National Semiconductor

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Evaluation Board Instruction Manual

WaveVision Digital Interface Board

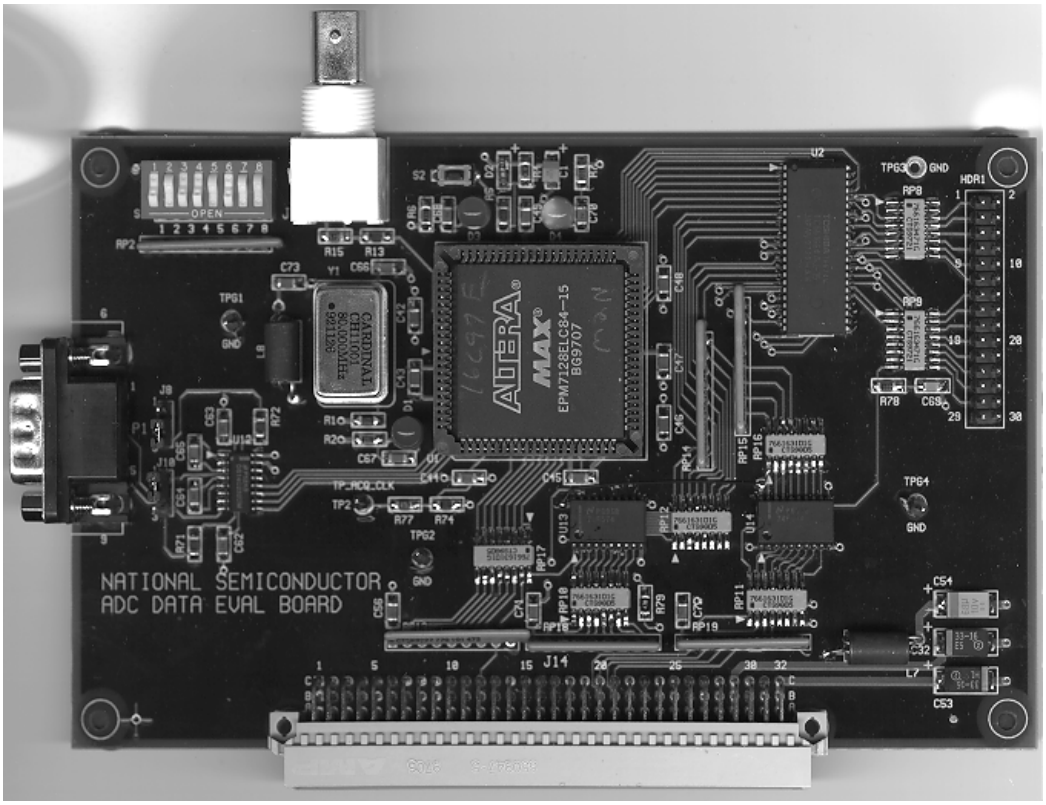


Table of Contents

1.0 Introduction

The Digital Interface Kit (order number WAVEVISION BRD) consists of the Wavevision Digital Interface Board, a 3.5" program diskette, and this manual. It is designed to ease evaluation and design-in of the various National Semiconductor analog-to-digital converters when used in conjunction with evaluation boards that are designed to plug into this board.

The Digital Interface Board can be operated in either of two modes: the Computer mode or the Manual mode.

In the Computer mode, evaluation of A/D converters is simplified by connecting the product evaluation board of a given converter to the Digital Interface Board, which is connected to a personal computer through a serial communication port. The Digital Interface Board is used with the Windows-based WaveVision software, which operates under Microsoft Windows 3.1 or later.

The digitized signal can be captured and displayed on the Computer monitor as a dynamic waveform. The Digital Interface Board provides a programmable clock for the A/D converter, stores the converted data (up to 8k words) in RAM at the conversion rate, and uploads the RAM contents to the host computer for use by the WaveVision software.

The WaveVision software can perform an FFT on the captured data. The FFT display also shows dynamic performance in the form of SNR, SINAD, THD and SFDR data.

A histogram of the captured data may be obtained as well. The histogram display indicates the standard deviation of the data, the first 13 missing codes (if any) in the data, the code with the highest number of hits and how many hits it has.

In the Manual mode, the board does not recognize commands from the computer (indeed, the computer does not even need to be connected to the board). Continuous data is available at the connector HDR1 and pressing the "Execute" button S2 causes a capture the data in RAM and spooling of that data to the RS-232 port.

In reference to Programming Switch S1 throughout this manual, "OFF" indicates an open switch and a logic high; "ON" indicates a closed switch and a logic low.

2.0 Quick Start

The Digital Interface Board comes ready for operation. Refer to Figure 1 for the location of various components on the board.

1. Set positions 1 through 3 of S1 to the "OFF" position to set the clock frequency to its lowest, or see Table 1 to set other frequencies.
2. Connect a product evaluation board at connector J14. The Digital Interface Board will receive its power through J14.
3. Connect an interconnecting cable from the board connector P1 to a communications port on your PC. If the interconnecting cable is a 1 to 1 cable without pins 2 and 3 swapped, jumpers J8 and J10 should be connected in their default positions, as shown in Figure 1. If these pins are swapped, the cable is a null modem type. A null modem cable may be used if pins 1 and 2 of jumper J8 and pins 2 and 3 of jumper J10 are shorted together.
4. Set positions 6 and 7 of S1 as indicated in Table 1a for the frequency of the clock oscillator used and turn on the power to the connected product evaluation board. Red LED D1 should be on, indicating the presence of a clock signal.
5. Set position 8 of S1 to the "OFF" position. Red LED D3 should be on, indicating that the board is in the Computer mode.
6. Copy the software (WAVEVSN.EXE) from the diskette to the desired directory and run it.
7. Connect a signal of appropriate amplitude to Analog Input BNC of the evaluation board that is connected at J14. See the product evaluation board manual.
8. With the WaveVision software, select the Communications Port that is to be used (ALT, O, then 1, 2, 3 or 4, corresponding to the communications port used).
9. Capture data by pressing CTRL-X. Yellow LED D4 will flash momentarily then stay on to indicate that a data transfer is occurring.
10. Perform an FFT on the data that was acquired by pressing CTRL-F.

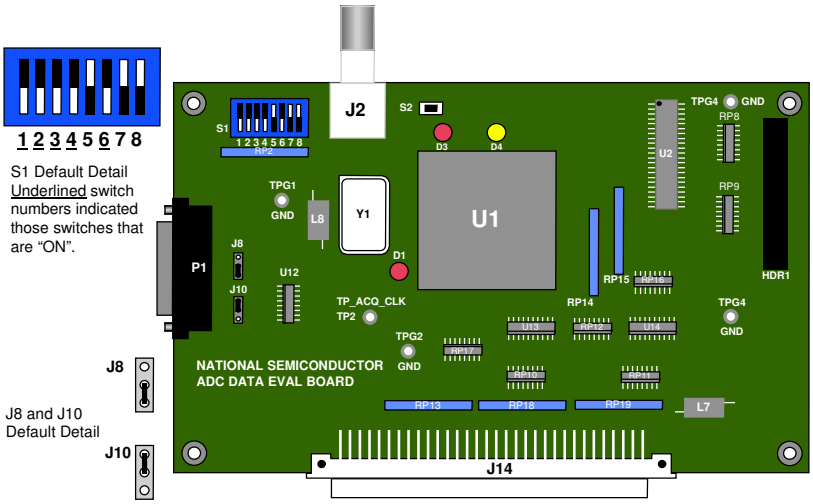


Figure 1. Component Location.

3.0 Functional Description

Refer to block diagram Figure 11 and schematic Figure 12 and Figure 13 for components and to Figure 1 for major component locations.

Board basic functions are controlled by program switch S1. Three LEDs are provided to provide a ready indication of board functioning and status, as described in Table 2.

The board has two modes of operation, as mentioned in Section 1.0 and described in section 4.

The heart of the Digital Interface Board is PLD U1, which is programmed to control the operation of the board. U1 sets the clock frequency to the ADC under test by selecting either the on board clock (Y1) or the external clock source connected to BNC connector J2. If using the on-board clock, U1 reads positions 1 through 3 of DIP switch S1 to determine the clock divider. Y1 should be an 80MHz, 100MHz or a 120MHz clock oscillator. Correct setting of positions 6 and 7 of S1 is important to obtain error free RS-232 communications.

Because many ADCs can digitize signals at much faster rates than the data can be uploaded to a computer, data is gather and stored into RAM (U2) at the output data rate of the ADC. Once the required amount of data has been loaded into RAM, U1 reads that data and uploads it to the host PC via U12 and the RS-232 serial link at P1.

3.1 Board Outputs.

The digital data from the converter board, as well as a clock signal for this data, is available at 30 pin connector HDR1. This connector has all the even numbered pins grounded and is suitable for connecting a ribbon cable to the board.

DB-9 connector P1 is an RS-232 port for connection to a computer.

3.2 Board Control.

PLD U1 performs the control functions of the board. It also contains registers and logic used to move data. The functions of this device are:

- Select the External Clock Input or select the on-board clock oscillator with desired divider.
- Enable writing of acquired data to RAM.
- Accept commands over the RS-232 link when in Computer mode (board controlled from a PC connected via an RS-232 link).
- Upload data in RAM to PC over RS-232 link upon command.
- Enable red LED D1 when an active clock source is present.
- Enable red LED D3 when in the Computer mode.
- Enable yellow LED D4 when data is being transferred over the RS-232 link.

SWITCH POSITIONS-->	1	2	3	4	5		6	7	8
CLOCK FREQUENCY	CLOCK FREQ			[don't care]		CLOCK OSC. USED			MODE
						Osc. Freq			$\overline{\text{Auto/Man}}$
EXT CLK	ON	ON	ON	x	x	80	x	1	Auto = 1
div by 2	OFF	ON	ON	x	x	100	0	0	
div by 4	ON	OFF	ON	x	x	120	1	0	-
div by 8	OFF	OFF	ON	x	x	-	-	-	-
div by 16	ON	ON	OFF	x	x	-	-	-	-
div by 16	OFF	ON	OFF	x	x	-	-	-	-
div by 16	ON	OFF	OFF	x	x	-	-	-	-
div by 16	OFF	OFF	OFF	x	x	-	-	-	-

Table 1a Programming Switch (S1) Functions (Computer Mode)

SWITCH POSITIONS-->	1	2	3		4	5	6	7	8
CLOCK FREQUENCY	CLOCK FREQ			EXECUTE FUNCTION				OSC. USED	MODE
				# Bytes				Must be 80MHz	$\overline{\text{Auto/Man}}$
EXT CLK	ON	ON	ON	256	0	0	0	-	Man = 0
div by 2	OFF	ON	ON	512	1	0	0	-	-
div by 4	ON	OFF	ON	1024	0	1	0	-	-
div by 8	OFF	OFF	ON	2048	1	1	0	-	-
div by 16	ON	ON	OFF	4096	0	0	1	-	-
div by 16	OFF	ON	OFF	8192	1	0	1	-	-
div by 16	ON	OFF	OFF	8192	0	1	1	-	-
div by 16	OFF	OFF	OFF	8192	1	1	1	-	-

Table 1b Programming Switch (S1) Functions (Manual Mode)

3.3 Data Memory.

The data memory consists of a single 64k word by 16 bit RAM chip, U2. Data is written to RAM directly from the product evaluation board via the 74F574 latches U13 and U14. During this write mode, the RAM address is incremented by sequencer U1. Data is read from RAM U2 and sent over the RS-232 connection. The number of words sent is determined by the instructions from the host computer when in the Computer mode, or by the programming of switches 4, 5, and 6 of DIP switch S1, when in the Manual mode. See Table 1.

3.4 Computer Interface.

The board communicates with a host computer through an RS-232 interface. The serial data path is through the DB-9 connector P1, located at the left side of the board.

For proper communications data rate, set the Programming switch S1-7 OFF (logic high) if an 80MHz crystal is used, and ON (logic low) if a 100MHz or 120MHz oscillator is used. Set S1-6 ON (logic low) if a 100MHz oscillator is used, and OFF (logic high) for a 120MHz oscillator. No other clock rates will allow proper communication over the RS-232 line. If an external clock is used, communications over the RS-232 link is not possible unless the external clock source is 80MHz, 100MHz or 120MHz and switches S1-6 and S1-7 are set appropriately.

3.5 Power requirements.

This board requires a single +5V supply, which is supplied from the product evaluation board through connector J14 at the front of the digital interface board. Individual product evaluation boards may require other voltages as well.

4.0 Modes of Operation

The board is capable of operating in two modes: Manual (stand-alone) mode and Computer (automatic) mode.

4.1 Computer (Automatic) Mode.

In the Computer mode of operation, control of board operation is through a personal computer running WaveVision under Windows™ and connected to the evaluation board through a serial (RS-232) port. The functions of switch S1 are as described in Table 1a. The number of words of conversion data sent by the board to the computer is determined by codes that are sent by the computer to the board, but the clock frequency is strictly controlled by the first three switches of S1, as described in Table 1a. The board will acquire data and then spool it through the RS-232 port when the appropriate command is received by the board.

The WaveVision software, upon receiving the data, displays (on the computer monitor) the waveform represented by the acquired data. WaveVision can also calculate and display an FFT with figures for SNR, THD, SINAD and SFDR.The program can also display a histogram of the captured data. The histogram display indicates the standard deviation of the data, the first 13 missing codes (if any) in the data, the code with the highest number of hits and how many hits it has. Please note that histograms taken on a small amount of data has little meaning. For this reason, it is best to take the maximum number of samples before obtaining a histogram.

In this mode it is permissible to use a 80MHz, 100MHz or a 120MHz clock oscillator. Be sure to set switch positions 6 & 7 (S1-6 and S1-7) according to Table 1a for the clock oscillator frequency used. The ADC clock frequency is selected with positions 1, 2 and 3 of S1, the settings of which will determine by how much the clock oscillator is divided before being sent to the ADC evaluation board, as described in Tables 1a and 1b.

The following are Computer mode functions:

- Select the External Clock Input or the internal clock source for the ADC clock with desired divider set by Switch S1.
- Acquire data and store it to RAM.
- Upload data in RAM to PC over RS-232 link.
- Enable red LED D1 when the selected (on-board or external) clock source is present.
- Enable red LED D3 when in the Computer mode.
- Enable yellow LED D4 when sending or receiving data over the RS-232 link.

Follow these steps to operate the board in the Computer mode. Refer to Table 1 and to Figures 1a and 1b.

1. Be sure that an 80MHz, 100MHz or 120MHz clock oscillator is in the Y1 socket of the Digital Interface Board. Remove any clock oscillator that may be present on the product evaluation board.
2. Set Program (DIP) switch S1 as follows:

S1-1	ON	S1-5	don't care
S1-2	OFF	S1-6	OFF for 120MHz Crystal *
S1-3	ON	S1-7	OFF for 80MHz Crystal *
S1-4	don't care	S1-8	OFF
			* ON for other frequencies

See Table 1 for Program Switch functions.

3. Set any adjustments on the product evaluation board according to that board's instructions.
4. Use WaveVision to set up the board (ALT, P, B, or CTRL-B) and select the desired number of samples to acquire. Remember that the clock frequency is set on the board by Program Switch S1 positions 1, 2 and 3. Click the "OK" button.
5. Acquire data by pressing ALT, P, A or CTRL-X or click on Acquire icon (See Appendix).
6. Once data transfer is complete, portions of the waveform may be selected for viewing by clicking the mouse pointer at one corner of the area to be viewed and dragging to the opposite corner. Restore the full display by right clicking anywhere on the display.

If desired, an FFT may be performed on the captured data by pressing ALT, P, F or CTRL-F or click on the FFT icon (See Appendix).

A histogram may also be obtained from the captured data by pressing ALT, P, H or CTRL-H or click on the Histogram icon (See Appendix).

4.2 Manual (Stand Alone) Mode.

In the Manual mode of operation, the digital word stream and a clock are available at HDR1 at the top right edge of the board. Commands over the RS-232 link are ignored by the board in this mode, red LED D3 is turned off to indicate the board is in the Manual mode and the functions of the switch SW1 are as described in Table 1b. Select this mode by closing (turning OFF) position 8 of S1 (S1-8).

The ADC clock is always enabled in this mode and data is spooled over the RS-232 port only after switch S2 is pressed (S2 is located at the top center of the

board, just to the right of external clock input BNC connector J2). Signals at the Digital Output Header (HDR1) are disabled during RS-232 transmission.

5.0 Software Installation

The WaveVision software requires 300kb of hard drive space.

1. Insert the disk into a 3.5" floppy drive of your computer.
2. Copy the WAVEVSN.EXE software to the desired directory.
3. To add the desired Program Group to Windows 3.1, go to the Program Manager and type ALT F N G and click on "OK". Add an appropriate Description, such as "WaveVision". There is no need to enter a Group File.
4. To add Program Item to Windows 3.1, go to the Program Manager and type ALT F N I and click on "OK". Enter the Description you want for the Icon you are about to add. You might call it "WaveVision" or "ADC Evaluation". Click on BROWSE and find the WAVEVSN.EXE file added in step 2, above, and double click on it. Click on the "Change Icon" button and click on "OK". Click "OK" again.
5. To add a shortcut Icon for Windows95/98, drag the WaveVision Icon from Windows Explorer to your desktop.

6.0 Installing the Digital Interface Board

The Digital Interface Board comes pre-tested and ready to use. Little preparation is necessary beyond installing the software, connecting it to a PC running Windows™ and to a Product Evaluation Board with applied power to begin using it.

6.1 Board Set-up

The evaluation board requires a single +5V power supply at 1.0A, which is supplied through the product evaluation board interface J14. The ±12V supplies that are available through J14 are available for future possible use and are not used at this time.

Connect a product evaluation board to J14 and apply power to that board. Connect a serial cable between P1 and an available (RS-232) Serial Port on your computer.

6.2 Quick Check of Board Functions

Refer to Figure 1 for locations of components on the board.

If at any point the expected response is not obtained, see section 6.3 on Troubleshooting.

1. Perform steps 1 and 2 of the setup procedures of Section 4.1, except S1-8 should be set ON.
2. Connect a product evaluation board to J14 and turn on the power to it.
3. Verify that LEDs D2 and D4 are off and D1 is on.
4. Set Program Switch S1-8 to OFF and verify that LED D2 is now on, indicating the board is in the Computer mode of operation.
5. Set jumpers J8 and J10 to their default positions, as shown in Figure 1, or to opposite positions for a null modem cable (see Section 2.0, step 3).
6. Connect an oscilloscope probe to TP2 and verify the presence of a clock signal.
7. Run the WaveVision software on your computer.
8. Select the Communication port (ALT, O, then 1, 2, 3 or 4) corresponding to the comm. port used.
9. Check communications (ALT, P, C or CTRL-K). A "Board Found" dialog box should be produced.
10. Acquire data (ALT, P, A or CTRL-X). Yellow LED D4 will come on to indicate data transfer in progress. Data transfer can take a few seconds.
11. When data transfer is complete, the data window should show a single horizontal line. The exact code represented by this line will depend upon the setting of any offset and other controls on the product evaluation board.
12. Supply a sine wave to the Analog Input of the product evaluation board. This signal should have a frequency of about 1MHz and an amplitude appropriate for the product evaluation board used.
13. Repeat step 10, above.
14. When transfer is complete, the data window should show many sine waves. The display may show a nearly solid area of red (Figure 2), which is O.K.
15. With the mouse, click and drag to select a portion of the displayed waveform.

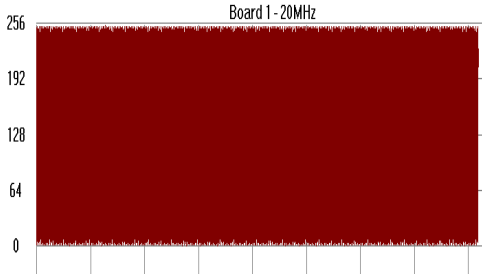


Figure 2. The WaveVision captured display of a 3.58 MHz sine wave at 20MHz ADC clock frequency. The input signal should be filtered to remove harmonic distortion and should be stable to prevent averaging of the data in the FFT process. The signal excursion should cause the minimum and maximum ADC output codes to come near, but not to their extremes to avoid signal clipping and distortion.

16. Be sure that the waveform does not reach minimum or maximum ADC output codes (avoid clipping in the output). Optimum performance measurements occur when the lowest and highest codes digitized are near but do not reach the ADC output code limits. On the product evaluation board, adjust the offset and gain controls and/or the signal input level to the board to get the output swing into the desired range.

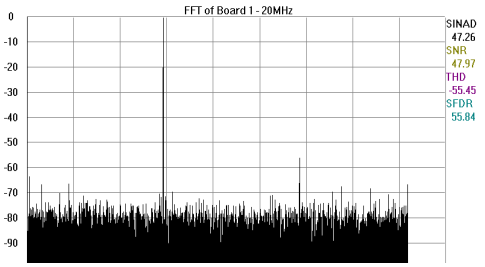


Figure 3. FFT display showing performance of the ADC1175. From this display the noise floor can be measured and spurious signals can be identified.

17. Select FFT (ALT, P, F or CTRL-F)

The FFT display will show measurements of SINAD, SNR, THD and SFDR (See Figure 3), easing the verification of ADC performance.

6.3 Troubleshooting

Problem: "Time Out Error" and/or "Check Comm failed. Board Not Available. Creating Simulated Data..." message displayed. This means that communication was unsuccessful. Check the following:

1. The Digital Interface board is connected to the PC through P1 and an RS-232 serial port and has a properly powered product evaluation board connected.
2. Be sure S1-8 is OFF (open). Red LED D3 should be on to indicate that the board is in the Computer mode.
3. Be sure switch S1 positions 6 and 7 indicate the frequency of oscillator Y1. See Table 1a.
4. Be sure cable connections are solid.
5. Be sure the correct communication port is selected.
6. Be sure J8 and J10 are set to select the type of cable used, as discussed in Section 2.0, step 4.

Problem: No clock signal and D1 is off.

1. If using an external clock source, be sure that the input levels at J2 are TTL levels.
2. Ensure that the expected clock source is selected by S1-1 through S1-3. See Table 1.

Problem: The converter seems to exhibit more distortion and/or noise than expected.

1. Be sure that the signal to the ADC does not have excessive amplitude or offset. (Be sure the output signal is not clipped).
2. Be sure that the input signal causes the ADC output codes come near the not quite reach the possible code limits of the ADC.
3. Be sure a clean signal is presented to the ADC. Even some fairly expensive generators can have more distortion and noise than some ADCs. It will probably be necessary to filter the analog input to the product evaluation board.

7.0 Exploring the Waveform

The WaveVision software, together with the Digital Interface Board and the Product Evaluation Board add a new tool to the video designer's toolbox. This evaluation combination can be used to capture a dynamic signal, display it on a computer screen and measure performance parameters.

See Appendix for WaveVision screen drawings of software operation.

7.1 Basic Waveform

After the Digital Interface Board has uploaded a captured waveform to the PC, WaveVision displays this waveform on the computer monitor. Remember that the waveform may not appear to be very well defined unless the sampling rate is much higher than the input frequency.

7.1.1 Looking at Frequency Response

A video multiburst signal can be used to evaluate system frequency response. This approach will show the overall system response, including that of the input signal conditioning.

A video multiburst signal has bursts of fixed frequencies, one after the other, that usually start at 0.5 MHz and increase to 4.5 MHz or 5.5 MHz, depending upon the video standard. Figure 4 shows a captured multiburst signal.

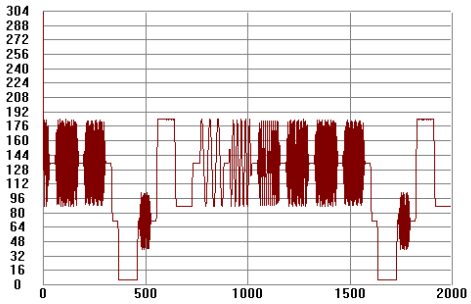


Figure 4 This multiburst signal shows the frequency response of the system through the ADC.

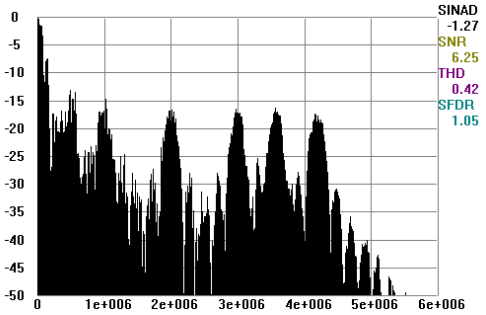


Figure 5 This FFT of the multiburst signal shows frequency on the horizontal axis, allowing a measurement of the bandwidth required for the burst of each frequency. This spectrum of the whole signal indicates the bandwidth required to pass this signal without distortion.

The individual preset frequencies of the multiburst signal can be determined by performing an FFT on the data as seen in Figure 5. The individual frequencies are, in this case, 0.5 1, 2, 3, 3.58 and 4.2 MHz. The dynamic data to the right of the spectrum plot is useless for such data.

7.1.2 Low Frequency Triangle Wave Input

A low frequency (about 0.1% of the ADC clock rate) triangle wave will provide general information on ADC performance.

When a voltage ramp is digitized, the code sequence shows increasing codes up to the peak level, or decreasing codes to the minimum level, depending upon whether the slope is positive or negative. A waveform with always increasing or decreasing codes is said to be monotonic, as in Figure 6a.

A converter that has one or more instances of codes going in the wrong direction, compared with the input signal, is said to be non-monotonic. The resulting DAC output is shown in Figure 6b.

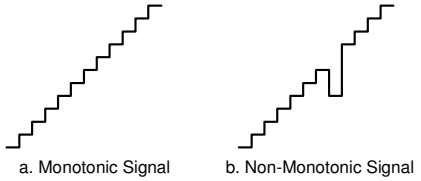


Figure 6 Monotonicity means codes are continually increasing or decreasing.

When digitizing signals with rise and fall times slow enough to result in more than one conversion result of the same code in sequence, it is normal to have some code uncertainty when the input is at a code transition point. See Figure 7. This condition is normal when the input signal moves very slowly as compared with the sampling rate.

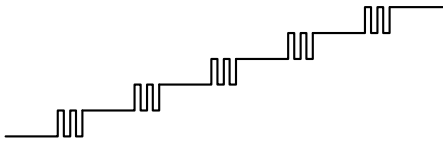


Figure 7 Code uncertainty when the ADC input voltage is near a code transition point.

7.2 The FFT Plot

The dynamic performance estimates of SINAD, SNR, THD and SFDR (Spurious-Free Dynamic Range) shown with the FFT plots are only meaningful for a sine wave input to the ADC and are only accurate to the extent that the input waveform is clean (contains a single frequency) and stable.

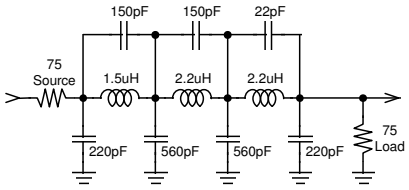


Figure 8 This elliptic filter, with a cutoff frequency of about 4MHz, can be used for input frequencies of 2MHz to 4MHz.

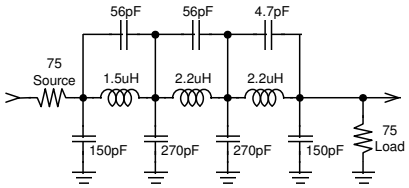


Figure 9 This elliptic filter has a cutoff frequency of about 11MHz and is suitable for input frequencies of 5MHz to 10MHz.

Harmonics and interfering signals can be attenuated by inserting an appropriate filter at the Analog Input. The elliptic filter of Figure 8 is an example of a suitable filter for input frequencies of 2MHz to about 4MHz. This filter is intended to use a square wave input, reducing 3rd and higher harmonics to negligible levels. It has attenuation of about 40dB at 7.2 MHz and 80 dB at 10 MHz. The elliptic filter of Figure 9 is an example of a suitable filter for input frequencies of 5MHz to 10MHz. These filters should be driven by a generator of 75 Ohms source impedance and terminated with 75 Ohms. Since these filters do not attenuate 2nd harmonics well, best performance is often achieved with a square wave input to this filter. The input resistor shown here is the generator impedance and the output resistor is part of the board input termination.

The FFT plot provides information from captured signals other than single frequency sinusoids. One example is shown in Figure 5.

7.2.1 Dynamic Performance Estimates

The dynamic performance as indicated by SINAD, SNR, THD and SFDR are estimates rather than hard and fast figures because their accuracy depends upon how much of the ADC's dynamic input range is used, and how many samples are taken.

For example, if the input is reduced below a full scale swing such that the maximum and minimum codes obtained at the output are, for an 8-bit ADC, 235 and 20, rather than the full scale values of 255 and 0, only about 84% of the code range is used. The result is an apparent degradation of SNR. On the other hand, if the input exceeds the input dynamic range such that the top and/or bottom of the input signal is clipped at the ADC's output, THD, SFDR and SINAD will be degraded. Apparent performance may also be limited by the purity of the input signal used. Some of finest signal generators available may not be clean enough to really show the performance possibility of a given ADC.

7.2.2 Bandwidth Estimation

If a constant amplitude frequency sweep is applied at the Analog Input of the product evaluation board and the signal at the ADC input is digitized and displayed, the data display will show any frequency dependent amplitude variation.

7.3 The Histogram

A histogram of the captured data may be obtained by clicking on the histogram icon (see appendix), by pressing CTRL-H, or by pressing ALT-P, H. The histogram indicates the number of times each code occurs in the data.

The histogram could be misleading if there are not enough samples taken. For this reason we suggest that the you take the maximum available number of samples before evaluating a histogram.

To the right of the histogram you will see the standard deviation of the data, the number of missing codes (zeros) in the data, as well as the code with the most number of hits (occurrences) and how many hits that is. If more than one code has this maximum number of hits, the lowest code with that maximum number of hits is indicated. In Figure 10 we see the histogram of simulated data that would result when trying to acquire data and the system could not detect a board connected to the computer. The "MAX 1:29" to the right means that the maximum number of codes is 29 and the lowest code with that number of his is code 1.

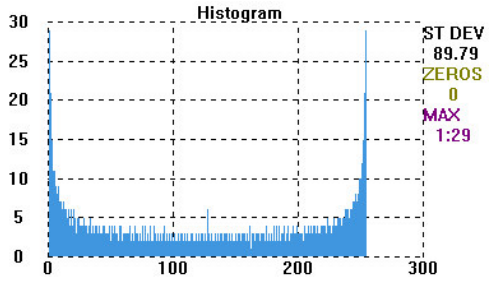


Figure 10. Histogram of simulated data. Note the display of the number of missing codes (zeros) and the code with the most hits (code 1 in this case) and the number of occurrences of that code (29).

8.0 Computer-Board Communications

Communication between the board and computer are through an RS-232 connection at connector P1. Communications is 9600 baud, 8 data bits, 1 stop bit, no parity.

The RAM address is incremented at the fall of each output clock from U1 and data is clocked into the RAM at the rising edge of the clock. The PLD (U1) counts the number of words clocked into RAM to be sure that data is not written over some of the previous data. Once the data has been acquired, the board responds in accordance with the request from the host computer.

Position 8 of DIP switch S1 determines if Manual or Computer mode operation is desired, changing to the required mode when the switch position is changed. Instructions from the PC are ignored when in the Manual mode.

9.0 Circuit Description and Hardware Schematics

Figure 11 shows the block diagram of the Digital Interface Board. U1 (a programmable logic device) controls I/O and interprets instructions from a host PC that is operating under WaveVision control. Communication between the board and the host computer is through an RS-232 link. After receiving a command from the host PC, the board interprets the instructions, performs the operation requested and returns the results. The board operates from a single +5V supply and supports ADCs with resolutions up to 12 bits with an appropriate product evaluation board.

The hardware schematic is divided into two sections: the Logic Section and the Data and Power Interface Section.

9.1 Indicators and Adjustments

The board has three LEDs to assist in determining the current state of the board. Table 2 shows the use of these LEDs.

9.2 Board Input/Output

There are two electrical inputs to the Digital Interface Board (refer to Figure 1): Data and Power Interface (J14) and RS232 Port (P1).

INDICATOR	LED COLOR	LOCATION	MEANING
D1	RED	Near & below Oscillator	Presence of the selected clock signal
D3	RED	Near Ext Clock connector J2	In the Computer mode
D4	YELLOW	To right of D3	RS-232 data transfer

Table 2. LED Indicators

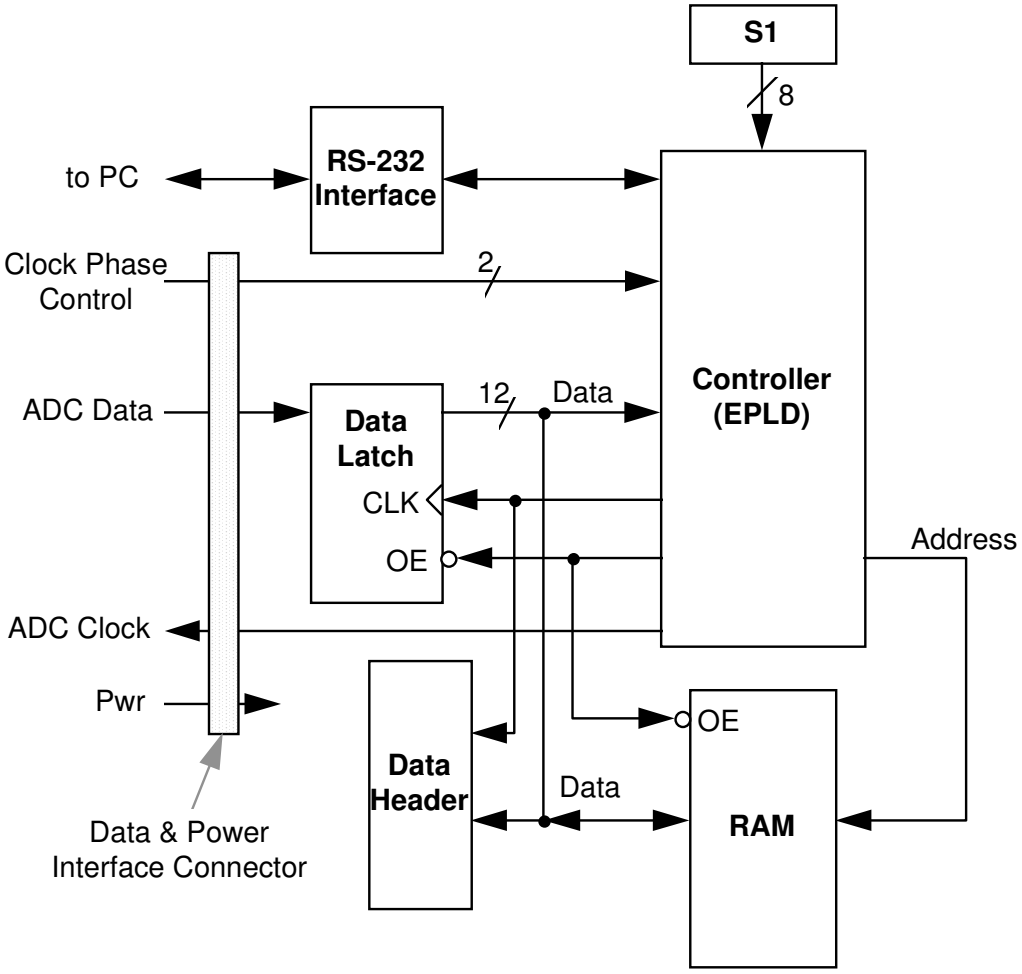


Figure 11. Digital Interface Board Block Diagram

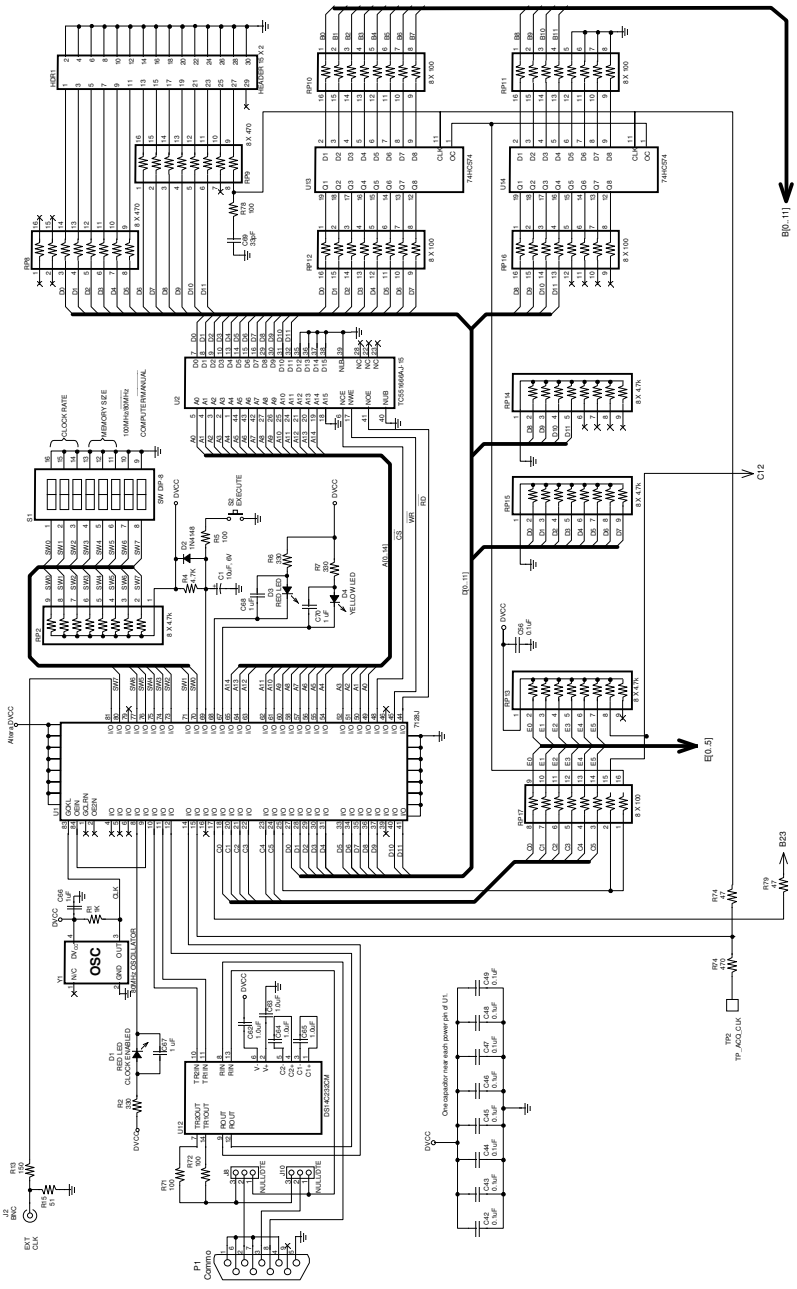


Figure 12. Digital Interface Logic

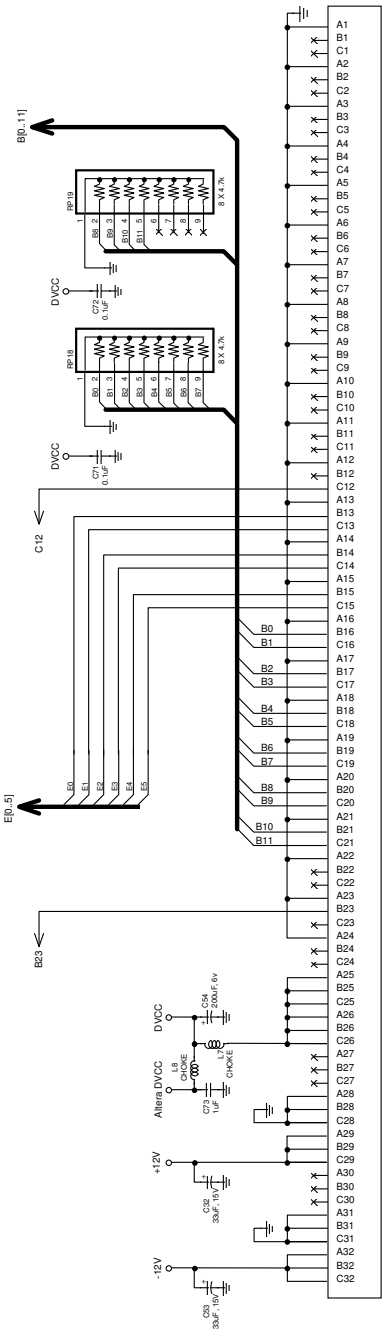


Figure 13. J14 Data and Power Interface

10.0 Setting up the Program Switch

The Program Switch (DIP Switch S1) is used to set the mode of operation (Computer or Manual) with S1-8, the on-board clock oscillator frequency with S1-6 and S1-7, the memory size (number of bytes spooled after S2 is depressed - Manual mode only) with S1-4 through S1-6 and the clock frequency and source with switches S1-1 through S1-3. Table 1 indicates the functions of the Program DIP Switch (S1).

Position 8 of the Program switch (S1-8) determines whether control is manual or through the RS-232 link. Close this switch for manual operation. Open this switch for computer control through the RS-232 link.

When in the Computer mode of operation (S1-8 is open), commands are received over the RS-232 link, red LED D3 is turned on to indicate the board is in the Computer mode. When in the Manual mode. you can use the digital word stream at the Digital Output port (HDR1).

Switch positions 3 through 1 are used to set the ADC clock frequency by selecting and dividing the External Clock Input (J2) or by dividing the on-board clock frequency, as indicated in Table 1.

11.0 Saving and Retrieving Files

WaveVision allows you to save data in two formats. One is a binary file, the other is an ASCII file. See the Appendix for the locations of the icons mentioned below.

11.1 Binary Files

To save a binary file for use later by WaveVision, you can either click on the save icon, enter ALT, F, S or enter CTRL-S. You will be prompted for a file name the first time you save a given set of data.

The binary file contains information as to program settings as well as the raw data.

To retrieve a binary file in WaveVision, you may click on the Open File icon, enter ALT, F, O or enter CTRL-O. You will be prompted for the name of the file you wish to retrieve.

11.2 ASCII Files

To export an ASCII file for use later by another program, such as Excel, you must enter ALT, F, D. You will be prompted for a file name.

The ASCII file will contains only raw data with one data point per line.

To import an ASCII file, whether created with WaveVision or with any other program or utility, enter ALT, F, I. You will be prompted for the name of the file you wish to retrieve. Remember that imported files must have one data point per line.

12.0 Evaluation Board Specifications

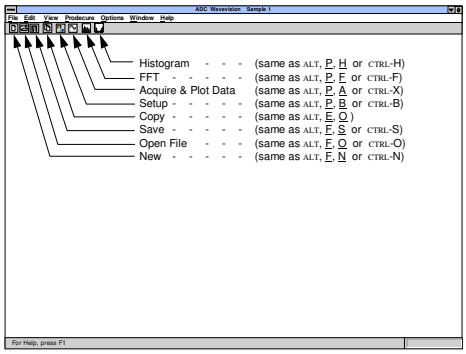
Board Size:	6.5" x 5.88" (16.5 x 15 cm)
Power Requirements:	+5V @ 1.0 A
Communications	
Baud Rate:	9600
Data Bits:	8
Stop Bits:	1
Parity:	none
Clock Freq. Range:	
External	1 MHz to 60 MHz
Crystal	80 MHz, 100MHz or 120MHz
ADC conversion	1 MHz to 60 MHz
Memory:	64k Words

13.0 Digital Interface Board Bill of Materials

Designator	Value	Type/Source
C1	10µF, 6V	Digi-Key # PCS1106CT-ND
C32, C53	33µF, 15V	Digi-Key # PCS3336CT-ND
C42, C43, C44, C45, C46, C47, C48, C,49, C56, C71, C72	0.1µF	Digi-Key # P4923-ND
C54	200µF, 6V	Nemco # PCT220 / 6H
C62, C63, C64, C65C66, C67, C68, C70, C73	1µF	Digi-Key # P4962-ND
C69	33pF	Digi-Key # P4843-ND
D1, D3	Red LED	Any Red LED (T-1¾)
D2	1N4148	Various
D4	Yellow LED	Any Yellow LED (T-1¾)
L7, L8	Choke	Digi-Key # M2204-ND
HDR1	24-Pin Post Header	Digi-Key # S1011-24-ND
J1	BNC	Digi-Key # ARF1177-ND
J8, J10	3-Pin Post Header	Digi-Key # A19351-ND
--	Shorting Jumper	Digi-Key # S9001-ND
J14	96-Pin Euro Connector Plug	Digi-Key # H5096-ND
L7, L8	Choke	Digi-Key # M2204-ND
P1	DB-9 Plug	Digi-Key # A2096-ND
R1	1kΩ	Type 1206
R3, R6, R7	330Ω	Type 1206
R4	4.7k	Type 1206
R2, R6, R7	330Ω	Type 1206
R4	4.7kΩ	Type 1206
R5, R71, R72, R74, R77, R78, R79	100Ω	Type 1206
R13	150Ω	Type 1206
R15	51Ω	Type 1206
R77	470Ω	Type 1206
RP8, RP9	8 x 470Ω	CTS # 766163471G
RP10, RP11, RP12, RP16, RP17, RP18, RP19	8 x 100Ω	CTS # 766163101G
RP2, RP13, RP14, RP15,	8 x 4.7kΩ	Bourns # 4309T-101-4701 FAD
S1	DIP Switch	Digi-Key # A5208-ND
S2	Push-Button Switch, SPST-NO	Digi-Key # CKN9016-ND or CKN9017-ND
TP2, TPG1, TPG2, TPG3, TPG4	Breakable Header, Single Row	Digi-Key # S1021-05-ND
U1, PLD	EPM7128ELC84-15	Altera
U2 Memory	TC551664AJ-15	Toshiba
U12, RS232 Interface	DS14C232CM	National
U13, U14 Latch	74HC574M	Various
Y1	80MHz Oscillator	Digi-Key # CTX-138-ND
Socket	for Y1	4-pin full-size oscillator socket

APPENDIX - WaveVision Screens

WaveVision Menu & Icon Description

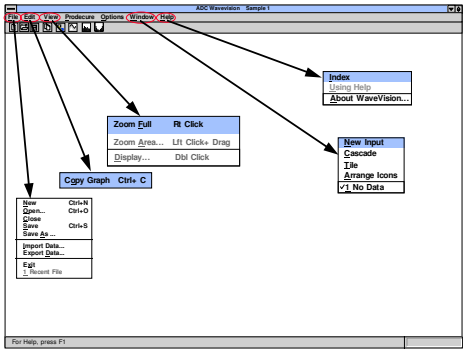


Opening a Wavevision file is done in the same manner as any other Windows™-based program. If you wish to import data created by another application, such as a spread sheet, see below.

The Copy command will copy the contents of the active window without the Title bar.

The Setup command is used to tell WaveVision you want to do.

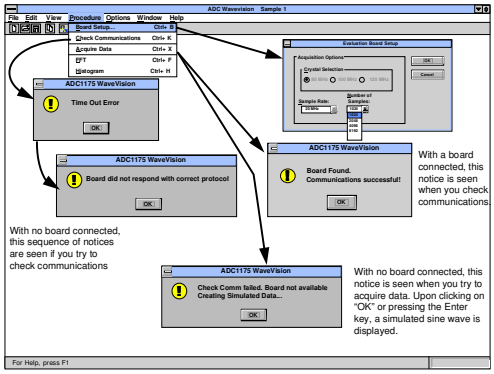
WaveVision Menu



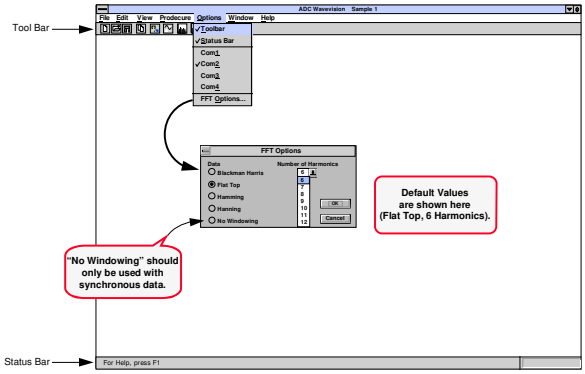
The IMPORT and EXPORT commands (under the FILE menu) are used to retrieve a text file and save a file as text, respectively. This differs from the SAVE and OPEN commands, which work with files specifically formatted for WaveVision only.

Currently, there is no on-line help available.

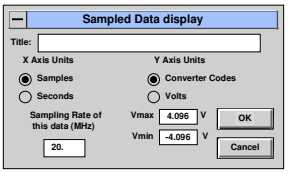
WaveVision Procedure Menu



WaveVision Options Menu

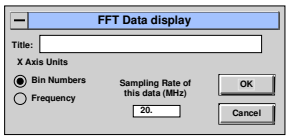


Sampled Data and FFT Data Display Options



This dialog box isobtained by double clicking on the sampled data plot.

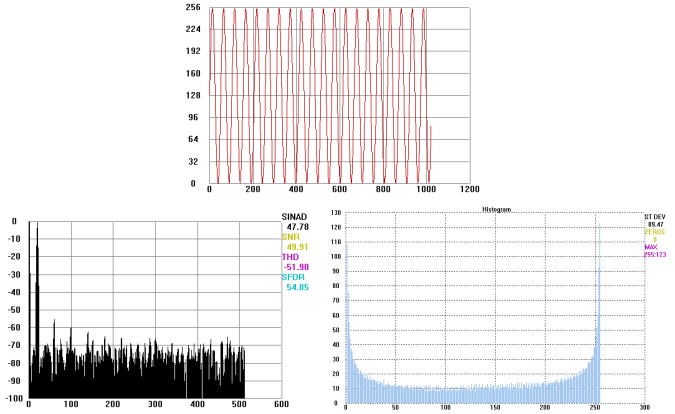
It allows you to set a title for the displayed waveform, to set X Axis and Y Axis units and to set min and max (reference?) voltage levels.



This dialog box iis obtained by double clicking on the FFT plot.

It allows you to set a title for the FFT and to set X /Axis units

WaveVision Data Display Examples



These are examples of displays obtained with the Digital Interface Board working with the ADC1175 Product Evaluation Board. The input frequency was 3.58MHz The input amplitude to the board was 590mV (RMS). This was amplified by the board to nearly $2V_{P-P}$ for the ADC1175 input.

The Digital Interface Board is intended for product evaluation purposes only and is not intended for resale to end consumers, is not authorized for such use and is not designed for compliance with European EMC Directive 89/336/EEC.

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