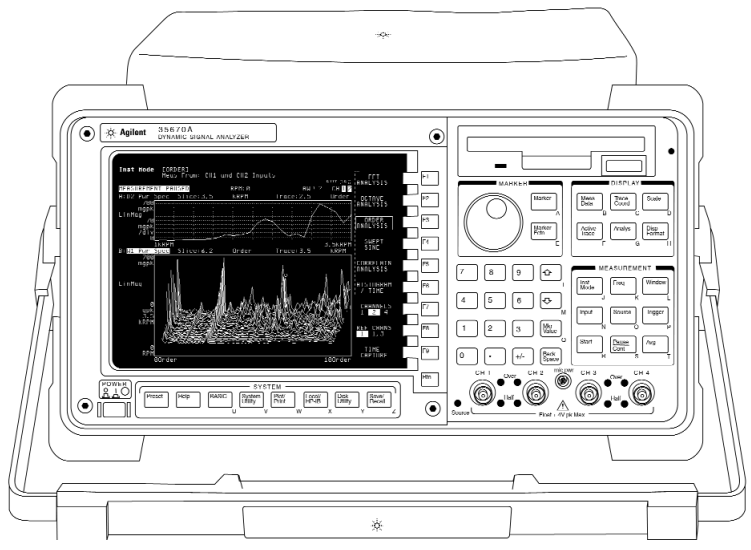


Agilent Technologies 35670A Dynamic Signal Analyzer

Technical Specifications

**Versatile two- or four-channel high-performance
FFT-based spectrum/network analyzer**

122 μ Hz to 102.4 kHz 16-bit ADC



Key Specifications

Frequency Range	102.4 kHz 1 channel 51.2 kHz 2 channel 25.6 kHz 4 channel
Dynamic Range	90 dB typical
Accuracy	± 0.15 dB
Channel Match	± 0.04 dB and ± 0.5 degrees
Real-time Bandwidth	25.6 kHz/1 channel
Resolution	100, 200, 400, 800 & 1600 lines
Time Capture	> 6 Msamples
Source Types	Random, Burst random, Periodic chirp, Burst chirp, Pink noise, Sine, Swept-Sine (option1D2), Arbitrary (option 1D4)

Summary of Features on Standard Instrument

The following features are standard with the Agilent 35670A:

Instrument Modes

FFT Analysis	Histogram/Time
Correlation Analysis	Time Capture

Measurement

Frequency Domain	
Frequency Response	Power Spectrum
Linear Spectrum	Coherence
Cross Spectrum	Power Spectral Density

Time Domain (oscilloscope mode)

Time Waveform	Autocorrelation
Cross-Correlation	Orbit Diagram
Amplitude Domain	
Histogram, PDF, CDF	

Trace Coordinates

Linear Magnitude	Unwrapped Phase
Log Magnitude	Real Part
dB Magnitude	Imaginary Part
Group Delay	Nyquist Diagram
Phase	Polar

Trace Units

Y-axis Amplitude: combinations of units, unit value, calculated value, and unit format describe y-axis amplitude

Units: volts, g, meters/sec², inches/sec², meters/sec, inches/sec, meters, mils, inches, pascals, Kg, N, dyn, lb, user-defined EUs

Unit Value: rms, peak, peak-to-peak

Calculated Value: V, V², V²/Hz, √Hz, V²s/Hz (ESD)

Unit Format: linear, dB's with user selectable dB reference, dBm with user selectable impedance.

Y-Axis Phase: degrees, radians

X-Axis: Hz, cpm, order, seconds, user-defined

Display Formats

Single
Quad
Dual Upper/Lower Traces
Small Upper and Large Lower
Front/Back Overlay Traces
Measurement State
Bode Diagram
Waterfall Display with Skew, -45 to 45 Degrees
Trace Grids On/Off
Display Blanking
Screen Saver

Display Scaling

Autoscale	Selectable Reference
Manual Scale	Linear or Log X-Axis
Input Range Tracking	Y-Axis Log
X & Y Scale Markers with Expand and Scroll	

Marker Functions

Individual Trace Markers
Coupled Multi-Trace Markers
Absolute or Relative Marker
Peak Search
Harmonic Markers
Band Marker
Sideband Power Markers
Waterfall Markers
Time Parameter Markers
Frequency Response Markers

Signal Averaging (FFT Mode)

Average Types (1 to 9,999,999 averages)	
RMS	Time Exponential
RMS Exponential	Peak Hold
Time	

Averaging Controls

Overload Reject
Fast Averaging On/Off
Update Rate Select
Select Overlap Process Percentage
Preview Time Record

Measurement Control

Start Measurement
Pause/Continue Measurement

Triggering

Continuous (Freerun)
External (Analog or TTL Level)
Internal Trigger from any Channel
Source Synchronized Trigger
GPIO Trigger
Armed Triggers
Automatic/Manual
RPM Step
Time Step
Pre- and Post-Trigger Measurement Delay

Tachometer Input:

±4V or ±20V range
40 mv or 200 mV resolution
Up to 2048 pulses/rev
Tach hold-off control

Source Outputs

Random	Burst Random
Periodic Chirp	Burst Chirp
Pink Noise	Fixed Sine

Note: Some source types are not available for use in optional modes. See option description for details.

Input Channels

Manual Range	Anti-alias Filters On/Off
Up-Only Auto Range	AC or DC Coupling
Up/Down Auto Range	LED Half Range and Overload Indicators
Floating or Grounded	A-Weight Filters On/Off
Transducer power supplies (4 ma constant current)	

Frequency

20 Spans from 195 mHz to 102.4 kHz (1 channel mode)
20 Spans from 98 mHz to 51.2 kHz (2 channel mode)
Digital zoom with 244 μHz resolution throughout the 102.4 kHz frequency bands.

Resolution

100, 200, 400, 800 and 1600 lines

Windows

Hann	Uniform
Flat Top	Force/Exponential

Math

+, -, *, /	Conjugate
Magnitude	Real and Imaginary
Square Root	FFT, FFT ⁻¹
LN	EXP
*jω or /jω	PSD
Differentiation	A, B, and C weighting
Integration	Constants K1 thru K5
Functions	F1 thru F5

Analysis

Limit Test with Pass/Fail
Data Table with Tabular Readout
Data Editing

Time Capture Functions

Capture transient events for repeated analysis in FFT, octave, order, histogram, or correlation modes (except swept-sine). Time-captured data may be saved to internal or external disk, or transferred over GPIB. Zoom on captured data for detailed narrowband analysis. Up to 6 Msamples of data can be saved in the standard unit.

Data Storage Functions

Built-in 3.5 in., 1.44-Mbyte flexible disk also supports 720-KByte disks, and 2 Mbyte NVRAM disk. Both MS-DOS® and HP-LIF formats are available. Data can be formatted as either ASCII or Binary (SDF). The 35670A provides storage and recall from the internal disk, internal RAM disk, internal NVRAM disk, or external GPIB disk for any of the following information:

Instrument Setup States	Trace Data
User-Math	Limit Data
Time Capture Buffers	Agilent Instrument BASIC Programs
Waterfall Display Data	Curve Fit/Synthesis Tables
Data Tables	
Tables	

Interfaces

GPIB (IEEE-488.1 and 488.2)
Parallel
RS-232C Serial

Hard-Copy Output

To Serial or Parallel HP-GL Plotters (PCL5e)
To Raster Printers
To Serial or Parallel HP-GL Printers
To Disk File (Supports Raster Printer, HP-GL Plotter, and HP-GL Printer)
Time Stamp

GPIB Capabilities

Listener/Talker (Direct control of plotters, printers, disk drives)
Conforms to IEEE 488.1/488.2
Conforms to SCPI 1992
Controller with Agilent Instrument Basic option

Standard Data Format (SDF) Utilities

Exchange data between virtually all Agilent Dynamic Signal Analyzers
Easy data transfer to spreadsheets
Data transfer to MATRIX_X and Matlab

SDF utilities run in an external PC

Calibration & Memory

Single or Automatic Calibration
Built-In Diagnostics & Service Tests
Nonvolatile Clock with Time/Date
Time/Date Stamp on Plots and Saved Data Files

Online Help

Access to Topics via Keyboard or Index

Fan

On/Off

MS-DOS® is a U.S. registered trademark of Microsoft Corporation.

Agilent 35670A

Specifications

Instrument specifications apply after 15 minutes warm-up and within 2 hours of the last self-calibration. When the internal cooling fan has been turned OFF, specifications apply within 5 minutes of the last self-calibration. All specifications are with 400 line frequency resolution and with anti-alias filters enabled unless stated otherwise.

Frequency

Maximum Range**

1 Channel Mode	102.4kHz, 51.2 kHz (option AY6*)
2 Channel Mode	51.2 kHz
4 Channel Mode (option AY6 only)	25.6 kHz

Spans

1 Channel Mode	195.3 mHz to 102.4 kHz
2 Channel Mode	97.7 mHz to 51.2 kHz
4 Channel Mode (option AY6 only)	97.7 mHz to 25.6 kHz

Minimum Resolution

1 Channel Mode	122 μ Hz (1600 line display)
2 Channel Mode	61 μ Hz (1600 line display)
4 Channel Mode (option AY6 only)	122 μ Hz (800 line display)

Maximum Real-Time Bandwidth

(FFT Span for Continuous Data Acquisition) (Preset, Fast Averaging)

1 Channel Mode	25.6 kHz
2 Channel Mode	12.8 kHz
4 Channel Mode (option AY6 only)	6.4 kHz

Measurement Rate

(Typical) (Preset, Fast Averaging)

1 Channel Mode	≥ 70 Averages/Second
2 Channel Mode	≥ 33 Averages/Second
4 Channel Mode (option AY6 only)	≥ 15 Averages/Second

Display Update Rate

Typical (Preset, Fast Average OFF)	≥ 5 Updates/Second
Maximum	≥ 9 Updates/Second

(Preset, Fast Average Off, Single Channel, Single Display, Undisplayed Trace Displays set to Data Registers)

Accuracy	± 30 ppm (.003%)
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Single Channel Amplitude

Absolute Amplitude Accuracy (FFT)
(A combination of Full Scale Accuracy, Full Scale Flatness, and Amplitude Linearity.)
 $\pm 2.92\%$ (0.25dB) of Reading
 $\pm 0.025\%$ of Full Scale

FFT Full Scale Accuracy at 1 kHz (0 dBfs)
 ± 0.15 dB (1.74%)

FFT Full Scale Flatness (0 dBfs)

Relative to 1 kHz

± 0.2 dB (2.33%)

FFT Amplitude Linearity at 1 kHz

Measured on +27 dBVrms range with time avg, 0 to -80 dBfs
 $\pm 0.58\%$ (0.05dB) of reading $\pm 0.025\%$ of full scale

Amplitude Resolution

(16 bits less 2 dB over-range) with averaging
0.0019% of full scale (typical)

Residual DC Response (FFT Mode)

Frequency Display (Excludes A-weight filter)

< -30 dBfs or 0.5 mVdc

* Option AY6 single channel maximum range extends to 102.4 kHz without anti-alias filter protection.

** Show All Lines mode allows display of up to 131.1, 65.5 and 32.7 kHz respectively. Amplitudes accuracy is unspecified and not alias protected.

FFT Dynamic Range

Spurious Free Dynamic Range 90 dB typical (<-80 dBfs)

(Includes Spurs, Harmonic Distortion, Intermodulation Distortion, Alias Products)
Excludes alias responses at extremes of span.

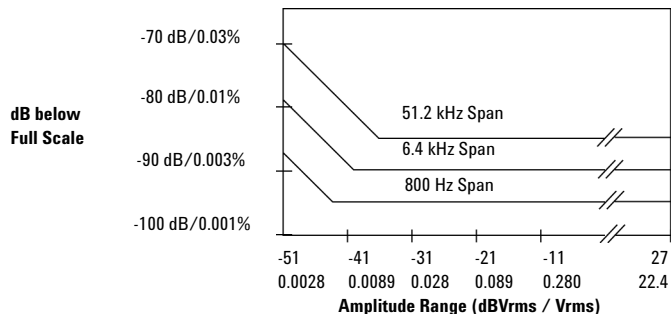
Source impedance = 50Ω.

800 Line Display.

Full Span FFT Noise Floor (typical)

Flat Top Window, 64 RMS Averages, 800 Line Display.

Typical Noise Floor vs. Range for Different Frequency Spans



Harmonic Distortion

<-80 dBfs

Single Tone (in band), ≤ 0 dBfs

Intermodulation Distortion

<-80 dBfs

Two tones (in-band), each ≤ -6.02 dBfs

Spurious and Residual Responses

<-80 dBfs

Source impedance = 50Ω.

Frequency Alias Responses

Single Tone (out of displayed range), ≤ 0 dBfs, ≤ 1 MHz
(≤ 200 kHz with IEPE transducer power supply On)

2.5% to 97.5% of the Frequency Span <-80 dBfs

Lower and Upper 2.5% of Frequency Span <-65 dBfs

Input Noise

Input Noise Level

Flat Top Window, -51 dBVrms range

Source Impedance = 50Ω

Above 1280 Hz

<-140 dBVrms/√Hz

160 Hz to 1280 Hz

<-130 dBVrms/√Hz

Note: To calculate Noise as dB below Full Scale:

Noise [dBfs] = Noise [dB/√Hz] + 10LOG(NBW) - Range[dBVrms]; where NBW is the Noise Equivalent BW of the Window (see below).

Window Parameters	Uniform	Hann	Flat Top
-3 dB Bandwidth*	0.125% of Span	0.185% of Span	0.450% of Span
Noise Equivalent Bandwidth*	0.125% of Span	0.1875% of Span	0.4775% of Span
Attenuation at ±1/2 Bin	4.0 dB	1.5 dB	0.01 dB
Shape Factor	716	9.1	2.6
(-60 dB BW/-3 dB BW)			

* For 800 line displays. With 1600, 400, 200, or 100 line displays, multiply bandwidths by 0.5, 2, 4, and 8, respectively.

Single Channel Phase

Phase Accuracy Relative to ±4.0 deg

External Trigger

16 Time Averages

Center of Bin, DC Coupled

0 dBfs to -50 dBfs Only

0 Hz < freq ≤ 10.24 kHz Only

For Hann and Flat Top windows, phase is relative to a cosine wave at the center of the time record. For the Uniform, Force, and Exponential windows, phase is relative to a cosine wave at the beginning of the time record.

Cross-Channel Amplitude

FFT Cross-Channel ±0.04 dB (0.46%)

Gain Accuracy

Frequency Response Mode

Same Amplitude Range

At Full Scale: Tested with 10 RMS Averages on the -11 to +27 dBVrms Ranges, and 100 RMS Averages on the -51 dBVrms Range

Cross-Channel Phase

Cross-Channel Phase Accuracy ±0.5 deg

(Same conditions as Cross-Channel Amplitude)

Input

Input Ranges (full scale) (Auto-Range Capability)	+27 dBVrms (31.7 Vpk) to -51 dBVrms (3.99 mVpk) in 2 dB steps
Maximum Input Levels	42 Vpk
Input Impedance	1 M Ω \pm 10% 90 μ F nominal
Low Side to Chassis Impedance	1 M Ω \pm 30% (typical)
Floating Mode	<0.010 μ F
Grounded Mode	\leq 100 Ω
AC Coupling Roll-off	<3 dB rolloff at 1Hz
Source Impedance = 50 Ω	
Common Mode Rejection Ratio	
Single Tone at or below 1 kHz	
-51 dBVrms to -11 dBVrms Ranges	>75 dB typical
-9 dBVrms to +9 dBVrms Ranges	>60 dB typical
+11 dBVrms to +27 dBVrms Ranges	>50 dB typical
Common Mode Range (floating mode)	\pm 4V pk
IEPE Transducer Power Supply	
Current Source	4.25 \pm 1.5 mA
Open Circuit Voltage	+26 to +32 Vdc
A-Weight Filter	
Conforms to ANSI Standard S1.4-1983; and to IEC 651-1979; 10 Hz to 25.6 kHz	

Crosstalk

Between Input Channels, and Source-to-Input (Receiving Channel Source Impedance = 50 Ω)	<-135 dB below signal or <-80 dBfs of receiving channel, whichever response is greater in amplitude
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Time Domain

Specifications apply in Histogram/Time Mode, and unfiltered time display	
DC Amplitude Accuracy	\pm 5.0 %fs
Rise Time of -1V to 0V Test Pulse	<11.4 μ Sec
Settling Time of -1V to 0V Test Pulse	<16 μ Sec to 1%
Peak Overshoot of -1V to 0V Test Pulse	<3%
Sampling Period	
1 Channel Mode	3.815 μ Sec to 2 Sec in 2x Steps
2 Channel Mode	7.629 μ Sec to 4 Sec in 2x Steps
4 Channel Mode (Option AY6 Only)	15.26 μ Sec to 8 Sec in 2x Steps

Trigger

Trigger Modes	Internal, Source, External (analog setting) GPIB
Maximum Trigger Delay	
Post Trigger	8191 seconds
Pre Trigger	8191 sample periods

No two channels can be further than
 \pm 7168 samples from each other.

External Trigger Max Input	\pm 42 Vpk
External Trigger Range	
Low Range	-2V to +2V
High Range	-10V to +10V

External Trigger Resolution

Low Range	15.7 mV
High Range	78 mV

Tachometer

Pulses per Revolution	0.5 to 2048
RPM	5 \leq RPM \leq 491,519
RPM Accuracy	\pm 100 ppm (0.01%) (Typical)

Tach Level Range

Low Range	-4V to +4V
High Range	-20V to +20V

Tach Level Resolution

Low Range	39 mV
High Range	197 mV
Maximum Tach Input Level	\pm 42 Vpk
Minimum Tach Pulse Width	600 nSec
Maximum Tach Pulse Rate	400 kHz (Typical)

Source Output

Source Types	Sine, Random Noise, Chirp, Pink Noise, Burst Random, Burst Chirp
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Amplitude Range

AC: $\pm 5V$ peak*
DC: $\pm 10V$ *
* $V_{ac, pk} + V_{dc} \leq 10V$

AC Amplitude Resolution

Voltage > 0.2 Vrms	2.5 mVpeak
Voltage < 0.2 Vrms	0.25 mVpeak

DC Offset Accuracy	± 15 mV $\pm 3\%$ of ($ DC + V_{ac, pk}$) Settings
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Pink Noise Adder	Add 600 mV typical when using pink noise
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Output Impedance	< 5 Ω
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Maximum Loading

Current	± 20 mA peak
Capacitance	0.01 μF

Sine Amplitude Accuracy at 1 kHz	$\pm 4\%$ (0.34 dB) of setting
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Rload > 250 Ω
0.1 Vpk to 5 Vpk

Sine Flatness (relative to 1 kHz)	± 1 dB
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0.1V to 5V peak

Harmonic and Sub-Harmonic Distortion and Spurious Signals (In Band)

0.1 Vpk to 5 Vpk Sine Wave

Fundamental < 30 kHz	< -60 dBc
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Fundamental > 30 kHz	< -40 dBc
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Digital Interfaces

External Keyboard	Compatible with PC-style 101-key keyboard
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GPIOB Conforms to the following standards:	IEEE 488.1 (SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C12, E2) IEEE 488.2-1987 Complies with SCPI 1992
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Data Transfer Rate (REAL 64 Format)	<45 mSec for a 401 point trace
---	--------------------------------

Serial Port**Parallel Port****External VGA Port**

Computed Order Tracking - Option 1D0

$$\left(\frac{\text{Maximum Order} \times \text{Maximum RPM}}{60} \right) \leq$$

Online (Real Time)	1 Channel Mode	25,600 Hz
	2 Channel Mode	12,800 Hz
	4 Channel Mode	6,400 Hz

Capture Playback	1 Channel Mode	102,400 Hz
	2 Channel Mode	51,200 Hz
	4 Channel Mode	25,600 Hz

Number of Orders ≤ 200 5 ≤ RPM ≤ 491,519

(Maximum useable RPM is limited by Resolution, Tach Pulse Rate, Pulses/Revolution and Average Mode Settings.)

Delta Order 1/128 to 1/1

Resolution ≤ 400

(Maximum Order) / (Delta Order)

Maximum RPM Ramp Rate 1000 RPM / second real-time (typical)

1000 - 10,000 RPM Run Up

Maximum Order 10

Delta Order 0.1

RPM Step 30 (1 Channel)

60 (2 Channel)

120 (4 Channel)

Order Track Amplitude Accuracy ±1 dB (typical)

Real Time Octave Analysis - Option 1D1

Standards Conforms to ANSI Standard S1.11 - 1986, Order 3, Type 1-D, Extended and Optional Frequency Ranges

Conforms to IEC 651-1979 Type 0 Impulse , and ANSI S1.4

Frequency Ranges (at centers)

Online (Real Time):

	Single Channel	2 Channel	4 Channel
1/1 Octave	0.063 - 16 kHz	0.063 - 8 kHz	0.063 - 4 kHz
1/3 Octave	0.08 - 40 kHz	0.08 - 20 kHz	0.08 - 10 kHz
1/12 Octave	0.0997 - 12.338 kHz	0.0997 - 6.169 kHz	0.0997 - 3.084 kHz

Capture Playback:

1/1 Octave	0.063 - 16 kHz	0.063 - 16 kHz	0.063 - 16 kHz
1/3 Octave	0.08 - 31.5 kHz	0.08 - 31.5 kHz	0.08 - 31.5 kHz
1/12 Octave	0.0997 - 49.35 kHz	0.0997 - 49.35 kHz	0.0997 - 49.35 kHz

One to 12 octaves can be measured and displayed.

1/1-, 1/3-, and 1/12-octave true center frequencies related by the formula: $f(i+1)/f(i) = 2^{(1/n)}$; n=1, 3, or 12; Where 1000 Hz is the reference for 1/1, 1/3 Octave, and $1000 \cdot 2^{(1/24)}$ Hz is the reference for 1/12 octave. The marker returns the ANSI standard preferred frequencies.

Accuracy

1 Second Stable Average

Single Tone at Band Center: ≤ ± 0.20 dB

Readings are taken from the Linear Total Power Spectrum Bin.

It is derived from sum of each filter.

1/3-Octave Dynamic Range > 80 dB (typical) per ANSI S1.11-1986

2 Second Stable Average

Total power limited by input noise level

Swept Sine Measurements - Option 1D2

Dynamic Range 130 dB

Tested with 11 dBVrms
source level at: 100 mSec
integration

Arbitrary Waveform Source - Option 1D4

Amplitude Range AC: ±5V peak*

DC: ±10V*

* $V_{ac, pk} + |V_{dc}| \leq 10V$

Record Length # of Points = 2.56 x

Lines of Resolution,

or # of Complex

Points = 1.28 x Lines

of Resolution

DAC Resolution

0.2828 Vpk to 5 Vpk

2.5 mV

0 Vpk to 0.2828 Vpk

0.25 mV

General Specifications

Safety Standards	CSA Certified for Electronic Test and Measurement Equipment per CSA C22.2, NO. 231 This product is designed for compliance to: UL1244, Fourth Edition IEC 348, 2nd Edition, 1978
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EMI / RFI Standards	CISPR 11
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Acoustic Power	LpA < 55 dB (Cooling Fan at High Speed Setting) < 45 dB (Auto Speed Setting at 25 °C)
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Fan Speed Settings of High, Automatic, and Off are available. The Fan Off setting can be enabled for a short period of time, except at higher ambient temperatures where the fan will stay on.

Environmental Operating Restrictions

	Operating: Disk In Drive	Operating: No Disk In Drive	Storage & Transport
Ambient Temp.	4 °C to 45 °C	0 °C to 55 °C	-40 °C to 70 °C
Relative Humidity (non-condensing)			
Minimum	20%	15%	5%
Maximum	80% at 32 °C	95% at 40 °C	95% at 50 °C
Vibrations (5 - 500 Hz)	0.6 Grms	1.5 Grms	3.41 Grms
Shock	5G (10 mSec 1/2 sine)	5G (10 mSec 1/2 sine)	40G (3 mSec 1/2 sine)
Max. Altitude	4600 meters (15,000 ft.)	4600 meters (15,000 ft.)	4600 meters (15,000 ft.)

AC Power	90 Wrms - 264 Wrms (47 - 440 Hz) 350 VA maximum
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DC Power	12 VDC to 28 VDC Nominal 200 VA maximum
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DC Current at 12V	standard: <10A typical 4 channel: <12A typical
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Warm-Up Time	15 minutes
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Weight	15 kg (33 lb) net 29 kg (64 lb) shipping
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Dimensions	(Excluding Bail Handle and Impact Cover)
Height	190 mm (7.5")
Width	340 mm (13.4")
Depth	465 mm (18.3")

Abbreviations

dBVrms = dB relative to 1 Volt rms.

dBfs = dB relative to full scale amplitude range. Full scale is approx. 2 dB below ADC overload.

Typical = typical, non-warranted, performance specification included to provide general product information.

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