



3DSS-DX-450 AUV Integration Guide

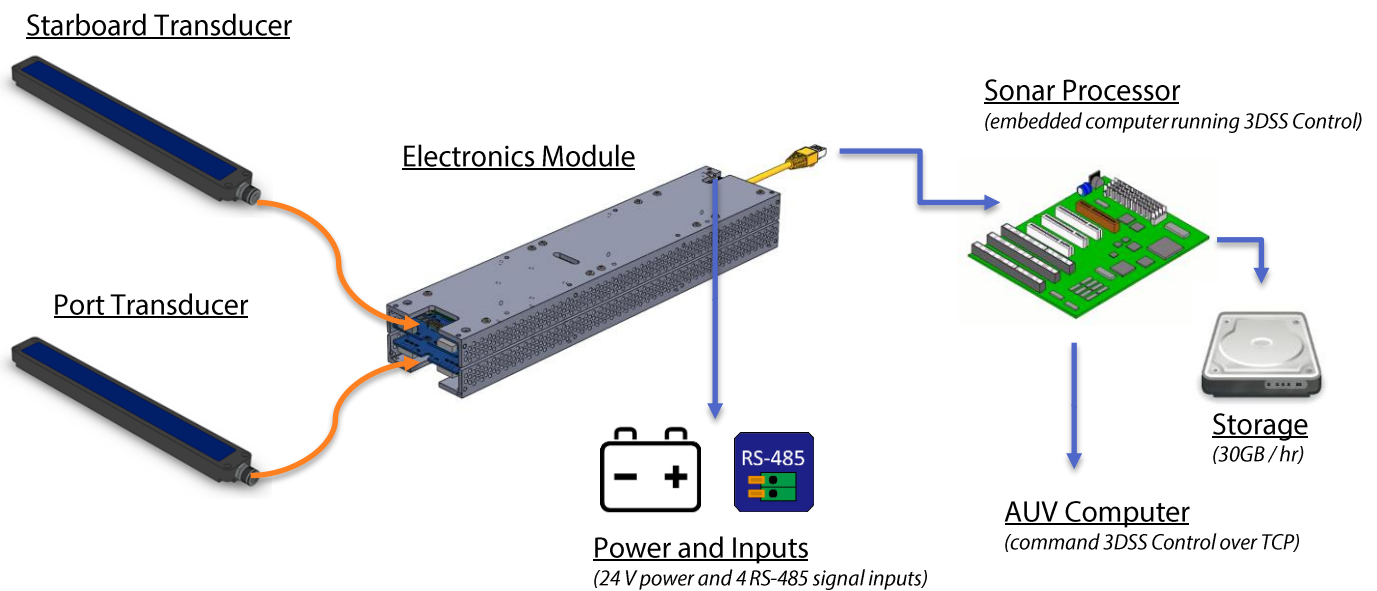
Revision 1.1 – 29 March 2017

SUMMARY

This guide describes mechanical, electrical, and software aspects of integrating the OEM variant of the 3DSS-DX-450 sonar on AUVs. The guide is a work-in-progress and any additional questions should be sent to mark@pingdsp.com for inclusion in this guide.

BLOCK DIAGRAM

Below is a general diagram of the 3DSS system and how it functions.



COMPONENTS

The 3DSS AUV package consists of

- two transducers with pig-tails and underwater connectors,
- two bulkhead mates for the underwater connectors with DF-13 connectors to electronics, and
- an electronics module consisting of a set of boards packaged in an aluminum cage.

TRANSDUCER – VT 100M

The 3DSS AUV transducers need to be mounted on the outside of the vehicle with a 20 to 30 degree tilt away from horizontal and an unobstructed acoustic front face. There are two transducers, one for port and one for starboard, both are interchangeable. Each transducer has a 15" cable with a diameter of 0.40" (*Trex-Onics #68809* [\[REF\]](#)) and a right-angle Teledyne Impulse connector (*MKS(W)-419-CPP / RA* [\[REF\]](#)).

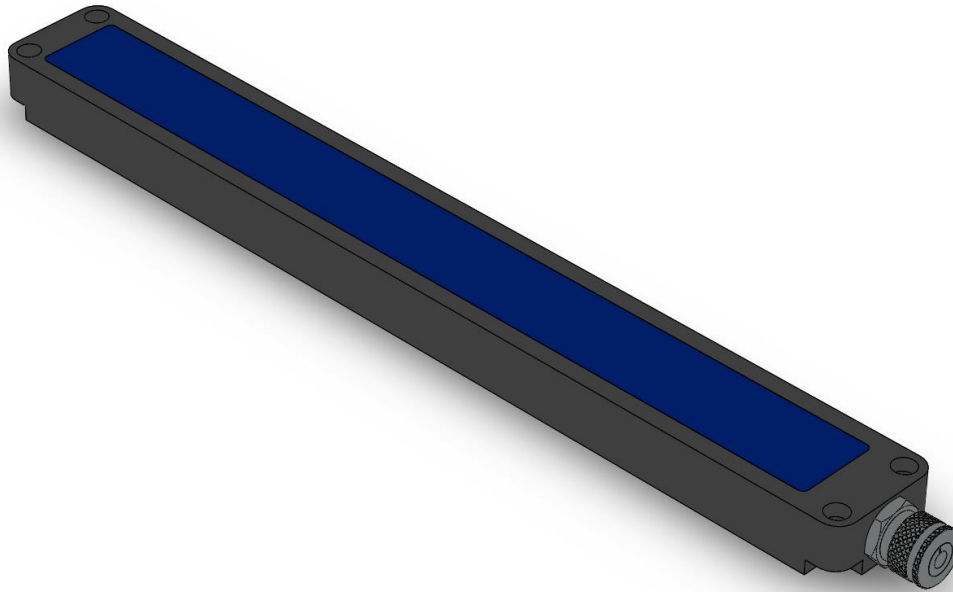


FIGURE 1. 3DSS AUV TRANSDUCER – VT 100M

The depth rating of the standard 3DSS AUV transducer is 100m, and should not be exceeded.

- Dimensions: 44cm x 5cm x 2.5cm 17.4" x 2.0" x 1.0"
- Weight: 1.1kg in air 2.4 lbs in air
- Volume: 530 cm³ 32 inch³
- Depth rating: 100m 330 ft

An optional 4000m transducer is being developed with goal of being identical in size.

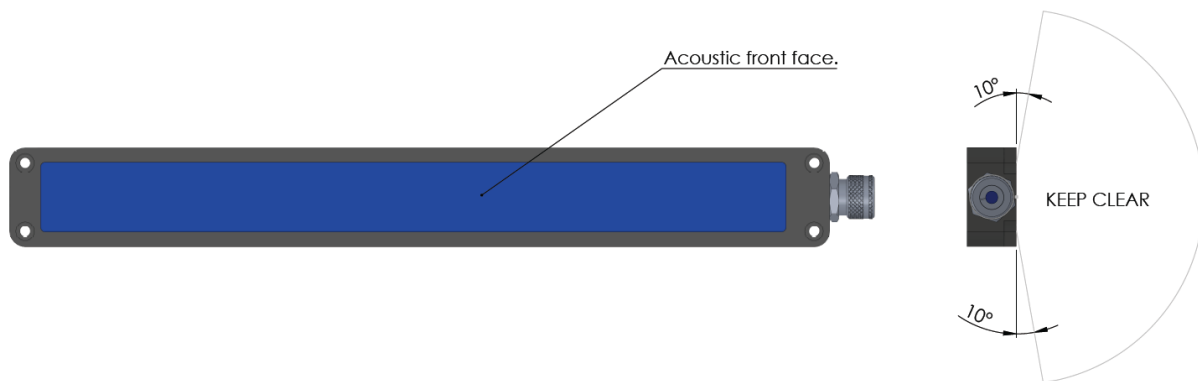
FIGURE 2. VT TRANSDUCER DIMENSIONS IN **INCHES**

FIGURE 3. UNOBSTRUCTED ACOUSTIC FRONT FACE

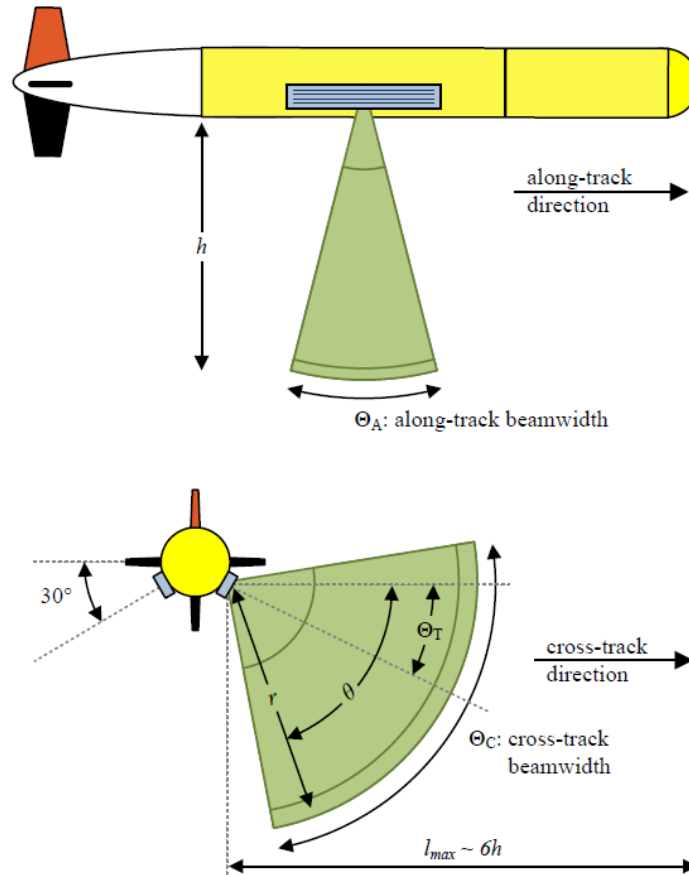


FIGURE 4. TYPICAL AUV TRANSDUCER MOUNTING / GEOMETRY

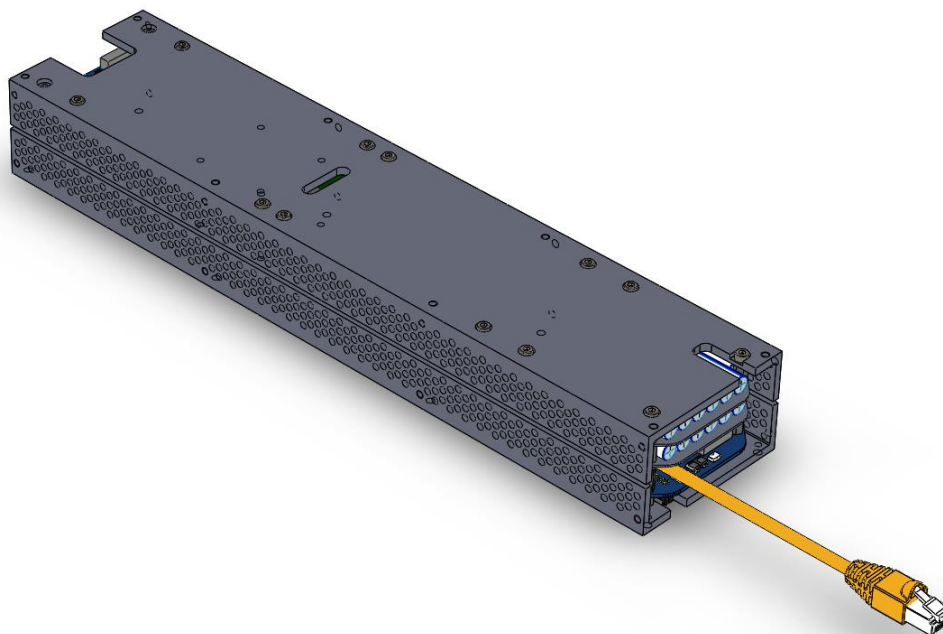
TRANSDUCER BULKHEAD CABLE ASSEMBLY – VT 100M AND 4000M

The transducer bulkhead cable assembly connects the transducer to the electronics. One end of the assembly features a Teledyne Impulse connector and the other end is wired to a Hirose DF13-20DS-1.25C connector.

[INSERT FIGURE SHOWING BULKHEAD CABLE ASSEMBLY]

3DSS ELECTRONICS MODULE – VT

The 3DSS electronics module is an acoustic data acquisition and pulse transmission electronics platform. The two 3DSS transducers (one for port and one for starboard) connect to it. Apart from the two transducers, the electrical interface also has two other connectors. One is a Hirose DF-11 connector through which the module is powered and auxiliary NMEA data is inserted into the sonar data stream. The second is an Ethernet interface to control the sonar and transfer sonar data. The module requires an Ethernet connection to a Windows 7+ computer for control, processing, and data storage.



The electronics module specs are as follows:

○ Dimensions:	36 cm x 8 cm x 5cm	14.1" x 3.1" x 1.9"
○ Weight:	1.4 kg	3.1 lb
○ Power:	24 V DC Input \pm 10%	
	0.7A to 0.9A average	3A periodically (10% duty cycle)
	<i>Recommended DC-DC regulator:</i>	Murata UQQ-24/4-Q12PB-C
	<i>Optional inline ferrite:</i>	Würth P/N: 74270113
		Digi-Key: 811-1889-5-ND
		Digi-Key: 732-1518-ND

Mounting of the electronics module can be done using 8 6-32 threaded holes on the top or bottom face of the sonar module. Alternatively it can also be mounted using 8 6-32 threaded holes on the perforated sides of the sonar module. **CAUTION: Please ensure the length of the 6-32 screws is sufficiently short not to damage / impact the components or boards in the electronics module.**

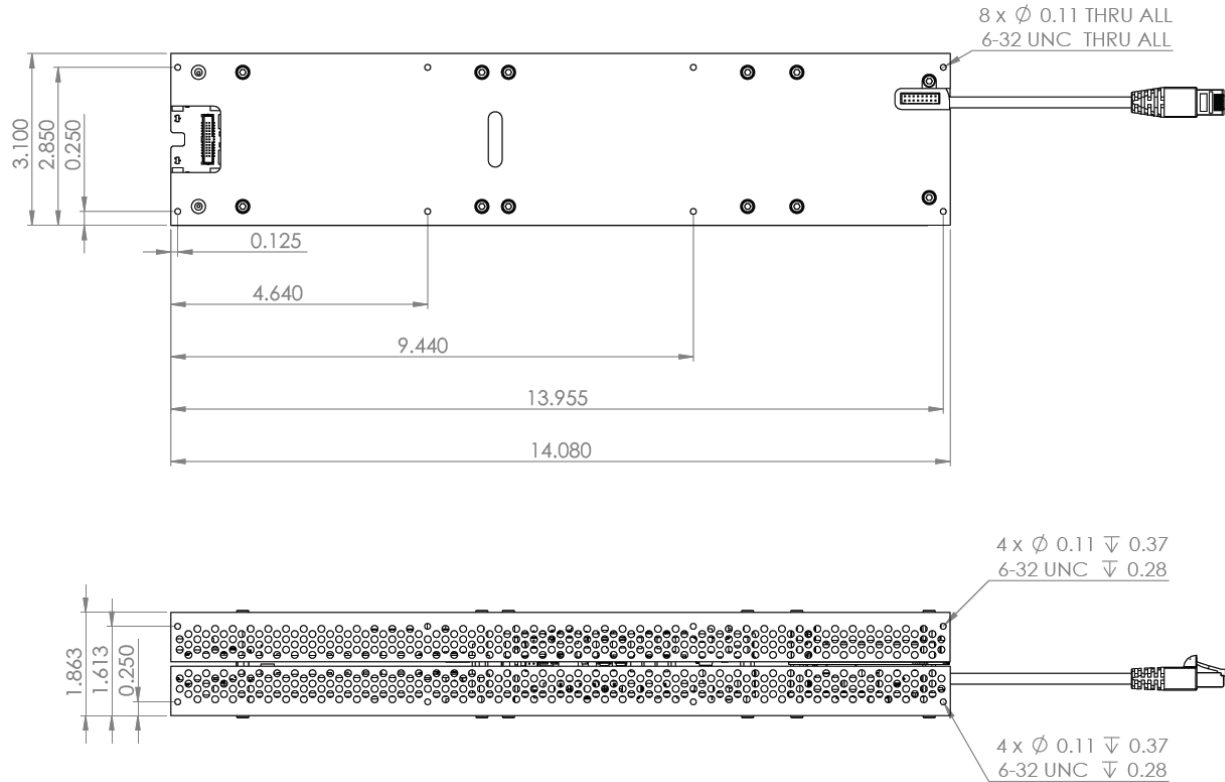
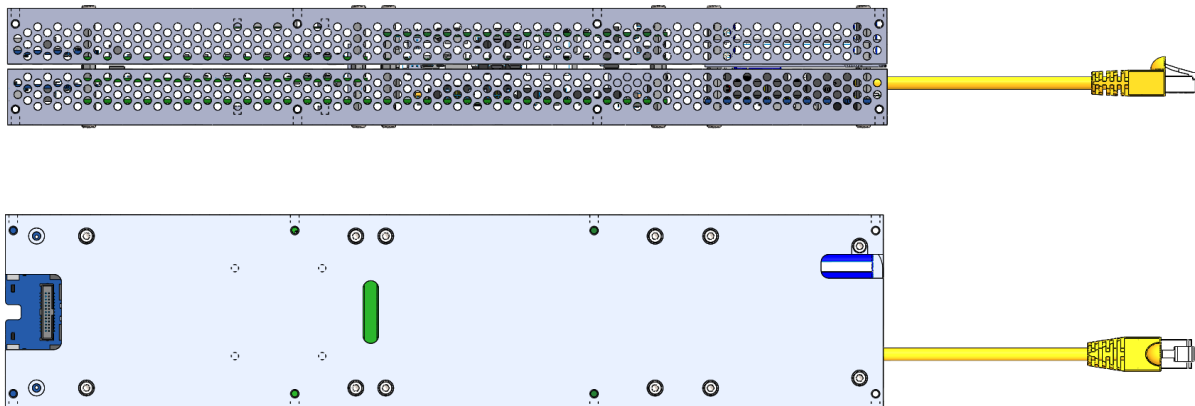
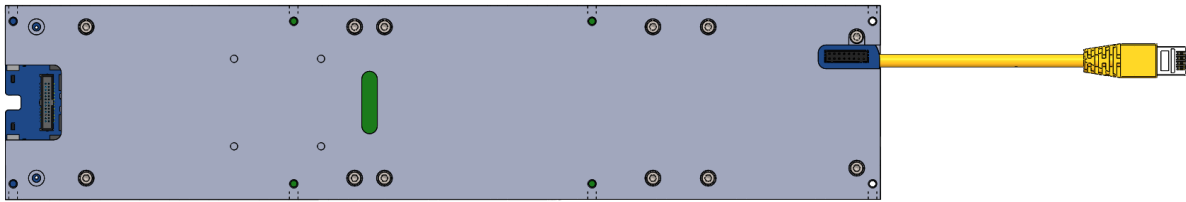
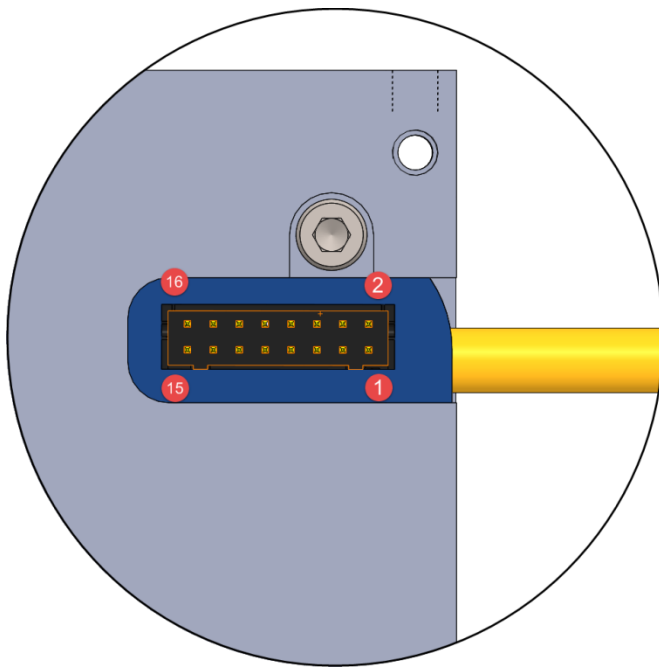


FIGURE 5. 3DSS SONAR MODULE DIMENSIONS AND MOUNTING POINTS





Power of the 3DSS electronics module is provided through a 16 pin Hirose DF-11 connector. The module expects a regulated 24V voltage. The module also has inputs for an external trigger line, an optional PPS signal for time synchronization, and two NMEA inputs for inserting auxiliary data into the sonar stream. All 4 of these inputs expect RS-422 / RS-485 signal levels.



1. 24V power +/- 10%
2. 24V power +/- 10%
3. 24V ground
4. 24V ground
5. not connected
6. not connected
7. RS485 signal ground (isolated from power ground)
8. RS485 signal ground (isolated from power ground)
9. RS485 Port A – Line B – (external trigger)
10. RS485 Port A – Line A +, (external trigger)
11. RS485 Port B – Line B – (optional PPS signal)
12. RS485 Port B – Line A +, (optional PPS signal)
13. RS485 Port C – Line B – (NMEA input 38400 bps)
14. RS485 Port C – Line A +, (NMEA input 38400 bps)
15. RS485 Port D – Line B – (NMEA input 115200 bps)
16. RS485 Port D – Line A +, (NMEA input 115200 bps)

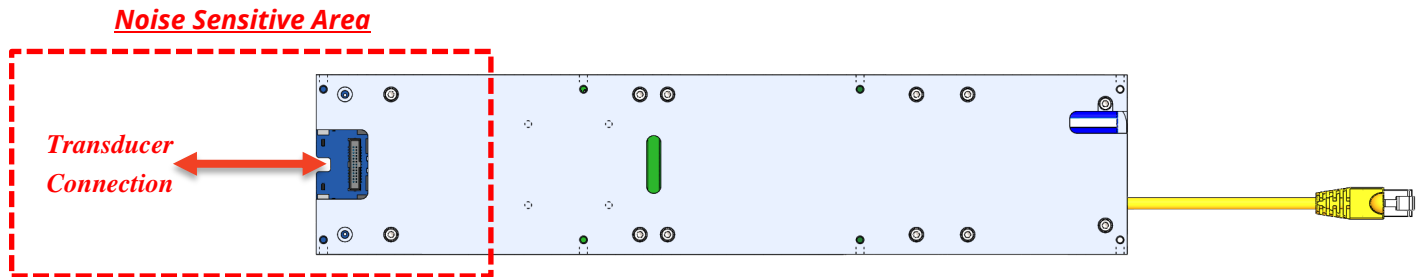
The external trigger input can be used to synchronize the pinging of the 3DSS sonar with the pinging of other devices. The sonar triggers on a positive edge of the external trigger line when the system is configured in external trigger mode using the 3DSS Control application.

The auxiliary NMEA inputs are pre-configured for specific baud rate and will accept serial NMEA-0183 data, where each sentence begins with a '\$' sign and ends with a CR (0x0D) or LF (0x0A). Each sentence will be time-stamped with the sonar time when it arrives, and inserted into the 3DSS data stream and finally written with each ping in the 3DSS-DX file being recorded. With 3DSS Control version 0.2.836 or greater, all NMEA sentences sent over UDP port 23841 to the computer running 3DSS Control will also be inserted into the 3DSS data stream.

The final connection to the 3DSS electronics module is Ethernet. The electronics module is assembled with a 1m flat CAT-5e Ethernet cable, and must be connected to a sonar processor. This connection can be made directly into

the network adapter (NIC) on the sonar processor or through an Ethernet switch. In both cases, the 3DSS electronics module uses IP address 192.168.228.1 and the NIC on the sonar processor should be set to use a static IP in the 192.168.228.x range. Once power is applied to the electronics module and an Ethernet link is established (typically takes 30 seconds), the module will respond to ICMP echo requests (commonly called pings). Pinging the electronics module using the command 'ping 192.168.228.1' is a good way to establish that it is up and running.

The electronics module has an integrated motion reference unit (MRU) which needs to be programmed with the correct orientation before shipping; therefore the orientation in which the module will be installed must be provided to Ping DSP prior to shipping the unit.



The area at the transducer end of the electronics module is sensitive to noise, as is the connection between the transducer and electronics module since it carries low amplitude analog signals. It is recommended to keep power lines and digital data lines away from this area.

SOFTWARE

The 3DSS-DX-450 sonar is controlled by 3DSS Control which also processes and records 3DSS data to disk at a rate of approximately 10MB/s. The 3DSS Control application must be installed on a computer dedicated to sonar processing or optionally it can be installed on a computer that is used to run the AUV if that computer runs Windows 7 or higher (embedded is okay). Please refer to the 3DSS-DX-450 sonar manual for sonar operation.

The computer requirements for 3DSS Control vary depending on whether the 3DSS Control will be used to both process and store 3DSS data, or only store 3DSS data for later processing. To both process and store data, 3DSS Control requires a dual-core 1.8 GHz computer, and will likely use the majority of resources on that computer. To reduce the load, 3D processing can be disabled in 3DSS Control by setting the *Threshold* value in the *Sidescan 3D* settings to **0 dB**.

3DSS Control has a TCP interface through which it can be programmatically controlled. To learn more about this interface please refer to the PDF document "3DSS-DX-Control Command Interface Guide".

Computer requirements:

- Intel or AMD X86-64 Dual-core 1.8 GHz or better.
- Windows 7 or higher, 64-bit preferably, embedded okay.
- RAM as required by Windows version (3DSS Control uses very little RAM, 250MB max).

- 100 Mbps or 1 Gbps Ethernet network adapter. Ethernet interface connected to 3DSS electronics module must be set to static IP 192.168.228.x where $x > 1$.
- Storage of 30GB for each hour of operation. Data can be written to an external USB device provided the device can sustain a write rate of 10MB/s. Recommended to use an SSD for storage, such as Samsung T3 portable SSD, which allows for removal of data from the AUV and very quick copying of data (400MB/s or 40x).

ADDITIONAL INFORMATION

Please contact mark@pingdsp.com for additional information.