



Specifications

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Analog Input Specifications

Table 7 lists the specifications for the A/D subsystem on the DT8824 and DT8824-HV instrument modules.

Table 7: A/D Subsystem Specifications

Feature	DT8824 Specifications	DT8824-HV
Number of analog inputs	4 Differential	4 Differential
Number of gains	4 (1, 8, 16, 32)	4 (1, 8, 16, 32)
Input range Gain = 1: Gain = 8: Gain = 16: Gain = 32:	± 10 V ± 1.25 V ± 0.625 V ± 0.3125 V	± 600 V ± 75 V ± 37.5 V ± 18.75 V
Resolution	24 bits	24 bits
Data encoding	Offset binary	Offset binary
Coupling	DC	DC
Sample frequency per channel	1.173 Hz to 4800 Hz	1.173 Hz to 4800 Hz
System accuracy @ 10 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.005%	0.008% 0.008% 0.012% 0.020%
System accuracy @ 100 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.006%	0.008% 0.008% 0.012% 0.024%
System accuracy @ 1200 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.004% 0.007%	0.008% 0.008% 0.016% 0.028%
System accuracy @ 4800 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.003% 0.005% 0.010%	0.008% 0.008% 0.02% 0.04%
Nonlinearity (integral) Gain = 1: Gain > 1:	± 5 ppm full-scale maximum ± 15 ppm full-scale maximum	± 25 ppm full-scale maximum ± 35 ppm full-scale maximum
Differential linearity	± 1 LSB (no missing codes)	± 1 LSB (no missing codes)

Table 7: A/D Subsystem Specifications (cont.)

Feature	DT8824 Specifications	DT8824-HV
Offset drift versus temperature ≤ 600 Hz: > 600 Hz:	50 nV/°C 150 nV/°C	3 μV/°C 9 μV/°C
Offset drift versus time	25 nV/1000 hours typical	1.5 μV/1000 hours typical
Gain drift versus temperature	±10 ppm/°C	±25 ppm/°C
Gain drift versus time	10 ppm/1000 hours typical	25 ppm/1000 hours typical
Input impedance Power off: Power on:	3 kΩ 10 MΩ// 3 kΩ in series with 4700 pF	3 kΩ 1 MΩ// 3 kΩ in series with 4700 pF
Input bias current	≤ ±1 nA	≤ ±1 nA
Input noise (@ 10 Hz sample rate; gain of 1)	3.6 μV rms = 23.8 μV pp or < 1.5 ppm	209.0 μV rms = 1.4 mV pp or < 1.5 ppm
System noise	See Table 8 and Figure 27 on page 96	See Table 9 and Figure 28 on page 97
Analog input filter	3 kHz	3 kHz
Common mode rejection @ 10 Hz	> -150 dB @ 50 Hz and 60 Hz	> -150 dB @ 50 Hz and 60 Hz
Common mode voltage	±500 V maximum (operational)	±1000 V maximum (operational)
Maximum input voltage	±40 V maximum (protection)	±800 V maximum (protection)
Channel-to-channel offset	±10 μV	±600 μV
Effective number of bits (ENOB) @ 100 Hz with a 10 Hz, ±9.9 V sine wave input	21 bits typical	20 bits typical
Channel crosstalk	-150 dB @ 1 kHz	-150 dB @ 1 kHz
Input coupling	DC	DC
Isolation voltage	±500 V to computer ground	±1000 V to computer ground
Channel-to-channel isolation	±500 V	±2000 V
ESD protection Arc: Contact:	8 kV 4 kV	8 kV 4 kV
Internal reference	1.25 V ±0.001 V	1.25 V ±0.001 V
-3 dB point (low pass) ^a Sample rate less than or equal to 600 Samples/s Sample greater than 600 Samples/s	f -3 dB = 0.24 x fADC f -3 dB = 0.23 x fADC	f -3 dB = 0.24 x fADC f -3 dB = 0.23 x fADC
Internal clock	±100 ppm maximum (typical initial ±25 ppm) ^b	±100 ppm maximum (typical initial ±25 ppm) ^b
Warm-up time	1 hour	1 hour

a. Refer to [page 98](#) for more information about the frequency response, input bandwidth, and correction factors.

b. This clock is derived from the crystal oscillator. The specification includes initial tolerance, power supply variations, temperature drift, and 1 year stability.

System Noise Of the DT8824

Table 8 lists the typical RMS noise, in microvolts, of the DT8824 at sampling rates of 10 Samples/s, 100 Samples/s, 960 Samples/s, and 4800 Samples/s and gains of 1, 8, 16, and 32.

Table 8: DT8824 System Noise

Gain	10 Samples/s	100 Samples/s	960 Samples/s	4800 Samples/s
1	3.6 μ Vrms	12.0 μ Vrms	25.0 μ Vrms	63.0 μ Vrms
8	0.7 μ Vrms	2.0 μ Vrms	4.2 μ Vrms	11.0 μ Vrms
16	0.6 μ Vrms	1.8 μ Vrms	2.8 μ Vrms	7.5 μ Vrms
32	0.4 μ Vrms	1.3 μ Vrms	2.3 μ Vrms	6.5 μ Vrms

Figure 27 shows this data in graphical form.

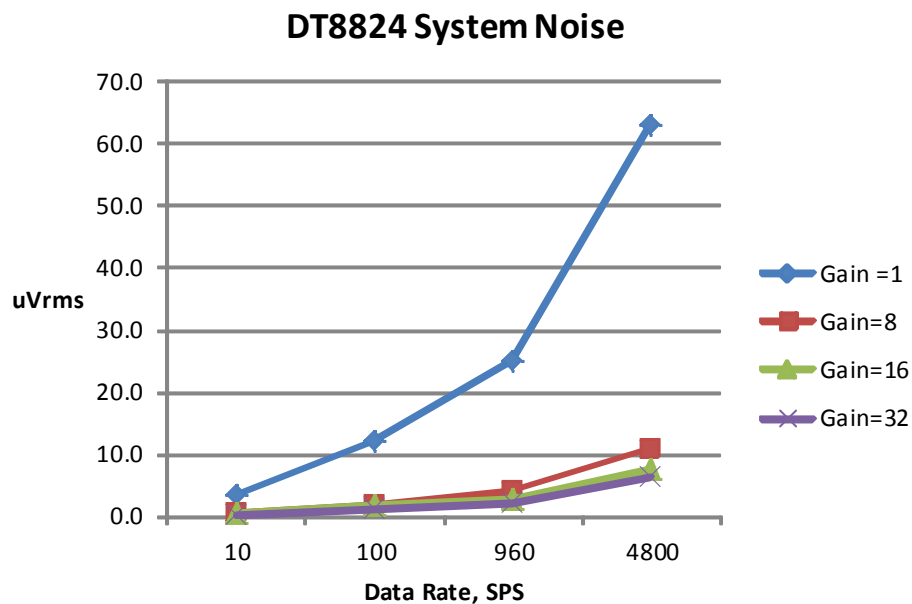


Figure 27: System Noise Specification for the DT8824

System Noise Of the DT8824-HV

Table 9 lists the typical RMS noise, in microvolts, of the DT8824-HV at sampling rates of 10 Samples/s, 100 Samples/s, 960 Samples/s, and 4800 Samples/s and gains of 1, 8, 16, and 32.

Table 9: DT8824-HV System Noise

Gain	10 Samples/s	100 Samples/s	960 Samples/s	4800 Samples/s
1	209.0 μ Vrms	680.0 μ Vrms	1470.0 μ Vrms	3760.0 μ Vrms
8	71.0 μ Vrms	209.0 μ Vrms	475.0 μ Vrms	1100.0 μ Vrms
16	63.0 μ Vrms	200.0 μ Vrms	435.0 μ Vrms	960.0 μ Vrms
32	58.0 μ Vrms	185.0 μ Vrms	415.0 μ Vrms	930.0 μ Vrms

Figure 28 shows this data in graphical form.

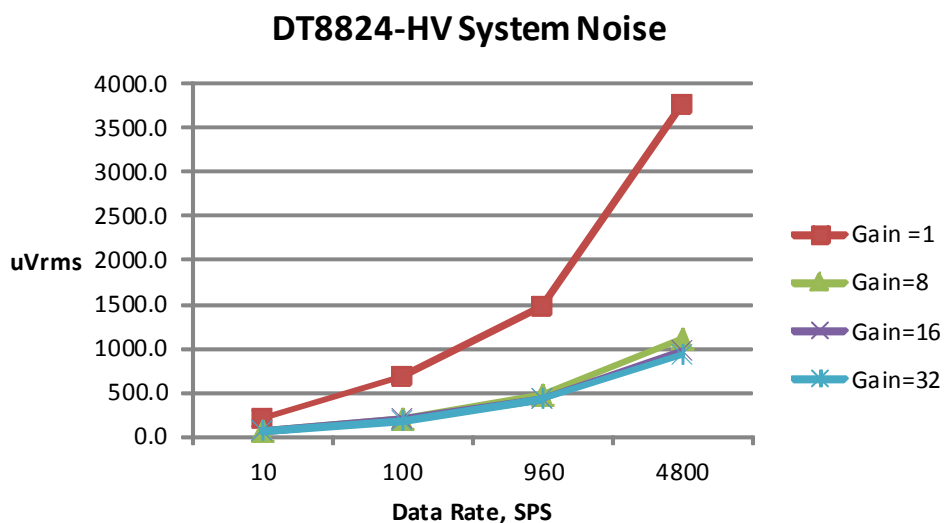


Figure 28: System Noise Specification for the DT8824-HV

Frequency Response and Input Bandwidth

Each channel of the DT8824 and DT8824-HV instrument modules include a dedicated 24-bit Sigma-Delta A/D converter. The ultra-low noise and accuracy of these converters is achieved using an oversampling Sigma-Delta modulator followed by a multi-order Sinc filter and a digital low-pass filter/decimator.

The filter response has a gentle rolloff from DC with a 3 dB signal bandwidth that is determined by the user-selected sampling rate, shown in [Table 10](#).

Table 10: -3 dB Bandwidth

Sampling Frequency	-3 dB Bandwidth Point
Less than or equal to 600 Samples/s	0.24 x sample rate
Greater than 600 Samples/s	0.23 x sample rate

[Figure 29](#) shows the frequency response using a sampling rate of 4800 Samples/s.

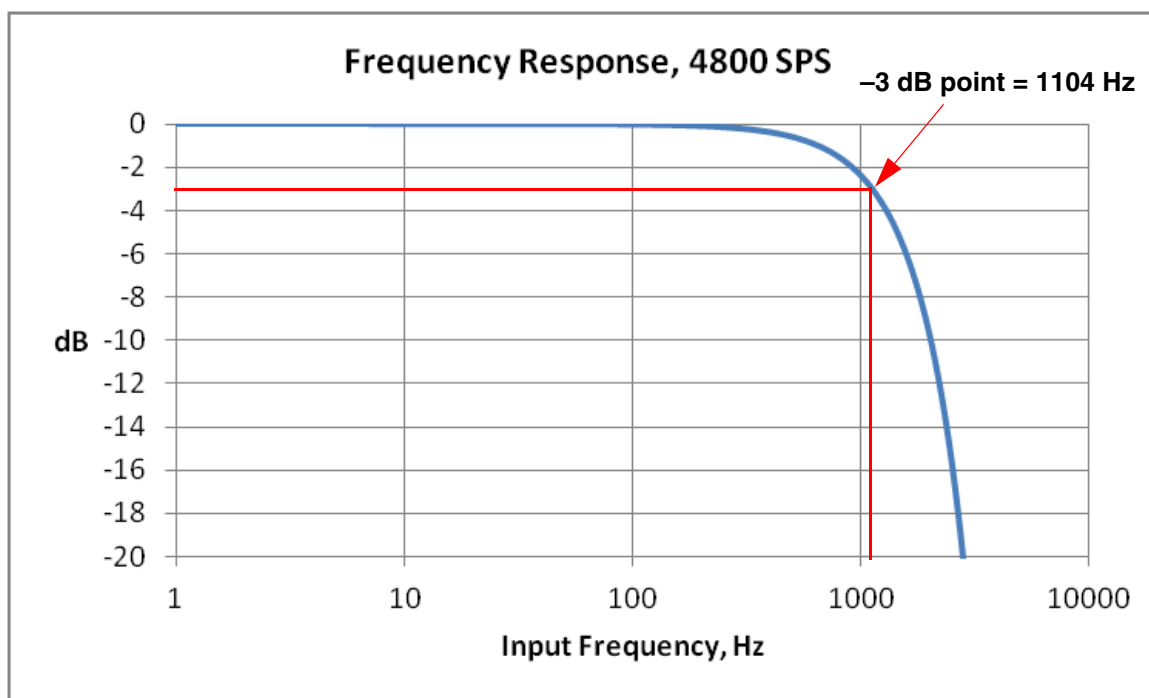


Figure 29: Frequency Response of the DT8824 and DT8824-HV When Using a Sampling Rate of 4800 Samples/s

As you can see, the frequency response of the DT8824 and DT8824-HV gently rolls off from DC due to the filtering of the Sigma-Delta A/D converter. You can use software to apply a correction factor to the acquired data to compensate for the filter response of the A/D converter. The correction factor depends on the input frequency of the signal you are trying to measure and the sampling rate of the instrument module. [Table 11](#) shows the gain correction factors for typical input frequencies and sampling rates.

Table 11: Gain Correction Factors

Frequency of the Input Signal (Hz)	Sampling Rate of the DT8824 or DT8824-HV							
	10 Samples/s	25 Samples/s	60 Samples/s	100 Samples/s	600 Samples/s	960 Samples/s	1600 Samples/s	4800 Samples/s
DC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	1.257	1.035	1.006	1.002	1.000	1.000	1.000	1.000
10	–	3.456	1.168	1.056	1.001	1.001	1.000	1.000
50	–	–	–	–	1.038	1.017	1.006	1.001
60	–	–	–	–	1.055	1.024	1.008	1.001
100	–	–	–	–	1.167	1.068	1.023	1.003
200	–	–	–	–	2.087	1.304	1.095	1.011
500	–	–	–	–	–	6.040	1.791	1.073
1000	–	–	–	–	–	–	–	1.325
2000	–	–	–	–	–	–	–	3.158

Digital Output Specifications

Table 12 lists the specifications for the digital output (DOUT) subsystem on the DT8824 and DT8824-HV.

Table 12: Digital Output Specifications

Feature	DT8824 and DT8824-HV Specifications
Number of digital output lines	4 isolated outputs
Number of ports	1, 4-bit output port
Outputs Output type: Output driver: High output: Low output: Breakdown voltage: Contact impedance:	Solid-state relay CMOS $\pm 30\text{ V}$ $0.4\text{ V @ }400\text{ mA}$ $\pm 60\text{ V}$ $1\ \Omega$
Isolation voltage To computer ground: Channel to channel	$\pm 500\text{ V}$ $\pm 250\text{ V}^a$

- a. Determined by the pin spacing in the 37-pin digital connector. For greater channel-to-channel isolation, use every other digital line; using every other digital line allows $\pm 500\text{ V}$ isolation channel-to-channel.

Power, Physical, and Environmental Specifications

Table 13 lists the power, physical, and environmental specifications for the DT8824 and DT8824-HV.

Table 13: Power, Physical, and Environmental Specifications

Feature	DT8824 Specifications	DT8824-HV Specifications
Power +5 V Standby: +5 V Enumeration: +5 V Power ON: Power Consumption:	500 μ A maximum 100 mA maximum (75 mA typical) 500 mA maximum (420 mA typical) 425 mA current draw	500 μ A maximum 100 mA maximum (75 mA typical) 500 mA maximum (420 mA typical) 425 mA current draw
Physical Dimensions Width: Length: Height: Weight:	8.380 inches (212.85 mm) 9.319 inches (236.7 mm) 1.720 inches (43.69 mm) 31 ounces (880 g)	8.380 inches (212.85 mm) 9.319 inches (236.7 mm) 1.720 inches (43.69 mm) 31 ounces (880 g)
Environmental Operating temperature range: Storage temperature range: Relative humidity:	0° C to 55° C –25° C to 85° C To 95%, noncondensing	0° C to 55° C –25° C to 85° C To 95%, noncondensing

Regulatory Specifications

The DT8824 and DT8824-HV are CE-compliant. [Table 14](#) lists the regulatory specifications for the DT8824 and DT8824-HV.

Table 14: Regulatory Specifications

Feature	Specifications
Emissions (EMI)	FCC Part 15, Class A EN55011:2007 (Based on CISPR-11, 2003/A2, 2006)
Immunity	<p>EN61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use</p> <p><u>EMC Requirements</u> EN61000-4-2:2009 Electrostatic Discharge (ESD) 4 kV contact discharge, 8 kV air discharge, 4 kV horizontal and vertical coupling planes</p> <p>EN61000-4-3:2006 Radiated electromagnetic fields, 3 V/m, 80 to 1000 MHz; 3 V/m, 1.4 GHz to 2 GHz; 1 V/m, 2 GHz to 2.7 GHz</p> <p>EN61000-4-4:2004 Electrical Fast Transient/Burst (EFT) 1 kV on data cables</p> <p>EN61000-4-6:2009 Conducted immunity requirements, 3 Vrms on data cables 150 kHz to 80 MHz</p>
RoHS (EU Directive 2002/95/EG)	Compliant (as of July 1st, 2006)
Safety	UL, CSA

Connector Specifications

Table 15 lists the cable and connector specifications for the DT8824 and DT8824-HV.

Table 15: Connector Specifications

Feature	DT8824 and DT8824-HV Specifications
RJ45 Ethernet Connector	Bothhand part number LU1S041C-43-LF
Digital Input/Output Connector	Tyco part number 5747845-4
4-Position Screw Terminal Block	Header: Phoenix Contact 1803293 Plug: Phoenix Contact 1803594
Trigger Bus Connectors	Molex part number 83619-9011

External Power Supply Specifications

Table 16 lists the specifications for the EP361 +5 V external power supply that is used with the DT8824 and DT8824-HV.

Table 16: External Power Supply (EP361) Specifications

Feature	Specifications
Type	Total Power medical power supply (TPES22-050400 or TPEMG24-S050400-7)
Input voltage	Typical 90 - 264 V AC
Input current TPES22-050400	Typical 0.38 A at 115 V AC, 0.15 A at 230 V AC
TPEMG24-S050400-7	Typical 0.347 A at 115 V AC, 0.215 A at 230 V AC
Frequency	47 to 63 Hz
Inrush current TPES22-050400	35 A at 230 V AC typical or less than 30 A by adding thermistor
TPEMG24-S050400-7	6.274 A RMS at 230 V AC
Output voltage	5 V DC
Output current	4.0 A
Output wattage TPES22-050400	Typical 22 - 24 W
TPEMG24-S050400-7	Typical 20 - 24 W
Noise and ripple	1% peak to peak
Regulatory specifications TPES22-050400	UL, N, CE, FCC Class B
TPEMG24-S050400-7	UL, ITE, CE, FCC Class B, Energy Star compliant