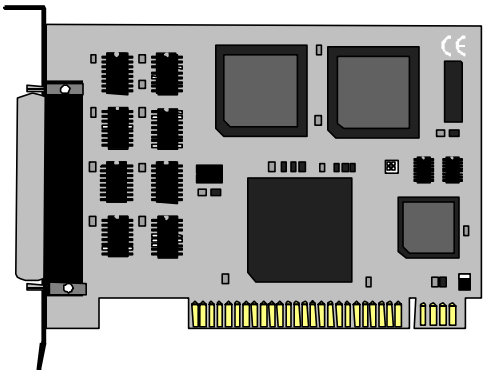
SEALEVEL
SYSTEMS INCORPORATED

SIO-104™

USER'S MANUAL

Part Number 3500, 3501



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Introduction

Overview

The **SIO-104** series provides the ultimate serial connection for your PC/104 application. The **SIO-104** is available in three different interfaces, RS-422/485, RS-232, and MIDI.

The RS-422/485 model (P/N 3500) provides an interface capable of long length, high speed communications.

The RS-232 model (P/N 3501) provides a standard RS-232C interface that is fully compatible all popular modem software, network operating systems software, and mouse drivers.

The MIDI model (P/N 3502) provides an interface suitable for control of musical instruments, MIDI sequencers and other compatible equipment.

What's Included

The **SIO-I04** is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- (1) **SIO-104** Serial Interface Adapter
- (1) DB-9 cable assembly (P/N 3500, 3501), or (1) MIDI cable assembly (P/N 3502)
- (1) Nylon Mounting Hardware Kit
- Serial Utility Software
- User Manual

Factory Default Settings

The **SIO-104** factory default settings are as follows:

	Base Address	IRQ
Port 1	280	5

To install the **SIO-104** using factory default settings, refer to Installation on page 6.

For your reference, record installed **SIO-104** settings below:

	Base Address	IRQ
Port 1		

Card Setup

The **SIO-104** contains several jumper straps for each port which must be set for proper operation.

Address Selection

The **SIO-104** occupies eight consecutive I/O locations. A DIP-switch is used to set the base address for these locations. Be careful when selecting the base address as some selections conflict with existing ports. The following table shows several examples that typically do not cause a conflict. SW1 sets the I/O address for the **SIO-104**.

Address	Binary	Switch Position Setting						
Hex	A9 A0	1	2	3	4	5	6	7
280-287	1010000XX X	Off	On	Off	On	On	On	On
2A0-2A7	1010100XX X	Off	On	Off	On	Off	On	On
2E8-2EF	1011101XX X	Off	On	Off	Off	Off	On	Off
2F8-2FF	1011111XX X	Off	On	Off	Off	Off	Off	Off
3E8-3EF	1111101XX X	Off	Off	Off	Off	Off	On	Off
300-307	1100000XX X	Off	Off	On	On	On	On	On
328-32F	1100101XX X	Off	Off	On	On	Off	On	Off
3F8-3FF	1111111XX X	Off	Off	Off	Off	Off	Off	Off

Figure 1 - Address Selection Table

The following illustration shows the correlation between the DIP-switch setting and the address bits used to determine the base address. In the example below, address 300 is selected as a base. Address 300 in binary is XX11 0000 0XXX where X = a non-selectable address bit.

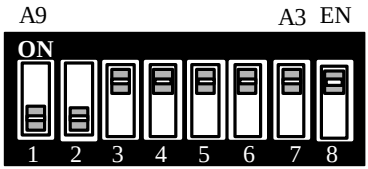


Figure 2 - DIP-Switch Illustration

Note: Setting the switch “On” or “Closed” corresponds to a “0” in the address, while leaving it “Off” or “Open” corresponds to a “1”.

Port Enable / Disable

The port on the **SIO-104** can be enabled or disabled with switch position 8 on the DIP-switch. The port is enabled with the switch "On" or "Closed" and disabled when "Off" or "Open" (refer to Figure 2). If the port is disabled, be sure to also disable the interrupt request for that port by removing the IRQ jumper at header J2.

IRQ Selection

The **SIO-104** has an interrupt selection jumper which should be set prior to use, if an interrupt is required by your application software. Consult the user manual for the application software being used to determine the proper setting. Position "R" is provided so that a jumper can be installed that connects a 1K Ohm pull-down resistor to the output of a high-impedance tri-state driver which carries the IRQ signal. Because the IRQ line is driven low only by the pull-down resistor, it is possible for two or more boards to share the same IRQ signal. Position "R" installed is the default setting and should be left as is unless multiple cards are sharing a single IRQ. If multiple adapters are sharing a single IRQ, then only one adapter should have the pull-down resistor (position "R" selected) in the circuit.

The IRQ can be set at jumper J2 for IRQ 2/9, 3-5, 7, 10, 11, 12, or 15. In the following example, the IRQ is set as IRQ4.

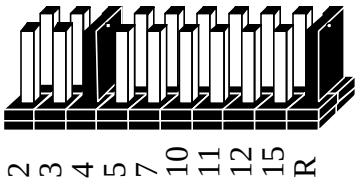


Figure 3 - Header J2, IRQ Selection (Factory Default)

RS-485 Mode (RTS Enable)

J4 selects whether the RS-485 driver is enabled by the UART signal **R**equest **T**o **S**end (RTS) or always enabled. With the jumper installed, RTS enables the RS-485 driver. Removing the jumper enables the driver regardless of RTS. The jumper should be installed for a 2/4 wire RS-485 application where the **SIO-104** is acting as a polled node on a multi-drop network. Remove the jumper if you are using a point to point RS-422 application such as programmable logic controllers (PLCs), etc.

Installation

Extreme care should be taken when installing the **SIO-104** so as not to cause damage to the connectors. Refer to Card Setup for information on setting the address and jumper options before connecting J1.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover (if applicable).
3. Gently insert the **SIO-104** connector J1 so that it lines up pin 1 to pin 1 of the expansion connector on a PC/104 compatible card. The **SIO-104** adapter is keyed per the PC/104 Revision 2.1 Specification, which aids in preventing the adapter from being inserted incorrectly.
4. Mounting hardware (nylon stand-off and screws) is provided to insure a good mechanical connection. Retain any mounting hardware not used to allow for future expansion.
5. Cabling:

   - P/N 3500 and 3501:

     After the board is installed, connect your I/O cable to J3. Please note, J3 is keyed so pin 1 of the cable matches with pin 1 of the connector (pin 1 is labeled on the Silk-Screen and the cable will have a colored stripe).

   - P/N 3502:

     This cable provides a standard MIDI interface via the on-board DB-9s to the three DIN-5 connections. After installing the cable on the **SIO-104,** connect the cable labeled "MIDI-OUT" to the equipment's "MIDI-IN" port and the connector labeled "MIDI-IN" to the equipment's "MIDI-OUT". The cable labeled "MIDI-THRU" is optional and should be used if the MIDI signal is to be "Echoed" to another MIDI instrument.

6. Replace the cover.
7. Connect the power cord.

Installation is complete.

Operating System Installation

For Windows Users

Start by choosing **Install Software at the beginning of the CD. Choose Asynchronous COM: Port Software, SeaCOM.**

Other Operating Systems

Refer to the appropriate section of the Serial Utilities Software.

Technical Description

The **SIO-104** series provides the ultimate serial connection for your PC/104 application. The **SIO-104** utilizes the 16550 UART. This chip features programmable baud rate, data format, interrupt control and a 16 Byte input and output FIFO.

The **SIO-104-422** (P/N 3500) is equipped with the RS-422/485 interface allowing long length, high speed communications suitable for data collection and shop floor control.

The **SIO-104-232** (P/N 3501) provides a standard RS-232C interface that is fully compatible with the DOS operating system, all popular modem software, network operating systems software, and mouse drivers.

The **SIO-104-MIDI** (P/N 3502) allows the controlling of Keyboards, sound modules, and drum machines which all can be interconnected and driven by sequencing software. The MIDI specification has been updated recently to include tape deck control for automated recording and stage & light show control for real-time theatrical production.

Features

- Selectable interrupts (IRQs) 2/9, 3, 4, 5, 7, 10, 11, 12, 15
- Multiple adapters can share the same IRQ
- 16550 UART standard, 16C650 UART optional
- Uses PC/104 compatible stack through connector for universal mounting
- 5 volt DC operation

Modem Control Signal Considerations

Some software packages require the use of the modem handshake signals such as CTS or DCD. Refer to your application software manual to determine the requirements for modem control signals. If no requirements are mentioned, a safe configuration is to tie DTR to DSR and DCD, and tie RTS to CTS. This configuration will typically satisfy the modem control signal requirements for most communications software.

Connector Pin Assignments

RS-232

Signal	Name	DB-9	Mode
GND	Ground	5	
TD	Transmit Data	3	Output
RTS	Request To Send	7	Output
DTR	Data Terminal Ready	4	Output
RD	Receive Data	2	Input
CTS	Clear To Send	8	Input
DSR	Data Set Ready	6	Input
CD	Carrier Detect	1	Input
RI	Ring Indicator	9	Input

Note: These assignments meet EIA/TIA/ANSI-574 DTE for DB-9 type connectors.

RS-422/485

Signal	Name	Pin #	Mode
GND	Ground	5	
TX +	Transmit Data Positive	4	Output
TX-	Transmit Data Negative	3	Output
RTS+	Request to Send Positive	6	Output
RTS-	Request to Send Negative	7	Output
RX+	Receive Data Positive	1	Input
RX-	Receive Data Negative	2	Input
CTS+	Clear to Send Positive	9	Input
CTS-	Clear to Send Negative	8	Input

Technical Note: Please terminate any control signals that are not going to be used. The most common way to do this is connect RTS to CTS and RI. Also, connect DCD to DTR and DSR. Terminating these pins, if not used, will help insure you get the best performance from your adapter.

MIDI

Signal	Name	Pin #	Mode
MTX +	Transmit Data +	5	Output
MTX-	Transmit Data -	9	Output
GND	Ground	2,6	
MRX+	Receive Data +	4	Input
MRX-	Receive Data -	8	Input
MIDI Thru +		3	Output
MIDI Thru -		7	Output

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 50º C (32º to 122º F)	-20º to 70º C (-4º to 158º F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Power Consumption

Supply Line	Product	Rating (mA)
+5 VDC	3500	60 mA
+5 VDC	3501	125 mA
+5 VDC	3502	125 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

The **SIO-104** is PC/104 "Compliant" meaning that it conforms to all non-optional aspects of the PC/104 Specification, including both the mechanical and the electrical specifications.

Board Length	3.775 inches	(9.588 cm)
Board Width	3.550 inches	(9.017 cm)

Appendix A - Troubleshooting

A Serial Utility Diskette is supplied with the Sealevel Systems adapter and will be used in the troubleshooting procedures. By using this diskette and following these simple steps, most common problems can be eliminated without the need to call Technical Support.

1. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.

2. Configure your Sealevel Systems adapter so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address. Refer to the section on Card Setup for help in choosing an I/O address.

3. Make sure the Sealevel Systems adapter is using a unique IRQ. While the Sealevel Systems adapter does allow the sharing of IRQs, many other adapters (i.e. SCSI adapters & on-board serial ports) may not. The ability to share IRQs in a PC/104 system is an optional feature and does not need to be implemented to claim PC/104 compatibility/compliance. The IRQ is typically selected via an on-board header block. Refer to the section on Card Setup for help in choosing an IRQ.

4. Make sure the Sealevel Systems adapter is securely installed in a PC/104 stack .

5. Use the supplied diskette and User Manual to verify that the Sealevel Systems adapter is configured correctly. The supplied diskette contains a diagnostic program “SSD” that will verify if an adapter is configured properly. This diagnostic program is written with the user in mind and is easy to use. Refer to the “README.txt” file on the supplied diskette for detailed instructions on using “SSD”.

6. The following are known I/O conflicts:

    - The 278 and 378 settings may conflict with your printer I/O adapter.
    - 3B0 cannot be used if a Monochrome adapter is installed.
    - 3F8-3FF is typically reserved for COM1:
    - 2F8-2FF is typically reserved for COM2:
    - 3E8-3EF is typically reserved for COM3:
    - 2E8-2EF is typically reserved for COM4: This is a valid setup option for the **SIO-104.** However, since only 10 address lines are actually decoded, a possible conflict with an advanced video card emulating the IBM XGA adapter (8514 register set) may occur.

Appendix B - How To Get Assistance

Please refer to Appendix A - Troubleshooting prior to calling Technical Support.

1. Read this manual thoroughly before attempting to install the adapter in your system.
2. When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the adapter installed in a computer ready to run diagnostics.
3. Sealevel Systems maintains a Home page on the Internet. Our home page address is www.sealevel.com. The latest software updates, and newest manuals are available via our FTP site that can be accessed from our home page.
4. Sealevel Systems maintains a forum on CompuServe providing utilities and new product information. This forum is accessed by typing 'GO Sealevel' at the command prompt.
5. Technical support is available Monday to Friday from 8:00 a.m. to 5:00 p.m. Eastern time. Technical support can be reached at (864) 843-4343.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

Appendix C - Electrical Interface

RS-232

Quite possibly the most widely used communication standard is RS-232. This implementation has been defined and revised several times and is often referred to as RS-232 or EIA/TIA-232. The IBM PC computer defined the RS-232 port on a 9 pin D sub connector and subsequently the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard is defined as the *9-Position Non-Synchronous Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*. Both implementations are in wide spread use and will be referred to as RS-232 in this document. RS-232 is capable of operating at data rates up to 20 Kbps at distances less than 50 ft. The absolute maximum data rate may vary due to line conditions and cable lengths. RS-232 often operates at 38.4 Kbps over very short distances. The voltage levels defined by RS-232 range from -12 to +12 volts. RS-232 is a single ended or unbalanced interface, meaning that a single electrical signal is compared to a common signal (ground) to determine binary logic states. A voltage of +12 volts (usually +3 to +10 volts) represents a binary 0 (space) and -12 volts (-3 to -10 volts) denotes a binary 1 (mark). The RS-232 and the EIA/TIA-574 specification defines two type of interface circuits, Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE). The Sealevel Systems adapter is a DTE interface.

RS-422

The RS-422 specification defines the electrical characteristics of balanced voltage digital interface circuits. RS-422 is a differential interface that defines voltage levels and driver/receiver electrical specifications. On a differential interface, logic levels are defined by the difference in voltage between a pair of outputs or inputs. In contrast, a single ended interface, for example RS-232, defines the logic levels as the difference in voltage between a single signal and a common ground connection. Differential interfaces are typically more immune to noise or voltage spikes that may occur on the communication lines. Differential interfaces also have greater drive capabilities that allow for longer cable lengths. RS-422 is rated up to 10 Megabits per second and can have cabling 4000 feet long. RS-422 also defines driver and receiver electrical characteristics that will allow 1 driver and up to 32 receivers on the line at once. RS-422 signal levels range from 0 to +5 volts. RS-422 does not define a physical connector.

RS-485

RS-485 is backwardly compatible with RS-422; however, it is optimized for partyline or multi-drop applications. The output of the RS-422/485 driver is capable of being **Active** (enabled) or **Tri-State** (disabled). This capability allows multiple ports to be connected in a multi-drop bus and selectively polled. RS-485 allows cable lengths up to 4000 feet and data rates up to 10 Megabits per second. The signal levels for RS-485 are the same as those defined by RS-422. RS-485 has electrical characteristics that allow for 32 drivers and 32 receivers to be connected to one line. This interface is ideal for multi-drop or network environments. RS-485 tri-state driver (not dual-state) will allow the electrical presence of the driver to be removed from the line. Only one driver may be active at a time and the other driver(s) must be tri-stated. The output modem control signal RTS controls the state of the driver. Some communication software packages refer to RS-485 as RTS enable or RTS block mode transfer. RS-485 can be cabled in two ways, two wire and four wire mode. Two wire mode does not allow for full duplex communication, and requires that data be transferred in only one direction at a time. For half-duplex operation, the two transmit pins should be connected to the two receive pins (Tx+ to Rx+ and Tx- to Rx-). Four wire mode allows full duplex data transfers. RS-485 does not define a connector pin-out or a set of modem control signals. RS-485 does not define a physical connector.

MIDI

The MIDI (Musical Instrument Digital Interface) specification grew out of the need for electronic musicians to link together synthesizers, drum machines, and all manner of other electronic instruments. Until the implementation of MIDI, each manufacturer of electronic musical equipment had it's own proprietary method of passing data. With MIDI, a universal language for synthesizer control could be adopted by all manufacturers. MIDI was introduced in 1983 and very quickly was considered the standard for passing data between musical instruments. The MIDI specification has been continually updated and in 1987 was edited to include MIDI Time Code and in 1992 MIDI Machine Control. The MIDI specification is administered by the MIDI Manufactures Association. From a hardware stand point, MIDI is a simple current loop data signal traveling serially at 31.25K bits per second. MIDI defines the mechanical connector as a 5 pin DIN connector. There are only two ways to connect the instruments with cables: MIDI-IN on one instrument to MIDI-OUT on another or connect the MIDI-THRU to the MIDI-IN. The MIDI-THRU cable "echoes" or re-transmits the data from the MIDI-IN port, thus providing a means of "daisy chaining" MIDI instruments.

Appendix D - PC/104

What is PC/104?

The PC has become extremely popular in both general purpose (desktop) and dedicated (embedded) applications. Unfortunately the PC has been hampered by the large size required to maintain PC compatibility. PC/104 addresses this by optimizing the PC bus in a form factor designed for embedded applications.

Briefly, the key differences between PC/104 and the standard "AT" or ISA bus computer are as follows:

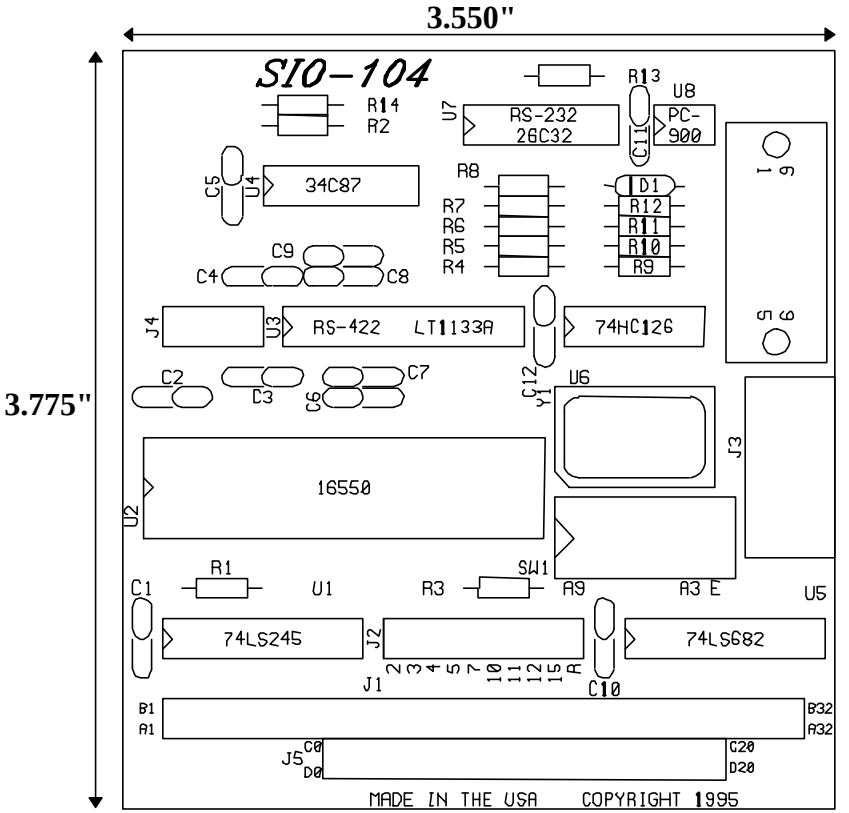
- Reducing the form factor, to 3.550 by 3.775 inches
- Eliminating the need for backplanes or card cages, through its self-stacking bus
- Minimizing component count and power consumption (typically 1-2 Watts per module) by reducing required bus drive on most signals to 4 mA.

Sealevel Systems has been a member of the PC/104 Consortium since its inception. Also Sealevel Systems has two members on the working group that is currently having the PC/104 bus approved by the IEEE as P996.1.

Questions about the PC/104 Consortium can be sent to:

PC/104 Consortium
P. O. Box 4303
Mountain View, CA 94040
(415) 903-8304 Ph. (415) 967-0995 Fax
www.controlled.com/pc104

Appendix E - Silk-Screen



Appendix F - Schematic

Warranty

Sealevel Systems, Inc. provides a lifetime warranty for this product. Should this product fail to be in good working order at any time during this period, Sealevel Systems will, at it's option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster.

Sealevel Systems assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Sealevel Systems will not be liable for any claim made by any other related party.

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Technical Support is available from 8 a.m. to 5 p.m. Eastern time.
Monday - Friday

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