

User Manual and Installation

EM

IO Data Logger + 4G Gateway



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1) Preface:

Purpose of Document

The document covers Installation and usage of Embedos EM IO Data Logger and 4G gateway.

2) IO description:

IO logger is currently provided with the following configuration.

- **Digital Inputs:**

- 1) Pulse Input (To measure RPM value input as digital pulse)

- **Analog Input:**

- 1) Analog Channel 1 Input (User configurable analog parameter 4 – 20 mA)
- 2) Analog Channel 2 Input (User configurable analog parameter 4 – 20 mA)
- 3) Analog Channel 3 Input (User configurable analog parameter 4 – 20 mA)
- 4) Analog Channel 4 Input (User configurable analog parameter 4 – 20 mA)

- **Digital Outputs:**

- 1) Digital Output for Analog Channel 1 Set point.
- 2) Digital Output for Analog Channel 2 Set point.
- 3) Digital Output for Analog Channel 3 Set point.
- 4) Digital Output for Analog Channel 4 Set point.
- 5) Digital Output for RPM Set point.

- **HMI:**

- 1) 1.5" OLED display.
- 2) Web based utility to view real-time data, download reports and configure device setting/parameters.

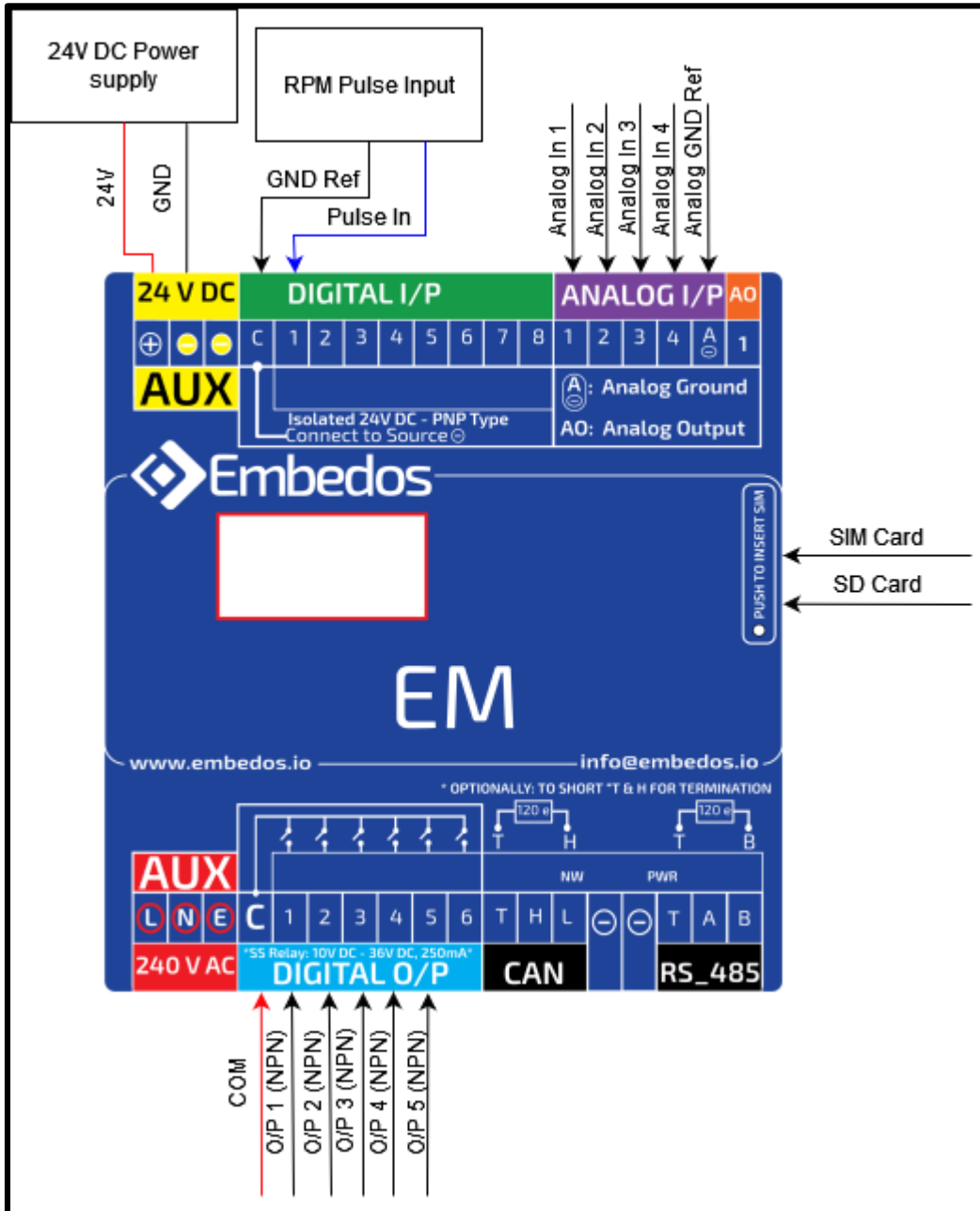
- **Data Storage(Logging):**

- 1) SD card for local data storage and logging.

- **Connectivity:**

SIM card for 4G connectivity.

3) Connection diagram:



4) Application Overview:

The IO data logger is designed to log data to device as analog inputs, a pulse input which is to be converted to RPM value. The logger is able to also display real-time data on a webpage based utility. The user can interact with the data-logger to configure and view all the settings and device parameters currently running on the device. The logger can store real-time data and send the same data via MQTT to a broker.

The IO data logger is provided with following connectivity interfaces:

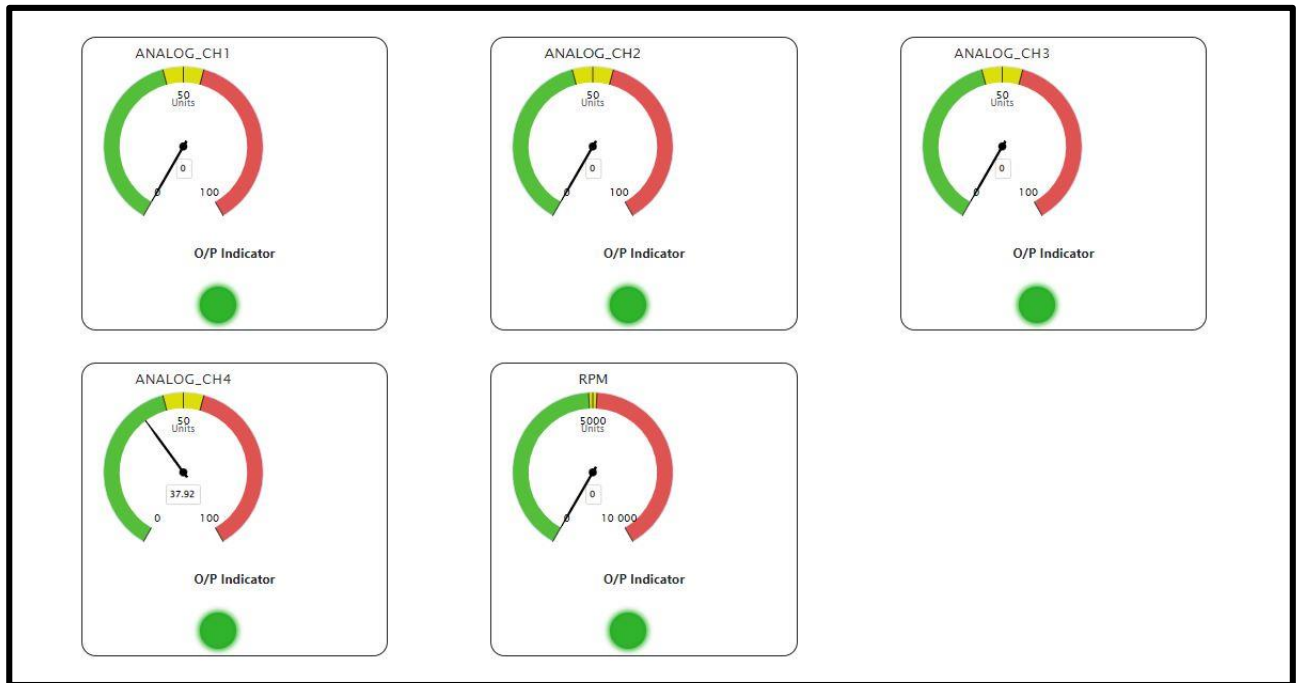
- i. Wifi to connect to an SSID for MQTT data transmission and access to webpage.
 - ii. 4G to connect to a network for MQTT data transmission.
- The device is configured to monitor and log data of five parameters.
 - Parameter 1 to 4 are analog input parameters corresponding to the devices 4 Analog inputs respectively. These parameters can be user configurable.
 - Parameter 5 is RPM parameter and will always output calculated RPM value measured through the devices Digital Input 1.
 - **Note:** Parameter 5 value RPM cannot be interchanged with other parameters.

5) Web utility Overview:

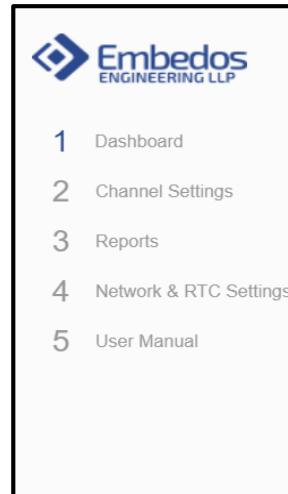
a. Connecting to IO logger using WiFi:

- To access the devices web utility page the user can either connect the computer/laptop to the WiFi AP (Hotspot) generated by the device.
- The default credentials for his AP are as follows:
- **SSID : EM-7C:87:CE:09:DA:D8**
- **Password : Edge@12345**
- **Default IP : 192.168.4.1**
- On successful connection to the AP, the web based utility of the device can be accessed by typing the default IP (192.168.4.1) in any web browser.
- The device will then load the web utility on the browser.
- To access the devices web utility when the device is connected to a WiFi network, the computer must also be connected to the same network.
- The device will display the SSID it is connected to on the OLED display. The device will also display an IP address which it has acquired.
- The user can access the web utility by entering this IP address in the computer.
- The device will then load the web utility on the browser.

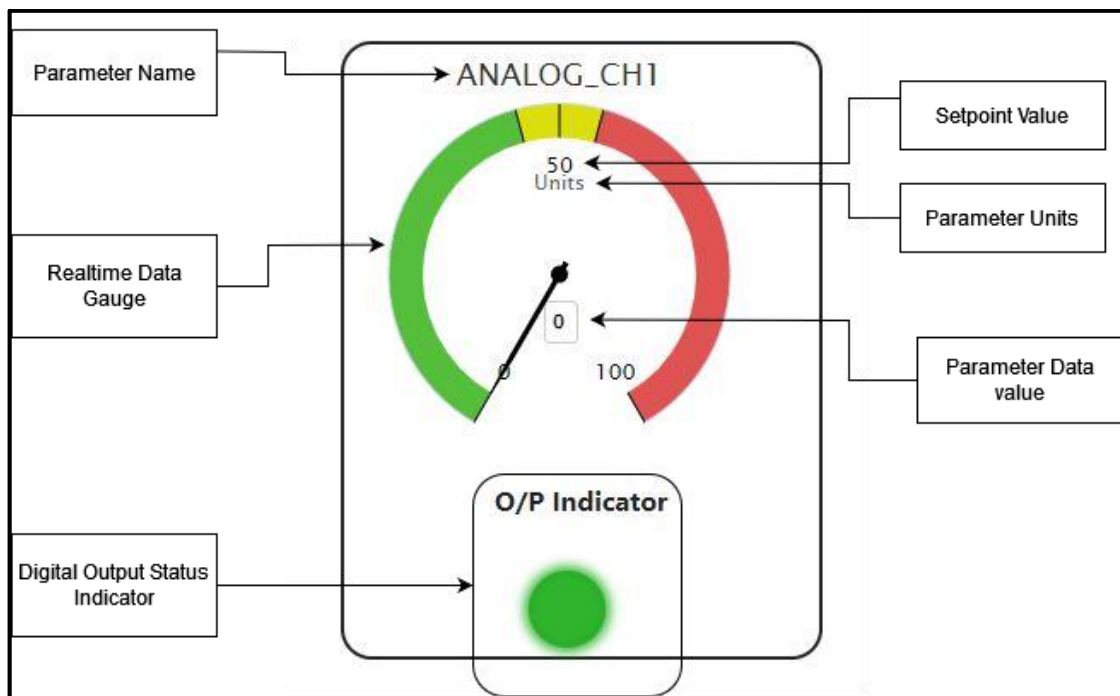
b. Dashboard page description:



- The Dashboard page is loaded when the user enters the devices IP (Default station IP 192.168.4.1 if connected to WiFi AP or Assigned DHCP IP when connected to an SSID) on the browser.
- The User can use the **navigation side bar** on the left side of the web utility to switch to different pages of the web utility. It can be accessed by hovering over the side bar on the extreme left side of the webpage.
- The navigation side bar is shown in the below picture.



- The dashboard page provides the user with real-time data of all parameters the device is currently monitoring. This data is displayed in graphical format using a gauge and an output status indicator for each parameter.



- Each gauge displays the name of the parameter on the top.
- Each gauge displays the units of the parameters at the bottom.
- The numerical value of the parameter is also displayed at the bottom of the gauge.
- The user configured range of the parameter is also displayed above the numerical value of

parameter.

- The graphical gauge represents the value of data in the given user range. The gauge is divided into three sections.
- The orange coloured section in the middle indicates the set-point and hysteresis region.
- The set-point configured by user is displayed on top of the orange region.
- The digital output associated with each parameter is turned on or off on crossing the set-point and hysteresis region. The green coloured region indicates where the digital output will be off and the red coloured region indicates where the digital output will be on.
- The output indicator associated with each gauge provides the user with the current status of the digital output of that parameter.
- The output indicator will be green when the digital output is off and red when the digital output is on.

c. Configuration page description:

The configuration page is provided so the user can configure details about the parameters that the device is currently connected to monitor or log data. The configuration page also provides the user with options to calibrate the devices analog input channels.

i. Parameter configuration overview table:

Analog Input Parameter Setting						
Edit Table						
Sr. No	Parameter	Low	High	SetPoint	Hysteresis	Unit
1	Pressure	0	100	50	5	mBar
2	ANALOG_CH_2	0	100	50	5	Unit
3	ANALOG_CH_3	0	100	50	5	Unit
4	ANALOG_CH_4	0	100	50	5	Unit
5	RPM	0	10000	6000	5	RPM

- The parameter configuration overview tables displays the current parameter configuration settings.
- The table provides the user with following options:
 - ➔ Parameter Name
 - ➔ Parameter User Ranger (Low value and High value)
 - ➔ Parameter Set-point
 - ➔ Parameter Hysteresis
 - ➔ Parameter Units

ii. Configuration of parameters settings:

Analog Input Parameter Setting						
Edit Table						
Sr. No	Parameter	Low	High	SetPoint	Hysteresis	Unit
1	Pressure	0	100	50	5	mBar
2	ANALOG_CH_2	0	100	50	5	Unit
3	ANALOG_CH_3	0	100	50	5	Unit
4	ANALOG_CH_4	0	100	50	5	Unit
5	RPM	0	10000	6000	5	RPM

Edit Configuration

Select Id:

Parameter Name:

Low Range:

High Range:

Set Point:

Hysteresis:

Unit:

- To configure the parameter settings the user must click on the “Edit Table” button.
- On clicking the button the utility will open a configuration section the right side of the table.
- To configure the parameter the user has to first select the ID which corresponds to the serial number present in the configuration table.
- After selection of the ID the previous configuration will be loaded in the fields of the configuration section.
- The user can configure the required parameters settings and click on submit button to save the configuration.
- After the user clicks the submit button the device will save the parameter changes and refresh the webpage.
- The new configuration will now be visible on the configuration table.

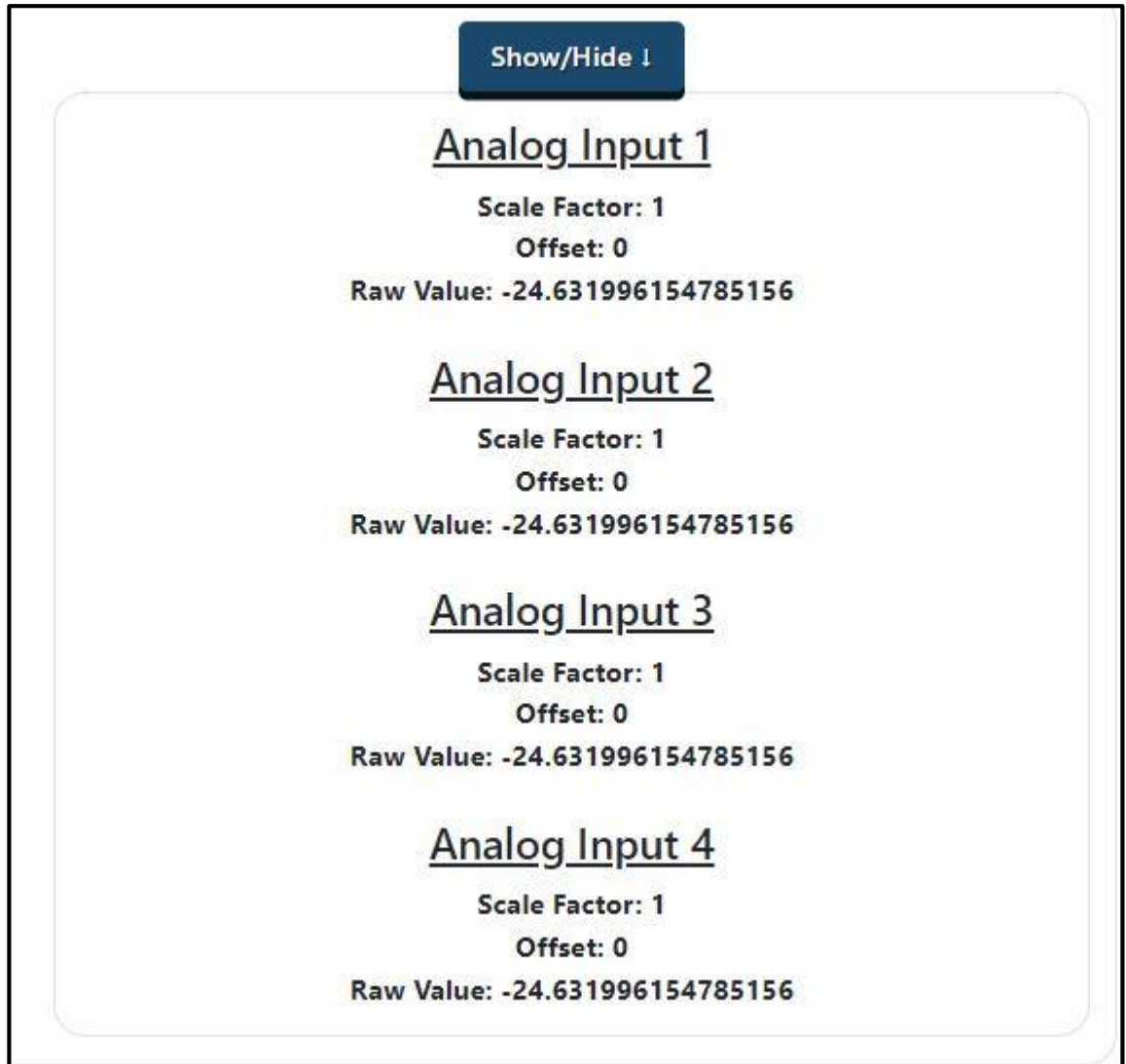
***Note:**

The configuration of parameters have the following constraints:

- Parameter name must not exceed 100 characters
- Parameter unit must not exceed 5 characters
- Set-point value must be between low and high values.
- Set-point and hysteresis region must not exceed low and high range values.

iii. Calibration Diagnostic section:

- The calibration section is provided so that user can calibrate the analog channels of the device as per the requirements.
- To display the calibration diagnostic section the user can click on the Show/Hide button.
- The calibration diagnostic sections is provided so the user can view the current calibration setting of each of the analog channels.
- The Scaling Factor and Offset of each analog channel is displayed.
- The RAW value of analog channels is also displayed for user reference.
- The device is internally calibrated to convert analog input values in range from 0 to 100.
- When a sensor is connected to analog input channel its raw value can be checked in range from 0 to 100.
- The user can check if the analog channel is working as expected by verifying the raw value and change in raw values when the actual analog input is varied.



Show/Hide ↓

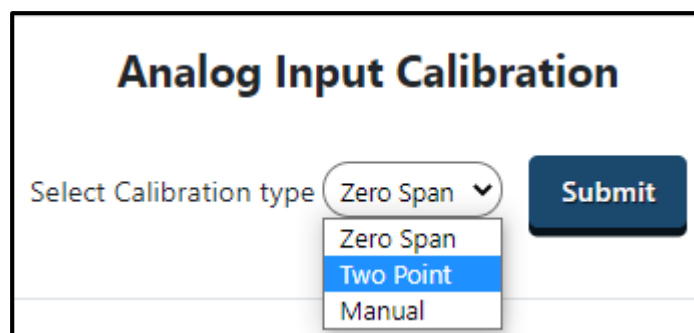
Analog Input 1
Scale Factor: 1
Offset: 0
Raw Value: -24.631996154785156

Analog Input 2
Scale Factor: 1
Offset: 0
Raw Value: -24.631996154785156

Analog Input 3
Scale Factor: 1
Offset: 0
Raw Value: -24.631996154785156

Analog Input 4
Scale Factor: 1
Offset: 0
Raw Value: -24.631996154785156

iv. Analog Input Calibration Section:



Analog Input Calibration

Select Calibration type **Submit**

- Zero Span
- Two Point**
- Manual

The Analog Input Calibration section is provided for the user to configure the

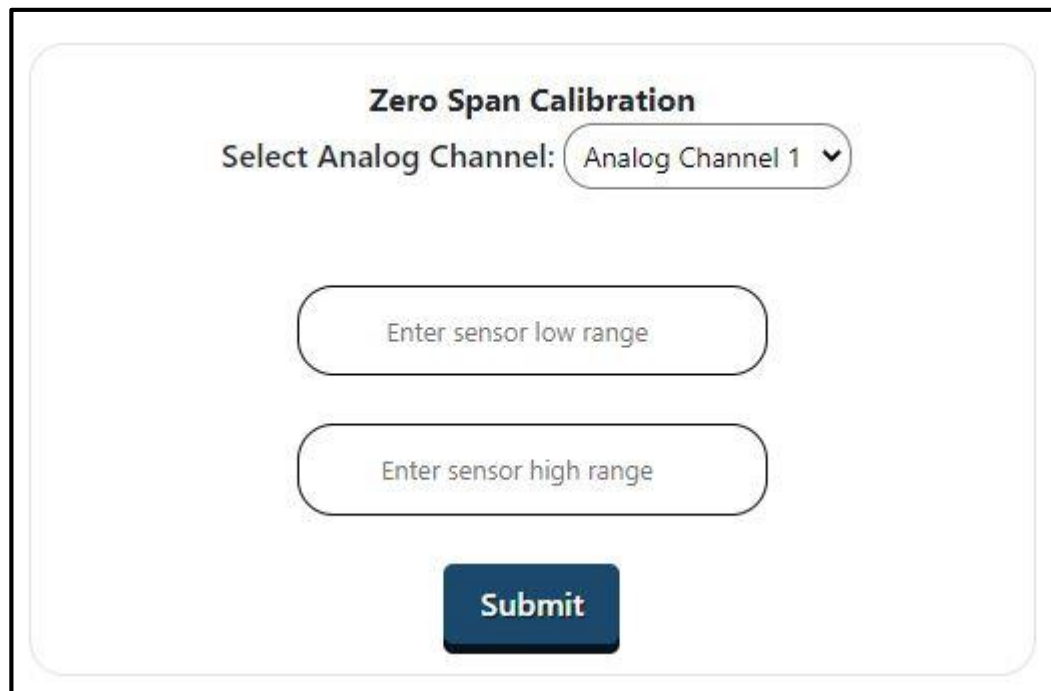
calibration of each analog input as per the user requirements.

Analog calibration can be done by the any of the following three methods:

- **Zero Span calibration:**

Zero Span calibration is a calibration method wherein the user knows the range of measurement of the respective parameter. The user must be aware of the lowest possible value of the parameter and highest possible value of parameter that the analog input represents.

For example, if a sensor is used to measure a physical quantity then the minimum and maximum value that the sensor can measured is to be noted.

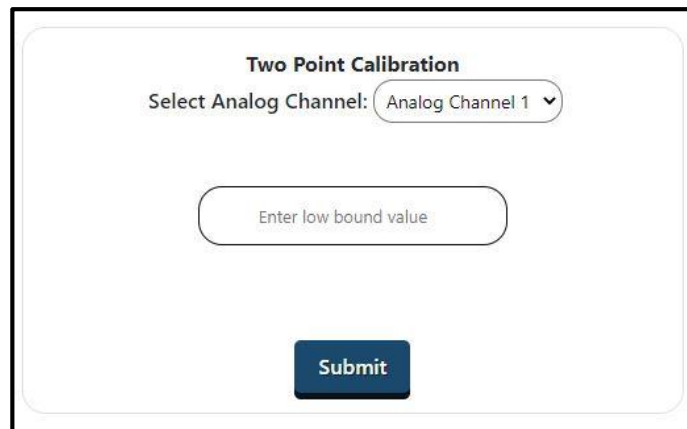


While configuration this minimum and maximum value has to be entered as sensor low range and sensor high range values.

When the user clicks on submit button after entering these values the device will then calibrate the selected analog channel to display calibrated values.

- **Two Point Calibration:**

Two point calibration method is used when the parameter to be measured is used when the exact range of measurement of the sensor is not known. The way two point calibration works is that user firsts sets the sensor input to a known value which is towards the lower end of the measuring range.

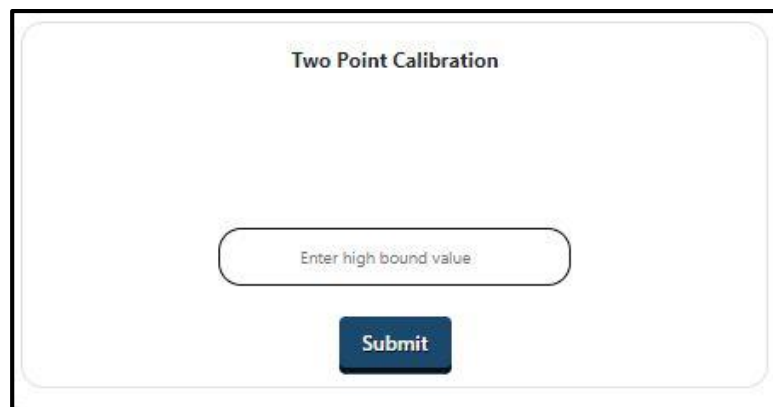


The screenshot shows a web interface titled "Two Point Calibration". At the top, there is a dropdown menu labeled "Select Analog Channel:" with "Analog Channel 1" selected. Below this is a large, rounded rectangular input field with the placeholder text "Enter low bound value". At the bottom of the interface is a blue "Submit" button.

When the sensor is set the user enters in the low value field what value of parameter corresponds to the sensor input. Example, if 4 mA sensor output value represents 0 degree Celsius.

The user then clicks the submit button to configure the low range value.

Now the user sets the sensor input to a known value which is towards the higher end of the measuring range.



The screenshot shows the same web interface titled "Two Point Calibration". The dropdown menu is no longer visible. The large, rounded rectangular input field now contains the placeholder text "Enter high bound value". The blue "Submit" button remains at the bottom.

When the sensor is set the user enters in the high value field what value of parameter corresponds to the sensor input. Example, if 20mA sensor output values represents 100 degree Celsius.

Now the user can click on the submit button. After this the device will calibrate the selected channel with reference to the two points used for configuration.

- **Manual Calibration:**

Manual calibration method is used when the user has knowledge about the sensor output range and the sensor measurement range. The user can manually calculate the required multiplying factor (scaling factor) and offset value from the above data.

Manual Calibration

Select Analog Channel: Analog Channel 1 ▼

Enter Scale Factor

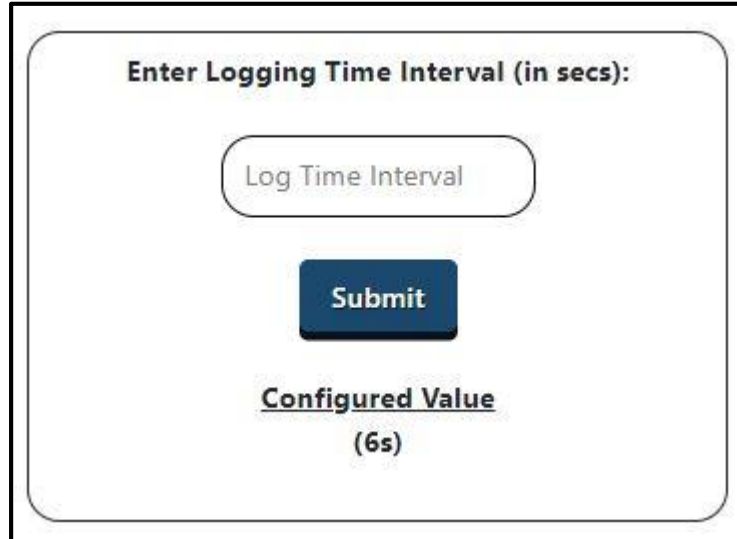
Enter Offset

Submit

The user can then enter these two values in the multiplying factor and offset fields provided.

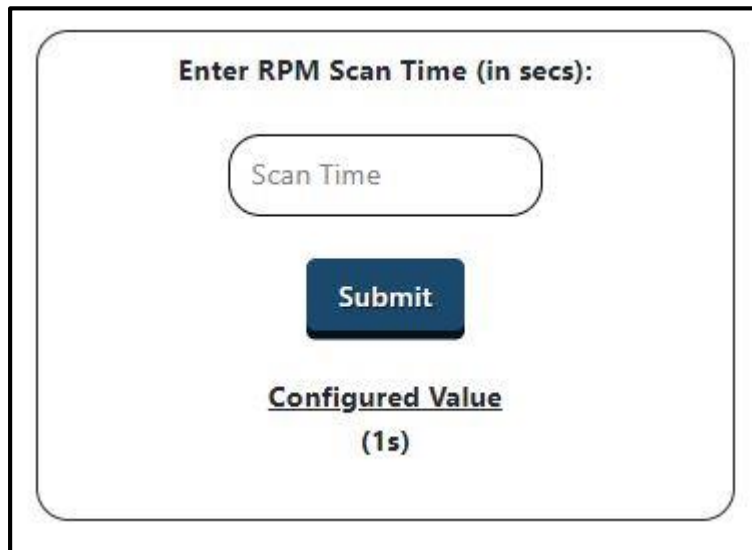
The user can click submit button to calibrate the selected channel based on the above configuration.

v. Logging Interval configuration:



- The user can configure the amount of time in which the device logs data onto the on-board SD card.
- The Logging interval configuration section provides user to enter the time delay between two successive log entries.
- The value of logging time can be set to any value between 1 second to 100000 seconds (approximately 24 Hrs).
- The user can enter the desired value in the field and click submit to update the configuration.

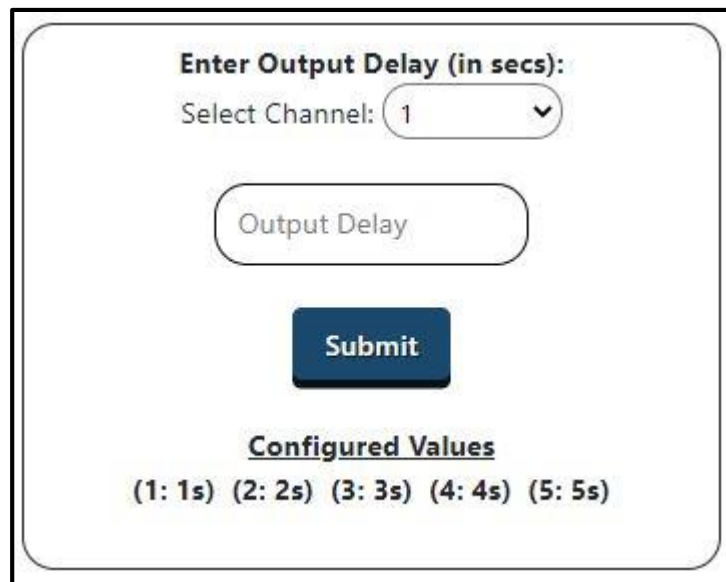
vi. RPM Scan time configuration:



- The user can configure the scan time duration for RPM counting.

- The device measures input digital pulses, where each pulse represents one rotation.
- The device calculates the number of pulses in a particular time interval, this interval is the scan time interval.
- The user is recommended to keep RPM scan time interval as 1 seconds if the measuring RPM value is greater than or equal to 60 RPM.
- If the measurement of RPM values lower than 60 RPM is needed then the user must enter a larger value than 1 second for RPM scan time.
- It is not recommended to keep the value of RPM scan time greater than 60 seconds.

vii. Output delay configuration:



Enter Output Delay (in secs):

Select Channel: 1

Output Delay

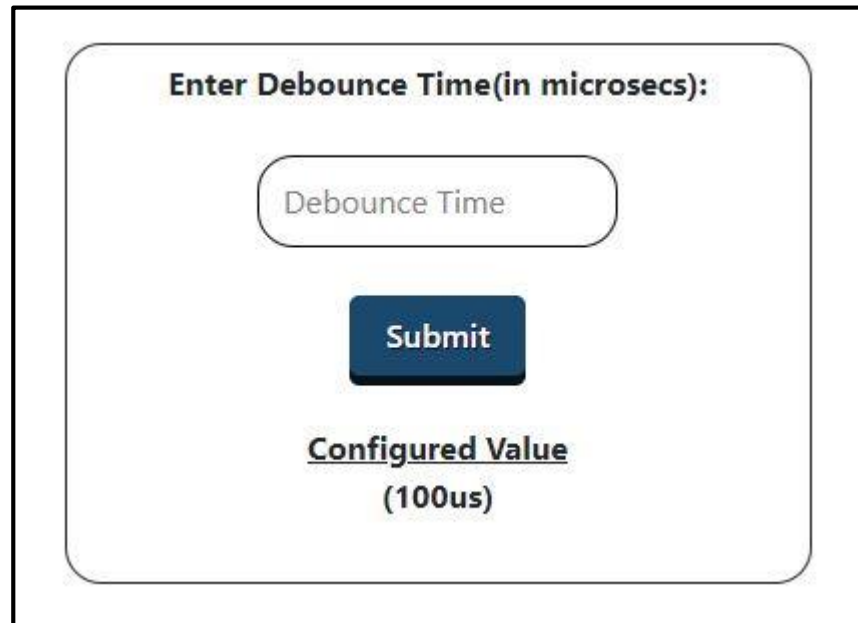
Submit

Configured Values

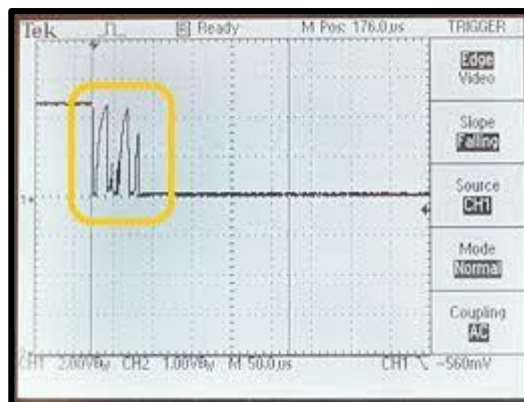
(1: 1s) (2: 2s) (3: 3s) (4: 4s) (5: 5s)

- The device is provided with a provision to delay the turning on of the digital output when the value crosses the set-point hysteresis region.
- If delayed output is required the user can select the channel (referring to configuration table) for which the output is to be delayed.
- The user can then enter the delay interval in seconds and click on submit to configure the channel delay.
- On crossing the set-point hysteresis region the digital output will be turned on only if the parameter value is in this region for the set delay duration.
- If the value crosses back into the green region of the gauge the output will not be triggered and reset to off state.
- If delayed output is not required the user can set the value of delay to 0 to disable the delayed output on the particular channel.

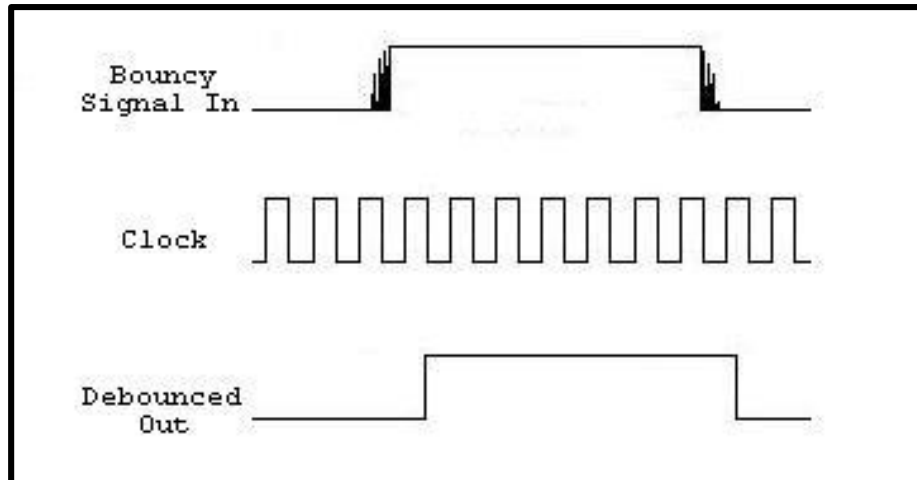
viii. Debounce time configuration:



- The device provides configurable debounce time for digital input pulses.
- This debounce time is needed if the digital input transitions from high to low are noisy and don't have a single high to low or low to high transition as shown in the below figure.



- To counter this a debounce feature is provided in the device through which user can configure the debounce time after which stable logic level can be read.
- **Note ; The debounce time in the device can be configured from 100 microseconds to 60000000. The device only accepts debounce time as multiples of 100 microseconds.**



- The above diagram shows an example of a noisy signal after debouncing.
- Default factory value of debounce time is 100 microseconds.

d. Reports page description:



- The reports page provides the user the option to download the data logs stored on the device.
- The user has to enter the Start Timestamp, this indicates the date and time from which the log report should start.
- The user has to also enter the End Timestamp, this indicates the date and time up-to where the log report should stop.
- If the user enters a Start Time which does not exist in the device file storage, the device will inform the user about this error using a prompt.
- The user must click on the “Download” button to create and download the report.
- While the device is creating the report the user must not refresh the browser.
- When the data transfer is complete from the device the user will get a browser prompt to download the requested report.
- **Note:** When a large report is requested the downloading of data may take greater time.
- The device will only allow downloading of reports if the SD card is connected correctly. If SD card is not detected the device will inform the user about SD card status and disable logging until SD card is connected successfully.
- **Warning:** The user must never insert or pull out the SD card when the device is running, doing so may damage the SD card as well as the device. Always power off the device before inserting or pulling out the SD card.

Download Historical Data

Start Time: End Time:

SD Card not detected!

- The reports page provides the user the option to also reset the device file system.
- When the file system is reset, all the data present on the SD will be cleared.
- To reset the file system, the user must first power off the device. The user must then pull the SD card out.
- The user must turn on the device now without the SD card. The user can then connect to device web utility and navigate to the reports page.
- The user must click reset button to reset the file system.
- The user can now power off the device after successful reset.
- The user must now connect the SD card to a computer/laptop using card reader and format the SD card.
- After formatting is complete the user can disconnect the SD card from the PC and insert it back into the device.
- The user can now power on the device. The file system is now successfully cleared.
- The device will continue to log data as previously configured.

e. Networks and RTC configuration page description:

The Networks and RTC page contains all the configuration settings regarding WiFi connectivity, MQTT configuration and internal RTC (Real-time clock) configuration.

i. Wifi Configuration section:



Scan and Set Wifi:

Scan Wifi

EMBEDOS_2.4G

Enter ssid

Enter password

Show Password

Close Connect

- The Wifi configuration section allows the user to scan and connect to a nearby WiFi Access Point.
- To perform a WiFi scan the user must click the scan WiFi button.
- The device will then scan for nearby WiFi APs and provide the user a list of available Aps to choose from.
- The user can then select one of the scanned AP from the list.

- The device will fill the SSID name in the SSID field. The user must now enter the password for the WiFi AP.
- The user can click on connect and the device will connect to new WiFi AP.
- The device will change network connection if WiFi connection is successful.
- The user might need to reconnect to the device through the new WiFi network as the device will change its IP address.
- After reconnection the user can verify the connection status through the Wifi Status section.
- If the device fails to connect to the new WiFi AP the user can connect to the device generated WiFi AP (Hotspot with SSID: EM-7C:87:CE:09:DA:D8) and retry the process.
- The WiFi credentials are stored on the device and the device will try to connect to the store WiFi SSID periodically or if the 4G connectivity fails.

ii. Wifi Status section:

Configured Wifi Details:

INTERFACE	SSID	IP ADDRESS
WIFI	EMBEDOS_2.4G	192.168.0.113

- The WiFi status section provides the user with status of current WiFi connection. It consist of the above table.
- The WiFi SSID that the device is currently connected to will be displayed in the SSID column.
- The IP address of the device on the network will be displayed in the IP Address column if the device is successfully connected to the WiFi SSID.
- If the device is not connect to the stored WiFi SSID the IP Address column will show the value “0.0.0.0”.

iii. RTC configuration section:



Set RTC DateTime:

Select Datetime: 

Submit

- The RTC (Real time clock) configuration section is provided for the user to configure the devices internal date time clock.
- This clock generates the timestamp values required for various device operations mainly for logging timestamps.
- The user can set the current date and time using the date time picker.
- The device will reconfigure the date and time of the device.
- **Note:** This option is only recommended to use if the reports generated have errors in timestamp values.
- Before updating the date time settings of the device the user must first follow the steps to reset the SD card file system. The device date time must be configured only when the SD card is not inserted in the device during the reset process.
- This is done to ensure no inconsistencies in the timestamps occurs.

iv. MQTT configuration section:

MQTT Configuration:

BROKER	STATUS
mqtt://solar.embeddos.io:1883	Disconnected

Enter Broker/Host
mqtt://solar.embeddos.io:1

Enter Topic
EM-7C:87:CE:09:DA:D8

Enter Interval
10

Enter Username

Enter Password
 Show Password

Update MQTT

- The MQTT configuration section allows the user to configure the MQTT settings to publish data to a broker.
- The user can configure the Broker URL, Publish topic and publish interval between two messages.
- The user is also provided with the option to enter the username and password to connect to the MQTT broker using secured credentials.
- The status of connection to the broker is displayed on the table at the top of the section.

- If connection with broker is successfully established the status will be shown as “Connected” and if connection to broker failed the status will be shown as “Disconnected”.

v. OTA firmware update section:



- The device provides a provision to update the device firmware through OTA updates.
- The user must ensure that the device is successfully connected to a reliable WiFi network with good internet connectivity.
- The user must ensure that power supply to the device is reliable and must not turn off during update process.
- The user can click on the “Update Version” button to start the firmware update process.
- When the user clicks the button the device will check if any updates available over the current firmware version.
- If there are no updates the device will simply restart.
- If the device finds an update the device will download the updated firmware and restart with the new version update.
- The new firmware version will be updated for the user to verify.