Xminilab Manual

The Xminilab and Xminilab-B are fully featured Mixed Signal Oscilloscopes (MSO) with Spectrum Analyzer and Arbitrary Waveform Generator (AWG).
The Xminilab's can also be used a development boards for the XMEGA AVR microcontroller.

Mixed Signal Oscilloscope

Specifications

- 1 Analog Inputs
- Input Impedance: 1MΩ
- Maximum Input Voltage: +/- 25V
- (+/- 250V if using a 10:1 probe)
- A/D Converter Resolution: 8 bits
- Max Sample Rate: 16MS/s
- 4 Digital Inputs: 3.3V level

Features:

Time Base (S/division):	1u	2u	5u	10u	20u	50u	100u	200u	500u	1m	2m	5m
	10m	20m	50m	0.1	0.2	0.5	1	2	5	10	20	50

Gain (Volts / division):	20m	50m	0.1	0.2	0.5	1	2	5

- Horizontal Cursors
- Vertical Cursors
- Automatic Average and Peak to Peak measurements
- FFT and automatic search of fundamental frequency
- Export to BMP through RS-232 using HyperTerminal
- Analog trigger and external digital trigger
- One time division consists of 16 pixels. Example: 5uS / division = 5uS / 16 pixels ==> 312.5nS / pixel
- One gain division consists of 16 pixels

User Interface

The K6 button exits from the current menu. If the current menu is the default menu, the '*' Key exits the MSO application.
The K7 button cycles thru 2 main menus, K1 thru K5 buttons select the menu item.

Menu \ Key	K1	K2	K3	K4	K5
1	Channel 1 Menu	Digital Input Menu	Trigger Type	Trigger Source	Cursor Menu
2	FFT Menu	AWG Control	Display Menu	Set MSO mode	Set FFT mode

If there is no menu shown, then the default menu is active.

	K1	K2	K3	K4	K5	Encoder 1	Encoder 2
default	Run / Stop					Horizontal Position	Sampling Rate
Channel 1 Menu	Channel on/off	Invert Channel	Probe X1/X10	Average Samples		CH1 position	CH1 gain
Digital Input	Digital on/off	Invert Channel	Thick Low	Serial Hex Display	Parallel Hex Display	Digital Position	Digital Size
Trigger Type	Force Trigger	Free	Normal	Single	Auto	Trigger Delay	Trigger Timeout
Cursor Menu	Reference Waveforms	Lock Auto Set	Vertical Cursors	CH1 Horizontal Cursors		Cursor 1	Cursor 2
Spectrum Analyzer	Apply Logarithm	Hamming Window	Hann Window	Cosine Window	Triangle Window	Horizontal Position	Sampling Rate
Trigger Source	CH1		DAC	PB0	PB1		Trigger Level
Display Menu	Persistent Mode	Line / Dot	Show Gain/Rate settings	Change Grid type	Backlight on/off		
AWG Control	Sine	Square	Triangle	Exponential	Toggle Encoder	Frequency / offset	Amplitude / Duty Cycle

Detailed Function Description

Default Menu

K1: Run / Stop	K2	K3	K4	K5
Starts or stops the data acquisition				

Channel 1

K1: CH1ON	K2: INVERT	K3: X10	K4: AVRG	K5
Toggles channel 1 on and off	Inverts the channel	Toggles between X1 probe or X10 probe	Toggles between averaging on and off	

Digital Input

K1: CHDON	K2: INVERT	K3: THCK0	K4: HEXS	K5: HEXP
Toggles logic on and off	Inverts the logic	Thick or thin line when the input is low	Shows the serial decoding	Shows the parallel decoding

Serial Hex Display: Shows the hexadecimal value of the stream of bits on each channel. The decoding starts at the first vertical cursor and ends at the second vertical cursor, 8 bits are decoded.

Parallel Hex Display: Shows the hexadecimal value of the 4 bit digital input lines.

Trigger Type

K1: Force Trigger: Pressing the K1 button will force a trigger.

K2: Free: The MSO trigger is free running, a new trace will be drawn when the last one ends.

K3: Normal: Trace when a trigger occurs

K4: Single: Trace once when a trigger occurs

K5: Auto: Trace when a trigger occurs, or when the trigger timeout is reached.

Cursors

K1: Reference Waveforms: A snapshot is taK5n of the analog waveforms to be used as reference waveforms.

K2: Lock Auto Set: The cursors are automatically set continuously in MSO and FFT modes

K3: Vertical Cursors: Toggles vertical cursors on and off.

K4: CH1 Horizontal Cursors: Toggles CH1 horizontal cursors on and off.

K5: CH2 Horizontal Cursors: Toggles CH2 horizontal cursors on and off.

Spectrum Analyzer

K1: Apply Logarithm: Apply Logarithm to the FFT

K2: Hamming Window: A Hamming window is used on the FFT.

K3: Hann Window: A Hann window is used on the FFT.

K4: Cosine Window: A Cosine window is used on the FFT.

K5: Triangle Window: A Triangle window is used on the FFT.

Trigger Source

K1: CH1: Select CH1 as the trigger source.

K2:

K3: DAC: Select the internal DAC as the trigger source.

K4: PB0: Select Digital Input PB0 as the trigger source.

K5: PB1: Select Digital Input PB1 as the trigger source.

Display Options

K1: PRSTENT	K2: LINE	K3: SHOW	K4: GRID	K5: BKLITE
Sets persistent mode	Selects line or dot display	Display gain and sampling rate	Selects the grid type	Toggles the backlight on and off

TIPS:

Persistent Mode: The persistent display is useful as a simple data logger or to catch glitches in the waveform.
The persistent mode can also be used to maK5 frequency plots by varying the frequency of the input signal.

Dot dispay: The dot display is useful at slow sampling rates or when used in combination with the persistent mode.

Menu * : AWG Control

K1: Sine: Selects a sine wave for the AWG.

K2: Square: Selects a square wave for the AWG.

K3: Triangle: Selects a triangle wave for the AWG.

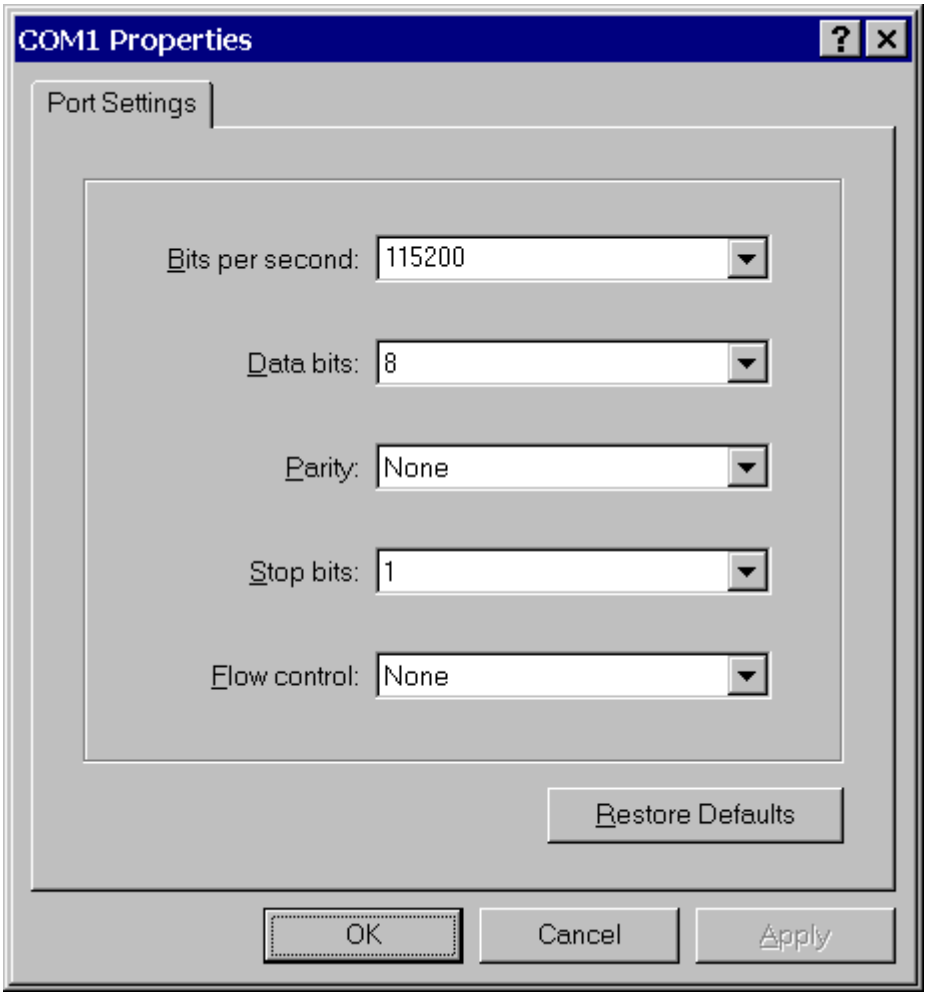
K4: Exponential: Selects an exponential wave for the AWG.

K5: Change Encoders:Toggles Encoders control from (Frequency / Amplitude) or (Offset / Duty Cycle).

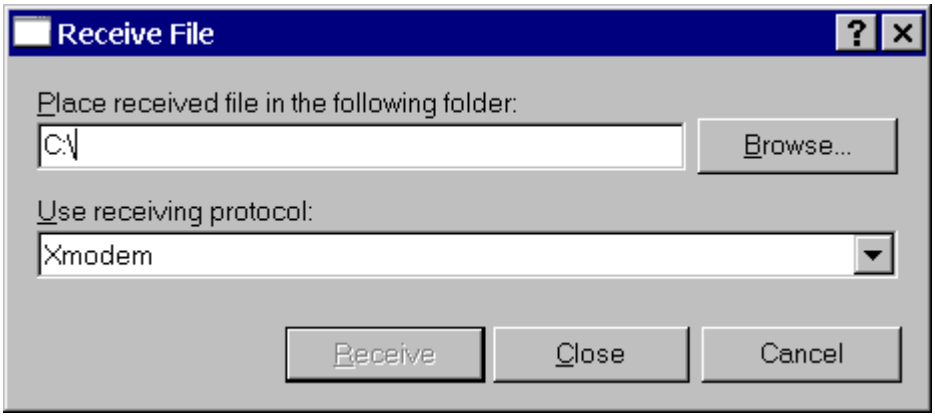
To send a BMP screen capture to a PC:

You can send a screen capture of the oscilloscope to your PC using hyperterminal. All oscilloscope bitmaps in this manual where generated using this method.

- Open HyperTerminal.
- Enter a name for a new connection (example: xmultikit).
- Enter the COM port where the XMultiKit is connected.
- Select 115200 bits per second, 8 data bits, Parity None, 1 Stop bit, Flow control None



- In the Transfer menu, select Receive File.
- Enter a folder where to save the file and use the XMODEM protocol.



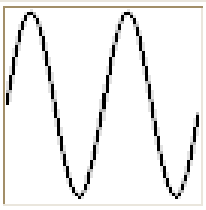
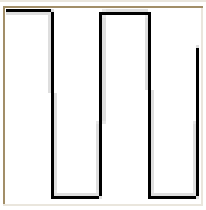
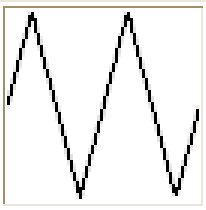
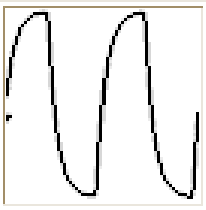
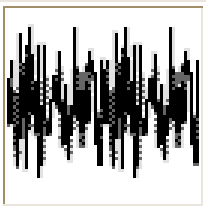
- Enter a file name with a BMP extension and press OK

Arbitrary Waveform Generator

The Xminilab can output the standard waveforms of a function generator and can adjust the frequency, amplitude, offset and duty cycle of the selected waveform.

The waveform is stored in a 256 byte long buffer, this buffer is fed to the XMEGA's DAC thru the DMA. Once the waveform is set, the waveform will be generated without any CPU intervention. The maximum conversion rate of the DAC is 1MSPS, this limits the maximum output frequency of the AWG as a system.For example, if the AWG is generating a sinewave with 256 points, the maximum frequency is 3906.25Hz. If generating a sinewave with only 32 points, the maximum frequency is 31.25KHz. The AWG amplifier has a cut off frequency of 66KHz.

The predefined waveforms of the AWG are:

				
Sine Wave	Square Wave	Triangle Wave	Exponential Wave	Random points

By modifying the source code, any kind of waveform can be generated on the AWG.

AWG Control

Buttons K1 thru K5 select the waveform.

Pressing the K7 button will toggle the behaviour of the rotary encoders:

	Encoder 1	Encoder 2
Mode 1	Frequency	Amplitude
Mode 2	Offset	Duty Cycle

To exit, press K6. The AWG will continue to output the waveform.