General Information

Usage of the Document

This document serves as a guide and also as a reference work. Familiarize yourself with the contents of the document to operate the device efficiently. The document must be available at all times to the personnel who are operating the device.

Customer Support

If you have any questions, your Regatron AG sales partner will be pleased to be of assistance. However, you can also reach Regatron Customer Support at tc.support@regatron.ch.

For more information on the Regatron Customer Support see section 6 Support.
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1 General Safety Information

1.1 Warning Symbols

Throughout this document the following symbols are used, wherever necessary, to indicate and specify hazardous or potentially hazardous situations:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td>Hazardous situation which, if not avoided, will result in death or serious injury</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>Hazardous situation which, if not avoided, could result in death or serious injury</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION" /></td>
<td>Hazardous situation which, if not avoided, could result in minor or moderate injury</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION" /></td>
<td>Hazardous situation which, if not avoided, could result in damage to the product or other items in its surroundings</td>
</tr>
<tr>
<td><img src="image" alt="Hazard due to high voltage" /></td>
<td>Hazard due to high voltage</td>
</tr>
<tr>
<td><img src="image" alt="Hazard due to suspended load" /></td>
<td>Hazard due to suspended load</td>
</tr>
<tr>
<td><img src="image" alt="Hazard due to hot surface" /></td>
<td>Hazard due to hot surface</td>
</tr>
<tr>
<td><img src="image" alt="Hazard due to a substance or mixture of substances (H361, H373)" /></td>
<td>Hazard due to a substance or mixture of substances (H361, H373)</td>
</tr>
<tr>
<td><img src="image" alt="Hazard due to a substance or mixture of substances (H302)" /></td>
<td>Hazard due to a substance or mixture of substances (H302)</td>
</tr>
</tbody>
</table>
1.2 **Ordinances and Regulations**

Follow the mounting and installation instructions during electrical installation!

In particular, in the countries of the European Union the following standard applies:

EN 50178 Electronic equipment for use in power installations

If you want to use the electrical power supply in special applications, you must comply with the related standards and health and safety regulations.

Due to the high operating voltage and the high output voltages, an industrial electrical power supply represents a mortal hazard.

To avoid serious injuries or significant damage, only appropriately qualified personnel who are familiar with industrial electrical power supplies are allowed to work on the devices. These individuals must carefully read these operating instructions prior to installation and commissioning and follow the safety instructions.

Electronic devices are in principle not fail-safe. The user is responsible for ensuring that the electrical power supply, mains supplies and loads connected to it are placed in a safe state in the event of a failure of the device.

1.3 **Categorization of the hazard Areas**

The assessment of the effects of hazards from low-voltage systems with a flow of energy for supply and possibly regeneration is divided into the following areas:

- Personnel Area (1.3.1)
- Systems and Material Area (1.3.2)
- Mains Connection Area (1.3.3)
- Surrounding Area (1.3.4)
- Area related to Interaction with the Device (1.3.5)
1.3.1 Personnel Area

The utmost attention is to be paid to the hazards for individuals. There are various risks and hazards, the most important of which are mentioned here.

1.3.1.1 Electric shock

The system can produce electrical potentials that can be dangerous or even fatal for individuals. During work on the system the following guidelines are to be observed:

- Work in electrically isolated state
  
  This is the recommended way of working, it should be rigorously applied during all connection and wiring work. Follow the rules:
  
  - Electrically isolate.
  - Secure against switching back on.
  - Discharge and short-circuit capacitors, disconnect and isolate batteries.
  - Verify the voltage free status by measurement.
  - Connect to earth.
  - Report and instruct.

- Work in the vicinity of live parts
  
  In these circumstances an increased hazard potential is to be expected. Minimize the risks by means of:
  
  - Guards
  - Covers
  - Insulating encapsulation, cladding
  - Imposed separation by means of mechanical features, protective grilles
  - Supervision, reporting

- Work on live equipment
  
  It is imperative that this form of working is avoided. If it cannot be avoided, careful work preparation is essential. Pay attention to the following:
  
  - The personnel must be specially trained (see NIV Art 26).
  - Work in accordance with recognized specialist methods.
  - Controlled personal protective equipment must be available (passive protection).
  - Organization of the working areas.
  - Supervision and preparatory measures (active protection).
  - Use appropriate protection against physical contact throughout.
  - Set up a suitable emergency stop chain and test it at regular intervals.
  - Mark all wires and cables to prevent mistakes.
1.3.1.2 Electrical heating

TopCon power supply systems operate with significant amounts of energy. High currents can cause heating of cables and wires. In particular, during unmonitored endurance tests insulation fires and short-circuits may be caused.

- At particular risk are connectors, switchgear and cable terminals. Check these parts particularly carefully and at regular intervals.
- Use wiring material suitable and stipulated for your application with the related insulation class.
- Monitor your system actively or passively using appropriate sensors or by monitoring parameters.

1.3.1.3 Arcing and sparking on opening Contacts

In relation to AC systems, note that on opening a circuit through which a current is flowing, arcing with very high energies can be produced depending on the inductance!

In some circumstances this arcing can result in burns, damage to the eyes as well as damage, destruction or fire on parts of the system. The usage of normal mains contactors as isolating devices in AC circuits is recommended! In case of doubt contact the related manufacturer. Take into consideration that the protective devices on the TopCon system cannot detect an arc as a fault condition, as this situation may be a required function.

1.3.1.4 Mechanical Injury

As on all electrical installations, mechanical injuries to the head and hands may be caused on removing and fitting covers, wire and cable connections. Always use the correct tool. If necessary protect the head and hands against injuries due to cuts and impacts.

1.3.1.5 Chemical Injury

While handling with cooling liquid, open doors and windows and ensure the room is well ventilated also on the ground level. Avoid work which leads to the formation of aerosols. Use, if necessary the personal safety equipment:

- Use the respiratory protection at short time and existing low concentrations of vapor and aerosols. Use breathing apparatus with independent air supply at long time and high concentrations of vapor and aerosols.
- Use protective gloves which are resistant against acids and solvents and safety gloves to avoid direct skin contact.
1.3.2 Systems and Material Area

1.3.2.1 Fire

TopCon power supply systems are built from non-combustible materials exclusively.

In case of fire, electrically isolate the system immediately, on the one hand to interrupt the supply of energy and on the other hand to shut down the fans.

Fight the fire from bottom to top in accordance with the rules in your organization using suitable firefighting equipment (CO₂ fire extinguisher). If possible use fire extinguishers with asphyxiation action to keep the secondary damage low.

1.3.2.2 Electromagnetic Fields

Like any electrical system, TopCon systems produce electrical and magnetic fields. However, these fields comply fully with the usual standards.

Note, however, that particularly the EM fields from your wires and equipment connected could nevertheless produce interference on objects in the immediate area.

- Keep data carriers and PC-based measuring environments at an adequate distance from live wires to prevent interference and data loss.
- Protect highly-sensitive sensors and instruments.
- Test effects on communication networks, in particular radio networks.
- Make individuals with electronic implants aware that implants may be affected.

1.3.2.3 Noise and Noise Level

The inductive elements as well as the fans on the TopCon low voltage system produce a lower or higher noise level dependent on the operating mode. However, in the immediate vicinity of the cabinet this noise is under the tolerance limit that would make acoustic protection equipment necessary.

The usage of acoustic protection equipment or acoustic insulation measures can be necessary in specific circumstances.

1.3.2.4 Mechanical Damage

Incorrect operation of the systems can result in mechanical damage to the downstream equipment and systems. In particular, on the supply of power to drives it is to be ensured, that excessively high speeds cannot result in load shedding. The monitoring of the maximum speed with intervention in the safety chain is recommended above all if the system runs unmonitored.
1.3.2.5 Handling Storage Systems containing large Amounts of Energy

Modern energy storage systems are able to absorb very large amounts of energy. This situation has the following consequences:

- The cabling should not just comply with the maximum charging and discharging currents to be expected, to some extent significantly higher peak currents are to be expected during switching processes.
- A short circuit or failure can be very serious in the case of stores containing large amounts of energy. Due to the high currents serious injuries and serious damage can be caused. The following, incomplete list indicates some of this damage:
  - Burning of wires and connectors
  - Sparking
  - Fires, insulation fires
  - Arcing, welding
  - Electric shocks
- Never short-circuit energy storage systems to discharge them! Always use a suitable discharge resistor of appropriate power rating!
- Visibly secure a discharged energy store using a short-circuit bridge.
- Always monitor the maximum storage voltage, also during practical test operation.
- Use a device that clearly indicates the charge state of the energy store, e.g. by monitoring the voltage.

1.3.3 Mains Connection Area

When a TopCon power supply device is switched on, there may be an uneven load on the three phases; this uneven load may cause older residual current circuit breakers to trip. Here a modern make of residual current circuit breaker is to be used that will tolerate such asymmetries during the switch-on process.

1.3.4 Surrounding Area

TopCon power supply devices are generally forced-air cooled (some are water-cooled in addition). Despite the very high efficiency, a power loss occurs in the components that must be dissipated in the form of heat to the surroundings. The energy is dissipated with the aid of forced ventilation to the rear of the TopCon device. It is to be ensured that the rooms in which TopCon power supply devices operate are cool so that the heat produced can actually be removed.

It is to be ensured that there are no undesirable effects (e.g. stirring up of dust or sand, deformation due to the action of heat etc.) due to the flow of air and the heat, which at high load may be powerful.
1.3.5  Area related to Interaction with the Device

Compliance with the design data for the specific device is a prerequisite for malfunction-free operation. Load systems can have significant effects on the power source. The following points are to be noted:

- The maximum voltage specified must not be exceeded.
- Protective measures must be provided against voltage spikes on the load side and their function must be monitored (voltage spikes could damage the filter capacitors and semiconductors in the device).
- Periodic over currents are to be avoided.
- The ripple currents produced on the load side are to be monitored to avoid overloading filter capacitors; in case of doubt ask the manufacturer.

The device is always to be operated within the permissible temperature range. High temperatures will significantly reduce the service life of various components.
2 Introduction

This section includes the following subsections:

- Range of Application (2.1)
- Operation (2.2)
- Product Variants (2.3)

2.1 Range of Application

The full 4-quadrant grid simulator TC.ACS allows for all relevant testing according to the grid-feed-in regulations (CENELEC, DIN, IEC). It can be operated in the following modes:

- Waveform Generator Mode (2.1.1)
- Amplifier Mode (2.1.2)
- Load Simulation Mode (Option) (2.1.3)

Generally, the device is capable of 4-Quadrant Operation (2.1.4).

The TC.ACS can be operated only in connection with an external cooling system (e.g. the liquid to air heat exchanger TC.LAE).

2.1.1 Waveform Generator Mode

There are the following kinds of the waveform generator mode:

- Basic Waveform Generator Mode (2.1.1.1)
- Full Waveform Generator Mode (Option) (2.1.1.2)

2.1.1.1 Basic Waveform Generator Mode

In the basic waveform generator mode the TC.ACS device simulates a grid. I.e. it generates a signal waveform that resembles the signal given by a grid, i.e. a sine wave. This signal can be configured and controlled via ACSControl.

2.1.1.2 Full Waveform Generator Mode (Option)

In the full waveform generator mode the TC.ACS device simulates a grid or any other kind of electrical source. I.e. it generates signal functions that resemble those being generated by the respective source. Here ACSControl allows to generate all kinds of signal waveforms and sequences of these in order to represent the influences of various factors (e.g. failures or interferences in the power system).
2.1.2 Amplifier Mode

In the amplifier mode the TC.ACS device works as a triphase voltage or current (option) amplifier. I.e. it receives external signals via its analogue interfaces for each phase. These signals are amplified and then transferred to the output. Here any device, which creates electrical signals, can be used as an external signal generator.

2.1.3 Load Simulation Mode (Option)

In the load simulation mode the TC.ACS device simulates loads and their properties within specified RLC-circuit topologies.

The load simulation mode is an optional feature. It needs to be enabled via key code and an external hardware filter may be needed in some applications (see Application Notes). Contact Regatron Customer Support, if necessary.

2.1.4 4-Quadrant Operation

The TC.ACS supports the feeding mode and the regenerative mode as a part of 4-Quadrant operation modes. Here the sign of the power determines the direction of the energy flow, and hence whether Feeding Mode (positive Power) or Regenerative Mode (negative Power) is active.

Alternating grids change between feeding mode and regenerative mode according to their reactive power by phase shifting between voltage and current.

2.1.4.1 Feeding Mode (positive Power)

In the feeding mode energy flows from the line to the device under test (DUT):

2.1.4.2 Regenerative Mode (negative Power)

In the regenerative mode energy flows from the device under test (DUT) to the line:
2.2 Operation

The TC.ACS device can be operated via the software ACSControl exclusively.

The software ACSControl is included in the scope of delivery.

2.3 Product Variants

The TC.ACS product range varies with regard to the following aspects:

- Power
- Load side voltage
- Line side voltage
- Product options

Detailed information on the possible product variants is given in the related datasheet.

For a specific device the combination of all these specifications is given on the type plate, i.e. in the model identifier:

Fig. 1: Model identifier (example)

Not every option is labelled in the model identifier. The type plate is placed on the rear of the device.
3 Interfaces, Controls and Displays

For more information on any of the individual interfaces see the related data sheet. There is a specific data sheet with respect to the optional interfaces.

3.1 Interfaces, Controls and Displays on the Front Side

![Fig. 2: Interfaces, displays and controls on the front side](image)

<table>
<thead>
<tr>
<th>Interfaces, displays and controls on the front side</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Device address selection switch</td>
</tr>
<tr>
<td><em>NOTE:</em> The selection switch is currently not used.</td>
</tr>
<tr>
<td><strong>2</strong> LED indication</td>
</tr>
<tr>
<td>indicates the current status of the device (for the possible indications and their meanings see 3.1.1)</td>
</tr>
<tr>
<td><strong>3</strong> Main switch, circuit breaker</td>
</tr>
</tbody>
</table>
3.1.1 LED Indications and their Meanings

The following LED patterns indicate the following states of the device:

<table>
<thead>
<tr>
<th>Indication</th>
<th>State</th>
</tr>
</thead>
</table>
| ![LED Patterns](image) | Power-up  
The device is powering up (including internal tests). There is no energy flow on the load side.  
*NOTE: This is an intermediate state. After successfully powering up, the standby state is automatically assumed.* |
| ![LED Patterns](image) | Standby  
The device is running. There is no energy flow on the load side. |
| ![LED Patterns](image) | Ready to switch on  
The device is running and the intermediate circuit is charged. There is no energy flow on the load side. |
| ![LED Patterns](image) | Switched on  
The device is running and power is supplied to drawn from the load. There is energy flow on the load side. |
| ![LED Patterns](image) | Update  
A firmware update is being performed. There is no energy flow on the load side.  
*NOTE: This state can only be entered from the state standby and it can only be exited by restarting the device.* |

In any case, a flashing LED (Emergency Stop) for ERROR indicates an error.

*In case of an error the device automatically switches to standby state.*
3.2 Interfaces on the Rear Side

*Fig. 3: Interfaces on the rear side*

<table>
<thead>
<tr>
<th>Interfaces on the rear side</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 X112-2</td>
</tr>
<tr>
<td>2 X601/X602</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2 PSLDIG8IOST</td>
</tr>
<tr>
<td>Interfaces on the rear side</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>X605</strong></td>
</tr>
<tr>
<td><strong>X604</strong></td>
</tr>
<tr>
<td><strong>X603</strong></td>
</tr>
<tr>
<td><strong>X607</strong></td>
</tr>
<tr>
<td><strong>X608</strong></td>
</tr>
<tr>
<td><strong>X620</strong></td>
</tr>
<tr>
<td><strong>X621</strong></td>
</tr>
<tr>
<td><strong>X609</strong></td>
</tr>
<tr>
<td><strong>NOTES:</strong></td>
</tr>
<tr>
<td><em>To use the interface you need a specific plug.</em></td>
</tr>
<tr>
<td>- <strong>Manufacturer:</strong> PHOENIX CONTACT AG</td>
</tr>
<tr>
<td>- <strong>Order number:</strong> 1430048</td>
</tr>
<tr>
<td>- <strong>REGATRON item number:</strong> 452-01244</td>
</tr>
<tr>
<td><em>For the pin definition see [3.2.3]</em></td>
</tr>
<tr>
<td><strong>4</strong></td>
</tr>
<tr>
<td><strong>5</strong></td>
</tr>
<tr>
<td><strong>6</strong></td>
</tr>
<tr>
<td><strong>7</strong></td>
</tr>
<tr>
<td><strong>8</strong></td>
</tr>
<tr>
<td><strong>NOTE:</strong> The figure above shows the standard version. As an option, the following interfaces may be replaced by a senseboard (see [3.2.2]).</td>
</tr>
<tr>
<td><strong>X606</strong></td>
</tr>
<tr>
<td><strong>NOTE:</strong> <em>This interface requires a cable with braided shield.</em></td>
</tr>
<tr>
<td><strong>X613</strong></td>
</tr>
<tr>
<td><strong>X612</strong></td>
</tr>
<tr>
<td><strong>X611</strong></td>
</tr>
<tr>
<td><strong>X610</strong></td>
</tr>
<tr>
<td><strong>X611</strong></td>
</tr>
<tr>
<td><strong>X610</strong></td>
</tr>
</tbody>
</table>
3.2.1 DIG8IOST (optional)

The DIG8IOST provides additional digital inputs and outputs, which are programmable via the software ACSControl.

![Fig. 4: Interfaces of the DIG8IOST (optional)]

<table>
<thead>
<tr>
<th>Interfaces on the DIG8IOST (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 X640 Relay contacts (output) (for pin definitions see 3.2.1.1)</td>
</tr>
<tr>
<td>2 X641 Digital output (for pin definitions see 3.2.1.2)</td>
</tr>
<tr>
<td>3 X642 Digital input (for pin definitions see 3.2.1.3)</td>
</tr>
<tr>
<td>4 X645 Auxiliary voltage supply +24 V (for pin definitions see 3.2.1.4)</td>
</tr>
</tbody>
</table>

### 3.2.1.1 Pin Definitions of X640 Relay Contacts (output)

<table>
<thead>
<tr>
<th>Order of Pins</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relay 8/14</td>
<td>Relay 8 NO, parallel to digital output 8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Relay 8/12</td>
<td>Relay 8 NC, parallel to digital output 8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Relay 8/11</td>
<td>Relay 8 COM, parallel to digital output 8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Relay 7/14</td>
<td>Relay 7 NO, parallel to digital output 7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Relay 7/12</td>
<td>Relay 7 NC, parallel to digital output 7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Relay 7/11</td>
<td>Relay 7 COM, parallel to digital output 7</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Relay 6/14</td>
<td>Relay 6 NO, parallel to digital output 6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Relay 6/12</td>
<td>Relay 6 NC, parallel to digital output 6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Relay 6/11</td>
<td>Relay 6 COM, parallel to digital output 6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Relay 5/14</td>
<td>Relay 5 NO, parallel to digital output 5</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Relay 5/12</td>
<td>Relay 5 NC, parallel to digital output 5</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Relay 5/11</td>
<td>Relay 5 COM, parallel to digital output 5</td>
<td></td>
</tr>
</tbody>
</table>
### 3.2.1.2 Pin Definitions of X641 digital Output

<table>
<thead>
<tr>
<th>Order of Pins</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output 1</td>
<td>Digital output 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Output 2</td>
<td>Digital output 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Output 3</td>
<td>Digital output 3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Output 4</td>
<td>Digital output 4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Output 5</td>
<td>Digital output 5, parallel to relay 5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Output 6</td>
<td>Digital output 6, parallel to relay 6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Output 7</td>
<td>Digital output 7, parallel to relay 7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Output 8</td>
<td>Digital output 8, parallel to relay 8</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2.1.3 Pin Definitions of X642 digital Input

<table>
<thead>
<tr>
<th>Order of Pins</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input 1</td>
<td>Digital input 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Input 2</td>
<td>Digital input 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Input 3</td>
<td>Digital input 3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Input 4</td>
<td>Digital input 4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Input 5</td>
<td>Digital input 5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Input 6</td>
<td>Digital input 6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Input 7</td>
<td>Digital input 7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Input 8</td>
<td>Digital input 8</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2.1.4 Pin Definitions of X645 auxiliary Voltage

<table>
<thead>
<tr>
<th>Order of Pins</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND Ext</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GND Ext</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>+24V Ext</td>
<td>+24VDC input (needs to be supplied for the interface to work)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+24V Ext</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>+24V Aux</td>
<td>+24VDC auxiliary power, output</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>+24V Aux</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2.2 Senseboard (optional)

The senseboard allows to measure the voltage directly at the load. Thus the voltage can be controlled more accurately and the voltage drop over the load cables can be compensated.

Fig. 5: Senseboard (optional)

<table>
<thead>
<tr>
<th>Interfaces on the senseboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1   X606 Service interface RS232 (only used for software update)</td>
</tr>
<tr>
<td>NOTE: This interface requires a cable with braided shield.</td>
</tr>
<tr>
<td>2   X614 Digital input interface (currently not supported)</td>
</tr>
<tr>
<td>3   X615 Sense input interface</td>
</tr>
</tbody>
</table>

3.2.3 Pin Definition of Interface X609

<table>
<thead>
<tr>
<th>Order of Pins</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AIN1</td>
<td>Analog input 1 (filtered or unfiltered)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AIN2</td>
<td>Analog input 2 (filtered or unfiltered)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AIN3</td>
<td>Analog input 3 (filtered or unfiltered)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AIN4</td>
<td>Analog input 4 (filtered or unfiltered)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GNDA_ISO</td>
<td>Analog ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>+10V_ISO</td>
<td>+10V reference voltage</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-10V_ISO</td>
<td>-10V reference voltage</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GNDA_ISO</td>
<td>Analog ground</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>AOUT1</td>
<td>Analog output 1 (unfiltered)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>AOUT2</td>
<td>Analog output 2 (unfiltered)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AOUT3</td>
<td>Analog output 3 (unfiltered)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>AOUT4</td>
<td>Analog output 4 (unfiltered)</td>
<td></td>
</tr>
</tbody>
</table>
4 Installation and Commissioning

4.1 Overview

The installation and commissioning of the TC.ACS includes the following steps:

- Case Installation (4.3)
- Electrical Installation (4.4)
- Connecting a Cooling System (4.5)
- Connecting a PC (4.6)
- Starting the TC.ACS (4.7)
- Running a Function Test (4.8)

4.2 Site Conditions

**CAUTION** Electric surge!
The system is designed for use in LPZ1 (Lightning Protected Zone 1).

**CAUTION** Overheating!
Make sure that the warm outlet air is not drawn back into the system.

<table>
<thead>
<tr>
<th>Site conditions for TC.ACS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance at the front</strong></td>
</tr>
<tr>
<td>(to the nearest wall or large surface area body)</td>
</tr>
<tr>
<td>For access to the front as well as for drawing in the cooling air</td>
</tr>
<tr>
<td><strong>Distance at the rear</strong></td>
</tr>
<tr>
<td>(to the nearest wall or large surface area body)</td>
</tr>
<tr>
<td>For blowing out the cooling air</td>
</tr>
<tr>
<td><strong>Pollution degree</strong></td>
</tr>
</tbody>
</table>
4.3 Case Installation

**Possible damage!**
- Due to soiling and foreign bodies at the installation location
- Due to a build-up of heat

**Avoidance:**
- The installation location must be free of conductive and aggressive substances as well as moisture.
- No foreign bodies such as drilling swarf or screws are to be allowed to fall into the system.
- The site conditions (see technical datasheet) must be met.
- The ventilation openings on the front panel and rear wall of the devices must not be covered or sealed.

The TC.ACS is intended to be installed in a standard 19” switch cabinet with an external air flow. In this case it is to be placed on rails or shelves and fastened at the holes on the left and right edges of the front panel. Usually M6 screws can be used.

**Fig. 6:** Case installation with the help of a trolley

**Due to the weight of the device the following is to be regarded:**
- Rails or shelves must be robust.
- The case for a TC.ACS must be in contact over full installation depth.
- At the rear a cross-member must be installed for additional fastening.
4.4 Electrical Installation

4.4.1 Safety Advice

**DANGER**

*Electric shock!*

*Avoidance:*
- The electrical installation is to be undertaken by personnel with electrical training.
- Never connect or disconnect electrical connections while they are live.
- After switching off the system, wait 5 minutes before working on it! In the devices built-in dangerous voltages may be present after switching off the mains voltage, as well as in case of loads that store energy.
- The system must be electrically isolated and secured against being switched on.
- Use cables carrying high currents with adequate cable cross-section area (refer to your national standards and the information on the type plates).
- Your mains voltage must equal the nominal voltage of the system (as given on the type plate).
- Output bus bars must be protected against touching (e.g. by fitting a suitable housing).
- After the installation, check the cables for firm fixing.

**CAUTION**

*Possible damage to the product!*
- Due to conductive aggressive substances in the installation location
- Due to a larger amount of moisture in the installation location
- Due to foreign objects within the system

*Avoidance:*
- If necessary, clean the installation location of aggressive substances or moisture using cloths.
- Remove foreign objects such as drilling swarf or screws from the system before you fit new devices

If you want to use a residual current device, please consider the varying requirements for protection against fire and the protection of individuals. Regatron recommends the usage of a residual current device sensitive to AC and DC leakage currents.

Prior to the electrical installation, Regatron recommends to confirm the following aspects:
- The type plate matches the data in the order and delivery documents.
- The device nominal data are suitable for the intended application.
- The supplied cables/connectors match the intended connections.
4.4.2 Prerequisites

For the electrical installation of the TC.ACS the following must be given:

- The TC.ACS is electrically isolated, switched off (via the main switch) and secured against being switched on.
- Correct Size of Cables and Cable Ends (4.4.2.1)
- Electromagnetic Compatibility of Cables (4.4.2.2)

4.4.2.1 Correct Size of Cables and Cable Ends

Cables carrying high currents must have an adequate cable cross-section area. If necessary, refer to your national standards and the information on the type plates in order to determine the correct size of cables.

The terminals X10 (AC line input) and X20 (AC load output) (see 3.2) allow for different types of cable ends, i.e. the following:

- flexible cable ends
- rigid cable ends
- cable ferrules

Regatron recommends to use cable ferrules.

In any case, the cable ends must meet the following conditions regarding their cross-section and their stripping length:

![Fig. 7: Cable end with diameter d and stripping length a](image)

<table>
<thead>
<tr>
<th>Clamp</th>
<th>Type of cable end</th>
<th>Cross-section area A (= (\pi d^2/4))</th>
<th>Stripping length</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20</td>
<td>Flexible</td>
<td>10 ... 25</td>
<td>10 ... 2</td>
</tr>
<tr>
<td></td>
<td>Rigid</td>
<td>6 ... 35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ferrule</td>
<td>4 ... 25</td>
<td>19 mm</td>
</tr>
<tr>
<td>X10</td>
<td>All</td>
<td>25 ... 50</td>
<td>2 ... 0/1</td>
</tr>
</tbody>
</table>

Stripping length:
4.4.2.2 Electromagnetic Compatibility of Cables

The system is equipped with interference suppression filters in all power and signal connections. Correct installation ensures conformity with the applicable standards.

For electromagnetic compatibility of cables the following must be given:

- Large area earthing (suitable for EMI)
- Shielded cables with shields earthed on both ends
- Star topology earthing (suitable for EMI) of the device

4.4.3 Procedure

To electrically install the TC.ACS, do the following:

⇒ Connect the mains via the X10 AC line input terminal (see 3.2).
⇒ Connect the load to the X20 AC load output terminal (see 3.2).
4.5 Connecting a Cooling System

4.5.1 Introduction

In order to dissipate the generated heat, the TC.ACS necessarily needs to be connected to an external cooling system.

The liquid to air heat exchanger TC.LAE is designed to be used as an external cooling system with the TC.ACS.

4.5.2 Safety Advice

**Possible harm by cooling liquid!**

Danger of serious damage to health by prolonged exposure through inhalation and if swallowed:

- Possible damage to organs (H373).
- Possible damage to the fertility or to a child in womb (H361).

**Avoidance:**

- Pay attention to the warning signs on the device.
- While handling with cooling liquid, open doors and windows and ensure the room is well ventilated also on the ground level.
- Use the personal protective equipment at existing concentrations of vapour and aerosols. E.g. the respiratory protection and protective cloves which are resistant against solvents.
- Close cooling liquid vessels immediately.

4.5.3 Procedure

To connect a cooling system, do the following:

- Remove the rubber plugs from the connection fittings on the rear side of the TC.ACS (see 3.2).

- Establish the following connections, e.g. using a coolant hose
  - Output interface of TC.ACS to input interface of cooling system
  - Input interface TC.ACS to output interface of cooling system
4.6 Connecting a PC

In order to operate the TC.ACS you need to connect a PC with the software ACSControl. You can connect the PC via the USB-interface X607 or the Ethernet-LAN-interface X605 (see 3.2).

The software ACSControl is included in the scope of delivery.

4.7 Starting the TC.ACS

4.7.1 Safety Advice

Electric shock!
Avoidance:
- Device and load must be isolated against accidental contact.
- No maintenance work must be carried out.
- Warning signs must be used and the area must be cordoned off.

DANGER

4.7.2 Prerequisites

For starting the TC.ACS, the following must be given:

- The device is electrically installed (see 4.4).
- A cooling system is connected (see 4.5) and it is running.

For starting the TC.ACS, the Case Installation (4.3) is not necessarily required.

4.7.3 Procedure

To start the TC.ACS, do the following:

⇒ Switch on the main switch (see 3.1).
    ✓ The device boots and a device self-test is performed.
    ✓ When finished, the LED for POWER (see 3.1.1) lights up.

If any other LED also lights up or flashes, then there is a warning or an error. Detailed information is provided by the software ACSControl.
4.8 Running a Function Test

With the software ACSControl you can run a function test on the TC.ACS to confirm that it actually works as intended.

For installing the software ACSControl as well as detailed information on how to use it, see the related software manual.

4.8.1 Prerequisites

For running a function test, the following must be given:

- The TC.ACS is connected to a PC (see 4.6).
- The TC.ACS has been started (see 4.7).
- The software ACSControl is running and it is connected to the TC.ACS.
- The TC.ACS has no error.

4.8.2 Procedure

To run a function test, do the following via the software ACSControl:

- Open the tab Basic Waveform Generator.
- Specify amplitude, voltages, frequency and number of phases in the respective fields.
- In the toolbar, click on 🔗.

✓ On the front of the TC.ACS the LED for VOLTAGE ON (see 3.1.1) lights up.

If there is a warning or an error, detailed information is provided by the software ACSControl.
5 Transport, Packaging and Disposal

This section addresses the following subjects:

- Transport (5.1)
- Packaging (5.2)
- Disposal (5.3)

5.1 Transport

**Possible damage!**

Before transporting a TC.ACS, the following points are to be regarded:

- All cables must be removed.
- Protruding parts such as main switch, controls and fan covers must not be damaged by transport aids (straps, blocks of wood, etc.).
- Due to the weight of the device, a robust trolley, a forklift, or a crane should be used.

The TC.ACS is equipped with four eyelet rings, which allow to attach hoisting slings.

⇒ Use the eyelet rings to lift the TC.ACS.

⇒ Make sure that the angle between hoist and device top side is greater than 72°.

⇒ Pay attention to tipping angle > 85° during the cabinet transport via forklift.
5.2 Packaging

The TC.ACS is shipped in a standard packaging:

1. Box of accessories
2. Upper cover
3. TC.ACS device
4. Lower protective support
5. Cardboard box
6. Transport pallet

Fig. 8: Standard shipping packaging
1. Box of accessories
2. Upper cover
3. TC.ACS device
4. Lower protective support
5. Cardboard box
6. Transport pallet

You can order new shipping packaging from Regatron Customer Support. Here you can also get additional package protection for the front and the sides, if necessary (e.g. for overseas shipping).
5.3 Disposal

When disposing a TopCon power supply, the following points are to be regarded:
- Electrical equipment is too valuable for household waste.
- Disposal with due care for the environment.
- On the disposal of electrical equipment, comply with national laws.
6 Support

Regatron Customer Support assists you in case of questions on hardware, software, interfaces and maintenance as well as in the event of a repair.

This section answers the following questions:

• How can you contact Regatron Customer Support? (6.1)
• What does Regatron Customer Support need to know? (6.2)

6.1 How can you contact Regatron Customer Support?

The Regatron Customer Support address is the following:

Regatron
Technical Customer Support
Feldmuehlestrasse 50
CH-9400 Rorschach
SWITZERLAND

E-mail: tc.supportregatron.ch
Phone: +41 (0)71 846 67 44
Web: www.regatron.com

6.2 What does Regatron Customer Support need to know?

To help you in a most efficient way, Regatron Customer Support needs the following information:

• Contact Information (6.2.1)
• Device Information (6.2.2)
• Problem Description (6.2.3)

You can send Contact Information and Device Information in advance. This way Regatron Customer Support will have it available in the support case.
6.2.1 Contact Information

Contact information is the following:

- Name of your company
- Name of a contact person, i.e. the person with whom further contact will be made
- E-mail address, telephone number (extension) of the contact person
- Support number, e.g. S12345678 (if you have already received one for your problem from Regatron Customer Support)

6.2.2 Device Information

The most important device information is the following:

- Device Type, input and output data
- Serial number
- Version(s) of software(s)
- Installed hardware and software options

Device Type, input and output data as well as the serial number are given on the type plate attached to the device on its rear side. Further information is provided by the software ACSControl.

The most convenient way to send complete device information is to send a support info file. You can send a support info file with the software ACSControl. For more information see the related software manual.

6.2.3 Problem Description

A problem description should document the actual technical problem using measured results, logs, photographs, screenshots or a scope analysis (software ACSControl), etc..

In specific, answers to the following questions would be of help:

- How exactly is the TopCon device applied?
- What kind of load is connected?
- What is the operating point of the application (voltage, current, power, frequency)?
- What are the operating conditions (laboratory, ambient temperature, pollution, etc.)?
- How does the problem show?
- When did the problem first occur?
- Does the problem occur permanently or does it occur sporadically?