

eXpert Digital Down Conversion (DDC) Firmware

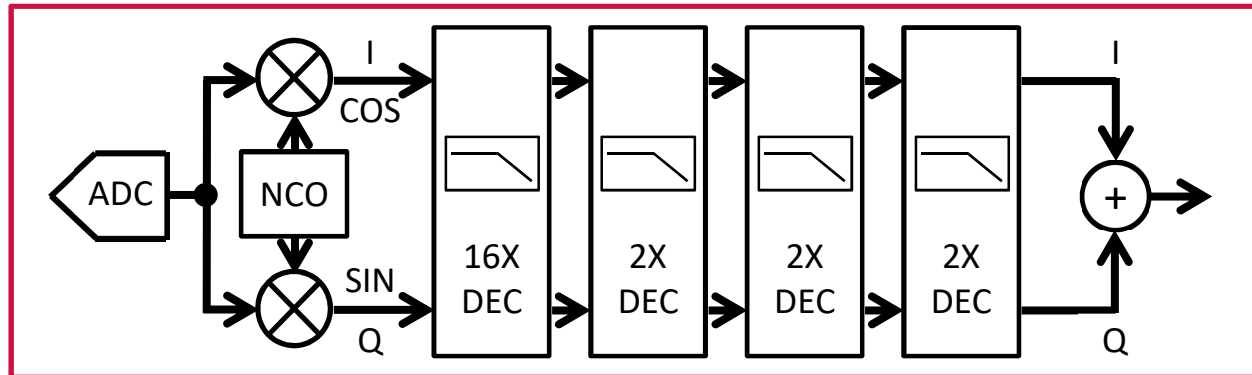


Figure 1: Block Diagram of DDC Data Flow

Digital Down Conversion (DDC) is a powerful signal processing technique providing significant real-time data reduction. It is particularly useful for the processing of communications signals that frequently occupy a relatively small band about a high carrier frequency. In addition to shifting this carrier frequency down to a lower IF, the DDC also reduces the output sampling rate. This reduced sampling rate leads to significant in-line data reduction.

The eXpert DDC firmware with the high-speed EON Express Digitizer provides the capability for shifting a radio or modulated signal captured on a single A/D input channel from a carrier frequency between 0 MHz to 1 GHz (at a sampling rate of 3 GS/s) down to a low frequency AC signal (baseband signal, non-demodulated). Figure 1 shows a block diagram of the DDC data flow within the EON Express high-speed digitizer. After the initial 16X decimation FIR filter, a selectable number of identical 2X anti-aliasing may be applied (three are shown in Figure 1).

The incoming analog signal from a single input channel is digitized by an ADC whose output is multiplied within two mixer elements (\otimes). The multiplication factors are values produced by a Numerically Controlled Oscillator (NCO) that generates cosine and sine signals.

The NCO supports a carrier frequency range from 0 to 1 GHz and generates both the I and Q (real and complex) carrier. Following the NCO are multiple FIR filter stages that allow for decimating data in steps of 16, 32, 64, 128, 256, 512, 1024 and 2048. As shown, the decimation signal chain is done for both I and Q components.

The I and Q outputs of the decimation filters are added combined together at the end of the signal chain in order to produce the real-only output, which results in cancellation of the lower sideband of the demodulated signal. This real-only output is sampled at the reduced sampling rate, which is equal to the raw ADC sampling rate divided by the decimation factor.

The DDC passband starts at the tuning frequency and has a bandwidth equal to half of the reduced sampling rate. Attenuation of over 60 dB is provided over most of the stopband. The final DDC result is then re-packed to 64bit words and sent back to the core FPGA module, where the output results may be optionally streamed to the host PC system via the PCIe interface.

The high data reduction afforded by the DDC decimation proportionately reduces the performance requirements on any data storage media or processing algorithm that consumes the data stream.

While the eXpert DDC firmware is able to operate in memory mode, its real power is evident when used in Streaming Mode. The DDC firmware includes PCIe data streaming capability built in, where data is continuously streamed directly to the PCIe bus and the DDC data reduction capability can be optimally exploited.

The following table shows how performing firmware DDC operations directly onboard the Digitizer drastically reduces the overall PCIe data streaming mode rates to the host system. This provides an enormous advantage in maximizing the collection of only the specific data of interest and greatly increases the duration time of conducted signal recording operations with large capacity storage systems.

EON Express Digital Down Conversion Data Reduction			
DDC Operating Mode	Reduced Sampling Rate (MS/s)	Reduced Bandwidth (MHz)	Reduced PCIe Streaming Rate (MB/s)
No DDC	3,000.000	1,500.000	6,000.000
DDC x16	187.500	93.750	375.000
DDC x32	93.750	46.875	187.500
DDC x64	46.875	23.438	93.750
DDC x128	23.438	11.719	46.875
DDC x256	11.719	5.859	23.438
DDC x512	5.859	2.930	11.719
DDC x1024	2.930	1.465	5.859
DDC x2048	1.465	0.732	2.930

The eXpert DDC Firmware is compatible with and requires one of the available GaGe Software SDKs for C/C# or LabVIEW that provide ready-made compiled sample programs illustrating how to configure and use the DDC feature with documentation for its use in custom developed applications.



ORDERING INFORMATION

eXpert DDC Firmware	Order Part Number
<p>eXpert DDC</p> <p>NOTE: The eXpert DDC Firmware requires one of the available GaGe Software SDKs for C/C# or LabVIEW and is compatible for use with the following GaGe Digitizer Model Series sold separately:</p> <ul style="list-style-type: none">• EON Express CSE123G2 <p>Please refer to the separate GaGe product datasheets for these digitizer models for their full specification details and ordering information.</p> <p>It is NOT necessary to order the eXpert PCIe Data Streaming Firmware with the eXpert DDC Firmware. The eXpert DDC Firmware already includes PCIe data streaming capability built-in.</p>	250-181-005

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www.gage-applied.com

WARRANTY

Standard two years parts and labor.

Unless otherwise specified, all dynamic performance specs have been qualified on engineering boards. All specifications are subject to change without notice.

Data Sheet Revision 0 – 03/13/2019

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