

# User Manual Simcenter SCADAS RS

Simcenter Testlab

**SIEMENS**



Unpublished work. © 2023 Siemens

This Documentation contains trade secrets or otherwise confidential information owned by Siemens Industry Software Inc. or its affiliates (collectively, "Siemens"), or its licensors. Access to and use of this Documentation is strictly limited as set forth in Customer's applicable agreement(s) with Siemens. This Documentation may not be copied, distributed, or otherwise disclosed by Customer without the express written permission of Siemens, and may not be used in any way not expressly authorized by Siemens.

This Documentation is for information and instruction purposes. Siemens reserves the right to make changes in specifications and other information contained in this Documentation without prior notice, and the reader should, in all cases, consult Siemens to determine whether any changes have been made.

No representation or other affirmation of fact contained in this Documentation shall be deemed to be a warranty or give rise to any liability of Siemens whatsoever.

If you have a signed license agreement with Siemens for the product with which this Documentation will be used, your use of this Documentation is subject to the scope of license and the software protection and security provisions of that agreement. If you do not have such a signed license agreement, your use is subject to the Siemens Universal Customer Agreement, which may be viewed at <https://www.sw.siemens.com/en-US/sw-terms/base/uca/>, as supplemented by the product specific terms which may be viewed at <https://www.sw.siemens.com/en-US/sw-terms/supplements/>.

SIEMENS MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS DOCUMENTATION INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF INTELLECTUAL PROPERTY. SIEMENS SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, LOST DATA OR PROFITS, EVEN IF SUCH DAMAGES WERE FORESEEABLE, ARISING OUT OF OR RELATED TO THIS DOCUMENTATION OR THE INFORMATION CONTAINED IN IT, EVEN IF SIEMENS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

TRADEMARKS: The trademarks, logos, and service marks (collectively, "Marks") used herein are the property of Siemens or other parties. No one is permitted to use these Marks without the prior written consent of Siemens or the owner of the Marks, as applicable. The use herein of third party Marks is not an attempt to indicate Siemens as a source of a product, but is intended to indicate a product from, or associated with, a particular third party. A list of Siemens' Marks may be viewed at: [www.plm.automation.siemens.com/global/en/legal/trademarks.html](http://www.plm.automation.siemens.com/global/en/legal/trademarks.html). The registered trademark Linux® is used pursuant to a sublicense from LMI, the exclusive licensee of Linus Torvalds, owner of the mark on a world-wide basis.

## About Siemens Digital Industries Software

Siemens Digital Industries Software is a global leader in the growing field of product lifecycle management (PLM), manufacturing operations management (MOM), and electronic design automation (EDA) software, hardware, and services. Siemens works with more than 100,000 customers, leading the digitalization of their planning and manufacturing processes. At Siemens Digital Industries Software, we blur the boundaries between industry domains by integrating the virtual and physical, hardware and software, design and manufacturing worlds. With the rapid pace of innovation, digitalization is no longer tomorrow's idea. We take what the future promises tomorrow and make it real for our customers today. Where today meets tomorrow. Our culture encourages creativity, welcomes fresh thinking and focuses on growth, so our people, our business, and our customers can achieve their full potential.

Support Center: [support.sw.siemens.com](http://support.sw.siemens.com)

Send Feedback on Documentation: [support.sw.siemens.com/doc\\_feedback\\_form](http://support.sw.siemens.com/doc_feedback_form)

# Copyright

Version: 2.2

Date: December 2023

© 2023 Siemens Digital Industries Software. All rights are explicitly reserved. All information in this manual, including additional drawings and technical descriptions, remains the property of Siemens. No part of this publication may be used (otherwise than for the use of this product), photocopied, duplicated, translated and/or disclosed to third parties without explicit prior written permission by Siemens.

# Contents

Copyright 3

Version history 9

## General terms

Manufacturer	1-1
Disclaimer	1-1
Conditions of change	1-1
Licenses and trademarks	1-2
Warranty	1-2
Inspection of received goods	1-2
Transportation of goods	1-2
Support	1-2
Feedback	1-2

## About this manual

Usage and availability	2-1
Target audience	2-1
Conventions	2-1
Cautions and Warnings	2-1
Related documentation	2-2

## Introduction

Introduction to SCADAS RS system	3-1
Main functions and intended use	3-1
Use in accordance with the purpose	3-2
Scope of delivery	3-2

## Safety information

Hazards and residual risks	4-1
Residual risks	4-1
Safety provisions	4-1
Product safety	4-1
Covering	4-2
Electrical safety	4-2
Components and accessories	4-2
Safety precautions	4-2
Built-in Li-Ion battery	4-3

## System overview

System architecture	5-1
Topologies	5-1

## Units overview

General dimensions and weight	6-3
Uninterruptable Power Supply Unit	6-4
Recorder Unit	6-6
Digital Pulse and CAN bus Conditioning Unit	6-8
24 Channel 120 $\Omega$ Bridge Conditioning Unit	6-9
24-Channel 350 $\Omega$ Bridge Conditioning Unit	6-10
24-Channel Sensor Conditioning Unit	6-11
12-Channel Universal Signal Conditioning Unit	6-12
12-Channel Universal Signal Conditioning Unit Extended Bandwidth	6-13
Ethercat <sup>®</sup> Unit	6-15
TC20 Thermocouple Conditioning Unit	6-16

## Unit features and conditioning options

Supported functions of REC and DI Unit	7-1
Supported functions of analog Signal Conditioning Units	7-3
8-Channel Thermocouple type K Conditioning Unit	7-6

## Mounting and combining units

Stacking and de-stacking	8-1
How to stack units	8-2
How to de-stack units	8-4
Back to back mounting	8-7
How to mount units back to back	8-7
Mounting onto a back plate	8-9
Strapping units	8-11
How to strap units	8-11

## Configuring units

Configuring	9-1
-------------	-----

## Connecting cables

Daisy chaining	10-1
Handling sensor plugs	10-2

## System connectivity

Host interface	11-1
Synchronization interface	11-2
Security	11-2

## Operating Simcenter SCADAS RS

<b>Preparing for first use</b>	12-1
<b>Setup and configuring</b>	12-1
<b>Grounding stacked units</b>	12-1
<b>Before powering up</b>	12-2
<b>ON/OFF switching</b>	12-3
<b>Remote ON/OFF switching</b>	12-4
<b>General operational considerations</b>	12-6
Li-ion battery safety precautions	12-7
Guidelines for aerial transport of batteries	12-8
<b>LED indications</b>	12-9
All Units status LED	12-9
UPS Unit LEDs	12-10
Conditioning Units status LED	12-12
REC Unit status LED	12-12
DI Unit Status LEDs	12-13
ECAT Unit LEDs states	12-13
Shaping filters	12-14
<b>Pin-out &amp; wiring</b>	
<b>Analog channels pin-out</b>	13-1
<b>Digital channels pin-out</b>	13-3
<b>Connecting sensors</b>	13-4
Wiring	13-4
Wiring Notes	13-11
<b>Maintenance and calibration</b>	
<b>Cleaning</b>	14-1
<b>Calibration</b>	14-2
<b>Software</b>	
<b>Simcenter SCADAS RS Recorder App and Configuration App</b>	15-1
<b>Simcenter Testlab Neo</b>	15-1
Firmware updates	15-1
<b>Troubleshooting</b>	
<b>Solving common problems</b>	16-1
<b>Glossary</b>	
<b>List of technical terms</b>	17-1
<b>Product compliance</b>	
<b>FCC compatibility</b>	18-2
<b>Safety labels</b>	18-3

## End of life and Disposal

Disposal at end-of-life ————— 19-1

## Notes

Remarks ————— 20-1



# Version history

Version	Date	Comment
1.0	May 2021	First issue
2.0	January 2023	Second issue
2.1	June 2023	Updated second issue
2.2	December 2023	Updated second issue



# 1. General terms

## Manufacturer

Simcenter SCADAS RS data acquisition systems are products of

Siemens Industry Software Netherlands B.V.

Simulation and Test Solutions

Weidehek 53

4824 AT Breda

P.O. Box 3132

4800 DC Breda

The Netherlands

This manual forms an integral part of the product. It gives information about the use of the Simcenter SCADAS RS system. Familiarize yourself with this information, and make sure that you understand it before using the Simcenter SCADAS RS system.

## Disclaimer

Siemens does not guarantee any work caused by or arising out of the failure of the user to comply with the instructions or recommendations in this User Manual.

Siemens reserves the right to change parts at any moment without prior notice or direct notification.

This User Manual is subject to change without prior notice or direct notification.

## Conditions of change

Changes and/or modifications to the product (to be conducted by the owner) may only be done after explicit prior written instruction, permission and/or approval by Siemens. Non-conformance to this rule will void the authority to further use of the product. Furthermore, any consequential damage, loss or costs thereof are the responsibility of the proprietor and user.

## Licenses and trademarks

Any software, described in this manual and/or delivered with the Simcenter SCADAS RS, is provided under license and may only be used in accordance with the conditions, stated in the licenses concerned.

Company and product names in this manual are trademarks or registered trademarks of their respective owners.

## Warranty

The conditions of the warranty are part of the delivery.

## Inspection of received goods

We recommend that you inspect the shipment upon receipt for completeness and signs of damage. In case the shipment is not complete, please contact your local Siemens representative. In case parts are damaged and/or defective, act as follows.

- Save all packing materials in case of return shipment.
- File a claim with the carrier.
- Contact your local Siemens representative for further instructions.

## Transportation of goods

In case you need to return parts to Siemens for repair, you are requested to contact your local Siemens representative first. You will be informed about the applicable procedures and follow-up.

## Support

The content of this manual has been designed and written with the aim to support you, the user, in the use of the Simcenter SCADAS RS system. In case you need specific information that is not described in this manual, please do not hesitate to contact your local Siemens representative for support. We are dedicated to help you accomplish your goals and tasks.

## Feedback

Although utmost care has been given to achieve a high level of quality for this manual, it may contain information that is not (fully) clear and/or accurate. In case you should find any unclarities or inaccuracies, please report this to Siemens. In case you have suggestions for improvement, we invite you to share your ideas with us.

Contact your local Siemens customer support center.

## 2. About this manual

### Usage and availability

This manual provides information for the safe and correct use of the Simcenter SCADAS RS system. Make sure that you carefully read the instructions to use the Simcenter SCADAS RS system in accordance with its purpose and intended use.

### Target audience

This User Manual is primarily aimed at experienced Test Engineers who have gained a level of proficiency through education, training and experience. Knowledge of other Simcenter SCADAS products is an advantage. When you work with the Simcenter SCADAS RS system it is assumed that you have appropriate knowledge of the hardware and software required to accomplish your tasks. These may include: working with computers and computer networks, Simcenter Testlab Neo, front-end and recording devices, sensors and instrumentation.

### Conventions

Standard font	Most of the content in this manual is presented in standard font.
<b>Special Bold</b>	Figure titles and captions are presented in <b>Special Bold</b> font.
<i>Emphasis</i>	Where necessary, words or phrases are <i>emphasized</i> in italic print.
Symbols	Elements that require extra attention by the reader (see <b>Cautions and Warnings</b> ).

### Cautions and Warnings

Where necessary, symbols are used to indicate cautions and warnings or instructions to perform certain actions.

All safety related measures described in this manual are based on the intended use of the products. Make sure to use the products in accordance with its purpose.

The user must adhere to the boundaries specified in this manual and work according to the Safety precautions (see **Safety information**).

Symbol	Explanation
	<p><b>Attention!</b></p> <p>Please pay attention while performing a task.</p>
	<p><b>Caution!</b></p> <p>There is a risk of minor damage to the equipment or minor personal injury.</p>
	<p><b>Warning!</b></p> <p>There is a risk of major damage to the equipment or major personal injury.</p>

## Related documentation

This User Manual describes the hardware that makes up the Simcenter SCADAS RS system. This system can only be used in combination with other Simcenter named products that have their own dedicated manuals. Where applicable, the relation between the Simcenter SCADAS RS system and other Simcenter named products is described. For details about other Simcenter named products or parts of products, reference is made to:

- Simcenter Testlab Neo – Software application manuals
- Simcenter SCADAS RS Recorder App \*)

\*) *Applies to Simcenter SCADAS RS systems containing a Recorder Unit.*

# 3. Introduction

## Introduction to SCADAS RS system

This chapter gives generic information about the Simcenter SCADAS RS system. The purpose of this chapter is to inform the user about what the Simcenter SCADAS RS system is meant for and what the products comprise of. It is the responsibility of the user to use the Simcenter SCADAS RS system in accordance with its purpose and intended use.

## Main functions and intended use

The Simcenter SCADAS RS system is a mobile system of the Simcenter SCADAS family. SCADAS stands for Signal Conditioning And Data Acquisition System.

Simcenter SCADAS RS is both a distributed and centralized system for front-end signal conditioning and data acquisition hardware. There are several ways of mounting and connecting the different units. Simcenter SCADAS RS is especially designed for data acquisition under demanding test conditions.

Each system may consist of one or more Signal Conditioning Units, connected in daisy chain to a Simcenter SCADAS RS Recorder Unit for autonomous operation or in combination with a PC, tablet or smartphone. Similarly, daisy chains of Signal Conditioning Units (CU) can be connected directly to a PC. Units are combined in daisy chains using a single cable for power and data.



### Simcenter SCADAS RS hardware for data acquisition under demanding test conditions

As and when required the Simcenter SCADAS RS system is connected with a host PC that runs Simcenter Testlab Neo software.

The user must adhere to the boundaries specified in this User Manual and the relevant Product Information Sheet and work according to the **Safety Information** given in this User Manual.

## Use in accordance with the purpose

Simcenter SCADAS RS systems must only be used for the specific purpose described above. Any attempt to alter or modify a Simcenter SCADAS RS system or its use for any other purpose will be considered not to be in accordance with its purpose and regarded as misuse. Misuse may result in injury to personnel or serious damage to equipment. In all cases any warranty will be void, while Siemens will not accept any liability for misuse.

## Scope of delivery

The Simcenter SCADAS RS system is delivered for one or more test configurations. The units that are required for testing depend on the test configuration that is chosen. Each Simcenter SCADAS RS system is delivered to customer order, which leads to a large variety of possible combinations of units. The System Overview chapter shows which units may be part of the delivery.

# 4. Safety information

## Hazards and residual risks

Simcenter SCADAS RS has been designed in such a way that known potential hazards have been eliminated to the highest possible extent. Where elimination of risks proved not (completely) feasible, safety provisions have been implemented to reduce the risks to a minimal or acceptable level.

### Residual risks

However, some risks still exist. These residual risks and relevant details are listed below. During normal operation, personnel who work with a Simcenter SCADAS RS system must obey the safety precautions and follow the instructions in this manual. It is important to meet these conditions to assure personal safety and product integrity.

Risk	Explanation		
Electrical shock	Connecting the equipment to mains power	Serious injury; death	See: <b>Safety provisions, Safety precautions</b>
Physical damage to a battery pack	At impact, e.g. a battery pack gets cracked	Leakage of dangerous fumes and/or materials; battery pack can catch fire	See: <b>Li-ion battery safety precautions</b>
Burn injuries	Ambient temperature above 40 °C (104 °F)	Units can get so hot that it is unsafe to touch them	Care should be taken to prevent burn injuries

## Safety provisions

By design, the Simcenter SCADAS RS system has several safety provisions to establish the required level of personal safety. Furthermore, the owner of the Simcenter SCADAS RS system has the responsibility to provide a safe environment to work in.

### Product safety

Simcenter SCADAS RS products SCRS-UPS, SCRS-REC, SCRS-DI, SCRS-S24, SCRS-B24-120, SCRS-B24-350, SCRS-U12, SCRS-U12-E, SCRS-ECAT and SCRS-TC20 comply with IEC 61010-1 on the aspects listed below.

- Simcenter SCADAS RS products are safe for indoor and outdoor use.
- Simcenter SCADAS RS products can safely be used to an altitude of 5,000 m above sea-level.
- Simcenter SCADAS RS products are safe for use in a wet location.
- Simcenter SCADAS RS products can withstand 100% relative humidity (IP67).

- Simcenter SCADAS RS products are rated Pollution degree 3 of the intended environment.
- The degree of ingress protection of Simcenter SCADAS RS products according to IEC 60529 is IP66 and IP67.

### Covering

During normal operation – i.e. unused connectors are properly capped – exposure to any hazards is reduced to a minimum. The units are not to be opened by the user. There are no serviceable parts inside.

### Electrical safety

The following applies.

- The Simcenter SCADAS RS system complies with international safety standards and local regulations.
- All circuits are adequately protected when used within limits.
- Power levels of the outputs of the Simcenter SCADAS RS system are within safe limits.

### Components and accessories

To assure the required level of personal safety and product integrity, Siemens applies approved and certified components and accessories. For the Simcenter SCADAS RS system, the most prominent items are:

- State-of-art connectors & plugs that provide a high level of protection against intrusion.
- Power cables that are approved by Siemens for use with the Simcenter SCADAS RS system.

### Safety precautions

The presence of safety provisions alone is no guarantee against injury. This section gives instructions and guidelines to help the user to work safely. Users of the Simcenter SCADAS RS system are always responsible for their actions, their own safety and that of others.

To prevent injury, obey these rules when working with the Simcenter SCADAS RS system.

- Use the system and its components in accordance with its purpose and within its design specifications.
- Only use original and approved devices, components and accessories. Apply them in accordance with their intended use.
- Prevent actions that can result in unsafe situations.

- Always report abnormal situations to your superior.
- Avoid – direct and indirect – contact with live electrical parts.
- Do not operate units at extreme temperatures.
- Do not cover units up and make sure they can dissipate generated heat.
- Do not drop units and avoid situations in which they can get crushed.
- Always place units in a stable position; if necessary, secure the units.
- Dispose used equipment and components in accordance with local laws and regulations.

## Built-in Li-Ion battery

- When not using UPS Units for a longer period of time, it is best to store them at room temperature and with a battery charge level between 40% and 80%.
- Do not exceed 50 °C storage temperature to avoid excessive degradation of battery capacity.



# 5. System overview

## System architecture

The Simcenter SCADAS RS System architecture looks as follows.

- Signal Conditioning Units are connected to each other using a daisy chain topology, data transfer and power.
- A single daisy chain usually starts at a DC power source, usually the power source of the vehicle or the system under test, and an Uninterruptable Power Supply Unit (UPS Unit).
- In multiple daisy chains setup, each daisy chain may start with a UPS Unit or a Sensor Conditioning Unit.
- Additional UPS Units can be added to a daisy chain. UPS Units feed only units “downstream”.
- The interconnection between the units provides the units also with bidirectional data exchange.
- A Recorder Unit (REC Unit) is at the heart of the system with respect to connectivity. It must be powered by a UPS Unit.

## Topologies

Several different topologies are possible. A basic topology may consist of a UPS Unit, a REC Unit and one or more Sensor Conditioning Units. DC power is delivered by the vehicle or system under test.

Units can be positioned close together or further apart. The maximum distance between units is approx. 50 m. If this maximum distance is needed between units, an additional UPS is recommended at the long end of the cable to provide enough power for those additional units. These UPS Units supply the next power segment "downstream" (subsequent units).

The REC Unit acts as a host for the measurement and recording applications. If a daisy chain is directly connected to a PC or a PC is connected to the REC Unit, Simcenter Testlab Neo software can be used for data acquisition.

The Simcenter SCADAS RS Recorder App is used to control the recording application embedded on the REC Unit.



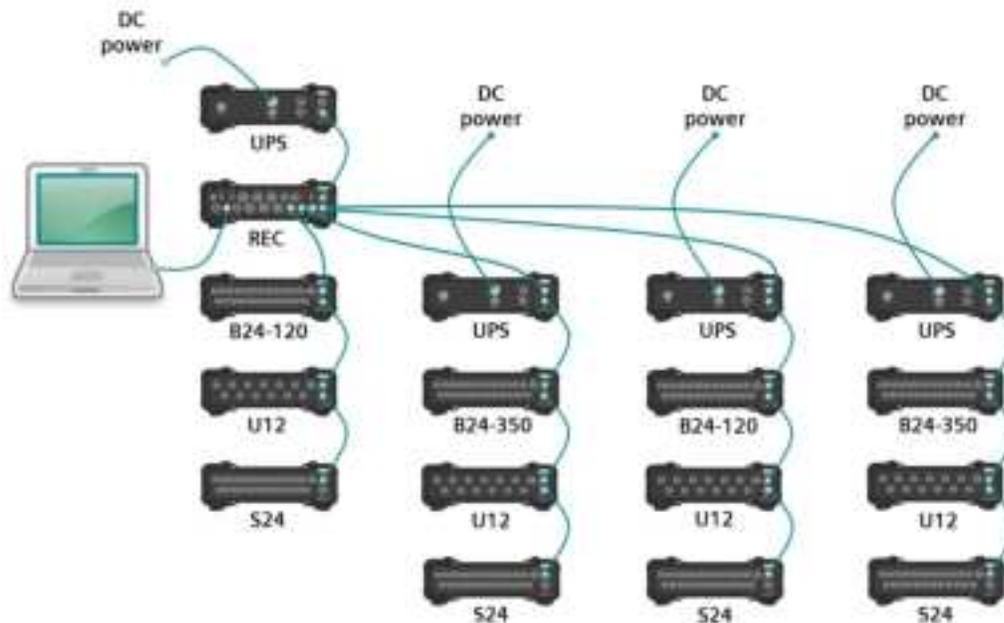
### Basic topology

A configuration topology consists of a Signal Conditioning Unit and a PC. This setup is intended for configuring a Signal Conditioning Unit and a simple measurement only. DC power is delivered by a Siemens approved AC/DC power adapter. Since there is no UPS Unit, this setup is not robust.



### Configuration topology

An extensive topology may consist of a REC Unit, several Sensor Conditioning Units and one or more UPS Units. The units are interconnected by daisy chain cables for power distribution downstream and bidirectional data exchange. DC power is delivered by the vehicle or system under test.



### Extensive topology with four daisy chains and four UPS Units

Up to four daisy chains of units can be connected to the PWR OUT CHAIN 1 – 4 connectors of a REC Unit. To make sure enough power is available, each daisy chain in the example above is equipped with a separate UPS Unit. Each daisy chain supports up to 1.7 MSA/s total throughput. The total accumulated throughput that can be handled by the REC Unit is 7.8 MSA/s.

The entire system can be connected to a network via a 1 Gb Ethernet connector on the Recorder Unit or via a Wi-Fi connection. The on-board application can be accessed through the 1Gb Ethernet connection or over the Wi-Fi connection of the REC Unit. Simcenter Testlab Neo can connect to the REC Unit in front-end mode via the 1Gb Ethernet port.

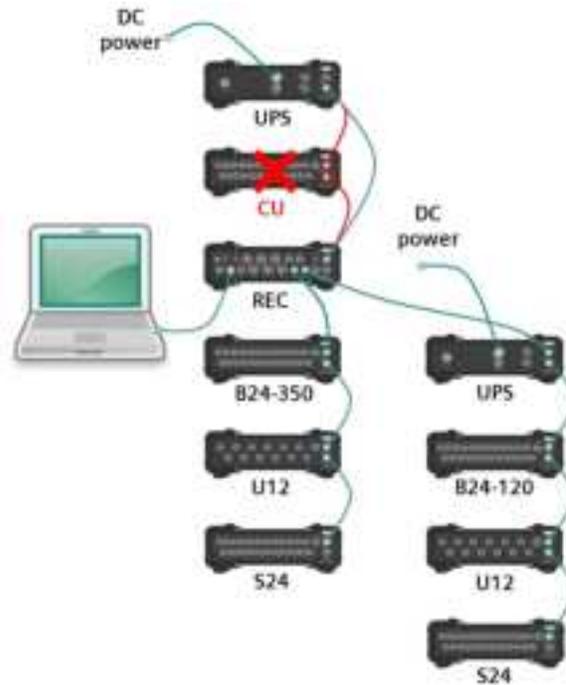


#### Attention!

Never connect a network or a PC to a daisy chain with Conditioning Units that are connected to a REC Unit. This can generate an error in the system, an error of a measurement or cause problems in the network or to the PC.

**Attention!**

The Recorder Unit does not support Signal Conditioning Units that are positioned between the top UPS Unit and the REC Unit. This is also important to guarantee proper power management.



## 6. Units overview

This section shows all units that are part of the Simcenter SCADAS RS System. Each unit will be described in more detail in the next sections.

Unit	Product code and description
	SCRS-UPS Uninterruptible Power Supply Unit
	SCRS-REC Recorder Unit
	SCRS-DI Digital Pulse and CAN bus Conditioning Unit
	SCRS-B24-120 24-Channel 120 $\Omega$ Bridge Conditioning Unit
	SCRS-B24-350 24-Channel 350 $\Omega$ Bridge Conditioning Unit

Unit	Product code and description
	SCRS-S24 24-Channel Sensor Conditioning Unit
	SCRS-U12 12-Channel Universal Sensor Conditioning Unit
	SCRS-U12-E 12-Channel Universal Signal Conditioning Unit Extended Bandwidth
	SCRS-ECAT EtherCAT® Unit
	SCRS-TC20 Unit Thermocouple Conditioning Unit

## General dimensions and weight



Item	Value
Dimensions [W x H x D]	254 mm x 85 mm x 90 mm
Weight	Approx. 1.8 kg

## Uninterruptible Power Supply Unit



No.	Description	No.	Description
1	ON/OFF button	4, 5	Reserved for future extensions
2	Remote ON/OFF connector	6	Data connector
3	Power connector	7	Power Out/Data connector

The UPS Unit provides the Simcenter SCADAS Rugged System with the necessary power for the system and sensors. The UPS Unit provides stable supply in all circumstances. It will power up to 5 Simcenter SCADAS RS units with their typical power consumption. Through power management by an on-board application, it indicates via LEDs if it can provide sufficient power to downstream Simcenter SCADAS RS units at the operational temperature range. If more power is needed, additional UPS units can easily be added to the Simcenter SCADAS RS configuration. Power can be inserted where needed depending on cable distance, number of units and sensor power needed.

In case of power loss, the UPS Unit provides power to the system through an internal power buffer. The power buffer has a capacity of 58.4 Wh.

Upon depletion of this power buffer, the system is shut down safely, preserving all data recorded on-board.



### Attention!

It is a good practice to start using the UPS Unit with a fully charged internal power buffer.

**Attention!****UPS buffer discharge notes**

- Buffer is not available for full load below  $-25\text{ }^{\circ}\text{C}$ , 3/4 load below  $-30\text{ }^{\circ}\text{C}$ , and 1/2 load below  $-35\text{ }^{\circ}\text{C}$ .
- Very quick discharge, at least 20 s, for full load below  $-20\text{ }^{\circ}\text{C}$ , 3/4 load below  $-25\text{ }^{\circ}\text{C}$  and 1/4 load below  $-35\text{ }^{\circ}\text{C}$ .
- Quick discharge, at least 2 minutes, for full load below  $-15\text{ }^{\circ}\text{C}$ .

## Recorder Unit



No.	Description	No.	Description
1	Mode button	7	USB 3.0 connector
2	Sync connector *)	8	CAN1/2, CAN3/4 connector (2x) **)
3	GNSS connector	9	Pulse Input connector (3x)
4	1 Gb Ethernet connector	10	USB 2.0 connector (2x), camera support
5	Digital I/O connector	11	Power OUT Chain connector (4x)
6	Wi-Fi antenna connector (2x)	12	Power IN connector

\*) future use

\*\*\*) NOT terminated internally!

The REC Unit combines data streams from analog conditioning units and digital buses, GNSS signals, digital pulses, quadrature encoders in a single unit for networked or standalone acquisition, analysis and on-board storage.

It collects raw measurement data from analog sensors and digital buses or signals in a single data stream. The raw data can be stored on an on-board SSD or streamed to an external PC running Simcenter Testlab over a wired LAN connection. The on-board web application can be accessed by any device (PC, tablet or smartphone) connected over LAN, Wi-Fi or even cellular networks.

The REC unit can be operated in several ways:

- Fully autonomous. Start/stop recording by pushing the Mode button. A long push (15 s) will bring REC Unit to its factory defaults.

- With a touch device (tablet, smartphone).
- Directly from a PC.
- It can be accessed from a LAN network, over Wi-Fi, or even remotely over public or cellular networks.

**Maximum power consumption in most demanding operating conditions:**

- Base consumption 21.5 W.
- Up to additional 10.25 W for 4x loaded CAN buses.
- Up to additional 8.2 W for 3x loaded Pulse inputs.
- Up to additional 3.3 W for USB 2.0 input.
- Up to additional 5.9 W for USB 3.0.
- Up to additional 0.5 W for Digital I/O.

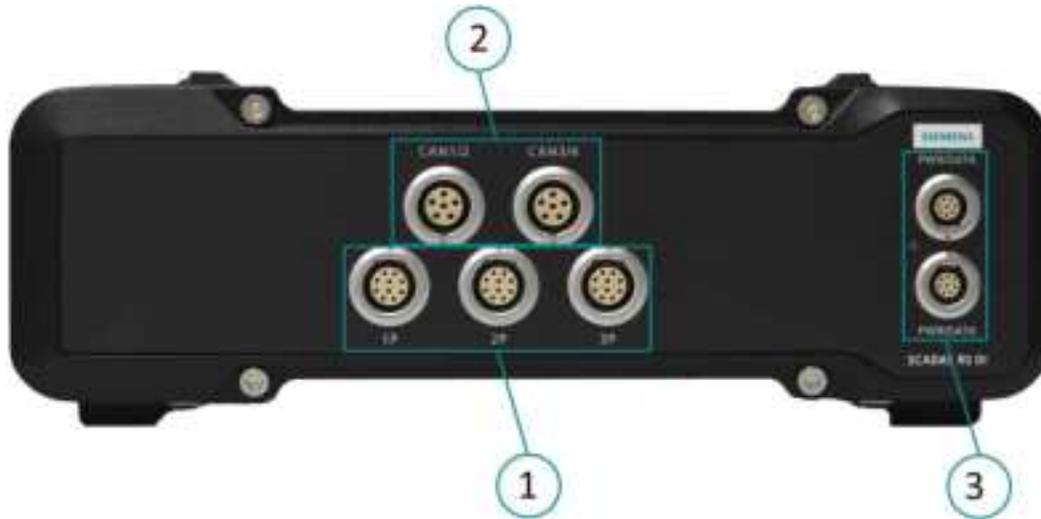
**Attention!****GNSS antenna connector**

Take care to screw the GNSS antenna in properly for a proper signal integrity, e.g. by using an SMA torque wrench.

**Attention!**

After booting up and all LEDs turn green, the REC Unit needs approx. 10 – 40 s to load any saved configuration from all units. During this time, a recording cannot be started and the Mode button turns insensitive. The REC Unit's status LED will turn solid green when it is recording data (refer to **REC Unit status LED**).

## Digital Pulse and CAN bus Conditioning Unit



No.	Description
1	Digital Input connectors 1P, 2P, 3P; with tacho function
2	CAN1/2, CAN3/4 connectors
3	Power/Data connectors

The DI Unit has multiple signal conditioning options, selectable per channel and supports true multi-physics test campaigns. The unit has 3 digital input connectors combined with analog tacho function and 2 CAN connectors for 4 CAN buses.

### Maximum power consumption in most demanding operating conditions:

- Base consumption 14.5 W.
- Up to additional 10.2 W for 4x loaded CAN buses.
- Up to additional 8 W for 3x loaded Pulse inputs.

## 24 Channel 120 $\Omega$ Bridge Conditioning Unit



No.	Description
1	Input connectors 01 – 24
2	Real-Time applications digital output connector
3	Power/Data connectors

The B24-120 Unit supports Wheatstone bridge based sensors (full, half and quarter bridges) with an internal 120 ohm termination for quarter bridges DC or AC supplied, force cells, torque cells, displacement sensors, piezo-resistive and piezo-capacitive sensors, differential voltage inputs, RTD or potentiometer conditioning in a single, 24-channel input unit.

Its multiple bridge conditioning options, selectable per channel, support true durability load data acquisition test campaigns.

It allows standardization of bridge-based sensors on a single unit.

*Housing and channel signal ground are connected internally.*

### Maximum power consumption in most demanding operating conditions:

- 24x Voltage: 25.2 W
- 24x Full Bridge: 24.5 W
- 24x Half Bridge/Quarter Bridge: 19.5 W

## 24-Channel 350 $\Omega$ Bridge Conditioning Unit



No.	Description
1	Input connectors 01 – 24
2	Real-Time applications digital output connector
3	Power/Data connectors

The B24-350 Unit supports Wheatstone bridge based sensors (full, half and quarter bridges) with an internal 350 ohm termination for quarter bridges DC or AC supplied, force cells, torque cells, displacement sensors, piezo-resistive and piezo-capacitive sensors, differential voltage inputs, RTD or potentiometer conditioning in a single, 24-channel input unit.

Its multiple bridge conditioning options, selectable per channel, support true durability load data acquisition test campaigns.

It allows standardization of bridge-based sensors on a single unit.

*Housing and channel signal ground are connected internally.*

### Maximum power consumption in most demanding operating conditions:

- 24x Voltage: 25.2 W
- 24x Full Bridge: 24.5 W
- 24x Half Bridge/Quarter Bridge: 19.5 W

## 24-Channel Sensor Conditioning Unit



No.	Description
1	Input 01 – 24 connectors
2	Real-Time applications digital output connector
3	Power/Data connectors

The S24 Unit combines 24 channels of signal conditioning for voltage, ICP, 0/4-20 mA transmitters (over shunt) or sensors that require external supply, in a single unit.

Its multiple signal conditioning options, selectable per channel, support true multi-physics test campaigns.

It allows standardization of measurement equipment on a single unit.

*Housing and channel signal ground are connected internally.*

### Maximum power consumption in most demanding operating conditions:

- 24x Mixed: 20 W
- 24x Voltage: 17 W
- 24x ICP: 15 W

## 12-Channel Universal Signal Conditioning Unit



No.	Description
1	Input connectors 01 – 12
2	Analog pulse/tacho input connector
3	Power/Data connectors

The U12 Unit combines 12 isolated channels of universal signal conditioning in a single unit. The unit supports Wheatstone bridge based sensors (full, half and quarter bridges) with an internal quarter bridge completion of 120 ohm and 350 ohm DC or AC supplied, force cells, torque cells, displacement sensors, piezo-resistive and piezo-capacitive sensors, differential voltage inputs, RTD or potentiometer conditioning in a single unit. It also supports signal conditioning for voltage, ICP, 0/4-20 mA transmitters (over shunt) or sensors that require external supply.

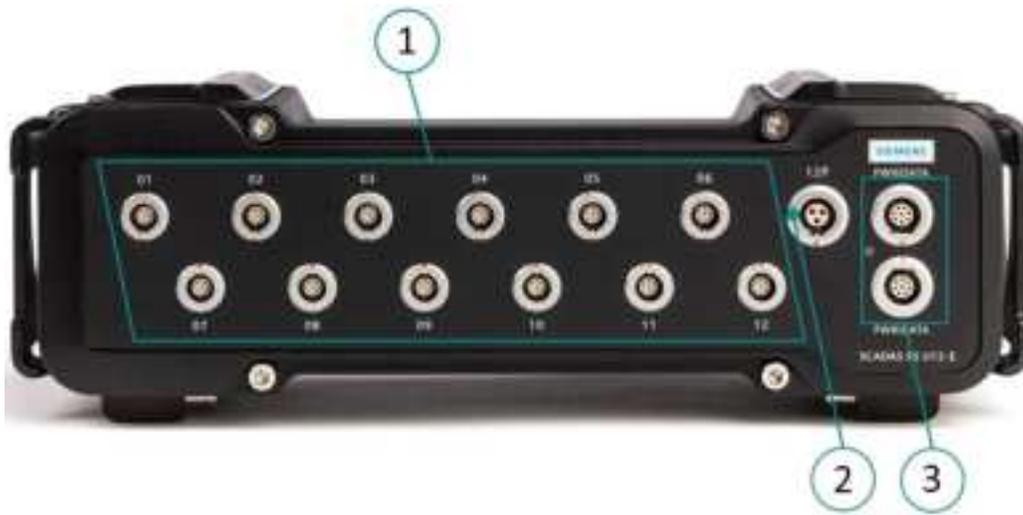
Its multiple signal conditioning options, selectable per channel, support true multi-physics test campaigns.

It allows standardization of measurement equipment on a single unit, and offers channel to channel isolation.

### Maximum power consumption in most demanding operating conditions:

- 12x Mixed: 19 W
- 12x ICP: 13.5 W

## 12-Channel Universal Signal Conditioning Unit Extended Bandwidth



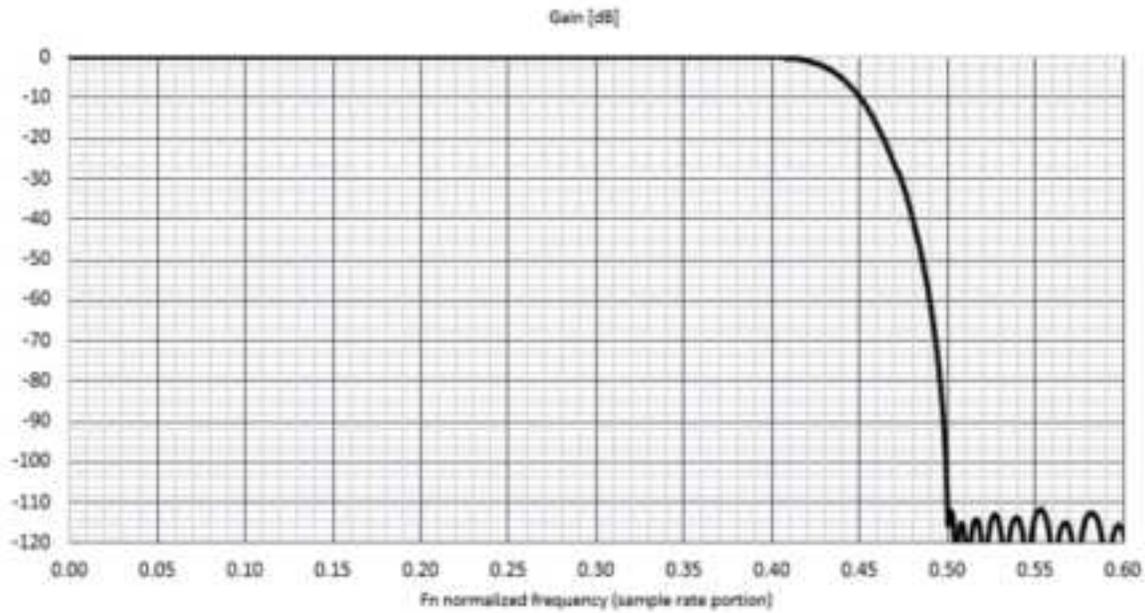
No.	Description
1	Input connectors 01 – 12
2	Analog pulse/tacho input connector
3	Power/Data connectors

The U12-E Unit combines 12 isolated channels of universal signal conditioning *with extended bandwidth* in a single unit. The unit supports Wheatstone bridge based sensors (full, half and quarter bridges) with an internal quarter bridge completion of 120 ohm and 350 ohm DC or AC supplied, force cells, torque cells, displacement sensors, piezo-resistive and piezo-capacitive sensors, differential voltage inputs, RTD or potentiometer conditioning in a single unit. It also supports signal conditioning for voltage, ICP, 0/4-20 mA transmitters (over shunt) or sensors that require external supply.

Its multiple signal conditioning options, selectable per channel, support true multi-physics test campaigns.

It allows standardization of measurement equipment on a single unit, and offers channel to channel isolation.

## U12-E Sharp FIR



Alias rejection is always better than 110 dB.

### Maximum power consumption in most demanding operating conditions:

- 12x Mixed: 19 W
- 12x ICP: 13.5 W

## Ethercat® Unit



No.	Description
1	Ethercat connectors: Ethercat IN, Ethercat OUT (Ethercat daisy chain)
2	UNIT connectors: 24 channel high speed data in
3	Power/Data connectors

The Simcenter SCRS-ECAT is an Ethercat compatible slave device. It requires an external Ethercat Master device in order to function and operate properly.

It allows to digitally connect the Simcenter SCADAS RS to the Ethercat® bus.

It provides a low latency data output to the Ethercat master. The specific task for a durability application is to provide a digital data output to test rig controllers, like MTS or IST (INSTRON).

Ethercat® is a real-time Ethernet based field bus. Main targets of Ethercat development were to provide the hardware and software interface to provide a low latency, low jitter and short cycle times ( $< 100 \mu\text{s}$ ) data communication and provide a method of  $< 1 \mu\text{s}$  synchronization between Ethercat devices.

The Ethercat Slave Information file (ESI) with the description of the functional Ethercat capabilities of the ECAT unit can be downloaded from the ECAT unit, so that it can be used by the Ethercat Master. The file location named "ECAT.XML" is: <http://SCRS-ECAT/ESI/download.htm>.

Most EtherCat Masters are also able to do an online interrogation of these functionality directly from the Slave device on the bus (CAN open over Ethercat - COE), and ECAT unit dynamically provides active channel information.

**Maximum power consumption in most demanding operating conditions 6 W.**

*Ethercat is a registered trademark of Beckhoff Automation GmbH.*

## TC20 Thermocouple Conditioning Unit



No.	Description
1	Input 01 – 20 Thermocouple miniature connectors
2	Real-Time applications digital output connector
3	Power/Data connectors

The TC20 Unit enables Simcenter SCADAS RS to condition up to 20 thermocouples of different types. These temperature sensors consist of two leads of different materials that have a single junction that is used as temperature sensing point.

The actual temperature difference between both materials at the junction produces a small output voltage directly related to the temperature of the junction. This phenomenon is known as the Seebeck effect. Several material combinations are standardized and have been given a type number. Each type has its own sensitivity and a non-linear relation between temperature and output voltage.

The TC20 Unit automatically corrects for sensitivity and linearity curves with the selection of the connected thermocouple type. Built-in linearization follows ITS-90 (International Temperature Scale) standard.

The TC20 Unit also detects open cable issues per channel (burnout detection).

The TC20 Unit supports the most common types K, J and T and in addition also B, E, N, R, and S.

Thermocouple leads are terminated with a standardized Miniature connector.



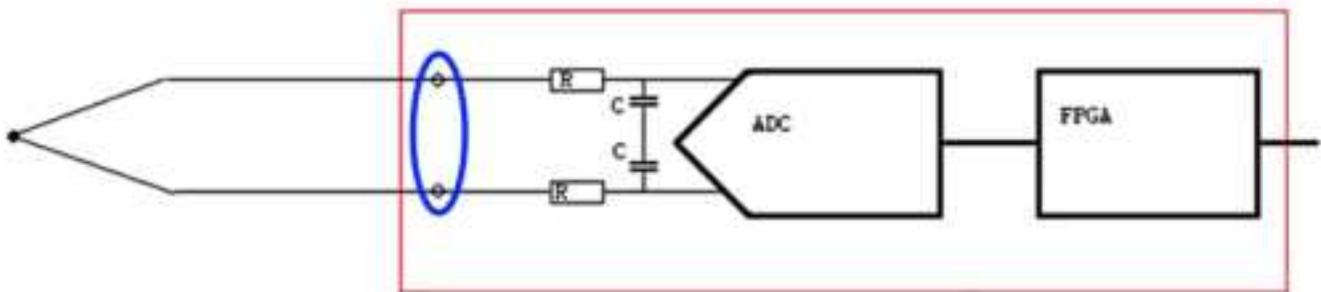
Each of these connectors are based on the same materials as the thermocouple leads and the connectors are color coded for each type.

ANSI Code	Alloy Combination		Maximum T/C Grande temp. range	IEC Code
	+ Lead	- Lead		
<b>K</b>	NICKEL-CHROMIUM Ni-Cr	NICKEL-ALUMINIUM Ni-Al	-270 to 1372°C -454 to 2501°F	<b>K</b>
<b>J</b>	IRON Fe (magnetic)	CONTANTAN COOPER-NICKEL Cu-Ni	-210 to 1200°C -348 to 2193°F	<b>J</b>
<b>T</b>	COPPER Cu	CONTANTAN COOPER-NICKEL Cu-Ni	-270 to 400°C -454 to 752°F	<b>T</b>
<b>E</b>	NICKEL-CHROMIUM Ni-Cr	CONTANTAN COOPER-NICKEL Cu-Ni	-270 to 1000°C -454 to 1832°F	<b>E</b>
<b>N</b>	NICROSIL Ni-Cr-Si	NISIL Ni-Si-Mg	-270 to 1300°C -450 to 2372°F	<b>N</b>
<b>S</b>	PLATINUM-10% RHODIUM Pt-10%Rh	PLATINUM Pt	-50 to 1788°C -58 to 3214°F	<b>S</b>
<b>R</b>	PLATINUM-13% RHODIUM Pt-13%Rh	PLATINUM Pt	-50 to 1788°C -58 to 3214°F	<b>R</b>
<b>B</b>	PLATINUM-30% RHODIUM Pt-30%Rh	PLATINUM-6% RHODIUM Pt-6%Rh	0 to 1820°C 32 to 3308°F	<b>B</b>

## Cold Junction Compensation

For the functional operation of the thermocouple there's the cold junction point at the copper connection of each TC20 channel. Technically this is also an internal thermocouple and it is internally measured with highly accurate built-in temperature sensors, which enables the TC20 Unit to correct or compensate for this bias voltage per channel.

*Cold junctions are shown within the blue oval below*



### Attention!

It is important for accuracy that the cold junction point is not influenced by external sources such as an airflow over the front of the TC20 Unit.

*Internal temperature sources are controlled by design in the TC20.*

**Maximum power consumption in most demanding operating conditions 7 W.**

# 7. Unit features and conditioning options

## Supported functions of REC and DI Unit

The tables below provide an overview of the supported functions of the Simcenter SCADAS RS Recorder unit (REC).

Features		REC	DI
Built-in intelligence	On-board Simcenter SCADAS RS Recorder App	✓ Recorder App	
	Measurement autonomy	✓	
	Data recording, reduction and processing	✓	
	Intelligent triggering	✓	
	Instrumentation & channel setup	✓	
	Calibration, validation and monitoring	✓	
Internal storage	Non-volatile memory for channel setup	✓ System level	
	At least 220 GB free SSD drive user space	✓	
	Recording setup template and measurement files	✓	
Daisy chaining	Distribute power and data over distances up to 50 m between units	✓	✓
	Up and downstream connectors	1x up 4x down	✓
	Manages data streams as a switch of high-speed downstream chains	✓	
Connectivity	1 Gb Ethernet: UTP to network or host PC	✓	
	Wi-Fi: 5.0 GHz and 2.4 GHz networks	✓	
	USB 3.0: Data transfer to external HD *)	✓	
	LTE: Trough external modem	✓	
	Synchronize multiple REC Units *)	✓	
Inputs isolation	Connector to Unit supply	✓	✓
	Connector to connector	✓	✓

\*) Future use

Conditioning options		REC	DI
GNSS	GPS, GLONASS, BeiDou	✓	
CAN bus	4x CAN (CAN 2.0B, CAN-FD)	✓	✓
	TCK8 module: Thermocouple K type sensors (2x per CAN, up to 64x channels)	✓	✓
Pulse & Tacho conversion	Conversion to counts (linear or angular position), and rate (frequency, speed, RPM, fuel flow, ...)	✓	✓
	Signal available up to 3 kHz	✓	✓
Digital Pulse & Tacho	Channels	9x	9x
	Up to 1 Mpulse/s	✓	✓
	DC supplies of 5 V and 12 V	✓	✓
	TTL, HTL (single ended and differential), RS422/RS485	✓	✓
	Rotary or linear encoder sensors (ref, sense of rotation, pulse)	✓	✓
	Zero position based on reference pulse (for encoder type sensors)	✓	✓

## Supported functions of analog Signal Conditioning Units

The tables below provide an overview of the supported functions of the Simcenter SCADAS RS Analog Signal Conditioning Units.

Features		U12	U12-E	B24	S24
Built-in intelligence	On-board Simcenter SCADAS RS Configuration App	✓	✓	✓	✓
	Instrumentation & channel setup	✓	✓	✓	✓
	Calibration, validation and monitoring	✓	✓	✓	✓
Internal storage	Non-volatile memory for channel setup	✓	✓	✓	✓
Daisy chaining	1x up and 1x downstream connectors	✓	✓	✓	✓
Connectivity	Ethernet to network or host PC (setup/monitoring)	✓	✓	✓	✓
Inputs isolation	Channel to Unit supply	✓	✓	✓	✓
	Channel to channel	✓	✓		
Extended temperature range	-40 to +85 °C (-40 to +185 °F)	✓	✓		

Conditioning options		U12	U12-E	B24	S24
Analog Pulse & Tacho	Channels	1x	1x		
	Conversion to counts (linear or angular position), and rate (frequency, speed, RPM, fuel flow, ...)	✓	✓		
	Signal available up to 3 kHz	✓	✓		
	Variable reluctance up to 400 Vpp	✓	✓		
Analog channels	Total	12x	12x	24x	24x
Sample rates per channel	Selectable rates	0.2 Hz to 48 kHz	0.2 Hz to 48 kHz	0.2 Hz to 24 kHz	0.2 Hz to 24 kHz
	24-bit $\Delta\Sigma$ ADC multiple-step decimation	✓	✓	✓	✓
Bandwidths per channel (-3 dB)	Selectable bandwidths	Up to 8 kHz	Up to 20.7 kHz	Up to 4 kHz	Up to 4 kHz
	Bessel, Butterworth, Gaussian and Steep FIR filters	✓	✓	✓	✓

Conditioning options		U12	U12-E	B24	S24
Differential conditioning per channel	Voltage up to $\pm 10$ V	✓	✓	✓	✓
	Current loop 0/4–20 mA (over shunt resistor)	✓	✓	✓ *)	✓
	DC and AC coupled	✓	✓	✓	✓
Single ended conditioning per channel	Voltage up to $\pm 60$ V	✓	✓		✓
	ICP® sensors	✓	✓		✓
	DC and AC coupled	✓	✓		✓
Supply power per channel	Unipolar DC: 15 V	✓	✓		✓
	Unipolar DC: 5 V **)	✓	✓	✓	
	Bipolar DC: 1 V ( $\pm 0.5$ V), 3 V ( $\pm 1.5$ V), 10 V ( $\pm 5$ V)	✓	✓	✓	
	Bipolar AC: 0.6 Vrms, 2 Vrms, 6 Vrms	✓	✓	✓	
Bridge conditioning per channel	Full and half bridge (120 $\Omega$ , 350 $\Omega$ , 1000 $\Omega$ , ... free entry)	✓	✓	✓	
	Quarter bridges with completion resistor 120 $\Omega$	✓	✓	✓ (B24-120)	
	Quarter bridges with completion resistor 350 $\Omega$	✓	✓	✓ (B24-350)	
	Ratio metric ranges from 3 mV/V to 10,000 mV/V	✓	✓	✓	
	Strain gauges	✓	✓	✓	
	Load cells	✓	✓	✓	
	Piezo-resistive sensors	✓	✓	✓	
	Piezo-capacitive sensors	✓	✓	✓	
	RTD sensors	✓	✓	✓	
	Internal and external shunt calibration	✓	✓	✓	
Other conditioning per channel	Inductive AC LVDT/RVDT	✓	✓	✓	
	Potentiometers	✓	✓	✓	

\*) Requires external supply

\*\*\*) 5V unipolar is available from the 10 V bipolar supply



**Attention!**

The channel signal ground of B24 and S24 units is connected to the chassis.



**Attention!**

Common supply for all channels of the S24 unit: if the supply is activated on one channel, it will be present on all other channels, regardless of channel settings.

## 8-Channel Thermocouple type K Conditioning Unit

The 8-Channel Thermocouple type K Conditioning Units (SC-TCK8-A and SC-TCK8-B) form a part of the already existing Siemens product portfolio. SC-TCK8 Units are external devices that allow extending the Simcenter SCADAS RS capability to acquire a high number of K-type thermocouples signals. They form a useful addition to the Simcenter SCADAS RS system.

An SC-TCK8-A and an SC-TCK8-B Unit can be connected in Main-Secondary configuration. Each unit uses two CAN messages to send its data.

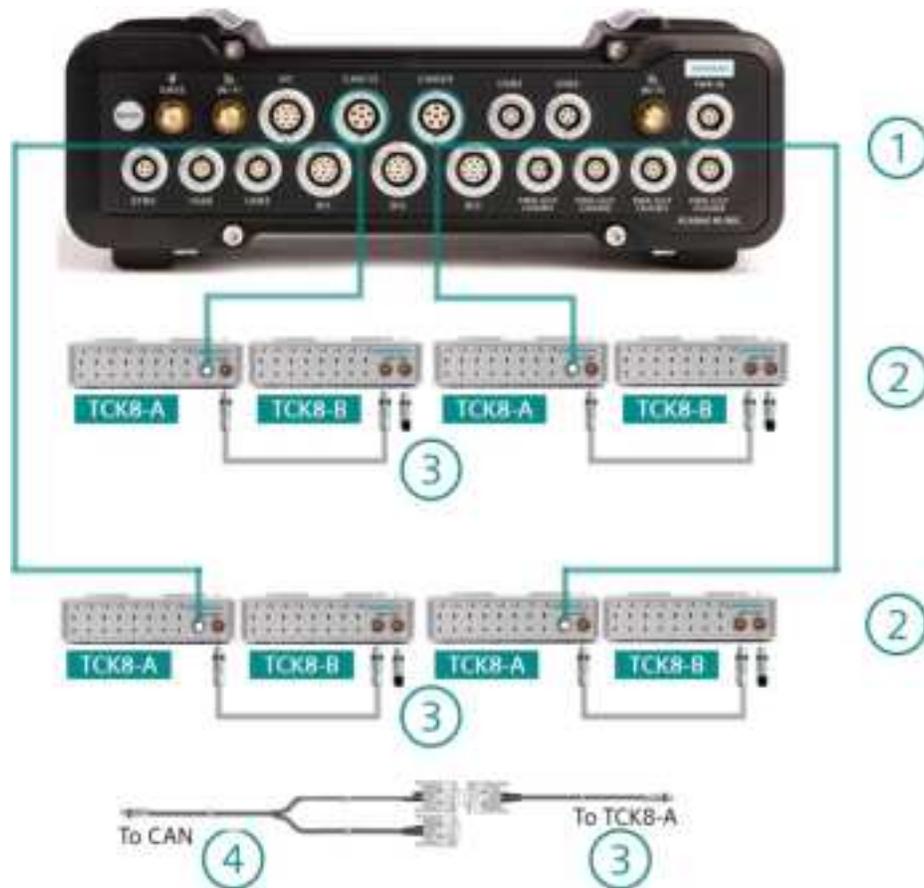
Power is provided from the CAN connector. Each CAN bus supports a maximum of two TCK8 units, so four per connector and eight in total (64 channels).

With each order of an SC-TCK8-A and/or SC-TCK8-B, the required cables and terminator plugs are included \*).

\*) Excluding mating cable from Simcenter SCADAS RS to 2xDB9 connectors.

The SC-TCK8-A comes with an SC-TCK-ICC cable and a SC-TCK-TER plug.

The SC-TCK8-B comes with an SC-TCK-MS cable. The terminator plug must then move from the SC-TCK8-A to the SC-TCK8-B.



No.	Description	No.	Description
1	Simcenter SCADAS RS Recorder Unit	3	Terminator plug and TCK8 cables
2	SC-TCK8-A, SC-TCK8-B	4	Mating cable from Simcenter SCADAS RS to 2x DB9 connectors (available as Simcenter SCADAS RS accessory)



# 8. Mounting and combining units

## Stacking and de-stacking

Units can be stacked and de-stacked by means of a convenient lock and pin system.



No.	Description
1	Release button
2	Locking pin
3	Fixed alignment pins
4	Left: spring suspended alignment pins (bottom side of a unit) Right: holes (top side of a unit)

## How to stack units

Step	Visual
1. Position the upper unit under a slight angle on top of the lower unit.	 The image shows two black industrial units stacked. The top unit is tilted slightly forward and to the right, resting on the top surface of the bottom unit. Both units have a front panel with a grid of circular ports. The top unit's ports are partially obscured by its tilt.
2. Insert the spring suspended pins on the left side of the upper unit into the openings on the top of the lower unit.	 The image shows the same two stacked units as in the previous step. A semi-transparent green circle is overlaid on the left side of the top unit, highlighting the area where spring-suspended pins would be inserted into the top of the bottom unit.

Step	Visual
3. Move the upper unit level to the right and push it onto the lower unit.	
4. Move the upper unit to the left. The upper unit will now with an audible click be fixed to the lower unit.	



### Attention!

- Siemens recommends stacking a maximum of 3 units to prevent instability and damage due to torque forces.
- *Stacking of more than 3 units is only allowed when using U-frame Supports (supports 3 units front and 3 units back), or when using straps!*

See [Back to back mounting](#).

## How to de-stack units

Step	Visual
1. Depress the release button of the upper unit.	
2. Keep the release button depressed and move the upper unit to the right.	

Step	Visual
3. Lift the upper unit under a slight angle.	 A photograph of two black industrial units stacked vertically. The top unit is being lifted upwards and slightly to the right. A teal arrow points upwards from the top surface of the lower unit towards the bottom of the upper unit, indicating the direction of movement.
4. Move the upper unit to the left and detach it from the lower unit.	 A photograph of the same two stacked units. The top unit is now being moved horizontally to the left. A teal arrow points to the left from the top surface of the upper unit, indicating the direction of movement.

Step	Visual
5. Lift the upper unit.	 A photograph showing two black industrial units. The lower unit is on the surface, and the upper unit is being held above it by two hands. A green arrow points upwards from the lower unit to the upper unit, indicating the direction of movement. Both units have a row of circular ports on their front face.

## Back to back mounting

Simcenter SCADAS RS units can be mounted back to back. In this case units are connected to each other by two U-frame Supports.

The maximum number of units that can be mounted back to back with two U-frame Supports is two stacks of three units each.



Back to back mounted units

### How to mount units back to back

1. Stack the units as described in [How to stack units](#).
2. Mount two T-frame Supports with the open side facing outside and with the slotted holes facing downward between the backs of the stacked units.
3. Mount each unit with four M6x12 bolts, a spring washer or a serrated washer followed by a flat washer to prevent them from vibrating loose (see picture on the next page).



**Attention!**

Use stainless steel bolts and washers if the units are going to be used in a corrosive environment.



**Caution!**

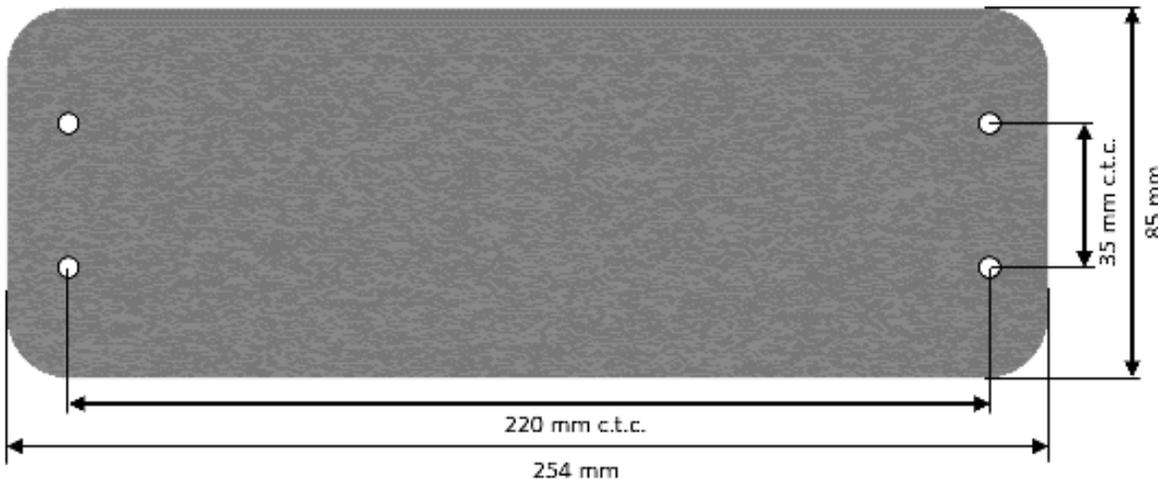
Do not over-tighten the bolts as it can damage the unit. The maximum applied torque is 6 Nm.

Recommended thread-locker when required: Loctite® 2400, medium-strength (refer to the TDS and MSDS for application and safety details).

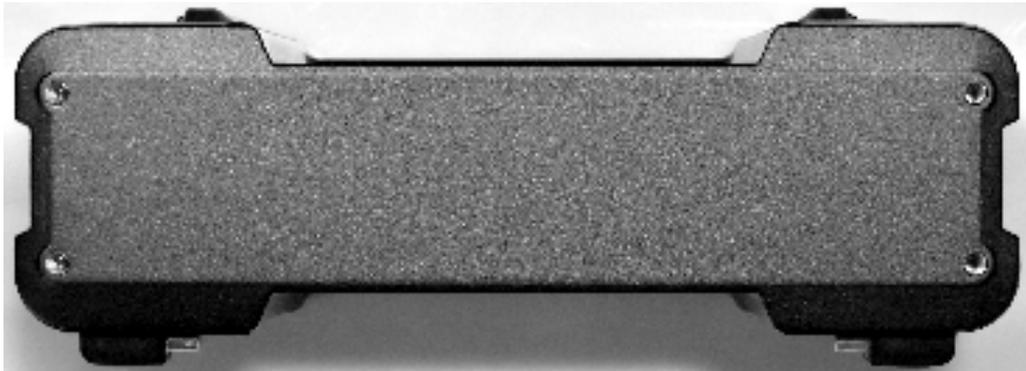
## Mounting onto a back plate

Units can be mounted onto a back plate.

Drill four 7 mm holes in the back plate for each unit, according to the template.



Mount each unit with four M6 bolts onto the back plate. Apply a spring washer or serrated washer to the bolts to prevent them from coming loose due to vibrations.



The depth of the threaded holes in the unit's rear side is 12 mm. To determine the maximum length of the bolt's stem, add the thickness of the washers and the back plate to the depth of the threaded holes.



### **Attention!**

Use stainless steel bolts and washers if the units are going to be used in a corrosive environment.



### **Caution!**

Do not over-tighten the bolts as it can damage the unit. The maximum applied torque is 6 Nm.

Recommended thread-locker when required: Loctite® 2400, medium-strength (refer to the TDS and MSDS for application and safety details).

## Strapping units

In case the Simcenter SCADAS RS system is to be strapped down to a vehicle or other object, it can be equipped with Mounting Clamps and high-strength straps. To prevent damage to the test object and/or the RS system, the units must be strapped securely.



### Caution!

Check the straps before use. Discard any damaged or worn strap. Replace it with a new one to prevent breakage and causing damage to the Simcenter SCADAS RS system and the test object.

Loose objects also present a safety hazard to personnel and may cause damage to the Simcenter SCADAS RS system and the test object. Make sure that no loose objects are present in the test environment.

## How to strap units

1. Stack or mount the units back to back as described in the previous sections (see [Stacking](#) and/or [Back to back mounting](#)).
2. Attach Mounting Clamps on *ALL* four corners of the stacked units with four M4x12 bolts. Apply a spring washer or a serrated washer followed by a flat washer to the bolts.



3. Strap the combination of units tightly on all four corners to the test object with 35 mm wide straps to prevent shifting and/or rattling.



### Attention!

Use stainless steel bolts and washers if the units are going to be used in a corrosive environment.



### Caution!

Do not over-tighten the bolts as it can damage the unit. The maximum applied torque is 6 Nm.

Recommended thread-locker when required: Loctite® 2400, medium-strength (refer to the TDS and MSDS for application and safety details).



### Caution!

Do not over-tighten the straps to prevent damaging the units.

The straps must have a minimum tensile strength of 500 kg.

# 9. Configuring units

## Configuring

*Units must be configured before they can be used.*

When positioned in a daisy chain, each unit can be addressed individually for configuration using its own Web App.

The Web App of the REC Unit can be used to configure the complete system and thereby each individual unit in the system.

For stand-alone configuration units can be powered by means of a Siemens approved 48 VDC AC/DC power adapter.



Use Simcenter Testlab Neo software, the Simcenter SCADAS RS Recorder App and/or the Simcenter SCADAS RS Configuration App to configure units.

Full information can be found in the User Manual of the Simcenter Testlab Neo application software.

The App is opened by typing the IP address of a unit in the web browser of the device to which the unit is connected or through an embedded discovery mechanism.

If a PC is used, the unit can always be found in Windows Explorer, section "Network - Other devices". The App will start up after double clicking the icon of the unit.



### **Attention!**

The Windows discovery process may take up to 20 s before showing the units as devices.

A PC, without extra tooling installed, can discover network devices using SSDP which is part of the UPnP standard. In Windows 10, the SSDP discovery service might be disabled by default. This can be fixed by opening "Windows Services" and activating SSDP.

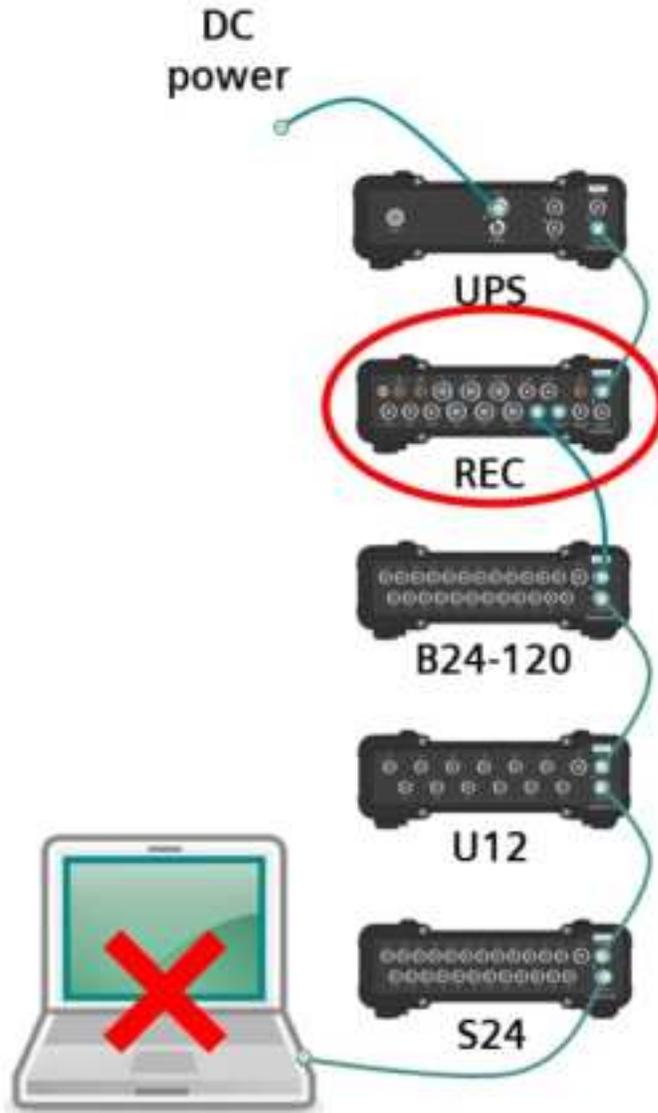
The IP configuration of the PC should be set to "Obtain an IP address automatically".

In case of problems refer to [Solving common problems](#) or contact your IT department.



**Attention!**

When a REC Unit is present, do not connect a PC to the daisy chain.



# 10. Connecting cables

## Daisy chaining

In order to function, *ALL* units must be connected by daisy chain cables that carry power and data.

The UPS Unit requires a DC power source, usually from the vehicle or system under test. The power is fed via the POWER connector on the front side of the UPS Unit.

Connect the UPS Unit's PWR OUT/DATA connector to one of the DATA connectors of the next unit, usually a REC Unit. From here the next unit must be connected in the same way.



### Warning!

Do NOT connect an individual daisy chain to more than one power source. Doing such will destroy the units.

It is allowed to use two or more UPS Units, because these units deliver power only "downstream" to subsequent units.



### Attention!

Make sure that all unused connectors are sealed with a cap against dirt and moisture.

## Handling sensor plugs

All connector and plug types shown are of the Yamaichi brand.



### Attention!

When connecting or disconnecting sensors from a unit, make sure to hold plugs by the ribbed part, NOT at the back nut.

*Yamaichi latching / de-latching mechanism is not operable from the back nut.*



# 11. System connectivity

## Host interface

The Simcenter SCADAS RS Recorder Unit is at the heart of the system and can be accessed in different ways. The REC Unit can serve as a Wi-Fi access point, conform IEEE 802.11g and IEEE 802.11ac, that can serve a maximum of four clients. The user can connect to the REC Unit via any device that contains a standard web browser.

The REC Unit can also be configured as a client using a wired or wireless network connection. The user can access the REC unit via its network ID over a wired connection.

In access point mode, devices can be connected to the WIFI networks created by the 2.4 GHz and 5.0 GHz antennas. The preset network names are "SCADAS-RS-2.4-nnnnnnnnnn" and "SCADAS-RS-5.0-nnnnnnnnnn" respectively, with the default password "SCADAS-RS". Although hardware is ready for 5.0 GHz, it is not yet supported. nnnnnnnnnn are unique serial numbers.

In client mode the unit connects to an external access point. In this case, the REC Unit must be configured to access the wireless network through its SSID and password.

The data stored on the internal SSD can be transferred to a PC via Wi-Fi or via the 1 Gb Ethernet port. The REC Unit provides file access to the user via Windows Explorer, Network - Computer section, and clicking the REC device, appearing as a computer. Default user name and password are "USER" (capital letters) and "SCADAS-RS" respectively. SFTP is also supported.

Another method is to transfer data from the internal SSD to an external disk connected to the USB 3.0 port \*).

\*) Although hardware is ready, it is not yet supported.



### Attention!

The REC Unit's wired adapter default configuration is dynamic IP. After unboxing, a first point to point access with a PC may be made. The REC Unit's wired and Wi-Fi network settings can be customized further.

When the REC Unit is wired to a PC, make sure your PC network adapter is set to "Automatic IP" (by default in Windows). If your SSDP Windows service is active, the REC unit should be visible under "Network" in Windows Explorer. The REC unit should be accessible anyway at its fallback APIPA IP (see physical label).

When the REC Unit is connected to a wired network, also make sure that the network router allows for a new device IP (DHCP).

When in doubt, contact your local IT department.

## Synchronization interface

The units in the system are synchronized using distributed clocks according to the IEEE1588 PTP protocol. The primary clock source is allocated inside the REC Unit. The primary clock source can be synchronized to an external clock using IRIG B <sup>\*\*</sup>), IEEE1588 PTP or GNSS depending on configuration. In absence of an external clock the real time clock of the REC Unit is used as primary wall clock. All data from all sensors is time-stamped. This ensures that all data samples are correctly positioned in time relative to each other.

<sup>\*\*</sup>) Although hardware is ready, it is not yet supported.

## Security

Security of the environment in which the Simcenter SCADAS RS is used is a prerequisite for the safe use of equipment and protection of any data present in the system.

Simcenter SCADAS RS has provisions to secure connections to external environments in order to protect any data present in the system; i.e. physical access areas and/or data transfer networks are administrated with proper access control.

- Wi-Fi connections are protected by encryption (network password required).
- For the built-in file server in the REC Unit Windows 7 or higher is required, with the same user and password as the one for the Recorder App. For file access, use the left pane of Windows Explorer. For the Recorder app, double click on the REC icon in the right pane of Windows Explorer. Simultaneous access of a file and recording is discouraged, to ensure throughput and data integrity. In case of problems contact your IT department.
- User name and password protection is used to prevent against unauthorized access to any data. It is up to the user to take proper measures to secure management of user names and passwords.
- Firmware updates are performed by digitally signed firmware images to confirm the authentication and integrity.

See also [Firmware updates](#) and [Troubleshooting](#).



Password requires a minimum length of 8 characters, with at least 1 special character and at least one capital.

**Attention!**

To disassemble the system, do not remove daisy chain cables from the REC Unit until the system is switched off and its LED does not light up anymore.



# 12. Operating Simcenter SCADAS RS

## Preparing for first use

The Uninterruptable Power Supply Unit is equipped with a built-in Li-Ion battery pack that serves as power buffer. Charge it before use with a Siemens approved AC/DC adapter or with the on-board power source of the vehicle or system under test.



### Attention!

The UPS Unit will charge the power buffer when the UPS Unit is connected to a DC power source and there is enough power available, which depends on the current load of the system.

When the power of the power buffer is getting close to its critical value, the UPS Unit will shut down the system after it has enabled the Recorder Unit to save the data first.

Power buffer charging stops above a load of 82 W and restarts when the load drops below 75 W.

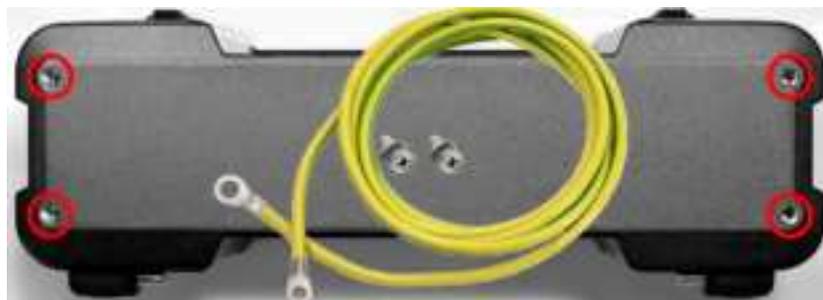
## Setup and configuring

For (initial) setup and configuring, units can be powered individually by a Siemens approved AC/DC power adapter. Units in a daisy chain setup are powered by a UPS Unit. The UPS Unit gets its power from a DC power source in the vehicle or the system under test.

## Grounding stacked units

Ground stacks of units properly before powering up.

1. Main stack: Bring external earth ground, or vehicle chassis ground in mobile setups, to the units' stack chassis.
  - Use an accessible metallic point, like one of the backside screw holes.



- Make an electrical contact to a grounded structure.
  - Mechanically or by using grounding cable accessory (SCRSA-CAB001).
- 2. Daisy chained stack (distance  $\geq$  10 m):
  - Repeat same process as for Main stack.
- 3. Daisy chained stack (distance  $<$  10 m):
  - No grounding needed (short daisy chain cable shield connects chassis between stacks).
- 4. Check proper grounding by measuring continuity between stack chassis and external ground with a multimeter while system is off, and only daisy chain cables are connected to the stacked units.



### Attention!

- **Simcenter SCADAS RS does NOT take ground from any power supply.**
- Electrical contact between units' chassis in a stack is provided by the short daisy chain cables, and *NOT* by the stack mechanism itself.

## Before powering up

- Make sure that the power buffer is charged.
- Make sure that *ALL* cables are properly connected before switching on the power.
- Make sure *ALL* units and components are mounted securely before operating the system.

## ON/OFF switching

The entire system is switched on by pushing the ON/OFF button of the "main" UPS Unit. This will start up the REC Unit. Next, the REC Unit will distribute the power to the daisy chain connectors. If there are UPS Units present in the daisy chains that are connected to the REC Unit, these secondary UPS Units will start up automatically from the moment they detect power in their upper daisy chain connector. Next, they will provide power to their bottom daisy chain connector.

To switch off the system manually, switch off the "main" UPS Unit in the system. The UPS Unit will send a shutdown request to the REC Unit. The REC Unit will safely terminate any running measurement and save the data. Next, the REC Unit will instruct all UPS Units in the system to enter power off mode.

The UPS Unit ensures a stable power supply. It can continue to provide full power for a specific time if the input voltage drops or fails. It indicates whether there is sufficient power in the system for a particular configuration. It publishes its health status and generates a warning to the user when action is needed to prevent power problems. All this contributes to the reliability and robustness of the entire system.

If the input voltage fails longer than a certain amount of time the UPS Unit will start a system shutdown procedure. The running measurement(s) will be safely terminated, and the data will be saved before the entire system shuts down.

The maximum time the UPS Unit can deliver power depends on the condition of the internal power buffer, the number of units and sensors connected, the configuration and the ambient temperature.

The UPS Unit provides power to the system through an internal power buffer. Upon depletion of this power buffer, the system is shut down safely, preserving all data recorded on-board.

The UPS enables an intelligent Power Management system that informs the user about the power needs of the current hardware topology and channel configuration.



### Attention!

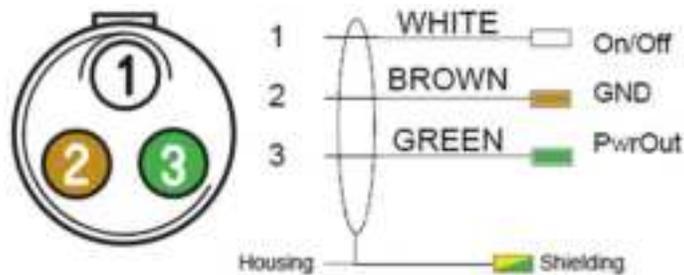
Secondary UPS Units are not meant to be operated locally. They are switched ON or OFF automatically, by the "main" UPS state. If one of the secondary UPS goes OFF, i.e. by lack of available power, only downstream units will be switched OFF.

## Remote ON/OFF switching

Instead of using the ON/OFF button (1), the REMOTE ON/OFF connector (2) of a UPS Unit can also be used to switch the system ON or OFF. This is especially useful if the system needs to be switched on or off manually or automatically from a remote location or a vehicle.



The REMOTE ON/OFF connector (2) allows the UPS Unit to be activated and deactivated by offering an external voltage or by opening or closing a remote switch.



**Pin arrangement REMOTE ON/OFF connector**

There are 2 ways to remotely switch UPS on/off using the 3-pin UPS remote on/off input:

- Using an external voltage source (6.5 V..60 V)
  - Between pins On/Off (1) and GND (2)
  - ON: If there is a voltage source
  - OFF: Otherwise

- Using a (potential free) switch
  - Between pins On/Off (1) and PwrOut (3)
  - ON: If the switch is closed and there is external DC Power available
  - OFF: Otherwise

OFF = Graceful shutdown.

In any case, the UPS Unit will not switch on, or will shut gracefully down, if there are no available power means: no external DC power input and very low internal buffer capacity.

The Remote ON/OFF function of the UPS Unit behaves as follows.

UPS REMOTE INPUT EVENTS		DC power available	Power buffer and/or ext. batteries OK	Power buffer and/or ext. batteries very low
VOLTAGE	6.5 V < High < 60 V	ON	ON (discharge)	SHUTDOWN
	Goes low < 4.5 V	SHUTDOWN	SHUTDOWN	SHUTDOWN
SWITCH	Closed	ON	SHUTDOWN	SHUTDOWN
	Opened	SHUTDOWN	–	–

NOTE: SHUTDOWN means gracefully shutting down.

NOTE: Tolerance in voltage values is  $\pm 10\%$ .

## General operational considerations



### Warning!

Do NOT connect the daisy chain to more than one power source such as a UPS Unit and a Siemens approved AC/DC adapter or two Siemens approved AC/DC adapters. This may cause damage to the units.

It is allowed to use two or more UPS Units, because these units deliver power only "downstream" to subsequent units.



### Caution!

At ambient temperatures higher than +40 °C (+ 104 °F), metal parts can get extremely hot. Please exercise caution when touching the housing and connectors of Simcenter SCADAS RS units and attached accessories. Ensure proper protection (e.g. gloves) against burns or other injuries that may be caused as a result of internal heating of the equipment.



### Attention!

Vents equalize internal and external pressure and provide an outward path for moisture and vapor, which are dissipated during heating and cooling during normal use.

A specific protective vent is used to comply to IP6X requirements in combination with the large temperature span of –40 to +85 °C (–40 to +185 °F) and altitude. It is recommended to avoid extreme sudden changes in temperature, like submersion into cold water from working at maximum operational temperature, or while units are wet or dirty.

**Attention!**

It is recommended to use a heat sink for the REC Unit and expose it to at light air flow.

**Attention!**

While operating the Simcenter SCADAS RS system, do not disconnect the daisy chain cable from the UPS Unit, since *ALL* other units are powered by the UPS Unit. Disconnecting the daisy chain cable will shut down all other units and data will be lost.

**Attention!**

It is recommended to switch off the power before connecting or disconnecting sensors.

**Attention!**

After using the Simcenter SCADAS RS system, shut off the power first, then disconnect the cables. Put a cap on the connector after disconnecting each cable before cleaning the units.

Alternatively, the units can be cleaned while the cables are still connected and unused connectors covered with a cap.

Refer to [Maintenance and calibration](#) for more information on cleaning.

## Li-ion battery safety precautions

**Warning!**

Misused or defective, Li-Ion batteries can build up heat very quickly, catch fire or explode. Make sure that you are aware of potential risks related to Li-Ion batteries. If the UPS Unit is damaged, warped or crushed, stop using it immediately.

**In case a battery is damaged, or you suspect it to be damaged because the unit is damaged, warped or crushed:**

- Do not touch the unit with bare hands, protect eyes and skin.
- Take the unit to a safe and open area and put it on a non-combustible surface.
- Observe the unit from a safe distance, report the incident.

- Do not ship battery packs, dispose of them locally.

### **Keep the unit away from:**

- Open fire.
- Flammable and/or combustible materials.
- Aggressive chemicals such as perchlorate, sulfuric acid, lye, in general chemicals with a pH value lower than 4 or higher than 9.
- Heat sources.

**Do not open units. Replacement of the battery is to be performed by authorized Siemens personnel only.**

### **Guidelines for aerial transport of batteries**

According to the register of Dangerous Goods in the DGR, Lithium-ion batteries are classified in Class 9 – Miscellaneous dangerous goods as UN 3481, "Lithium-ion batteries *contained in equipment*".

There are no special requirements for (air) transport for these batteries (capacity per cell  $\leq 20$  Wh, capacity per battery  $\leq 100$  Wh).

Since the capacity of the Li-Ion battery of the UPS Unit is 58.4 Wh., there are no special requirements for (air) transport of Simcenter SCADAS RS UPS Units.

## LED indications

LEDs on the front of the units indicate the different states with different colors. The LED can either be ON or OFF in a certain color or blink in a certain color with a certain blink rate. The colors and blink rates in principle are identical for *ALL* units. Not all units may show them, depending on the type of unit.

In case a LED needs to represent more than one piece of information with the same priority, information of individual channels will take priority over information of the unit.

Blinking timing loop	
Blinking type and meaning	0 s ..... 1 s ..... 2 s
Solid (steady state)	
Fast (waiting)	
Normal (transient)	
Slow (sleep)	



### Attention!

For more detailed information on LED indications and unit states, consult the software application.

## All Units status LED

LEDs on the front of all units provide information by means of blinking frequency (see table above) and color. The status LED of *ALL* units is in the same location on the front of the units.



General Unit status LED states	Blinking	Color
Booting and Initializing	Normal	White
Upgrading firmware	Normal	Cyan
Identification (via GUI)	Fast	Magenta *)
Internal Error / Unexpected Error	Solid	Red
Idle state	Slow	Green

\*) 5 s default, user editable.

## UPS Unit LEDs

The UPS Unit has three status LEDs, each with a specific function.



UPS Unit status LED states	Blinking	Color
Idle state	Solid	Green
Shutdown (via button or remote)	Normal	Green



UPS Unit power LED states	Blinking	Color
OFF and no DC power	Solid	–
Power buffer FULL and DC power	Solid	Green
Power buffer not FULL and DC power (charging)	Normal	Green
Power buffer discharging	Solid	Yellow
Power buffer discharging and power buffer is low	Normal	Yellow
DC power is present, no battery is being charged (high load, or over-temperature, or battery failure)	Solid	Cyan
Switching on or shutting down because of power overload, over-temperature, battery too low, or general error	Fast	Red



UPS Unit BAT LED states *)	Blinking	Color
No DC power	Solid	–
No external Battery Unit detected	Solid	–
DC power and external Battery Unit is detected and not charging	Normal	Green
DC power and external Battery Unit is detected and charging	Normal	Green
DC power and external Battery Unit is detected and battery error	Fast	Green

\*) Future use.

## Conditioning Units status LED

Conditioning Units have a status LED to indicate the unit's states (see [All Units status LED](#)).

Conditioning Unit status LED states	Blinking	Color
Transmitting data	Solid	Green
Channel supply overload	Fast	Red *)
Transmitting data and Shunt active	Solid	Cyan
Transmitting data and Balancing active	Solid	Cyan
Transmitting data and Calibrating	Solid	Cyan
Transmitting data	Solid	Cyan

\*) Until user action

## REC Unit status LED

The Recorder Unit has a status LED to indicate the unit's different states.



REC UNIT status LED states	Blinking	Color
Publishing data, no recording	Normal	Green
Recording	Solid	Green
Waiting for trigger	Fast	Green
Waiting for wake up	Slow	Green
Busy (stopping recording, closing files, shutting down, synchronizing, etc.)	Fast	Yellow
Data storage almost full	Fast	Red
Throughput exceeded in one or more daisy chains	Normal	Red

## DI Unit Status LEDs



DI UNIT status LED states	Blinking	Color
Transmitting data	Solid	Green
Channel supply overload	Fast	Red *)
CAN Error	Normal	Red

\*) Until user action

## ECAT Unit LEDs states



ECAT status LED states	Blinking	Color
High speed digital inputs detected	Solid	Green



Run LED	Slave state	Error LED	Slave state
Off	INIT	Off	No error
Blinking	PRE-OPERATIONAL	Blinking	Invalid configuration
Single Flash	SAFE-OPERATIONAL	Single flash	Local error
On	OPERATIONAL	Double flash	Watchdog timeout
		On	Application controller failure



LINK/ACT LED	Slave state
Off	Port closed
Flickering	Port opened (activity on port)
On	Port opened (no activity on port)

## Shaping filters

Each channel filter of a Conditioning Unit input can be individually configured with a selectable type, and a bandwidth (at  $-3$  dB) to obtain the desired oversampling factor.

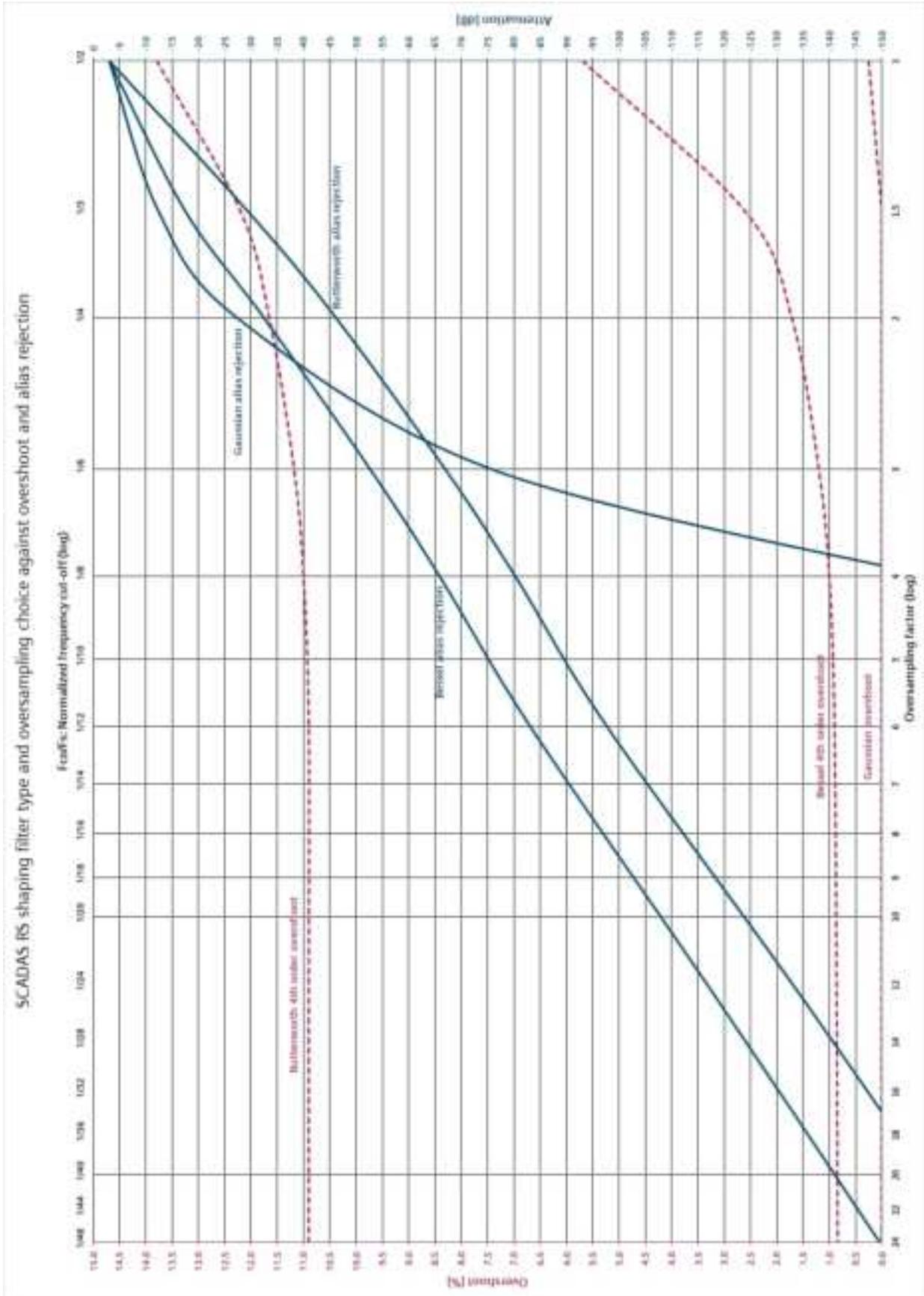
In-band alias attenuation and overshoot characteristics of these filters are shown in the figure on the opposite page.



### Attention!

Plot valid for any selectable sample rate different than the maximum. At maximum sample rate, in-band alias rejection is better than  $-110$  dB.

SCADAS RS shaping filter type and oversampling choice against overshoot and alias rejection

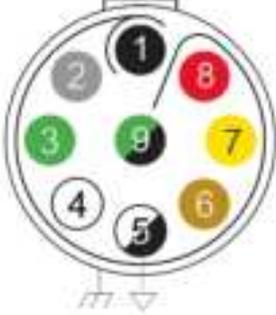


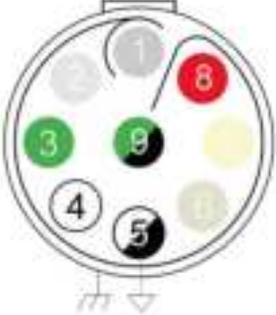
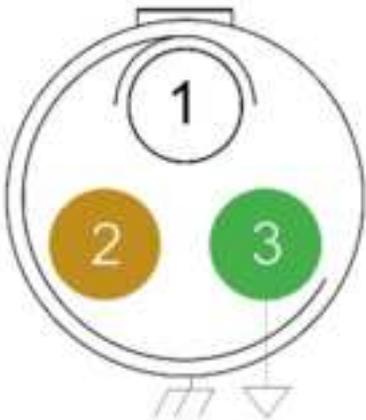


# 13. Pin-out & wiring

## Analog channels pin-out

This section gives an overview of the pin-out of analog channels. It shows inputs, pin functions and which type of connectors are present on which unit(s).

Analog inputs	Pin function	Chassis front connector	Unit(s)
Bridge – strain gage Bridge – RTD Bridge – sense lines Potentiometer AC LVDT/RDVT ICP® Differential Single ended Current loop TEDS I *) TEDS II *)	 <ul style="list-style-type: none"> <li>1 VSupply-</li> <li>2 %BRG</li> <li>3 Vin+</li> <li>4 Vin-</li> <li>5 GND</li> <li>6 Sense+</li> <li>7 Sense-</li> <li>8 VSupply+</li> <li>9 SE/TEDS I/II</li> <li>SHIELD</li> </ul>	 <p>Chassis (female): YCP-TIA09BCG-09FPCY-18708            Plug (male): YCP-TPR09BCX-09MSCBX-051X</p>	U12
Bridge – strain gage Bridge – RTD Potentiometer AC LVDT/RDVT Differential Current loop (externally supplied) TEDS II *)	 <ul style="list-style-type: none"> <li>1 VSupply-</li> <li>2 %BRG</li> <li>3 Vin+</li> <li>4 Vin-</li> <li>5 GND</li> <li>6 N.C.</li> <li>7 N.C.</li> <li>8 VSupply+</li> <li>9 TEDS II</li> <li>SHIELD</li> </ul>	 <p>Chassis (female): YCP-TIA09BCG-09FPCY-18708            Plug (male): YCP-TPR09BCX-09MSCBX-051X</p>	B24-120 B24-350

Analog inputs	Pin function	Chassis front connector	Unit(s)
ICP® Differential Single ended (up to 60 V) Current loop TEDS I *) TEDS II *)		 <p>Chassis (female): YCP-TIA09BCG-09FPCY-18708 Plug (male): YCP-TPR09BCX-09MSCBX-051X</p>	S24
Tacho – analog		 <p>Chassis (female): YCP-TIA12BCG-03FPKZX-000X Plug (male): YCP-TPR12BCX-03MSKFX-056X</p>	U12

\*) Although hardware is ready for TEDS, it is not yet supported.



### Attention!

The S24 Unit has a common supply for all channels: if the supply is activated on one channel, it will be present on all other channels, regardless of channel settings.

## Digital channels pin-out

This section gives an overview of the pin-out of digital channels. It shows inputs, pin functions and which type of connectors are present on which unit(s).

Digital inputs	Pin function	Chassis front connector	Unit(s)
Pulse – digital Incremental encoder	 <p>1 U1/B-            2 U1/B+            3 INDEX-            4 INDEX+            5 VSupply            6 GND            7 U0/A-            8 U0/A+            9 N.C.            10 N.C.            SHIELD</p>	 <p>Chassis (female): YCP-TIA15FCG-10FPGZX-000X            Plug (male): YCP-TPR15FCX-10MSGEX-076X</p>	REC DI
CAN bus	 <p>1 H1            2 H2            3 L2            4 PW            5 L1            6 GND            SHIELD</p>	 <p>Chassis (female): YCP-TIA15ACG-06FPKZX-000X            Plug (male): YCP-TPR15ACX-06MSKFX-061X</p>	REC DI
Digital I/O – TTL – UART / RS-232	 <p>1 IO3            2 IO4            3 TX2            4 RX2            5 TX1/TXD+            6 RX1/TXD-            7 IO1/RXD+            8 IO2/RXD-            9 GND            10 GND            SHIELD</p>	 <p>Chassis (female): YCP-TIA15BCG-10FPGZX-000X            Plug (male): YCP-TPR15BCX-10MSGEX-076X</p>	REC

## Connecting sensors

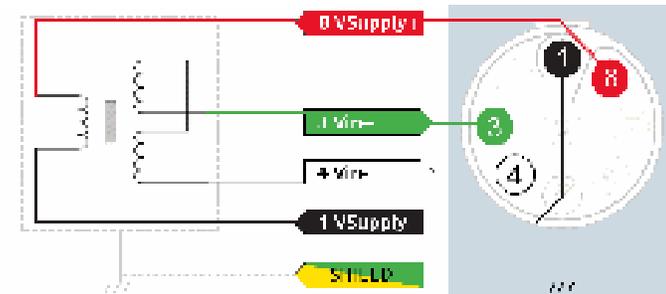
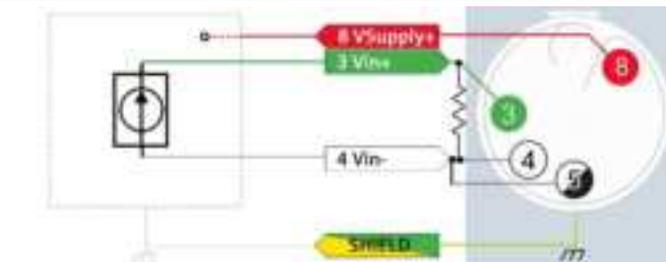
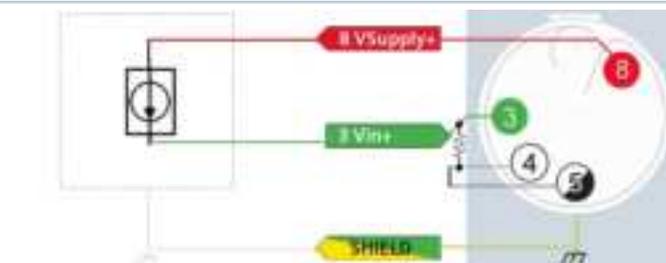
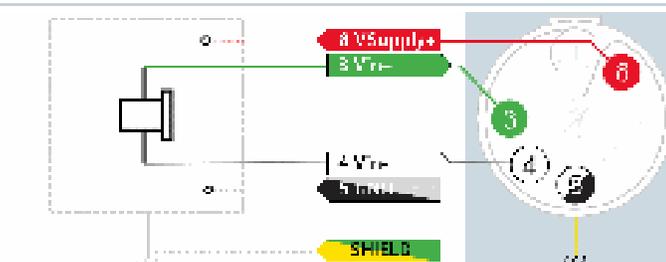
### Wiring

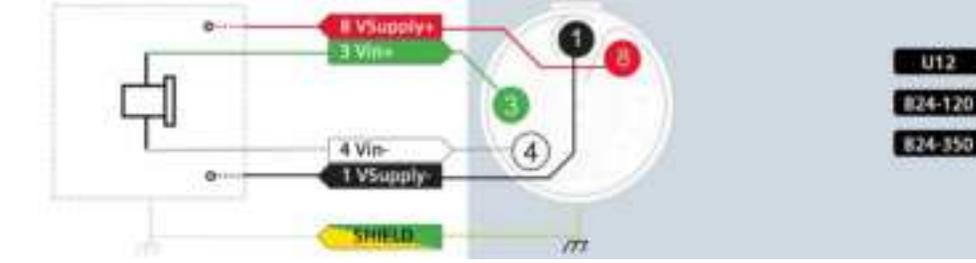
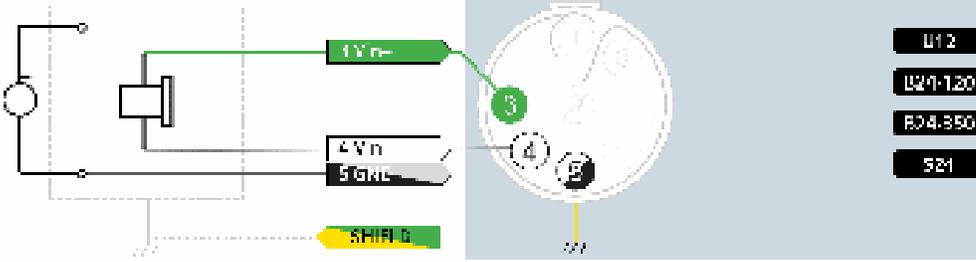
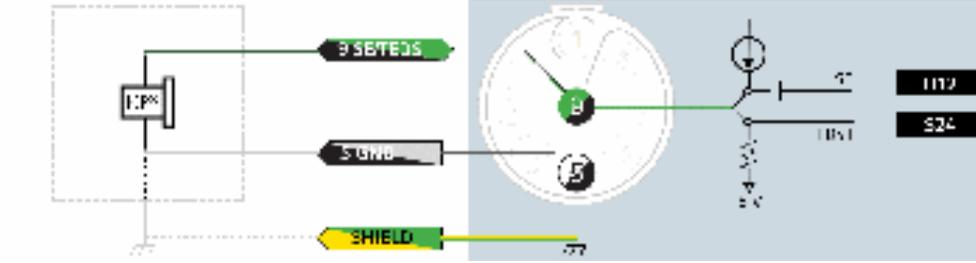
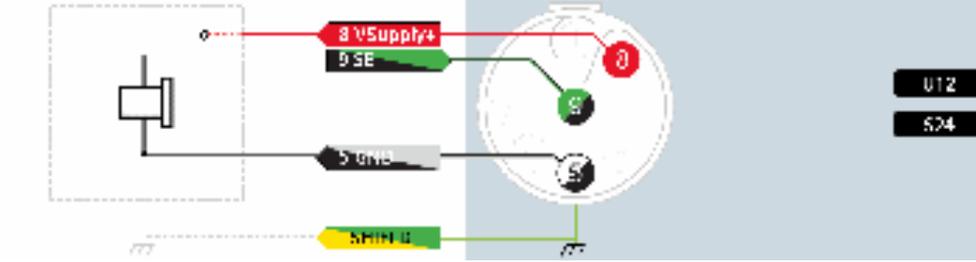
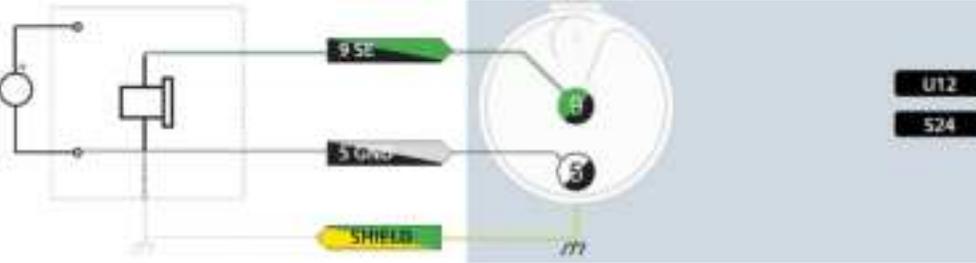
This section shows how sensors are to be wired and to which unit(s) they can be connected.

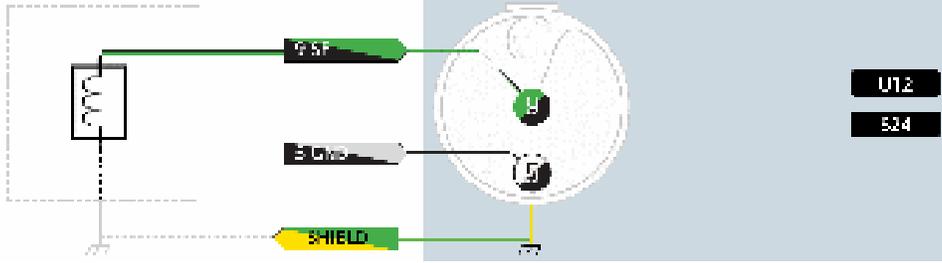
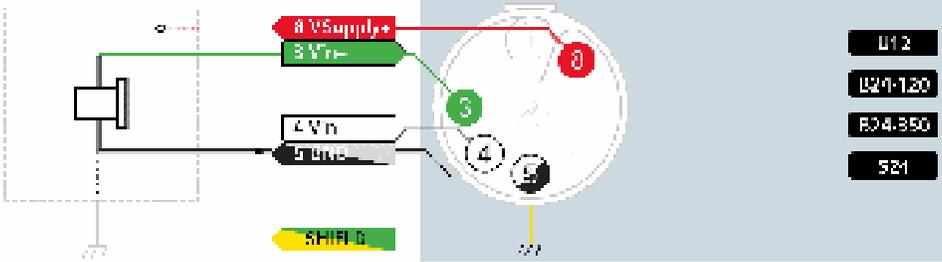
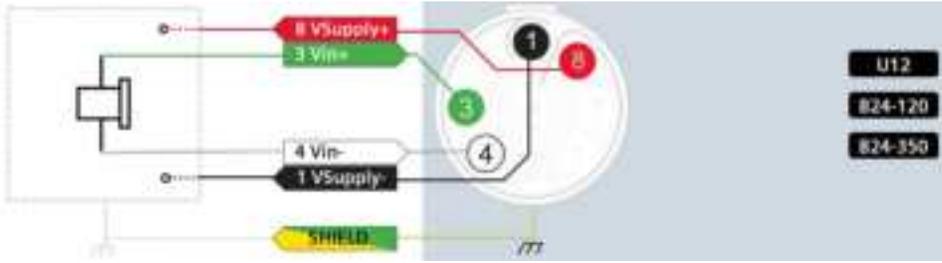
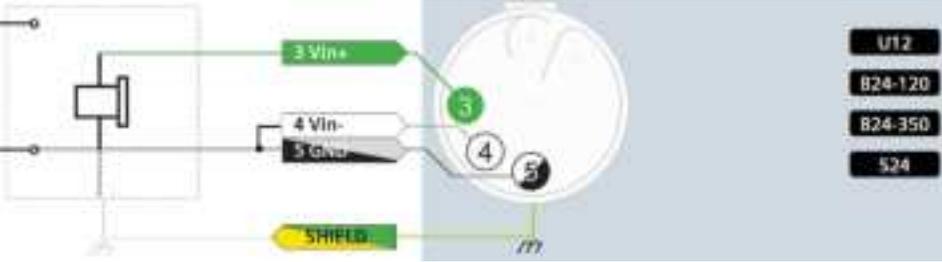
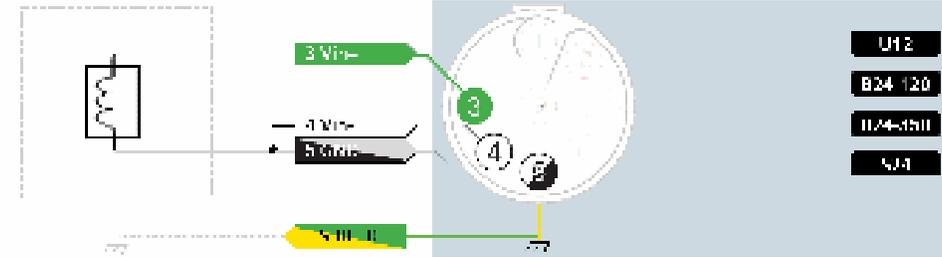
The part shown in gray blue is within the unit.

Analog sensor	Wiring / Unit(s)	
Full bridge 6-wire (sense lines)		<p style="text-align: right;"><b>U12</b></p>
Full bridge (4 wire)		<p style="text-align: right;"><b>U12</b> <b>U24-120</b> <b>U24-250</b></p>
Half bridge 5-wire (sense lines)		<p style="text-align: right;"><b>U12</b></p>
Half bridge 3-wire		<p style="text-align: right;"><b>U12</b> <b>U24-120</b> <b>U24-250</b></p>

Analog sensor	Wiring / Unit(s)
Quarter bridge 4-wire (sense line)	
Quarter bridge 3-wire	
Quarter bridge 2-wire <i>This bridge configuration is not recommended</i>	
Potentiometer (sense lines)	
Potentiometer	

Analog sensor	Wiring / Unit(s)
<p>AC LVDT/RVDT</p>	 <div style="float: right; text-align: right;"> <p>U12</p> <p>B24-120</p> <p>B24-150</p> </div>
<p>Current loop 0/4–20 mA (external supply)</p> <p><i>Using mating cable with included shunt</i></p>	 <div style="float: right; text-align: right;"> <p>U12</p> <p>B24-120</p> <p>B24-350</p> <p>S24</p> </div>
<p>Current loop 0/4-20 mA (3 wires)</p> <p><i>Using mating cable with included shunt</i></p>	 <div style="float: right; text-align: right;"> <p>U12</p> <p>S24</p> </div>
<p>Current loop 4-20 mA</p> <p><i>Using mating cable with included shunt</i></p>	 <div style="float: right; text-align: right;"> <p>U12</p> <p>S24</p> </div>
<p>Differential (with unipolar supply)</p> <p><i>B24: VSupply- pin is also active. If accidentally shorted, positive supply pin will also be disabled.</i></p>	 <div style="float: right; text-align: right;"> <p>U12</p> <p>U24-1-100</p> <p>B24-350</p> <p>S24</p> </div>

Analog sensor	Wiring / Unit(s)
Differential (with bipolar supply)	
Differential (external supply)	
ICP® (TEDS class I support) *)	
Single ended (with supply)	
Single ended (external supply)	

Analog sensor	Wiring / Unit(s)
Single ended (no supply – inductive)	
Single ended (with unipolar supply) using differential input  <i>B24: VSupply- pin is also active. If accidentally shorted, positive supply pin will also be disabled.</i>	
Single ended (with bipolar supply) using differential input	
Single ended (external supply) using differential input	
Single ended (no supply – inductive) using differential input	

\*) Although hardware is ready for TEDS, it is not yet supported.

Digital sensor	Wiring / Unit(s)
<p>Single ended pulse input (with supply)</p> <p><i>two more single pulse inputs available using pins 2 or 4 instead of 8</i></p>	
<p>Single ended pulse input (external supply)</p> <p><i>two more single pulse inputs available using pins 2 or 4 instead of 8</i></p>	
<p>Differential pulse input (with supply)</p> <p><i>two more single pulse inputs available using pins 1 &amp; 2 or 3 &amp; 4 instead of 7 &amp; 8</i></p>	
<p>Differential pulse input (external supply)</p> <p><i>two more single pulse inputs available using pins 1 &amp; 2 or 3 &amp; 4 instead of 7 &amp; 8</i></p>	
<p>Single ended incremental encoder (with ref. pulse) with supply)</p> <p><i>If the sensor does not provide a reference pulse, pin 4 may be left unconnected</i></p>	

Digital sensor	Wiring / Unit(s)
Single ended incremental encoder (external supply)  <i>If the sensor does not provide a reference pulse, pin 4 may be left unconnected</i>	
Differential incremental encoder (with supply)  <i>If the sensor does not provide a reference pulse, pins 3 &amp; 4 may be left unconnected</i>	
Differential incremental encoder (external supply)  <i>If the sensor does not provide a reference pulse, pins 3 &amp; 4 may be left unconnected</i>	

Insert the required sensor plugs into the appropriate unit's connector. Use the red dot to align plugs.

Make sure that plugs and connectors engage and latch (see [Handling sensor plugs](#)).



### Attention!

Make sure that all unused connectors are sealed with a cap to prevent dirt and moisture entering.



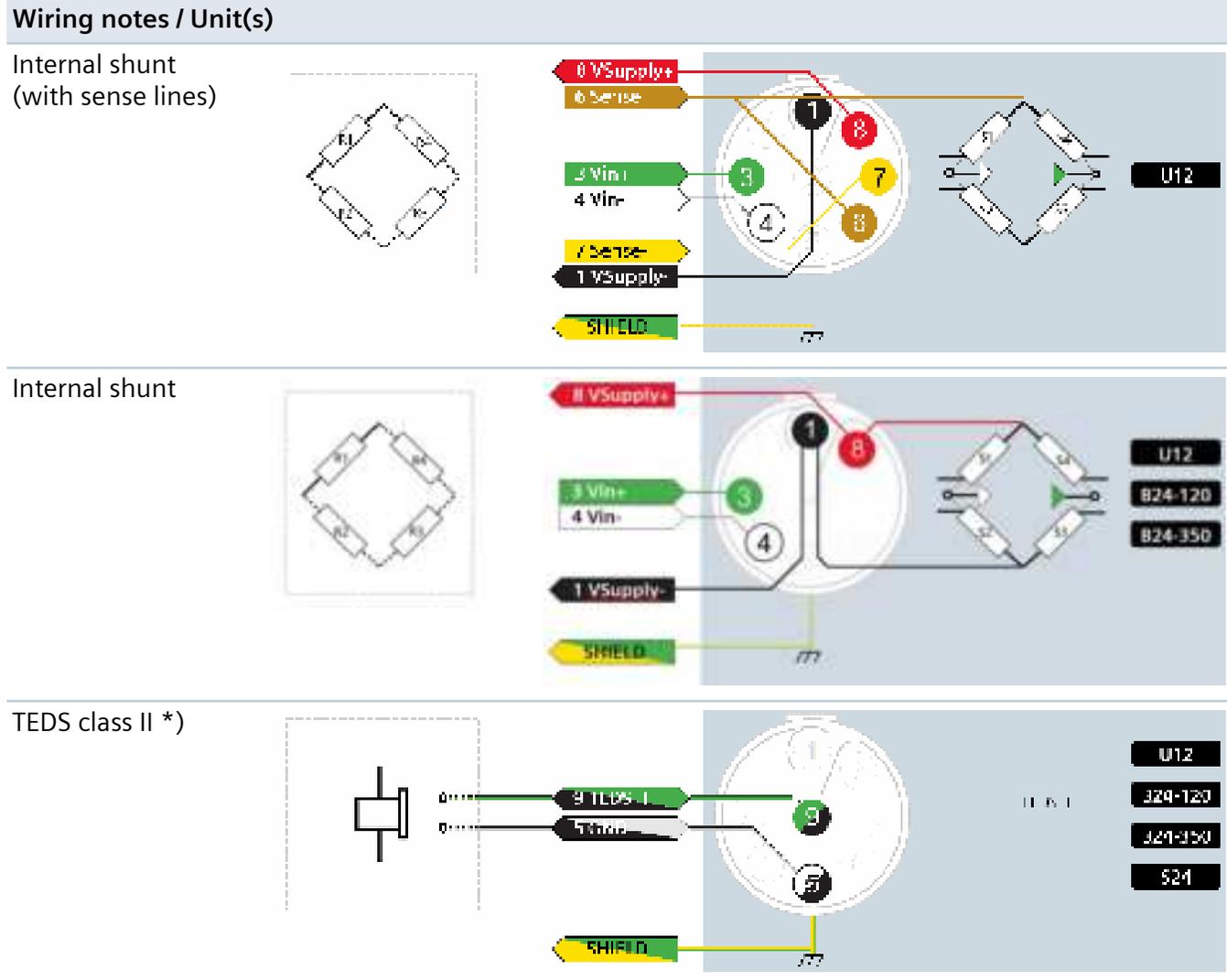
### Caution!

Make sure that all plugs and cables are heat-resistant to at least +65 °C to prevent damage.

## Wiring Notes

This section shows notes on wiring sensors and to which unit(s) they can be connected.

*The part shown in gray blue is within the unit.*



\*) Although hardware is ready for TEDS, it is not yet supported.



# 14. Maintenance and calibration

## Cleaning

There is little maintenance to be performed on Simcenter SCADAS RS units. There are no user serviceable parts inside.

It is important to remove any dirt or grease from the outside of the units.

### Cleaning of units on a vehicle



#### Caution!

When using a pressure washer to clean units on a vehicle, do not exceed the values listed below. Failing to do so may cause damage to units.

**Water volume: 100 l/min**

**Pressure: 100 kPa at a distance of 3 m.**

### Cleaning of individual units

- De-stack units that are stacked.
- Dismount units that are mounted back to back.
- Dismount all units that are mounted onto a back plate.
- Make sure all connectors are sealed with a cap to protect them against dirt, water and/or cleaning agent.



#### Caution!

Do NOT use a pressure washer to clean individual units from a close distance, because this will cause damage due to the high water pressure.

### Cleaning instructions

- Use a brush to wipe off dirt.

If necessary, use lukewarm tap water.

If necessary, apply a mild cleaning agent to remove grease.

- Rinse the units thoroughly off with lukewarm tap water.
- Wipe the units dry with a lint-free cloth.

### Calibration

Simcenter SCADAS RS signal conditioning units are factory calibrated and are accompanied by a calibration report. We recommend having your Simcenter SCADAS RS equipment calibrated on a yearly basis by our Customer Support team through either a maintenance or calibration contract.

In case you or your organization require a calibration under accreditation that is formally traceable to international measurement standards we offer calibrations in our accredited factory calibration laboratory that is fully compliant with the requirements of the ISO 17025:2017 standard and is registered with the Dutch Accreditation Council ([www.rva.nl](http://www.rva.nl)) under scope K159. Please contact your local Siemens support organization for calibration of your Simcenter SCADAS RS equipment.

# 15. Software

## Simcenter SCADAS RS Recorder App and Configuration App

Every unit comes with software embedded on the device. It does not require any installation and it is accessible through any web browser (on PC, tablet, smartphone). The Simcenter SCADAS RS Configuration App is intended to configure units.

The Simcenter SCADAS RS Recorder App can be used for data acquisition and on-board calculations and track-side data validation. For advanced data acquisition and analysis, use Simcenter Testlab Neo application software.

Full information can be found in the User Manual of the Simcenter SCADAS RS Recorder App and Configuration App.

## Simcenter Testlab Neo

Simcenter Testlab Neo is a complete, integrated software solution for advanced data acquisition and analysis. With its unique workflow-based interface, it sets new standards for ease-of-use, productivity, data acquisition, advanced data analysis and data consistency.

The key features of Simcenter Testlab Neo for Road load acquisition, analysis and reporting, are fast and accurate configuration, synchronized recording, streamlined analysis and actionable reports.

Full information can be found in the SCADAS RS Recorder App documentation.

## Firmware updates

When new firmware is available, it must be uploaded to the REC Unit using the Simcenter SCADAS RS Recorder App, using the SCRSA-CABN02 (REC to PC) cable accessory.

In order to upload firmware on other units, the SCRSA-CABN01 (daisy chain to PC) cable accessory is also required.

Full information of this procedure can be found in the SCADAS RS Recorder App User Manual.

Simcenter SCADAS RS firmware, including embedded Simcenter SCADAS RS Recorder App, and Simcenter Testlab Neo can be downloaded from: <https://support.sw.siemens.com>

See also [Security](#).



# 16. Troubleshooting

This is a para in the topic template.

## Solving common problems

The table below gives information on how to proceed when an error occurs.

Status / Error condition	Possible cause(s)	Possible solution(s)
UPS Unit LED blinks red	Mains power lost	Check circuit breaker Check DC power source Check power cord Check cabling
	Power buffer defective	Check power buffer
	Power buffer weak Power buffer partially charged	Check DC power source Check cabling
UPS Unit will not power down	Fault condition Microprocessor defective Communication disrupted	Push the ON/OFF button for more than 10 seconds
Incorrect behavior and/or data in Web app after upgrading firmware	Browser cache still holds old data	Windows: Ctrl + F5 Mac/Apple: Apple + R or Command + R Linux: F5
	Static IP is set outside of the host IP network range	Connect through Wi-Fi interface and change static IP setting, or change host IP network range and change static IP setting
Recorder unit is not visible in Windows Explorer of a connected PC and it is not possible to access recording files	PC is installed with a Windows version older than Windows 7	Windows versions prior to Windows 7 will not be able to connect
	Samba server is not discovered by WSDiscovery	Refresh explorer window (F5)
	WS-Discovery is not enabled on Windows PC	Enable WS-Discovery. Contact your local IT department
	Samba server is not discovered by WSDDiscovery	"\\A.B.C.D" in the windows search box, where A.B.C.D is the REC Unit HOST port IP address.

Status / Error condition	Possible cause(s)	Possible solution(s)
	Samba server in REC Unit is disabled	Restart the REC Unit
	Out of security concerns LLMNR and/or WS-Discovery, SSDP and NBNS may be blocked entirely in a customer corporate network. This will disable discovery or (when WS-Discovery is allowed but LLMNR is not) make the REC Unit visible but not reachable from double-clicking in "Network".	Contact your local IT department to add a DNS record for the REC Unit host name
	None of the above recommended actions resolve the problem	Use SFTP instead to connect to the REC Unit
Access to the REC Unit internal storage using Windows explorer is intermittent	Security products active on the network (such as virus scanner/behavioral scanner, rogue device detection, etc.) that affect the REC Unit's connection the network	Contact your local IT department
Unable to access Web app or Samba share	Forgotten or wrong password input when set	Reset to factory defaults
WebApp is not opened for unknown reason	Maximum number of supported clients exceeded	Close not-used Web clients or wait until number of used clients is below the maximum number supported
Unable to access unit using static IP address	IP settings host device and static IP address of the unit do not match	Check subnet mask address and default gateway address of the host device/PC
	Wrong IP address used; Static IP address of the unit forgotten	In order to retrieve the static IP address of a CU it must be connected to a PC or network with an active DHCP server.  Reset to factory defaults will bring the IP setting to defaults.
Conflicting names Don't know which device is connected	No unique name configured for a Wi-Fi access point	Rename device/SSID

# 17. Glossary

## List of technical terms

Abbreviation	Full text	Explanation
$3\sigma$	Three-sigma rule	A frequently used heuristic; most values are within three times the standard deviation ( $\sigma$ ) of the mean ( $\mu$ )
A/D converter	Analog-to-Digital Converter	A system that converts an analog signal into a digital signal
AAF	Anti-Aliasing Filter	A filter used before a signal sampler to restrict the bandwidth of a signal to create an digital reconstruction of the signal
AC	Alternating Current	A type of electrical current in which the current repeatedly changes direction
ADC	Analog-to-Digital Converter	See A/D converter
AES/EBU	Audio Engineering Society (AES) European Broadcasting Union (EBU)	See S/PDIF
AES3	Audio Engineering Society 3	See AES/EBU
APIPA	Automatic Private IP Addressing	A process that allows an operating system to automatically assign itself an IP address when a DHCP server is not available
Bluetooth	Bluetooth	A wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves from 2.400 to 2.485 GHz
BNC	Bayonet Neill-Concelman	A miniature quick connect/disconnect radio frequency connection used for coaxial cable
CAMAC	Computer Automated Measurement And Control	A standard bus and modular-crate electronics standard for data acquisition and control
CAN (bus)	Controller Area Network	A message-based vehicle bus standard that allows micro-controllers and devices to communicate with each other's applications without a host computer
CAN FD	CAN with Flexible Data-Rate	An extension to the original CAN bus protocol that yields more accurate, "real-time" data
CCP microphone	Constant Current Power microphone	Special type of microphone for measuring purposes

Abbreviation	Full text	Explanation
CIM	Camera Interface Module	Module for imaging and video applications such as video streaming, image processing and surveillance applications
CJC	Cold Junction Compensation	Compensation for temperature-measurement applications because the cold end of the measuring instrument is not at its reference temperature, specifically in thermocouples
D/A converter	Digital-to-Analog converter	A system that converts a digital signal into an analog signal
DAC	Digital-to-Analog Converter	See D/A converter
DC	Direct Current	Electric current that flows in only one direction
DHCP	Dynamic Host Configuration Protocol	A computer protocol that describes how a unit dynamically obtains its network settings (IP address and other network configuration parameters)
DSCU	DAC Shutdown Control Unit	The DAC signal is shut down smoothly by using a power buffer
DSP	Digital Signal Processor	Microprocessor chip for digital signal processing, used to measure, filter or compress continuous real-world digitized analog signals
D-SUB	D-subminiature	A type of electrical connection, named for the D-shaped metal shield
DUT	Device Under Test	The device that is being tested
ECU	Electronic Control Unit	Any embedded system in automotive electronics that controls one or more of the electrical systems or subsystems in a vehicle
ECU	Engine Control Unit	A type of electronic control unit that controls a series of actuators on an internal combustion engine to ensure optimal engine performance
ECM	Engine Control Module	See Engine Control Unit
EMC	ElectroMagnetic Compatibility	The ability of electrical equipment and systems to function acceptably in their electromagnetic environment, by limiting unintentional electromagnetic energy that may cause unwanted effects, such as EMI or RFI
EMI	ElectroMagnetic Interference	A source that disturbs the performance of an electrical circuit or even stops it altogether
EtherCAT	Ethernet for Control Automation Technology	An Ethernet-based fieldbus system, suitable for both hard and soft real-time computing requirements in automation technology

Abbreviation	Full text	Explanation
Ethernet	Ethernet	Computer networking technology, current most extended standard for physical and data link of the OSI model
Ethernet PHY transceiver	Ethernet PHYsical layer transceiver	Transceiver that provides all physical layer functions to transmit and receive data over both standard twisted-pair cables or connected to an external fiber optic transceiver
FPGA	Field-Programmable Gate Array	An integrated circuit consisting of programmable logic components
FlexRay	FlexRay	Automotive network communications protocol to govern on-board automotive computing
GNSS	Global Navigation Satellite System	Provides geolocation and time information to a GPS receiver
GPS	Global Positioning System	A satellite-based radio navigation system
HMS	Head Measuring System	A measuring device that can record aurally accurate binaural sound
HP filter	High-Pass filter	An electronic filter that passes signals with a frequency higher than a certain cut-off frequency and attenuates signals with frequencies lower than the cut-off frequency
I/O	Input / Output	Input signals or data to a (computer) system and output signals or data from the system to another device
ICP transducer	Integrated Circuit Piezoelectric	IEPE piezoelectric sensor with an integrated amplifier
IE	Incremental Encoder	Sensor for detecting position changes (linear) or angle changes (rotating) that can detect distance and direction of travel or angle changes and direction of rotation
IEEE 1451	Institute of Electrical and Electronics Engineers 1451	A set of smart transducer interface standards for connecting transducers (sensors or actuators) to microprocessors, instrumentation systems and control/field networks. See also TEDS.
IEPE	Integrated Electronics Piezo-Electric	A technical standard for piezoelectric sensors that contain built-in impedance conversion electronics
IMU	Inertial Measurement Unit	An instrument that can integrate the movements of a moving object to estimate its orientation, its linear velocity and its position
IPAC	Internet Protocol Automatic Configuration	See APIPA

Abbreviation	Full text	Explanation
IP code	Ingress Protection code	Classifies and rates the degree of protection provided by mechanical casings and electrical enclosures against intrusion, dust, accidental contact and water
IPv4LL	IPv4 Link-Local	See APIPA
IRIG timecode	Inter-Range Instrumentation Group timecode	A standard format for transferring timing information
LAN	Local Access Network / Local Area Network	A computer network that interconnects within a limited area such as one or more buildings
Li-Ion	Lithium Ion	A type of rechargeable battery based on a lithium compound
LIN	Local Interconnect Network	A serial network protocol used for communication between components in vehicles
LTE	Long Term Evolution	A standard for wireless broadband communication for mobile devices and data terminals (3.95G)
LVDT	Linear Variable Differential Transformer	An electrical transformer for measuring linear displacement (position)
MAC address	Media Access Control address	A unique identification number assigned to a device in an Ethernet network
Master/Slave	Master/Slave	Asymmetric communication or control where one device or process controls one or more other devices or processes
MCX	Micro Coaxial connection	Small coaxial RF connection, frequently used to connect external antennas to GPS receivers
MEMS	Micro-Electro-Mechanical Systems	Small embedded systems consisting of a combination of electronic, mechanical and possibly chemical components, such as piezoresistive DC accelerometers in airbags
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests	A United States military standard that defines tests for the compatibility of equipment and devices with extreme temperatures and air pressures, solar radiation, humidity, chemicals, acceleration forces and vibrations
MST	Micro System(s) Technology	See MEMS
NIM standard	Nuclear Instrumentation Module standard	Specifications for cabling, connections, impedances and levels for logic signals (see also CAMAC)
NVH	Noise, Vibration, Harshness	Main application fields for SCADAS
OBD	On-Board Diagnostics	A term referring to the vehicle management system and the interface for reading information of different parts of the vehicle

Abbreviation	Full text	Explanation
PBN	Pass-by Noise	The overall acoustic signature of a vehicle
PoE	Power over Ethernet	Standard or ad hoc systems that pass electric power along with data on twisted pair Ethernet cabling
PPS	Pulse per second	An electrical signal that lasts less than one second, has a sharp rising or falling edge and is repeated precisely once per second
PTP	Point-To-Point	The minimum form of a computer network in which two devices are connected by a cable
PWM	Pulse Width Modulation	A modulation technique in which pulses are emitted at a fixed frequency whose width is varied
RCA connection	Radio Corporation of America connector	An electrical connection used to carry audio and video signals, also called Cinch connection or phono connection
RF	Radio Frequency	The oscillation rate of an alternating electric current or voltage or of a magnetic, electric or electromagnetic field or mechanical system, frequency range from around 20 kHz to around 300 GHz
RFI	Radio Frequency Interference	An RF source disturbs the performance of an electrical circuit or even stops it altogether
RJ45	Registered Jack 45	A modular 8 position 8 contact (8P8C) connection for twisted pair and flat cable for Ethernet over twisted pair and other applications
RPM	Rotations Per Minute	The number of rotations or revolutions per minute of an encoder, axle or wheel etc.
RP-SMA	Reverse Polarity SubMiniature version A	Semi-precision coaxial RF connection that reverses the gender of the interface
RS-232	Recommend Standard 232	A standard for serial communication transmission of data
RS-422	Recommend Standard 422	A standard that specifies electrical characteristics of a digital signaling circuit
RS-485	Recommend Standard 485	A standard defining the electrical characteristics of drivers and receivers for serial communications systems
RSMA	Reverse Polarity SubMiniature version A	Semi-precision coaxial RF connection that reverses the gender of the interface
RTD	Resistance Temperature Device / Resistance Temperature Sensor	Device that determines the temperature by measuring the resistance of a pure electrical wire

Abbreviation	Full text	Explanation
RTK	Real-Time Kinematic	A satellite navigation technique to enhance the precision of position data from satellite-based positioning systems
RVDT	Rotary Variable Differential Transformer	An electrical transformer to measure rotary displacement
S/PDIF S/P-DIF	Sony/Philips Digital Interface	Digital audio signal transmission over a coaxial cable with RCA connections or a fiber optic cable with TOSLINK connections
SCADAS	Signal Condition And Data Acquisition System	Reference instrument for the professional mobile NVH market
SDIF	Sound Description Interchange Format	An open file format standard that specifies the types of data used to describe (digital) audio signals and their representation
SMA	SubMiniature version A	Semi-precision coaxial RF connection
SNR	Signal-to-Noise-Ratio	The ratio of signal power to the noise power, often expressed in decibels (dB)
SPL	Sound Pressure Level	A rapid local pressure variation in air or other medium around the prevailing static pressure, measured in dB or Pa by a microphone or hydrophone
SSD	Solid State Disk / Drive	Device with integrated circuit assemblies to store data persistently, typically flash memory
SSDP	Simple Service Discovery Protocol	A network protocol used to search for UPnP devices on the network
SWIFT	Spinning Wheel Integrated Force Transducer	Wheel force transducer for spinning and non-spinning automotive applications
TEDS	Transducer Electronic Data Sheet	A standardized method of storing transducer (sensors or actuators) identification, calibration, correction data and manufacturer-related information
TOSLINK	Toshiba Link	A standardized optical fiber connection system
TTL	Time To Live	The maximum network lifetime in seconds of a data packet to prevent it from circulating indefinitely
UART	Universal Asynchronous Receiver-Transmitter	A computer hardware device for asynchronous serial communication in which the data format and transmission speeds are configurable
UDMA	Ultra DMA, Ultra Direct Memory Access	Fast interface to transfer data
UpnP	Universal Plug and Play	A collection of computer protocols that allow devices to be connected wirelessly

Abbreviation	Full text	Explanation
UPS	Uninterruptible Power Supply	An electrical device that provides emergency power when the normal power fails
USB	Universal Serial Bus	An industry standard that establishes specifications for cables, connectors, plugs and protocols for connection, communication and power supply between computers and peripheral devices
UTP	Unshielded Twisted Pair	A type of wiring in which two conductors of a single circuit are twisted together to improve electromagnetic compatibility
VSS	Vehicle Speed Sensor	A type of tachometer, a sender device for reading the speed of a vehicle's wheel rotation
UVC	USB Video Class	Devices that stream video over USB
WoC	Wake-on-CAN	An ECU can be powered up by receiving a CAN message on a wake-enabled CAN bus
VCXO	Voltage-Controlled Crystal Oscillator	An oscillator whose frequency is determined by a crystal, the frequency can be adjusted by a small amount by changing a control voltage
WoL	Wake-on-LAN	An Ethernet computer networking standard that allows a computer to be turned on or awakened by a network message
WFI	Wheel Force sensor Interface	Digital interface for clock and trigger signals to an external controlling device
WFS	Wheel Force Sensor	System for real-time measurement of forces and moments acting on a wheel hub under dynamic conditions
WFT	Wheel Force Transducer	Device to determine and record forces and torques at wheels during test drives
Wi-Fi	Wi-Fi	Wireless networking technology for local area networking of devices
WLAN	Wireless LAN	A wireless computer network that links two or more devices using wireless communication to form a local area network (LAN) within a limited area
XCP	Universal Measurement and Calibration Protocol	A network protocol for connecting calibration systems to electronic control units (ECUs)



# 18. Product compliance

## Europe

Simcenter SCADAS RS products SCRS-UPS, SCRS-REC, SCRS-DI, SCRS-S24, SCRS-B24-120, SCRS-B24-350, SCRS-U12, SCRS-U12-E, SCRS-ECAT and SCRS-TC20 comply with the following European directives:

- 2014/35/EU – Low Voltage Directive (LVD) on health and safety risks of electrical and electronic equipment
- 2014/30/EU – EMC Directive on electromagnetic emissions and immunity of electrical and electronic equipment
- 2014/53/EU – Radio Equipment Directive (RED, SCRS-REC only)
- 2011/65/EU – RoHS Directive on the use of hazardous substances

In order to comply with these directives, the products have successfully been tested against the following standards:

- IEC 61326-1: Electrical equipment for measurement, control and laboratory use: EMC requirements
- EN 55011: Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use
- EN 301-489-1 v2.2.3: EMC standard for radio equipment and services – common technical requirements
- EN 301-489-17 v3.2.4: Specific conditions for Broadband Data Transmission Systems; Harmonized Standard for Electromagnetic Compatibility (SCRS-REC only)
- EN 301-489-19 v2.1.1: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data (SCRS-REC only)
- EN 300 328 v2.2.2: Wide-band transmission systems; Data transmission equipment operating in the 2.4 GHz band; Harmonized Standard for access to radio spectrum (SCRS-REC only)
- EN 301 893 V2.1.1: 5 GHz WLAN; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU (SCRS-REC only)

- EN 300 440 v2.2.1: Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonized Standard for access to radio spectrum (SCRS-REC only)
- EN 62311:2020: Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz) (SCRS-REC only)

The SCRS-REC uses the following radio frequency bands:

Band	Frequency	Output power
2.4 GHz	2412-2462 MHz	0.067 W
5 GHz	5180-5875 MHz	0.034 W

## USA

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To comply with FCC and Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20 cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.

See also [FCC compatibility](#).

## Brazil

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

## FCC compatibility

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television

reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced technician for help.

## Safety labels

Label	Location	Description
	On the bottom of the unit	CE marking, indicating that the product complies with the applicable EEC directives
	On the bottom of the unit	<b>Attention!</b> Read the User Manual before using this equipment; it gives important safety information
	On the bottom of the unit	WEEE conformity



# 19. End of life and Disposal

## Disposal at end-of-life

When the product has reached its end of life, dispose of it according to local rules and regulations.



Do **NOT** throw any piece or part in with normal waste.



Recycle any piece or part that can be recycled.

---



# 20. Notes

## Remarks

Page no.	Paragraph	Remark
.....	..... ..... ..... .....	..... ..... ..... .....

Page no.	Paragraph	Remark
.....	..... ..... ..... ..... .....	..... ..... ..... ..... .....
.....	..... ..... ..... ..... .....	..... ..... ..... ..... .....