


ADC Driver and 5x5mm  
 High-Speed ADC

**DESCRIPTION**

Demonstration circuit 900 is a reference design featuring Linear Technology Corporation's Analog-Digital Converter (ADC Driver and 5x5mm High-Speed ADC families). DC900 demonstrates good circuit layout techniques and recommended component selection for optimal system performance. The ADC driver input and output networks are flexible, allowing for AC or DC coupling, single-ended or differential configurations, and signal low-pass or bandpass filtering before the ADC.

DC900 allows flexibility of supply voltages, and supports Linear Technology's entire line of 5mm x 5mm pin-compatible high-resolution high-speed ADC family. DC900 includes an on-board 40-pin edge connector for use with the DC718 Data Acquisition demo board and Linear Technology's QuickEval-II data processing software, available on our website at <http://www.linear.com>.

**Design files for this circuit board are available. Call the LTC factory.**

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**QUICK START PROCEDURE**

Validating the performance of the ADC Driver-ADC combination is simple with DC900, and requires only two signal generators and some basic lab equipment. Table 1 shows the function of each I/O connector on the board. Refer to Figure 1 for proper board evaluation equipment setup and follow the procedure below:

1. Connect the power supplies as shown. The power supply connector labeled VCC powers the ADC driver. VDD powers the ADC, and OVDD provides power to both the ADC output stage and the two CMOS output buffers. The entire board and all components share a common ground. Check the datasheets of the respective IC's before applying power, to avoid damage from over-voltage conditions.
2. Provide an encode clock to the ADC via SMA connector J2. For best performance, a high-quality sine wave synthesizer with an external band-pass filter will provide a stable, low-phase-noise clock source. A crystal oscillator will also provide good performance. DC900 includes an

on-board clock buffer IC to provide a large-amplitude clock source to the ADC.

**NOTE.** A poor quality encode clock can significantly degrade the signal-to-noise ratio (SNR) of the driver-ADC combination.

**Table 1: DC900 Connector and Descriptions**

REFERENCE	FUNCTION
J1 (AIN+)	Analog Input
J2 (CLK)	ADC Encode Clock. For best performance, use a high-quality low-jitter clock source.
J3 (AIN-)	Analog Input (by default, tied to ground via resistor R3 for transformer single-ended-to-differential conversion)
J4 (40 pin conn)	Provides direct connection to DC718. CMOS Output Buffers provide parallel data output and clock signals (see schematic).

3. Apply an input signal to the board. DC900 allows great flexibility in applying input signals (see the section on Applying Input Signals). For best results, use a low distortion, low noise signal generator with high order low-pass or band-pass filtering to avoid degrading the measured performance of the ADC driver and ADC.

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4. Observe the ADC output with demo circuit DC718, a USB cable, a Windows computer, and Linear Technology's QuickEval-II data process-

ing software. See Figure 2 for the general board evaluation setup diagram.

**NOTE.** See the DC718 Quick Start Guide for instructions on using the DC718 QuickDAACS data acquisition demo board.

**NOTE.** Even a high-quality signal synthesizer will still have noise and harmonics that could be attenuated with a low-pass or band-pass filter. For good-quality high order filters, see TTE, Lark Engineering, or equivalent.

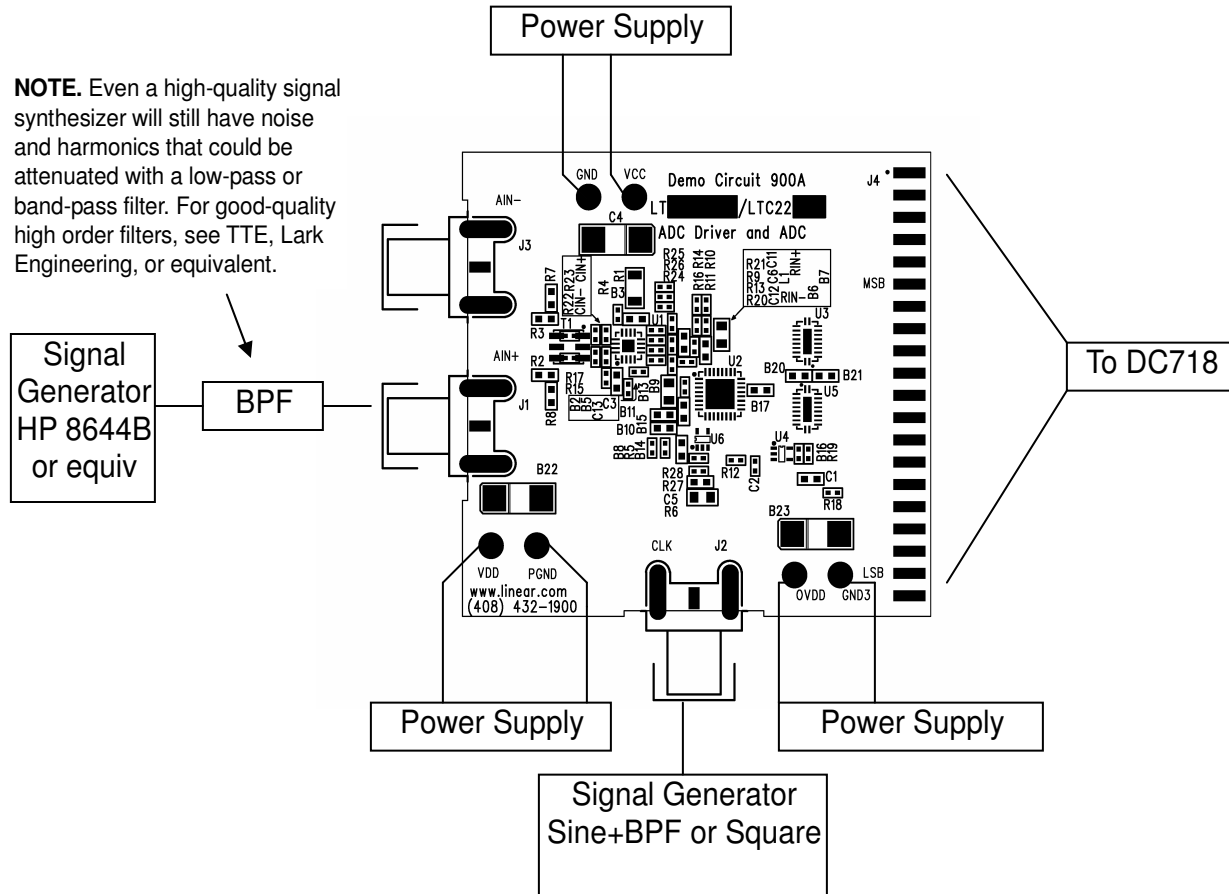


Figure 1. Proper Evaluation Equipment Setup

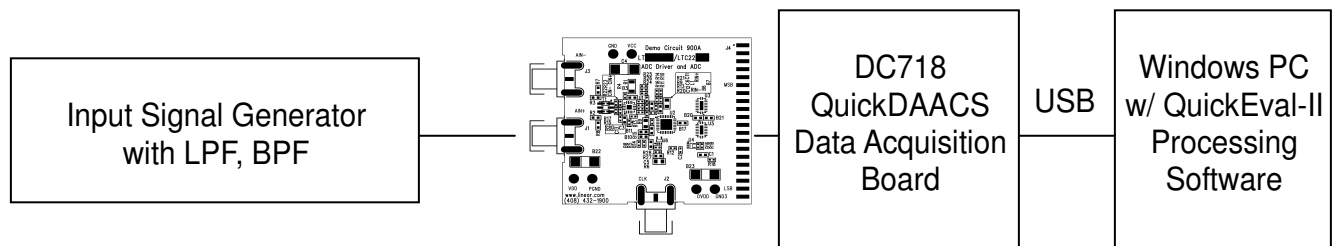
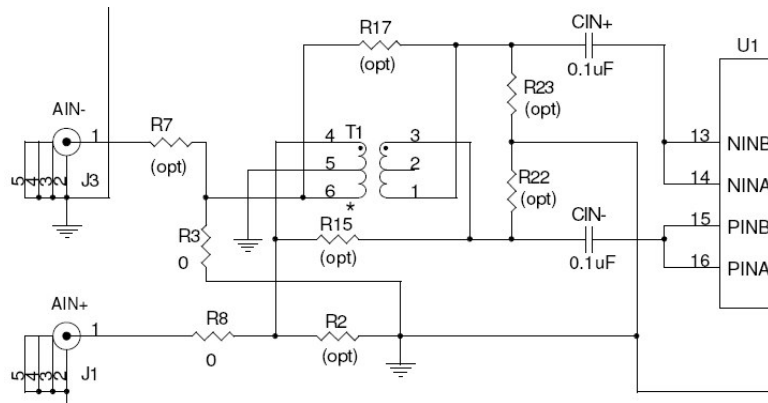


Figure 2. Evaluation Setup with DC718, Computer, and QuickEval-II Software



**Figure 3. DC900 Input Network**

## ADDITIONAL INFORMATION

Although the DC900 demo board is ready to use, it has additional flexibility built in for various types of input networks, filtering configurations, and single-ended or differential inputs. Below is some information about configuring DC900 to meet the specific needs of any application.

### APPLYING INPUT SIGNALS

The input network consists of various components designed to allow either single-ended or differential inputs, transformer-coupled or DC-coupled. Table 2 shows some possible input configurations, and which components to install. Linear Technology's ADC driver families are generally characterized and designed for both single-ended and differential input drive, but for optimal performance differential input drive (or transformer-coupled drive) is recommended. By default, transformer drive is used on DC900 so that only a single-ended input is needed.

**Table 2: DC900 Input Configuration Guide**

CONFIGURATION	COMPONENTS NECESSARY
Single-Ended Input Transformer Drive	Install 0Ω jumpers at R8 and R3, or R7 and R2. Install transformer T1. If necessary, install R22 and R23 for impedance matching. Remove R15, R17. Install CIN+ and CIN- for AC coupling.
Single-Ended Input Single-Ended Drive	Install 0Ω jumpers at R8 and R3, or R7 and R2. Remove T1. Install R15, R17. Install R22 or R23, if necessary, for impedance matching. Install CIN+ and CIN- for AC coupling.
Differential Input Transformer Drive	Install 0Ω jumpers at R7 and R8, remove R2 and R3. Install transformer T1. If necessary, install R22 and R23 for impedance matching. Remove R15, R17. Install CIN+ and CIN- for AC coupling.

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Differential Input No Transformer AC-Coupled	Install 0 $\Omega$ jumpers at R7 and R8, remove R2 and R3. Remove T1. Install R15, R17. Install R22 or R23, if necessary, for impedance matching. Install CIN+ and CIN- for AC coupling.
Differential Input No Transformer DC-Coupled*	Install 0 $\Omega$ jumpers at R7 and R8, remove R2 and R3. Remove T1. Install R15, R17. Install R22 or R23, if necessary, for impedance matching. Remove CIN+ and CIN-, replace with 0 $\Omega$ jumpers.

**NOTE.** \* When driving the ADC driver with a direct DC-coupled path, be aware of the increased input currents that may occur due to the output common-mode voltage and internal resistor networks.

The DC common-mode voltage requirements of Linear Technology's ADC drivers do not always extend to ground (the negative supply voltage). When replacing CIN+ and CIN- with 0 $\Omega$  jumpers, make sure to level-shift the inputs so that the ADC driver's input common-mode voltage requirement is met.

Recommended 1:1 transformers for populating T1 are M-A/Com's ETC1-1-13 and ETC1-1T. For 4:1 transformers, ETC4-1-2 and Mini-Circuit's TCM4-19 is a good choice.

## POWER SUPPLY BYPASS CAPACITANCE

Depending on the quality of the power supplies provided to DC900, it may be desirable to add larger capacitors at C4, B22, and B23. This will not be necessary with good-quality lab power supplies with short wire leads.

## FILTER NETWORKS

For narrowband input signals, L1 and C6 are included at the output of the ADC driver for easy band-pass filter design. In addition, there are resistor pads R9, R13, R20-21 at the outputs of the ADC driver that could be populated with filtering components.

## CHANGING THE ADC DRIVER'S OUTPUT COMMON-MODE VOLTAGE

The output common-mode voltage of the ADC driver is independently tunable from the input common-mode voltage. This is done in one of two ways. By changing the resistors R25 and R26 that comprise a resistive divider from the VCC voltage, it is possible to tune the common-mode voltage independently of all other factors. Alternatively, R25 and R26 can be removed, and the ADC can supply the common-mode voltage by installing R24.

The optimum common-mode input voltage of the ADC (the voltage supplied by R24) may not exactly match the optimum common-mode output voltage of the ADC driver. See the datasheets of the ADC driver and ADC.

## USING QUICKEVAL-II SOFTWARE

QuickEval-II, downloadable from Linear Technology's website <http://www.linear.com/>, processes data from the DC718 QuickDAACS board and displays FFT and signal analysis information on the computer screen. This section describes how to use the software to view the output from DC900.

The first step is to select the correct input board. See Figure 4. From the Configure menu in the toolbar, select DC718 (QuickDAACs). The next step is to use the proper settings for the DC900 output. See Figure 5 for the proper settings. Be sure to select a resolution that matches the on-board ADC. All of the other settings should be entered as shown in Figure 5. After configuration is through, the program should be ready to collect and display data. See the Help file for instructions on general software use.

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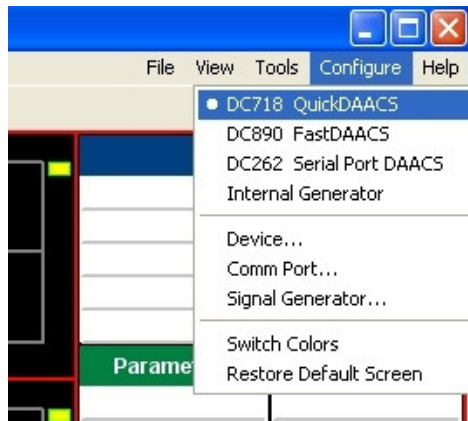


Figure 4. Selecting the correct input to QuickEval-II

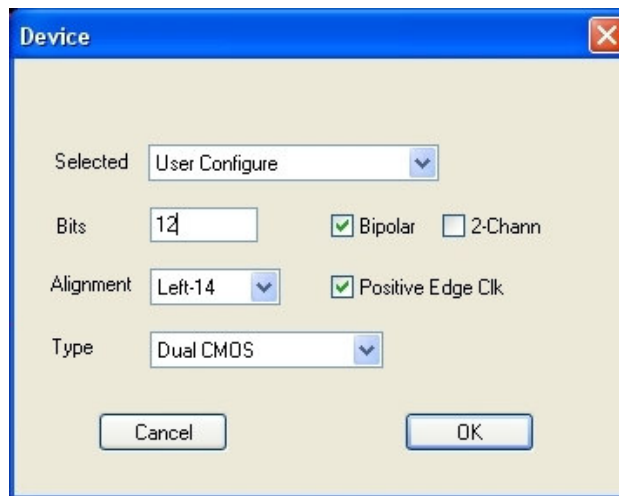


Figure 5. Entering the correct device information for your ADC. Only the resolution (bits) should differ from this figure.

