1、**Product introduction**

The Soil Soil Heat Flux Sensor, also known by names such as Heat Flux Plate, Soil Heat Flux Plate, Heat Flux Meter, is an instrument used to measure heat flux, which can be used for internal soil measurements. It passes through a thermoelectric stack and outputs in the form of a voltage which is proportional to the heat flux, it is easy to operate and is particularly suitable for measuring the thermal conductivity of soils and building walls and glass walls. The soil heat flux value is obtained by using a heat flux plate measured at 2cm buried in the soil. Throughout the year, it changes with the seasons; in summer, the soil heat flux is positive, with heat entering the soil layer, and the value is large; in winter, the soil heat flux is negative, with heat in the soil being released to the atmosphere, but the value is small.

2、Scope of application

This product can be widely used in environment, agriculture, forestry, planting, construction, and other fields.

3、Technical parameters

◆ Supply voltage: □12-24V □5V
◆ Output Signal: □ Current type 4-20mA □ 0-2V □ RS485
◆ Measuring range: -200 to 200 w/m2
◆ Internal resistance less than 300Ω
◆ Measurement accuracy: less than 5%
◆ Heat Flow Calculation Formula
◆   Heat flow (w/m2) = Coefficient (w*m-2/mv) * Output (mv)
◆ Working current:12V power up about 26mA

NiuBoL

◆ **Line Colour Definition**

Current signal output.

Line Colour	Definition
Red	Power
Black	Ground
Yellow	Signal

RS485 signal output:

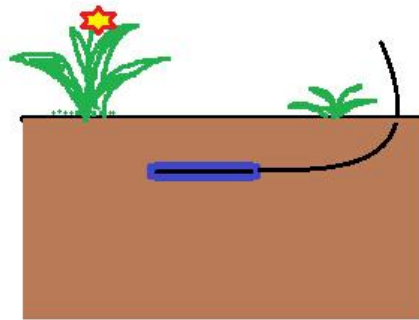| Line Colour	Definition
Red	Power
Black	Ground
Yellow	485 A
Blue	485 B

4、Functional features

1. Compact size, fast and accurate measurement
2. Low power consumption design, using reasonable power consumption control mode
3. Stable performance

5、Measurement methods

（1）Measurement methods in soil

The plate should be placed horizontally in the soil layer so that the surface is perpendicular to the direction of heat flow. The burial depth of the sensor, usually 3-10 cm deep from the natural subsurface, should be avoided as much as possible to be set directly on the surface of the soil layer, because the natural subsurface is not geometrically flat, and small undulations on the surface will make the sensor readings unrepresentative, while the upper surface of the sensor is in direct contact with the air and may also produce radiation errors. Usually, a representative lot is selected at the observation site, and a profile is dug vertically downwards with a spade.

From the soil surface down along the profile measured out the required depth, and then hollowed out along the horizontal direction, the size of which can be placed on the heat flow plate, and so that the sensor up and down the two sides of the surface can maintain good contact with the soil, the lead along the profile and then backfill the soil. However, it should be noted that the depth of burial of the heat flow plate should be the distance between its centre line and the soil surface.

（2）Measurements on the wall

Firstly, the surface of the heat flow sensor is evenly coated with petroleum jelly, and the heat flow sensor coated with petroleum jelly is pasted on the surface of the wall, so that the wall and the heat flow sensor can make close contact, and stay for a few minutes, and then the heat flow sensor can start to measure after adapting to the ambient temperature.
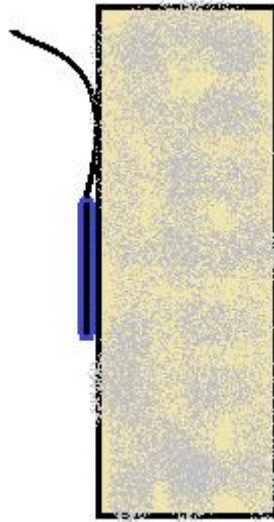
6、Common failure phenomena and solutions

　6.1 Abnormal sensor output signal

　　　a) Check if the supply voltage is stable

　　　b)Check whether the power supply range is normal

　　　c)Check whether the wiring is false connection

　6.2 No signal output from the sensor

　　　a)Check whether the positive and negative poles of the power supply and

　　　the earth wire are connected correctly

　　　b) Check whether the power supply voltage meets the requirements

7、Maintenance and upkeep

　　This instrument is a precision electronic product, proper maintenance and care will help to protect the performance of the instrument and prolong the service life of the instrument, please pay attention to the following points:

1、Please use the instruction manual correctly according to the requirements of the instruction manual, receiving money incorrectly may lead to instrument damage.

2, do not use volatile liquids to wipe the instrument, otherwise it may lead to discolouration and deformation of the instrument; soft cloth to avoid scratching the external protective film of the instrument, to extend the service life of the instrument.

3, the instrument should be held lightly, not drop or heavy pressure, otherwise it will lead to deformation of the instrument, internal circuit board damage.

4、Do not touch the inductive part of the instrument when it is electrified, which may affect the measurement result or lead to the damage of the internal circuit of the instrument.

5、Do not disassemble and modify the instrument privately to avoid damage to the instrument.

6, the instrument should be firmly fixed with screws when using, otherwise it may damage the instrument.

7、Check the power supply voltage of the instrument regularly to ensure the normal operation of the instrument.

8、RS485 communication protocols

A subset of the commands of the MODBUS-RTU protocol is used, using the read register commands (03) (06).

1、Data transmission method:

8 data bits, 1 stop bit, no parity bit.

2、Data transmission rate:

Default baud rate is 9600bps, not modifiable, users wish to use other baud rates, please declare when ordering. Support baud rate: 9600bps, 4800bps, 2400bps.

3、Data Message Format

(1) Function code 0x03 - query slave device register contents

Master Device Message	Slave device correct message
Slave address (0x01-0x7F 1 byte)	Slave address (0x01-0x7F 1 byte)
Function code (0x03 1 byte)	Function code (0x03 1 byte)
Start register address (2 bytes)	Data area bytes (2*number of registers 1 byte)
Number of registers (2 bytes)	Data area (register content 2*number of registers 1 byte)
CRC check code (2 bytes)	CRC check code (2 bytes)

⑵Function code 0x06 - set number to slave device registers

Master Device Message	Slave device correct message
Slave address (0x01-0x7F 1 byte)	Slave address (0x01-0x7F 1 byte)
Function code (0x06 1 byte)	Function code (0x06 1 byte)
Start register address (2 bytes)	Data area byte count (2*register count 1 byte)
Data written to register (2* number of registers 1 byte)	Data area (register contents 2* number of registers 1 byte)

CRC check code (2 bytes)	CRC check code (2 bytes)

Notes:

1, CRC check code low bit in the front, high bit in the back, register address, number of registers, data are high bit in the front, low bit in the back.

2、The register word length is 16bit(two bytes).

4、Register Description and Command Format

（1）Parameter Data Register Definition Table

Register address (Hex)	Register contents	Number of registers	Register Status	Data range (Hex)
0x002A	Heat flux	1	Read-only	-2000~2000 （0XF830-0x07D0）

Register address (Hex)	Register contents	Number of registers	Register Status	Data range (Hex)
0x2000	Device address	1	Read/Write	1~127（0x01~0x7F）

（2）Examples of commands：

All register address bytes, register digit bytes, and data bytes in the command are preceded by the high bit and followed by the low bit;

CRC check code low byte in front, high byte after;

Reads the current value of the sensor:

(from device address 02, baud rate 9600, N,8,1)

Slave Device Address	function code	Start Register Address		Number of registers		CRC-L	CRC-H
0x02	0x03	0x00	0x2A	0x00	0x01	0xA5	0xF1

Respond from the device::

slave address	function code	Number of bytes in the data area	register data		CRC-L	CRC-H
0x02	0x03	0x02	0x00	0x00	0xFC	0x44

After modifying the address of the device, it needs to be re-powered.

Wiring instructions: red wire to the positive terminal, black wire to the negative terminal, yellow wire to A+, blue wire to B-