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DASH IV Operations Manual

part number 22834-054

4/20/94

Specifications are subject to change without notice.

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Limited Warranty

Astro-Med warrants all portions of the DASH IV against defects in materials or workmanship for a period of one year from the date of original purchase. If you discover a defect, Astro-Med will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement parts will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts become the property of Astro-Med.

This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication; or has been modified without the written permission of Astro-Med.

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Recorder Identification Data

Congratulations. Your Astro-Med purchase is an investment in the finest of state-of-the-art chart recorder technology. Please use the spaces below to list the model number, serial number, and software version number of your chart recorder. The software provided with your DASH IV is the most current available. Any upgrades of the chart recorder's resident software should be noted in the space provided.

If, for any reason, it should be necessary for you to contact Astro-Med regarding your purchase, please refer to the following:

model number _____

serial number _____

software version
(original installation) _____

upgraded software version
(date installed) _____

upgraded software version
(date installed) _____

upgraded software version
(date installed) _____

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Emissions Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Declaration of Conformity
Declaration de Conformité
Ubereinstimmungserklärung
Dichiarazione di Conformità

Application of Council Directives Application des Decisiõns du Conseil Anwendbar für die Richtlinien Applicazione delle Direttive del Comitato	89/336/EEC 84/539/EEC

Standards to which conformity is declared Standards auquel la conformité appartient Normen für welche Übereinstimmung erklärt wird Norme per le quali si dichiara la conformità	IEC 601-1 IEC 801-2 IEC 801-3	IEC 801-4 EN 55011, Class A EN50082-1:1992	

Manufacturer's name Nom du fabricant Hersteller Nome del costruttore	Astro-Med, Inc.	Model no. Modèle N° Model Nr. Modello N°	DASH IV

Manufacturer's address Adresse du fabricant Anschrift des herstellers Indirizzo del costruttore	600 E. Greenwich Ave. West Warwick, RI 02893 USA	Serial no. N °de série Serien Nr. N.° di serie	_____

Type of equipment Type d'equipement Beschreibung des Gerates Tipo di apparecchio	printer / plotter	year of manufacture année de fabrication herstellungsjahr anno di costruzione	_____

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standard.

Je, Soussigné, déclare que l'équipment spécifié ci-dessus est en conformité avec la directive et le standard ci-dessus.

Ich, der unterzeichnende erkläre hiermit, daß das oben beschriebene Gerät den vorgenannten Richtlinien und Normen entspricht.

Il sottoscritto dichiara che l'apparecchio sopra specificato è conforme alle Direttive e Norme.

Table of Contents

Quick Start

QS	To begin real-time recording right now	QS-1

1 Description and specifications

1.1	A description of the DASH IV	1-1
1.2	Basic system specifications	1-4
1.3	Optional plug-in modules	1-11

2 Hardware features

2.1	Front-panel features	2-1
2.2	Rear-panel features	2-2
2.2.1	Rear-panel connection pin tables	2-3

3 Speed controls

3.1	Controlling the DASH IV's chart speed	3-1
3.1.1	Using the six fixed-speed keys to select a chart speed	3-1
3.1.2	Using the insta-speed keys to select a chart speed	3-2
3.1.3	Programming the insta-speed keys	3-3
3.1.4	Setting the chart speed using the [SPD] key	3-4
3.1.5	Setting the chart speed for data logger recording	3-5
3.2	Referencing the DASH IV to an external motor-clock source	3-6

Table of Contents

4 Setting up a custom grid

4.1	Accessing the grid setups	4-1
4.2	The "MODIFY CHART" setups	4-1
4.2.1	CHANGE GRID: specifying a grid's layout and location on the chart	4-4
4.2.1.1	CHANGE GRID: labeling the grid edges with their voltage values	4-8
4.2.1.2	CHANGE GRID: synchronizing the grid to trilevel timing marks	4-9
4.2.2	CHANGE WAVE: suppressing or enabling the printing of waveforms	4-11
4.2.2.1	CHANGE WAVE: enabling or suppressing signal conditioner reporting	4-12
4.2.3	CHANGE EVENTS: enabling event markers; selecting their chart locations	4-13
4.2.3.1	CHANGE EVENTS: selecting a global event marker style	4-14
4.2.4	DEFAULT TEXT: printing default text in annotation buffers	4-15
4.2.5	DEFAULT CHARTS: selecting a default chart layout	4-16

5 Adding text to the chart

5.1	Adding text to the chart	5-1
5.1.1	Enabling or suppressing printing of text buffers	5-2
5.1.2	Editing text buffers	5-2
5.1.3	Positioning a text buffer on the chart	5-4
5.1.4	Printing the on-demand text buffer	5-5
5.2	Printing channel ID numbers	5-6

Table of Contents

6 Recorder sensitivity and signal adjustment

6.1	Recorder sensitivity and signal adjustment in previous versions of the DASH IV	6-1
6.2	The new-generation DASH IV	6-2
6.3	DASH IV zero and gain controls	6-3
6.3.1	Selecting the voltage sensitivity of the chart	6-7
6.3.2	Selecting either the peak-to-peak or RMS recording mode	6-9
6.3.3	Grounding individual waveform channels	6-10
6.3.4	Positioning a waveform's zero baseline	6-11
6.3.5	Applying zero suppression to waveform signals	6-13
6.3.6	Using the recorder's signal filters	6-14
6.3.7	Converting voltage data to engineering units for numeric reporting	6-16
6.3.8	Selecting a real-time amplitude scaling factor	6-20
6.3.9	Using the DASH IV's DSP integration processing capability	6-24
6.3.10	Using the DASH IV's DSP differentiation processing capability	6-29
6.3.11	Calibrating individual channels with the DASH IV's built-in precision voltage references	6-31

7 Setting up and enabling triggers

7.1	DASH IV triggering capabilities	7-1
7.1.1	Turning on MANUAL, HOST, and EXTERNAL trigger sources	7-2
7.1.2	Combining waveform trigger sources into trigger groups	7-4
7.1.3	Setting trigger reference values	7-7

Table of Contents

8 Data capture

8.1	About capturing data with the DASH IV	8-1
8.2	Data-capture setups	8-2
8.2.1	Selecting a data-capture playback timebase	8-5
8.2.2	Selecting a data capture record size	8-8
8.2.3	The data-capture window and trigger placement	8-10
8.2.4	Selecting a data-capture method	8-12
8.2.5	Setting up the multi-capture data-capture method	8-15

9 Data playback

9.1	Playing back data with the DASH IV	9-1
9.1.1	Selecting either the entire record or a specific part of the record for playback	9-4
9.1.2	Expanding or compressing a data-capture record playback in the time or amplitude axes	9-7
9.1.3	Selecting a chart format for the playback	9-9
9.1.4	Selecting a destination for the playback	9-12

10 Diskette-based input/output

10.1	Input/output functions when using diskettes	10-1
10.2	About the settings that make a recorder setup	10-3
10.3	Saving a recorder setup to diskette	10-4
10.4	Recalling a recorder setup from diskette	10-5
10.5	Renaming files on diskette	10-7
10.6	Deleting files from diskette	10-8
10.7	Formatting diskettes	10-9

Table of Contents

11 System input/output

11.1	DASH IV input/output	11-1
11.2	Setting the system clock	11-3
11.3	Setting up the RS232 interface	11-4
11.4	Setting up the GPIB interface	11-5
11.5	Performing a system software upgrade	11-7

12 Dual speed recording

12.1	Timed and triggered dual speed recording	12-1
12.2	Setting up timed dual-speed recording	12-1
12.3	Setting up triggered dual-speed recording	12-7

13 Using the TIMED START recording mode

13.1	Setting up the TIMED START recording mode	13-1

14 Data-capture record format

14.1	Introduction	14-1
14.2	Floppy operation	14-1
14.3	Data-capture record file format	14-2
14.4	Data description for data-capture record items	14-4
14.5	Waveform data words	14-13

Table of Contents

15 Using the PI-DC bridge module

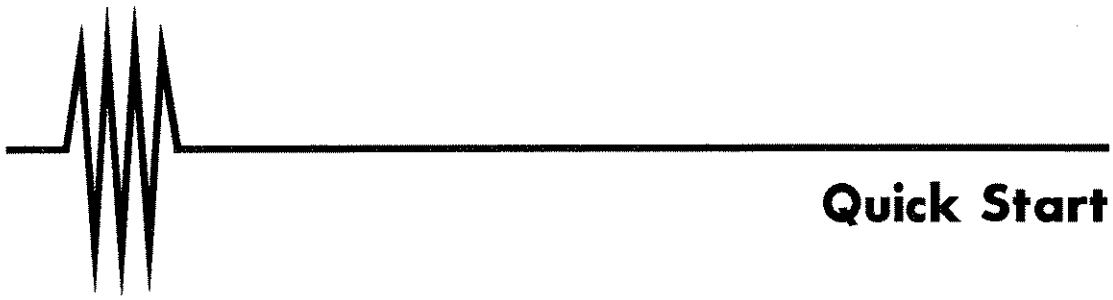
15.1	A description of the PI-DC bridge module	15-1
15.2	Using the module's front-panel controls	15-4
15.2.1	PI-DC module and DASH IV balance controls	15-5
15.2.2	Selecting the excitation voltage	15-5
15.2.3	Selecting a bridge type	15-6
15.2.4	About shunt calibration	15-8
15.3	Sensitivity, measurement units, and balance	15-9
15.3.1	About full-scale sensitivity and measurement units	15-10

16 Miscellaneous recorder functions

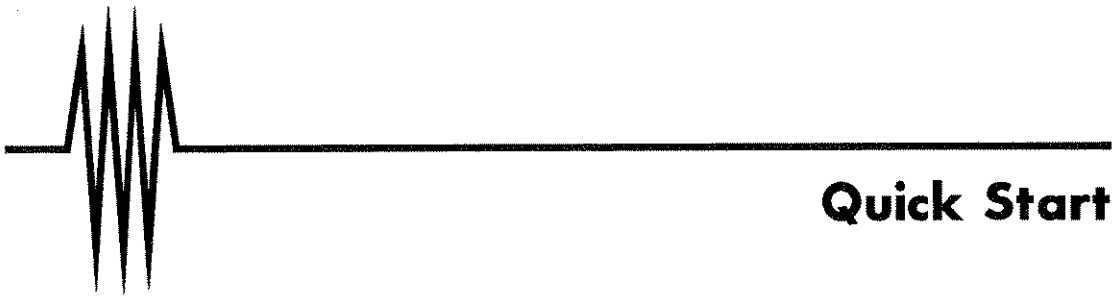
16.1	Miscellaneous recorder functions	16-1
16-2	Using the [HELP] key	16-1
16-3	Using the [EVNT] key	16-8
16-4	Using the [FEED] key	16-8
16-5	Using the [RUN/HALT] key	16-8

17 Maintenance

17.1	Maintenance procedures	17-1
17.2	Changing the fuses / line-voltage setting	17-1
17.3	Cleaning the printhead	17-3
17.4	Replacing or adjusting the printhead	17-5
17.5	Replacing a battery pack	17-11
17.6	Calibrating DASH IV voltage plug-in modules	17-13



Quick Start



Quick Start

QS-1

To begin real-time recording

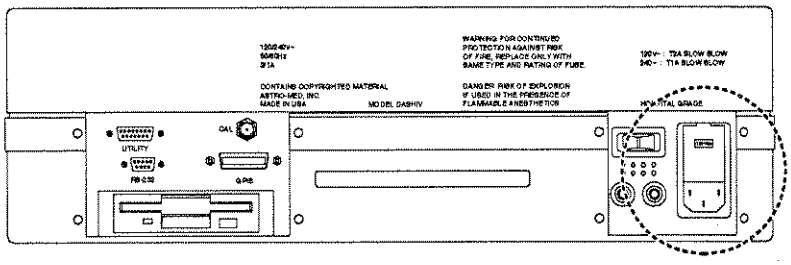
This Quick Start section assumes that you have unpacked your DASH IV and have removed and noted the standard accessories provided with the recorder.

The Quick Start procedure uses the recorder's built-in signal conditioners and is intended to provide a brief introduction to several important operational features.

When recording with the DASH IV's optional plug-in modules, refer to the documentation that accompanies the module.

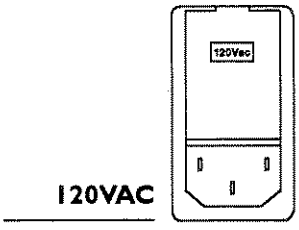
1 **Examine the DASH IV and verify that the recorder has not been damaged during shipment.**

2 **Locate the fuse block / voltage selection box on the recorder's rear panel.**

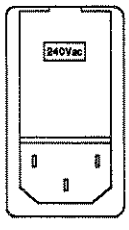


3 **Verify that the recorder is set to the voltage that you will be using.**

- **View the voltage selection cylinder through the window on the fuse block / voltage selection box.**



120VAC

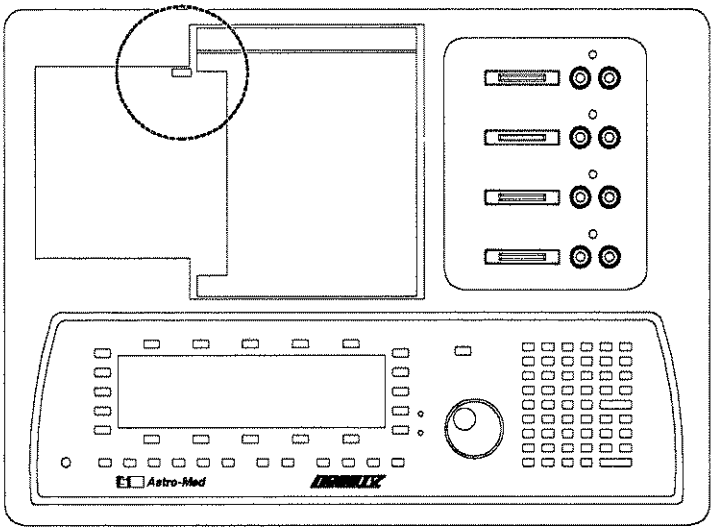


240VAC

To begin real-time recording right now

4 Locate the roll thermal paper supplied with your DASH IV.

5 Open the paper-chamber door by press the paper-chamber door release.

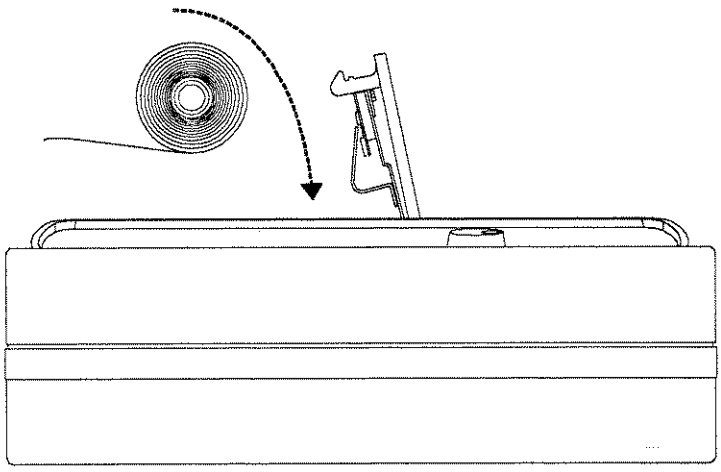


6 As shown in the illustration on the next page, place a roll of thermal paper into the paper chamber.

- Ensure that the thermal paper is inserted so that it unwinds from the bottom of the roll.
- Allow a few inches of paper to extend out of the chamber.

7 Close the paper-chamber door.

To begin real-time recording right now

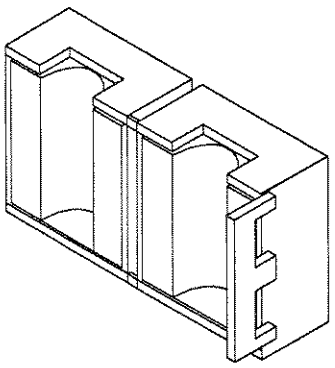


8 Plug the recorder in and turn it on.

9 Locate your banana-jack signal input connectors.

- Signal input connectors are not supplied with your DASH IV. You must supply the signal input connectors.

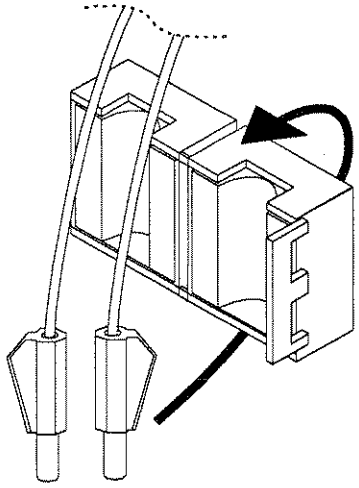
10 Locate and open the ferrite clamp supplied with your recorder.



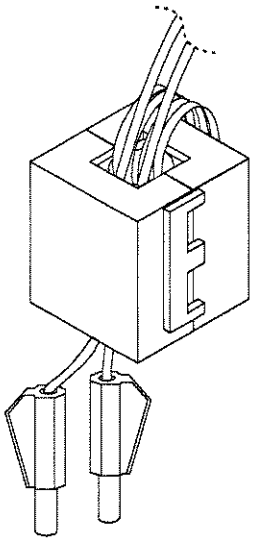
To begin real-time recording right now

11 **Loop the wiring of both of the banana-jack signal inputs several times through and around the ferrite clamp.**

- **The clamp should be positioned as close to the connectors as possible**

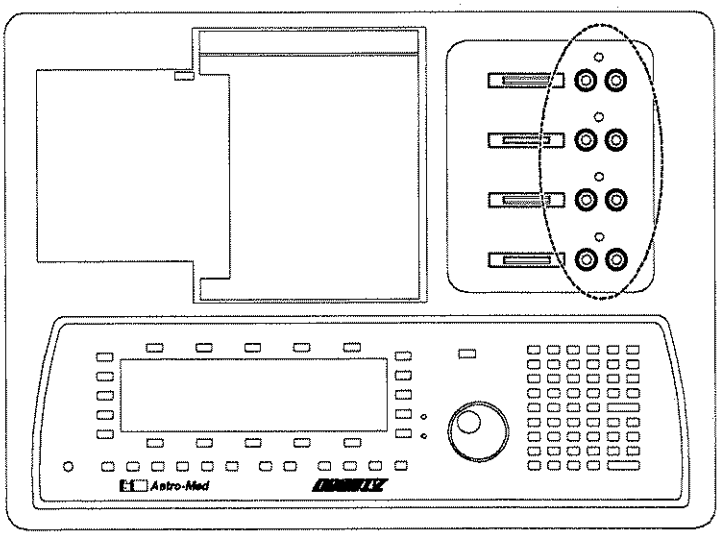


12 **Close the ferrite clamp around the looped wiring.**



To begin real-time recording right now

13 **Using the clamped banana-jack inputs, bring your signals into the recorder at the front-panel signal connections.**



14 **For each channel, use the procedure below to set the voltage sensitivity of the chart so that it is appropriate to the voltage of the input signal.**

- **In the DASH IV, the gain of each channel is expressed as sensitivity and is defined as a specific value in units per centimeter of the chart.**

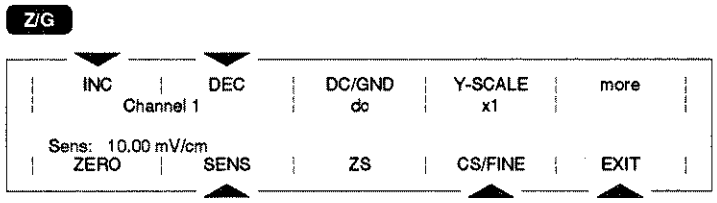
- **Press the front-panel [Z/G] key.**

- **Press the soft key above "INC" or "DEC" until the channel that you want to set the sensitivity for is selected.**

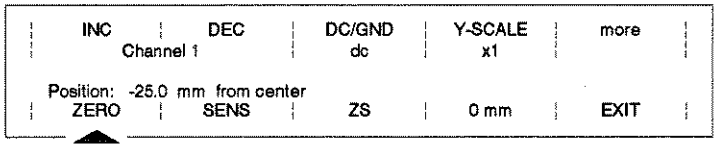
- **Press the soft key below "SENS."**

To begin real-time recording right now

- **Use the encoder wheel to set the voltage sensitivity for the selected channel.**
  - **Sensitivity is expressed as either mV/cm or V/cm.**
- **Press the soft key below "CS/FINE" and select either coarse or fine.**
  - **CS** **the coarse setting uses larger increments to step quickly through the sensitivity settings.**
  - **FINE** **the fine setting uses smaller increments and steps through the full range of sensitivity settings.**



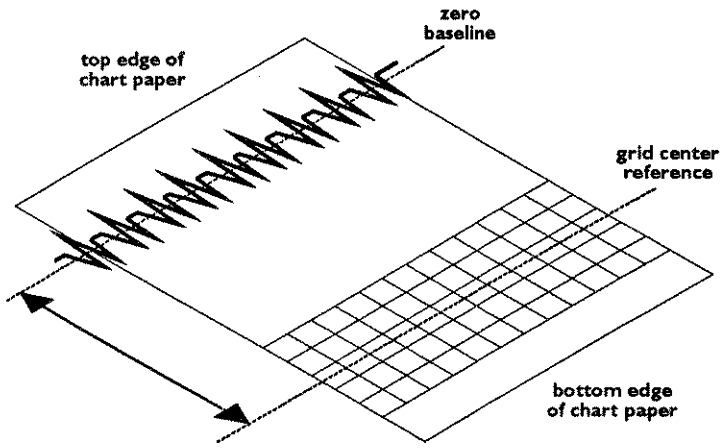
15 **Press the soft key below "ZERO."**



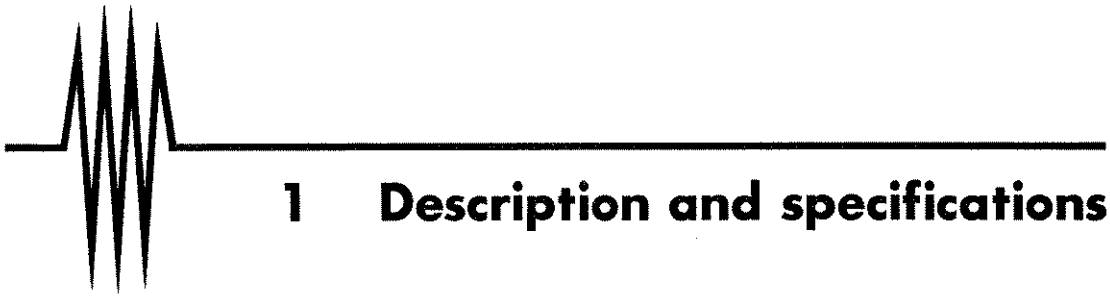
To begin real-time recording right now

16 Use the encoder wheel to position the waveform at the chart location you want.

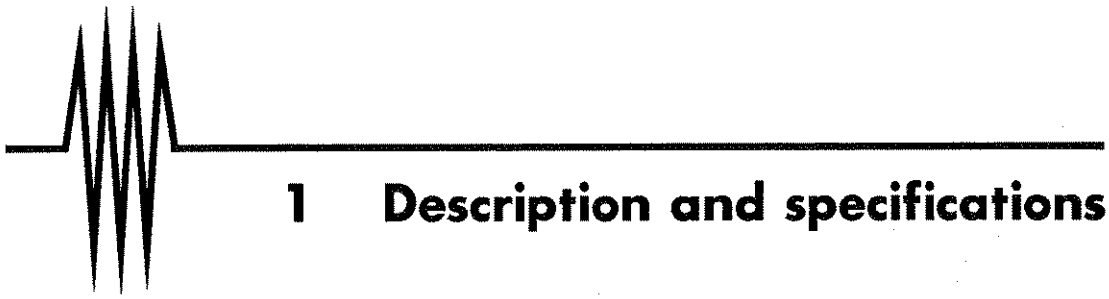
- The zero baseline of the signal moves with reference to the center line of the grid.
- When the encoder wheel is rotated to the right, the zero baseline shifts toward the top edge of the chart.
- When the encoder wheel is rotated to the left, the zero baseline shifts toward the bottom edge of the chart.



17 Press the soft key below "EXIT" to leave the [Z/G] menu.



1 Description and specifications



1 Description and specifications

1.1

A description of the DASH IV

The DASH IV is a four-channel portable field recorder that can operate using AC power, DC power, or optional internal battery. With cast-aluminum chassis, compact size, and advanced signal processing, the DASH IV is ideal for demanding field and laboratory applications.

This extraordinary new-technology recorder offers the following advantages:

- easy-access front-panel controls
  - every significant recorder function is readily accessed using the simple, straightforward controls of the front panel.
  - controls include zero/gain key, system parameter key, speed selection keys, HELP key, battery status LED, trigger status LED, encoder wheel, and much more.
- bright, vacuum-fluorescent front-panel monitor
  - view real-time waveform activity at a distance, halt the chart paper and view data on the monitor only.
  - 100 Hz refresh rate displays high-frequency signals clearly.
- convenient rear-panel connections
  - RS232 and GPIB communications interfaces standard.
  - standard 3.5", 1.4 MByte DOS-compatible floppy drive used for nonvolatile storage of system setups, captured data, and for system software upgrades.
  - output for 2.5/10V precision voltage reference used to ensure exactly calibrated charts.
- digital signal processing (DSP)
  - each channel is supported by a dedicated digital signal processing circuit and an analog-to-digital converter (ADC).
  - each DSP processes the ADC output for printing or data-capture memory.
  - allows low-pass filtering in 1 Hz increments.

1.1

A description of the DASH IV

- high-performance built-in signal conditioning
  - standard built-in signal conditioners provide 20 kHz frequency response, zero suppression, inputs for 250 VDC or RMS, and isolated inputs.
- four flexible-format recording channels
  - four channels up to 128mm wide can be placed anywhere on the chart in any combination of single-channel or overlapped formats.
  - grid sizes from 1mm to 128mm with complete control of minor division spacing.
  - six types of alphanumeric annotation including:
    - four 128-character channel annotation buffers.
    - one system log buffer that prints the time, date. chart speed, time mark setting, and operating mode.
    - signal conditioner reporting prints the gain settings for each waveform channel in the last 32 character spaces of the channel annotation buffers.
    - one 128-character on-demand annotation buffer.
    - channel identification numbers over-printed on waveforms when front-panel [ID] key is pressed.
  - full-scale values of grid edges printed in either voltage or specified engineering units.
  - event marker manually activated from front-panel [EVENT] key.
  - tri-level timing marks can be printed on the chart's right edge, left edge, or both.
    - vertical grid lines can be synchronized to the timing marks making the entire grid a time line for easier waveform analysis.

1.1

A description of the DASH IV

- chart calibration in engineering units
  - print scale values directly in °C, °F, PSI, or any engineering units appropriate to your application.
  - all chart annotations and all menu selections appear in the defined engineering units.
- optional plug-in modules
  - thermocouple, DC bridge, high voltage, and current shunt modules plug directly into front-panel inputs.
  - modules are automatically recognized.
- optional data-capture and playback
  - capture up to 128 ksamples per channel at sample rates from 10 Hz to 200 kHz.
  - data from all channels captured in 16, 32, 64, or 128 ksample blocks.
  - up to sixteen 16-ksample records per channel can be stacked to a total of 1 MegaSample.
  - playback data to VF monitor, to the chart, or to both.
  - archive captured data to floppy drive for nonvolatile storage.
  - archive captured data to host computer over either GPIB or RS232 interfaces.

1.2

Basic system specifications

input type	single-ended, isolated
input connector	guarded banana jack
input range	5 mV/cm to 30 V/cm
maximum operating input	±10V for sensitivities ≤ 425mV/cm ±350V for sensitivities > 425mV/cm
operating modes	peak-to-peak or RMS
input coupling	DC
input impedance	1 Megohm
maximum safe input	250 VRMS, 350 VDC, 350 Vpeak
CMR (IMR)	greater than 95 dB @ 60 Hz
common mode voltage	250 VRMS
cold start drift	<0.75 mm in 10 minutes
baseline drift with time	<.05 mm/24 hours
baseline drift with temperature	.05 mm/°C
intrinsic noise	<0.5 mm
baseline offset	<0.2 mm
calibration accuracy	± 0.5%
calibration stability with time	<0.5 mm/24 hours

1.2

Basic system specifications

calibration stability with temperature	<0.05 mm/°C
RMS accuracy	±2.0%
RMS crest factor	5% error at crest factor of 10 (peak less than 384V)
nonlinearity	<0.1%
frequency response	-1 db @ 12 kHz -2 db @ 16 kHz -3 db @ 20 kHz
A/D sample rate	200 kHz 20 kHz when any internal filter enabled
user-selectable filter	2 pole 12 dB/octive
user-selectable filter range	1 to 1000 Hz in 1 Hz increments, 50 or 60 Hz notch, or mean
user-selectable filter response	-3 dB at selected low pass frequency -40 dB at notch frequency
chart speed accuracy	±2%
zero suppression range	±250V or ±5V on in millvolt range
zero suppression accuracy	±5% of zero suppression setting
zero position accuracy	±0.2%
AC input leakage current	<50 µA
AC input hypot breakdown	>1500VRMS

1.2

Basic system specifications

AC input current rating	2 Amps @ 120VAC 1 Amp @ 240VAC
power rating	120/240 VAC, 50/60 Hz
DC input min/max	12 - 21VDC
battery charge time	12 hours with power off
battery life	1 hour nominal
operating temperature	0°C to 45°C
storage temperature	-20°C to 80°C
operational relative humidity	0% to 95% RH noncondensing
operational vibration	2G
weight	26lb without battery 30lb with battery
data capture memory	128 ksamples/channel (optional)
stacked captures	2 - 16 captures, 1 MegaSample total, all channels
data capture rearm time	0.7 to 7 seconds; more if real-time in parallel
data capture archive to/from floppy time	2 minutes or more depending on record size
time bases	100 µs/mm, 200 µs/mm, 400 µs/mm, 1 ms/mm, 2 ms/mm, 4 ms/mm, 10 ms/mm, 20 ms/mm, 40 ms/mm, 100 ms/mm, 200 ms/mm, 400 ms/mm, 1 s/mm, 2 s/mm

1.2

Basic system specifications

playback magnifications	x1, x2, x4, x8, x1/2, x1/4, x1/8
time speeds	0.02s, 0.04s, 0.1s, 0.2s, 0.4s, 1s
internal event markers	8 interchannel 1 system
annotation buffers	eight 128-character buffers one 28-character system log buffer one 128-character on-demand buffer
host computer interfaces	RS232 - XON/XOFF - hardwire GPIB
baud rate	300, 600, 1200, 2400, 4800, 9600, 19200
GPIB address	0 - 31
nominal bandwidth	20 kHz
grid choices	complete metric grid builder for flexible widths
grid synchronization	grid time lines can be synchronized to internal time reference
custom recording formats	user designs unique charts by means of standard recorder menus
data capture option	■ provides each channel with 128 Ksamp ■ memory is independent and records can be stacked but not linked. ■ Records can be stacked. ■ data capture occurs in background ■ data capture records timed stamped

1.2

Basic system specifications

sample rates	■ 10 to 200 ksamples per second ■ rates expressed in terms of time per mm of x1 playback ■ for filtered channels with timebases faster than 20 kHz data will be captured at 20 kHz and expanded
record sizes / trigger window	■ 16 ksamp x 4 channel: start, center, or end trace ■ 32 ksamp x 4 channel: start, 25%, center, 75%, or end trace ■ 64 ksamp x 4 channel: start, 11.5%, 25%, 37.5%, center, 61.5%, 75%, 87.5%, or end trace ■ 128 ksamp x 4 channel: start, 11.5%, 25%, 37.5%, center, 61.5%, 75%, 87.5%, or end trace ■ a maximum of 16 data capture records stacked in CPU DRAM ■ 1 million sample (2 Mb) total archival storage
indicators	■ battery status ■ arm ■ trigger
recording method	direct writing thermal array
amplitude resolution	300 dpi
system log	automatic printing of time, date, chart speed, and time mark setting
channel identification	numerical identification of waveform channels via front-panel [ID] key

1.2

Basic system specifications

time base resolution	■ 8 dpm: speeds of 101 mm/s to 200 mm/s ■ 16 dpm: speeds of 1 mm/s to 100 mm/s ■ 20 dpm: data capture playback
paper type and size	roll thermal paper; 48 meters per roll
real-time speeds	1 mm/min to 200 mm/s
maximum number of waveforms	4
maximum waveform size (viewable)	128 mm
chart width	140 mm
real-time clock	provides time stamping for channel and data
remote start/stop	TTL or remote switch closure
disk drive	■ 3.5 inch removable diskette ■ format: MDOS compatible ■ maximum capacity: 1.4MB ■ used to: - save recorder setups and annotation - store waveform data - perform software upgrades
trilevel timing marks	located on either the right, left, or both sides of the chart and printed at intervals of x1, x10, x100 based on one of five time mark intervals: .02s, .04s, .1s, .5s, or 1s.

1.2

Basic system specifications

front-panel display	■ built-in vacuum fluorescent screen used to display text and waveforms. ■ size: 166.25mm x 41.45mm ■ resolution: 256 (w) by 64 (h) ■ waveform format: waterfall scroll ■ refresh rate: 100 Hz
data conversion and signal processing	each channel has its own analog-to-digital converter (ADC) and digital signal processor (DSP)
ADC resolution	12 bits
datalogger recording	numeric reporting of waveform data in user-specified engineering units
dual speed recording	system toggles between any two chart speeds based on time interval or trigger
timed recording	system programmed to start and stop recording at specific dates and times
basic triggering	waveform, front panel, host computer, external TTL, or switch closure
dimensions	■ 5.5" high ■ 17.5" wide ■ 11.62" deep

1.3

Optional plug-in modules

For special recording requirements, the DASH IV can be equipped with any of the following plug-in modules:

- thermocouple amplifiers
- DC Bridge amplifiers
- high voltage amplifiers
- current shunt amplifiers

These optional modules plug directly into the recorder front-panel signal inputs. A maximum of four modules of any type may be used. Modules are powered by the DASH IV. The modules are automatically recognized. The identities and functions of the modules are displayed on the monitor and printed on the chart.

The menus displayed by the recorder automatically reflect of the functions of the plug-in module in use.

Specifications for each plug-in module are given below.

thermocouple input module

maximum input range	■ Type K: -40 °C to 1200 °C ■ Type J: -40 °C to 600 °C ■ Type T: -40 °C to 350 °C
sensitivity	10 °F/cm to 400 °F/cm
modes	°C or °F
maximum CMV	250V
gain error	<3%
noise	<1 mm
warm-up time	less than 5 minutes

1.3

Optional plug-in modules

thermocouple input module

drift	<2 mm
reporting	yes
external tranducer requirement	none

high voltage input module

maximum input range	1200V peak or 500Vrms
sensitivity	1 V/cm to 100V/cm
modes	peak-to-peak or RMS
maximum CMV	1000V
input impedance	10 MegOhm
frequency response	-3 dB at 1 kHz
CMR	≥80 dB at 60 Hz
gain error	<1% of full scale
noise	<1 mm
warm-up time	less than 2 minutes
drift	<1 mm
reporting	yes
external tranducer requirement	none

1.3

Optional plug-in modules

current shunt input module

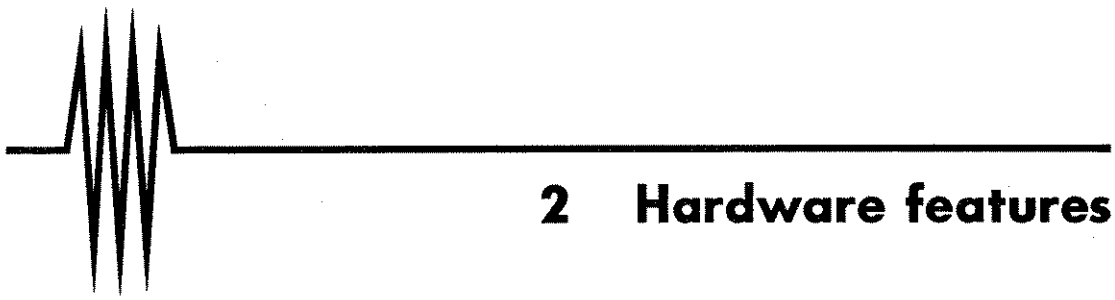
maximum input range	9 VDC or RMS
sensitivity	5 mV/cm = 5/R external shunt mA/cm
modes	peak-to-peak or RMS
maximum CMV	1000 V
input impedance	≥10 MegOhm
frequency response	-3 dB at 1 kHz
CMR	≥100 dB at 60 Hz
gain error	<1% of full scale
noise	<1 mm
warm-up time	less than 2 minutes
drift	<1 mm
reporting	yes
external tranducer requirement	yes, external shunt resistor

1.3

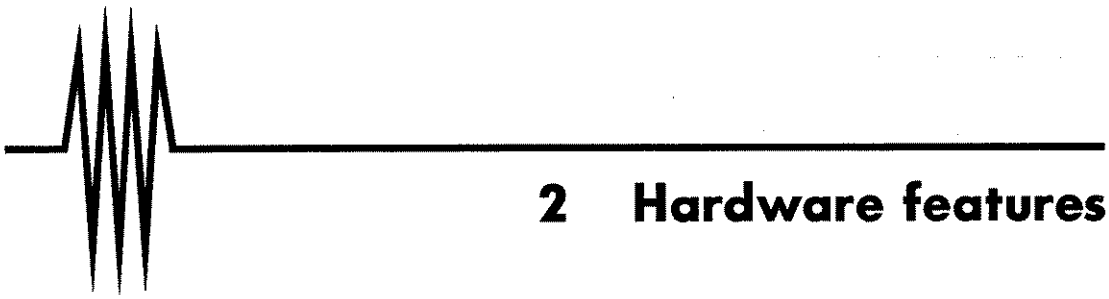
Optional plug-in modules

DC bridge input module

maximum input range	500 mV
sensitivity	250 µV/cm to 50 mV/cm
modes	peak-to-peak or RMS
maximum CMV	250V peak
input impedance	20 MegOhm, balance to common
frequency response	≥3.5 kHz
bridge completion	■ 1/2 bridge: internal ■ 1/4 bridge: external resistor with equal value of the gage (active arm required)
bridge balancing (zero)	manual using encoder wheel
CMR	≥100 dB at 60 Hz
gain error	<1%
noise	<2 mm (input shorted)
warm-up time	1 minute
drift	<2 mm
reporting	yes
external tranducer requirement	yes



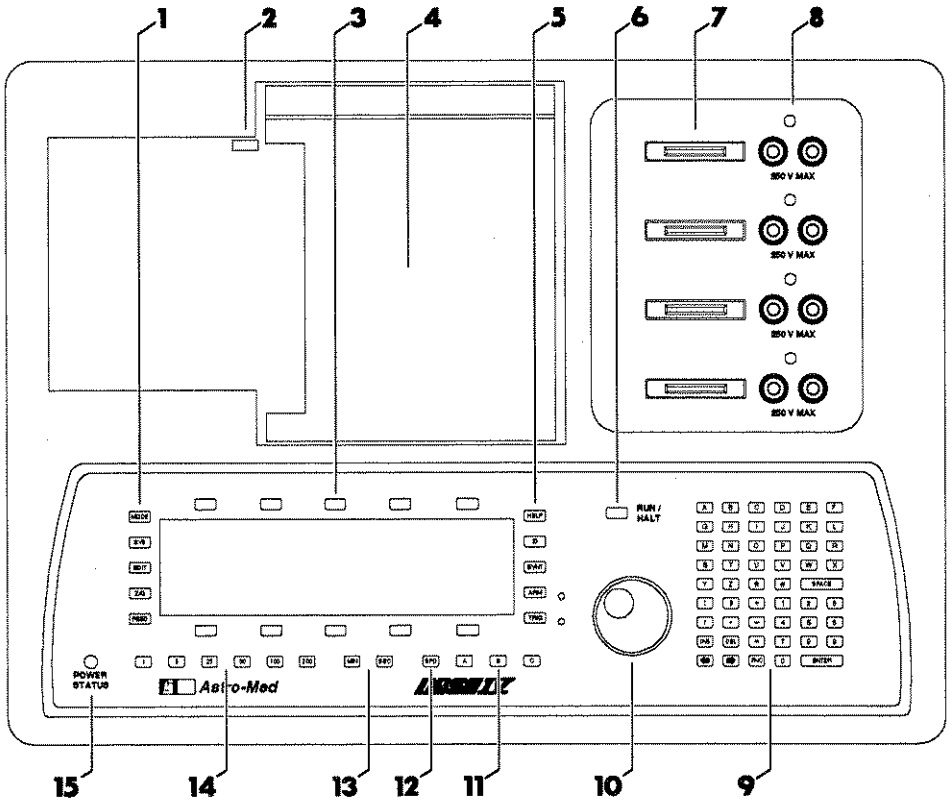
2 Hardware features



2 Hardware features

2.1

Front-panel features



callout	description
1	left-side control group: • [MODE] key • [SYS] key • [EDIT] key • [Z/G] key • [FEED] key
2	paper-chamber door release
3	soft keys
4	paper-chamber door

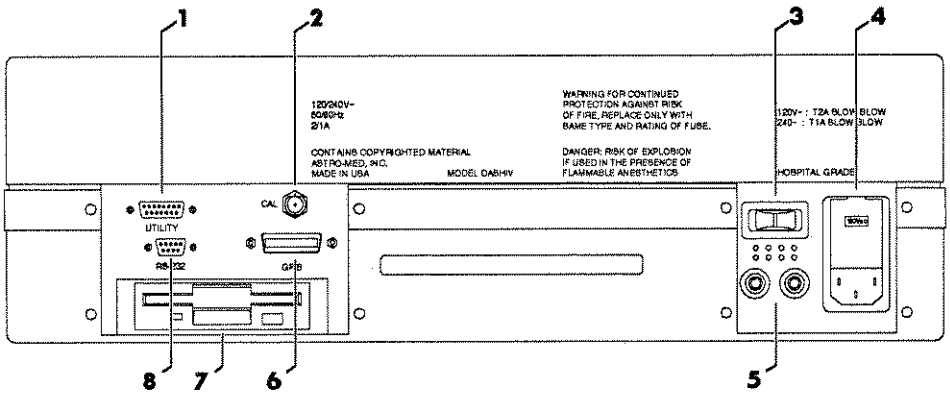
2.1

Front-panel features

callout	description
5	right-side control group: • [HELP] keys • [ID] keys • [EVENT] keys • [ARM] keys • [TRIG] keys
6	[RUN/HALT] key
7	plug-in module connections
8	built-in signal input connections
9	alphanumeric keypad
10	encoder wheel
11	[A], [B], [C] insta-speed keys
12	custom-speed key
13	speed range keys
14	fixed-speed selection keys
15	POWER STATUS indicator

2.2

Rear-panel features



2.2

Rear-panel features

callout	description
1	UTILITY D-shell connector
2	calibration connector (2.5V/10V out) Do not use.
3	power on/off switch
4	AC power input connector
5	DC input connectors
6	GPIB D-shell
7	disk drive
8	RS232 D-shell connector

2.2.1

Rear-panel connection pin tables

RS232 D-SHELL CONNECTOR

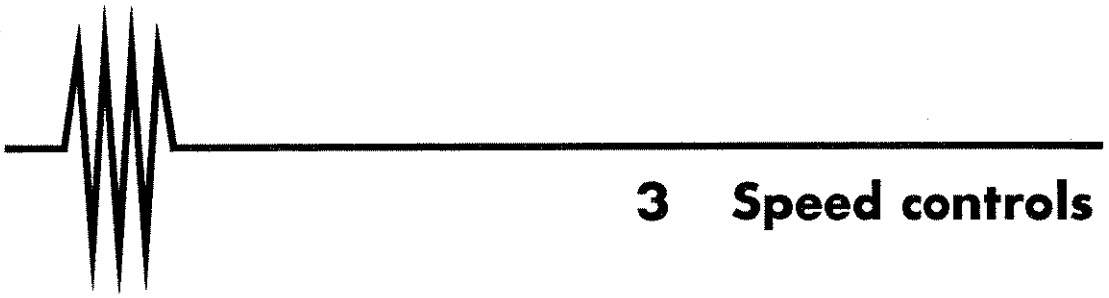
pin	description
1	not used
2	TXD
3	RXD
4	DSR
5	ground
6	DTR
7	internally connected
8	internally connected
9	not used

2.2.1

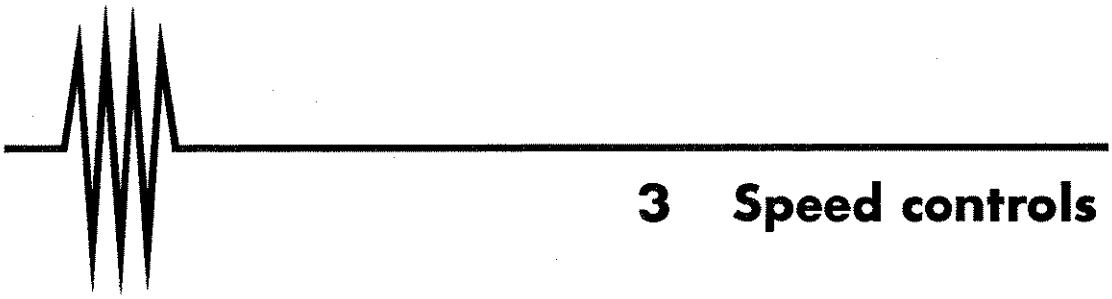
Rear-panel connection pin tables

UTILITY D-SHELL CONNECTOR

pin	description
1	event 1
2	event 2
3	event 3
4	event 4
5	event 5
6	event 6
7	event 7
8	event 8
9	external trigger
10	external motor clock input
11	remote start/stop
12	ground
13	reserved
14	reserved
15	system event



3 Speed controls



3 Speed controls

3.1

Controlling the DASH IV's chart speed

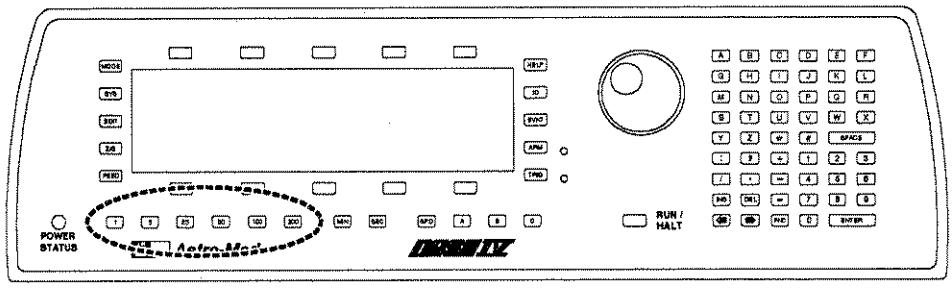
The DASH IV provides you with unmatched versatility in controlling the real-time speed of the chart.

- six front-panel keys allow you to instantly select chart speeds of 1, 5, 25, 50, 100, and 200 mm/second or mm/minute.
- three front-panel insta-speed keys labeled [A], [B], and [C] are programmable to provide three instantly available chart speeds of your choice.
- a front-panel [SPD] (speed) key permits you to program the chart speed of your choice within the DASH IV's operational limits.

3.1.1

Using the six fixed-speed keys to select a chart speed

The six front-panel fixed-speed keys are the simplest way to control the DASH IV's real-time chart speed. Press the key of your choice to have the recorder instantly operate at that speed in mm/sec or mm/min.



3.1.1

Using the six fixed-speed keys to select a chart speed

Press the fixed-speed key of your choice to instantly select that chart speed in millimeters per second or millimeters per minute.

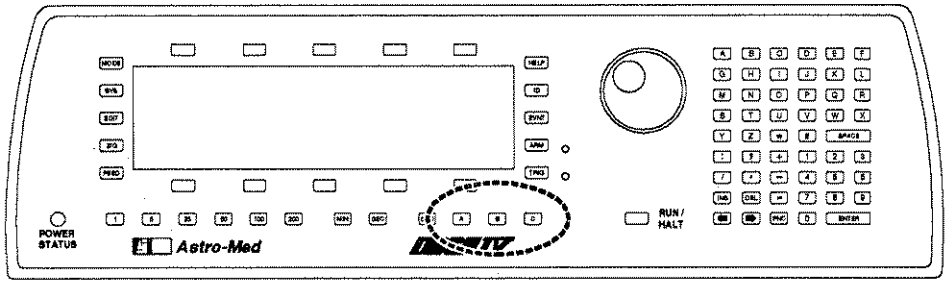
- **[1] selects a speed of 1 mm/sec or mm/min.**
- **[5] selects a speed of 5 mm/sec or mm/min.**
- **[25] selects a speed of 25 mm/sec or mm/min.**
- **[50] selects a speed of 50 mm/sec or mm/min.**
- **[100] selects a speed of 100 mm/sec or mm/min.**
- **[200] selects a speed of 200 mm/sec or mm/min.**

3.1.2

Using the insta-speed keys to select a chart speed

If they have not been programmed to provide other chart speeds, the [A], [B], [C] insta-speed keys will provide the following factory-default speeds instantly when they are pressed:

- [A] 10 mm/sec.
- [B] 75 mm/sec.
- [C] 150 mm/sec.



3.1.3

Programming the insta-speed keys

The [A], [B], [C] insta-speed keys can be programmed to provide any chart speed within the operational range of the DASH IV. Use the procedure below to program the insta-speed keys to the specific speeds your recording requires.

1 **Press the front-panel [SPD] key.**

2 **Press the soft key beneath "INSTA SPEED."**

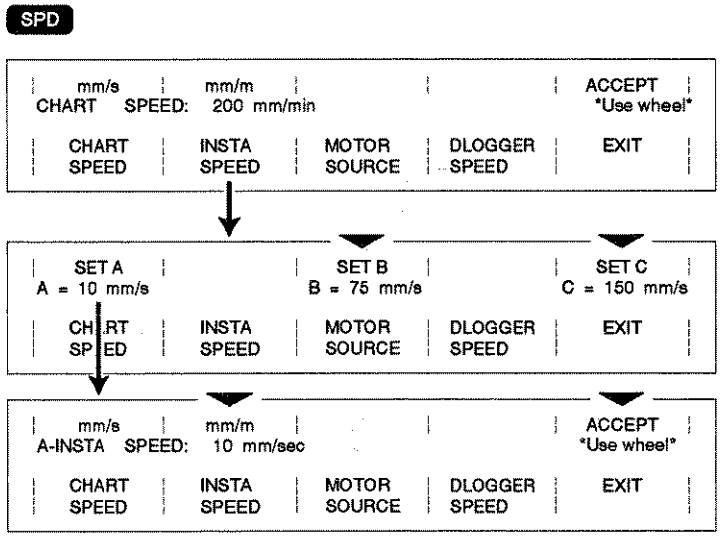
3 **Press the soft key above "SET A" to set the insta-speed for [A].**

4 **Press the soft key above the speed range that you want:**

- **millimeters per second (mm/s).**
- **millimeters per minute (mm/m).**

5 **Use the encoder wheel to select the chart speed that you want to program into insta-speed key [A].**

- **In the mm/s speed range, the available speeds are 1 mm/s to 200 mm/s in 1 mm/s intervals.**
- **In the mm/m speed range, the available speeds are 1 mm/m to 200 mm/m in 1 mm/m intervals.**



3.1.3

Programming the insta-speed keys

6 Press the soft key above "ACCEPT" to confirm the speed choice.

7 Repeat steps 3 through 5 to program insta-speed keys [B] and [C].

3.1.4

Setting the chart speed using the [SPD] key

1 Press the front-panel [SPD] key.

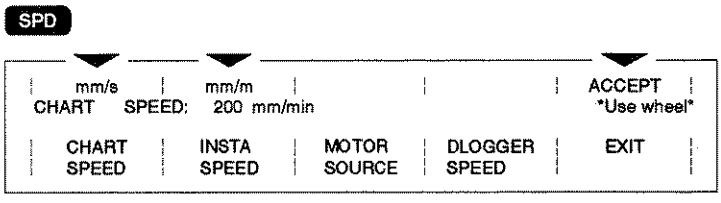
4 Press the soft key above the speed range that you want:

- millimeters per second (mm/s).
- millimeters per minute (mm/m).

3 Use the encoder wheel to select the chart speed that you want.

- In the mm/s speed range, the available speeds are 1 mm/s to 200 mm/s in 1 mm/s intervals.
- In the mm/m speed range, the available speeds are 1 mm/m to 200 mm/m in 1 mm/m intervals.

4 Press the soft key above "ACCEPT" to confirm the speed choice.



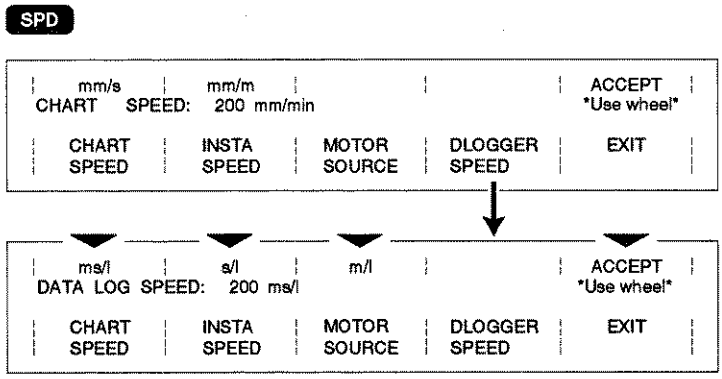
3.1.5

Setting the chart speed for data logger recording

1 **Press the front-panel [SPD] key.**

2 **Press the soft key below "DLOGGER SPEED."**

- **If the active chart format is Data logger, pressing the [SPD] key automatically places you into the "DLOGGER SPEED" menu.**



3 **Press the soft key above the speed range you want:.**

- **milliseconds per line (ms/l)**
- **seconds per line (s/l)**
- **minutes per line (m/l)**

4 **Use the encoder wheel to select the speed you want.**

- **In the ms/l speed range, the available speeds are 200 ms/l to 999 ms/l in 1 ms/l intervals.**
- **In the s/l speed range, the available speeds are 1 s/l to 999 s/l in 1 s/l intervals.**
- **In the m/l speed range, the available speeds are 1 m/l to 999 m/l in 1 m/l intervals.**

5 **Press the soft key above "ACCEPT" to confirm your speed selection.**

3.2

Referencing the DASH IV to an external motor-clock source

Typically, the print rate of the DASH IV's stepper motor is referenced to a dedicated internal clock specifically tasked with stepper-motor timing control. Under this internal control during real-time recording, the stepper motor moves the chart to a maximum rate of 16 steps per millimeter of distance on the chart.

For certain recording applications, it may be convenient to reference the speed of the stepper motor to an external motor-clock source that you supply. This is especially useful when you want the stepper motor speed to be controlled by a variable other than time. For instance, it might be more meaningful to monitor railroad measurements as functions of distance rather than time.

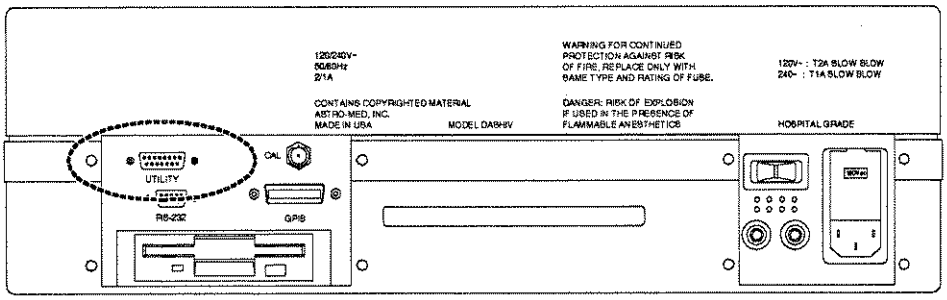
The maximum external motor clock frequency is 800Hz. This corresponds to a speed of 50 mm/s.

When you have configured an external stepper-motor timing source to be referenced in place of the DASH IV's internal clock, use the "MOTOR SOURCE" setup of the [SPD] key to enable the external timing source.

1 **Connect your input stepper-motor clock source to pin 10 of the rear-panel UTILITY D-shell.**

   - **The complete pin table for the UTILITY D-shell is given on page 3-4.**

2 **Connect the associated ground to pin 12 of the UTILITY D-shell.**



3.2

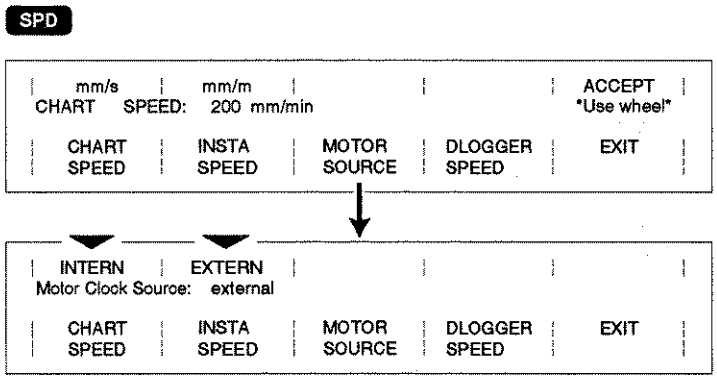
Referencing the DASH IV to an external motor-clock source

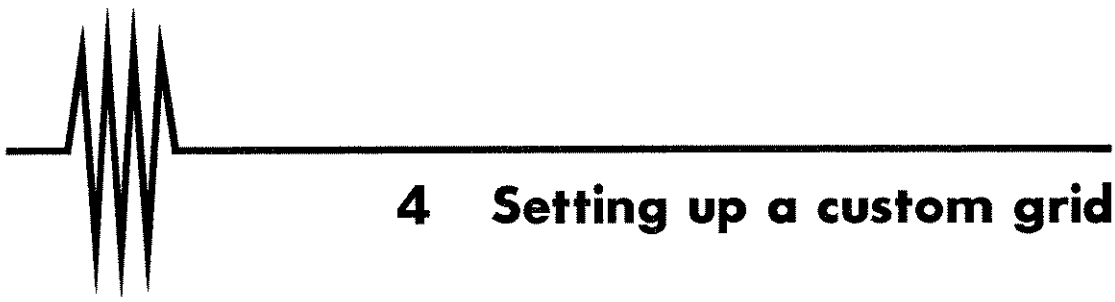
3 **Press the front-panel [SPD] key.**

4 **Press the soft key below "MOTOR SOURCE."**

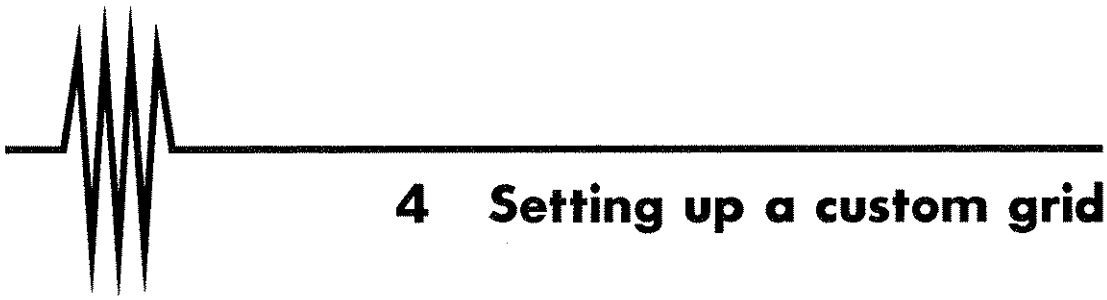
5 **Press the soft key above "EXTERN."**

- **Note that the motor clock source selection shown in the display reads "external."**





4 Setting up a custom grid



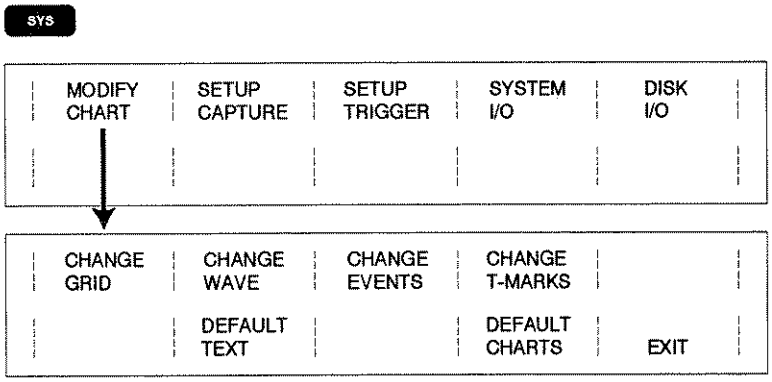
4 Setting up a custom grid

4.1

Accessing the grid setups

To setup a custom recording grid, each of the setups found under the "MODIFY CHART" parameter needs to be defined.

The "MODIFY CHART" setups are accessed by pressing the front-panel [SYS] key and then pressing the soft key above "MODIFY CHART."



4.2

The "MODIFY CHART" setups

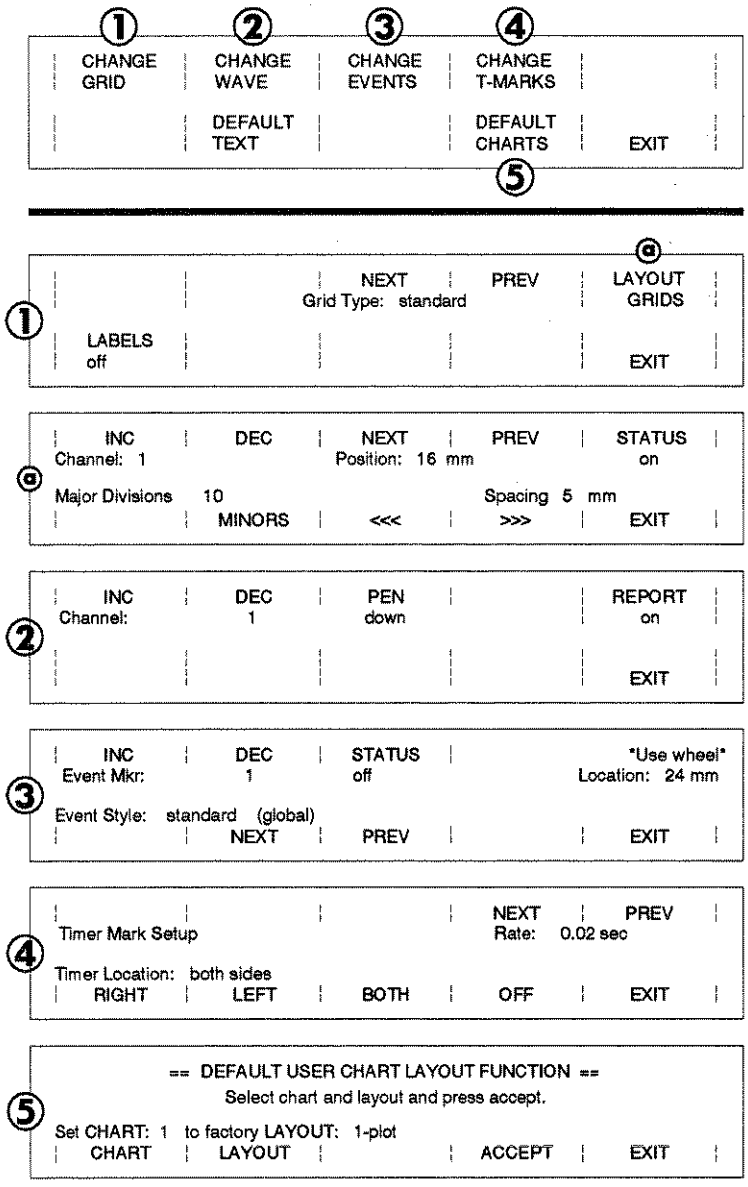
The complete menu flow of the "MODIFY CHART" parameter is shown on the next page.

The "MODIFY CHART" parameter provides the following chart format setups:

- CHANGE GRID
  - synchronizes the time-axis grid lines to trilevel timing marks or prints the time-axis grid lines at the recorder's standard 5mm intervals.
  - enables printing of labels that identify the voltage values of the grid's left and right edges when the recorder's [ID] key is pressed.

4.2

The "MODIFY CHART" setups



4.2

The "MODIFY CHART" setups

- turns printing of the grid on and off.
- turns printing of major and minor grid divisions on and off.
- selects the spacing in millimeters that you want between the grid's major and minor divisions.
- positions the grid on the chart.

■ CHANGE WAVE

- turns printing of the waveform on and off.
- enables or suppresses printing of signal conditioner reporting in the annotation buffer associated with the selected channel.

■ CHANGE EVENTS

- selects an event marker.
- turns printing of the event marker on or off.
- selects an event marker style that will apply to all of the recorder's event markers when they are printed.
- selects the location on the chart where the event marker will be printed.

■ CHANGE T-MARKS

- turns printing of timing marks on and off.
- selects whether the timing marks will be printed on the chart's left edge, right edge, or both edges.
- selects the internal time reference that will serve as the base time that determines the duration represented between each timing mark tick.

4.2

The "MODIFY CHART" setups

- DEFAULT TEXT
  - causes all interchannel annotation buffers to print a default channel identification such as "CHANNEL 1."
- DEFAULT CHARTS
  - provides a selection of four default grid layouts to be used with one of four chart setups.

4.2.1

CHANGE GRID: specifying a grid's layout and location on the chart

The LAYOUT GRIDS selection of the CHANGE GRID parameter permits you to design exactly the grid you want by allowing you to specify:

- the number of major divisions your grid will contain.
- the number of minor divisions your grid will contain.
- the spacing in millimeters between grid divisions.
- the location of the right edge of the grid on the chart.

Use the following procedure to layout the grid that you want.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE GRID."**

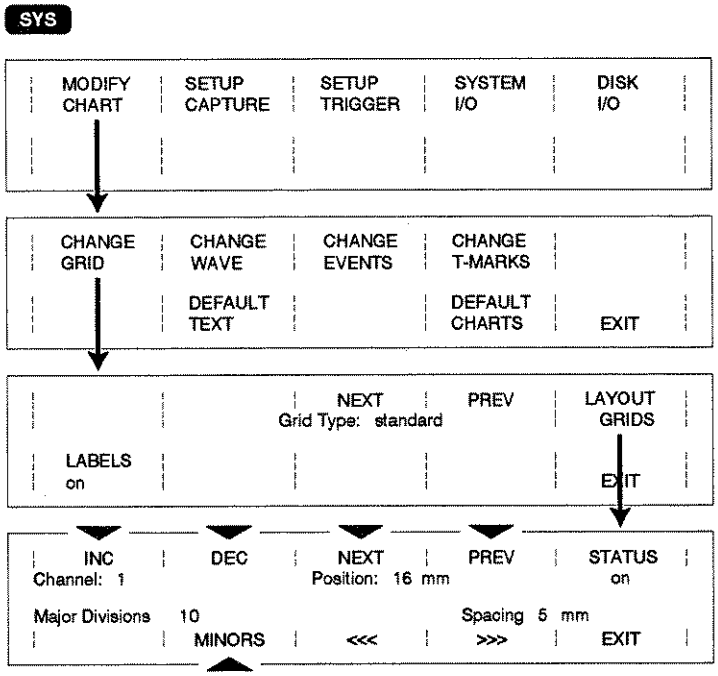
4 **Press the soft key above "LAYOUT GRIDS."**

5 **Press the soft key above "INC" or "DEC" and select a channel for the grid.**

- **See the illustration at the top of the next page.**

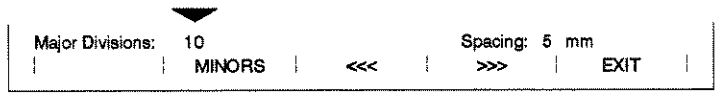
4.2.1

CHANGE GRID:
specifying a grid's layout and location on the chart



6 **Press the soft key below the "MINORS" / "MAJORS" selection until the "Major Divisions" parameter appears in the menu.**

7 **Press the soft key below "<<<" or ">>>" to select the major division parameter.**



8 **Use the encoder wheel to select the number of major amplitude divisions you want your grid to contain.**

- **Your grid can contain from 1 to 25 major amplitude divisions.**

CHANGE GRID:
specifying a grid's layout and location on the chart

9 **Press the soft key below "<<<" or ">>>" to select the spacing parameter.**



10 **Use the encoder wheel to select the spacing in millimeters that you want between the major amplitude divisions you just specified.**

- **The spacing selection allows you from 1 millimeter to 100 millimeters of distance between the major divisions that you have specified.**

11 **Press the soft key above "NEXT" or "PREV" to select a chart location for the right edge of your grid.**

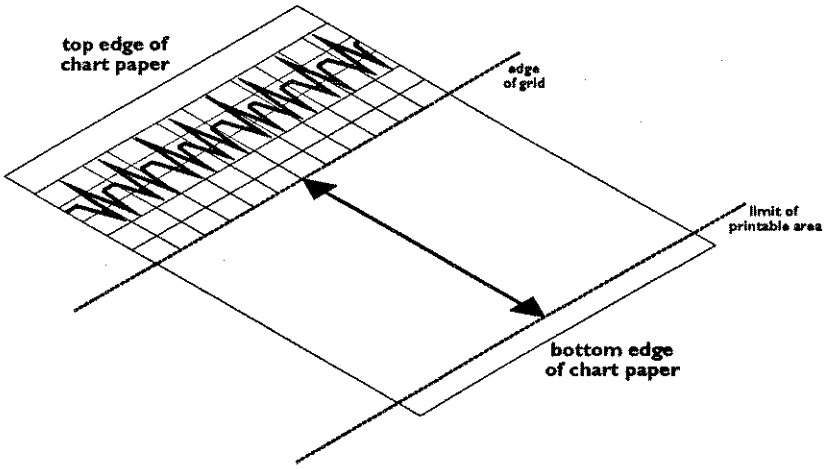
- **Hold down the "NEXT" or "PREV" soft key until the chart location that you want is selected.**
- **The menu displays a "Position:" value that dynamically shows the chart locations as they are selected.**



4.2.1

CHANGE GRID:
specifying a grid's layout and location on the chart

- The center-line of your grid will move dynamically to each chart location as you continue to hold down the soft key.
- Chart locations are measured across the chart from 1 mm near the bottom of the chart to 120 mm near the top of the chart paper.





+ rotate right.

positive values
shift waveform
toward top of chart.

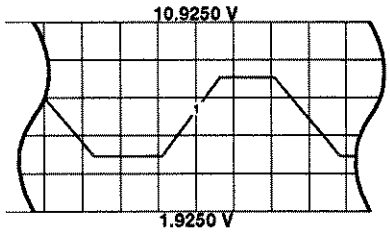
− rotate left.

negative values
shift waveform
toward bottom of chart.

CHANGE GRID:
labeling the grid edges with their voltage values

The DASH IV can label the left and right edges of the grids you set up with the voltage values they represent.

This is done by turning on the "LABELS" selection of the CHANGE GRID parameter and pressing the front-panel [ID] key.



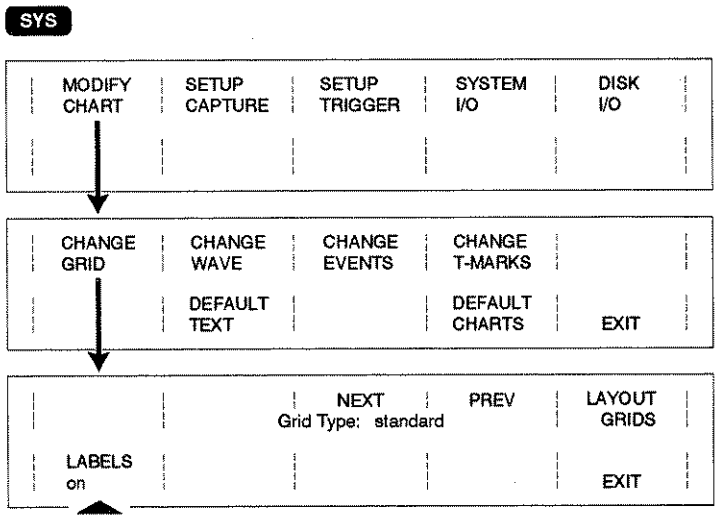
Use the procedure that follows to turn on labels that identify the values represented at the grid's edge.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "MODIFY CHART."**
3. **Press the soft key above "CHANGE GRID."**
4. **Press the soft key below "LABELS" and turn the selection on.**

   - **When the front-panel [ID] key is pressed, the grid edges will be labeled with their values.**
   - **See the menu illustration at the top of the next page.**

4.2.1.1

CHANGE GRID:
labeling the grid edges with their voltage values



4.2.1.2

CHANGE GRID:
synchronizing the grid to trilevel timing marks

The CHANGE GRID parameter allows you to select from two DASH IV grid types: standard and t-based.

- "standard" grids are printed in standard 5mm increments and are not synchronized to the recorder's trilevel timing marks.
- "t-based" grids are time-based grids printed with divisions that are synchronized to the recorder's trilevel timing marks.

CHANGE GRID:
synchronizing the grid to trilevel timing marks

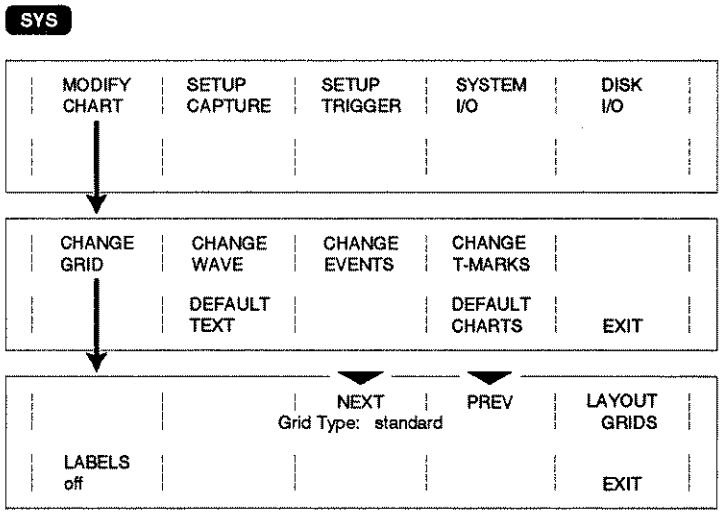
Use the procedure below to select the grid type that you want: unsynchronized (standard) or synchronized (t-based).

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE GRID."**

4 **Press the soft keys above "NEXT" or "PREV" to select either the standard grid type or a t-based grid type.**



4.2.2

CHANGE WAVE: suppressing or enabling the printing of waveforms

The waveforms printed by the DASH IV can be individually selected and kept from printing to achieve an effect like the "pen up" condition of traditional pen-based recorders.

Use the procedure on the next page to set individual channels to "PEN UP" to suppress printing of the selected waveform.

1 **Press the front-panel [SYS] key.**

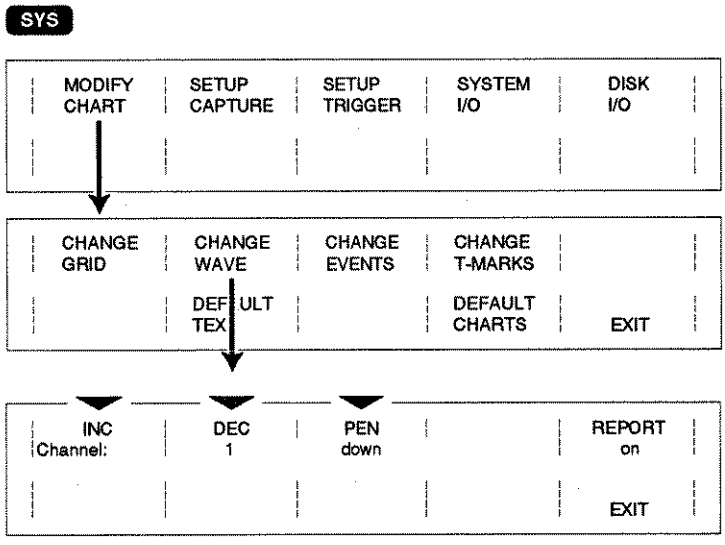
2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE WAVE."**

4 **Press the soft key above "INC" or "DEC" to select the channel of interest.**

5 **Press the soft key above "PEN."**

- **When the menu reads "PEN up," the waveform will not be printed.**
- **When the menu reads "PEN down," the waveform will print.**

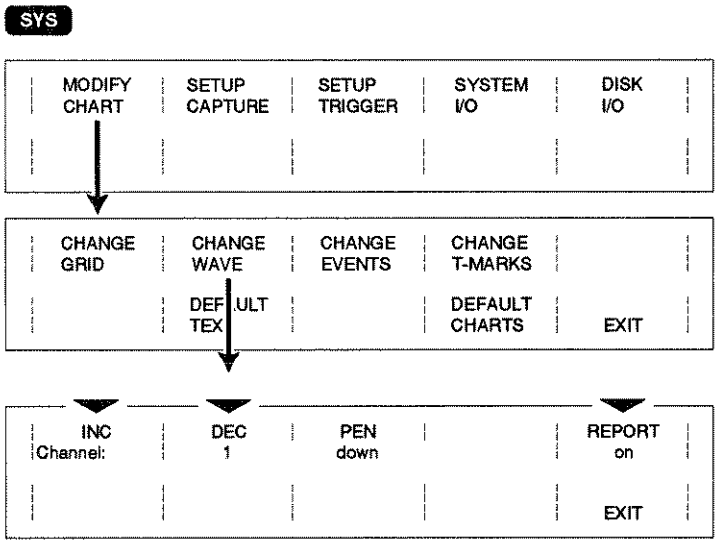


4.2.2.1

CHANGE WAVE: enabling or suppressing signal conditioner reporting

The DASH IV can print the gain and zero position settings associated with each channel in the channel's annotation buffer. This information is referred to as signal conditioner reporting. Generally, this information is printed in the last forty character spaces of the annotation buffer. Use the procedure below to turn signal conditioner reporting on or off.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "MODIFY CHART."**
3. **Press the soft key above "CHANGE WAVE."**
4. **Press the soft key above "INC" or "DEC" to select the channel of interest.**
5. **Press the soft key above "REPORT."**
   - **When the menu reads "REPORT off," signal conditioner reporting will not be printed.**
   - **When the menu reads "REPORT on," signal conditioner reporting will be printed.**



4.2.3

CHANGE EVENTS: enabling event markers; selecting their chart locations

The DASH IV is equipped with eight event markers. The CHANGE EVENTS selection of the CHANGE GRID parameter permits you to choose each event marker and:

- turn printing of the event marker on and off.
- position the event marker on the chart.
- select a global event marker style.

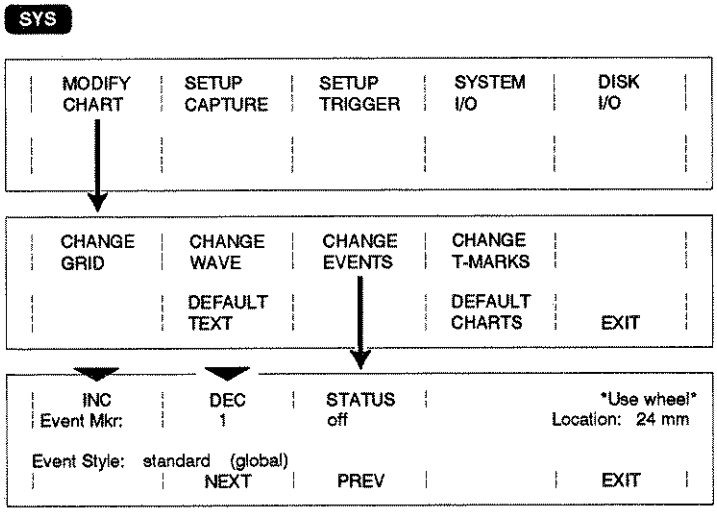
The procedure below describes how to enable an event marker and place the event marker at the chart location that you want. The procedure for selecting a global event-marker style is given in paragraph 4.2.3.1.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE EVENTS."**

4 **Press the soft key above "INC" or "DEC" until the event marker you want is selected.**



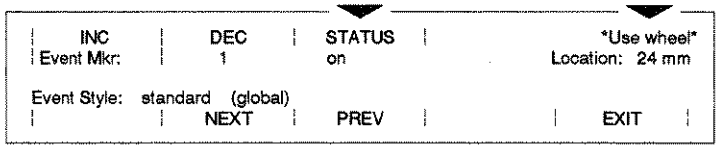
4.2.3

CHANGE EVENTS:
enabling event markers; selecting their chart locations

5 **Press the soft key above "STATUS" and turn the event marker on to have it printed on the chart.**

6 **Use the encoder wheel to specify the location in millimeters on the chart at which you want the event marker to print.**

- **The event marker can be placed at locations from 0 millimeters (near the bottom of the chart) to 126 millimeters (near the top of the chart).**



4.2.3.1

CHANGE EVENTS:
selecting a global event marker style

Event markers can be printed in any of four printing styles:

- standard 
- tick mark 
- block/line 
- block/off 

4.2.3.1

CHANGE EVENTS:
selecting a global event marker style

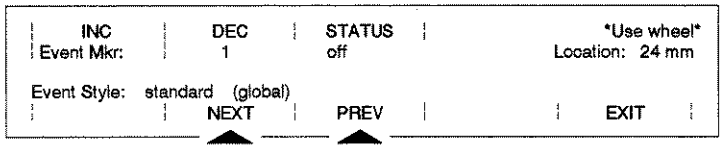
Use the following procedure to select the event marker style that you want. The style you select will apply to all of the event markers.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE EVENTS."**

4 **Press the soft key above "NEXT" or "PREV" until the event marker style that you want is selected.**



4.2.4

DEFAULT TEXT:
printing default text in annotation buffers

The DEFAULT TEXT selection resets all interchannel annotation buffers so that they each print a simple line of channel identification text such as "CHANNEL 1."

Use the procedure below to default all interchannel annotation buffers to the basic channel identification text.

1 **Press the front-panel [SYS] key.**

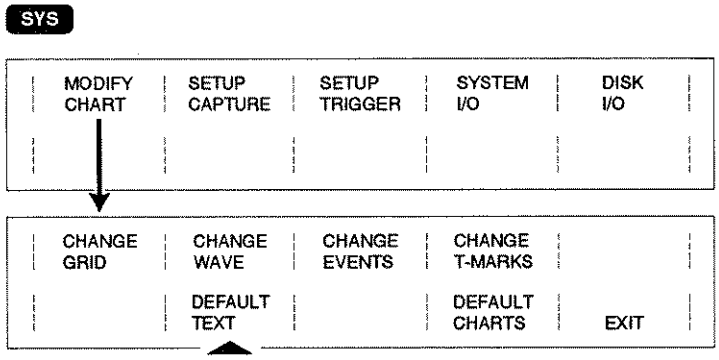
2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key below "DEFAULT TEXT."**

■ **See the illustration at the top of the next page.**

4.2.4

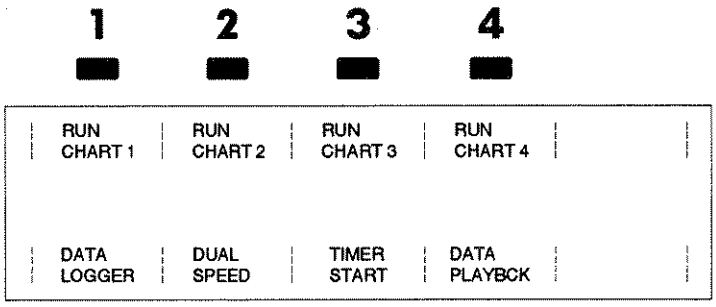
DEFAULT TEXT:
printing default text in annotation buffers



4.2.5

DEFAULT CHARTS:
selecting a default chart layout

The DASH IV has four front-panel programmable "RUN CHART" keys.



The DEFAULT CHARTS selection resets any selected front-panel "RUN CHART" soft key to any of four preset chart layouts. These layouts are:

- 1-plot—provides a single channel containing twenty-five major divisions each of which is 5mm wide.
- 1-plot w/evts—provides a single channel containing eight major divisions each of which is 10mm wide.

4.2.5

DEFAULT CHARTS: selecting a default chart layout

- 2-plot—provides two channels each of which contains ten major divisions. Each major division is 5mm wide.
- 4-plot—provides four channels each of which contains five major divisions. Each major division is 5mm wide.

Examples of each of the default chart layouts are provided on the pages that follow. Use the procedure below to set any of the programmable chart keys to any of the four default chart layout selections.

1 **Press the front-panel [SYS] key.**

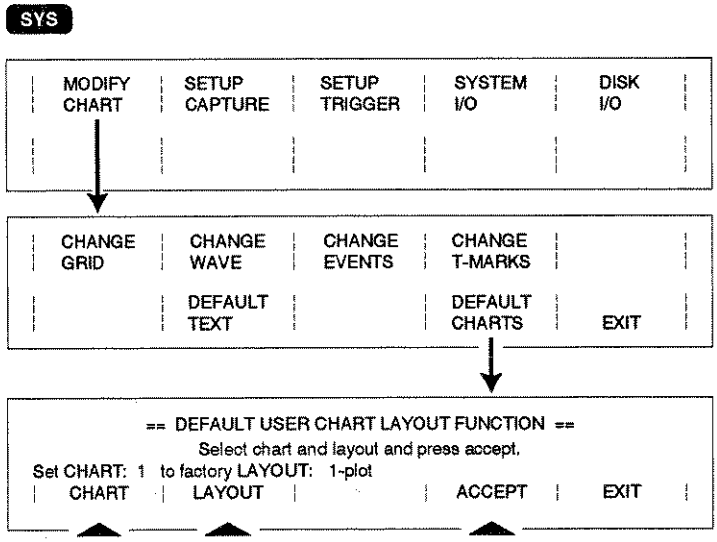
2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key below "DEFAULT CHARTS."**

4 **Press the soft key below "CHART" to select the chart soft key that you want to program.**

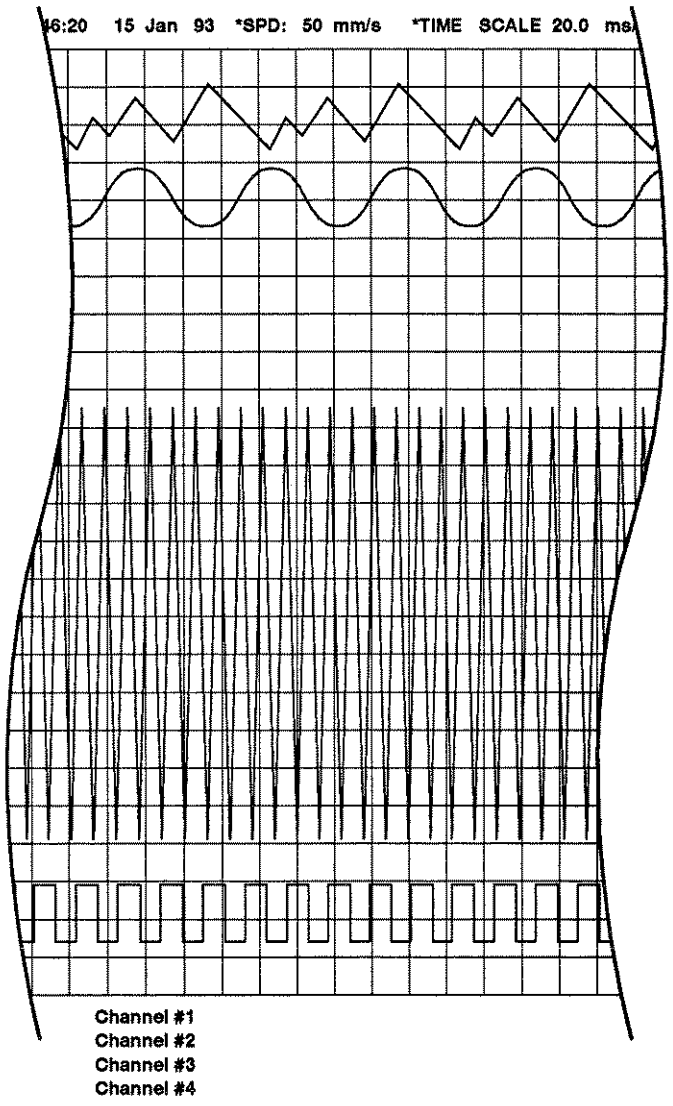
5 **Press the soft key below "LAYOUT" to select the chart layout that you want to program into the soft key.**

6 **Press the soft key beneath "ACCEPT."**



DEFAULT CHARTS:
selecting a default chart layout

DEFAULT CHART LAYOUT: 1-PLOT
- **1 grid**
- **25 major divisions**
- **5mm between divisions**

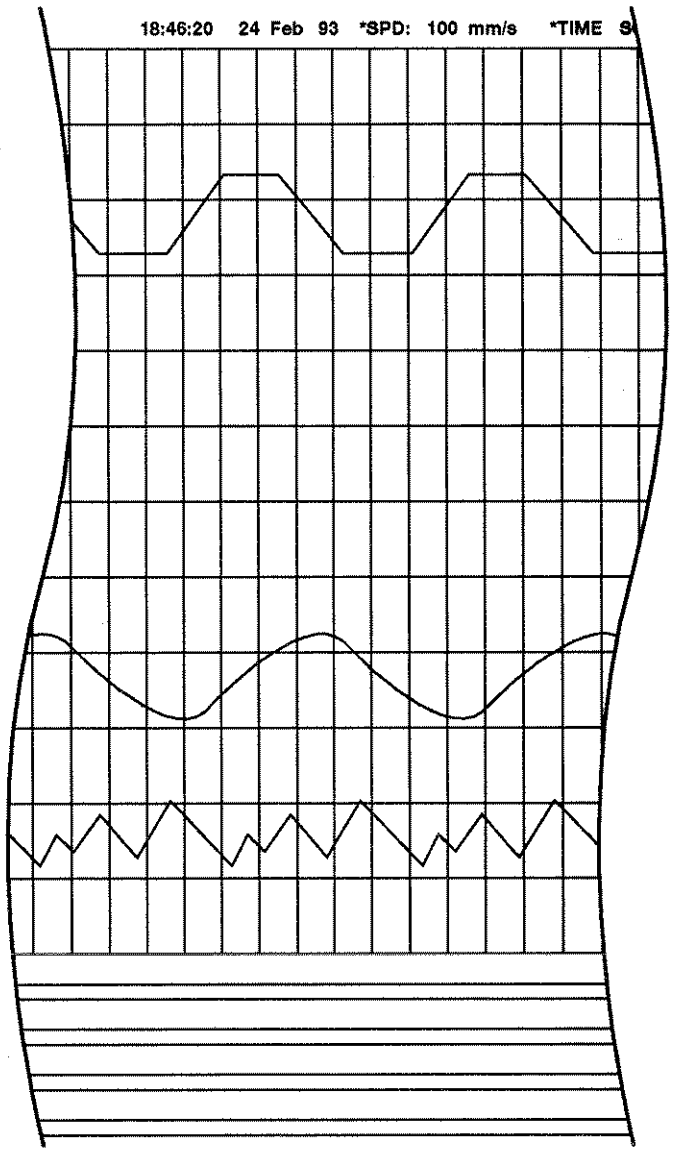


1-plot default layout

4.2.5

DEFAULT CHARTS:
selecting a default chart layout

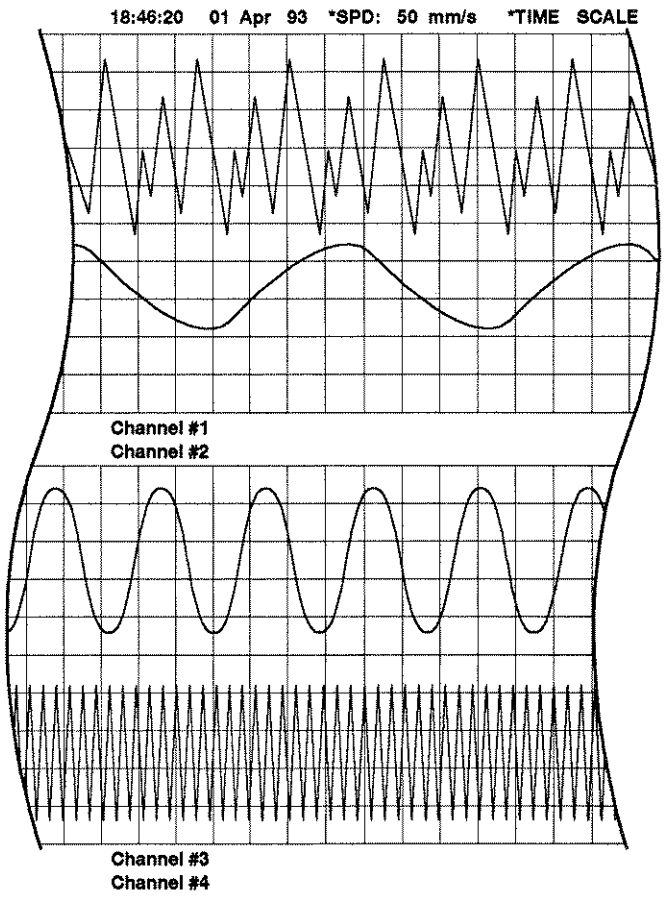
DEFAULT CHART LAYOUT: 1-W/EVTS
- **1 grid**
- **8 major divisions**
- **10mm between divisions**



1-plot w/evts default layout

DEFAULT CHARTS:
selecting a default chart layout

DEFAULT CHART LAYOUT: 2-PLOT
- **2 grids**
- **10 major divisions/grid**
- **5mm between divisions**



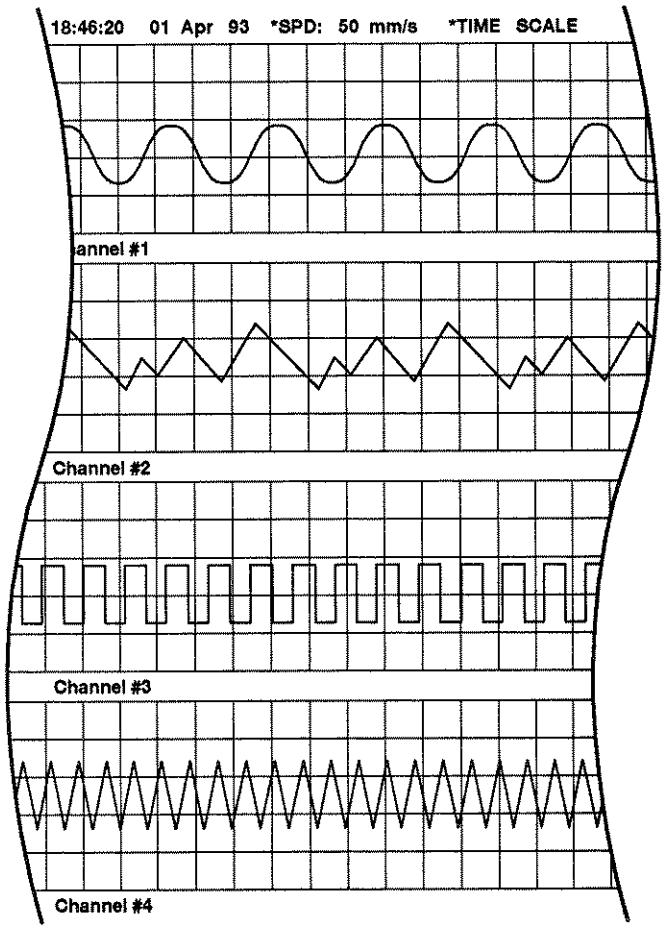
2-plot default layout

4.2.5

DEFAULT CHARTS:
selecting a default chart layout

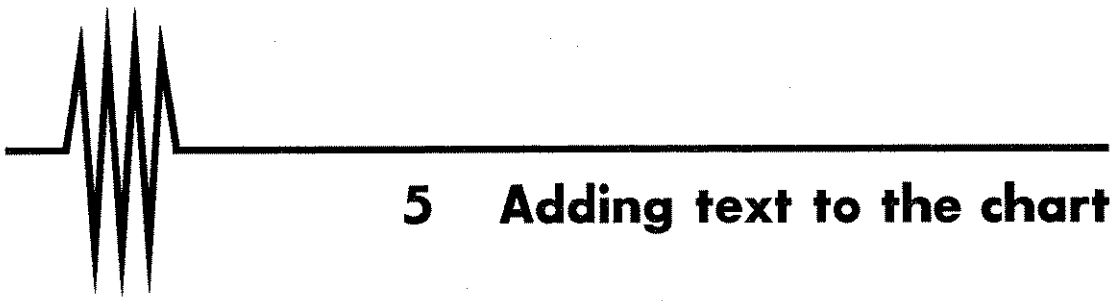
DEFAULT CHART LAYOUT: 4-PLOT

- **4 grids**
- **5 major divisions/grid**
- **5mm between divisions**

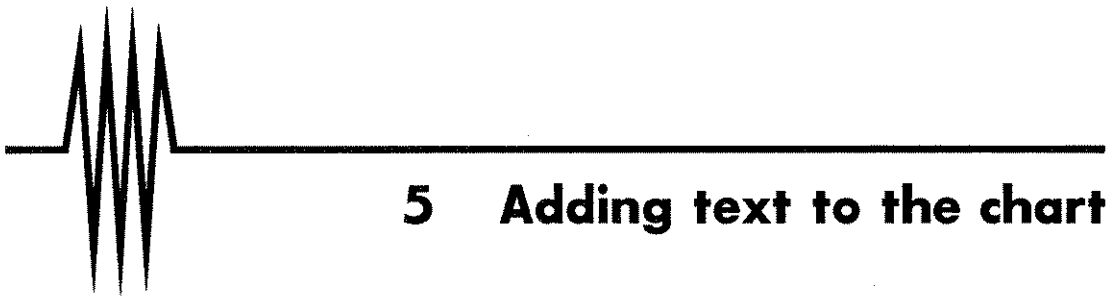


4-plot default layout





5 Adding text to the chart



5 Adding text to the chart

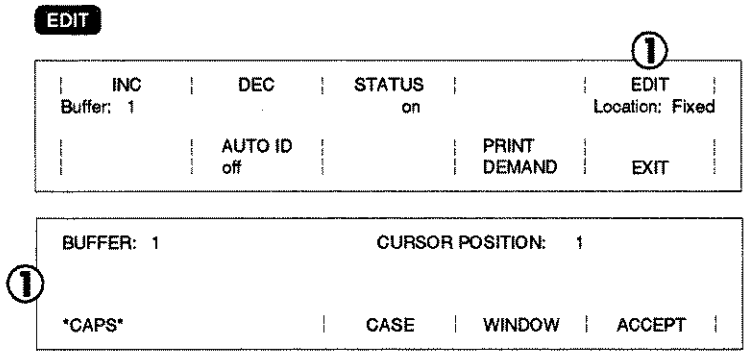
5.1

Adding text to the chart

When you need to add alphanumeric text to the your charts, the DASH IV provides a variety of annotation tools. The DASH IV is equipped with:

- four 128-character annotation buffers each of which can be moved to any of 127 positions across the chart.
- one on-demand buffer that can be printed when you want in any of 127 locations across the chart.
- one system log buffer fixed near the top of the chart.
- capacity to print channel identification numbers either on-demand or automatically and continuously.

The front-panel [EDIT] key is used to add text to your chart and to edit text on your chart. The [EDIT] key menu flow is shown below.



The following procedures are discussed in this section:

- turning the printing of text buffers on and off.
- editing the alphanumeric content of the text buffers.
- positioning text buffers on the chart.
- printing and positioning the on-demand text buffer.
- printing automatic, continuous channel identification numbers.

5.1.1

Enabling or suppressing printing of text buffers

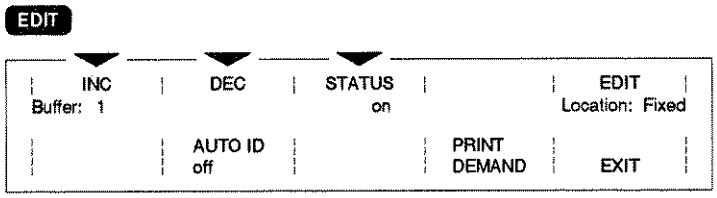
The printing status of any of the annotation buffers can be set to either on or off. When set to "on" the selected buffer will print the text that you have typed at the chart location that you have selected. When set to "off" the selected buffer will not be printed.

1 **Press the front-panel [EDIT] key.**

2 **Press the soft key above "INC" or "DEC" to select the text buffer that you want.**

3 **Press the soft key above "STATUS."**

- **Turn the status to "on" to enable printing of the selected buffer.**
- **Turn the status to "off" to prevent the selected buffer from printing.**



5.1.2

Editing text buffers

The four text buffers which are standard on the DASH IV are synchronized with one another and, when turned on, are printed repeatedly and continuously at a standard distance on the chart. Each buffer can hold up to 128 alphanumeric characters. You can position the text buffers to print with specific channels or you can position them completely independently of the channels.

5.1.2

Editing text buffers

You can even group any or all of the text buffers together on the chart to create an extended block of annotation comments.

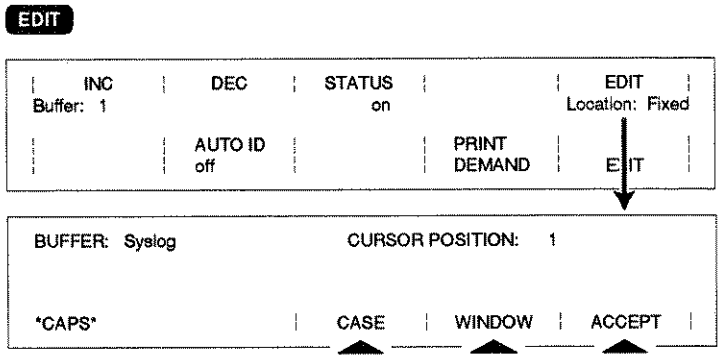
Use the procedures that follow to edit any of the four interchannel text buffers, the on-demand text buffer, or the recorder's system log.

1. **Press the front-panel [EDIT] key.**
2. **Press the soft key above "INC" or "DEC" to select the text buffer that you want to edit.**
3. **Press the soft key above "EDIT."**
4. **If you want your typing to be in upper case letters, press the soft key below "CASE" until the word *CAPS* appears in the display.**
5. **Use the alphanumeric keypad to position and type the text you want to appear in the buffer. There is enough room for a 128-character message.**
   - **Use the arrow keys of the keypad to move through the text buffer.**
   - **Note that a number indicating the location of the cursor within the buffer is shown in the display.**
   - **Use the alphanumeric keys of the keypad to type the letters, numbers, and symbols that you want.**
   - **Use the [SPACE] key to add a blank space before a character.**
   - **Use the [DEL] key to delete a selected character.**
   - **Use the [INS] (insert) key to insert text before a selected character without overwriting any existing text.**

5.1.2

Editing text buffers

6 **Press the soft key below "ACCEPT" to confirm the buffer contents that you just typed.**



5.1.3

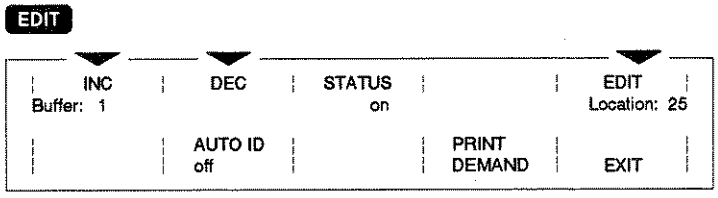
Positioning a text buffer on the chart

1 **Press the front-panel [EDIT] key.**

2 **Press the soft key above "INC" or "DEC" to select the text buffer that you want.**

3 **Use the encoder wheel to select the chart location at which you want the text buffer printed.**

- **There are 127 locations across the chart.**

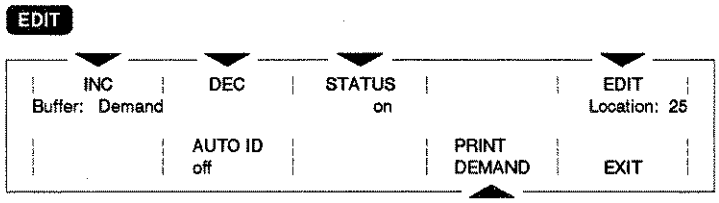


5.1.4

Printing the on-demand text buffer

The on-demand text buffer is immediately printed when the front-panel [EDIT] key is pressed and then the soft key beneath "PRINT DEMAND" is pressed.

1. **Press the front-panel [EDIT] key.**
2. **Press the soft key above "INC" or "DEC" until the "DEMAND" buffer is selected.**
3. **Ensure that the print status of the buffer is set to "on."**
4. **Ensure that the buffer contains the text that you want.**
5. **Use the encoder wheel to select the chart location at which you want the on-demand buffer printed.**
   - **There are 127 locations across the chart.**
6. **Press the soft key below "PRINT DEMAND."**
   - **The on-demand text buffer will be printed immediately at the chart location you selected.**

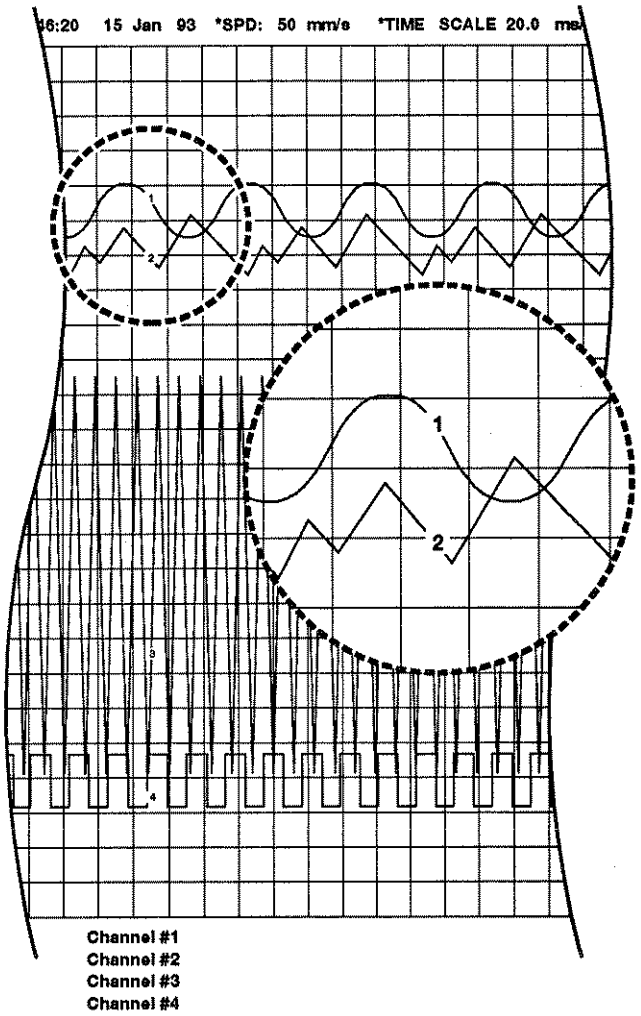


5.2

Printing channel ID numbers

The DASH IV can print channel identification numbers onto waveforms. As the name implies, channel ID numbers clearly indicate the number of the waveform channel. Channel identification numbers are either overprinted directly on the waveforms or are printed very close to the waveforms.

Channel identification numbers provide a simple way of quickly locating each waveform channel on the chart. This is especially useful when waveforms overlap during recording.



5.2

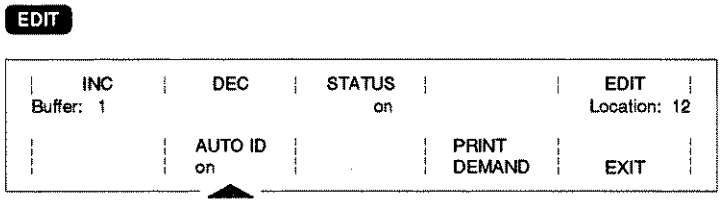
Printing channel ID numbers

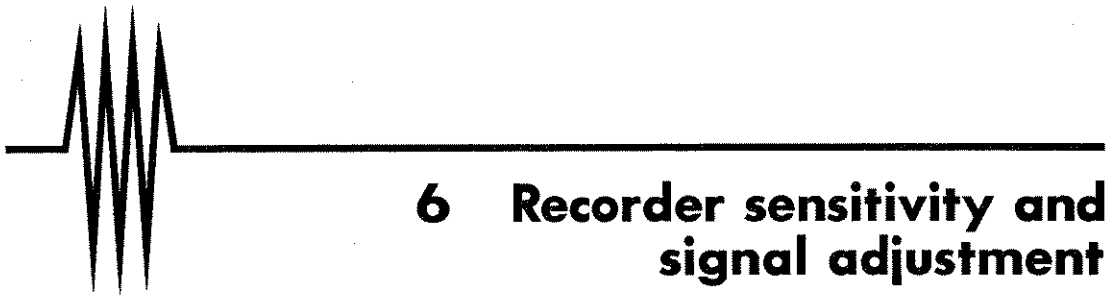
Channel identification numbers are automatically printed once on each waveform each time the front-panel [ID] key is pressed.

You can also make channel ID numbers print automatically and continuously by setting the status of the recorder's AUTO ID function to "on." Follow the procedure below to enable automatic printing of channel ID numbers.

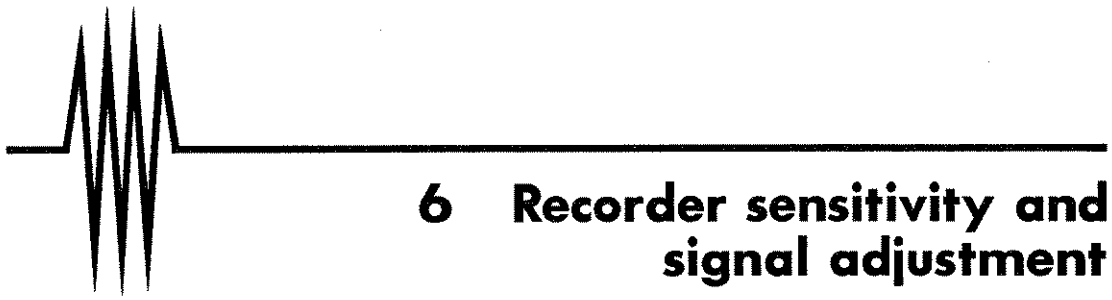
1 **Press the front-panel [EDIT] key.**

2 **Press the soft key beneath "AUTO ID" until the setting reads "on."**





6 Recorder sensitivity and signal adjustment



6 Recorder sensitivity and signal adjustment

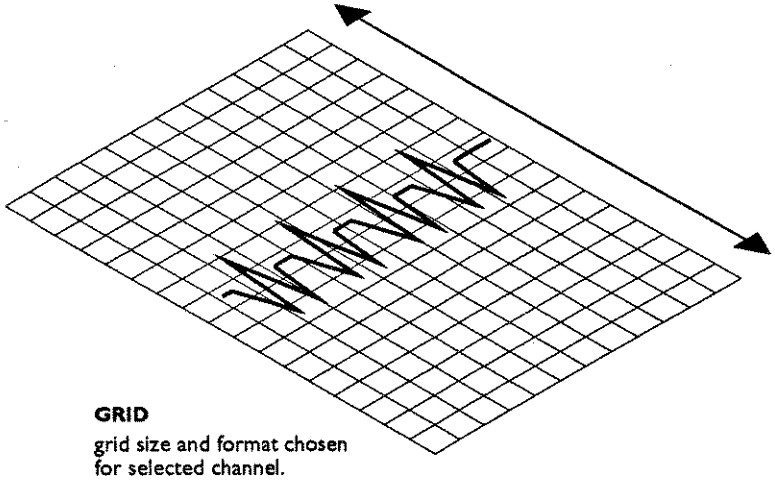
6.1

Recorder sensitivity and signal adjustment in previous versions of the DASH IV

Although similar in appearance to the previous DASH IV, the new-generation DASH IV differs in important ways from its predecessor.

Typically in previous versions of the DASH IV:

- a grid size and format were chosen and a full-scale voltage value was selected for the channel by means of sensitivity.
- the recorder referenced the full-scale range of the channel and the waveform signal was scaled to the selected grid size.



GRID
grid size and format chosen for selected channel.

VOLTAGE RANGE
full-scale voltage value chosen from grid edge to grid edge.

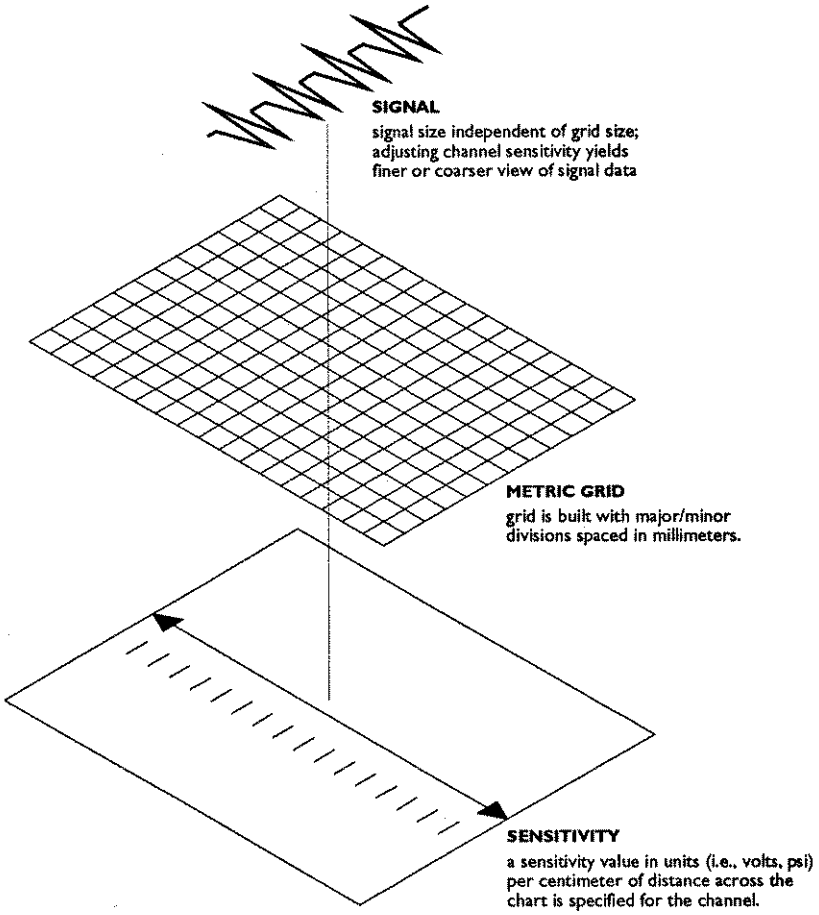
SIGNAL
scaled to grid;
adjusting sensitivity of channel scales waveform larger or smaller.

6.2

The new-generation DASH IV

In the new-generation DASH IV recorder:

- there is no reference to full-scale voltage.
- a sensitivity per unit of metric distance across the chart is chosen for the selected channel.
- grids are also metric and can be designed with varied arrangements of major and minor divisions.
- signal size is independent of grid size.



6.3

DASH IV zero and gain controls

For each of the DASH IV's four recording channels, the [Z/G] key (zero and gain) key is used to:

- select a voltage sensitivity for the chart.
- select a chart location for the zero baseline of the waveform input signal.
- suppress up to 250VDC of the waveform input to enable the use of higher gains without exceeding the recorder's range.
- ground the signal.
- choose between RMS and peak-to-peak recording modes.
- setup signal filtering.
- scale waveform data so that voltage data is expressed in engineering units of your choice.
- calibrate each channel to an internal precision reference.

The parameters of the [Z/G] key include:

- DC/GND grounds the selected waveform input signal.
- Y-SCALE selects a scaling factor for the amplitude of the selected waveform input signal.
- ZERO selects a chart location for the zero baseline of the waveform input.
- SENS selects the channel's sensitivity in units (i.e. volts, psi) per centimeter of distance across the chart.
- ZS (zero suppression) selects the amount of suppression in VDC that will be applied to a channel's waveform input signal.
- FILT/DSP selects between notch, low-pass, and mean signal filtering and enables or disables the filtering.

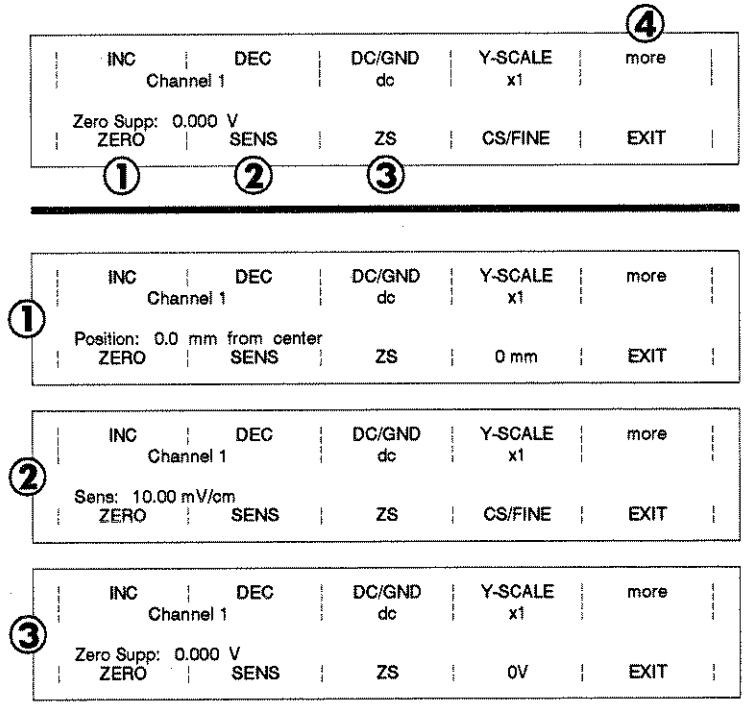
  sets up the digital signal processors to perform integration or d/dt.

6.3

DASH IV zero and gain controls

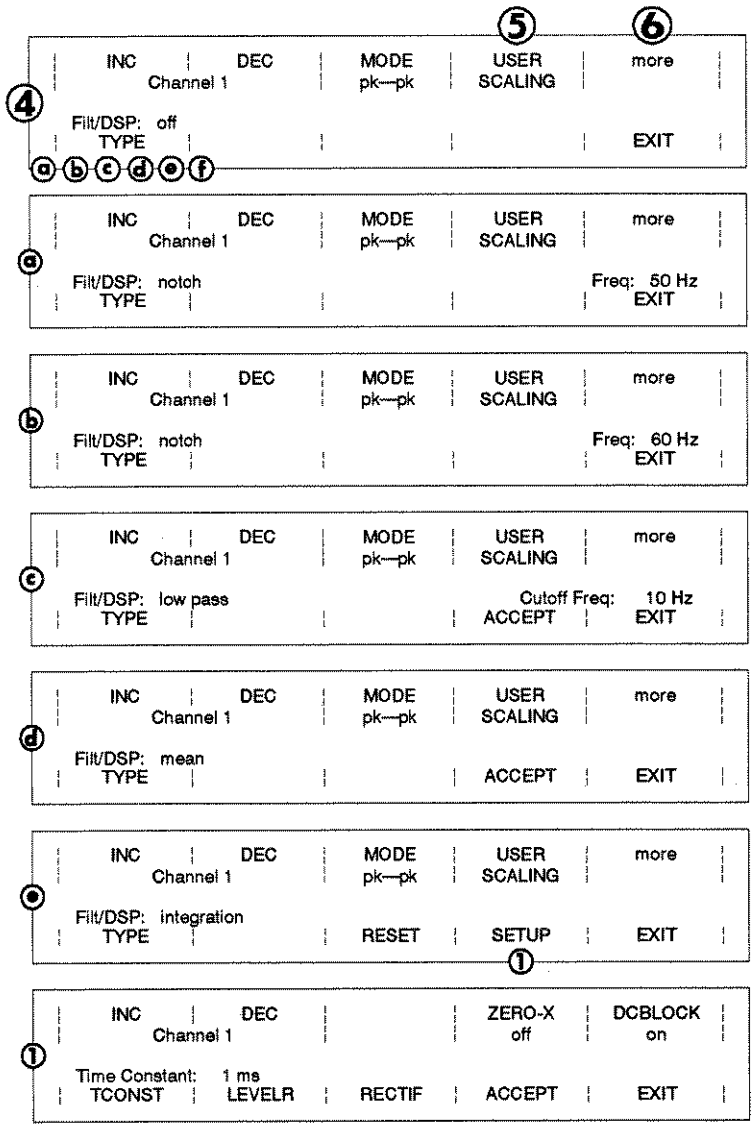
- **MODE** — selects between peak-to-peak and RMS recording modes for the specified recording channel.
- **USER SCALING** — selects a scaling value used to convert voltage values into user-defined engineering units.
- **SYSTEM CAL** — initiates a channel calibration procedure that compares the channel to the DASH IV's built-in precision voltage reference.
- **SENSITIVITY LIMIT** — locks out the recorder's millivolt range to prevent unintentiontal changes in impedance.

The menu flow for the [Z/G] key is shown below and continues on the next two pages.



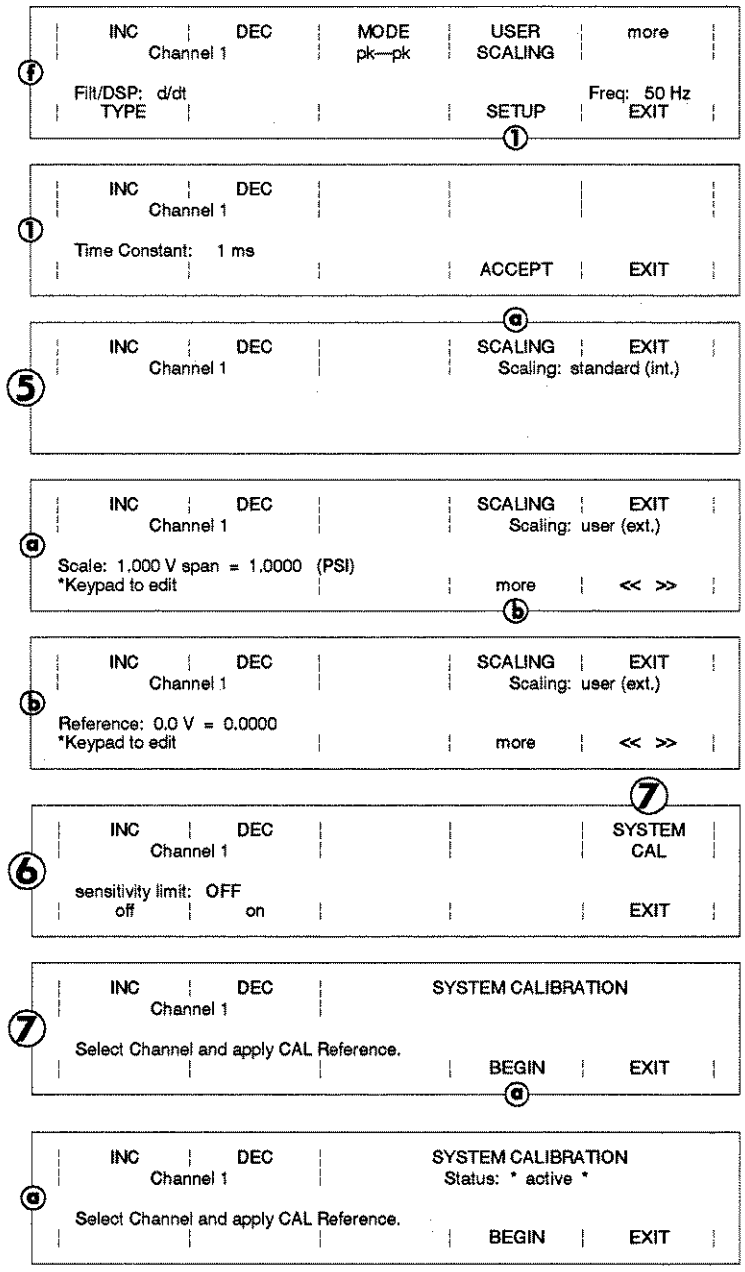
6.3

DASH IV zero and gain controls



6.3

DASH IV zero and gain controls



6.3.1

Selecting the voltage sensitivity of the chart

NOTE

The voltage sensitivity information given in this paragraph applies only to the DASH IV's built-in signal conditioners.

When optional, plug-in signal conditioning modules are used in the recorder, the sensitivity values shown in the zero and gain menus will be given in units appropriate to the type of module in use.

In the DASH IV, the gain of each channel is expressed as sensitivity. Channel sensitivity is defined as a specific value in units per centimeter of the chart.

The "USER SCALING" parameter discussed in paragraph 6.3.7 of this section is used to convert the voltage values of the selected waveform input signal into engineering units (i.e., psi, mmhg) that you specify. In the procedure below, the voltage values of the built-in signal conditioners are expressed in volts/millivolts and have not been scaled to any other engineering unit.

Use the following procedure to set the selected channel's voltage sensitivity.

1. **Press the front-panel [Z/G] key.**
2. **Press the soft key above "INC" or "DEC" until the channel that you want to set the sensitivity for is selected.**
3. **Press the soft key below "SENS."**
4. **Use the encoder wheel to set the voltage sensitivity for the selected channel.**
   - **Sensitivity is expressed as either mV/cm or V/cm.**
   - **Sensitivity ranges are incremented as shown in the table on the next page.**

6.3.1

Selecting the voltage sensitivity of the chart

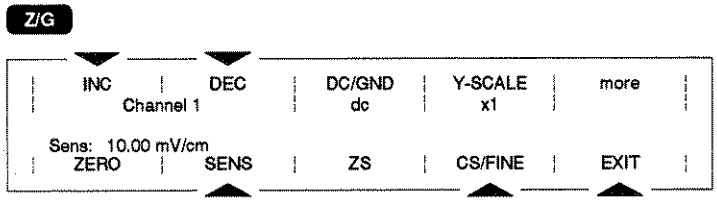
sensitivity range*					increment	
5.00	to	10.00	mV/cm	.....	.05	mV/cm
10.00	to	20.00	mV/cm	.....	.10	mV/cm
20.00	to	25.00	mV/cm	.....	.20	mV/cm
25.00	to	50.00	mV/cm	.....	.25	mV/cm
50.00	to	100	mV/cm	.....	.5	mV/cm
100	to	200	mV/cm	.....	1	mV/cm
200	to	250	mV/cm	.....	2	mV/cm
250	to	500	mV/cm	.....	2.5	mV/cm
500	to	1.00	V/cm	.....	.5	mV/cm
1.00	to	2.00	V/cm	.....	.01	V/cm
2.00	to	2.50	V/cm	.....	.02	V/cm
2.5	to	5.00	V/cm	.....	.025	V/cm
5.00	to	10.00	V/cm	.....	.050	V/cm
10.00	to	30	V/cm	.....	.1	V/cm

* If further sensitivity is desired, you can use the amplitude scaling feature described in paragraph 6.3.8 of this manual.

5 Press the soft key below "CS/FINE" and select either coarse or fine.

- **CS** **the coarse setting uses larger increments to step quickly through the sensitivity settings.**
- **FINE** **the fine setting uses smaller increments and steps through the full range of sensitivity settings.**

6 Press the soft key below "EXIT" to leave the [Z/G] menu.

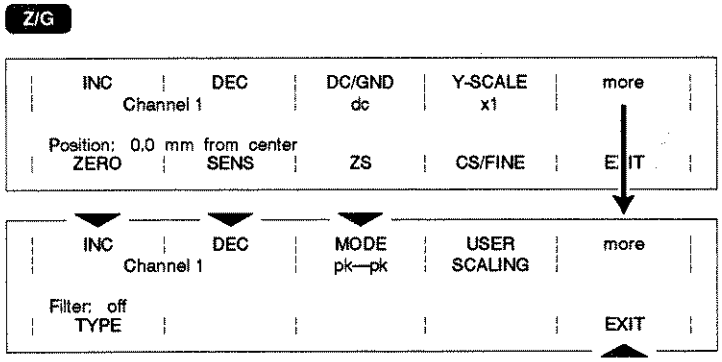


6.3.2

Selecting either the peak-to-peak or RMS recording mode

The DASH IV can record data using either the peak-to-peak recording method or the root-mean-square method. Use the procedure below to select the mode you want to use.

1. **Press the front-panel [Z/G] key.**
2. **Press the soft key above "more."**
3. **Press the soft key above "INC" or "DEC" until the channel that you want is selected.**
4. **Press the soft key above "MODE" until the recording mode that you want is selected.**
5. **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.3.3

Grounding individual waveform channels

NOTE

The information given in this paragraph applies only to the DASH IV's built-in signal conditioners.

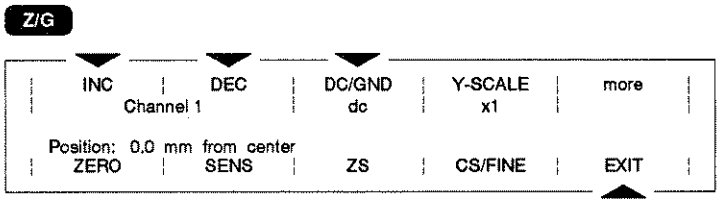
When optional, plug-in signal conditioning modules are used in the recorder, the values shown in the zero and gain menus will be appropriate to the type of module in use.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "INC" or "DEC" until the channel that you want is selected.**

3 **Press the soft key above "DC/GND" until ground (gnd) is selected in the menu.**

4 **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.3.4

Positioning a waveform's zero baseline

NOTE

The waveform's zero baseline can be positioned using the ZERO parameter discussed below or using the recorder's zero suppression capability. Applying zero suppression to a waveform signal is discussed in paragraph 6.3.5.

Depending on your specific purpose, it can be useful to use the ZERO control to move the baseline in fine steps and to use zero suppression for applications that involve a large DC bias.

When positioning the waveform in the channel, the center of grid is used as the reference location. See the illustration on the next page.

Use the procedure below to select a chart location for the zero baseline of the waveform with reference to the center of the grid.

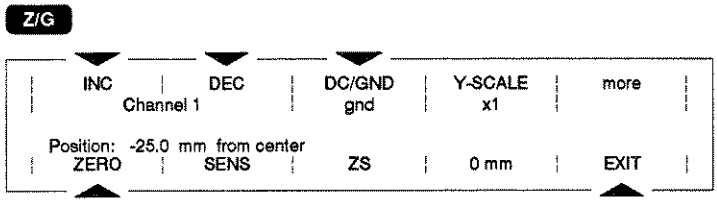
1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "INC" or "DEC" until the channel that you want is selected.**

- **If you find it useful, ground the signal by pressing the soft key above "DC/GND."**
- **This will provide a flat zero-baseline that is easily positioned on the chart.**

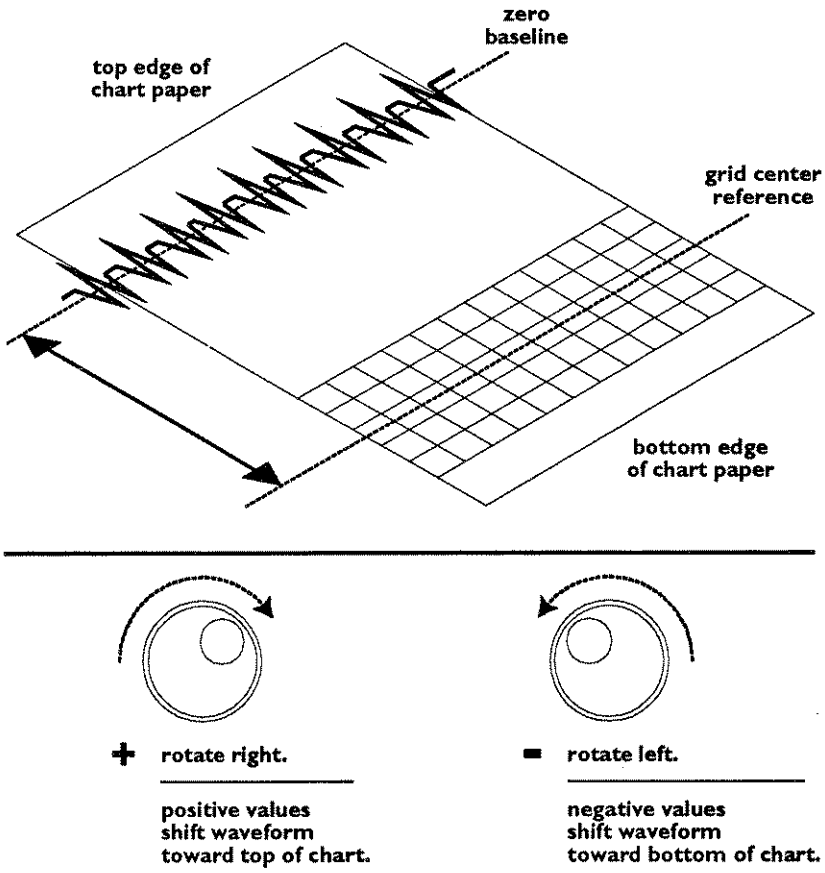
3 **Press the soft key below "ZERO."**

- **Note the "Position:" parameter that appears in the menu.**



6.3.4

Positioning a waveform's zero baseline



6.3.4

Positioning a waveform's zero baseline

4 **Use the encoder wheel to position the waveform at the chart location you want.**

- **The zero baseline of the signal moves with reference to the center line of the grid.**
- **When the encoder wheel is rotated to the right, the zero baseline shifts toward the top edge of the chart.**
- **When the encoder wheel is rotated to the left, the zero baseline shifts toward the bottom edge of the chart.**

5 **Press the soft key below "EXIT" to leave the [Z/G] menu.**

6.3.5

Applying zero suppression to waveform signals

Some waveform input signals may contain an unwanted direct-current (DC) component. The signal's DC component may make it difficult to bring the waveform data of interest onto the chart.

Depending on the DASH IV's sensitivity setting, zero suppression can be used to remove from 5V to 250V of a waveform's DC component and so bring the data of interest onto the chart for recording and analysis.

Use the procedure below to select the amount of zero suppression that will be applied to the waveform input signal.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "INC" or "DEC" until the channel that you want is selected.**

6.3.5

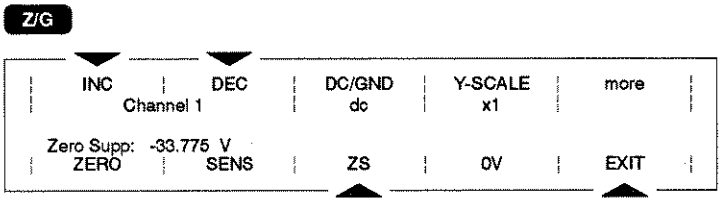
Applying zero suppression to waveform signals

3 **Press the soft key below "ZS."**

- **Note that the "Zero Supp:" parameter appears in the menu.**

4 **Use the encoder to select the amount of zero suppression that you want to apply to the waveform input.**

5 **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.3.6

Using the recorder's signal filters

The DASH IV is equipped with four types of signal filtering:

- notch (50 Hz) -
  filters the 50 Hz frequency component out of the input signal.
- notch (60 Hz) -
  filters the 60 Hz frequency component out of the input signal.
- low-pass-
  filters out frequencies above a specified cutoff frequency.
- mean-
  outputs the mathematical mean amplitude of the input signal.

6.3.6

Using the recorder's signal filters

NOTE

When signal filtering of any type is turned on, data capture sample rates are limited to 20 kHz. The DASH IV uses linear interpolation to achieve data-capture time bases that correspond to sampling frequencies greater than 20 kHz.

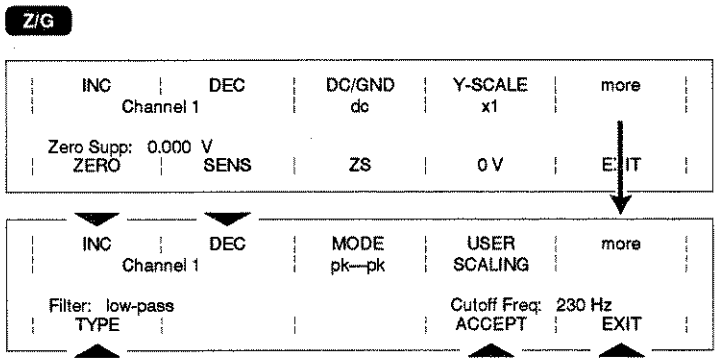
Use the procedure below to select a filter that will be applied to the waveform input signal.

1. **Press the front-panel [Z/G] key.**
2. **Press the soft key above "more."**
3. **Press the soft key above "INC" or "DEC" until the channel that you want to filter is selected.**
4. **Press the soft key below "TYPE" until the type of filter that you want to use is selected.**
   - **Filter types are notch (50 Hz), notch (60 Hz), low pass, and mean.**
5. **If you have chosen the low-pass filter, use the encoder to select the cutoff frequency above which frequencies will be attenuated.**
   - **The range of the low-pass filter is from 1 Hz to 1000 Hz in 1 Hz increments.**
6. **Press the soft key below "ACCEPT" to implement the low-pass frequency that you selected.**

6.3.6

Using the recorder's signal filters

7 Press the soft key below "EXIT" to leave the [Z/G] menu.



6.3.7

Converting voltage data to engineering units for numeric reporting

NOTE

The information given in this paragraph applies only to the DASH IV's built-in signal conditioners.

When you are recording with optional, plug-in signal conditioning modules, the information provided may not apply to the type of module in use.

When you are recording changes in temperature, pressure, or any other quantity that is not specifically voltage, it can be very convenient to have the DASH IV print your data as numeric engineering units rather than waveforms on a grid.

6.3.7

Converting voltage data to engineering units for numeric reporting

When recording with the DASH IV, all signal information enters the recorder as electrical voltage. The recorder's "USER SCALING" feature is used to convert these voltages into numeric data that directly corresponds to the units of pressure, temperature, etc. that you are interested in monitoring.

Numeric scaling begins with selecting the voltage sensitivity of the channel in millivolts or volts per centimeter of distance on the chart. The "USER SCALING" parameter is used to redefine the voltage sensitivity of the chart as the engineering units you desire. The DASH IV will then convert all of the signal voltage data into the engineering units you have specified.

When USER SCALING is used, all pertinent DASH IV menus will be displayed in the engineering units that you define.

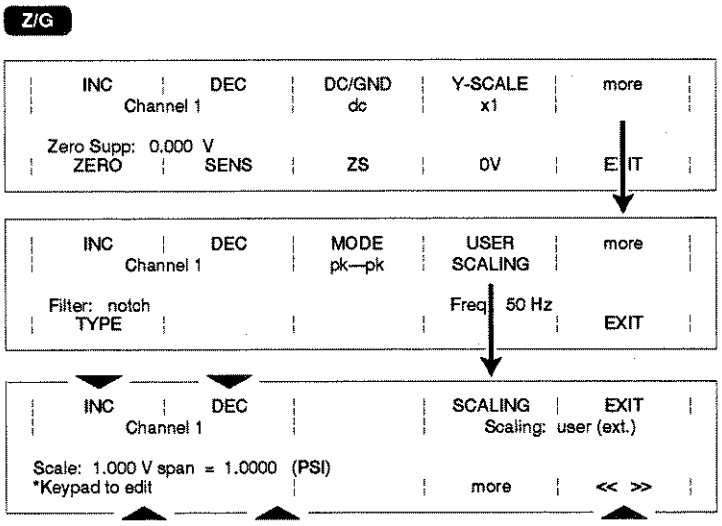
Use the procedure below to convert the electrical value of the waveform input data into engineering units that you specify.

1. **Press the front-panel [Z/G] key.**
2. **Press the soft key above "more."**
3. **Press the soft key above "INC" or "DEC" until the channel that you want to scale is selected.**
4. **Press the soft key above "USER SCALING."**
5. **Press the soft key above "SCALING" until the scaling parameter reads "Scaling: user (ext.)"**

   ■ **See the illustration at the top of the next page.**

6.3.7

Converting voltage data to engineering units for numeric reporting



6 **Note that the scaling menu is used to define two values:**

- **V span** **the voltage increment that will be defined as equaling one engineering-unit increment.**
- **PSI** **the engineering-unit increment that will be defined as equaling one voltage increment.**
  - **By default this parameter reads PSI but you will change this label to the engineering unit with which you will be working.**



Converting voltage data to engineering units for numeric reporting

7 **With the "V span" parameter selected:**

- **use the numeric part of the alphanumeric keypad to define the amount of voltage that will equal one engineering unit.**
- **For example, in the illustration on the previous page, 1.000 volts has been defined as equalling 1.0000 PSI (pounds / square inch).**

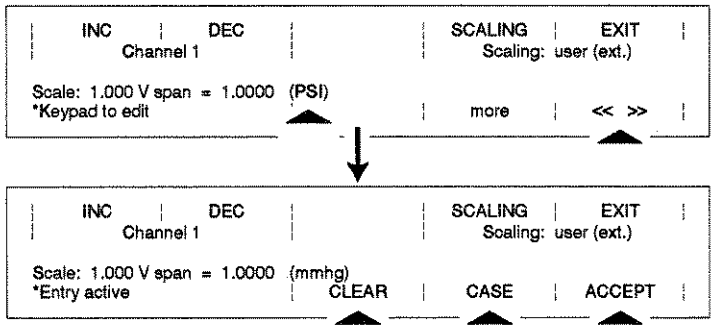
8 **Press the soft key below "<< >>" and select the numerical expression of engineering-unit parameter.**



9 **With the numerical expression of the engineering-unit selected:**

- **use the numeric part of the alphanumeric keypad to define the numerical increment that will equal one engineering unit.**

10 **Press the soft key below "<< >>" and select the alphabetic label of the engineering-unit parameter.**



6.3.7

Converting voltage data to engineering units for numeric reporting

11 **With the engineering-unit label selected:**

- **use the alphabetic part of the alphanumeric keypad to spell a four-character name for the engineering unit.**
- **Note that the menu changes automatically to enable typing in upper- or lower-case letters (CASE) or to delete (clear) the name for retyping.**
- **The illustration on the previous page, shows that then label of the engineering unit was changed from 1.0000 PSI to 1.0000 mmhg (millimeters of mercury).**

12 **Press the soft key below "ACCEPT" to have the recorder use the parameters you just defined.**

13 **Press the soft key above "EXIT" to leave the menu.**

6.3.8

Selecting a real-time amplitude scaling factor

The amplitude axis of the selected real-time waveform can be scaled by factors of x1, x2, and x4. The scaling factor that you select acts as a multiplier of chart sensitivity . For example, a sensitivity setting of 1.5V/cm and a scaling factor of 2 results in a sensitivity of 3.0V/cm.

Increased sensitivity brings more of the waveform onto the chart because each unit of distance contains more waveform data.

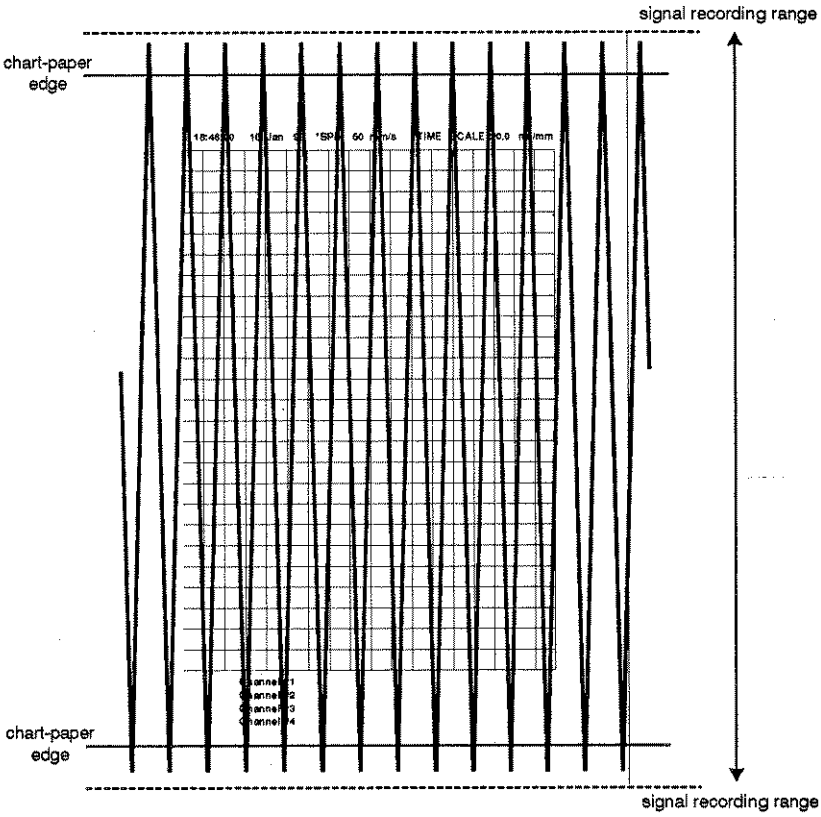
6.3.8

Selecting a real-time amplitude scaling factor

The maximum recording range of the DASH IV is 20cm (200mm). This is actually a larger range than can be recorded on the chart.

- Amplitude scaling is particularly useful when the real-time signal that is being recorded is bigger than the recording range of the chart.

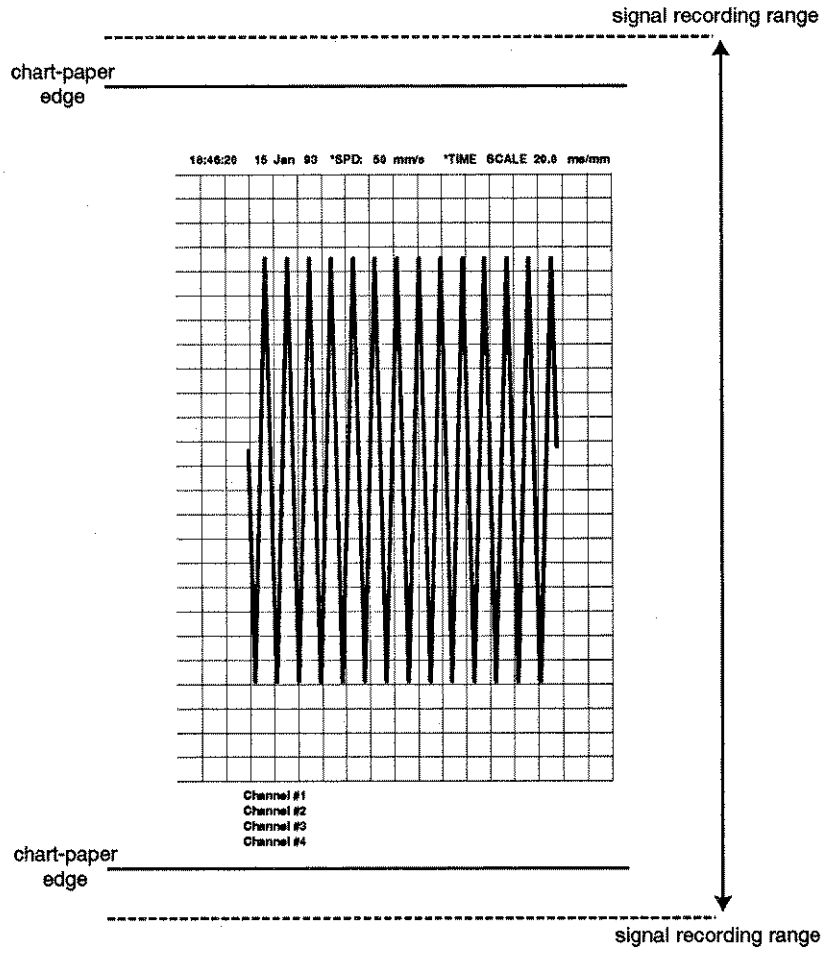
The example below illustrates the condition in which the amplitude of the waveform exceeds the limits of the chart.



6.3.8

Selecting a real-time amplitude scaling factor

As shown in the example below, increasing the chart's sensitivity by applying a Y-SCALE multiplier brings more of the signal onto the chart.



6.3.8

Selecting a real-time amplitude scaling factor

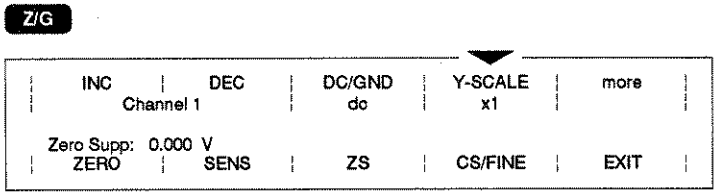
Amplitude scaling is done using the "Y-SCALE" parameter of the [Z/G] key. Use the procedure below to select an amplitude scaling factor to be applied to the selected waveform input.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "INC" or "DEC" until the channel that you want to scale is selected.**

3 **Press the soft key above "Y-SCALE" until the amplitude scaling factor that you want to use is selected.**

- **scaling factors: x1, x2, x4.**
- **when Y-scaling is used, signal span is limited to either 20cm, 10cm, or 5cm depending on which scaling factor is selected. The larger the scaling factor, the smaller the signal span.**
- **when Y-scaling is used, signal positioning capability is limited to spans of 100 mm, 50 mm, or 25 mm depending on which scaling factor is selected. The larger the scaling factor, the more limited the signal positioning capability.**

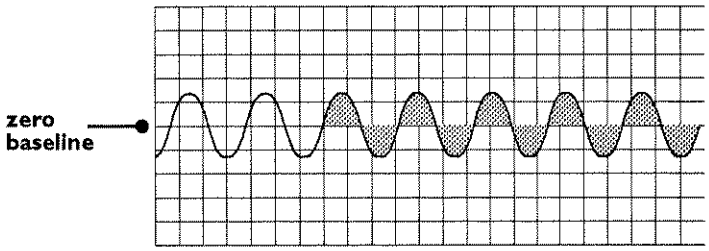


6.3.9

Using the DASH IV's DSP integration processing capability

Among its data analysis tools, the DASH IV has the capacity to perform integral analysis on real-time waveform data.

In the DASH IV integration can be used to determine the area beneath a waveform's curve with reference to the location of the zero volt baseline.



Integration processing is performed in real-time at a sample rate of 20 kHz. Because integral calculations have an inherent tendency to accumulate DC signal components, the DASH IV's integration capability offers four methods to compensate for this accumulation:

- manual reset
  - resets the output to zero whenever the reset soft key is pressed.
- zero crossing
  - resets the output to zero whenever the input crosses zero.
- level reset
  - resets the output to zero when the output reaches a specified level.
- DC block
  - functions as a high pass filter to remove the DC component of the waveform signal.

In addition to integration, the DASH IV can perform full-wave, positive wave, and negative wave rectification on the waveform input.

6.3.9

Using the DASH IV's DSP integration processing capability

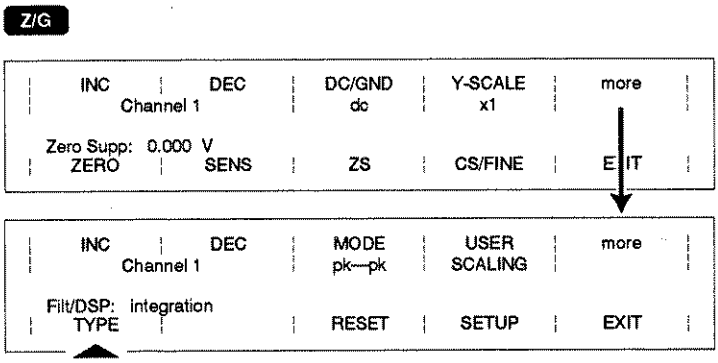
Use the procedure on the below, to perform integration on signal input data.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "more."**

3 **Press the soft key above "INC" or "DEC" until the channel that you want to perform integration on is selected.**

4 **Press the soft key below "TYPE" until integration is selected.**



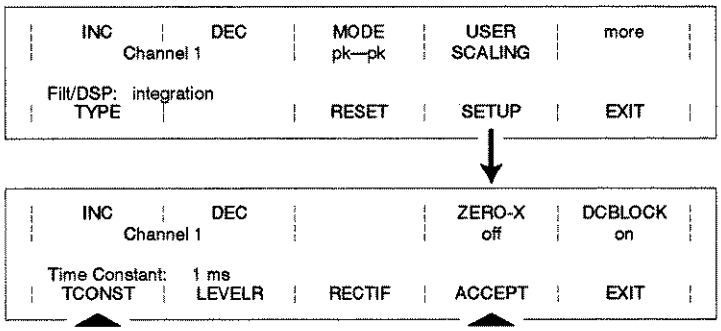
5 **Press the soft key above "SETUP."**

6 **Press the soft key below "TCONST" and use the encoder wheel to select a time constant.**

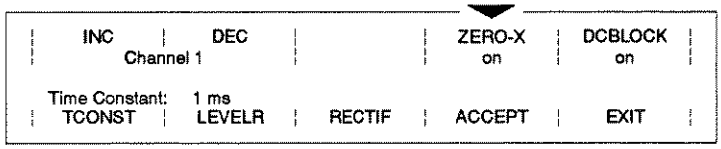
- **The time constant is selectable between 1 ms and 1000 ms in 1 ms increments.**
- **The integration output is divided by the time constant which effectively scales the output.**
- **Smaller time constants result in larger output signals.**

Using the DASH IV's DSP integration processing capability

7 Press the soft key above "ACCEPT" to confirm the time constant selection.



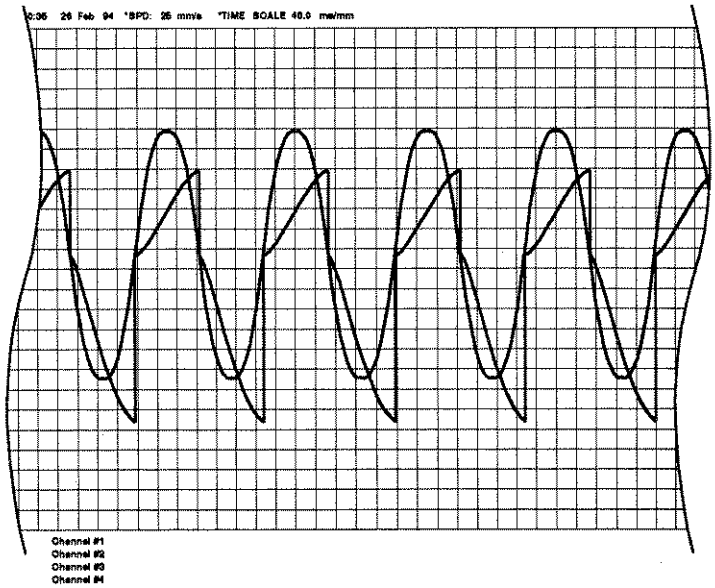
8 If you want to use "zero crossing," press the soft key above "ZERO-X" until the parameter is turned on.



- **Zero crossing resets the output to zero each time the input signal crosses the zero baseline.**
- **This corrects for the continuous tendency to accumulate error that is inherent in integration processing.**
- **Zero crossing can be enabled when DC block and level reset are enabled.**
- **See the illustration at the top of the next page.**

6.3.9

Using the DASH IV's DSP integration processing capability

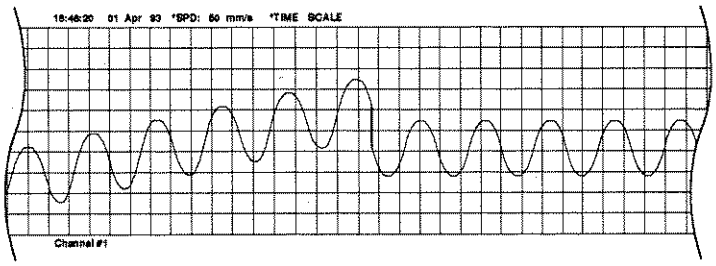


9 **If your signal rides a DC offset voltage that you want to suppress during integration processing, press the soft key above "DCBLOCK" until the parameter is turned on.**

INC	DEC		ZERO-X	DCBLOCK
Channel 1			off	on
Time Constant: 1 ms				
TCONST	LEVELR	RECTIF	ACCEPT	EXIT

- **DC blocking acts as a high pass filter to remove the DC component of the waveform signal.**
- **This corrects for the continuous drift that always results when DC offset is present in a signal that is undergoing integration processing.**
- **See the illustration at the top of the next page.**

Using the DASH IV's DSP integration processing capability



10 To have the output reset to zero whenever a specific percentage of the recording range is exceeded, press the soft key below "LEVELR."

- LEVELR stands for "level reset."

11 Use the encoder wheel to specify a percentage of the recording range.

- Percentages are selectable in 0.5% increments.
- When the signal exceeds a specified percentage of the recording range, it is automatically reset to zero.
- Note that the voltage value counterpart of the selected percentage is also displayed in the menu.

INC	DEC		ZERO-X	DCBLOCK
Channel 1			off	on
Level Reset: 55.5%			3.0008V	
TCONST	LEVELR	RECTIF	ACCEPT	EXIT

12 To rectify the signal voltage, press the soft key below "RECTIF."

INC	DEC		ZERO-X	DCBLOCK
Channel 1			off	on
Rectification: full wave				
TCONST	LEVELR	RECTIF		EXIT

6.3.9

Using the DASH IV's DSP integration processing capability

13 **Use the encoder wheel to select the kind of rectification that you want to use.**

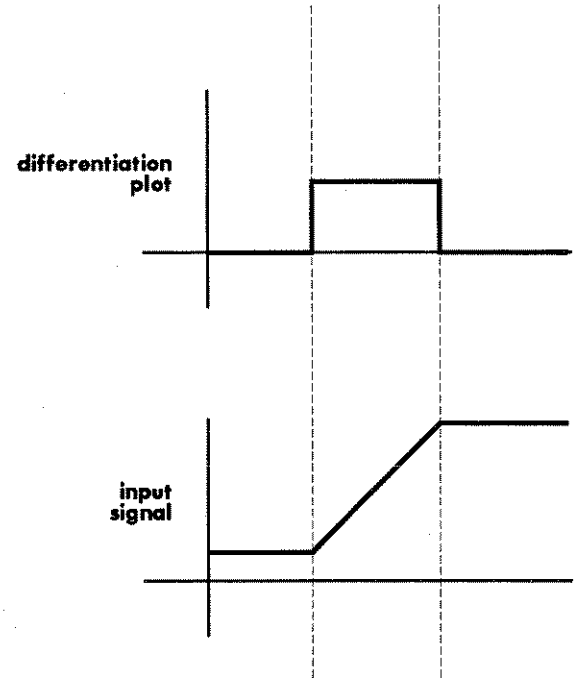
- **rectification choices: none, full wave, positive wave, negative wave.**

14 **Press the soft key below "EXIT" to leave the menu.**

6.3.10

Using the DASH IV's DSP differentiation processing capability

As shown in the simplified example below, differentiation is used to plot the slope of the input waveform and is computed as the slope between t and t-1.



6.3.10

Using the DASH IV's DSP differentiation processing capability

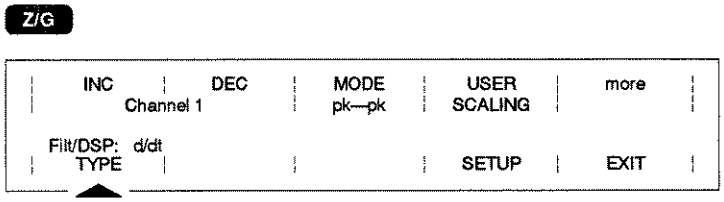
Differentiation processing is done in real-time at a 20 kHz sample rate. Use the procedure on the below, to perform integration on signal input data.

1 **Press the front-panel [Z/G] key.**

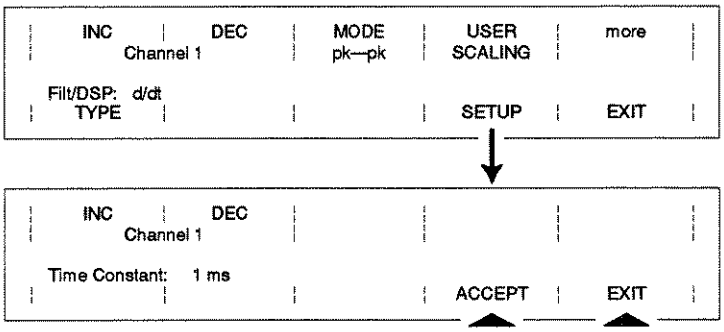
2 **Press the soft key above "more."**

3 **Press the soft key above "INC" or "DEC" until the channel that you want to perform differentiation on is selected.**

4 **Press the soft key below "TYPE" until differentiation (d/dt) is selected.**



5 **Press the soft key below "SETUP."**



6.3.10

Using the DASH IV's DSP differentiation processing capability

6 **Use the encoder wheel to select a time constant.**

- **The time constant is selectable between 1 ms and 1000 ms in 1 ms increments.**
- **The time constant is multiplied by the output which effectively scales the output.**
- **Smaller time constants result in smaller output signals.**

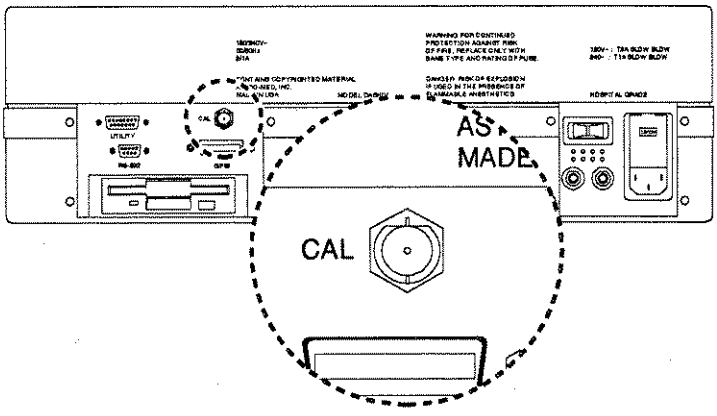
7 **Press the soft key below "EXIT" to leave the menu.**

6.3.11

Calibrating individual channels with the DASH IV's built-in precision voltage references

For the purpose of system calibration, the DASH IV is equipped with two extremely precise internal voltage references: 2.5V and 10V. Use the procedure given below to calibrate each channel to the recorder's precision voltage references.

1 **Locate the CAL BNC connector on the rear panel.**



Calibrating individual channels with the DASH IV's built-in precision voltage references

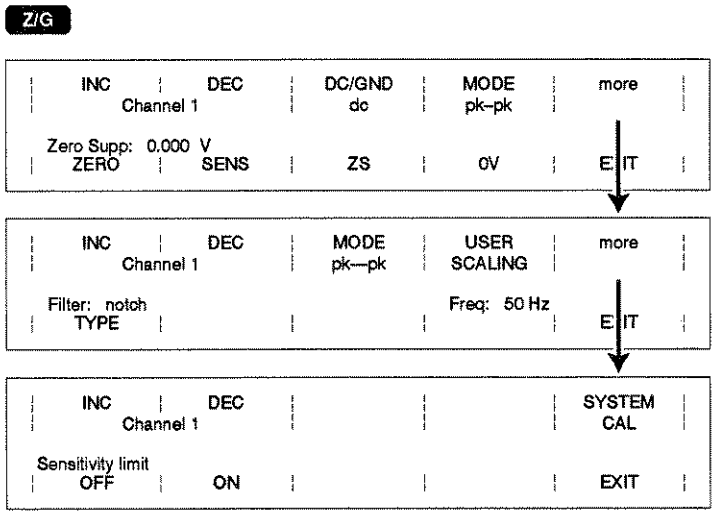
2 **Run a connector cable from the rear-panel CAL BNC connector to the front-panel signal inputs of any of the recorder's four channels.**

- **The necessary cable must have a male BNC connector on one end and a dual banana-jack connector at the other end.**

3 **Press the front-panel [Z/G] key.**

4 **Press the soft key above "more."**

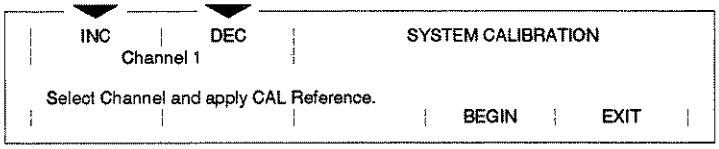
5 **Press the soft key above "SYSTEM CAL."**



6.3.11

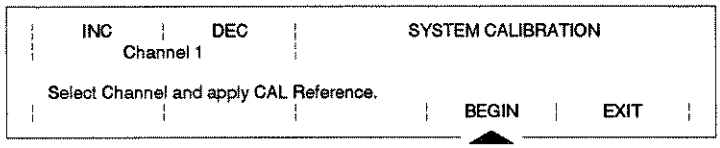
Calibrating individual channels with the DASH IV's built-in precision voltage references

6 **Press the soft key above "INC" or "DEC" until the channel that you want to calibrate is selected.**

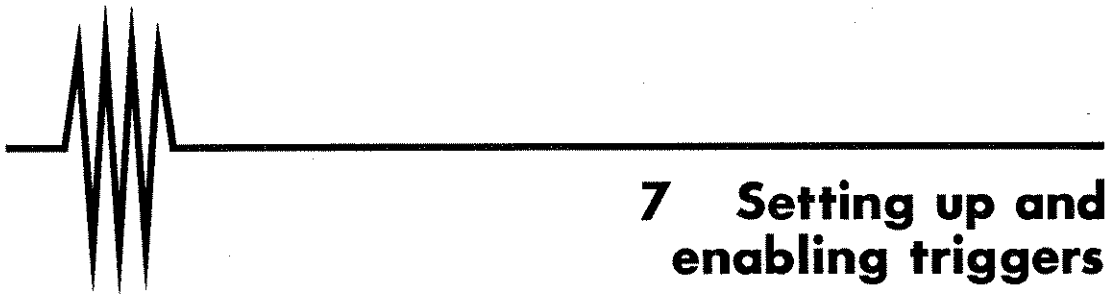


7 **Press the soft key below "BEGIN" to start the automatic calibration process:**

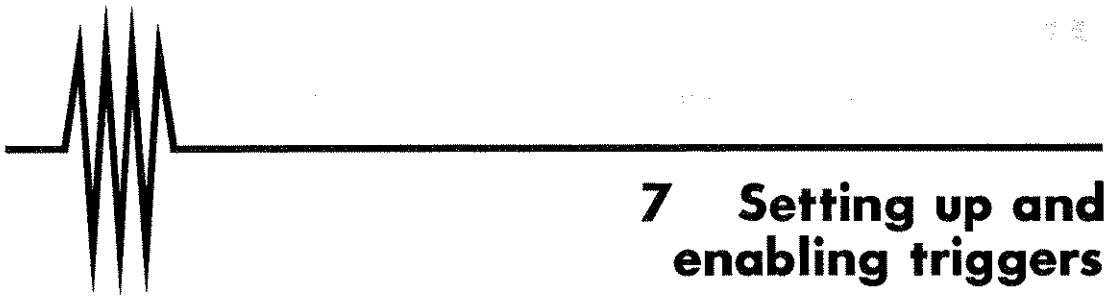
- **the selected channel is grounded.**
- **the precise reference voltage is input.**
- **internal adjustments are automatically made as necessary to exactly maintain the original zero and position selections.**



8 **Repeat steps 6 and 7 for each channel that you want to calibrate.**



7 Setting up and enabling triggers



7 Setting up and enabling triggers

7.1

DASH IV triggering capabilities

The DASH IV has one net trigger. The trigger can be generated by any of four sources:

- MANUAL — triggers generated when the front-panel [TRIG] key is pressed.
- HOST — triggers generated on command from a host computer.
- WAVE — waveform-generated triggers occurring when a signal exceeds or falls below user-defined trigger limits.
- EXTERNAL — externally generated triggers communicated through the rear-panel UTILITY D-shell.

Triggers can be put together in AND and OR groups to create a large number of trigger combinations.

Triggers are defined using the menus of the "SETUP TRIGGER" parameter found in the [SYS] key setups. The complete menu flow for all "SETUP TRIGGER" parameters is shown on the next page.

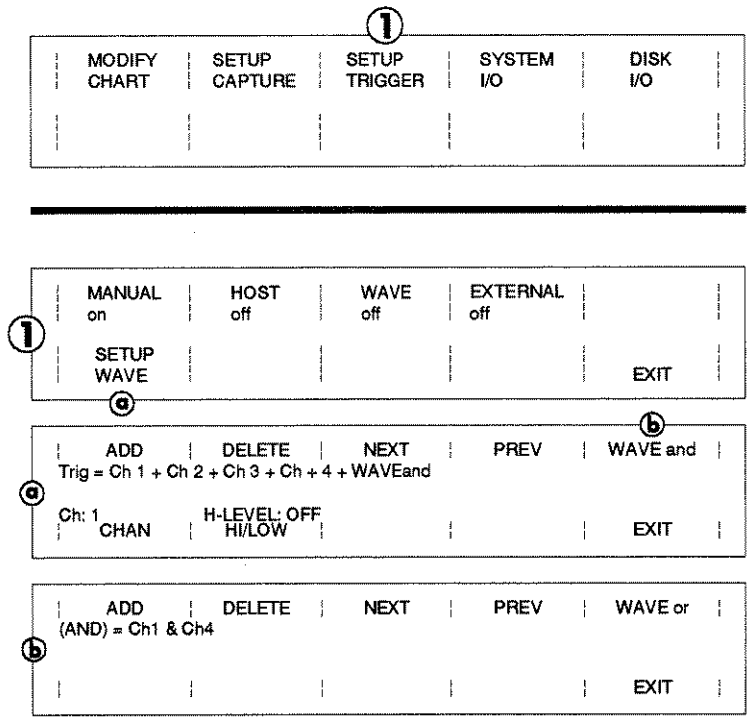
As the above menu flow shows, the "SETUP TRIGGER" parameter is used to:

- turn trigger sources on or off.
- define OR trigger combinations and combined AND / OR trigger combinations.
- define voltage levels over which and below which the input signal will cause a trigger condition.

The paragraphs that follow present the detailed procedures for defining each of these trigger setups.

7.1

DASH IV triggering capabilities



7.1.1

Turning on MANUAL, HOST, and EXTERNAL trigger sources

Trigger sources must be turned on in order for triggers to be generated. Turning on MANUAL, HOST, and EXTERNAL trigger sources is explained in the simple procedure that follows. The WAVE trigger source is automatically turned on whenever any waveform is selected as a trigger source. Turning on and combining waveform trigger sources is discussed in paragraph 7.1.2, "Combining waveform trigger sources into trigger groups."

7.1.1

Turning on MANUAL, HOST, and EXTERNAL trigger sources

Use the procedure below to selectively turn on or turn off manually generated, host-computer generated, or externally generated trigger sources.

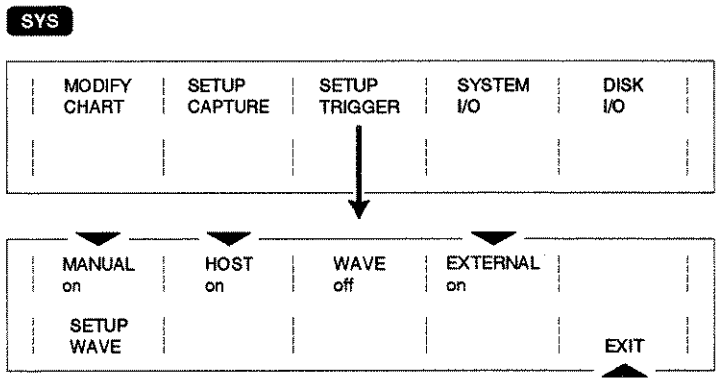
1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP TRIGGER."**

3 **Turn any of the three trigger source on or off by pressing the soft keys above:**

- **MANUAL**
- **HOST**
- **EXTERNAL**

4 **Press the soft key below "EXIT" to leave the "SETUP TRIGGER" parameter.**

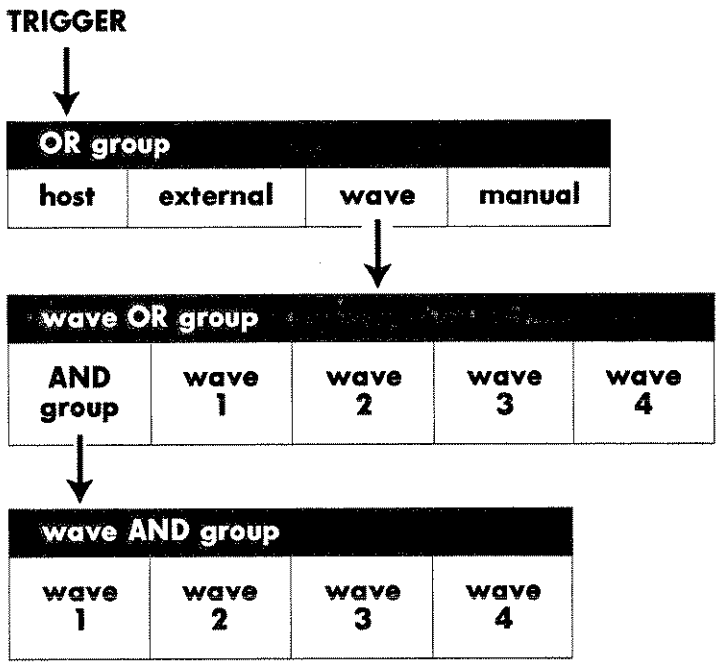


7.1.2

Combining waveform trigger sources into trigger groups

Trigger sources can be grouped to create a large number of triggering combinations. Waveforms are grouped as trigger sources by using the selections of the "SETUP WAVE" parameter to create both AND and OR triggering combinations.

- An OR trigger group allows you to combine one or more trigger sources so that a valid trigger in any one source generates a trigger.
- An AND trigger group allows you to combine waveform trigger sources so that a trigger is generated when valid trigger conditions are detected at the same time in all waveforms of the AND group.
- An AND trigger group is always part of a WAVE OR trigger group.



7.1.2

Combining waveform trigger sources into trigger groups

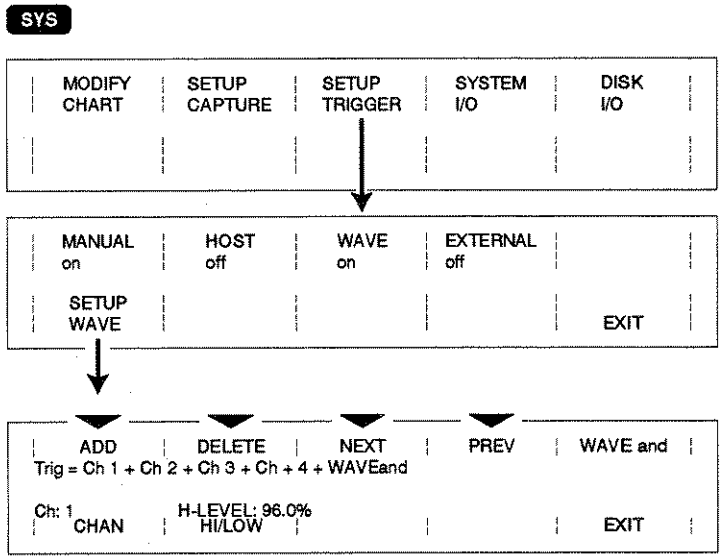
Use the procedure below to combine individual waveform trigger sources into AND / OR trigger groups.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SETUP TRIGGER."**
3. **Press the soft key below the "SETUP WAVE" parameter.**
4. **Press the soft key above "ADD" to add individual waveform trigger sources to the OR trigger combination you are creating.**

   - **OR "combinations" can consist of a single channel.**

NOTE

Be aware that the symbol "+" that appears in the OR menu stands for the word "or."



Combining waveform trigger sources into trigger groups

5 Press the soft key above "DELETE" to remove the last trigger source added to the OR combination.

6 Press the soft key above "NEXT" to progressively set each trigger channel to the next higher-numbered waveform trigger channel.

7 Press the soft key above "PREV" to progressively set each trigger channel to the next lower numbered waveform trigger channel.

8 Press the soft key above "WAVE and."

9 Press the soft key above "ADD" to add waveform trigger sources to the AND combination.

- An AND combination can consist of a single channel selection.

NOTE

Be aware that the ampersand symbol "&" that appears in the AND menu stands for the word "and."

The symbol "+" appears in the OR menu stands for the word "or."

10 Press the soft key above "DELETE" to remove the last trigger source added to the AND combination.

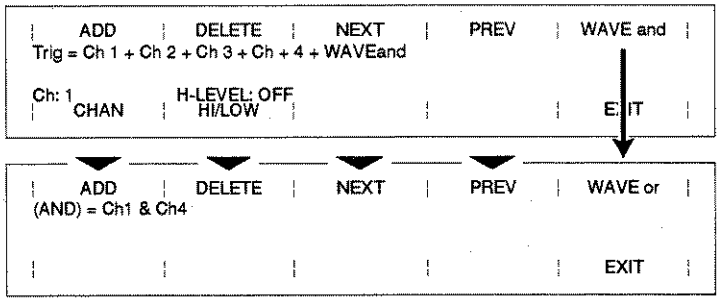
11 Press the soft key above "NEXT" to progressively set each trigger channel to the next higher-numbered waveform trigger channel.

12 Press the soft key above "PREV" to progressively set each trigger channel to the next lower-numbered waveform trigger channel.

- See the illustration at the top of the next page.

7.1.2

Combining waveform trigger sources into trigger groups



7.1.3

Setting trigger reference values

Trigger levels are reference values over which or below which triggers will be generated as a result of the activity of waveform trigger sources.

- Trigger levels are selected as 0.5% increments of the channel's A/D range.
- Trigger levels are specified in units applicable to the type of channel. For example, voltage for voltage channels, temperature for thermocouple channels, etc.

For each trigger channel, use the procedure on the following page to set trigger reference values.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SETUP TRIGGER."**
3. **Press the soft key below the "SETUP WAVE" parameter.**

7.1.3

Setting trigger reference values

4 **Press the soft key below "CHAN."**

- **Select the channel for which you will be setting high and low reference values.**

5 **Press the soft key below "HI/LOW."**

- **As the soft key is pressed, note that the reference level parameter alternates between "H-Level:" and "L-Level:" so that each level can be separately specified.**

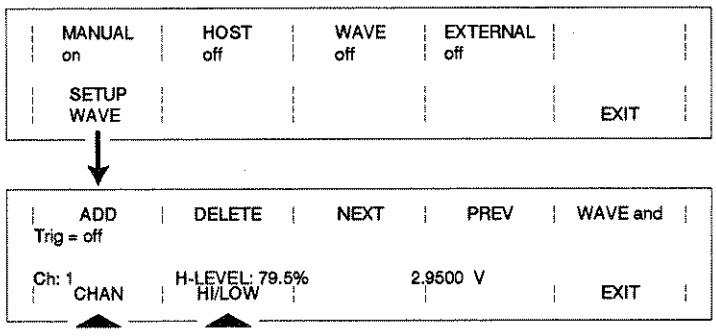
6 **With the high-level reference parameter (H-Level:) selected, use the encoder wheel to select a percentage value.**

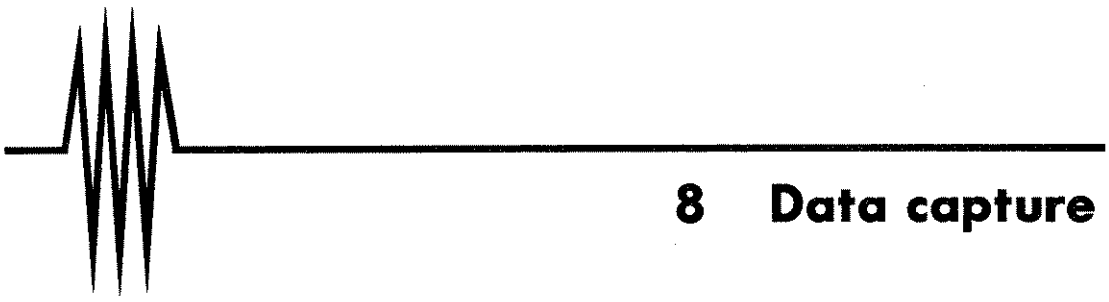
- **Waveform activity above the reference percentage of the A/D range will cause a trigger to be generated.**

7 **With the low-level reference parameter (L-Level:) selected, use the encoder wheel to select a percentage value.**

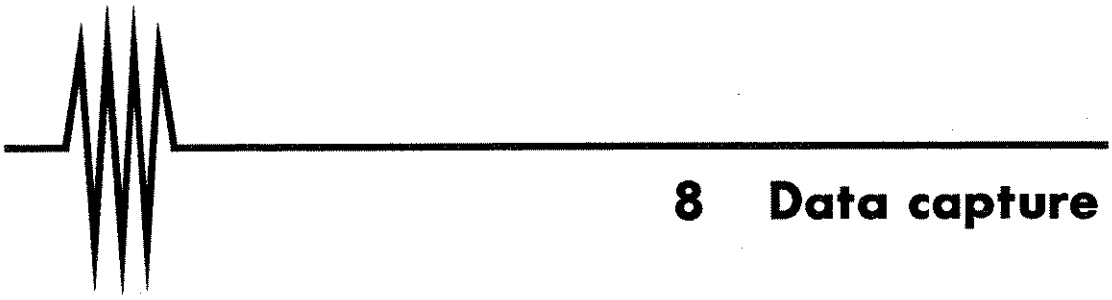
- **Waveform activity below the reference percentage of the A/D range will cause a trigger to be generated.**

8 **Press the soft key below "EXIT" to leave the SETUP WAVE.**





8 Data capture



8 Data capture

8.1

About capturing data with the DASH IV

In order to capture data, the DASH IV must be equipped with the Data Capture option (DC-65).

The DC-65 option provides the DASH IV with the following data capture capabilities:

- one megasample (2 megabytes) of volatile memory for the storage of data capture records.

NOTE

When capturing data it is important to keep in mind that data-capture memory is volatile. As explained later in this section, it is essential to store data-capture records to nonvolatile media such as floppy disks if you want to retain the data. If captured data is not stored to nonvolatile media, the data will be lost if power to the recorder is interrupted or if the recorder is powered down.

- three data capture methods:
  - single acquisitions without automatic record playback.
    - Single acquisitions are individually added to the inventory of records in system memory.
  - single acquisitions with automatic record playback.
    - Real-time recording is aborted during playback and the record is retained in the inventory of records in DRAM.
  - multi-stacking of acquisitions with optional auto-triggering and auto-rearming.
    - Automatic system arming and data acquisition with automatic "stacking" of the resulting records to system memory.

8.1

About capturing data with the DASH IV

- four data-capture record sizes: 16 k/channel, 32 k/channel, 64 k/channel, 128 k/channel.

  maximum of sixteen data-capture records: four records of 16 k/channel.

- data playback specified in fourteen available timebases when signal filtering in not used:

  - 2s, 1s, 400.0ms/mm, 200.0ms/mm, 100.0ms/mm, 40.0ms/mm, 20.0ms/mm, 10.0ms/mm, 4.0ms/mm, 2.0ms/mm, 1.0ms/mm, 400.0µs/mm, 200.0µs/mm, 100.0µs/mm.

- maximum available playback timebase of 1ms/mm when signal filtering is used.

The essence of data capture is the acquisition and storage of real-time waveform data as the result of either a command or the occurrence of an initiating trigger. In the data-capture setups described on the pages that follow, it is assumed that you have setup the trigger conditions that you want. See section X, "Setting up and enabling triggers."

Data capture in the DASH IV always requires:

- the Data Capture (DC-65) option.
- defining and turning on triggers.
- arming the system to respond to triggers.

8.2

Data-capture setups

A number of parameters must be defined when data-captures are setup. In a DASH IV equipped with the Data Capture option (DC-65), the menus used to setup data capture are found under the "SETUP CAPTURE" parameter.

8.2

Data-capture setups

"SETUP CAPTURE" is one of the [SYS] key setups and is used to define the parameters listed below. The settings of these parameters apply to all recording channels.

- SET RATE
  - specifies the data-capture playback in terms of any of fourteen available timebases.
- SET TRIGGER
  - defines for all channels the relationship between the data-capture window and the trigger.
- SET WINDOW
  - selects a record size for the next data capture that applies to all channels.
- CAPTURE CONTROL
  - selects one of three data capture methods:
    - single acquisitions without automatic record playback.
    - single acquisitions with automatic record playback.
    - multi-stacked acquisitions with optional auto-triggering and auto-rearming.

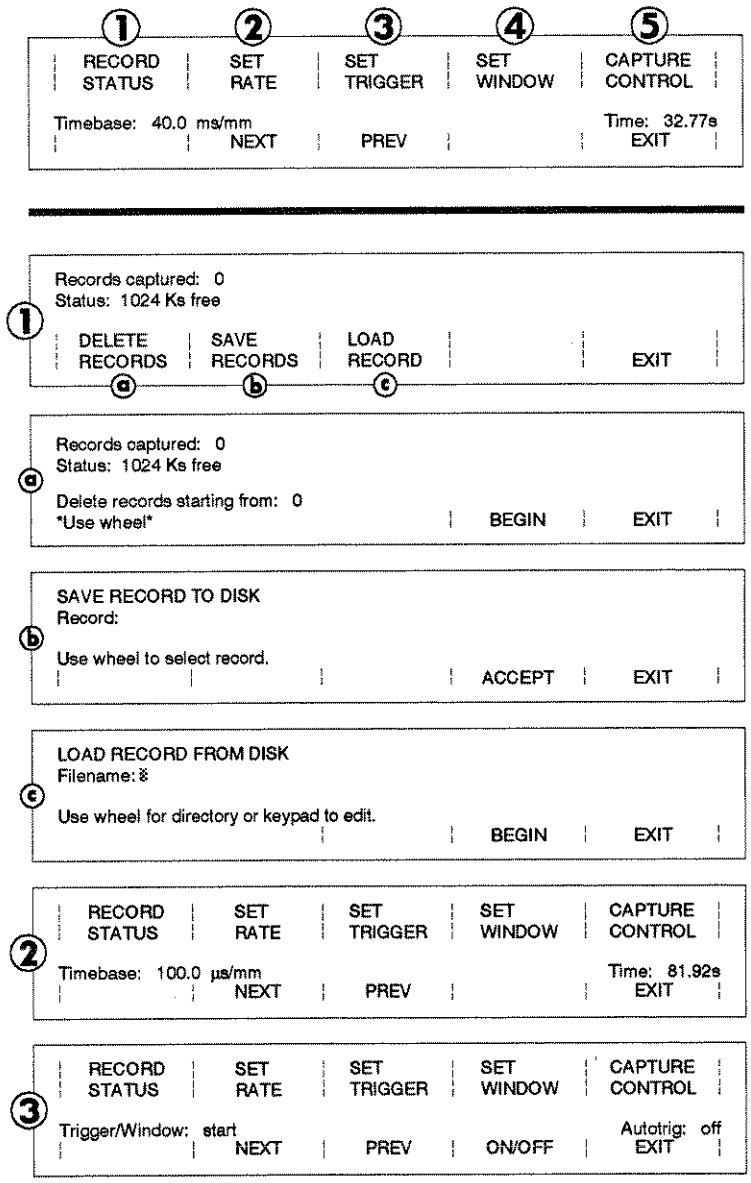
In addition to these data-capture setups, the "SETUP CAPTURE" parameter provides an additional parameter:

- RECORD STATUS
  - allows data-capture records to be deleted, saved to diskette, or uploaded from diskette.

The complete menu flow for the "SETUP CAPTURE" parameter is shown on the next two pages.

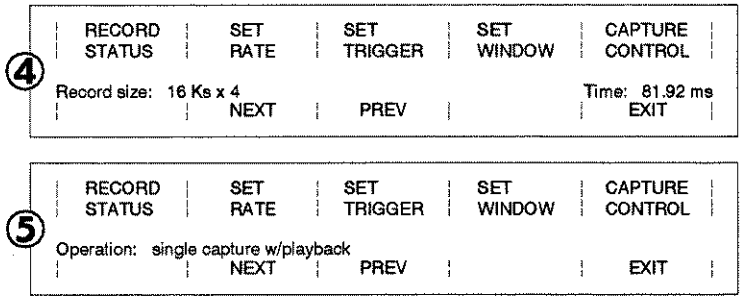
8.2

Data-capture setups



8.2

Data-capture setups



8.2.1

Selecting a data-capture playback timebase

When playing back data-capture records, previous versions of the DASH IV required you to select a playback sample rate specified as a frequency in Hz or kHz.

As a result of the real-time digital signal-filtering techniques used in the new-technology DASH IV, a different approach to selecting a playback sample rate is employed.

- A playback timebase is selected instead of selecting a playback sample rate specified as frequency,
- In the DASH IV, a playback timebase is expressed as time per millimeter.
- The DASH IV has fourteen data-capture playback time-base selections. The fourteen available timebases directly correspond to the sample rates shown in the table on the next page.
- In most cases, sampling data at a rate approximately 10 times faster than the highest waveform frequency provides excellent playback resolution.

8.2.1

Selecting a data-capture playback timebase

DASH IV playback timebase		equivalent sample rate	
100	µs/mm	200	kHz*
200	µs/mm	100	kHz*
400	µs/mm	50	kHz*
1	ms/mm	20	kHz
2	ms/mm	10	kHz
4	ms/mm	5	kHz
10	ms/mm	2	kHz
20	ms/mm	1	kHz
40	ms/mm	500	Hz
100	ms/mm	200	Hz
200	ms/mm	100	kHz
400	ms/mm	50	Hz
1	s/mm	20	Hz
2	s/mm	10	Hz

***NOTE**

When signal filtering is used during real-time recording, the maximum available non-interpolated data-capture playback timebase is 1 ms/mm. This is equivalent to a data-capture sample rate of 20 kHz.

During playback of data captured with timebases requiring greater than 20 kHz and with signal filtering turned on, linear interpolation is used to achieve the desired time-base resolutions.

The relationship between data-capture playback timebase and sample rate is expressed in the basic formula for finding frequency:

$$^{1}/_{period} = \text{frequency}$$

Consider the example in which a timebase of 400µs/mm is chosen. From the table above, we know that:

400µs/mm = 50 kHz

8.2.1

Selecting a data-capture playback timebase

- The equation indicates that there 400µs of data in 1 mm of a x1 playback.
- There are 20 dots of resolution per millimeter of chart.
- This means that 400µs contains 20 samples in a x1 playback.
- 400µs ÷ 20 samples yields a period of 20µs per sample.
- Knowing the period, frequency can be derived using the formula:

$$^{1}/_{period} = \text{frequency}$$

- Applying the formula for frequency results in the equation:

$$^{1}/_{20\mu s} = \text{frequency}$$

- Dividing 1 by 20µs yields a frequency of 50000 or 50 kHz.

Use the procedure below to select a data-capture playback timebase that applies to all channels.

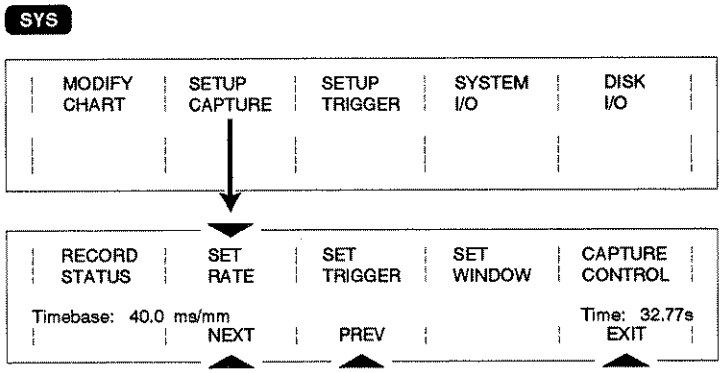
1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SETUP CAPTURE."**
3. **Press the soft key above "SET RATE."**
4. **Press the soft key below "NEXT" or "PREV" until the timebase that you want to use is selected in the "Timebase:" parameter.**

   - **Note that, as record sizes are selected, the "Time:" parameter of the display dynamically changes to show how much time the data capture will require.**
   - **The time required to complete a data capture is a function of the timebase selected and the record size selected.**

8.2.1

Selecting a data-capture playback timebase

5 **Press the soft key below "EXIT" to leave the "SET RATE" menu.**



8.2.2

Selecting a data-capture record size

When capturing data with the DASH IV, the terms "record size" and "window size" mean the same thing. "Record size" and "window size" indicate, in kilosamples per record per channel, the total amount of data capture memory allocated to the next data-capture record.

The "SET WINDOW" selection of the "SETUP CAPTURE" parameter is used to select the size of the next data-capture record. The record size that you select applies to all recording channels.

Use the procedure below to select a record size.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key above "SET WINDOW."**

8.2.2

Selecting a data-capture record size

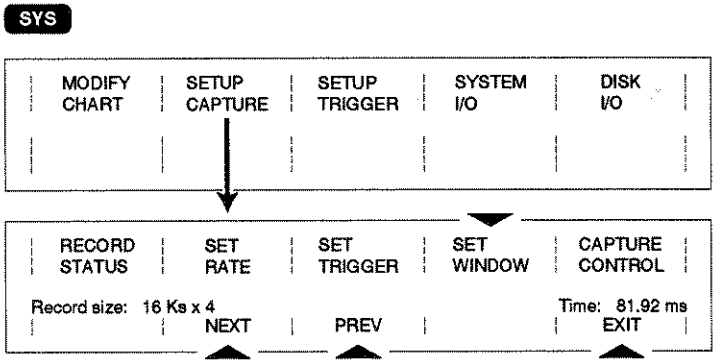
4 **Press the soft key below "NEXT" or "PREV" until the record size you want is selected.**

- **record sizes:**
  - **16 ksamp/channel**
  - **32 ksamp/channel**
  - **64 ksamp/channel**
  - **128 ksamp/channel**

- **Note that, as record sizes are selected, the "Time:" parameter of the display dynamically changes to show how much time the data capture will require.**

- **The time required to complete a data capture is a function of the timebase selected and the record size selected.**

5 **Press the soft key above "EXIT" to leave the "SET WINDOW" menu.**



8.2.3

The data-capture window and trigger placement

Data is captured with reference to a trigger. The term "trigger/window relationship" is used to describe the location of the trigger within the data-capture window. As with all data-capture setups, the trigger/window relationship has to be defined before data is captured. After a data-capture record has been created, the trigger/window relationship cannot be changed for that record.

The location of the trigger within the window determines the percentages of pretrigger and post-trigger data that are captured. The DASH IV menus make it convenient to discuss the trigger/window relationship in terms of four trigger location possibilities. These are:

- start triggers
  - Start triggers place the trigger at the very beginning of the window. The only data captured is after the trigger.
- end triggers
  - End triggers place the trigger at the very end of the window. The only data captured is before the trigger.
- center triggers
  - Center triggers place the trigger at the very middle of the window. 50% of the data captured is pretrigger and 50% of the data is post-trigger.
- percentage triggers
  - Percentage triggers are placed within the window at 12.5% increments. Pretrigger data and post-trigger data are captured with reference to where the trigger is placed.

    Depending on the selected record size, the trigger can be placed at the start of the window, into the window at 12.5%, 25%, 37.5%, 50%, 62.5%, 75%, 87.5%, or at the end of the window.

8.2.3

The data-capture window and trigger placement

The number of trigger locations within the window depends on the record size that is selected. Placement options within specific record size selections are:

- 16 ksamp/channel windows
  - start, center, end
- 32 ksamp/channel windows
  - start, 25%, center, 75%, or end
- 64 ksamp/channel windows
  - start, 12.5%, 25%, 37.5%, center, 75%, 87.5%, or end trace
- 128 ksamp/channel windows
  - start, 12.5%, 25%, 37.5%, center, 75%, 87.5%, or end trace

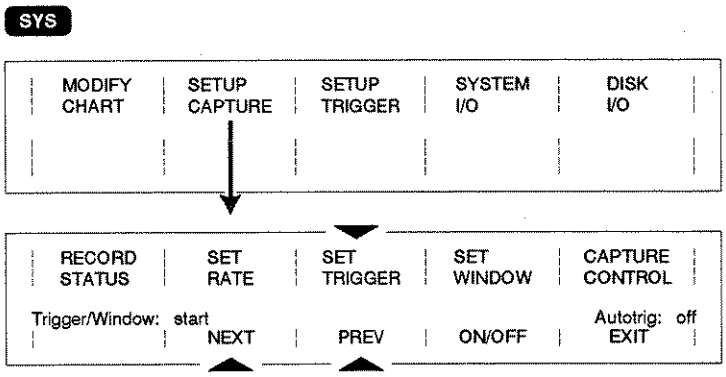
Use the procedure below to place the trigger within the window you have selected.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SETUP CAPTURE."**
3. **Press the soft key above "SET TRIGGER."**
4. **Press the soft key below "NEXT" or "PREV" until the trigger is placed at the location that you want within the window.**
   - **Where the trigger can be placed within the window depends on the record size that you have selected.**
   - **Placement options within specific record size selections are given above.**

8.2.3

The data-capture window and trigger placement

5 Press the soft key below "EXIT" to leave the "SET TRIGGER" menu.



8.2.4

Selecting a data-capture method

As earlier mentioned, DASH IV recorders equipped with the Data Capture option (DC-65) provide three data capture methods:

- single acquisitions without automatic record playback.

  Single acquisitions are individually added to the inventory of records in system memory.

- single acquisitions with automatic record playback.

  Real-time recording is aborted during playback and the record is retained in the inventory of records in system memory.

8.2.4

Selecting a data-capture method

- multi-stacking of acquisitions with optional auto-triggering and auto-rearming.
  - automatic system arming and data acquisition with automatic "stacking" of the resulting records to the capacity of data-capture system memory.

The "CAPTURE CONTROL" selection of the "SETUP CAPTURE" parameter is used to select the data-capture method that you want to use.

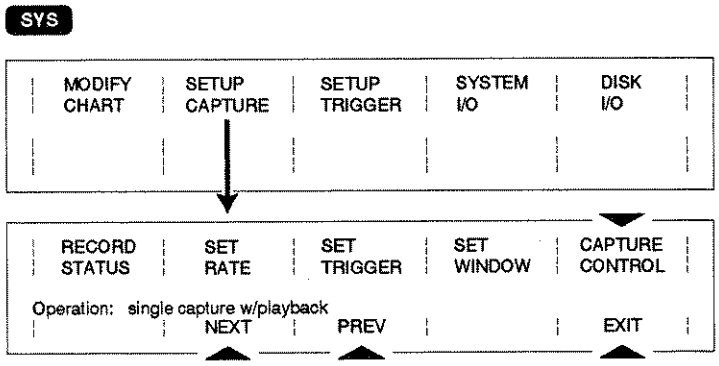
Use the procedure below to select either the "single capture" data-capture method or the "single capture with playback" data-capture method.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SETUP CAPTURE."**
3. **Press the soft key above "CAPTURE CONTROL."**
4. **Press the soft key below "NEXT" or "PREV" until the method you want is selected.**
   - **If a data acquisition occurs with "single capture" selected:**
     - **each capture is individually added to the next data capture record.**
     - **the system must be manually re-armed after each capture.**

Selecting a data-capture method

- If a data acquisition occurs with "single capture w/ playback" selected:
  - data is captured.
  - a hard-copy of the captured data is printed immediately and automatically.
  - real-time recording is aborted during data playback.
  - each capture is individually added to the next data capture record.
  - the system must be manually re-armed after each capture and playback.

5 Press the soft key above "EXIT" to leave the "CAPTURE CONTROL" menu.



8.2.5

Setting up the multi-capture data-capture method

The "multi-capture" data-capture method uses automatic triggering and automatic re-arming to allow the DASH IV to automatically capture data and "stack" the resulting data-capture records to the full capacity of data-capture memory.

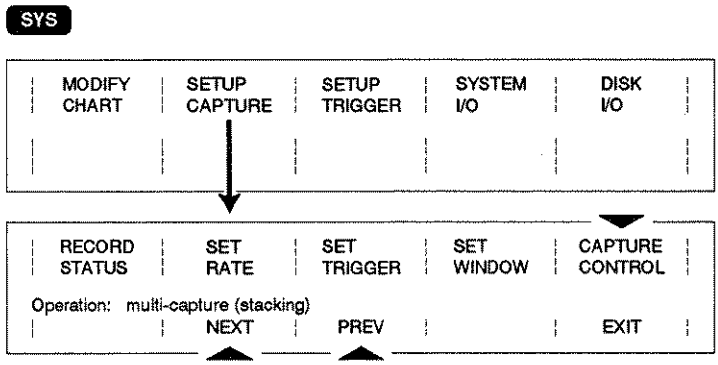
Use the procedure below to setup the "multi-capture" data-capture method.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key above "CAPTURE CONTROL."**

4 **Press the soft key below "NEXT" or "PREV" until the "multi-capture (stacking)" method is selected.**



5 **Press the soft key above "SET TRIGGER."**

6 **If you want to use the optional autotriggering function, press the soft key below "ON/OFF" until the "Autotrig:" parameter shown in the display is set to "on."**

7 **Press the soft key below "EXIT" to leave the "SET TRIGGER" menu.**

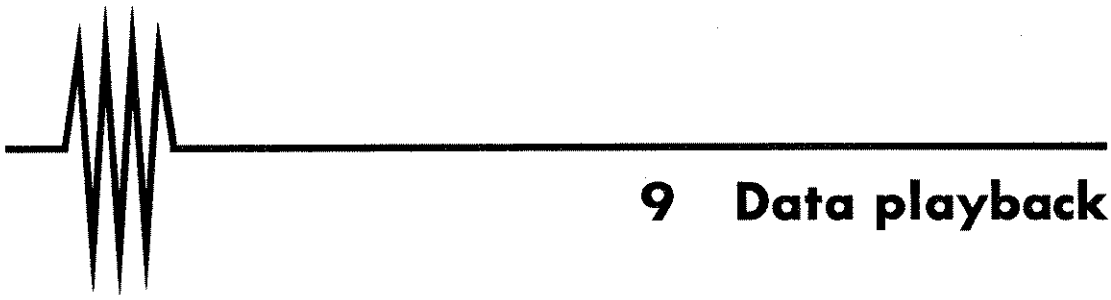
Setting up the multi-capture data-capture method

7 **Press the soft key below "EXIT" to leave the "SET TRIGGER" menu.**

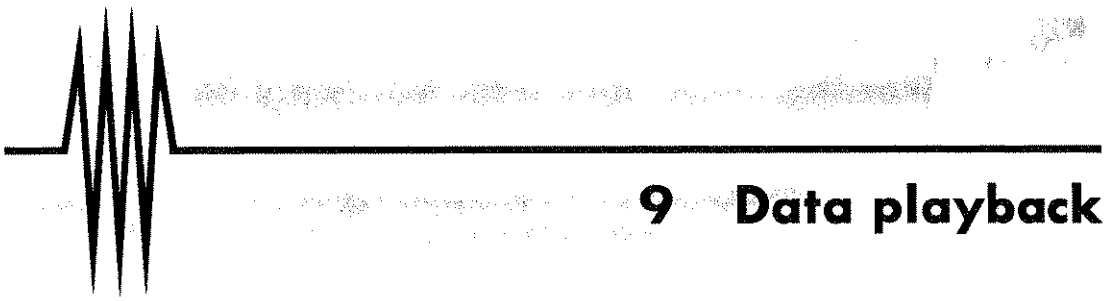


8 **Press the front-panel [ARM] key and arm the system.**

- **The system is armed when the ARM indicator light next to the [ARM] key is illuminated.**
- **If the optional autotrigger function is turned on, a trigger is generated immediately and automatically when the system is first armed.**
- **If the optional autotrigger function is turned on, the system automatically creates a data capture record and re-arms itself.**
- **The system remains armed.**
- **If the optional autotrigger function is turned on, as triggers are sensed, the system automatically:**
  - **creates data capture records.**
  - **consecutively "stacks" the data capture records.**
  - **rearms itself at the completion of each acquisition and stacking.**
- **Unless the recorder's settings or mode of operation are changed, this automatic sequence of system arming, data acquisition, data-capture record stacking, and re-arming continues to the full capacity of data-capture memory.**



9 Data playback



9 Data playback

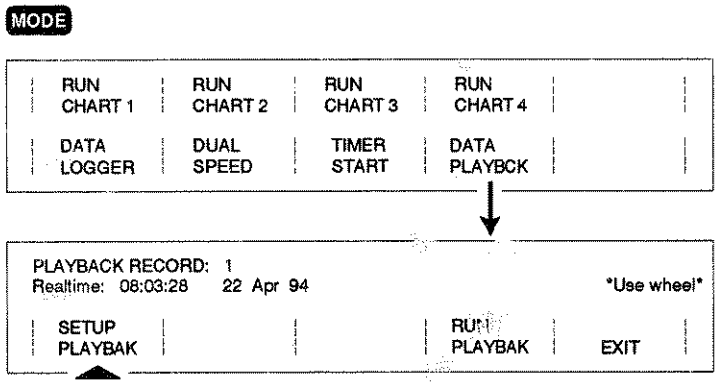
9.1

Playing back data with the DASH IV

After capturing data you will want to replay the data for examination and analysis. The DASH IV provides playback controls that allow you to:

- select for playback all the captured data in the record.
- select for playback any portion of the captured data of interest down to the level of individual samples.
- playback the captured data as:
  - hardcopy only.
  - hardcopy with simultaneous playback on the recorder's display.
  - playback to the front panel display only.

When the DASH IV's front-panel [MODE] key is pressed, the data playback setups are found under the "SETUP PLAYBACK" parameter of the "DATA PLAYBACK" mode.



9.1

Playing back data with the DASH IV

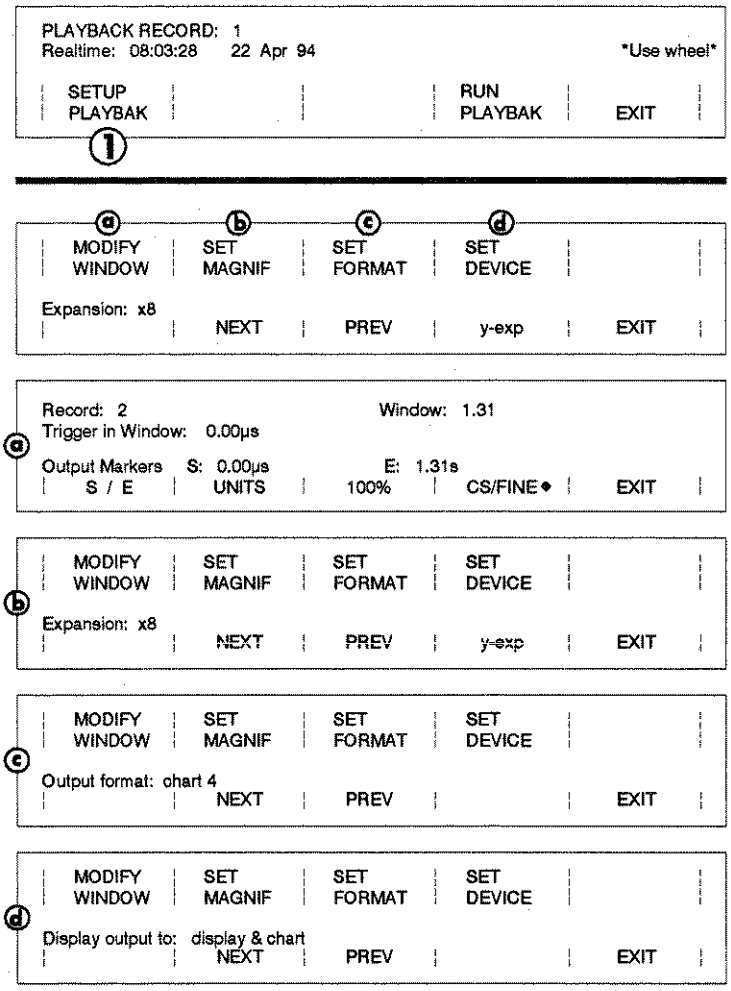
"SETUP PLAYBACK" parameters include:

- MODIFY WINDOW
  - selects all of the captured data or any specific portion of the data for playback.
- SET MAGNIF
  - expands or compresses the playback to allow detailed examination of data or to obtain an overview of the data.
- SET FORMAT
  - selects an output format that determines the "layout" of the captured data on the chart paper or on the front-panel display.
- SET DEVICE
  - selects as the playback destination either:
    - chart paper only.
    - chart paper and the front-panel display.
    - the front-panel display only.

The complete menu flow for the "SETUP PLAYBACK" setups is shown in the illustration on the next page.

9.1

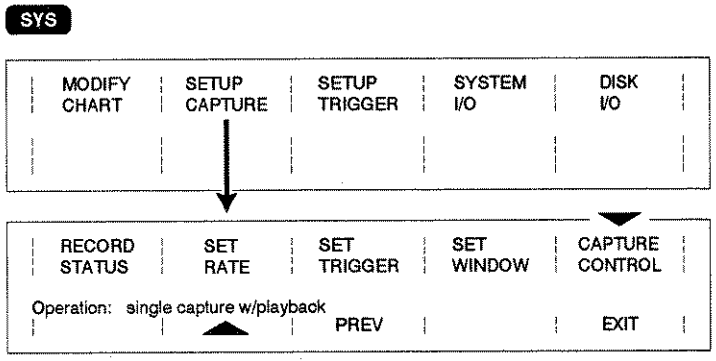
Playing back data with the DASH IV



9.1

Playing back data with the DASH IV

When recording with the DASH IV, automatic playback of captured data occurs only when the data-capture method used is single capture with playback. In all other cases, data capture records must be manually selected and the playback must be initiated manually.



9.1.1

Selecting either the entire record or a specific part of the record for playback

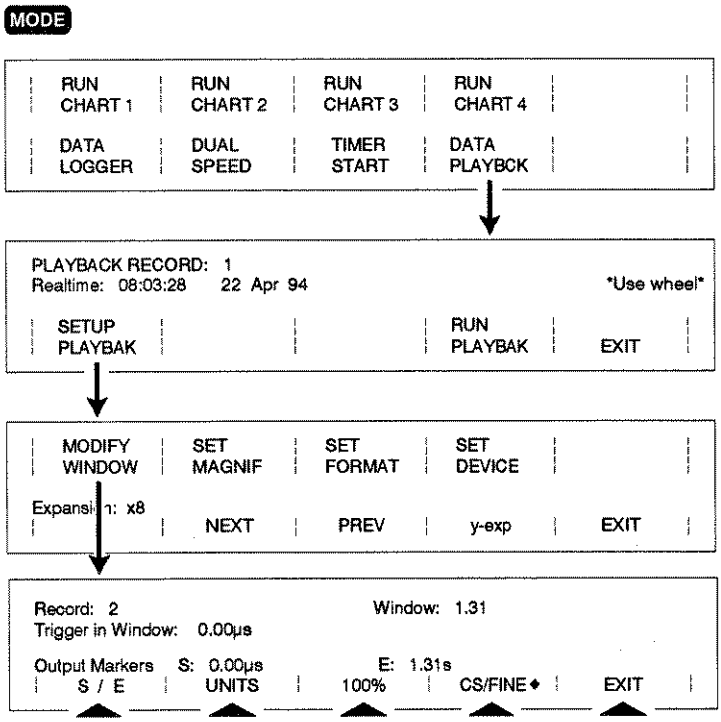
The "MODIFY WINDOW" parameter found under the "DATA PLAYBACK" setup is used to select either the whole data-capture record or any part of the record for playback.

Use the procedure below to select the data you want to replay.

1. **Press the front-panel [MODE] key.**
2. **Press the soft key below "DATA PLAYBACK."**
3. **Press the soft key below "SETUP PLAYBACK."**
4. **Press the soft key above "MODIFY WINDOW."**

9.1.1

Selecting either the entire record or a specific part of the record for playback



- **Note that the top portion of the "MODIFY WINDOW" menu shows the following parameters:**

  - **"Record:"**
    the number of the record that has been selected.

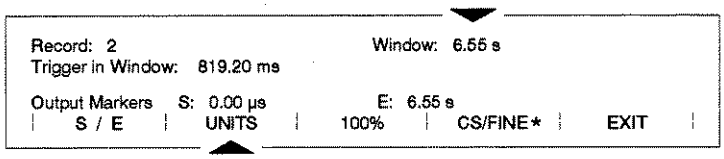
  - **"Trigger in Window:"**
    the position of the trigger within the data capture window expressed either as time or data sample number.

  - **"Window:"**
    the size of the data-capture window expressed either as time or data sample number.

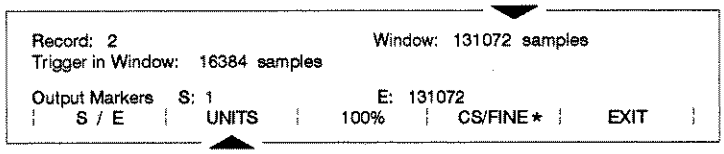
Selecting either the entire record or a specific part of the record for playback

4 **Press the soft key below "UNITS" to select the units in which the data capture window will be described.**

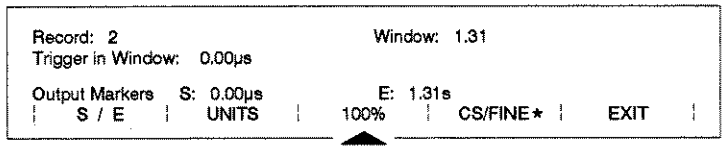
- **The DASH IV can describe the data capture window in units of time:**



- **or quantity of data samples:**



5 **If you want to quickly select the entire data-capture window for replay, press the soft key below "100%."**

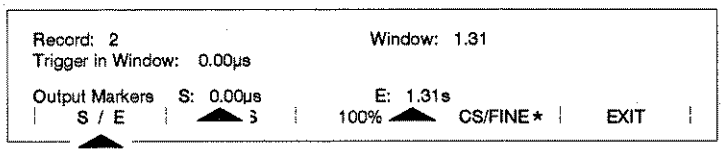


6 **Press the soft key below "S / E."**

- **This selects the "Output markers:" parameter.**
- **This parameter allows you to select, from any location within the window, the starting point (S) and the end point (E) of the data to be replayed.**
- **Individually select each output marker (beginning point and end point).**
- **See the illustration at the top of the next page.**

9.1.1

Selecting either the entire record or a specific part of the record for playback



7 **When each parameter has been selected, use the encoder wheel to select the value you want.**

8 **Press the soft key below "CS/FINE" and select either coarse (CS) or fine.**

- **The coarse setting is used to step quickly through the data-capture window using large increments.**
- **The fine setting is used to step through the data-capture window using the smallest increments.**

9 **Press the soft key below "EXIT" to leave the "MODIFY WINDOW" menu.**

9.1.2

Expanding or compressing a data-capture record playback in the time or amplitude axes

Use the "SET MAGNIF" setup of the "SETUP PLAYBACK" parameter to expand or compress the playback of the captured data.

Expansion is used to examine data in detail. Compression is used to obtain an overview of the data. Expansion factors can be set for the playback's time axis and amplitude axis.

Use the procedure below to set the magnification level select the data you want to replay.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBACK."**

9.1.2

Expanding or compressing a data-capture record playback in the time or amplitude axes

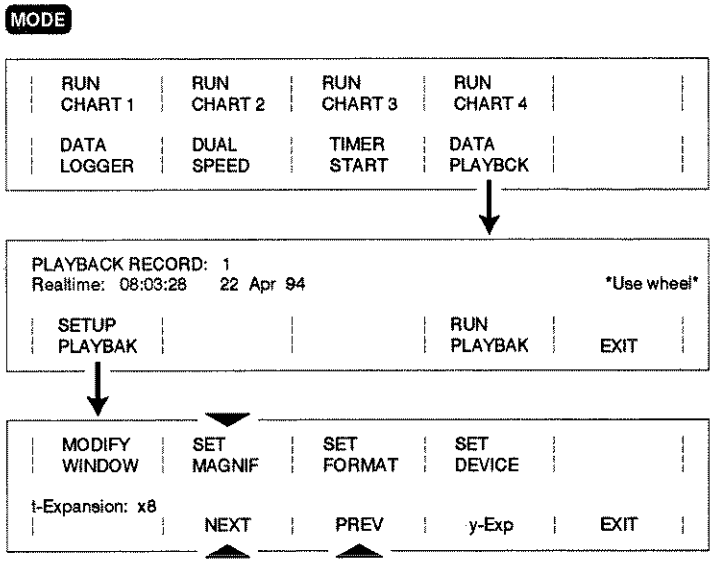
3 **Press the soft key below "SETUP PLAYBACK."**

4 **Press the soft key above "SET MAGNIF."**

- **The menu that results is used to expand the playback along the time axis (t-Expansion).**

5 **Press the soft key below "NEXT" or "PREV" until the expansion factor that you want is selected.**

- **expansion factors: x 1/8, x 1/4, x 1/2, x1, x2, x4, x8.**



6 **Press the soft key below "y-Exp" to expand the playback along the amplitude axis (y-Expansion).**

7 **Press the soft key above "INC" or "DEC" and select a channel for expansion along the amplitude axis.**

8 **Press the soft key above "NEXT" or "PREV" until the expansion factor that you want is selected.**

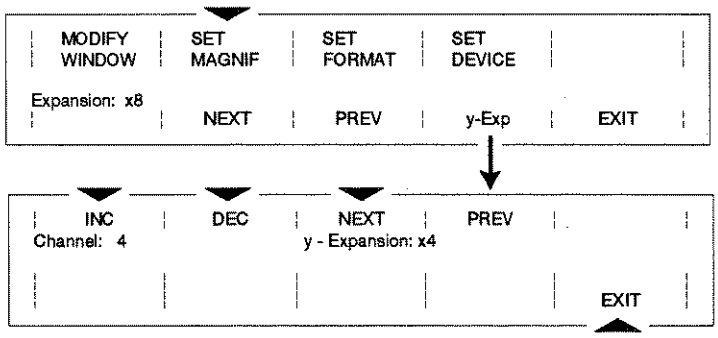
9.1.2

Expanding or compressing a data-capture record playback in the time or amplitude axes

8 **Press the soft key above "NEXT" or "PREV" until the expansion factor that you want is selected.**

- **expansion factors: x1, x2, x4.**

9 **Press the soft key below "EXIT" to leave the "SET MAGNIF" setup.**



9.1.3

Selecting a chart format for the playback

When playing back captured data, it is important to understand that the only chart formats that will be available for the playback will be those of the active recorder setup.

- Unless data playback is immediate or the active setup remains unchanged, it is possible for the chart formats of the current active setup to be unrelated to, or inappropriate for, the captured data being played back.
  - For example, if the data-capture record contains four channels but the chart formats of the active setup are for two channels then no sensible relationship would exist between the data being played back and the available chart formats.

9.1.3

Selecting a chart format for the playback

There are three solutions to this situation:

- When the data capture occurs, save the currently active setup with the data-capture record. When you are ready to play back the data-capture record, download the saved recorder setup so that the saved recorder setup becomes the active setup. This will ensure an appropriate correlation between the captured data and the chart format.

- When the data capture occurs, note the formats of the active setup so that you can reconstruct the recorder setup when the data-capture record is played back.

- Configure the appropriate recorder setup "from scratch" so that the available chart formats will be appropriate for playback of the data-capture record.

Use the procedure below to select the chart format on which the captured data will be replayed.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBACK."**

3 **Press the soft key below "SETUP PLAYBACK."**

4 **Press the soft key above "SET FORMAT."**

5 **Press the soft key below "NEXT" or "PREV" until the chart that you want to use is selected.**

   - **You will be able to select either:**

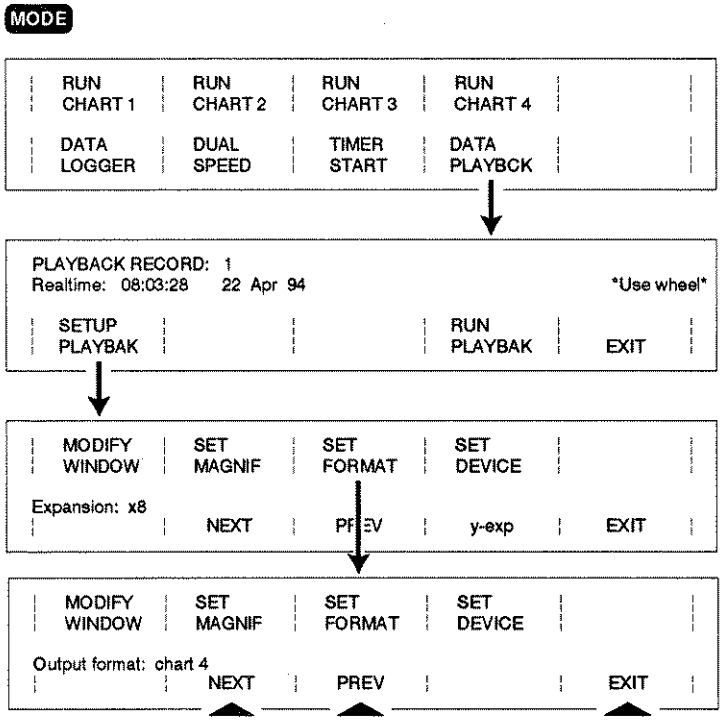
     - **one of the four charts formats of the active recorder setup.**

     - **any two recording channels to be printed as an XY plot.**

9.1.3

Selecting a chart format for the playback

6 Press the soft key below "EXIT" to leave the "SET FORMAT" menu.

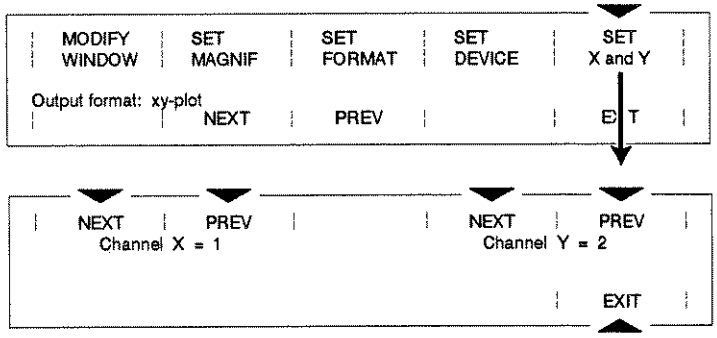


9.1.3

Selecting a chart format for the playback

7 **To setup an XY plot:**

- **Press the soft key below "NEXT" or "PREV" until "xy-plot" is selected as the output format.**
- **Press the soft key above "SET X and Y."**
- **Press the soft key above "NEXT" or "PREV" in both the channel X parameter and the channel Y parameter until you have selected the channels you want to use.**
- **Press the soft key below "EXIT."**



9.1.4

Selecting a destination for the playback

The DASH IV allows you to playback the data-capture record to any of the following:

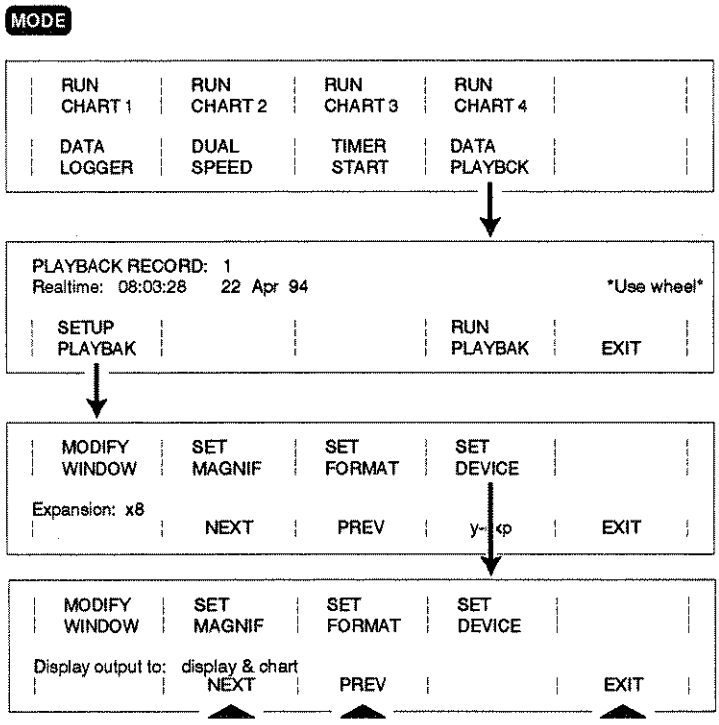
- chart paper only.
- chart paper and the front-panel display.
- the front-panel display only.

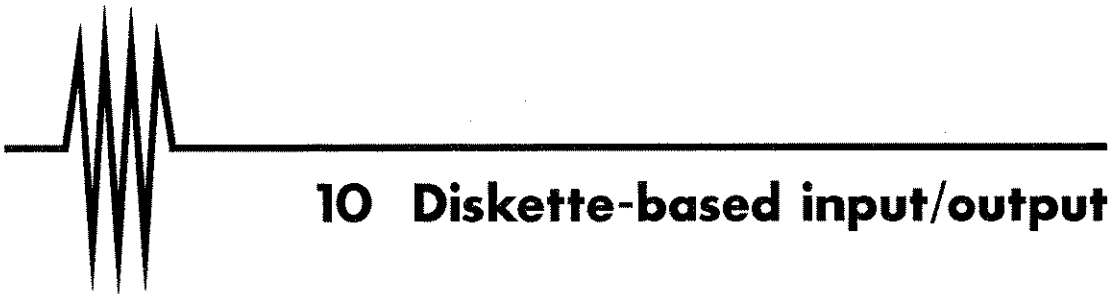
9.1.4

Selecting a destination for the playback

Use the procedure below to select the destination to which the data-capture record replayed.

1. **Press the front-panel [MODE] key.**
2. **Press the soft key below "DATA PLAYBACK."**
3. **Press the soft key below "SETUP PLAYBACK."**
4. **Press the soft key above "SET DEVICE."**
5. **Press the soft key below "NEXT" or "PREV" until the playback destination that you want to use is selected.**
6. **Press the soft key below "EXIT" to leave the "SET DEVICE" menu.**





10 Diskette-based input/output



10 Diskette-based input/output

10.1

Input/output functions when using diskettes

DASH IV diskette-based input/output functions include:

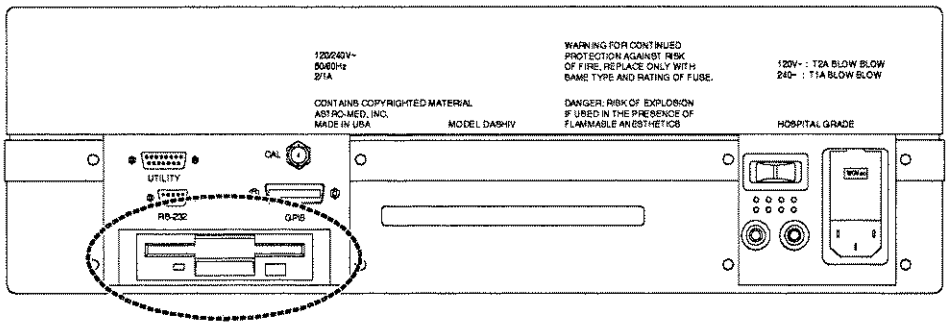
- saving almost all active recorder setups to diskette.
- recalling saved recorder setups from diskette.
- renaming files on diskette.
- deleting files from diskette.
- formatting diskettes.
- upgrading operating system software.*

*System software upgrades are discussed in section 11, System input/output.

The procedures presented in this section describe how to define each of the DASH IV system input/output functions.

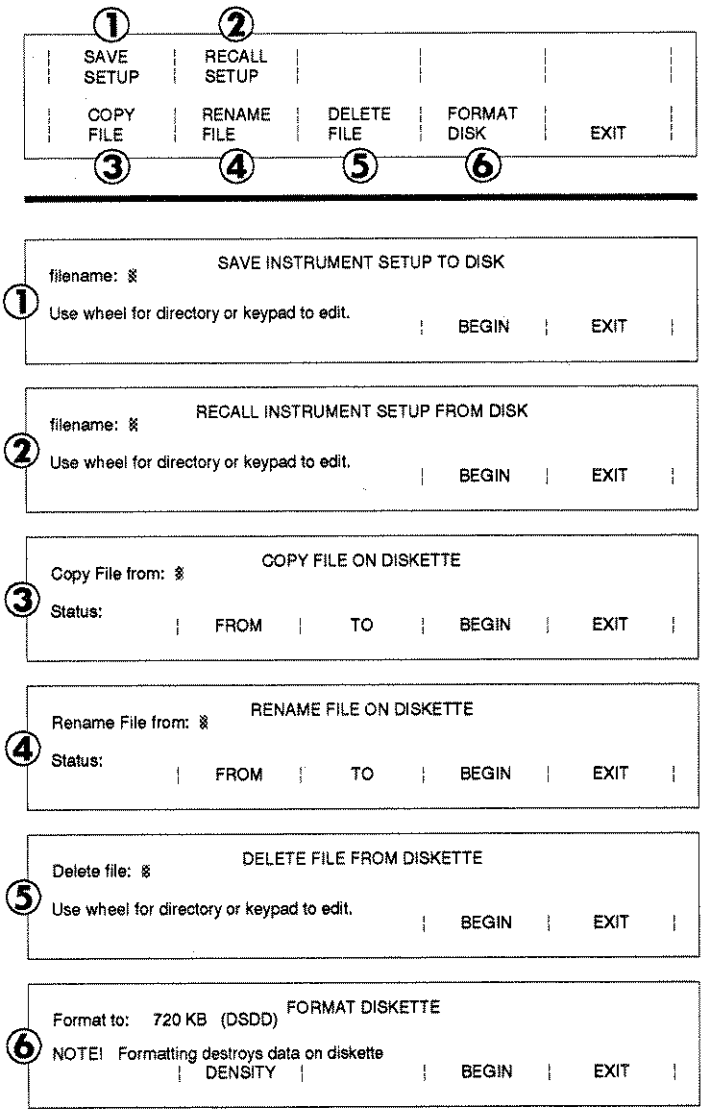
The complete menu flow for the DISK I/O selection is shown on page 10-2.

Diskette-based input/output functions are done using the recorder's rear-panel disk drive.



10.1

Input/output functions when using diskettes



10.2

About the settings that make a recorder setup

The DASH IV has the ability to permanently save to diskette almost all active recording setups. This ability can be exceptionally useful because it completely eliminates the need for time-consuming, repetitive recorder preparation. Equally important, it allows you to create a "library" of recorder setups so that, whenever necessary, you can easily retrieve and reuse formats that have been previously setup.

When an active recorder setup is saved, the parameters that are saved are numerous and include:

- [Z/G] key settings.
- [EDIT] key settings.
- [SPD] key settings.
- MODIFY CHART settings.
- SETUP CAPTURE settings.
- SETUP TRIGGER settings.
- SYSTEM I/O settings (except for CAL REF switch).
- DATALOGGER recording mode settings.
- DUAL SPEED recording mode settings.
- TIMER START recording mode settings.
- DATA PLAYBACK settings.
- host control settings.

Setups are saved as a group in a named file so it is convenient to refer to saving all the recorder setups as saving "the setup."

The DASH IV's "SAVE SETUP" function is used when you want to save the setup selections of a recording session to diskette. The "SAVE SETUP" function is discussed in the paragraph that follows.

10.3

Saving a recorder setup to diskette

1 Put a formatted 3.5 inch diskette into the rear-panel disk-drive.

- If necessary, use the FORMAT DISK procedure described in paragraph 10.7 of this section.

2 Press the front-panel [SYS] key.

3 Press the soft key above "DISK I/O."

4 Press the soft key above "SAVE SETUP."

5 Use the DASH IV's alphanumeric keypad to create a file name for the active recorder setup.

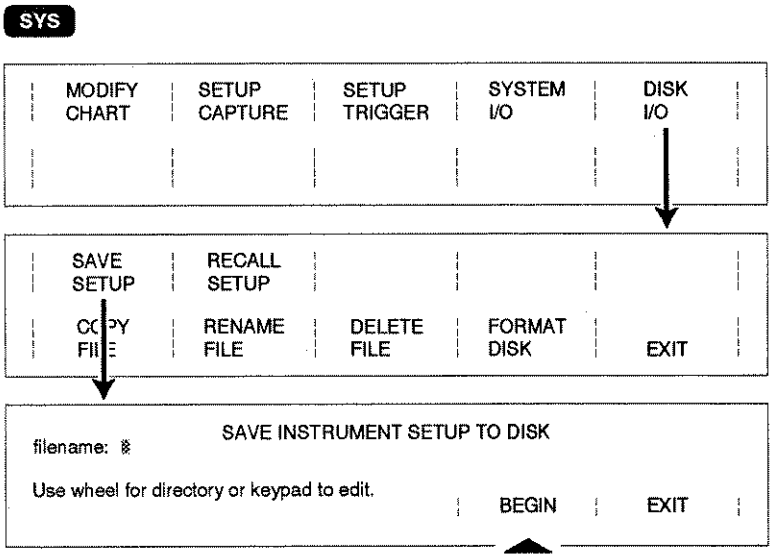
- The length of file name must be twelve characters.
- Eight characters form the file name.
- Three characters are used to designate an extension.
- A dot separates the file name from the extension.
- For example, file names might look like: MYTEST12.dos, STRESSLB.dos, etc.
- If the diskette you are using already contains setup files, you can select any of the files and save the new recorder setup under the selected setup's name.

6 Press the soft key below "BEGIN."

- The active setup is saved to diskette under the file name you created or under an existing name.
- See the illustration at the top of the next page.

10.3

Saving a recorder setup to diskette



10.4

Recalling a recorder setup from diskette

When a saved recorder setup is recalled from diskette, the active recorder setup is lost and cannot be recovered. If you want to retain the active setup, always save it to diskette before recalling the saved setup.

1. **Put the diskette containing the saved recorder setup into the rear-panel disk-drive.**
2. **Press the front-panel [SYS] key.**
3. **Press the soft key above "DISK I/O."**
4. **Press the soft key above "RECALL SETUP."**

10.4

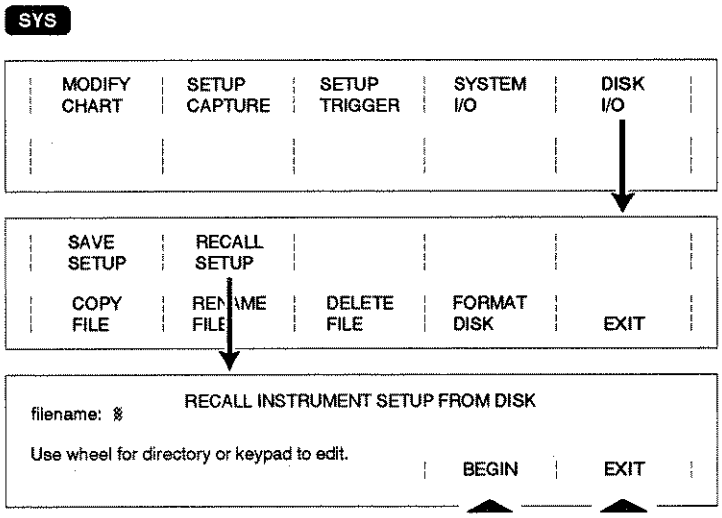
Recalling a recorder setup from diskette

5 **Use the encoder wheel to select the name of the saved recorder setup file that you want to upload from the diskette.**

6 **Press the soft key below "BEGIN."**

- **The selected recorder setup is recalled from diskette and becomes the active recorder setup.**

7 **Press the soft key below "EXIT" to leave the "RECALL SETUP" menu.**



10.5

Renaming files on diskette

Use the procedure on the procedure below to edit the name of any recorder setup file that you have saved to diskette.

1 **Put the diskette containing the saved recorder setup into the rear-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

4 **Press the soft key below "RENAME FILE."**

5 **Use the encoder wheel to select from the diskette the file name that you want to edit.**

6 **Press the soft key below "TO."**

7 **Use the DASH IV's alphanumeric keypad to type a new name for the selected file on diskette.**

- **The length of the file name must be twelve characters.**
- **Eight characters form the file name.**
- **Three characters are used to designate an extension.**
- **A dot separates the file name from the extension.**

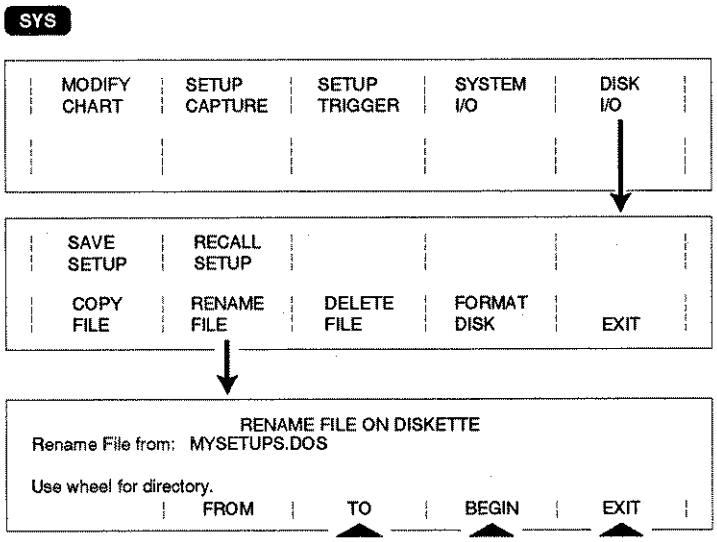
8 **Press the soft key below "BEGIN."**

- **The old file name is immediately replaced by the new name you just typed.**
- **See the illustration at the top of the next page.**

9 **Press the soft key below "EXIT" to leave the "RENAME FILE" menu.**

10.5

Renaming files on diskette



10.6

Deleting files from diskette

Use the procedure on the procedure below to delete any recorder setup file that you have saved on a diskette.

1. **Put the diskette containing the saved recorder setup into the rear-panel disk-drive.**
2. **Press the front-panel [SYS] key.**
3. **Press the soft key above "DISK I/O."**
4. **Press the soft key below "DELETE FILE."**
5. **Use the encoder wheel to select from the diskette the name of the file that you want to delete.**

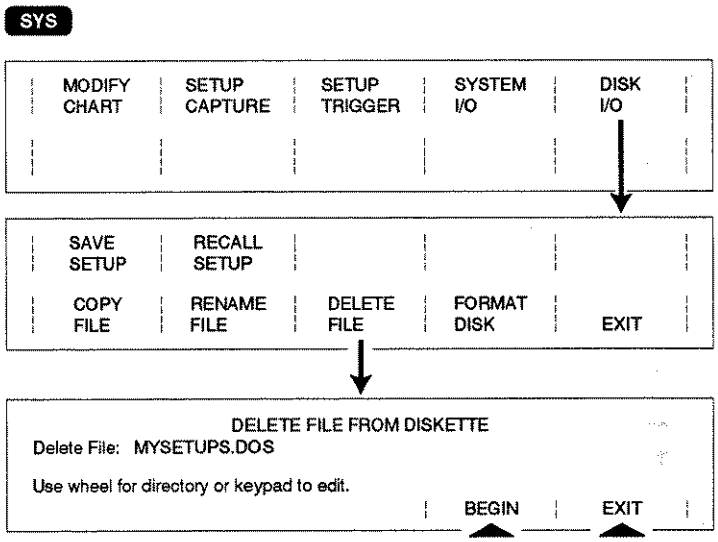
10.6

Deleting files from diskette

6 **Press the soft key beneath "BEGIN."**

- **The selected file is immediately deleted from the diskette.**

7 **Press the soft key below "EXIT" to leave the "DELETE FILE" menu.**



10.7

Formatting diskettes

The DASH IV's rear-panel disk drive requires the use of 3.5-inch diskettes. The recorder can format diskettes to either of two format densities:

- 720KB double-sided, double-density (DSDD).
- 1.44MB double-sided, high-density (DSHD).

Use the procedure on the next page to use the DASH IV's rear-panel disk drive to format 3.5-inch diskettes.

10.7

Formatting diskettes

1 **Put a 3.5 inch diskette into the rear-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

4 **Press the soft key below "FORMAT DISK."**

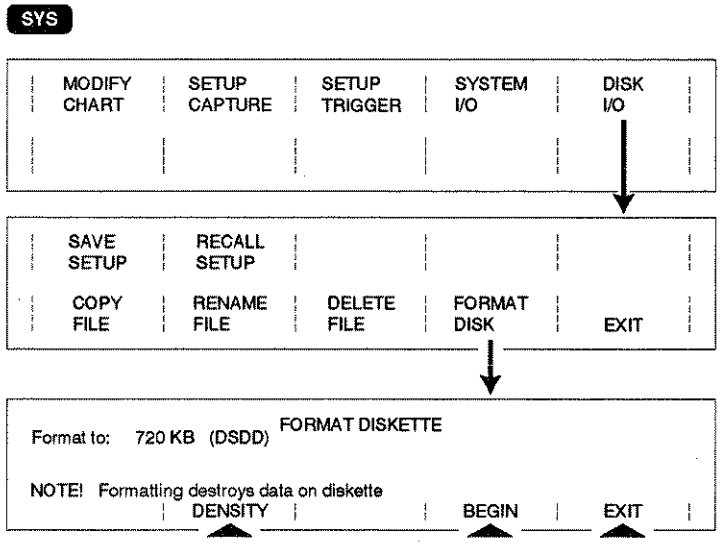
5 **Press the soft key below "DENSITY."**

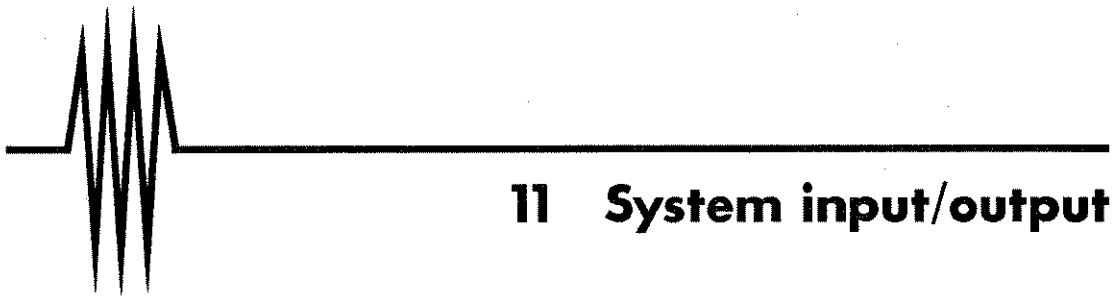
- **If you are formatting a double-sided, double-density diskette, select the 720KB (DSDD) setting.**
- **If you are formatting a high density diskette, select the 1.44 MB (DSHD) setting.**

6 **Press the soft key below "BEGIN."**

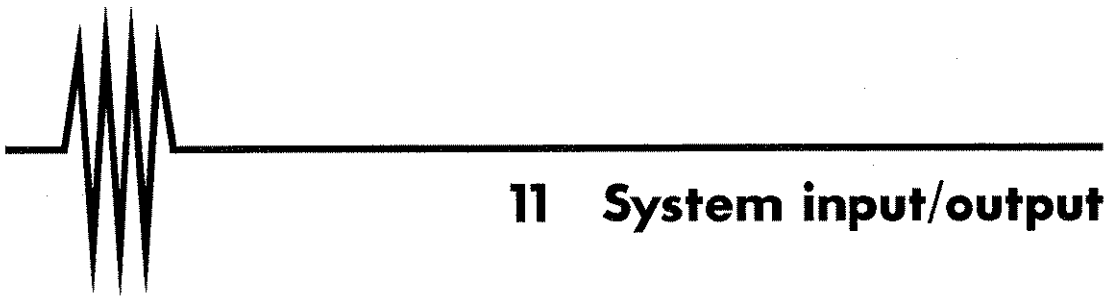
- **The formatting process will begin and the display dynamically shows the number of tracks formatted.**

7 **Press the soft key below "EXIT" to leave the "FORMAT DISK" menu.**





11 System input/output



11 System input/output

11.1

DASH IV input/output

DASH IV system input / output functions include:

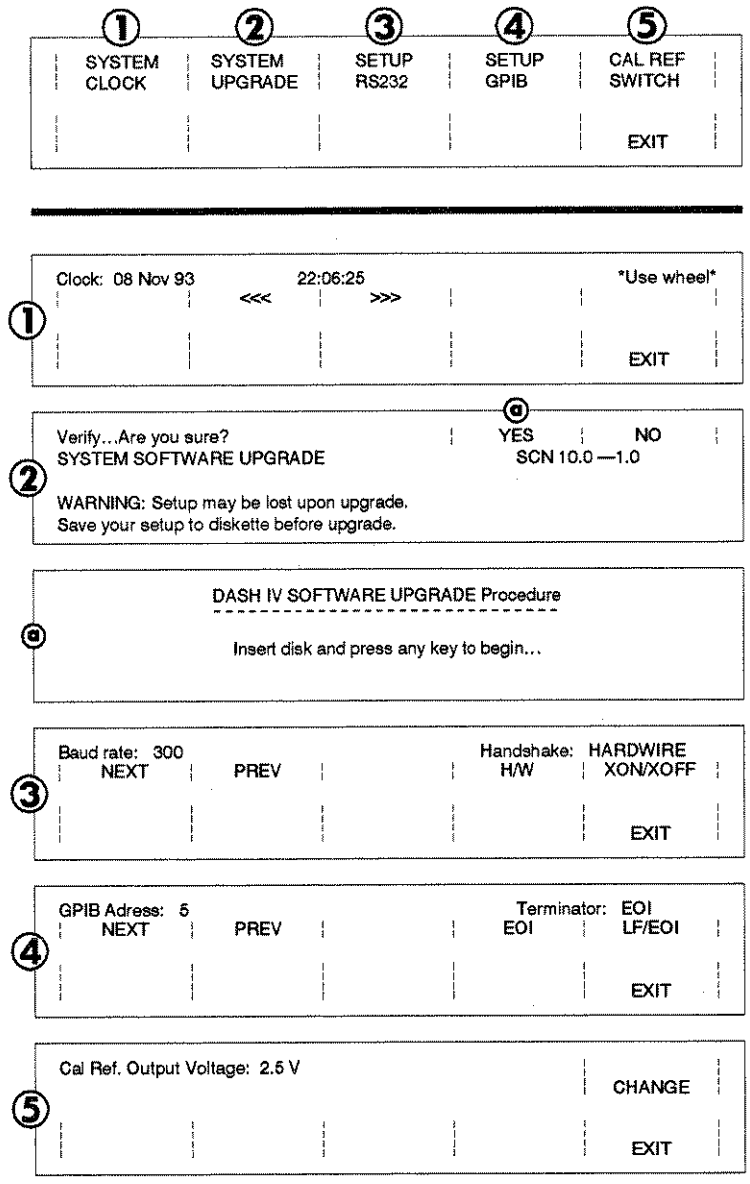
- setting the system clock.
- setting up the RS232 communications interface for host-computer control, if desired.
- setting up the GPIB communications interface for host-computer control, if desired.
- verifying the accuracy of the DASH IV's internal precision voltage reference.
- performing system software upgrades.

These functions are defined using the SYSTEM I/O setups of the [SYS] key. The complete menu flow for the SYSTEM I/O setups is shown on page 11-2.

The procedures presented in this section describe how to use each of the DASH IV system input/output functions.

11.1

DASH IV input/output



11.2

Setting the system clock

1 Press the front-panel [SYS] key.

2 Press the soft key above "SYSTEM I/O."

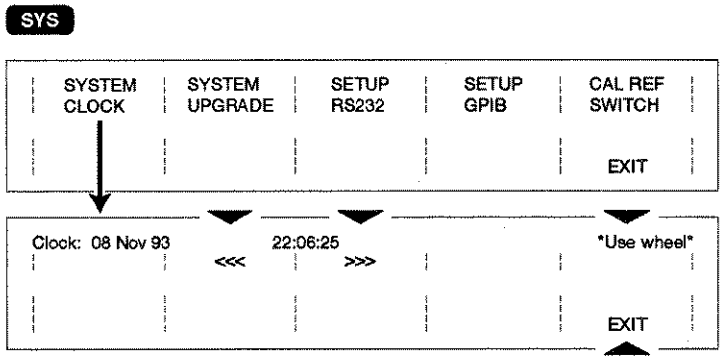
3 Press the soft key above "SYSTEM CLOCK."

4 Press the soft keys above "<<<" or ">>>" and individually select each parameter of the date and time.

- system clock parameters: day, month, year, hour, minute, second.

5 When each parameter is selected, use the encoder wheel to set the parameter to the value you want.

6 Press the soft key below "EXIT" to leave the SYSTEM CLOCK setup menu.



11.3

Setting up the RS232 interface

The complete process of setting up host control over the DASH IV requires more than setting up the RS232 communications interface. Please refer to the DASH IV Host Control Manual for additional instructions regarding establishing host control of the recorder.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SYSTEM I/O."**

3 **Press the soft key above "SETUP RS232."**

4 **Press the soft keys above "NEXT" and "PREV" and select the baud rate you want to use.**

- **baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200.**
- **baud rate limited to 1200 when XON/XOFF is selected as the handshaking method.**

5 **Press the soft key above "H/W" or "XON/XOFF" and select the communications handshaking method you want to use.**

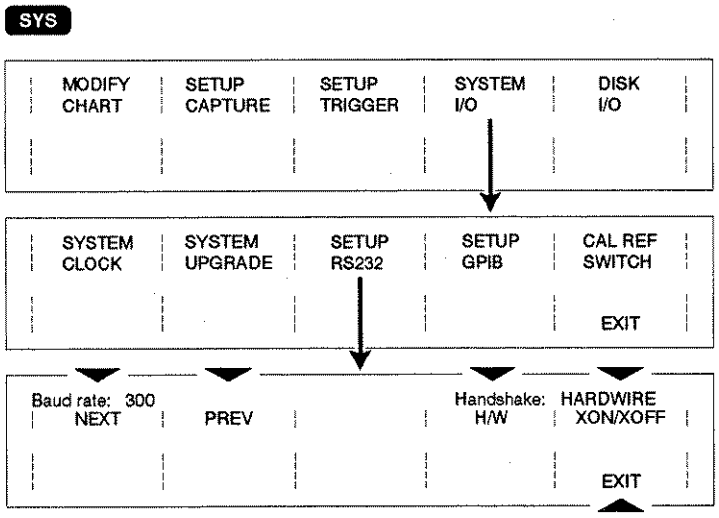
- **handshake methods: hardwire or XON/XOFF.**

6 **Press the soft key below "EXIT" to leave the RS232 setup menu.**

- **See the illustration at the top of the next page.**

11.3

Setting up the RS232 interface



11.4

Setting up the GPIB interface

The complete process of setting up host control over the DASH IV requires more than setting up the GPIB communications interface. Please refer to the DASH IV Host Control Manual for additional instructions regarding establishing host control of the recorder.

1. **Press the front-panel [SYS] key.**
2. **Press the soft key above "SYSTEM I/O."**
3. **Press the soft key above "SETUP GPIB."**
4. **Press the soft keys above "NEXT" and "PREV" and select the GPIB address you want to use.**

   - **GPIB addresses: 0 through 31.**

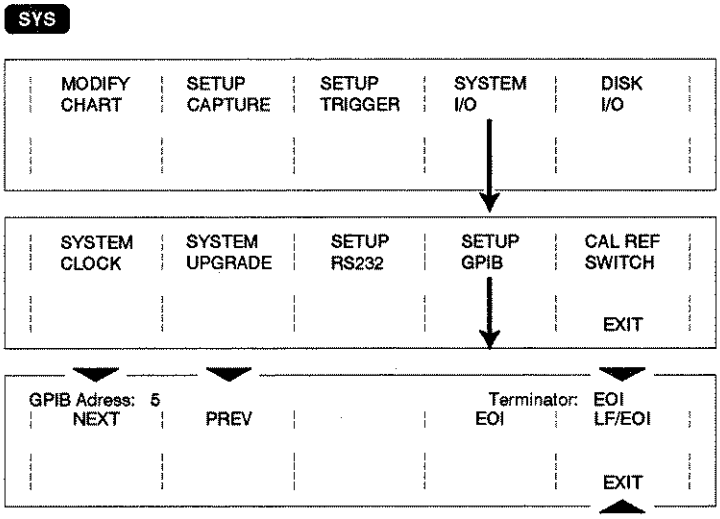
11.4

Setting up the GPIB interface

5 **Press the soft key above "EOI" or "LF/EOI" and select the GPIB communications termination method you want to use.**

- **GPIB terminators: EOI or LF/EOI.**

6 **Press the soft key below "EXIT" to leave the GPIB setup menu.**



11.5

Performing a system software upgrade

1 **If you want to save the active recorder setup to diskette, use the procedures described in section X (Saving recorder setups to diskette) of this operations manual.**

- **If you do not save the active recorder setup, it will be lost during the upgrade procedure and will not be recoverable.**

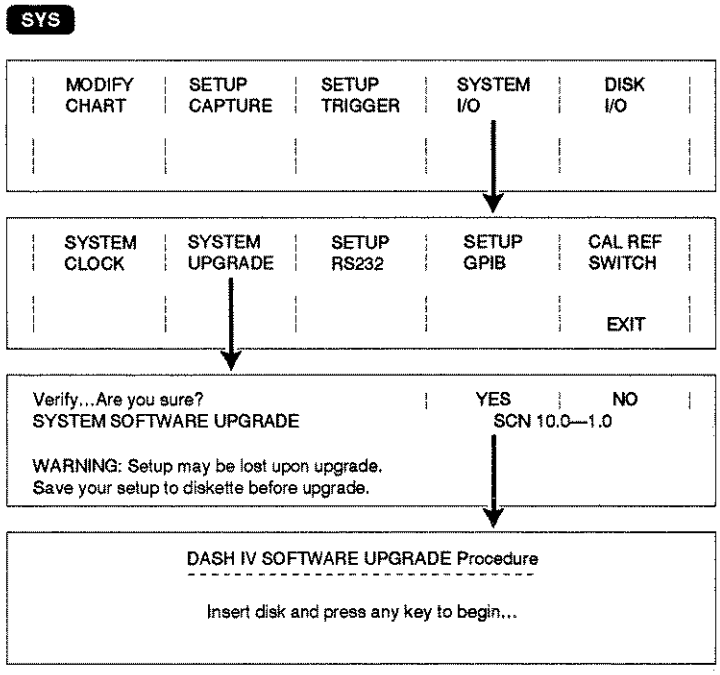
2 **Press the soft key front-panel [SYS] key.**

3 **Press the soft key above "SYSTEM I/O."**

4 **Press the soft key above "SYSTEM UPGRADE."**

- **At this point, a menu prompts you to confirm you intention of performing the software upgrade.**

5 **Press the soft key above "YES" to proceed with the upgrade procedure.**



11.5

Performing a system software upgrade

6 Insert the diskette containing the software upgrade into the recorder's rear-panel disk drive.

7 Press any front-panel key to start the system software upload.

- A display is automatically generated informing you that the erasure phase of the system software upgrade is in progress.

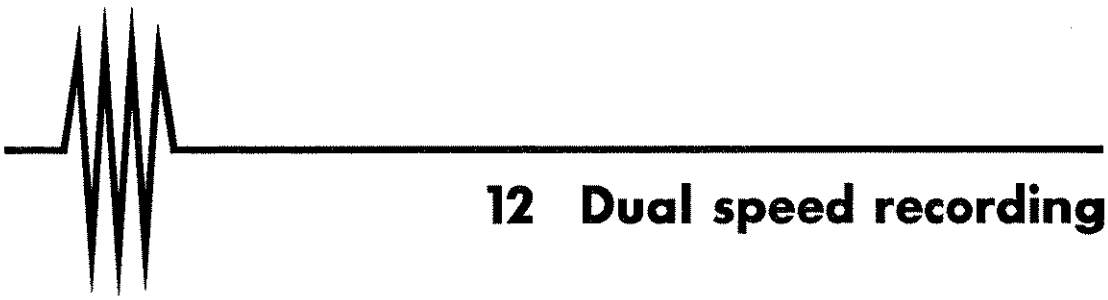
  The message is dynamic and shows the percentage of the erasure phase that has been completed.

- The erasure message is followed automatically by a message informing you that the programming phase of the system software upgrade is in progress.

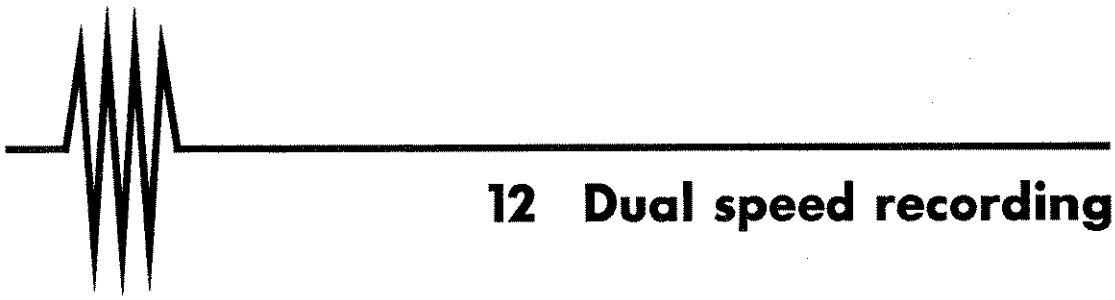
  The message is dynamic and shows the percentage of the programming phase that has been completed.

- A final message is generated automatically informing you that the upgrade procedure is complete.

8 Press any front-panel key to begin operating the recorder with the upgraded system software.



12 Dual speed recording



12 Dual speed recording

12.1

Timed and triggered dual speed recording

Dual speed operation allows the DASH IV to toggle between two recording speeds either as the result of a trigger or the passage of a duration of time.

- Timed dual-speed recording toggles the recorder between two different chart speeds continuously and automatically after operating at each speed for a specified duration of time.
- Triggered dual-speed recording toggles the recorder between two different chart speeds continuously and automatically each time a trigger is sensed.

Time and triggered dual-speed operation are separately discussed below.

12.2

Setting up timed dual-speed recording

Timed dual-speed operation causes the DASH IV to toggle automatically and continuously between two recording speeds after specific time durations.

When you setup a timed dual-speed recording session, you must define the following parameters:

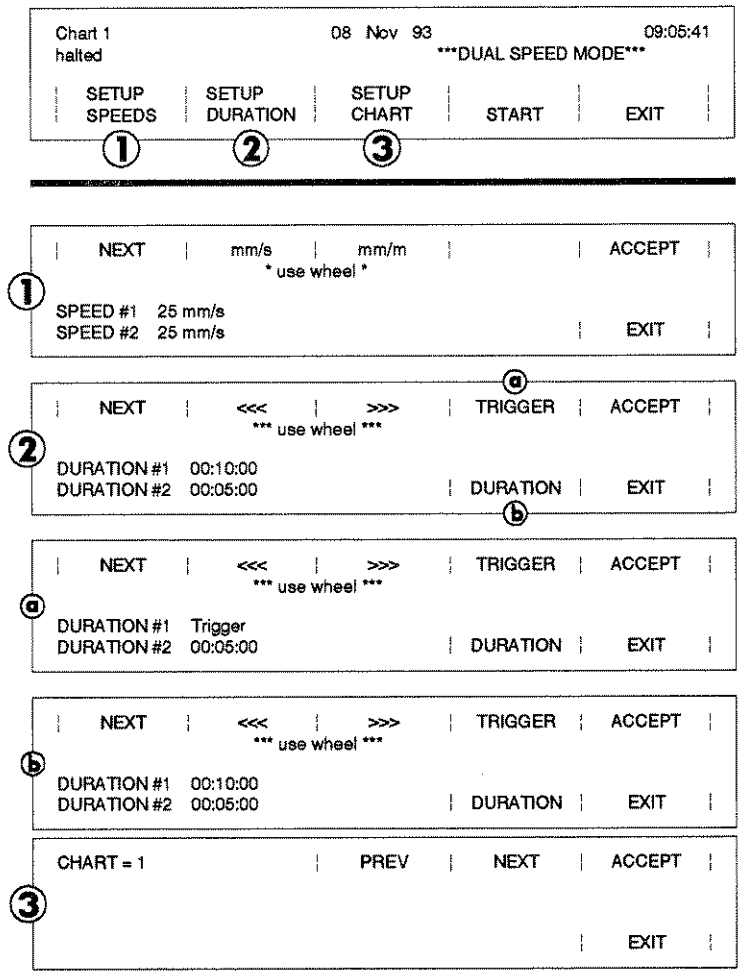
- speed 1.
- speed 2.
- duration 1.
- duration 2.
- chart format.

The complete menu flow for all DUAL SPEED mode setups is shown in the illustration on the next page.

Use the procedure on the pages that follow to prepare the recorder for timed dual-speed operation.

12.2

Setting up timed dual-speed recording



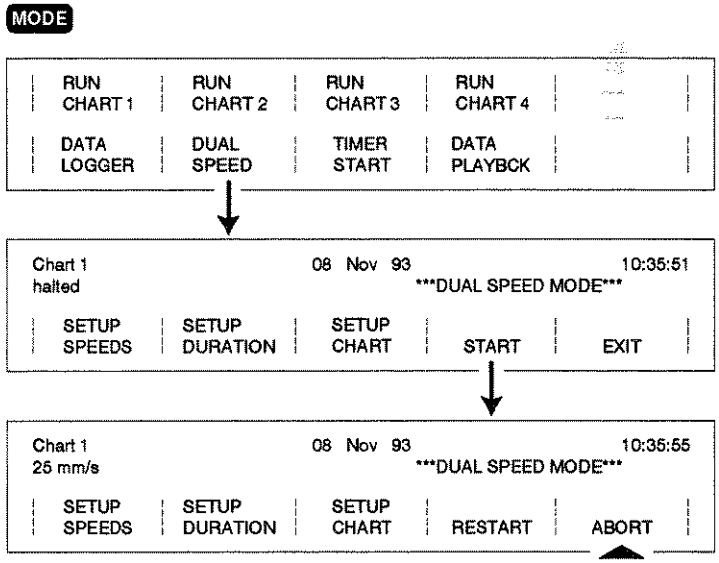
12.2

Setting up timed dual-speed recording

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DUAL SPEED."**

- **If the last dual-speed session was a timed session (not a triggered session), then you have the option of using the setup parameters as defined in that last session.**
- **Press the soft key "START" to begin timed dual-speed recording immediately using the setups of the last timed dual-speed recording session.**



12.2

Setting up timed dual-speed recording

3 To define new values for a timed dual-speed mode, press the soft key below "SETUP SPEEDS."

4 Press the soft key above "NEXT" until the speed 1 parameter is selected.

- The parameter blinks when selected.

5 Press the soft key above "mm/s" or "mm/m" and select the speed range for the speed 1 parameter.

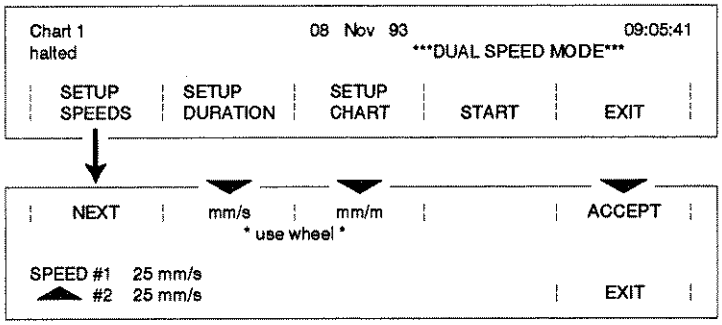
6 Use the encoder wheel to select the chart speed for speed 1.

7 Press the soft key above "NEXT" until the speed 2 parameter is selected.

- The parameter blinks when selected.

8 Repeat steps 5 and 6 for speed 2.

9 Press the soft key above "ACCEPT."



10 Press the soft key below "SETUP DURATION."

11 Press the soft key above "NEXT" until the duration 1 parameter is selected.

- The parameter blinks when selected.

12.2

Setting up timed dual-speed recording

12 Press the soft key above "<<<" or ">>>" and select hours, minutes, and seconds settings for the duration 1 parameter.

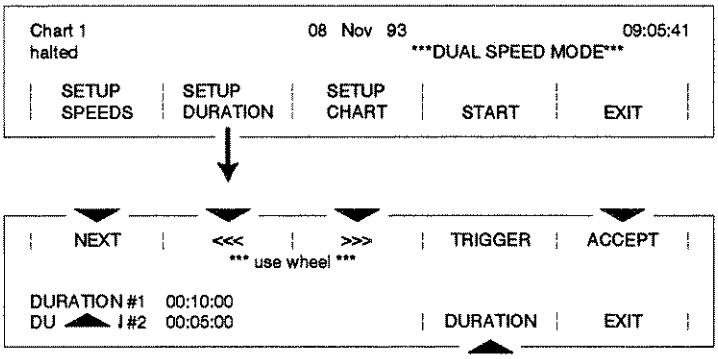
13 When each of the time parameters is selected, use the encoder wheel to set the duration in hours, minutes, and seconds.

14 Press the soft key above "NEXT" until the duration 2 parameter is selected.

- The parameter blinks when selected.

15 Repeat steps 12 and 13 for duration 2.

16 Press the soft key above "ACCEPT."



17 Press the soft key below "SETUP CHART."

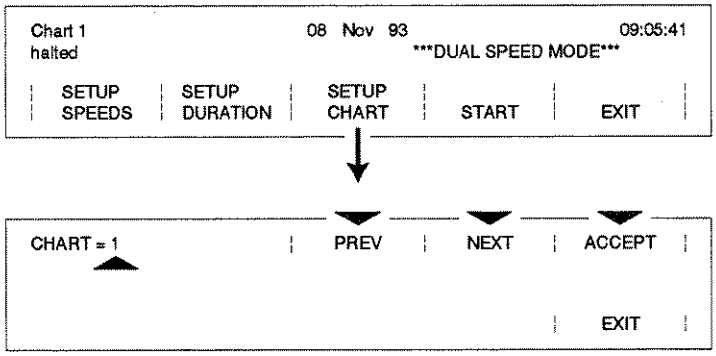
18 Press the soft key above "NEXT" or "PREV" and select the chart format that you want to use.

- The "Chart =" parameter changes dynamically as the soft keys are pressed.

12.2

Setting up timed dual-speed recording

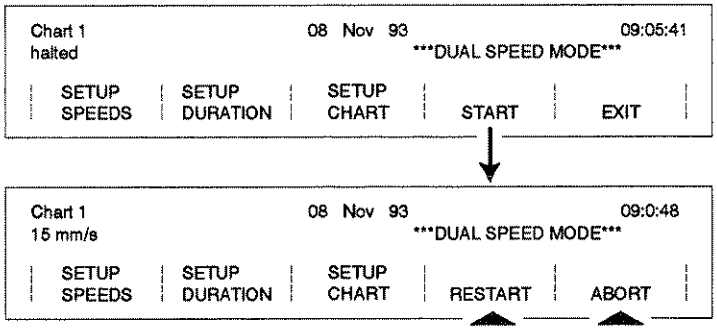
19 Press the soft key above "ACCEPT."



20 Press the soft key below "START" to enter the timed dual-speed recording mode you just setup.

21 If you use the [RUN/HALT] key to halt timed dual-speed recording, press the soft key below "RESTART" to resume recording.

22 Press the soft key below "ABORT" if you want to cancel timed dual-speed recording and exit the mode.



12.3

Setting up triggered dual-speed recording

Triggered dual-speed operation causes the DASH IV to toggle automatically and continuously between two recording speeds each time the DASH IV detects a trigger from any of the four valid trigger sources.

A trigger must be defined using the "SETUP TRIGGER" parameter found under the [SYS] key setups before the DASH IV is used in the triggered dual-speed recording mode. See section 7, Setting up and enabling triggers.

When you setup a triggered dual-speed recording session, you must define the following parameters:

- speed 1
- speed 2
- duration 1 to trigger
- duration 2 to trigger
- chart format

Use the procedure below to prepare the recorder for triggered dual-speed operation.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DUAL SPEED."**

- **If the last dual-speed session was a triggered session (not a timed session), then you have the option of using the setup parameters as defined in that last session.**
- **Press the soft key below "START" to begin triggered dual-speed recording immediately using the setups of the last triggered dual-speed recording session.**
- **See the illustration on page 12-3.**

3 **To define new values for a triggered dual-speed mode, press the soft key below "SETUP SPEEDS."**

12.3

Setting up triggered dual-speed recording

4 **Press the soft key above "NEXT" until the speed 1 parameter is selected.**

- **The parameter blinks when selected.**

5 **Press the soft key above "mm/s" or "mm/m" and select the speed range for the speed 1 parameter.**

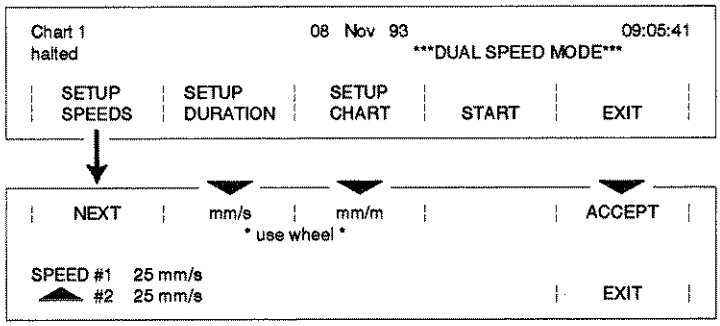
6 **Use the encoder wheel to select the chart speed for speed 1.**

7 **Press the soft key above "NEXT" until the speed 2 parameter is selected.**

- **The parameter blinks when selected.**

8 **Repeat steps 5 and 6 for speed 2.**

9 **Press the soft key above "ACCEPT."**



10 **Press the soft key below "SETUP DURATION."**

11 **Press the soft key above "NEXT" until the duration 1 parameter is selected.**

- **The parameter blinks when selected.**

12.3

Setting up triggered dual-speed recording

12 **Press the soft key above "TRIGGER."**

- **Note that the duration parameter in the menu dynamically changes to "Trigger."**

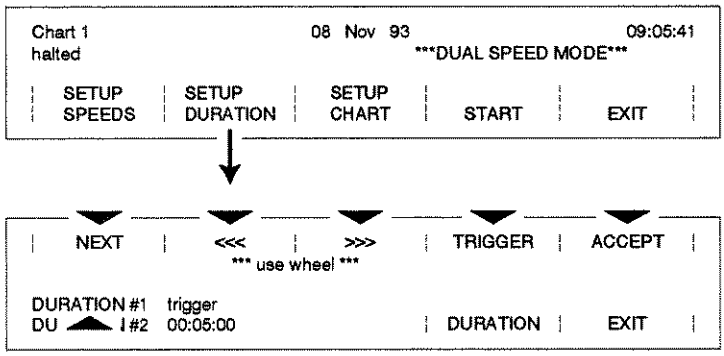
13 **Press the soft key above "NEXT" until the duration 2 parameter is selected.**

- **The parameter blinks when selected.**

14 **Press the soft key above "TRIGGER."**

- **Note that the duration parameter in the menu dynamically changes to "Trigger."**

15 **Press the soft key above "ACCEPT."**



16 **Press the soft key below "SETUP CHART."**

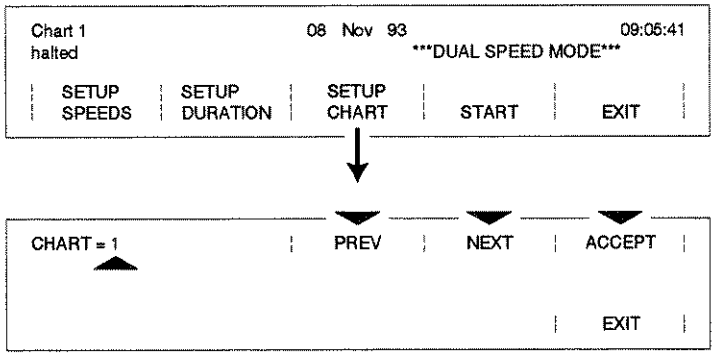
17 **Press the soft key above "NEXT" or "PREV" and select the chart format that you want to use.**

- **The "Chart =" parameter changes dynamically as the soft keys are pressed.**

12.3

Setting up triggered dual-speed recording

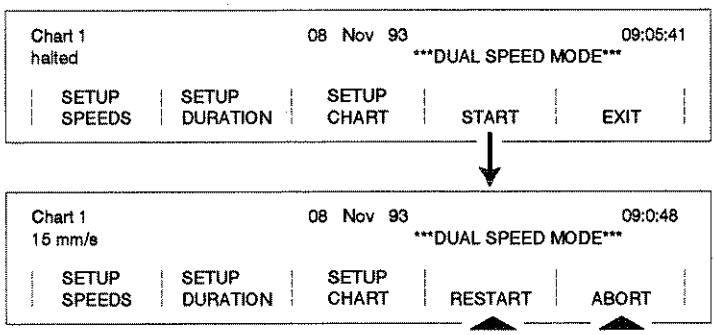
18 Press the soft key above "ACCEPT."

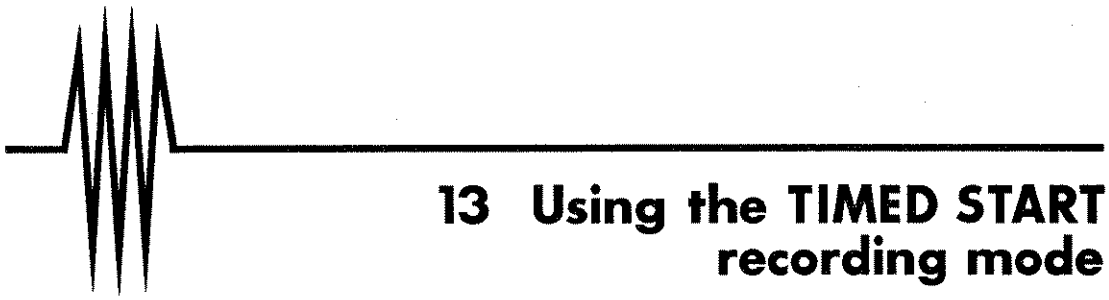


19 Press the soft key below "START" to enter the triggered dual-speed recording mode you just setup.

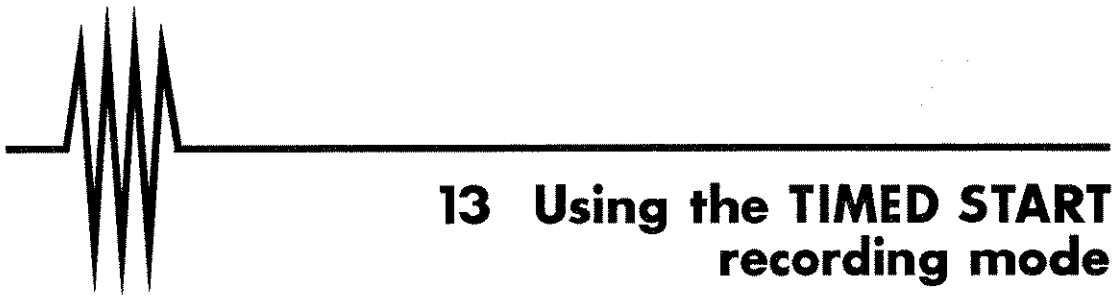
20 If you use the [RUN/HALT] key to pause triggered dual-speed recording, press the soft key below "RESTART" to resume recording.

21 Press the soft key below "ABORT" if you want to cancel triggered dual-speed recording and exit the mode.





13 Using the TIMED START recording mode



13 Using the TIMED START recording mode

13.1

Setting up the TIMED START recording mode

The TIMED START setup is used to program the DASH IV to start recording at a specific time and date and to end recording at a specific time and date. When you setup a timed recording session, you must define the following parameters:

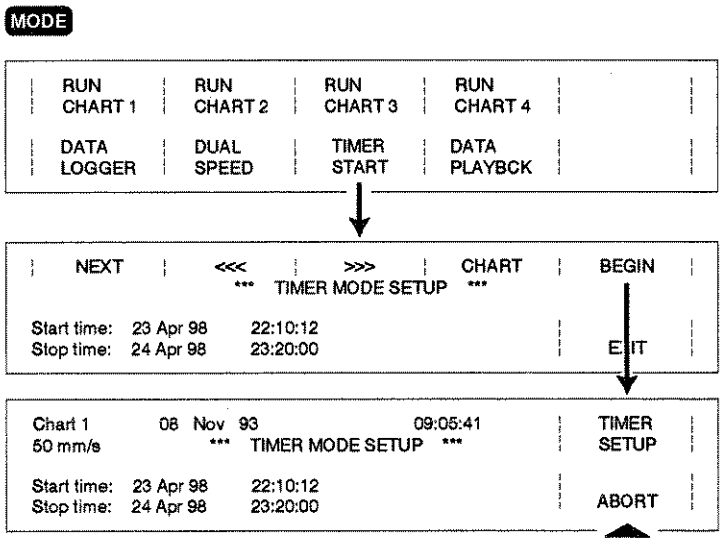
- start time: day, month, year, hour, minute, second.
- stop time: day, month, year, hour, minute, second.
- chart format.

Use the procedure below to prepare the recorder for timed operation.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "TIMER START."**

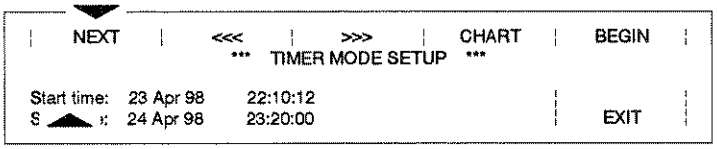
- **If you want to use the setup parameters of the last timed recording session and begin timed operation immediately, press the soft key above "BEGIN."**
- **Press the soft key below "ABORT" if you want to cancel the timed recording session and exit the timed mode.**



13.1

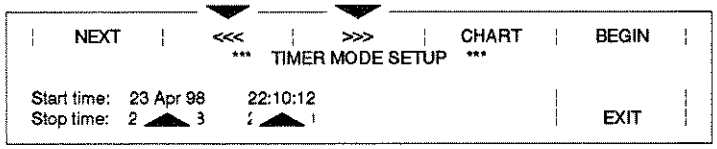
Setting up the TIMED START recording mode

3 **To set the START TIME for a new timed recording session, press the soft key above "NEXT" until the start time parameter is selected.**



4 **Press the soft key above "<<<" and ">>>" to individually select the day, month, year, hour, minute, and seconds parameters.**

- **When each element is selected, use the encoder wheel to specify the settings that you want.**



5 **To set the STOP TIME for a timed recording session, press the soft key above "NEXT" until the stop time parameter is selected.**

6 **Press the soft key above "<<<" and ">>>" to individually select the day, month, year, hour, minute, and seconds parameters.**

- **When each element is selected, use the encoder wheel to specify the settings that you want.**

7 **Press the soft key above "CHART."**

13.1

Setting up the TIMED START recording mode

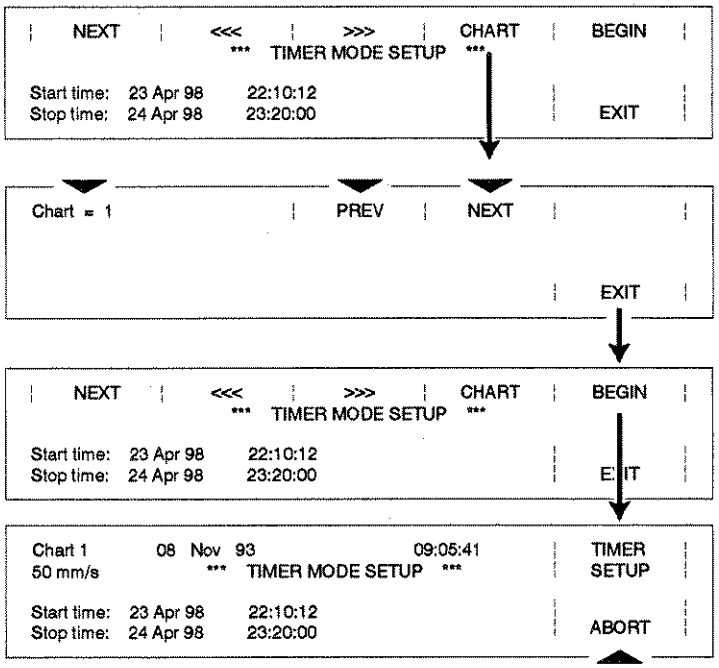
8 **Press the soft key above "NEXT" or "PREV" to select the chart format that you want used during the timed recording.**

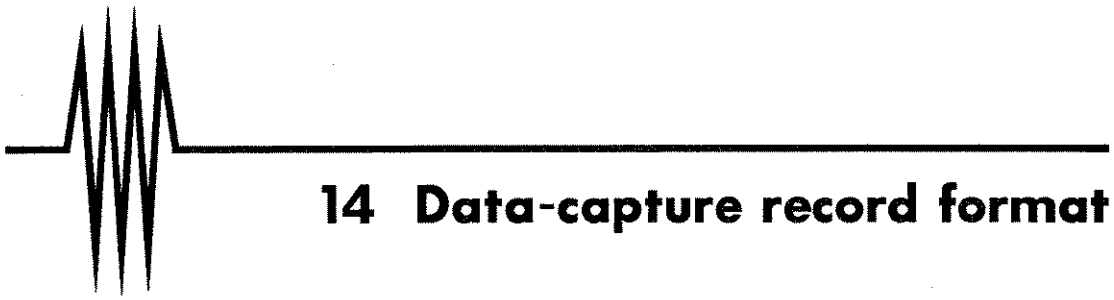
- **Note that the "Chart=" parameter in the menu changes dynamically to show the chart selection as the "NEXT" / "PREV" soft keys are pressed.**

9 **Press the soft key below "EXIT" after you have selected a chart format.**

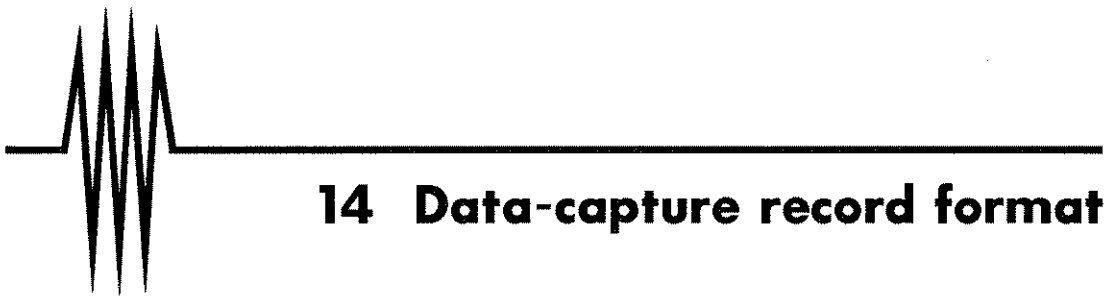
10 **Press the soft key above "BEGIN" to start the TIMER MODE.**

11 **Press the soft key below "ABORT" if you want to cancel the timed recording session and exit the timed mode.**





14 Data-capture record format



14 Data-capture record format

14.1

Introduction

This section presents the content and format of the Dash IV data-capture record file format:

- as created and used by the 3 1/2 inch floppy disk drive.
- as communicated through the host interfaces.

When files are simply SAVED and later RECALLED, the data-capture record file format is generally of little concern. However, when creating or interfacing with data-capture records, it may be helpful to refer to this section.

As DASH IV capabilities are enhanced or improved, Astro-Med reserves the right to expand the size and content of data-capture record files. As a result, to ensure upward compatibility, it is recommended that programs created to interface with the data-capture record file format be written to handle special data such as versions and data counts.

The content of a data-capture record file generally includes information about how the capture was performed and the actual data (signals) stored. This signal data will also include event marker data.

14.2

Floppy operation

- To load: Select file name of data capture record and begin. Record will be added to inventory if room.
- To save: Specify record (by number) and specify file name and begin. Record will be moved if sufficient disk space.

14.3

Data-capture record file format

address (dec.)	qty byte(s)	qty data items	description
0000-0007	8	8 char	file ID (contains ASTROMED)
0008-0011	4	1 word	version of record/format
0012-0015	4	1 word	size of general record information

general record information section

0016-	4	1 word	data capture application method
	36	9 words	trigger time of record
	16	4 words	sample rate of record (x4 channels)
	4	1 word	record length
	4	1 word	record width (number channels)
	16	4 words	channel list of channels stored
	4	1 word	trigger window setup
	16	4 words	pretrigger samples stored (x4)
	16	4 words	post-trigger samples stored (x4)
	16	4 words	channel type (x4)
	16	4 words	conditioning - sensitivity (x4)
	16	4 words	conditioning - position (x4)
	16	4 words	conditioning - offset (x4)
	16	4 words	conditioning - filter (x4)
	16	4 words	conditioning - filter data 1 (x4)
	16	4 words	conditioning - filter data 2 (x4)
	16	4 words	conditioning - mode (x4)
	16	4 words	conditioning - dc/gnd (x4)
	16	4 words	conditioning - extended scaling (x4)
	16	4 words	conditioning - int/dif time const. (x4)
	16	4 words	conditioning - integr. DC block (x4)
	16	4 words	conditioning - integr. zero x rst (x4)
	16	4 words	conditioning - integ. reset level (x4)
	16	4 words	conditioning - int rectification (x4)
	128	4 (note 3)	conditioning - user units/ other (x4)

14.3

Data-capture record file format

waveform and discrete line storage information

note 1	note 2	note 3	waveform data (beginning)

NOTE 1

Waveform data begins at Address 16 (dec) + Size of General record Information.

Waveform data is stored in file in repeating sets of 16 bit data items. For example, sets are ch1, 2, 3, 4 for four channels.

NOTE 2

It is expected that the first 16 bytes of above format will remain fixed in purpose and only the following section may change based on version if needed.

NOTE 3

The remaining front end data is grouped (as a structure) rather than individually detailed. There are **four** of these structures one after another and is defined as follows.

address (dec.)	qty byte(s)	qty data items	description
remaining front end structure data			
	4	1 word	scaling choice
	4	4 chars	external units (ASCII chars)
	8	1 double	equality (external qty)
	8	1 double	equality (internal qty)
	8	1 double	external reference offset
Total:	32		

14.4

Data description for data-capture record items

NOTE

One data word is **four** bytes. One character is one byte. One double is an **8** byte (64-bit) IEEE-754 floating point number.

File Id: **8** characters representing a fixed Identification ('ASTROMED') symbolic of a valid file.

Version: One data word representing the unique file format version. Valid: 1 decimal (only currently existing) represents version 1.0.

Size of General Record Information: One data word offset to conveniently offset into the waveform data portion of the disk file. This word is the number of bytes to offset to get to the waveform data.

Data Capture Method: One data word. 0 = STANDARD 4 Channel Data Capture.

Trigger Time: Nine (9) data words (36 bytes) representing the time and date information.

word	description	valid data
1	seconds	0-59
2	minutes	0-59
3	hours	0-23
4	day	1-31
5	month	0-11
6	year	0-99
7	reserved	
8	reserved	
9	reserved	

14.4

Data description for data-capture record items

Sample Rate/ Time Base: These data words (4) define the time base of the data capture. For standard capture all channels are the same time base. The data value corresponds to the Dash 4 selections as defined in table. Valid 0-13 (i.e. 0 = 100us/mm [200 Khz].)

Record Length: One word representing the amount of kilosamples per channel. This value (N) fits the formula 2 to the power of N x 16Ks. Thus N=0 will be a 16ks per channel length. Standard capture supports N=0 to 3.

Record Width: One word specifiying number of channels stored in record. This value will define the layout pattern of the Waveform Data section. Time periods are transferred in cycles matching channels stored (.i.e. point for channel 1,2,3,4,1,2,3,4,etc). Standard data capture records yield a width of 4.

Channel List: Four data words of which only (N = Format size) are valid. A channel number will be in range (1 to 4). Example: Dash 4 standard capture where size is always 4 will always yield 1,2,3,4 for channel list.

Trigger Window: One data word representing eighths (12.5%) of window. Data range 00-08. Trigger / window relationship setting of how the data capture record was performed. Actual results of importance are the pre trigger and post counts. This data word is not particularly useful for any needed calculations.

Pre-trigger amount stored: Four data words (one per channel). For standard records only need to look to the first word. This word is number of pretrigger time period (data sets) that are in the data record. Combined with post-trigger yields total window or total time periods.

14.4

Data description for data-capture record items

Post-trigger amount stored: Four data words (one per channel). For standard records only need to look to the first word. This word is number of post-trigger time period (data sets) that are in the data record. Combined with pretrigger yields total window or total time periods.

Conditioner Type: Conditioner type for each applicable channel (4). See table for list of valid conditioners. Type determines what conditioner data represents. Valid ID will be in range 0-F.

conditioner	identification code (hex)
standard	000F
high voltage	000D
shunt	000E
thermocouple-T	0008
thermocouple-J	0009
thermocouple-K	000A
thermocouple-E	000B
DC bridge	000C

Waveform conditioning data and its meaning is based on conditioner type and applicable information is found in next section.

Extended Y-Scaling: One data word (0:2) per channel representing the EXTENDED SCALING (also thought of as sensitivity magnification factor) in use when the capture occurred. This is data element N fills in formula "2 to the power N" (i.e. 0 is x1, 1 is x2, etc). This element is the same for all conditioner types.

Integration / Differentiation Time Constant: One data word (1:1000) per channel representing the time constant in ms used for integration and differentiation filter/DSP choices.

14.4

Data description for data-capture record items

Integration DC Blocking: One data word (0:1) per channel representing the status of the DC blocking high pass filter used for the integration filter/DSP choice.

Integration Zero Crossing Reset: One data word (0:1) per channel representing the status of the zero crossing reset used for the integration filter/DSP choice.

Integration Level Reset: One data word (0:1000) per channel representing the status of the level reset used for the integration filter/DSP choice. This parameter is in tenths of percent of the A/D range. The value 0 represents off.

Integration Rectification: One data word (0:3) per channel representing the status of the rectification used on the input to the integration filter/DSP choice. 0=none, 1=full wave, 2=positive wave, and 3=negative wave rectification.

Scaling Choice: One data word (0:1) representing the state of the SCALING choice. This item is only available to STD and HIGH VOLTAGE conditioners. 0-standard internal voltage units, 1-external user units recording.

External units: Four characters (20-7FH) representing the user editable engineering units currently selected for this channel.

Equality: Two (double) floating point numbers representing the external and internal elements of a ratio. This ratio is the scaling factor that provides user units recording.

Offset: Single (double) floating point number of offset constant which is the equality to 0 Volts.

14.4

Data description for data-capture record items

standard conditioner data definition

gnd or DC 0,1	gnd, DC	
sensitivity 5000 - 100000000	µV/cm	5mV/cm - 100V/cm
position 0 - 1000	mm	tenths of millimeters
offset - zero supp ±2000	mV or V	step = 2.5mV if sensitivity < 390 mV/cm step = 175mV if sensitivity > 390 mV/cm
filter 0-6	filter choice	off, 50Hz notch, 60Hz notch, low pass, mean, integration, differentiation
filter data 1 0-n	filter data (Hz)	if filter is lowpass, then this (n) is cutoff
filter data 2 undefined	undefined	
mode 0, 1	pk—pk, RMS	

14.4

Data description for data-capture record items

shunt conditioner data definition

gnd or DC 0,1	gnd, DC	
sensitivity 5000 - 100000000	µV/cm	5mV/cm - 100V/cm
position 0 - 1000	mm	tenths of millimeters
offset - zero supp ±2000	mV or V	step = 2.5mV if sensitivity < 390 mV/cm step = 175mV if sensitivity > 390 mV/cm
filter 0-6	filter choice	off, 50Hz notch, 60Hz notch, lowpass, mean, integration, differentiation
filter data 1 0-n	filter data (Hz)	if filter is lowpass, then this (n) is cutoff
filter data 2 undefined	undefined	
mode 0, 1	pk—pk, RMS	

14.4

Data description for data-capture record items

high voltage data definition

gnd or DC 0,1	gnd, DC	
sensitivity 5000 - 400000	µV/cm	(data/1000) * 250 = mV/cm i.e. 5000 yields 1250 mV/cm or 1.25 V/cm
position 0 - 1000	mm	tenths of millimeters
offset - zero supp ±2000	mV or V	step = 2.5mV * 250 or 625 mV
filter 0-6	filter choice	off, 50Hz notch, 60Hz notch, lowpass, mean, integration, differentiation
filter data 1 0-n	filter data (Hz)	if filter is lowpass, then this (n) is cutoff
filter data 2 undefined	undefined	
mode 0, 1	pk—pk, RMS	

14.4

Data description for data-capture record items

thermocouple plug-ins data definition

gnd or DC 0,1	not applicable	not applicable
sensitivity 5000 - 200000	µV/cm	(data/1000) * 1.0 = degrees C/cm i.e. 5000 yields 5 C/cm (*see note below)
position 0 - 1000	mm	tenths of millimeters
offset - zero supp ±2000	steps	1 step = 2.5 C 4.5 F if mode = C then 0000=0° C (ICE) if mode = F then 0000=32° F (ICE)
filter 0-6	filter choice	off, 50Hz notch, 60Hz notch, low pass, mean, integration, differentiation
filter data 1 0-n	filter data (Hz)	if filter is lowpass, then this (n) is cutoff
filter data 2 undefined	undefined	not applicable
mode 0, 1	C or F	key part of thermocouple data

*Sensitivity in F derived by formula sF = data/1000 * 2, i.e., 5000 yields 10 F/cm

14.4

Data description for data-capture record items

DC bridge data definition

gnd or DC 0,1	gnd, DC	
sensitivity 5000 - 1000000	µV/cm	Sens = data * 0.05 µV/cm i.e. 5000 yields 250 µV/cm
position 0 - 1000	mm	tenths of millimeters
offset - zero supp ±2000	mV or V	step = 2.5mV * 0.05 = 125 µV (0.125 mV)
filter 0-6	filter choice	off, 50Hz notch, 60Hz notch, lowpass, mean, integration, differentiation
filter data 1 0-n	filter data (Hz)	if filter is lowpass, then this (n) is cutoff
filter data 2 undefined	undefined	
mode 0, 1	pk—pk, RMS	

14.5

Waveform data words

bits 0-11	12-bit signed data.
bit 12	system net trigger activity. First rising edge (0/1) represents trigger point.
bit 13,14	event marker data (see below table).
bit 15	system event marker.

Event markers are stored in pairs embedded within a waveform channel data point. See below.

channel	events (data bits 14, 13)
1	1, 2
2	3, 4
3	5, 6
4	7, 8

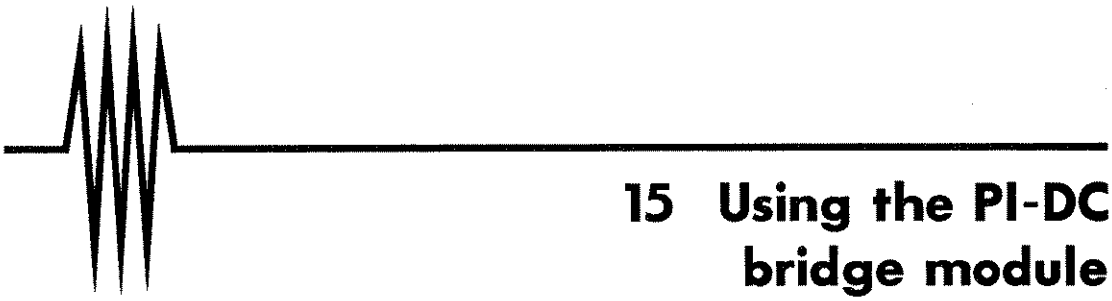
Formulas and understanding of waveform data

To place and convert raw 12-bit waveform data into correct engineering units, DASH IV formulas and scaling must be used. The formula used should be based on the type of signal conditioner (see element in format) producing the waveform data.

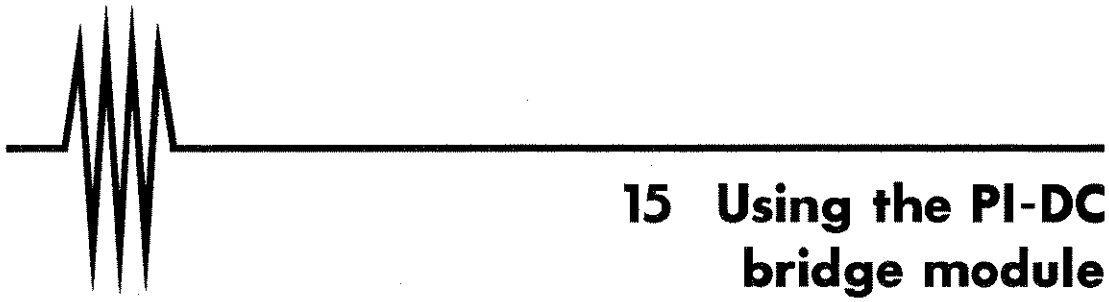
Initially, all waveform data is in 12-bit signed format. As required, the 12-bit data should be extended to 16 bit for easy manipulation after separating off high 4 bits.

Scaling:

IF extended scaling (sens x1) Normal 16 a/d points per centimeter.
IF extended scaling (sens x2) then 32 a/d points per centimeter.
IF extended scaling (sens x4) then 64 a/d points per centimeter.



15 Using the PI-DC bridge module



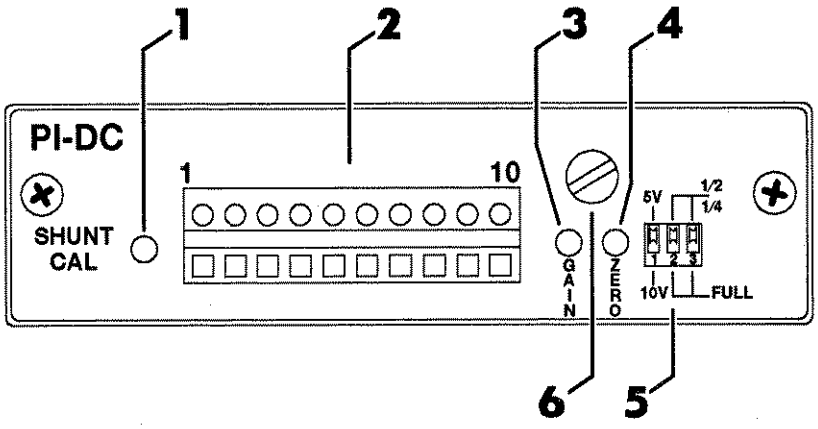
15 Using the PI-DC bridge module

15.1

A description of the PI-DC bridge module

The PI-DC bridge module is a signal conditioner designed for use in the DASH IV when working with strain gages and strain-gage based transducers.

The controls of the PI-DC bridge module are identified and briefly described below.



1 SHUNT CAL momentary pushbutton switch

When pressed, this momentary switch simulates a known transducer output which can be used for calibration.

Calibration requires connecting the remote calibration resistor to the appropriate pins of the PI-DC input connector.

2 transducer input connector

Transducers are attached to the PI-DC at this 10-pin connector.

Contacts provided in this connector include bridge excitation, signal inputs, 1/4 bridge completion, and shunt calibration.

■ See the connector pin table on the next page.

15.1

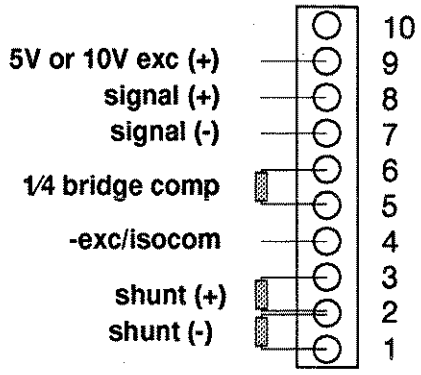
A description of the PI-DC bridge module

TRANSDUCER INPUT CONNECTOR

pin	function
1 and 2	external shunt resistor connection for negative calibration
3 and 2	external shunt resistor connection for positive calibration
4	- excitation (isolated common)
5 and 6	bridge completion resistor for 1/4 bridge application*
7	- signal
8	+ signal
9	+ excitation (10 or 5VDC)
10	not used

* The value of the dummy resistor must be equal to the gage resistance.

TRANSDUCER INPUT CONNECTOR PINOUT DETAIL



15.1

A description of the PI-DC bridge module

3 GAIN potentiometer

This control is used to adjust the analog output of the bridge module to maintain the accuracy and sensitivity of the module with reference to the calibrated ranges of the DASH IV.

When fine-tuning the system to any individual application, the GAIN potentiometer can be used as a limited span/ attenuation control.

4 ZERO potentiometer

The zero potentiometer is factory-set to the electrical zero of the amplifier. The zero adjustment is performed at the DASH IV's most sensitive setting (250 µV/cm) by shorting the signal input pins.

Because balancing the strain gage / transducer to a null condition can be accomplished using the DASH IV's zero/gain controls, in most cases, the setting should not be changed during a measurement sequence.

CAUTION

When a channel has been grounded using the DASH IV's DC/GND parameter, the selected amplifier output is disconnected and the signal input line is connected to a local ground/zero reference potential.

This can be used as part of the process of setting the baseline reference to any position on the chart. However, when balancing a transducer or compensating offset using the PI-DC zero potentiometer, the selected DASH IV channel must always be set to DC.

15.1

A description of the PI-DC bridge module

5 selection switches

The DASH IV's selection switches are used to choose an excitation voltage and a bridge setup.

The functions of the selection switches are clearly identified on the module's front plate. The table below summarizes PI-DC selection switch setting and functions.

switch	function	
1	down	for 10VDC excitation.
	up	for 5VDC excitation.
2 and 3	both up	for 1/4 and 1/2 bridge selections.
	both down	for full bridge selection.

6 mounting screw

Secures the module's physical and electrical connection to the DASH IV's front panel.

15.2

Using the module's front-panel controls

The PI-DC module provides front-panel controls for zero and gain adjustments, excitation voltage selection, and 1/4 bridge, 1/2 bridge, full bridge selection.

The paragraphs that follow discuss each of these setups.

15.2.1

PI-DC module and DASH IV balance controls

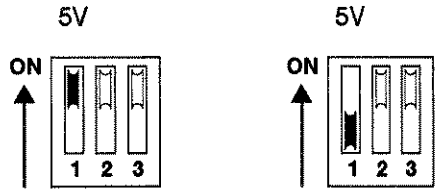
NOTE

System balancing should always be done after an excitation voltage has been selected. Balance and sensitivity settings are not retained if excitation is changed during operation.

15.2.2

Selecting the excitation voltage

Excitation voltage is set to either 10V or 5V using selection switch 1 of the PI-DC front-panel selection switches. Setting the switch "up" selects 5V excitation. Setting selection switch 1 "down" selects 10V excitation.



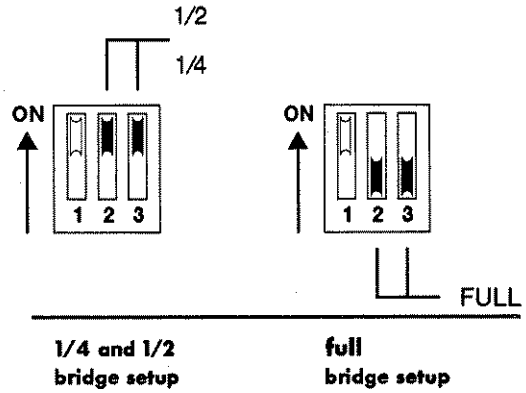
5V excitation **10V excitation**

15.2.3

Selecting a bridge type

Setting both selection switch 2 and selection switch 3 "up" enables the 1/4 bridge and 1/2 bridge setting.

Setting both selection switch 2 and selection switch 3 "down" enables the full bridge setting.



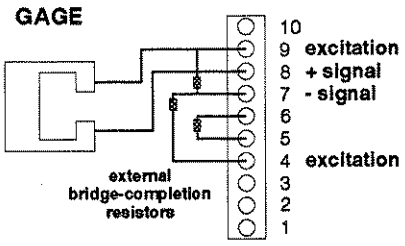
For 1/4 and 1/2 bridge applications, an internal half bridge is provided. The half bridge consists of two 1000 ohm dummy gages and is enabled by positioning the PI-DC selection switches. 1/4 bridge applications require the use of an external dummy resistor equivalent to the value of the active gage.

When the full bridge configuration is selected, the internal half bridge forms a quadrilateral) with the external transducer.

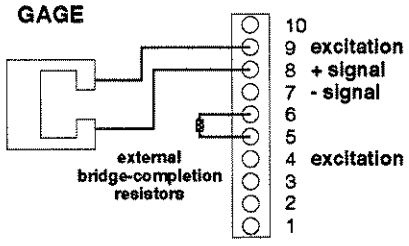
- See the typical wiring diagrams on the next page.

15.2.3

Selecting a bridge type

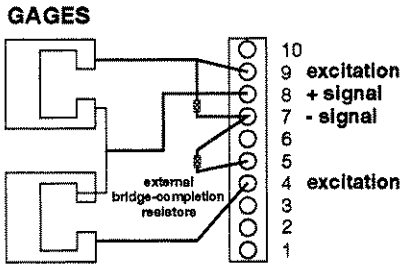


Switch set at full.

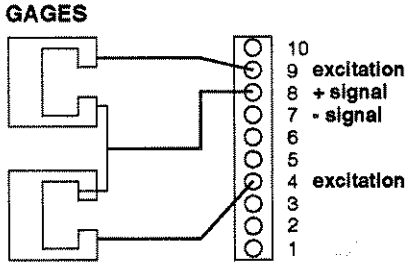


Internal bridge completion.
Switch set at 1/2 - 1/4.

quarter bridge

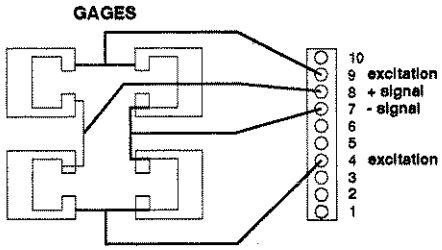


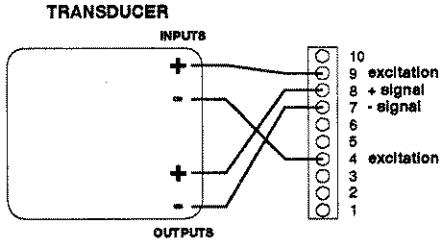
Switch set at full.



Internal bridge completion.
Switch set at 1/2 - 1/4.

half bridge





full bridge

15.2.4

About shunt calibration

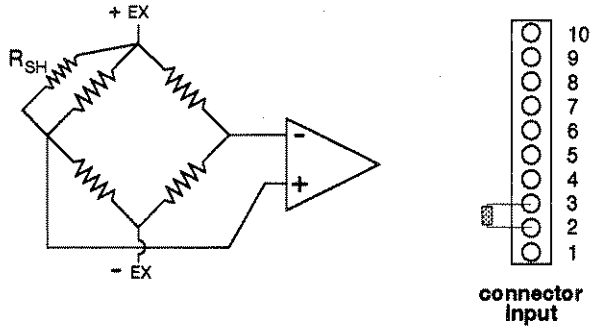
Shunt calibration is achieved by connecting a shunt resistor across an active gage arm to simulate either compression (+CAL) or expansion (-CAL).

In 1/4 bridge applications, the shunt resistor must be across the external dummy resistor for -CAL.

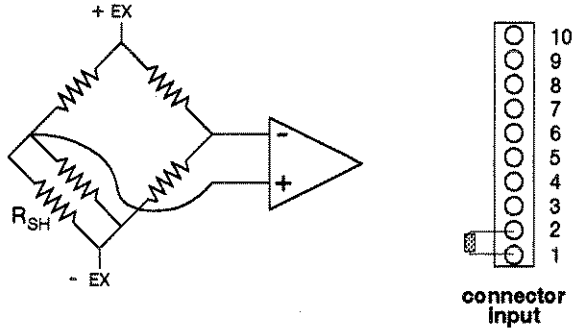
The reference shunt is activated only when the SHUNT CAL momentary switch is pressed.

It is recommended that only one shunt resistor (shunt+ or shunt-) be connected. If two resistors are connected, they will not have any significant effect on the bridge. See the illustrations below and on the next page.

correct connection for CAL+



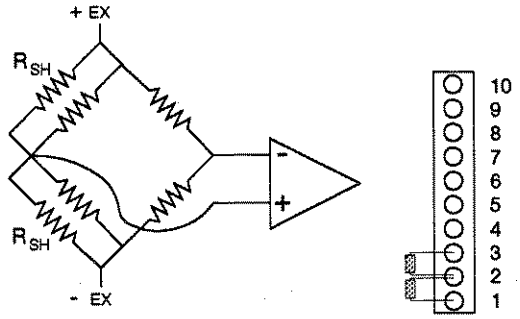
correct connection for CAL -



15.2.4

About shunt calibration

wrong shunt resistor connection



***bridge is still balanced**

connector input

15.3

Sensitivity, measurement units, and balance

The full-scale sensitivity of the PI-DC is a function of both of the following:

- the module's gain circuitry.
- the voltage sensitivity of the chart in mV/cm or V/cm as set by the DASH IV's zero and gain controls.

The formula for determining full-scale voltage can be written as:

- full scale IN =sensitivity x chart width

  where:
  sensitivity = from 250µV/cm to 50 mV/cm
  chart width = from 1 mm to 12.5 cm

15.3.1

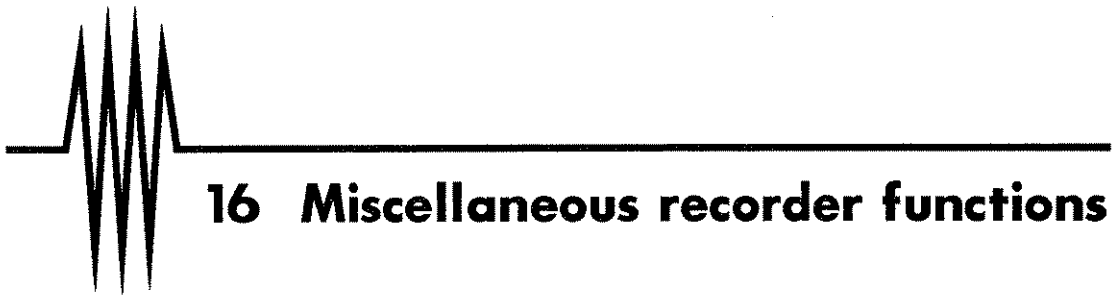
About full-scale sensitivity and measurement units

The standard measurement unit of the PI-DC is microvolts per centimeter (µV/cm). The standard measurement unit can be changed to any measurement unit (PSI, mmHg, etc.) appropriate to your application by using the DASH IV's "USER SCALING" feature. See paragraph 6.3.7 of this manual for further information on user scaling.

The balance range of the recorder can be adjusted in fine or course increments. All balance signals are generated by the DASH IV. Balancing voltages are generated in either of two ways:

- a 12-bit digital-to-analog converter (DAC) injects the balance voltage into a summing junction amplifier prior to the gain stage.
- digital signal processing is used after the DASH IV's A/D circuitry.

Both of these methods eliminate potentiometric bridge loading errors without compromising the measurement range of the PI-DC module.



16 Miscellaneous recorder functions



16 Miscellaneous recorder functions

16-1

Miscellaneous recorder functions

This section discusses the use of the following miscellaneous DASH IV front-panel keys:

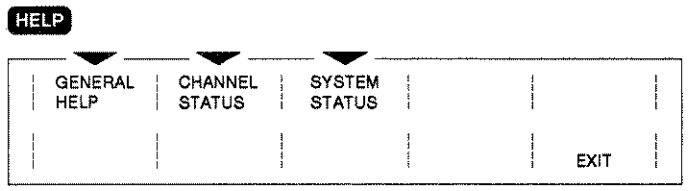
- [HELP] key.
- [EVNT] key.
- [RUN/HALT] key.
- [FEED] key.

16-2

Using the [HELP] key

When the front-panel [HELP] key is pressed, the menu that results provides the following selections:

- GENERAL HELP
- CHANNEL STATUS
- SYSTEM STATUS



- When the soft key above "GENERAL HELP" is pressed, the DASH IV automatically prints a report called "An Overview of the Astro-Med DASH IV Recorder." The overview provides concise discussions of the following aspects of operating the recorder and understanding its features:

  - quick method of operating the recorder.
  - using soft keys.
  - using the encoder wheel.
  - controlling chart speed.
  - understanding the real-time menu.
  - using the [FREEZE DISPLAY] soft key.
  - using the [DISPLAY TEXT] soft key.

Using the [HELP] key

- using the trilevel timing marks.
- using grids.
- using the built-in waveform monitor.
- using the floppy disk drive.
- selecting a chart format.
- using annotation.

An example of a GENERAL HELP printout is given on the next page.

■ When the soft key above "CHANNEL STATUS" is pressed, the recorder automatically prints a report called a "DASH IV CHANNEL STATUS REPORT." This report summarizes the following channel status parameters:

- channel type.
- sensitivity.
- scaling.
- zero suppression.
- position.
- mode.
- filter.
- filter data.
- ground/signal.
- pen lift.
- grid printing.
- reference distance.
- number of major divisions.
- major spacing.
- minor spacing.
- signal conditioner reporting status.
- text buffer content, location, and status.

An example of a CHANNEL STATUS printout is given on page 16-4.

16-2

Using the [HELP] key

An Overview of the Astro-Med DASH IV Recorder

This recorder offers a wide range of recording capabilities with easy to use front panel control. The bright vacuum fluorescent displays provide clear menus which quickly guide the user through system operation with little or no prior training.

TO OPERATE THE RECORDER QUICKLY: Simply turn on the recorder and push the [RUN/HALT] key. This will cause the system to record real-time waveforms using a traditional recorder grid format.

SOFT KEYS: There are ten keys mounted directly around the displays. The function of these soft keys changes with the menu. When they are active a label will appear just below the key indicating its function.

ENCODER WHEEL: Some menus make use of the wheel (a large knob on the front panel) to change settings quickly.

CHART SPEED: A group of keys in the lower center of the panel controls chart speed. Dedicated keys provide a means for quickly setting common chart speeds. Non-standard speeds chan be set easily by pressing the [SPD] key and using the Wheel. The three insta-speed keys [A], [B], and [C] can be programmed for any available speed using the same [SPD] menu.

REALTIME MENU: When the DASH IV has been instructed to record realtime waveforms and/or events, it displays the Realtime Menu. On the top it indicates the chart number, the time/date, the chart speed and the state of the recorder (usually running or halted).

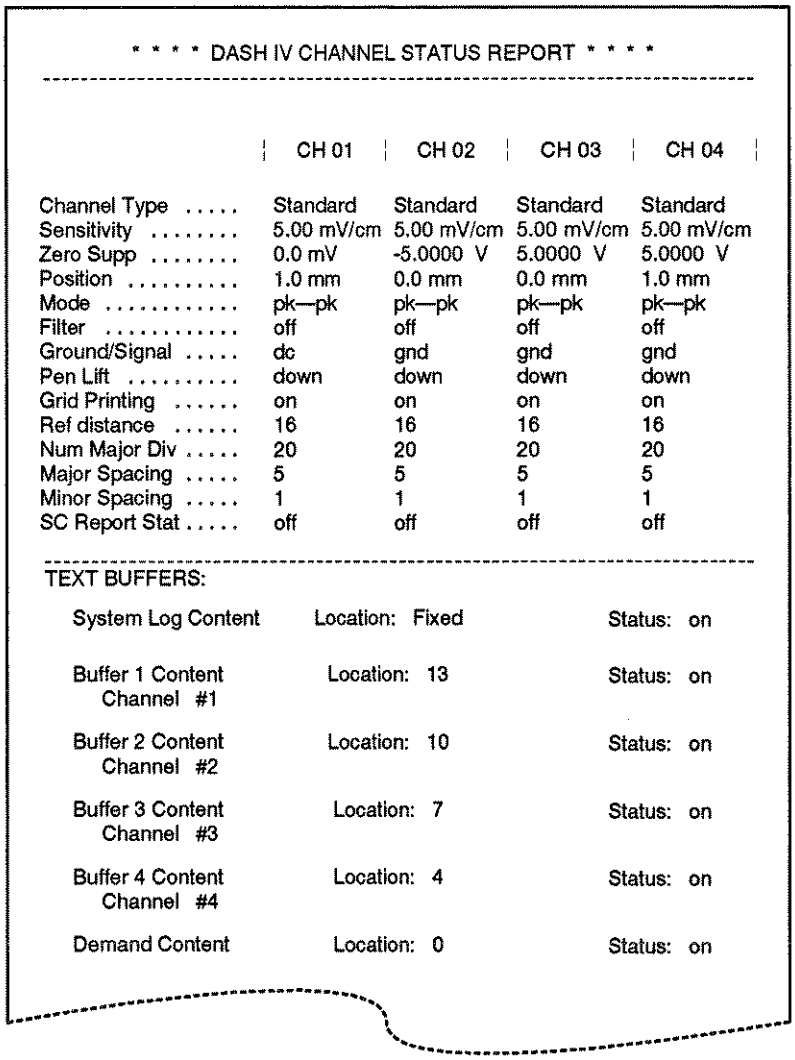
The [FREEZE DISPLAY] soft key will halt the waveform monitor without affecting the chart. When the display is frozen the key label changes to [RUN DISPLAY]. If pressed, the monitor begins operating again.

The [DISPLAY TEXT] softkey will clear the bottom two lines of text and allow the waveform data to use that remaining display area.

TIMER: The DASH IV can record a tri-level time mark. The shortest mark is synchronized to an internal time reference. The medium mark occurs once for every ten short [illegible] the long mark occurs once for every 100 short [illegible]ed on the left side of the chart.

16-2

Using the [HELP] key



* * * * DASH IV CHANNEL STATUS REPORT * * * *

	CH 01	CH 02	CH 03	CH 04
Channel Type	Standard	Standard	Standard	Standard
Sensitivity	5.00 mV/cm	5.00 mV/cm	5.00 mV/cm	5.00 mV/cm
Zero Supp	0.0 mV	-5.0000 V	5.0000 V	5.0000 V
Position	1.0 mm	0.0 mm	0.0 mm	1.0 mm
Mode	pk—pk	pk—pk	pk—pk	pk—pk
Filter	off	off	off	off
Ground/Signal	dc	gnd	gnd	gnd
Pen Lift	down	down	down	down
Grid Printing	on	on	on	on
Ref distance	16	16	16	16
Num Major Div	20	20	20	20
Major Spacing	5	5	5	5
Minor Spacing	1	1	1	1
SC Report Stat	off	off	off	off

TEXT BUFFERS:

System Log Content	Location: Fixed	Status: on
Buffer 1 Content Channel #1	Location: 13	Status: on
Buffer 2 Content Channel #2	Location: 10	Status: on
Buffer 3 Content Channel #3	Location: 7	Status: on
Buffer 4 Content Channel #4	Location: 4	Status: on
Demand Content	Location: 0	Status: on

Using the [HELP] key

- When the soft key above "SYSTEM STATUS" is pressed, the recorder automatically prints a report called a "DASH IV GENERAL STATUS REPORT." This report summarizes the following:

  - system settings
    - motor clock
    - grid type
    - grid labels
    - auto ID
    - recording speed
    - insta-speeds [A], [B], and [C]
    - data logger speed
    - dual speeds 1 and 2
    - dual speed durations 1 and 2
    - communication type
    - baud rate
    - RS232 handshake method
    - GPIB address
    - GPIB terminator

  - timer mode settings
    - chart format
    - chart speed
    - start time
    - stop time

  - event marker settings
    - timer mark rate
    - timer mark location
    - event style, status, and location

  - data capture settings
    - number of records
    - available data capture space
    - timebase
    - trigger/window relationship
    - capture control

Using the [HELP] key

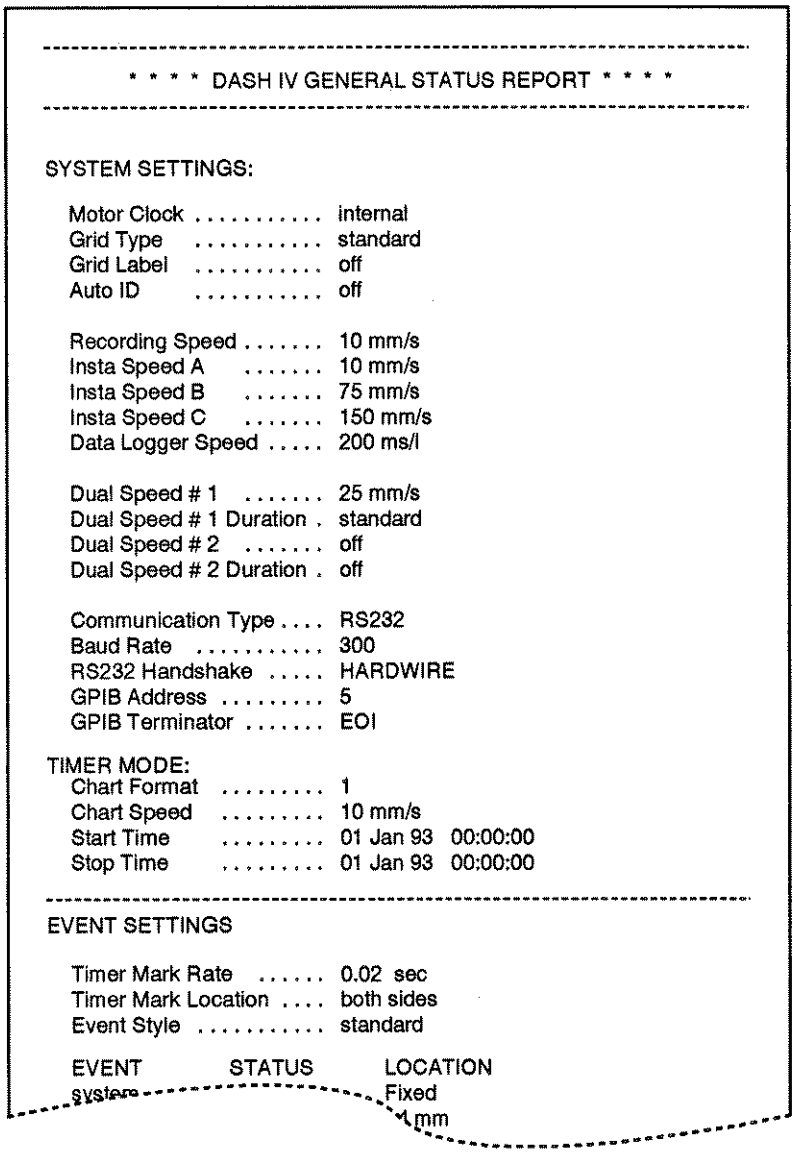
- playback settings
  - playback format
  - expansion factor
  - output devise

- trigger settings
  - source
  - waveform triggers
  - WAVEand combinations
  - channels 1, 2, 3, and 4 high and low trigger levels

An example of a GENERAL STATUS printout is given on page 16-7.

16-2

Using the [HELP] key



```
* * * * DASH IV GENERAL STATUS REPORT * * * *

SYSTEM SETTINGS:

  Motor Clock ..... internal
  Grid Type ....... standard
  Grid Label ...... off
  Auto ID ......... off

  Recording Speed ..... 10 mm/s
  Insta Speed A ....... 10 mm/s
  Insta Speed B ....... 75 mm/s
  Insta Speed C ....... 150 mm/s
  Data Logger Speed ..... 200 ms/l

  Dual Speed # 1 ....... 25 mm/s
  Dual Speed # 1 Duration . standard
  Dual Speed # 2 ....... off
  Dual Speed # 2 Duration . off

  Communication Type .... RS232
  Baud Rate ..... 300
  RS232 Handshake ..... HARDWIRE
  GPIB Address ..... 5
  GPIB Terminator ..... EOI

TIMER MODE:
  Chart Format ..... 1
  Chart Speed ..... 10 mm/s
  Start Time ..... 01 Jan 93  00:00:00
  Stop Time ..... 01 Jan 93  00:00:00

EVENT SETTINGS

  Timer Mark Rate ..... 0.02 sec
  Timer Mark Location .... both sides
  Event Style ..... standard

  EVENT          STATUS        LOCATION
  system         Fixed
                               mm
```

16-3

Using the [EVNT] key

Pressing the front-panel [EVNT] key causes the system event marker to deflect to the left to indicate data of interest. The system event marker is printed beneath the System Log on the left side of the chart as viewed from the recorder's front.

16-4

Using the [FEED] key

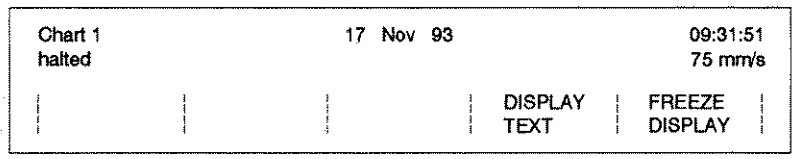
Pressing the front-panel [FEED] key causes the chart paper to advance. The chart paper feeds through the recorder while the [FEED] key is pressed and stops when the key is released.

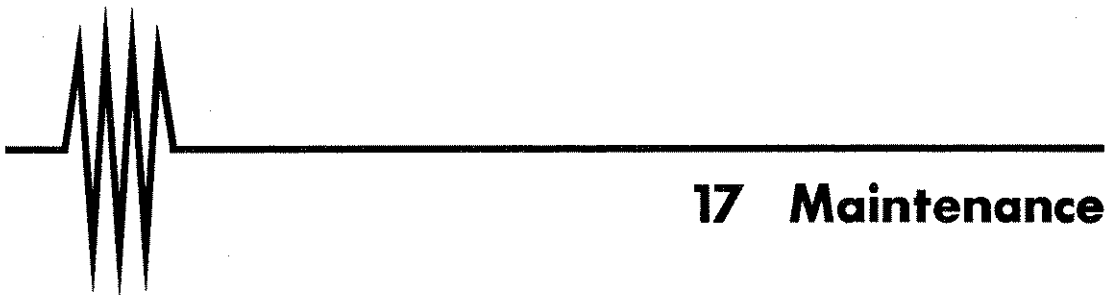
16-5

Using the [RUN/HALT] key

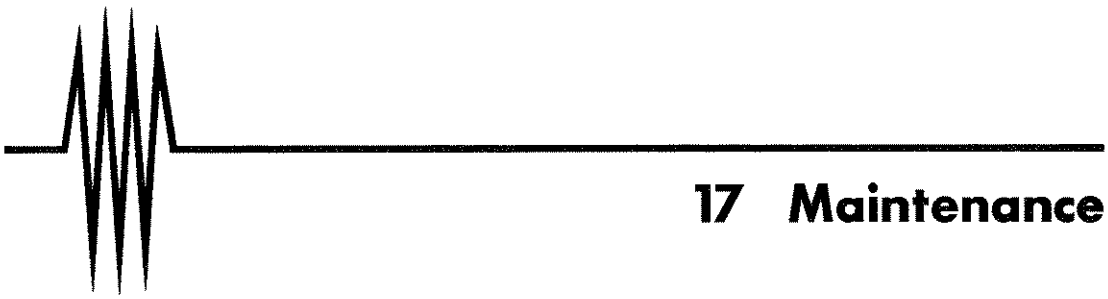
If printing is ongoing when the front-panel [RUN/HALT] key is pressed, the chart paper stops. The built-in waveform monitor shows the base display and indicates that recording activity is halted.

If printing is halted when the front-panel [RUN/HALT] key is pressed, printing resumes and the chart paper advances. The built-in waveform monitor shows the base display and indicates that realtime recording is ongoing.





17 Maintenance



17 Maintenance

17.1

Maintenance procedures

Maintenance of the DASH IV is discussed in the following order:

- changing the recorder's fuses / operating voltage.
- cleaning the printhead.
- replacing or adjusting the printhead.
- replacing a battery pack.
- calibrating voltage plug-in modules.
- replacement parts.

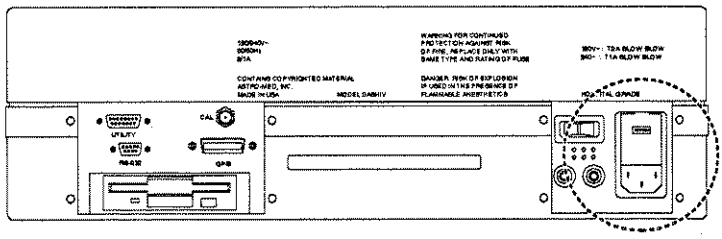
17.2

Changing the fuses / line-voltage setting

The line voltage of your DASH IV has been factory set to your specifications and should not need adjustment. If you want to change the line voltage at which the recorder will operate, use the procedure below.

1 **Turn off the recorder, uplug it, and remove its power cord.**

2 **On the recorder's rear panel, locate the power input receptacle / voltage selection box.**

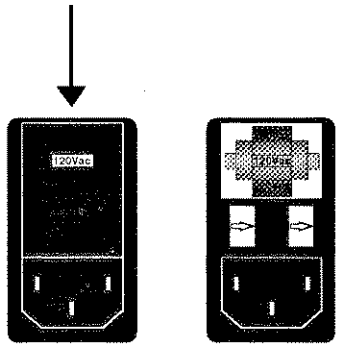


17.2

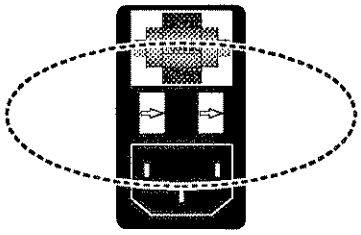
Changing the fuses / line-voltage setting

2 With a small flat-head screwdriver:

- open the fuse block/voltage selection box.
- this exposes the fuses and the voltage selection cylinder.



3 Locate the fuses just below the voltage selection cylinder.



4 To change the recorder's fuses:

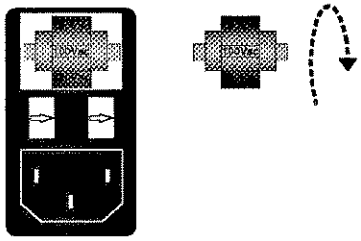
- remove the two fuse-holding fixtures from the block.
- replace both fuses with fuses appropriate to the voltage that will be powering the recorder:
  - two 1A 250V fuses for operation at 220VAC.
  - two 2A 250V fuses for operation at 120VAC.

17.2

Changing the fuses / line-voltage setting

5 **To change the recorder's line-voltage setting:**

- **remove the cylindrical voltage indicator from the voltage selection box.**
- **orient the indicator to match the operating voltage that you are selecting: 100VAC, 120VAC, 220VAC, or 240VAC.**
- **reinsert the voltage indicator.**
- **close the voltage selection box.**



17.3

Cleaning the printhead

For best performance, the print elements of the DASH IV's printhead must be kept free of any debris or residue buildup. Cleaning the printhead refers to cleaning the hairline row of print elements that can be seen running across the bottom of the printhead.

17.3

Cleaning the printhead

Printheads must be cleaned on a regular basis according to the following schedule:

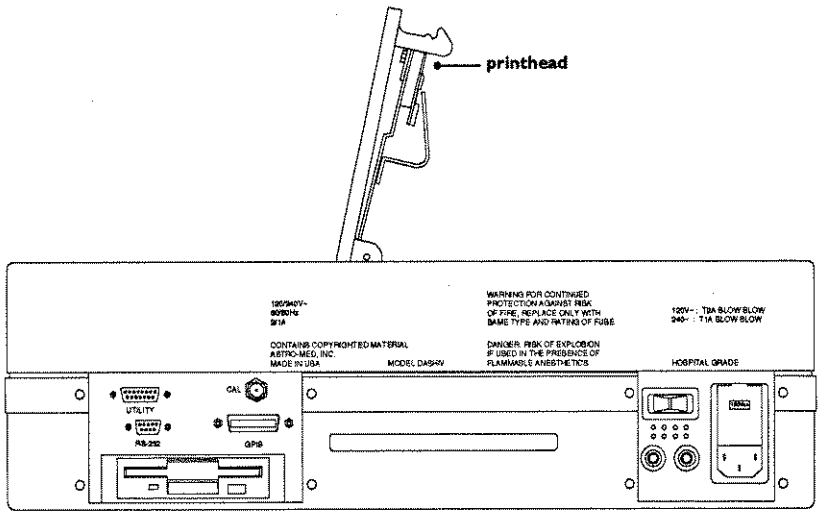
- If your application primarily trends to speeds slower than 5 mm/second, clean the printhead every time you load the recorder with a new roll of chart paper.
- If your application primarily trends to speeds higher than 5 mm/second, clean the printhead every ten rolls of chart paper.

Use the procedure below to clean the DASH IV's printhead.

1 **Turn off the DASH IV.**

2 **Press the paper-chamber door release to open the paper chamber door.**

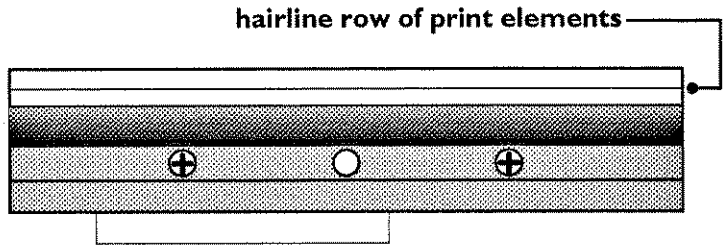
- **Note that the printhead is attached to the printhead plate mounted to the underside of the paper-chamber door.**



17.3

Cleaning the printhead

3 **Locate the hairline row of print elements on the printhead.**



4 **Wet a clean, lint-free cloth or cotton swab with isopropyl alcohol.**

5 **Run the cloth or swab beneath the printhead repeatedly as necessary to remove any residue that may be present.**

■ **This complete's the printhead cleaning process.**

17.4

Replacing or adjusting the printhead

The DASH IV's printhead is attached to the printhead plate on the underside of the paper chamber door. The printhead is extremely reliable and would only require adjustment or replacement in rare instances.

Use the procedure below to replace or adjust the DASH IV's printhead.

1 **Turn off and unplug the DASH IV.**

2 **Press the paper-chamber door release to open the paper chamber door.**

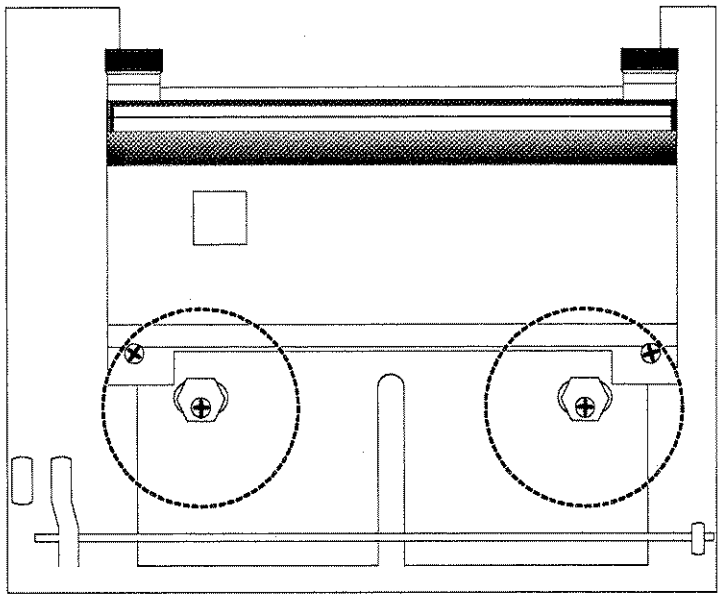
3 **Locate the printhead plate and the printhead on the underside of the paper-chamber door.**

17.4

Replacing or adjusting the printhead

4 **Remove the two Phillips-head screws and the eccentric nuts that secure the printhead plate with the attached printhead to the door.**

- **When the printhead plate is taken off, two Phillips-head screws, their associated eccentric nuts, and three printhead springs are removed.**
- **Ensure that the screws, nuts, and springs are retained and set aside for later reuse in the reassembly process.**
- **To simplify the reassembly, keep the removed hardware within easy reach.**



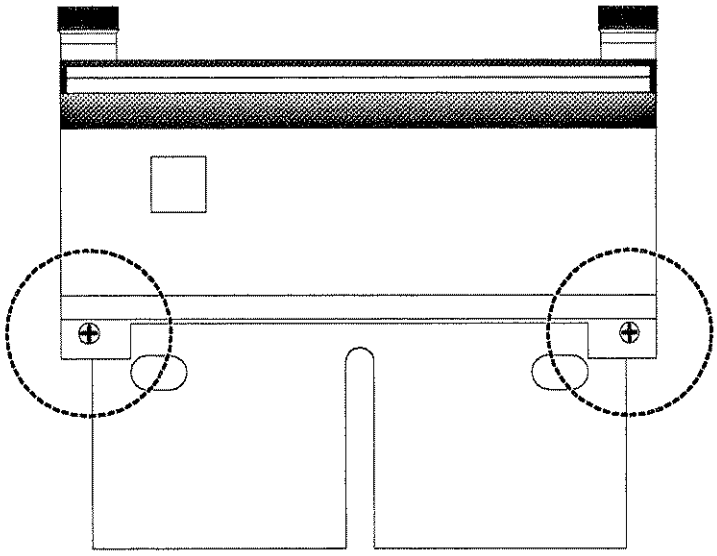
17.4

Replacing or adjusting the printhead

5 Completely detach the printhead plate by unplugging the ribbon cable that attaches to the printhead.

6 Remove the two Phillips-head screws and the associated washers that attach the printhead retainer to the printhead plate.

- Set the printhead retainer and its screws aside.

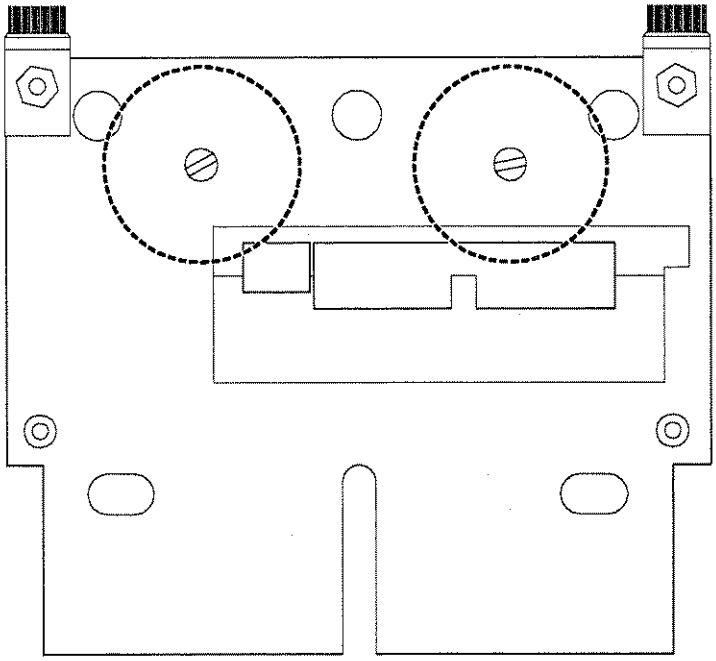


7 On the rear of the printhead plate, remove the two slot-headed screws and the associated washers that secure the printhead to the plate.

- See the illustration at the top of the next page.

17.4

Replacing or adjusting the printhead



8 Set the removed printhead aside.

9 Attach the replacement printhead to the printhead plate using the screws and washers removed in step 7.

10 Reattach the printhead retainer using the screws and washers removed in step 6.

11 Reattach the printhead ribbon cable to its receptacle on the printhead.

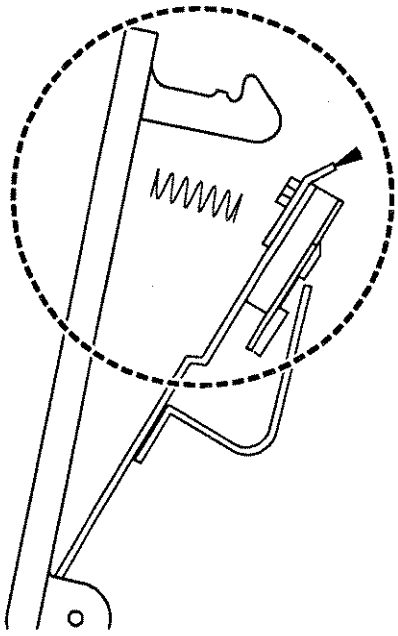
12 Position the printhead plate on the underside of the paper-chamber door.

17.4

Replacing or adjusting the printhead

13 Insert each of the three printhead springs between the rear of the printhead and the paper-chamber door.

- Recesses are provided for the springs on the rear of the printhead plate and the underside of the paper chamber door.
- A pair of needle-nosed pliers helps to simplify inserting the springs.



14 Hold the printhead plate in place against the underside of the paper chamber door keeping the springs under tension.

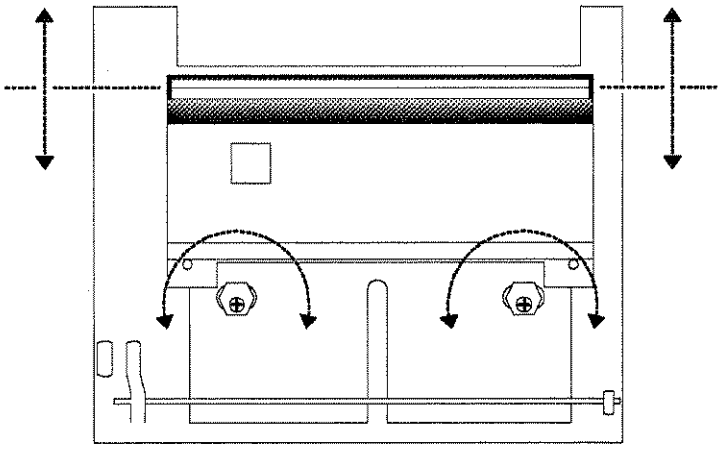
15 Insert and slightly tighten the two Phillips-head screws that secure the printhead plate to the paper-chamber door.

17.4

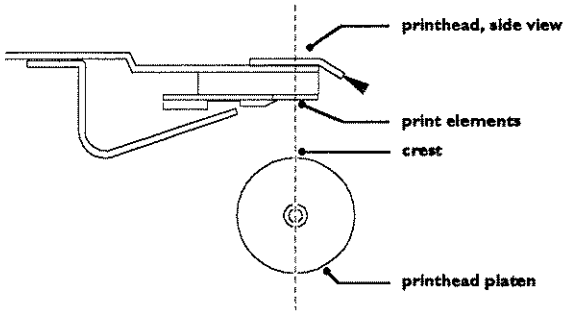
Replacing or adjusting the printhead

14 Horizontally align the thermal print elements of the new printhead with the crest of the printhead platen.

- Tighten or loosen the two Phillips-head screws that secure the printhead plate to the underside of the paper-chamber door.
- As the screws are adjusted, the movement of the eccentric nuts affects the alignment of the thermal printing elements.



- As shown below, "aligning the printhead" means horizontally adjusting the hairline row of print elements along the crest of the printhead platen.



17.5

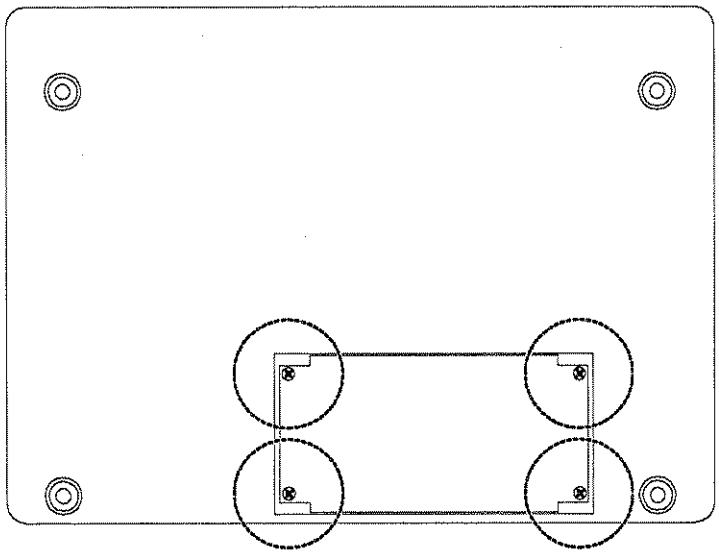
Replacing a battery pack

1 Turn off and unplug the DASH IV.

2 Turn the recorder bottom up.

3 Remove the four Phillips-head screws that secure the battery retaining plate.

- Set the screws and the retaining plate aside.



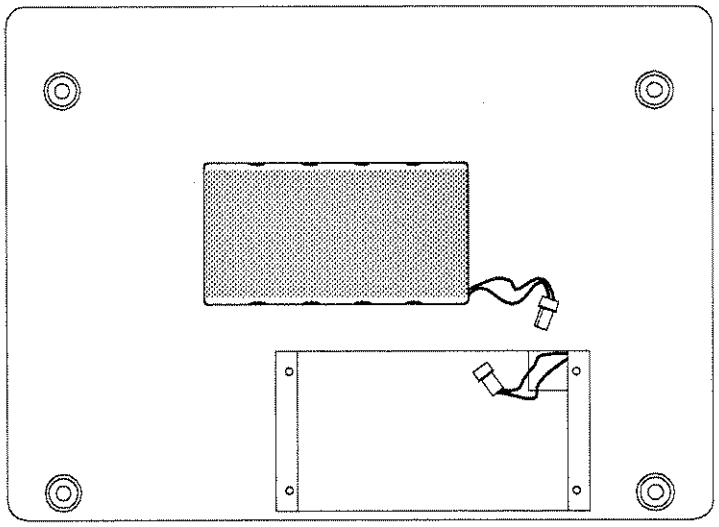
4 Remove the battery from the open compartment.

5 Unplug the connector that runs from the battery and attaches the battery to an internal harness.

- Set the old battery aside.
- See the illustration on the next page.

17.5

Replacing a battery pack



6 Plug the new battery pack into the battery connector.

7 Place the connected battey pack into the battery compartment.

8 Position the battery cover plate over the battery pack and secure the plate with the four screws removed in step 3.

■ This completes the battery replacement procedure.

17.6

Calibrating DASH IV voltage plug-in modules

Use the procedure on the procedure below to calibrate any of the recorder's optional voltage plug-in modules.

1 **Calibrate the DASH IV system.**

- **Use the procedure given in paragraph 6.3.11, "Calibrating individual channels with the DASH IV's built-in precision voltage references."**
- **Remove the calibration cable when the procedure is complete.**

2 **Turn the recorder off.**

3 **Insert and screw down each plug-in module.**

4 **Turn the recorder on.**

5 **Run signals into the recorder.**

6 **Select a 10cm grid format by:**

- **pressing the front-panel [MODE] key.**
- **pressing the soft key above "RUN CHART 1."**

7 **Select and ground a channel.**

- **Use the procedure given in paragraph 6.3.3, "Grounding individual waveform channels."**

8 **Set the grounded baseline to the right edge of the chart.**

- **Use the procedure given in paragraph 6.3.4, "Positioning a waveform's zero baseline."**

9 **Apply zero volts or switch from ground to DC and short the signal at the plug-in module.**

17.6

Calibrating DASH IV voltage plug-in modules

10 Using the ZERO potentiometer on the front-panel of the plug-in, position the signal at the right edge of the chart.

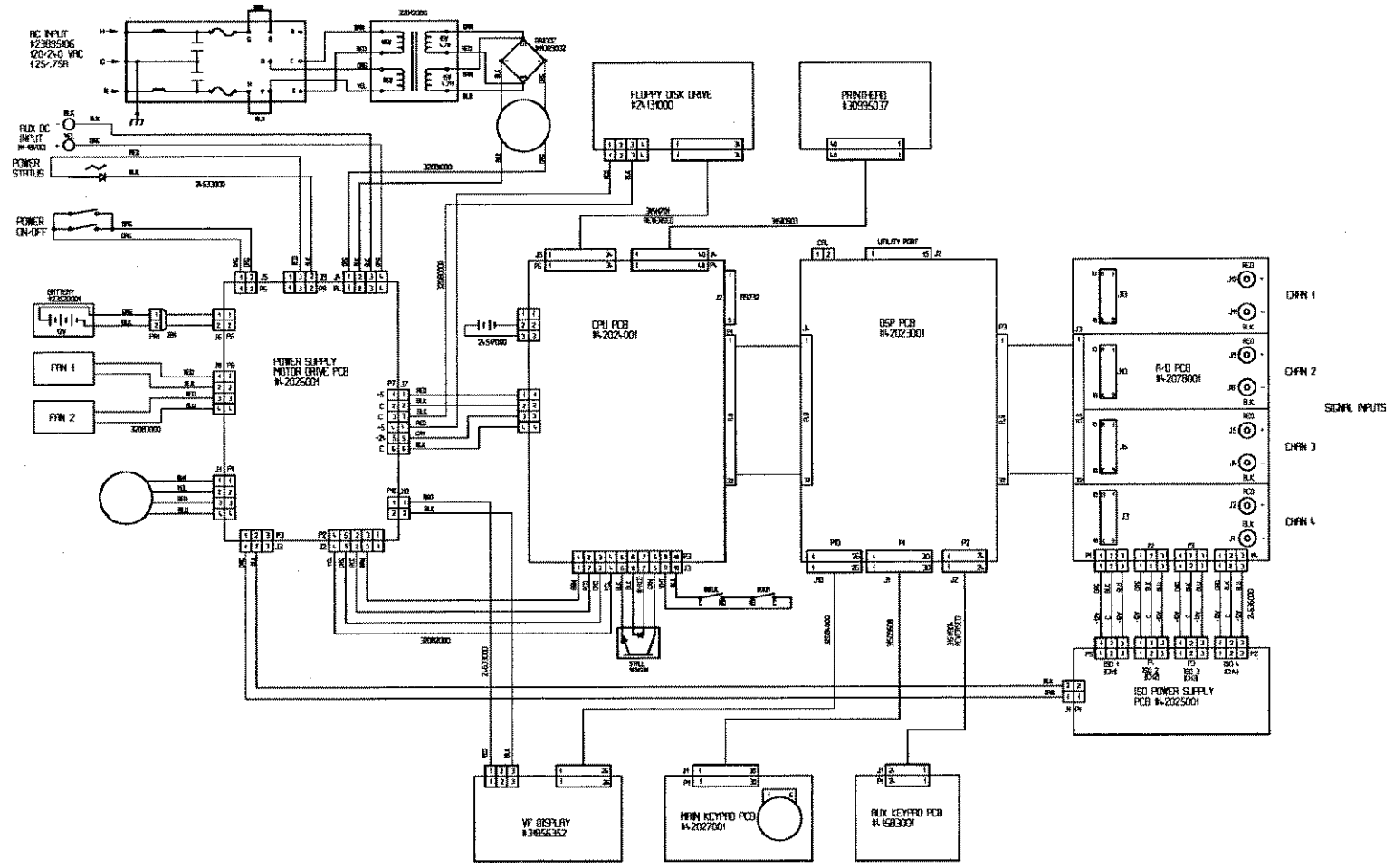
11 Apply a known DC signal.

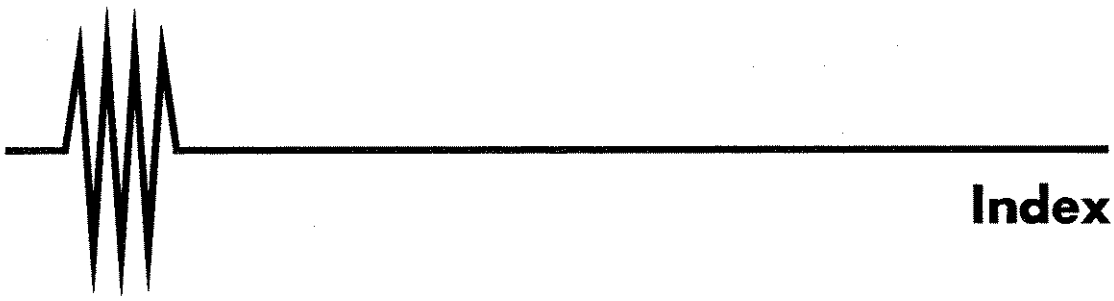
12 Set the chart sensitivity to the appropriate full-scale range.

- Use the procedure given in paragraph 6.3.1, "Selecting the voltage sensitivity of the chart."

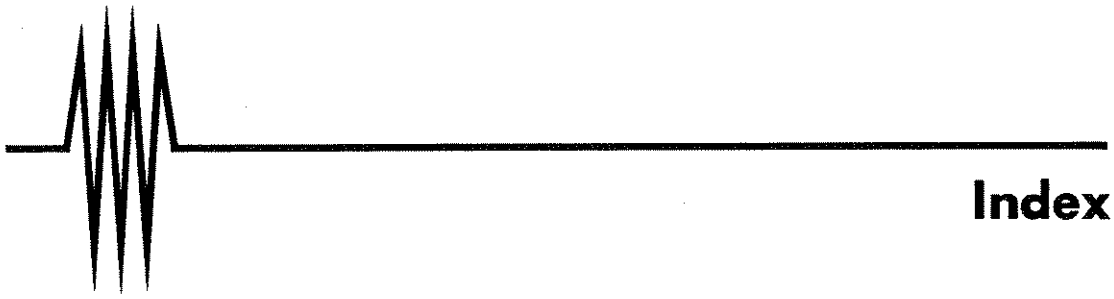
13 Adjust the GAIN potentiometer on the front-panel of the plug-in for the full-scale output (left edge of the chart).

DASH IV system schecmatic





Index



Index

A

[A], [B], [C] insta-speed keys 3-2 - 3-4
AC input current rating 1-6
AC input hypot breakdown 1-5
AC input leakage current 1-5
ADC resolution 1-10
A/D sample rate 1-5
amplitude resolution 1-8
amplitude scaling factor, selecting a real-time 6-20 - 6-23
AND / OR trigger groups 7-1, 7-4 - 7-7
annotation, alphanumeric 1-2
annotation buffers 1-7, 5-1
[ARM] key 8-16
ARM indicator light 8-16
AUTO ID 5-7
auto-rearming 8-13
auto-triggering 8-13
autotrig parameter 8-15

B

banana jack inputs QS-3
bandwidth, nominal 1-7
baseline drift with temperature 1-4
baseline drift with time 1-4
baseline, zero, positioning a waveform's 6-11 - 6-13
battery charge time 1-6
battery life 1-6
battery pack, replacing 17-11, 17-12
baud rate 1-7, 11-4, 11-5
bridge module, PI-DC, using 15-1 - 15-10
buffers, annotation 1-7

C

CAL BNC 6-31, 6-32
calibrating individual channels 6-31 - 6-33
calibrating voltage plug-in modules 17-13 - 17-14
calibration accuracy 1-4
calibration, chart 1-3
calibration stability with temperature 1-5
calibration stability with time 1-4

C

CAPTURE CONTROL 8-3, 8-13
center triggers 8-10
channel identification 1-8
channels, individual, calibrating 6-31 - 6-33
CHANNEL STATUS parameter 16-1, 16-2, 16-4
CHANNEL STATUS REPORT 16-4
chart formats, selecting for data-capture playback 9-9 - 9-12
chart speed accuracy 1-5
chart speed, data logger, setting 3-5
chart speeds 3-1 - 3-7
chart speed, setting with [SPD] key 3-4
chart width 1-9
CMR (IMR) 1-4
clock, real-time 1-9
clock, system, setting 11-3
common mode voltage 1-4
computer, host, interfaces 1-7, 11-4 - 11-6
current shunt input module 1-13
CHANGE EVENTS setup 4-3, 4-13 - 4-15
CHANGE GRID setup 4-1, 4-2, 4-4 - 4-10
CHANGE T-MARKS setup 4-3
CHANGE WAVE setup 4-3, 4-11, 4-12
channel ID numbers, printing 5-6, 5-7
channels, waveform, grounding 6-10

D

data capture 8-1 - 8-16
data capture, about 8-1, 8-2
data capture archive to floppy 1-6
data capture memory 1-6
data capture methods 8-1, 8-12 - 8-14
data capture option 1-7
data capture, optional 1-3
data capture playback, selecting a chart format for 9-9 - 9-12
data capture playback, selecting a destination 9-12, 9-13
data capture playback, selecting timebase 8-5 - 8-8
data capture rearm time 1-6
data-capture record file format 14-2, 14-3
data-capture record items, data description 14-4 - 14-12
data capture record playback, expanding/compressing 9-7 - 9-9
data capture record, selecting all or part 9-4 - 9-7
data capture record sizes 8-2, 8-8, 8-9
data capture records, multi-stacking 8-13, 8-15, 8-16

D

data capture setups 8-2 - 8
data captures, stacked 1-6
data capture window and trigger placement 8-10 - 8-12
data conversion / signal processing 1-10
data description, data-capture record items 14-4 - 14-12
data logger chart speed, setting 3-5
data logger recording 1-10, 3-5
data playback 9-1 - 9-13
data playback time bases 8-2
data words, waveform 14-13
DC-65 8-1, 8-2, 8-12
DC block 6-24, 6-26
DC bridge input module 1-14
DC input min/max 1-6
default chart, 1-plot example 4-18
default chart, 1-w/evts example 4-19
default chart, 2-plot example 4-20
default chart, 4-plot example 4-21
default charts, selecting a layout 4-16 - 4-21
DEFAULT CHARTS setup 4-4, 4-16 - 4-21
default text, printing in annotation buffers 4-15, 4-16
DEFAULT TEXT setup 4-4, 4-15, 4-16
DELETE FILE parameter 10-8, 10-9
deleting files from diskette 10-8, 10-9
description, DASH IV 1-1 - 1-3
door, paper chamber QS-2
differentiation processing, DSP, using 6-29 - 6-31
digital signal processing 1-1
dimensions 1-10
disk drive 1-9, 10-1
diskette, deleting files from 10-8, 10-9
diskette, recalling a recorder setup from 10-5, 10-6
diskette, renaming files on 10-7, 10-8
diskette, saving a recorder setup to 10-4, 10-5
diskettes, formatting 10-9
diskettes, input/output functions when using 10-1 - 10-10
DISK I/O 10-1 - 10-10
DISK I/O menu flow 10-2
display, front panel 1-10
drift, baseline, with time 1-4
drift, cold start 1-4
DSP differentiation processing, using 6-29 - 6-31
DSP integration processing, , using 6-24 - 6-29
DUAL SPEED recording mode 12-1 - 12-10
DUAL SPEED recording mode menu flow 12-2

D

dual speed recording 1-10, 12-1 - 12-10
dual-speed recording, timed, setting up 12-1 - 12-6
dual-speed recording, triggered, setting up 12-7 - 12-10

E

editing text buffers 5-2 - 5-4
[EDIT] key 5-1 - 5-7
encoder wheel 4-5 - 4-7, 5-4, 6-12, 6-13
end triggers 8-10
engineering units, converting voltage data to 6-16 - 6-20
event markers, chart location, selecting 4-13, 4-14
event markers, enabling 4-13, 4-14
event markers, internal 1-7
event markers, selecting a global style 4-14, 4-15
[EVNT] key, using 16-8
expanding/compress data capture record playback 9-7 - 9-9
external motor-clock source, referencing 3-6, 3-7
external triggers 7-1 - 7-3

F

[FEED] key 16-8
filters, signal, using 6-14 - 6-16
filter, user selectable 1-5
filter, user selectable range 1-5
filter, user selectable response 1-5
files, deleting from diskette 10-8, 10-9
files, renaming on diskette 10-7, 10-8
fixed-speed keys 3-1, 3-2
floppy operation 14-1
format, data-capture record file 14-2, 14-3
formats, chart, selecting for data-capture playback 9-9 - 9-12
formats, custom recording 1-7
formatting diskettes 10-9, 10-10
frequency response 1-5
front-panel features 2-1, 2-2
fuse, values 17-2
fuses, changing 17-1 - 17-3

G

GENERAL HELP parameter 16-1 - 16-3
GENERAL STATUS REPORT 16-5, 16-7
GPIB address 1-7, 11-5, 11-6
GPIB interface, setting up 11-5, 11-6
GPIB terminators 11-6
grid choices 1-7
grid, custom, setting up 4-1 - 4-21
grid edges, labeling with voltage values 4-8, 4-9
grid, layout and location 4-4 - 4-7
grid, metric 6-2
grid setups, accessing 4-1
grid synchronization 1-7
grid synchronizing to trilevel timing marks 4-9
grounding waveform channels 6-10

H

handshaking method, XON/XOFF 11-4, 11-5
[HELP] key, using 16-1 - 16-7
high voltage input module 1-12
host computer interfaces 1-7
host-generated triggers 7-1 - 7-3

I

[ID] key 4-8
ID numbers, channel, printing 5-6, 5-7
impedance, input 1-4
indicators 1-8
input connector 1-4
input coupling 1-4
input impedance 1-4
input, maximum operating 1-4
input, maximum safe 1-4
input/output functions when using diskettes 10-1 - 10-10
input/output, system 11-1 - 11-8
input range 1-4
input type 1-4
insta-speed keys 3-2 - 3-4
insta-speed keys, programming 3-3, 3-4

I

integration processing, DSP, using 6-24 - 6-29
interface, GPIB, setting up 11-5, 11-6
interface, RS232, setting up 11-4, 11-5
interfaces, host computer 1-7

L

level reset 6-24, 6-28
line voltage, setting 17-1 - 17-3
loading roll thermal paper QS-3
low-pass filter 6-14, 6-15

M

maintenance 17-1 - 17-13
manual reset 6-24
manual triggers 7-1 - 7-3
mean filter 6-15
memory, data capture 1-6
modes, operating 1-4
MODIFY CHART setups 4-1 - 4-21
MODIFY WINDOW parameter 9-2, 9-4 - 9-7
modules, plug-in, optional 1-3
monitor, front-panel 1-1
motor clock source, external, referencing 3-6, 3-7
MOTOR SOURCE menu 3-6, 3-7
multi-capture 8-15, 8-16
multi-stacking data capture records 8-13, 8-15, 8-16

N

noise, intrinsic 1-4
nonlinearity 1-5
notch filter (50Hz) 6-14
notch filter (60Hz) 6-14
numeric reporting 6-16 - 6-20

O

offset, baseline 1-4
on-demand annotation buffer 5-1
on-demand text buffer, printing 5-5
operating temperature 1-6

P

pack, battery, replacing 17-11, 17-12
paper chamber door QS-2
paper, roll thermal, loading QS-3
paper type and size 1-9
peak-to-peak recording mode 6-9
pen up / down 4-11
percentage triggers 8-10
PI-DC bridge module, description 15-1 - 15-4
PI-DC bridge module, front-panel controls 15-4 - 15-8
PI-DC bridge module, selection switch settings 15-4, 15-6
PI-DC bridge module, transducer input connector 15-2
PI-DC bridge module, using 15-1 - 15-10
PI-DC bridge type, selecting 15-6, 15-7
PI-DC excitation voltage, selecting 15-5
PI-DC full-scale sensitivity 15-9, 15-10
PI-DC shunt calibration 15-8, 15-9
pin tables, rear-panel connections 2-3, 2-4
playback 1-3
playback, data 9-1 - 9-13
playback, data-capture record, expanding/compressing 9-7 - 9-9
playback, data-capture, selecting time base 8-5 - 8-8
playback, data menu flow 9-3
playback destination, selecting 9-12, 9-13
playback magnifications 1-7
playback, selecting a chart format for 9-9 - 9-12
playback time base vs sample rate 8-6
plug-in modules, voltage, calibrating 17-13, 17-14
plug-in modules, optional 1-11 - 1-14
power rating 1-6
print elements, aligning 17-10
printhead, cleaning 17-3 - 17-5
printhead, location 17-4
printhead, print elements, hairline row of 17-5
printhead, replacing or adjusting 17-5 - 17-10
printhead springs, inserting 17-9

R

rear panel QS-1
rear-panel connections 1-1
rear-panel features 2-2, 2-3
recalling a recorder setup from diskette 10-5, 10-6
RECALL SETUP parameter 10-5, 10-6
recording method 1-8
record, data capture, selecting all or part 9-4 - 9-7
record format, data capture 14-1 - 14-13
record items, data-capture, data description for 14-4 - 14-12
recorder setup, recalling from diskette 10-5, 10-6
recorder setup, saving to diskette 10-4, 10-5
recorder setup, settings that make 10-3
record, playback, selecting a chart format for 9-9 - 9-12
record sizes, data capture 8-2, 8-8, 8-9
record sizes / trigger window 1-8
RECORD STATUS 8-3
rectify signal voltage 6-28
reference values, setting trigger 7-7, 7-8
relative humidity, operational 1-6
remote start/stop 1-9
RENAME FILE parameter 10-7, 10-8
reporting, signal conditioner, enabling or suppressing 4-12
resolution, ADC 1-10
resolution, amplitude 1-8
resolution, time base 1-9
RMS accuracy 1-5
RMS crest factor 1-5
RMS recording mode, selecting 6-9
roll thermal paper QS-2
roll thermal paper, loading QS-3
RS232 D-shell connector pin table 2-3
RS232 interface, setting up 11-4, 11-5
[RUN/HALT] key 12-10, 16-8

S

sample rates 1-8
saving a recorder setup to diskette 10-4, 10-5
SAVE SETUP parameter 10-3 - 10-5
scaling factor, amplitude, selecting a real-time 6-20 - 6-23
sensitivity, voltage, selecting chart 6-7, 6-8
sensitivity, in previous DASH IV versions 6-1
SET DEVICE parameter 9-2, 9-13
SET FORMAT parameter 9-2, 9-11

S

SET MAGNIF parameter 9-2, 9-8, 9-9
SET RATE parameter 8-3
SET TRIGGER parameter 8-3
SETUP CAPTURE menu flow 8-4, 8-5
SETUP CAPTURE parameter 8-3 - 8-16, 9-4
SETUP CHART parameter 12-6, 12-10
SETUP DURATION parameter 12-5, 12-8, 12-9
SETUP PLAYBACK 9-1 - 9-13
SETUP SPEEDS parameter 12-4, 12-8
setups, recorder, saved to diskette 10-3
SETUP TRIGGER parameter 7-1 - 7-8
SETUP TRIGGER menu flow 7-2
SET WINDOW parameter 8-3, 8-8, 8-9
SHUNT CAL switch 15-1
signal conditioner reporting, enabling or suppressing 4-12
signal conditioning, built-in 1-2
signal filters, using 6-14 - 6-16
single capture 8-13
single capture w/playback 8-14
signal input connections QS-3
software, system, upgrade, performing 11-7, 11-8
[SPD] key, setting chart speed with 3-4
specifications, basic system 1-4 - 1-10
speed controls 3-1 - 3-7
speed keys, fixed 3-1, 3-2
speeds, real-time 1-9
start/stop remote 1-9
start triggers 8-10
storage temperature 1-6
synchronizing the grid to timing marks 4-9, 4-10
SYSTEM CAL parameter 6-32
system clock, setting 11-3
SYSTEM I/O menu flow 11-2
system log 1-8
system software upgrade, performing 11-7, 11-8
SYSTEM STATUS parameter 16-1, 16-5 - 16-7

T

temperature, operating 1-6
temperature, storage 1-6
text, adding to the chart 5-1 - 5-7
text buffer, on-demand 5-1

T

text buffer, on-demand, printing 5-5
text buffers, editing 5-2 - 5-4
text buffers, enabling or suppressing 5-2
text buffers, positioning on the chart 5-4
thermal paper, roll QS-2
thermal paper, roll, loading QS-3
thermocouple input module 1-11, 1-12
time base resolution 1-9
time bases 1-6
time bases, data playback 8-2
time base, selecting data-capture playback 8-5 - 8-8
timed and triggered dual-speed recording 12-1
timed dual-speed recording, setting up 12-1 - 12-6
timed recording 1-10
TIMED START recording mode, using 13-1 - 13-3
TIMER START parameter 13-1
time speeds 1-7
timing marks, trilevel 1-9
triggered dual-speed recording, setting up 12-7 - 12-10
triggering, basic 1-10
trigger groups 7-4 - 7-7
trigger locations 8-11
trigger reference values, setting 7-7
triggers, center 8-10
triggers, end 8-10
trigger sources, combining into trigger groups 7-4 - 7-7
trigger sources, turning on 7-2, 7-3
triggers, setting up and enabling 7-1 - 7-8
triggers, percentage 8-10
triggers, start 8-10
trigger window / record sizes 1-8
trigger/window relationship 8-10 - 8-12

U

upgrade, system software, performing 11-7, 11-8
USER SCALING parameter 6-17 - 6-20
UTILITY D-shell 3-6
UTILITY D-shell connector pin table 2-4

V

vibration, operational 1-6
voltage, common mode 1-4
voltage data, converting to engineering units 6-16 - 6-20
voltage plug-in modules, calibrating 17-12, 17-13
voltage references, internal, precision 6-31, 6-32
voltage selection box QS-1, 17-2, 17-3
voltage selection cylinder QS-1, 17-2, 17-3
voltage sensitivity, selecting chart 6-7, 6-8
voltage, signal, rectify 6-28

W

waveform channels, grounding individual 6-10
waveform data words 14-13
waveform, maximum viewable size 1-9
waveform printing, suppressing or enabling 4-11
waveforms, maximum number 1-9
waveform triggers 7-1
waveform trigger sources, combining 7-4 - 7-7
weight 1-6

X

XON/XOFF handshaking method 11-4, 11-5
XY plot 9-10, 9-12

Z

zero and gain controls 6-3 - 6-33
zero and gain menu flow 6-4 - 6-6
zero baseline, positioning a waveform's 6-11 - 6-13
zero crossing 6-24, 6-26
ZERO menu QS-5
zero baseline positioning QS-5
zero suppression accuracy 1-5
zero suppression, applying to waveform signals 6-13, 6-14
zero suppression range 1-5
[Z/G] key QS-4, 6-3 - 6-33

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