PHYTO-SENSOR™ GROUP
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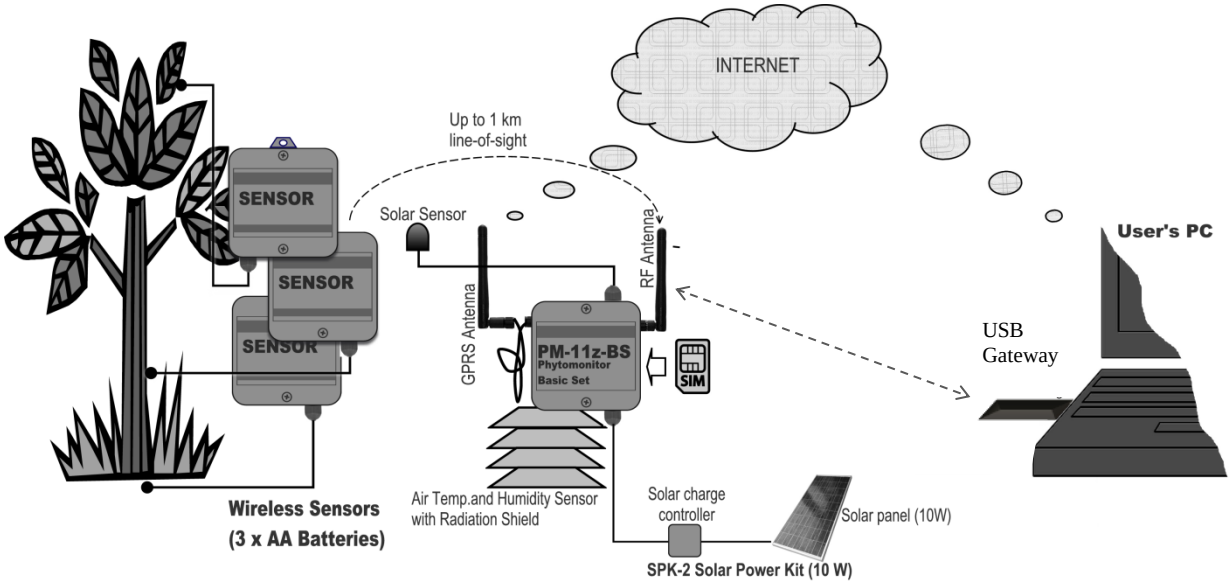
PM-11z-BSO Phytomonitor Basic Set

User's Guide

(Version 2017-BSO: SPK-2 Solar Power Kit, ATH Sensor with radiation shield)

ABOUT THE PM-11z-BSO PHYTOMONITOR BASIC SET

Basic configuration of the PM-11z-BSO Phytomonitor Basic Set is illustrated below:

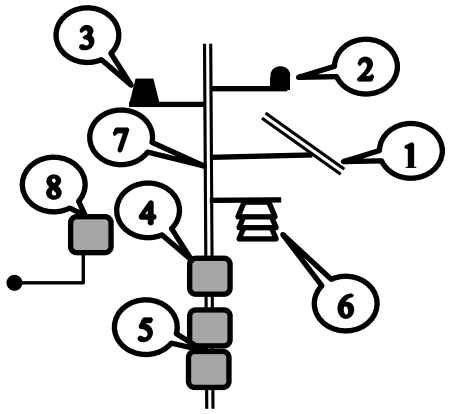


The PM-11z-BSO Basic Set includes a special model of the PM-11z Phytomonitor with the built-in Solar Radiation Sensor (either Pyranometer – *BSOP model* or Quantum (PAR) Sensor – *BSOQ model*), and the Air Temperature and Humidity Sensor with radiation shield[1]. In addition to that, the Basic Set includes the SPK-2 Solar Power Kit, the UGWz USB Gateway, and Software CD. A customized set of wireless Phyto Sensors is optional. To put all these parts into operation, you need also a PC (or notebook). It is recommended to do the first start on site keeping the sensors near the PM-11z-BSO.

[1] There are two basic models of PM-11z-BS Phytomonitor, which differ in aspiration mode of the air temperature and humidity sensor. The PM-11z-BSP was designed for using in protected crops where air movement is fairly slow and external electrical power is commonly available. This model has a built-in blower for powered aspiration of the sensor that significantly improve accuracy in still air. The PM-11z-BSO model was designed for using in the open where the power sources are commonly limited. It has a passive solar radiation shield only.

FIRST START

The recommended positioning of the PM-11z-BSO parts and accessories is shown below:



Mount parts 1 to 5 on a sturdy pole or mast (7). The T-1000 Tripod is recommended. Please refer to our catalog No. B20.

1.Solar Panel

Sunlit place, looking to the South in Northern hemisphere.

2.Solar radiation sensor

Sunlit place. Direct the holder to the South in Northern hemisphere.

3. GPRS Antenna.

At least 1 m distance from the PM-11z (4) to avoid interference.

4. PM-11z Phytomonitor.

Well airing shaded place, behind the Solar Panel, for instance.

5.Solar charge controller of the SPK-2 Solar Power Kit

Well airing shaded place, behind the solar panel, for instance.

6.Air Temperature and Humidity Sensor with Radiation Shield.

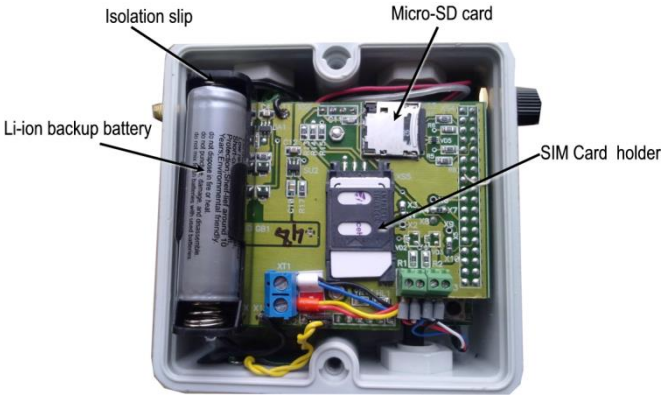
8. Sensors

Direct the side with the RF antenna to the PM-11z. This is usually the left side if you look at the front panel of the sensor.

1. Activation of the PM-11z Phytomonitor

a. At first, please locate all parts of the PM-11z-BSO:

b. Open the front lid of the PM-11z-BSO



c. Insert a local SIM card (shall be purchased form a local provider).

d. Remove the isolating slip from the battery compartment.

e. Close the lid. Please take care to keep the blower's cable away from the blower's blades and the lid's edges.

f. Attach antennas.

g. Mount the PM-11z-BSO using the mounting plate located at the rear side of the enclosure. For best communication range, mount the PM-11z-BSO as high as possible.

h. Mount the Solar Radiation Sensor using the enclosed holder.

The sensor should be mounted with the cable pointing toward the nearest magnetic pole. For example, in the Northern Hemisphere, point the cable toward the North Pole. In the Southern Hemisphere, point the cable toward the South Pole.

2. SPK-2 Solar Power Kit.

Please see the attachment.

3. PC and USB Gateway

a. Insert installation CD into your CD drive and install the program.

b. Insert the USB Gateway's plug into any free USB port of your PC. The green LED located at the USB Gateway indicates that it is activated.

c. Locate the PM-11z Phytomonitor program icon on desktop, and click it to run the program.

d. Follow on-screen instructions during program setup. Please select USB connection type on the first screen.

e. In the <System View> window click <Settings> button. Set 5 min measurement period and 1 in the <Go online after every> box. Click OK.

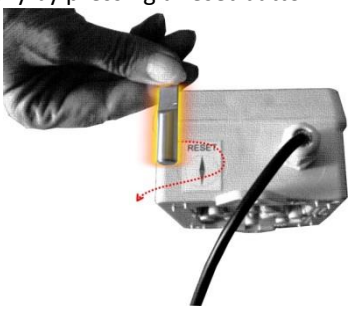
4. Sensors

a. Take a sensor, unscrew two screws and remove the lid. Please note that, at this stage, the sensor should be located close to the PM-11z-BSP and your PC, i.e. within line-of-sight.

b. Remove the isolation slip from the battery compartment. This applies power to the sensor's electronics and starts activation procedure. The following light and beep indications represent progressive activation stages:

i. Short light and beep – beginning of activation.
ii. Searching network – continuous LED light and no beep. It may take about a minute.
iii. The network is found – double LED blink and double beep. (If network was not found – continuous beep and LED blinking during 8-10 sec).
iv. Representing index of communication quality – 1 to 6 beeps of higher tone. Six beeps correspond to excellent quality index. Three to five beeps – acceptable quality index. One or two – low index. If the quality index is low, the following measures are recommended: 1) to place a sensor closer to the PM-11z Phytomonitor; 2) to place a Router between the sensor and the PM-11z Phytomonitor. Important note: the higher the communication quality index, the lesser power is used during communication sessions, and the lifetime of batteries is longer.

c. You may repeat the activation process as many times as necessary by pressing a reset button. The stage 'iv' allows finding the best location and orientation of the sensor in terms of optimal communication quality. It is important to note that the next activation (i.e. reset) processes may be initiated with the lid closed. There is a magnet-operated switch inside the sensor's electronics. You may use the enclosed magnet stick to reset the sensor from outside as shown in the picture below. Please note that the PM-11z-BSP may be reset same way.



d. When the sensor is activated, close and fix the lid by two screws.

e. Take next sensor and repeat steps 4a-4d.

f. When all sensors have been activated, open the PC program and check readings of all sensors in <Data View> window. The readings are updating every five minutes.

g. If the readings are reasonable, the startup procedure is completed. Now please go to <Settings> in the <System View> window, and set desired measurement period and communication interval. The recommended values are 10 min, and 1 or 2, respectively.

h. Now you may place sensors and other system parts where necessary. Please refer to a particular sensor's documentation to provide correct installation.

5. Router (optional)

The Router simply relays the signals between the PM-11z and sensors. The Router may be used for two reasons: a) to extend the communication distance between sensors and the PM-11z. In that case, the Router shall be

positioned somewhere between the PM-11z and a distant sensor (sensors), and b) to increase the total number of sensors in a single network above 15. The Router may be powered either from the Solar Power Kit or from any regulated power supply 7 to 30 Vdc.

NORMAL SHUTDOWN AND STORAGE

1. Sensors
   - Open a sensor's housing, and remove batteries from the battery compartment.
   - Close the lid and store the sensor and batteries separately in dry place.
2. PM-11z-BSO Phytomonitor
   - Open the Phytomonitor's housing, and remove the rechargeable battery.
   - Close the lid and store the Phytomonitor and its battery separately in fry place.
3. SPK-2 Solar Power Kit
   - Open the lid of the upper box, move the jumper (3d, p.4) from operating position to the transfer position/
   - Disassemble the Tripod.
4. USB Gateway
   - Disconnect the USB cable from a PC port. Keep the USB Gateway in dry place.
5. Batteries
   - Remove batteries every time when the sensor is not in use for a while.
   - Please check sensors' batteries with a tester after long-term operation and storage. Please use new standard AA Alkaline batteries when necessary.
   - The rechargeable battery has long lifetime comparable with the lifetime of the PM-11 Phytomonitor. Please contact your supplier for battery replacement if necessary.

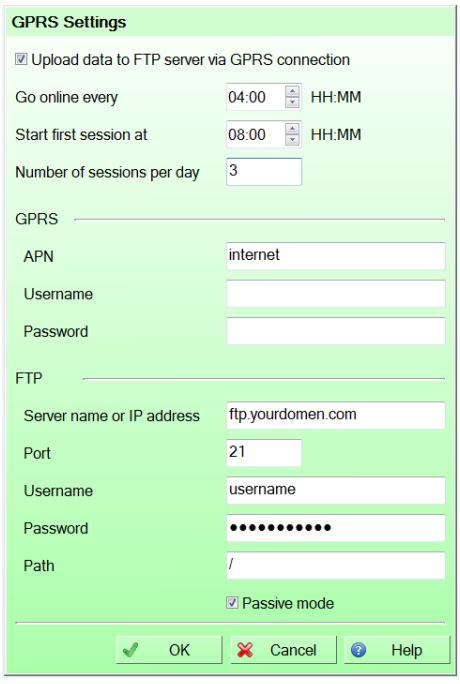
NEXT PUTTING INTO OPERATION

1. Please check batteries in insert them into appropriate battery compartment of each sensor.
2. Insert the rechargeable battery into the battery compartment of the PM-11z Phytomonitor. Please use only the recommended type of the Li-ion battery – model 14500.
3. Assemble Tripod and make all connections as described in the First start section.

ACTIVATION OF THE GPRS MODULE

The PM-11z-BS comes with the GPRS module to provide data transmission over Internet. The activation procedure is following:Make sure that the PM-11z-BS is not powered on.

- Open PM-11z-BSP box
- Insert a local GPRS-enabled SIM card into the appropriate slot inside the PM-11z box.
- Power the PM-11z on. Establish communication via USB Gateway.
- Open the 'System view' window and click 'GPRS' button. Enter necessary information in empty fields:
  a. Check the 'Upload data…' box.
  b. Set the desired time interval for data transmission.
  c. The GPRS settings shall be acquired from a local GSM operator.
  d. The FTP settings shall be acquired from the appropriate provider. If you have no your own provider, please contact Bio Instruments S.R.L. at support@phyto-sensor.com for arranging data transfer via Bio's FTP server.



SPECIFICATIONS

Solar Radiation Sensors

Pyranometer

Calibration: Natural sunlight
Range of Measurement: 0 to 1250 W/m2
Absolute accuracy: ±5%
Resolution: 1 W/m^2
Operating Environment: -25 to +55 °C
Probe dimensions, mm: 24 ∅ × 27.5 H
Cable length: 3m min

Quantum (PAR) sensor

Calibration: Natural sunlight
Range of Measurement: 0 to 3000 $\mu mol \cdot m^{-2} \cdot s^{-1}$
Absolute accuracy: ±5%
Resolution: 1 $\mu mol \cdot m^{-2} \cdot s^{-1}$
Operating Environment: -25 to +55 °C
Probe dimensions, mm: 24 ∅ × 27.5 H
Cable length: 3m min

Air Temperature and Humidity Sensor

Temperature
Range: -5 to 50 °C
Resolution: 0.1 °C
Accuracy: ±0.5 (5 to 40 °C)
Humidity
Range: 0 to 100% RH
Resolution: 0.1 %RH
Accuracy: ±2 %RH (5 to 90%RH)
±3 %RH (above 90%RH)

Data logger

Data memory: 2 GB min.
Radio Frequency: 2.4 GHz
RF Power: 10 mW
Communication range: 1 km line-of-sight
Network capacity: up to 10 additional wireless sensors
Power: SPK-2 Solar Power Kit
Data processing: the PM-11z-BSO records the average value of solar radiation, temperature and humidity collected ten times evenly during the period between records.

Customer Support

If you ever need assistance with your Phyto-Sensor™ System, or if you just have questions or feedback, please e-mail at support@phyto-sensor.com. Please include as part of your message your name, address, phone, and fax number along with a description of your problem.

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SPK-2 Solar Power Kit

The SPK-2 Solar Power Kit is designed for powering PM-11z Phytomonitor when the normal electric power is not available, in the open field, for instance.

Typical mounting of the SPK-2 Solar Power Kit is shown on Page 3.

The holder of the Solar panel shall be fixed on a mast by using four enclosed bolts. The panel must be oriented strictly to South (in Northern hemisphere).

The Solar Charge Controller with Junction Box shall be attached to the mast using a couple of enclosed cable ties.

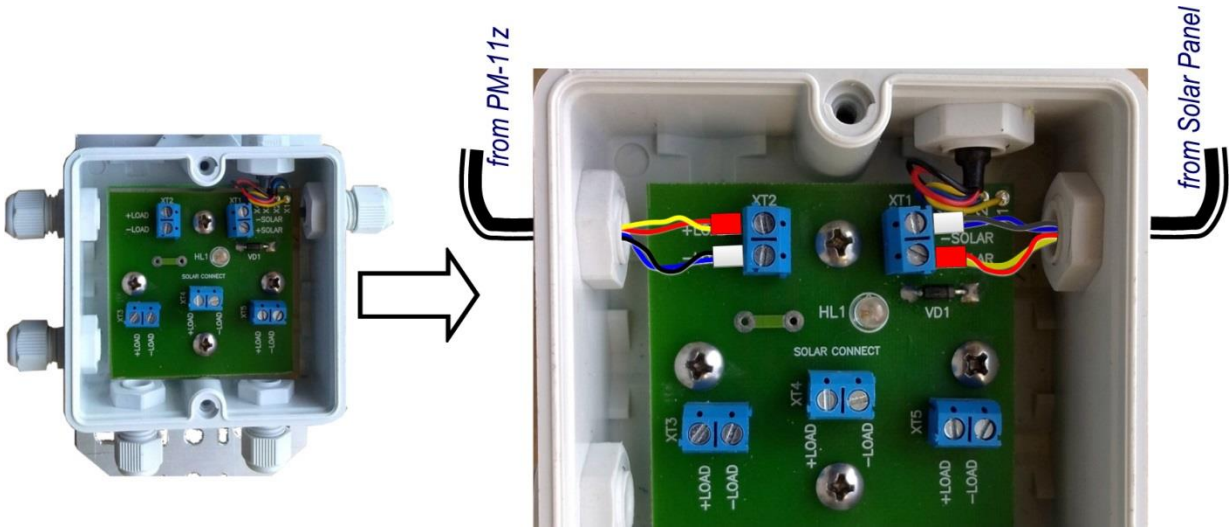
Connections

Precaution! All connections shall be made when the main power switch is in OFF position (see the photo below):

a. Remove the lid from the lower SPK-2 enclosure named as 'Junction box'.

b. Run the PM-11z Phytomonitor's cable through a left cable gland of the Junction Box (please note that this cable must be already connected to the PM-11z Phytomonitor), and connect the cable to the terminal block marked as "+LOAD","-LOAD" keeping correct polarity. Positive – Red end; Negative – White end.
NOTE: There are four terminal blocks for connecting external power loads. Some other devices may be powered form available terminals, a router, for instance.

c. Run the Solar Panel's cable through the right cable gland of the Junction Box, and connect the cable to the terminal block marked with "+SOLAR","-SOLAR" keeping correct polarity. Positive – Red end; Negative – White end. If a solar pane is exposed to the sun at this time, the HL1 LED shall be on.



d. Please prepare the PM-11z for operation: SD-card and SIM card must be inserted, and the internal battery must be activated.
e. Now you may switch the main power switch ON. The appropriate LED on the PM-11z's PCB shall be on.
f. Close and tighten the lids of the junction box SPK-2 and PM-11z.

Specifications

- Solar Panel Power Rate: 9V, 10 W
- Standard zenith angle: 45°
- Azimuth: 180° in Northern hemisphere, and 0° in Southern hemisphere
- Rechargeable battery capacity: 2.2 Ah 2xPack plus 0.9 Ah backup battery in PM-11z. Total: 3 Ah approx.
- Battery type: Li-ION 2.200 Ah 7.4V 2xPack plus Li-ION 0.9 Ah 3.7 V.
- Maximal depth of discharge: 0 %
- Cables length: 3 m typical