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**Technical Note TN-214** **Version 1.1**

# Technical Product Information for the iDSC 816 ™

The iDSC 816 model features :

- guaranteed anti-aliasing
- 16-bit resolution
- eight-channel simultaneous sampling
- variable cut-off frequencies independent of sampling rate — from 2% to 80% of Nyquist
- independently configurable filters for each of the eight channels
- linear phase response
- very steep transition bands — typically -96dB / quarter-octave
- onboard Intel DX4 96 MHz processor
- two onboard 80 MHz Motorola DSP56303 digital signal processors
- 4MB of DRAM onboard memory
- 56-bit internal precision arithmetic
- 64 available sampling rates for analog inputs ranging from 8 to 153,600 samples/second per channel
- fast real-time processing
- expandable analog inputs — up to 64 simultaneous analog inputs by combining 8 boards
- 500 volts input signal isolation from PC ground
- consistent user interface across all applications

The introduction of the iDSC 816 represents the first iDSC model and features an advanced new architecture for data acquisition. The iDSC 816 combines 16-bit resolution on eight simultaneous channels of data acquisition with anti-alias filters on each channel. The iDSC 816 samples analog inputs at an overall maximum rate of 614.4k samples/second, with the rate on each channel ranging from 8 samples/second to 153.6k samples/second. Eight iDSC 816 boards can be combined to sample 64 simultaneous channels with individually configurable filters.

The coupling of the filters and the data acquisition allows a complete system to be formed using a PC and the iDSC 816 without the need for additional expenses such as filtering modules and carrier boards. The brick wall-like filters and eight-channel simultaneous sampling provides a PC-based acquisition system capable of filtering out high frequency noise. Monitoring rotating assemblies in the power generation industry is one example of a vibrational application where high frequency noise must be filtered out with high resolution. Other example applications include monitoring vibration, sound, and rotating assemblies in the aerospace and automotive industries as well as a variety of other sonar and acoustic applications.

Adding a DAP board to the iDSC 816 extends the system capabilities to include control functions. Any combination of 14 iDSC 816 or DAP models can provide for your data acquisition needs in a single system. Additional PCs can communicate through a network allowing for endless possibilities in data acquisition with multiple data acquisition boards.

The iDSC 816 board incorporates three levels of onboard filtering to accomplish its high filter performance. The first level uses fourth order analog anti-alias filters; this is followed by decimation filters in the Sigma-Delta A/D converters. The final level of filtering applies configurable symmetric FIR filters implemented in two DSP chips. The FIR filters are designed using DSCview, a program provided with the iDSC 816 board. By changing the sampling rate and configuring the filters, the transition band can be set to meet a variety of requirements. A -96dB rolloff can be achieved within a quarter-octave when the cutoff frequency is set slightly under 50% of the Nyquist. An even sharper transition band of 1/14th of an octave can be achieved with a cutoff frequency setting of 80% of Nyquist.

All software included with the iDSC 816 has a consistent graphical interface to ensure ease of use across all applications. No programming is required to use the iDSC 816. DSCview allows the user to design filters using a graphical interface. The program provides a simple pull-down menu to choose between a lowpass and bandpass filters and displays the filter response on screen. Slide bars are used to vary the cutoff and sharpness of the filters. This allows users to change the shape of the response curve for a given filter to match their needs exactly. In addition to configuring the iDSC 816 for data acquisition, DSCview also acquires, graphs, and logs data. The iDSC 816 also comes with drivers for industry-standard PC software such as DASY*Lab*, LabVIEW, and HPVEE. For additional flexibility, programming in Visual Basic and C/C++ is available through the DLL; Pascal is available through the Component supplied with the iDSC 816.

Each input channel on the iDSC 816 can have a different filter applied. The filters have variable cutoff frequencies ranging from 2% to 80% of the Nyquist frequency, or 0.8 to 61.44k Hz. Although the onboard hardware can sample each of the eight channels as fast as 153.6k samples/second, the aggregate sampling rate of the board is tested to 614.4k samples/second. Each of the analog channels are sampled at the same rate. The filter decimates the data so that the following sampling rates can be achieved by each channel. There are 64 possible sampling rates listed below in samples/second and grouped in octaves.

**Table 1: iDSC 816 Sampling Rates, listed by octaves**

| | | | | | |
|---|---|---|---|---|---|
| | | | 153,600 | | |
| | | | 76,800 | | |
| 51,200 | | | 38,400 | | |
| 25,600 | | | 19,200 | | 15,360 |
| 12,800 | | 10,240 | 9,600 | | 7,680 |
| 6,400 | | 5,120 | 4,800 | | 3,840 |
| 3,200 | 3,072 | 2,560 | 2,400 | 2,048 | 1,920 |
| 1,600 | 1,536 | 1,280 | 1,200 | 1,024 | 960 |
| 800 | 768 | 640 | 600 | 512 | 480 |
| 400 | 384 | 320 | 300 | 256 | 240 |
| 200 | 192 | 160 | 150 | 128 | 120 |
| 100 | 96 | 80 | 75 | 64 | 60 |
| 50 | 48 | 40 | | 32 | 30 |
| 25 | 24 | 20 | | 16 | 15 |
| | 12 | 10 | | 8 | |

**Table 2: iDSC 816 Typical Hardware Specifications**

| Specification | iDSC 816 |
|---|---|
| Dimensions | 13.33” x 4.80” |
| Weight | 13.1 oz |
| CPU type | Intel 80486 DX4 |
| CPU clock speed | 96 MHz |
| CPU DRAM | 4 Mbytes |
| Bus support | ISA |
| PC interface hardware | 1 kB BiFIFO interface |
| PC transfer mode | I/O Interrupt |
| Power requirements | +5 V, 3.0 Amps |
| Operating temperature | 0-50° C |
| Type of A⇒D converter | Sigma-Delta |
| Number of A⇒D converters | 8 |
| Type of DSPs | Motorola 80 MHz DSP56303 |
| Number of DSP’s | 2 |
| Number of analog channels | 8 |
| Expandable with multiple iDSC 816 boards to | 64 simultaneous analog inputs |
| Input voltage range | ±5 V |
| Max. input voltage (fault-protected inputs) | ±40 V |
| Resolution<br>±5 V range | 16 bits<br>153 µV |
| Maximum analog sampling rate per channel | 153,600 samples/second |
| PC Interface :[1]<br>Samples transferred per second[2]<br>Samples logged per second | <br>614,400 samples/second<br>537,600 samples/second |
| Signal to Noise Ratio (SNR) | 91dB typical |
| Signal to Noise and Distortion Ratio (SINAD) | 87dB at 1 kHz typical |
| Total Harmonic Distortion (THD)[3] | 0.004% at 1 kHz maximum |
| Channel-to-channel amplitude matching | 4 counts RMS maximum |
| Channel-to-channel phase delay matching | 20 ns maximum<br>(0.144° maximum at 20 kHz) |
| DC Noise | 1 count RMS maximum |

* All specifications are applicable from DC through the entire frequency range unless otherwise noted.

[1] Benchmark rates vary with PC platform.

[2] Maximum sustainable rate given. Higher sampling rates require DAPL commands or a burst mode application.

[3] Total Harmonic Distortion includes contributions from the second through sixth harmonics.