ISIO 200

User Manual

Contents

1 Preface and general safety instructions

The purpose of this manual is to familiarize users with the *ISIO 200* and to show how to properly use it. The manual contains important tips on how to use the *ISIO 200* safely, properly, and efficiently. Its purpose is to help you avoid danger, repair costs, and down time as well as to help maintain the reliability and life of the *ISIO 200*.

This manual is to be supplemented by existing national safety standards for accident prevention and environmental protection. Keep it available at the site where the *ISIO 200* is used. It should be read by all personnel operating the device. In addition to the manual and the applicable safety regulations in the country and at the site of operation, heed the usual technical procedures for safe and competent work.

This manual describes the *ISIO 200* device and its built in configuration interface. In order to get familiar with the referenced software for advanced GOOSE configuration (The GOOSE Configuration module), please refer to the OMICRON Test Universe and the accompanying software manuals.

1.1 Safety instructions

Before operating the *ISIO 200*, carefully read the following safety instructions. Only operate the *ISIO 200* after you have read this manual and fully understood the instructions herein.

The *ISIO 200* may only be operated by trained personnel. Any maloperation can result in damage to property or persons.

1.1.1 For your safety please note

The binary I/O terminals of the *ISIO 200* test set can conduct life-hazardous voltages.

Throughout the manual, this symbol indicates special safety-relevant notes/directions linked to the possibility of touching live voltages and/or currents. Please thoroughly read and follow those directions to avoid life-hazardous situations.

This symbol indicates potential hazards by electrical voltages/currents caused by, for example, wrong connections, short-circuits, technically inadequate or faulty equipment or by disregarding the safety notes of the following sections.

1.1.2 Rules for use

- The *ISIO 200* must only be used when in a technically sound condition. Its use must be in accordance with the safety regulations for the specific job site and application. Always be aware of the dangers of high voltages. Pay attention to the information provided in the documentation.
- The *ISIO 200* is exclusively intended for the application areas specified in section 1.2 on page 7. The manufacturer/distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.
- The instructions provided in this manual and the associated software manuals are considered part of the rules governing proper usage.
- Do not open the *ISIO 200* or remove any of its housing components.

1.1.3   Orderly practices and procedures

- Keep this manual available on site where the *ISIO 200* is used.
- Personnel assigned to using the *ISIO 200* must have read this manual and fully understood the instructions herein.
- Do not carry out any modifications, extensions or adaptations at the *ISIO 200*.

1.1.4   Operator qualifications

- Installation and configuration of the *ISIO 200* should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction, direction, or education on the *ISIO 200* should remain under the constant supervision of an experienced operator while working with the equipment.

1.1.5   Safe operation procedures

- Follow the instructions in sections 2 to 8 that describe how to set the setup and use of the *ISIO 200*.
- Do not use any other power supply options for the *ISIO 200* than the ones described in section 5 on page 15.
- Before wiring the terminals, verify that the conducting parts are de-energized.
  The terminal connectors have hazardous live parts.
- Product safety according to IEC 61010-1 is only achieved by operating the *ISIO 200* in a secured area (with safety barrier and safety indicator) or in permanent/stationary setups.
- Do not operate the *ISIO 200* under wet or moist conditions (condensation).
- Do not operate the *ISIO 200* when explosive gas or vapors are present.
- If the *ISIO 200* is opened by unauthorized personnel, all guarantees are invalidated.
- Connect the ETH connector only to Ethernet ports.
- If the *ISIO 200* seems to be functioning improperly, please contact the OMICRON Technical Support, →"OMICRON Service Centers" on page 41.

1.2   Designated use

The *ISIO 200* is a binary I/O terminal to be used in protection and automation systems for electrical power utilities that utilize GOOSE according to IEC 61850.

The *ISIO 200* performs a conversion between its binary I/Os and IEC 61850 GOOSE messages.

The information carried with the subscribed (received) GOOSE messages is output at the binary outputs. The status of the binary inputs is published (sent out) via GOOSE messages.

The *ISIO 200* may be either:

- a portable accessory for testing protection and power utility automation systems
- permanently installed as a test terminal
- permanently installed to perform operational functions in protection and power utility automation systems

Any other use of the *ISIO 200* is considered improper and may result in damage to property or persons.

Matched pairs

When two *ISIO 200* devices are set up accordingly, the binary I/O status sensed on the inputs of one device will be mirrored on the output of the other device. To utilize this feature right out of the box without further configuration, the devices can be delivered in matched pairs. For the setup of arbitrary *ISIO 200* devices for this use, see section 7.4.2 on page 20.

2   Scope of delivery

Figure 1:   *ISIO 200* with accessories at delivery in box

Main unit

ISIO 200

Binary Input/Output (I/O) terminal with IEC 61850 GOOSE interface

Accessories included with delivery

Binary I/O connector: MSTB 2.5HC/5-STF-5.08

4 x 5 pin connector for binary I/O terminals

Power connector: MC 1.5/2-STF-3.81

1 x 2 pin connector for POWER

DIN rail mounting clip: Hutsclip/AL/0009

DIN rail mounting clip for 35 mm top hat rail according to IEC 50022 including 2x M3x12 (TX10).

For assembling the clip to the *ISIO 200* please refer to section 4.1.1 on page 13.

Mounting brackets: AB-WL 3

Brackets for mounting the *ISIO 200* on a flat surface (a wall mounting, for example).

For detailed assembling information please refer to section 4.2 on page 14.

Welcome letter and quick start guide

Hardcopies of instructions for initial use.

Recommended accessories for laboratory use

These adapter cables are recommended for the laboratory use according to IEC 61010-1.

Terminal Adapters: 1 pole FLEXI-2V black 4 mm isolated

Flexible 2.5 mm² adapter, inclusive 4 mm banana jack

OMICRON article number: VEHS0009

One article contains 12 flexible terminal adapters for screw-type terminals, so two of them are required for serving all terminals of one *ISIO 200*.

The use of these adapters alone does not comply with the requirements of IEC 61010-1. Be aware that a secured operating environment is necessary (see section "Safe operation procedures" on page 7).

2.1 Spare parts

The recommended connectors for the power input and the binary I/O terminals are included in the accessories. Other variants may be more suited for specific applications and are listed below.

2.1.1 Power connector

Type	Manufacturer	Purchase code	Comment
MC 1.5/2-STF-3.81	Phoenix Contact	1827703	with screw connection
284511-2	TE Connectivity	284511-2	with screw connection

2.1.2 Binary I/O connector

Type	Manufacturer	Purchase code	Comment
MSTB 2.5/ 5-STF-5.08	Phoenix Contact	1912210	with screw connection
796859-5	TE Connectivity	796859-5	with screw connection
FKC 2.5 HC/ 5-STF-5.08	Phoenix Contact	1942510	with spring-cage connector
MSTBC 2.5/ 5-STZF-5.08	Phoenix Contact	1809763	with crimp connection

These connectors are safe according to IEC 61984 and IEC 60999-1. They are required for the use in substation automation systems according to IEC 60255-27. Be aware that a secured operating environment is necessary (see section "Safe operation procedures" on page 7).

These connectors are available from many major distributors for electrical components.

The spare connectors cannot be ordered from OMICRON.

3 Device overview

3.1 Front panel
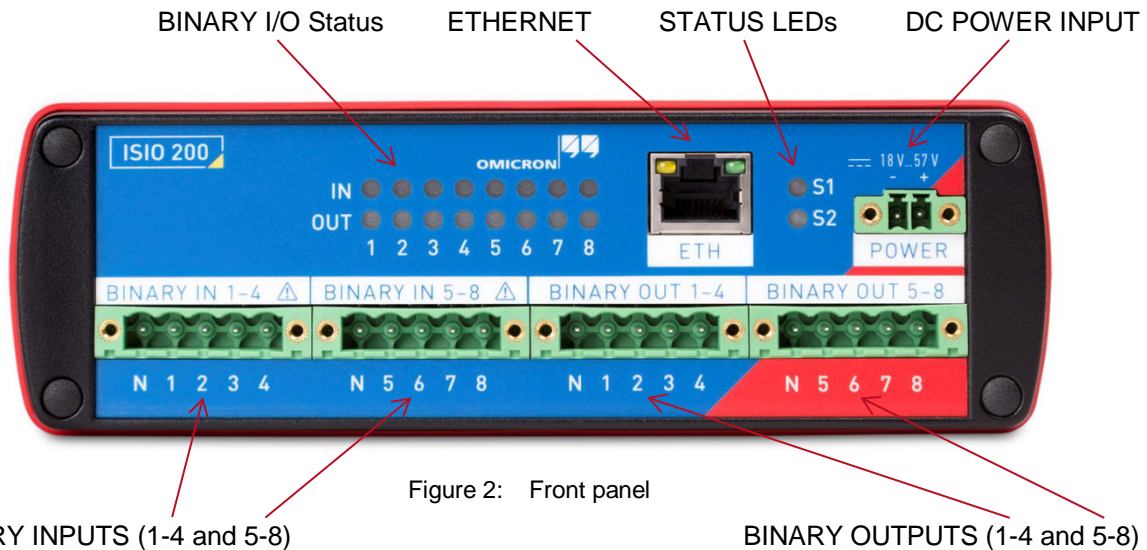
Figure 2: Front panel

BINARY IN 1-4 and BINARY IN 5-8

Two connectors, each representing an independent potential group with a common GND.

For compatible connectors, see the spare parts on page 10.

BINARY OUT 1-4 and BINARY OUT 5-8

Two connectors, each representing an independent potential group with a common GND.

For compatible connectors, see the spare parts on page 10.

IN / OUT Status LEDs

The IN LEDs lights green if an input is stimulated and the OUT LEDs lights red if an output is set.

ETH

Ethernet connector for communication and supplying the *ISIO 200* with power over Ethernet (PoE).

POWER

A DC supply connector (MC 1.5/2-STF-3.81) to alternatively supply the *ISIO 200* if PoE is not available is included in the delivery package.

Status LEDs S1 and S2

The status LEDs S1 and S2 are of interest in case of troubleshooting:

S1: green status LED

S2: red status LED

S1 and S2 continuously off	The *ISIO 200* is not supplied with power.
S1 off S2 lights red	Reboot is in progress.
S1 off S2 flashes red	Software update is in progress. Attention: Do not disconnect the *ISIO 200* device from the Ethernet during the software update.
S1 lights green and S2 lights red	Intermediate state when entering the recovery mode manually or when initiating a factory reset (see also section 8 on page 30).
S1 flashes green S2 off	The *ISIO 200* is in the recovery mode, waiting for new software. In the recovery mode, the device provides only a rudimentary web interface, only to allow the upload of a software image (see also section 8.3 on page 30).
S1 lights green S2 off	The *ISIO 200* is ready for operation.

3.2   Rear panel

Figure 3:   Rear panel

Hole to access the Reset button
(for example with a paper clip, diameter < 0.9 mm)

DIN rail clip

The picture above shows the rear plate with the mounted DIN rail clip, which is included in the delivered accessories. For detailed information about assembling the DIN rail clip please refer to section 4.1.1 on page 13.

The Reset button can be used to:

- Initiate a reboot.
- Initiate a factory reset to set the device configuration to the factory defaults
  (if you forgot your password, for example).
- Enter the recovery mode in order to upload software
  (after a software update process failed, for example).

Please refer to section "Resetting the Device" on page 30 for more detailed descriptions.

4 Mounting

4.1 DIN rail mounting

4.1.1 Assemble DIN rail clip to the *ISIO 200*

For mounting the DIN rail clip to the *ISIO 200* please follow this instruction:

- Fix the DIN rail clip to the rear plate via 2x M3x12 (TX10) screws. Therefor use a Torx screw driver with dimension 10.
- Notice that the spring side of the clip should be mounted in direction to the Reset button (see picture of rear plate on page 12).

Figure 4: DIN rail clip with screws

Do not use any other screws as included in the delivery package.

4.1.2 Typical mounting position on DIN rail

Mount the *ISIO 200* to a standardized 35 mm top hat DIN rail according to EN 50022.

- Place the unit on the DIN rail.
- Press-in the spring on top side of the clip.
- Snap-On the *ISIO 200* to the DIN rail.

Figure 5: Typical mounting position on DIN rail

4.1.3 Removing *ISIO 200* from DIN rail

For removing the device from the DIN rail:

- Compress the spring of the DIN rail clip by pressing the *ISIO 200* downwards.
- Release the device from the DIN rail.

No screw driver or special tool is needed.

4.2 Wall mount

For mounting the *ISIO 200* on a flat surface (a wall mounting, for example), the mounting brackets are included in the delivery package. Please follow the included instruction leaflet for assembling the brackets to the *ISIO 200*.

- Remove the black screw covers and screws.
- Insert the included seal rings.
- Fix the brackets to the device via the included 22 mm screws.

Figure 6:   Mounting brackets

4.3 Tabletop use

The rubber sealings around the housing guarantee a soft and secure stand when using the *ISIO 200* as a tabletop device. A typical use is with a CMC test set in a temporary test setup or in a laboratory.

The binary I/O terminals may be connected to hazardous voltages and do not protect the user from electric shocks. The connector itself may become a live part with hazardous voltages. Therefore, the *ISIO 200* must be mounted inside a control cabinet that provides protection against touching life parts. If the device is used outside such an enclosure, for example on a laboratory desk, additional protection using safety barriers and safety indicators must be established. Ensure that the wiring of the I/O terminals is done only in de-energized condition.
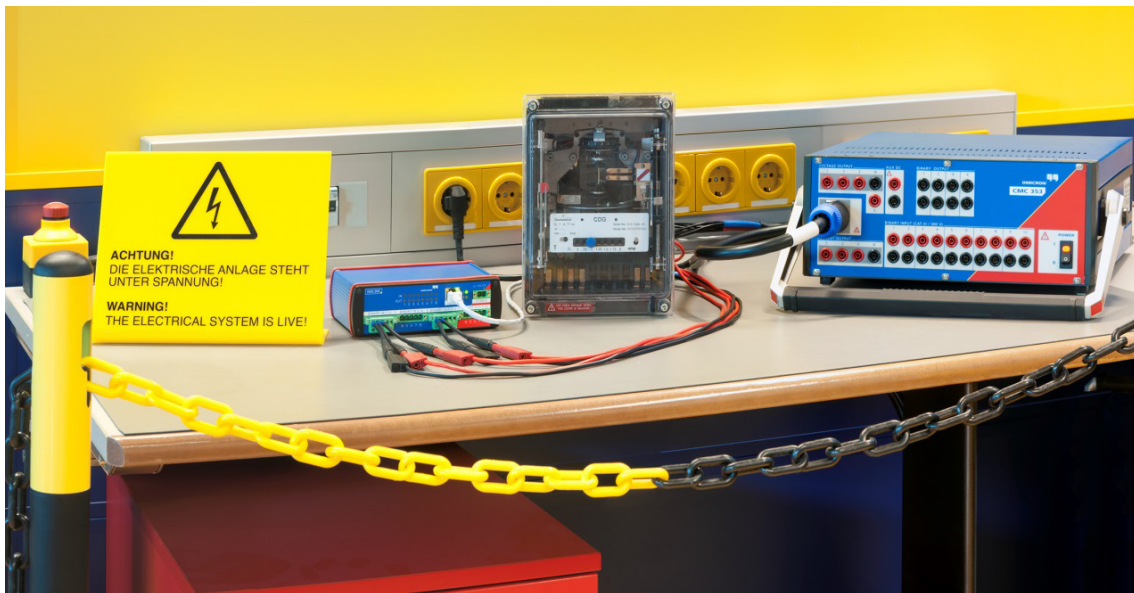

Figure 7:   Typical tabletop use

Product safety according to IEC 61010-1 is only achieved by operating the *ISIO 200* in a secured area (with safety barrier and safety indicator). Be aware that a secured operating environment is necessary (see section 1.1.5 on page 7).

5   Power supply

The *ISIO 200* offers two possibilities for supplying the device with electrical power. The preferred method is by Power over Ethernet. When no Power over Ethernet is available there is the alternative by supplying the *ISIO 200* over an external DC supply.

5.1   Power over Ethernet

The easiest and preferred method for supplying the *ISIO 200* is with Power over Ethernet (PoE) according to IEEE 802.3af. The insulation concept is optimized therefor. The same Ethernet cable for communication is used for powering and no additional cabling is required.

The network port connected to the *ISIO 200* must be able to supply a class 2 powered device (Power Consumption < 6.49 W). The *ISIO 200* automatically powers up after connecting the Ethernet cable.

If no PoE compatible source (an Ethernet switch, for example) is available, there is also the possibility to use a Power over Ethernet injector.

For detailed specification please refer to technical data of "Power over Ethernet" on page 32.

5.2   Power input

There is an alternative way to power the *ISIO 200* by an external DC supply. The *ISIO 200* works with a DC input voltage from 18 V to 57 V. The power consumption of the device is less than 5 W.

Connect the DC supply via terminal connector (MC 1.5/2-STF-3.81), which is included in accessories (see section 2), to the POWER input and the *ISIO 200* automatically powers up.

If both powering possibilities of the *ISIO 200* are connected, the DC Power Input gains priority. When supplying voltage to the POWER input during PoE operation, the *ISIO 200* changes to DC supply without rebooting. The PoE supply will be deactivated automatically.

The POWER input is only functionally isolated to the SELV group and therefore the external supply unit needs to comply with the safety standard according to IEC 61140.

The safety requirements according to IEC 61010-1 and IEC 60255-27 are only complied with by using a DC supply unit that provides SELV (safety extra low voltage) regarding IEC 61140.

A power supply with a galvanic connection to the station battery of a power utility automation system violates the safety requirements according to IEC 60255-27. If the device is to be supplied from the station battery, a power supply with SELV insulation according to IEC 61140 is required.

For detailed specifications please refer to technical data of "Power input" on page 32.

6 Communication and access

6.1 OMICRON Device Browser

The OMICRON Device Browser (ODB) is a component to find OMICRON devices on a local network even if the IP address of the device is not known yet. When an *ISIO 200* is found and listed by the ODB, further functions can be applied. Two functions of particular interest are:

- Setting a static IP address for the *ISIO 200.*
- Invoking the web interface of the *ISIO 200.*

6.1.1 Installing the OMICRON Device Browser

The ODB installer for MS-Windows operating systems can be downloaded from the *ISIO 200* website. Go to the *ISIO 200* product page. The download link for the OMICRON Device Browser is provided there. Execute the downloaded installer to install ODB on your computer. An icon with the label **OMICRON Devices** will be placed on the desktop.

6.1.2 Finding OMICRON devices in the device browser manually (OMFIND)

Normally, the ODB automatically finds the OMICRON devices connected to the network. If not, it is also possible to manually search the network for available OMICRON devices.
Proceed as follows:
- Right-click the **OMICRON Devices** desktop icon.
- On the context menu, select **OMFind** and then click **Find Devices**.
- This will start the Device Discovery tool. This tool is intended to diagnose network/firewall problems when the Device Browser lists no or not all expected devices.
- Click the **Start Discovery** button to manually search for OMICRON devices connected to the network. Once the search is finished, the discovered devices section lists network parameters of all found OMICRON devices.

Clicking on the on the **ODB** icon will open the browser, presenting a list of found OMICRON devices.

6.1.3 Setting an IP address with the OMICRON Device Browser

The OMICRON Device Browser can be used to assign a static IP address to the *ISIO 200*.
- Right-click the *ISIO 200* device symbol, select **Set Network Configuration …**
- Enter the IP settings and apply them

6.1.4 Accessing the web interface from the OMICRON Device Browser

The *ISIO 200* web interface can be directly accessed through the OMICRON Device Browser:
- Right-click the *ISIO 200* device symbol, select **Open Web Interface**.
- The start page of the *ISIO 200* web interface will open in the default web browser on your computer.

6.2 Web Browser

The web interface can be invoked by entering the IP address of the *ISIO 200* as the URL in a browser.

7 Configuration and web interface

The *ISIO 200* hosts a web server for providing status information and configuration via a web interface.

7.1 Security certificate

The *ISIO 200* uses a secure HTTPS connection to the PC. The HTTPS protocol requires a security certificate to be present when a server (*ISIO 200*) and client (PC with web browser) connect.

With the *ISIO 200*, the self-signed certificate method is used and a certificate is generated when such a connection is established for the first time. The browser will display a corresponding message that has to be acknowledged. This certificate remains valid for the specific client/server pair and following connections will be established without further overhead.

A self-signed certificate is initially created that is certified to the hostname "ISIO-<SerialNumber>". The browser will display a security warning when accessing the *ISIO 200*. This has to be acknowledged and/or installed in the browser to avoid further security warnings.

The installed certificate will be not or no longer valid, when

- another PC is used to connect to the *ISIO 200* or
- the same PC, but another web browser is used.

To avoid the situation with the changed IP address of the *ISIO 200* during an established connection to the web interface, it is recommended to use the OMICRON device browser and to set the IP address before the *ISIO 200* is accessed via a web browser for the first time.

7.2 Homepage

The homepage of the *ISIO 200* is displayed when connecting to the *ISIO 200* with a browser by specifying the device's IP address or URL.
Clicking the *ISIO 200* logo in the upper left corner redirects to the homepage.

7.2.1 Authentication

The web interface can be only accessed after a successful login. The default password at delivery is printed on the nameplate on the bottom side of the *ISIO 200*.
Once logged in the logout function is presented in this place.
An automatic logout will occur when the user interface is not actively used for 15 minutes.

7.2.2 Time and system status

Selected general information about the device is displayed in these sections.

7.3 Network

7.3.1 Network interface

Auto-IP

At delivery, the *ISIO 200* is set for using Auto-IP *to* avoid conflicts and network problems when multiple, not yet configured *ISIO 200* devices are connected to a common network. Although the obtained Auto-IP addresses are not known and therefore not usable, it is assured that all devices have unique IP addresses.

Static

Static IP is the most important mode for a substation automation device like the *ISIO 200*. During the planning of the SAS, the IP addresses are assigned to the IEDs and such an address has to be configured statically in the *ISIO 200*.

As a consequence of changing the IP address using the web interface, the connection to the *ISIO 200* gets lost. A new connection using the new IP address has to be established. For the implications concerning the security certificate, see section 7.1 on page 17.

DHCP

DHCP is provided for completeness only and for some rare use cases. There is no likely use for this mode in real applications, unless a DHCP server is explicitly configured to assign predefined IP addresses to certain devices (identified by their MAC address).

IP Address, Mask, and Gateway

When the *ISIO 200* is in Static IP mode, the IP address setting values have to be specified here. The MAC address and the link speed are displayed.

7.3.2 Device discovery

The device discovery protocols OMFIND and Zeroconf are provided for finding the *ISIO 200* in local networks even if the IP address of the device is not yet known. For this purpose, they are enabled at delivery. Since these protocols are not security hardened, it is recommended to disable them after the initial setup of the *ISIO 200* when cyber security is a concern.

OMFIND is an OMICRON proprietary method to discover OMICRON devices, such as test sets. The OMICRON Device Browser (ODB) for MS-Windows operating systems makes use of this method. The ODB is installed with many OMICRON software packages, such as the OMICRON Test Universe. A standalone installer for the ODB can be downloaded from the OMICRON homepage (see section 6.1.1 on page 16).

Zeroconf is a device finding method used in many consumer devices, such as home routers or network storage devices. This function is just provided for convenience and only "as is" without guarantee of its function or specific features.

7.4 GOOSE

7.4.1 Default and custom GOOSE configuration

Default configuration

In the default configuration, the number of used GOOSE messages and the GOOSE dataset is predefined.

The *ISIO 200* subscribes to exactly one GOOSE message and publishes exactly one GOOSE message.

The dataset contains eight Boolean attributes (one for each binary input or output). Each of these Boolean attributes is accompanied by its quality attribute (of type BitString[13]).

The following figure illustrates how such a dataset would be represented in the GOOSE Configuration module of the OMICRON Test Universe software.
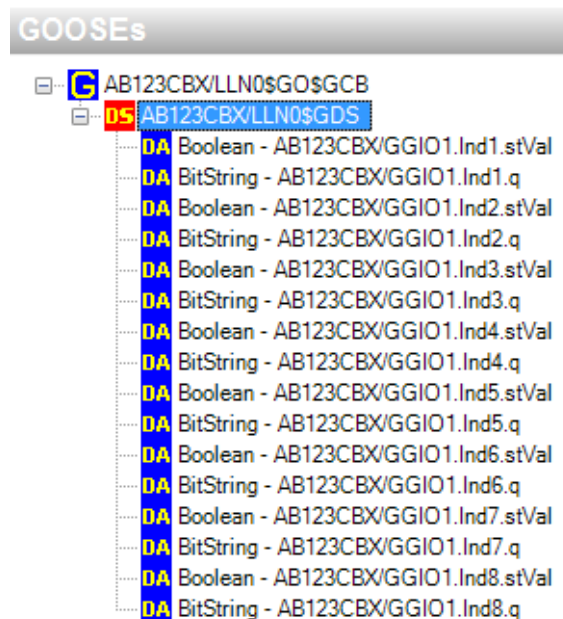
Figure 8:   Dataset layout for the default GOOSE configuration with typical object references

This applies for the subscribed and the published GOOSE as well. This default configuration is the precondition for the operation of matched pairs (see section 7.4.2 on page 20) and for the availability of the download functions for the current configuration.

Custom configuration

When a custom configuration is selected, a configuration file needs to be uploaded to the *ISIO 200*. The corresponding controls are displayed as soon as the custom configuration is selected.

A custom GOOSE configuration needs to be set up with external tools. For the details of this custom configuration process, see the sections 7.7 on page 21 and 7.8 on page 23.

The Subscription, Publishing, and Download page are not accessible any more when a custom configuration is applied.

7.4.2   Matching pairs of *ISIO 200*

A matched pair of *ISIO 200* devices is preconfigured at delivery to communicate with each other "out-of-the-box". There is no further configuration needed. When two paired devices (the peers) are connected to the same network (or more specifically: to the same broadcast domain), they will immediately exchange their binary I/O status. This means, the information sensed at the inputs of one device will be output at the outputs of the peer device.

Of course, other devices can subscribe to the GOOSE messages published by such a pair of *ISIO 200* and access the information transmitted.

Matching an *ISIO 200* with its peer

Both *ISIO 200* to be paired (the peers) need to be first set to the default GOOSE configuration. Specify the IED name of the peer device in the field of the paring section. At delivery and after reset to factory defaults, this is the serial number of the peer device. The subscription will then be set up accordingly.

Of course, devices can be paired as well by making corresponding entries for the multicast MAC address and the IED name in the subscription and publishing settings.

7.4.3   Restarting the GOOSE application

When the GOOSE application in the *ISIO 200* is restarted, all binary outputs will be reset to the "off" state. The output status will be updated when the subscribed GOOSEs are again received. All published GOOSEs will be republished with status number set to one, reflecting the current status of the binary inputs.

7.5   GOOSE Subscription

This page is only available and displayed when the default GOOSE configuration (see section 7.4.1 on page 19) is selected.

The multicast MAC address and the GOOSE control block reference (GCB) of the GOOSE to be subscribed can be specified. No special checking of the values takes place. Also MAC addresses outside the range recommended in IEC 61850 can be set. The string entered for the GCB is not checked to match an object hierarchy of a data model in an IEC 61850 IED.

When the subscription is successful, information from the received GOOSE is displayed in the Status section. The dataset information of the currently subscribed GOOSE is a compacted display, with 0 for the False and 1 for the True value. The rightmost number refers to binary output 1, the leftmost to binary output 8.

In case of a timeout (timeAllowedtoLive expired) of a subscribed GOOSE, the corresponding mapped binary outputs will remain in the last received status.

7.6   GOOSE Publishing

This page is only available and displayed when the default GOOSE configuration (see section 7.4.1 on page 19) is selected.

The multicast MAC address (used as destination MAC address of the Ethernet packet) and the IED name for the GOOSE control block reference of the GOOSE to be published can be specified. No special checking of the values takes place. Also MAC addresses outside the range recommended in IEC 61850 can be set. The user has to make sure that the multicast bit in the address is set.

The GOOSE control block reference is constructed with the IED name. The VLAN-ID and priority in the VLAN tag can be set. The timing parameters for the retransmission can be set. The retransmission strategy is fixed: a geometric progression with a factor of 2.

Information about the published GOOSE is displayed as well in the Status section. The dataset information of the currently published GOOSE is a compacted display, with 0 for the False and 1 for the True value. The rightmost number refers to binary input 1, the leftmost to binary input 8.

7.7 Custom GOOSE configuration

Besides using the default configuration, the *ISIO 200* can be configured to subscribe to and to publish arbitrary GOOSE messages. Such a custom GOOSE configuration is set up by using the GOOSE Configuration module which is part of the OMICRON Test Universe software.

The GOOSE Configuration module was made for the CMC test sets. Part of the terminology used in this module refers specifically to this application. To use this module for setting up a configuration for an *ISIO 200*, some important differences have to be kept in mind.

To use the GOOSE Configuration module it must be installed with the OMICRON Test Universe software. For the details of using the GOOSE Configuration module see the related documentation.

GOOSE configuration for a CMC test set

The intended use of the GOOSE Configuration module is to set up CMC test sets. The details explained here are provided only to point out the differences to be regarded when using the module with the *ISIO 200*.

Typically, a CMC is not publishing GOOSE messages for its own purpose. Mostly, the CMC publishes "on behalf" of another protection or substation automation device to mimic some part of the behavior of that device. Therefore, the publishing functions of the CMC are configured in the *Simulations* tab.

The data attributes from subscribed GOOSE messages operate the (virtual) inputs of the test set.

The (virtual) outputs of the test set manipulate the values of data attributes in simulated (published) GOOSE messages.

When using the GOOSE Configuration module for configuring an *ISIO 200*, part of the context needs to be reversed. The following figure illustrates this.
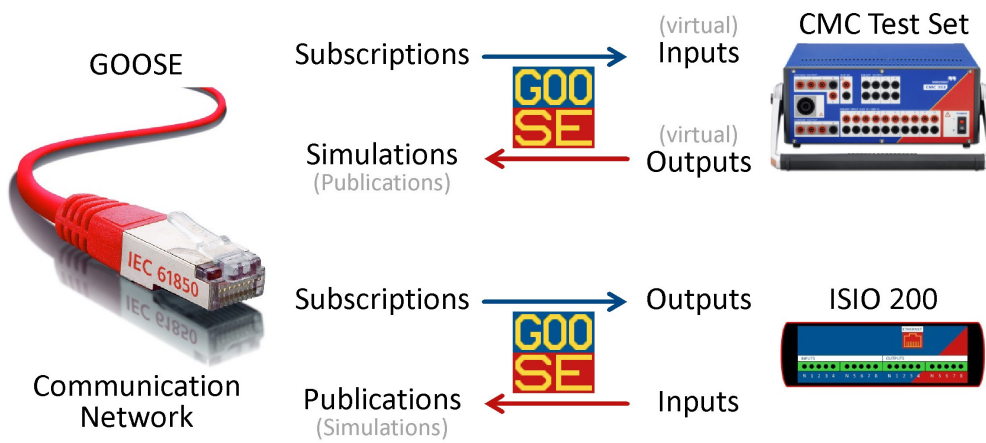

Figure 9:   Relation of Subscription & Publishing (Simulation) with CMC and *ISIO 200*

GOOSE configuration for the *ISIO 200*

The GOOSE Configuration module will not be changed or adapted for the *ISIO 200*. Therefore, some terms have different meanings when used with the *ISIO 200*.

Subscriptions are configured in the *Subscriptions* tab. The data attributes in the subscribed GOOSE messages operate the binary outputs of the *ISIO 200*. Even though the hardware terminals offered for mapping are labeled "Inputs" in the *Subscriptions* tab, the mappings actually refer to the outputs of the *ISIO 200*. Only mappings to the "Bin. In." 1 to 8 (corresponding to the binary outputs 1 to 8 of the *ISIO 200*) are valid and recognized by the *ISIO 200*.

The publications are configured in the *Simulations* tab. The data attributes in the published GOOSE messages reflect the status of the binary inputs of the *ISIO 200*. Even though the hardware terminals offered for mapping are labeled "Outputs" in the *Simulations* tab, the mappings actually refer to the inputs of the *ISIO 200*. Only mappings to the "Bin. Out." 1 to 8 (corresponding to the binary inputs 1 to 8 of the *ISIO 200*) are valid and recognized by the *ISIO 200*. Up to eight GOOSE messages can be set up for subscription and publication in the *ISIO 200*.

The *ISIO 200* supports mapping to status value attributes (stVal) from the IEC 61850 common data classes SPS (single point status) and DPS (double point status). The status value attributes in these data classes are of the type boolean and bit string. Other data types are not supported for mapping.

When such a GOOSE configuration is set up, it must then be saved by using the function **Export Configuration …** in the *File* menu. This file is then uploaded to the *ISIO 200* (see section 7.7.1 on page 22). After uploading, the GOOSE application restarts automatically and checks if the custom GOOSE configuration can be applied. An invalid custom GOOSE configuration is not loaded and the GOOSE application does not start.

7.7.1 Uploading a custom GOOSE configuration

This function is only available if the custom GOOSE configuration is selected (see section 7.4.1 on page 19). A custom made GOOSE XML file (see section 7.7 on page 21) can be uploaded.

Even if one part of the GOOSE configuration (subscription or publication) is kept the same as the default configuration, it has to be modeled in the GOOSE Configuration module as soon as a custom configuration is used.

Use of information in SCL format

A configuration of the power utility automation system (and a related SCL file) is assumed to be present prior to setting up a custom GOOSE configuration. The process corresponds to creating a CID file for the *ISIO 200*. As of now, this process is to be done manually with the GOOSE Configuration module.

Configuration and web interface

7.8   Download

The downloading of two different kinds of configuration files (SCL/ XML) is performed in the **Download** page in the web interface.

The download of configuration data is only provided for the default GOOSE configuration and the Download page is only accessible if the default configuration is selected.

Terminology: Download / Upload

To avoid confusion, the usage of the terms *download* and *upload* within this document shall be unambiguously declared.

The *ISIO 200* is the server device and considered to be "up". The PC, which is used for configuring the *ISIO 200,* is the client and considered to be "down".

Consequently,

- a file transfer from the *ISIO 200* to the PC is a *download*, and
- a file transfer from the PC to the *ISIO 200* is an *upload.*

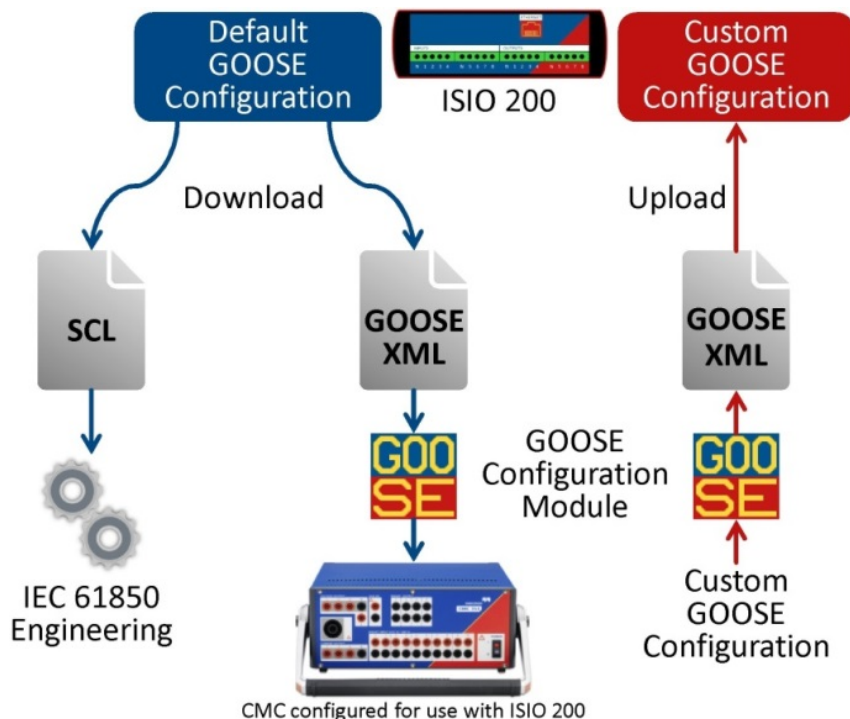The figure below illustrates this together with the usage of the data.

Figure 10: Downloading files from and uploading files to the *ISIO 200*

7.8.1 Downloading the configuration in SCL format

To perform a substation configuration according to the IEC 61850 engineering process, a configuration file (SCL file) can be downloaded from the *ISIO 200*.

The SCL (ICD, IID) file provided reflects the current configuration of the *ISIO 200*. A minimal, generic data model is contained, the binary I/Os are modeled as GGIOs. The following figure gives an overview about the model.

The 8 binary inputs are modeled as Ind1 to Ind8. The 8 binary outputs are modeled as SPCSO1 to SCPSO8.

This SCL file can be further used in an IEC 61850 engineering tool for creating the configuration for the power utility automation system. The SCL file format is according to IEC 61850 Edition 1.

AB123C -> Data Model -> BX -> GGIO1	
LN GGIO1	
Name	**Value**
DO Mod	on
DO Beh	on
DO Health	Ok
DO NamPlt	OMICRON
DO SPCSO1	
DO SPCSO2	
DO SPCSO3	
DO SPCSO4	
DO SPCSO5	
DO SPCSO6	
DO SPCSO7	
DO SPCSO8	
DO Ind1	
DO Ind2	
DO Ind3	
DO Ind4	
DO Ind5	
DO Ind6	
DO Ind7	
DO Ind8	

Figure 11: Binary I/Os modeled as GGIOs in the default configuration

7.8.2 Downloading the configuration for usage with a CMC

To configure a CMC test set to communicate with an *ISIO 200*, a configuration file (GOOSE XML file) can be downloaded from the *ISIO 200*.

To specify the (virtual) inputs and outputs of the CMC that the data in the GOOSE messages shall be mapped to, the virtual input/output group and range of inputs within these groups have to be specified. Selecting group 0 means that the "normal" (non-virtual, physical) inputs and outputs of the CMC are used.

The GOOSE XML file can be imported into the GOOSE Configuration module to configure a CMC test set to communicate with the *ISIO 200*.

The GOOSE published (simulated) by the CMC will be set up with the same identifiers as set in the Subscription page of the *ISIO 200*. When this is properly set prior to downloading the configuration from the *ISIO 200*, the file can be used without further adaptations. Otherwise, the configuration for the CMC has to be edited in the GOOSE Configuration module.

Using multiple *ISIO 200* with one CMC test set

To use multiple *ISIO 200* units with a CMC, this process of importing the GOOSE XML file needs to be done for each *ISIO 200*. To make this work properly, the chosen virtual I/O group and range settings must not overlap. The imported configurations are accumulated in the GOOSE Configuration module.

This is supported by the GOOSE Configuration module starting with OMICRON Test Universe version 3.

7.9 Hardware

7.9.1 Input settings

Threshold and hysteresis

The threshold voltage and the hysteresis can be set. The possible values are given in the technical data (see section 10.3 on page 33).

The inputs become active when the input voltage is higher than the threshold voltage. The inputs become inactive when the input voltage drops below the fallback voltage. The fallback voltage V_{Fb} is always lower than threshold voltage V_{Th} and is calculated from the actual threshold voltage and the hysteresis H as follows:

$$V_{Fb} = V_{Th} - V_{Th} \frac{H}{100\,\%} = V_{Th} \left(1 - \frac{H}{100\,\%}\right)$$

Example: when the threshold is set to 50 V and the hysteresis is set to 20 %, the inputs will fall back at 40 V:

$$V_{Fb} = 50\,\text{V} \left(1 - \frac{20\,\%}{100\,\%}\right) = 50\,\text{V} \cdot 0.8 = 40\,\text{V}$$

Deglitch and debounce time

The deglitch time and debounce time can be set for the binary inputs. For the possible values and the effect of the parameters see the technical data (section 10.3 on page 33).

7.9.2 Input / output status

The I/O status display resembles the display on the front panel of the device (see section 3.1 on page 11). It represents the current status of the binary I/Os of the *ISIO 200*.
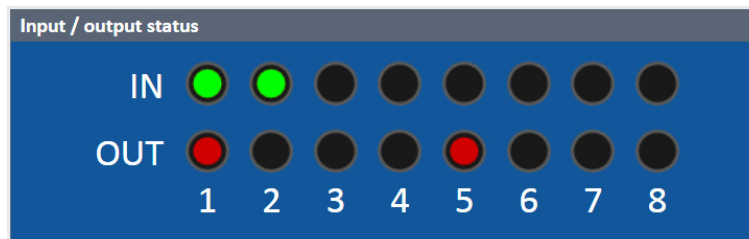
Figure 12: I/O status display

7.9.3 Component information

Some information about the hardware components is displayed:

- CPU board revision
- FPGA firmware
- Binary output firmware
- Binary input firmware

This information may be requested by the technical support for analysis purposes.

7.10   Time

The actual time of the clock in the *ISIO 200* is used to set the time stamp in the headers of published GOOSE messages with changed data (new status number). The following retransmissions have the same time stamp. There is a slight delay (typical 20 to 100 µs) between setting the timestamp and the actual publishing of the GOOSE message through the network interface.

Each connection established between the *ISIO 200* and the browser on a PC has a time limit. When the time is adjusted forward several hours it may happen that the actual time jumps beyond this limit. This results in a termination of the connection and a new login is required.

7.10.1 Internal clock

The time is set manually. The clock relies solely on the free running internal oscillator of the processor board in the *ISIO 200*. Consequently, the setting accuracy is poor and an additional time error will accumulate over time.

The manual setting process may incur an offset of several seconds. The free running internal oscillator has a frequency error of up to 50 ppm, which may result in an additional error of 4.32 seconds per day.

Internal clock configuration

The current device time from the *ISIO 200* is shown on the web interface. The time of the PC (host) can be set to the device by clicking **Get PC time** and applying this.

7.10.2 NTP

The Network Time Protocol (NTP) is widely used and provides time synchronization for many IT applications. The time servers can be in remote networks, since IP is used to exchange the synchronization messages. Only IPv4 is supported by the *ISIO 200*.

The accuracy is good enough for many applications. The achievable accuracy depends heavily on the performance of the network connection between the *ISIO 200* and the time server(s), which cannot be predicted. NTP provides no means for a formal specification. Typical synchronization errors are in the range from 5 to 100 ms.

Up to three NTP servers can be specified as time sources. The servers can be either specified via an IP address or an URL (if DNS is available).

Minpoll and Maxpoll specify the minimum and maximum polling interval. The value in the input field is the exponent to 2 for the interval in seconds. For example, if a value of 5 entered, the *ISIO 200* will poll the NTP time server every $2^5 = 32$ seconds. The possible values are from 4 to 17, resulting in an interval between 16 and 131072 seconds.

7.10.3 PTP

The Precision Time Protocol (PTP) is an advanced method for accurate time synchronization. The supported protocol versions are according to IEEE 1588-2008 and especially the "Power Profile" IEEE C37.238-2011. The achievable synchronization error is below 1 µs when all involved components support PTP accordingly.

The settings are the domain number, which is the same for all PTP clocks the *ISIO 200* shall synchronize with. Domain numbers are in the range from 0 to 127. The VLAN settings are used by the power profile of PTP and determine how the IEEE 802.1Q VLAN tags of outgoing PTP messages are set.

7.11   System

7.11.1 Status

Some general information about the *ISIO 200* system are shown (such as the serial number).

7.11.2 Maintenance

The **Maintenance** box offers some functionality to service the *ISIO 200*:

Reboot

This function reboots the *ISIO 200*. The current configuration is maintained.

Factory reset

This function resets the *ISIO 200* to factory defaults. The current configuration gets lost.

After the reset, the following settings are restored:

- Device finding via OMFIND is enabled, IP addressing mode is Auto-IP.
- The default password is restored as printed on the nameplate of the device.
- The GOOSE configuration is set to the default configuration with the serial number as IED name.
- The VLAN and retransmission parameters of the published GOOSE are reset to default values.
- The input threshold voltage, hysteresis, deglitch and debounce times are reset to defaults.
- Be aware that the peer device for matched pairs cannot be restored by this process and has to be set manually (see section "Matching pairs of *ISIO 200*" on page 20).
- A new self-signed certificate is generated that is certified to the URL "ISIO-<SerialNumber>".

System log

The log can be downloaded, for example for submitting it to the technical support for further analysis.

System snapshot

Click the **Download** button to download a system snapshot containing all configuration settings and the log file. This file includes important information for the technical support in case of problems.

7.11.3 Firmware upgrade

Current version

Displays the firmware version currently installed on the *ISIO 200*.

Keep settings

If this check box is selected, the user specific configuration settings (Network/ GOOSE/ Hardware/ Time) are kept during a software update. Deselect the check box to automatically reset the device configuration to the factory defaults after a software update.

Firmware upgrade

The firmware image on the *ISIO 200* can be upgraded by pressing **Upload** and selecting the correct firmware image file. The update process starts immediately.

This may take up to 10 minutes. Do not disconnect the *ISIO 200* or the computer during this process. The *ISIO 200* automatically restarts after the software update completed.

During the update, the LED S1 is off and LED S2 flashes red. When the update is finished, S2 goes off and S1 lights green. See also section 3.1 on page 11.

If the software update process fails due to any reason, the *ISIO 200* will enter a recovery mode on the next power-up. In this mode, the device provides only a rudimentary web interface (similar to the System page) just allowing for the upload of a software image.

Do not turn off the device during a firmware upgrade. The upgrade process takes several minutes!

7.11.4 Change password

At delivery, each *ISIO 200* has an individual password that is printed on the nameplate.

Changing the password to one different from the one at delivery is an important cyber security measure.

When a factory reset is performed, the password is also reset to the original password at delivery.

7.11.5 Licenses information

Open source license information is displayed to view copyright and license information regarding open source products used in the *ISIO 200* software.

Please refer to section "Open Source Software License Information" on page 31.

8 Resetting the device

This section describes the operating procedures that can be performed directly on the *ISIO 200* itself.

8.1 Reboot

To reboot the *ISIO 200*, perform the following steps:
1. Press the Reset button and release it immediately.
   The device starts the reboot.
2. The S1 status LED goes off for approximately 1 second.
3. The S2 status LED lights up red during the boot process
4. After approximately 15 seconds, the S2 LED goes off and the S1 LED lights up green.
5. The device has successfully rebooted and is ready for operation.

A reboot of the *ISIO 200* can also be initiated via the web interface (see section 7.11.2 on page 28).

8.2 Reset to factory defaults

To reset the *ISIO 200* to factory defaults, perform the following steps:
1. Press the Reset button and keep it pressed.
2. The S1 status LED goes off.
3. After approximately 5 seconds, the S1 and S2 LEDs lights up.
   Keep the button pressed and wait approximately 10 seconds until only the S2 LED lights up red.
4. Release the Reset button.
5. After approximately 15 seconds, the S2 LED goes off and the S1 LED lights up green.
6. The device now has the factory default configuration settings and is successfully rebooted.

A reset to factory defaults of the *ISIO 200* can be also initiated via the web interface. For more information about that and for details about the status of the parameters after a reset see section "Firmware upgrade" on page 28.

8.3 Recovery mode

Under normal circumstances it is not necessary to use this mode. This feature is only required if a software update initiated via the web interface fails.
1. Press the Reset button and keep it pressed.
2. The S1 status LED goes off for approximately 5 seconds.
3. Release the Reset button as soon as the S1 (green) and S2 (red) LED lights up.
4. After approximately 30 seconds, the S1 LED flashes green to indicate the recovery mode.
5. Open the OMICRON Device Browser and right-click the *ISIO 200* device. **Set Network Configuration …** and select the **Open Web Interface** from the context menu. The device provides a rudimentary web interface, allowing for an upload of a software image.
6. The firmware image on the *ISIO 200* can be upgraded by pressing **Upload** and selecting the correct firmware image file. The update process starts immediately and may take several minutes. Do not disconnect the *ISIO 200* or the computer during this process.
   The *ISIO 200* automatically restarts after the software has installed completely.

9   Open source software license information

Parts of the *ISIO 200* software are under OMICRON license, other parts are under open source software licenses. For the complete licensing information on the open source software, please launch the *ISIO 200* web interface and click the License Information hyperlink on the system page.

The open source code is available on the Internet via www.omicron.at/opensource.

10 Technical data

10.1 Power supply

10.1.1 Power over Ethernet

Power over Ethernet (PoE): ETH	
PoE class	Power over Ethernet (PoE); Class 2 powered device according to IEEE 802.3af
Power consumption	< 5 W
Ethernet type	10/100Base-TX (10/100Mbit, twisted pair, auto-MDI/MDIX or auto-crossover)
Status indication	Green LED: physical link present Yellow LED: traffic on interface
Connector	RJ45

10.1.2 Power input

External DC power input: POWER	
Nominal DC input voltage	18 V ... 57 V
Power consumption	< 5 W
Connector	Terminal block Maximum conductor cross section 1.5 mm²
Insulation	Product safety according to IEC 61010-1 and IEC 60255-27 only achieved by using an external power supply unit that complies with the SELV standard.

10.2 Insulation coordination

Insulation coordination	
Protection class	Class II (double insulated)
Pollution degree	2
Insulation of functional groups POWER and ETH on front panel from each other	Working insulation Clearance: > 2 mm Creepage: > 2 mm

10.3 Binary inputs

Binary inputs: BINARY IN 1-8		
Number of binary inputs	8	
Number of potential groups	2 (BINARY IN 1-4 and BINARY IN 5-8)	
Rated input voltage	250 V	
Sampling frequency	10 kHz	
Time resolution	100 µs	
Threshold 　Range 　Resolution 　Error	 10 ... 240 V; configurable via web interface; default: 18 V 1 V < 5 % of reading + 250 mV offset	
Hysteresis 　Range 　Resolution	 5 ... 50 % of threshold voltage; configurable via web interface; default: 10 % 1 %	
Deglitch time 　Range 　Resolution	 100 µs ... 100 ms; configurable via web interface; default: 0.5 ms 100 µs	
Debounce time 　Range 　Resolution	 0 ... 100 ms; configurable via web interface; default: 1 ms 100 µs	
Input impedance	148 kΩ	
Measurement category	CAT II / 250 V (rms)	IEC 61010-2-030
Overvoltage category	III	IEC 60255-27
Connector	One terminal block for each potential group Maximum conductor cross section 2.5 mm²	
Insulation	Two reinforced insulated binary input groups	

Deglitching input signals

In order to suppress short spurious pulses a deglitching algorithm could be configured. The deglitch process results in an additional dead time and introduces a signal delay. In order to be detected as a valid signal level, the level of an input signal must have a constant value at least during the deglitch time. The figure below illustrates the deglitch function.
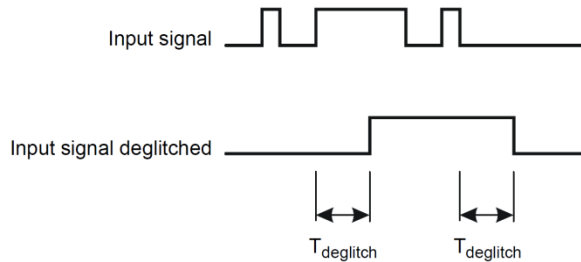
Figure 13: Signal curve, deglitching input signals

Debouncing input signals

For input signals with a bouncing characteristic, a debounce function can be configured. This means that the first change of the input signal causes the debounced input signal to be changed and then be kept on this signal value for the duration of the debounce time.

The debounce function is placed after the deglitch function described above and both are realized by the firmware of the *ISIO 200* and are calculated in real time.

The figure below illustrates the debounce function. On the right-hand side of the figure, the debounce time is too short. As a result, the debounced signal rises to "high" once again, even while the input signal is still bouncing and does not drop to low level until the expiry of another period $T_{debounce}$.
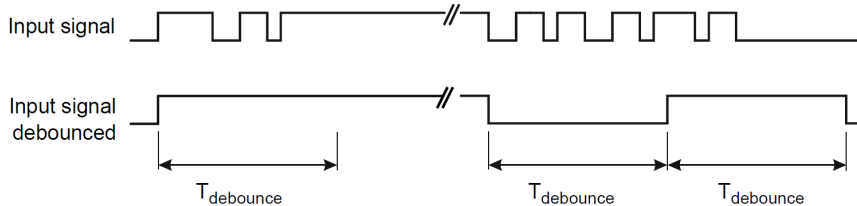
Figure 14: Signal curve, debounce input signals

10.4   Binary outputs

Binary outputs: BINARY OUT 1-8		
Number of binary outputs	8	
Number of potential groups	2 (BINARY OUT 1-4 and BINARY OUT 5-8)	
Type	Potential-free contacts; GOOSE controlled	
AC loading	V_{max} 250 V; I_{max} 8 A; S_{max} 2000 VA	
DC loading	V_{max} 250 V; I_{max} 8 A; P_{max} 50 W (refer to load limit curve)	
Carry capacity	5 A continuous @ 60 °C	
Electrical lifetime	100 000 switching cycles at 230 V AC / 8 A and resistive load	
Total make time	< 6 ms	
Total break time	< 3 ms	
Bounce time	approximately 0.5 ms	
Overvoltage category	II	IEC 61010-1
	III	IEC 60255-27
Connector	One terminal block for each potential group. Maximum conductor cross section 2.5 mm²	
Insulation	Two reinforced insulated binary output groups	

The diagram below shows the load limit curve for DC voltages. For AC voltages, a maximum power of 2000 VA is achieved.
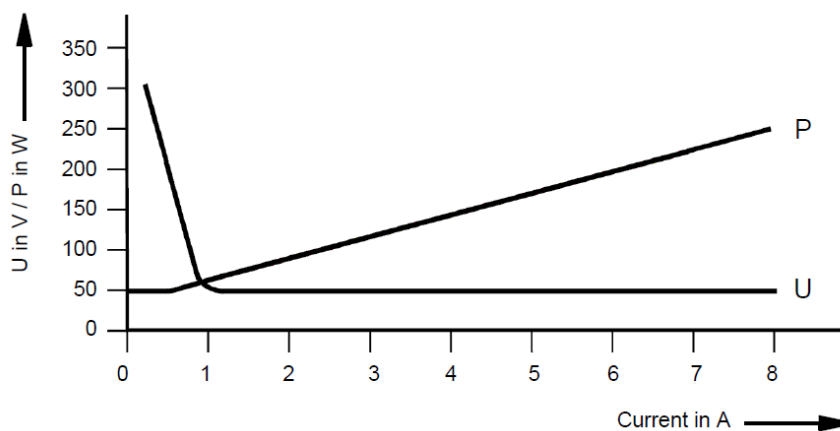

Figure 15: Load limit curve for relays on the binary outputs with DC voltages

10.5   Communication

10.5.1 Protocols

Protocols	
Internet Protocol	IPv4; IETF RFC 791
Hypertext Transfer Protocol	HTTPS; IETF RFC 2818
GOOSE	IEC 61850-7; IEC 61850-8-1
Network Time Protocol (NTP)	NTPv4; IETF RFC 5906
Precision Time Protocol (PTP)	IEEE 1588-2008; IEEE C37.238-2011 (Power Profile)
Zeroconf	mDNS; DNS-SD and RFC 3927/IPv4LL (Avahi)
OMFIND	OMICRON device finding protocol (proprietary)

10.5.2 IEC 61850 GOOSE

GOOSE	
Number of GOOSE messages	Maximum 8 published and 8 subscribed; default: 1 published and 1 subscribed
Binary input state change to publishing timing	850 µs (typical); < 1.1 ms for 99.99 % of all status changes
Received status change to binary output activation timing	5.5 ms (typical); < 6.0 ms for 99.99 % of all status changes
Binary input to binary output between two devices	6.1 ms (typical); < 6.5 ms for 99.99 % of all status changes
Retransmission interval	2 ms to 60 000 ms; initial value < final value; default: 8 ms / 4096 ms
VLAN	IEEE 802.3Q tags. VLAN ID and priority selectable; default: VLAN ID: 0 / priority: 4

Test conditions for GOOSE timing:

Publishing: default GOOSE configuration, deglitch time 100 µs, wetting voltage 14 V, threshold voltage 10 V, response on falling slope

Subscribing: default GOOSE configuration, response on status change to contact closed, all output contacts open, four contacts simultaneously closing

Binary IN to OUT: as for publishing and subscription, one switch between devices

10.6   Time synchronization

Time synchronization	
Internal clock	Time source is the free running internal oscillator
Accuracy	No accuracy specifications
Network Time Protocol (NTP)	
Accuracy	Typical achievable errors are in the range from 5 ms to 100 ms
Precision Time Protocol (PTP)	
Accuracy	Maximum synchronization error 1 µs (IEEE C37.238)

10.7   Environmental conditions

10.7.1 Climate

Climate		
Ambient temperature for operation	-20 °C ... +55 °C recommended (+70 °C for 96 h)[1]	

Storage and transportation
  Cold Temperature
  Dry Heat
	-40 °C ... +85 °C
	-40 °C for 96 h
	+85 °C for 96 h
		
		IEC 60068-2-1
		IEC 60068-2-2

Maximum altitude	2000 m	
Humidity	5 % ... 95 % relative humidity; no condensation	
Climate Damp Heat	6 cycles: 12 h 25 °C + 12 h 55 °C; 95 % r.H.	IEC 60068-2-30

10.7.2 Shock and vibration

Dynamics	
Vibration	Tested according to IEC 60068-2-6 and IEC 60255-21-1 (Class 2)
Response	frequency range 10 ... 150 Hz; 1 g; 1 sweep cycle per axis
Endurance	frequency range 10 ... 150 Hz; 2 g; 20 sweep cycles per axis
Shock	Tested according to IEC 60068-2-27 and IEC 60255-21-2 (Class 2)
Response	10 g / 11 ms; half-sinusoid; 3 pulses in each direction
Withstand	30 g / 11 ms; half-sinusoid; 3 pulses in each direction
Bump test	20 g / 16 ms; half-sinusoid; 1000 pulses in each direction

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[1] Operation beyond the recommended temperature range will affect durability.

10.8   Mechanical data

Mass, dimensions and protection	
Mass	800 g
Dimensions W x H x D	170 mm x 50 mm x 125 mm (including DIN rail mounting clip)
Ingress Protection rating (IP code)	IP40 according to IEC 60529

10.9   Cleaning

To clean the *ISIO 200*, use a cloth dampened with isopropanol alcohol or water. Prior to cleaning, always unplug all connectors so that all hazardous life parts are disconnected and the device is turned off.

10.10 Safety standards, Electromagnetic Compatibility, certificates

CE conformity, requirements	
C€	The product adheres to the specifications of the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) Directive 2004/108/EC and the low voltage Directive 2006/95/EC.

Electromagnetic Compatibility (EMC)		
Emission		
Europe	EN 61326-1; EN 60255-26; EN 61000-6-4	
International	IEC 61326-1; IEC 60255-26; IEC 61000-6-4	
USA	FCC Subpart B of Part 15 Class A	
ISM devices	Radiated: 30 MHz – 1 GHz Conducted: 150 kHz – 30 MHz	EN 55011/22 IEC 60255-25 FCC, 47 CFR Part 15, Class A
Technology equipment	Radiated: 1 GHz – 6 GHz Radiated: 1 GHz – 5 GHz	EN 55022, Class A FCC, 47 CFR Part 15, Class A
Immunity		
Europe	EN 61326-1; IEC 60255-26; EN 61000-6-2	
International	IEC 61326-1; IEC 60255-26; IEC 61000-6-2	
Electro Static Discharge	Contact discharge: 6 kV Air discharge: 8 kV	IEC 61000-4-2, Level 3 IEC 60255-22-2
Electromagnetic Fields	10 V/m, 80 % AM, 1 kHz Sinus 80 MHz – 6 GHz horizontal/vertical	IEC 61000-4-3, Level 3 IEC 60255-22-3

Electromagnetic Compatibility (EMC) – *cont.*		
Burst	Binary I/O: 4 kV (peak) Power: 2 kV (peak) Communication: 2 kV (peak)	IEC 61000-4-4, Level 4 IEC 60255-22-4
Surge	Binary I/O: 4 kV (I/O-GND) / 2 kV (I/O-I/O) Power: 2 kV (I/O-GND) / 1 kV (I/O-I/O) Communication: 1 kV (I/O-GND)	IEC 61000-4-5, Level 4 IEC 60255-22-5
Conducted Disturbance	0.15 MHz – 80 MHz, 10 V (unmod.) 80 % AM (1 kHz) Binary I/O Power Communication	IEC 61000-4-6, Level 3 IEC 60255-22-6
Safety standards		
Europe	EN 61010-1; EN 60255-27 EN 60950-1 (Insulation of ETH and SELV interfaces)	
International USA Canada	IEC 61010-1; IEC 60255-27 UL 61010-1; UL 60255-27 CAN/CSA-C22.2 No 61010-1-04	
Insulation test		
Dielectric strength	Binary I/O: 4000 V, 1.2/50 µs Power: 2000 V, 1.2/50 µs Communication: 1500 V (DC)	IEC 61010-1 IEC 60255-27

Glossary

CID	Configured IED Description
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
GCB	GOOSE Control Block
GOOSE	Generic Object Oriented Substation Event
EMC	Electromagnetic Compatibility
ESD	Electro Static Discharge
HTTPS	Hypertext Transfer Protocol Secure
ICD	IED Capability Description
IED	Intelligent Electronic Device
IID	Instantiated IED Description
IP	Internet Protocol
ISM devices	Industrial, Scientific and Medical devices
LD	Logical Device
MAC address	Media Access Control address
NTP	Network Time Protocol
ODB	OMICRON Device Browser
OMFIND	Protocol for finding devices on an Ethernet network
PoE	Power over Ethernet (IEEE 802.3at)
PTP	Precision Time Protocol (IEEE 1588, IEEE C27.238)
RTU	Remote Terminal Unit
SAS	Substation Automation System
SCL	Substation Configuration Language
SELV	Safety Extra Low Voltage
stVal	Status Value
TAL	Time allowed to live of a GOOSE message (timeAllowedtoLive)
URL	Uniform Resource Locator ("Internet address")
VLAN	Virtual Local Area Network
XML	Extensible Markup Language

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