



## PM-IO-6-WIFI IO Module

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### FEATURES

- Optional Single or Double Tinovi Soil Moisture/EC/Temperature sensor option
- Optional BME280 Air Temperature/Humidity/Pressure sensor option (Not waterproof)
- Optional OPT3001 light lux sensor option
- Optional 12v booster pulse solenoid reverse switch output option
- Pulse counter for utility meter reporting
- Water leak detector and valve close output trigger
- Dust and waterproof IP67
- Android application for Bluetooth LE setup
- Configurable URL for JSON data post
- 50m range with indoor WiFi router





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### ELECTRICAL PROPERTIES

	Min/Sleep	Typical	Max
Supply voltage (VCC), V	2.5	3.6	6
Working current (VCC=3.6V) , mA	Sleep 22uA	22	150
Operating Temperature Range, Celsius	-20	25	70

Sensor sleep mode consumes 20 uA, Active mode consumption 30-150 mA. Required battery is **3.7v 18650**. Or **26650** if configured additionally. After power up sensors wait 20 seconds for Bluetooth configuration session connection from android application. If none is not connected, device turns off Bluetooth hardware and starts normal operation. Device should be restarted, before attaching to Bluetooth for configuration, it means battery should be removed or reset button pressed.

### PHYSICAL PROPERTIES

dimensions 80x130x35  
Soil Sensor cable length 1.4m or optional up to 5m

### SOIL SENSOR MEASUREMENT PROPERTIES

Soil Sensor	Resolution	Range /avg Tolerance
Dielectric permittivity ( $\epsilon$ ) (Temperature corrected)	0.1 $\epsilon$	1 (air) to 80 (water) /5%
Volumetric water content - VWC calculation from Dielectric permittivity $\epsilon$ . VWC = 0.002974 * pow( $\epsilon$ ,2) + 0.07424 * $\epsilon$ -1.295;		
Electrical Conductivity (mS/m) <b>(0.1 mS/m = 1 uS/cm)</b>	0.1 mS/m	0...300 mS/m 20% 300...800 mS/m 40%
Temperature (°C)	0.1°C	-20 to



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		70°C/3%
Degree of water saturation in the soil	0.1%	0 - 100% /8%

### JSON DATA MESSAGE

You may configure to device http/https post ("Content-Type", "application/json") to configured endpoint for receiving device data. Data is sent by http POST request containing single level JSON message containing fields:

Key	Meaning
set	Setup byte (on water leak trigger changed)
bat	Bat percent
rssi	RSSI signal strength
s0_e25	Soil Sensor 0 Dielectric pemitivity at 25c
s0_ec	Soil Sensor 0 Electric conductivity
s0_temp	Soil Sensor 0 Temperature
s0_vwc	Soil Sensor 0 Degree of water saturation in the soil
s1_e25	Soil Sensor 1 Dielectric pemitivity at 25c
s1_ec	Soil Sensor 1 Electric conductivity
s1_temp	Soil Sensor 1 Temperature
s1_vwc	Soil Sensor 1 Degree of water saturation in the soil
w_press	Water pressure if pressure sensor present
b_temp	Air temperature if BME280 air sensor present
b_hum	Air humidity if BME280 air sensor present
b_press	Air pressure if BME280 air sensor present
lux	Light LUX if OPT3001 Light sensor present
pulse	Pulse counter output



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### CONTROL MESSAGE

Device support binary base64 encoded POST response.

HEX to base64 converter [link](#)

Control message contains 1st command byte followed by value:

1. 0x01 + device sleep time (data sending interval) adjustment. Message should contain 5 bytes, 1st byte is 0x01 and following 4 bytes is unsigned 32-bit integer time in seconds to sleep. For example sending HEX 010000000A or "AQAAAAo=" base64 will set interval to 10 seconds, but 0100000E10 or "AQAADhA=" base64 will set interval to 3600 secs = 1 hour.
2. 0x02 + data config byte :
  - a. Bit 0 - enable Tinovi PM-WCS-3-I2C Soil sensor
  - b. Bit 1 - enable BME280 air temp - humidity sensor
  - c. Bit 2 - enable OPT3001 light lux sensor
  - d. Bit 3 - 2nd soil sensor
  - e. Bit 4 - enable pulse counter
  - f. Bit 5 - reserved
  - g. Bit 6 - Water Leak detector flag - leak detected
  - h. Bit 7 - read only -valve status
3. 0x03 + 0x01 or "AQ==" base64 -valve ON or 0x00 "AA==" base64 - valve off
4. 0x04 + 2-byte valve pulse time millis
5. 0x05 + 4-byte max valve on time millis, 0 -disabled
6. 0x06 + 2-byte valve trigger ON VWC limit
7. 0x07 + 2-byte valve trigger OFF VWC limit
8. 0x08 + 4-byte pulse counter offset (pulse counter not supported)
9. 0x09 + 1-byte water leak valve OFF trigger enable =1 , disable =0
10. 0x0A + 1-byte sensor number 0 or 1 - if soil moisture present - calibrate AIR
11. 0x0B + 1-byte sensor number 0 or 1 - if soil moisture present - calibrate WATER
12. 0x0C + 1-byte sensor number 0 or 1 + 2 byte EC value - if soil moisture present - calibrate EC. Example sending 0C0585 will calibrate sensor for 1413 uS/cm
13. 0x0D + 4 byte valve open time in seconds - valve will be closed after this time (device will sleep all that time and close valve on wake up)
14. 0x0E + 1 byte HTTP posting data format 1 = OUT\_JSON or 2 - OUT\_BIN\_BASE64
15. 0x0F + 1 byte over air firmware update check cycles skip, default 10, if you posting messages once in 5 min, then FOTA check will be in 10 x 5 = 50 min intervals.



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### VALVE CONTROL

Valve controller switch max output continues current is 0.5A, (1A max pulse). Battery max current draw is almost 3 times more than your load current, if you apply 0.5A load current, your battery should support 1.5A current. Switch Supports reverse polarity latching relay. In open direction Red wire is Positive, Black negative, but in close direction Black - Positive and Red - Negative. Valve may be controlled via downlink messages, send 0x0301 to open valve, and 0x0300 to close valve. Device remembers last valve status sends it in read only setup byte bit 7: if setup bit 7 is set, then valve is open, if bit is cleared - valve is closed state. (See payload decoder sample- parameter "valve" - indicates valve status 0-close, 1-open). See CONTROL MESSAGES section for other valve control commands. As alternative to booster dedicated 12v battery for switch may be used. That allows up to 3A current via switching circuit from battery.

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### WATER LEAK DETECTOR

Water leak detector on trigger will interrupt device sleep and send message immediate with water leak flag enabled in settings byte. It will repeat sending this flag in 5 messages, then will reset the flag. If valve OFF on water leak trigger is enabled, then valve off will be triggered. 2 electrode water leak detector is supported, triggers when resistance between electrodes is less than 250 kOhm. For water leak detector are used Green and White wires.

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### SOIL SENSOR CALIBRATION

Sensors are already factory calibrated, but in case needed they may be recalibrated using Android application.  
Hold sensor in air and issue this command **air**, response OK.  
Put sensor in to water and issue command **water**, response OK.  
For **ec** <uS/m> calibration put sensor int to liquid and set right sensor reading value in uS/m.

We recommend Android mobile application for sensor setup and data reading/storage

#### SENSOR CALIBRATION ON ANDROID APP

1. open application & wait for USB connected status or connect
3. go to SETTINGS tab,
4. hold sensor in the air – click button AIR
5. submerge sensor in the water or soil with water, click button WATER
6. go to MAIN tab click read to test calibrated values

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### ANDROID APP

<https://play.google.com/store/apps/details?id=com.tinovi.wifiio&hl=en>








Android application lets you configure and calibrate soil moisture sensors your device.

1. Your phone should support Bluetooth..
2. Turn on Bluetooth on your phone
3. Restart device by pressing restart button on device main board or removing and replacing battery.
4. Press pair button and choose TINOVIXXXXXXXXXX device (pair with device, if adding for first time).
5. Wait up to 5 second while application shows Connected TINOVIXXXXXXXXXX in main page, if no connection, repeat restart device and pair operation. Device may be restarted by removing replacing battery or clicking button in PCB board left bottom corner, when battery looks upwards.
6. Click read in main page to read sensor values for test.
7. Switch to settings tab to setup your device
8. In WiFi section input your access point's SSID and pass and click according SET... buttons.
9. Input your backend URL to let sensor post data.
10. Alternatively for demo purposes we have developed our own dashboard for device testing. To register device to Tinovi dashboard, you should authorize with your google account (only first time you open application, then this button will disappear), input device name and click "REG TINOVI" button. This action will generate and set to device URL for posting data to <https://www.tinovi.com/graf/>  
There you also may login with your google account.



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**READ SETTINGS**

S0  S1  Air  Light

**SET CONFIG**

**SET PULSE CNT.**

Sleep:

**SET SLEEP SEC.**

WiFi:

**SET SSID**

**SET PASSWORD**

mydevicename **REG TINOVI**

**SET URL**

Output Format  JSON  BINARY

**SET OTA CHECK.**

**MAIN** **SETTINGS** **LOG**

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