MICROSENS Smart I-O Controller Integrates Digital Component Into IP Network User Guide

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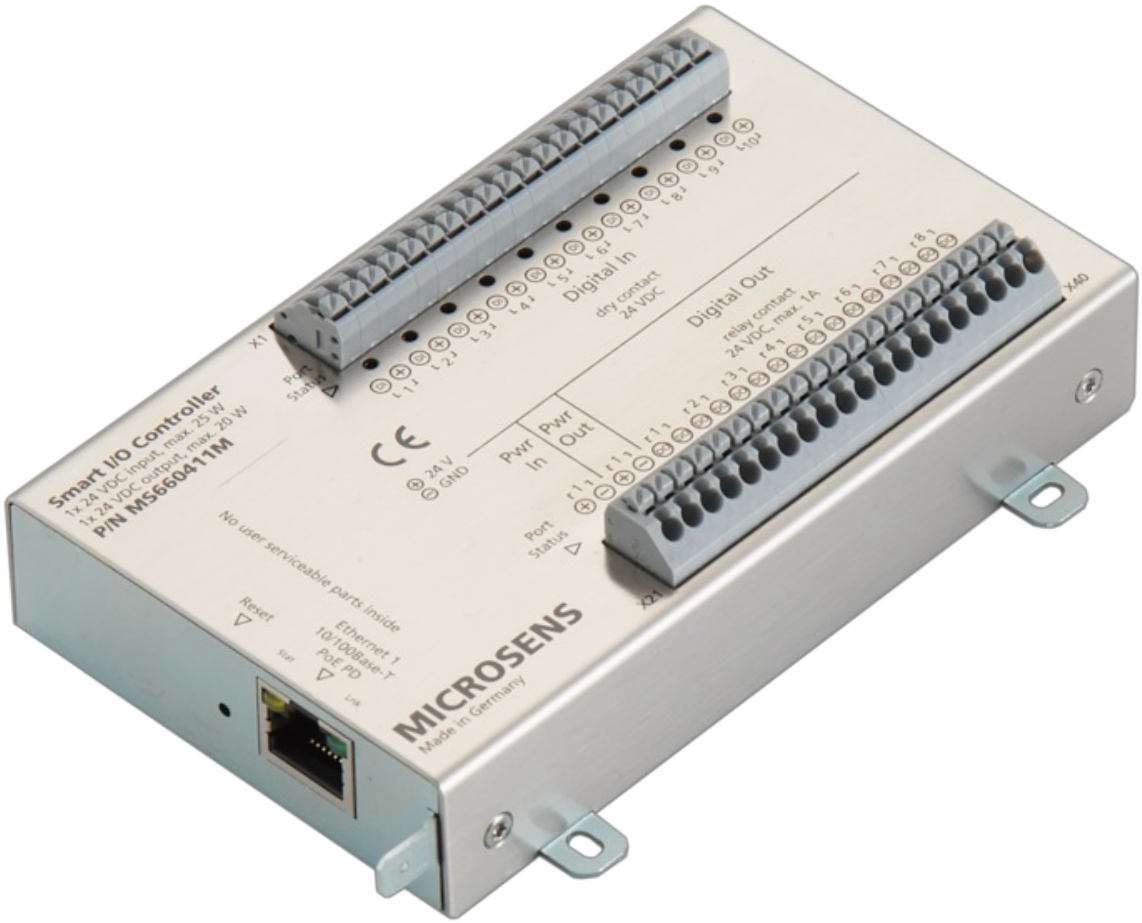
MICROSENS

MICROSENS Smart I-O Controller Integrates Digital Component Into IP Network



Mechanical Handling

The MICROSENS Smart I/O Controller is ready to be attached via two different mountings:

- A clamp for top-hat rail mounting,
- and four mounting tabs for direct attachment to wall, ceiling or any other backing equipment.

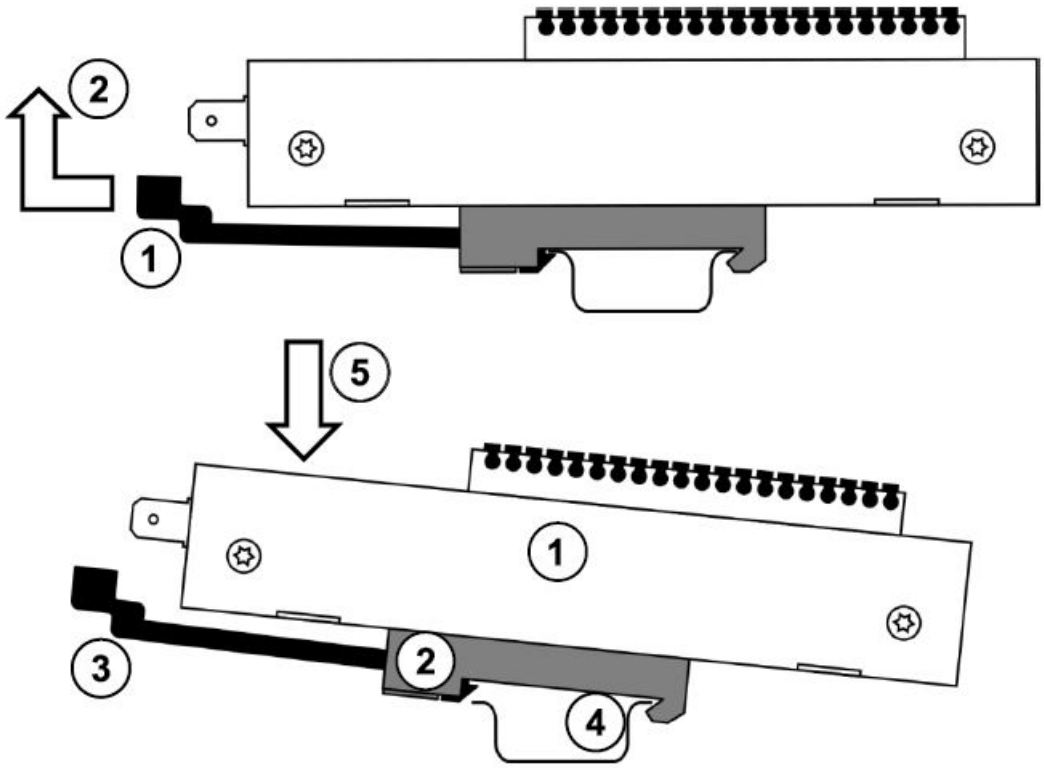
Top Hat Rail Mounting and Demounting

On its bottom side, the Smart I/O Controller housing (Figure 1, Pos. 1) is equipped with a clamp for mounting the device onto a standard top-hat rail (Figure 1, Pos. 2).
N**ote:** Assemble the clamp to the housing if not shipped with clamp already adapted. Be sure the clamp's release lever (Figure 1, Pos. 3) is pointing to the side with the Ethernet port.

Mounting on Top Hat Rail

1. Place the housing with the clamp's stationary fixture over the top hat rail (Figure 1, Pos. 4).
2. Gently press the housing (Figure 1, Pos. 5) until the clamp snaps into the top hat rail with an audible click.

Demounting from Top Hat Rail



1. Pull the release lever (Figure 2, Pos. 1) to unlock the clamp and lift the device (Figure 2, Pos. 2) to remove it from the top-hat rail.

Mounting Tabs

To attach the Smart I/O Controller directly to a wall, ceiling, or any other suitable backing equipment, use the four mounting brackets (Figure 3, Pos. 1 to 4).

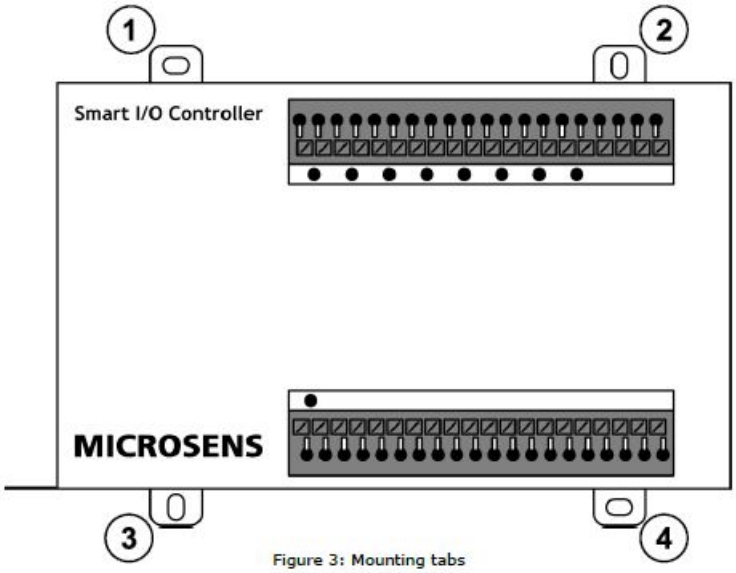


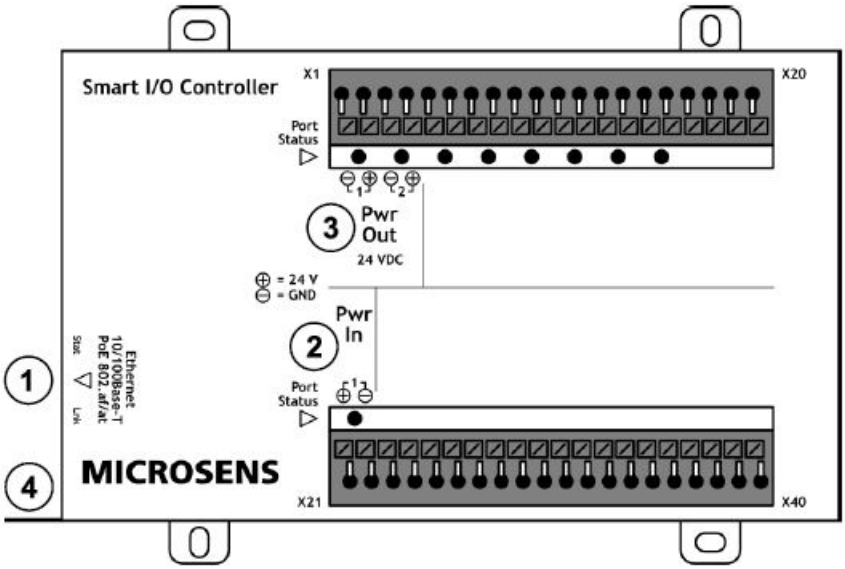
Figure 3: Mounting tabs

Note: Make sure to secure the attachment adequately when using fewer mounting tabs! It is not recommended to use only one mounting tab or mounting tabs of only one side.

Connecting the Power Supply

The MICROSENS Smart I/O Controller can be supplied by two alternative power inputs (single or joint):

1. PoE+ (PD) via Ethernet port (Figure 4, Pos. 1).
2. External 24 VDC via push clamp ports X21 and X22 (Figure 4, Pos. 2)



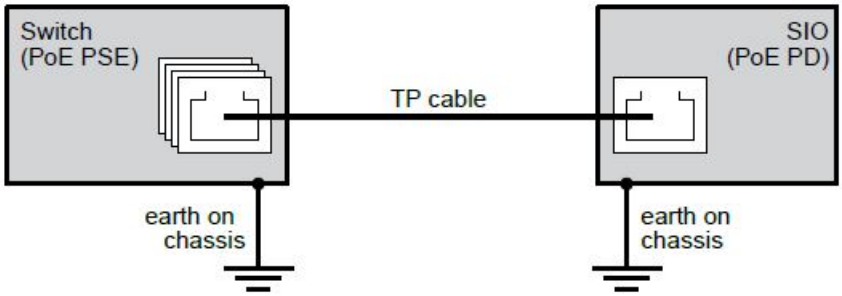
Power Supply Specifications

Power Supply	Voltage	Consumption	Plug
PoE/PoE+ PD	44 — 54 VDC (54 VDC typ.)	3.2 W	Ethernet uplink port (Figure 4, Pos. 1)
External	24 VDC	1.2 W	Push clamp ports X21 and X22 for two-wire cable (Figure 4, Pos. 2) **Note:** Make sure to connect the cable with the correct polarity!

Note: Make sure to enable PoE/PoE+ PD on the powering device. For enabling PoE on MICROSENS devices please refer to the respective documentation shipped with the device.
As soon as the external power supply is connected to the clamp ports X21 and X22 the respective “Pwr In” port status LED lights up indicating the supply voltage is present.
As soon as one of either PoE or external power supply is plugged in and present, the port status LEDs of “Pwr Out” ports 1 and 2 light up (Figure 4, Pos. 3).

Grounding with PoE Supply

For the installation of PoE components in corporate networks it is necessary to reference the DC supply voltage of all devices to the same ground level. Normally this will be the positive polarity connected to the ground level of the building's electrical system (i.e. "earth").
Assuming, powering of the Smart I/O Controller is done via a centralized far-off PoE PSE device it is important to connect the grounding lead of the controller's chassis (Figure 4, Pos. 4 to the building's ground potential and thus to avoid "floating ground" problems. Besides safety issues, a floating ground of the network can cause problems if only one component accidentally or on purpose is grounded (Figure 5).



Grounding with External Power Supply

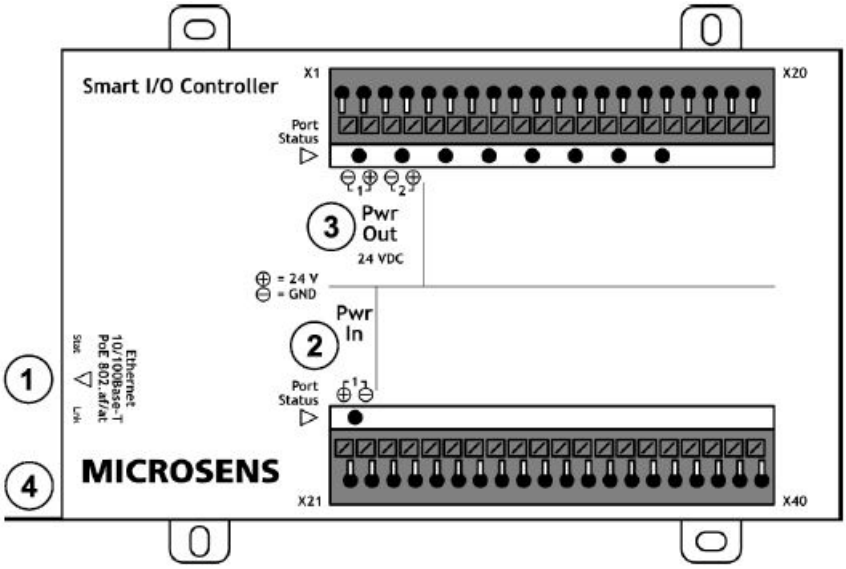
In contrast to the common use of negative polarity connected to ground level when using an external power supply make sure to connect the positive polarity of the power supply to ground level.

Reset the Smart I/O Controller

The Smart I/O Controller is equipped with a reset button next to the Ethernet port (see Figure 6).
Pressing the reset button with a pointed object for 1 second will reset the controller. During the reset operation, both LEDs "Digital Out" (indicators for ports X5 to X8) will light up for approx. 1 second.
Note: Pressing the reset button for more than 1 second after reboot enables the mode "Load Bootloader". This is for MICROSENS service purposes only!

Connecting the Input/Output Cables and Setting the DIP Switches

The Smart I/O Controller is equipped with two 20-pin push clamp ports for input and output signals as well as input and output voltage (wire diameter 0.1 to 1.5 mm², stranded/solid). Additionally, a 2-way and a 4-way DIP switch enables specific settings for analog input and sensor input signals.



The push clamp pins (X1 to X40) and the Ethernet uplink port have the following functions:

Port	Signal	Meaning
X1, X2	Power Out 1	**Power output:** 2x 24 VDC, combined maximum load 20 mW
X3, X4	Power Out 2	
X5, X6	Digital Out 1	**Digital output:** 2x 24 VDC, open collector, PWM (max. 100 Hz) combined maximum current 1 A
X7, X8	Digital Out 2	
X9, X10	Digital In 1	**Digital input:** 4x max. 24 VDC (threshold: low < 1.0 – 1.3 > high) opto-isolated The port assignments are as follows: · X9, X11, X13, X15: Port voltage between 0 VDC and 24 VDC · X10, X12, X14, X16: Ports connected to 24 VDC (“+”)
X11, X12	Digital In 2	
X13, X14	Digital In 3	
X15, X16	Digital In 4	

Port	Signal	Meaning
X17, X18	PT100/1000 1	**Temperature sensor input:**

X19, X20	PT100/1000 2	2x 2-wire input for Pt100 or Pt1000 resistance temperature detectors (RTDs). **Note:** Selection of sensor type for the respective temperature input port can be determined via a 2-port DIP switch: · ON 1/2: Pt100 selected · OFF 1/2: Pt1000 selected
X21, X22	Power In	**External power input:** 1x 24 VDC maximum internal consumption 1.2 W
X23, X24, X25	Analog Out 1	**Analog output:** 2x 0..10 V combined maximum current 1 A The port assignments are as follows: · X23, X26: Ports connected to 24 VDC (“+”) · X24, X27: Port voltage applied between 0 V ≤ UAO ≤ 10 V · X25, X28: Ports connected to GND (“-”)
X26, X27, X28	Analog Out 2	
X29, X30, X31	Analog In 1	

X32, X33, X34	Analog In 2	**Analogue input:** 4x 0..10 V (voltage mode) / 0..20 mA (current mode) The port assignments are as follows: · X29, X32, X35, X38: Ports connected to 24 VDC (“+”) · X30, X33, X36, X39: Port voltage between 0 V ≤ UAI ≤ 10 V Port current between 0 mA ≤ IAI ≤ 20 mA · X31, X34, X37, X40: Ports connected to GND (“-”) **Note:** Mode selection of the respective port can be determined via a 4-port DIP switch: · ON 1/2/3/4: Current mode (0..20 mA) · OFF 1/2/3/4: Voltage mode (0..10 V)
X35, X36, X37	Analog In 3	
X38, X39, X40	Analog In 4	
Ethernet		**Ethernet uplink port:** 1x 10/100Base-T, RJ-45, PoE (PD)

Understanding the Status LEDs

The MICROSENS Smart I/O Controller is equipped with nine status LEDs indicating the following signal states:

Port	**Signal**	**Meaning**

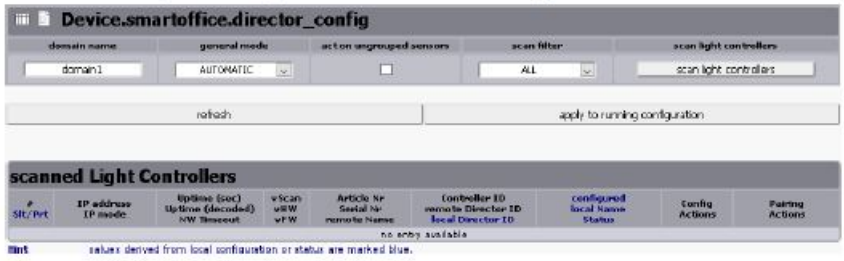
X1, X2	Power Out 1	**Power output:** · Green: Power supply active · Off No power supply
X3, X4	Power Out 2	
X5, X6	Digital Out 1	**Digital output:** · Green: Output active (open collector pulls low) · Off: Output inactive · Indicate a reset when both LEDs light up green for approx. 1 second.
X7, X8	Digital Out 2	
X9, X10	Digital In 1	**Digital input:** · Green: Input contact closed · Off Input open
X11, X12	Digital In 2	
X13, X14	Digital In 3	
X15, X16	Digital In 4	

X21, X22	Power In	**External power input:** · Green: Device powered by the external power supply · Off Device unpowered or powered by PoE.

Operating the Smart I/O Controller with MICROSENS Switches

Using MICROSENS Smart I/O Controller is possible with MICROSENS switches containing firmware 10.7.4a and newer.
Since firmware 5. x the controller supports MQTT which allows working in applications without MICROSENS switches. In this case, there is no need for pairing. The configuration can be done via the MICROSENS SmartConfig **Tool.** As soon as the Smart I/O Controller is connected to the power supply (PoE or external supply) and to the corporate network the controller is accessible via a MICROSENS switch containing the MICROSENS SmartDirector.
Note: Because of using IPv6 link-local addresses it is possible to operate a remote Smart I/O Controller with a MICROSENS switch via the IPv6 corporate network as long as the connection is not routed.6.1 Pairing the Smart I/O Controller and the MICROSENS Switch The following steps describe how to pair a Smart I/O Controller via the Web Manager of a MICORSENS switch.
Note: For this overview primarily the use of the Web Manager is shown. Using the CLI for pairing the devices is relatively easy because the Web Manager uses the respective CLI commands as labels for fields and sections.
Using the Web Manager:

- Start the web browser and enter the IP address of the respective G6 device.
- Log into the Web Manager with the administrator credentials.
- Select the SmartOffice screen, then select the tab Basic Configuration.

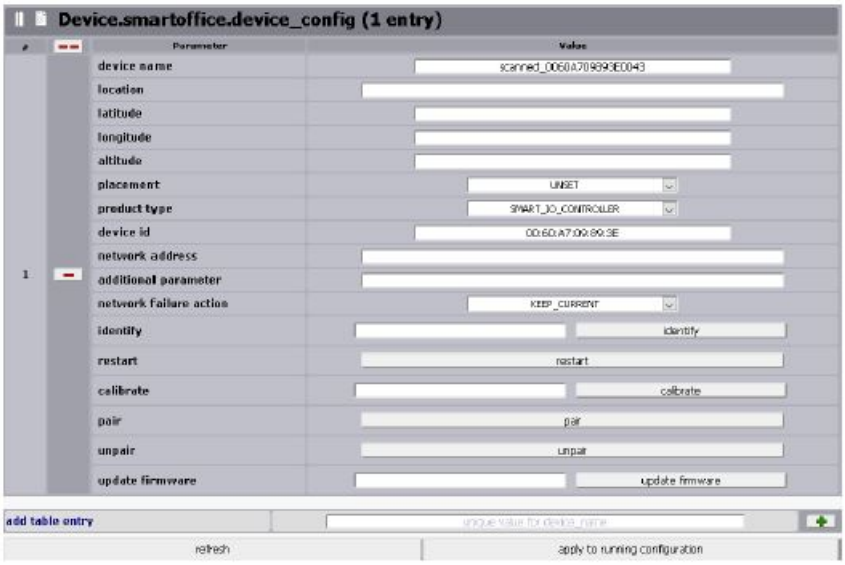


- In the section Device.smart office.director_config click on the button scan light controllers.
- The SmartDirector starts searching for Smart Controllers. As long as no controller is found the section scanned Light Controllers stays empty.
- After successfully scanning for available Smart Controllers the Web Manager lists all found controllers.

If you did not define a unique “device name” in the section Device. smart office.device_config on the tab Device configuration previously, the dialogue will not show a button force pair as and the respective drop-down list in the controller’s table row. In this case, proceed with the next step. Otherwise, select the respective device name from the list and click on the button force pair as.

Note: It is strongly recommended to assign all necessary parameter values of the controller in the section Device.smart office.device_config on the tab Device configuration because this information is used during the pairing process. If the configuration takes place after the pairing process many internal settings have to be reworked manually.

- Select the tab Device Configuration.



- The device name contains the prefix “scanned_” and the controller ID. Change this name as needed.
- The product type is “SMART_IO_CONTROLLER”.
- The device ID by default consists of the device’s MAC address.

- In the column Pairing Actions of the respective Smart I/O Controller row select the previously generated device from the drop-down list and click on the button force pair as.
- The Smart I/O Controller is now properly paired to the SmartDirector of the MICROSENS G6 Switch.

Functional Test of the Paired Smart I/O Controller

The following steps describe how to test the correct pairing of a Smart I/O Controller via the Web Manager of the paired MICORSENS switch.
Note: For this overview primarily the use of the Web Manager is shown. Using the CLI for pairing the devices is relatively easy because the Web Manager uses the respective CLI commands as labels for fields and sections. Using the Web Manager:

- Select the Controller screen, then select the tab SIO.
- In the section Device.controller.smart_io_config all available ports of the paired Smart I/O Controller is listed.

- Search for the parameter dout1 mode for the port “Digital Out 1” and select a value from the drop-down list that matches your application.
- Click on the button apply to running configuration to save the changes to the running configuration. Search for the parameter manual set output, enter the value “dout1 1” and click on the button manual set output.
- The port status LED of “Digital Out 1” should light on indicating the digital output is set to digital high level.
- For the parameter manual set output, enter the value “dout1 0” and click on the button manual set output.
- The port status LED of “Digital Out 1” should light off indicating the digital output is set to a digital low level.

Note: If this pairing test fails try to pair the Smart I/O Controller again from the beginning.

Using Analogue Input and Output Ports
Every analog input and output port (X23 to X40) consists of 3 parts each:

- “+”: This port is connected to 24 VDC.
- “-”: This port is connected to 0 V (GND).
- “AO”/“AI”: The actual voltage value referred to 0 V (GND).

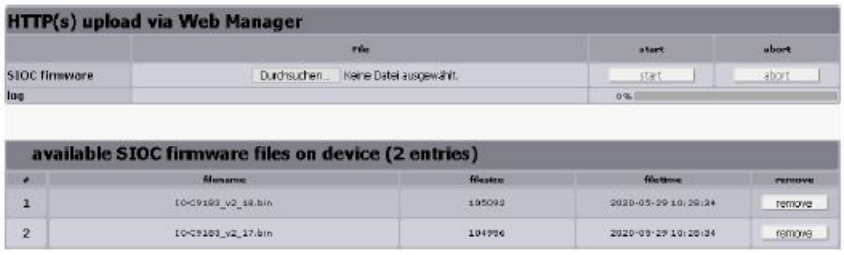
The input and output values refer to the reference value 0 V (positive polarity)
Example for using micro script with Smart I/O Controller Ports
Note: For more information on how to use micro script please refer to the product manual “micro script Programmers Guide” provided with the MICROSENS G6 Switch and available via Web Manager under menu item “Documentation”.The following example shows the macro script code for reading a temperature value (ports 17/18) and setting a digital output (ports 5/6) from 0 to 1 when reaching a temperature threshold of 24.5 °C:

Updating the Device’s Firmware

The Smart I/O Controller has its own firmware that can be manually updated via the Web Manager of a connected MICROSENS G6 switch. To update the firmware proceed as follows:
Using the Web Manager:

- Start the web browser and enter the IP address of the respective G6 device.
- Log into the Web Manager with the administrator credentials.
- Select the Controller screen, then select the tab SIOC and scroll down to the bottom of the dialogue.
- In the section HTTP(s) upload via Web Manager open the browser’s file selection dialogue with a click on the

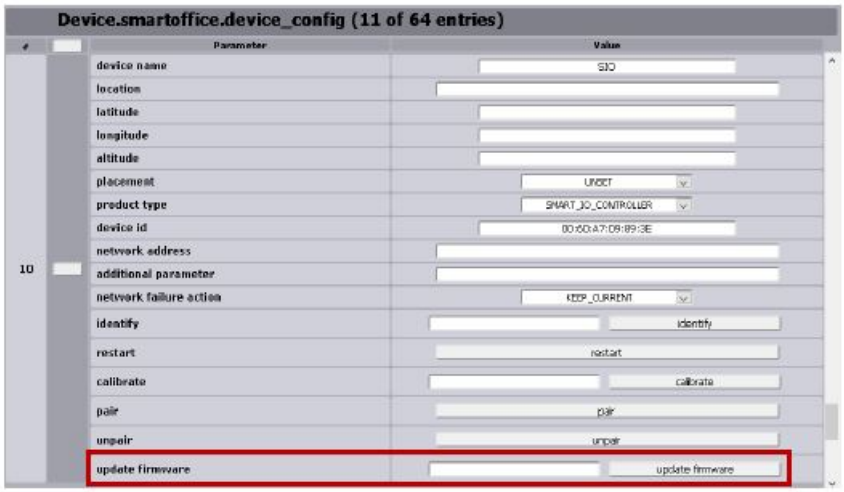
button Browse:



- In the file selection dialogue select the local firmware file and click the button Ok.
- Click on the button Start to begin the upload process to the G6 device.
- After successfully uploading the file it appears in the section available SIOC firmware files on the device.

Note: This list contains all available firmware files stored in the controller-specific directory of the G6 device's memory. To remove this file click on the respective button remove.

- To update the controller's firmware open the screen SmartOffice and change to the tab Device Configuration.



- In the section Device.smart office.device_config scroll down to the respective controller.
- In the field update firmware enter the name of the firmware file you want to load into the controller and click on the button update firmware.

Note: If the input field is left blank the latest firmware file is selected by default.

Configuring MQTT

The MICROSENS Smart I/O Controller acts as an MQTT client for sending and receiving MQTT messages from and to an MQTT broker in the network, regarding the controller's input and output port values. This is important if you want to use the Smart I/O Controller in automation projects with the interaction between field devices.

Prerequisites

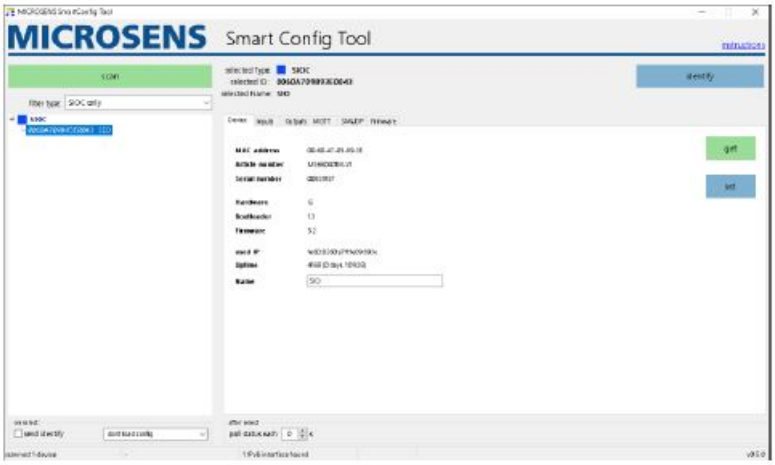
The controller always works with IPV6 Link-Local Addresses. Therefore, the MQTT broker has to be enabled to work with IPv6 addresses. However, he can easily translate between IPv4 and IPv6 because of the architecture of MQTT.

The MQTT protocol enables a very large range of different devices acting as broker, publisher and subscriber on the OSI transport layer. The device communicates only via TCP port 1883 or – if adjusted – over Websockets on Port 9001 for external communications.

Using Smart Config Tool for MQTT Configuration

Note: Use the MICROSENS Smart Config Tool for the MQTT configuration of the Smart I/O Controller. The application is available for download via the MICROSENS website (www.microsens.com). Therefore, navigate to the controller's product page, scroll down to the secure download area, and log in with your credentials. If you are not registered yet, click on "Not registered?" to apply for login data.
To configure the MQTT settings as follows:

1. Start the Smart Config Tool.
Note: This is a portable Microsoft® Windows® application that works without installation. For general information about using the Smart Config Tool please refer to the application's help function via the button instructions on the upper right-hand pane.
2. Hit the button Scan on the upper left-hand pane.



- Connection Status: Shows the connection status to the MQTT broker (read only).
- Disconnected: No active connection to an MQTT broker in the network.
- Accepted: The Smart I/O Controller is connected to an MQTT broker.
- Timeout: The connection to the MQTT broker is closed due to a timeout.
- refused protocol: The MQTT broker refused the connection due to an invalid or unknown MQTT protocol version.
- refused ID: The MQTT broker refused the connection due to an invalid client ID.
- refused server: The MQTT service is unavailable.
- refused authentication: The MQTT broker refused the connection due to invalid client credentials
- refused authorization: The client does not have the appropriate access rights.
- unknown: The connection closed due to unknown reasons.
- connecting: The Smart I/O Controller is connecting to the MQTT broker.
- paused: The connection is paused. Client ID: The client ID that is built from a part of the MAC-Adress which is shown on the tab Device (read only).
- Mode: Determines the MQTT mode (read/write). Disabled: MQTT disabled. QoS 0 (at most once):

1. no guarantee for message delivery
2. no acknowledgment of receiving the message by the MQTT broker
3. no storing or retransmitting the message by MQTT publisher
4. Packet ID automatically set to "0"

- o QoS 1 (at least once):

- guarantee for delivering the message successfully at least one time to the broker
- storing and re-transmitting the message unless acknowledgment by the broker
- acknowledgment contains the unique packet ID only, so the publisher can assign message and acknowledgement o QoS 2 (exactly once):
- guarantee for delivering every message exactly one time to the broker
- publisher and broker using a four-part handshake for sending and acknowledgment
- acknowledgment messages between publisher and broker contain the packet ID only to assign message and acknowledgments

1. **Broker:** Sets the IPv6 address of the MQTT broker (read/write).
2. **Username:** Username for MQTT broker access (read/write).
3. **Password:** Password for MQTT broker access (write).
4. **As soon** as valid parameters for broker IPv6 address, credentials, and MQTT mode are set and the broker is reachable, the MQTT broker connection status changes to “accepted”.
5. **Keepalive:** Sets the interval in seconds within which the controller sends a message to its MQTT broker (read/write) to announce itself as a present. This prevents being disconnected by the broker.
6. Retain: This flag determines whether the broker will save this message as the last valid sample for this specific topic. In case a new MQTT client subscribes for this topic the broker transmits this message to the subscriber.
7. Topic Prefix: The MQTT topics will always start with this string as an identifier (read/write).
8. **Will Topic:** This “last will topic” is sent to the MQTT broker on every first connection or on a parameter change. The broker forwards it to subscribers in case the controller (as publisher) loses the connection to the broker indicating the connection failure (read/write).
9. **Will Message**: Sets the message for the last will topic in case of loss of connection (read/write).
10. **Will QoS**: Sets the MQTT mode for the last will topic (read/write).o Settings correspond to the MQTT mode settings above. It is recommended to use a higher QoS level for last will topics.
11. **Will Retain:** If set the broker saves the last will message to inform new subscribers about the controller has lost its connection previously (read/write).
12. P**ublish uptime:** Sets the interval in seconds at which the controller sends its uptime to the broker using the topic “<topic prefix>/uptime” (read/write). o Setting this parameter to “0” disables this function.

Using MQTT Topics with MICROSENS Switches

A topic can be understood as the category of a message. Topics are structured hierarchically (with a forward slash as a delimiter between levels), comparable to a file system structure (e.g. “Building/Floor1/Room1/CeilingLight”). Topics are defined by the user, where a user-friendly self-descriptive naming convention mirrors the Smart Building infrastructure. Topic names are case sensitive (“…/CeilingLight” differs from “…/ceiling light”) and must contain at least one character. **Note:** It is possible to use every UTF-8 character (besides “$” since this character is used by the broker for internal statistics).
The use of the following wildcards is possible:

Example: “Building/Floor1/+/Temperature”
This topic addresses the “Temperature” related messages for all rooms on “Floor1”. #: This character replaces multiple levels in a topic. Example: “Building/Floor1/#”
This topic addresses all occurring messages on “Floor1”.

Note: The use of wildcards is allowed when using a micro script to register topics. It is not allowed to use the MQTT mapping table and matching multiple topics to only one component is not appropriate (e.g. matching a

sensor to a topic containing multiple rooms). For setting up topics or IDs more easily it is possible to use specific variables. The following variables with their respective value are available:

- {SMO}: fixed text “SmartOffice”
- {MFG}: fixed manufacturer’s name (i.e. “MICROSENS”)
- {MAC}: MAC address of the device
- (Device.factory.device_mac, e.g. “00:60:A7:09:37:4E”)
- {IP4}: IPv4 address of this device
- (Device.ip.v4_status.dynamic_device_ip, e.g. “10.100.89.187”)
- {IP6}: IPv6 address of this device
- (if enabled, Device.ip.v6_status.ip, e.g. “fe80::260:a7ff:fe09:374e/64”)
- {DMN}: Domain name of the Smart Office network
- (Device.smartoffice.director_config.domain_name, e.g. “domain1”)
- {ART}: article number of this device
- (Device.factory.article_number, e.g. “MS652119PM”)
- {SER}: serial number of this device
- (Device.factory.serial_number, e.g. “00345860”)
- {LOC}: SNMP SysLocation
- (Management.snmp.device_info.sys_location, e.g. “Office”)
- {NAM}: SNMP SysName
- (Management.SNMP.device_info.sys_name, e.g. “MICROSENS G6 Micro Switch”)

The variables can be combined e.g. in topics like “{SMO}/{MFG}_{MAC}/”.
Note: These variables are limited to the use with MICROSENS G6 switches (e.g., for micro scripts). They cannot be used i.e. with MQTT topics of a Smart I/O Controller.

Documents / Resources

	MICROSENS Smart I-O Controller Integrates Digital Component Into IP Network [pdf] User Guide Smart I-O Controller Integrates Digital Component Into IP Network, Smart I-O, Controller Integrates Digital Component Into IP Network
	MICROSENS Smart I-O Controller Integrates Digital Component Into IP Network [pdf] User Guide Smart I-O Controller Integrates Digital Component Into IP Network

References

- MICROSENS - Downloads