
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.

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- 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.

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.

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	$\pm 10\text{V}$ for sensitivities $\leq 425\text{mV/cm}$ $\pm 350\text{V}$ for sensitivities $> 425\text{mV/cm}$
operating modes	peak-to-peak or RMS
input coupling	DC
input impedance	1 Megohm
maximum safe input	250 VRMS, 350 VDC, 350 V _{peak}
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	$\pm 0.5\%$
calibration stability with time	<0.5 mm/24 hours

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	-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 millivolt 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

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 μ s/mm, 200 μ s/mm, 400 μ s/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

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	<ul style="list-style-type: none">■ 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

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

Basic system specifications

time base resolution	<ul style="list-style-type: none">■ 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	<ul style="list-style-type: none">■ 3.5 inch removable diskette■ format: MDOS compatible■ maximum capacity: 1.4MB■ used to:<ul style="list-style-type: none">- 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.

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

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	<ul style="list-style-type: none"> ■ 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

Optional plug-in modules

thermocouple input module

drift	<2 mm
reporting	yes
external transducer 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 transducer requirement	none

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 transducer requirement	yes, external shunt resistor

Optional plug-in modules

DC bridge input module

maximum input range	500 mV
sensitivity	250 $\mu\text{V}/\text{cm}$ to 50 mV/cm
modes	peak-to-peak or RMS
maximum CMV	250 V peak
input impedance	20 MegOhm, balance to common
frequency response	≥ 3.5 kHz
bridge completion	<ul style="list-style-type: none"> ■ 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 transducer requirement	yes