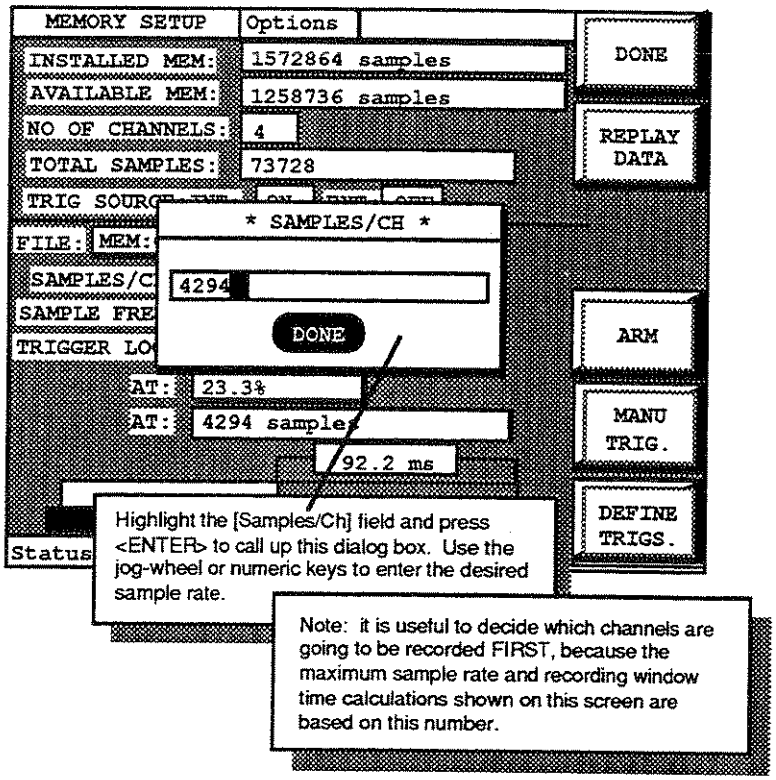
Setting the Filename and Path of the Next Acquisition

Set the path and filename of the next acquisition, or accept the default (MEM:CAP_0001.DAT). To change it, move the highlight to the [FILENAME} field and press <ENTER>:



Selecting the filename to capture

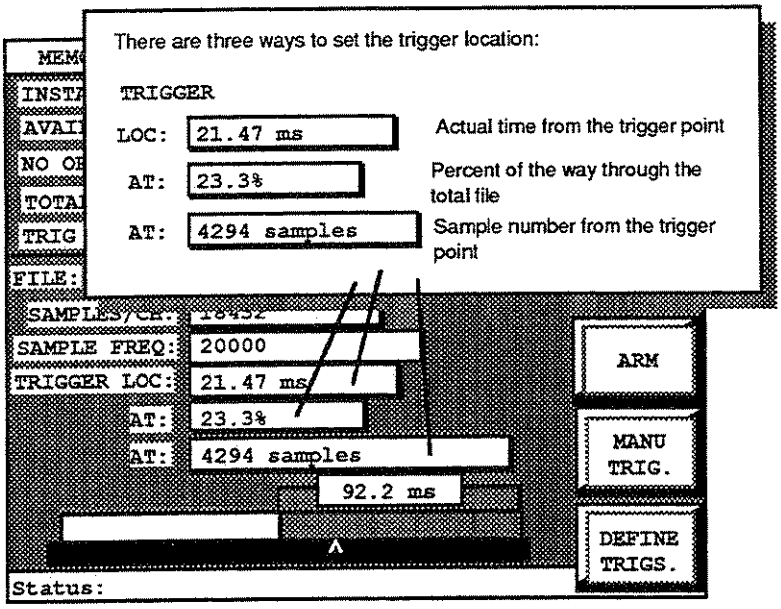
9.3.2 Setting the Number of Samples/Channel



Selecting the Number of Samples per Input Channel

Move the highlight to the [Samples/Ch] field and press <ENTER>. The *SAMPLES/CH* dialog box will appear. Use the jog-wheel to scroll the number up or down, or enter a number directly using the numerical hardKeys.

9.3.3 Setting the Pre-Trigger Amount

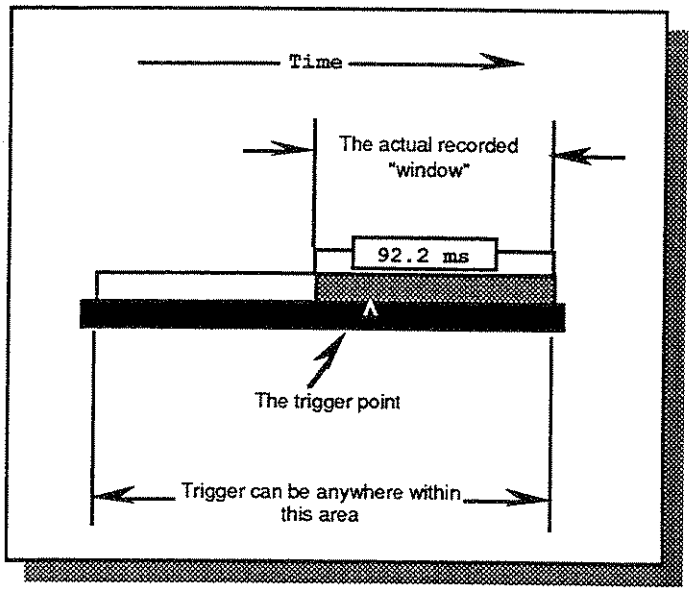


Setting the Pre-Trigger Amount

The Mark 12 lets you work in the units that you think in. For example, when determining pre-trigger amounts, some people like to think about them in terms of a percentage of the overall acquisition, like "20% pre-trigger. Other people prefer to think in real-time. For example, if the acquisition is 2 seconds long, you might want to have 22 milliseconds of pre-trigger. There are even those who prefer to think in terms of an exact number of samples. For example, if you have selected a total number of samples per channel of 10,000, you may wish to determine that the trigger fall on the 215th sample from the beginning.

No matter which of these three methods you choose, the Mark 12 can handle it. In fact, there are three fields that set the pre-trigger amount. Use whichever one you prefer, and the other two fields will be updated accordingly. It does not matter which unit of measurement you use for this parameter.

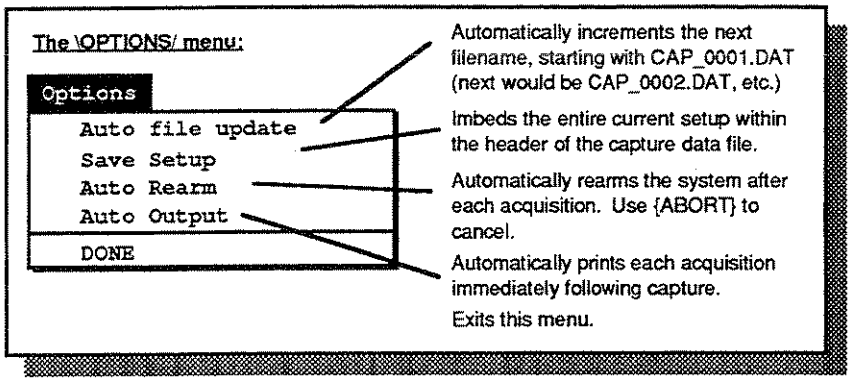
9.3.4 Using the Graphical Display



As you change the number of samples/channel or sample rate fields, notice that the recording window time value will change. In the example above, the current recording window time is 92.2 ms. Increase the number of samples/ch and this value will increase proportionately. This field is updated constantly, so you can use it as a handy reference while changing the other fields. This eliminates tedious calculation on your part.

The caret (^) symbol indicates where the trigger will be located within the acquisition window. Since the DMS1000 has full ±100% pre/post trigger capability, the trigger point can actually be located well ahead of the acquisition. In these cases it is not recorded, but is used as a "delay" timer.

9.3.5 The \OPTIONS/ Menu



The -CAPTURE- Screen's \OPTIONS/ Menu

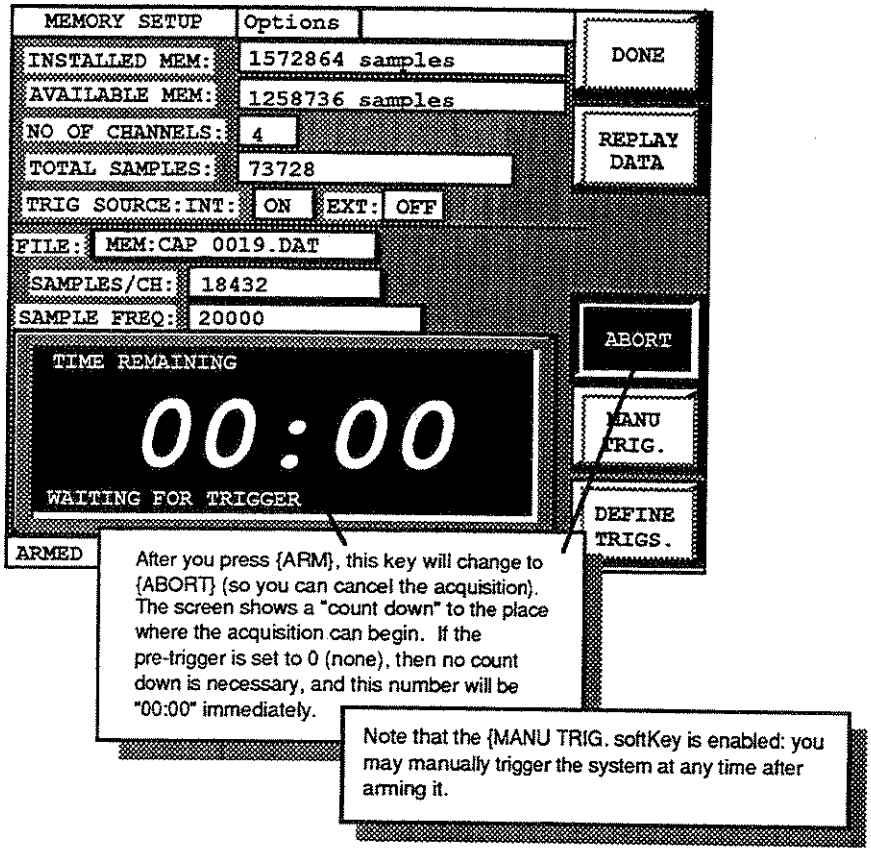
The illustration above shows you the optional parameters that you can check or uncheck on this menu.

Basically, these are options that allow you to better control how data are captured, and what happens immediately following an acquisition.

Note: *The \Save Setup/ parameter used to be more important than it is starting in v5.0 firmware. Previous to v5.0, the input range/span/offset were not automatically stored with capture data files. The only way that you could store them for later recall was to check this option, which causes the entire setup to be compressed and stored within the capture data file header. Starting with v5.0, however, these basic input parameters were added to the parameters that are automatically stored, and you need not archive the entire setup merely to recall them. Please note also that capture data files created under v5.0 and above have a different header file format.*

9.3.6 Capturing Data

Now that everything is set up properly, you can arm the system and capture some data. Press the {ARM} softKey, and the screen will look like this:



The System is Armed and Ready to Acquire Data

When the acquisition is complete, press the {REPLAY DATA} softKey to open the -REPLAY- screen. When you do, the most recently acquired file will be loaded automatically and the top four inputs will be displayed on the screen (you can scroll down to see the rest).

Note: If you have \Auto Output/ checked on the \OPTIONS/ menu, the capture data file will be replayed to the chart without operator intervention.

[SAMPLES/CH]

Field on -CAPTURE- screen

Sets the number of samples that will be recorded for each channel. All channels are sampled at the same frequency and duration, and so have exactly the same number of samples. Highlight this field and press <ENTER> to change it.

[TOTAL SAMPLES]

Reference Field on -CAPTURE- screen

Shows the total number of samples that will be taken during the next acquisition. This is simply the product of the number of channels to be recorded and the samples/channel parameters. For example, setting up to record 4 channels @ 256 samples/channel gives a [TOTAL SAMPLES] value of 1024.

[TRIGGER LOC]

Field on -CAPTURE- screen

Sets the location of the trigger in relation to the recording window. This is selectable from -100% to +100%. Accordingly, the trigger can actually fall before the actual recorded data and will not be recorded itself.

This field is active only when SRAM is the device or volume to be written to in the next acquisition. This is because "pre-triggering" is not possible with hard drives, tape, etc.

The second and third fields, both labeled [AT], are provided as a convenience. They allow you three ways to set this value:

Time	The actual time from the beginning of the recording window
Percent	The percent of the way through the file
Sample	The actual sample number, starting from the file beginning

[TRIG SOURCE INT / EXT]

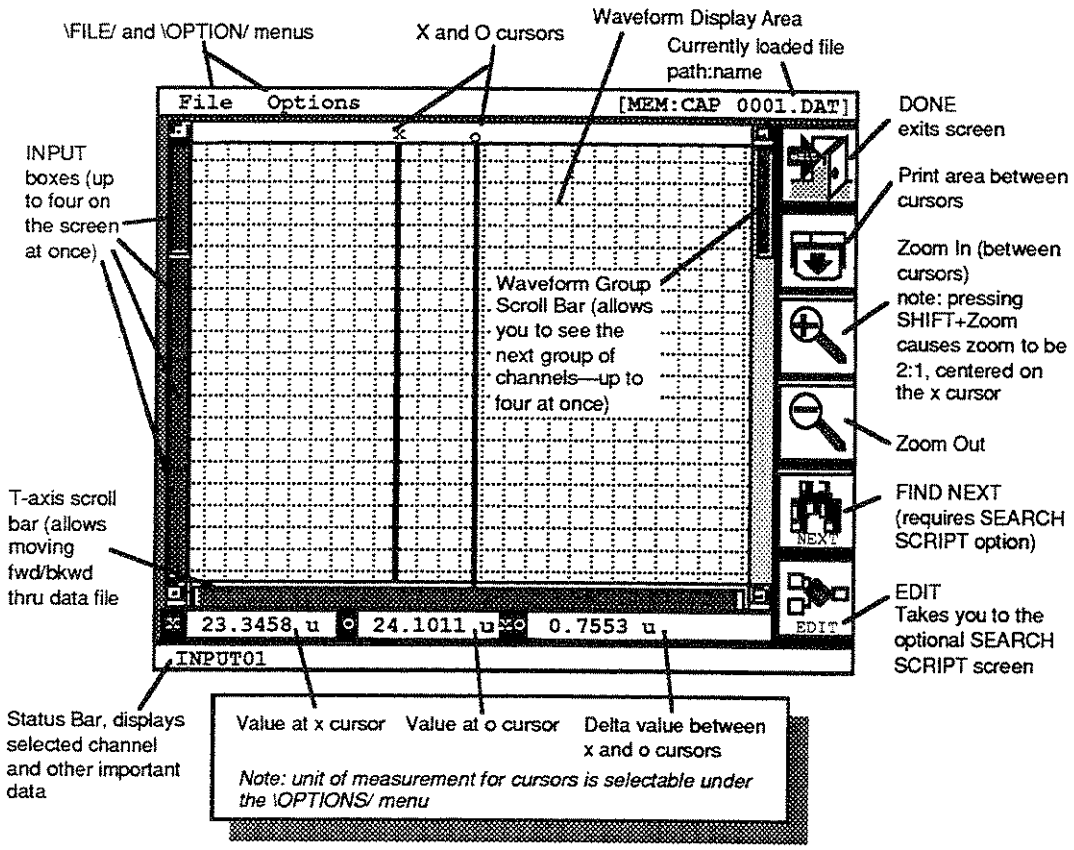
Reference Field on -CAPTURE- screen

Shows the status of the internal and external trigger detection circuits, as presently set up on the -TRIGGER- screen.

Section 10 The Replay Screen

This section contains a graphical tour of the -REPLAY- screen, followed by an alphanumeric listing of each screen object (menus, menu items, softKeys, screen fields and buttons).

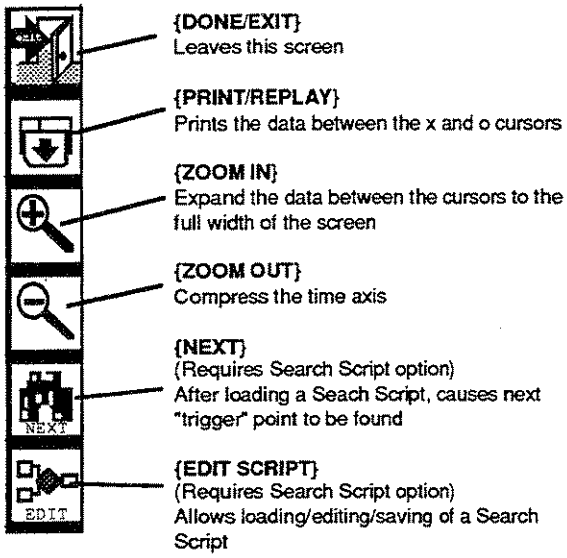
10.1 Overview



The -REPLAY- Screen

10.2 SoftKeys

There is only one bank of softKeys on this screen:

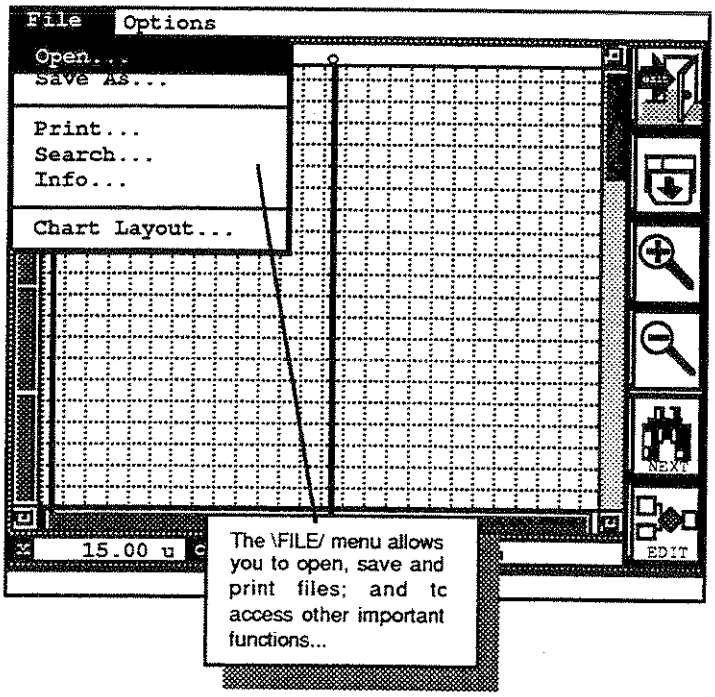


SoftKeys on the -REPLAY- screen

These keys provide access to the most often-used functions of this screen. As always, the top-most softKey is "Done" or "Exit", which closes this screen and returns you to the one that you came here from.

See the descriptions for the other five keys in the illustration above.

10.3 File Menu

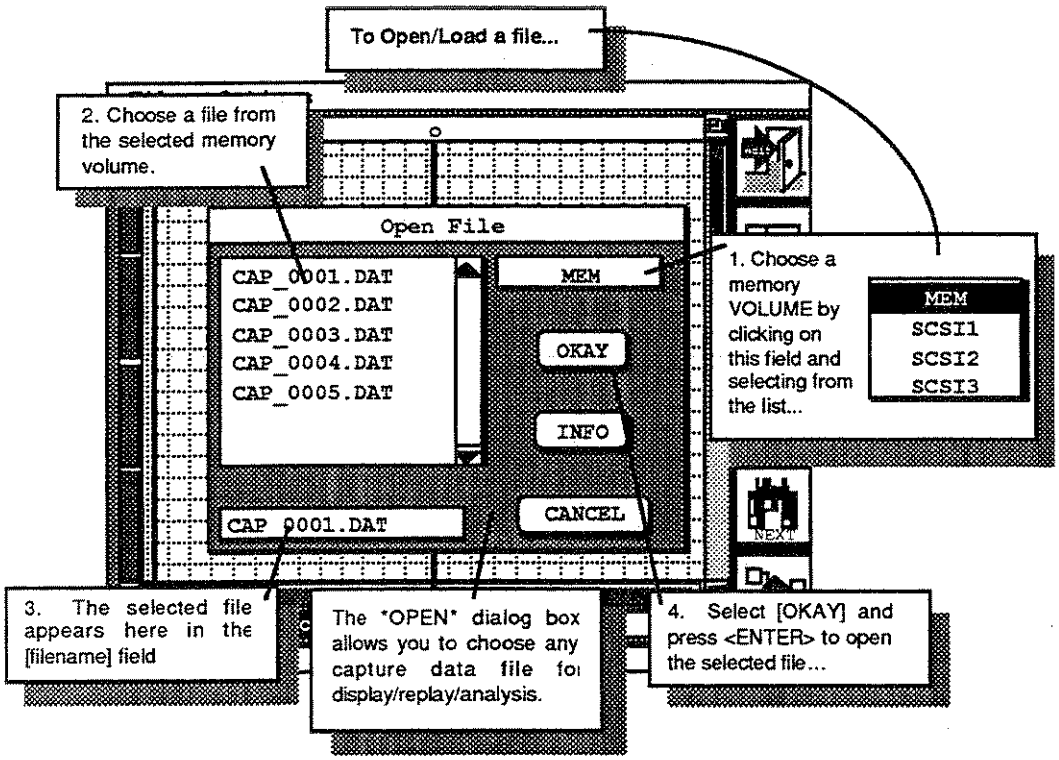


The -REPLAY- screen's \FILE/ menu

Let's cover the important features found on this screen's \FILE/ menu.

10.3.1 Opening a Data File

Select \Open.../ form the \FILE/ menu, and this dialog will appear:

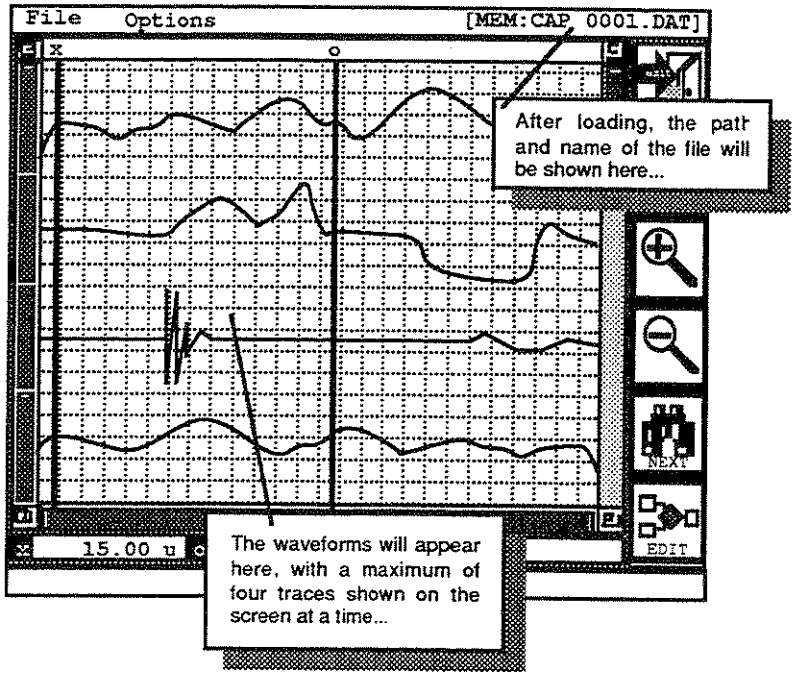


The -REPLAY- screen and "OPEN FILE" dialog box

Use standard techniques for locating the *.DAT file that you wish to analyze/replay, then move the highlight to the [OKAY] button and press <ENTER>. The file will be loaded and the first four channels will be displayed across the screen. If there are more than four channels in this file you can easily scroll down to them, or bring any four to the top, as we will see later in this section.

After the file is loaded, the screen will resemble this.

Note: *Of course, your actual data will differ in appearance...*

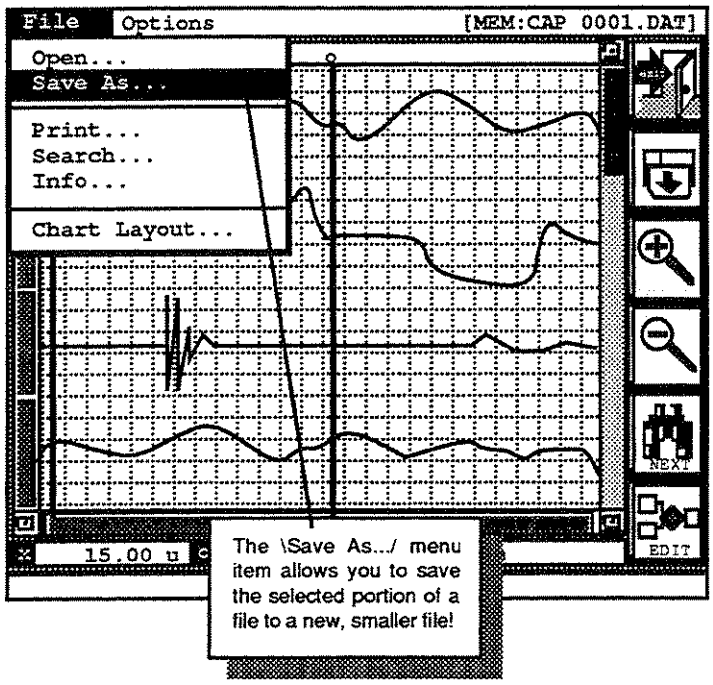


The -REPLAY- screen, with file loaded

We will learn how to zoom in/out, select different channels, and perform basic waveform analysis later in this section. First, let's carry on with the rest of the items under the \FILE/ menu.

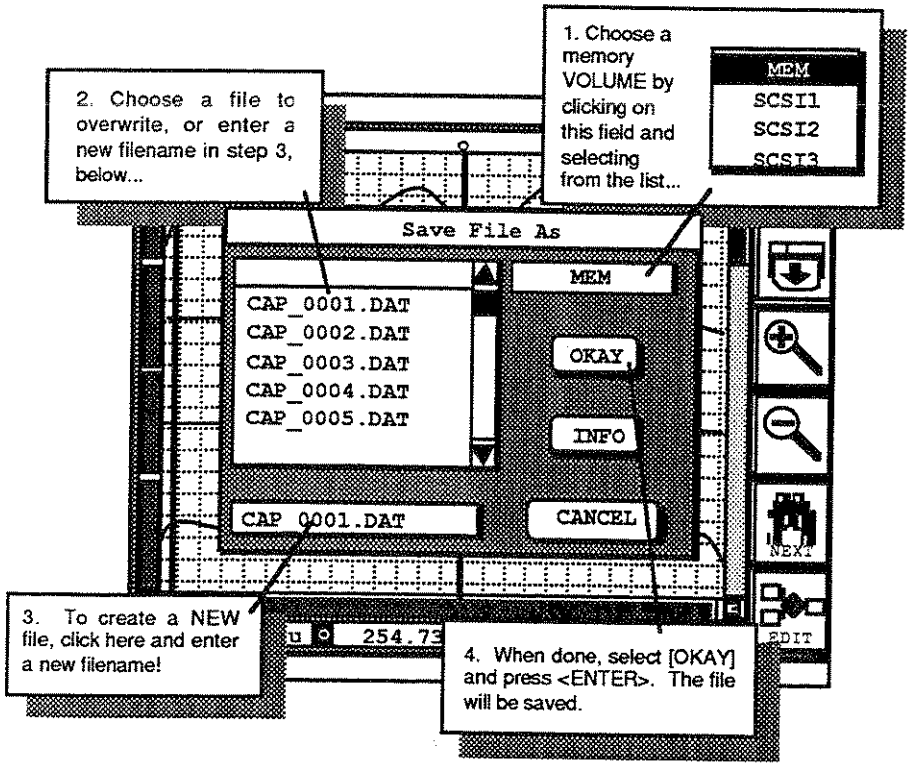
10.3.2 Saving a Data File

After zooming in on a particular portion of the file and/or deleting one or more inputs from it, you may wish to save it to a new filename. Use the \Save As... menu item under the \FILE/ menu for this:



The -REPLAY- screen's \Save As.../ menu item

After you select this menu item the *Save File As* dialog box will appear:



*The -REPLAY- screen and *Save File As* dialog box*

Note: *it is not recommended to "Save as..." a file to the same name and location. Always use a new name. If you are running short on space, save the file to a new name and then delete the first file. If you overwrite a file with a new version of itself, it will become corrupted.*

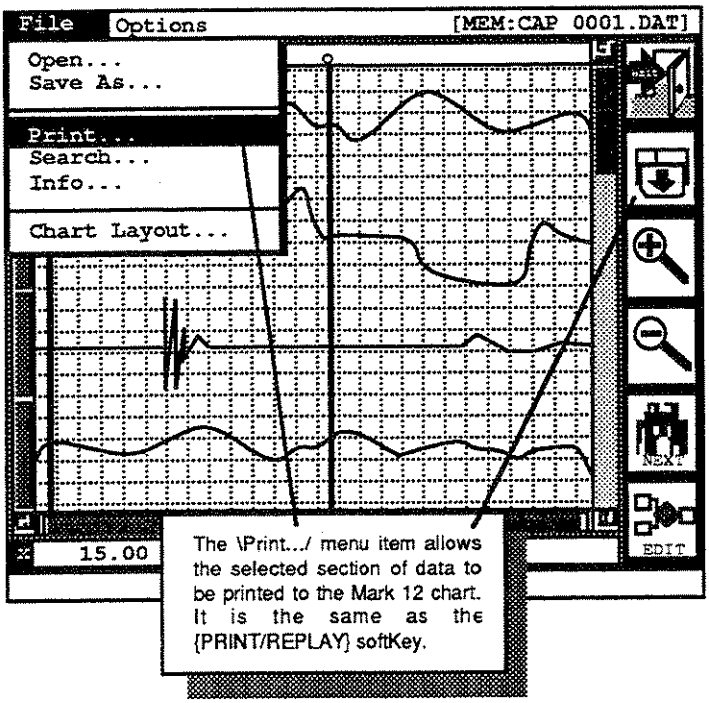
10.3.3 Printing a Data File

There are two ways to start printing a file to the chart:

The \FILE/ \Print.../ menu item, or...

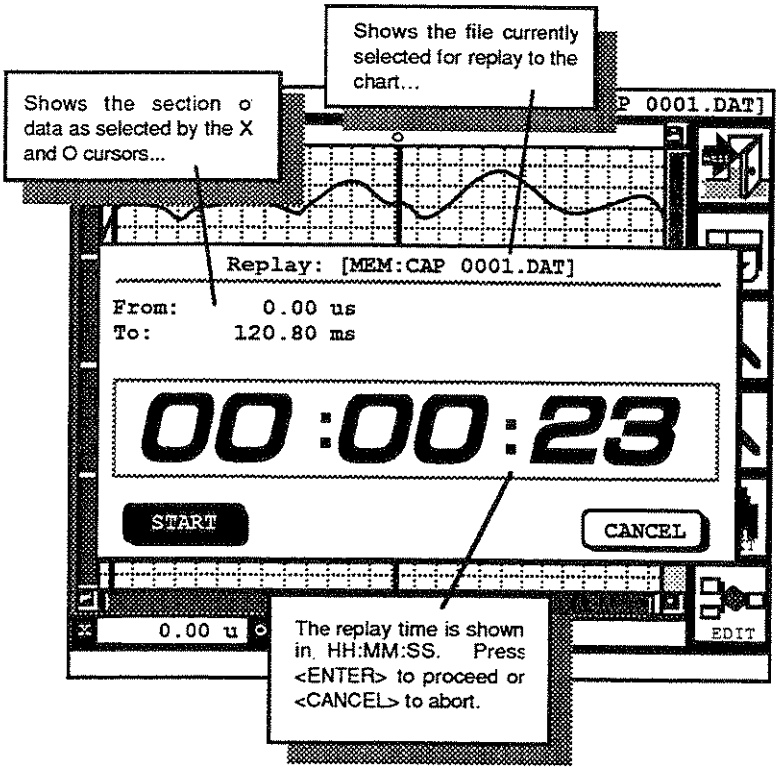
The {PRINT} softKey (DMS1000 icon)

Note: Only the area between the x and o cursors will be replayed to the chart!



The -REPLAY- screen

After you make this selection, the *REPLAY* dialog appears. This shows you the area selected for replay.



*The -REPLAY- screen and *REPLAY* dialog box*

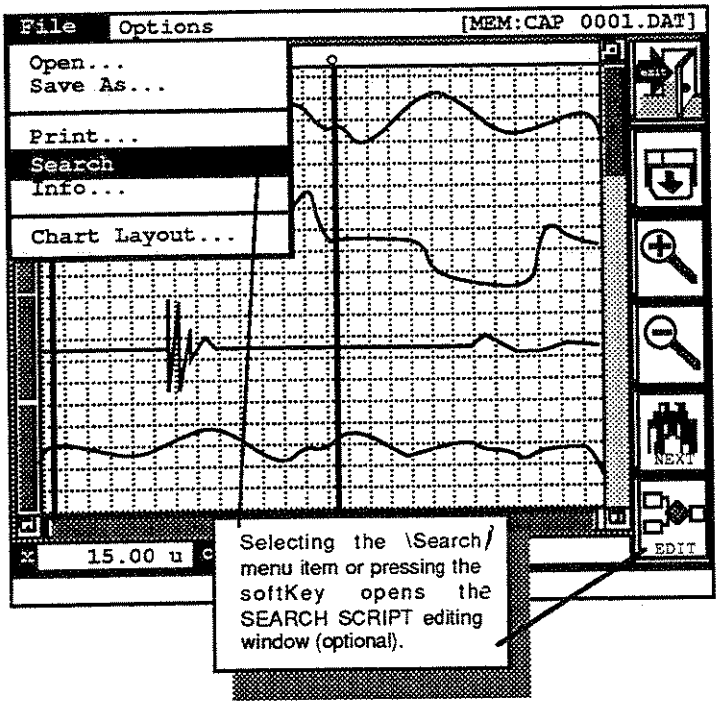
The large numerals indicate how long the replay will take given the amount of data selected and the replay rate. The replay rate can be changed under the \OPTIONS/ \Print option >/ \\Replay Rate// menu item.

10.3.4 Searching Through a Data File

There are two ways to search through a captured data file:

The \FILE/ \Search.../ menu item, or...

The {Edit} softKey (Logic icon with "Edit" caption)



The -REPLAY- screen

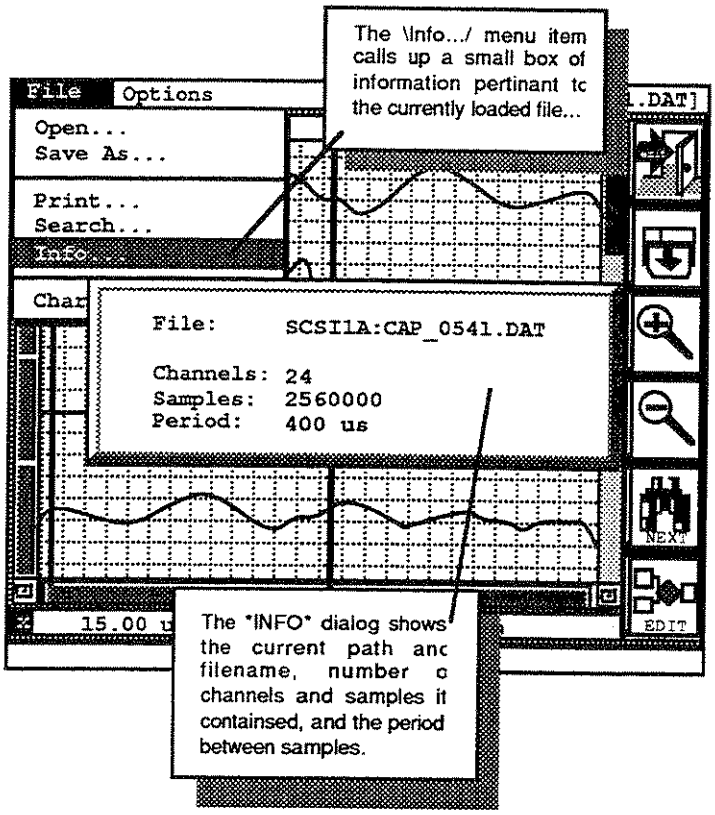
After selecting either the \Search.../ menu item or {Search Edit} softKey, you wi be taken to the *Search Script* screen. Here is where you create and/or ed powerful Boolean "scripts" that can be applied to the current data capture file.

Note: *Search Script capability is an extra-cost firmware option! If you cannot acces this screen, this is feature is not installed within your DMS1000. Contact you local Western Graphtec representative for ordering information. In DMS1000' with firmware revision 5.0 and higher, this option can be installed remotely Other systems require only that v5.0x be installed via memory card (there is n charge for upgrading any DMS1000 to version 5.0x. Revisions starting at 5.0 may require some hardware changes that are may or may not be free c charge. Please contact your local Western Graphtec representative fc details).*

Search Script capability is described in detail in the next section of this manua Applying previously created Search Scripts to a data file is covered at the end c this section.

10.3.5 Getting Data File Info

You may see important basic information about the currently loaded file by selecting the \Info.../ menu item under the \FILE/ menu. When you select this item, you will see this message box:



*The -REPLAY- screen and *INFO* message box*

This message box provides the path and file name of the currently opened capture data file (SCSI1A and CAP_0541.DAT respectively, in the example above).

Then it shows the number of input channels contained within the file, the total number of samples, and the sample interval/period.

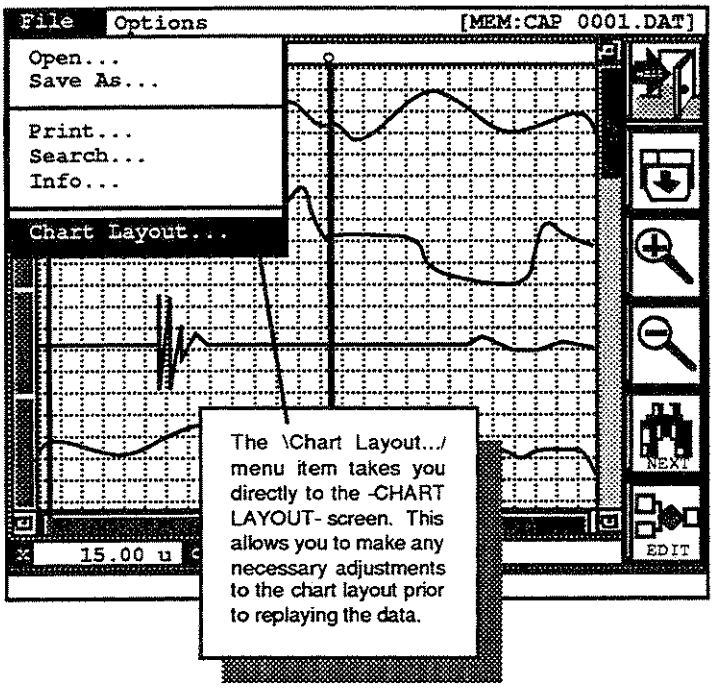
10.3.6 Going to the Chart Layout Screen

You can access the chart layout screen directly (without having to exit this screer and make your way back to the -MAIN- screen, then come back here and reloac the capture data file, moving the cursors back to where they are now, etc.). This is very convenient for those who wish to make a change to the chart presentatior between replays.

Select \Chart Layout/ from the \FILE/ menu, and you will be taken to the -CHART LAYOUT- screen.

Note: The chart format that is currently selected: Y-T, X-Y, or data logger, wil determine which layout screen you are brought to

When you are done, exit from the -CHART LAYOUT- screen, and you will returr directly to the -REPLAY- screen, with everything the way that you left it.



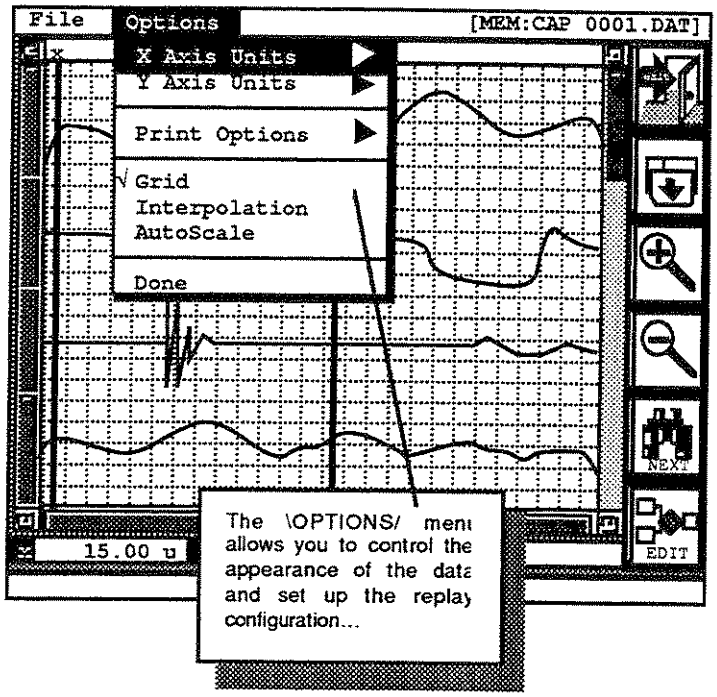
Accessing the -CHART LAYOUT- Screen from the -REPLAY- screen

10.4 The Options Menu

The \OPTIONS/ menu allow you to control the appearance of the data both on the screen and on the chart, independently.

Note: *These menu items pertain only to the screen display of the data: \X-Axis Units >/, \Y-Axis Units >/, \Grid/, \Interpolation/, \AutoScale/*

However, the \Print Options >/ menu and its sub-menu provide many controls analogous to the ones mentioned above for the chart output. We will look at each of these and its effect in the next few pages. Open the \OPTIONS/ menu and see the choices:

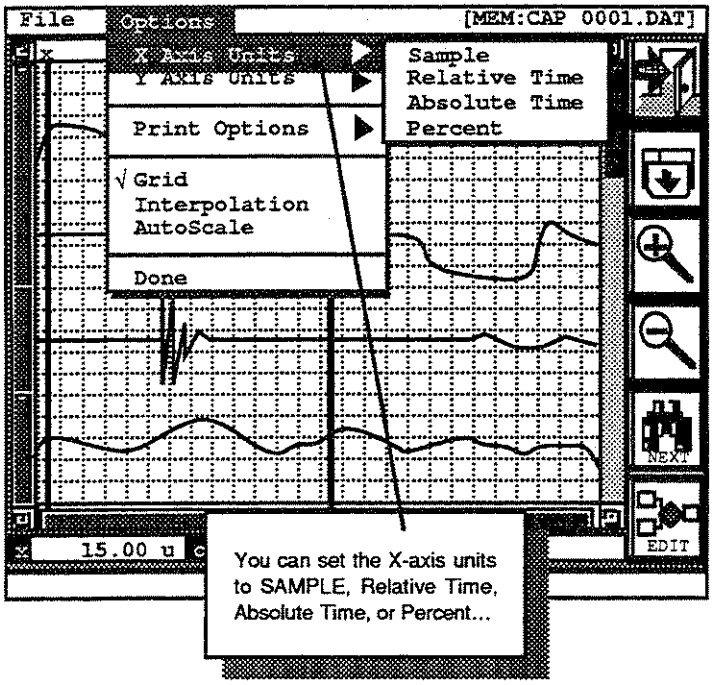


The -REPLAY- screen's \OPTIONS/ menu

10.4.1 Setting the X-Axis Units

The X-Axis is the "time axis" on this screen. It is the horizontal axis on the screen, with time incrementing to the right. You may set the unit of measuremen of this time axis to any one of the following:

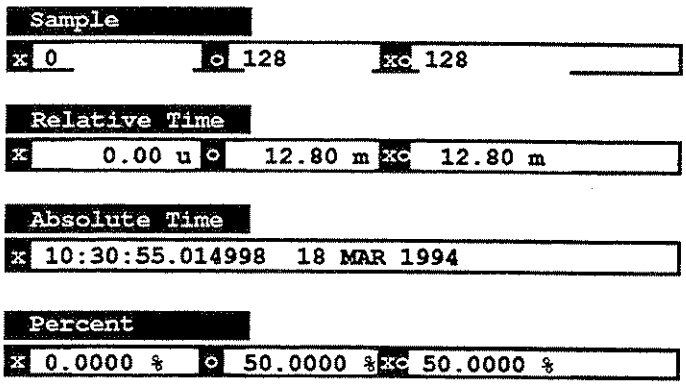
Sample	The actual sample number starting from 1 and going to however many samples/channel there are in this file
Relative Time	Time relative to the trigger point
Absolute Time	The actual time of day when the data was written
Percent	The percent through the file, starting from 0% and ending with 100%



Selecting the X-Axis Units

The selection that you make will be shown "checked" on the sub-menu. You will notice immediately that the fields along the bottom of the screen will change according to which X-Axis unit of measurement has been selected, as follows:

Sample	The samples at the x and o cursors are shown, as well as the "delta-samples" (number of samples between the x and o cursors).
Relative Time	The time relative to the trigger point at the x and o cursors are shown, as well as the delta-Time (amount of time between the cursors).
Absolute Time	Because the absolute time of day (which also includes the date) is so long (HH:MM:SS:UUUUUU DD-MMM-YYYY), there is only enough room on the display to show the location of the x cursor.
Percent	The percentages of the way through the file (starting from 0%) at the x and o cursors are shown, as well as the "delta-%" (percentage of the file between the cursors).

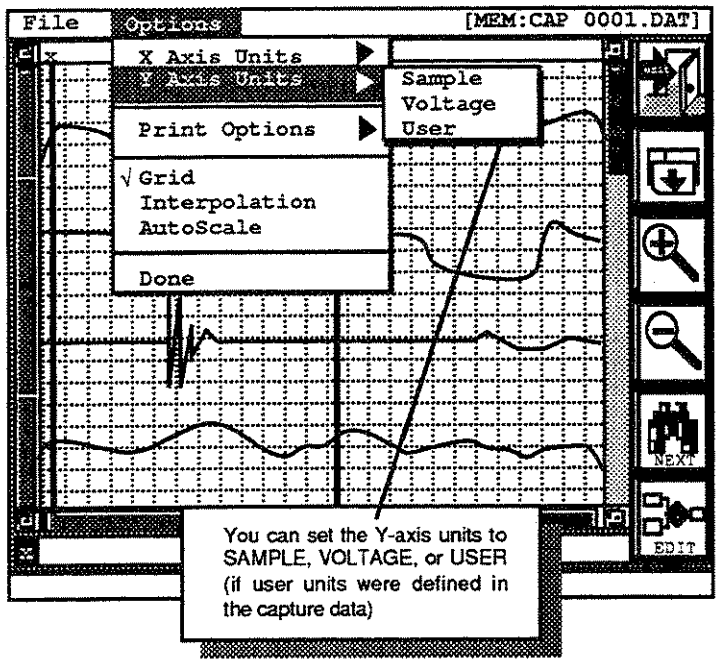


Various Reference Field Configurations Based on the X-Axis Units Setting.

10.4.2 Setting the Y-Axis Units

The Y-Axis is the "amplitude axis" on this screen. It is the vertical axis on the screen, with amplitude increasing upward (assuming that the input was not inverted prior to acquiring the data). You may set the unit of measurement of this axis to any one of the following:

Sample	The actual sample number starting from 1 and going to however many samples/channel there are in this file
Voltage	The DMS1000's voltage reading for this input
User	The engineering units scaling that you may have applied to this input prior to acquiring the data. For example, although an input is ±7.000V as far as the DMS1000 is concerned, you may have set the user units to represent 0 to 1000 PSI. Now that you have acquired and are examining this data, you can restore this scaling factor and units of measurement.



-REPLAY- screen and \Y-Axis Units >/ sub-menu

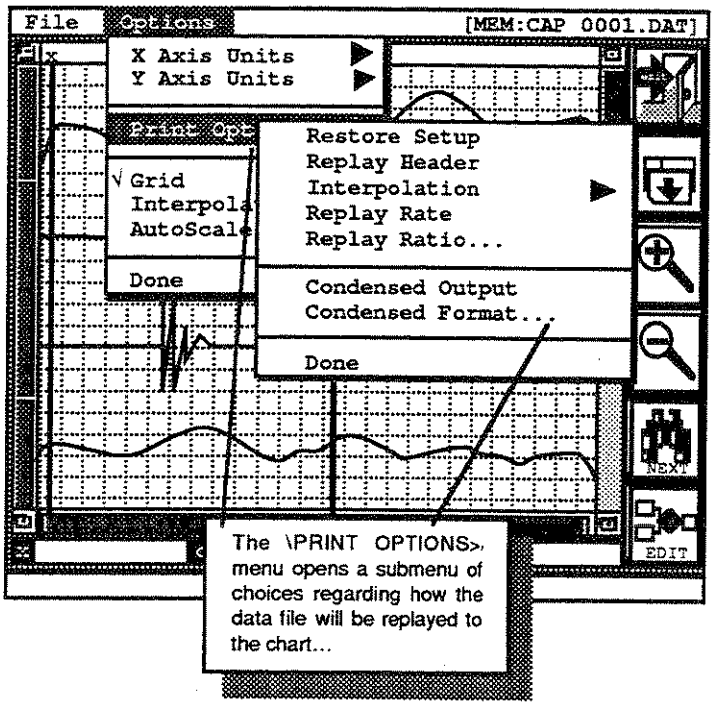
The selection that you make will be shown "checked" on the sub-menu.

10.4.3 Setting the Print Options

There are a number of ways in which you can affect the hard copy presentation of data on the chart. These are accessed using the \\Print Options// sub-menu under the \OPTIONS/ menu. They include:

\Restore Setup/	Restores the setup that may have been saved within the capture data file
\Replay Header/	Turns on/off the replay header that precedes the hard copy printout
\Replay Rate/	Selects the number of samples per second that will be replayed to the chart
\Replay Ratio.../	Used only when data containing and IRIG time code were recorded by the DMS1000 at a rate other than real-time (i.e., replayed data and IRIG time code from tape at a higher or lower tape speed)
\Condensed Output/	Turns on or off the condensed, "book" replay format
\Condensed Format.../	Setting up the style of the condensed, "book" format

We will look at each of these selections in the following pages.



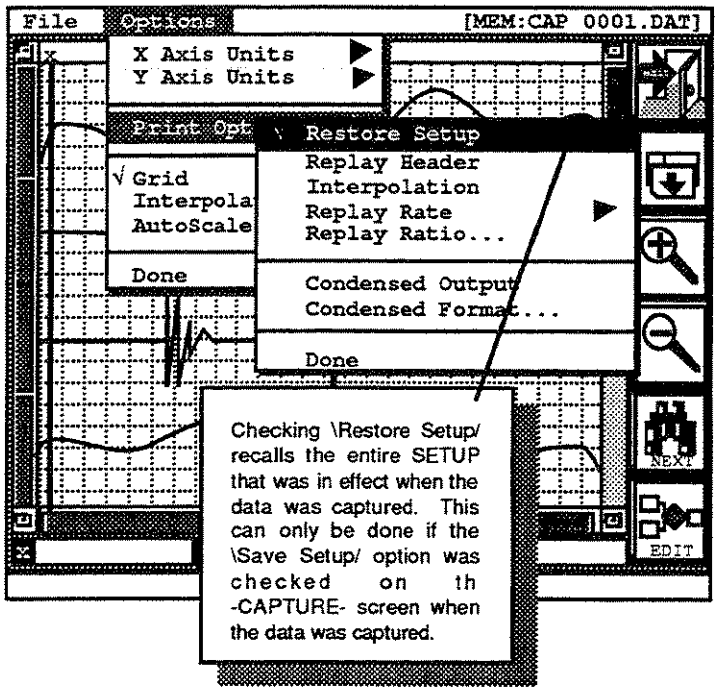
-REPLAY- screen and \\Print Options// sub-menu

10.4.4 Restoring the Setup

Prior to acquisition you may choose to store the entire setup file within the heade portion of the capture data file. You do this on the -CAPTURE- screen under th \OPTIONS/ menu. If you have done this, then the \Restore Setup/ menu item wi be enabled here and you will be able to select it.

If a complete setup file was NOT stored within the capture data file, then thi menu item will be disabled ("grayed out").

Selecting this menu item will restore the entire setup that was in effect at the tim that the data was captured. This includes the entire input and chart layouts, tex annotation, chart speed, etc.

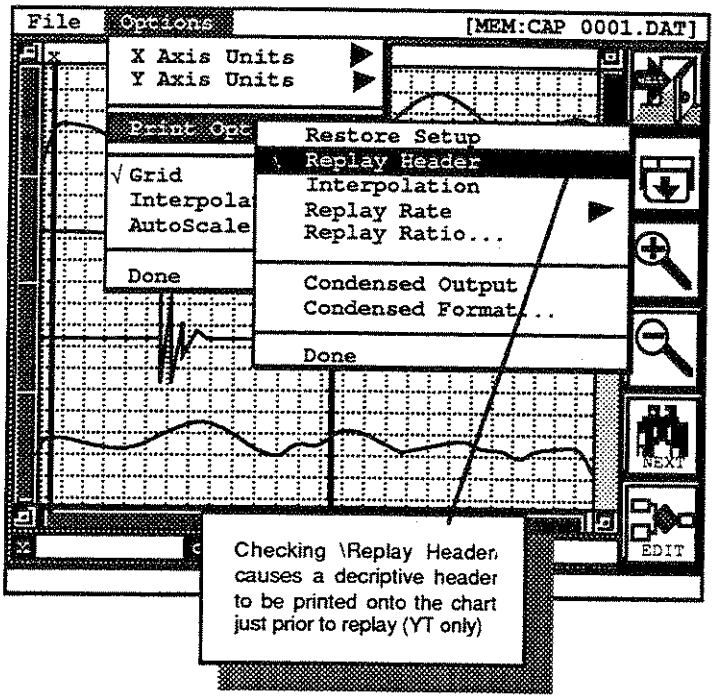


Restoring the Setup Embedded within the Capture Data File

10.4.5 Toggling the Replay Header On/Off

The "Replay Header" is the text box that is printed on the chart just prior to replay. It summarizes pertinent information about the capture data file, including its path and filename, the input channels that it contains, the sample rate, time of acquisition, number of samples, trigger channel, etc.

It is useful reference later on that will help you to better interpret and catalog your hard copy replays. However, it is possible to turn it off so that you do not waste time and paper when you are making hard copies that you do not intend to archive.



Toggling the Replay Header On/Off

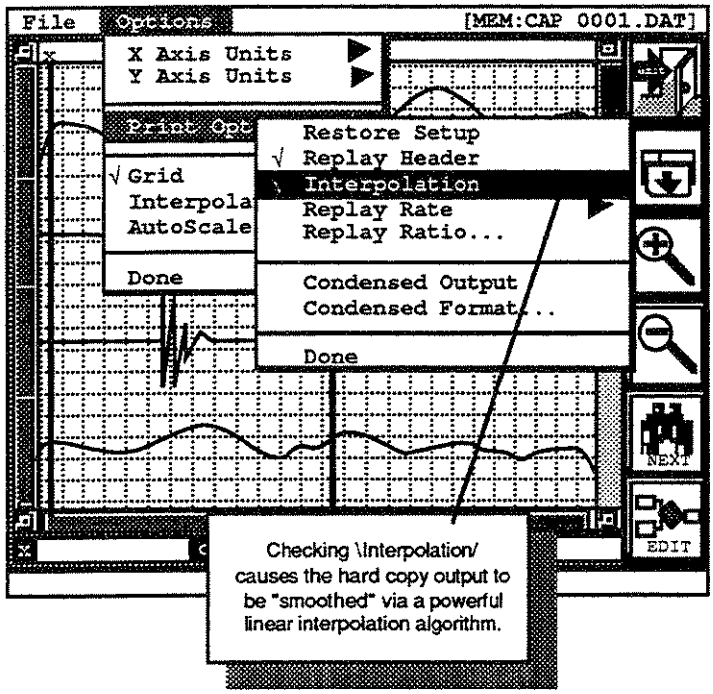
10.4.6 Activating Hard Copy Interpolation

Your may toggle display interpolation on or off with this menu item. This has nc effect on the screen presentation of the data.

Interpolation may be desirable when you have expanded the time axis of a signa greatly by reducing the Replay Rate (see 10.4.7, below) and/or increasing the chart speed by large amounts. If the hard copy develops a "staircase" o "stepped" appearance and you wish to smooth out the data to be more pleasing turn on this \Interpolate/ feature.

This causes the locations between real sample points to be linearly interpolated So instead of simply drawing a line parallel to the X (time) axis between sample points, samples are connected with smooth lines.

The effect is very pleasing to look at, but of course, non-interpolated data is less potentially misleading. This is why we have provided an on/off control, and the default position of this control is OFF.



Activating Interpolation for the Hard Copy Output

Important Notes:

- *Keep in mind that other systems often interpolate as a matter of course and dc not provide any way for the user to disable it. Those users who move to the DMS1000 are sometimes curious about why the default position of this contro is OFF, and why it is necessary.*

- *To apply linear interpolation to the screen display of data, see the \Interpolation/ menu item on the \OPTIONS/ menu, in 10.4.13, below.*

10.4.7 Selecting the Replay Rate

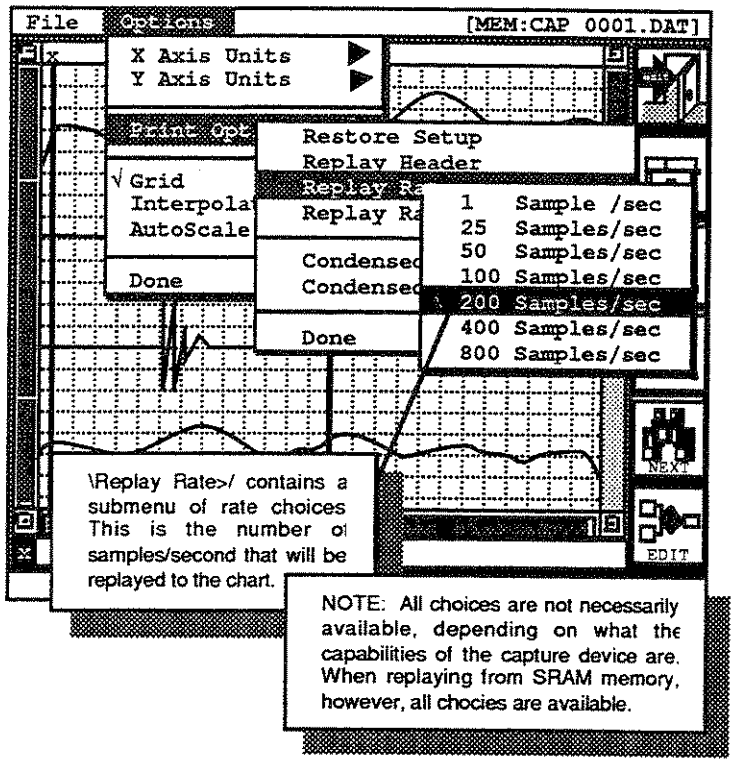
The "Replay Rate" is the number of sample points per second that will be taken from the file and sent to the DMS1000 for hard copy printing. This parameter greatly affects the time base of the hard copy.

Note: You may also change the actual chart speed of the DMS1000 at any time—even during a replay—to affect the effective time base of the hard copy.

Many users leave the actual chart speed at 25 mm/sec or similar, which yields a very dark high-contrast hard copy, and they use the Replay Rate to change the time base.

For example, to "stretch" out the replay (get more time axis resolution), decrease the Replay Rate. When you decrease it, fewer samples are sent to the printer every second. Decreasing the Replay Rate increases the amount of actual time that it takes to replay the data.

To "compress" the replay (get less time axis resolution), increase the Replay Rate. When you increase it, more sample are sent to the printer every second. Increasing the Replay Rate reduces the amount of actual time that it takes to replay the data.



Selecting the Replay Rate

Please note that all selections may not be enabled, depending on which memory volume the file is stored on. Certain hard disks and tape drives, for example, are not fast enough to support the 800 pts/sec rate.

10.4.8 Setting the Replay Ratio

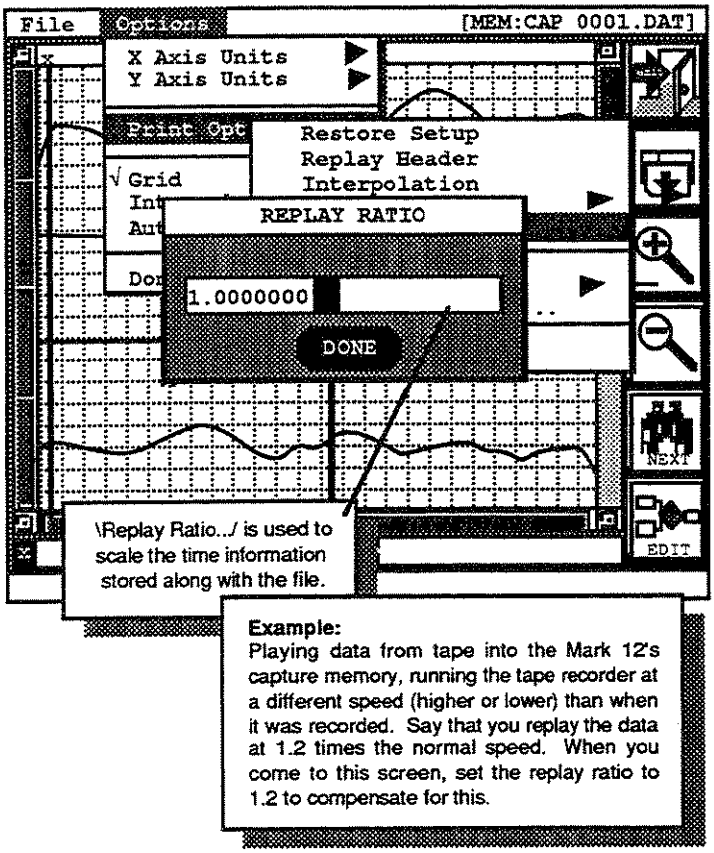
Replay Ratio only applies to data captured when:

- IRIG/NASA Time Code was input and selected as the time source (requires optional M12-TCT), and...
- This data and the time code were not input at 1:1 time ratio.

The second condition only occurs when the data and IRIG were recorded on tape or some other medium and were then replayed into the DMS1000 at a rate other than 1:1. For example, replaying from tape and setting the tape speed to 0.5 of what it was at the time of recording. You must also direct the tape channel containing the time code to the IRIG input jack on the back of the DMS1000 and select this code as the time source prior to acquisition.

If all of these conditions are met, when you come to this screen to replay the data, the "Replay Ratio" parameter allows you to enter a ratio that corresponds to the amount the data

Enter the same number here that represents the time ratio of the data. For example, if you played data into the DMS1000 at 1/2 speed (0.5:1), then you would enter a Replay Ratio of 0.7. If you played data into the DMS1000 at 4.23/1 speed (4.23:1), then you would enter a Replay Ratio of 4.23.



Selecting the Replay Ratio

10.4.9 Condensed Output Mode

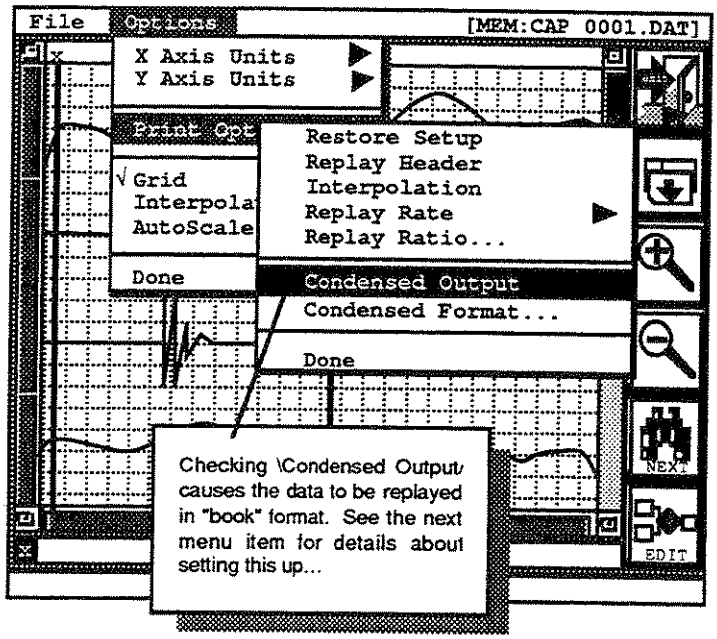
This is an alternate to the regular Y-T presentation that you may be familiar with from using the -CHART LAYOUT- screen. Instead of using whatever chart layout is currently active, the DMS1000 will replay one or two channels of data in a condensed, "book" form, where each input is shown more than once per page.

For example, let's say that you want to replay a single channel to the chart. Given the amount of the file that you wish to replay and the desired time axis resolution, the replay will take 50 meters of chart paper and about 6 minutes of your time.

However, this is just one little channel on a 17.3" wide sheet of chart paper. The Condensed Output Mode will take your single channel and put it on 8 or 16 grids per page, reducing the amount of chart paper and time required to replay the data.

By selecting the 1 x 16 format, you have reduced 50 meters to a little over 3 meters, and 6 minutes of standing around to about 40 seconds.

Please see the next page for a discussion of each of the four Condensed Output Mode formats.



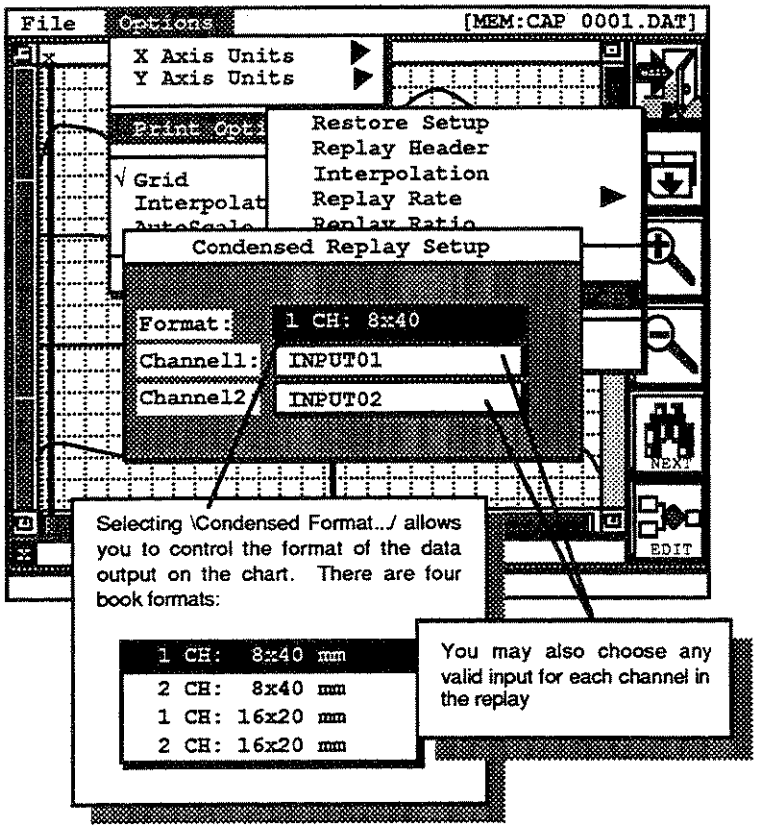
Replaying One or Two Input Channels in Condensed Replay Format

10.4.10 Condensed Output Formats

There are four Condensed Output Mode formats:

- 1CH: 8x40 (1 channel on eight 40 mm wide grids)
- 1CH: 16x20 (1 channel on sixteen 20 mm wide grids)
- 2CH: 8x40 (2 channels on eight 40 mm wide grids)
- 2CH: 16x20 (2 channels on sixteen 20 mm wide grids)

Your may assign any of the inputs that are contained within the current capture data file to the one or two channels to be replayed, as well as the format, via the *Condensed Replay Setup* dialog that appears when you select the \Condensed Output Mode/ menu item:

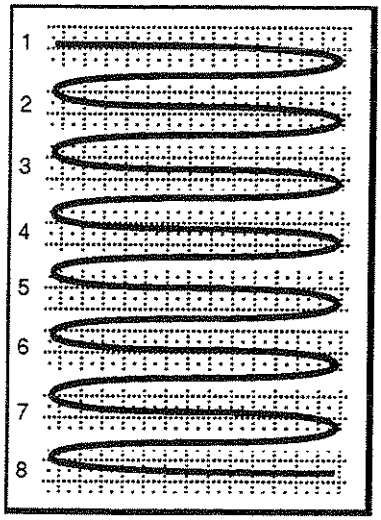


*-REPLAY- screen with *Condensed Replay Setup* dialog box*

When you later select PRINT to make a hard copy, you will see that the capture data file is broken into pages. The screen will indicate how many pages there are to print, as well as which page is currently printing.

Note: When using any of the Condensed Output Modes, overscale printing is not possible

The DMS1000 finds top-of-form before printing each page, and labels each grid with the channel that it contains. The pages are then read just like a book, as in the following illustration:



Reading the Condensed Output Format

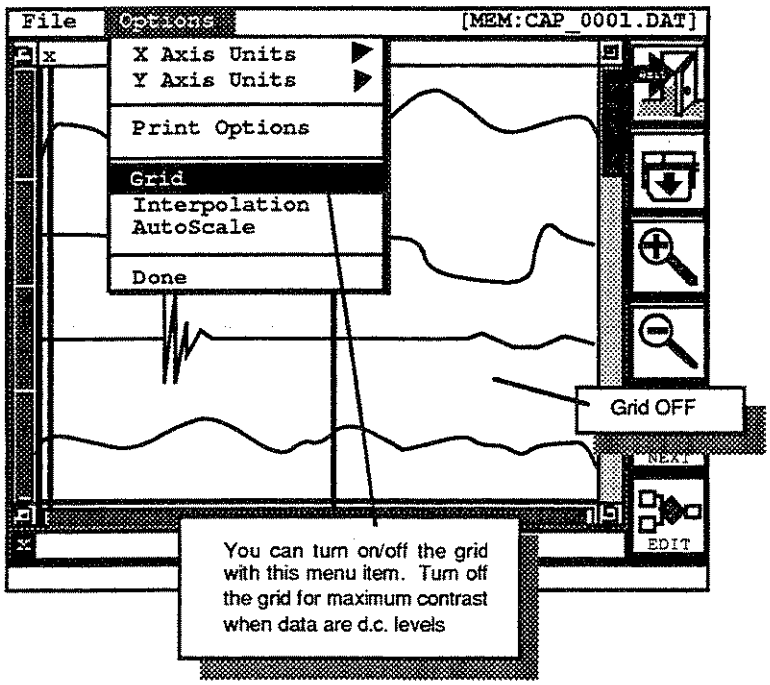
Holding the chart as shown, the top grid is the first "line."

Read left to right and top to bottom just like a book..

How to Read the Condensed Output Format on the Chart

10.4.11 Turning the Display Grid On/Off

You may toggle on/off the grid that is displayed behind the data on the screen This has no effect on the hard copy output.



-REPLAY- screen with \Grid/ sub-menu

Note: To change the grid pattern(s) on the hard copy output, go to the -CHART LAYOUT- screen by selecting \Chart Layout.../ from the \FILE/ menu.

10.4.12 Turning Display Interpolation On/Off

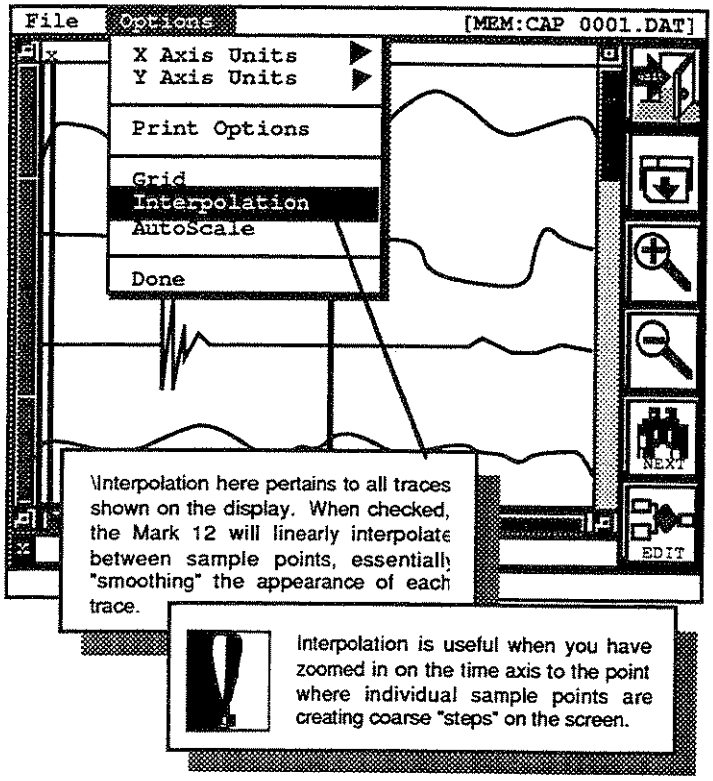
Your may toggle display interpolation on or off with this menu item. This has no effect on the hard copy output.

Interpolation may be desirable when you have expanded the time axis of a signal greatly by zooming in ("magnifying") a very small portion of the file. If the data develops a "staircase" or "stepped" appearance and you wish to smooth out the data to be more pleasing, turn on the \Interpolate/ feature.

This causes the locations between real sample points to be linearly interpolated. So instead of simply drawing a line parallel to the X (time) axis between sample points, samples are connected with smooth lines.

The effect is very pleasing to look at, but of course, non-interpolated data is less potentially misleading. This is why we have provided an on/off control, and the default position of this control is OFF.

Note: *Keep in mind that other systems often interpolate as a matter of course and do not provide any way for the user to disable it. Those users who move to the DMS1000 are sometimes curious about why the default position of this control is OFF, and why it is necessary.*



-REPLAY- screen with \\Print Options// sub-menu

The illustration below shows the effects of linear interpolation.

Example of Linear Interpolation in Action:

Raw sample points

Sample points connected via straight lines (no interpolation)

Line after linear interpolation. Note that "staircase" effect is gone

Linear interpolation is available both for the REPLAY SCREEN display of data as well as for the actual hard copy chart output. There are separate menu commands for controlling each of these functions.

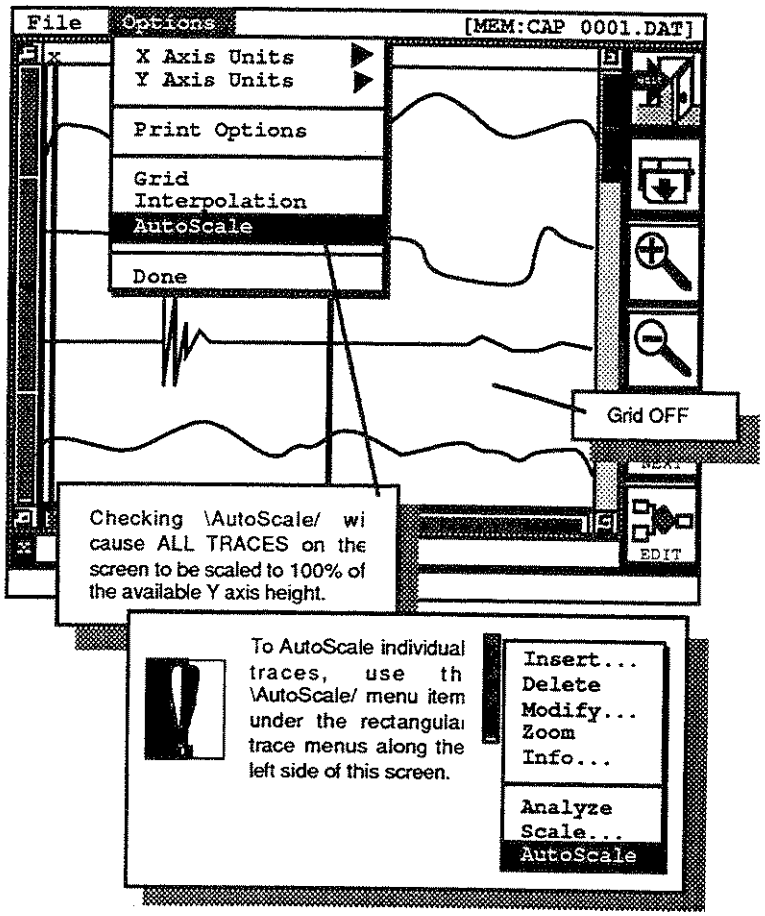
Linear interpolation—before and after

Note: To apply linear interpolation to the hard copy output, see the \Interpolation\ menu item on the \\Print Options >/ sub-menu, above.

10.4.13 AutoScaling the Display

You may wish to scale all of the traces on the display so that they are as large as possible on the amplitude axis. This is called "autoScaling." To AutoScale all of the traces on the display at once, select use the \AutoScale.../ menu item from the \OPTIONS/ menu.

If you wish to AutoScale only individual traces, see the separate \AutoScale/ menu item under the individual \TRACE/ menus described later in this section. See *10.7.8, AutoScaling a Trace*



AutoScaling the Mark 12's -REPLAY- Screen Display

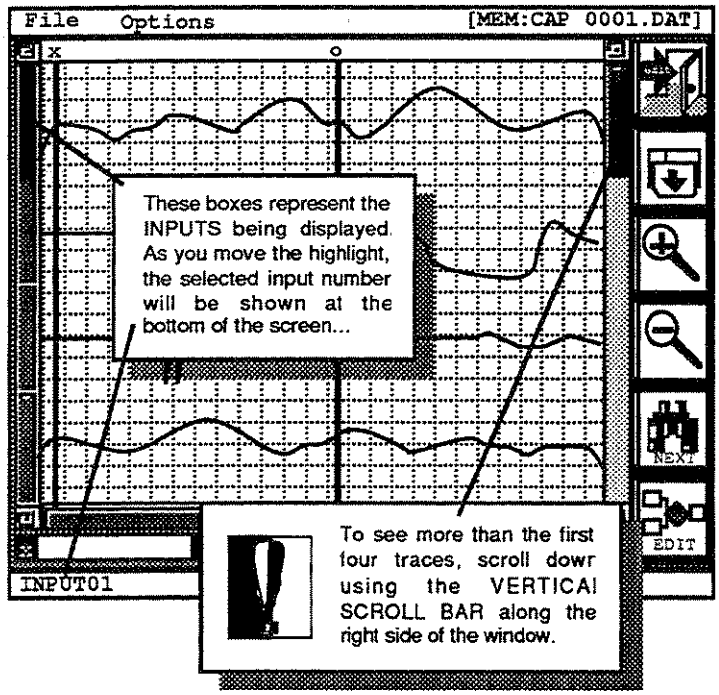
Important Notes:

- *This menu command will AutoScale ALL of the inputs on the display.*
- *To AutoScale individual traces, see the separate \AutoScale/ menu item under the individual \TRACE/ menus described later in this section. See* 10.7.8, AutoScaling a Trace.
- *This has no effect on the hard copy output!*

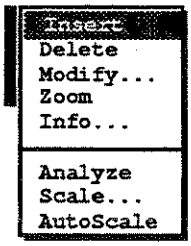
10.5 Trace Menus

Each trace on the display has a rectangular icon along the left edge of the screen. These icons can be selected and, when you press <ENTER>, will revea a \TRACE/ menu containing a variety of important items.

These \TRACE/ menus provide independent control over each trace on the display.



-REPLAY- screen showing the \TRACE/ menus



The \TRACE/ menu

We will examine each of the menu items contained within the \TRACE/ menus in the following pages.