

TECOTEC Technologies

UNDERWATER TRANSCIVER TESTBED

| Data Sheet



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Introduction

A comprehensive test platform for the calibration, verification, and analysis of underwater acoustic transducers.

The Underwater Transceiver Testbed is for digital calibration of underwater acoustic transducers used in underwater applications such as ocean bottom profiling, underwater telephony, etc.

Special techniques have been employed, taking into consideration various requirements of calibration principles, limitations of the water medium, frequency range of operation, and the type of parameter to be measured.

System includes:

- Two equipment racks: Main rack and Slave rack
- A laptop serves for the calibration of the test / reciprocal transducer.

Applications

The applications of this system are introduced as follows:

- Hydrophone calibration and sensitivity measurement for underwater acoustic transducers and sonar sensors.
- Underwater acoustic communication testing for evaluating transmission and reception performance in water environments.
- Sonar transducer performance evaluation for research, development, and quality verification purposes.
- Multi-channel underwater signal recording and analysis for acoustic monitoring and signal processing applications.
- Acoustic waveform generation and modulation testing for analog and digital communication experiments.
- Oceanographic and marine acoustic research in laboratory tanks or open-water environments.
- Underwater telemetry and communication system development for marine and autonomous underwater platforms.
- Laboratory and field acoustic experiments for underwater sensing and propagation studies.
- Education and professional training in underwater acoustics, hydrophone calibration, and sonar technology.
- Defense and naval acoustic equipment testing for underwater surveillance and communication systems.

Features

- Supports both hydrophone calibration and underwater communication test modes
- Integrated Master Rack and Slave Rack architecture for flexible system expansion
- Multi-channel configuration with 8 receiver channels and 6 transmitter channels
- Broadband underwater acoustic testing from 10 kHz to 12 MHz
- High-power acoustic signal transmission using integrated RF and wideband amplifiers
- Real-time underwater signal recording, monitoring, and analysis
- Software with intuitive graphical user interface for system control and measurement
- Supports analog and digital modulation/demodulation functions
- Automatic test procedure sequencing and report generation
- Compatible with laboratory tanks and open-water test environments
- Supports reciprocity calibration measurements for underwater transducers
- Ethernet-based communication and remote system control



System Information

System diagram

This block diagram illustrates the overall architecture of the Underwater Transceiver System, including the control software, hardware configuration, signal flow, and operational modes.

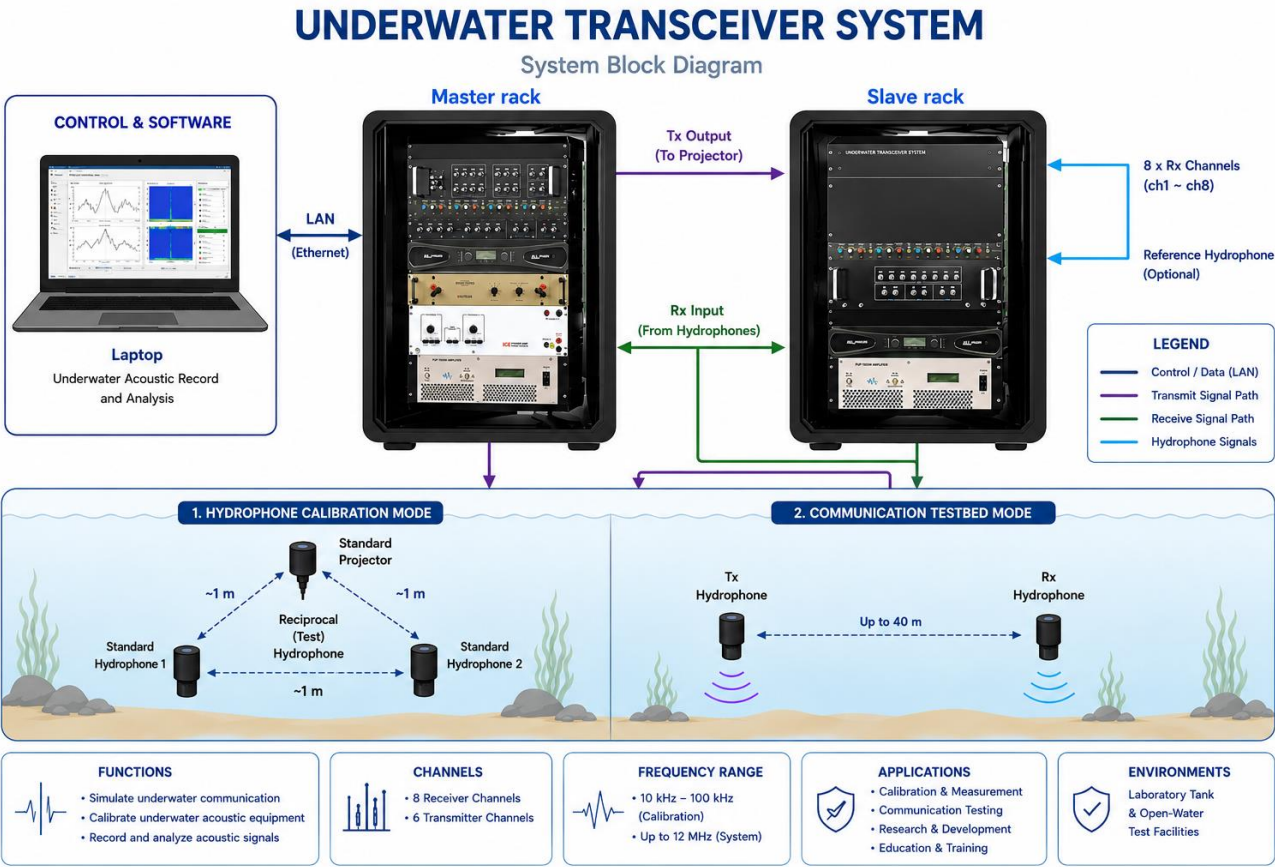


Figure 1. Block Diagram of the Underwater Transceiver Testbed

Main components

Master rack



Slave Rack

The Master Rack serves as the central control and signal processing unit of the Underwater Transceiver System. It integrates signal generation, power amplification, hydrophone signal conditioning, data acquisition, and I/O routing into a single platform, enabling precise control and monitoring of underwater acoustic measurements.

Supporting 6 transmit channels and 8 receive channels, the Master Rack is designed for both Hydrophone Calibration and Underwater Communication Testbed applications. It incorporates a 10 kHz–12 MHz RF power amplifier, a DC–1 MHz wideband power amplifier with an impedance matching transformer, and a 1 Hz–600 kHz multichannel hydrophone amplifier featuring programmable gain and high-pass/low-pass filtering. Connected to the host computer via Ethernet and controlled by the software, the Master Rack delivers accurate synchronization, flexible system configuration, and reliable data acquisition for advanced underwater acoustic testing.

The Slave Rack extends the transmission and reception capabilities of the system, enabling distributed underwater acoustic testing and multi-node communication scenarios. Operating in synchronization with the Master Rack, it expands system capacity while maintaining precise timing and signal integrity.

The Slave Rack integrates a 10 kHz–12 MHz RF power amplifier, a high-power Class-D low-frequency amplifier, and a 1 Hz–600 kHz multichannel hydrophone amplifier to support broadband signal transmission and reception. Through dedicated inter-rack power and signal connections, it provides a scalable architecture for distributed acoustic measurements and large-scale transceiver system evaluation, ensuring high-performance operation across a wide range of underwater test applications.



Software Interface

The software is used to advanced underwater acoustic record-and-analysis software designed to control, monitor, and process underwater acoustic measurements. The software provides an intuitive graphical user interface for hydrophone calibration, underwater communication testing, signal generation, recording, modulation, and post-processing applications.

The software supports multi-channel data acquisition and real-time signal analysis, enabling users to perform automated test procedures, waveform analysis, and report generation efficiently. The software is suitable for laboratory and open-water acoustic experiments, research and development, education, and defense-related underwater acoustic applications.

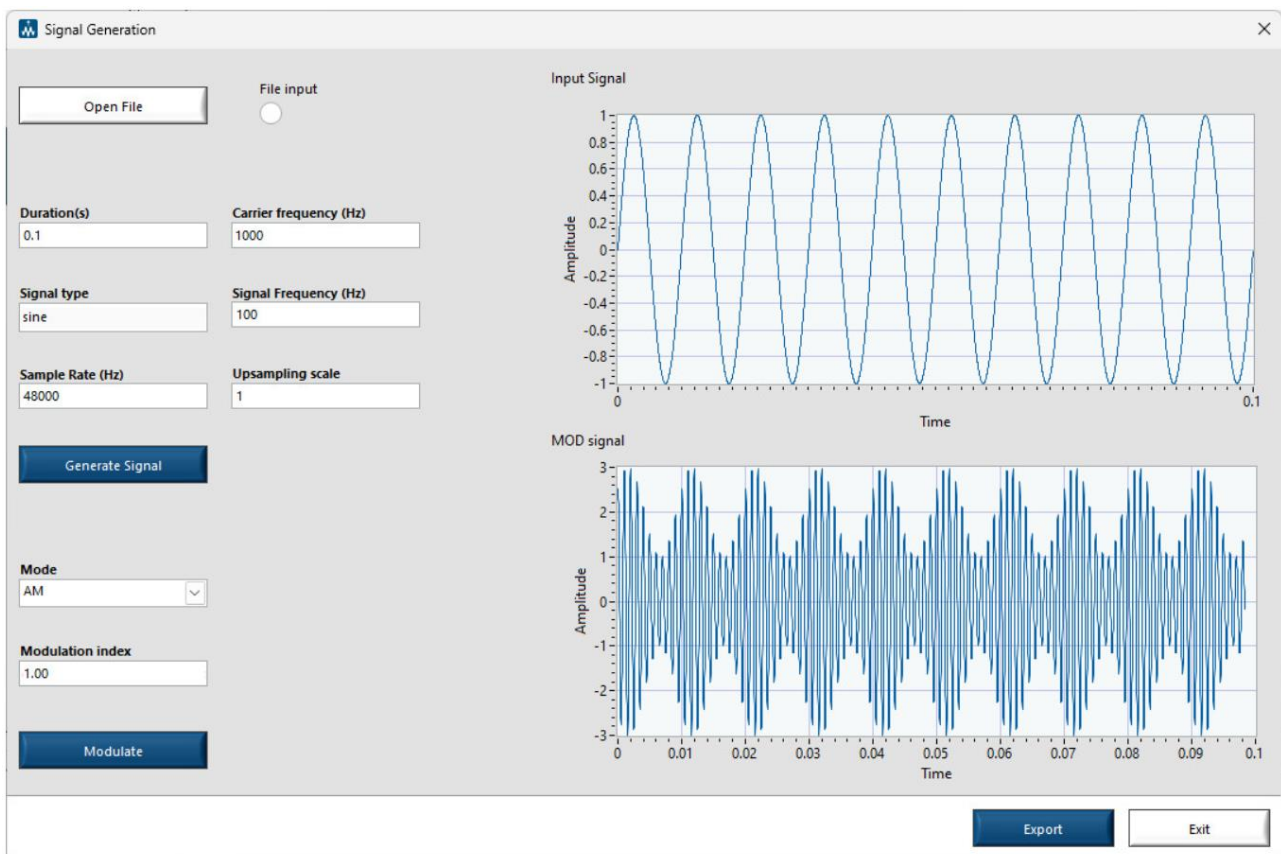


Figure 2. Generate a user-defined AM-modulated signal

Specifications

Multichannel Hydrophone Amplifier

Broadband	1 Hz to 600kHz
Number of channels	4 channels
Gain	10 dB, 20 dB, 30 dB, 40 dB, 50 dB, 60 dB
High pass filter setting	1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 20 kHz
Low pass filter setting	100 kHz, 200 kHz, 300 kHz, 400 kHz, 500 kHz, 600 kHz

Data Acquisition

Number of input channels	4 channels
Voltage range	±10 V
Sampling rate	500 KS/s/ch
ADC resolution	16 bits
Input impedance	Input impedance

Transmitter

Signal Generator

Output range	±10 V
Number of output channels	6 channels
Update rate	1 MS/s/ch
DAC resolution	16 bits

Low Frequency Power Amplifier

Number of channels	2 channels
Output power	775 W (with 2 Ω load)
THD	< 0.5 %
Intermodulation Distortion (60 Hz and 7 kHz at 4:1) from full rated output to -30 dB	< 0.3 %
Crosstalk (below rated 8 Ω power)	> 85 dB at 1 kHz > 55 dB at 20 kHz

Medium Frequency Power Amplifier

Frequency range	10 kHz to 12 MHz
Linear output	Nominal 100 W
Power gain	Nominal 50 dB ± 1.5 variation
Harmonic level	< -25 dBc @ 100 W Pout

Attenuator

Number of channels	2 channels
Attenuation	20:1
Input impedance	10 MΩ, 25 pF
Accuracy (adjusted)	± 0.2 % at 1 - 100 kHz

Ordering Information

Select the configuration that matches your measurement scope.

Part Number	Model / Configuration	Included Measurements
TT- UTT-001	UTT06	Underwater Transceiver Testbed with broadband from 1 Hz to 600kHz

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Our project focuses on system integration for advanced measurement solutions, ensuring seamless connectivity between hardware and software components. We develop and implement high-precision measurement systems tailored to diverse industrial and research applications.

For more information, please contact your local TECOTEC Technologies office. The complete list is available at:

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