

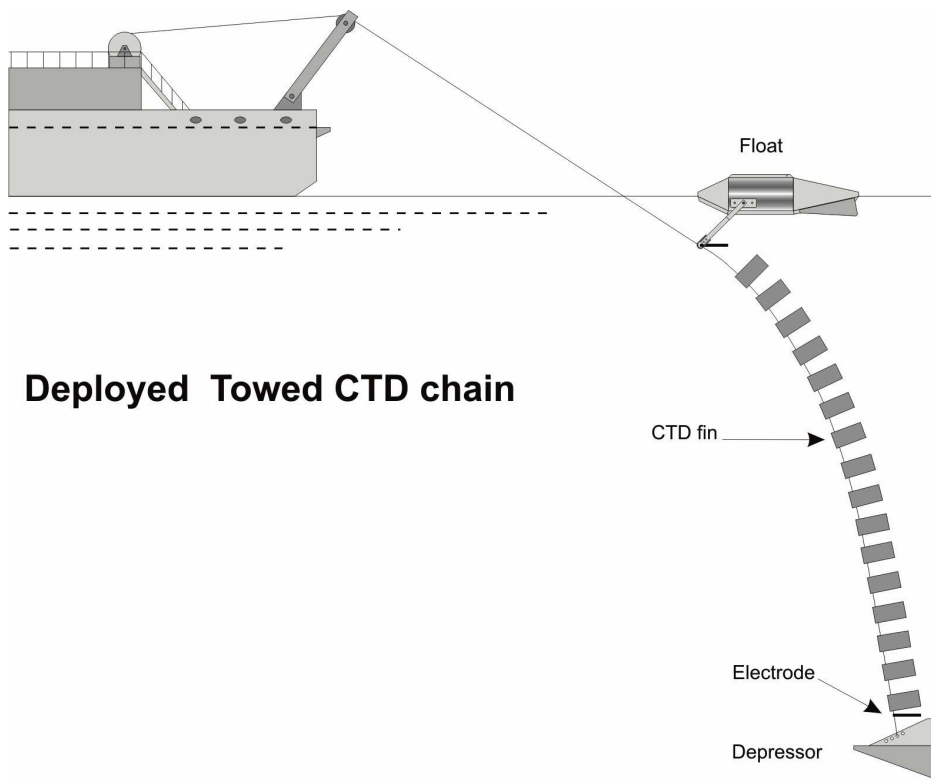


# Towed CTD chain

The new "**Towed CTD chain**" is the response to the need for accurate two-dimensional data sets of temperature and salinity in the upper layer of the ocean.

The "**Towed CTD chain**" system is to be deployed from a ship equipped with an oceanographic winch, and consists of an insulated steel cable on which several CTD-fins are mounted. At the lower part of the tow-cable, a depressor insures the right chain deployment at a speed of up to eight knots.

As surface unit a special interface working together with a PC and a software package provides the current supply for the CTD-fins, the bi-directional communication and the data acquisition.



## Deployed Towed CTD chain

### Inductive coupling to the tow cable

The tow cable is a simple insulated wire with an external diameter of approx. 10 mm. It is connected to the deck unit at the upper end and to an electrode at the lower end.

The current loop from the electrode to the deck unit is closed by the sea water. The tow cable runs through ring cores which are part of the sensor electronics and act as coils of inductive couplers.

The other side of a coupler is connected to send and receive circuitry of the sensor.

### Fins with integrated sensors and electronics:

Low-cost sensors are moulded in fins and may be randomly placed on the tow-cable, to which they are inductively coupled. The sensor fins power supply and communication with the deck unit are via this link. The advantage of this design is that no cable bunches, underwater-connectors or pressure resistant electronic housings are needed.

Each fin consists of a 16-bit resolution microprocessor controlled probe with conductivity, temperature and pressure sensors. A pressure sensor is not needed for each fin. A complete data conversion for the parameters requires approx. 15 ms.

### Data communication:

The command to start a measurement cycle and the requests for data are sent as 1 byte by the deck unit. Cycle start is common to all sensors, while calling addresses are individual for each sensor in a chain.

Each produced sensor has its own address. As soon as a sensor receives its address, it sends a message containing the momentary data set.

### Data transmission to the deck unit:

Real-time assessment of the oceanographic parameters on board the towing ship is ensured because the data set of every sensor is transmitted within a data cycle.

This transmission requires approx. a second because of the serial data transmission with frequency shift keyed bits.

Data is permanently transmitted on this way, no data storage is necessary.

### Power supply from the deck unit

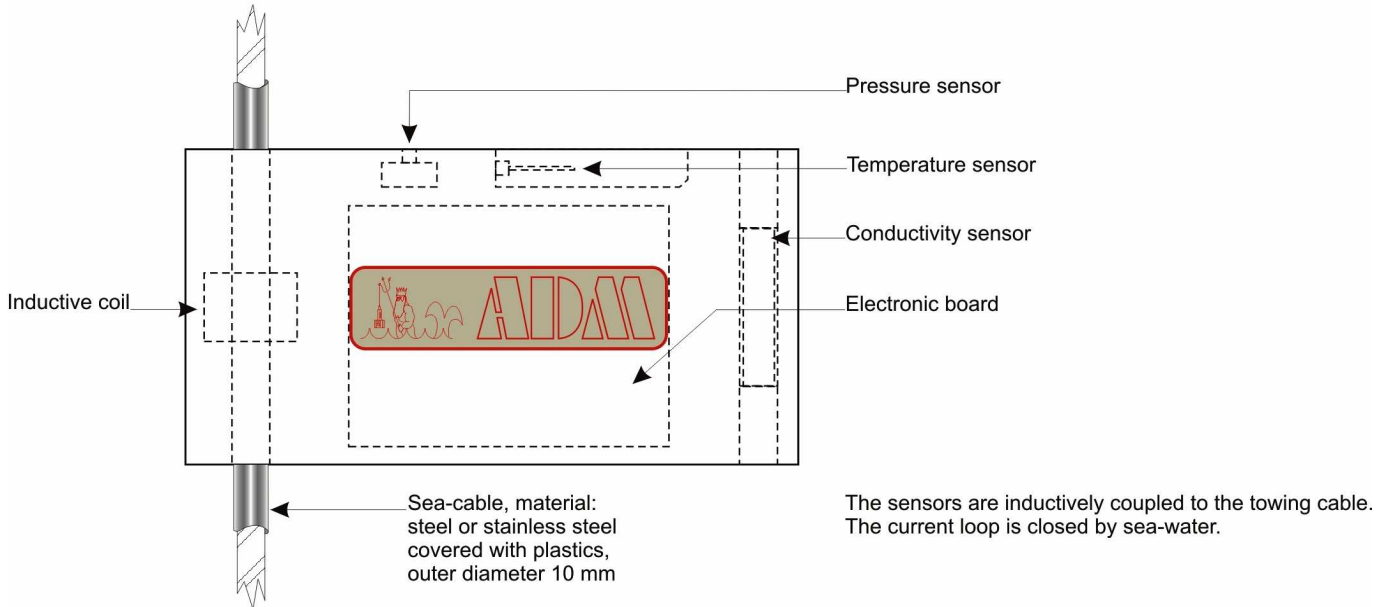
No battery is needed in any underwater unit.

All energy, which is necessary to drive the sensor electronics, is supplied by the deck unit, which periodically switches between send and receive.

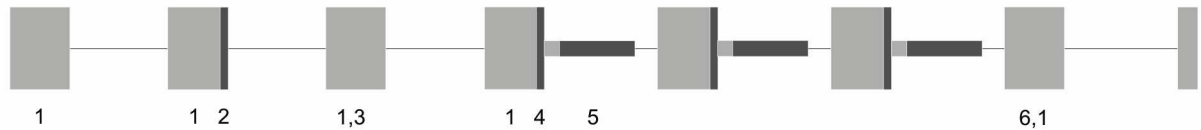
The one byte sending time, which would be sufficient to control the chain, is elongated in order to power the sensors. The few milliseconds of interruption, when the deck unit pauses its transmission, are easily bridged by the capacitor in the power supply circuit of the sensor.

**further system description : see next page**

## Schematic of a CTD-fin



## Communication between deck unit and sensors



- 1 Supply sensor in periodic intervals
- 2 Send cycle trigger to all sensors
- 3 Wait for completion of measurements

- 4 Send specific sensor addresses
- 5 Listen for sensor data
- 6 Interrogation of sensors completed

Periodic send and receive intervals are maintained during a data cycle.

## Sensor data

sensor	principle	measuring range	accuracy	resolution	response time
temperature	Pt 100	-2 ÷ 38 °C	± 0,01 °C	0,001 °C	160 ms
pressure	piezo-resistive	0 ÷ 500 dbar	± 0,1 % f.s.	0,02 % f.s.	30 ms
conductivity	7-pole cell	0 ÷ 60 mS/cm	± 10 µS/cm	1 µS/cm	50 ms

## Main features

- 2-Dimensional CTD-measurement
- Precise measurement down to 500 m
- Inductive power supply and data transmission
- CTD-fin (probe) with 16 bit resolution
- Up to 50 CTD data sets per second
- Each fin with its own address, therefore exchangeable
- Power consumption of a CTD-fin approx. 150 mW
- Insulated steel sea-cable, diameter 10 mm
- No underwater connector necessary
- Special software package for data acquisition included

## Dimensions of a CTD-fin

Length	: approx. 180 mm
Height	: approx. 90 mm
Thickness	: approx. 30 mm
Weight	: approx. 0,6 kg

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