

UNDERWATER ECHOSOUNDER MODULE

SONAR 2D-ENHANCED

Features

- Compact size: d21.5 x 35mm, weight 40g
- Wide supply voltage range: 5-14V
- Low current consumption: less than 400mA
- Wide dynamic range: 95dB (with logarithmic amplifier)
- Configurable transducer frequency: 200-800kHz
- 24V booster onboard
- 6-axis ICM-20602 IMU sensor embedded
- Open binary and NMEA protocols supported
- UART interface (5V tolerant) with up to 1Mbit data-rate speed for real-time picturing
- Every module is tested under 35 bar water pressure before shipping

Applications

- Underwater ROV/AUV equipment
- Obstacle avoidance
- Bathymetric surveys
- RC toys and robotics
- Liquids level measurement
- Education and experiments

Description

The SONAR 2D-ENHANCED is a low-cost, ultra-compact, high-performance, multi-purpose sonar. It contains a logarithmic amplifier which combines high-sensitivity and high-dynamic range, a high-performance processor with DSP, and MEMS



inertial sensors. SONAR 2D-ENHANCED is the top model in the SONAR 2D line, providing the best of KOGGER technology. A distinctive feature of this model is increased emission power with the ability to adjust the frequency over a wide range as well as a built-in IMU. Its complete solid-state design within a stainless-steel case makes it a durable and unpretentious operational device for industrial applications.

It's easy to get started with a simple UART interface and open source examples. Its binary protocol provides for maximum performance and data integrity checking. Updating the firmware is simple, providing the most current features or even individualized solutions according to customer needs. Built-in non-volatile flash memory saves its settings even when not connected to power or a host.

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Specifications

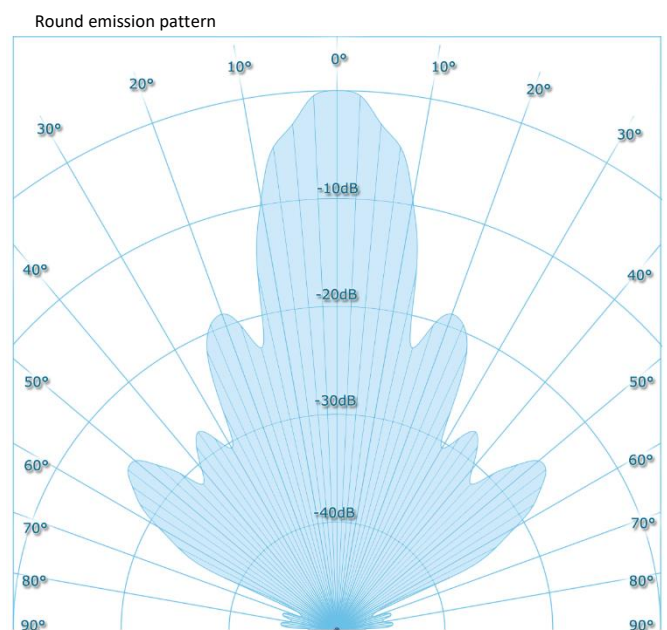
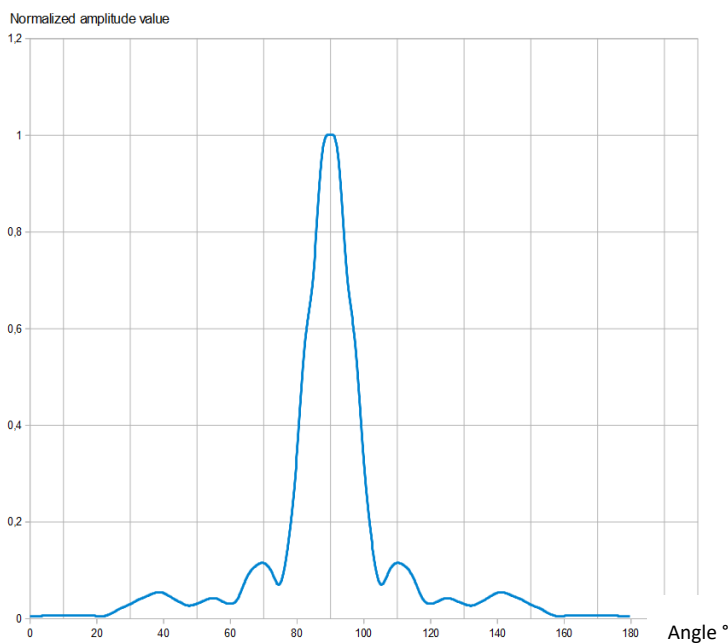
Electrical parameters:

PARAMETER	MIN	TYP	MAX	UNITS
Supply Voltage	4.9	-	14	V
Supply Current	0.1	0.2	0.5	A
Logic Level	3.3	-	5	V
Booster Voltage (Internal)	5	-	24	V
PZT Transducer Supply Voltage (Internal)	±100	-	±600	V
Transducer Operation Frequency	200	-	800	kHz

Physical parameters:

PARAMETER	MIN	TYP	MAX	UNITS
Length	35	38	40	mm
Diameter	21	21.5	22	mm
Weight in air	38	40	42	g
Depth rating	-	-	100	m
Operation temperature	-5	-	+60	°C

Emission pattern:



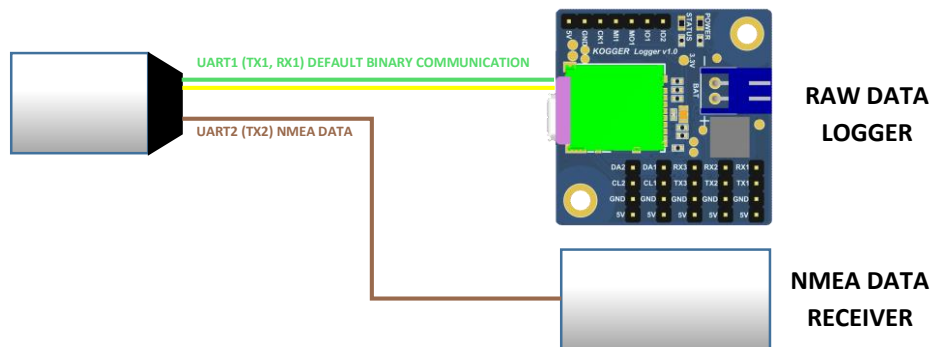
Wiring information:

There are two options of polyurethane cable available: 10-wire Helukabel DATAPUR-C ® PN:52506, or 5-wire Helukabel DATAPUR-C ® PN:52493. Every wire in the cable has its own insulation, colored according to DIN47100 standards and the following functions:

10-wire cable option:

DIN47100 color index	01	02	03	04	05	06	07	08	09	10
Function	RESET	AUX1/ TX2/ RX2	TX1	RX1	AUX4	AUX2	BOOT	VCC	GND	AUX3

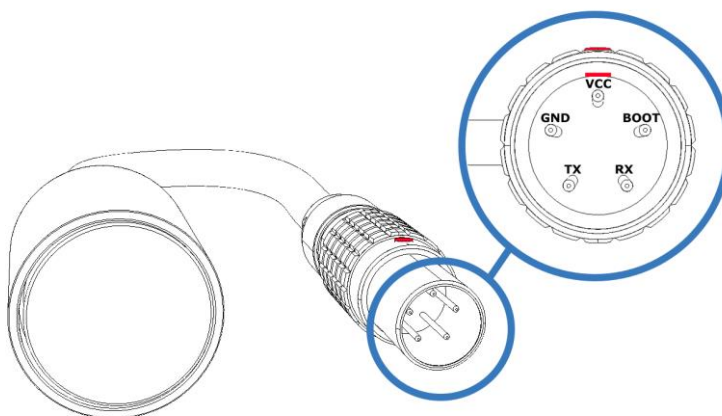
10-wire cable option allows to utilize both types of data in parallel: raw echogram binary data and NMEA



5-wire cable option:

DIN47100 color index	01	02	03	04	05
Function	VCC	GND	TX1	RX1	BOOT

The SONAR 2D-ENHANCED 5-wire option can be equipped with a connector:



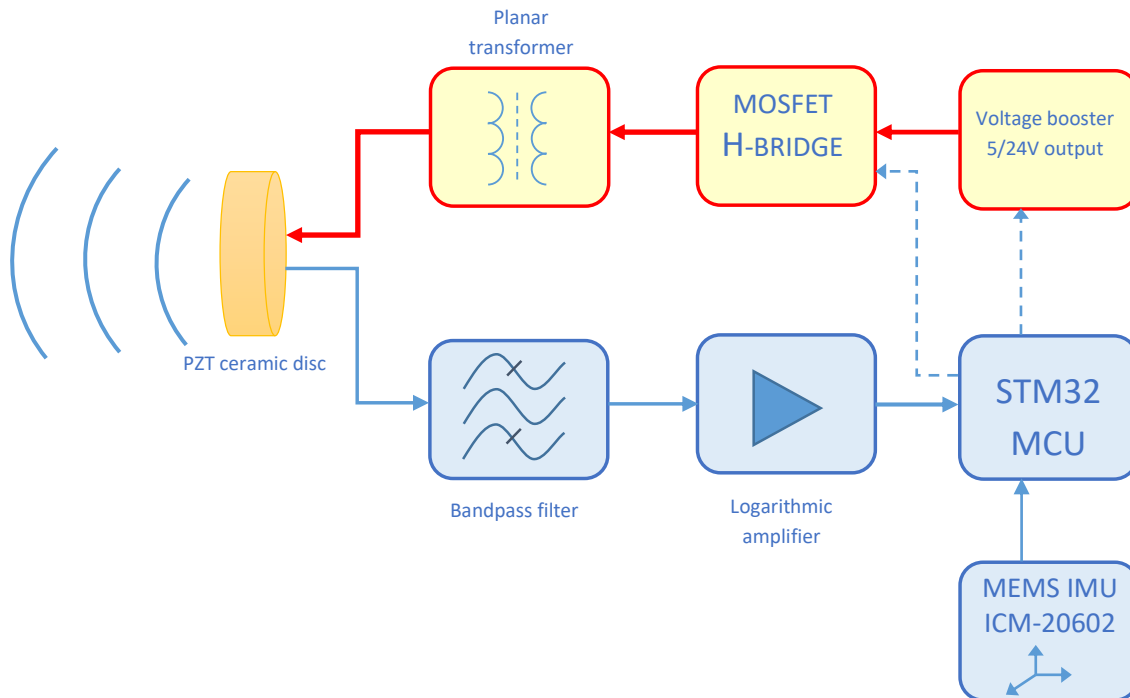
The type of cable and connector can be chosen on the product order page.

Detailed description

Principal of operation

The microcontroller unit (MCU) generates a number of probing impulses at a set frequency. The impulses are amplified in the power amplifier (H-Bridge + transformer). The piezoelectric transducer (PZT) emits amplified electric impulses into the environment as mechanical waves. Impulses reflected by obstacles are captured by the transducer and go through the bandpass filter into the logarithmic amplifier. The amplified signal goes to the ADC module of the MCU and is converted into digital form for further processing.

Block diagram



Hardware interfaces

The SONAR 2D-ENHANCED employs a UART hardware interface by default. By customer request, any of the following alternative interfaces can be implemented: RS422/485, I2C, CAN, USB.

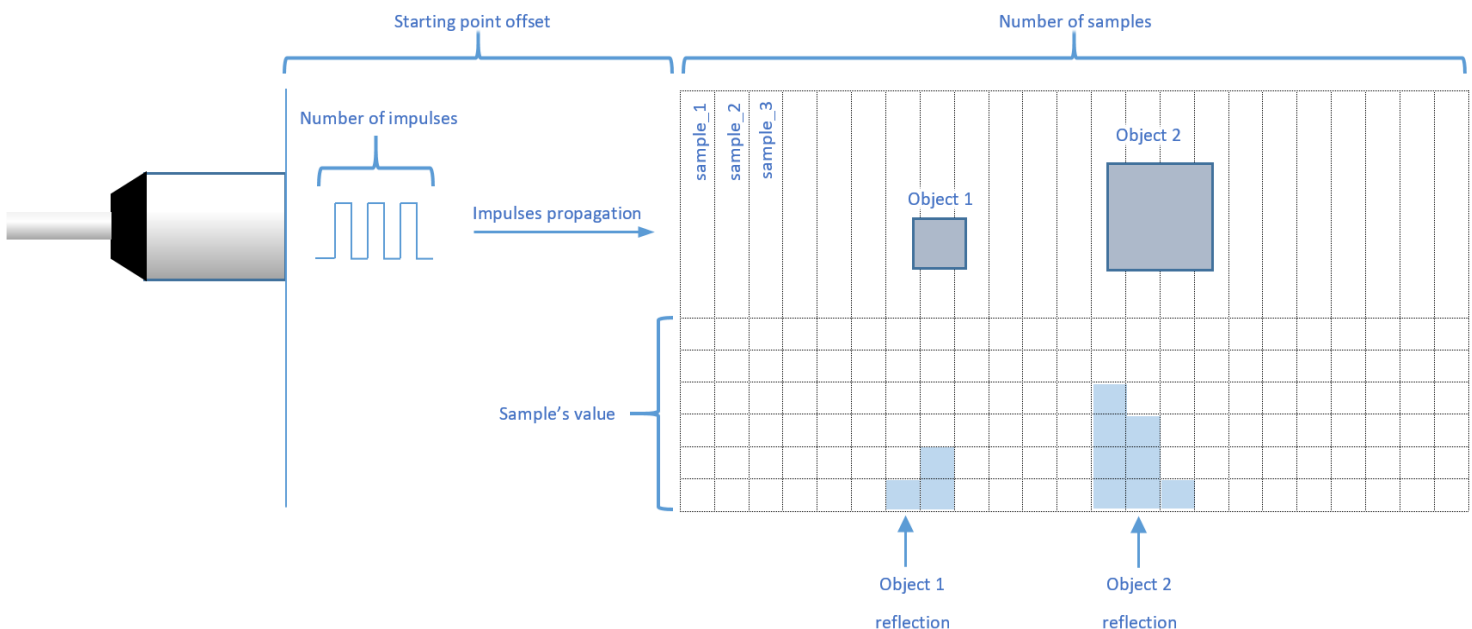
Powering up

The baud rate is set to 115200bps 8-N-1 by default. The first 3 seconds after powering on, the SONAR 2D-ENHANCED is in boot mode, ready for firmware updates. Once 3 seconds have elapsed, the main firmware starts and sends the “RESTORE SETTINGS” command to the device’s Tx-line (“Erase non-volatile memory” ID_FLASH (0x23) <https://github.com/koggertech/Kogger-Protocol>). If the Rx and Tx lines are shorted at the moment the firmware is started, the “RESTORE SETTINGS” command is captured by the device itself and forces the device settings to be restored to "default" conditions that will take effect next time the device is powered on.

The generation of the “RESTORE SETTINGS” command can also be a sign that the main firmware has started and the device is ready.

Number of samples, resolution, starting point offset

Each sample is an array element that contains a reflection value. The index of the array element is proportional to the range to the reflected obstacle. The number of samples determines the array length and range. The resolution property is the distance between neighboring samples. By changing the “starting point offset” property and number of samples, it is possible to scan a particular range of the environment and significantly decrease the amount of data, especially when interface data speed is limited.



Inertial GYRO/ACC sensor

The SONAR 2D-ENHANCED has an inertial motion unit embedded. This captures not only the distance of the reflected object, but also its direction relative to the device (corrected for emission patterns).

Voltage booster

The internal boost voltage converter supplies the power amplifier and provides a stable high output acoustic signal emission regardless of the voltage supplied to the device.

To reduce a dead zone of measurements when measuring short ranges, it is recommended to switch the booster off.

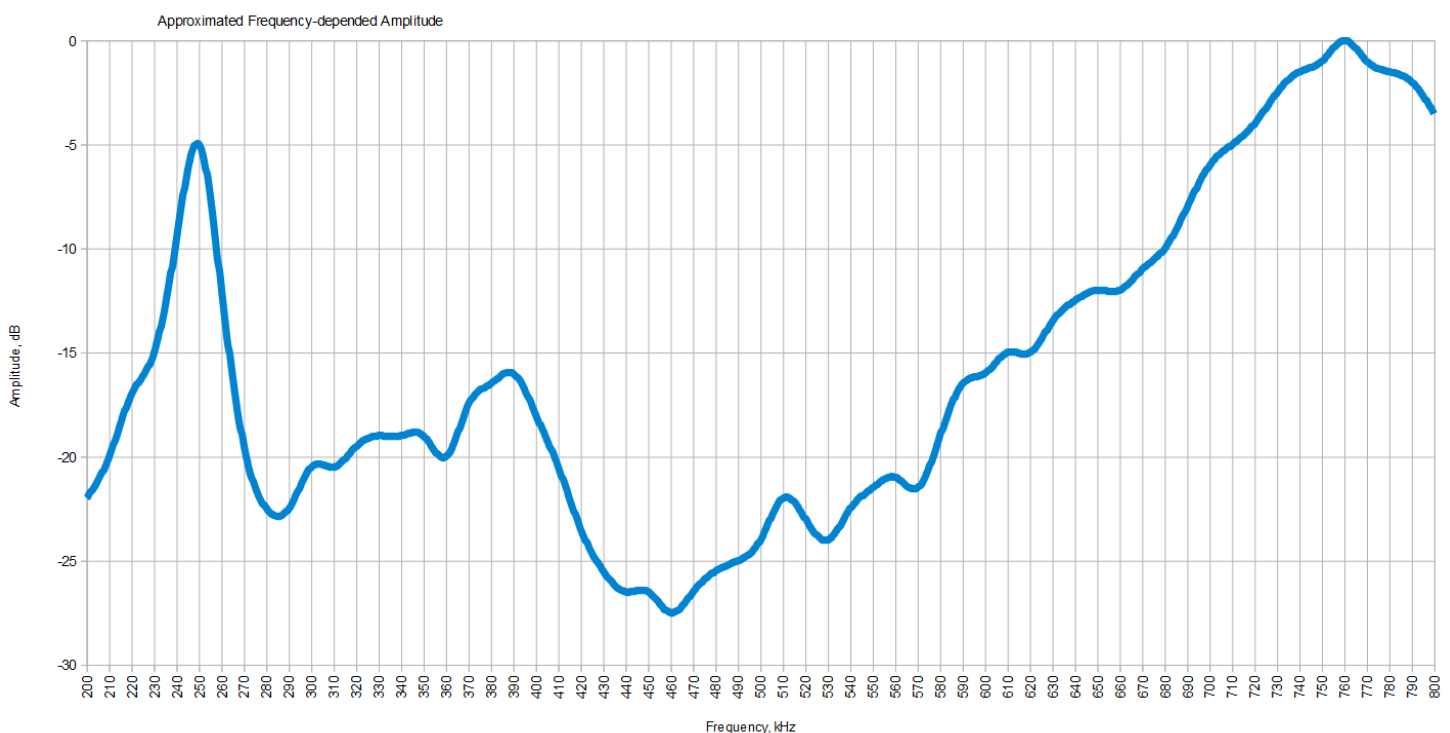
Logarithmic amplifier

The SONAR 2D-ENHANCED's logarithm amplifier gives an output signal level proportional to the logarithm of the applied input signal. This results in both increasing the sensitivity of weak reflections, while also being able to capture strong reflections without data loss or clipping.

Transducer frequency, number of impulses

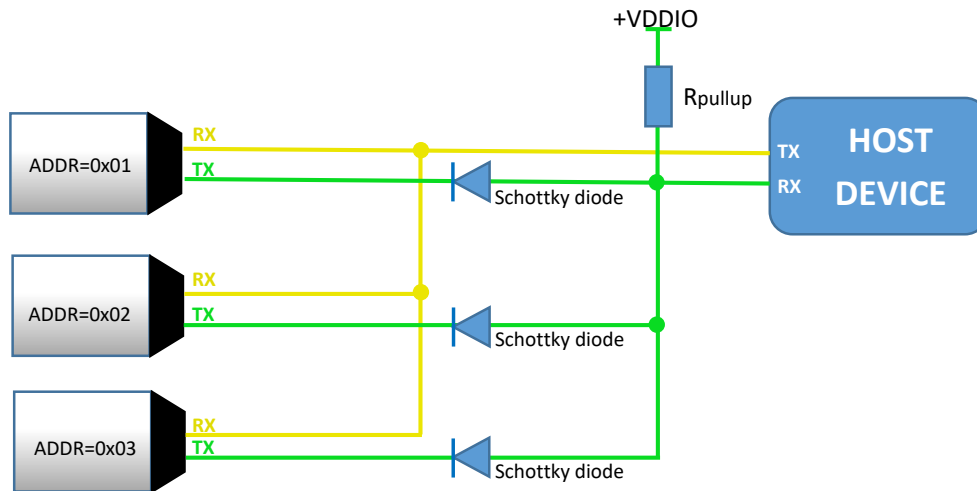
Setting the number and frequency of the probing impulses to suit different environment conditions and the surveyed object properties results in more accurate data and while minimalizing wave interference effects. The SONAR 2D-ENHANCED can be set to an arbitrary number of impulses and frequency, but it is recommended not to exceed 50 impulses and to set a frequency between 200-800kHz.

Because the device contains components with frequency-dependent parameters (such as the PZT transducer and bandpass filter), the received level of reflections depends on the frequency.



Device addressing and multiple connections

It is possible to create a network of multiple devices with each SONAR 2D-ENHANCED having its own unique address. Each device can have an address within 0x00 – 0xFF range. By default, the address is set as 0x00. The 0x00 address also acts as a broadcast. Commands sent to 0x00 are executed by each device in the network, regardless of its address.



Correction for the speed of sound

For accurate distance calculations, the “speed of sound” parameter can be tuned. It is set to 1500m/s by default.

Firmware updates

The device allows firmware updates, allowing for both access to new functions and improving existing ones. The simplest way to update firmware is to use the Kogger GUI

(<https://github.com/koggertech/SonarViewer> <https://github.com/koggertech/Kogger-Android>)



IMPORTANT !

EXPORT CONTROL —THE ITEM DESCRIBED HEREIN MAY BE SUBJECT TO EXPORT CONTROL REGULATIONS. EXPORT MIGHT REQUIRE A PRIOR AUTHORIZATION FROM COMPETENT AUTHORITIES.