

Product description

FIELAX HeatFlowProbe Plus

The HeatFlowProbe Plus is a scientific device for the measurement of the thermal gradient and the in-situ thermal conductivity. With these two parameters, the heat flux density can be determined. The new probe is designed to measure in-situ values in the sediments of the seafloor down to a penetration depth of 6 m. It is a follow-up of an instrument which has been in use for more than 10 years. Research interests in marine sciences related to e.g. gas hydrates at water depths less than 2000 m require longer penetration depths whereupon the development of this new HeatFlowProbe Plus was indicated.

Heat flow measurements provide important information about:

- boundary conditions for sedimentary basin modelling
- maturity estimation for oil and gas exploration
- continent/ocean boundaries and transition zones
- fluid flow and fault zones
- gas hydrate stability

The mechanical design of the probe follows the violin bow concept and is adapted in size and material strength to the desired maximum penetration depth. Numerical modelling of the dimensions of sensor string and strength member assisted in the final design. The acquired data can either be saved to the data logger to be read out later on board (operation in autonomous mode) or it can be transferred online to the ship via a deep sea cable (operation in real-time mode).

The HeatFlowProbe Plus described in this fact sheet is unique with respect to its innovative design:

- Excellent performance was proven during several cruises
- High stability allows operation even in critical areas where e.g. carbonate crusts or gas hydrates may occur
- Measurement with a relative resolution < 1 mK
- 22 channels work at a sampling rate of 1 Hz
- Real-time data acquisition at a transmission rate of 2400 baud through deep sea cable
- The probe is operated in 'pogo-style', i.e. extended profiles can be acquired whilst minimizing the expenditure of time

Specifications

- 6 m lance, total length 8.4 m, total weight about 950 kg
- Weight stand with additional weights up to 3000 kg
- Power pack, data acquisition and autonomous control integrated in the probe
- Online or memory-based data recording
- Autonomous and online control modes
- Operation range down to a water depth of 6000 m
- Containerized dimensions
- Sensor string with 22 temperature sensors and heating wire (consumable item)
- Quality check and online data evaluation with deck unit

The complete mechanical system is shown in Figure 1.

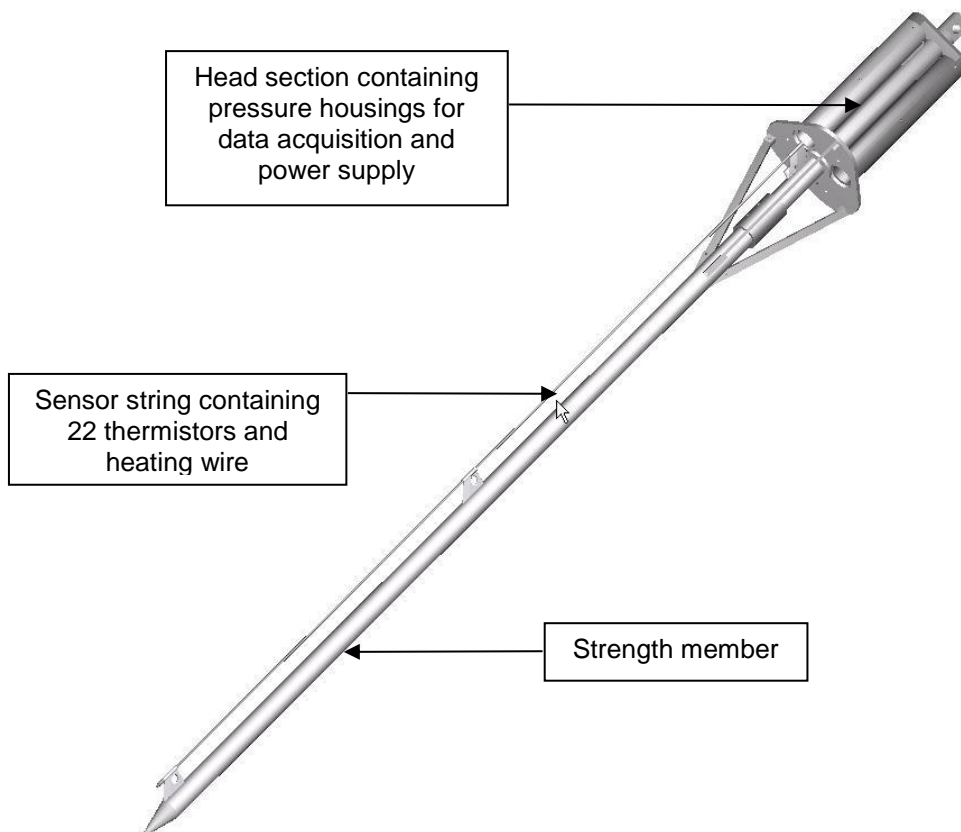


Figure 1: Sketch of the FIELAX HeatFlowProbe Plus.

Deck unit (to use with PC on board of the vessel)

- Communication with the HeatFlowProbe Plus at the seafloor through coax deep sea cable
- Data capture and storage on hard disk
- Monitoring of conditions during measurement: pressure, tilt, acceleration, temperature
- Real-time graphical display of data
- Processing software for fast evaluation of measurements

Data acquisition unit (data logger in HeatFlowProbe Plus)

The data acquisition system including the communication package is designed and built by our partners according to our specifications. It is also equipped with a high precision PT100 temperature sensor, a pressure sensor, a 2 axis tilt sensor and a vertical acceleration sensor.

- Grade 5 Titanium pressure housings with degassing screw for data acquisition unit and power supply unit
- Measuring range -2 °C to 60 °C
- Resolution < 1 mK from -2 °C to 30 °C
- Absolute accuracy up to +/- 2 mK with in-situ calibration using a calibrated PT100 sensor in deep sea bottom water
- Sampling frequency 1 Hz
- Control of high energy heat pulse (ca. 270 W) for in situ thermal conductivity measurement
- Signal conditioning of analogue temperature signal
- A/D conversion with 20 bit resolution
- Magnetic switch
- Internal 3.6V Lithium battery or 1.5V Alkaline battery for logger supply in autonomous mode
- Recording of conditions during measurement: pressure, tilt, acceleration, temperature
- Real-time communication with deck unit through coax deep sea cable
- Battery and storage capacity allow continuous operation for 4-6 days
- Housekeeping sensors:



PT100

- Range: -2°C to 36°C
- Resolution: 1 mk
- Accuracy: < 2 mK

X-Y Inclinometer

- Range: -90° to 90
- Outputs: linear with sinX, sinY
- Zero point: vertical position
- Calibration range: -15° to 15°
- Resolution: 0.02°
- Stability: < 0.1°

Pressure sensor

- Range: 0 to 12000m
- Accuracy: 0.1%FS

Acceleration sensor Z

- Range: -1.7 g to 1.7 g
- Output: linear with g
- Zero point: horizontal position
- Calibration range: -g to g
- Resolution: 0.001 g
- Stability: < 0.01°

Power supply unit

- 19 NiMH cells in serial connection
- Voltage: 26.2V
- More than 250 times heat pulse in 20s duration
- Rechargeable

Heat pulse

- Duration: selectable by software (typ. 20 s)
- Current range: 0...22 A
- Resolution: < 1 mA
- Accuracy: 10 mA / 10 mV
- Voltage range: 0...25 VDC
- Resolution: < 1 mV
- Power: 0...500 W



Sensor string

The sensor string is an array of 22 temperature sensors (thermistors, named NTC1 – NTC22) which are mounted in a tube of 6 m length and 15 mm diameter. The sensor string also contains a heating wire, with which a distinct amount of energy is released into the sediments. The connection of the thermistors with the data acquisition unit is made via three Subconn MCIL16F connectors

- Range : -2°C to 60°C
- Resolution: < 0.5 mK in the range -2°C to 30°C
- Absolute accuracy up to ± 2 mK with in-situ calibration using a calibrated PT100 sensor in deep sea bottom water



Data acquisition software

- Menu language: English, German, Chineses
- Real-time control
- Configuration Setting
- Data Download
- Condition monitoring
- Field Calibration for Air Pressure compensation
- Smart event mode

Processing software (FIELAX HF FELLOW)

- Software for managing and processing acquired heat flow data with the FIELAX HeatFlowProbe Plus equipment.
- The software bears a convenient GUI for easy data access and visualization of recorded temperature data and status sensors (i.e. pressure, tilt, acceleration)
- The software follows a holistic approach to integrate processing scripts and interpretation tools
- Calculation of depth dependent parameters (in situ temperatures, thermal conductivities and diffusivities)
- Geothermal gradient calculation and heat flow estimation

Spare Parts and Options

- Additional weights (zinc dipped, 50kg/pcs.)



- Lifting gear



- 8to rotator with chain link and 17to shackle (left)
- Crow's foot (right)
- Load testing for all lifting points and lifting gear on request

- Trolleys for rigging and mounting (pair) (2016 plus model: stainless steel)

- Taken apart for easier handling e.g. in workshop and for transportation in a 20 ft container



- Mounted together for better handling on deck

