



EMS Brno

Data Acquisition Environment

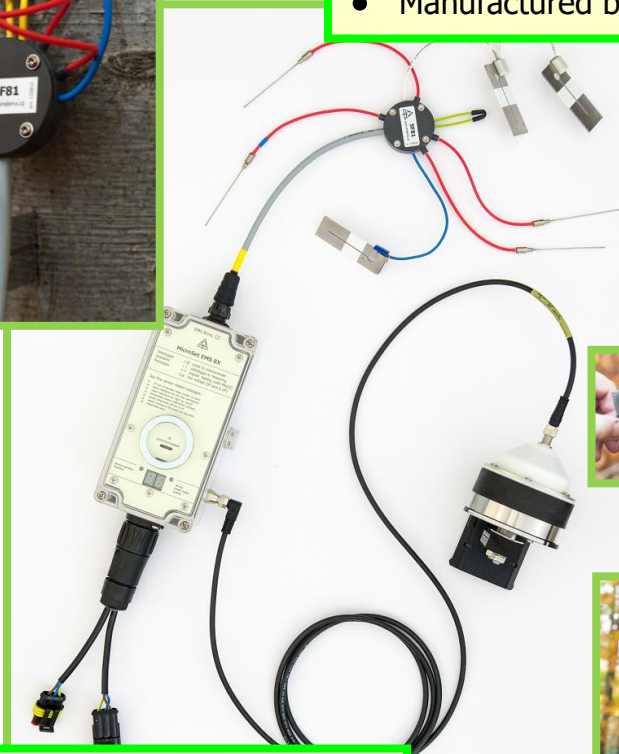
Hardware – Software – Cloud application

www.emsbrno.cz

Sap flow system EMS 81 based on MicroSet 8X datalogging modules

Main features:

- Tissue heat balance method with variable power and constant dT
- Input for stem increment sensor
- Built-in datalogger
- No overheating of stem tissues
- Power requirements proportional to sap flow rate – fits to solar powering
- Battery operated with extremely high efficiency > low energy consumption
- Manufactured by EMS



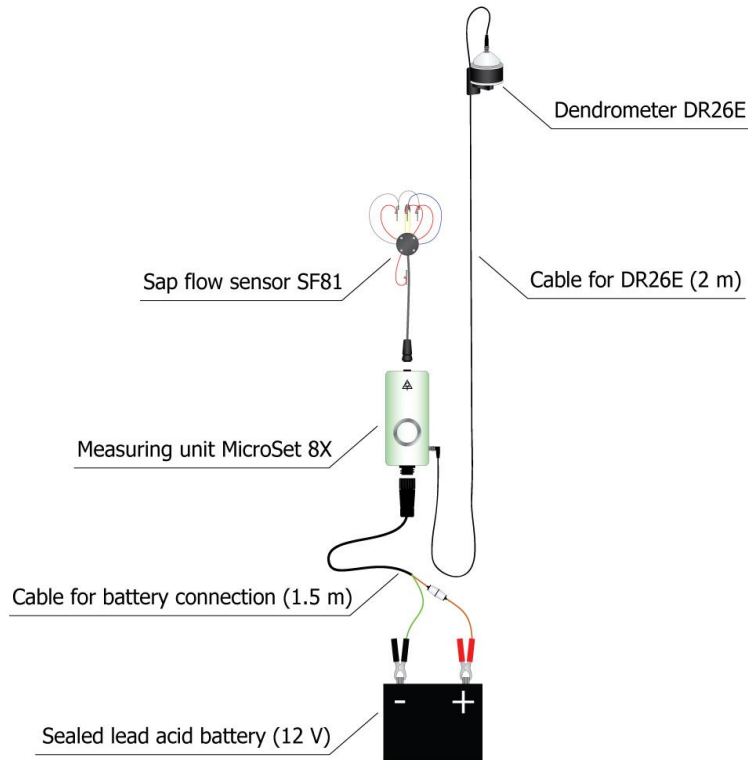
Specification:

- Minimal stem diameter at cambium level 12 cm
- Constant temperature difference adjustable to 1, 2 or 3 K
- Average power consumption 0.3 – 0.4 W @ $dT=1$ K
- Datalogger memory sufficient for one year of ten-minute readings of sap flow and stem increment



System description

Measuring system consists of the MicroSet 8X controlling unit with built-in datalogger, sap flow sensor SF 81, set of stainless electrodes, weather shields and connecting cables. System can be equipped with stem increment sensor DR26E.



System components

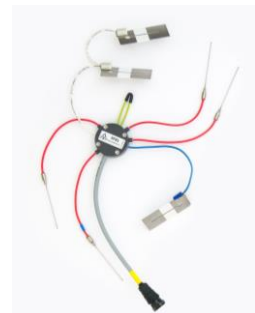
Measuring unit MicroSet 8X

Electronic unit is controlling the measurement and store data to the built-in datalogger. It has a two-digit display which, when activated by the magnetic head of communication cable, shows the status of the unit, mainly operating errors. Since the measuring unit contain built-in datalogger, it does not need additional data acquisition equipment.



Sap flow sensor SF81

Sensor intended for continuous measurement of volumetric sap flow in tree trunks larger than 12 cm (at cambium level). The stainless electrodes (terminals) are hammered into the stem and thermosensor needles are inserted into the geometrical center of the part of electrode inside xylem. Highly conductive steel equalizes radial differences in temperature of the sapwood and allows measurement of mean xylem temperature. Therefore, measured values are nearly independent on the radial profile of sap flow density. The sap flow values in [kg/h] are calculated directly according to the sensor parameters in EMS Mini32 software.



Dendrometer DR26E

Sensor designed for long-term measurement of tree trunk circumference increment by stainless tape that encircles the tree trunk. Tape length variations are measured with a rotary position sensor. The sensor is connected to the measuring unit MicroSet 8X, that collects and saves measured values.



Weather protection set

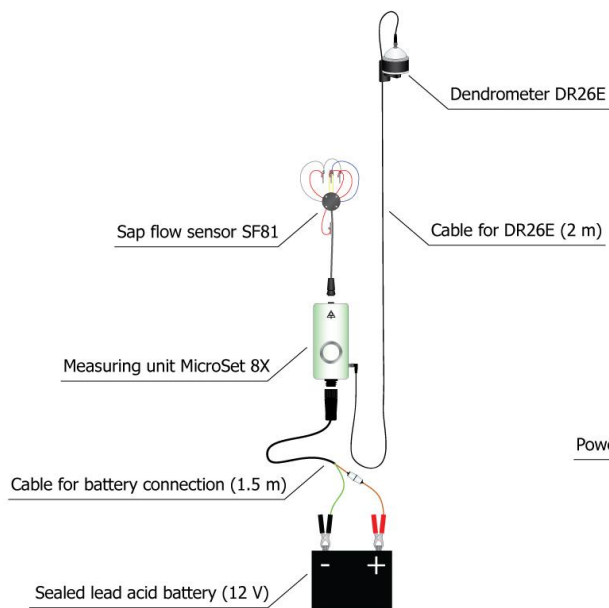
The measuring point at the tree is protected against ambient factors, mainly against direct sun irradiation by means of reflective insulating weather shields. It reflects the sunshine and reduces the effect of the ambient temperature on the heat field. It also protects sensor against heavy rain and wind although a little wetness on the stem does not affect measurements.



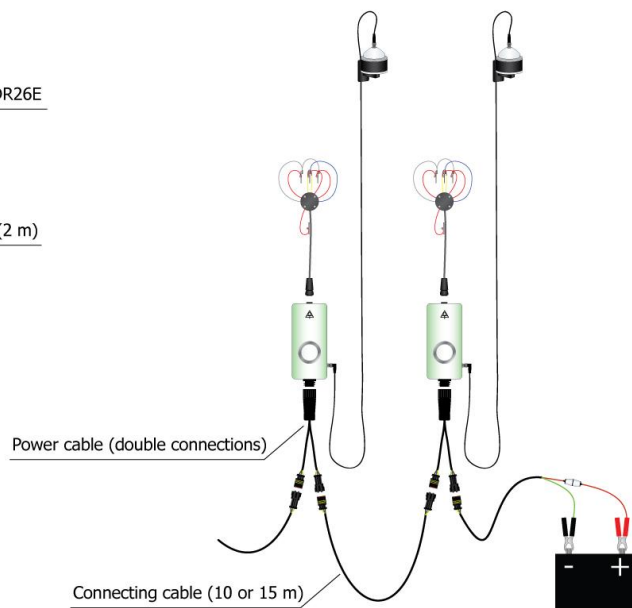
Powering

In terms of measurement layout there are two possibilities of powering – individual and in network. Sensors can be spread over large area with individual batteries, or they can be connected as a chain to one big battery or solar powering system.

Individual powering:



Network powering:



Accessories

Installation tools

The set of installation tools are designed to ensure efficient and precise installation of sap flow sensor SF81. In portable case you will find all the necessary tools for measuring the bark and phloem thickness, hammering of electrodes, cleaning slots in electrodes and extraction of needles and electrodes.



Specification:

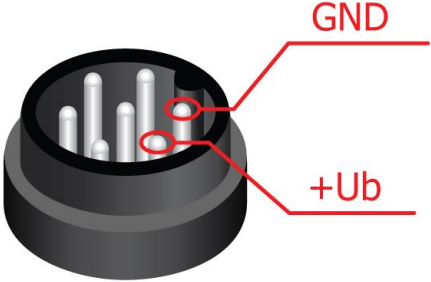
Measuring unit MicroSet 8X

Heating method	direct heating of stem tissues by passing of electrical AC current
Sap flow values	kg/h kg/h per cm of stem circumference
Preset temperature difference	1, 2 or 3 K
Sap flow range (dT=1K)	0 to 0.38 kg/h per cm;
Sap flow range (dT=2K)	0 to 0.188 kg/h per cm;
Sap flow range (dT=3K)	0 to 0.13 kg/h per cm;
Range of xylem resistance	300 Ohm to 35 kOhm
Power voltage for increment sensor	at least 7 V DC
Starting voltage	11.7 V DC
Nominal voltage	12 V DC
Turn off voltage	10 V DC
Wide operating voltage range	10 – 16 V DC
Absolute maximum voltage	± 30 V DC
Maximum current consumption	ca 400 mA
Maximum heating power	2.4 W (limited)
Average efficiency	better than 85 %
Heating voltage	AC 1 kHz, non-sinusoidal, max 150 V _{ef} @25 kΩ
Average current consumption	Approx. 20 mA to 50 mA daily average (according to the sap flow rate)
Memory capacity	256 kB; ca 120,000 readings; non-volatile
Controlled temperature	average of all three electrodes
Back-up battery	SAFT 14250 keeps internal clock
Communication	Infrared (with IrDA/USB special cable)
Dimensions	160 x 80 x 60 mm; 500 g
Operating environment	-20 to 50 °C; 0 to 100% RH
Sap flow sensor connection	6-pin Switchcraft EN3 P6 connector female
Increment sensor connection	3-pin M8 connector female

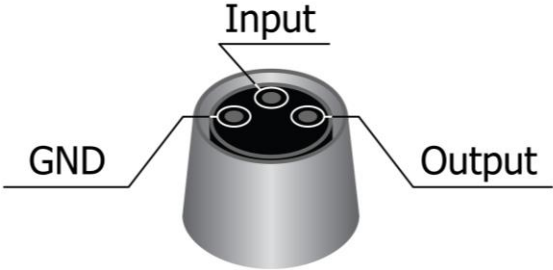
Sap flow sensor SF81

Terminals/electrodes	three stainless plates 25 x 1 mm, 60, 70 or 80 mm long
Distance between electrodes	20 mm
Temperature sensors	four thermocouples in stainless needles (T-type)
Thermocouple needles diameter	1 mm
Thermosensor arrangement	three needles placed in the middle of electrodes, one reference

**Sap flow measuring unit MicroSet 8X
- Amphenol C016 male connector wiring**



**Sap flow measuring unit MicroSet 8X
- female connector for DR26E wiring**



Standard M8 male connector cable wiring



- Brown - Output
- Black - Input
- Blue - GND