

APPENDIX E: IWXX3XX HARDWARE MANUAL

Overview

The iWorx/3xx hardware in combination with LabScribe2 recording software provides a system that allows coordinated control of both analog inputs and outputs. The hardware offers many benefits including low noise, high speed, range, resolution. The iWorx/3xx interfaces with LabScribe2 software via the popular USB port. The USB port is the most current computer peripheral interface, and the iWorx/3xx capitalizes on three of its features: high speed, built in error checking, and 'Plug and Play' connectivity. All of this is packaged in a low profile aluminum enclosure that provides both durability and increased noise immunity.

Included Items

The iWorx/3xx is shipped with the following:

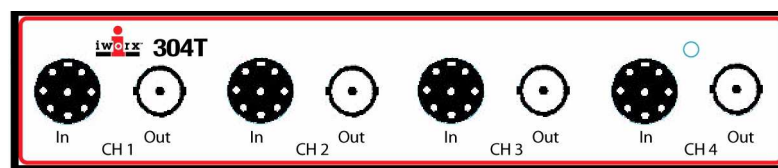
- 1 iWorx/3xx Hardware (1)
- 2 USB A-To-B Cable (1)
- 3 Power Supply Cable
- 4 LabScribe2 software CD (1)
- 5 Hardware/Software Manual (1)

If any items are missing, they should be reported to iWorx within 10 days of receipt.

Setting Up

- 1 Load the LabScribe2 software from the provided CD onto the computer. Be sure to install the software before connecting the hardware
- 2 Connect the iWorx/3xx hardware to the computer via the USB cable.
- 3 Connect the power supply and switch the hardware On.

Panels



304 FrontPanel



304 Rear Panel

Quick-view Specification Table

Analog Inputs	4 differential transducer
Input Impedance	10 Gohm
Amplifier Frequency Response	2 KHz
ADC Resolution	24 Bit
System Noise	<100 uV (20uV typical)
Sampling Rate	5,000 samples/second per channel continuous
Input Range	+/-5V
Excitation Voltage	+/-5V
Analog Output	4
Output Range	+/-5V
Output Current	5 mA
Output Resolution	16 Bit
Trigger	1 (TTL)
Warranty and Upgrades	The iWorx 304 hardware is protected by a three-year warranty. Software and firmware upgrades are free, and are automatically delivered to registered users via the Web. LabScribe2 software may be freely distributed to students.
Part Number	IX/304

Analog Inputs

The iWorx/3xx hardware contains four channels of analog input, that will accept practically any sensor you're likely to encounter, as well as voltage output of pH meters, spectrophotometers and other laboratory devices.

The input signal range is ± 5 Volts. The signals are digitized to 24-bit resolution. In simple terms this means that the input signal is passed to the software as a number between 0 and 16,777,216 where 0 maps to -5 volts, 8,388,608 maps to 0 volts, and 16,777,216 maps to $+5$ volts. One bit of resolution, often referred to as an LSB (Least Significant Bit), is then the total range ($+5$ volts minus -5 volts equals 10 volts) divided by 16,777,216 or 0.59 μ V.

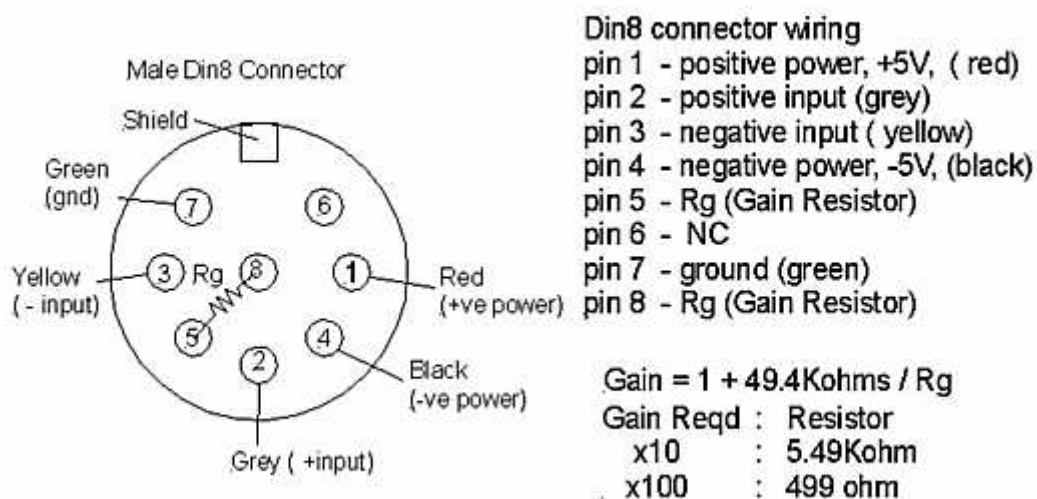
The iWorx/3xx like all analog to digital converters, displays some analog noise and some digitizing noise. So it makes sense to look at the system noise. The iWorx/3xx system noise is typically less than 100 uVolt. This is measured with the input shorted to ground to eliminate external noise.

The maximum sampling speed of the analog channels of the iWorx/3xx is 5 ks/S. This is independent of the number of channels selected. The iWorx 3xx using multiple ADC's to sample all the channels simultaneously. The sampling speed is user configured in the LabScribe2 software.

The analog input channels are single pole filtered at 2 kHz. This is designed to remove noise existing above the highest possible frequency of interest.

DIN8 Transducer Inputs

Four DIN8 transducer inputs accept practically any sensor you're likely to encounter. The DIN8 input connector provides +/- 5V excitation voltage for various transducers. iWorx transducers can set the appropriate gain automatically using the Gain set resistor.



Analog Output (stimulator)

The iWorx/304 hardware contains four stimulator output channels. The stimulator output is with reference to ground.

The output signal range is ± 10 Volts. The stimulator is capable of sourcing and sinking up to 10 mAmperes of current when feeding a low impedance load. As with all stimulators, compliance is a factor—simply put, driving 10mAmperes through any load impedance greater than 1 Kohms would, according to Ohm's law, generate a voltage larger than 10 Volts, or greater than the voltage output range of the stimulator. Therefore, the largest current output possible will be the smaller of either the stimulator output amplitude divided by the impedance of the load, or 10 mAmperes.

The resolution of the analog output is 1mV. The noise on the stimulator output is typically less than 1 mVolt.

The output impedance of the stimulator will typically be around 60ohms and should never exceed 100 ohms. Note that with very low load impedances (RLOAD < 600ohms), loading will occur. This means the actual stimulator output voltage will be a portion of the set stimulator output voltage.

The stimulator is updated independently of analog acquisition speed, at a rate between 0.2 Hz and 10 kHz. This means that in pulse mode, the fastest output frequency would occur by turning the stimulator on and then off at 10 kHz, resulting in a pulse frequency of 5 kHz. At lowest speed this would result in an output frequency of 0.1 Hz. LabScribe2 software determines the actual stimulator protocols allowed. For more information on setting the stimulator rate and protocol, consult the LabScribe2 user manual.

The stimulator output of the iWorx/3xx hardware is designed primarily for output protocols involving pulses and steps, where sharp transitions are not only acceptable, but are desired. Therefore, the stimulator outputs are single pole filtered at 50 kHz. This is a best compromise filter value that allows the maximum output frequency of 5 kHz to pass with sharp transitions while limiting the overall noise bandwidth.

Trigger/SyncIn

On the iWorx/3xx rear panel, is an edge triggered input, . When configured in Trigger Mode, the LabScribe2 software starts analog data acquisition upon detecting a trigger impulse. While awaiting the trigger impulse, the hardware is actually acquiring data, and so pre-triggering is allowed. This is useful when the data of interest is known to coincide or slightly precede the trigger impulse, or when the trigger impulse is too short to resolve at the sampling speed appropriate for capturing the data of interest. Though the trigger input is edge triggered, it must remain high long enough for the hardware to detect it—this requires approximately 10 micro seconds.

Digital Output

Digital Output is connected via a DB-9 receptacle on the rear panel and provides eight outputs, and a ground connection. The digital outputs provide 5 Volts and up to 5mA.

DB9.1 == D_OUT1	DB9.5 == D_OUT5	DB9.5 == Gnd
DB9.2 == D_OUT2	DB9.6 == D_OUT6	
DB9.3 == D_OUT3	DB9.7 == D_OUT7	
DB9.4 == D_OUT4	DB9.8 == D_OUT8	

Ganging

Multiple iwx3xx series devices can be ganged together using the SyncIn and SyncOut ports. Upto 4 devices can be ganged together. Connect the SyncOut port of the first device to the SyncIn port of the second Device, SyncOut port of the second device to the SyncIn port of the third Device, SyncOut port of the third device to the SyncIn port of the forth Device. When LabScribe2 is launched it will detect the multiple devices and Gang them in the order they are connected. So you can gang 2 iwx304 's to get a 8 channel device. The Composite device will have channels 1 through 4 from Device 1 and Channels 5 through 8 from device 2. The

▪
▪
▪
▪
▪

digital outputs of only the first device can be used. When recording is started the first device or the Master will synchronize all the slaves to start recording data within a few microseconds of each other.

