

SENSORS AND SYSTEMS
FOR MONITORING GROWING PLANTS

**SF-4M, SF-4Mi
SF-5M, SF-5Mi
Sap Flow Sensors
User's Manual**



Contents

Introduction3
Sensor specifications4
Sensor installation5
Cable connection7
PDB Power Distribution Board8
Example data logger program9
Warranty and repairs11
Contact details12

Important Information and How to Cite

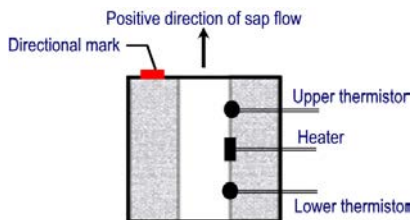
The SF-4M and SF-5M Sap Flow Sensors are manufactured by the Phyto-Sensor Group.

The following protocol should be used when citing the SF-4M and SF-5M sensors in a scientific publication:

"SF-4/5M, Phyto-Sensor Group, Chisinau, Moldova."

Introduction

The SF-4M and SF-5M are designed for monitoring relative variations of sap flow rate in a leaf petiole or small shoot. The sensor's probe is made as a hollow collapsible heat-insulating cylinder. A spring loaded heater and a pair of bead thermistors are located inside the cylinder.



A signal conditioner provides powering of the heater and conditioning of the output signal.

All SF-type sensors are tested on the water filled hose within the approximate measurement range of 12 ml/h.

The probe is connected by a standard 1-meter cable to the waterproof box with the signal conditioner inside.

The output cable length should be specified in the order if required.

Specifications

	SF-4M	SF-5M
Measurement range	Not specified	
Approximate range of 12 ml/h was determined on a stem simulator – a fiber-filled PVC hose with 5 mm in diameter.		
Output		
SF-4/5M	0 to 2 VDC, linear	
SF-4/5Mi	0 to 2 VDC and 4 to 20 mA	
Output signal zero offset		
SF-4/5M	0.5 V approx.	
SF-4/5Mi	8 mA approx.	
Accuracy	Not specified	
Suitable stem diameter, mm	1 to 5	4 to 10
Operating temperature	0 to 50 °C	
Warm up time	5 min	
Overall dimensions, mm	30 × 30 × 40	30 × 35 × 40
Supply voltage	10 to 30 VDC @ 400 mW max	
Cable length between probe and signal conditioner	1 m	

Installation

- Choose an appropriate part of stem for installing the sensor. Make sure that sap flow rate in the stem does not exceed 12 ml/h. The rough estimation may be done assuming the average transpiration rate equal to 1.5 ml/h per square decimeter of leaf surface.
- Open the sensor wide enough to place it on the stem. Make sure that the red directional mark corresponds to upward flow.



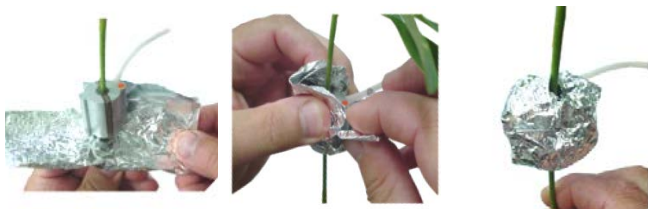
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- Make sure that the sensor is firmly placed and cannot slide or twist with application of gentle force.

- Carefully cover the sensor with two or three layers of aluminum foil in order to protect the sensor from external heat effects. It is absolutely necessary for reliable measurements.

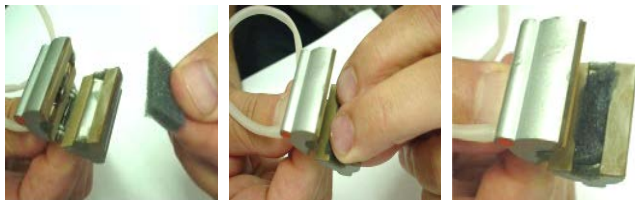


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- To provide the firm positioning of a sensor on stems with diameter below 4 mm for SF-4M and 8 mm for SF-5M, insert a foam-rubber bar into the internal empty part of a sensor as it is shown below

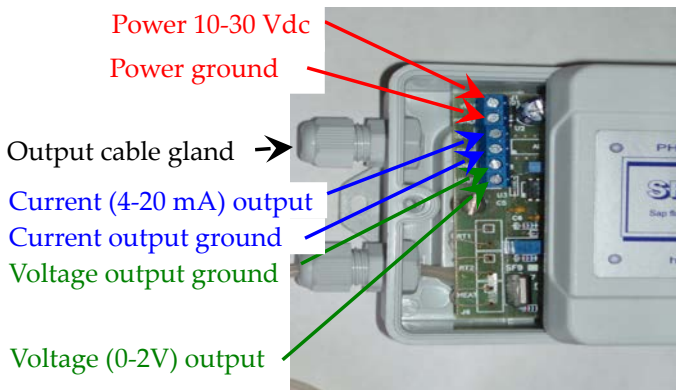


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Conditioning box cable connection

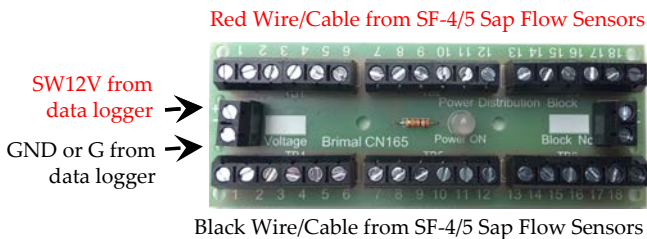


Data logger cable connection

- Red** - 12Vdc Power Supply
(SW12V on CR1000 and CR300 or
PDB Power Distribution Board)
- Black** - Power Ground
- Blue** - Coms Data
(SE1,SE2, etc on CR1000 and CR300)
- Yellow** - Coms Ground

PDB Power Distribution Board

- The PDB Power Distribution Board is designed to conveniently supply power to up to 18 x SF-4/5 Sap Flow Sensors.
- Power input must be from the SW12V power terminal on the CR1000 or CR300 data loggers (see page 7 wiring diagram).
- The upper terminals are wired for a positive (power input) connection.
- The lower terminals are wired for a ground, or negative, connection.
- **WARNING: alternating positive and negative connections on the PDB may damage sensors!**



Example CR1000 program

'CR1000 Series Datalogger

'date: 20/6/2016

'program author: Edaphic Scientific Pty Ltd

'Program to measure sap flow via SF-4 sensors with 5 min heating protocol.

'Wiring:

'===== SF-4M Sensor =====

'Red = Power input = SW12V Power (or +ve on Power Distribution Board)

'Black = Power ground = G Power (-ve on Power Distribution Board)

'Blue = Signal positive = SE1

'Yellow = Signal ground = G

'Declare Public Variables

'SF-4M Sensor:

Public SF1

Public SF2

Public batt_volt

Public panel_temp

'Define Data Tables

DataTable (SF_Example,1,-1)

 DataInterval (0,15,Min,10)

 Sample (1,batt_volt,FP2)

 Sample (1,panel_temp,FP2)

 Sample (1,SF1,FP2)

 Sample (1,SF2,FP2)

EndTable

Example CR1000 program (cont.)

'Main Program
BeginProg

Scan (15,Min,0,0)

'Record battery voltage and panel temperature
 Battery (batt_volt)
 PanelTemp (panel_temp,_50Hz)

'Apply power on to sensor through SW-12V
 PortSet (9,1)

'Delay for 5 minutes for sensor to heat.
 Delay (0,5,Min)

'Measure voltage of sensors on SE1 and SE2.

VoltSe (SF1,1,mv2500C,1,0,0,_50Hz,1,0)
VoltSe (SF2,1,mv2500C,2,0,0,_50Hz,1,0)

'Turn power off to sensors through SW-12V
 PortSet (9,0)

'Call Output Tables
 CallTable SF_Example

NextScan

EndProg

Warranty and Liability

This product is for research use only. Not for use in human diagnostic or therapeutic procedures.

The SF-4/5 Sensor is covered by a one year limited warranty.

The warranty does not include repair or replacement necessitated by accident, neglect, misuse, unauthorized repair, or modification of the product. In no event will Edaphic Scientific Pty Ltd be liable for any direct, indirect, consequential or incidental damages, including lost profits, or for any claim by any third party, arising out of the use, the results of use, or the inability to use this product.

REPAIR OR ADJUSTMENT

Equipment that is not covered by the warranty will, if possible, be repaired by Edaphic Scientific Pty Ltd with appropriate charges paid by the customer. In case of return of equipment please contact us for return authorization.

For further information on terms and conditions associated with products purchased from Edaphic Scientific Pty Ltd:

<http://www.edaphic.com.au/terms-and-conditions/>



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