

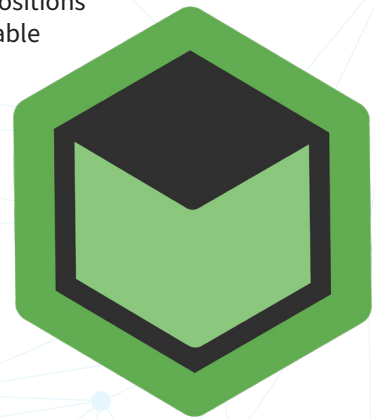
4G USE® Headless

Cross Platform Application Software Development Kit (SDK)

Live Autonomous Perception with Echoscope PIPE® Technology

4G USE® Headless is a software application employing the communication, control, and data integration components from Coda Octopus 4G USE® application – a full-featured, multi-device, Echoscope®, LiDAR, navigation, pan-and-tilt, control, acquisition, processing, and display software. 4G USE®, and hence 4G USE® Headless, can integrate Echoscope® range and intensity data, with platform navigation and orientation data, and with angular offsets from any Coda Octopus pan-and-tilt unit, can apply speed of sound corrections and compute global XYZ positions for every beam in Echoscope® data, all in real-time. This data is then made available over a UDP network interface.

4G USE® Headless has been developed as a non-Graphical User Interface (non-GUI) based application (i.e. “headless”) making it ideal for integrating into third party applications that wish to control and acquire Echoscope® data without the need to develop their own 3D XYZ processing. The application allows OEM third parties to control one or more Echoscope®, and the Rotators they may be mounted on, via a simple command-line style interface over Ethernet. Since the interface employs simple commands, integration is possible using many different programming languages and/or operating systems.



Key capabilities include:



Windows and Linux Support, Including Embedded ARM Systems

Runs on Windows 11 and Ubuntu Linux, with support for both AMD64 and ARM64 processor architectures - ideal for embedded and edge compute environments



Navigation, Attitude and Speed of Sound Sensor Integration

Merge real-time position, attitude and speed of sound data with the sonar data to generate globally referenced live point cloud data



4G USE® Feature Set Including Sequencer

A streamlined, headless design enables direct control via a simple API, allowing autonomous systems to manage all sonar functions without a human operator



Live XYZ and Intensity Output to Third Party Applications

Output live point cloud data to third-party applications, enabling real-time perception and automated decision making. Multiple data streams filtered by View allow data to be filtered for specific applications.



Coda Octopus Rotator (IPT and ISAR) Support

Supports the Coda Octopus range of Rotators, such as the Integrated Pan & Tilt (4G IPT) and the Integrated Single Axis Rotator (4G ISAR), allowing the Operator to control their Sonar with up to ±90° Tilt and ±180° Pan Motion



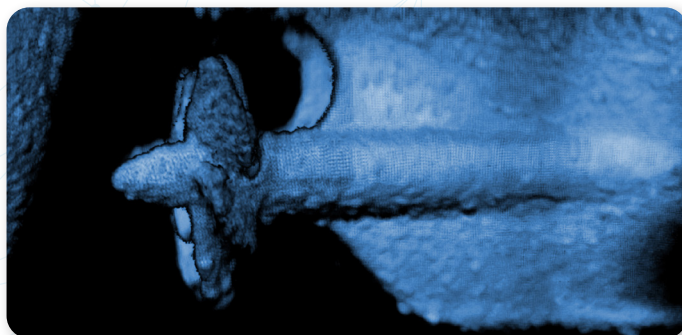
Coda Octopus 4G USE® Processor Support for Visualization and Data Processing

Recorded data is fully compatible with fully-featured 4G USE® Replay for beam editing, navigation processing, area mosaicking and reporting deliverables.

4G USE® Headless Cross Platform Application Software Development Kit (SDK)

The main 4G USE® Headless Application is provided with comprehensive instructions for installation on different operating systems, and with a software development kit that will allow you to write and interface for your software package. We also provide a Virtual Training Room (VTR) with Video Training Materials.

Communication with 4G USE® Headless is conducted over UDP via a simple set of ASCII commands. 4G USE® Headless Application will record data in a format that is compatible with our regular 4G USE® software, allowing you to perform review, post-processing and reporting tasks from within our fully featured, tried-and-tested software package. 4G USE® Headless Application can also output georeferenced 3D point cloud data for live consumption by your autonomous package, which can feed into live decision-making processes and be recorded for reporting afterwards.

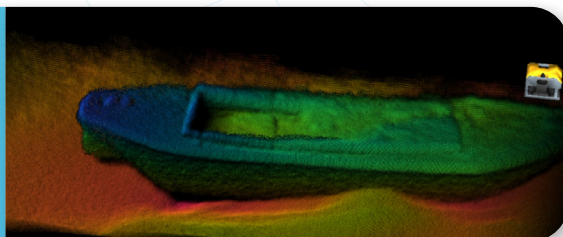


4G USE® Headless Application also benefits from our intelligent object detection algorithm and can provide live range and bearing information over UDP, helping your platform avoid obstacles or stay on target.

We will also provide a license for our industry-leading 4G USE® software for data review and processing (Replay Module only (Not Live)). Also included will be a project configurator license, which allows you to define all of the inputs and outputs needed for your project, define coordinate systems, and configure network adapters etc. This project will then be copied across to the machine that will run the 4G USE® Headless Application.

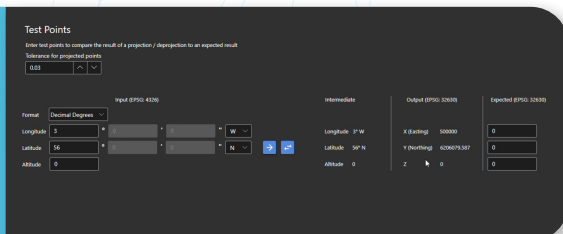
REPLAY LICENSE:

- Review Data Recorded with Headless 
- Full Range of Data and Navigation Processing 
- Comprehensive Suite of Reporting Tools and Output Options 



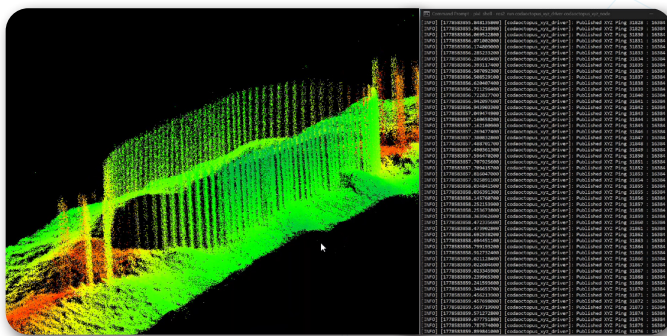
CONFIGURATOR LICENSE:

- Easily Define Input and Output for Live Operation 
- Define Coordinate Reference System per Project Requirements 



Echoscope PIPE® XYZ ROS Driver

To assist with integrations for users of the Robot Operating System (ROS) environment, we provide a ROS driver that will read our XYZ and intensity data stream. This plug-and-play feature makes it easy to get live data into your system. It is backwards-compatible with regards to our XYZ format, allowing you to import either the Version 1, or to take advantage of the new Version 2, with it reduced bandwidth requirements, and the capacity to filter data based on Sequencer View, allowing tailored data streams to be applied to specific applications.



Plug-and-Play Compatibility with Existing ROS Environments



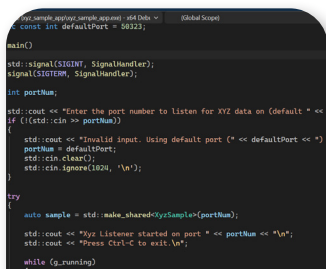
Cross Platform- Compatible with Linux or Windows® ROS Implementations



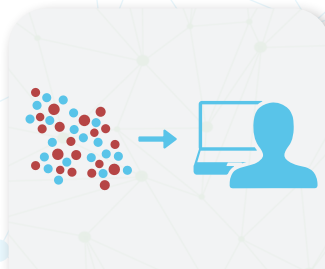
Cross Platform- Compatible with Linux or Windows® ROS Implementations

Sample Application

For Integrations where ROS is not in use, we can provide a sample application that illustrates how to parse the XYZ stream and reconstruct the 3D ping data.



Example Code (C++) to parse XYZ data stream and construct pings



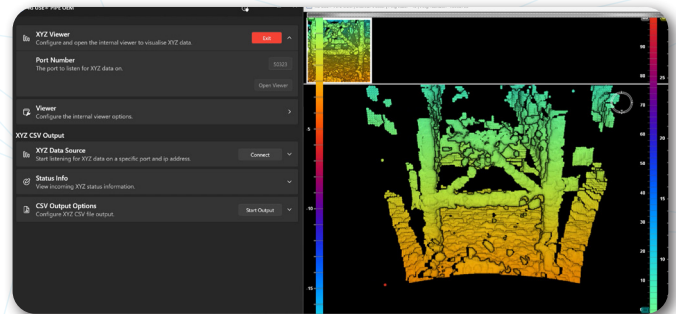
Assists with Implementation of XYZ data stream in third-party applications



Compatible with both Version 1 and Version 2 of our XYZ data format

4G USE® PIPE OEM Viewer Application

4G USE® PIPE OEM Viewer Application is a test application, designed to allow you to connect directly to the sonar to check on its current status. With a simple, easy-to-use graphical interface, it can help by ensuring that your commands are being properly received and applied by the device. It can also parse and reconstruct our XYZ data stream, either to display on screen as a point cloud or output to a CSV file for analysis in third party applications.



In CSV Logger Mode:

```
std::signal(SIGINT, SignalHandler);
signal(SIGTERM, SignalHandler);

int portnum;

std::cout << "Enter the port number to listen for XYZ data on (default = " << defaultPort <<
  << "): ";
if ((std::cin >> portnum))
{
  std::cout << "Invalid input. Using default port (" << defaultPort << ") \n";
  portnum = defaultPort;
}
std::cin.clear();
std::cin.ignore(1024, '\n');

try
{
  auto sample = std::make_shared<Sample>(portnum);
  std::cout << "XYZ listener started on port " << portnum << " \n";
  std::cout << "Press Ctrl-C to exit \n";
}
catch (std::exception& e)
{
  std::cout << "Error: " << e.what() << " \n";
}
```

Example Code (C++) to parse XYZ data stream and construct pings

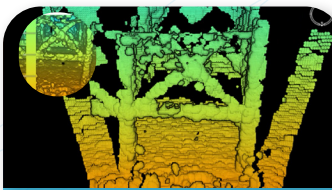


Assists with Implementation of XYZ data stream in third-party applications



Compatible with both Version 1 and Version 2 of our XYZ data format

In XYZ Viewer Mode:



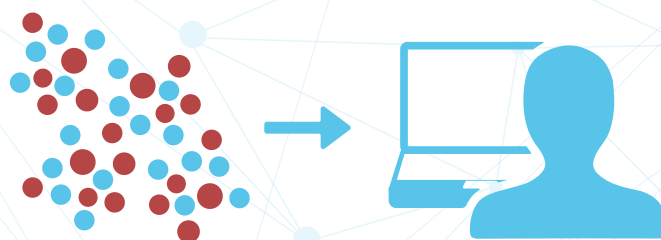
Complete Control of Real-Time XYZ Series Sonar Live



Listen Across Different Ports to Allow Filtering by Sequence View

Headless Test App

The Headless Test App is a simple command line client application, which can send commands to, and receive status messages from, the 4G USE® Headless Application, running either on the same PC or on a separate machine. It can be used during the integration stage to verify that Headless is correctly receiving and responding to commands.



Validate Network Communications and Headless Responses



Allows Human Interaction with the 4G USE® Headless Application



Cross-Platform and will Run on Windows® or Linux

Documentation Pack

Alongside the software applications, we provide comprehensive documentation covering the hardware and software elements of the package. This includes full details of the API, the XYZ file format documentation, separate manuals for each software application, and a series of training videos that will guide you through the process of performing the integration and configuring the system to provide optimum data quality during operation.