Marine Sonic Technology, Ltd.

5508 George Washington Memorial Hwy. • White Marsh, VA 23183

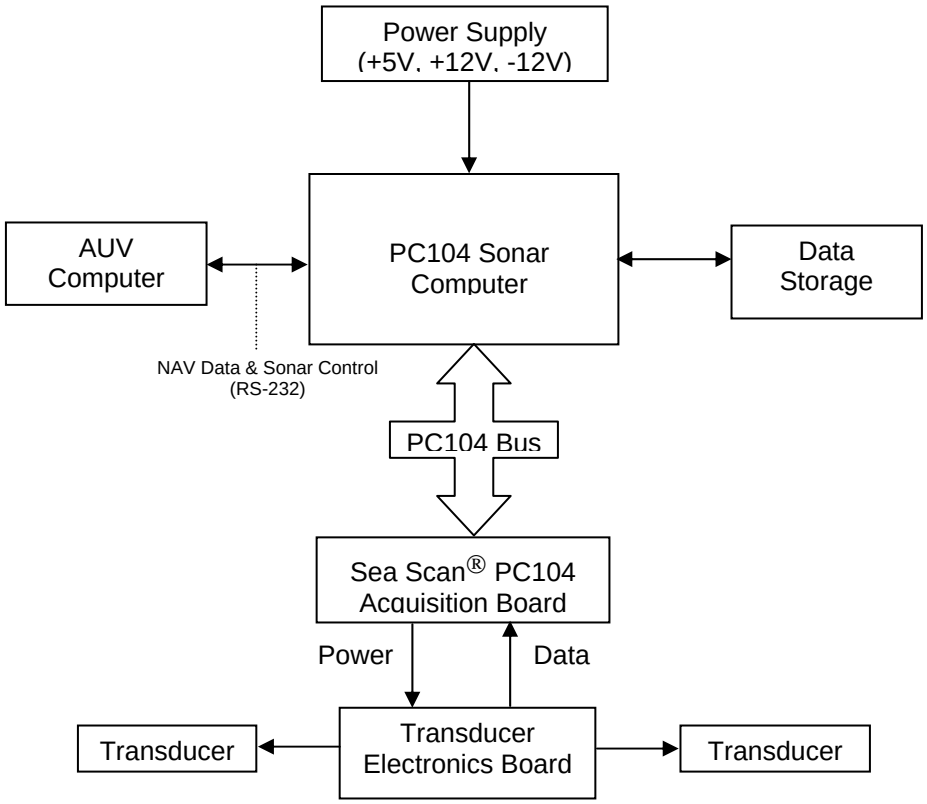
Sea Scan PC in Embedded Applications

Purpose:

The intent of this document is to answer many of the common questions regarding the typical installation of Sea Scan PC in an un-manned configuration (e.g. AUV, UUV, etc). This document discusses the selection of support hardware/software and common installation problems.

This document is not intended to be an instruction manual for the installation of Sea Scan PC. Most systems of this type are custom installations. As such, we can not provide a single exacting set of installation guidelines.

Hardware:



System Level Block Diagram

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Acquisition System Hardware

Our system utilizes a PC104-based acquisition card (SSPC104) that uses a 16-bit PC104 bus for data transfer. The SSPC104 card provides:

- Data acquisition timing
- Analog to digital signal conversion
- Power to transducer electronics

Like any PC104 card, the SSPC104 requires a computer with a PC104 bus onboard. In addition to this, here are a few minimum requirements:

- 16bit PC104 bus
- 200Mhz CPU
- 128Mb RAM
- Mass Storage (Hard Disk or Compact Flash Card)
- Serial port
- Windows 95/98/ME/XP
- Sea Scan PC software

Sea Scan PC software is required to operate the SSPC104 acquisition card. It has features built in specifically designed to accommodate embedded operations such as those found on un-manned systems. These features include a remote-control interface (Host-Remote) and an Auto-Gain function that automatically adjusts the time-varying-gain without user intervention.

The mass storage device that holds Windows is typically the same drive where the sonar data is stored. This is typically a 2.5” laptop-type hard disk drive though one could use a compact flash card if the computer supported it.

Typically installations have a dedicated side scan sonar computer. This helps to reduce and/or avoid bus, software and electrical noise conflicts.

Power Requirements

The SSPC104 acquisition card requires the following voltages:

- +5 VDC, 100mA typical
- +12 VDC, 250mA typical
- -12 VDC , 30mA typical

These voltages are part of the PC104 bus specification. Please note that a number of PC104 I/O cards do not require a -12VDC supply and thus some “PC104-compliant” power cards fail to provide this. The SSPC104 card will not operate correctly without this supply.

The transducer electronics power is provided by a small DC/DC converter that is integrated onto the SSPC104 card.

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Transducer Hardware

The transducer electronics are responsible for creating an acoustic pulse and receiving the responses. It is connected to the SSPC104 acquisition card. The SSPC104 card provides the transducer electronics with power, a trigger and frequency select commands and receives the resulting amplified sonar signal.

Typical Noise Sources

Our system is designed to amplify very small electrical signals and display them. Unfortunately, other sources of electrical signals can be amplified and interfere with the image quality. These noise sources need to be handled properly to reduce their affect on the system.

Typical noise sources include (but are not limited to):

- Radiated (RF)
- Power supply ripple
- Common mode ripple

The transducer electronics are the most noise-sensitive part of our system. This is where most of the signal amplification occurs. In most systems, the transducer electronics are installed in the main dry-housing along with the sonar computer. To help prevent radiated electrical noise from affecting the sonar data, it is best to keep it as far away from other electronics as possible. Some of our customers put it on the back-side of their grounded chassis to help shield it from other active electronic noise sources.

Our newest transducers/electronics have a limit on the distance from the transducer electronics to the transducer of ~1 meter to maintain optimum conditions. If any longer distances are required, the system will still operate but the image quality will begin to be degraded.

Another method is to use separate external transducer modules which integrate the transducer electronics into the transducers themselves. External standalone transducer modules do help reduce noise transmitted by proximity but may not solve all noise problems. External modules are typically custom made to your specifications.

Our experience is that most noise problems originate at the power supply. Most DC/DC supplies switch at frequencies that are right in our band-pass. If this is allowed to get to our electronics it will be amplified and displayed.

Here is a list of suggestions for helping reduce noise. Not all of these may be required and some of these extremely difficult to accomplish but they are still listed for reference.

- Use a power supply with a switching frequency below 60 kHz or above 1.8 MHz.
- Use BIG common mode chokes on ALL of the supply inputs and outputs
- Isolate (via distance and/or shielding) the transducer electronics from other electronics
- Do not place any other electronics or magnetic components over our SSPC104 card (our A/Ds are close to the top of our card).
- Carefully place and route any electronics, magnetic components, or cabling with any high frequency signals.

If you follow good EMI practices and the suggestions above, noise will probably not be an issue in the first place. If electrical noise still exists, we can work with you to find a solution.

External Sonar Interference

Some sonar systems can cause acoustic interference with our system. If other sonar systems are installed on board, care must be taken to ensure they do not affect our image collection. There are a number of ways to accomplish this. Here are a few:

- Use systems with frequencies very different from ours (i.e. if you have a 600kHz side scan, make the other system a 150kHz)
- Disable them during side scanning operations
- Synchronize their acoustic pulse with our own

We provide an external synchronization pulse that will allow other systems to know when we are collecting data. This sync pulse occurs every time our sonar system transmits a burst of sound.

Our ping rates can vary (depending on vehicle speed) from 1Hz up to 60Hz. This can far exceed the typical sonar ping rates. As such, it may be required to decimate our sync pulse (i.e. divide it down) so that the other sonar system only transmits after N number of our pings.

Software:

Host-Remote

Sea Scan PC is controlled remotely using our Host-Remote interface. This gives one the ability to change sonar collection parameters (e.g. range, frequency, and gain) during embedded operation. This communication typically takes place through a standard RS232 port but Sea Scan PC can utilize any communication scheme in which Windows assigns a COM port (i.e. RS422, RS485).

The full host-remote specification can be found at this URL:
http://www.marinesonic.com/documents/hostremotemanualv1.7.2.pdf

NMEA Data Input

We recommend that other navigation information be provided in the form of NMEA sentences (NMEA0183 v1.5) over a second serial port. These inputs are integrated into the data we collect and will enable extra features in the software that would previously be unavailable or inaccurate.

These features include:

- Aspect ratio correction
- Geo-referencing sonar data.
- Time Synchronization
- Accurate along-track measurements

We can take in Latitude, Longitude, course over ground (COG), speed over ground (SOG), depth and altitude. We do not currently accept or utilize roll/pitch inputs.

The set of strings that would work best are:

- RMC Contains Latitude, Longitude, COG, and SOG
- DPT Provides water depth and transducer offset
- HDT Carries the current compass heading
- ZDA For time synchronization

We can take a modified interpretation of the DPT sentence where the transducer offset is water depth (from the surface to the boat) and the water depth is the altitude (from the floor to the boat).

For best results, the Latitude/Longitude should be accurate to at least to 4 to 5 decimal places.

When using the ZDA sentence, the time zone environment variable needs to be set in the sonar computer. There are instructions located in the appendix of our operator's manual in the section titled "Setting the Time Zone". We recommend setting the time zone to GMT.

Our system uses the SOG to calculate the appropriate ping-rate to maintain a 1:1 aspect ratio. You can operate the system without this input, but you will need to be able to approximate the SOG of the vehicle in order to collect quality images. If the actual SOG and the manually entered SOG are significantly different, the collected data will be distorted.

Other NMEA inputs are supported but not covered in this document. For more information, please refer to the Sea Scan PC v1.8 Operators Manual that can be found here:

http://www.marinesonic.com/documents/seascanpcoperatorsmanualv1.8.0.pdf

Data Format

The data is stored in a MSTIFF file format. We have this format described in detail here:

http://www.marinesonic.com/documents/mstiff.pdf.

You are welcome to write any code to read this format or you can use our review software.

Other Resources:

Our website has miscellaneous documents that can assist in the selection and installation of Sea Scan PC. These documents can be found in both the "Downloads" and the "Maintenance" pages.

http://www.marinesonic.com/

We are available to aide in the installation and/or troubleshooting of our systems. This type of support is a standard part of our product offering. We have worked with many companies to ensure their success in using our system.

Please feel free to contact us for more information