

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

SIEMENS

7MH4910-0AA01

ELECTRONIC WEIGHING MEASUREMENT MODULE

Used with the applicable SIWAREX CS configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Siemens SIWAREX CS technical documentation



SIWAREX[®] CS

Device Manual

Status 05/2008



The layout of this manual is based on activities that must be performed as part of configuration, commissioning, operation and service / maintenance.

Chapter	Description of Content
1 Preface	Notes on using this manual
2 Scope of Delivery	Description of the SIWAREX CS scope of delivery
3 Preface	Overview of - Structure - Functionality - System integration of SIWAREX CS.
4 Hardware Configuration and Assembly	Description - of individual hardware components - of structure and installation - of connections - of preparations for operation.
5 Weighing Functions	Description of all weighing parameters and corresponding functions.
6 Commands	Description of commands that can be executed by SIWAREX CS.
7 Messages and Diagnosis	Description of messages with notes on problem resolution.
8 Programming in SIMATIC STEP 7	Description of data exchange with SIMATIC CPU. This chapter is aimed at those who are writing application software.
9 Setting the Scale – SIWATOOL CS	Description - Software installation - Software functions
10 Calibrating Applications	Description of conditions for calibration
11 Accessories	Ordering information for optional components such as: - Remote digital displays - Ex interface - STEP 7 software
12 Technical Data	Technical Data
13 Index	Index
14 Abbreviations	List of Abbreviations

Table 1-2 Overview of Chapter

1.4 Further Support

Do you have any more questions about using the SIWAREX CS? If so, please contact your Siemens representative in the office or business location responsible for your area or the SIWAREX technical support line Tel.: +49 (0)721 595 2811.

Updated information on SIWAREX weighing technology can be found on the relevant Internet site.

<http://www.siemens.com/siwarex>

2 Scope of Delivery

2.1 Scope of Delivery

The scope of delivery of the SIWAREX CS includes the manufacturer's declaration of conformity and a supplementary sheet containing up to date information about the product.

To configure the SIWAREX CS, you will require the SIWAREX CS for SIMATIC S7 configuration package, which must be ordered separately.

The configuration package is made up of the following components:

- The Windows program SIWATOOL CS for adjusting the scale at commissioning
- Software „Getting Started“, it contains the S7 blocks for operating the SIWAREX CS in SIMATIC S7. For the initial programming steps, the "Getting Started" software is also extremely useful. Newer versions may be obtained free of charge on the Internet (www.siemens.com/siwarex).
- Device manuals in several languages

The required and optional accessories are summarized in chapter [11 .Accessories](#).

2.2 Required Head Modules for SIWAREX CS

SIWAREX CS can be used for following head modules:

- IM 151-7 CPU order number 6ES7 151-7AA10-0AB0 Version 2.1 and later
- IM 151-1 HF order number 6ES7 151-1BA00-0AB0 and later
- IM 151-1 BASIC order number 6ES7 151-1CA00-0AB0 and later
- IM 151-1 STANDARD order number 6ES7 151-1AA02-0AB0 and later

2.3 Required PLC Controllers for SIWAREX CS

SIWAREX CS can be used for following controllers:

- S7-300 CPUs: Firmware 2.x and later
- S7-318 and S7-400 CPUs: Firmware version 3.x and later

3 Product Overview

3.1 General

SIWAREX CS (Compact Scale) is a versatile and flexible weighing module, which can be used wherever static scales are to be used in the ET 200S automation system or a force measurement is necessary.

The SIWAREX CS function module (FM) can be used in SIMATIC ET 200S and takes full advantage of all the features of the modern automation system, including the integrated communication, the diagnostic system and the configuration tools.

The weighing functionality of the SIWAREX CS includes the non-automatic weighing instrument functions in accordance with OIML R-76.

Customer benefits:

SIWAREX CS is characterized by a number of crucial advantages:

- o Standardized connection technology and integrated communication due to use in SIMATIC ET 200S
- o Standardized configuration using SIMATIC Manager
- o Use in a decentralized system concept through connection to PROFIBUS DP via ET 200S
- o Weight or force measurement to a high resolution of 16 Bit
- o High accuracy 0.05 %
- o Calibration 2000 d
- o High measuring rate of 50 Hz
- o Monitoring of limit values
- o Flexible adaptation to different requirements with SIMATIC control
- o Easy adjustment of scale using the SIWATOOL CS program via the RS 232 interface
- o Theoretical adjustment without adjustment weights
- o Exchange of module possible without readjusting scales
- o Use in Ex zone 2 / ATEX certification.
- o Intrinsically safe load cell power supply for use in zone 1 areas with risk of explosion (SIWAREX IS option)
- o Diagnostic functions

3.2 Area of Application

SIWAREX CS is the optimum solution wherever signals from DMS sensors or load cells are to be recorded. As a weighing electronics system, SIWAREX CS offers high accuracy and a calibration rating of 2000d. With a measurement time of 20 ms, the module can also be used as evaluation electronics for force measurement.

SIWAREX CS is optimally equipped for the following applications:

- o Filling level monitoring for silos and bunkers
- o Measurement of crane and cable loads, other force measurement
- o Load measurement for industrial elevators or mill trains
- o Weighing in areas with a risk of explosion (with SIWAREX IS Ex interface)
- o Belt tensioning measuring equipment

3.3 Structure

SIWAREX CS is a function module (FM) of SIMATIC ET 200S and can be plugged directly into a terminal module. The installation and cabling for the 30 mm wide module is minimal. The load cells, the power supply and the serial interfaces are connected via the terminal module with 16 connection points. Operation of the SIWAREX CS in SIMATIC guarantees complete integration of weighing technology into the automation system.

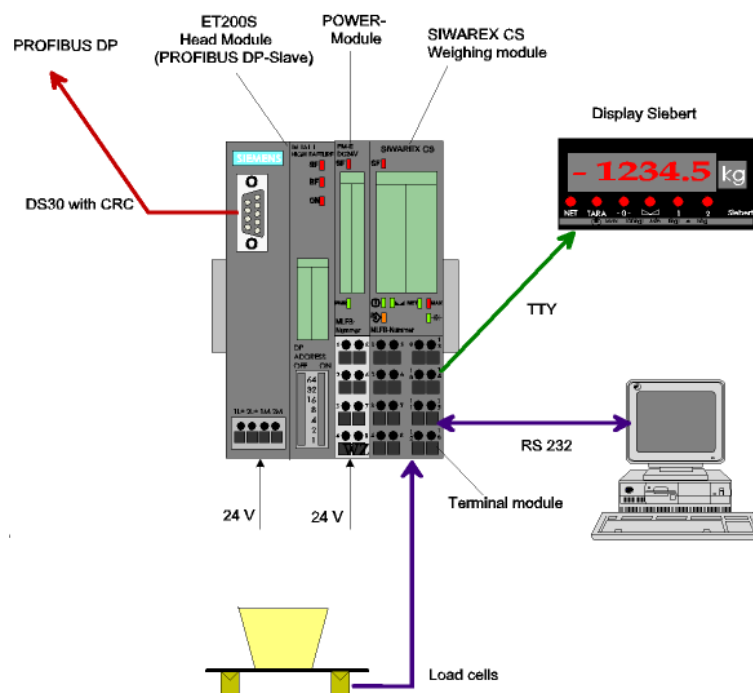


Figure 3-1 System Overview

3.4 Function

The primary task of the SIWAREX CS lies in the measurement of the current weight value. Integration into SIMATIC makes it possible to process the weight value directly in the PLC.

SIWAREX CS is pre-adjusted in the factory. This means that the scale can be adjusted to theoretical settings without using any adjustment weights and modules can be exchanged without readjusting the scale. Modules can be exchanged during operation in ET 200S.

The SIWAREX CS has two serial interfaces. A TTY interface is used for connecting remote digital displays. A PC for adjustment of the SIWAREX CS can be connected to the RS 232 interface.

The SIWAREX CS weighing module can also be used in areas with a risk of explosion (zone 2). An optional Ex interface SIWAREX IS gives load cells an intrinsically safe power supply for applications in zone 1. Further information about use for potentially explosive area you find in chapter 4.6.

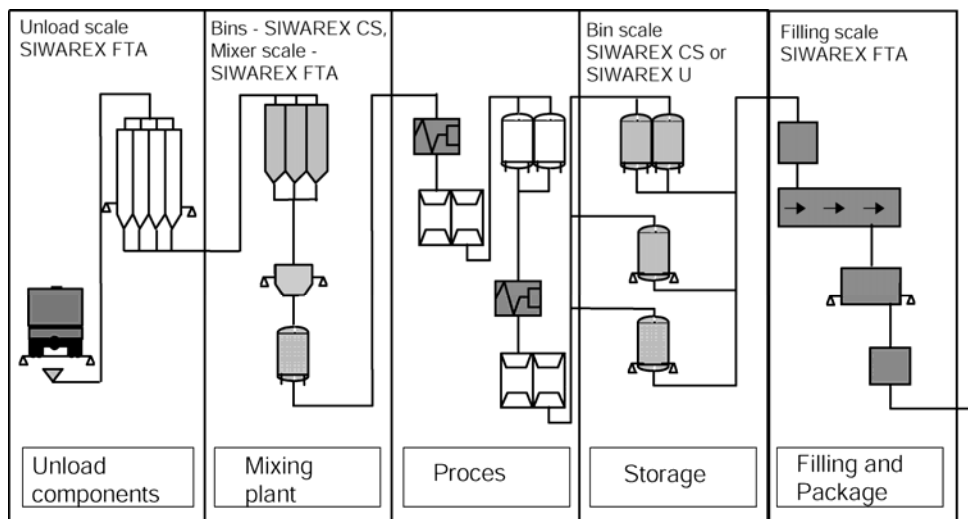


Figure 3-2 Areas of Application for SIWAREX in the Production Chain

3.5 System Integration in SIMATIC

SIWAREX CS is a component of SIMATIC ET 200S. This gives you complete freedom for configuration of the automation solution – including the weighing application. The optimum solution can be created for small, medium and large systems by selectively combining the SIMATIC components. The configuration package and the example applications for SIMATIC can help you to quickly and

efficiently develop customer or industry specific solutions. The following figure shows a typical setup for a medium sized system.

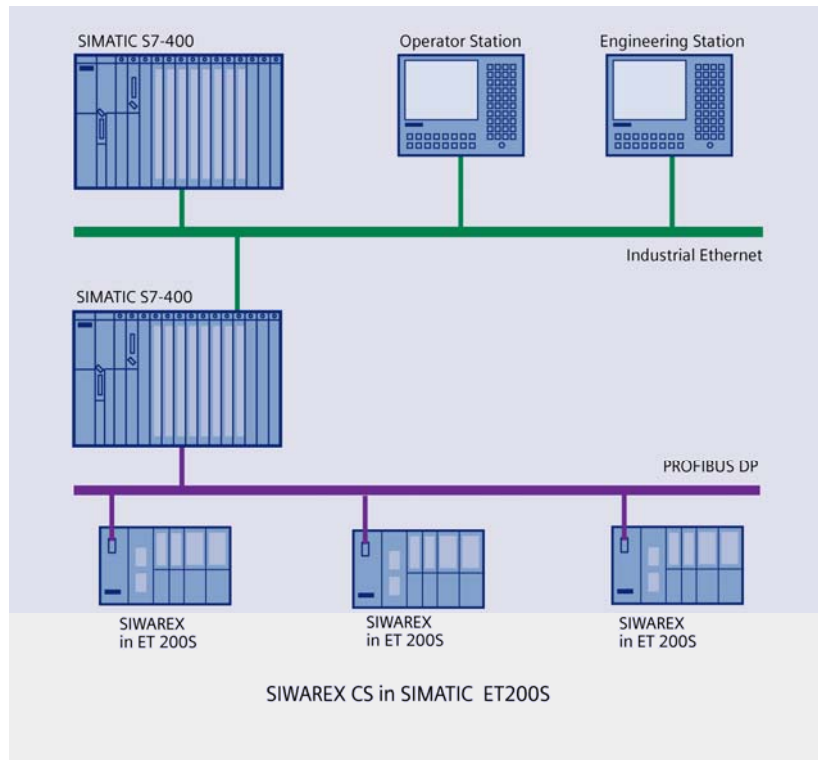


Figure 3-3 Typical Configuration of SIMATIC S7 with SIWAREX CS

3.6 Scale Adjustment with SIWATOOL CS

For adjustment of the scale, there is a special program – SIWATOOL CS for Windows operating systems.

The program enables the scale to be commissioned without having to understand automation technology. During servicing, you can analyze the processes in the scale and test them with the aid of a PC independently of the automation system. Reading the diagnostic buffer from the SIWAREX CS is very helpful in analyzing events.

The following figure shows the structure of the individual program windows.

Product Overview

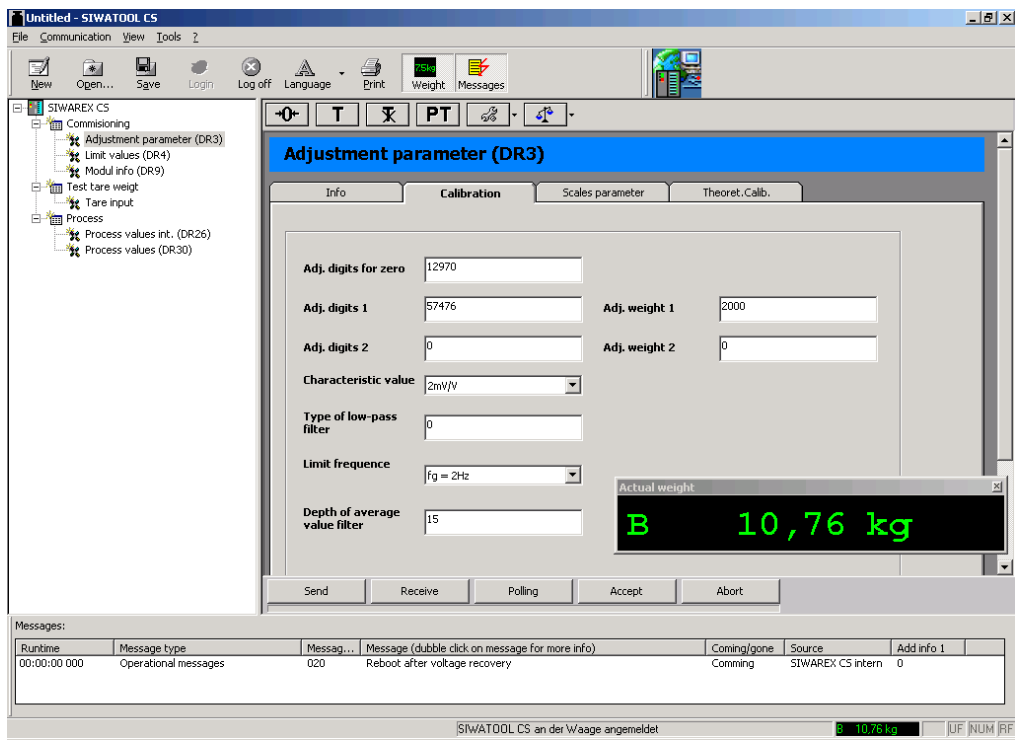


Figure 3-4 SIWATool CS Overview

SIWATool CS does more than support you in adjusting the scale. It is very useful to analyze the diagnostic buffer, the contents of which can be saved along with the parameters after reading from the module.

In the program, you can choose between several languages.

4 Hardware Configuration and Assembly



Warning Notes

For configuration, assembly and commissioning, the definitions from the manual for the ET 200S decentralized peripheral system are applicable. This chapter provides you with additional information for hardware configuration and assembly, and for preparing the SIWAREX CS for operation.

The technical safety information is to be strictly adhered to.



Warning

Unqualified intervention in the device/system or not adhering to the warning notices can result in serious injury or damage to equipment. Only qualified personnel are permitted to access the operational components of this device / system.



Warning

The unit has been developed, manufactured, tested and documented in accordance with the corresponding safety standards. The device itself will not cause any danger to equipment or personal health under normal circumstances.



Danger

Commissioning is not permitted until it is guaranteed that the machine in which these components are to be integrated meets with the guidelines in 89/392/EC.

4.1 Configuring the Hardware in SIMATIC

SIWAREX CS is a function module (FM) in the ET 200S decentralized peripheral automation system. It can be plugged into terminal modules that are designed for double width function modules (see chapter [11 Accessories](#)).

When estimating the maximum number of SIWAREX CS units that can be integrated into one head system, the following information may be helpful.

Number of SIWAREX CS modules = n

Total width	RAM requirements in SIMATIC CPU
n x 30 mm	3750 bytes + n x 312 bytes For CPU and HF head module
n x 30 mm	1800 bytes + n x 88 bytes For basic and standard head

Table 4-1 Requirements for n SIWAREX CS modules

Each SIWAREX CS requires 8 bytes from the peripheral range of the head module. This information and the manual for the ET 200S decentralized peripheral system can be used to determine the maximum expansion. Depending on the head station, the maximum expansion for SIWAREX CS can be between 11 and 30 SIWAREX CS modules per head station.

Selecting the appropriate ET 200S head station, the SIMATIC CPU and the SIMATIC HMI (Human Machine Interface) is not based exclusively on the SIWAREX CS requirements but also on the overall task that the automation system has to perform.

4.2 Structure to EMC Guidelines

SIWAREX CS is a high precision measuring instrument, which must be able to reliably measure tiny signals (approx. 1 µV). For this reason, proper assembly and wiring are absolutely essential for fault-free operation.

4.2.1 Definition: EMC

EMC (Electromagnetic Compatibility) describes the ability of an electrical device to function without faults in a defined electromagnetic environment without being influenced by its surroundings and without negatively influencing the surroundings.

4.2.2 Introduction

Although SIWAREX CS was developed for use in industrial environments and meets high EMC specifications, you should carry out EMC planning before

installing your controller to determine and take into account any possible interference sources.

4.2.3 Possible Effects of Interference

Electromagnetic interference can influence the automation system and the SIWAREX CS in various ways:

- Electromagnetic fields that have a direct influence on the system
- Interference that infiltrates the environment through bus signals (PROFIBUS DP etc.)
- Interference through process cabling (e.g. measurement lines)
- Interference infiltrating the system through the power supply and/or protective ground

Interference can impair the fault-free functioning of the SIWAREX CS.

4.2.4 Coupling Mechanisms

Depending on the means of distribution (conductive or non-conductive bound) and the distance between the interference source and the device, interference can be introduced into the automation system through four different coupling mechanisms.

Galvanic coupling

Capacitive coupling

Inductive coupling

Radiation coupling

4.2.5 Five Basic Rules for Guaranteeing EMC

If you follow these five basic rules, EMC can reach the demands in most cases!

Rule 1: Large surface area grounding connection

Ensure that while installing the automation devices, a well-made large surface area ground connection is made between the inactive metal components (see following sections).

Connect all inactive metal components and low-impedance components with ground (broad cross-section).

Use screwed connections on painted or anodized metal surfaces either with special contact washers or remove the insulated protective surface at the contact points.

Do not use aluminum components for ground connections if at all possible. Aluminum oxidizes easily and is therefore less suitable for grounding connections.

Find a central location for connections between the grounding point and the ground wiring system.

Rule 2: Proper wiring

Separate the cabling into groups (high-voltage lines, power supply lines, signal lines, ground wiring, data lines etc.).

Run the high-voltage lines and ground wiring or data cables in separate channels or bundles.

Run measurement lines as close to grounding surfaces as possible (e.g. support beams, metal rails, cabinet panels).

Rule 3: Fixed cable shielding

Ensure that the cable shielding is connected properly.

Use shielded data lines only. The shielding must be connected to ground using a large surface area at both ends of the data lines.

The shielding of measurement lines must also be connected to ground at both ends.

The shielding should continue right up to the terminal connection. Unshielded cable ends should be kept as short as possible. Run cable shielding directly under the SIWAREX CS in the shielding channeling. The connection between the shielding rail and the cabinet/housing must be low impedance.

Use metallic or metal-plated connector housings for the shielded data lines.

Rule 4: Special EMC measures

All inductivity that is to be controlled should be connected with suppressors.

Use interference suppressed fluorescent lighting or incandescent lamps for illuminating cabinets or housings in the immediate vicinity of your controller.

Rule 5: Uniform reference potential

Create a uniform reference potential and ground all electrical operational elements.

If potential differences arise or can be expected between components of your system, install adequately dimensioned potential equalizing lines. For applications in areas with a risk of explosion, potential equalization is mandatory.

4.3 Assembly

When assembling the SIMATIC components and the SIWAREX CS, the installation, assembly and wiring guidelines for the SIMATIC ET 200S must be followed (see manual for ET 200S decentralized peripheral system).

This manual describes supplementary aspects of assembly and wiring that are specific to the SIWAREX CS.

4.4 Connection and Wiring

4.4.1 Connection Areas for SIWAREX CS

All external connections run via the terminal block.

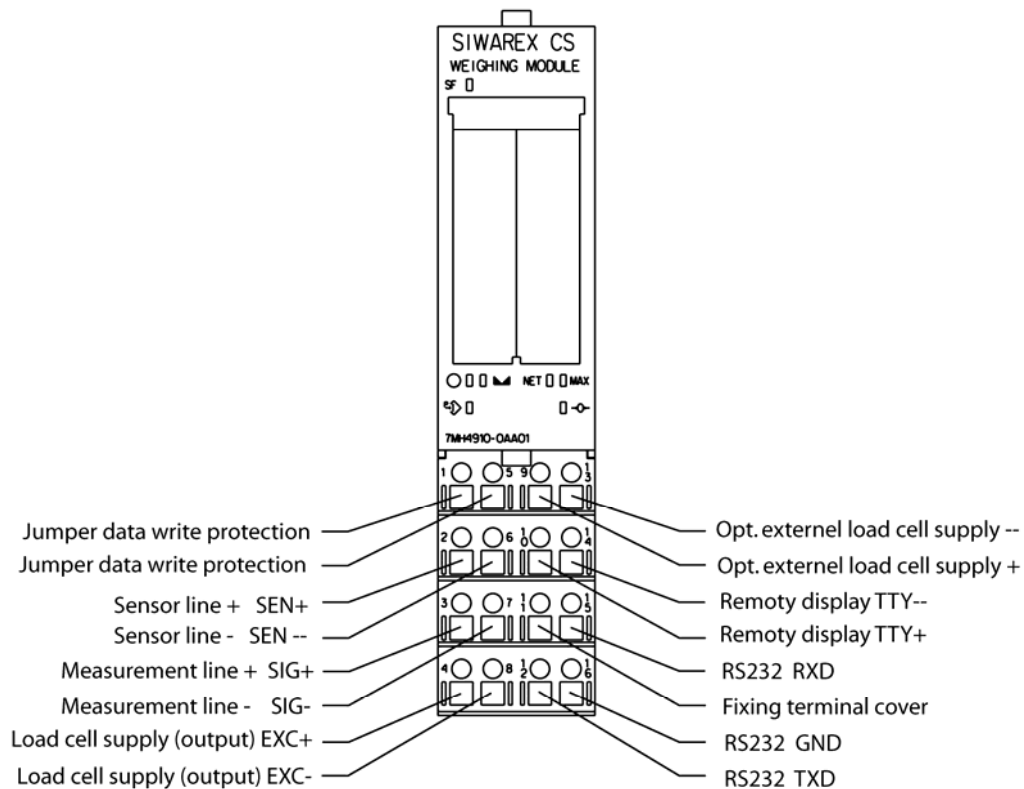


Figure 4-1 SIWAREX CS Connection Areas

4.4.2 Shielding connection

Special attention must be given to the shield strip for the shielded lines. Only correct installation guarantees that the system will be immune to interference. A wire is shielded to lessen the effect of magnetic, electrical and electromagnetic interference on it. Interference on cable shielding is routed to ground through shielding rails that are conductively connected with the housing. To ensure that this interference does not become a source of interference, a low impedance connection to ground is especially important.

Use only wires with braided shielding (see recommended cable types in chapter [11 Accessories](#)). Shielding should provide at least 80% coverage.

To fasten the braided shielding, use only the proper metal cable clamps. The clamps must cover as much shielding as possible and ensure a good contact. Shield clamps must be ordered separately from the grounding elements. Approximately 1.5 cm of the cable insulation must be exposed in the area of the cable to be fastened to the shielding clamp. The exposed shielding is then pressed firmly against the grounding element with the shielding clamp. The insulated cable shielding can then continue up to the terminal connection.

The following figure shows the assembly of the shield clamps.

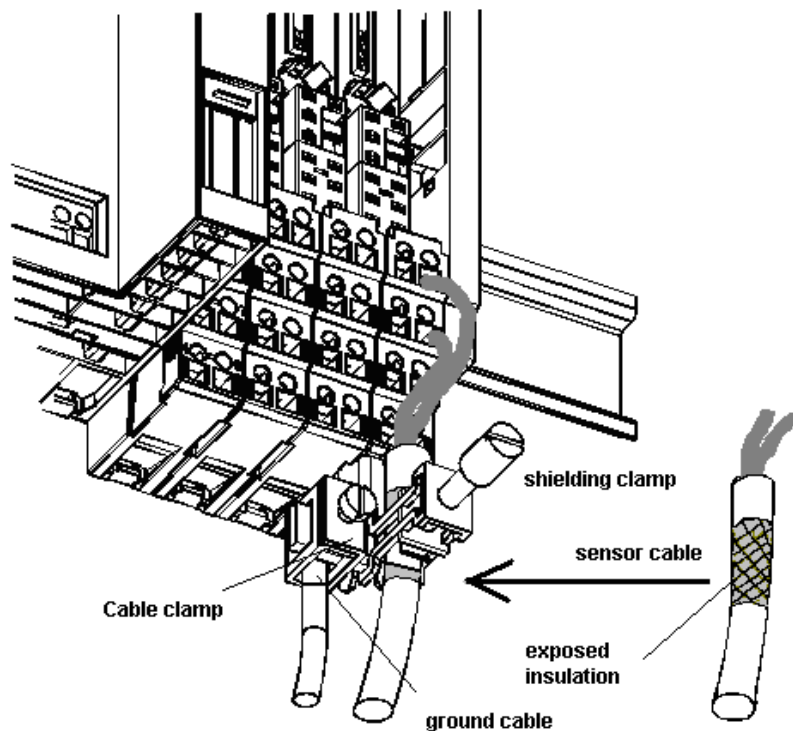


Figure 4-2 Assembly of Shield Clamps

The shielding should be pressed against the shielding rail by the screw in the shielding clamp.

12 Technical Data

12.1 Power Supply 24 V

An isolated function low voltage (in accordance with EN60204-1) is to be ensured by the system power supply.

Rated voltage	DC 24 V feed from PM-E power module
Static upper / lower limits	DC 20.4 V/28.8V
Dynamic upper / lower limits	DC 18.5 V/30.2 V
Non-periodic over-voltages	DC 35 V for 500 msec with a recovery time of 50 sec.
Max. current consumption	150 mA
Typical module power loss	5 W

Table 12-1 Data: Power Supply 24 V

12.2 Power Supply from ET 200S Backplane Bus

Power consumption from ET 200S backplane bus	Typical < 10 mA
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Table 12-2 Data: Power Supply from ET 200S Backplane Bus

12.3 Load Cell Connection

EU type certification as non-automatic weighing instrument, class III	2000 d (pi = 0.4)
Precision with Ex-i interface	2000 d (pi = 0.4)
Error limit conforming to DIN1319-1 from measurement range end value at 20 °C ± 10 K	≤ 0.05 %
Refresh rate internal / external	50 Hz
Internal resolution	65,535 parts
3 measuring ranges	0 to 1 mV/V 0 to 2 mV/V 0 to 4 mV/V
Max. distance to load cell (calibration)	1000 m (500 m)**
Max. distance between load cell and Ex-I interface in Ex area	150/500 m for gas group IIC 1000 m for gas group IIB (see SIWAREX IS device manual)
Lowest permitted input signal for a calibration value in calibrating operation	≥ 1.5 μ V/e
Load cell power	
Voltage	Typical DC 6 V *
Maximum current	68 mA
Permitted load cell resistance without Ex-I interface with feed from SIWAREX CS	> 87 Ω < 4010 Ω
Permitted load cell resistance with Ex-i-Interface	> 87 Ω < 4010 Ω

Technical Data

Permitted load cell resistance without Ex-I interface with external feed (24V isolated) via terminals 9 and 13	> 40 Ω < 4010 Ω
Monitor for sensor inputs	Typical ≥ 5.4 V Hysteresis 0.2 V
Response time for sensor line monitor	≤ 1 s
Common mode rejection CMRR @50 Hz	Typical 120 dB
Low pass filter limit frequency	0.05...5 Hz
Measured value filtering for average value filter	2...255 values (20 ms)
Isolation	500 V (DC)

* Values apply to module output

**When using recommended cables (accessories)

Table 12-3 Data: Load Cell Connection

12.4 RS 232C Interface

Baud rate	9600 baud
Data bits	8
Parity	Even
Stop bits	1
Max. distance	15 m
Signal level	Conforms to EIA-RS232C
Isolation	500 V (DC)

Table 12-4 Data: RS 232C Interface

12.5 TTY Interface

Operating mode	Passive and unidirectional, i.e. transmitter only (TxD)
Baud rate	9600 baud
Data bits	8
Parity	Even
Stop bits	1
Max. line length (@ 20 mA)	125 m
Isolation	500 V (DC)
Transmitter voltage drop	< 2 V
Max. loop current	25 mA

Table 12-5 Data: TTY Interface

12.6 Dimensions and Weight

Dimensions W x H x D	30 x 80 x 50 mm
Weight	75 g

Table 12-6 Data: Dimensions and Weight

12.7 Ambient Conditions

The SIWAREX CS is designed to be used in SIMATIC ET 200S systems under the following conditions.

Usage conditions in accordance with IEC 60721:

Operation: IEC60721-3-3
Stationary use, weatherproof
Class 3M3, 3K3

Storage/Transport: IEC 60721-3-2
Transport packaged, no condensation
Class 2M2, 2K4

For use in extreme operating conditions (e.g. heavy dust, acidic moisture or gasses etc.), additional measures are to be taken such as B. Encapsulation.

Table 12-7 Data: Ambient Conditions

12.8 Mechanical Requirements and Data

Testing	Standards	Test values
Vibration In operation	IEC 60068-2-6	<u>Testing Fc</u> 10 ... 58 Hz: 0.075 mm movement 58 ... 150 Hz: 9.8 m/s ² 10 cycles per axis 1 octave / min.
Shock in operation	IEC 60068-2-27	<u>Test Ea</u> 150 m/s ² , Half sinus Duration: 11 ms Number: 3 per axis each in neg. and pos. direction
Vibration during transport	IEC 60068-2-6	<u>Testing Fc</u> 5 ... 9 Hz: 3.5 mm movement 9 ... 500 Hz: 9.8 m/s ² 10 cycles per axis 1 octave / min.
Shock during transport	IEC 60068-2-29	<u>Testing Eb</u> 250 m/s ² , Half sinus Duration: 6 ms Number: 1000 per axis each
Free fall	IEC 68000-2-32	<u>Testing Ed</u> Height of fall 1m

Table 12-8 Data: Mechanical Requirements