



**EMS Brno**

## Data Acquisition Environment

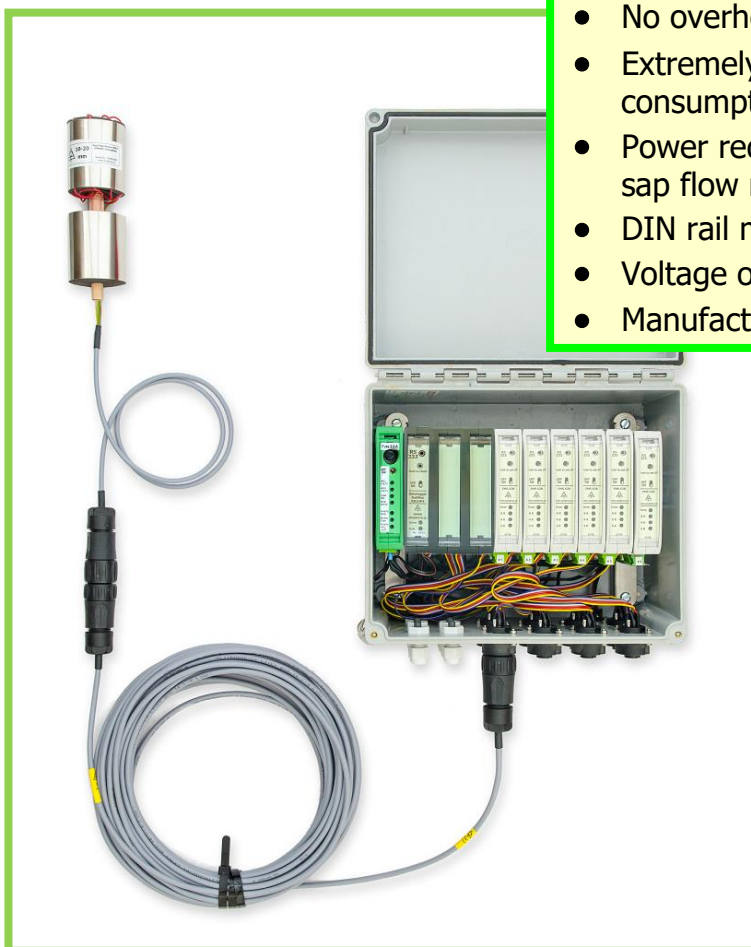
Hardware – Software – Cloud application

[www.emsbrno.cz](http://www.emsbrno.cz)

**Modular Sap flow system**  
**EMS 62** consists of SF 62B module, SF 64 sensor and datalogger

### Main features:

- Tissue heat balance method with variable power and constant  $dT$
- External heating and internal temperature measuring of stem tissue
- No overheating of stem tissues
- Extremely high efficiency > low energy consumption
- Power requirements proportional to sap flow rate – fits to solar powering
- DIN rail mounting modules
- Voltage output
- Manufactured by EMS



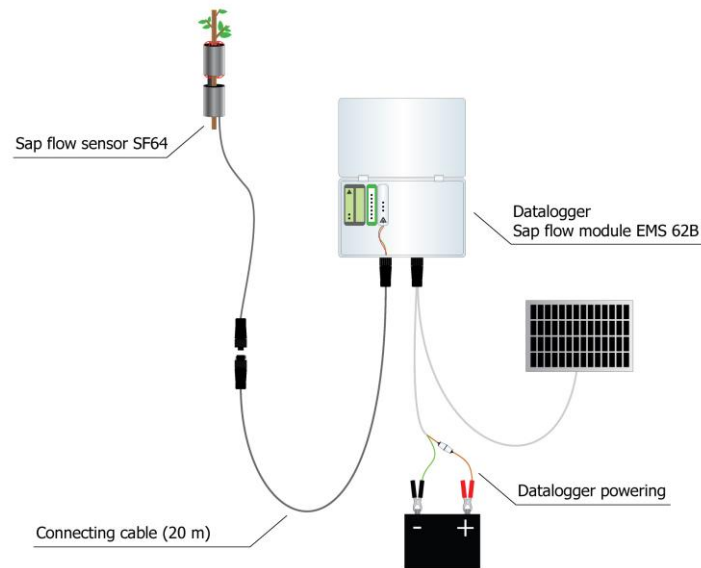
### Specification:

- Two sensor sizes for diameters 6 to 12 and 10 to 20 mm
- Constant temperature difference adjustable to 2, 4 or 8 K
- Daily power consumption 0.2 to 1.2 Ah ( $dT=4$  K;  $U_b=12$  V) according to sap flow rate



## System description

Measuring system consists of the EMS 62B (DIN rail mounting) module with voltage output, sap flow sensor SF 64 (6-12 or 10-20 mm), weather shield and connecting cables. System is ready to be connected to the datalogger supporting single-end or differential voltage (2.5 V) measuring.



## System components

### Module SF 6X (SDI-12)

Electronic unit includes the power unit, the temperature and heating power measuring circuits, the controlling system and the output D/A convertor. Electronic circuits are designed for maximal power efficiency in order to save batteries. The power consumption is directly proportional to heating power.

EMS 62 controlling module is not protected against weather. It is designed for DIN-rail mounting into an enclosure together with a datalogger and power terminals.

The module is equipped with a button for setting the temperature difference (2, 4 or 8 K) and LED indicators indicating preset dT and an error status.



### Sap flow sensor SF 64

Sensor intended for continuous measurement of volumetric sap flow in stems with diameter between 6 to 20 mm (two dimensions of sap flow sensors according to the stem thickness - 6 to 12 and 10 to 20 mm). The sensor consists of two similar cylindrical parts. Each part wraps the stem with insulation foam. One part contains linear heating elements which are gently pressed to the stem by soft foam. A needle thermocouple is inserted to the stem in radial direction at the level of upper edge of heating elements (in direction of water movement). Second cylinder has no heater and it just covers the reference needle thermocouple located with respect to the



thermal symmetry. The water passing along the sensor is warmed and the heating power is controlled in order to keep the temperature difference between needles. Then, the input power is directly proportional to the amount of water passing the sensor in terms of kg/hr.

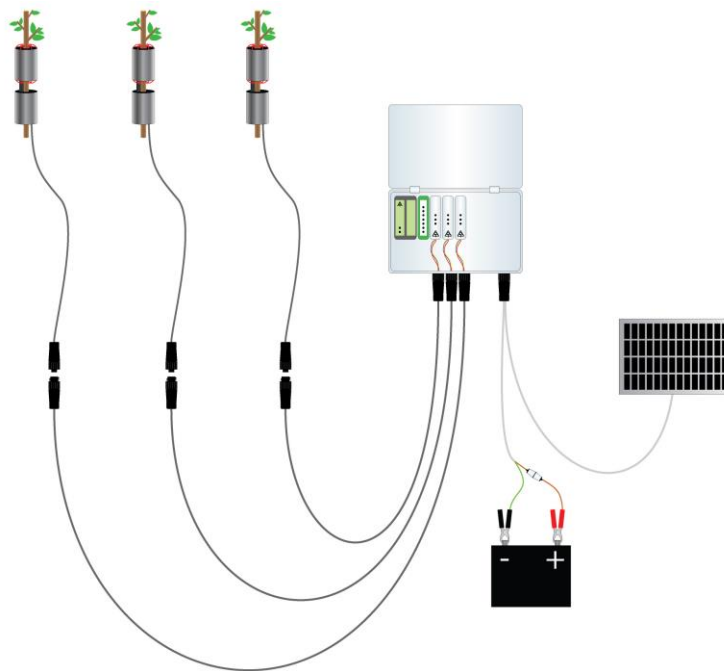
#### Weather protection set

The measuring point at the stem is protected against ambient factors, mainly against direct sun irradiation by means of reflective insulating weather shield. 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. Approximately 30 cm of free stem is demanded for proper sensor installation.



#### Powering and data access:

System is ready to be connected to the datalogger supporting single-end or differential voltage (2.5 V) measuring. The arrangement with EMS datalogger RailBox RB is shown here.



### **Accessories**

#### Installation tools

The drill is necessary for drilling holes for sensor needles (0.8 mm diameter) in xyloid stems. It is strongly recommended to use a drill with controlled revolutions. The drill should keep revolutions nearly independent to drilling load in order to avoid overheating or burning plant tissues.



## Specification:

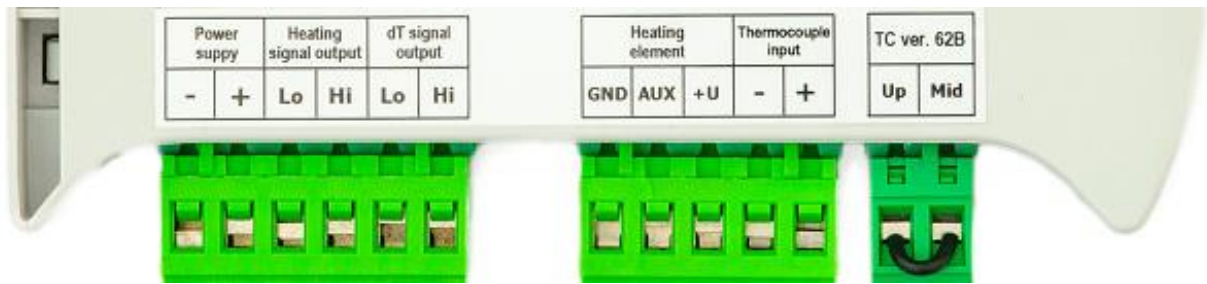
### Sap flow module EMS 62B

Output	voltage (heating power per dT [mW/K])
Heating method	external heating of stem, internal measurement of dT
Preset temperature difference	2, 4 or 8 K
Output signal conversion factor	$-25 + 0.25 \cdot U$ [mW/K, mV] $\rightarrow$ P/dT $-0.0215 + 0.000125 \cdot U$ [kg/hr/ mV] $\rightarrow$ Q
Operating voltage range	10.5 – 16.5 V DC
Starting voltage for measurement	11.9 V
Shut-down voltage for measurement	10 V
Absolute maximum voltage	30 V DC
Maximum current consumption	ca 400 mA
Maximum heating power	3.2 W (limited)
Average efficiency	better than 85 %
Daily power consumption	0.2 to 1.2 Ah (dT=4 K; Ub=12 V) (according to the sap flow rate)
Dimensions	22 x 120 x 112 mm
Weight	170 g
Operating environment	Module is not protected against weather. It is designed for DIN-rail mounting into an enclosure together with a datalogger.

### Sap flow sensor SF64

Stem diameter range	6 to 20 mm covered by two sensor types: 6 to 12 mm and 10 to 20 mm
Temperature sensing element	two thermocouples in stainless needles (T-type)
Thermocouple needles diameter	0.8 mm
Thermosensor arrangement	two needles placed in a distance 12 cm, inserted in radial direction into the stem
Sensor heater resistance	100 ohm ( $\pm$ 10%)
Necessary stem length for sensor installation (incl. radiation shield)	30 cm
Sap flow sensor connector	Amphenol C16 connector female
Sap flow sensor cable length	0.8 m

## Sap flow module EMS 62B wiring



## Sap flow sensor SF64 Amphenol C16 female connector wiring

