USER MANUAL

Simcenter SCADAS MOBILE & SCADAS RECORDER

Version 2.12

SIEMENS

CONTENTS

GENERAL CONDITIONS

Simcenter SCADAS data acquisition systems are products of:

Siemens Industry Software BV
Simulation and Test Solutions
Weidehek 53
4824 AT Breda
P.O. Box 3132
4800DC Breda
The Netherlands

This manual forms an integral part of the product. It gives information about the day-to-day use of the Simcenter SCADAS Mobile & Recorder. Familiarize yourself with this information, and make sure that you understand it before using the Simcenter SCADAS Mobile & Recorder.

IN THIS PART:

COPYRIGHT

CONDITIONS OF CHANGE

Siemens reserves the right to change parts at any moment without prior notice or direct notification. This manual may also be subject to change without prior notice.

Changes and/or modifications to the product (to be conducted by the owner) may only be conducted 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 is the responsibility of the proprietor and user.

LICENSES AND TRADEMARKS

Any software, described in this manual and/or delivered with the Simcenter SCADAS Mobile & Recorder, 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.

PRODUCT COMPLIANCE

Europe:

The Simcenter SCADAS Recorder products SCM/R2E01, SCM/R2E02, SCM/R2E05 and SCM/R2E09 comply with the following European directives:

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

In order to comply with these directives, the Simcenter SCADAS Mobile and Recorder products have been successfully tested against the following product standards:

- IEC 61326-1: Electrical equipment for measurement, control and laboratory use: EMC requirements
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use
- EN 301-489-1 v2.2.0: EMC standard for radio equipment and services – common technical requirements
- EN 301-489-3 v2.1.1: EMC standard for radio equipment and services – specific conditions for Short Range Devices (SRD)
- EN 300 328 v2.1.1: Wideband transmission systems (clauses 4.3.2.9 and 4.3.2.10).

To comply with the Radio Equipment Directive 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.

FCC and ISED declarations

Compliance statement (part 15.19)

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

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempt de licence. L'exploitation est autorisée aux deux conditions suivantes :
1. L'appareil ne doit pas produire de brouillage ;
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le functionnement.

Warning (part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Information to the User (Part 15.105 (b))

Note: 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 receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de Classe B est conforme à la norme Canadienne ICES-003.

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 20cm 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.
This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference;
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
1. L'appareil ne doit pas produire de brouillage ;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

Export compliance:

For all products (including V-RB) except SCM "V" Vibration control frames:
Classification and Export Control EAR99. This equipment is not listed on Commerce Control Lists. This equipment is not classified as dual use.

For SCM-V full capability "V" Vibration control frames:
Classification and Export Control EAR99. This equipment is listed on Commerce Control Lists. This equipment is classified as dual use. Dual use classification number 2B116B acc. EU428/2009.

ABOUT THIS MANUAL

This manual provides information for the safe and correct use of the Simcenter SCADAS Mobile & Recorder. Make sure to read the instructions you need to use the Simcenter SCADAS Mobile & Recorder in accordance with its purpose and intended use.

IN THIS PART:

AVAILABILITY

This manual forms an integral part of the Simcenter SCADAS Mobile & Recorder. Upon delivery, copies are supplied in accordance with regulations and/or specific terms of delivery. If necessary, Siemens can supply additional copies upon request. Copies of the manual are normally supplied in electronic format.
Keep this manual available for the users of the Simcenter SCADAS Mobile & Recorder. In case of re-commissioning or transfer of ownership the User Manual of the Simcenter SCADAS Mobile & Recorder must be handed over too.

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 Mobile & Recorder it is assumed that you have appropriate knowledge of the hardware and software required to accomplish your task(s). These may include: computers and computer networks, Simcenter Testlab, Simcenter Testxpress, front-end and recording devices, sensors and instrumentation.

CONVENTIONS

Standard font	The majority of the content in this manual is presented in standard font.
Special Bold	Table and figure titles are presented in Special Bold font. Also printed captions on the product are presented in Special Bold font.
Emphasis	Where necessary, words or phrases are *emphasized* in italic print.
Special elements	Elements that need extra attention by the reader, such as Notes and Warnings. An example is shown below.

Important: Carry out procedures in the sequence given.

RELATED DOCUMENTATION

This User Manual describes the hardware that makes up the Simcenter SCADAS Mobile & Recorder. These systems 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 Mobile & Recorder and other Simcenter named products is described in this User Manual. For details about (parts of) other Simcenter-named products reference is made to:

- Simcenter Testlab – Software application manuals
- Simcenter Testxpress – Software application manuals
- Simcenter SCADAS – Hardware Support Matrix
- Simcenter Testlab Control App [1]

[1] Applies to Simcenter SCADAS Recorder only.

Chapter 1
INTRODUCTION

This chapter gives generic information about the Simcenter SCADAS Mobile & Recorder systems. The purpose of this chapter is to inform the user about what the Simcenter SCADAS Mobile & Recorder systems are meant for, and what the products comprise of.
It is the responsibility of the user to use the Simcenter SCADAS Mobile & Recorder systems in accordance with their purpose and intended use.

IN THIS CHAPTER:

- Main functions and intended use
- Use in accordance with purpose
- What did you get

MAIN FUNCTIONS AND INTENDED USE

The Simcenter SCADAS Mobile & Recorder are the mobile systems of the Simcenter SCADAS family. SCADAS stands for Signal Condition And Data Acquisition System.

The Simcenter SCADAS Mobile offers hardware solutions for front-end signal conditioning and data acquisition. The Simcenter SCADAS Recorder is built on the same hardware platform and offers the same front-end capabilities, but adds a number of functionalities that also allow stand-alone operation. Both systems are reference instruments in the professional mobile NVH [2] market by combining best-in-class performance with low power consumption, excellent environmental specifications and small frame dimensions. The picture below shows a typical frame as example.

Example of a Simcenter SCADAS Mobile frame.

A Simcenter SCADAS Mobile or Recorder system can be used in a single-frame configuration or in a multi-frame configuration. A frame always consists of a number of system modules and one or more I/O modules. As and when required the Simcenter SCADAS Mobile & Recorder is connected with a host PC that runs Simcenter Testlab or Simcenter Testxpress.
Further information is described in the chapters System description and Component description.

[2] NVH stands for Noise, Vibration and Harshness.

The user has to adhere to the boundaries specified in this manual and the relevant Product Information Sheet(s), and work according to the Safety precautions.

USE IN ACCORDANCE WITH PURPOSE

The Simcenter SCADAS Mobile & Recorder systems must only be used for the specific purpose described above. Any attempt to alter or modify a Simcenter SCADAS Mobile or Recorder 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 in force will be invalidated, while Siemens will not accept any liability for misuse.

WHAT DID YOU GET

The Simcenter SCADAS Mobile or Recorder is delivered for one or more test configurations; the items that are required for testing depend on the test configuration(s) that is (are) chosen.
Each Simcenter SCADAS Mobile or Recorder system is built to customer specifications, which leads to a large variety of possible combinations. Inclusion of that information in this manual provides no added value for the user. The item list below shows the system-level accessories that are supplied.

Simcenter SCADAS Mobile & Recorder – item list

SYSTEM-LEVEL ACCESSORIES	SCM	VIBCO	SCR	IP54 [3]
USB3.0 to LAN Ethernet adapter	✓	✓	✓	✓
Ethernet interface cable	✓	✓	✓	✓
AC/DC adapter	✓	✓	✓	✓
DC power cable	✓	✓	✓	✓
Mobile grounding assembly	✓	✓	✓	✓
DAC adapter cable	✓	✓	✓	✓
Tacho adapter cable	✓		✓	✓
CAN adapter cable	✓		✓	✓
Termination plug (for STOP connection)		✓		
GPS/QZSS/Glonass antenna			✓	✓
Bluetooth/WLAN antenna (RP SMA) *			✓	✓
Protection caps (1 or more sets)				✓

*: Please note that our WLAN connection is of the dual band type, requiring the dual band antenna that has been delivered with your product and has been marked: 2.4GHz-5GHz

Each system is inspected and tested before shipment. The shipment that you received must contain the items that were ordered, undamaged and fully operational.

[3] IP54 certified systems use specific types of DC power and Ethernet interface cables.

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:

- 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

The information in this part is given as a guideline; we recommend that you act accordingly.

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.

In case parts need to be transported:

- Preferably use the original factory packaging.
- In case the original factory packaging is not available, use packaging of identical construction (available via your local Siemens representative).
- In case you need to provide packaging yourself:
  - Use a double-wall carton box – or similar container – of the correct dimensions.
  - Put the part in an anti-static plastic envelope.
  - Use cushion material to keep the part from moving in the box.
- Mark the container *FRAGILE* to ensure careful handling.

Chapter 2

SAFETY INFORMATION

This chapter gives safety information about the Simcenter SCADAS Mobile & Recorder. The purpose of this chapter is to make the user aware of relevant safety aspects, when working with the Simcenter SCADAS Mobile & Recorder. It is the responsibility of the user to read this information before working with the Simcenter SCADAS Mobile & Recorder, to make sure that it is used correctly and safely.

IN THIS CHAPTER:

HAZARDS AND REMAINING RISKS

The Simcenter SCADAS Mobile & Recorder 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 an acceptable level.

However, some risks still exist. These *remaining risks* and relevant details are listed below. During normal operation personnel who work with the Simcenter SCADAS Mobile & Recorder 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.

Important:

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

The user has to adhere to the boundaries specified in this manual and the relevant Product Information Sheet(s), and work according to the Safety precautions.

Simcenter SCADAS Mobile & Recorder – remaining risks

RISK	WHEN	EFFECTS	RISK MITIGATION
Component-level risks: Battery pack			
Physical damage to the battery pack.	At impact, e.g. battery pack gets cracked or even crushed.	Leakage of dangerous fumes and/or materials. Battery pack can get on fire.	See: Safety provisions, Safety precautions.
Exposure to extreme temperatures [4].	Extreme high or low temperatures. Device is covered, i.e. heat cannot dissipate.	Leakage of dangerous fumes and/or materials. Battery pack can get on fire.	See: Safety precautions.
Exposure to liquids.	Immersion; splashing or spraying conditions.	Leakage of dangerous fumes and/or materials. Battery pack can get on fire.	See: Safety precautions.
Direct contact with battery pack.	Replacement.	Prohibited during normal operation.	See: Safety precautions.

SAFETY PROVISIONS

By design, the Simcenter SCADAS Mobile & Recorder has a number of safety provisions to establish the required level of personal safety. Furthermore, the owner of the Simcenter SCADAS Mobile or Recorder has the responsibility to provide a safe environment to work in.

These safety provisions are divided in groups as listed below:

- Covering
- Electrical safety
- Components and accessories
- Safety labels

[4] For limitations related to temperature see the relevant Product Info Sheet.

COVERING

The components of the Simcenter SCADAS Mobile & Recorder are enclosed. During normal operation – i.e. the covering is properly installed – exposure to any hazards is reduced to a minimum.
The user is *not* allowed to remove the covering; for normal operation it is not necessary to do so. Moreover, the covering cannot be removed without the use of tools and all systems have no serviceable parts inside.

With respect to modules the following applies:

- It is recommended to use the SCM-MODXTR SCADAS Mobile extraction tool for module replacement.
- In case of IP54-rated systems removal of covering and extraction of modules will eliminate the enhanced ingress protection; the system will have to be sent to Siemens for re-certification.

ELECTRICAL SAFETY

The following applies:

- The Simcenter SCADAS Mobile & Recorder complies with international safety standards and local regulations.
- All circuits are adequately protected when used within limits.
- It is strongly recommended to ground the Simcenter SCADAS Mobile & Recorder properly.
- Some components of the Simcenter SCADAS Mobile & Recorder are designed to operate on internal battery power; they can also be powered and/or charged with appropriate adapters.
- Power levels of the outputs of the Simcenter SCADAS Mobile & Recorder 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 Mobile & Recorder the most prominent items are:

- A built-in Li-Ion battery pack. Certification of battery according to standard IEC62133.
- State-of-art connectors that provide a high level of protection against intrusion.
- Power adapters and cables that are approved by Siemens for use with the Simcenter SCADAS Mobile & Recorder.

SAFETY LABELS

To assure the required level of user awareness with respect to remaining hazards the Simcenter SCADAS Mobile & Recorder have these safety labels:

LABEL	COMPONENT / LOCATION	DESCRIPTION
CE	On product type plate	CE marking. Indicates that the product complies with the applicable EEC directives.
	On product type plate	Attention! Read the manual before use; it gives important safety information.
	On product type plate	WEEE conformity.
Frames with single battery: Li Ion 22.2V 2250 mAh Frames with dual battery: Li Ion 22.2V 4500 mAh	On product type plate	The product has a Li-Ion battery pack inside.

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. The users of the Simcenter SCADAS Mobile & Recorder are always responsible for their actions, their own safety and that of others.

To prevent injury, obey these rules when you work with the Simcenter SCADAS Mobile & Recorder:

- 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(s).
- Avoid – direct and indirect – contact with live electrical parts.
- Dispose used equipment and components in accordance with local regulations.
- With respect to the built-in Li-Ion battery pack in the frames:
  - When misused or defective, Li-Ion batteries can build up heat very quickly, explode or cause fire. Make sure that you are aware of potential risks related to Li-Ion batteries.
  - In case the battery pack is damaged, or you suspect it to be damaged:
    - do not touch it with bare hands, protect eyes and skin,
    - take the instrument to a safe and open area, and put it on a non-combustible surface,
    - observe it from a safe distance,
    - report the incident.

- Keep the instrument away from:
  - open fire,
  - flammable and/or combustible materials,
  - aggressive chemicals,
  - heat sources.
- Do not immerse in and/or expose to liquids.

Note: IP54-rated systems have enhanced ingress protection.

- Do not operate the instrument at extreme temperatures.
  Do not cover it up and make sure it can dissipate generated heat.
- Do not drop the instrument, and avoid situations in which it can get crushed.
  Always place it in a stable position; if necessary, secure the instrument.
- It is recommended to use the SCM-MODXTR SCADAS Mobile extraction tool for module replacement.
  (In case of IP54 certified SCR207, the removal can only be done by authorized Siemens personnel.)

EMC CONSIDERATIONS

In order for the Simcenter SCADAS system to be completely immune to external and intrusive electromagnetic fields the Simcenter SCADAS system needs to be shielded at every location of the frame. This can be accomplished by either populating the frame slots with modules or covering open slots with dummy front plates.

Chapter 3
SYSTEM DESCRIPTION

This chapter gives information about the features and functions of the Simcenter SCADAS Mobile & Recorder. The purpose of this chapter is to make the user familiar with *what* these system-level features and functions mean.

IN THIS CHAPTER:

- System identification
- Single-frame and multi-frame configurations
- Modules
- Principles of operation
- Modes of operation

SYSTEM IDENTIFICATION

A Simcenter SCADAS Mobile & Recorder system is built to customer specifications and can consist of one or more so-called frames, depending on the test configurations that need to be supported.

These frames normally consist of a particular combination of system modules and I/O modules. From a hardware point of view a frame can consist of any desired combination of system and I/O modules. However, from a software-application point of view the actual combination of system and I/O modules will have to be suitable in order to support the type of test (application) at hand. Information about hardware selection with respect to a particular software-application is described elsewhere; refer to Simcenter SCADAS – Hardware Support Matrix.

The next paragraphs give more information about:

- System Type Numbers
- Frame types
- Frame sizes

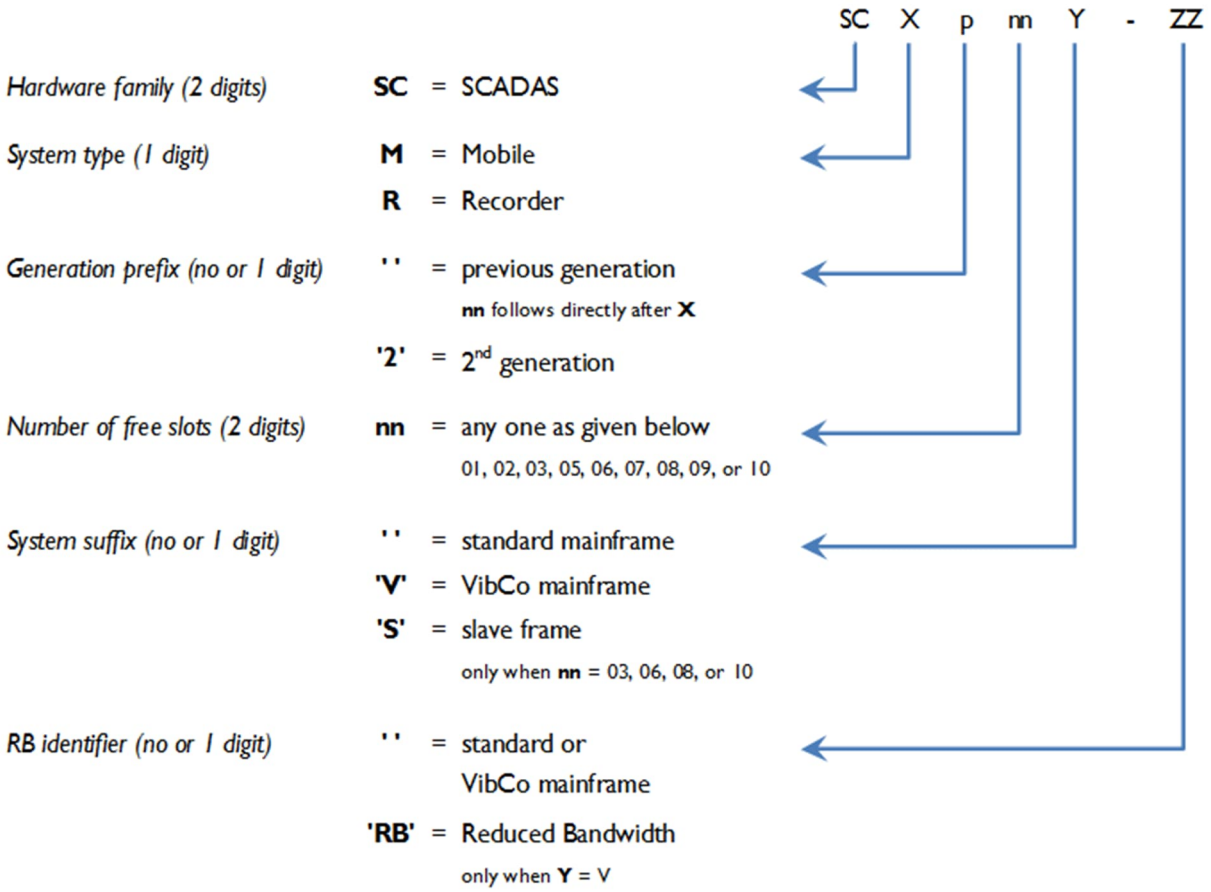
SYSTEM TYPE NUMBERS

A Simcenter SCADAS hardware product has a *Type Number* in accordance with the corresponding price list(s). The *Type Number* of a hardware product helps to identify its distinctive features and dedicated functions that it can support. An example of a system level *Type Number* is shown below:

Example of a system *Type Number*: SCM2E09V

A system *Type Number* consists of several elements; what these elements are and what they mean is described next.

Type Number elements and their meaning



Additional information and related topics

Hardware family	Simcenter SCADAS Mobile (SCM) and Simcenter SCADAS Recorder (SCR) are hardware products within the Simcenter SCADAS family.
System type	Whether a system is an SCM or an SCR is determined by the type of System Controller module. Related topic: SYSCON modules.
Generation prefix	This only shows in case of a '2nd generation' standard (2) or enhanced (2E) product.
Number of free slots	This indicates the maximum number of I/O modules that the frame can contain. Related topic: Frame types.
System suffix	No system suffix means that the frame is a standard SCM or SCR frame. A V means Vibration Control. Related topic: SYSCON modules. An S means Secondary frame. Related topic: Multi-Frame interface module.
RB identifier	No RB identifier means that the frame is an SCM or SCR Vibration Control frame. RB means that the frame is a Vibration Control frame with reduced bandwidth. Related topic: SYSCON modules.

FRAME TYPES

A system can consist of one or more frames, depending on the test configurations that need to be supported. The particular combination of system modules and I/O modules per frame determine suitability for a specific test configuration.

Details of frame types are described in the next paragraphs:

- Main frames
- Secondary frames
- Frames with enhanced ingress protection

MAIN FRAMES

Main frames are available for both Simcenter SCADAS Mobile and Simcenter SCADAS Recorder systems.
They have distinctive Type Numbers: a Mobile main frame has an SCM Type Number; a Recorder main frame has an SCR Type Number.
A main frame always has a Power Supply Unit (PSU), a battery pack and a SYSCON module. Beside other functions the SYSCON module enables communication with a host PC that runs Simcenter Testlab or Simcenter Testxpress.

A main frame can operate in either a single-frame configuration or a multi-frame configuration.
In case it is used in a single-frame configuration it does not need to have a Multi-Frame interface module. In case is it used in a multi-frame configuration it must have such a module for communication with the connected secondary frames.

Presence of other system modules and I/O modules depends on the frame size and the test configurations that need to be supported.

SECONDARY FRAMES

Secondary frames are available for both Simcenter SCADAS Mobile and Simcenter SCADAS Recorder systems.
However, a secondary frame always has an SCM Type Number
A secondary frame always has a Power Supply Unit (PSU) and a battery pack, but does not have a SYSCON module.

A secondary frame can only operate in a multi-frame configuration and always has a Multi-Frame interface module for communication with the main frame and/or other secondary frames.

Presence of other system modules and I/O modules depends on the frame size and the test configurations that need to be supported.

FRAMES WITH ENHANCED INGRESS PROTECTION

Within the range of Simcenter SCADAS Recorder systems a number of frames with enhanced ingress protection and their corresponding modules are available; their level of ingress protection is IP54.
To support specific test configurations that require the use of such equipment, IP54 certified main frames and secondary frames are available.
The size of the corresponding IP54-rated modules differs from standard modules. Hence, frames and modules with different IP-rating are neither compatible nor interchangeable.

Further details are described elsewhere: refer to Ingress Protection (IP) levels.

FRAME SIZES

The frame size of a Simcenter SCADAS Mobile & Recorder is determined by the number of free slots (the element nn within the Type Number). The higher the number of free slots the higher the maximum number of I/O modules that the frame can contain.

Main frames are available in five (5) sizes; secondary frames are available in four (4) sizes. The smallest main frame has one (1) free slot and no room for a Multi-Frame interface module.
For all other sizes this rules applies: a secondary frame will have one (1) free slot more than the main frame of comparable size, since one of the available slots in the main frame will be occupied by a SYSCON module.

In the figure below the smallest frame size (SCM/SCR2E01) is only shown as main frame; it has no room for a Multi-Frame interface module and can only be used in a single-frame configuration.
All other frame sizes are shown with a Multi-Frame interface module. Main frames only need to have that module in case of a multi-frame configuration.

Simcenter SCADAS Mobile and Simcenter SCADAS Recorder – frame sizes

SYSCON	PSU
I/O	

SCM / SCR 2(E)01

SYSCON	M/S
I/O	PSU
I/O	

SCM / SCR 2(E)02

I/O	M/S
I/O	PSU
I/O	

SCM 03S

I/O	SYSCON	M/S
I/O	I/O	PSU
I/O	I/O	

SCM / SCR 2(E)05

I/O	I/O	M/S
I/O	I/O	PSU
I/O	I/O	

SCM 06S

I/O	SYSCON	M/S
I/O	I/O	PSU
I/O	I/O	
I/O	I/O	BAT

SCR 207

I/O	I/O	M/S
I/O	I/O	PSU
I/O	I/O	
I/O	I/O	BAT

SCM 08S

I/O	SYSCON	M/S
I/O	I/O	PSU
I/O	I/O	
I/O	I/O	BAT
I/O	I/O	BAT

SCM / SCR 2(E)09

I/O	I/O	M/S
I/O	I/O	PSU
I/O	I/O	
I/O	I/O	BAT
I/O	I/O	BAT

SCM 10S

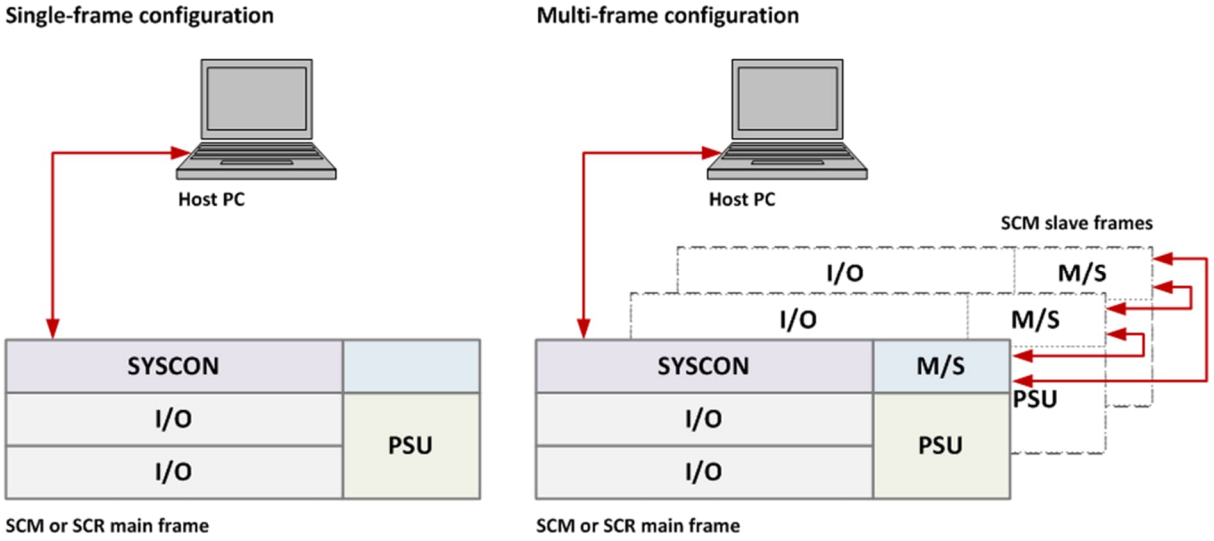
SINGLE-FRAME AND MULTI-FRAME CONFIGURATIONS

The Simcenter SCADAS Mobile & Recorder support different test configurations, provided that the main frame in a particular test configuration has the required combination of system modules and I/O modules.

Simcenter SCADAS Mobile and Simcenter SCADAS Recorder systems can operate in two basically different frame configurations:

- Single-frame configuration: only one main frame is used in a test.
- Multi-frame configuration: one main frame is used in combination with one or more secondary frames.

The figure below shows examples of both configurations.



Notes:

This set-up represents operation in front-end mode: the main frame is connected to a host PC. Both configurations can also apply when an Simcenter SCADAS Recorder system operates in stand-alone mode.

The sizes of the frames only serve as example; the principles also apply to other frame sizes.

The main criteria for multi-frame configurations are:

- An SCR-IP54 main frame can be connected with only one (1) other IP54-rated frame;
- Other types of main frame can connect to up to 256 modules, including the SYSCON and Multi-Frame interface modules.

Further details and criteria are described elsewhere, refer to:

- the section Modules in general;
- the paragraph Multi-Frame interface module in particular.

MODULES

A frame consists of a particular combination of system modules and I/O modules.
Which system modules are used in a frame depends on the frame type, the frame size and the test configurations that need to be supported. Which I/O modules are used in a frame depends on the frame size and the test configurations that need to be supported.

The figure below shows one typical main frame arrangement for the purpose of module recognition. Information about the individual modules is described in the paragraphs that follow.

Simcenter SCADAS Mobile and Simcenter SCADAS Recorder – typical main frame configuration

<table>
<tr><th>I/O</th><th>SYSCON</th><th>M/S</th></tr>
<tr><td>I/O</td><td>I/O</td><td rowspan="2">PSU</td></tr>
<tr><td>I/O</td><td>I/O</td></tr>
<tr><td>I/O</td><td>I/O</td><td>BAT</td></tr>
<tr><td>I/O</td><td>I/O</td><td>BAT</td></tr>
</table>

Note: In a standard main frame configuration the SYSCON module is located in the top-slot close to the PSU.

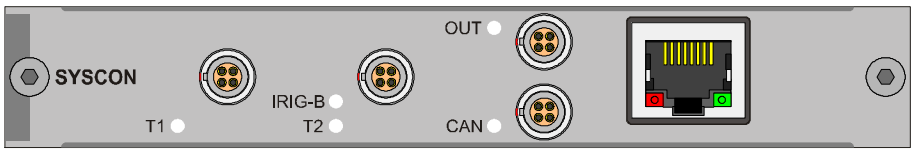
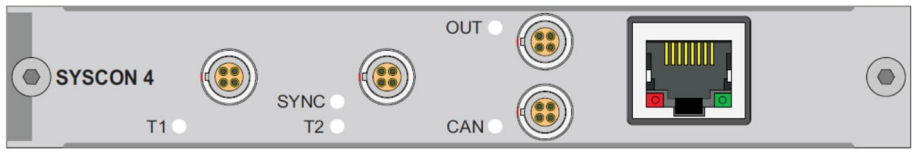
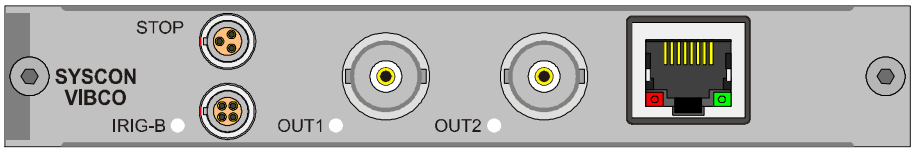
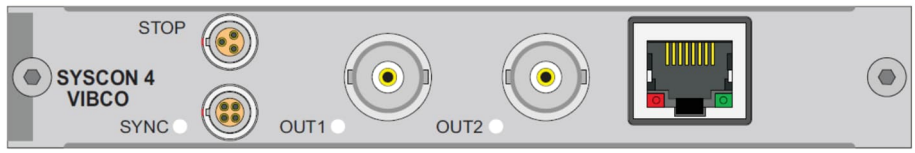
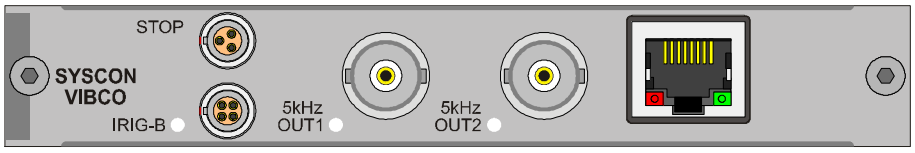
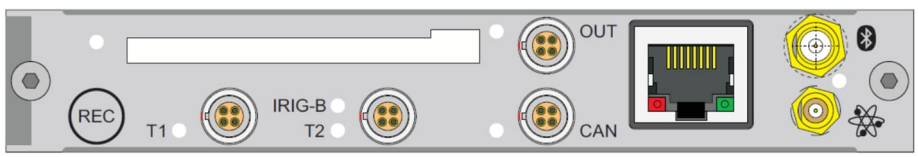
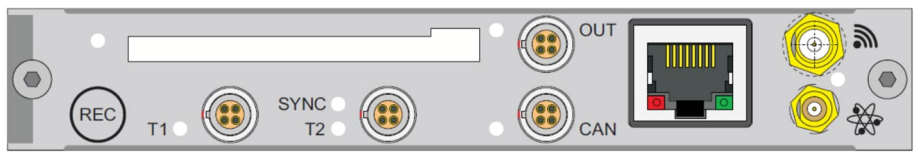
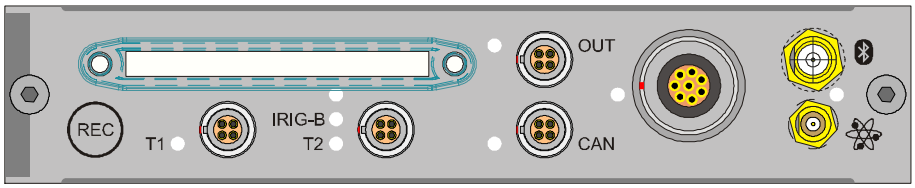
Details of modules are described in the next paragraphs:

- SYSCON see SYSCON modules
- PSU see Power Supply Unit and batteries
- BAT see Power Supply Unit and batteries
- M/S see Multi-Frame interface module
- I/O see I/O modules

SYSCON MODULES

The primary tasks of a SYSCON module are to act as main controller of a system and to transmit data as fast as possible. Beside these tasks the SYSCON module can accommodate other functions that are relevant for specific test configurations that need to be supported. To achieve flexibility in frame and system design a number of SYSCON modules are available.

The table below shows the SYSCON modules that are available and when they are used.

SYSCON MODULE	USED IN
	SCM2xx
	SCM2Exx
	SCM2xxV
	SCM2ExxV
	SCM2xxV-RB
	SCM2ExxV-RB
	SCR2xx
	SCR2Exx
	SCR IP54

Details about the individual front connections and their functions are described in the paragraphs that are listed below; details of LEMO connectors are given where applicable.

- Ethernet connectivity
- Tacho and IRIG-B in/OUTputs
- Generator outputs
- CAN-bus input
- STOP input
- GNSS receiver
- Recording features

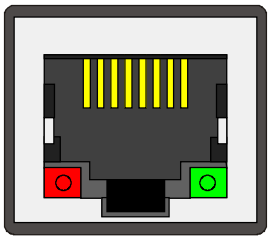
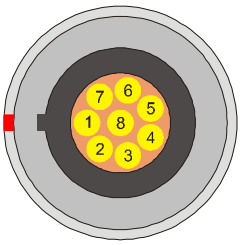
ETHERNET CONNECTIVITY

Each main frame is equipped with a USB to Ethernet adapter to enable data transmission to and communication with the host PC. Physical connection is established with an Ethernet cable (standard accessory). The type of Ethernet connection on the SYSCON module and the applicable communication speed depend on the Type Number.

Ethernet connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

Note1: Specified communication speeds are based on an unshared Ethernet connection with the host PC. In case other devices use that same connection, lower speeds will be the result.

Note 2: All protocols except IPV4 should be disabled. The IPV4 protocol should be set to either an automatic or a fixed IP address within the APIPA IP address range: 169.254.x.x. with netmask 255.255.0.0. The gateway should not be set. If allowed by company rules, any virus scan filtering should be disabled. Network performance problems like congestion or retransmissions can occur when left enabled, effectively reducing the performance of the front-end measurement.

CONNECTION	DETAILS	REMARKS
RJ45; all except SCR IP54. 		Mating connector: Standard RJ45.
8-pin LEMO; SCR IP54. 	Connector type: LEMO-EGG.1B.308 Pin details: 1) Cx1+ 2) Cx2+ 3) Cx3- 4) Cx4+ 5) Cx4- 6) Cx2- 7) Cx1- 8) Cx3+	Mating connector: LEMO-FGG.1B.308

TACHO AND IRIG-B IN/OUTPUTS

A Tacho input is used to capture RPM signals and can be used in two modes: analog or digital. Physical connection is established with LEMO to BNC adapter-cables (standard accessory).

An IRIG-B timecode input is used for sampling clock and time-of-day synchronization. Physical connection is established with LEMO to BNC adapter-cables (standard accessory).

On SYSCON modules that support both functions, T2 and IRIG-B share one connector. The function of that connector is software switchable and is configured in Simcenter Testlab or Simcenter Testxpress.

Analog & digital IRIG-B time code mode (software selectable)

• IRIG-B AM (analog) according to B126 code format

• IRIG-B DCLS (digital) according to B006 code format (galvanically Isolated TTL input)

On SYSCON 4 modules that support both functions, T2, IRIG-B in and IRIG-B out share one connector named “SYNC”. “SYNC” can be switched to output to generate a digital IRIG-B signal.

The function of that connector is software switchable and is configured in Simcenter Testlab or Simcenter Testxpress

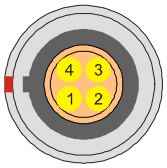
Analog tacho.

The analog tacho mode guarantees very accurate frequency and RPM determination when the tachometer is of an analog nature (capacitive, inductive, etc.) and when the tacho frequency is between 5Hz and 40kHz.

Digital tacho.

The digital tacho mode is designed to support “clean” digital tacho input signals in order to acquire tacho information from conditioned tachometers such as incremental encoders, up to a tacho frequency of 230kHz.

T1, T2 and IRIG-B connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

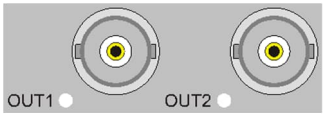
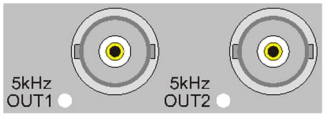
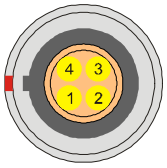
CONNECTION	DETAILS	REMARKS
4-pin LEMO: T1 – IRIG-B/SYNC/T2 (SCM, SCR) IRIG-B/SYNC (SCM-VIBCO). 	Connector type: LEMO-EGG.00.304-L Pin details: 1) Ground 2) +5V supply 3) – Signal 4) + Signal	Mating connector: LEMO-FGG.00.304.CLADxx

GENERATOR OUTPUTS

A SYSCON module supports two generator outputs, either via:

- two separate BNC connectors;
  physical connection is established with standard BNC to BNC cable,
- one LEMO connector;
  physical connection is established with a LEMO to BNC adapter-cable (standard accessory).

OUT connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

CONNECTION	DETAILS	REMARKS
2x BNC connector.   	SCM-VIBCO SCM-VIBCO-RB	Mating connector: BNC.
4-pin LEMO: OUT (all other frame types)  	Connector type: LEMO-EGG.00.304-L Pin details: 1) Ground 2) Generator output 2 3) Ground 4) Generator output 1	Mating connector: LEMO-FGG.00.304.CLADxx

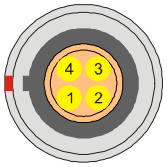
Note on the DAC output operation on the SYSCON:
If the Tacho channels are activated, the DAC output is switched off. In case DAC4 module is installed in the system, the output channels will work independently from the SYSCON module

CAN-BUS INPUT

A SYSCON module can be equipped with a CAN-bus input that supports the high speed CAN protocol. Physical connection is established with a LEMO to 9-pin SUB-D adapter-cable (standard accessory).

The CAN-bus interface is designed to operate in “listen only” mode by default. This means that it will read any messages that are transmitted on an existing CAN bus. Other interface operating modes may be provided.
However, in situations where just one CAN device is present – instead of a fully operational CAN bus – the CAN-bus interface will initiate a so-called “acknowledge” action. After this action is done communication can take place from that particular CAN device to the SYSCON module, now in “listen only” mode again.

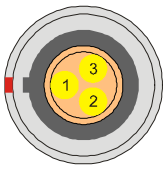
CAN connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

CONNECTION	DETAILS	REMARKS
4-pin LEMO: CAN (all except VIBCO frames) 	Connector type: LEMO-EGG.00.304-L Pin details: 1) Ground 2) Not used 3) CAN LOW 4) CAN HIGH	Mating connector: LEMO-FGG.00.304.CLADxx

STOP INPUT

A SYSCON module that supports Vibration Control (VIBCO) is equipped with a STOP input. A typical use for this input for instance is an Emergency Stop source (DSCU).
Physical connection is established with a LEMO to BNC adapter cable (standard accessory).

STOP connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

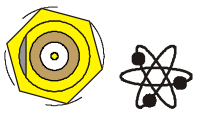
CONNECTION	DETAILS	REMARKS
3-pin LEMO: STOP (VIBCO frames only) 	Connector type: LEMO-EGG.00.303-L Pin details: 1) DSCU switch 2) Ground 3) +5V supply	Mating connector: LEMO-FGG.00.303.CLADxx

GNSS RECEIVER

A SYSCON module that supports Global Navigation Satellite System (GNSS) is equipped with a GNSS receiver and a dedicated connection. A typical use for this input for instance is GPS tracking. GNSS is established with an antenna (standard accessory).

The GNSS receiver input allows the user to annotate measurement data with absolute time, position and velocity. As an additional feature, the front-end time base (system clock) is locked onto the GPS atomic clock source. This means that multiple independent front-ends can be fully synchronized on a short and long term basis.

GNSS connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

SYSCON FEATURE	DETAILS	REMARKS
Antenna connection. 	Connector type: MCX	

Note on the SCR SYSCON GPS:

Please connect the GPS antenna before booting the frontend.

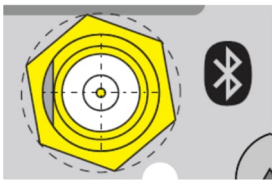
RECORDING FEATURES

A SYSCON module that supports recording of measurement data is equipped with either Bluetooth or WLAN (SYSCON 4 only) connectivity, a Compact Flash card interface and a REC button.
Bluetooth or WLAN connection is established with an antenna (standard accessory).

Please note that the WLAN connection is of the dual band type, requiring the dual band antenna that has been delivered with your product and has been marked as such: 2.4GHz-5GHz

The Bluetooth or WLAN connectivity allows communication with a device that runs Simcenter Testlab Control App (e.g. a tablet).
A Compact Flash interface allows high-speed local-storage of measurement data.

Recording features are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

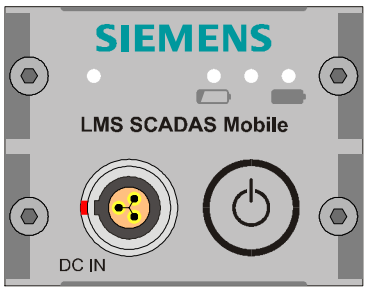
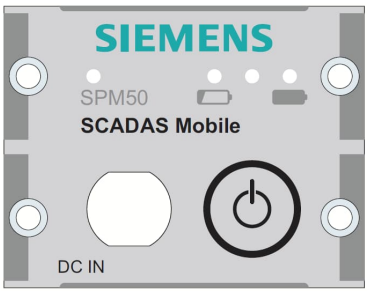
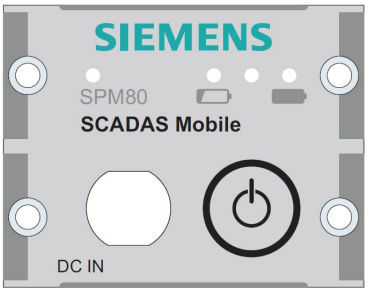
SYSCON FEATURE	DETAILS	REMARKS
Bluetooth connectivity. 	Connector type: SMA	SYSCON
WLAN connectivity. 	Connector type: SMA	SYSCON 4
Compact Flash.  	SCR SCR IP54	Supported types (these also support DMA mode): • Transcend 128GB 1000x TS128GCF1000 • Transcend 64GB 1000x TS64GCF1000 • Renice X5 128 GB MLC • Transcend 16GB 1066x UDMA7 • Lexar Professional 256GB 1066x UDMA7 • Sandisk Extreme Pro 256GB UDMA7
REC button. 	Used to: ▸ start / stop a recording (no start-function in case Simcenter Testlab Control App is used) ▸ off-set adjustments for bridge inputs	Further details are described in: ▸ Operation / Prepare for stand-alone operation

POWER SUPPLY UNIT AND BATTERIES

The primary task of the Power Supply Unit (PSU) and batteries is to provide the required electrical power for the equipment in the frame and if necessary to connected sensors as well. The PSU has a DC IN connection to receive power from an external DC source. In case the external source provides AC power, a power adapter must be used (standard accessory). To prevent voltage inversion, the PSU is protected against reverse polarity.
Depending on the frame size, one or more battery packs enable autonomous operation for a certain period of time.

PSU and battery features are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

Important: Always check the voltage and power sources before plugging in the instrument.

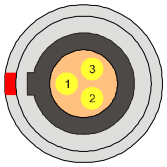
PSU FEATURE	DESCRIPTION
	PSU front (PS12-2 and PS12-3)
	PSU front (SPM50)
	PSU front (SPM80)
	DC IN connection to receive power from an external source. For more information see: Power requirements and details.
	On / OFF button.
	LEFT: Power indicator. RIGHT: Battery status indicators. For more information see: Status indications

POWER REQUIREMENTS AND DETAILS

The Simcenter SCADAS Mobile & Recorder have a DC power input that is 11~42V tolerant.
For AC mains operation, the instrument comes with an AC/DC adapter (standard accessory) that is 90~240VAC and 50~60Hz tolerant.
For DC supplied operation, the instrument comes with a DC power cable (standard accessory).
For frame types up to and including 6 free slots the DC power cable is suitable for connection to a power socket in the vehicle. Typically, a lighter socket is used for this purpose.
For frame types with 7 or more free slots the DC power cable must be directly connected to the vehicle battery. *Do not* use cable types that connect to a power socket for these larger frames.

Important: In case of DC supplied operation the combination of power cable length and wire gauges is critical. Make sure to use the DC power cable that is supplied by Siemens.
In case a power socket can be used, make sure that it is appropriately secured by a fuse.

DC IN connections are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

CONNECTION	DETAILS	REMARKS
3-pin LEMO: DC IN 	Connector type: LEMO-EGG.1B.303-L Pin details: 1) +DC 2) -DC 3) If Remote ON / OFF switching is not supported Not connected (do NOT use) If Remote ON / OFF switching is supported external signal	Mating connector: LEMO-FGG.1B.303.CLADxx

About the function: Remote ON / OFF switching (Recorder mode only)

PSU's that support the function Remote ON / OFF switching are switched on or off by:

- using the ON / OFF button, or
- a command from an external device.

Note 1: In case the external device is to perform the switching, certain prerequisites and conditions must be met. This is explained further on.

Note 2: Remote ON / OFF is supported on SPM50 and SPM80 power supplies only, not on PS12 power supplies (delivered until 2017).

Please check your system for indication of SPM50 or SPM80 on the front plate or check the power supply type using SCADAS Diagnostics)"Using the ON / OFF button on the PSU prevails over the function Remote ON / OFF switching.
In case the PSU was controlled by Remote ON / OFF switching, and the ON / OFF button is used to:

- switch on the PSU, the function Remote ON / OFF switching is disabled,
- switch off the PSU, it will do so immediately regardless of the current conditions.

Remote ON / OFF switching uses an external command/status signal. Pin 3 of the DC IN connection is reserved for this purpose. In this way a control line is provided for the external on/off command.

When pin 3 is not connected to an external device, the default value is “off” (or: weak pull-down) and power switching is controlled by the ON / OFF button.

When pin 3 is connected to an external device, the PSU will react to external signal transitions. The switching threshold is 3.3VDC; maximum input voltage is 42VDC.

A low to high external signal transition results in a command for the PSU to switch on, independent of the button status, but only if external power or sufficient battery power is available.
After this, the SYSCON module will boot up the Simcenter SCADAS system.

A high to low external signal transition will not trigger any immediate action in the PSU. The new status of the external signal will be transmitted by the PSU with the next inquiry from the SYSCON module. With this new external signal status, the SYSCON module decides what to do from that point on.

A couple of possible scenarios are described below:

1) The SYSCON module switches off all PSUs in the current (main/secondary) configuration or sets the system in standby.
2) In case of SCR: the SYSCON module closes all data transfer to CompactFlash local storage, and then switches off all PSUs in the current configuration.
3) The SYSCON module decides to continue measuring for a certain amount of time (for instance to record run-down or cool-down effects), then closes all data transfer either to the host or to local storage, and finally switches off all PSUs in the current configuration.

BATTERY LIFE

The Simcenter SCADAS Mobile & Recorder is equipped with one or two Li-Ion battery packs to enable autonomous operation for a certain period of time. The autonomy period depends on different operational aspects, such as:

- The number of battery packs
- The charge level of the battery at the start of a measurement
- The sensor density (population) during a measurement
- Ambient temperature

Important:

It is strongly recommended *not* to leave Li-Ion batteries fully discharged. Always keep the battery charged to some extent to avoid malfunction and enhance battery life.

All rechargeable batteries wear out with time and usage. As time and cumulative use increase, the performance will degrade. Noticeable reduction in run time generally will be observed after 18 to 24 months.

Please note that battery life can be extended by a repeated cycle of partial discharge and full recharge will prolong the battery lifetime noticeably.

When you find the runtime is no longer satisfactory, or the battery is not fully charging, it is advised to install a new battery.

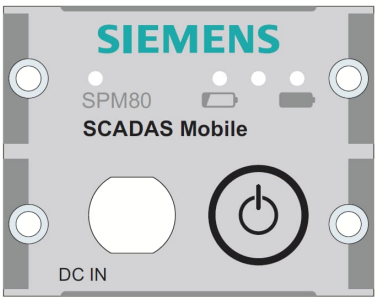
In case of AC mains or DC supplied operation the battery is automatically charged; during measurements this may happen at a reduced rate. The instrument will stop the automatic charging when the internal temperature becomes too high in order to prevent battery degradation.
In case charging-discharging cycling is necessary, it is best practice to do so with the instrument switched off.

Note on battery packs with hardware revision 5 or higher:

With battery packs that have revision H5 or higher (shipments from 2019 onwards), a new function called “ship mode” has been introduced.
Ship mode is an ultra-low power mode, providing long shelf life for a battery pack that is not in use. Spare (replacement) battery packs are shipped in this mode by default and when a battery pack is drained inside a SCADAS Mobile or Recorder the battery pack will automatically enter this mode again. The battery pack will automatically exit ship mode when installed in a SCADAS Mobile or Recorder and power is applied to the system.

STATUS INDICATIONS

The top part of the PSU front provides two types of indications (see figure below):

	Top LEFT: Power indicator. Top RIGHT: Battery status indicators.
Power indicator	Off: instrument switched OFF; no external power. Yellow flashing: instrument switched OFF; external power supplied; battery is charging. Green/yellow: instrument switched ON; external power supplied; battery is charging. Yellow: instrument switched OFF; external power supplied; battery is fully charged. Green: instrument switched ON; external power supplied; battery is fully charged. Red: instrument switched ON; error detected: I2C fault, no battery or battery capacity < 8%
Battery status indicators	The top right three LEDs provide information on battery status: ● ● ● between 80% and 100% capacity ● ● ● between 60% and 80% capacity ● ● ● between 40% and 60% capacity ● ● ● between 20% and 40% capacity ● ● ● between 8% and 20% capacity ● ● ● below 8% capacity

Note:

When the most left battery status indicator flashes red, this means either that the SCADAS system cannot detect a battery, or there is no battery installed. If this is not expected behavior, please contact your local support organization.

SCM-UPS: POWER BACKUP FOR VIBRATION CONTROL APPLICATIONS

Simcenter Testlab Environmental Control workbooks on Simcenter SCADAS Mobile:

- Require a SYSCON “V” or “V-RB” (Reduced Bandwidth) variant;
- Require connection to mains AC power;
- Require min. 30% battery capacity for safe DAC shutdown.

In typical setups, Simcenter SCADAS Mobile frames are permanently connected to mains power, resulting in a gradual decrease of battery capacity:

- After a long period without cycling the battery, the battery capacity can drop below 30%;
- As a result, it is impossible to start a measurement in the TL-ENV software;
- Cycling the battery (full charge/discharge) a few times will bring the battery level near full capacity.

To avoid having to cycle the battery on a regular basis, it is recommended to connect the Simcenter SCADAS Mobile Vibration Control frame to an Uninterruptable Power Supply SCM-UPS and disable the battery check in Simcenter Testlab (supported as of Rev. 17A).

The SCM-UPS consists of the following items:

- 19 inch rack housing containing Power buffer and Power supply
- 1x SCX-DSCU-II DAC shutdown control unit
- 1x 10m cable to interconnect SCX-DSCU-II to UPS
- 1x 1m cable to interconnect UPS to SCM-V Stop connection

- 1x 1m power cable to interconnect UPS to SCM-V Power input

The SCM-UPS consists of a unit that monitors mains AC power and a unit with an internal power buffer. When mains AC power is interrupted, the SCM-UPS interrupts the normally closed (NC) circuit to the DAC Shutdown Control Unit (DSCU) and shuts down the DAC. A smooth shutdown of the DAC signal is ensured through the power buffer.

WARNING: DISABLING THE BATTERY CHECK WITHOUT USING A PROPERLY CONNECTED UPS IS PROHIBITED! Failure to comply may result in damage to the test specimen or test equipment (e.g. electrodynamic shaker).
More information on how to correctly use the SCM-UPS in combination with a Simcenter SCADAS Mobile Vibration Control frame is explained further in the Operation section.
Please read these instructions carefully.

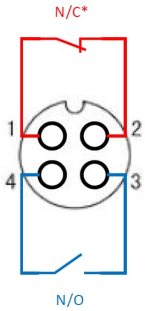
SCM-UPS specifications

Input voltage rating	120/230 VAC, 50/60 Hz
AC mains supply voltage fluctuations	Up to ±10 % of the nominal voltage
Fuse	5A (slow)
Overvoltage category	II
Input current at rated input voltage 120 V	2.34 A
Input current at rated input voltage 230 V	1.36 A
Rated output voltage	24 V DC
Rated output current	5 A
Backup time	1.6 s. with 5A load current
Rated environmental conditions	Ambient temperature -20 °C to +55 °C Relative humidity: non condensing up to 95 % at 23 °C; up to 50 % at 45 °C Altitude up to 2 000 m Pollution degree 2
Connectors	AC mains DC 24V out STOP connector DSCU connector
Recommended use	Indoor use only

SCX-DSCU-II: DAC SHUTDOWN CONTROL UNIT FOR VIBRATION CONTROL APPLICATIONS

The SCX-DSCU-II unit, when used in combination with a SCADAS front-end supporting vibration control functionality, allows the user to initiate a controlled shutdown of the excitation source during a vibration control campaign. The controlled shutdown can be initiated either manually by pressing the yellow button, or remotely by disconnecting an internal electrical circuit through the NC (normally closed) / NO (normally open) connector through an external device such as the SCM-UPS. The SCX-DSCU-II comes standard with an NC loopback plug.

When operated from a remote device the external wiring should follow this schematic and recommendations:



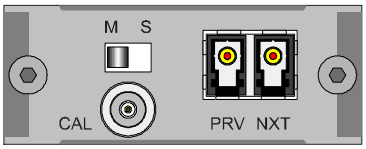
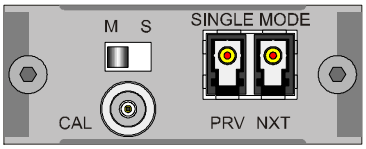
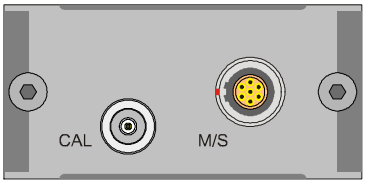
- SCX-DSCU-II side: M12 connector, female, A-coding
- Mates with: M12 connector, male, A-coding

* With the default loopback plug installed pins 1 and 2 are connected.

MULTI-FRAME INTERFACE MODULE

The primary task of a Multi-Frame interface module is to enable communication between a main frame and one or more secondary frames. This type of communication is required to achieve multi-frame configurations. To achieve flexibility in frame and system design a number of Multi-Frame interface modules are available.

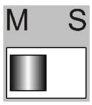
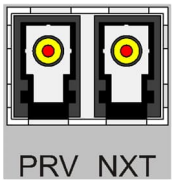
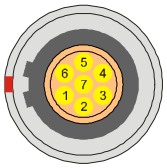
The table below shows the Multi-Frame interface modules that are available and when they are used.

MULTI-FRAME INTERFACE MODULE	USED IN
	All frame types *except* SCR IP54. Use this module in combination with Multi-mode glass-fiber cable only. Maximum number of modules: 256, including SYSCON and Multi-Frame interface modules. Maximum cable length, point-to-point: 250m.
	All frame types *except* SCR IP54. Use this module in combination with Single-mode glass-fiber cable only. Maximum number of modules: 256, including SYSCON and Multi-Frame interface modules. Maximum cable length between the Main and the last Secondary frame: 3000m. Maximum cable length between two individual frames: 3000m. Maximum number of frames in a loop: 10.
	SCR IP54. For IP54 applications only one (1) Secondary frame can be connected to a Main frame. Maximum cable length between the Main and Secondary frame: 10m.

Important:

Do not mix / combine Single-mode and Multi-mode Multi-Frame connections in the same configuration.

Features of the modules are described below.
Other details are described elsewhere; refer to the relevant Product Information Sheet.

FEATURE	DESCRIPTION	
	Switch to set the frame in Main or Secondary mode. In a single-frame configuration – and a Multi-Frame interface module is installed – this switch must be set to M. In a multi-frame configuration only one main frame can operate in main mode. Other frames operate in secondary mode.	
	Optical connections, to be used in a ring topology. The main frame connects from its “NXT” to the first secondary frame’s “PRV”. The 1st secondary frame connects from its “NXT” to the 2nd secondary frames’s “PRV”. Etcetera. The last secondary frame connects from its “NXT” to the main frame’s “PRV”.	
7-pin LEMO: M/S (SCR IP54 frames only) 	Connector type: LEMO-EGA.0B.307-L Pin details: 1) +IN 1 2) SH 1 3) -IN 1 4) +IN 2 5) SH 2 6) -IN 2 7) Multi-Frame detection (depending on cable)	Mating connector: LEMO-FGA.0B.307.CLADxx
	Calibration output. Service engineering purposes only.	

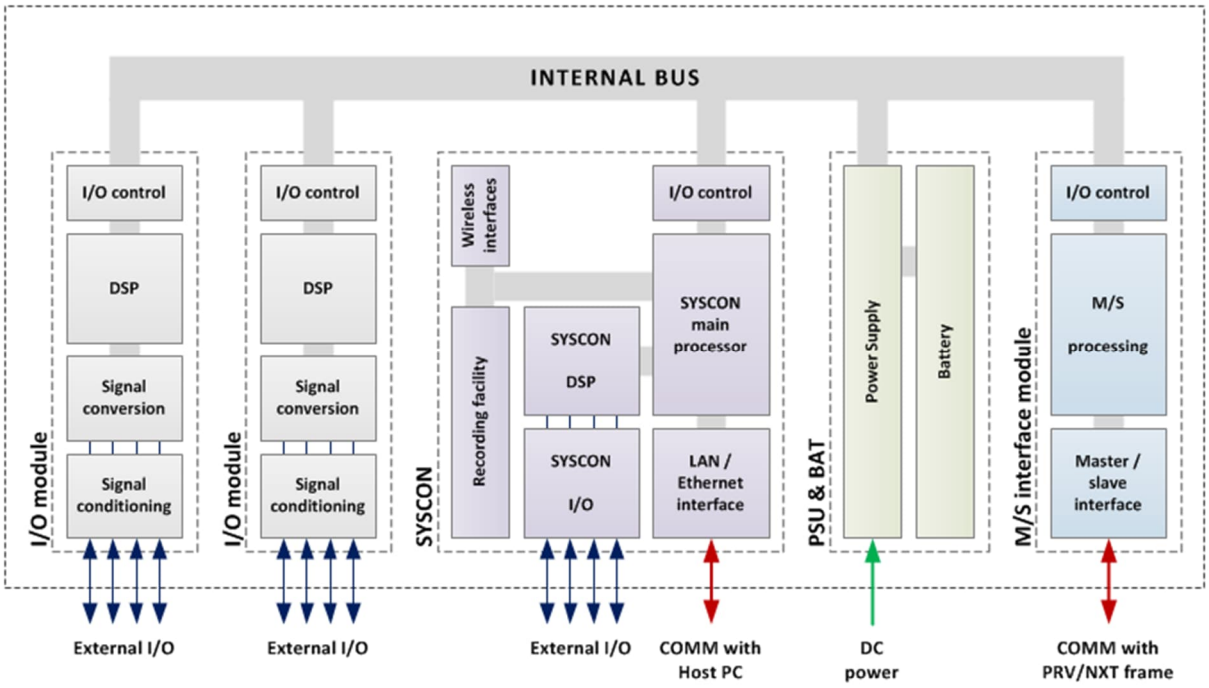
I/O MODULES

The number and combination of I/O modules depends on the frame size and the test configurations that need to be supported.

Information about I/O modules, their features and functions is described elsewhere; refer to Component description.

PRINCIPLES OF OPERATION

The block diagram below gives a high-level impression of the architecture of a frame in a Simcenter SCADAS Mobile & Recorder system. The elements are shown as generically as possible to represent any frame configuration, although not every frame topology will have all these elements.
The most complete architecture is shown here.



SYSTEM ARCHITECTURE

The concept of the Simcenter SCADAS Mobile & Recorder is built around an internal bus that provides all internal communication. It is designed for versatility and high speed data transfer in order to deliver guaranteed performance irrespective of the large variety of combination of modules.

The SYSCON module that is shown here represents a Simcenter SCADAS Recorder main frame. In a Simcenter SCADAS Mobile mainframe the elements 'Recording facility' (Compact Flash) and 'Wireless interfaces' (GNSS and Bluetooth/WLAN) are not present. A secondary frame does not have a SYSCON module at all, although the rest of the architecture is the same.

The Power Supply Unit and Battery (PSU & BAT) are also connected to the internal bus, for user interaction and status indication.

The Multi-Frame interface module operates as the communication interface between connected frames in a multi-frame configuration. In a single-frame configuration the Multi-Frame interface module has no function.

All types of I/O modules contain the elements that are shown here as blocks, although at component level the various types of I/O modules will differ distinctly. Further information about the internal architecture of I/O modules and the differences between specific types is described elsewhere; refer to Component description.

FUNCTIONAL DESCRIPTION

A Simcenter SCADAS Mobile & Recorder frame operates on external DC power – either with or without an AC/DC adapter – or on internal battery power. The required software settings for system, test and I/O behavior are determined by the application on the host PC. These settings are communicated and processed via the SYSCON main processor. Settings for I/O behavior are communicated to the applicable module(s) via the internal bus.

In case of stand-alone operation settings for system and test behavior are stored on a Compact Flash card, which is part of the Recording facility.
In case of a multi-frame configuration, settings for I/O behavior are communicated via the Multi-Frame interface modules of the main and secondary frames.

Input signals are conditioned and converted as necessary to enable digital signal processing (DSP). The I/O control communicates with the internal bus, which takes care of the communication to and from the SYSCON main processor.
Output signals are initiated by the SYSCON main processor and communicated via the internal bus to the applicable I/O channel. The I/O control and DSP of that channel interpret and process the 'instructions' from the SYSCON main processor and supply the correct digital signal. This digital signal is converted and conditioned as necessary before it is send out as the final output signal.

MODES OF OPERATION

The Simcenter SCADAS Mobile & Recorder can operate in these modes of operation:

MODE OF OPERATION	SIMCENTER SCADAS MOBILE	SIMCENTER SCADAS RECORDER
Front-end mode	Yes	Yes
Stand-alone mode	No	Yes

FRONT-END MODE

In front-end mode the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder is connected to a host PC that has Simcenter Testlab or Simcenter Testxpress installed. Connection is established over LAN via Ethernet. Simcenter Testlab or Simcenter Testxpress will be in full control during data acquisition.

In this set-up the Simcenter SCADAS Mobile & Recorder can be powered either:

- Via the AC/DC adapter.
- Via the DC power cable.
- Relying on the built-in Li-Ion battery pack.

The choice for a particular power source will mainly depend on the duration of the test(s).

STAND-ALONE MODE

In stand-alone mode the Simcenter SCADAS Recorder operates as recorder; it is *not* connected to a host PC. The Simcenter SCADAS Recorder will execute appropriately prepared recordings, reading the applicable template data from a Compact Flash card and writing the test results onto the same Compact Flash card. The Recorder will either be controlled by a device that runs Simcenter Testlab Control App (e.g. a tablet) or it will operate fully independently using the manual recording feature (the REC button).
In case Simcenter Testlab Control App is used, communication between the Recorder and the control device is established via Bluetooth or WLAN.

In this set-up the Simcenter SCADAS Recorder can be powered either:

- Via the AC/DC adapter.
- Via the DC power cable.
- Relying on the built-in Li-Ion battery pack.

During a test the Simcenter SCADAS Recorder typically operates on battery power, however the choice for a particular power source will mainly depend on the duration of the test(s).
How to prepare the Simcenter SCADAS Recorder for stand-alone operation, and the conditions that apply, is described elsewhere; refer to Operation.

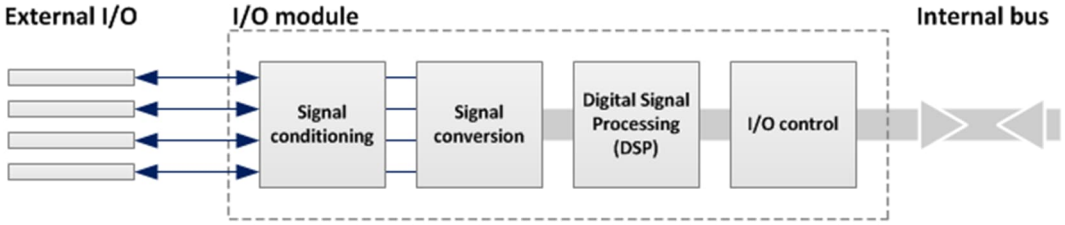
Chapter 4
COMPONENT DESCRIPTION

This chapter gives information about the Input and Output (I/O) modules of the Simcenter SCADAS Mobile & Recorder. The purpose of this chapter is to make the user familiar with *what* the features and functions of these components are.

The Simcenter SCADAS Mobile & Recorder can be equipped with a large variety of I/O modules. The choices for I/O modules that are used in a system depend on the specific needs of the user and the software application that a particular module must support.
Information about hardware selection with respect to a particular software-application is described elsewhere; refer to Simcenter SCADAS – Hardware Support Matrix.

I/O module architecture

The block diagram below gives a high-level impression of the architecture of an Simcenter SCADAS I/O module. All types of I/O modules contain the elements that are shown here as blocks, although at component level the various types of I/O modules will differ distinctly.



In general it can be stated that the differences between types of I/O modules will be largest where the I/O module – or individual connections – interfaces with the external I/O. Signal conditioning and signal conversion for analog and digital signals require dedicated solutions to achieve uniformity for digital signal processing, I/O control and interaction between the I/O module and the internal bus. Different types of analog signals require tailored signal conditioning for each type, although signal conversion will be handled quite the same. For digital signals the method of signal conditioning is common, but specific differences will show in the way signal conversion is done.

How this chapter is structured

I/O modules can be divided in a number of groups. Modules within a certain group share basic functional principles but may have different specific features or extended capabilities. Information about a particular group of modules is provided in separate sections. The main focus of this information is aimed at common functional principles that modules share. Any distinctions within a group are described as and where required. For further information refer to:

- Functions of analog input modules
- Functions of analog output modules
- Functions of digital modules

Technical data (Specifications) are described elsewhere; refer to the relevant Product Information Sheet.

COMPONENT OVERVIEW

The list below contains titles of sections *and* sub-sections to help the user find the required module-related information quickly.

IN THIS CHAPTER:

FUNCTIONS OF ANALOG INPUT MODULES

This part gives information about analog input modules. Most analog input modules support various channel functions that are software configurable; some modules offer specific and dedicated channel functions. Configuration is done in the Application software of Simcenter Testlab or Simcenter Testxpress.

The table below shows the relation between the channel functions (top-row) and the modules that support a function (left column). Click on a function or type number for more information.

	Single ended V/ICP	Differential V/ICP	Differential bridge input	SPDIF – digital audio	Semi differential V/ICP	Monitoring output	Single ended charge	Differential charge	Microphone input	Thermocouple input	ICP ®/ TEDS	Active sensor supply	Bridge supplies	Dynamic strain
V4-E	✓										✓			
V8-E (-RT)	✓										✓			
VS8-E	✓			✓							✓			
VM8-E	✓								✓		✓			
V8-E-II	✓										✓			
V24 / V24-II					✓						✓	✓		
V24M					✓						✓			
VD8-E	✓	✓									✓			
VD8MO-E	✓	✓				✓					✓			
VC8-E/-QS/-ER	✓						✓				✓			
DCH4-E							✓	✓						
VB8-II / III (-RT)	✓		✓								✓	✓	✓	
DB8-II / III	✓		✓								✓	✓	✓	
DB8A	✓		✓										✓	
DB8B	✓		✓								✓		✓	
DB8C / IIIC	✓		✓								✓	✓	✓	
BDS4-E			✓										✓	✓
VBDS4-RT	✓		✓			✓					✓		✓	✓
T8A (-RT)										✓				
TCK8										✓				

FUNCTIONS OF ANALOG OUTPUT MODULES

This part gives information about analog output modules. All of these modules offer specific and dedicated channel functions.

The table below gives an abstract of the channel function of each I/O module.
Click on a function or type number for more information.

MODULE	ABSTRACT OF CHANNEL FUNCTION
DAC4	Digital to Analog Converter
AO16	Mapped monitoring outputs

FUNCTIONS OF DIGITAL MODULES

This part gives information about digital I/O modules. All of these modules offer specific and dedicated channel functions.

The table below gives an abstract of the channel function of each I/O module.
Click on a function or type number for more information.

MODULE	ABSTRACT OF CHANNEL FUNCTION
CN4 (-II)	CAN bus interface
FR4	FlexRay interface
WFI2 (-KR)	Wheel force sensor interface
RV4	Rotational vibration module
CIM2	Camera Interface module
ESO64	EtherCAT Interface Module

[5] Functional information is described in: Bridge input – Voltage supply.

ANALOG INPUT – VOLTAGE

The group of analog input modules is the largest group within the range of I/O modules and is divided in a number of sub-groups. Most of these modules can support several functions, while some are designed to support more specific functions.
A complete overview of I/O modules and the function(s) they support is given at the beginning of this chapter; see Component overview.

This part provides information about one or more analog voltage-input functions and those I/O modules that primarily support those functions. Each function is described in a dedicated paragraph (see list below).
A paragraph starts with a brief functional description based on a simplified schematic diagram. Next, key features and physical appearance of the relevant I/O modules are provided; reference is made to other modules that also support the function at hand. Connection details are given where applicable.

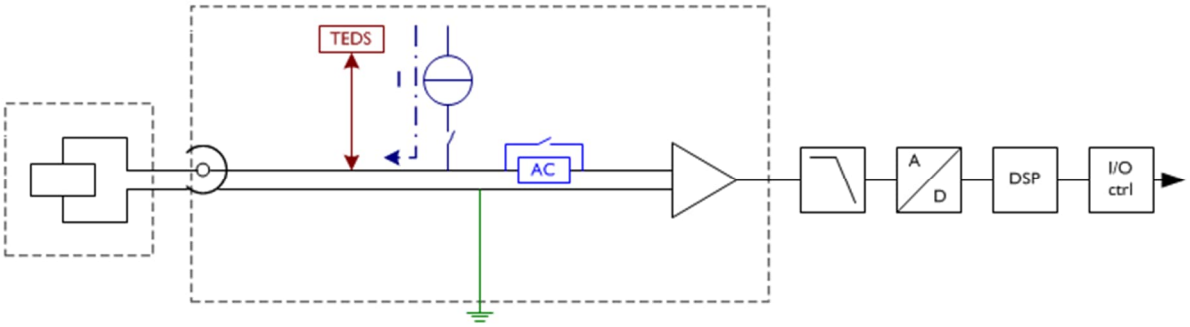
IN THIS SECTION:

SINGLE-ENDED V/ICP INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as single-ended voltage input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The external I/O can be any type of voltage source, either AC or DC. ICP and/or TEDS can be configured per connection. Signal conditioning basically consists of a filter for AC or DC coupling and input-range selection by a programmable amplifier. One of the incoming lines is connected to ground. Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

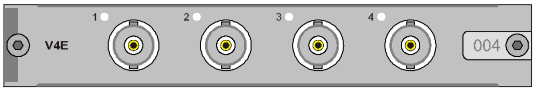
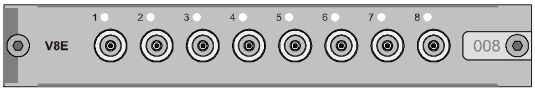
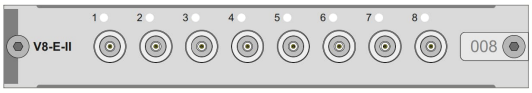
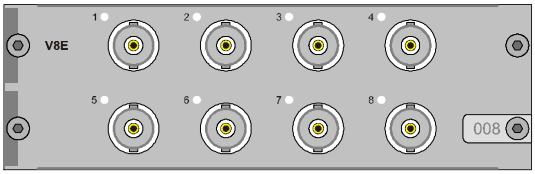
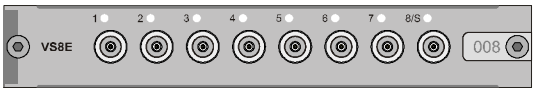
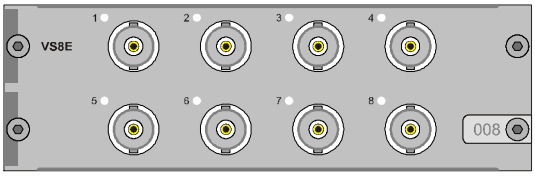
Key features and physical appearance

The primary modules that support this function are:

- V4-E, V8-E, VS8-E, V8-E-RT, V8-E-II

The V4-E, V8-E and V8-E-II modules support analog inputs for AC and DC voltage sources, as well as ICP® sensors such as accelerometers and microphones. AC/DC coupling and input ranges are software-selectable.
The VS8-E module offers the same capabilities, but adds digital-audio input functionality (SPDIF) on one of its connections (CH8) that is software-switchable.
All these modules support IEEE1451.4 compliant smart sensors (TEDS).

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	4 x BNC connector.
	8 x CAMAC connector.
	8 x CAMAC connector.
	8 x BNC connector.
	8 x CAMAC connector. Channel 8S can be used as SPDIF input. Related topic: SPDIF – digital audio.
	8 x BNC connector. Channel 8S can be used as SPDIF input. Related topic: SPDIF – digital audio.

Other modules that basically support this function are:

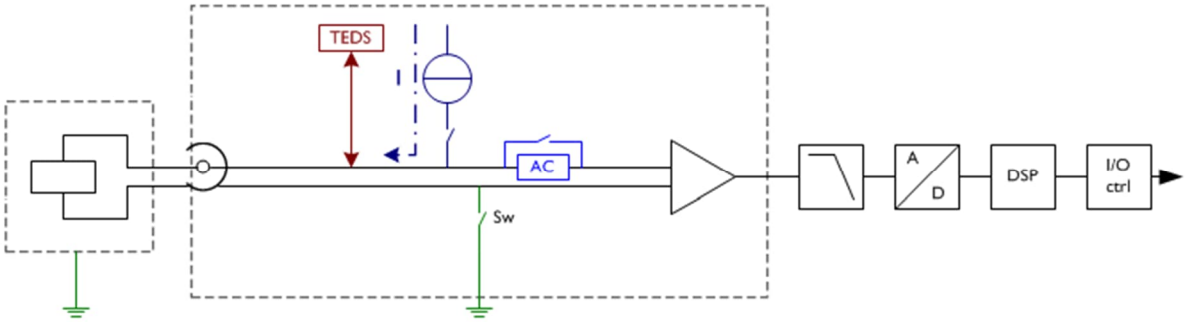
- VD8-E, VD8MO-E
- VM8-E
- VC8-E
- DB8-II, DB8III, VB8-II, VB8III-RT, DB8A, DB8B, DB8C, DB8IIIC

DIFFERENTIAL V/ICP INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as differential voltage input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



A connection of this module can be configured to support either a Differential Voltage input or a Single-ended V/ICP input. This can be done by means of a software-selectable switch (Sw).
To support a Differential Voltage input this switch must be open. In case this switch is closed a ground loop is created and the connection will act as a Single-ended V/ICP input.
Only the *Differential* Voltage input is described below.

The external I/O can be any type of voltage source, either AC or DC. ICP and/or TEDS can be configured per connection. Signal conditioning basically consists of a filter for AC or DC coupling and input-range selection by a programmable amplifier.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

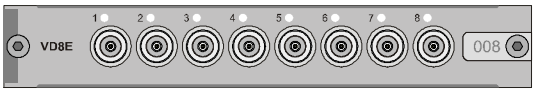
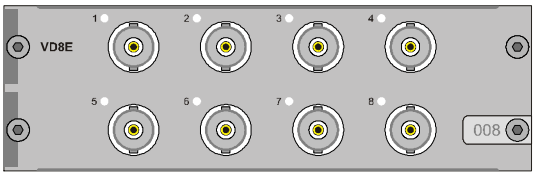
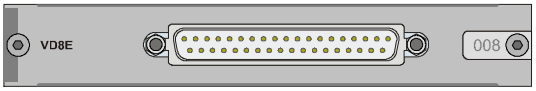
Key features and physical appearance

The primary modules that support this function are:

- VD8-E.

The VD8-E module supports analog inputs for AC and DC voltage sources, as well as ICP® sensors such as accelerometers and microphones. Differential or single-ended mode, AC/DC coupling and input ranges are software-selectable.
All these modules support IEEE1451.4 compliant smart sensors (TEDS).

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8 x isolated CAMAC connector.
	8 x BNC connector.
	1 x Sub-D connector, 37-pin.

Other modules that basically support this function are:

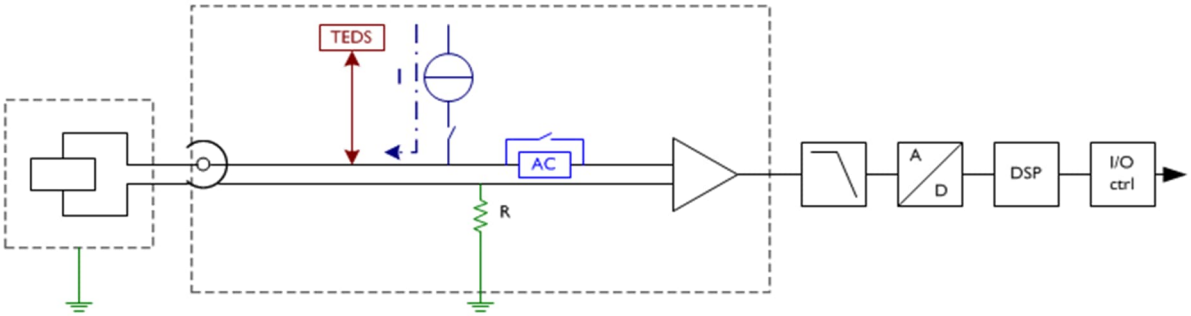
- VD8MO-E

SEMI-DIFFERENTIAL VOLTAGE INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as semi-differential voltage input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The external I/O can be any type of voltage source, either AC or DC. ICP and/or TEDS can be configured per connection. Signal conditioning basically consists of a filter for AC or DC coupling and an amplifier. One of the incoming lines is connected to ground via a resistor circuit (R). In case a ground loop exists, this resistor circuit (R) decreases the current in that ground loop and thus minimizes the impact of disturbances.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

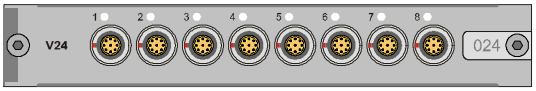
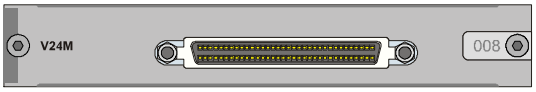
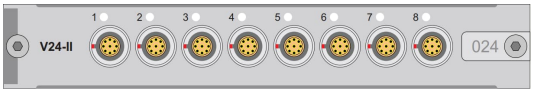
Key features and physical appearance

The primary modules that support this function are:

- V24, V24M, V24-II.

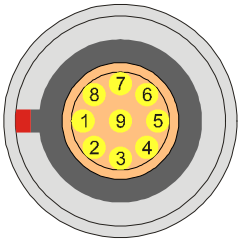
The V24(-II) and V24M modules support analog inputs for AC and DC voltage sources, as well as ICP® sensors such as (triaxial) accelerometers and microphones. AC/DC coupling and input ranges are software-selectable. The V24(-II) module can also provide Active sensor supply for capacitive and MEMS DC accelerometers. The V24M module comes with a 'Break Out Box'.
All these modules support IEEE1451.4 compliant smart sensors (TEDS).

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8 x 9-pin LEMO connector. Connection details are described below.
	1 x multi-pole connector, 68-pin. Optional accessories are available.
	8 x 9-pin LEMO connector. Connection details are described below.

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
9-pin LEMO: V24(-II) - channels 1 to 8  Chassis = Analog Ground Not connected implicates: DO NOT USE	Connector type: LEMO-EGG.0B.309 Pin details: 1) Not connected 2) Ground - B 3) IN - B 4) Not connected 5) + 6V5 supply 6) IN - C 7) Ground - C 8) IN - A 9) Ground - A	Mating connector: LEMO-FGG.0B.309.CLADxx

ANALOG INPUT – CHARGE

The group of analog input modules is the largest group within the range of I/O modules and is divided in a number of sub-groups. Most of these modules can support several functions, while some are designed to support more specific functions.
A complete overview of I/O modules and the function(s) they support is given at the beginning of this chapter; see Component overview.

This part provides information about one or more analog voltage-input functions and those I/O modules that primarily support those functions. Each function is described in a dedicated paragraph (see list below).
A paragraph starts with a brief functional description based on a simplified schematic diagram. Next, key features and physical appearance of the relevant I/O modules are provided; reference is made to other modules that also support the function at hand. Connection details are given where applicable.

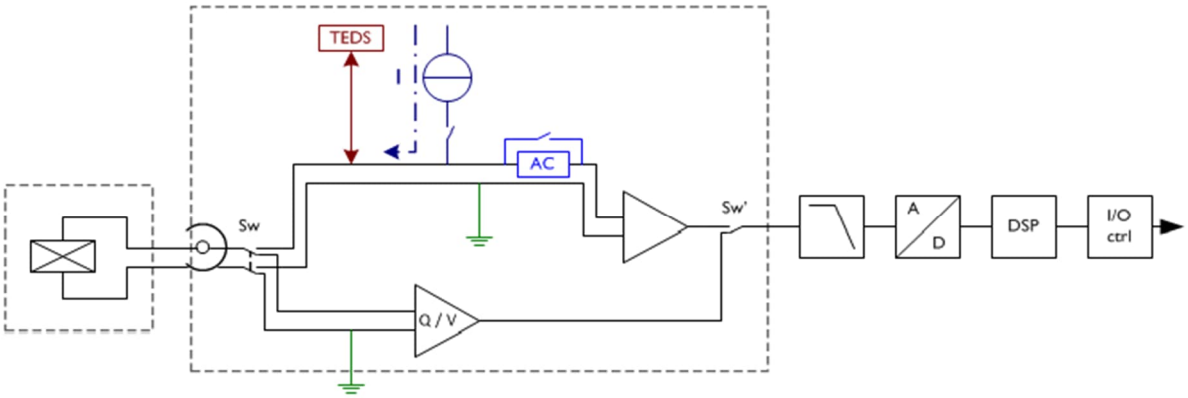
IN THIS SECTION:

SINGLE-ENDED CHARGE INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as single-ended charge input. From left to right the elements shown represent:

- external I/O
  (once shown as single-ended voltage input and once as single-ended charge input),
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



A connection of this module can be configured to support either a Single-ended Charge input or a Single-ended V/ICP input. This can be done by means of a set of software-selectable switches (Sw and Sw').
To support a Single-ended Charge input these switches must be positioned as shown here. In case the switches are in the other position the connection will act as a Single-ended V/ICP input.
Only the Single-ended *Charge* input is described below.

The external I/O is typically a piezoelectric transducer. One of the incoming lines is connected to ground. Signal conditioning basically consists of a charge-to-voltage converter that also provides input-range selection (through a programmable amplifier). The analog voltage value is available for signal conversion.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

Key features and physical appearance

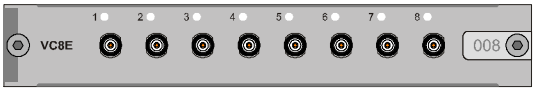
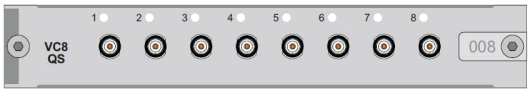
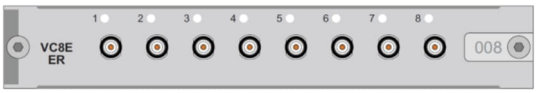
The primary modules that support this function are:

- VC8-E.
- VC8-QS is a variant of VC8-E, providing a lower HP filter (0.015Hz) and different input ranges
- VC8-ER is a second variant of VC8-E, providing higher input ranges

VC8-E		VC8-QS		VC8-ER	
Charge	V/ICP	Charge	V/ICP	Charge	V/ICP
± 10 000 pC	± 10 V	± 31 600 pC	± 10 V	± 100 000 pC	± 10 V
± 3 160 pC	± 3.16 V	± 10 000 pC	± 3.16 V	± 31 600 pC	± 3.16 V
± 1 000 pC	± 1 V	± 3 160 pC	± 1 V	± 10 000 pC	± 1 V
± 316 pC	± 316 mV	± 1 000 pC	± 316 mV	± 3 160 pC	± 316 mV

The VC8-E, QS and ER modules supports analog inputs for charge sources (charge mode) and AC and DC voltage sources (V/ ICP® mode). Charge or V/ ICP® mode is software-selectable per channel. In charge mode input ranges are software-selectable. In V/ICP® mode AC/DC coupling and input ranges are software-selectable, and IEEE1451.4 compliant smart sensors (TEDS) are supported.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	VC8-E 8 x industry standard 10-32 Microdot connector. The connectors of this module are fitted with neoprene rings. Make sure these rings do not come off and replace them if necessary. Further details are described elsewhere; refer to Operation, Connecting transducers.
	VC8-QS 8 x industry standard 10-32 Microdot connector. The connectors of this module are fitted with neoprene rings. Make sure these rings do not come off and replace them if necessary. Further details are described elsewhere; refer to Operation, Connecting transducers.
	VC8-ER 8 x industry standard 10-32 Microdot connector. The connectors of this module are fitted with neoprene rings. Make sure these rings do not come off and replace them if necessary. Further details are described elsewhere; refer to Operation, Connecting transducers.

Other modules that basically support this function are:

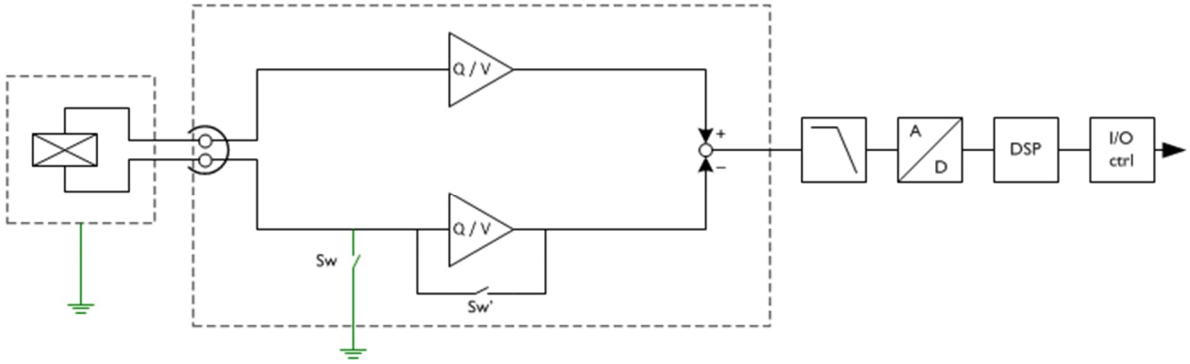
- DCH4-E.

DIFFERENTIAL CHARGE INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as differential charge input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



A connection of this module can be configured to support either a Differential Charge input or a Single-ended Charge input. One of the incoming lines can be connected to ground by means of a software-selectable switch (Sw); a by-pass switch (Sw') is operated simultaneously.
To support a Differential Charge input the switches (Sw and Sw') must be open. In case these switches are closed a ground-loop is created and the connection will act as a Single-ended Charge input. Only the *Differential* Charge input is described below.

The external I/O is typically a piezoelectric transducer. Signal conditioning basically consists of dual charge-to-voltage converters that also provide input-range selection (through a programmable amplifier). The analog voltage values are available for signal conversion.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

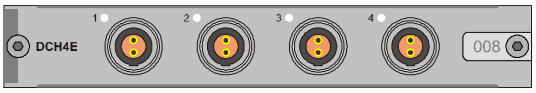
Key features and physical appearance

The primary modules that support this function are:

- DCH4-E.

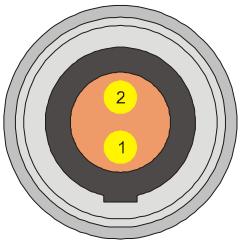
The DCH4-E module supports analog inputs for charge sources. Differential or single-ended mode and input ranges are software-selectable. The DCH4-E has enhanced cable-compensation capabilities, allowing the use of long cable lengths.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	4 x 2-pin LEMO connector. Connection details are described below.

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
2-pin LEMO: DCH4-E - channels 1 to 4  Chassis = Analog Ground	Connector type: LEMO-EHG.1B.302 Pin details: 1) + IN 2) - IN	Mating connector: LEMO-FGG.1B.302.CLADxx

ANALOG INPUT – MICROPHONE

The group of analog input modules is the largest group within the range of I/O modules and is divided in a number of sub-groups. Most of these modules can support several functions, while some are designed to support more specific functions.
A complete overview of I/O modules and the function(s) they support is given at the beginning of this chapter; see Component overview.

This part provides information about one or more analog microphone-input functions and those I/O modules that primarily support those functions. Each function is described in a dedicated paragraph (see list below).
A paragraph starts with a brief functional description based on a simplified schematic diagram. Next, key features and physical appearance of the relevant I/O modules are provided; reference is made to other modules that also support the function at hand. Connection details are given where applicable.

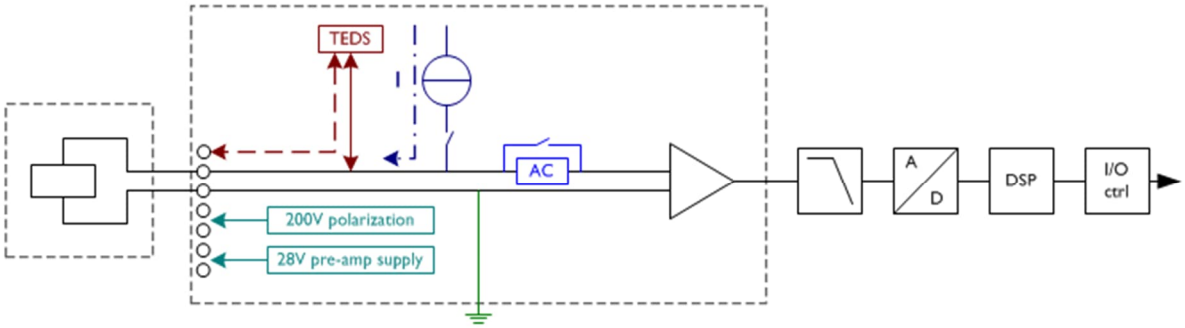
IN THIS SECTION:

SINGLE-ENDED MICROPHONE INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as single-ended microphone input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The external I/O can be any type of microphone or voltage source, either AC or DC. ICP and/or TEDS can be configured per connection. Signal conditioning basically consists of a filter for AC or DC coupling and input-range selection by a programmable amplifier. One of the incoming lines is connected to ground. This basic functionality is similar to that of a Single-ended V/ICP input.

For certain types of microphones (e.g. conventional microphones) it is required to use the dedicated microphone pre-amplifier supply and an accurate polarization voltage.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

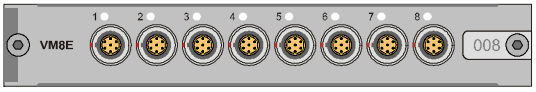
Key features and physical appearance

The primary modules that support this function are:

- VM8-E.

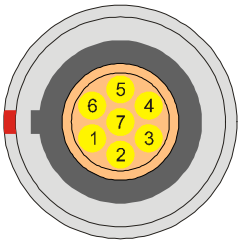
The VM8-E module supports analog inputs for AC and DC voltage sources, as well as ICP® sensors such as accelerometers and microphones. AC/DC coupling and input ranges are software-selectable. The VM8-E module also has a dedicated microphone preamplifier supply and an accurate 200V DC polarization voltage, commonly required for conventional microphones.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8 x 7-pin LEMO connector. Connection details are described below.

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
7-pin LEMO: VM8-E - channels 1 to 8  Chassis = Analog Ground	Connector type: LEMO-EGG.0B.307 Pin details: 1) SIG - Ground 2) SIG - Ground 3) MIC - 200V 4) SIG - OUT 5) TEDS 6) MIC - 28V (pre-amp supply) 7) Power - Ground	Mating connector: LEMO-FGG.0B.307.CLADxx

ANALOG INPUT – THERMOCOUPLE

The group of analog input modules is the largest group within the range of I/O modules and is divided in a number of sub-groups. Most of these modules can support several functions, while some are designed to support more specific functions.
A complete overview of I/O modules and the function(s) they support is given at the beginning of this chapter; see Component overview.

This part provides information about one or more analog thermocouple-input functions and those I/O modules that primarily support those functions. Each function is described in a dedicated paragraph (see list below).
A paragraph starts with a brief functional description based on a simplified schematic diagram. Next, key features and physical appearance of the relevant I/O modules are provided; reference is made to other modules that also support the function at hand. Connection details are given where applicable.

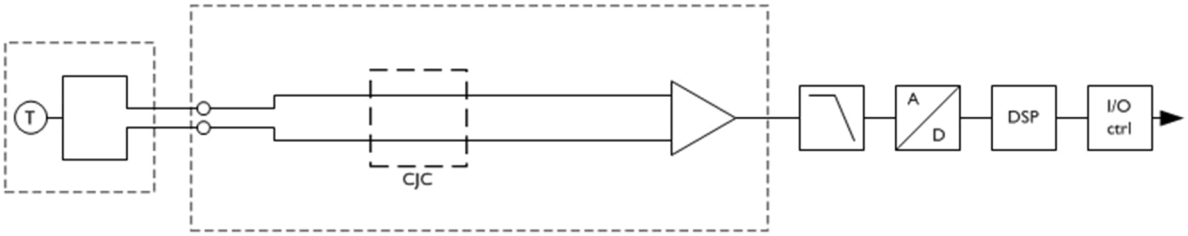
IN THIS SECTION:

THERMOCOUPLE INPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as thermocouple input. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The external I/O can be any type of slow or fast changing temperature signal from a thermocouple sensor. Signal conditioning basically consists of signal amplification with Cold Junction Compensation (CJC), and thermocouple-type selection and signal linearization.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, linearization, on-line calibration of amplitude and offset errors, and digital low-pass filtering. Finally the I/O control communicates the result to the internal bus.

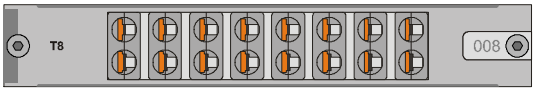
Key features and physical appearance

The primary modules that support this function are:

- T8, T8-RT

The T8 module provides thermocouple conditioning with galvanic isolation. It supports analog inputs for thermocouple types B, E, J, K, N, R, S and T. Thermocouple types are software-selectable per channel.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8x standard miniature thermocouple connector (standard type B in accordance with IEC584-3). An IP54 version is also available.

Other modules that basically support this function are:

- TCK8

ANALOG INPUT – BRIDGE FUNCTIONS

The group of analog input modules is the largest group within the range of I/O modules and is divided in a number of sub-groups. Most of these modules can support several functions, while some are designed to support more specific functions.
A complete overview of I/O modules and the function(s) they support is given at the beginning of this chapter; see Component overview.

This part provides information about one or more analog bridge-input functions and those I/O modules that primarily support those functions. Each function is described in a dedicated paragraph (see list below).
A paragraph starts with a brief functional description based on a simplified schematic diagram. Next, key features and physical appearance of the relevant I/O modules are provided; reference is made to other modules that also support the function at hand. Connection details are given where applicable.

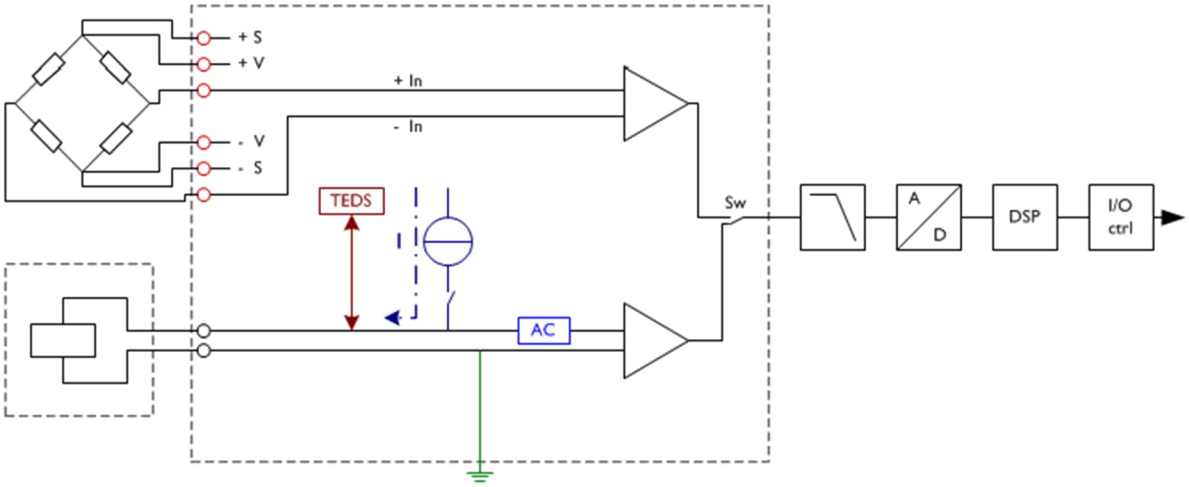
IN THIS SECTION:

BRIDGE INPUT – VOLTAGE SUPPLY

Functional description

The diagram below shows the basic functionality for a set of connections that are configured as bridge input for voltage sources. From left to right the elements shown represent:

- external I/O
  (once shown as a full bridge set-up and once as single-ended voltage input),
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The connections of this module can be configured to support either Bridge inputs or a Single-ended V/ICP input. This can be done by means of a software-selectable switch (Sw).
Only the *Bridge input* functionality is described below.

The external I/O can be any type of bridge set-up with voltage sources. AC and DC capability as well as other features depend on the module type (see 'Key features' below), and configuration settings. Signal conditioning basically consists of input-range selection by a programmable amplifier and accurate bridge supply.
Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

Various bridge set-ups are possible; for more detailed information see Operation, Connecting transducers.

Key features and physical appearance

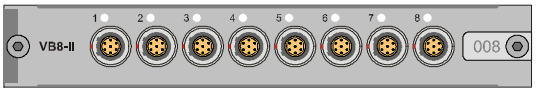
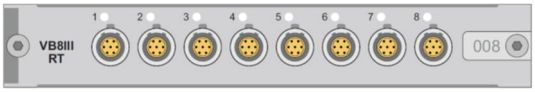
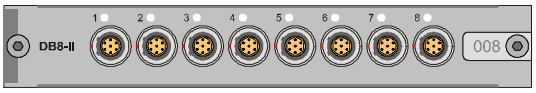
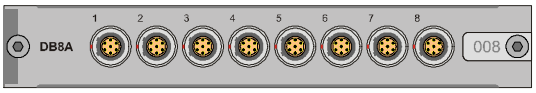
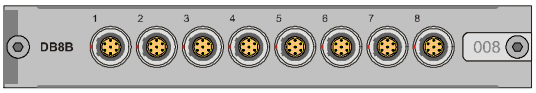
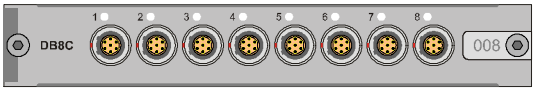
The primary modules that support this function are:

- VB8-II, VB8II-RT, VB8III-RT, DB8-II, DB8III, DB8A, DB8B, DB8C, DB8IIIC.

The table below shows which key features are supported by these modules and points out the main differences between them. More detailed information is described in the relevant Product Information Sheet.

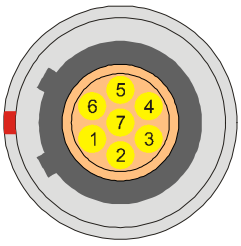
FEATURE	VB8-II/III	DB8-II/III	DB8A	DB8B	DB8C/ IIIC
Analog to digital conversion:					
▸ sampling frequency (kHz)	204.8	102.4	51.2	51.2	51.2
▸ alias free bandwidth (kHz)	92	5	5	5	5
Signal conditioning:					
▸ DC bridge	✓	✓	✓	✓	✓
▸ ICP®	✓	✓	-	✓	✓
▸ AC bridge, LVDT and more (see 'Sensor support' below for further details)	✓	✓	-	-	✓
Sensor support:					
▸ DC bridge supporting Wheatstone bridge type sensors (e.g. strain gages in full, half & quarter bridge configurations, DC accelerometer/pressure transducers)	✓	✓	✓	✓	✓
▸ Potentiometers to measure linear displacement	✓	✓	✓	✓	✓
▸ ICP® input (e.g. accelerometers, load cells, strain)	✓	✓	-	✓	✓
▸ TEDS class 1 (ICP sensors) and TEDS class 2 (DC sensors) is supported according to IEEE 1451.4	✓	✓	-	✓	✓
▸ Carrier frequency (AC bridge) supporting strain gages in full, half & quarter bridge configurations and inductive half bridge	✓	✓	-	-	✓
▸ Active sensors such as MEMS or variable capacitance	✓	✓	-	-	✓
▸ LVDT sensors to measure displacement or rotation	✓	✓	-	-	✓
▸ 4-20mA transmitters for measuring pressure or temperature	✓	✓	✓	✓	✓
Overload & cable check:					
▸ Overload detection	✓	✓	✓	✓	✓
▸ Bridge cable check	✓	✓	✓	✓	✓
▸ ICP cable check	✓	✓	-	✓	✓
▸ LED indicator on front panel	✓	✓	-	-	✓

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	VB8-II: 8 x 7-pin LEMO connector. Connection details are described below.
	VB8III-RT: 8 x 7-pin LEMO connector. Connection details are described below.
	8 x 7-pin LEMO connector. Connection details are described below.
	8 x 7-pin LEMO connector. Connection details are described below.
	8 x 7-pin LEMO connector. Connection details are described below.
	8 x 7-pin LEMO connector. Connection details are described below.

Other modules that basically support this function are:

- BDS4-E
- VBDS4-RT

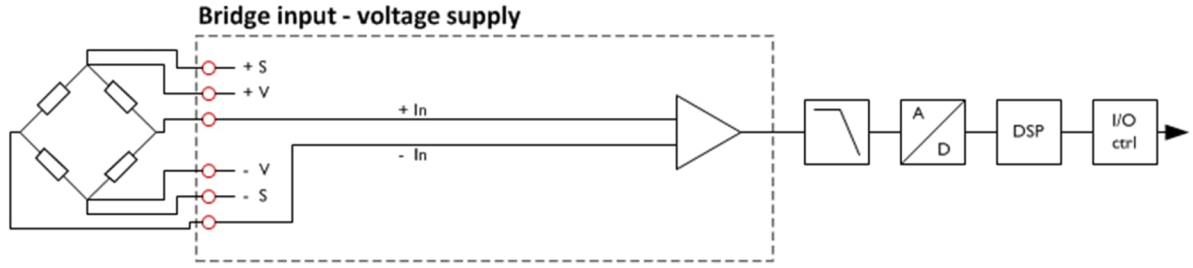
CONNECTION	DETAILS	REMARKS
7-pin LEMO: channels 1 to 8  Chassis = Analog Ground Not connected implicates: DO NOT USE	Connector type: LEMO-EGB.0B.307 Pin details: 1) +V supply 2) +V sense 3) +V IN 4) -V IN 5) -V sense 6) -V supply 7) ICP / TEDS (DB8A: Not connected)	Mating connector: LEMO-FGB.0B.307.CLADxx

BRIDGE INPUT – DYNAMIC STRAIN

Functional description

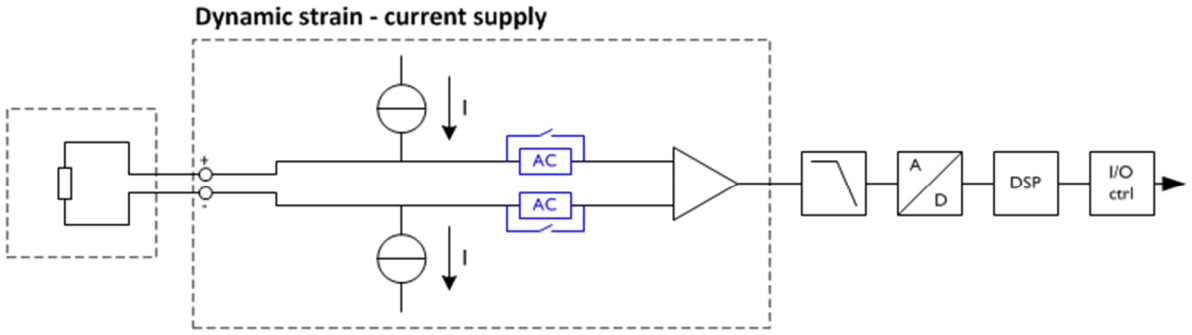
The diagrams below show the basic functionality for two possible set-ups. The first shows a set of connections that are configured as Bridge input with voltage supply; the second shows a set-up with a single strain sensor (gage) for Dynamic strain with current supply.
From left to right the elements shown represent:

- external I/O,
- analog signal conditioner,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



In this set-up the module basically functions as a Bridge input – Voltage supply module.
The external I/O can be any type of bridge set-up with voltage sources. AC and DC capability as well as other features depend on the configuration settings.
Signal conditioning basically consists of input-range selection by a programmable amplifier.

Various bridge set-ups are possible; for more detailed information see Operation, Connecting transducers.



In this set-up the module functions in AC Dynamic-strain mode.
The external I/O can be any type of two-wire strain sensor (gage) that connects directly to the module. Signal conditioning basically consists of a balanced current supply, an AC filter per incoming line and input-range selection by a programmable amplifier.

The steps after signal conditioning apply to both set-ups.

Next signal conversion takes place; this basically consists of an anti-alias filter and an analog-to-digital converter. The converted signal is offered to the DSP for digital processing. This basically takes care of sample-rate reduction, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

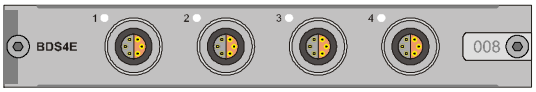
Key features and physical appearance

The primary modules that support this function are:

- BDS4-E (static and dynamic strain)
- VBDS4-RT (V/ICP, static and dynamic strain, with monitor output)

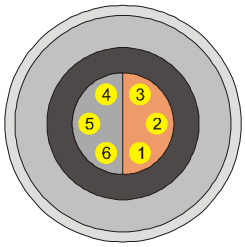
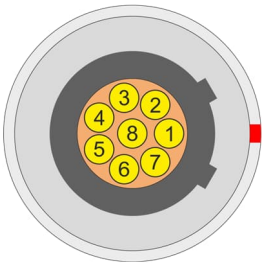
In dynamic strain mode the BDS4-E and VBDS4-RT have enhanced cable-compensation capabilities, allowing the use of long cable lengths. This mode is typically used for relatively high frequency strain measurements.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	4 x 6-pin LEMO connector. Connection details are described below.
	4 x 8-pin LEMO connector 4 x CAMAC connector for monitor output

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
BDS4-E 6-pin LEMO: channels 1 to 4  Chassis = Analog Ground	Connector type: LEMO-ERA.1S.306 Pin details: 1) +V supply 2) -V sense 3) +V IN 4) -V IN 5) -V shunt 6) -V supply	Mating connector: LEMO-FFA.1S.306.CLACxx
VBDS4-RT 8-pin LEMO: channels 1 to 4  Chassis = Analog Ground	Connector type: LEMO-EGB.1B.308.CLVY Pin details: 1) +V IN 2) -V IN 3) -Shunt 4) TEDS Class 2 5) +V supply 6) -V supply 7) -V sense 8) Ground	Mating connector: LEMO-FGB.1B.308.CLAD62

ANALOG OUTPUTS

The group of analog output modules consists of modules with a particular purpose; most of these modules are designed to support specific functions. A complete overview of the groups and sub-groups of modules is given at the beginning of this chapter; see Component overview.

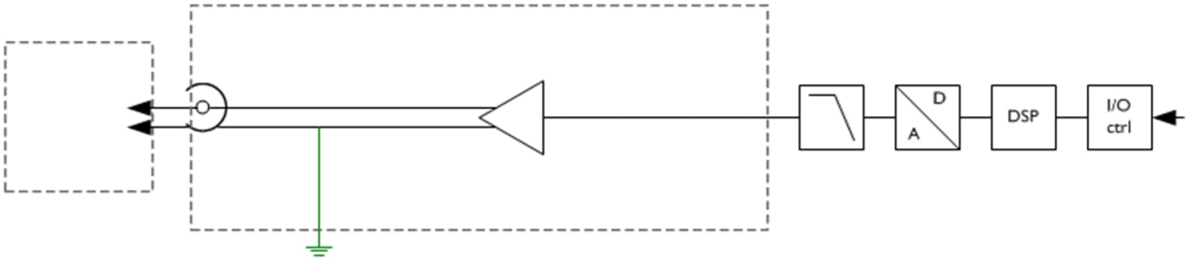
IN THIS SECTION:

DIGITAL-TO-ANALOG CONVERTER

Functional description

The diagram below shows the basic functionality for one output connection of a Digital-to-Analog converter module. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner / buffer,
- reconstruction filter,
- Digital-to-analog (D/A) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



This process is described starting at the internal bus (right side of the schematic).

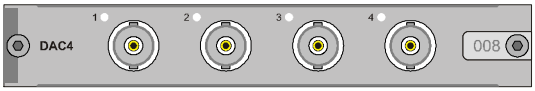
The type and profile of the output signal is determined / configured in the Application software, and initiated via the SYSCON of the system. These ‘instructions’ are communicated to the I/O control of the converter module. These ‘instructions’ are offered to the DSP for digital processing. This basically takes care of signal generation, on-line calibration of amplitude and offset errors, and digital low-pass or high-pass filtering.
Next signal conversion takes place; this basically consists of a digital-to-analog converter and a reconstruction filter. The converted signal is offered to the analog signal conditioner that basically buffers the analog output signal. Finally the output signal is fed to the connected external source.

Key features and physical appearance

The primary modules that support this function are:

- DAC4

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	4x BNC connector.

Other modules that basically support this function are:

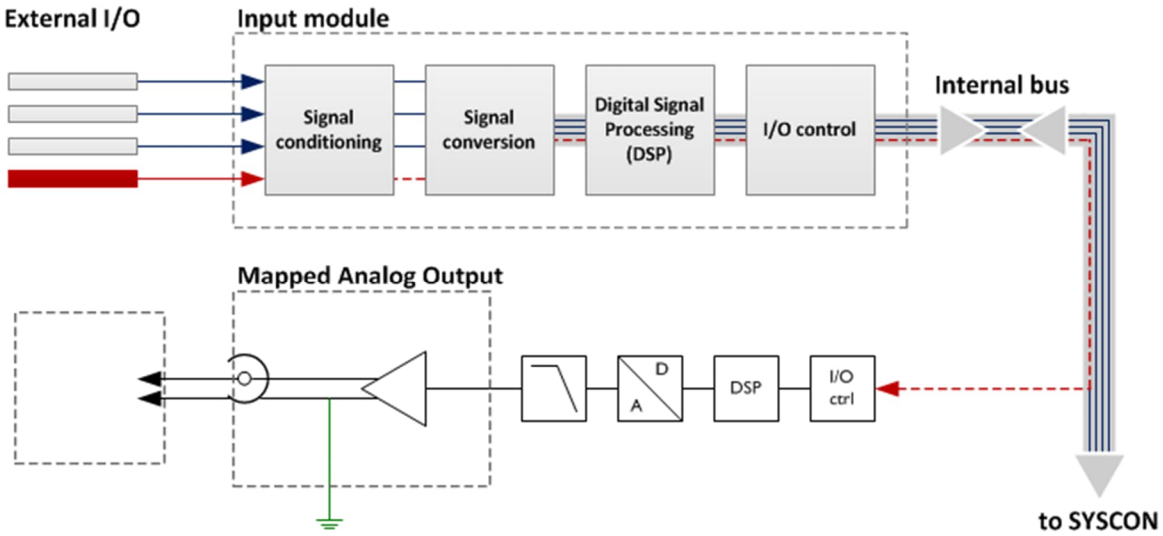
- SYSCON DAC

MAPPED MONITORING OUTPUTS

Functional description

The diagram below shows the basic functionality for one mapped output connection of an Analog output module. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner / buffer,
- reconstruction filter,
- Digital-to-analog (D/A) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The schematic shows a generic input module and one mapped analog output connection, and the way they are connected with each other and the SYSCON over the internal bus.

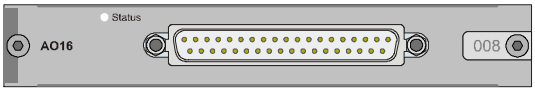
Any input signal that is processed and communicated to the internal bus will be communicated onto the SYSCON and finally to the host PC that runs the Application software.
The purpose of a mapped analog output is that a designated input can be 'linked' (mapped) to it for monitoring purposes. Designation – or mapping – of such an input signal is determined / configured in the Application software, and initiated via the SYSCON of the system.
These 'instructions' are communicated to the I/O control of the designated input module and the analog output module. The designated input signal will be communicated to both the SYSCON of the system and the I/O control of the analog output module. The mapped input is offered to the DSP for digital processing. This basically takes care of signal reproduction and on-line calibration of amplitude and offset errors.
Next signal conversion takes place; this basically consists of a digital-to-analog converter and an anti-alias filter. The converted signal is offered to the analog signal conditioner that basically buffers the analog output signal. Finally the output signal is fed to the connected external source.

Key features and physical appearance

The primary modules that support this function are:

- AO16.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	1x Sub-D connector, 37-pin. Delivered with a breakout box.

Other modules that basically support this function are:

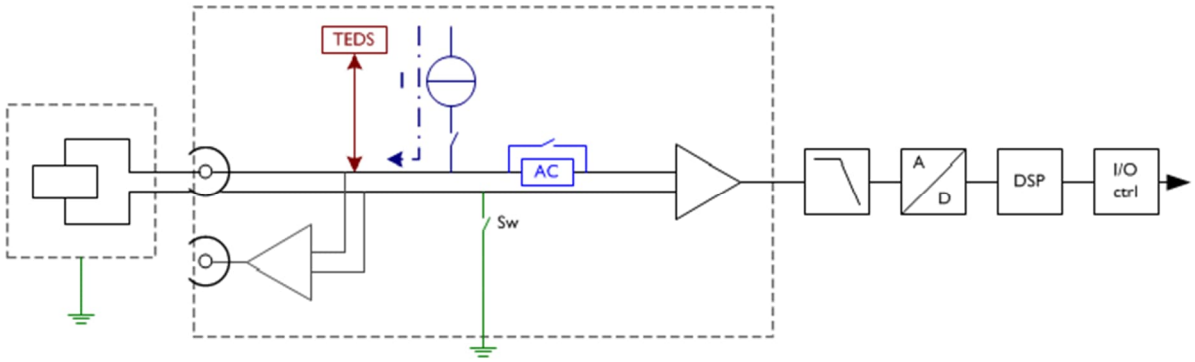
- None.

MONITORING OUTPUT

Functional description

The diagram below shows the basic functionality for one connection that is configured as differential voltage input with monitoring output. From left to right the elements shown represent:

- external I/O,
- analog signal conditioner - with an analog monitoring output,
- anti-alias filter,
- Analog-to-digital (A/D) converter (24 bit per channel),
- Digital Signal Processor (DSP),
- Input/Output control.



The connections of this module can be configured to support single-ended and differential voltage inputs, as described for a Differential V/ICP input.

The processed signal will be offered to the internal bus and – via the SYSCON – to the Application software. Furthermore, each connection of this module has a direct coupled analog output for monitoring purposes.

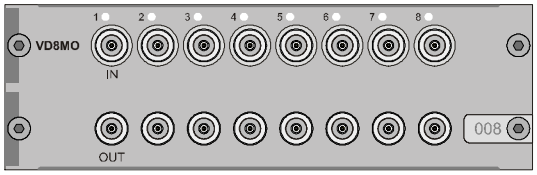
Key features and physical appearance

The primary modules that support this function are:

- VD8MO-E.

The VD8MO-E module supports analog inputs for AC and DC voltage sources, as well as ICP® sensors such as accelerometers and microphones. Differential or single-ended mode, AC/DC coupling and input ranges are software-selectable.
In addition each connection has a direct coupled analog output for monitoring purposes.
This module supports IEEE1451.4 compliant smart sensors (TEDS).

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8x isolated CAMAC connector (IN). 8x CAMAC connector (OUT).

Other modules that basically support this function are:

- None.

DIGITAL I/O MODULES

The group of digital input/output modules consists of modules with a particular purpose; these modules are designed to support specific functions. A complete overview of the groups and sub-groups of modules is given at the beginning of this chapter; see Component overview.

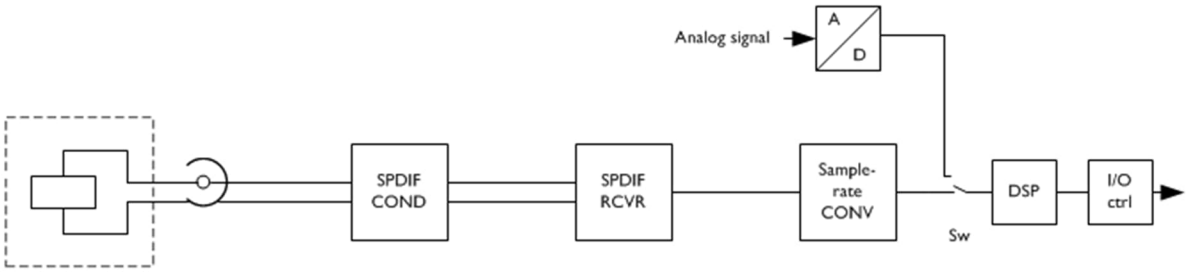
IN THIS SECTION:

SPDIF – DIGITAL AUDIO

Functional description

The diagram below shows the basic functionality for one software-selectable digital input connection of an Analog module; this input supports SPDIF audio signals. From left to right the elements shown represent:

- external I/O,
- digital signal conditioner,
- Sample-rate converter,
- Digital Signal Processor (DSP),
- Input/Output control.



A connection of this module can be configured to support a Single-ended V/ICP input or SPDIF audio (digital) inputs. This can be done by means of a software-selectable switch (Sw).
To support a V/ICP input this switch must connect the A/D converter to the DSP. To support SDIF audio (digital) inputs this switch must connect the Sample-rate converter to the DSP.
Only the *SDIF audio* (digital) input is described below.

The external I/O is an SPDIF source. Signal conditioning consists of voltage conversion to obtain the correct level for the SPDIF receiver. The SPDIF receiver converts the incoming bit stream into digital samples. Next the sample-rate converter synchronizes the digital samples to the ADC sample rate. The synchronized signal is offered to the DSP for digital processing. This takes care of sample-rate reduction and digital low-pass or high-pass filtering. Finally the I/O control communicates the result to the internal bus.

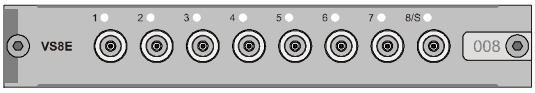
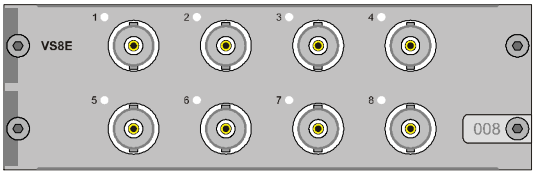
Key features and physical appearance

The primary modules that support this function are:

- VS8-E.

The VS8-E module supports analog inputs for AC and DC voltage sources, as well as ICP® sensors such as accelerometers and microphones. AC/DC coupling and input ranges are software-selectable. In addition it supports digital-audio input functionality (SPDIF) on one of its connections (CH8) that is software-switchable.
This module supports IEEE1451.4 compliant smart sensors (TEDS).

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	8x CAMAC connector. Channel 8S can be used as SPDIF input. Related topic: Single-ended V/ICP input.
	8x BNC connector. Channel 8S can be used as SPDIF input. Related topic: Single-ended V/ICP input.

Other modules that basically support this function are:

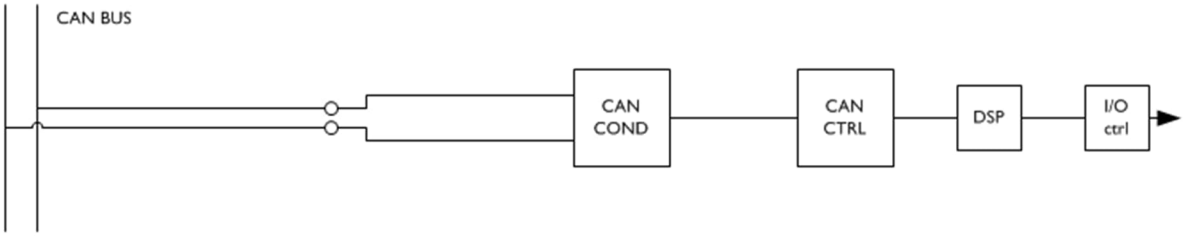
- None.

CAN BUS INTERFACE

Functional description

The diagram below shows the basic functionality for one digital input connection of a CAN interface module. From left to right the elements shown represent:

- external I/O,
- digital signal conditioner,
- CAN receiver,
- Digital Signal Processor (DSP),
- Input/Output control.



The CAN-bus interface is designed to operate in “listen only” mode by default. This means that it will read any messages that are transmitted on an existing CAN bus. Other interface operating modes may be provided.
However, in situations where just one CAN device is present – instead of a fully operational CAN bus – the CAN-bus interface will initiate a so-called “acknowledge” action. After this action is done communication can take place from that particular CAN device to the SYSCON module, now in “listen only” mode again.

The CAN-bus interface will listen to the messages that are transmitted on the CAN-bus. The CAN receiver will filter messages. The filtered messages are offered to the DSP for further processing. The DSP synchronizes the messages to the ADC sample rate. Finally the I/O control communicates the result to the internal bus.

Key features and physical appearance

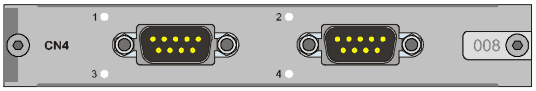
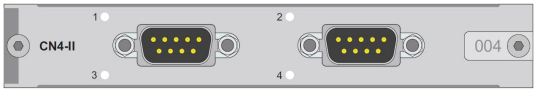
The primary modules that support this function are:

- CN4
- CN4-II (adding CAN-FD functionality)

The CN4(-II) module provides four CAN inputs that support communication with both low and high speed CAN buses.

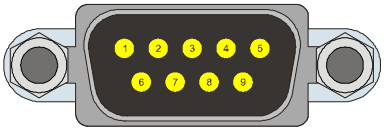
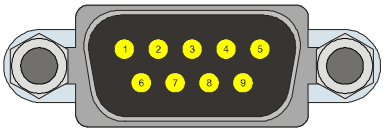
Important note: The CN4 and CN4-II provide a +15V and a -15V supply voltage. These voltages are present on the connector the moment the instrument is powered and switched on.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	2x Sub-D connector, 9-pin. Connection details are described below.
	2x Sub-D connector, 9-pin. Connection details are described below.

Other modules that basically support this function are:

- SYSCON CAN interface

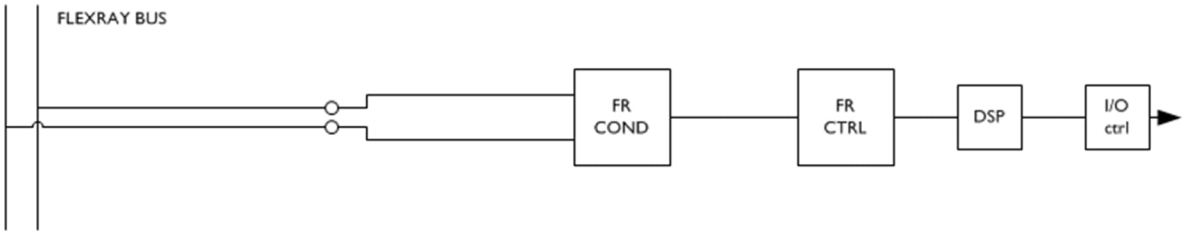
CONNECTION	DETAILS	REMARKS
9-pin Sub-D: CN4 – Left-hand connector  Not connected implicates: DO NOT USE	Connector type: DSUB9M Pin details: 1) + 15V supply 2) CN1 – L 3) Ground 4) CN3 – L 5) - 15V 6) Not connected 7) CN1 – H 8) CN3 – H 9) Not connected	Mating connector: DSUB9F The +15V and -15V supplies are for TCK8 power only. Do not make any other connection to these signals.
9-pin Sub-D: CN4 – Right-hand connector  Not connected implicates: DO NOT USE	Connector type: DSUB9M Pin details: 1) + 15V supply 2) CN2 – L 3) Ground 4) CN4 – L 5) - 15V 6) Not connected 7) CN2 – H 8) CN4 – H 9) Not connected	Mating connector: DSUB9F The +15V and -15V supplies are for TCK8 power only. Do not make any other connection to these signals.

FLEXRAY INTERFACE

Functional description

The diagram below shows the basic functionality for one digital input connection of a FlexRay interface module. From left to right the elements shown represent:

- external I/O,
- digital signal conditioner,
- FlexRay receiver,
- Digital Signal Processor (DSP),
- Input/Output control.



The FlexRay interface – when connected to a FlexRay bus – will integrate with that bus and listen to the messages that are transmitted on the FlexRay bus. The FlexRay receiver will acquire these messages that are offered to the DSP for further processing.
The DSP synchronizes the messages to the ADC sample rate. Finally the I/O control communicates the result to the internal bus.

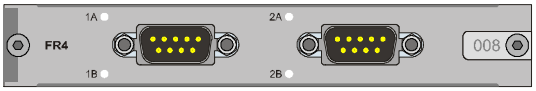
Key features and physical appearance

The primary modules that support this function are:

- FR4.

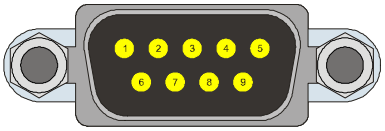
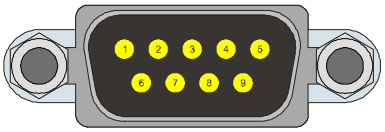
The FR4 module includes four channels that are configured as dual FlexRay configuration. In this way the module supports two dual FlexRay buses.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	2x Sub-D connector, 9-pin. Connection details are described below.

Other modules that basically support this function are:

- None.

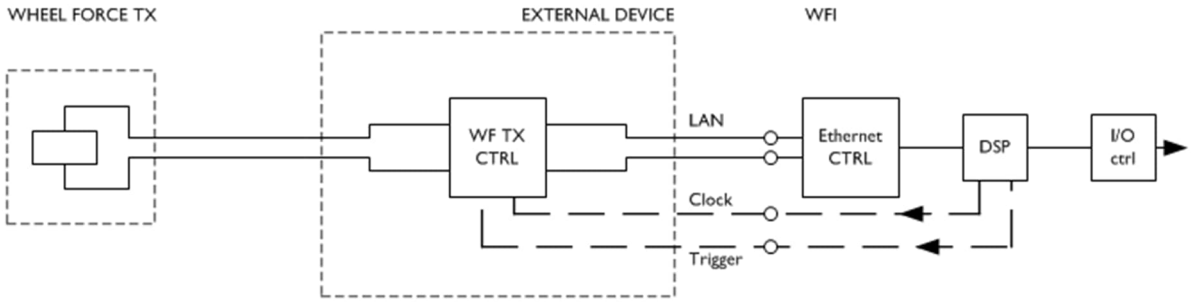
CONNECTION	DETAILS	REMARKS
9-pin Sub-D: FR4 – Left-hand connector  Not connected implicates: DO NOT USE	Connector type: DSUB9M Pin details: 1) Not connected 2) FR1 – L 3) Ground 4) FR3 – L 5) Not connected 6) Not connected 7) FR1 – H 8) FR3 – H 9) + 7V	Mating connector: DSUB9F
9-pin Sub-D: FR4 – Right-hand connector  Not connected implicates: DO NOT USE	Connector type: DSUB9M Pin details: 1) Not connected 2) FR2 – L 3) Ground 4) FR4 – L 5) Not connected 6) Not connected 7) FR – H 8) FR4 – H 9) + 7V	Mating connector: DSUB9F

WHEEL-FORCE SENSOR INTERFACE

Functional description

The diagram below shows the basic functionality for one digital input connection of a Wheel-Force sensor interface module. From left to right the elements shown represent:

- external I/O,
- external device (digital signal conditioning and conversion),
- Ethernet controller,
- Digital Signal Processor (DSP),
- Input/Output control.



For synchronization and measurement-control purposes the Wheel-Force sensor Interface (WFI) sends out Clock and Trigger signals to the external controlling device (WF TX CTRL).

The external I/O is a dedicated rotational-force transducer that is connected to an external controlling device. This external device performs signal conditioning and conversion. The result is communicated over LAN to the WFI.
An Ethernet controller of the WFI receives the converted signal and offers it to the DSP for digital processing. Finally the I/O control communicates the result to the internal bus.

Key features and physical appearance

The primary modules that support this function are:

- WFI2, WFI2-KR.

The WFI2 is a dual channel digital interface module that is connected with the KISTLER ROADYN® 2000 Wheel Force Transducer system. By means of an Ethernet connection synchronous acquisition of all relevant wheel force signals is supported:

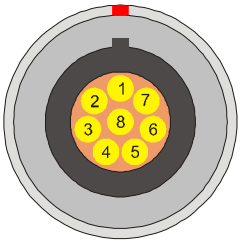
- forces in X, Y & Z directions,
- moments in X, Y & Z directions,
- Angle & Angular speed,
- temperature of the wheel,
- power supply.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	2 x LEMO connector, 8-pin. Connection details are described below. 2 x CAMAC connector. One for a lock (CLK) input. One for a Trigger (TRG) input.
	2 x LEMO connector, 8-pin. Connection details are described below. 2 x CAMAC connector. One for a lock (CLK) input. One for a Trigger (TRG) input.

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
8-pin LEMO: channels 1 and 2  Chassis = Analog Ground Not connected implicates: DO NOT USE	Connector type: LEMO-EGG.1B.308 Pin details: 1) MX2+ 2) MX1+ 3) Not connected 4) Not connected 5) Not connected 6) MX1- 7) MX2- 8) Not connected	Mating connector: LEMO-FGG.1B.308.CLADxx

Connection and configuration details are described elsewhere; refer to Connecting transducers.

ROTATIONAL VIBRATION MODULE

Functional description

The RV4 input module is a signal conditioner for low speed and high speed tacho channels from analog sources, digital sources. It also supports incremental encoders.

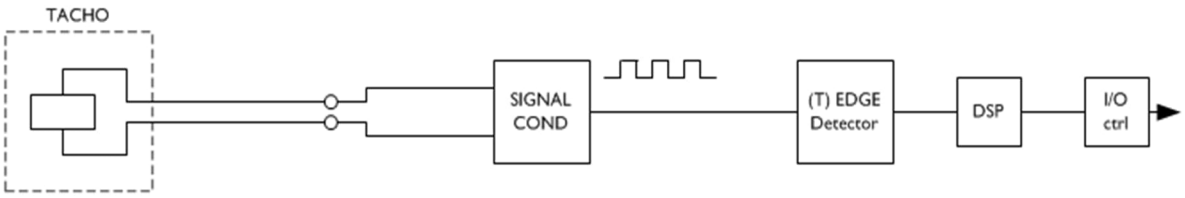
The following 3 combinations of inputs are supported for concurrent use:

- Up to four tacho inputs
- Up to two tacho inputs and one Incremental encoder input
- Up to 2 incremental encoder inputs

For Tacho (T) input:

The diagram below shows the basic functionality for Tacho input connections of a rotational vibration module: From left to right the elements shown represent:

- External sensor connections,
- signal conditioner,
- Edge detector,
- Digital Signal Processor (DSP) and Output control.

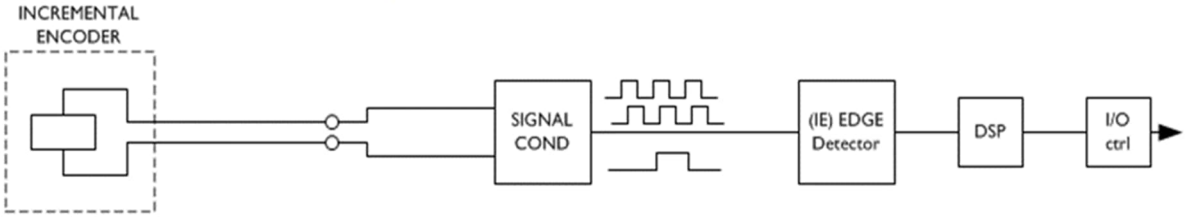


In tacho mode the input signal comes from an analog or digital tacho source. The output of the dedicated signal conditioner is a single pulse train that is offered to a Tacho (T) edge detector for signal conversion that creates the tacho timestamps.

- The analog tacho signals can be single ended (ground referenced) or differential.
- The digital tacho signals are single ended TTL (ground referenced).

For Incremental Encoder input:

The diagram below shows the basic functionality of the incremental encoder for a rotational vibration module: From left to right the elements shown represent:



- External incremental encoder connections (A, B, Index digital interface RS-422),
- signal conditioner,
- Digital Signal Processor (DSP) and Output control.

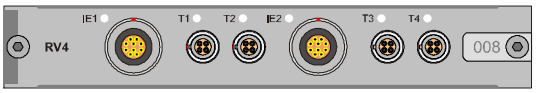
In Incremental Encoder mode the input comes from an incremental rotary encoder quadrature output. The output of the dedicated signal conditioner is a dual pulse quadrature signal and a one pulse per period reference signal. The dual pulse and reference signal are offered to the Incremental Encoder (IE) edge detector for signal conversion.
The DSP create a timestamp on the quadrature outputs and also can produce a rotation angle output and direction of rotation.

Key features and physical appearance

The primary modules that support this function are:

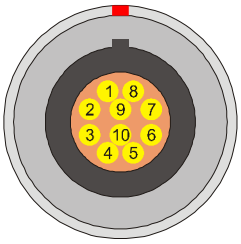
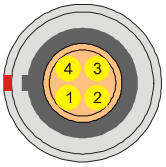
- RV4, RV4-RT.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	2 x LEMO connector, 10-pin. Connection details are described below. 4 x LEMO connector, 4-pin.

Other modules that basically support this function are:

- None.

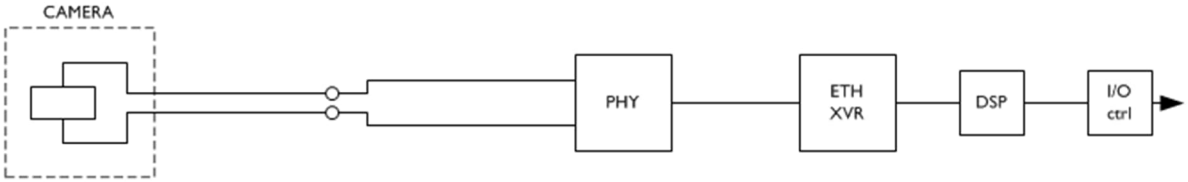
CONNECTION	DETAILS	REMARKS
10-pin LEMO: channels IE1 and IE2  Chassis = Analog Ground	Connector type: LEMO-EGG.1B.310 Pin details: 1) -U1 (-B) 2) +U1 (+B) 3) -U0 (-A) 4) +U0 (+A) 5) + 5V supply 6) Ground 7) Sense ground 8) + 5V supply sense line 9) -Ref pulse (-Index) 10) +Ref pulse (+Index)	Mating connector: LEMO-FGG.1B.310.CLADxx
4-pin LEMO: channels T1 to T4  Chassis = Analog Ground	Connector type: LEMO-EGG.00.304 Pin details: 1) Ground 2) + 5V supply 3) - IN 4) + IN	Mating connector: LEMO-FGG.00.304.CLADxx

CAMERA INTERFACE MODULE

Functional description

The diagram below shows the basic functionality for one digital input connection of a Camera Interface module. From left to right the elements shown represent:

- external I/O,
- Ethernet PHY,
- Ethernet Transceiver,
- Digital Signal Processor (DSP),
- Input/Output control.



The external I/O is an IP camera. When connected to the Camera Interface Module (CIM) the camera is initialized. Next the camera will synchronize its internal clock to the system clock. After synchronization a stream is started on the camera to send frames to the physical interface (PHY) of the CIM. The PHY makes these frames suitable for receipt by the Ethernet Transceiver. The transceiver offers the results to the DSP. The DSP buffers the frames to allow triggering. Finally the I/O control communicates the result to the internal bus.

Key features and physical appearance

The primary modules that support this function are:

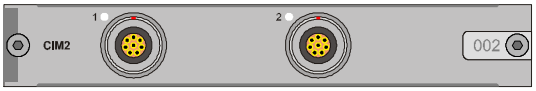
- CIM2.

The CIM2 module is used as an information collector to support the analyses of data that is collected during measurements. In that way the synchronized video information can help the analyst to correctly interpret the circumstances that prevailed during measurements.

Important:

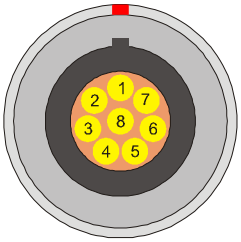
The number of CIM2 modules is limited to one (1) per frame for these frame types:
SCM/R 205, 2E05, 06S, 209, 2E09, 10S.

The table below shows the physical appearance of the primary modules in this group.

MODULE FRONT	DETAILS
	2 x LEMO connector, 8-pin. Connection details are described below.

Other modules that basically support this function are:

- None.

CONNECTION	DETAILS	REMARKS
8-pin LEMO: channels 1 and 2  Chassis = Analog Ground Not connected implicates: DO NOT USE	Connector type: LEMO-EGG.1B.308 Pin details: 1) CAM_TX+ 2) CAM_RX+ 3) Ground 4) -V_{PoE} 5) -V_{PoE} 6) CAM_RX- 7) CAM_TX- 8) Ground	Mating connector: LEMO-FGG.1B.308.CLADxx

ETHERCAT INTERFACE MODULE

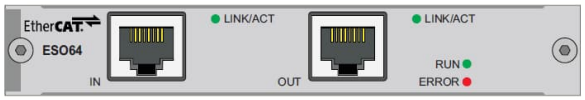
Functional description

The EtherCAT interface module ESO64 enables the Simcenter SCADAS Mobile front-end to communicate and send out measurement data on an EtherCAT bus. The ESO64 will present itself as an EtherCAT *slave* device, meaning that it will require an external EtherCAT *master* device in order to function and communicate properly.

Key features and physical appearance

The primary modules that support this function are:

- ESO64
- V8-RT and V8B-RT (real time processing of measurement data)
- VB8II-RT (real time processing of measurement data)
- RV4-RT (real time processing of measurement data)
- T8a-RT (real time processing of measurement data)
- VB8III-RT (real time processing of measurement data)

MODULE FRONT	DETAILS
	2x RJ45 connector

Simcenter SCADAS SATELLITE SYSTEM

The Simcenter SCADAS Satellite System consists of a one (1) slot wide Simcenter SCADAS Satellite Interface Module (SCM-SAT1-IP) installed in the Simcenter SCADAS Mobile frontend and one (1) IP67 certified Simcenter SCADAS Satellite Device (SCS-B12 or SCS-V12) for remote sensor connectivity.

Simcenter SCADAS SATELLITE INTERFACE MODULE (SCM-SAT1)

The Simcenter SCADAS Satellite System consists of a 1 slot wide Simcenter SCADAS Satellite Interface Module (SCM-SAT1) installed in the Simcenter SCADAS Mobile frontend and one Simcenter SCADAS Satellite Device for remote sensor connectivity.

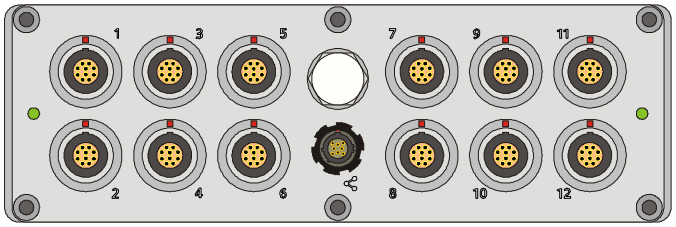
The SCM-SAT1 interface module enables the acquisition of synchronized time signals from Simcenter SCADAS Satellite Devices through a 100 Mbit Ethernet interface.

SCM-SAT1 Satellite Interface Module

Besides the signal transmission, Simcenter SCADAS Satellite Interface Module provides continuous, remote power for the Simcenter SCADAS Satellite Devices.

Simcenter SCADAS SATELLITE DEVICE (SCS-B12, SCS-V12)

Connected via a dedicated Ethernet cable to the Simcenter SCADAS Satellite Interface Module, the Simcenter SCADAS Satellite Device provides a dust, water and shock proof, IP 67 certified, galvanically isolated 12 channel input interface for Bridge/Strain gauges in full (6 wire), half bridge (5 wire) and quarter bridge (3 wire) configurations (SCS-B12) or Voltage/ICP (SCS-V12) sensors up to 50 m distance from the Simcenter SCADAS Mobile Frontend.



SCS-B12 top view

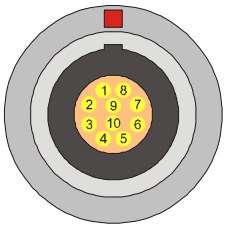
CONNECTIVITY

Input Identification

There are two ways to identify if a Simcenter SCADAS Satellite Device is having Bridge or a Voltage/ICP inputs. Each satellite has two coloured dots at the top of the housing. The Bridge satellite has two green dots; the Voltage/ICP satellite has two red dots. Each satellite has a label on the side where SCS-B12 indicates a Bridge satellite and SCS-V12 indicates a Voltage/ICP satellite.

SENSOR INPUT CONNECTOR PINNING AND SENSOR CONNECTION

All sensors are connected through HGG.2K.310.CLNP (FYG 2K 310.CLA30ZN used for sensor connectivity) 10-pin LEMO 2K connectors. Below the pinning layout is listed.



10 pin LEMO 2K

Satellite type	SCS-B12			SCS-V12			
Conditioning	1/1 bridge	1/2 bridge	¼ bridge	Potmeter	Voltage	Voltage	ICP/TEDS
Connection	Differential	Differential	Differential	Single Ended	Single Ended	Differential	Single Ended
Pin 1	NC	NC	QB 120Ω	NC	NC	NC	NC
Pin 2	NC	NC	QB 350Ω	NC	NC	NC	NC
Pin 3	+V in	NC	NC	Sensor OUT	Sensor +	Sensor +	Sensor + (ICP)
Pin 4	-V in	-V in	-V in	Pot -	Sensor -	Sensor -	Sensor -
Pin 5	+V supply	+V supply	+V supply	Pot +	+V supply	+V supply	NC
Pin 6	+V sense	+V sense	NC	NC	NC	NC	NC
Pin 7	-V sense	-V sense	NC	NC	NC	NC	NC
Pin 8	-V supply	-V supply	NC	GND	GND	GND	GND
Pin 9	TEDS	TEDS	TEDS	NC	NC	NC	NC
Pin 10	GND	GND	GND	GND	GND	GND	GND

Note 1: "NC" stands for Not Connected

Note 2: In *three* wire quarter bridge mode, one side of the measurement strain gage should be connected to pin 5 (+V supply) and the other side should be connected to pin 4 (-V IN) as well as to either pins 1 or 2 (quarter bridge completion) depending on the strain gage resistance value. For a *two* wire quarter bridge setup, pin 4 needs to be shorted to either pin 1 or 2 in the mating connector

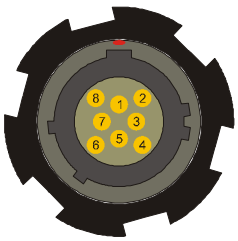
Important: For the proper operation of bridge and strain sensors in full or half bridge mode the supply sense lines MUST be connected to their respective voltage supply lines, either at the sensor side or in the mating LEMO connector.

For quarter bridge operation we strongly recommend not to use the supply sense lines and short them in the mating LEMO connector

To short the sense lines at the connector connect pin 5 to pin 6 and pin 7 to pin 8.

SATELLITE CONNECTION CABLE

Cables to connect the Simcenter SCADAS Satellite Interface Module to the Simcenter SCADAS Satellite Device are available in 5m, 10m and 50m lengths. A special industrial Ethernet cable is used that is oil resistant and that can withstand the required extended temperatures.
It is continuously flexible with a minimum bending radius of 84mm.
The cable is fitted with a 1B LEMO connector on the Satellite Interface side and with an ODU connector on the Satellite Device side. This cable carries both power and data.



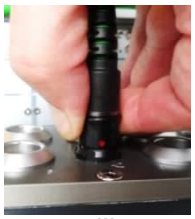
8 Pin ODU Ethernet connection

Warning: Do not use the cable if the isolation is damaged to prevent data loss and damage to the satellite system or the connected sensors.

INSTALLATION STEPS

For the proper and safe operation for the Simcenter SCADAS Satellite System, please follow the installation steps below:

1. Make sure that the Simcenter SCADAS mainframe is powered off



2. Install the Simcenter SCADAS Satellite Devices to the desired location. Use the SCx-SBK-01 mounting bracket if it's needed.

3. Connect the factory provided cable with ODU connector to the Simcenter SCADAS Satellite Device Module.

4. Connect the factory provided cable with 1B LEMO connector to the Simcenter SCADAS Satellite Interface Module.

5. Power ON the mainframe

Warning: Please be aware to establish the proper grounding for both Simcenter SCADAS Satellite Interface Module and for the Simcenter SCADAS Satellite Device.

Important: In order for Simcenter Testlab to automatically detect the Simcenter SCADAS Satellite Devices and its type, all cables should be connected during boot of the Simcenter SCADAS Recorder.

ERROR DETECTION AND INDICATION

The two colours LED on the SCM-SAT1 module provides information on the connection and synchronization status, as well as any sensor supply overload/under loads status.

The Satellite Devices themselves detect and report signal overloads and sensor supply overloads or under loads.

The front of the SCM-SAT1 contains a LED (light) that indicates the status of this controller and the attached Satellite Device. The table below lists all statuses indicated by the LED on the front panel.

Satellite LED status overview

LED colour	LED pattern	Description
Off	Off	No link
Green	Slow 50	Link detected
Green	Fast 50	Synchronizing
Green	On	Operational
Red/Green	Alternating	Fail safe
Red	On	Overload
Red	Fast 10	Major Exception
Red	Fast 50	Critical Exception

LED pattern description

Pattern	Frequency	Duty cycle
Slow 50	1 Hz	50% on, 50% off
Fast 10	2 Hz	10% on, 90% off
Fast 50	2 Hz	50% on, 50% off

Simcenter SCADAS SATELLITE DEVICE LED STATUS DESCRIPTION

Status	Description
Synchronizing	A connection has been established with the satellite, the system is waiting for the satellite to synchronize.
Operational	The satellite is synchronized and ready for operation.
Fail safe	The satellite has booted in fail safe mode because an error occurred during normal boot. In fail safe mode the satellite can be updated with new software.
Overload	See the section on overloads.
Major exception	The communication with the satellite is lost; verify the connection to the satellite.
Critical exception	The satellite is switched off because of a power overload. The satellite is switched off to protect the Simcenter SCADAS system from permanent damage.

Note: in case of critical exception, the frontend needs to be restarted!

OVERLOADS AND NOTIFICATIONS IN Simcenter Testlab

Overloads indicate problems with the inputs or connected sensors.
These errors are reported in Simcenter Testlab. For the satellite the following errors have been defined.

Error	Description
Signal out of range	The input level is near or above the input limits.
Bridge supply overload	The bridge supply has been turned off because the connected bridge was drawing too much current.
Sensor supply overload	The sensor supply has been turned off because the connected sensor was drawing too much current.
ICP error	This error indicates that the ICP sensor is operating outside the safe operating area. Usually these errors are related to cable open and short conditions.
Bridge supply shorted	The connected bridge draws more than 22mA.
Bridge supply open	No bridge is connected (or a bridge that draws less than 3mA).
Connection lost	The connection to the satellite is lost, reconnect the satellite to continue.
Datagrams missing	An error occurred in measurement data transfer from satellite to controller. The error was recovered but the link may be bad.
Temperature overload	The temperature inside the satellite is too high.

TROUBLESHOOTING

Status / Error condition	Impact of error condition	What to do in hardware	What to do in software Simcenter Durability Acquisition	What to do in software Simcenter Testlab Control App
No link – this happens during booting. In case the link would get broken after the frontend was booted.	Not possible to arm	Plug in the satellite and wait until the LED starts blinking green	Push Arm as soon as the LED stats blinking green. Arming will only succeed when the link is operational and the LED is green.	Wait to go into Monitoring mode until the LED is green. If you are already in Monitoring mode, leave this mode and start it again once the LED is green.
Fail safe – this happens during booting, so not during the measurement	Not possible to arm	Reboot the system	/	/
Overload	It cannot be guaranteed that the data measured on the involved channel is correct. The hardware check flag for the particular error will be raised.			
Major Exception - – can be caused by connection loss between SCM-SAT I and the Satellite Device	The level bar will be red.			
Critical Exception	I don't know about the impact on the other channels.	Solve the error condition on the involved channel. No reboot is needed.	Restart the measurement	Restart the measurement

SPECIFICATIONS

SPECIFICATION	SCS-B12 SIMCENTER SCADAS SATELLITE 12 CHANNEL BRIDGE DEVICE	SCS-V12 SIMCENTER SCADAS SATELLITE 12 CHANNEL V/ICP DEVICE
Number of Inputs	12	
Sensor Connector Type	10-pin LEMO 2K vacuum tight HGG.2K.310.CLNP (FYG 2K 310.CLA30ZN used for sensor connectivity)	
Sensor support	Strain gages: 6-wire full and 5-wire half bridge, including sense leads. 3-wire quarter bridge 120Ω-350Ω Bridge based sensors	Voltage/Potentiometer/ICP/TEDS
Input range	±100 mV (±20 mV/V) for 5 V bridge supply ±50 mV (±20 mV/V) for 2.5 V bridge supply Including sense leads	±10 V fixed input range
Input mode	Differential	Selectable differential and single ended modes
Input coupling	DC	DC/AC
TEDS support	Yes (inverted class II)	Yes (class I)
Shunt resistor	100kOhm, any shunt calibration leg	-
Supply	2.5V 5V	0V (no supply) 5V 10V 15V
Instrumentation amplifier	Chopper	FET (Differential)
Sampling rate	51.2 kHz	51.2 kHz
Bandwidth	3.2 kHz	12.8 kHz
Phase match	0.1º @ 1 kHz between satellite channels and SCM channels with equal range settings	
Resolution	24 bit	
Gain drift	10 ppm/ºC	
Offset drift	100 nV/ºC	20 µV/ºC
Signal to noise ratio (SNR)	>120 dB for 5 V bridge supply (100 mV full scale) >115 dB for 2.5 V bridge supply (50 mV full scale) over 3.2 kHz	> 124 dB over 1 kHz
Crosstalk	-102 dB @1 kHz typical between any two channels	
Accuracy	Channel gain error is adjusted to within 0.1%	
Total Harmonic Distortion @ 200 Hz	<-94 dB for 5 V bridge supply <-92 dB for 2.5 V bridge supply	<-95 dB

SPECIFICATION	SCS-B12 SIMCENTER SCADAS SATELLITE 12 CHANNEL BRIDGE DEVICE	SCS-V12 SIMCENTER SCADAS SATELLITE 12 CHANNEL V/ICP DEVICE
Sensor Power Budget	12x full/half 350Ω bridges at 5V supply 12x full/half 120Ω bridges at 2.5V supply or any combination 2.5W max./satellite	2.7mA max current/sensor from a 19 V supply 2.5W max./satellite
ESD Immunity	8 kV contact on SATELLITE INTERFACE MODULE and SATELLITE DEVICE, on horizontal and vertical planes near the satellite and cable 15 kV air discharge to the SATELLITE INTERFACE MODULE and the SATELLITE DEVICE	
Temperature range	SATELLITE DEVICE -40 ºC up to 85 ºC (-40 ºF up to 185 ºF) SATELLITE INTERFACE MODULE -20 ºC up to 55 ºC (-4 ºF up to 131 ºF)	
Ingress Protection	IP67, solid particle protection: dust tight (no ingress of dust IP6x), liquid ingress protection: water immersion up to 1m (IPx7)	
Shock resistance	MIL-STD-810F [60 gpk applying an 11 ms saw tooth shock pulse; 3 shocks per direction]	
Vibration resistance	MIL-STD-810F [20-2000 Hz (random): 17 grms]	
Dimensions	230 x 75 x 65 mm/9.05” x 2.95” x 2.55” (w x d x h)	
Weight	1 650 gr Aluminum housing	

Color coding of the CAS21 LEMO to pigtail sensor cable:

LEMO pin	Color on pigtail	SCS-B12	SCS-V12
1	red	1/4 BRG 120Ω	N.C.
2	blue	1/4 BRG 350Ω	N.C.
3	grey	+IN	+IN
4	pink	-IN	-IN
5	white	+V supply	Sensor supply
6	green	+V sense	N.C.
7	yellow	-V sense	N.C.
8	brown	-V supply	N.C.
9	violet	TEDS	N.C.
10	black	TEDS ground	ground
shield	white-green		

Chapter 5

OPERATION

This chapter gives information about the operation of the Simcenter SCADAS Mobile & Recorder. The purpose of this chapter is to guide the user to use the Simcenter SCADAS Mobile & Recorder correctly, safely and effectively.

IN THIS CHAPTER:

- Prerequisites and considerations
- Preparation
- Connecting transducers

PREREQUISITES AND CONSIDERATIONS

The user of the Simcenter SCADAS Mobile & Recorder is expected to:

- Have the required skills, experience and knowledge.
- Be familiar with the intended use, functions and safety aspects of the Simcenter SCADAS Mobile & Recorder.
- Take the required preparations as described in this chapter.
- Use serviceable equipment only.

The information in this chapter – about the required Preparation and Connecting transducers – is restricted to the specific use of the Simcenter SCADAS Mobile & Recorder itself. Information about the use of other equipment is normally not included, but may be referred to.

All communication between the Simcenter SCADAS Mobile & Recorder and the host PC is established through a standard Ethernet connection. For maximum performance and reliability Siemens recommends:

- a peer-to-peer connection between the front-end and the host PC, using the host interface card that has been delivered with your system,
- that you appoint a separate and isolated network branch for your Simcenter SCADAS front-end,
- that you use the Ethernet interface cable that has been delivered with your system.

Note: In case you use other cable make sure it is equal to or better than the provided cable and the cable length does not exceed 80 meters.

The connection process itself takes place during the hardware initialization phase of Simcenter Testlab or Simcenter Testxpress; it can take up some time. This process can be speeded up by manually entering the IP address of your instrument. Follow the instructions of the application program after it is started up.

Note: Installed firewalls, either on your computer or in the network domain you are logged on to, can block connection to the Simcenter SCADAS front-end.
In case you encounter connection problems, you are advised to review your firewall settings.

PREPARATION

This section describes what is required to prepare the Simcenter SCADAS Mobile & Recorder for operation.

IN THIS SECTION:

- Instrument grounding
- Cooling requirements
- Single-frame or multi-frame operation
- Prepare for front-end operation
- Prepare for stand-alone operation

INSTRUMENT GROUNDING

The Simcenter SCADAS Mobile & Recorder are Class A instruments. This means that it is safe to operate the instrument under all conditions, provided the end-user takes care of proper grounding to the instrument, independent of either an AC or DC power source. Proper grounding is essential, not only from a safety point of view but also to control and prevent ground loops.

Important: If possible, use a separate AC mains group for sensitive measurement equipment. Always be aware of your grounding arrangements.

AC operation

When you plug in the mains cable, please be aware of any other equipment using power from the same mains group. Like any measurement devices, the Simcenter SCADAS Mobile & Recorder have finite rejection capability for external disturbances and 50/60Hz ground loop effects.

DC operation

Be aware that when you operate more than one device from the same DC power source (like a car battery), the presence of a ground loop in combination with an aggressive magnetic field can cause erroneous results during a measurement.

COOLING REQUIREMENTS

The heat management of the Simcenter SCADAS Mobile & Recorder is designed to enable operation without the help of a cooling fan. Most of the internally dissipated energy is thermally conducted to the case and the cooling ribs at the back of the instrument.
The instrument can operate under ambient temperatures between -20°C to +55°C. More detailed information is described elsewhere; refer to the relevant Product Information Sheet.

Important:
To avoid self-heating of the instrument – in particular when operated in hot conditions – there must be sufficient free space around the instrument to allow convection and radiation of heat.

SINGLE-FRAME OR MULTI-FRAME OPERATION

Which frame(s) can be used for a test configuration is mainly determined by these statements:

- Main frames that do not have a Multi-Frame interface module can only be used for single-frame operation.
- Main frames that do have a Multi-Frame interface module can be used for both single-frame and multi-frame operation.
- Secondary frames always have a Multi-Frame interface module and can only be used in multi-frame configurations.

Important:

When starting up and booting a multi-frame configuration make sure that all secondary frames are powered up and booted individually before the main frame is switched on.

Optical connections and optical cables are very sensitive to dust.
When they are not used protect the optical connections and cable ends with dust caps.

Optical cables can easily get damaged; handle them with great care.
Do not bend the cables, neither in use nor when stored.

PREPARE FOR FRONT-END OPERATION

In front-end mode the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder is connected to a host PC that has Simcenter Testlab or Simcenter Testxpress installed. Connection is established over LAN via Ethernet. Simcenter Testlab or Simcenter Testxpress will be in full control during data acquisition.

Important:

For limitations related to temperature see the relevant Product Information Sheet.

When equipment is powered from mains, make sure to use the correct mains supply and adapter(s).

When equipment operates on battery power, make sure batteries are sufficiently charged.
Also, be aware that low voltage DC power uses a high current, which results in a voltage drop over the power cable. It is essential to use cables with the correct wire gage.
It is strongly recommended that you only use accessories delivered by Siemens.

In this part Simcenter Testlab and Simcenter Testxpress are addressed as 'the application program'.

To establish front-end operation do these steps:

1) Make sure that:
   - power is provided,
   - on the host PC the application program is not yet running,
   - the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder is switched off.
2) Connect the communication cable:
   - to the receptacle of the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder,
   - to the host PC.
3) Switch on the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder.
4) Network configuration: all protocols except IPV4 should be disabled. The IPV4 protocol should be set to either an automatic or a fixed IP address within the APIPA IP address range: 169.254.x.x. with netmask 255.255.0.0. The gateway should not be set. If allowed by company rules, any virus scan filtering should be disabled. Network performance problems like congestion or retransmissions can occur when left enabled, effectively reducing the performance of the front-end measurement.
5) Start the application program.
   The program will try to start a new project and detect the connected device.
6) Make sure the program completes the detection and the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder is recognized.
7) The Simcenter SCADAS Mobile or Simcenter SCADAS Recorder is now ready for front-end operation.

Note:

The application program Simcenter Testxpress supports the so-called ‘Compact Flash parallel mode’ when an Simcenter SCADAS Recorder is connected. In this special front-end mode a back-up of the measurement can be recorded onto the Compact Flash card of the Recorder.

PREPARE FOR STAND-ALONE OPERATION

In stand-alone mode the Simcenter SCADAS Recorder operates as recorder; during data acquisition it is *not* connected to a host PC. The Simcenter SCADAS Recorder will execute appropriately prepared recordings, reading the applicable template data from a Compact Flash card and writing the test results onto the same Compact Flash card.
The Recorder will either operate fully independently using the manual recording feature (the REC button) or it will be controlled by a device that runs Simcenter Testlab Control App (e.g. a PDA or tablet).
In case Simcenter Testlab Control App is used, communication between the Recorder and the control device is established via Bluetooth or WLAN.

Important:

For limitations related to temperature see the relevant Product Information Sheet.

When equipment is powered from mains, make sure to use the correct mains supply and adapter(s).

Please make sure that the Simcenter SCADAS Recorder or Mobile frame has no input slots left open. In case of empty slots, please use a blank front plate.

When equipment operates on battery power, make sure batteries are sufficiently charged.
Also, be aware that low voltage DC power uses a high current, which results in a voltage drop over the power cable. It is essential to use cables with the correct wire gage.
It is strongly recommended that you only use accessories delivered by Siemens.

In this part Simcenter Testlab and Simcenter Testxpress are addressed as 'the application program'.

Do these main steps as necessary to prepare for stand-alone operation:

- Prepare the Recorder
- Format the Compact Flash card
- Prepare the template
- Finish the preparations

Further information is included in this paragraph:

- Guidelines for stand-alone operation

PREPARE THE RECORDER

To prepare an Simcenter SCADAS Recorder for stand-alone operation do these steps:

1) Make sure that:
   - power is provided,
   - on the host PC the application program is not yet running,
   - the Simcenter SCADAS Recorder is switched off,
   - no Compact Flash card is inserted in the Recorder.
2) Connect the communication cable:
   - to the receptacle of the Simcenter SCADAS Recorder,
   - to the host PC.
3) Switch on the Simcenter SCADAS Recorder.
4) Start the application program.
   The program will try to start a new project and detect the connected device.
5) Make sure the program completes the detection and the Simcenter SCADAS Recorder is recognized.

FORMAT THE COMPACT FLASH CARD

The Simcenter SCADAS Recorder needs to have an adequately formatted CF card inserted to support stand-alone operation.

In case the CF card is already formatted you do not need to do this procedure.
In case the CF card is not yet formatted do the steps below.

Important:

Make sure to use the correct type of CF card.

1) Unpack the CF card.
1) Insert the CF card in the appropriate slot of a PC.
   As an alternative you can use an external card reader (not supplied with the Simcenter SCADAS Recorder).
2) Wait for the PC to detect the new device.
3) Prepare to format the disk (a dialog may appear that prompts for formatting).
4) Make the required settings to format the disk, using one of these *file system formats*:
   - *FAT32*
   - *exFAT*
5) Make sure you use the proper facilities provided by the Windows OS to do this step.
   After formatting is completed, safely remove the disk.
6) The CF card is now ready for operation.

PREPARE THE TEMPLATE

To make a recording in stand-alone mode the Simcenter SCADAS Recorder must have a Compact Flash (CF) card inserted with a valid template on it.

Important:

In case multiple templates are on the CF card, the Simcenter SCADAS Recorder will use the file that is considered 'first'. 'First' is determined by file-name, based on standard alpha-numerical ordering.

To prepare a template for stand-alone operation do these steps:

1) Make sure to use an appropriately formatted CF card.
2) Insert the CF card in the card reader of the host PC.
   Certain versions of the application program may support writing to the CF card while it is in the Recorder.
3) Make sure the application program is prepared for the Simcenter SCADAS Recorder.
4) Do the required steps in the application program to configure the test project for the Simcenter SCADAS Recorder.
5) Save the project settings as a template file onto disk.
   Make sure to determine an appropriate file name! See Important notice above.
6) Copy the template file to the CF card.
7) Make sure you use the proper facilities provided by the Windows OS to do this step.
   After copying is completed, safely remove the disk.
8) The CF card is ready for use in the Simcenter SCADAS Recorder.

FINISH THE PREPARATIONS

1) Switch off the Simcenter SCADAS Recorder.
2) Disconnect the communication cable at both ends.
3) The Simcenter SCADAS Recorder is now ready for stand-alone operation.

GUIDELINES FOR STAND-ALONE OPERATION

This part provides basic guidelines to enable correct stand-alone operation of an Simcenter SCADAS Recorder. These guidelines apply:

- Make sure that the required preparations have been done; see the previous paragraphs.
- The Simcenter SCADAS Recorder needs to have an adequately prepared Compact Flash card inserted to support stand-alone operation; i.e. formatted and containing a valid template.
- Do not eject a Compact Flash card during a recording. If you do, this will result in a corrupt throughput file, with a risk of loss-of-data.
  Make sure that the Recording indicator LED is green (continuous) or off before you eject the card.
- A recording (i.e. data acquisition) is always started manually.
  Data acquisition can be stopped in two ways:
  - usually this is controlled by a so-called 'stop-condition' that is configured in the template,
  - when needed a stop can be forced by the user.
- In case the Recorder operates fully independently the REC button is used:
  - to start a recording (i.e. data acquisition),
  - when needed, to force a stop of the data acquisition.
- In case a device is used that runs Simcenter Testlab Control App (e.g. a PDA or tablet):
  - communication is established via Bluetooth or WLAN,
  - you can *only* start a recording (i.e. data acquisition) from the Simcenter Testlab Control App,
  - when needed, you can force a stop of the data acquisition from either the Simcenter Testlab Control App or on the Recorder itself (REC button).
- Further details about the use of the REC button. This button can be used to:
  - Start and stop a recording (i.e. data acquisition).
    1. Make sure the required preparations have been done.
    2. Press and release the REC button to start or stop a recording.
  - Initiate nulling and balancing of bridge-measurements to adjust for offset and other deviations.
    1. Make sure the required preparations have been done.
    2. Press and hold the REC button for about 3 seconds.
- At the end of a recording – directly after data acquisition is stopped – 'epilogue-data' will be added to the throughput file. During the course of this action the Recording indicator LED will flash. Wait until this action is finished.

- About GNSS (including GPS) and IRIG-B operation:
  - the Recorder operates in GNSS mode by default,
  - in case GPS tracking is required and configured, IRIG-B operation is not possible,
  - in case IRIG-B operation is required and configured, GPS tracking is not possible,
  - be aware that GNSS and IRIG-B operation require some time for synchronization after the Recorder is switched on;
    a flashing LED indicates 'synchronizing';
    continuous LED operation indicates 'synchronized'.

- To load another template for recording:

1. Safely eject the Compact Flash card that was used.
2. Insert the Compact Flash with the template that needs to be used.

- To change from stand-alone mode to front-end mode.

1. Safely eject the Compact Flash card that was used.
2. Reboot the Recorder.

INSTALLING, CONNECTING AND OPERATING THE SCM-UPS

Please respect the following instructions when installing and operating the SCM-UPS:

- The SCM-UPS shall always be connected to an adequate protective earth wall socket
- The SCM-UPS comes with an AC mains power chord that complies with your local safety standards. You should only use the provided AC mains chord, or an AC mains chord having the same specifications
- The mains plug or appliance inlet is regarded as a disconnecting device. If the unit will be installed in a 19-inch rack in the end use application, it shall be equipped with a disconnecting device which is accessible to the user
- All external I/O connections must have re-enforced isolation from AC mains and shall be a non-hazardous voltage
- Only clean the SCM-UPS with a dry cloth on the complete product, or a damp cloth on areas not populated by electrical connectors. It is advised to disconnect the SCM-UPS from mains power before cleaning
- Important: if the SCM-UPS is used in a manner not specified by the manufacturer, the protection from dangerous situations can be impaired. Please only use the SCM-UPS according to the instructions in this manual.

The cabling scheme for the SCM-UPS consists of three connections:

1. Connect cable from UPS DC out to Simcenter SCADAS Mobile power input connector
2. Connect the splitter cable from UPS Power Fail (NC) out to the DSCU
3. Connect the other end of the splitter cable to the Simcenter SCADAS Mobile STOP connection on the SYSCON module

Next, disable the battery check in Simcenter Testlab Environmental Control. In your local configuration folder, edit the TestLabEnvironmental.ini file:

```
[Mobile]
CheckBattery=OFF
```

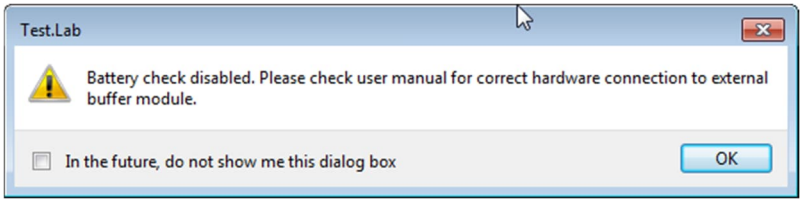
Note: this feature is supported in Simcenter Testlab 17A and later releases; it will not work in versions prior to Simcenter Testlab 17A.

DISABLING THE BATTERY CHECK WITHOUT USING A PROPERLY CONNECTED UPS IS PROHIBITED!

Failure to comply may result in damage to the test specimen or test equipment (e.g. electrodynamic shaker).

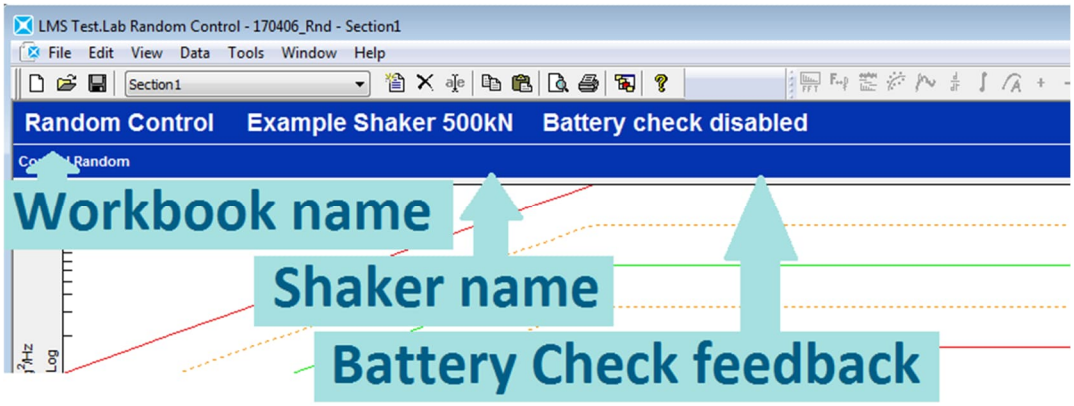
The user is informed of the disabled battery check in two ways:

1. When arming the test the following message pops up:

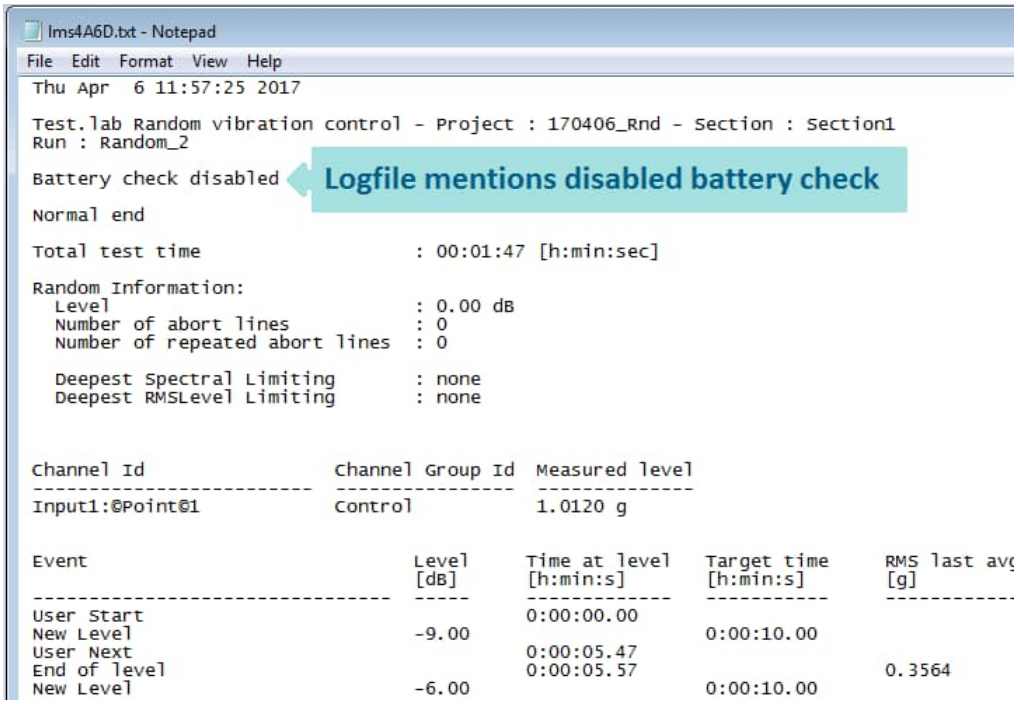


The user can select to hide this message by checking the checkbox in the bottom of the window.

2. During acquisition, the Control workbook contains a 'Battery Check disabled' text:



The action of disabling the battery check is logged in the logfile of the test:




```
Thu Apr  6 11:57:25 2017

Test.lab Random vibration control - Project : 170406_Rnd - Section : Section1
Run : Random_2

Battery check disabled

Normal end

Total test time                  : 00:01:47 [h:min:sec]

Random Information:
  Level                          : 0.00 dB
  Number of abort lines          : 0
  Number of repeated abort lines : 0

  Deepest Spectral Limiting      : none
  Deepest RMSLevel Limiting      : none


Channel Id                 Channel Group Id  Measured level
-------------------------  ----------------  --------------
Input1:©Point©1            Control           1.0120 g


Event                             Level     Time at level   Target time     RMS last avg
                                  [dB]      [h:min:s]       [h:min:s]       [g]
--------------------------------  -----     -------------   -----------     ------------
User Start                                  0:00:00.00
New Level                         -9.00                     0:00:10.00
User Next                                   0:00:05.47
End of level                                0:00:05.57                      0.3564
New Level                         -6.00                     0:00:10.00
```

CONNECTING TRANSDUCERS

This section gives information about specific (types of) transducers and best practices how to connect them. These best practices are proven in use and recommended by Siemens.

Notes:

It is assumed that you have taken the appropriate preparations as described in this chapter; refer to Preparation.

For most types of transducers that are included in this section information about connection details is described elsewhere; refer to the relevant paragraph(s) of Component description.

IN THIS SECTION:

ICP TRANSDUCERS

This part provides advised methods and relevant details for connection of ICP transducers.

General information

ICP (Integrated Circuit Piezoelectric) transducers, also called Piezotron™, Isotron™ or Deltatron™, are IEPE piezoelectric sensors with an integrated amplifier. This amplifier, powered by a constant current supply, converts the high impedance charge signal from a piezoelectric crystal or microphone membrane to a low impedance voltage signal.

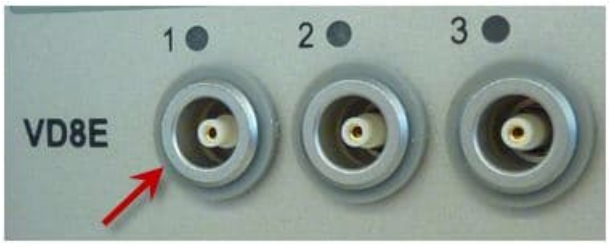
I/O modules that support ICP transducers will provide power to the ICP sensor, de-bias the output signal with a blocking capacitor (AC coupling) and indicate open loop or short circuit faults.
A constant current supply to the sensor allows two-wire operation over coaxial cable.

Single-ended inputs

Channels that are configured as single-ended inputs require case-isolated sensors.
In this configuration the amplifier of the channel acts as single-ended amplifier with a grounded input connector to accommodate ICP sensors. In order to avoid ground loops it is essential to use a case-isolated sensor or to isolate the sensor from the test object with an insulated mounting stud.

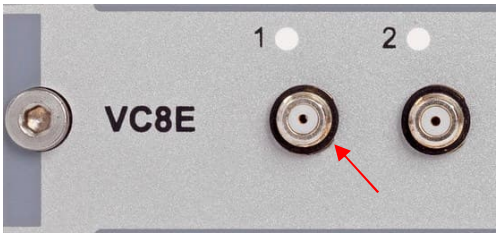
Differential inputs

Channels that are configured as differential inputs require case-grounded sensors.

	Some types of modules are equipped with isolated connectors; see figure on the left.
	These modules are delivered with standard module-level accessories, amongst which: ▸ a pair of CAMAC-to-BNC cables (1), ▸ isolation sleeves (4). The cables (1) are normally connected with BNC-to-BNC cables (2). Make sure to protect the established connections (3) with the delivered isolation sleeves (4) to avoid ground loops and disturbances (e.g. noisy signals).

CHARGE TRANSDUCERS

This part provides details with respect to I/O modules of type: VC8-E (single-ended charge input).

	The Microdot connectors of this module are fitted with neoprene rings; see figure on the left. Make sure these rings do not come off and replace them if necessary. The neoprene rings serve these purposes: ▸ prevention of over-tightening the mating connector, ▸ dampening of physical vibrations, ▸ make the mechanical connection more stable to avoid unintentional disconnection.

CONNECT A WHEEL FORCE SENSOR TO WFI2

This part provides advised methods and relevant details for connection of a wheel force sensor to the WFI2 module.

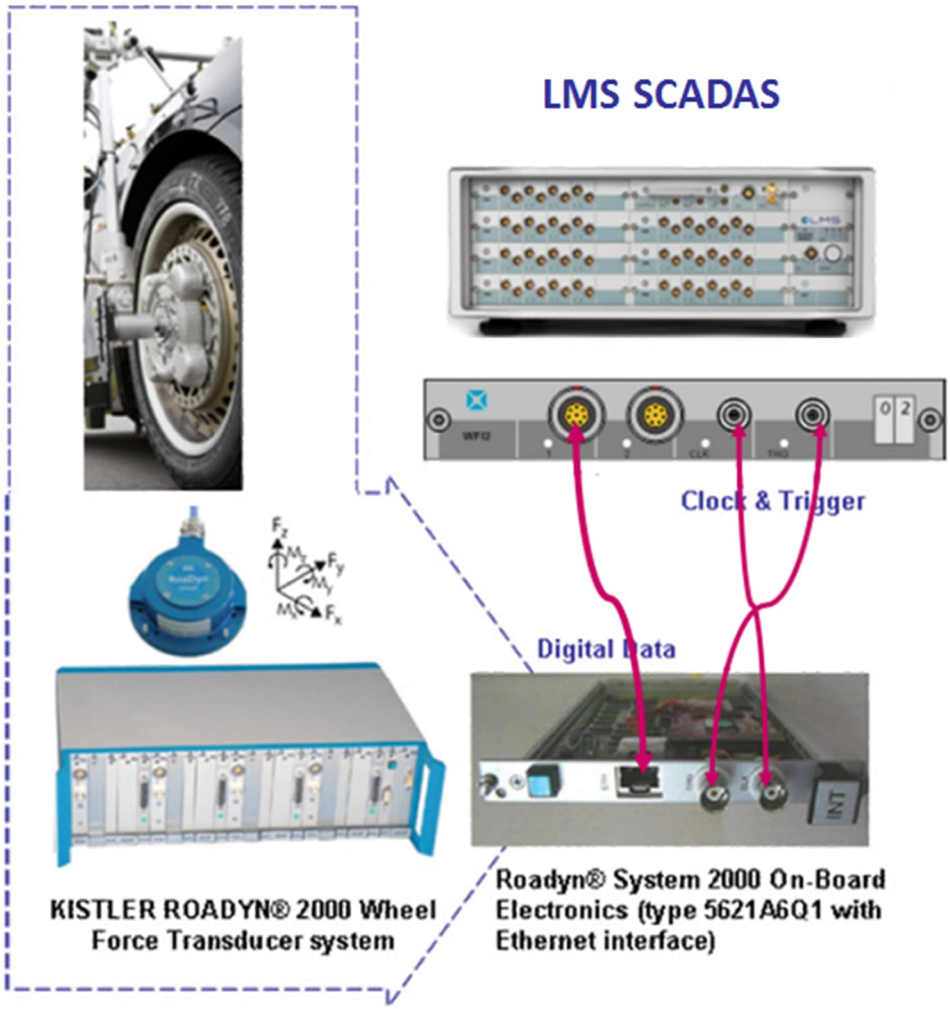
Note:

The Simcenter SCADAS system checks certain configuration conditions and settings. The information in this part is limited to those actions that the user can influence.

Hardware requirements

- Kistler RoaDyn® System 2000 with Interface card 5621A6Q1 (Ethernet interface). Version VC33 is supported.
- Simcenter SCADAS Mobile or Simcenter SCADAS Recorder with WFI2 interface card.
- Cables for clock, trigger and Ethernet connection (cables are delivered with the WFI2 module).

Connection scheme



Supported clock frequencies

1280 Hz (max), 1024 Hz, 819.2, 640 Hz.

These basic frequencies can be combined with dividers (e.g. 2, 4, 8, etc.).

Known limitations

Kistler RoaDyn® System 2000 - IP address:

- No communication between the Simcenter SCADAS system and the Kistler RoaDyn® System 2000 can be established if the Kistler RoaDyn® System 2000 is not on default IP factory settings.
- Typically systems in the field will have different IP field settings, as infield systems are plugged in into customer networks to download calibration values for Kistler RoaDyn® System 2000. With these settings the Simcenter SCADAS system cannot communicate to the Kistler RoaDyn® System 2000.
- See the relevant steps under 'Minimal software requirements' below to check and/or reset IP addresses.

Kistler RoaDyn® System 2000 – other DSP boards:

- Communication will not work if SBC31 DSP board is present in Kistler RoaDyn® System 2000.

Miscellaneous:

- Analog input boards are allowed in Kistler RoaDyn® System 2000 when communicating with the Simcenter SCADAS system, but data acquisition is not supported.
- In case a Temperature channel shows 500 K instead of ambient temperature, this implies that no temperature sensor is present (or connected) on the Wheel Force Transducer.

Booting sequence

Important:

Obey the order as described below.

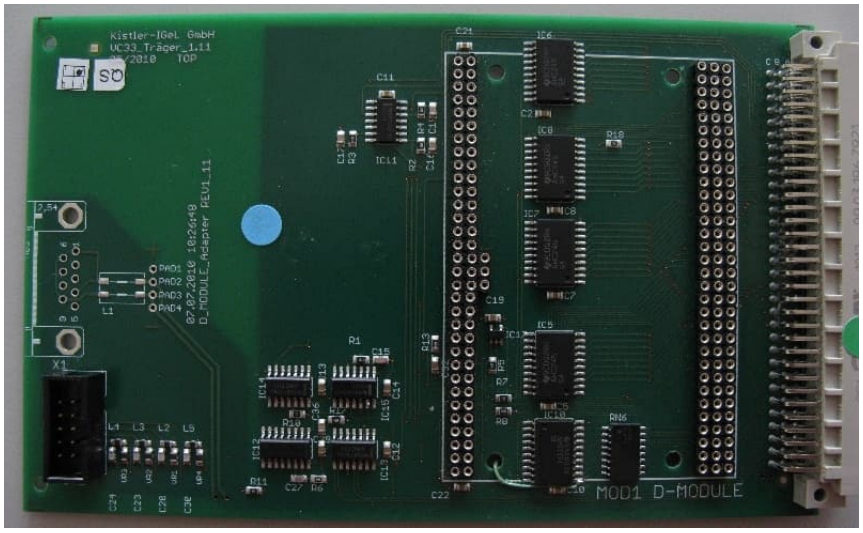
- Boot the Kistler RoaDyn® System 2000, with Kistler Remote control connected.
- Get rid of angle errors;
  spin each wheel at least 2 revolutions and clear the angle errors on the remote control.
  Be aware that angle and similar errors can cause the Kistler RoaDyn® System 2000 to 'jump back' into the set-up mode. If this occurs no data acquisition is possible.
- Make sure that the RoaDyn® Remote Control displays the online values of a wheel,
  but does not show the remote control in setup mode.
- Boot the Simcenter SCADAS Mobile or Simcenter SCADAS Recorder.
- Start the Simcenter software application.

Minimal software requirements

- Software – a recent version of Simcenter Testlab or Simcenter Testxpress.
- Firmware – see steps below.
- User controllable settings – see steps below.

All steps below relate to the Kistler RoaDyn® System 2000.

1) Do a visual check on the Printed Circuit Board (PCB):



Module details: SDSP Baseboard.
DSP Type: VC33 (Rev >= 1.11).

If necessary, contact Kistler Support for an on-site upgrade.

2) Verify the IP-address settings on the on Kistler Remote Control.

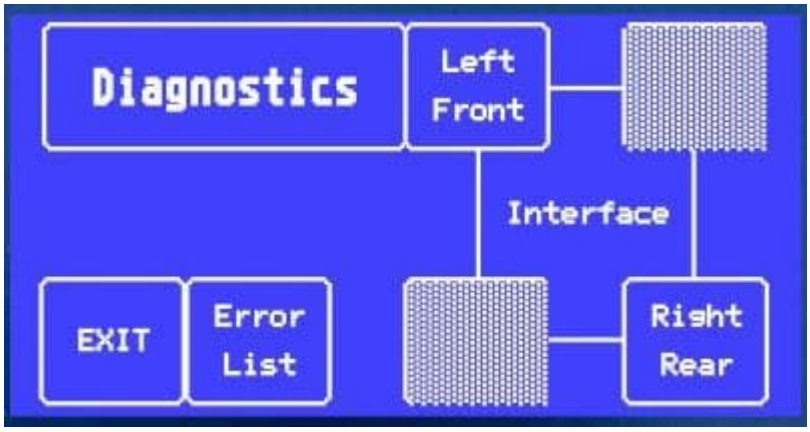
Module details: DSP version >= 4.0.1a.

If necessary, contact Kistler Support for an on-site upgrade.

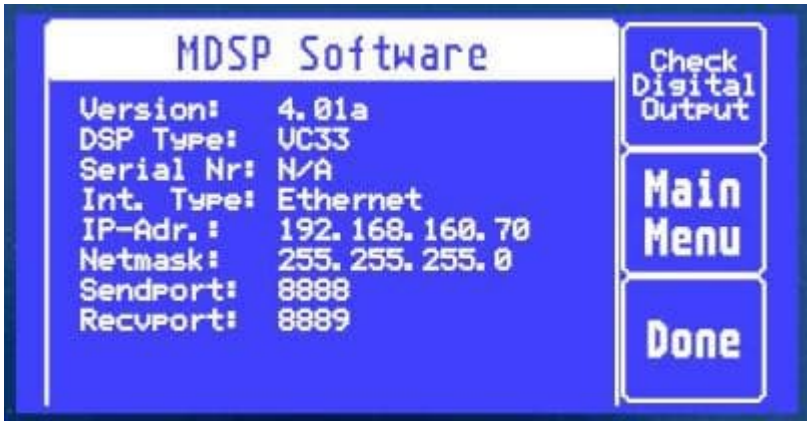
IP address: 192.168.160.70.

1. On the Remote Control display (see below) make these selections in sequence: → Setup; → Diagnostics.

2. In the Diagnostics screen (see below) make this selection:
   → Interface.



3. In the presented list (see below) do a check of these entries:
   → Version; → DSP Type; → IP-Adr.



4. If necessary, do the steps below to reset the IP-address:
   1. Switch off the RoaDyn® System 2000.
   2. Use a BNC-cable with a maximum length of 0,5m.
      Connect the BNC-socket CLK with BNC-socket TRG of Ethernet Interface Card 5621A6.
   3. Switch on the RoaDyn® System 2000 and wait for 5 seconds.
   4. Disconnect the BNC-cable.
   5. The IP-address is now reset.

CONNECT STRAIN GAGES TO BRIDGE INPUTS (V-SUPPLY)

This part provides advised methods and relevant details for connection of strain gages to modules that support bridge inputs (voltage supply), being: VB8-II, VB8-III, DB8-II, DB8-III, DB8A, DB8B, DB8C, DB8-IIIC.

What each of these module supports is specified in:
Component description / Analog input – Bridge functions / Bridge input – Voltage supply.

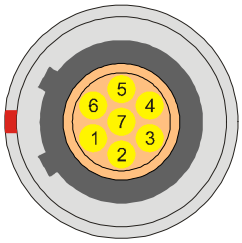
IN THIS PART:

- Using pigtail cables
- Full bridge connection: 6 wire or 4 wire
- Half bridge connection: 5 wire or 3 wire
- Quarter bridge connections
- Bridge calibration techniques

USING PIGTAIL CABLES

Information about (standard) connection details are included in:
Component description / Analog input – Bridge functions / Bridge input – Voltage supply.

More specific connection details for 'pigtail cables' are included in the table below.

CONNECTION	DETAILS	PIGTAIL CABLE
7-pin LEMO: channels 1 to 8  Chassis = Analog Ground Not connected implicates: DO NOT USE	Connector type: LEMO-EGB.0B.307 Pin details: 1) +V supply 2) +V sense 3) +V IN 4) -V IN 5) -V sense 6) -V supply 7) V / ICP / TEDS Chassis = Analog Ground/Shield	Mating connector: LEMO-FGB.0B.307.CLADxx Cable details: White Green Grey Pink Yellow Brown Blue Black

The relevant I/O modules come standard with module-level accessories, including a 3 meter LEMO to pigtail adapter cable (see color codes in the table above).

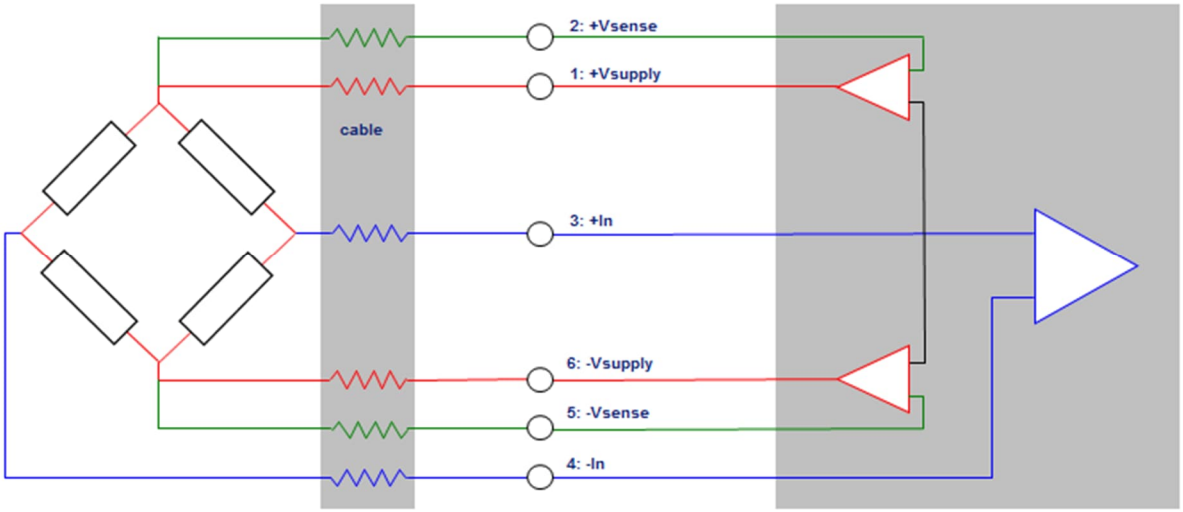
The black wire is used for cable shielding.

FULL BRIDGE CONNECTION: 6 WIRE OR 4 WIRE

From a pure measurement point of view, the full bridge is always the preferred configuration, even if you don't have an active full bridge and the number of active gages is less than four.
On the other hand, the full bridge is also the least practical of strain gage configurations, in terms of installation time.

The full bridge configuration offers three important advantages:

- Full compensation of voltage loss over power lines through the use of sense lines.
  Even with very long cables, the sensing principle ensures that the bridge voltage is exactly what you want it to be at both ends of the gages.
- The full bridge allows for differential signal transmission, offering the best common-mode noise (like 50/60Hz or EMI) rejection possible.
- With four active gages, the full bridge configuration adds 12dB to the signal-to-noise ratio possible when comparing it to a ¼ bridge arrangement, and 6dB when comparing it to a ½ bridge arrangement.



Notes:

Connection 1: +Vsupply can be powered by either DC or AC sources. AC excitation is also known as 'carrier frequency'.

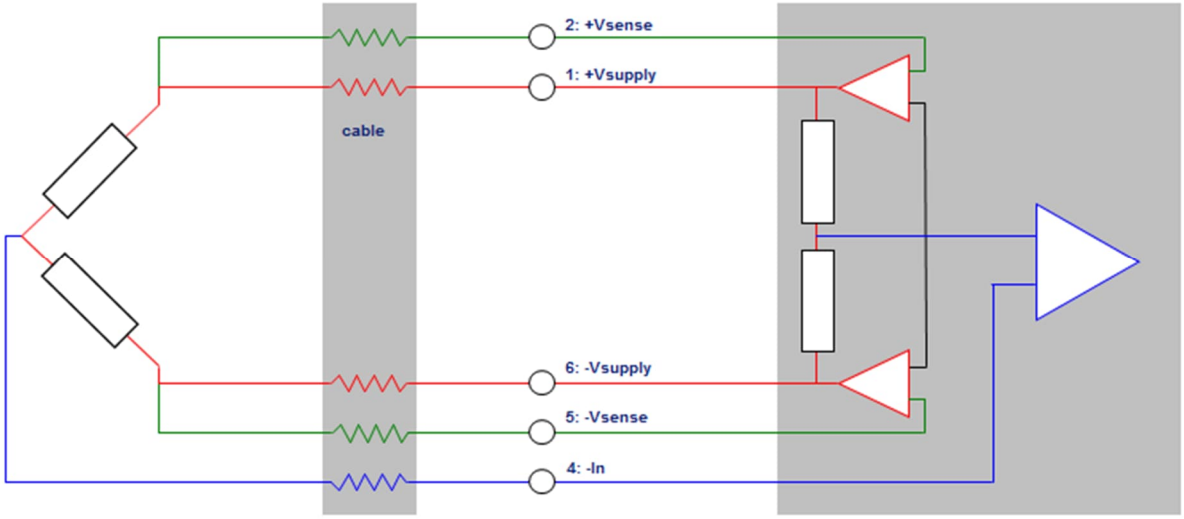
Connection of the sense lines is optional, but is strongly recommended in this configuration.

HALF BRIDGE CONNECTION: 5 WIRE OR 3 WIRE

The half bridge configuration works best with two active gages, but is often used with one active gage and one “passive” gage for compensation purposes.

The half bridge configuration offers two important advantages:

- Full compensation of voltage loss over power lines through the use of sense lines. Even with very long cables, the sensing principle ensures that the bridge voltage is exactly what you want it to be at both ends of the gages.
- With two active gages, the half bridge configuration adds 6dB to the signal-to-noise ratio possible when comparing it to any ¼ bridge arrangement.



Notes:

Connection 1: +Vsupply can be powered by either DC or AC sources. AC excitation is also known as ‘carrier frequency’.

Connection of the sense lines is optional, but is strongly recommended in this configuration.

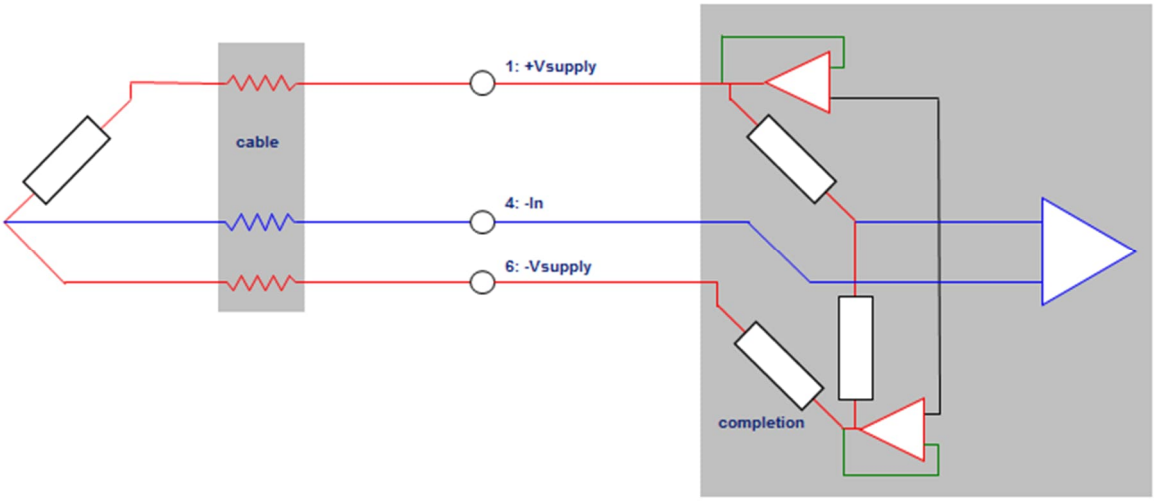
QUARTER BRIDGE CONNECTIONS

The single gage quarter bridge mode is the most common bridge mode. The positive supply sense line (pin 2) is optional and will generally not be used in practical scenarios. The modules offer two values for the internal completion resistor: 120Ω or 350Ω (selectable in the application software).

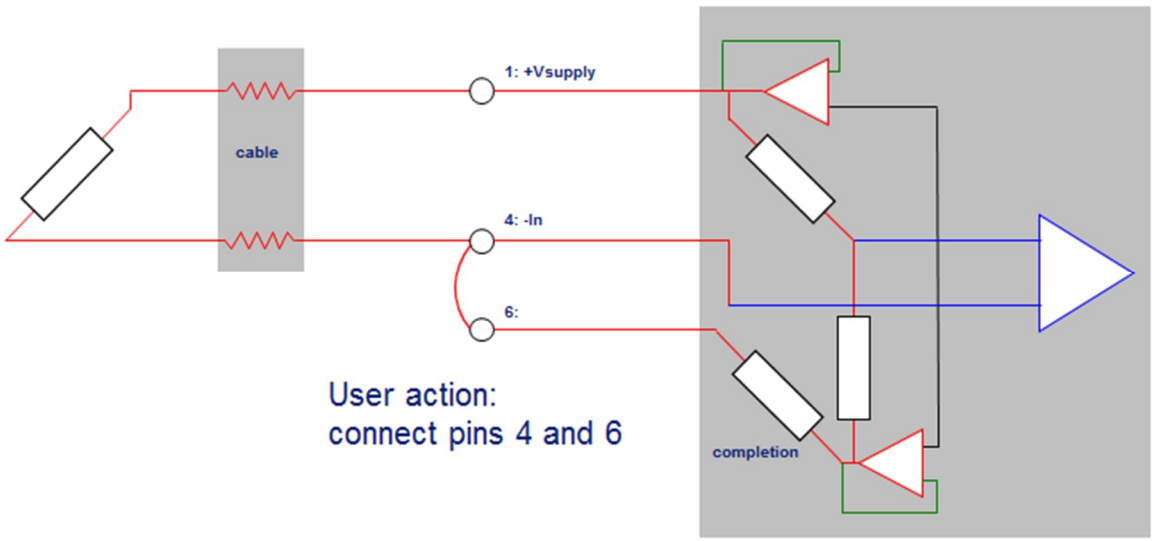
Note: Connection 1: +Vsupply can be powered by either DC or AC sources. AC excitation is also known as 'carrier frequency'.

Quarter bridge: 3 wire

The 3 wire quarter bridge is the best compromise between a minimum amount of wires and measurement accuracy.

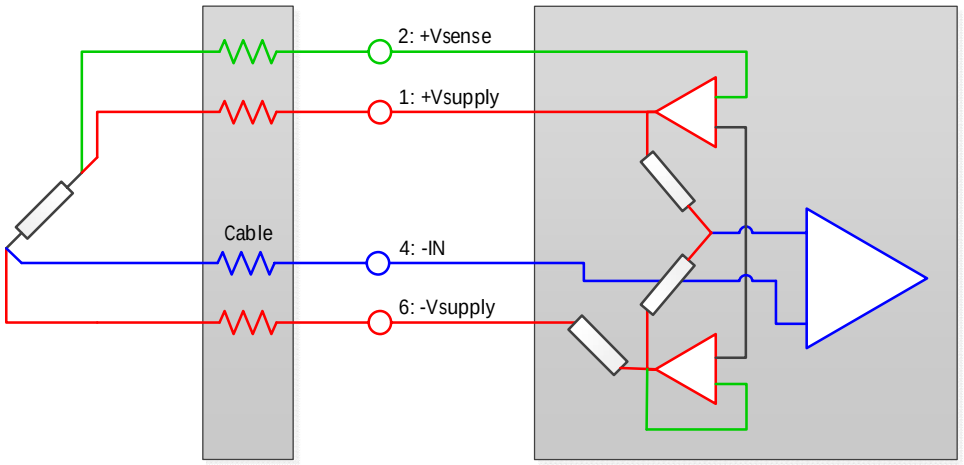


Quarter bridge: 2 wire



Quarter bridge: 4 wire *(DB8IIIC and VB8III-RT only)*

To compensate the measurement error for a quarter bridge configuration caused by sensitivity loss due to temperature dependent cable resistance a four wire quarter bridge can be used.



BRIDGE CALIBRATION TECHNIQUES

The modules offer two calibration methods for achieving maximum accuracy:

- bridge nulling through current injection,
- shunt calibration.

Bridge nulling

Bridge nulling is performed by the Digital Signal Processor (DSP) of the module.

Shunt calibration

The modules offer the possibility to perform accurate shunt calibration with shunt resistors that are built in the module.

These modules have two shunt resistors: 50kΩ and 100kΩ.

The shunt resistor can be shunted to all of the four branches of the Wheatstone bridge to simulate either compressive or tensile strain.

The shunt resistor is switched between one of the power sense lines at one end, and either the plus or minus input at the other end. If no sense lines are used, one end of the resistor is connected to the power line (not advised for accurate calibration).

CONNECT OTHER SENSORS TO BRIDGE INPUTS (V-SUPPLY)

This part provides advised methods and relevant details for connection of other types of sensors (than strain gages) to modules that support bridge inputs (voltage supply), being: VB8-II, VB8III-RT, DB8-II, DB8III, DB8A, DB8B, DB8C, DB8IIIC.

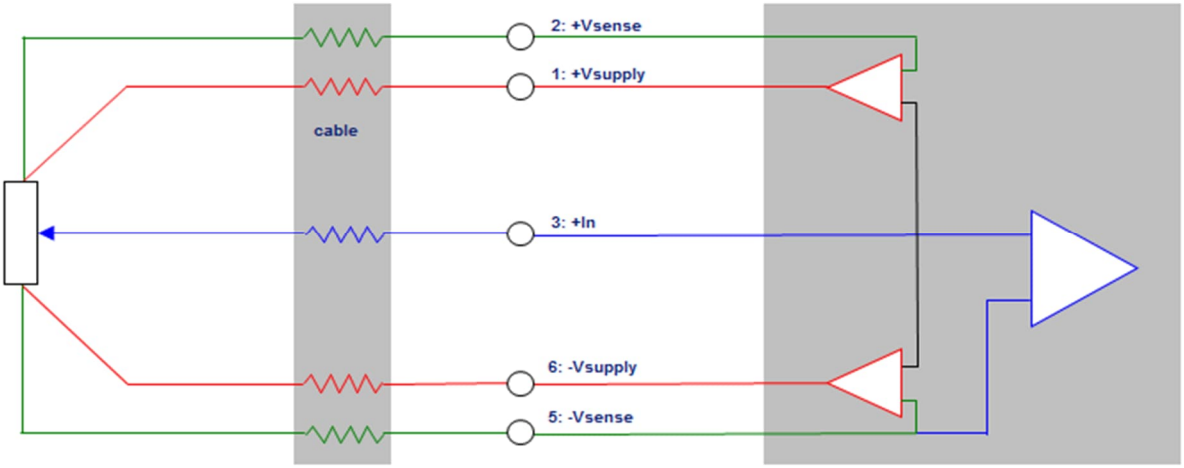
Next to bridge type sensors such as strain gages, these modules allow connection of potentiometers, active sensors, ICP sensors and voltage sources.
What each of these module supports is specified in:
Component description / Analog input – Bridge functions / Bridge input – Voltage supply.

IN THIS PART:

- Potentiometer connections
- Active sensor connections
- Differential voltage mode connections
- Single ended voltage / ICP / TEDS mode connections
- LVDT – AC excitation
- DC accelerometers

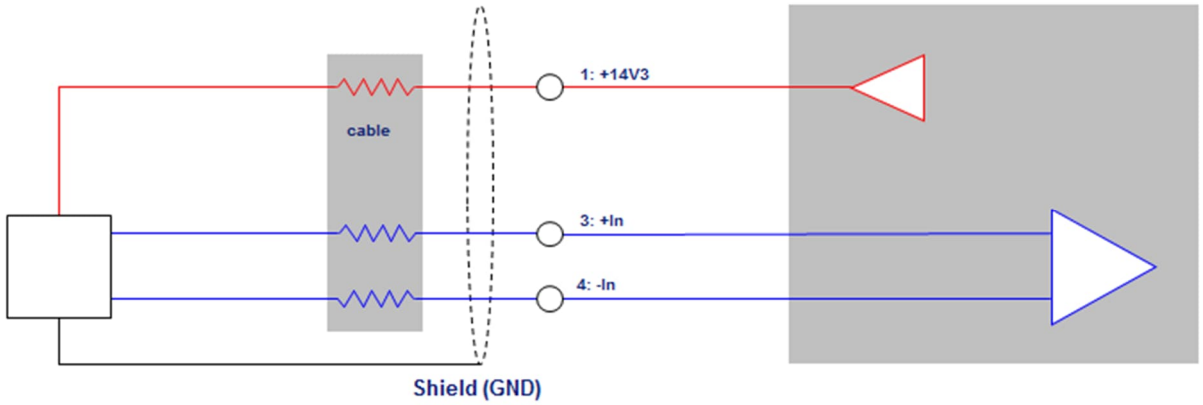
POTENTIOMETER CONNECTIONS

The potentiometer mode is similar to the previously mentioned half bridge mode, with one important difference: the negative side of the input amplifier is connected to -Vsupply. This provides a unipolar output for potentiometer. As with the bridge configurations, you can work without sense lines.

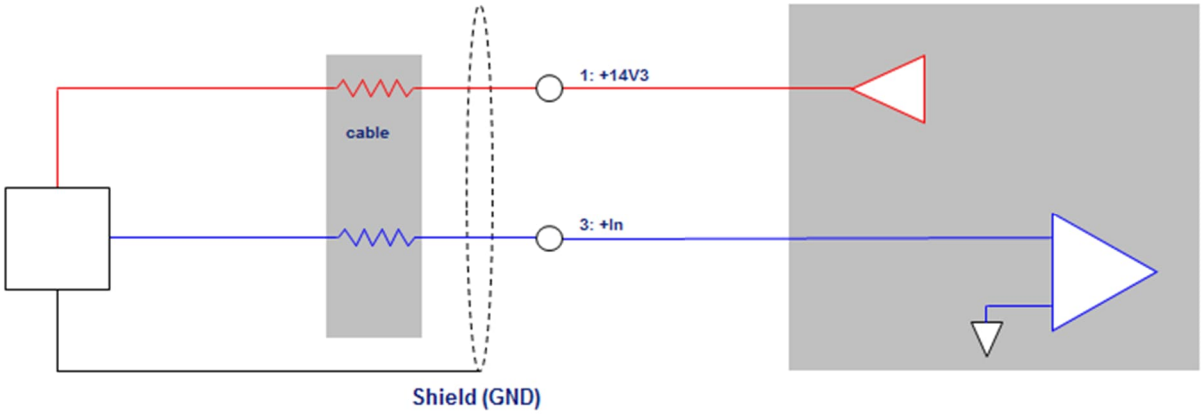


ACTIVE SENSOR CONNECTIONS

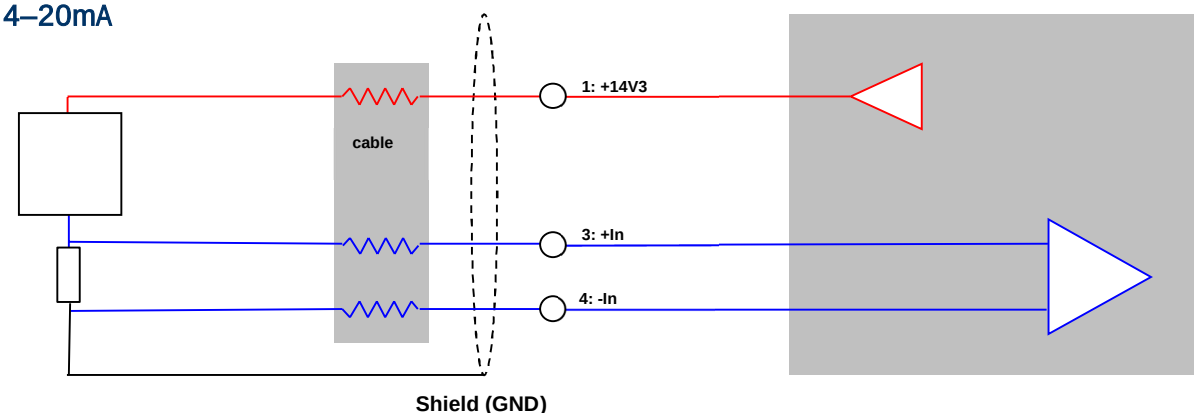
Differential



Single ended



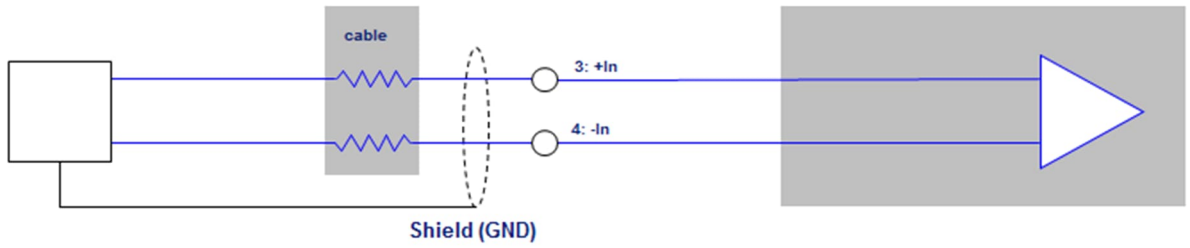
4–20mA



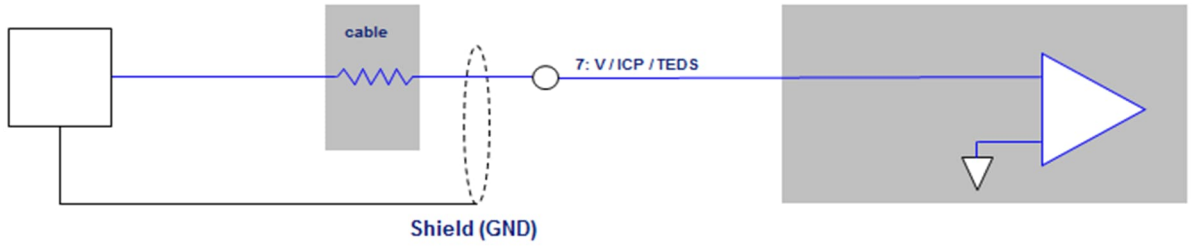
4-20mA sensors can be connected to the input provided that the SCx-CAS10 cable is used. This cable contains a high precision 82 Ω shunt resistor that converts the sensor current into a voltage.

Note: Be aware that in active sensor mode (both differential and single-ended) the positive power supply is a fixed +14.3 VDC.

DIFFERENTIAL VOLTAGE MODE CONNECTIONS

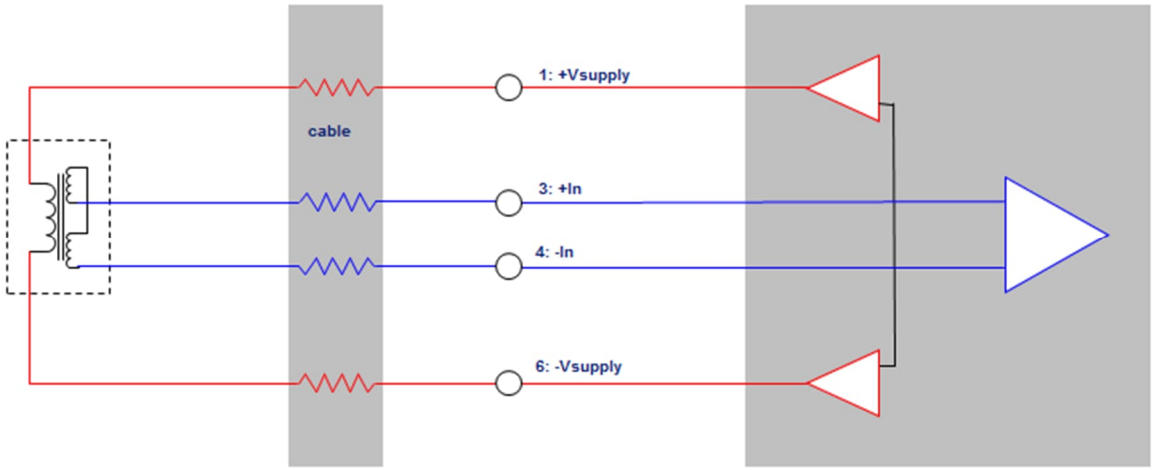


SINGLE ENDED VOLTAGE / ICP / TEDS MODE CONNECTIONS



Note: Be aware that for single-ended V/ICP/TEDS mode a different input signal pin is used (pin 7).

LVDT – AC EXCITATION



Note: Connection 1: +Vsupply and -V supply are powered by an AC source. AC excitation is also known as 'carrier frequency'.

DC ACCELEROMETERS

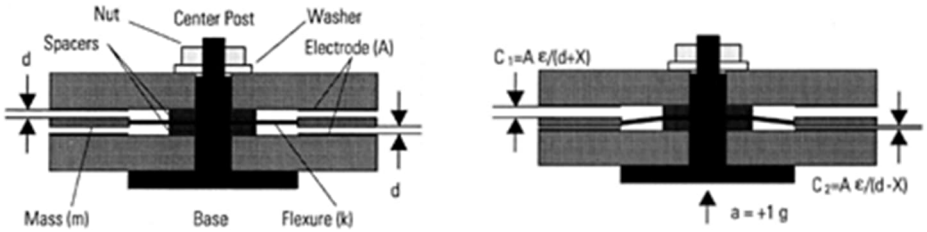
There are three different underlying technologies for DC accelerometers:

- Capacitive DC accelerometers (mechanical)
- Capacitive DC accelerometers (MEMS)
- Piezoresistive DC accelerometers (MEMS)

The term “MEMS” stands for Micro Electro Mechanical System.

CAPACITIVE DC ACCELEROMETERS (MECHANICAL)

The principle of the mechanical capacitive DC accelerometer is depicted below:



This is a mechanical structure, basically consisting of two fixed electrodes and two flexible electrodes. Together they form a matched set of electrical capacitors, the value of which depends on the distance between the flexible electrodes and the fixed electrodes. As this distance will vary with acceleration, the functional result is a transducer that is able to translate acceleration into an amount of electrical charge in a capacitor.

A typical capacitive DC accelerometer will use that ability in the following manner:

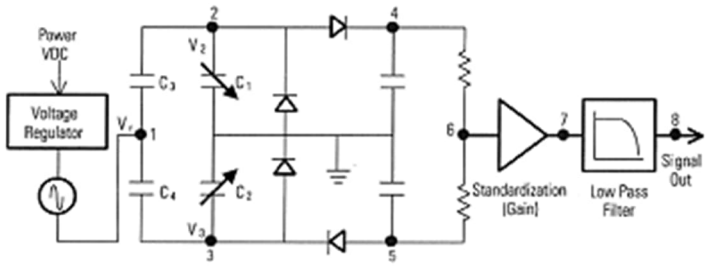
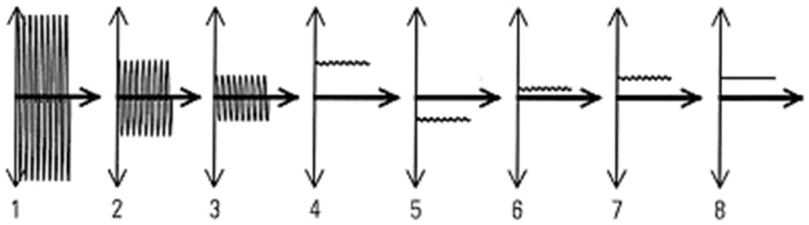


Figure 2a Circuit Schematic



The two variable capacitors are placed in a classical Wheatstone bridge, and an AC bridge excitation is applied. The AC output (imbalance) of the bridge is filtered, resulting in a DC output of the sensor, representing the amount of acceleration. This type of sensor obviously has some on-board electronics for the AC bridge excitation generation, buffering, low pass filtering etc. Hence the name: active sensor.

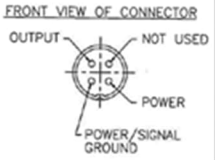
Consequently, this type of sensor needs an external voltage supply to power the internal electronics. In most cases this means that the sensor requires a power voltage that should be:

- more than a certain amount of Volts (such as >5V) in order to be able to power the internal electronics;
- less than a certain amount of Volts (such as <30V) in order to avoid damage to the internal electronics.

In the next topics some examples of mechanical capacitive DC accelerometers are examined more closely. These examples are:

- PCB 3701 series
- Endevco 7290 series
- Kistler 8310 series.

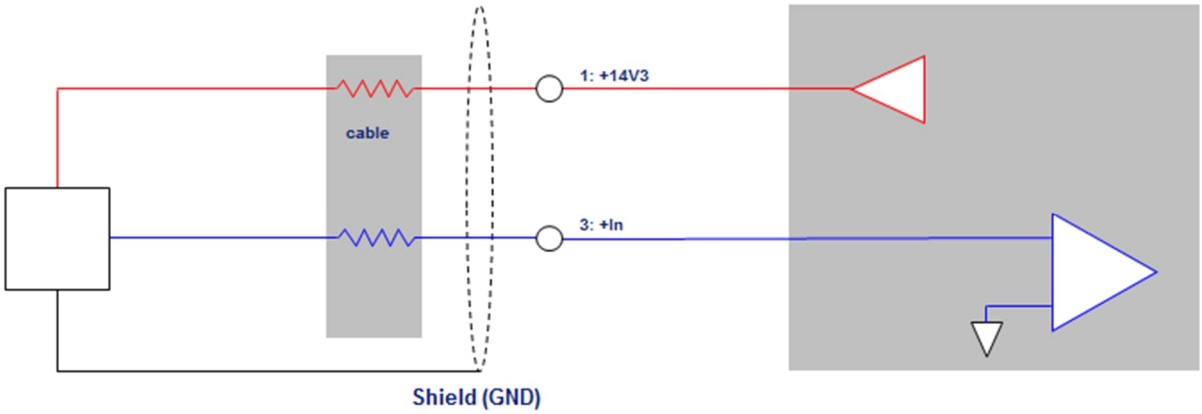
PCB 3701 series



ELECTRICAL	
Excitation Voltage	5 to 30 VDC
Current Consumption	≤ 10 mA
Output Impedance	≤ 50 ohm
Offset Voltage(0 g)	± 40 mVDC

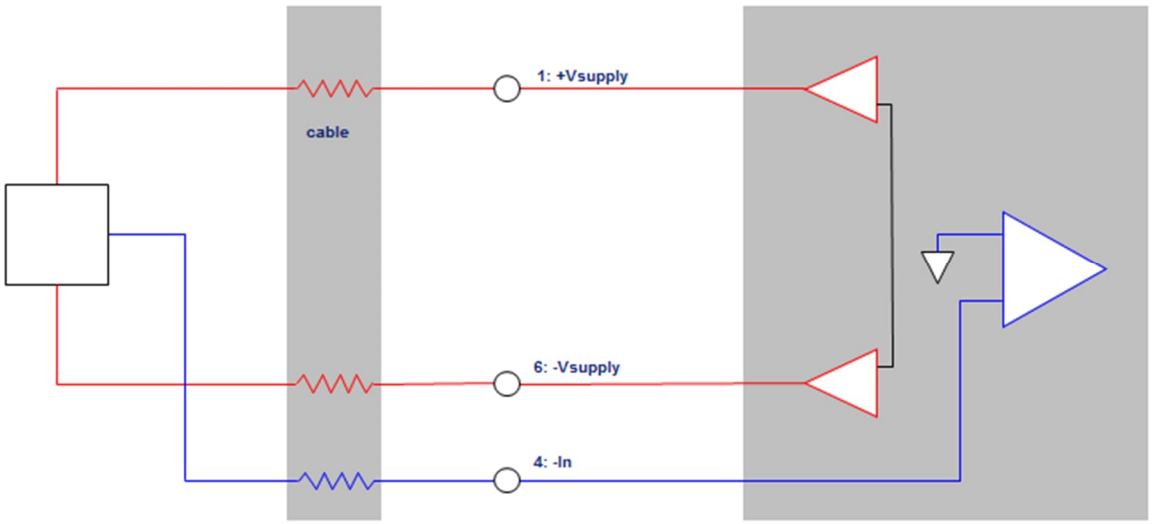
The PCB 3701 sensor series expects a single-ended power supply (between ground and +5VDC to +30VDC). This is a typical example of a “active sensor single-ended”: both positive and negative power supplies are provided and regulated by the sensor itself, resulting in a bipolar sensor output (nicely around 0 Volts, with a maximum DC offset of only ±40mV)

The preferred conditioner for this type of sensor is VB8-II, DB8-II or DB8C, as it has a dedicated active sensor single-ended mode (see figure below):



The module provides an active sensor supply of +14.3VDC and it can provide a maximum sensor supply current of 20mA (which are both OK for the 3701). Make sure to look at these two parameters, as they are crucial in deciding whether a sensor can be connected to the module in active sensor mode or not: required supply voltage and required supply current.

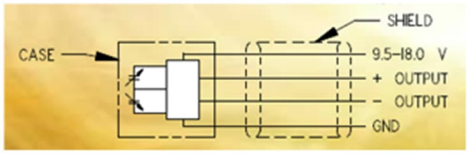
Alternative connection setup:
The PCB 3701 can also be connected as “Sensor with Excitation Single ended” e.g. similar to half bridge mode:



In “Sensor with excitation” (see figure above), the single-ended active sensor is fed by a symmetrical bridge supply. The supply voltage is OK (±5VDC equals 10VDC), and the bridge supply can provide enough current, but the sensor ground is now connected to the negative side of the bridge supply: usually -5V. This offset must be compensated for in software.
In this set-up these problems can occur:

- This arrangement may not work if the sensor is not case isolated, and the sensor ground is electrically connected to the sensor case.
- As the sensor signal is biased around -5V, the input range of the conditioner should be set to ±10V. When dealing with very low amplitude signals this could mean that you have a less than optimal dynamic range. On the other hand, DC accelerometers usually produce a fairly high output voltage.

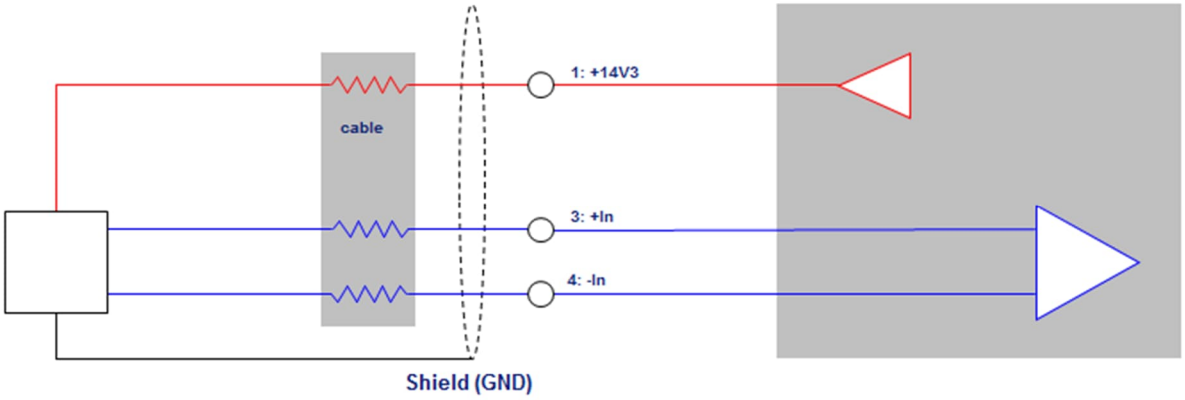
Endevco 7290 series



ELECTRICAL	
EXCITATION [3]	9.5 to 18.0 Vdc, 20 Vdc maximum without damage; excitation voltage can be applied to any lead without damage
CURRENT DRAIN [10]	8.5 mA Typ, 10 mA Max
OUTPUT IMPEDANCE/LOAD	500 ohms max/10K ohms resistance minimum, 0.1 μF capacitance maximum

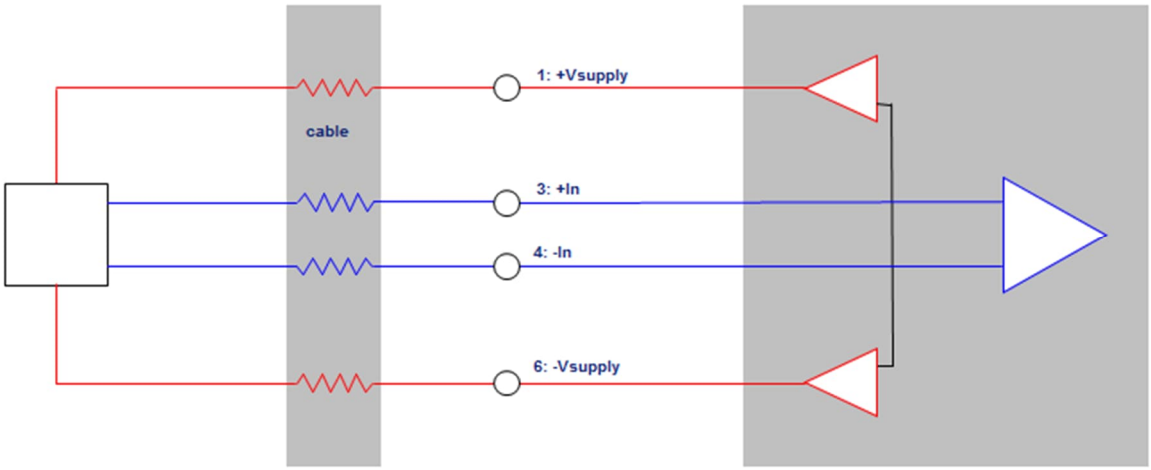
Another popular capacitive DC accelerometer is the Endevco 7290. The main difference between the 3701 and the 7290 is that the 7290 has a differential output, instead of a single-ended one.

VB8-II, DB8-II and DB8C offer a dedicated input mode for this type of sensor:



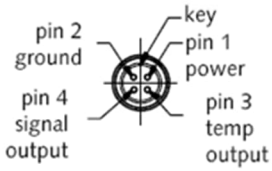
This is the so-called active sensor differential mode that is able (like the single-ended active sensor mode) to provide a +14.3VDC sensor supply at 20mA max.

Another way of connecting the 7290 is in “sensor with excitation differential” which is similar to full bridge mode:



In this mode, the sensor supply ground is connected to the negative bridge supply voltage and the signal is picked up differentially.

Kistler 8310 series

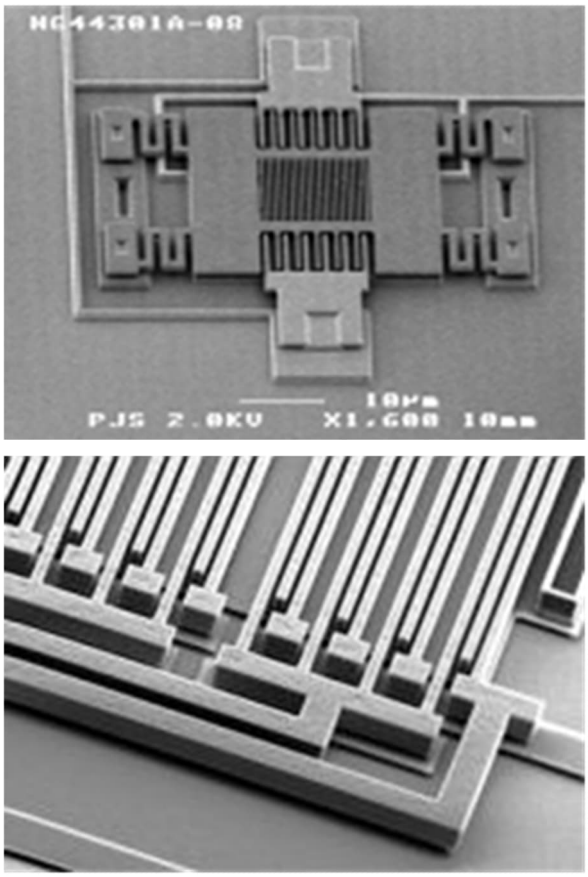


Supply:					
Voltage	VDC	3,8 ... 32	3,8 ... 32	6 ,.. 32	6 ... 32
Current nom.	mA	1,3	1,3	13	13
Zero *g* Output	mV	±30	±30	±40	±40

The Kistler 8310 is again a typical example of a single-ended active sensor, and it can be connected to Simcenter SCADAS hardware in a similar way as the PCB 3701. The “sensor with excitation single ended” connection mode (with a bridge supply of ±5VDC) will also work.

CAPACITIVE DC ACCELEROMETERS (MEMS)

A MEMS capacitive DC accelerometer principally works according to the same mechanism as a mechanical capacitive DC accelerometer, only now the mechanical structure is built on an electronic chip (silicon):



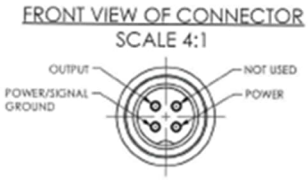
The advantage of such an architecture is obvious, as both the conditioning electronics and the sensor itself can be located on the same chip. Consequently, the cost of MEMS sensors is usually significantly lower than that of traditional accelerometers.

In the next topic an example of a capacitive MEMS DC accelerometer is examined more closely. The example is:

- PCB 3711 series

PCB 3711 series

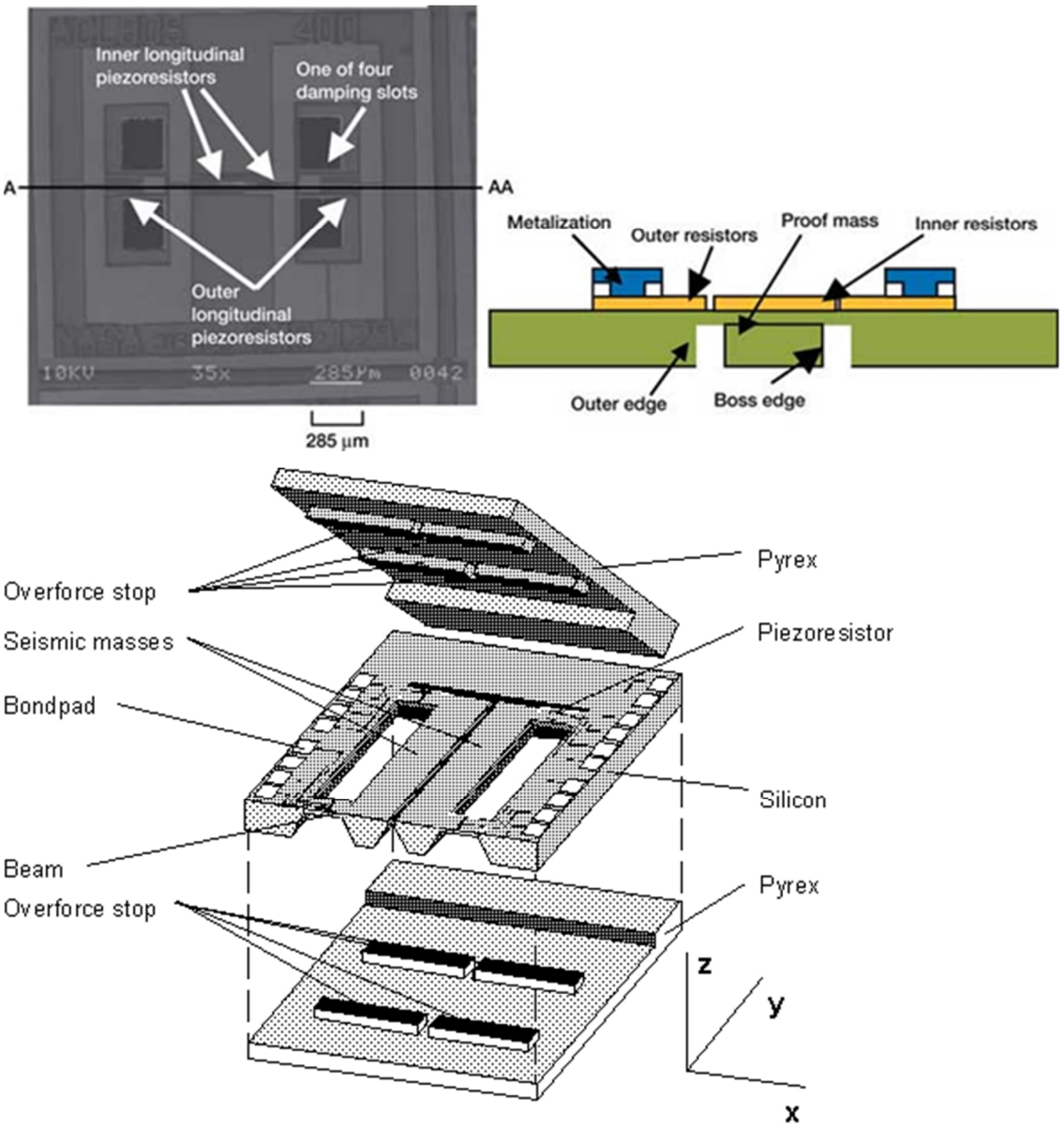
ELECTRICAL	
Excitation Voltage	5 to 30 VDC
Current Consumption	≤ 10 mA
Output Impedance	≤ 100 ohm
Offset Voltage(0 g)	2460 to 2540 mVDC



The 3711 can again be connected in both single-ended active sensor mode and “sensor with excitation single ended” mode, but depending on the type of 3711 there can be different output offsets at zero g. The one shown above is the 3711A, which has approx. 2.5V offset, but the 3711D will have no structural offset around its power/signal ground potential.

PIEZORESISTIVE DC ACCELEROMETERS (MEMS)

Silicon, being a crystal type of material, possesses certain properties that make it useful as a piezoresistive sensor material. When a force is applied to this sensor, as a result of acceleration, the resistive properties of the material change.

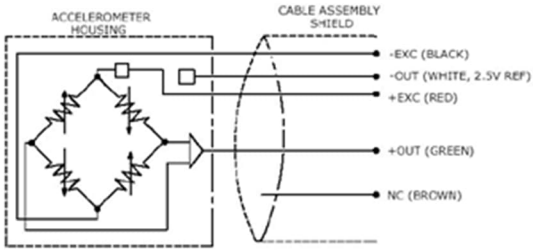


As a rule, piezoresistive sensors are internally configured as a full bridge, quite similar to a strain gage full bridge. Some sensors will add some electronics to buffer or amplify the bridge output signal; others will be passive (purely resistive) devices.

In the next topics some examples of piezoresistive MEMS DC accelerometers are examined more closely. These examples are:

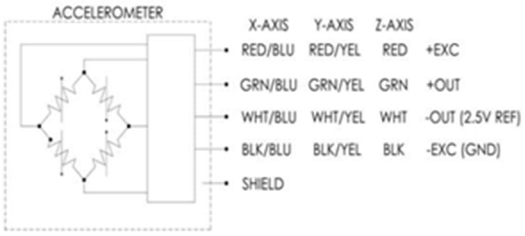
- Measurement Specialties 4600 and 4630 series
- Endevco 2262 sereis

Measurement Specialties 4600 (single axis) and 4630 (triax) series



ELECTRICAL

Zero Acceleration Output (mV)	±50
Excitation Voltage (Vdc)	8 to 36
Excitation Current (mA)	<5
Bias Voltage (Vdc)	2.5
Output Resistance (Ω)	<100

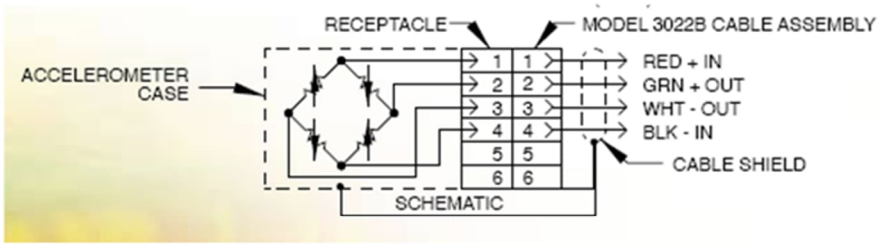


ELECTRICAL		
Excitation Voltage	8 to 24	Vdc
Excitation Current	5.0	mA
Reference Voltage	2.5	Vdc
Output Impedance	100	Ω
Insulation Resistance (@ 50Vdc)	100	MΩ
Ground Isolation	Isolated	

As the diagram shows, the internal architecture is clearly a full bridge, but the 4600 and 4630 have some output electronics.

The most logical way to connect these sensors is in “sensor with excitation differential” mode, but the active sensor differential mode is also a possibility.

Endevco 2262 series



Electrical

Excitation [4] [5]	10.0 Vdc maximum, 15 Vdc maximum
Input resistance	600 ohms
Output resistance [4] [6]	400 ohms
Insulation resistance	100 megohms minimum at 100 Vdc; all leads to case

As the 2262 behaves as a passive full bridge, the preferred connection method for this sensor is “sensor with excitation differential”.

SUPPORT AND FEEDBACK

SUPPORT

Thank you for consulting this User Manual. The content of this manual has been designed and written with the aim to support you, the user, in the day-to-day use of the Simcenter SCADAS Mobile & Recorder.
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 regarded 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.

Mailto: info.benelux.plm@siemens.com

APPENDIX A – SPECIFICATIONS

This part provides the technical specifications of the Simcenter SCADAS Mobile & Recorder. Here you can find the distinct features that the Simcenter SCADAS Mobile & Recorder offer, but also operational boundaries that apply.

IN THIS APPENDIX:

- Ingress Protection (IP) levels

INGRESS PROTECTION (IP) LEVELS

Electrical equipment is potentially hazardous for persons and sensitive to ingress of dust and moisture. Design and construction of equipment needs to be such that it offers sufficient protection:

- Against intrusion and accidental contact,
- To prevent ingress of dust and/or moisture.

The required protection level depends on the (expected) environmental circumstances the equipment has to operate in.

The International Protection Marking (IP Code) in IEC60529 classifies and rates the degree of protection. The digits (characteristic numerals) indicate conformity with predefined conditions and agreed criteria. Where there is no protection rating with regard to one of the criteria, the digit is replaced with the letter X.

The enhanced level of ingress protection of main frames and secondary frames and their corresponding modules is IP54. This *only* applies to the frame type numbers SCR207 and SCM08S.

The Simcenter SCADAS Satellite units are IP66 / IP67 rated.

The table specifies the 1st and 2nd digits for the applied IP Codes.

1ST DIGIT	SOLID PARTICLE PROTECTION	2ND DIGIT	LIQUID INGRESS PROTECTION
3	Protected against solid objects over 2.5 mm (tools, wires, etc.).	0	No protection.
5	Complete protection against contact. Dust protected; ingress of dust is not entirely prevent - no harmful deposit.	4	Splashing of water; water splashing against the enclosure from any direction shall have no harmful effect.
6	No ingress of dust; complete protection against contact (dust tight).	6	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects
		7	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).

APPENDIX B – FRONT PANEL INDICATIONS

This part provides generic information about LED indications on the front panel of a Simcenter SCADAS Mobile & Recorder frame. Any type of module can have LED indicators depending on the type number.

IN THIS APPENDIX:

LED INDICATIONS (ALL EXCEPT CAN AND TACHO)

The table below gives relevant details about LED indications for all conditioning modules functionality except CAN and Tacho:

MODULE(S)	INPUT MODE	STATUS	COLOR
All except V24(-II)	V/ICP single ended	OK	Green
V24(-II)	Voltage	OK	Blue
V24(-II)	ICP	OK	Green
All	V/ICP	Overload	Red
All	ICP	ICP error	Alternating yellow / red
VC8-E/-ER/-QS	Charge	OK	Blue
VC8-E/-ER/-QS	Charge	Overload	Red
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge / differential voltage / active sensor / pot	OK	Blue
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge / active sensor / pot	Overload	Red
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge / active sensor / pot	Sensor supply error	Alternating yellow / red
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge	Balancing active	Cyan
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge	Balancing error	Alternating yellow / red
VB8-II, VB8III-RT, DB8-II, DB8A, DB8B, DB8C, DB8IIIC	Bridge	Shunting active	Magenta
All	TEDS	Reading	Yellow

LED INDICATIONS (FOR CAN)

The table below gives relevant details about LED indications for CAN functionality:

COLOR	STATUS
Green	The CAN-bus is enabled; (active listener or passive / normal operation).
Red	An error-warning condition has occurred.
Alternating red / green	When a bus error occurs, the LED will be set red for a duration of 200ms. When the LED blinks alternatingly (red / green) the module is detecting bus errors repeatedly. The most likely errors in this situation are: ▸ High speed CAN is not properly terminated. ▸ Bit rate is not set correctly. ▸ Setting the module to high speed and connecting to a low speed bus. ▸ Setting the module in low speed and connecting to a high speed bus.

LED INDICATIONS (FOR TACHO ON SYSCON AND RV4)

The table below gives relevant details about LED indications for Tacho functionality on Syscon and RV4:

COLOR	STATUS
No Led	Tacho channel not activated, or no pulse detected
Green	Pulse detected
Red	Overload
	▸

APPENDIX C – HARDWARE CHECKS (Simcenter Testlab and Simcenter Testlab Control App)

This appendix provides information on the different hardware checks and how they are visualized in the Simcenter Testlab and Simcenter Testlab Control App software.

Description	Simcenter Testlab Time Data Acquisition - Label	Simcenter Testlab Control App Color in Status view	DB8II / DB8III / VB8II / VB8III / DB8C / DB8III C	SCS-V12	SCS-B12	WFI2	T8	TACHO	BDS4
Bridge voltage supply overload	Supply Overload		X	-	X	-	-	-	X
External voltage supply overload	Supply Overload		X	X	-	-	-	-	X
ICP error	ICP Error		X	X	-	-	-	-	X
Conditioning has signal out of range	Overload		X	X	X	-	-	-	X
Bridge current supply open	Supply Open		-	-	-	-	-	-	X
Bridge voltage supply shorted	Supply Shorted		X	-	X	-	-	-	X
Bridge voltage supply open	Supply Open		X	-	X	-	-	-	X
AC phase overload	Carrier phase Unaligned		X	-	-	-	-	-	-
Phase correction possible	Carrier phase Unstable		X	-	-	-	-	-	-
Bridge current supply shorted	Supply Shorted		-	-	-	-	-	-	-
Input outside thermo couple range	Overload		-	-	-	-	X	-	-
Loss of connection to Roadyn2000	Remote module Disconnected		-	X	X	X	-	-	-
Some datagrams were missing	Remote module Data error		-	X	X	X	-	-	-
Temperature overload	Temperature overload'		-	X	X	-	-	-	-
Power overload	Power overload		-	X	X	-	-	-	-

APPENDIX D – FRONT-END CONFIGURATION TOOL

Introduction

FeConfig is an internal tool for frontend configuration. The tool supports the following functionality:

- Discovery of available front-end(s) in a network or direct connection to the computer.
- Each discovered front-end will be assigned a unique TCP IP address and a name.
- All discovered front-end / TCP IP / name entries are stored in the registry.

In this way a front-end can be accessed using the same TCP IP address.

Required actions:

- Specify the network segment(s) in which to discover front-end(s).
- Display these network segment(s).
- Export and import a list of front-end / TCP IP / name entries.
    - This allows a user to access a specific front-end from 2 different computers using the same TCP IP address.
    - It also allows a user to give a specific front-end a name.
    - This name can then be used in an application to refer to that front-end.

- Supported platforms
    - Currently the tool is only available for the windows platform.

Command line arguments

argument	description	format
	Perform a discovery.	FeConfig
-h or /?	Help.	FeConfig –h
-l	List configured network segments.	FeConfig –l
-a	Add a network segment.	FeConfig -a {first_addr} {last_addr} {net_mask}
-s	Set the network segment.	FeConfig -s {first_addr} {last_addr} {net_mask}
-e	Export current list of front-end/tcpip/name entries.	FeConfig -e {text_file_name_to}
-i	Import list of front-end/tcpip/name entries.	FeConfig -i {text_file_name_from}

Command line examples:
The bold text is the command line, the *italic text* is the response.

FeConfig
Found 1 front-ends
IP: 169.254.22.81 MAC: 00:04:45:00:1A:88 ProdId: 2 App: 1 Status: 0x04 Host: 0.0.0.0

FeConfig –h
Usage to perform discovery:
    FeConfig
To list configured networks:
    FeConfig -l or
To set one (first) network:
    FeConfig -s {first_addr} {last_addr} {net_mask}
To add a network:
    FeConfig -a {first_addr} {last_addr} {net_mask}
To export the list of known ip-mac devices:
    FeConfig -e {text_file_name_to}
To import the list of known ip-mac devices:
    FeConfig -i {text_file_name_from}

FeConfig –l
There are 1 networks configured:
169.254.1.0 to 169.254.254.255 netmask 255.255.0.0

FeConfig -e list.txt
Exported 2 devices to file !

FeConfig -i list.txt
Saved 2 devices to the windows registry !

INDEX

SIEMENS

11-2020