control solutions
TERACOM

# TCG120-4
# 4G LTE wireless I/O module

# USER MANUAL

www.teracomsystems.com

## 1. Short description

The TCG120-4 is a 4G LTE Cat.1 wireless I/O module that also supports 2G communication, enabling data connectivity over LTE-FDD, EDGE, and GPRS networks. It features two digital inputs, two analog inputs, a 1-Wire interface for connecting external sensors, and two relays. The relays can be activated remotely via SMS, HTTP API commands, or MQTT messages, or locally based on the status of monitored parameters.

This module is fully compatible with all Teracom 1-Wire sensors, providing a wide range of integration possibilities. It supports both HTTP API and MQTT protocols, making it suitable for modern IoT applications. The device periodically sends an HTTP/HTTPS POST request to a remote server containing a status file in XML or JSON format. Additionally, it supports MQTT for publishing sensor data and receiving commands as a subscriber, offering enhanced flexibility for real-time communication and control.

The TCG120-4 is a versatile and reliable solution for IoT projects requiring robust wireless communication, efficient remote management, and support for MQTT-based messaging systems.

## 2. Features

- Multi-band connectivity - ensures compatibility with various network environments.
- Flexible setup options - configurable via USB, SMS, or HTTP API.
- 2 digital "dry contact" inputs.
- 2 analog inputs with a range of 0 to 60VDC.
- 2 relays with normally open (NO) and normally closed (NC) contacts.
- 1-Wire interface - supports all Teracom sensors for seamless integration.
- MQTT support - compatible with MQTT 3.1.1 for publish-and-subscribe messaging.
- SMS alarm notifications for up to 5 phone numbers.
- Email alarm notifications for up to 5 email recipients.
- Periodic status updates - sends HTTP/HTTPS POSTs with current status in XML or JSON to a remote server.
- Remote control - accepts HTTP API commands for relay control and parameter adjustments.
- GSM geolocation - provides approximate location based on GSM data.
- Firmware updates via USB or over the mobile network.

## 3. Applications

The TCG120-4 is a versatile device designed for applications where reliable wireless connectivity is essential. It excels in scenarios such as industrial automation, data acquisition, environmental monitoring, and building automation, particularly in areas lacking Ethernet connectivity.

- SCADA systems

  The TCG120-4 integrates easily into SCADA systems, using periodic HTTP/HTTPS POSTs for client-server communication. This makes it ideal for monitoring and controlling industrial processes in remote locations without Ethernet access.

- Environmental monitoring and control

  Equipped with analog and 1-Wire sensor support, the TCG120-4 is perfect for tracking environmental parameters like temperature, humidity, and voltage. Its cellular connectivity ensures data transmission from remote monitoring sites where Ethernet infrastructure is unavailable.

- Remote infrastructure monitoring

  The module is well-suited for monitoring remote assets such as pipelines, storage tanks, or communication towers. Its wireless communication capabilities enable real-time data reporting and alarm notifications even in areas without Ethernet coverage.

- Smart agriculture in remote locations

  In agricultural settings where Ethernet connectivity is impractical, the TCG120-4 can manage irrigation systems, monitor soil moisture, and track weather conditions. Its SMS and MQTT capabilities allow for efficient resource management and control from afar.

These applications demonstrate the TCG120-4's reliability and flexibility in environments where Ethernet connectivity is unavailable, making it an indispensable tool for wireless IoT solutions

## 4. Specifications

- Physical characteristics
  Dimensions: 109 x 65 x 32 mm
  Weight: 152 g

- Environmental limits
  Operating temperature: -20 to 55°C
  Operating temperature for USB setup: 0 to 40°C
  Storage temperature: -25 to 60°C
  Ambient relative humidity: 5 to 85% (non-condensing)

- Standards and Certifications
  Safety: EN 62368-1:2014 + EN 62368-1:2014/AC1-3:2015 + EN 62368-1:2014/A11:2017 + EN 62368-1:2014/AC:2017-03:2017, EN 62311:2008
  EMC: EN 55032: 2015 + EN 55032: 2015/AC:2016-07 + EN 55032: 2015/A11:2020
  EN 55024: 2010 + EN 55024: 2010/A1:2015
  EN 61000-3-2: 2014
  EN 61000-3-3: 2013 + EN 61000-3-3: 2013/A1:2019
  RFU: EN 301 489-19 V2.1.1, EN 301511 V12.5.1, EN 301 908-1 V11.1.1, EN 301 908-13 V11.1.2, EN 301 908-2 V11.1.2, EN 303 413 V1.1.1
  Green: RoHS

- Warranty
  Warranty period: 3 years

- Power supply
  Operating voltage range (including -15/+20% according to IEC 62368-1): 10 to 28 VDC
  Current consumption: 0.24A @ 12VDC

- Cellular interface
  SIM card size: Standard
  Antenna connector: SMA-F
  Standards: LTE-FDD, EDGE and GPRS
  TCG120-4E (h2.xx) bands:
  4G LTE: B1/B3/B5/B7/B8/B20
  2G: B3/B8

TCG120-4G (h2.xx) bands:

| | |
|---|---|
| 4G LTE: | B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28/ B66/B34/B38/B39/B40/B41 |
| 3G: | B1/B2/B4/B5/B6/B8/B19 |
| 2G: | B2/B3/B5/B8 |

⚠ **Attention!**
The device can be used only in networks that support IPV4 addresses (IPV6 is not supported).
The device exclusively relies on the IMS (IP Multimedia Subsystem) for SMS functionality.
We recommend contacting your mobile operator to verify IPv4 and IMS support.

- Analog inputs
  Isolation: Non-isolated
  Type: Single-ended
  Resolution: 10 bits
  Input Range: 0 to 60 VDC
  Accuracy: ±1%
  Sampling Rate: 500ms per channel (averaged value of 250 samples)
  Input Impedance: 1 mega-ohm (min.)

- Digital inputs
  Isolation: Non-isolated
  Type: Dry contact and logic level
  Minimum high-level input voltage for digital inputs: +2.5VDC
  Maximum low-level input voltage for digital inputs: +0.8VDC
  Maximum input voltage for digital inputs: +5.5VDC
  Sampling rate: 10ms
  Digital filtering time period: 30ms

- Relay outputs
  Type: Form C (N.O. and N.C. contacts)
  Contact current rating: 3 A @ 24 VDC, 30 VAC (resistive load)
  Initial insulation resistance: 100 mega-ohms (min.) @ 500 VDC
  Mechanical endurance: 10 000 000 operations
  Electrical endurance: 100 000 operations @ 3 A resistive load
  Contact resistance: 50 milli-ohms max. (initial value)
  Minimum pulse output: 0.1 Hz at rated load

  CAUTION: The device does not contain any internal overcurrent protection facilities on the relays' contact lines.
  External fuses or short circuit current limiting circuit breakers, rated to 3 Amps, are to be used for overcurrent protection of the connecting lines.

- 1-Wire interface
  Output voltage: 5.0 ± 0.3 VDC
  Maximum output current: 200 mA

- Internal FLASH memory
  Endurance: 100,000 cycles (each relay status change or settings save counts as one memory cycle).

# 5. Installation

The TCG120-4 must be installed by qualified personnel to ensure proper operation and safety. The installation process involves the following steps: mounting the device, connecting the antenna, wiring the inputs and outputs, supplying power, and completing the configuration via a web browser.

This device is designed for indoor use only and should not be installed directly outdoors.

> **Attention!** Before inserting the SIM card into the device, ensure that the PIN code is disabled to avoid connectivity issues.

## 5.1. Mounting

The TCG120-4 must be installed in a clean, dry location on a non-flammable surface. If the installation environment has high ambient air temperatures, ensure adequate ventilation around the device to maintain optimal operation.

To mount the device to a wall, use two 8x60 mm plastic dowels (e.g., Würth GmbH 0912 802 002) and two 6x70 mm dowel screws (e.g., Würth GmbH 0157 06 70). Refer to Appendix D, figure 1 for detailed mechanical specifications.

Ensure proper spacing from adjacent equipment to allow sufficient ventilation and electrical isolation. Maintain a minimum clearance of 50 mm on all sides, as shown in figure 2 of Appendix D.

## 5.2. Connectors

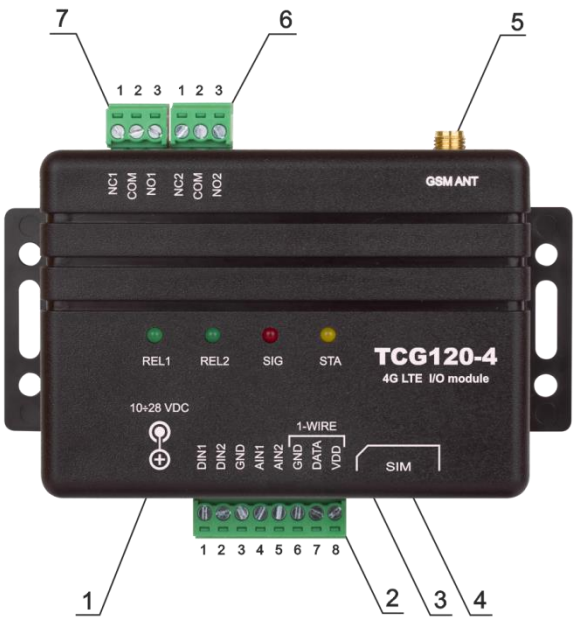
**Attention!** Always disconnect the power supply before starting any wiring to avoid electrical hazards or equipment damage.

Follow these steps for correct wiring**:**

- Ensure the power supply to the device is turned off;
- Make the necessary wiring connections to the terminals;
- Apply power.

It is strongly recommended to test and configure the TCG120-4 without connecting it to any controlled devices. Ensure that all wires are securely attached to the terminals and that the terminal screws are properly tightened. Improper wiring or configuration may cause permanent damage to the module, the connected equipment, or both.

Refer to the diagram below for the exact locations of inputs and outputs:




**Connector 1 – Power**
**Connector 2, Pin1 -** Digital input 1 (**Din1**)
**Connector 2, Pin2 -** Digital input 2 (**Din2**)
**Connector 2, Pin3 -** Ground
**Connector 2, Pin4 -** Analog input 1 (**Ain1**)
**Connector 2, Pin5 -** Analog input 2 (**Ain2**)
**Connector 2, Pin6 -** Ground
**Connector 2, Pin7 –** 1-Wire data
**Connector 2, Pin8 –** 1-Wire power supply
**Connector 3** – mini USB
**Connector 4 –** SIM card holder
**Connector 5 –** GSM Antenna
**Connector 6, Pin1** – NC Relay2
**Connector 6, Pin2** – COM Relay2
**Connector 6, Pin3** – NO Relay2
**Connector 7, Pin1** – NC Relay1
**Connector 7, Pin2** – COM Relay1
**Connector 7, Pin3** – NO Relay1

### 5.2.1. Power supply connection

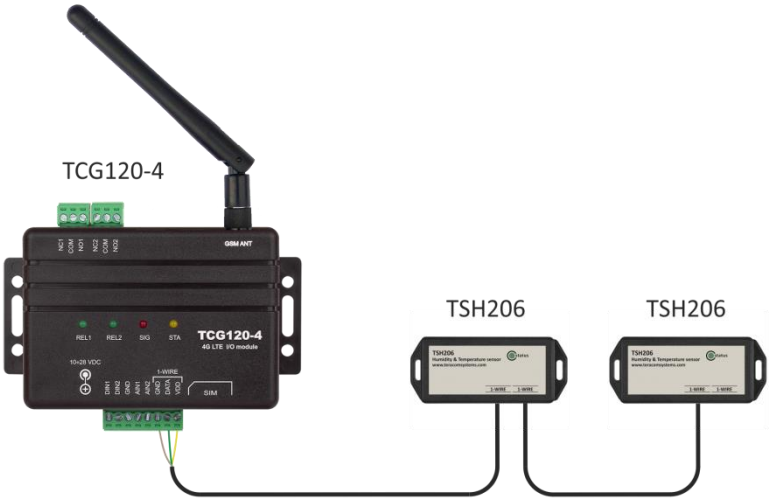
TCG120-4 must be powered by the adapter SYS1308(N)-2412-W2E or equivalent, suitable for overvoltage category II and certified for safety compliance. The power supply device should be able to withstand short circuits and secondary circuit overloads. Ensure the equipment is easily accessible for disconnecting from the power supply during use.

### 5.2.2. 1-Wire interface

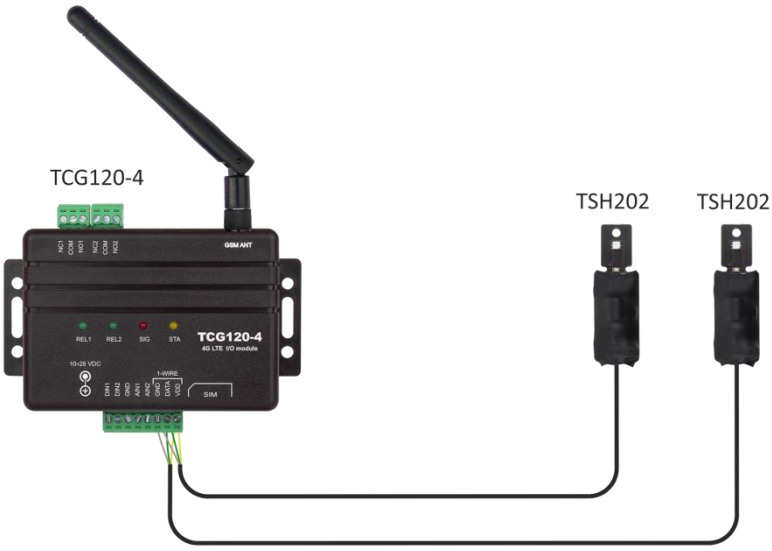
The 1-Wire interface, a registered trademark of Analog devices Inc., is designed for connecting multiple sensors over short wiring distances. However, it is not suitable for long cable runs or environments with high electrical noise.

The TCG120-4 supports up to four 1-Wire sensors simultaneously. All Teracom 1-Wire sensors are compatible with this device. Once connected, sensors are automatically detected, and the corresponding measurement dimension is assigned.

For multi-sensor setups, it is strongly recommended to use a daisy-chained (linear) topology to ensure proper operation and reliable communication between the device and sensors:




“Star” topology may be used as a last resort, but only for connecting up to four sensors with a total cable length not exceeding 10 meters:



It is strongly recommended to use only UTP/FTP cables for the 1-Wire interface and to keep the total cable length within 30 meters. While functionality has been observed at longer distances, error-free operation cannot be guaranteed beyond the specified limit.

For best practices and detailed guidance on reliable long-line 1-Wire networks, refer to the guidelines available here.

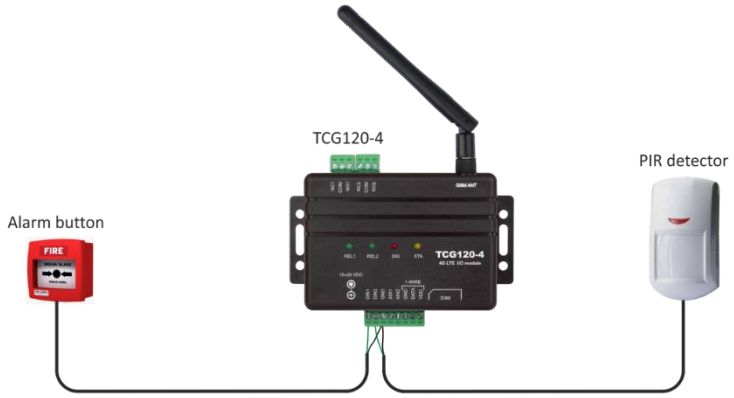
Please note that we guarantee proper operation only when using Teracom 1-Wire sensors.

### 5.2.3. Digital inputs connection

Note that all inputs are not isolated from the power supply ground.

The TCG120-4 digital inputs are intended solely for use with "dry contact" devices. A "dry contact" refers to devices with open-drain outputs or relay outputs, such as door contact switches, push buttons, and PIR (passive infrared) detectors.

To connect an alarm button to a TCG120-4 digital input, one side of the button contact should be connected to the "DIN" terminal, while the other side is connected to the "GND" terminal. A diagram below provides a visual representation of this connection.

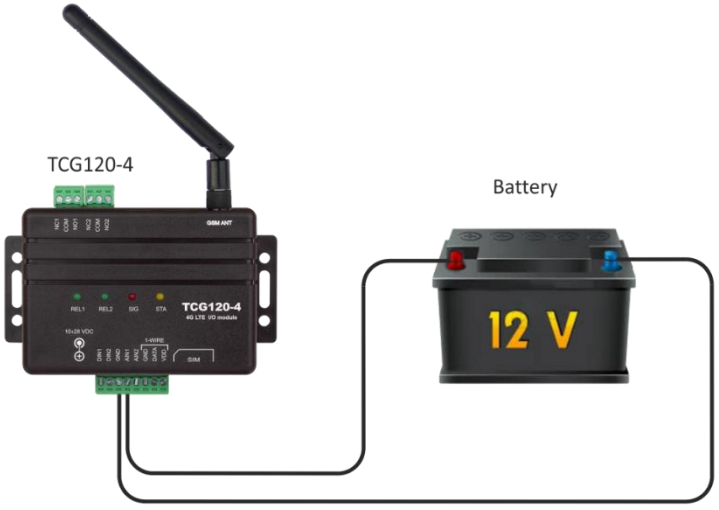



The maximum cable length should not exceed 30 meters.

### 5.2.4. Analog inputs connection

Note that all inputs are not isolated from the power supply ground.

The analog inputs of TCG120-4 can be used to monitor DC voltage up to 60VDC. The illustration shows how to connect a battery to the analog input of TCG120-4, with the positive terminal connected to "AIN" and the negative terminal to "GND"



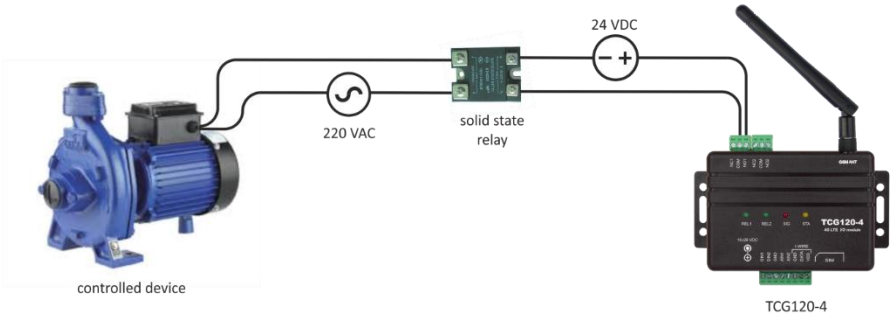

The maximum cable length should not exceed 30 meters.

### 5.2.5. Relays connection

Note that the relay contacts are directly connected to the terminal connectors and there is no internal overcurrent protection on the relay contact lines.

For all relays, normally open, normally closed, and common contacts are available. If the load requires a switchable current or voltage higher than the specified limits, an external relay must be used.

When mechanical relays switch inductive loads, such as motors, transformers, or other relays, an arc may form across the relay contacts each time they open. This can lead to accelerated wear on the relay contacts, reducing their lifespan. To protect the contacts and extend their service life, it is strongly recommended to use relay contact protection devices when switching inductive loads. Using an external solid-state relay is a good option.



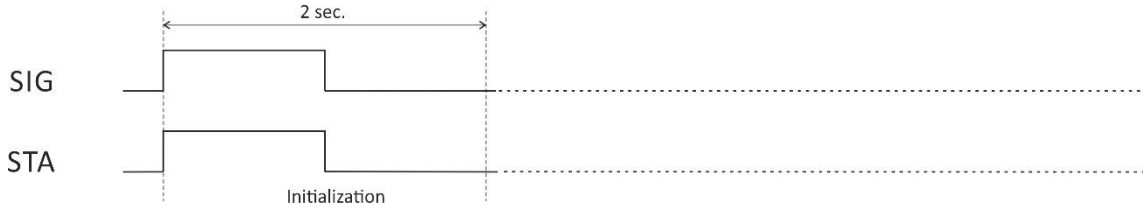

## 6. LED indicators

The LED indicators provide a visual representation of the module's status:

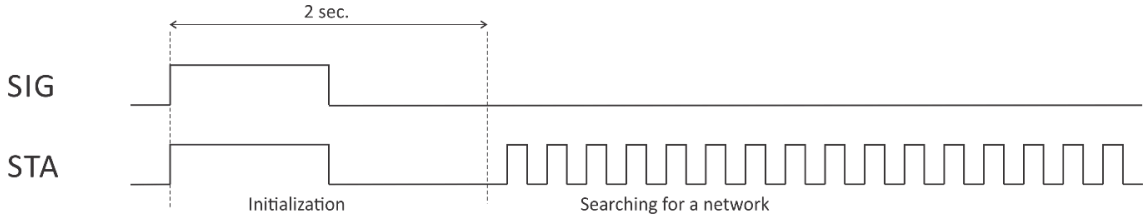
- **REL1 – REL2 (green)**: This LED lights up when the corresponding relay is activated, meaning the normally open (NO) contact is connected to the common (COM) terminal.
- **SIG (red)**: Indicates the device's status, working in conjunction with the STA indicator.
- **STA (yellow)**: Also indicates the device's status, working in conjunction with the SIG indicator.

The following states are displayed:

- **Module initialization** – during the module initialization process, the SIG (red) and STA (yellow) indicators first turn on for one second immediately after power-on. Following this, they turn off for another secon.

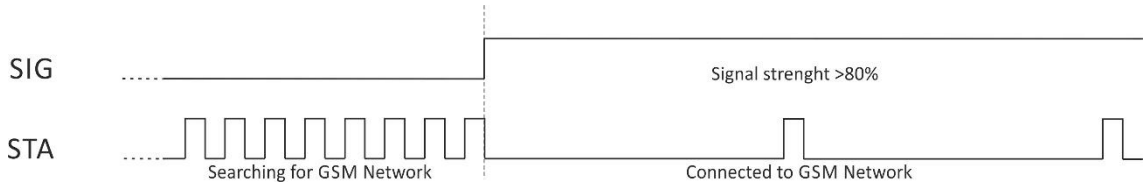



- **Searching for a network** – after the initialization process, the SIG indicator remains off, while the STA indicator flashes with a period of 200 milliseconds.

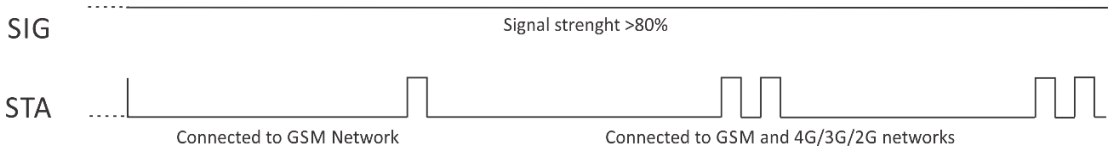



- **Connected to a network** – once the module successfully connects to a mobile network, the STA indicator shows the type of connection, and the SIG indicator displays the signal strength.

If there is only a GSM connection, the STA indicator flashes once for 200 milliseconds within a 2-second period.




If there are GSM and 4G/3G/2G connections available, the STA indicator flashes twice for 200 milliseconds within a 2-second period.




In the same time, the SIG indicator provides five states to represent the signal strength:

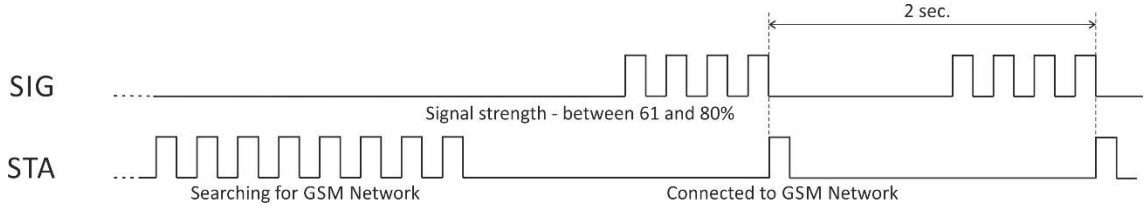
0–20%: SIG flashes once in a 2-second period.

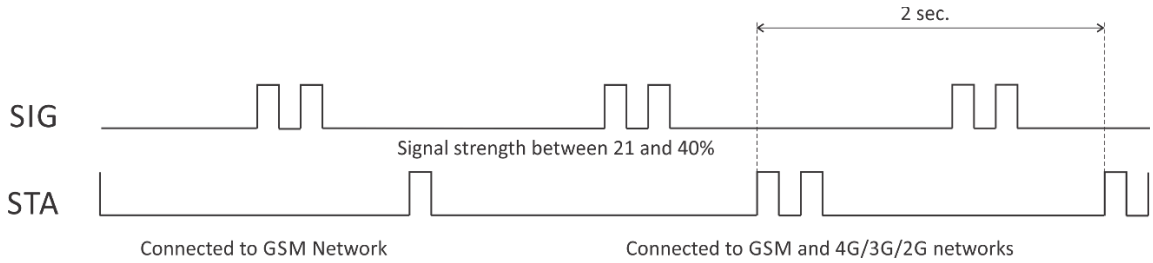
21–40%: SIG flashes twice in a 2-second period.

41–60%: SIG flashes three times in a 2-second period.

61–80%: SIG flashes four times in a 2-second period.

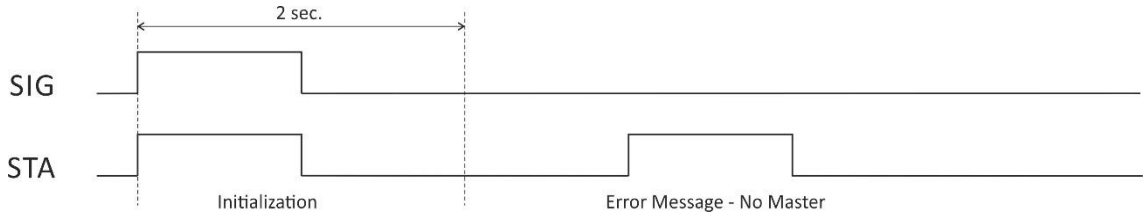
81–100%: SIG remains solid on.

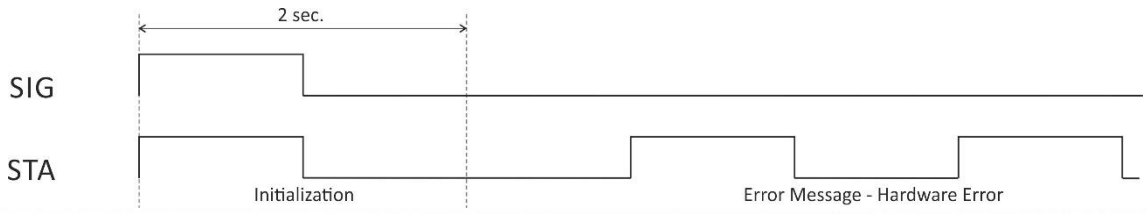



- **Error message** – if an error occurs after initialization, the SIG indicator will remain solid off, and the STA indicator will flash to indicate the type of error.

  STA flashes once for 1 second: Master phone number is not set.
  STA flashes continuously for 1 second within a 2-second period: Permanent hardware error.

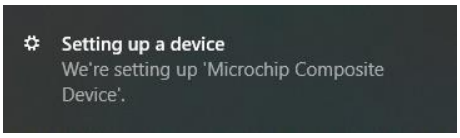


## 7. Initial setup via USB

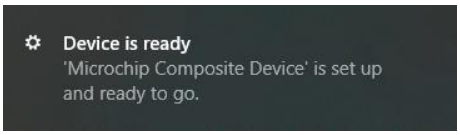
The initial setup of the TCG120-4 is performed using a computer with Windows 10 or a newer version of Microsoft Windows. After powering up the module, connect it to the computer using a USB cable. Once connected, the operating system will automatically begin installing the necessary drivers for communication with the device.

A notification will appear indicating the installation process:



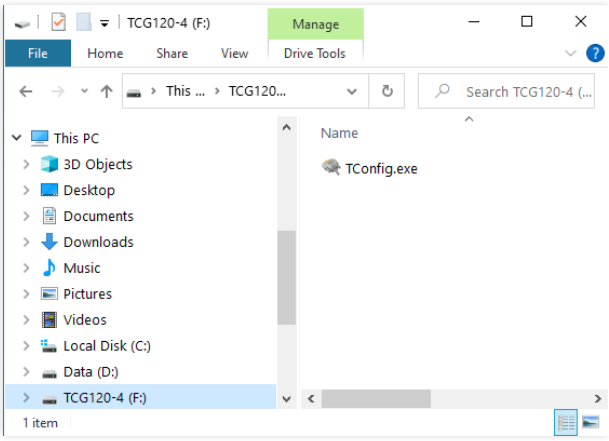

The following drivers will be installed:

- Microchip composite device
- USB serial port driver

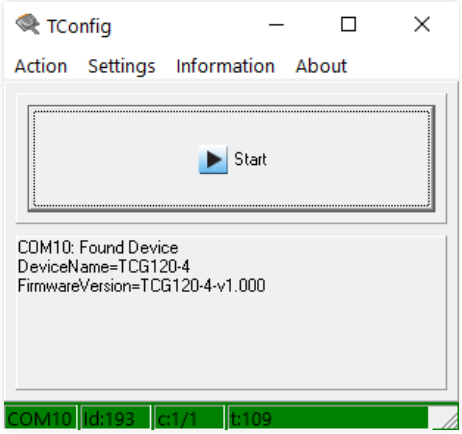



If the USB serial port driver cannot be installed automatically, it must be installed manually. The driver can be downloaded from the TCG120-4 product page at www.teracomsystems.com.

After the driver is successfully installed, the device will be recognized as Mass Storage. The following window will appear on the screen:




The only file stored on the mass storage is a tool called “TConfig”, which facilitates communication between the TCG120-4 and the PC:




Clicking the “Start” button will open the browser and display the Monitoring page of TCG120-4.

## 7.1. Monitoring page

The monitoring page provides real-time information about the current status of TCG120-4 inputs and outputs. It is divided into four sections: "1-Wire sensors," "Analog inputs," "Digital inputs," and "Relays." Each parameter (sensor, input, or relay) is displayed with a description of up to 15 characters. These descriptions can be customized on the "Setup-Input/Output" page.

### 7.1.1. Sensors section

1-Wire sensors

| Pos | Description | Value 1 | Value 2 | ID |
|---|---|---|---|---|
| 1 | S1:TST1xx | 25.247°C | ------ | 28B3B464080000AB |
| 2 | S2:TSH2xx | 25.875°C | 45.188%RH | 015225B71700FF45 |
| 3 | S3 | ------ | ------ | 0000000000000000 |
| 4 | S4 | ------ | ------ | 0000000000000000 |

The TCG120-4 module supports up to four sensors. All detected 1-Wire sensors are displayed in the "1-Wire sensors" section. These sensors need to be configured in the "1-Wire sensors setup" section, accessible via the Setup -> Sensors page.

For each sensor, the page displays a description, value, and ID information. Descriptions can be up to 15 characters in length and can be modified on the Setup -> Conditions page.

Sensors with a single parameter, such as Teracom temperature sensors, display their readings only in the Value 1 column. Some sensors provide two parameters. For example, TSH2xx temperature-humidity sensors display the temperature reading in the Value 1 column and the second parameter, such as humidity, in the Value 2 column.

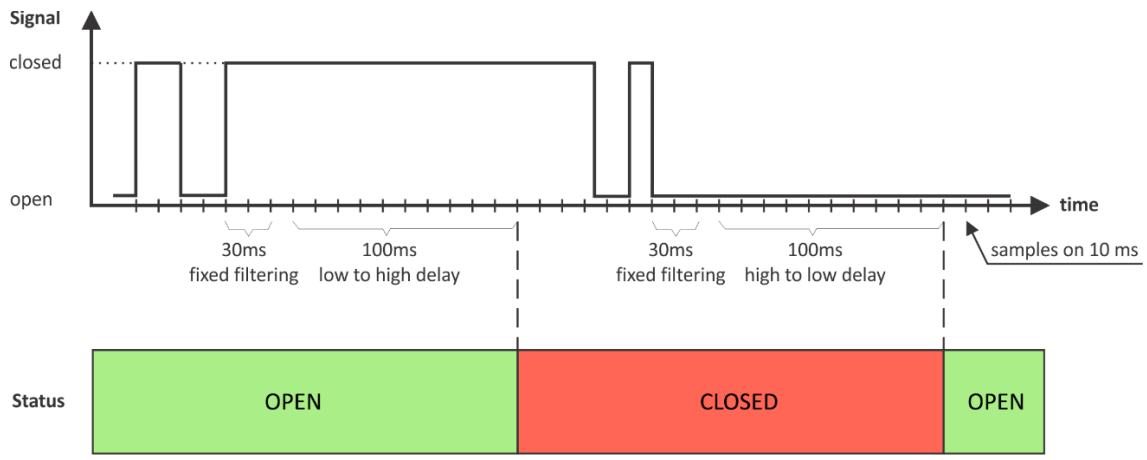
### 7.1.2. Digital inputs section

Digital inputs

| Digital input | Status | Digital input | Status |
|---|---|---|---|
| Digital Input 1 | OPEN | Digital Input 2 | OPEN |

The digital inputs are used to monitor the state of discrete devices such as motion sensors, door contacts, relay contacts, alarm outputs, and similar devices.

The inputs are sampled every 10 milliseconds, and a change in input status is considered valid only if the same value is consistently read in three consecutive samples (30 milliseconds).




The status of each input is displayed both as text and with color coding. Descriptions and status text can be customized in the Setup -> Input/Output section.

### 7.1.3. Analog inputs section

Analog inputs

| Analog input | Value | Analog input | Value |
|---|---|---|---|
| Analog Input 1 | 0.000V | Analog Input 2 | 0.000V |

Analog inputs are used to monitor DC voltage sources, such as analog sensors, batteries, power supplies, or solar panels.

While analog inputs are sampled at a high rate, the displayed value is updated every 0.5 seconds. The displayed value is an average of 250 readings taken during this interval.

For each analog input, the Unit, Multiplier, and Offset can be configured in the Setup -> Input/Output section.

### 7.1.4. Relay section

Relays

| Relay | Status | Control |
|---|---|---|
| Relay 1 | OFF | ON OFF Pulse |
| Relay 2 | OFF | ON OFF Pulse |
| | | All On All Off Pulse All |

This section displays the current state of the relays. Each relay can be activated either remotely or locally based on the status of a monitored parameter. For relays activated locally, a text description of the controlling parameter is shown instead of control buttons.

Pulse duration and parameters for local relay activation can be configured individually for each relay in the Setup -> Input/Output -> Relay outputs section.

## 7.2. Setup

### 7.2.1. SMS

SMS setup

| | Number format | | Connectivity alert | Alarm notification |
|---|---|---|---|---|
| Master | [+][Country code][Network prefix][Number] | +359888613610 | ☐ | ☐ |

| | Number format | | Superuser rights | Alarm notification |
|---|---|---|---|---|
| User 1 | [+][Country code][Network prefix][Number] | | ☐ | ☐ |
| User 2 | [+][Country code][Network prefix][Number] | | ☐ | ☐ |
| User 3 | [+][Country code][Network prefix][Number] | | ☐ | ☐ |
| User 4 | [+][Country code][Network prefix][Number] | | ☐ | ☐ |

send test SMS

In this section, you can configure SMS alarm recipients.

The Master recipient has special privileges, including the ability to modify device settings using SMS commands. By default, the Master receives SMS alarm messages, though this can be disabled by unchecking the alarm notification checkbox. Additionally, the Master will receive SMS alerts for internet connectivity loss if the "Connectivity alert" checkbox is enabled, which it is by default. The Master's phone number must be entered in the E.164 international format (ITU-T Recommendation) to ensure global uniqueness and proper routing of calls and messages.

Up to four additional recipients can be set to receive SMS alarms when monitored parameters enter an alarm state. To enable this, the "Alarm Notification" checkbox must be activated for each number. These recipients can also query parameter states/values by sending an SMS request.

Granting "Superuser rights" to any of these four recipients allows them to send SMS commands with similar permissions to the Master, except for creating new users or changing the Master. Numbers for these users can be entered in either the E.164 international format or as short codes.

Short codes are typically 3–8 digits long and are used for high-volume application-to-person (A2P) messaging within the same country or region. These codes cannot be used for international messaging and are valid only for communication within the country where they are based.

A "Send test SMS" button allows you to send a test SMS to all recipients to verify the configuration.

All SMS commands, their syntax, and the corresponding responses are detailed in the "Setup via SMS" section.

Note: SMS is not a reliable communication method and is not recommended as a primary monitoring technology.

### 7.2.2. Sensors

1-Wire sensors setup

| Pos | Description | Value 1 | Value 2 | ID | Lock |
|---|---|---|---|---|---|
| 1 | S1:TST1xx | 26.747°C | ------ | 28B3B464080000AB | ☐ |
| 2 | S2:TSH2xx | 26.875°C | 43.063%RH | 015225B71700FF45 | ☐ |
| 3 | S3 | ------ | ------ | 0000000000000000 | ☐ |
| 4 | S4 | ------ | ------ | 0000000000000000 | ☐ |

Scan

Detection of connected 1-Wire sensors occurs automatically at power-on or can be triggered manually by pressing the "Scan" button. All detected sensors are displayed in ascending order according to their unique ID numbers.

It is possible to lock a 1-Wire sensor into a specific position. To do this, sensors must be added one by one. After each addition, perform a new scan, and then lock the newly detected sensor to its position. Once all sensors are locked, removing one sensor "in the middle" will not affect the positions of the others after a system reset.

This feature is especially valuable when the TCG120-4 is integrated into a monitoring and control system managed via HTTP API commands, ensuring consistent sensor identification and positioning.

### 7.2.3. Input/Output

#### 7.2.3.1. Sensors

This section allows configuration of the parameters for 1-Wire sensors.

Sensors

| Sensor # | Description | Unit | Multiplier | Offset | |
|---|---|---|---|---|---|
| S1 | S1:TST1xx | °C | 1.000000 | 0.000000 | |
| | | --- | | | |
| S2 | S2:TSH2xx | °C | 1.000000 | 0.000000 | |
| | | %RH | 1.000000 | 0.000000 | |
| S3 | S3 | --- | | | |
| | | --- | | | |
| S4 | S4 | --- | | | |
| | | --- | | | |

For each sensor, a description of up to 15 characters can be set. These descriptions will appear on the monitoring page, conditions page, in XML/JSON data, as well as in SMS and email alerts.

For certain sensors, additional fields—Unit, Multiplier, and Offset—are available to convert raw sensor values into meaningful units. The scaled value is calculated using the following formula:

SV[Un] = RV * MU + OF

Where:

SV – scaled (displayed) value;
Un – unit;
RV – raw value from the sensor;
MU – multiplier;
OF – offset.

#### 7.2.3.2. Digital inputs

This section allows configuration of parameters for digital inputs, including descriptions and state names.

Digital inputs

| Input # | Description | Low level | High level | | |
|---|---|---|---|---|---|
| DI1 | Digital Input 1 | CLOSED | OPEN | | |
| DI2 | Digital Input 2 | CLOSED | OPEN | | |

For every digital input, a description, up to 15 symbols and states up to 15 symbols can be set. These descriptions will appear in the monitoring page, conditions page, XML/JSON data, SMS, and e-mail alerts.

#### 7.2.3.3. Analog inputs

This section allows configuration of parameters for analog inputs, including descriptions, units, multiplier and offset.

Analog inputs

| Input # | Description | Unit | Multiplier | Offset | Type |
|---|---|---|---|---|---|
| AI1 | Analog Input 1 | V | 1.000 | 0.0000 | |
| AI2 | Analog Input 2 | V | 1.000 | 0.0000 | |

For every digital input, a description, up to 15 symbols and states up to 15 symbols can be set. These descriptions will appear in the monitoring page, conditions page, XML/JSON data, SMS, and e-mail alerts.

The fields Unit, Multiplier, and Offset can be configured to convert raw voltage or current values into meaningful engineering units or to correct the displayed analog input readings.

The scaled value is calculated using the following formula:

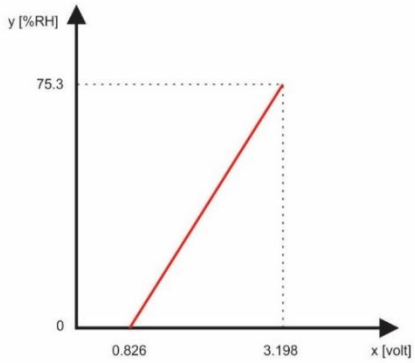
SV[Un] = RV * MU + OF

Where:

SV – scaled (displayed) value;
Un – unit;
RV – raw voltage from the source;
MU – multiplier;
OF – offset.

Example:
For the humidity sensor HIH-4000-003, the following data is available from the datasheet:

VOUT = 0.826 at 0% RH
VOUT = 3.198 at 75.3% RH




The sensor outputs raw voltage values, but our goal is to convert these into corresponding relative humidity (RH) values. To achieve this, we use a multiplier and an offset. These parameters enable us to calculate the relative humidity for any voltage within the sensor's operational range.

Calculation of the multiplier (MU)

The multiplier (MU) is determined by the ratio of the change in relative humidity (ΔRH%) to the change in voltage (ΔV). Geometrically, this resembles finding the slope of a line. For this sensor, the line is represented by the equation ΔRH%/ΔV. We can calculate the multiplier as follows:

MU = (75.3 - 0) / (3.198 - 0.826) = 75.3 / 2.372 = 31.745 %RH/V

Calculation of the offset (OF)

The offset (OF) is calculated using the multiplier and one of the known points. By substituting the scaled value (SV) and the corresponding raw value (RV) into the equation SV = RV * MU + OF, we can solve for the offset:

OF = SV - (RV * MU)

Using the point where SV = 0 and RV = 0.826, we find:

OF = 0 - (0.826 * 31.745) = 0 - 26.22 = -26.22

We can also calculate the offset using the other known point, where SV = 75.3 and RV = 3.198:

OF = 75.3 - (3.198 * 31.745) = 75.3 - 101.52 = -26.22

Final formula

Thus, the formula for this sensor become:

SV = RV * 31.745 - 26.22

Verification

To verify the accuracy of this formula, let's check the case where VOUT = 0.826 V (0%RH):

SV = 0.826 * 31.745 - 26.22 = 26.22 - 26.22 = 0 %RH

This confirms that the formula accurately converts voltage readings to their corresponding relative humidity values.

#### 7.2.3.4. Relay outputs

For each relay, a description of up to 15 characters can be set. These descriptions will appear on the monitoring page, in XML/JSON data, as well as in SMS and email alerts

Relay outputs

| Relay # | Description | Pulse (seconds) | Activated from | Action on alarm/event |
|---|---|---|---|---|
| R1 | Relay 1 | 0.1 | SMS/HTTP API | Turn on |
| R2 | Relay 2 | 0.2 | SMS/HTTP API | Turn on |

Relays state after restart: Last state

The pulse duration for each relay can be set individually, with a resolution of 0.1 seconds and a maximum value of 3600 seconds.

Relays can be activated either remotely via SMS, phone call, or HTTP/HTTPS API, or locally based on the status of a monitored parameter. This configuration is done using the "Activated from" drop-down menu, which offers the following options:

- **SMS/HTTP API**: Allows relay outputs to be activated via SMS from an authorized number or through HTTP API commands.
- **Local activation**: Enables activation based on a monitored parameter's status

For local activation, alarm conditions from various sources are used. These conditions are configured in the "Setup -> Conditions" section. To assign a parameter to a relay, the following options are available:

- **S?**: The relay is activated based on the value measured by a specific 1-Wire sensor, following the range rules set in "Setup -> Conditions". The question mark represents sensor numbers 1 to 4.
- **Analog input?**: The relay is activated based on the value measured by a specific analog input, following the range rules set in "Setup -> Conditions". The question mark represents analog input numbers 1 to 2.
- **Digital input?**: The relay mirrors the state of the specified digital input. The question mark represents digital input numbers 1 to 2.
- **Any alarm**: The relay is activated when any alarm condition is met.

All changes in these settings must be saved by pressing the "Save" button.

### 7.2.4. Conditions

This section is used to configure trigger and alert conditions for sensors, analog inputs, and digital inputs. It allows the setup of rules that determine how and when alarms or actions are triggered based on monitored parameters.

#### 7.2.4.1. Sensors and analog inputs

Each sensor has two sets of fields: one for configuring trigger conditions ("Min," "Max," and "Hys") and another for defining the desired action.

- "Min" and "Max": These define the boundaries of the acceptable range for the monitored parameter.
  - A "Max" trigger occurs when the value exceeds the upper limit.
  - A "Min" trigger occurs when the value falls below the lower limit.
  - In either case, the monitored parameter is considered out of range.
- Returning to range: The parameter is considered back in range when:
  - The value rises above (Min + Hys) after falling below the "Min" threshold.
  - The value falls below (Max – Hys) after exceeding the "Max" threshold.
- Hysteresis ("Hys"): This setting prevents frequent triggering due to minor fluctuations around the defined thresholds, ensuring stable operation.

Sensors — If out of range

| # | Description | Type | Parameter | Min | Max | Hys | mail | sms | post | mqtt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1:TST1xx | | Temperature, °C | -40.000 | 85.000 | 8.500 | ☐ | ☐ | ☐ | ☐ |
| | | | --- | --- | --- | --- | ☐ | ☐ | ☐ | ☐ |
| 2 | S2:TSH2xx | | Temperature, °C | -40.000 | 85.000 | 8.500 | ☐ | ☐ | ☐ | ☐ |
| | | | Humidity, %RH | 0.000 | 100.000 | 10.000 | ☐ | ☐ | ☐ | ☐ |
| 3 | S3 | | --- | --- | --- | --- | ☐ | ☐ | ☐ | ☐ |
| | | | --- | --- | --- | --- | ☐ | ☐ | ☐ | ☐ |
| 4 | S4 | | --- | --- | --- | --- | ☐ | ☐ | ☐ | ☐ |
| | | | --- | --- | --- | --- | ☐ | ☐ | ☐ | ☐ |

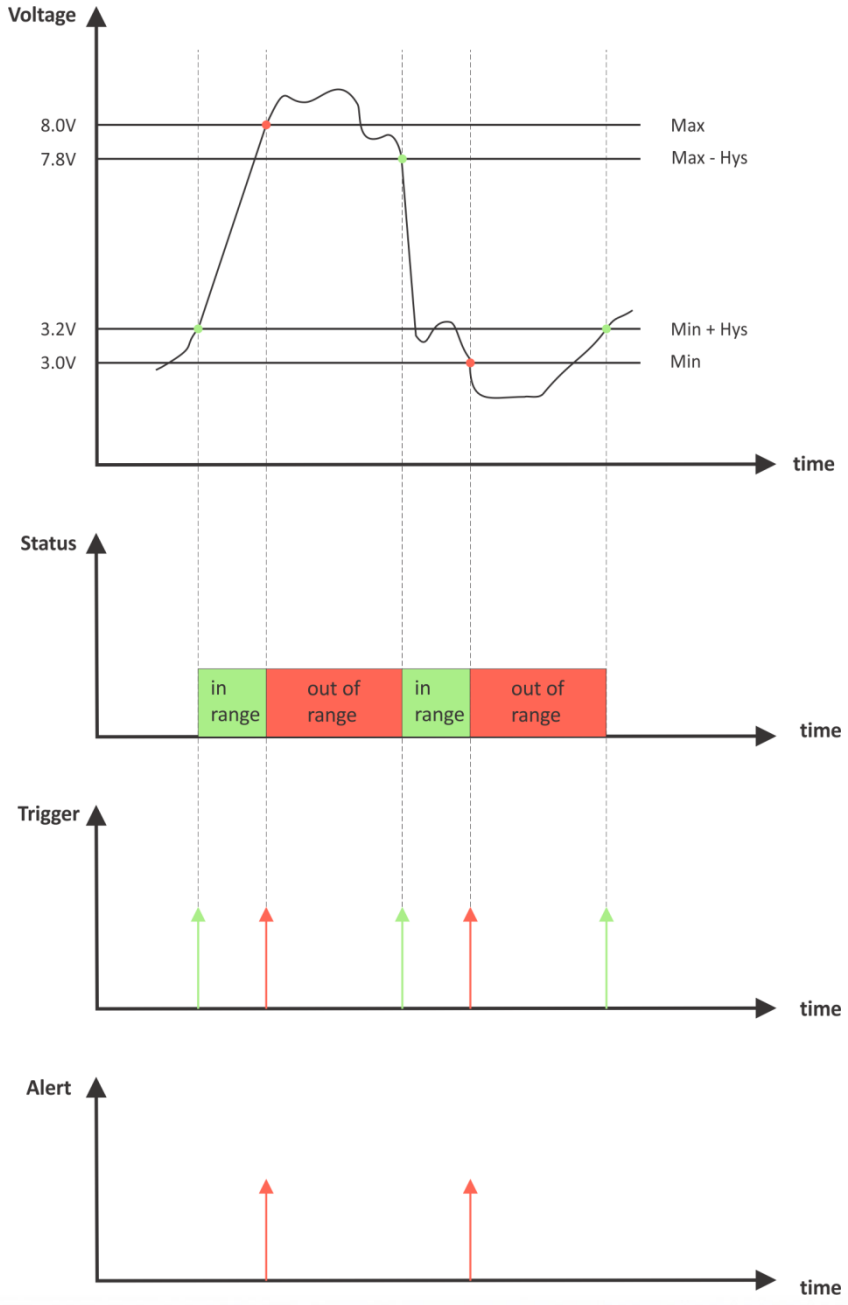
Notification in case of a sensor communication lost ☐ ☐ ☐ ☐

Return notification ☐ Notification delay (seconds) 0 (0-3600)

Analog inputs — If out of range

| # | Description | | Dimension | Min | Max | Hys | mail | sms | post | mqtt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Analog Input 1 | | V | 0.000 | 30.000 | 1.000 | ☐ | ☐ | ☐ | ☐ |
| 2 | Analog Input 2 | | V | 0.000 | 30.000 | 1.000 | ☐ | ☐ | ☐ | ☐ |

Return notification ☐ Notification delay (seconds) 0 (0-3600)



Example – room temperature control:

In this example, the TCG120-4 module, a TST100 sensor, and a heater are used to maintain a room temperature of at least 19°C. The initial room temperature is 17°C.

Configuration:

The TST100 sensor is assigned to the first position for 1-Wire sensors.

Relay1 is configured for local activation based on Sensor1.

The following parameters are set for Sensor1: Min=19, Max=100 and Hys=0.5.

Sensors — If out of range

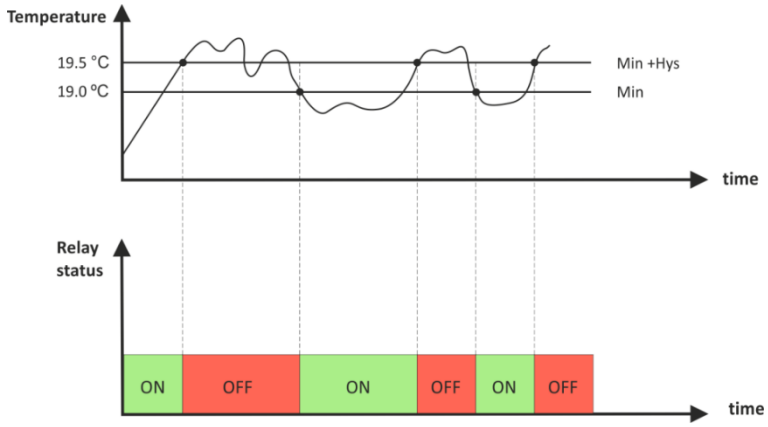
| # | Description | Type | Parameter | Min | Max | Hys | mail | sms | post | mqtt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S1:TST1xx | 1W | Temperature, °C | 19.000 | 100.000 | 0.500 | ☑ | ☑ | ☐ | ☐ |

Operation:

Upon powering up the module, Relay1 is activated immediately since the temperature (17°C) is below the minimum threshold (19°C). This turns the heater on..

As the temperature rises, it reaches 19.5°C (19.0 + 0.5). At this point, the temperature enters the defined range, triggering Relay1 to deactivate and switching the heater off.

The temperature starts to fall. When it drops back to 19°C, it goes out of range, triggering and alerting conditions. Relay1 is activated again, switching the heater on, and an email notification is sent.

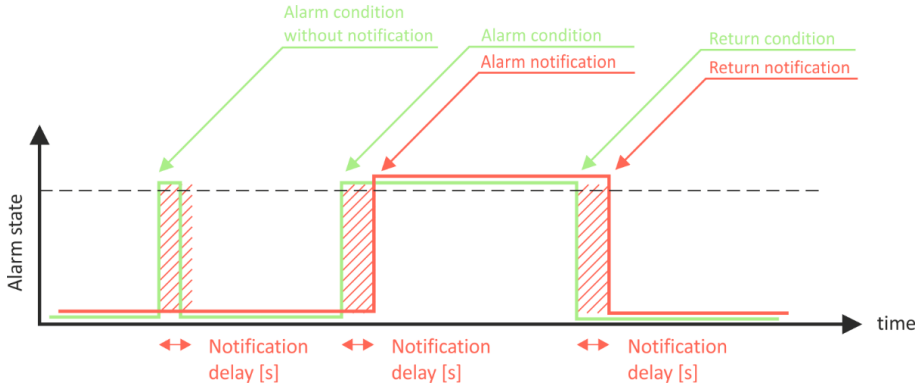



The Max value is set well above the desired temperature range to avoid unnecessary trigger or alert conditions near the desired threshold.

For each sensor or analog input, there are four independent alert methods available during an alarm condition – email, SMS, POST (HTTP POST with XML/JSON file) and MQTT publish. Each alert method can be activated using a checkbox.

A global "Return notification" checkbox is available for all sensors and analog inputs. If enabled, notifications will also be sent when the parameter returns to its normal range.

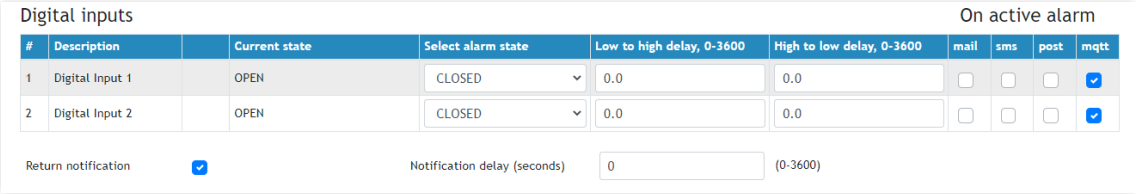
A global "Notification delay" parameter can be set for all sensors and analog inputs. This feature acts as a filter to avoid notifications for short-lived alarm conditions.



### 7.2.4.2. Digital inputs

This section is used to set up alarm notification parameters for digital inputs.

For each digital input, an alarm state must be defined. The state texts are configured on the "Input/Output" page



Digital inputs — On active alarm

| # | Description | | Current state | Select alarm state | Low to high delay, 0-3600 | High to low delay, 0-3600 | mail | sms | post | mqtt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Digital Input 1 | | OPEN | CLOSED | 0.0 | 0.0 | ☐ | ☐ | ☐ | ☑ |
| 2 | Digital Input 2 | | OPEN | CLOSED | 0.0 | 0.0 | ☐ | ☐ | ☐ | ☑ |

Return notification ☑ Notification delay (seconds) 0 (0-3600)

When a digital input enters an alarm state, up to four independent alert methods are available – email, SMS, POST (HTTP POST with XML/JSON file) and MQTT publish. Each alarm notification method is activated by a checkbox.

A global "Return notification" checkbox is available for all digital inputs. When enabled, notifications will also be sent when the parameter returns to its normal state.

A global "Notification delay" parameter is available for all digital inputs. This acts as a filter to prevent alerts for short-lived alarm conditions.

When a digital input is in an alarm state, the corresponding input is highlighted in red on the "Monitoring page".

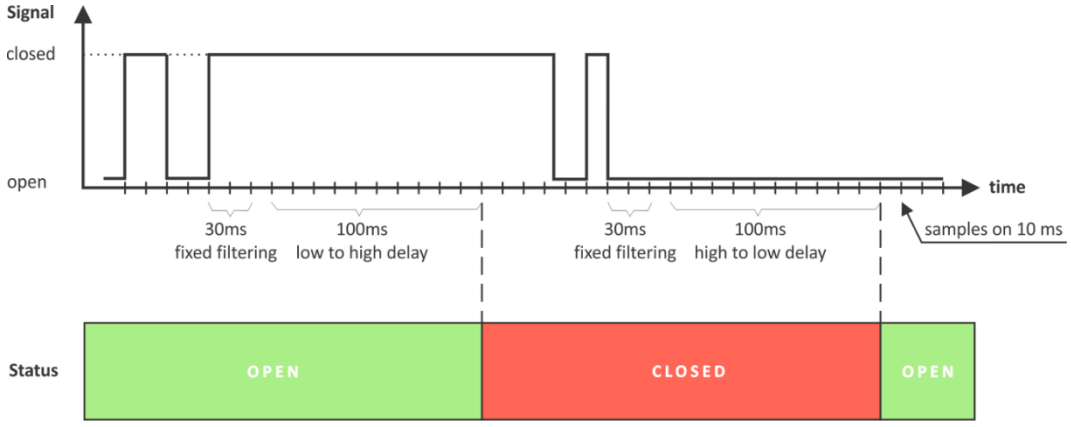
There are two delays for state changes:

Low-to-high delay

High-to-low delay

These delays are added to the standard 30ms delay and can be configured with a resolution of 0.1 seconds. By default, they are set to zero. These delays provide additional filtering to avoid unnecessary state changes.

In the example image below, both low-to-high and high-to-low delays are set to 0.1 seconds:

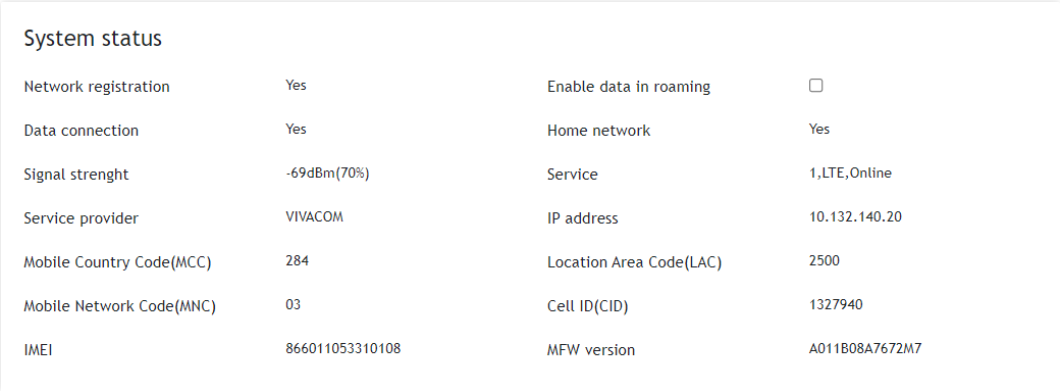



## 7.2.5. System

This page provides specific details about the device's operation, including signal strength, IP address, service provider, and other relevant information. It also offers options for configuring certain global settings, primarily related to communication.

### 7.2.5.1. System status

This section provides details about the module's status regarding the mobile network, including information such as the IMEI number and firmware version of the module.



System status

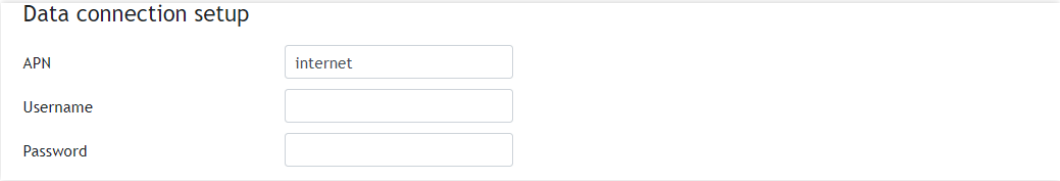
| | | | |
|---|---|---|---|
| Network registration | Yes | Enable data in roaming | ☐ |
| Data connection | Yes | Home network | Yes |
| Signal strenght | -69dBm(70%) | Service | 1,LTE,Online |
| Service provider | VIVACOM | IP address | 10.132.140.20 |
| Mobile Country Code(MCC) | 284 | Location Area Code(LAC) | 2500 |
| Mobile Network Code(MNC) | 03 | Cell ID(CID) | 1327940 |
| IMEI | 866011053310108 | MFW version | A011B08A7672M7 |

The only configurable setting in this section is the “Data in roaming” checkbox. By default, this option is disabled to prevent additional charges for data usage while roaming.

If you are using a SIM card from another operator, you must enable “Data in roaming” to access all data services, such as email, HTTP POST, NTP, and others.

#### 7.2.5.2. Data connection setup

The settings in this section are highly dependent on the mobile operator. We recommend consulting your service provider for detailed information.



Data connection setup

| | |
|---|---|
| APN | internet |
| Username | |
| Password | |

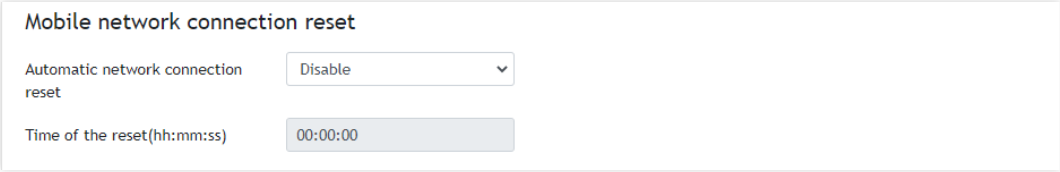
By default, the APN (Access Point Name) is set to "internet". Some mobile operators may also require a username and password to complete the configuration.

#### 7.2.5.3. Mobile network connection reset

In areas with low signal strength or where the mobile network frequently drops or blocks connections, enabling automatic restarting of the network connection can help maintain communication with the device. This feature can prevent the device from permanently losing its network connection.

When enabled, the device will automatically restart the network connection once per day.

By default, this feature is disabled.

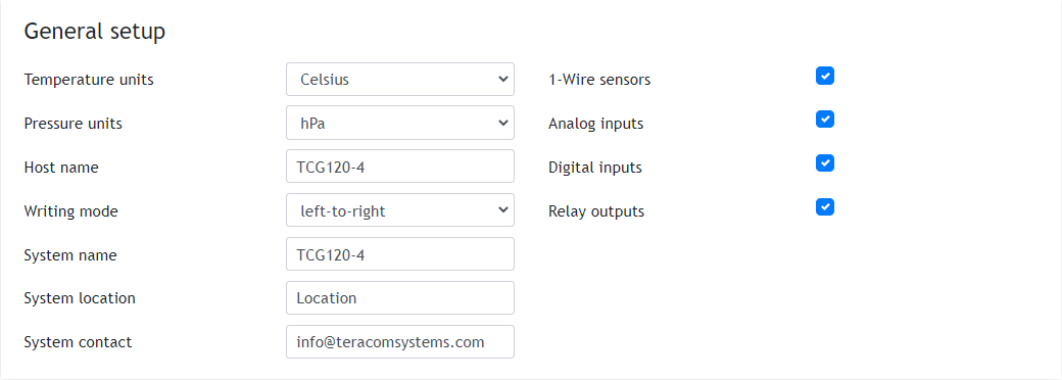


Mobile network connection reset

| | |
|---|---|
| Automatic network connection reset | Disable |
| Time of the reset(hh:mm:ss) | 00:00:00 |

#### 7.2.5.4. General setup

This section contains options for configuring general device settings




You can select your preferred units for temperature and pressure measurements.

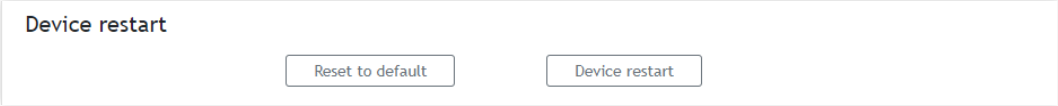
Writing mode adjusts the alignment of text in the web interface and SMS messages.

These details are included in XML/JSON files for flexible device identification. They can also be included in the body of email notifications.

Checkboxes on the right allow you to customize what is displayed on the "Monitoring page." By default, all options are enabled.

#### 7.2.5.5. Device restart

From this section, you can perform a software restart of the device or restore it to its factory default settings.




### 7.2.6. NTP

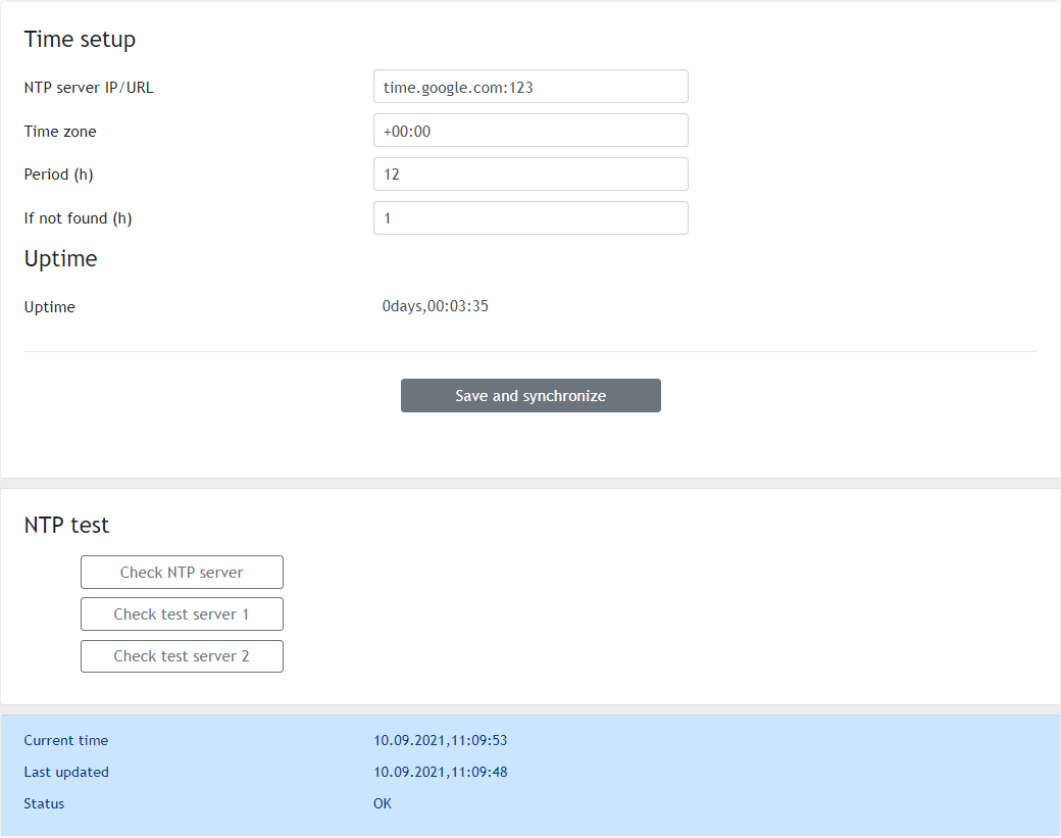
The module's internal RTC (real-time clock) is set automatically using NTP (Network Time Protocol). All necessary parameters for automatic synchronization can be configured in this section. Clock synchronization occurs based on the defined period. If an attempt fails, the next synchronization will occur after the specified “If not found” time.

Pressing the “Save and synchronize” button initiates an immediate synchronization attempt. The status information displayed in the blue box is useful for verifying the availability of the time server and general Internet connectivity. When HTTP POST is enabled, the current system time is included in the XML/JSON file.

Default Settings:

- NTP synchronization: Enabled
- Server: time.google.com:123
- Time zone: 00.00
- Period: 12 hours

The functionality of the settings and the NTP service can be checked using tools in the NTP test section

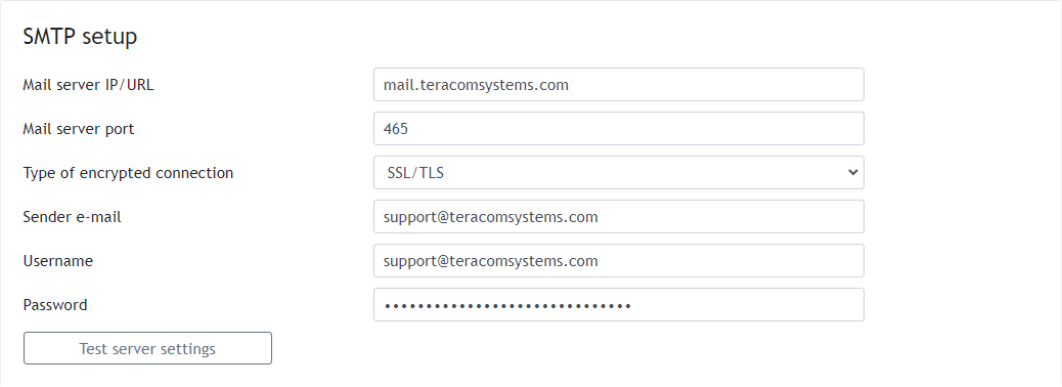



## 7.3. Services

### 7.3.1. SMTP

This page is used to enter valid SMTP settings for email alerts and recipients' addresses.

#### 7.3.1.1. SMTP setup



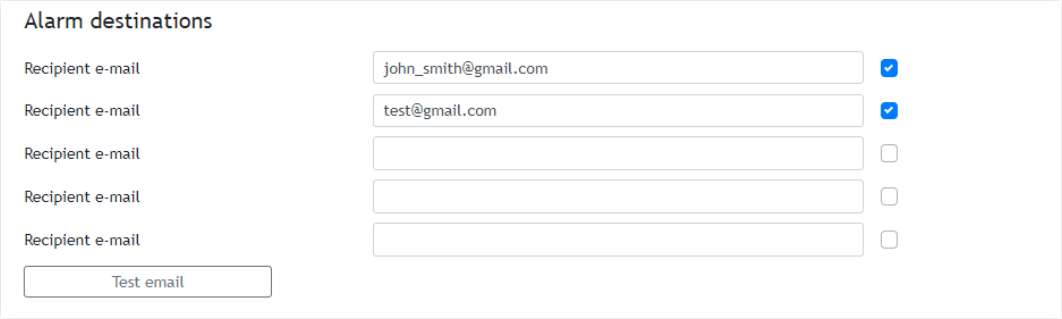

The mail server address can be configured using either a hostname (e.g., mail.teracomsystems.com) or an IP address. By default, the SMTP port is set to 25 for non-encrypted connections. If the default port does not work, please consult your Internet Service Provider (ISP).

The sender's email, username, and password are standard authentication details. In the TCG120-4, each of these fields can accommodate up to 128 characters in length.

A button is available to test the server settings, providing feedback on the results. In this test, the sender and recipient email addresses are the same.

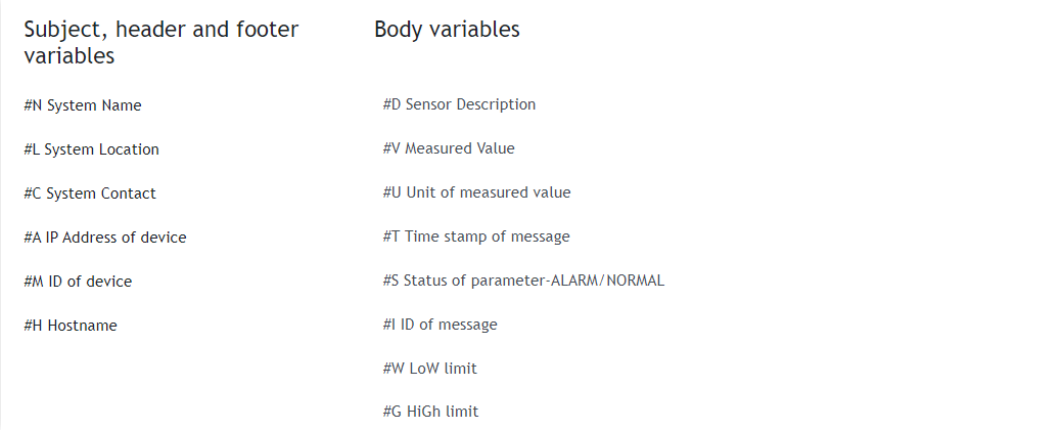
For secure communication with mail servers, the Transport Layer Security (TLS) protocol is employed. The TCG120-4 supports TLS versions 1.0, 1.1, and 1.2, using RSA for key exchange, agreement, and authentication. STARTTLS is not supported.

#### 7.3.1.2. Alarm destination



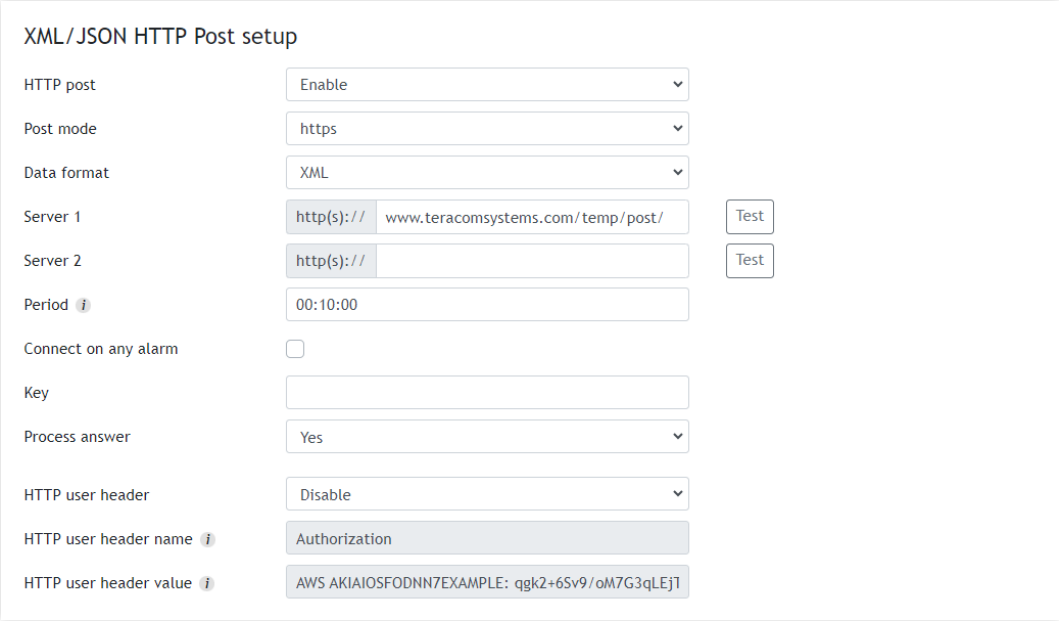

You can configure up to five email recipients, each of whom can be activated independently using a checkbox.

#### 7.3.1.3. E-mail details




The subject, body header, body, and footer of the email can be customized using a predefined set of keys. All available keys are described on the page.

### 7.3.2. HTTP/HTTPS POST




The HTTP POST method is used for the periodic upload of XML/JSON files to a server via HTTP/HTTPS requests (POST method). These files contain the current status of all monitored parameters along with additional system information. The format of the file (XML or JSON) can be selected from a drop-down menu.

The HTTP servers can be addressed using either a domain name or an IP address.

The upload interval, referred to as the “Period,” can be set between 1 minute and 48 hours. This parameter can also be adjusted remotely via command. The "Period" defines how frequently the control software receives updated information from the TCG120-4 device, enabling it to make changes to certain parameters. A shorter "Period" allows the system to operate closer to real-time but increases data traffic through the mobile network.

If the “Connect on any alarm” checkbox is enabled, an HTTP POST request will be sent immediately upon the occurrence of any alarm.

The “Key” field is user-defined. Its value is included in the XML/JSON file and can be used to identify the device.

When the “Process Answer” option is enabled, the TCG120-4 device will execute commands sent by the remote server in response to an HTTP/HTTPS POST.

An HTTP user header can be configured for services requiring additional header information. By default, this parameter is disabled. Note that this feature is available only for TCG120-4 with firmware version h2.xx or higher.

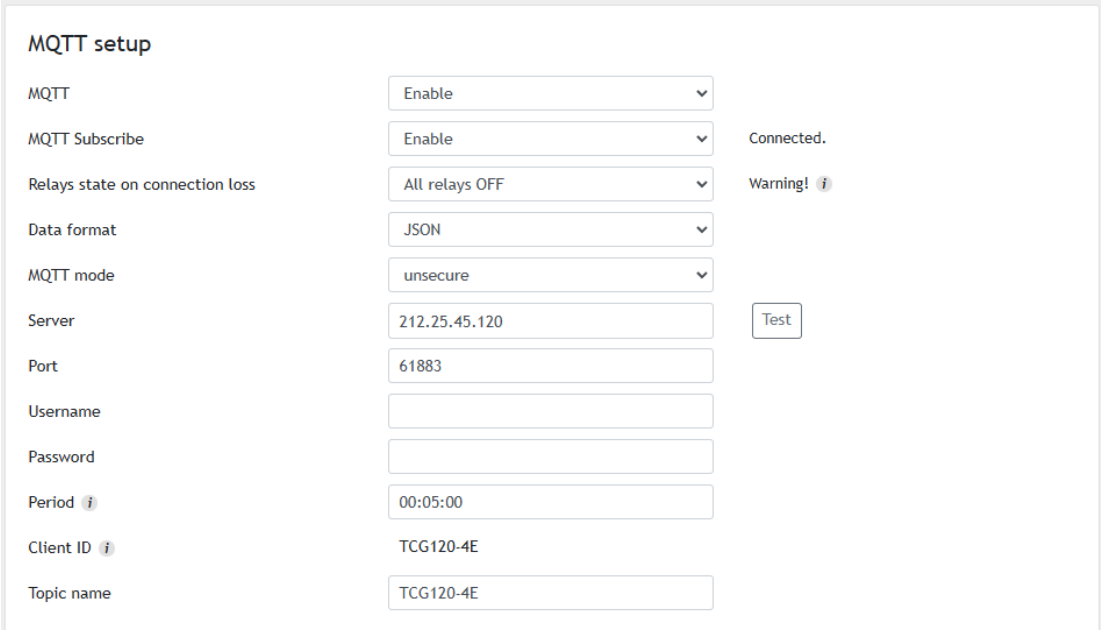
For more details about HTTP/HTTPS POST, refer to the HTTP API section of the manual.

### 7.3.3. MQTT

The TCG120-4 supports MQTT version 3.1.1 in both "Publisher" and "Subscriber" modes. This section outlines the settings required to configure the MQTT protocol on the device.

#### 7.3.3.1. MQTT general setup

This section allows configuration of the general parameters for MQTT operation. By default, the MQTT publish and MQTT subscribe services are disabled. After enabling them, the controller establishes a connection with the MQTT broker, whose parameters are configured in the fields “Server”, “Port”, “Username”, and “Password”. The “Username” and “Password” fields allow up to 31 characters, while the “Server name” field supports up to 127 characters. The publishing interval ranges from 1 minute to 48 hours.




Messages can be sent to the MQTT broker in JSON or plain text format, with an option for an encrypted (TLS) or unencrypted connection. In case of a connection loss with the MQTT

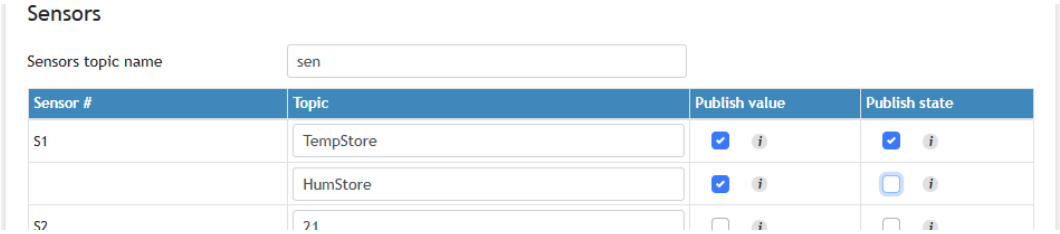
broker, the following settings for the behavior of the relays are provided: ” All relays OFF”, “All relays ON” and “Keep last state”.

In the "Topic name" field, the **root topic** is set.

Note: The System ID is used as the Client ID.

#### 7.3.3.2. MQTT sensors topic

This section allows you to configure the publishing parameters for each sensor.

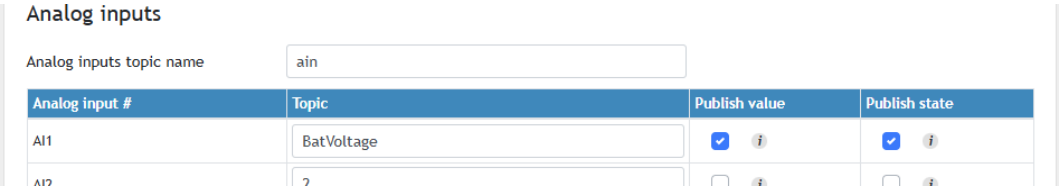



It is possible to monitor all four sensors, with each sensor's value and status available for publishing. Based on these settings, the specific topics for values and statuses will be as follows:

- TRC/sen/TempStore/value
- TRC/sen/TempStore/state
- TRC/sen/HumStore/value

#### 7.3.3.3. MQTT analog inputs topic

This section allows you to configure the publishing parameters for analog inputs.




Based on these settings, the specific topics for values and statuses will be as follows:

- TRC/ain/BatVoltage/value
- TRC/ain/BatVoltage/state

#### 7.3.3.4. MQTT digital inputs topic

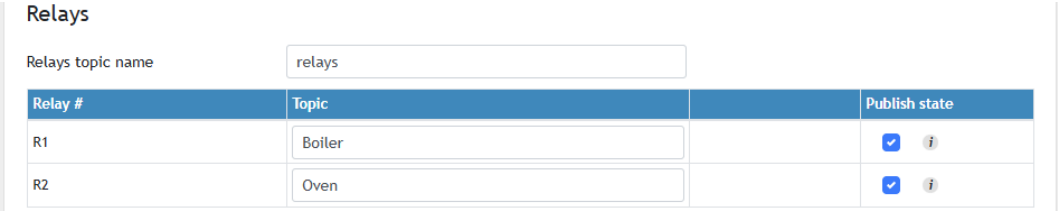
This section allows you to configure the publishing parameters for digital inputs.

Based on these settings, the specific topics for values and statuses will be as follows:

- TRC/din/PanicButton/value
- TRC/din/PanicButton/state
- TRC/din/MainButton/value

#### 7.3.3.5. MQTT relays topic

In this section, the publishing and subscription parameters for each built-in relay are configured.




With these settings, the exact topics for relay statuses will be:

- TRC/relays/Boiler/state
- TRC/relays/Oven/state

#### 7.3.3.6. Relay control using MQTT Subscribe method

The built-in relays of TCG120-4 can be controlled using the MQTT subscribe method. After enabling the MQTT subscribe service, the device automatically subscribes to the following topic: TRC/relays/Boiler/command , where “TRC” is the **root topic** and “Boiler” is the topic for the specific relay (relay 1 In the above example).

Publishing a value of 0 or 1 in the above topic will turn the respective relay off or on.

#### 7.3.3.7. Configuration and Control of TCG120-4 Using MQTT Subscribe Method

After enabling the MQTT subscribe service, the TCG120-4 module subscribes to the following topic: TRC/api , where “TRC” is the **root topic**. Publishing a specific command in text format will cause the controller to read and execute it. For example:

- The command **r1=pl** will make the relay 1 to perform a pulse
- The command **r2=on** will turn relay 2 on.
- The command **pper=15** will change the HTTP post period to 15 seconds

A full list of supported commands can be found in Appendix C.

### 7.3.4. GSM geolocation

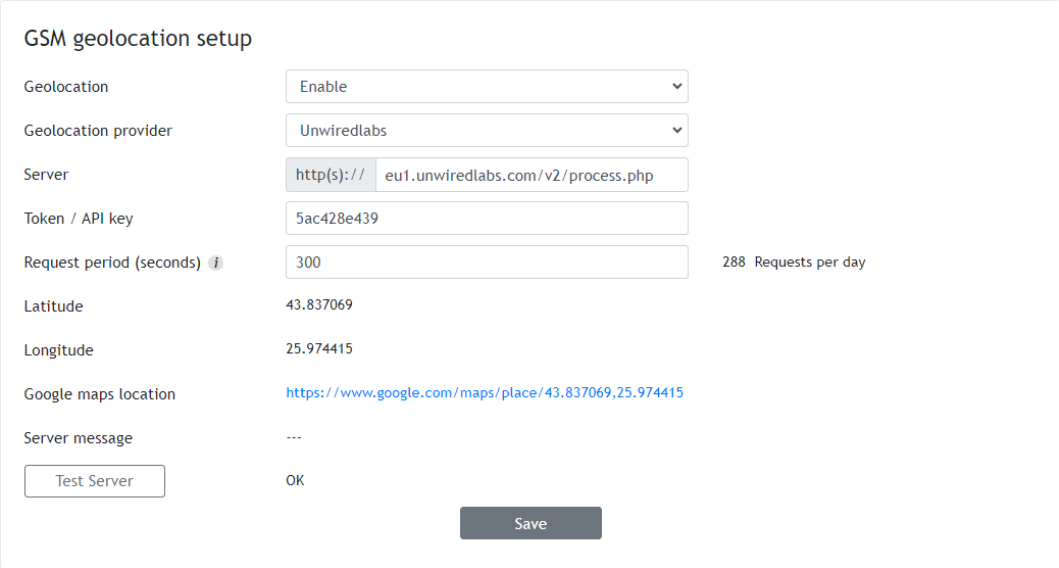
GSM geolocation provides a way to determine the device's position without relying on GPS. Instead, it uses information from the mobile network. This data is sent to a third-party operator, who returns the device's coordinates with a certain level of accuracy.

While GSM geolocation is less precise compared to GPS, it has the advantage of functioning indoors. This makes it particularly suitable for applications such as tracking parcels, refrigerated display cases, refrigerators, machinery, and equipment operating in areas without GPS coverage.

The TCG120-4 supports the following operators for GSM geolocation services:

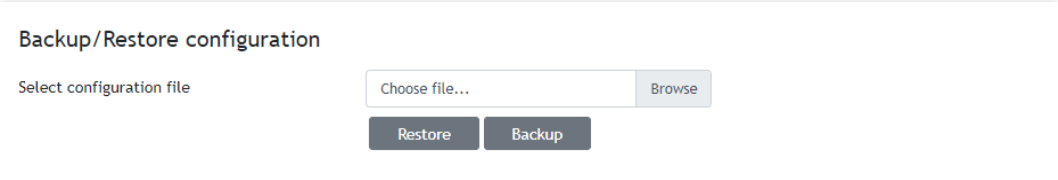
- Google
- Unwired Labs

To use this service, registration with the chosen operator is required.




## 7.4. Administration

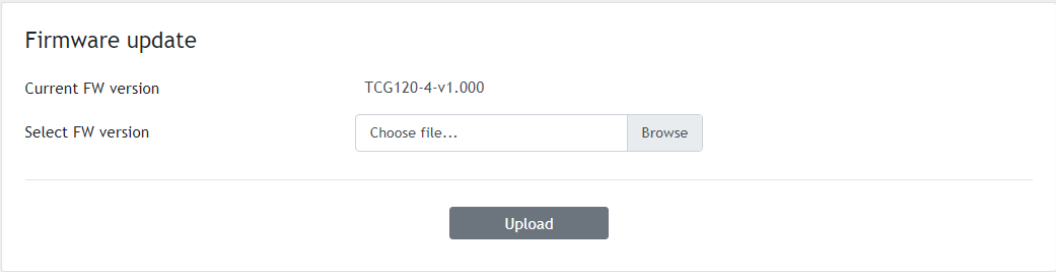
### 7.4.1. Backup/Restore




TCG120-4 allows for the backup and restoration of all user settings. These settings are saved in an XML backup file, which can be utilized for restoring configurations on multiple devices. This feature is particularly useful for applying similar settings across a batch of modules.

### 7.4.2. FW update

The TCG120-4 supports firmware updates via the WEB interface.




TCG120-4 supports firmware update over the WEB interface.

To update the firmware:

- Download the latest firmware from www.teracomsystems.com.
- Select the downloaded file.
- Press the “Upload” button to begin the update process.

**Important:**

Do not turn off the power supply during the update. Interrupting the power supply may cause permanent damage to the device.

## 8. Setup via SMS

The TCG120-4 supports SMS commands for parameter changes, status reports, and firmware updates over the air. Commands are executed only if sent from phone numbers listed in the "SMS Setup" section.

Each command requires specific access rights (Master/User).

Note: Replace the underscore character "␣" with a single space character when entering commands.

Below is a list of supported SMS commands:

- **Set new master number**

  Rights: Master
  Syntax: set␣master␣<number>
  Where
  <number> is a mobile number in the international format

  *Example*
  *Command:* *set master +359885885885*
  *Answer:* *You are the new master!*

- **Set SMS users numbers -** this message is used to add/delete SMS users

  Rights: Master
  Syntax: set␣sms␣user␣<user>:<number>
  Where
  <number> is a mobile number in the international format
  <user> can be u1, u2, u3 or u4

  *Example*
  *Command:* *set sms user u1:+359885887766*
  *Answer:* *u1:+359885887766,u2,u3,u4*
  *Command:* *set sms user u2:+359885999888*
  *Answer:* *u1:+359885887766, u2:+359885999888,u3,u4*
  *Command:* *set sms user u1:*
  *Answer:* *u1, u2:+359885999888,u3,u4*

- **Set superuser rights for users -** this message is used to activate/deactivate superuser rights for SMS users

  Rights: Master
  Syntax: set␣suser␣<user>=<cmd>
  Where
  <cmd> is "on" for activation or "off" for deactivation
  <user> can be u1, u2, u3 or u4

  *Example*
  *Command:* *set suser u1=on*
  *Answer:* *m:+ 359885885885,su1:+359885887767,u2,u3,u4*
  *Command:* *set suser u1=off*
  *Answer:* *m:+ 359885885885,u1:+359885887767,u2,u3,u4*
  *Command:* *set suser u1=off,u2=on,u3=off,u4=off*
  *Answer:* *m:+ 359885885885,u1:+359885887761,su2:+359885887762, u3:+359885887763,u4:+359885887764*

- **Display SMS users numbers**

  Rights: Master, Superusers, Users
  Syntax: display␣sms␣users

  *Example*
  *Command: display sms users*
  *Answer: m:+359885885885,u1:+359885887766,u2:+359885999888,u3,u4*

- **Set email users -** this message is used to add/delete email users

  Rights: Master, Superusers
  Syntax: set␣email␣user␣<user>:<email>
  Where
  <email> - a valid email address
  <user> can be e1, e2, e3, e4 or e5

  *Example*
  *Command: set email user e1:mail1@teracomsystems.com*
  *Answer: e1:mail1@teracomsystems.com*
  *Command: set email user e2:mail2@teracomsystems.com*
  *Answer: e2:mail2@teracomsystems.com*
  *Command: set email user e2:*
  *Answer: e2:*

- **Display email users** - this message is used to request the email of a user

  Rights: Master, Superusers, Users
  Syntax: display␣email␣<user>
  Where
  <user> can be one of: e1, e2, e3, e4 or e5

  *Example*
  *Command: display email e1*
  *Answer: e1:mail1@teracomsystems.com*
  *Command: display email e2*
  *Answer: e2:mail2@teracomsystems.com*

- **Set call users numbers -** this message is used to add/delete call users

  Rights: Master
  Syntax: set␣call␣user␣<user>:<number>
  Where
  <number> is a mobile number in the international format
  <user> can be c1, c2, c3,c4 or c5

  *Example*
  *Command: set call user c1:+359885887766*
  *Answer: c1:+359885887766, c2,c3,c4,c5*
  *Command: set call user c2:+359885999888*
  *Answer: c1:+359885887766,c2:+359885999888,c3,c4,c5*
  *Command: set call user c1:*
  *Answer: c1,c2:+359885999888,c3,c4,c5*

- **Display call users** - this message is used to request a list of call users

  Rights: Master, Users
  Syntax: display␣call␣users

  *Example*
  *Command: display call users*
  *Answer: c1:+359885122112,c2:+359885322343,c3:+359885431276, c4:+359885128734,c5:+359888343434*

- **Status of system** - requests main parameters of the device

  Rights: Master, Superusers, Users
  Syntax: status␣system

  *Example*
  *Command: status system*
  *Answer:*
  *06.01.2021,16:09:06,4G=y,ss=80%,fw=1.00*

- **Status of parameter** - requests status of digital input (di), analog input (ai), relay (r) and sensor(s)

  Rights: Master, Superusers, Users
  Syntax: status␣<param>
  Where
  <param> is one of: di1, di2, ai1, ai2, r1, r2, s11, s12, s21, s22, s31, s32, s41, s42

*Example*

*Command:* *status di1*
*Answer:* *di1(Garage_door)=CLOSED*
*Command:* *status s22*
*Answer:* *s22(Office)=34.5%RH*

- **Set a relay** - this message is used to switch on/off the selected relay output

Rights: Master, Superusers, Users
Syntax:set␣<relay>=<state>␣[option]
Where
<relay> is r1 or r2
<state> is on, off
[option] -w

*Example*
*Command:* *set r1=on*
*Answer:* *r1=on,r2=off*
*Command:* *set r1=off*
*Answer:* *r1=off,r2=off*
*Command:* *set r1=off,r2=on*
*Answer:* *r1=off,r2=on*
*Command:* *set r1=on -w*
*Answer:* *no answer*
*Command:* *set r1=off,r2=off -w*
*Answer:* *no answer*

- **Set pulse a relay** - this message is used to pulse the selected relay output

Rights: Master, Superusers, Users
Syntax: set␣<pulse relay>=<state>␣[option]
Where
< pulse relay > is pl1 or pl2
<state> is on
[option] –w

*Example*
*Command:* *set pl1=on*
*Answer:* *r1=on,r2=off*
*Command:* *set pl1=on,pl2=on*
*Answer:* *r1=on,r2=on*

*Command:* *set pl1=on -w*
*Answer:* *no answer*
*Command:* *set pl1=on,pl2=on -w*
*Answer:* *no answer*

- **POST URL** – sets URL for XML/JSON HTTP POST

Rights: Master, Superusers
Syntax: set␣purl=<link> or set␣purl2=<link>
Where
<link> is the address of remote server (domain or IP)

*Example*
*Command:* *set purl=www.teracomsystems.com:8801/POSTtest.php*
*Answer:* *purl=www.teracomsystems.com:8801/POSTtest.php,POST=on, period=00:01:00*

*Command:* *set purl2=www.teracomsystems.com:8802/POSTtest.php*
*Answer:* *purl2=www.teracomsystems.com:8802/POSTtest.php,POST=on, period=00:01:00*

- **Status URL** – status URL's for XML/JSON HTTP POST

  Rights: Master, Superusers, Users
  Syntax: status_purl or status_purl2

  *Example*
  *Command:* *status purl*
  *Answer:* *purl*=www.teracomsystems.com:8801/POSTtest.php*,* *POST=on,period=00:01:00*
  *Command:* *status purl2*
  *Answer:* *purl2*=www.teracomsystems.com:8802/POSTtest.php*,* *POST=on,period=00:05:00*

- **POST period in seconds** – sets XML/JSON HTTP POST period in seconds

  Rights: Master, Superusers
  Syntax: set_pper=<value>
  Where
  <value> is a number between 60 and 172800 (seconds)
  *Example*
  *Command:* *set pper=120*
  *Answer:* *POST=off,period=00:02:00*

- **POST period in hh:mm:ss** – sets XML/JSON HTTP POST period in hh:mm:ss

  Rights: Master, Superusers
  Syntax: set_pperh=<value>
  Where
  <value> is a number between 00:01:00 and 48:00:00
  *Example*
  *Command:* *set pper=00:05:00*
  *Answer:* *POST=off,period=00:05:00*

- **POST on** – sets XML/JSON HTTP POST on

  Rights: Master, Superusers
  Syntax: set_POST=on

  *Example*
  *Command:* *set POST=on*
  *Answer:* *POST=on,period=00:02:00*

- **POST off** – sets XML/JSON HTTP POST off

  Rights: Master, Superusers
  Syntax: set POST=off

  *Example*
  *Command:* *set POST=off*
  *Answer:* *POST=off,period=00:02:00*

- **MQTT on** – sets MQTT on

  Rights: Master, Superusers
  Syntax: set_mqtt=on

*Example*
*Command:* *set mqtt=on*
*Answer:* *mqtt=on,mdata=json,period=00:05:00*

- **MQTT off** – sets MQTT off

Rights: Master, Superusers
Syntax: set␣mqtt=off

*Example*
*Command:* *set mqtt=off*
*Answer:* *mqtt=off,mdata=json,period=00:05:00*

- **MQTT period** – sets MQTT publish period

Rights: Master, Superusers
Syntax: set␣mper=<time>
Where
<time> is between 00:01:00 and 48:00:00 (hh:mm:ss)
*Example*
*Command:* *set mper=00:05:00*
*Answer:* *mqtt=on,mdata=json,period=00:05:00*

- **MQTT data** – sets MQTT data format

Rights: Master, Superusers
Syntax: set␣mdata=<format>
Where
<format> is “json” or “plain”
*Example*
*Command:* *set mdata=plain*
*Answer:* *mqtt=on,mdata=plain,period=00:05:00*

- **MQTT server** – sets MQTT server

Rights: Master, Superusers
Syntax: set␣murl=<link>
Where
<link> is the address of remote server (domain or IP)
*Example*
*Command:* *set murl= www.teracomsystems.com*
*Answer:* *mqtt=on,murl= www.teracomsystems.com,port=1883*

- **MQTT port** – sets MQTT port

Rights: Master, Superusers
Syntax: set␣mport=<port>
Where
<port> is a MQTT port
*Example*
*Command:* *set mport= 8883*
*Answer:* *mqtt=on,murl= www.teracomsystems.com,port=8883*

- **Set a time server**

Rights: Master, Superusers
Syntax: set␣ts=url:port

*Example*
*Command:* *set ts=time.google.com:123*
*Answer:* *ts=time.google.com:123,tz=+02:00*

- **Set a time zone**

  Rights: Master, Superusers
  Syntax: set␣tz=±hh:mm

  *Example*
  *Command:* *set tz=+03:00*
  *Answer:* *ts=time.google.com:123,tz=+03:00*

- **Restart** – restarts the device

  Rights: Master, Superusers
  Syntax:restart

  *Example*
  *Command:* *restart*
  *Answer:* *Device is restarting!*

- **Send test email** – a message for sending a test email to the email users

  Rights: Master, Superusers
  Syntax: test␣email

  *Example*
  *Command:* *test email*
  *Answer:* *Emails are sending!*

- **Send test SMS** – a message for sending a test SMS to the authorized users

  Rights: Master, Superusers
  Syntax: test␣sms

  *Example*
  *Command:* *test sms*
  *Answer:* *This is a test SMS!*

- **Update** – a message for update the device over the air (needs LTE/WCDMA/GPRS)

  Rights: Master, Superusers
  Syntax: update␣<URL>
  Where
  <URL> is a valid URL to public server, pointing update (.cod) file

  *Example*
  *Command:* *update www.teracomsystems.com/docs/TCG120-4-v1.000-P-S.cod*
  *Answer 1:* *Downloading firmware...*
  *Answer 2:* *Firmware file downloaded. Updating...*

  Following answers are also possible in different situations:
  *Answer:* *File corrupt or wrong version!*
  *Answer:* *Can't connect to server!*
  *Answer:* *Download time out!*
  *Answer:* *4G/3G/2G is not connected!*
  *Answer:* *Connection lost!*

*Answer:* *Response timeout!*
*Answer:* *Socket error!*

- **Set Mobile network connection reset**

Rights: Master, Superusers
Syntax: set mncr=<status>,hh:mm:ss
Where
<status> - "on" or "off"

*Example:* *enable mobile network connection reset and set time*
*Command:* *set mncr=on,10:00:00*
*Answer:* *mncr=on,10:00:00*
*Example:* *disable mobile network connection reset*
*Command:* *set mncr=off*
*Answer:* *mncr=off,10:00:00*

- **Set a sensor notification delay**

Rights: Master, Superusers
Syntax: set delsen=xxxx
where
xxxx – notification delay in seconds (0-3600)

*Example:*
*Command:* *set delsen=5*
*Answer:* *delsen=5*

- **Set a sensor limits**

Rights: Master, Superusers
Syntax: set ls**pt**=**n**aaaa,**x**bbbb,**y**cccc
where
**p** sensor number; valid values 1,2,3 or 4;
**t** parameter of the sensor; valid values 1 or 2;
**n** stands for "Mi**n**"
aaaa value for limit "Min";
**x** stands for "Ma**x**"
bbbb value for limit "Max"
**y** stands for "H**y**s"
cccc value for "Hys".

*Example:* *set of sensor 1 parameter 1 (temperature):*
*Command:* *set ls11=n25.0,x35.0,y1.0*
*Answer:* *ls11=n25.0,x35.0,y1.0*
*Command:* *set ls11=n31.0*
*Answer:* *ls11=n31.0,x35.0,y1.0*

*Example:* *set of sensor 1 parameter 2 (humidity):*
*Command:* *set ls12=n45.0,x60.0,y1.0*
*Answer:* *ls12=n45.0,x60.0,y1.0*

- **Set API command. Execute full list of HTTP API commands - Appendix C.**

| | | |
|---|---|---|
| Rights: | Master, Superusers | |
| Syntax: | set api **cmd**=**value** | |
| | where | |
| | **cmd** | API command |
| | **value** | API value |

| | |
|---|---|
| *Example:* | *set APN for data connection* |
| *Command:* | *set api APN=internet* |
| *Answers:* | *OK (If executed successfully)* |
| | *Wrong or missing parameters! (if not executed successfully)* |
| | *Unknown command! (if not executed successfully)* |

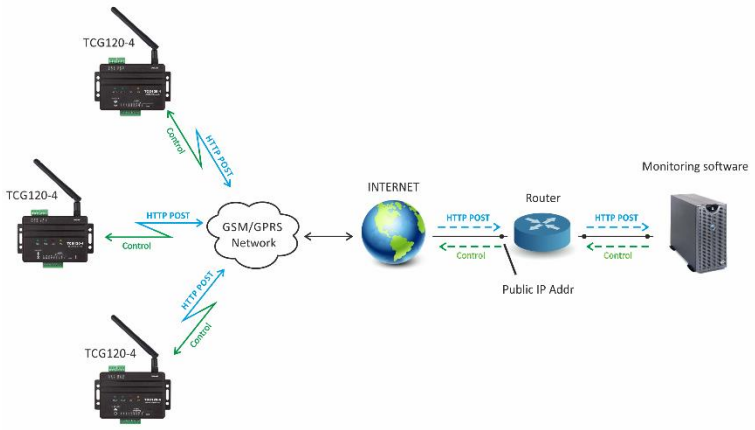
| | |
|---|---|
| *Example:* | *activation of email alarm notification for digital input 1* |
| *Command:* | *set api d1m=1* |
| *Answer:* | *OK* |

| | |
|---|---|
| *Example:* | *deactivation of email alarm notification for digital input 1* |
| *Command:* | *set api d1m=0* |
| *Answer:* | *OK* |

# 9. Protocols and API

## 9.1. HTTP/HTTPS API

HTTP/HTTPS is a widely adopted protocol for implementing remote monitoring and control in SCADA systems, which are based on client-server architecture. The TCG120-4 operates in client mode for HTTP/HTTPS POST, ensuring seamless integration with any SCADA software using the HTTP/HTTPS protocol.
Below is an example of a typical monitoring application:




### 9.1.1. Periodic HTTP/HTTPS POST

While this service is operational, the module consistently dispatches HTTP/HTTPS POST requests to a server. These POST requests encapsulate an XML or JSON file detailing the current status of the monitored parameters. The HTTP/HTTPS POST can also be sent in response to triggered alarm conditions, similar to an SNMP trap.

Following each HTTP/HTTPS POST, the server responds according to the HTTP/HTTPS protocol. The response may include API command(s).

An important consideration in this communication setup is the HTTP/HTTPS POST interval. A shorter interval increases data traffic but ensures that information and control of the device

remain closer to real-time. The server can adjust the HTTP/HTTPS POST interval using the appropriate command, providing a high degree of flexibility to the communication process.

### 9.1.2. API commands

The commands are transmitted within the body of the HTTP/HTTPS POST request's response. The majority of commands follow this structure:

set yyy=xxx

Where:

"yyy" represents the command;

"xxx" denotes the parameter.

Example:

set r1=on

This command will activate relay 1.

Multiple commands can be sent simultaneously, concatenated with "&".

Example:

set r1=on&r2=on

This command will activate both relay 1 and relay 2.

Two exceptions to the aforementioned structure exist for the following commands

set FIN for session termination

get <filename> for retrieving a specific file from the controller

Both commands cannot be concatenated and should be placed on separate lines.

Example1:

set r1=on&r2=on

set FIN

These commands will activate relay 1 and relay 2 and subsequently close the session.

**Attention!** The execution of the commands only occurs if the "Process Answer" feature is enabled; otherwise, the device promptly concludes the connection immediately after receiving the response.

A very short list of commands:

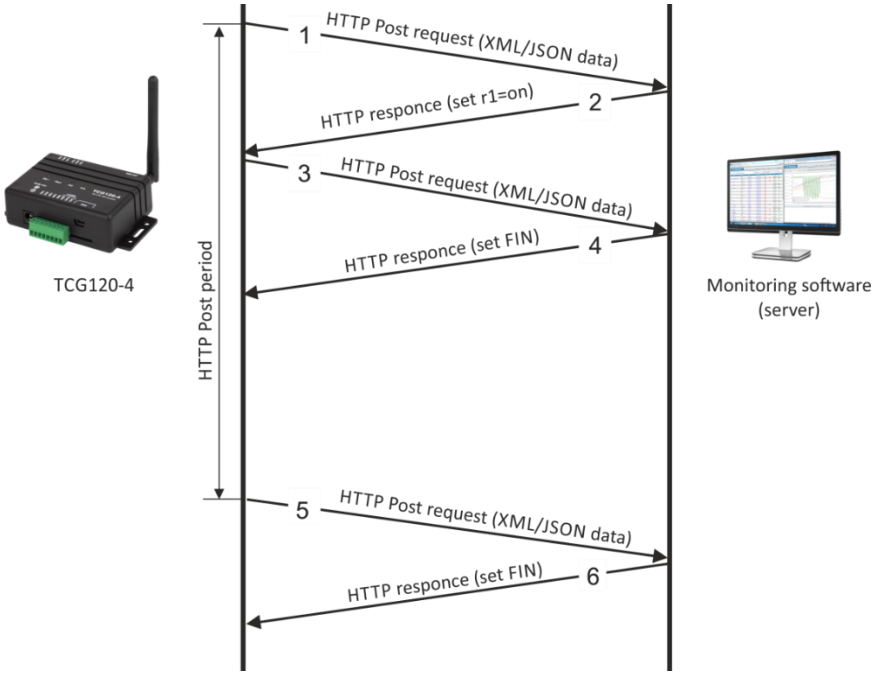
| Command | Description |
|---|---|
| r**n**=xxx | Turn relay **n** ON (xxx=on) or OFF (xxx=off)<br>(**n** is 1,2,3 or 4 for the respective relay)<br>r2=on – will turn relay 2 ON<br>r4=off – will turn relay 4 OFF<br>r1=on&r2=on&r3=on&r4=on – will turn all relays ON<br>r1=off&r2=off&r3=off&r4=off – will turn all relays OFF |
| r**n**=tg | Toggle relay **n**<br>(**n** is 1,2,3 or 4 for the respective relay)<br>r2= tg – will toggle relay 2<br>r1=tg&r4=tg – will toggle relay 1 and 4 |
| r**n**=pl | Pulse relay **n**<br>(**n** is 1,2,3 or 4 for the respective relay)<br>r3=pl – will pulse relay 3<br>r1=pl&r2=pl&r3=pl&r4=pl |
| pper=x | XML/JSON HTTP POST period in seconds |

| | |
|---|---|
| | (x is between 60 and 172800)<br>pper=600 – will set POST period to 600 seconds |
| ddly=xx | Set the delay time for sending the next XML/JSON HTTP POST in "real-time" mode after receiving a response from the server.<br><br>xx is a number between 3 and 59 seconds |
| save | Save all previous changes (except relays' one) in the FLASH memory.<br>**As every save reflects the FLASH cycles (endurance), this command should be used very carefully.**<br>pper=120&save – will set POST period to 120 seconds and save it |
| get <filename> | Returns <filename> in the next HTTP/HTTPS POST. The <filename> could be dummy.xml, dummy.json, status.xml or status.json. |
| FIN | Terminate the session |

You can find the complete list of commands in Appendix C. Additionally, the structures of status.xml and status.json are provided in Appendix A and Appendix B, respectively.

### 9.1.3. Communication session for a periodic HTTP/HTTPS POST

Here is a standard communication session featuring TCG120-4 and a remote server, with the "Process Answer" function activated:




- Step 1: The device sends an HTTP/HTTPS POST request with XML/JSON data to the remote server, either triggered by the POST period or an alarm condition.
- Step 2: The server returns an HTTP/HTTPS response containing the "set r1=on" command as plain text in the message body, without a "set FIN" command.
- Step 3: The device immediately sends a new HTTP/HTTPS POST request with updated XML/JSON data, confirming the execution of the "set r1=on" command.
- Step 4: The server responds with a new HTTP/HTTPS response, which includes the "set FIN" command in the message body. This indicates that no further commands are pending, and the session can be closed.

- Step 5: During the next HTTP/HTTPS POST period, the TCG120-4 sends a new HTTP/HTTPS POST request to the server.
- Step 6: The server responds with “set FIN”, signaling that no pending commands exist and the session can be closed.

### 9.1.4. Testing HTTP/HTTPS POST functionality

To test the HTTP/HTTPS POST functionality, follow the steps outlined below:

- Save the provided code as POST.php:

```
<?php
    define("FILENAME", 'status.xml');
    define("FOLDER", '');
    define("SEPARATOR", '');
    define("STR_SUCCESS", 'set FIN');
    define("STR_ERROR", 'error');

    if($_SERVER['REQUEST_METHOD'] == 'POST'){
        $datePrefix = date('YmdHis', strtotime('now'));
        $pathname = FOLDER.SEPARATOR.$datePrefix.'_'.FILENAME;
        $POSTdata = file_get_contents("php://input");
        $handle = fopen($pathname, 'w+');
        $content = var_export($POSTdata, true);
        fwrite($handle, substr($content, 1, strlen($content)-2));
        fclose($handle);
        echo (($handle === false) ? STR_ERROR : STR_SUCCESS)."\r\n";}
        else {echo "The PHP script is working!";}
?>
```

- Upload the POST.php file to a web server that supports PHP, ensuring the server is accessible from the Internet. Popular choices for Windows include UniServer and XAMPP.
- To confirm the script's functionality, enter the URL (e.g., www.yourserverURL.com/POST.php) in a web browser. A web page displaying "The PHP script is working!" should appear if everything is functioning correctly.
- Enable the XML/JSON HTTP/HTTPS POST service and enter www.yourserverURL.com/POST.php into the Server1 field, for example.
- Click the "Test HTTP POST" button.
- If the HTTP/HTTPS POST is successfully received and processed, the button will display "OK." Additionally, an XML/JSON file will be generated in the same directory as POST.php, with a filename incorporating timestamp information, such as 20240106103318_status.xml.

### 9.1.5. “Real-time” mode

The module has the capability to operate in the so-called "real-time" mode. In this mode, the connection with the module is much more dynamic, allowing for near real-time processing of information and sending commands back.

In order to enable “real-time” monitoring mode, upon receiving a periodic HTTP/HTTPS POST, the server should respond with the following two commands instead of a "set FIN" response:

set ddly=xx

get <filename>

Where:

xx is a number between 3 and 59 seconds.

<filename> is one of dummy.xml, dummy.json, status.xml or status.json. The files dummy.xml or dummy.json are empty to minimize data traffic in “real-time” monitoring mode.

If the module receives the following commands:

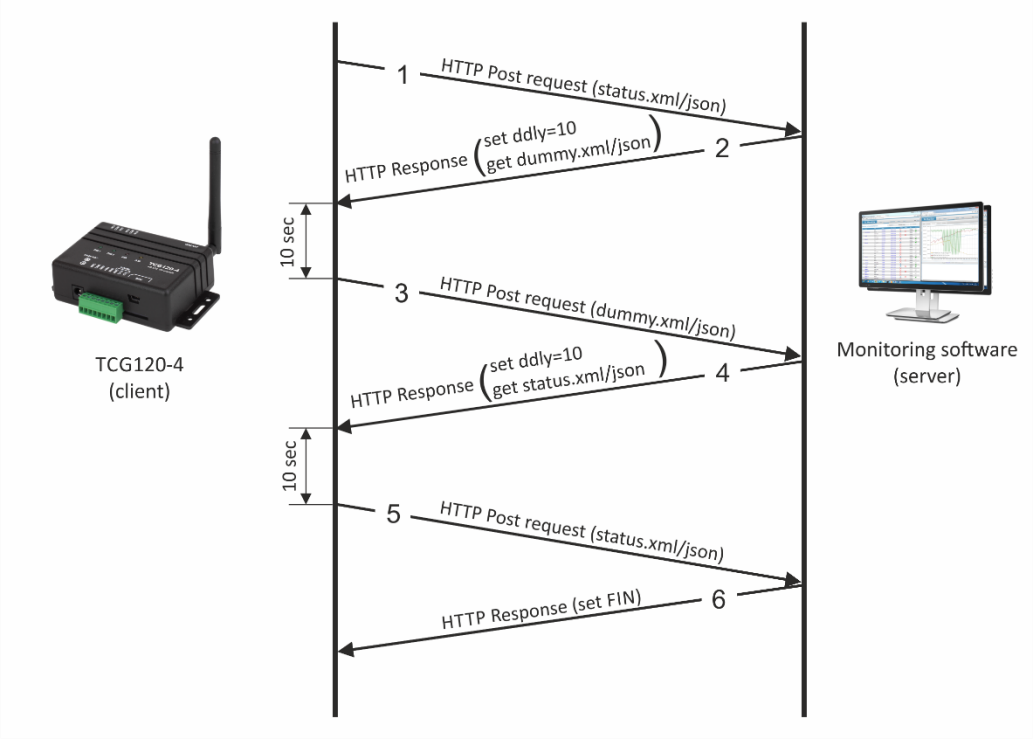
set ddly=10

get dummy.xml

it will send an HTTP/HTTPS POST with dummy.xml after a delay of 10 seconds.

In response to this and each subsequent POST, the server can reply with:

- Command set FIN – This will terminate the "real-time" monitoring mode.
- A new set of commands (set ddly=xx and get <filename>) – This indicates that after xx seconds, the controller will send an HTTP/HTTPS POST with the specified <filename> (either dummy.xml, dummy.json, status.xml, or status.json).
- Another valid combination of API commands.




**Attention!**

If the combination does not include ddly=xx (where xx is a number between 3 and 59 seconds), the controller will begin sending HTTP/HTTPS POST requests as quickly as possible with the last requested file. It is strongly recommended not to use this.

While the device is in "real-time" monitoring mode, all periodic and alarm-related HTTP/HTTPS POST requests for that specific server are suspended.

If a second server is configured, it will continue to operate with periodic and alarm-related HTTP/HTTPS POST requests as usual.

## 9.2. Full list of HTTP API commands

Please see Appendix C.

## 9.3. File structures

For XML file structure please see Appendix A.

For JSON file structure please see Appendix B.

## 9.4. MQTT

MQTT is a client-server, publish/subscribe messaging transport protocol. It is lightweight, open, and simple, making it easy to implement.

MQTT is widely used across various industries, including automotive, manufacturing, oil, gas, telecommunications, and more.

For more information about MQTT, visit www.mqtt.org.

# 10. Firmware update

The TCG120-4 supports firmware updates via the WEB interface and over the air.

For firmware update over the WEB interface refer to section 7.4.2. FW update.

For firmware updates over the air (requires 4G LTE/3G/2G connection) follow the steps below:

- Upload the update file (with a .cod extension) to a public HTTP server;
- Send the firmware update command (the syntax for the SMS message is detailed in section 8. Setup via SMS).

  **Attention!** Only Master and Superusers are authorized to send this command.

  The firmware will be downloaded and verified. The download takes about 3 minutes. If the file is correct, the Master will receive a confirmation SMS message. The update procedure takes about 2 minutes. Once the firmware update is complete (about 5 minutes), TCG120-4 will restart.

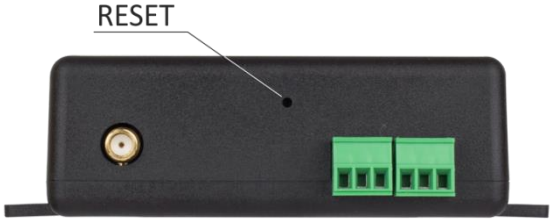
**Important:** Don't turn off the power supply during the update. Turning off the power supply will damage the device.

# 11. Factory default settings

The TCG120-4 can be restored to its factory default settings by following these steps:

- Turn off the power supply;
- Press and hold the RESET button then turn on the power supply;
- STA and SIG LEDs will turn ON;
- Release the RESET button.

The module will then restore its default settings.



## 12. Operating environment

This equipment is intended for use in a Pollution Degree 2 environment, at altitudes of up to 2000 meters.

When the controller is part of a larger system, all other elements of the system must comply with EMC (Electromagnetic Compatibility) requirements and be suitable for use under the same ambient conditions.

## 13. Safety

This device must not be used for medical or life-saving purposes or for any application where its failure could result in serious injury or loss of life.

To reduce the risk of fire, use only flexible stranded wire with a cross-section of 0.5mm² or larger for wiring digital and analog inputs and relay outputs of the device.

To avoid electric shock and fire hazards, do not expose this product to liquids, rain, or moisture. Objects filled with liquids, such as vases, should not be placed on this device.

There is a risk of overheating (and potential damage) to the controller if the recommended free spaces next to adjacent devices are not maintained. Ensure that there is sufficient space for attaching and removing cables after installation.

Teracom does not guarantee the successful operation of the product if it is used under conditions that deviate from the product specifications.

To ensure proper operation of the device, follow these steps:

- ensure that the device is installed correctly, refer this user manual;
- log into the devices via a web browser;
- perform the necessary setup;
- short the “Din1” and “GND” terminals;
- install sensor on the 1-Wire bus;
- navigate to the “Monitoring page” of the WEB interface. The correct parameter values should be displayed, and the “SIG” and “STA” LEDs should indicate the "Connected to Network" status.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Teracom Ltd. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment

## 14. Maintenance

After any service or repair of the device, or at least once a year, a safety check must be performed to ensure that the product is in proper operating condition.

Clean the device only with dry cloth. Do not use liquid cleaners or aerosol cleaners. Do not use a magnetic/static cleaning device (dust remover) or any kind of abrasive materials to clean the device.

Following these guidelines will help maintain the device in optimal condition and ensure its longevity.

The XML file (status.xml) structure:


```
<Monitor>
    <DeviceInfo>
        <DeviceName>TCG120-4</DeviceName>
        <HostName>TCG120-4</HostName>
        <ID>867648045420609</ID>
        <FwVer>TCG120-4E-h2.66-v1.012</FwVer>
        <MnfInfo>www.teracomsystems.com</MnfInfo>
        <SysContact>info@teracomsystems.com</SysContact>
        <SysName>TCG120-4</SysName>
        <SysLocation>Location</SysLocation>
    </DeviceInfo>
    <S>
        <S1>
            <description>S2:TSH2xx</description>
            <id>015225B71700FF45</id>
            <item1>
                <value>29.525</value>
                <unit>°C</unit>
                <alarm>0</alarm>
                <min>-40.000</min>
                <max>50.000</max>
                <hys>0.500</hys>
            </item1>
            <item2>
                <value>51.147</value>
                <unit>%RH</unit>
                <alarm>0</alarm>
                <min>0.000</min>
                <max>60.000</max>
                <hys>1.000</hys>
            </item2>
        </S1>
        <S2>
            <description>S2</description>
            <id>0000000000000000</id>
            <item1>
                <value>---</value>
                <unit>---</unit>
                <alarm>0</alarm>
                <min>---</min>
                <max>---</max>
                <hys>---</hys>
            </item1>
            <item2>
                <value>---</value>
                <unit>---</unit>
                <alarm>0</alarm>
                <min>---</min>
                <max>---</max>
                <hys>---</hys>
            </item2>
        </S2>
        <S3>
            <description>S3</description>
            <id>0000000000000000</id>
            <item1>
                <value>---</value>
                <unit>---</unit>
                <alarm>0</alarm>
                <min>---</min>
                <max>---</max>
                <hys>---</hys>
            </item1>
            <item2>
```

```
            <value>---</value>
            <unit>---</unit>
            <alarm>0</alarm>
            <min>---</min>
            <max>---</max>
            <hys>---</hys>
        </item2>
    </S3>
    <S4>
        <description>S4</description>
        <id>0000000000000000</id>
        <item1>
            <value>---</value>
            <unit>---</unit>
            <alarm>0</alarm>
            <min>---</min>
            <max>---</max>
            <hys>---</hys>
        </item1>
        <item2>
            <value>---</value>
            <unit>---</unit>
            <alarm>0</alarm>
            <min>---</min>
            <max>---</max>
            <hys>---</hys>
        </item2>
    </S4>
</S>
<AI>
    <AI1>
        <description>Analog Input 1</description>
        <value>3.240</value>
        <unit>V</unit>
        <multiplier>1.000</multiplier>
        <offset>0.0000</offset>
        <alarm>0</alarm>
        <min>0.000</min>
        <max>30.000</max>
        <hys>1.000</hys>
    </AI1>
    <AI2>
        <description>Analog Input 2</description>
        <value>3.202</value>
        <unit>V</unit>
        <multiplier>1.000</multiplier>
        <offset>0.0000</offset>
        <alarm>0</alarm>
        <min>0.000</min>
        <max>30.000</max>
        <hys>1.000</hys>
    </AI2>
</AI>
<DI>
    <DI1>
        <description>Digital Input 1</description>
        <value>OPEN</value>
        <valuebin>1</valuebin>
        <alarmState>CLOSED</alarmState>
        <alarm>0</alarm>
    </DI1>
    <DI2>
        <description>Digital Input 2</description>
        <value>OPEN</value>
        <valuebin>1</valuebin>
        <alarmState>CLOSED</alarmState>
        <alarm>0</alarm>
    </DI2>
```

```
    </DI>
    <R>
        <R1>
            <description>Relay 1</description>
            <value>OFF</value>
            <valuebin>0</valuebin>
            <pulseWidth>0.1</pulseWidth>
            <control>0</control>
        </R1>
        <R2>
            <description>Relay 2</description>
            <value>OFF</value>
            <valuebin>0</valuebin>
            <pulseWidth>0.2</pulseWidth>
            <control>0</control>
        </R2>
    </R>
    <HTTPPush>
        <Key/>
        <PushPeriod>180</PushPeriod>
    </HTTPPush>
    <MQTT>
        <Period>300</Period>
    </MQTT>
    <signalpercent>77</signalpercent>
    <hwerr>[Uncalibrated]</hwerr>
   <Alarmed>0</Alarmed>
   <Scannig>Scan</Scannig>
   <Time>
       <Date>05.10.2023</Date>
       <Time>09:26:07</Time>
   </Time>
   <NetworkInfo>
       <Name>A1 BG A1 BG</Name>
       <SC>
           <MCC>284</MCC>
           <MNC>01</MNC>
           <LAC>28201</LAC>
           <CID>3587</CID>
           <SQ>-65</SQ>
       </SC>
       <Latitude>43.835283</Latitude>
       <Longitude>25.965967</Longitude>
   </NetworkInfo>
</Monitor>
```


Where:

*<value>--- </value> and <unit>--- </unit> means no 1-Wire sensor on this position;*

*<alarm>1</alarm> means there is a trigger condition.*

The JSON file (status.json)structure:


```
{
  "Monitor": {
    "DeviceInfo": {
      "DeviceName": "TCG120-4",
      "HostName": "TCG120-4",
      "ID": "862632040544279",
      "FwVer": TCG120-4E-h2.66-v1.012",
      "MnfInfo": "www.teracomsystems.com",
      "SysContact": "info@teracomsystems.com",
      "SysName": "TCG120-4",
      "SysLocation": "Location"
    },
    "S": {
      "S1": {
        "description": "S1:TST2xx",
        "id": "015225B71700FF45",
        "item1": {
          "value": "29.525",
          "unit": "°C",
          "alarm": "0",
          "min": "-40.000",
          "max": "50.000",
          "hys": "0.500"
        },
        "item2": {
          "value": 51.147",
          "unit": %RH",
          "alarm": "0",
          "min": “0.000",
          "max": "60.000",
          "hys": "1.000"
        }
      },
      "S2": {
        "description": "S2",
        "id": "0000000000000000",
        "item1": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        },
        "item2": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        }
      },
      "S3": {
        "description": "S3",
        "id": "0000000000000000",
        "item1": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        },
```

```
        "item2": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        }
      },
      "S4": {
        "description": "S4",
        "id": "0000000000000000",
        "item1": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        },
        "item2": {
          "value": "---",
          "unit": "---",
          "alarm": "0",
          "min": "---",
          "max": "---",
          "hys": "---"
        }
      }
    },
    "AI": {
      "AI1": {
        "description": "Analog Input 1",
        "value": "0.000",
        "unit": "V",
        "multiplier": "1.000",
        "offset": "0.0000",
        "alarm": "0",
        "min": "0.000",
        "max": "2.000",
        "hys": "0.010"
      },
      "AI2": {
        "description": "Analog Input 2",
        "value": "0.000",
        "unit": "V",
        "multiplier": "1.000",
        "offset": "0.0000",
        "alarm": "0",
        "min": "0.000",
        "max": "2.000",
        "hys": "0.010"
      }
    },
    "DI": {
      "DI1": {
        "description": "Digital Input 1",
        "value": "OPEN",
        "valuebin": "1",
        "alarmState": "CLOSED",
        "alarm": "0"
      },
      "DI2": {
        "description": "Digital Input 2",
        "value": "OPEN",
        "valuebin": "1",
        "alarmState": "CLOSED",
        "alarm": "0"
```

```
        }
      },
      "R": {
        "R1": {
          "description": "Relay 1",
          "value": "OFF",
          "valuebin": "0",
          "pulseWidth": "0.1",
          "control": "0"
        },
        "R2": {
          "description": "Relay 2",
          "value": "OFF",
          "valuebin": "0",
          "pulseWidth": "0.2",
          "control": "0"
        }
      },
      "HTTPPush": {
        "Key": "",
        "PushPeriod": "300"
      },
      “MQTT”: {
        “Period”: “300”
      },
      "signalpercent": "67",
      "hwerr": "",
      "Alarmed": "0",
      "Scannig": "Scan",
      "Time": {
        "Date": "05.10.2023",
        "Time": "09:39:55"
      },
      "NetworkInfo": {
        "Name": "A1 BG A1 BG",
        "SC": {
          "MCC": "284",
          "MNC": "01",
          "LAC": "28201",
          "CID": "3587",
          "SQ": "-71"
        },
        “Latitude”:  43.835283,
        “Longitude” :  25.965967
      }
    }
  }
```

## Full list of HTTP API commands

TCG120-4 supports following HTTP commands (case sensitive):

| Command | Description |
|---|---|
| **Monitoring** | |
| r**n**=xxx | Turn relay **n** ON (xxx=on) or OFF (xxx=off)<br>(**n** is 1 or 2 for the respective relay)<br>r1=on – will turn relay 1 ON<br>r2=off – will turn relay 2 OFF<br>r1=on&r2=on – will turn all relays ON<br>r1=off&r2=off – will turn all relays OFF |
| r**n**=tg | Toggle relay **n**<br>(**n** is 1 or 2 for the respective relay)<br>r2= tg – will toggle relay 2<br>r1=tg&r2=tg – will toggle relay 1 and 2 |
| r**n**=pl | Pulse relay **n**<br>(**n** is 1 or 2 for the respective relay)<br>r1=pl – will pulse relay 1<br>r1=pl&r2=pl |
| **SMS/Call** | |
| unumf**n**=x | Set SMS number format for Users - short codes (x=0) or E.164 international format (x=1)<br>(**n** is 1,2,3 or 4 for the respective user)<br>SMS number format for Master is E.164 international standard only and can't be changed.<br>unumf1=0 – set short code number format for User1<br>unumf2=1 – set E.164 international format for User2 |
| sr**n**=xxx | Set SMS number **n**<br>(**n** is 0 for master and 1,2,3 or 4 for the respective user)<br>sr0=+359885180709 – set Master number. E.164 international format is mandatory.<br>sr1=57575701 – set User1 number in short code format. Before this command must be set SMS number format - short codes or E.164 international format. |
| conal=x | Set connectivity alert for Master - activation (x=1) or deactivation (x=0) |
| suser**n**=x | Set superuser rights for users - activation (x=1) or deactivation (x=0)<br>suser1=1 – activation superuser right for User 1<br>suser2=0 – deactivation superuser right for User 2 |
| ual**n**=x | Activation (x=1) or deactivation (x=0) of alarm notification<br>(**n** is 0 for master and 1,2,3 or 4 for the respective user)<br>ual0=1 – activation alarm notification for Master<br>ual1=1 – deactivation alarm notification for User 1 |
| cu**n**=xxx | Set phone call number **n**<br>(**n** is 1,2,3,4 or 5 for the respective user)<br>Number format is E.164 international standard only and can't be changed.<br>cu1=+359886455736 - set phone call number for user 1 |
| **Input/Output** | |
| sd**n**=xxx | Set sensor **n** description<br>(**n** is 1,2,3 or 4 for the respective sensor)<br>sd1=S1-Temp – set sensor 1 description |

| | |
|---|---|
| ad**n**=xxx | Set analog input **n** description<br>(**n** is 1 or 2 for the respective analog input)<br>ad1=AN1 – set analog input 1 description |
| au**n**=xxx | Set analog input **n** unit<br>(**n** is 1 or 2 for the respective analog input)<br>au1=VDC – set analog input 1 unit |
| am**n**=x.xxx | Set analog input **n** multiplier<br>(**n** is 1 or 2 for the respective analog input)<br>am1=2.000 – set analog input 1 multiplier |
| ao**n**=x.xxxx | Set analog input **n** offset<br>(**n** is 1 or 2 for the respective analog input)<br>ao1=0.0005 – set analog input 1 offset |
| dd**n**=xxx | Set digital input **n** description<br>(**n** is 1 or 2 for the respective digital input)<br>dd1=DIN1 – set digital input 1 description |
| dl**n**=xxx | Set digital input **n** low level description<br>(**n** is 1 or 2 for the respective digital input)<br>dl1=CLOSED – set low level description for digital input 1 |
| dh**n**=xxx | Set digital input **n** high level description<br>(**n** is 1 or 2 for the respective digital input)<br>dh1=OPEN – set high level description for digital input 1 |
| rd**n**=xxx | Set relay **n** description<br>(**n** is 1 or 2 for the respective relay)<br>rd1=REL1 – set relay 1 description |
| pw**n**=x.x | Set relay **n** pulse time in seconds<br>(**n** is 1 or 2 for the respective relay)<br>pw1=0.5 – set relay 1 pulse time to 0.5 sec |
| rc**n**=xx | Set relay **n** activated from xx<br>(**n** is 1 or 2 for the respective relay)<br>Where xx:<br>SMS/HTTP API(0),<br>S11(1), S12(2), S21(3), S22(4),<br>S31(5), S32(6), S41(7), S42(8), Analog input 1(9), Analog input 2(10), Digital input 1(11), Digital input 2(12), Any Alarm(13)<br>rc1=13 – set relay 1 activated from Any alarm<br>rc2=0 – set relay 2 activated from SMS/HTTP API |
| aae**n**=x | Set relay **n** action on alarm – Turn on(x=0) or Single pulse(x=2)<br>(**n** is 1 or 2 for the respective relay)<br>aaen1=0 – set relay 1 action on alarm Turn on |
| sn**pt**=30.0 | Set Min of sensor to 30.0<br>(**p** is 1,2,3 or 4 for the respective sensor<br>**t** is 1 or 2 for the respective parameter of sensor)<br>sn12=30.0 will set Min for sensor 1, parameter 2 |
| sx**pt**=40.0 | Set Max of sensor to 40.0<br>(**p** is 1,2,3 or 4 for the respective sensor<br>**t** is 1 or 2 for the respective parameter of sensor)<br>sx42=40.0 will set Min for sensor 4, parameter 2 |
| sy**pt**=2.0 | Set Hysteresis of sensor to 2.0<br>(**p** is 1,2,3 or 4 for the respective sensor<br>**t** is 1 or 2 for the respective parameter of sensor)<br>sy31=2.0 will set Hys for sensor 3, parameter 1 |
| **Conditions** | |

| | |
|---|---|
| s**xy**m=b | Activation (b=1)/deactivation (b=0) of Mail alarm notification for sensor x, part y<br>(**x** is 1,2,3 or 4 for the respective sensor<br>**y** is 1 or 2 for the respective parameter of sensor)<br>s11m=1 – activation mail alarm notification for sensor 1, part 1 |
| s**xy**s=b | Activation (b=1)/deactivation (b=0) of SMS alarm notification for sensor x, part y<br>(**x** is 1,2,3 or 4 for the respective sensor<br>**y** is 1 or 2 for the respective parameter of sensor)<br>s21s=1 – activation sms alarm notification for sensor 2, part 1 |
| s**xy**p=b | Activation (b=1)/deactivation (b=0) of HTTP POST alarm notification for sensor x, part y<br>(**x** is 1,2,3 or 4 for the respective sensor<br>**y** is 1 or 2 for the respective parameter of sensor)<br>s12p=1 – activation of HTTP POST alarm notification for sensor 1, part 2 |
| s**xy**q=b | Activation (b=1)/deactivation (b=0) of MQTT alarm notification for sensor x, part y<br>(**x** is 1,2,3 or 4 for the respective sensor<br>**y** is 1 or 2 for the respective parameter of sensor)<br>s22q=1 – activation of MQTT alarm notification for sensor 2, part 2 |
| sclm=x | Mail notification in case of a sensor communication lost - activation (x=1) or deactivation (x=0) |
| scls=x | SMS notification in case of a sensor communication lost - activation (x=1) or deactivation (x=0) |
| sclp=x | HTTP POST notification in case of a sensor communication lost - activation (x=1) or deactivation (x=0) |
| sclq=x | MQTT notification in case of a sensor communication lost - activation (x=1) or deactivation (x=0) |
| srn=x | Return notification for sensors - activation (x=1) or deactivation (x=0) |
| delsen=xxxx | Notification delay for sensors<br>(xxxx is between 0 and 3600) |
| delsen=xxxx | |
| vn**f**=10.0 | Set Min of analog input to 10.0<br>(**f** is 1 or 2 for the respective input)<br>vn1=10.0 will set Min for analog input 1 |
| vx**f**=20.0 | Set Max of analog input to 20.0<br>(**f** is 1 or 2 for the respective input)<br>vx2=20.0 will set Max for analog input 2 |
| vy**f**=1.0 | Set Hys of analog input to 1.0<br>(**f** is 1 or 2 for the respective input)<br>Vy1=1.0 will set Hys for analog input 1 |
| a**n**m=b | Mail alarm notification for analog input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective analog input)<br>a1m=1 – mail alarm notification for analog input 1 is activated |
| a**n**s=b | SMS alarm notification for analog input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective analog input)<br>a1s=1 – sms alarm notification for analog input 1 is activated |

| | |
|---|---|
| a**n**p=b | HTTP POST alarm notification for analog input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective analog input)<br>a2p=1 – HTTP POST alarm notification for analog input 2 is activated |
| a**n**q=b | MQTT alarm notification for analog input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective analog input)<br>a2q=1 – MQTT alarm notification for analog input 2 is activated |
| arn=x | Return notification for analog inputs - activation (x=1) or deactivation (x=0) |
| delanl=xxxx | Notification delay for analog inputs<br>(xxxx is between 0 and 3600) |
| ds**n**=x | Select digital alarm state to Low level(x=0) or High level(x=1)<br>(**n** is 1 or 2 for the respective digital input) |
| dda**n**=xxxx | Low to high delay for digital input **n**<br>(**n** is 1 or 2 for the respective digital input)<br>(xxxx is between 0 and 3600) |
| ddd**n**=xxxx | High to low delay for digital input **n**<br>(**n** is 1 or 2 for the respective digital input)<br>(xxxx is between 0 and 3600) |
| d**n**m=b | Mail alarm notification for digital input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective digital input)<br>d1m=1 – mail alarm notification for digital input 1 is activated |
| d**n**s=b | SMS alarm notification for digital input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective digital input)<br>d1s=1 – SMS alarm notification for digital input 1 is activated |
| d**n**p=b | HTTP POST alarm notification for digital input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective digital input)<br>d2p=0 – HTTP POST alarm notification for digital input 2 is deactivated |
| d**n**q=b | MQTT alarm notification for digital input - activation (b=1) or deactivation (b=0)<br>(**n** is 1 or 2 for the respective digital input)<br>d2p=1 – MQTT alarm notification for digital input 2 is activated |
| drn=x | Return notification for digital inputs - activation (x=1) or deactivation (x=0) |
| deldig=xxxx | Notification delay for digital inputs<br>(xxxx is between 0 and 3600) |
| **System** | |
| APN=xxx | Set APN for data connection |
| authmod =x | Set authentication mode for data connection – None(x=0), PAP(x=1), CHAP(x=2), PAP or CHAP(x=3) |
| APNU=xxx | Set username authentication for data connection |
| APNP=xxx | Set password authentication for data connection |
| aren=x | Enable(x=1)/disable(x=0) automatic network connection reset |
| timers=hh:mm:ss | Time of automatic network connection reset (hh:mm:ss) |
| tu=x | Set temperature units – Celsius(x=0)/ Fahrenheit(x=1) |

| | |
|---|---|
| pu=x | Set pressure units – hPa(x=0), mbar(x=1) or mmhg(x=2) |
| hn=xxx | Set host name - xxx, max 15 symbols |
| wm=x | Set writing mode - left-to-right(x=0) or right-to-left(x=1) |
| sn=xxx | Set system name – xxx, max 31 symbols |
| sl=xxx | Set system location – xxx, max 31 symbols |
| sc=xxx | Set system contact – xxx, max 31 symbols |
| **Time** | |
| TS=xxx | Time server URL – xxx=IP/URL:port, max 36 symbols |
| TZ=hh:mm | Time zone – hh:mm<br>TZ=+03:00 |
| interval1=x | NTP time synchronization interval, hours<br>interval1=12 - NTP time synchronization interval 12 hours |
| interval2=x | Repeat NTP time synchronization if not found, hours<br>Interval2=1 – repeat NTP synchronization if not found after 1 hour |
| **HTTP POST** | |
| pmet=x | HTTP POST disable (x=0) or enable (x=1) |
| pDrv=x | HTTP POST mode – http (x=2) or https (x=3) |
| dataf=x | Data format XML/JSON for HHTP POST – 0 XML, 1 JSON |
| purl=yyy | URL for XML/JSON HTTP POST to Server 1, where yyy is a full path to php file<br>purl=212.25.45.120:30181/xampp/test/pushtest.php |
| purl2=yyy | URL for XML/JSON HTTP POST to Server 2, where yyy is a full path to php file<br>purl=212.25.45.120:30181/xampp/test/pushtest.php |
| pper=x | XML/JSON HTTP POST period in seconds<br>(x is between 60 and 172800)<br>pper=600 – will set POST period to 600 seconds |
| pperh=hh:mm:ss | XML/JSON HTTP POST period in format hh:mm:ss<br>pperh=00:30:00 – will set POST period on 30 minutes |
| dk=xxx | XML/JSON HTTP POST key – xxx is up to 17 characters |
| pans=x | Process answer - No (x=0) or Yes (x=1) |
| **MQTT** | |
| mqtten=x | MQTT service disable (x=0) or enable (x=1) |
| mdata=x | Data format JSON/Plain text for MQTT Publish – JSON (x=0) or Plain text (x=1) |
| mmode=x | Publish protocol, where x is 0 for unsecure and 1 for TLS/SSL |
| murl=xxx | URL for MQTT publish – xxx=IP/URL, max 63 symbols |
| mport=xxxx | Port for MQTT publish, where xxxx is a port |
| muser=xxxx | Username authentication for MQTT, where xxxx is a username |
| mpass=xxxx | Password authentication for MQTT, where xxxx is a password |
| mper=xxx | MQTT publish period in seconds<br>(x is between 60 and 172800)<br>mper=600 – will set MQTT publish period to 600 seconds |
| nametopic=xxx | MQTT main topic name |
| senstopic=xxx | MQTT sensors topic name |
| std**ny**=xxx | MQTT sensor **n** part **y** topic name, where **n** is a sensor number and **y** is a sensor part<br>std21=21, set topic name for sensor 2 part 1 |
| antopic=xxx | MQTT analog inputs topic name |
| atd**n**=xxx | MQTT analog input **n** topic name<br>atd1=1, set analog input 1 topic name |

| | |
|---|---|
| digtopic=xxx | MQTT digital inputs topic name |
| dtd**n**=xxx | MQTT digital input **n** topic name<br>dtd1=1, set digital input 1 topic name |
| **Geolocation** | |
| glocen=x | Geolocation service disable (x=0) or enable (x=1) |
| glpr=x | Geolocation provider – Unwiredlabs (x=0) or Google (x=2) |
| glurl=xxx | Geolocation server URL |
| token=xxx | Token / API key |
| glper=xx | Geolocation period request, where **xx** are seconds from 60 to 14400 |
| save | Save all previous changes (except relays' one) in the FLASH memory.<br>**As every save reflects the FLASH cycles (endurance), this command should be used very carefully.**<br>pper=120&save – will set POST period to 120 seconds and save it |
| FIN | Terminate the session |

Multiply commands are sent concatenated with "&".

The commands are sent in the answer on XML/JSON or CSV HTTP POSTs. They are executed if "Process Answer" is enabled.

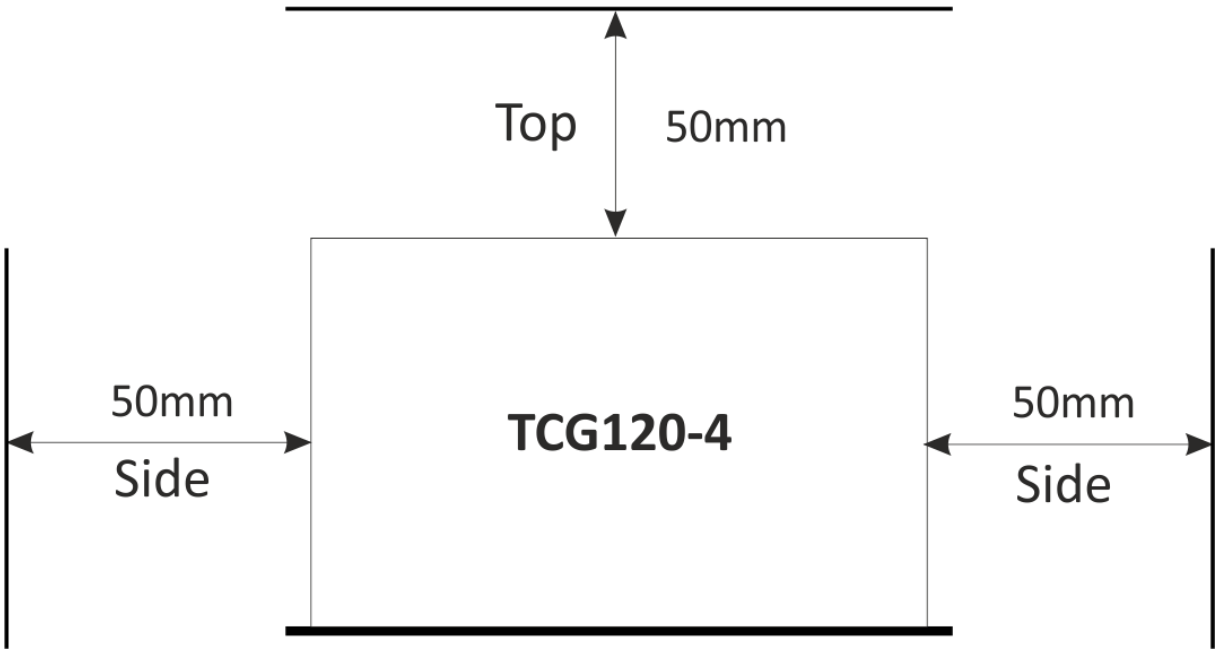



Fig.1

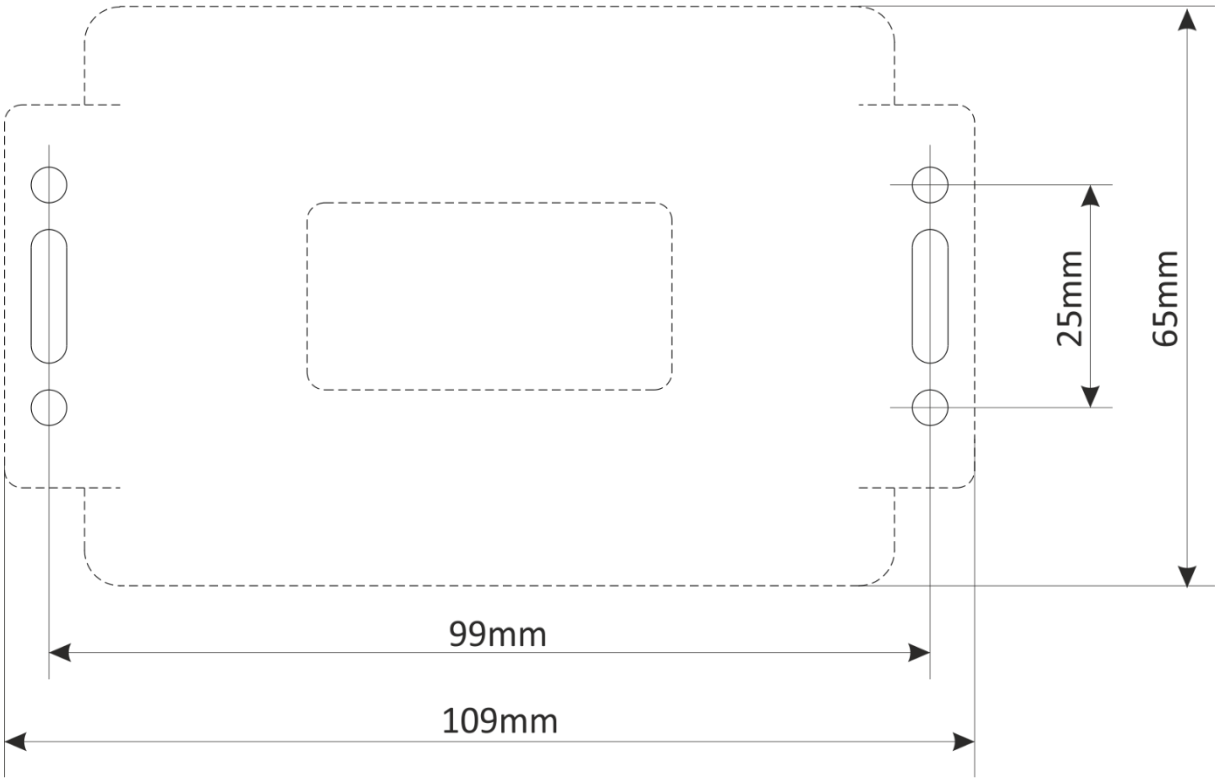



Fig.2