SIEMENS

SIWAREX M

Weighing Electronics

Equipment Manual

Release 06/2005

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Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

Danger

indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage **can** result if proper precautions are not taken.

Caution

No warning triangle means that property damage may occur if proper precautions are not taken.

Notice

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Technical data subject to change.

Preface

Purpose

This manual is part of the documentation for the SIWAREX M weighing module.

Users will find all information needed to handle the SIWAREX M.

Installation and **commissioning personnel** will find all information needed to install and commission the SIWAREX M.

Complete documentation package

The complete documentation package includes the following manuals.

- SIWAREX M Equipment Manual
- Catalog

Hardware and software prerepuisites for this manual

- SIWAREX M, firmware version 0122 and later
- SIMATIC S7/C7 configuration package
  (order no. 7MH4 583-**3**FA64)

The operation of SIWAREX M with SIMATIC S5 is not any longer supported in accordance with product run-off plan for SIMATIC S5.

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System Overview

1

This section gives you an overview of the functions of the SIWAREX M weighing module and a description of its integration into the system.

1.1 Introduction

Just what is the SIWAREX M?

The SIWAREX M is a weighing module appropriate for verification. It permits complete integration of weighing and proportioning functions in the SIMATIC.

The basic system is the SIMATIC S7-300.

Standard components

Since the SIWAREX M can be expanded as desired using standard components from the SIMATIC, SIMATIC HMI and SIMATIC NET series it provides you with an optimal hardware and software environment in which to implement customized solutions.

The SIWAREX M handles the execution of weighing functions and the time-critical control of proportioning elements for proportioning scales within a complete weighing system. The SIWAREX M can also be connected decentrally to a SIMATIC PCS 7 via the ET 200M modular I/O system.

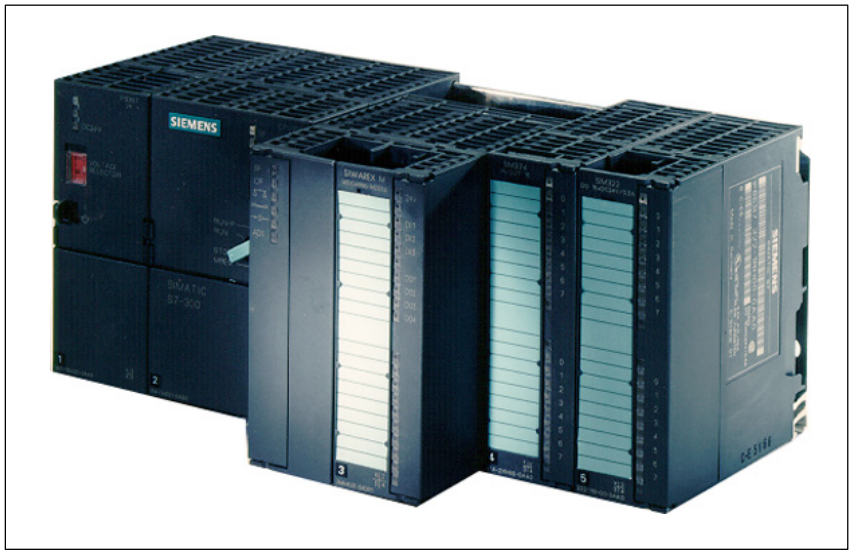


Figure 1-1 SIWAREX M with the SIMATIC S7-300

What can the SIWAREX M do?

The SIWAREX M handles the execution of all weighing functions in a processing application.

Time-critical control of proportioning elements for proportioning scales is also handled directly by the SIWAREX M. Since the SIWAREX M is not dependent on the cycle time of the programmable controller, proportioning valves can be shut off precisely to achieve an optimum in proportioning precision.

The SIWAREX M can be used for applications under obligation of verification (commercial scales) as well as for potentially explosive areas (i.e., zones 1 and 2). An optional Ex-i interface ensures intrinsically safe supply of power to the load cells.

Additional features:

- S7-300 standard construction, connection technology and design
- Fill level and single-component proportioning scales with EC qualification approval for applications under obligation of verification (class III, 6000 d, commercial scales)
- High degree of measuring precision (0.01%) with a measuring value resolution of up to ±524,000 parts
- CE, UL, CSA, FM and ISO 9001 certification
- Use in the S7-300 (direct integration as FM)
- Connection to SIMATIC S7/PCS 7 via ET 200M modular I/O systems
- 2 serial interfaces for connection of a verifiable printer, a verifiable memory and a verifiable remote display/PC or host
- 4 digital outputs, 3 digital inputs, 1 analog output
- Choice of parameterization methods:
  - "SIWATOOL" parameter assignment software on PC under MS-WINDOWS; direct transmission to the RS 232 interface of the SIWAREX M
  - Data block presetting entry in STEP 5/7; transmission of the data block from the S7 CPU to SIWAREX M
- Load cell interface
  - Short circuit and overload-proof power supply of the load cell (max. of 180 mA)
  - Detection of wire breaks on sensor, supply and measuring lines
  - Load cell adjustment via software
  - Intrinsically safe power supply of the load cell (option)
- SIWAREX M can be replaced without having to adjust the scales again.
- Operator control and monitoring via SIMATIC HMI
- Data buffering during power failure
- Write protection for adjustment data via calibration switch

System integration of the SIWAREX M into the SIMATIC

Integration of the SIWAREX M into the SIMATIC provides a freely programmable weighing system with which even complex tasks (e.g., multi-component scales and multi-scale systems) can be implemented easily.

Central integration into the S7-300

The SIWAREX M is snapped directly onto the SIMATIC S7 bus as a function module. This direct integration of the SIWAREX M into the SIMATIC S7-300 permits optimal utilization of all functions of the SIMATIC S7-300 programmable controller.

Hardware and software flexibility permits the implementation of a wide variety of applications (e.g., in the chemicals industry and foodstuffs industry). The complete family of SIMATIC S7-300 modules is available as the hardware platform. Easy operator control and monitoring is available e.g. with the SIMATIC HMI operator panels.

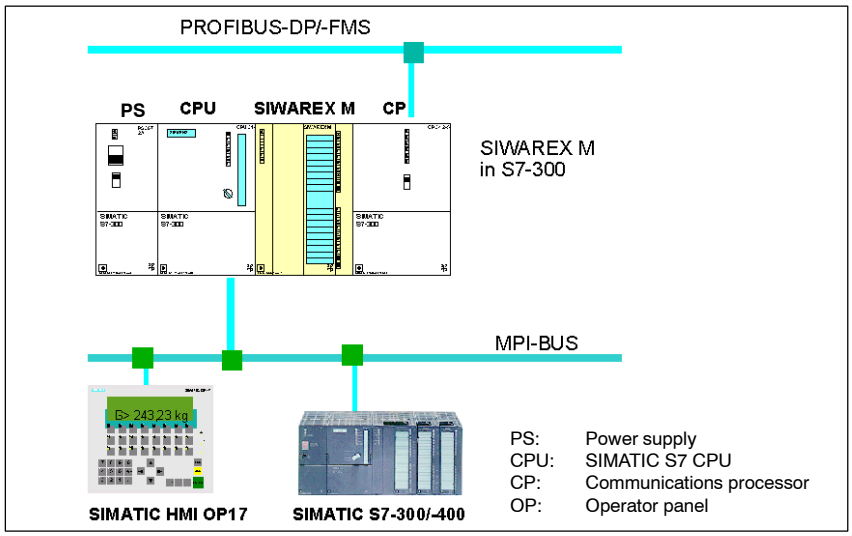


Figure 1-2 SIWAREX M in the SIMATIC S7-300

Multiple-line setup with the SIMATIC S7

Starting with CPU 314, a multiple-line setup can be used with the SIMATIC S7-300. The multiple-line setup requires the IM 360/IM 361 or IM 365 (starting with version 2) interface modules.

Multiple-line setup with the SIMATIC C7

The IM 621 interface can be used to connect SIWAREX M to the SIMATIC C7-621. The IM 361 interface is used to connect SIWAREX M to the SIMATIC C7-623/624/626. IM 360 has already been integrated in the SIMATIC C7-623/624/626.

Distributed integration in the S7/C7

Since the SIWAREX M can be connected to the PROFIBUS-DP via the ET 200M modular I/O system (IM 153-1 or IM 153-2 interface), the SIWAREX M can be linked as distributed periphery to the SIMATIC S7-300, SIMATIC S7-400, SIMATIC S7-400H, SIMATIC C7 or SIMATIC PCS 7.

Transmission distances of up to 23 km are permitted. The IM 153-2 is only necessary when required by other modules (e.g., FM 353).

Maximum number of SIWAREX M units per IM 153-1 or IM 153-2 interface

- For distributed connection to SIMATIC S7 → Max. of 7 SIWAREX Ms
  (Exception: Max. of 8 SIWAREX Ms with CPU 318-2 DP, CPU 417-4 DP, IM 467 and CPU 443-5 Ext.)
- With active backplane bus → Max. of 4 SIWAREX Ms

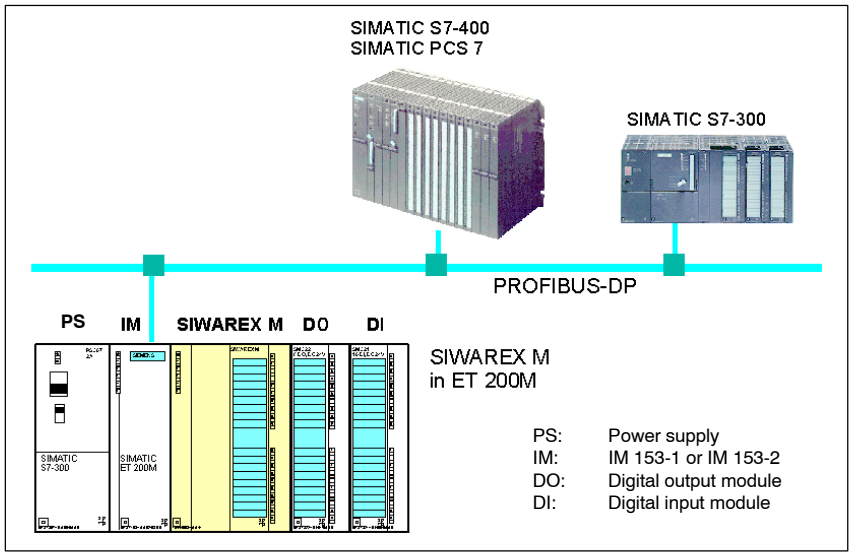


Figure 1-3 The SIWAREX M as distributed periphery in the SIMATIC S7

When the SIWAREX M is connected decentrally to a SIMATIC S7-300/400, SIMATIC C7 or SIMATIC PCS 7, an CPU with PROFIBUS-DP interface, a CP 443-5 (from version 2) or an IM 467 for connection to PROFIBUS is required. The version (status 4/99) of the CP 342-5 cannot be used for the bus connection.

Distributed integration in SIMATIC PCS 7

While the SIWAREX M is usually integrated in SIMATIC S7 programmable controllers with the typical PLC programming languages STL (statement list), LAD (ladder diagram) or FBD (function block diagram), integration in the SIMATIC PCS 7 process control system is performed via graphic configuration in the CFC (continuous function chart). In other words, integration is structured instead of programmed.

The SIWAREX M modules are represented in the engineering system (ES) with technology blocks in the CFC chart. In contrast, the SIWAREX M modules are represented on the operator station (OS) as faceplates (i.e., screen blocks).

The faceplates can be used to monitor the weight values and control the SIWAREX M modules.

A separate configuration package is available for the SIMATIC PCS 7 process control system which contains a block for the CFC chart, a faceplate for the OS and the documentation.

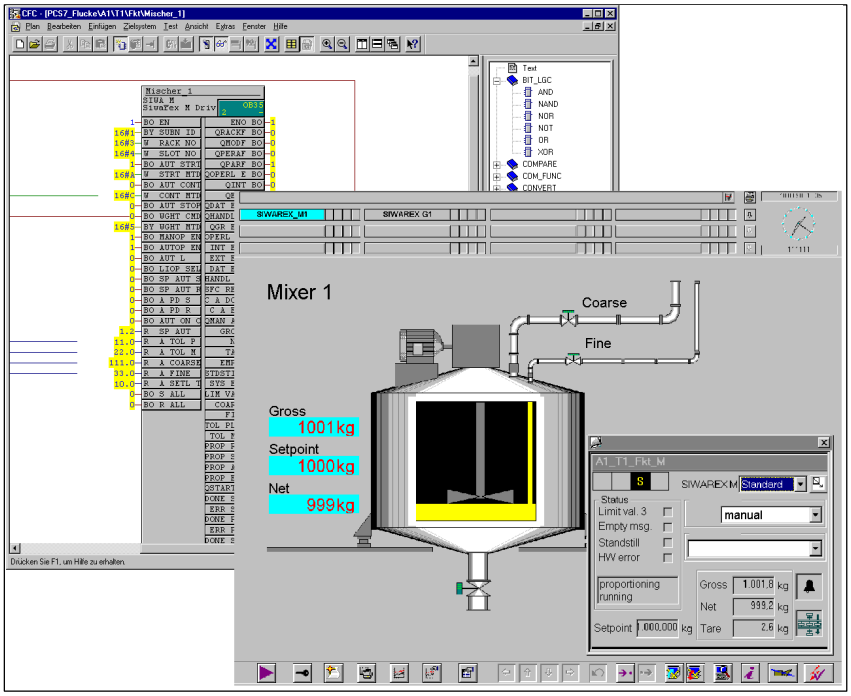


Figure 1-4 Representation of the SIWAREX M in the ES engineering system (left) and on the OS operator station (right)

Integration of the SIWAREX M independent of the controller

The many functions of the SIWAREX M (e.g., an analog output for analog indicators or process recorders, DI/DO for weighing functions, and serial interfaces for printer and remote display with operator control) also permit it to be used as a field device independent of the controller.

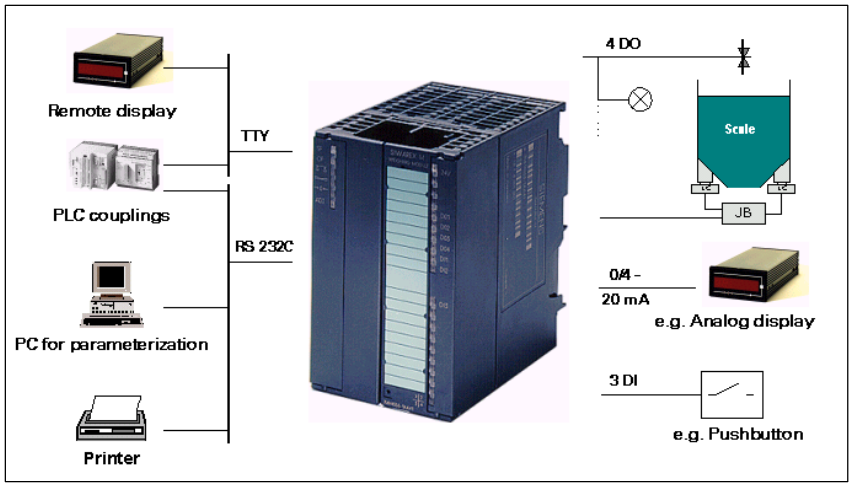


Figure 1-5 The SIWAREX M as a controller-independent field device

Periphery

In addition to the bus interface for the SIMATIC and two serial interfaces (TTY and RS 232C), the SIWAREX M is equipped with 4 digital outputs, 3 digital inputs and 1 analog output.

The functions to be handled by the inputs and outputs can be specified by parameterization as required by your specific applications.

Using STEP 7 or SIWATOOL (a WINDOWS parameter assignment program), you can optimize parameter specifications for weighing applications.

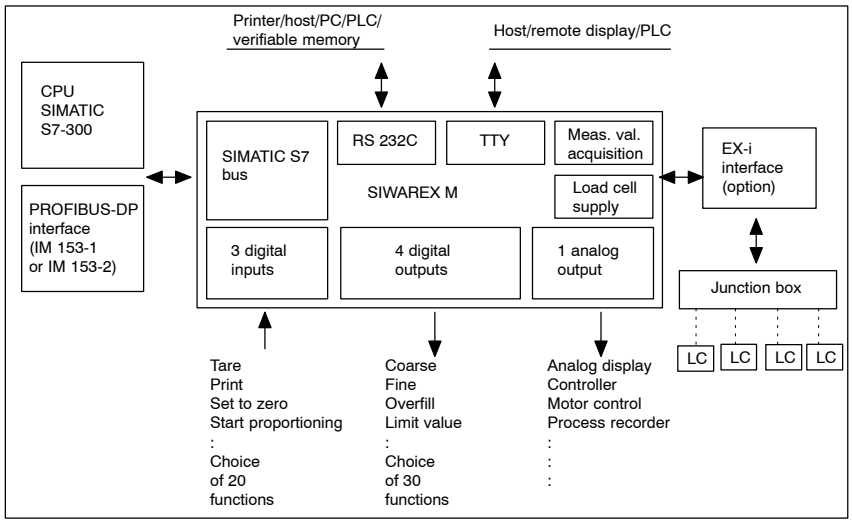


Figure 1-6 Diagram of the SIWAREX M setup

1.2 Setup and Components of a Weighing Machine

A complete industrial weighing machine (scales) consists of the following primary components.

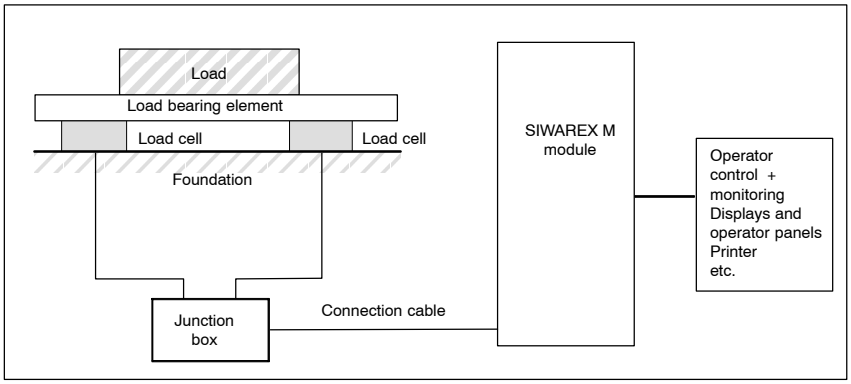


Figure 1-7 Setup of the weighing system with a SIWAREX M

Load bearing implement

Load bearing implements are used to hold the load to be weighed. Examples include platforms, hoppers, trolleys, containers and so on.

Load cell

Load cells are measuring sensors which convert a physical value (i.e., weight) into a proportionate electrical signal.

Built-in elements

Built-in elements ensure that the load cells function correctly. Built-in and guide elements prevent faulty loading which can cause measuring errors and damage to the load cells. Faulty loading is caused by forces (e.g., lateral forces) for which the direction of action of the load cell springs is not designed.

Junction box

The junction box is used to add together the load cell signals from several load cells switched in parallel.

SIWAREX M

The SIWAREX M module is used as an electronic evaluation device which acquires and further evaluates the signal coming from the load cell.

1.3 Weighing Functions

SIWAREX M offers the following functions.

- Setting to zero
- Taring
- Automatic zero point offset
- Scales standstill message
- Limit values (min/max/empty/overfilled)
- Proportioning valve control (coarse/fine)
- Tolerance monitoring of the proportioning process
- Automatic reproportioning
- Automatic proportioning optimization (switchoff value “fine”)
- Proportioning monitoring (monitoring of material flow and time)
- Inching mode

These functions support fill level scales, single-component scales, and multi-component scales.

1.4 Fill Level Scales

Fill level scales

Fill level scales are used to acquire the fill level of hoppers, tanks and other containers. The SIWAREX M offers weighing functions such as gross/net weight calculation, setting to zero, taring, limit value monitoring, scales stand-still check and printing. These basic weighing functions can also be used to implement other types of scales such as platform scales, crane scales, vehicle scales, etc.

1.5 Single-Component Scales

Single-component scales for fill weighing

The SIWAREX M provides the functions required by single-component scales. These functions include coarse/fine flow proportioning, tolerance check and finished message. Material feed is controlled for fill weighing. Special supplementary functions (e.g., automatic reproportioning when tolerances are underranged, inching mode, and automatic correction of the fine flow switchoff value) are also included in the module.

Single-component scales for deduction weighing

In principle, the functions of a single-component weighing machine for deduction weighing are the same as those for fill weighing. The only difference is that material removal is controlled and not material addition (sign reversal for net weight calculation).

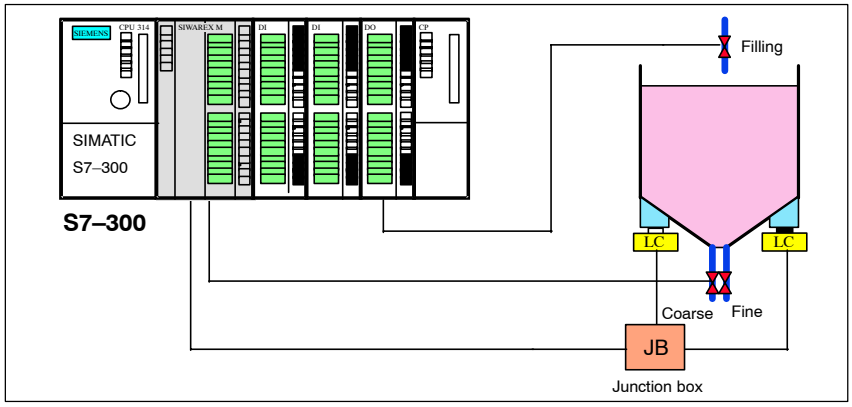


Figure 1-8 Single-component scales

1.6 Multi-Component Scales

Principle of function

Multi-component scales are used to make mixtures based on preset recipes and can be set up from standard components (e.g., SIWAREX M, SIMATIC digital input/output modules, and so on).

The SIWAREX M handles the function of a multiplexed single-component weighing system within a multi-component weighing system (i.e., during proportioning, the SIWAREX M performs the setpoint-actual value comparison and controls proportioning independently of the cycle time of the automation system. The coarse and fine flow signal on the digital outputs of the SIWAREX M is available for controlling the proportioning devices. Two digital outputs are sufficient since, with a multiple-component weighing system, these are switched through to the applicable bin (see figure) via the root of a floating digital output module of the SIMATIC (e.g., relay module). This permits almost any number of supply bins to be addressed.

Note

If the nominal current (0.5 A) and the total current (1 A) of the digital outputs of the SIWAREX M are not exceeded, a SIMATIC relay output module can be used to switch through the coarse and fine flow signals to the individual bins. If the nominal current or the total current is exceeded, a coupling relay must be used in addition to the SIMATIC relay output module.

Recipe sequence control on the CPU or a host control system gives the SIWAREX M the material-related proportioning data (e.g., setpoint, coarse and fine flow switch-off value, tolerance limits, and so on) for each individual component.

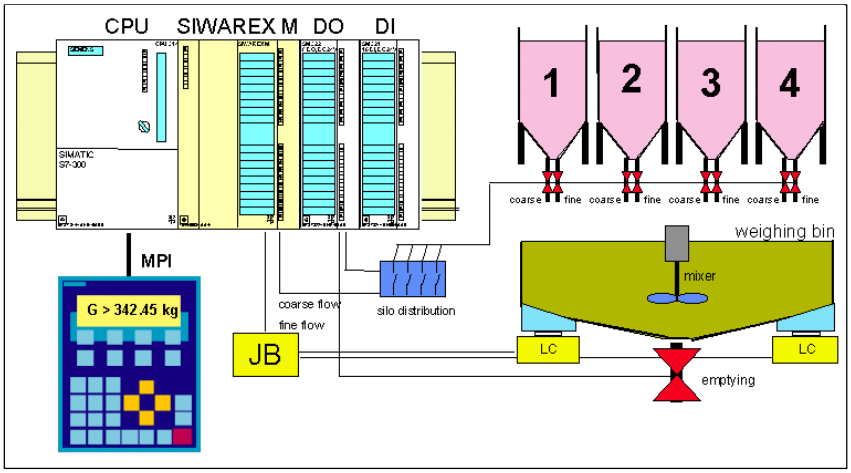


Figure 1-9 Multi-component scales based on SIWAREX M + SIMATIC

Depending on the components to be proportioned (e.g., component 1), a digital output module of the SIMATIC now switches through the signal path of the coarse and fine flow signal to bin 1. The scales are then tared, and proportioning is started. After conclusion of proportioning, the process is repeated for all other components.

Standard packages for multi-component scales

Depending on the requirements, various standard packages are available for implementation of multi-component scales (e.g., Batch *flexible* for high-end performance range or SIWAREX Batch for low-end and medium performance range).

Recipe control with SIWAREX Batch (optional package)

The SIWAREX Batch option package supports use of the SIWAREX M as proportioning scales. It can be run on programmable controllers SIMATIC S7-300 and SIMATIC S7-400. A configuration on ProTool which can be adapted to the specific application is standardly made available for operator control and monitoring with SIMATIC HMI operator panel OP27. Using an open interface, other operator panels (e.g., OP37) or the WinCC visualization system can also be integrated.

Since SIWAREX Batch can be scaled, it can be adapted to the particular requirements. The number of production lines and scales in the system can be defined by the user as well as the numbers of recipes and components.

The SIWAREX Batch software package contains all necessary standard functions which are required regardless of sector. SIWAREX Batch is designed so that application-specific expansions and supplements can be easily added via defined interfaces which are open for the user (e.g., accepting recipes from a host control system).

SIWAREX Batch consists of a kernel for batch control and several subprograms for functions such as weighing, mixing, emptying and so on.

SIWAREX Batch can be used for several production lines at the same time. This permits proportioning procedures to be run simultaneously on several scales.

1.7 Scales for Potentially Explosive Areas

Scales for potentially explosive areas, zones 1 and 2

Connection of load cells located in potentially explosive areas requires an intermediate box (type SIWAREX IS) which is circuited between the SIWAREX weighing module and the load cell (special model for the Ex area) or the junction box (JB).

Since the intermediate box contains an Ex-i interface, it must be located outside the potentially explosive area.

Process I/O in the Ex area

Appropriate SIMATIC modules are available for digital or analog inputs/outputs in the potentially explosive area.

Ex modules are used in the automation of chemical plants and are suitable for applications in measuring, and open-loop and closed-loop control technology. The primary task of the Ex modules is to separate the intrinsically safe electrical circuits of the potentially explosive area and the non-intrinsically safe, internal electrical circuits of the programmable controller.

If the digital inputs/outputs of the SIWAREX M are to be installed in the Ex area, conventional explosion-proof circuit breakers (24 V) can be used.

Remote displays in the Ex area

Remote displays with an analog interface can be used, for example, as remote displays for the Ex area. These remote displays are connected via an explosion-proof circuit breaker to the analog output of the SIWAREX M or via an intrinsically safe analog output of the SIMATIC. Another choice is to use pressure encapsulated remote displays.

Controlling and monitoring in the Ex area

Special intrinsically safe operator panels are available from various manufacturers for use in the potentially explosive areas of zones 1 and 2. These operator panels can be connected to the SIMATIC S7 via the MPI interface of the S7 CPU or via an additive communications processor (CP), for example.

Pressure encapsulated operator panels (SIMATIC HMI) can also be used instead of intrinsically safe devices.

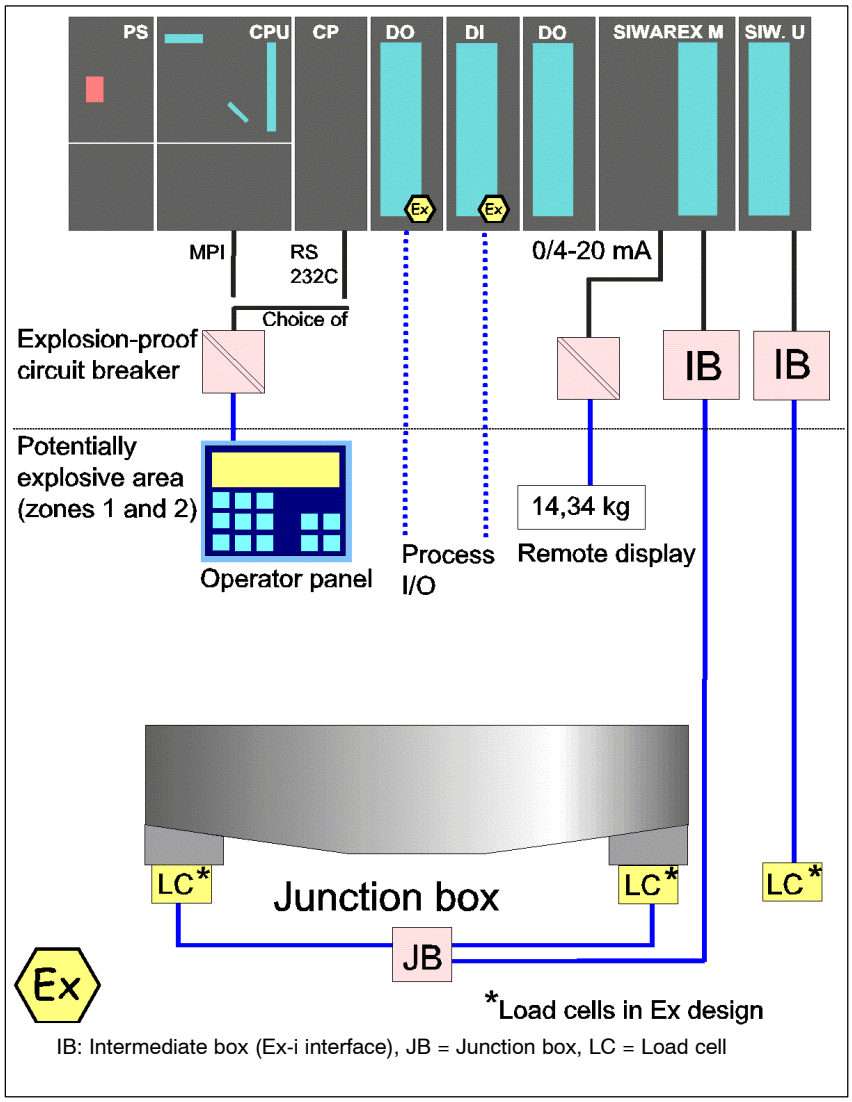


Figure 1-10 Scales for potentially explosive area

1.8 Other Types of Scales

Other types of scales

By using standard components of the SIMATIC, SIMATIC HMI and SIMATIC NET series, other types of scales can also be implemented. A few examples are listed below.

- Counting scales
- Check weighers
- Vehicle scales
- Filling scales
- Conveyor belt scales
- Loss in weight scales

Hardware Description and Commissioning 2

This section contains all information required for commissioning. Subjects include mounting, connection, assignment of parameters, and a description of the interfaces and indicator and setting elements.

General safety notes

Adherence to these safety notes is mandatory. Non-compliance will invalidate your warranty.

Warning

Persons who are not qualified should not be allowed to handle this equipment/system. Non-compliance with warnings appearing on the equipment itself or on the system cabinet can result in severe personal injury or substantial property damage. Only qualified personnel should be allowed to work on this equipment/system.

Note

This product has been developed, manufactured, tested and documented in accordance with relevant safety standards. Under normal conditions, this product will not be a source of danger to property or life.

Caution

Commissioning is prohibited until it has been determined that the machine in which these components are to be installed meets the requirements of the 89/392/EC guidelines.

Warning

The following rules must be complied with to ensure that the requirements contained in EU guidelines 89/336/EC are complied with.

- The setup guidelines and safety notes in the applicable manuals and supplementary documentation must be adhered to for both the automation system and the SIWAREX M.
- All signal lines to the SIWAREX M must be shielded and applied to a grounded shield retainer rail (see section 2.2).
- Sub D plug connectors with shield braiding and plug connector hood with shielding must be used.

2.1 Installing the SIWAREX M

Preparations

Before beginning actual, physical installation, relevant safety precautions must be taken and the following points adhered to or clarified.

- Was the module still in its original packaging ?
- Check the shipment for transportation damages.
- Check the shipment for completeness.

Slot

The S7 interface of the SIWAREX M corresponds to the I/O bus (P bus) of the SIMATIC S7-300.

All slots of the SIMATIC S7-300 which can be used by function modules (FM) can also be used for the SIWAREX M.

For additional information, see the SIMATIC S7-300 manual.

The maximum number of SIWAREX M modules which can be installed in the SIMATIC depends on the following factors.

- Maximum number of modules in the central/expansion rack (CR/ER) or modular ET 200M I/O device
- Storage requirements on the S7-/C7-CPU
- Maximum permissible current consumption (5 V) from the S7 backplane bus

2.1.1 Settings

(BASP/OD) = Disable command output/output disable)

Setting elements

A quadruple **DIP** switch on the back of the housing is used as the **calibration switch**, and to switch off the **BASP/OD** function.

The settings on this DIP switch must be performed before installing the SIWAREX M since the switch can no longer be accessed after installation.

Warning

If the BASP function is switched off, you must provide other suitable measures to prevent outputs which are not switched off from endangering people or systems.

If the BASP function is not switched off, the digital and analog outputs are reset and a running proportioning procedure is stopped when the BASP signal is output by the SIMATIC CPU. See also chapter 3.18.

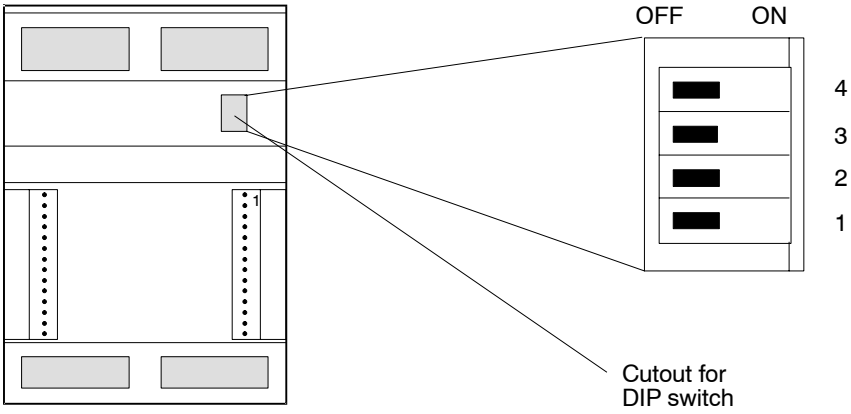


Figure 2-1 Back of the SIWAREX M

Table 2-1 Setting functions of the DIP switch

Switch	Description	Status on Delivery
1)	Switch must be set to OFF (service function).	OFF
2)	Download function – OFF = Operation mode – ON = Download mode (only for service purposes)	OFF
3)	**BASP/OD function:** Use in S7-300 or ET 200M: – OFF=BASP/OD active – ON=BASP/OD inactive Use without SIMATIC: – Always ON	OFF
4)	Switch activates write protection (only required for verified scales) Standard setting: OFF (i.e., write protection deactivated)	OFF

2.1.2 Mounting the Module on the Rail

Note

It is imperative to adhere to EMC guidelines when installing the cables (also those outside cabinets).

Do not place cables next to energy-technology cables, and shield the cables as described.

In most cases, two-sided shield application is recommended. However, if interference is primarily low-frequency, one-sided shield application may be more effective.

Adhere to the grounding concept of the SIMATIC S7-300 to avoid problems with the potential.

The setup guidelines of the SIMATIC S7 (see manual of the S7-300 programmable controller under setup and CPU data) must be adhered to for all mounting steps, and the following instructions must be performed in the order shown below.

A setup which does not conform to EMC guidelines will reduce measuring accuracy and, in extreme situations, cause ”internal error 04” or ”external error 02.”

Mounting steps

1. Switch off all voltages on the SIMATIC S7, ensure that it cannot be switched back on again, and mark accordingly.
2. Make or check protective conductor connection. (See setup guidelines.)
3. Mount shield connecting element.
   - The shield connecting element must be mounted on the rail directly under the slot in which the SIWAREX M is installed.
   - Each cable to be connected to the SIWAREX M requires a shield terminal on the shield rail of the shield connecting element (see section 2.2).
4. Insert bus connector. (See setup guidelines.)
   - A bus connector is supplied with each SIWAREX M. The bus connector must be inserted first on the module installed in the slot to the left of the SIWAREX M.
5. Hang SIWAREX M. (See setup guidelines.)
6. Screw down SIWAREX M. (See setup guidelines.)
7. Label SIWAREX M. (See setup guidelines.)

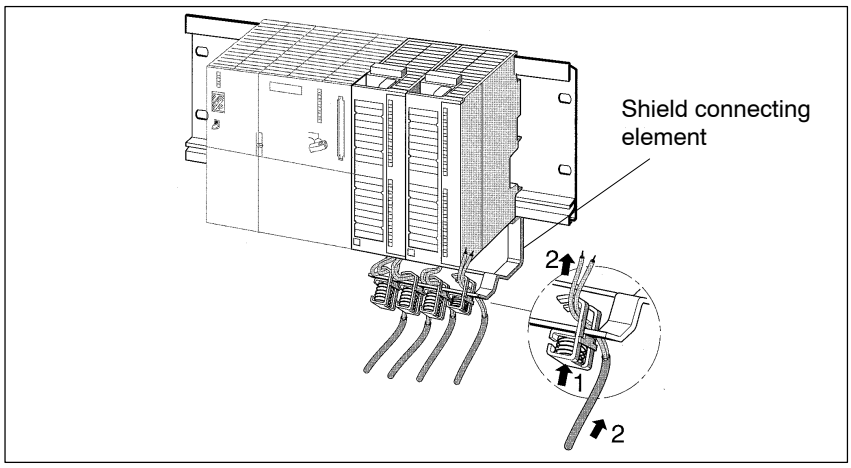


Figure 2-2 Shield connecting element

2.2 Connection and Wiring

Rules for wiring

Since the rules for wiring listed in the table below apply to SIMATIC S7-300 modules, they must also be used for the wiring of front connector X1 on the SIWAREX M.

Table 2-2 Rules for wiring

Rule for	Flexible Line	Flexible Line with Core End Sleeves
Max. line cross section	0.25 to 1.5 mm^2	0.25 to 1.5 mm^2
Number per connection	1	Max. of 2 (in one end sleeve)
Stripping length	6 mm	6 mm
Core end sleeves	-	Without insulation collar (short) DIN 46228
Turning moment	60-80 Ncm	60-80 Ncm

Non-flexible lines may not be used.

Shield terminals

Select the shield terminal size appropriate to the cable diameter.

Securing a cable with the shield terminal requires that approximately 1.5 cm of the cable insulation be cut away at the appropriate location so that the shield is bared.

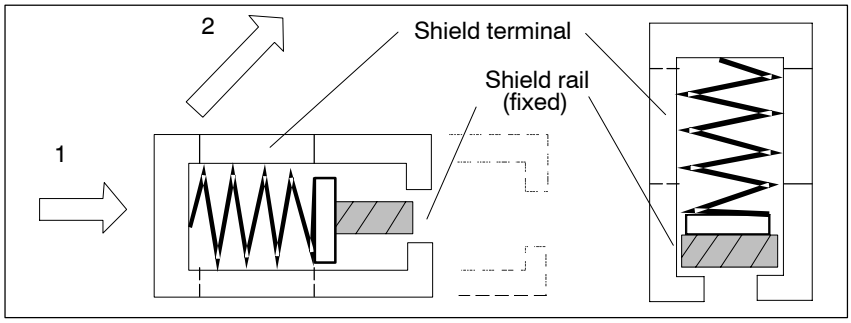


Figure 2-3 Mounting the shield terminals

Caution

Make sure that you do not damage the shield braiding when stripping the cable.

When applying shields to all cables connected to the SIWAREX M, make sure that there is enough cable between the shield connecting element and the SIWAREX M so that the SIWAREX M can be removed with all its cables still connected.

Indication and connection elements

The following figure shows all available indication and connection elements on the front of the SIWAREX M.

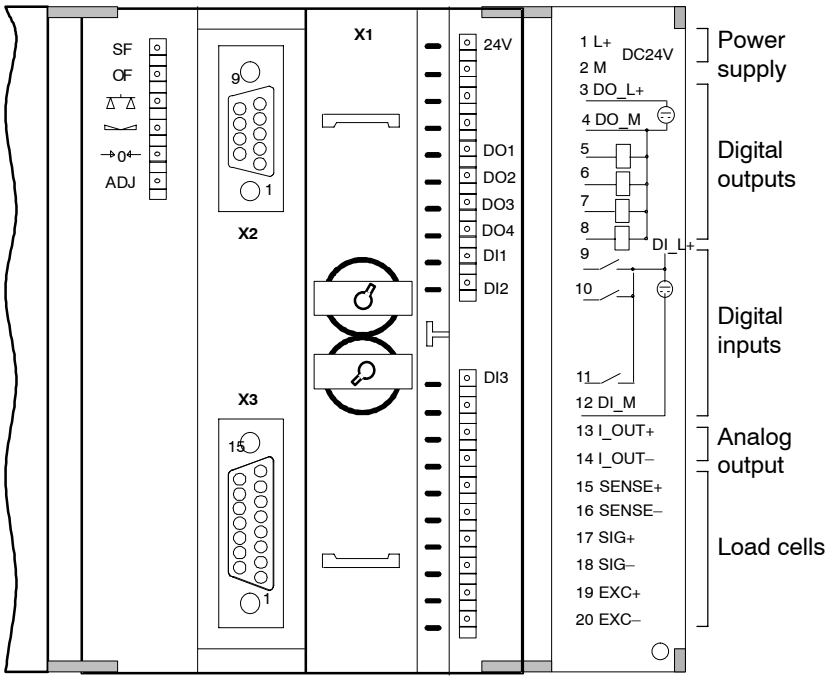


Figure 2-4 Connection elements on the front of the SIWAREX M

Indication elements

Table 2-3 Indication elements on the front of the SIWAREX M

Label	LED Color	Position	Explanation
SF	Red	LED 1 (to the left)	System fault
OF	Red	LED 2 (to the left)	Operation fault
△▽△	Green	LED 3 (to the left)	Scales calibrated
≥≤	Green	LED 4 (to the left)	Standstill
→ 0←	Green	LED 5 (to the left)	1/4d zero
ADJ	Green	LED 6 (to the left)	Scales adjusted
24 V	Green	LED 1 (to the right)	Power supply

Located on the right side of the housing are additional status lamps which indicate the status of the DI/DOs. The LEDs are permanently assigned to the respective input/output.

2.2.1 Front Plug Connector (X1)

Labelling

You can label the individual connections of the front plug connector with a label strip which is included. This provides customized identification of your input and output assignments.

Power supply

The SIWAREX M module requires 24 V direct current.

The 24 V must be turned on and off at the same time the 24 V for the SIMATIC CPU or ET 200 is turned on and off.

The maximum current consumption is 300 mA.

The lines are connected in front plug connector X1 on screw contacts 1 and 2 (see figure 2-4).

Front connector

The X1 front connector is equipped with 20 screw contacts for wiring the following connections.

- Power supply
- Load cells
- Digital inputs/outputs
- Analog output

The required cable cross sections can be found in this section.

Disconnect the front connector from the module to make connection work easier.

2.2.2 Load Cells (X1)

Load cells which can be connected

In principle, all measured value sensors (i.e., load sensors) can be connected to the SIWAREX M provided they meet the following requirements.

- Characteristic value up to 4 mV/V
- Supply voltage 10.2 V
- Measuring procedure based on the Wheatstone bridge

Connection allocation on front connector X1

Table 2-4 Allocation of the load cell connection

Screw Terminal	Load Cell	Signal	Meaning
X1.15	U_F +	SENSE +	Sensor line +
X1.16	U_F -	SENSE -	Sensor line -
X1.17	U_M +	SIG +	Meas. voltage +
X1.18	U_M -	SIG -	Meas. voltage -
X1.19	U_S +	EXC +	Supply voltage +
X1.20	U_S -	EXC -	Supply voltage -

Load cell connection for normal areas (standard)

Load cells must be connected in accordance with the following rules.

1. A junction box must be used under the following conditions.
   - More than one load cell is connected. (Remember that the load cells must then be switched in parallel.)
   - The distance between load cell and SIWAREX M is greater than the longest available length of load cell connection cable.
2. When there is a danger of equipotential bonding currents from the cable shield, an equipotential bonding conductor must be installed parallel to the load cell cable, or the shield terminal in the junction box must be used to apply the shield. (Under normal conditions, the shield is applied to the cable leadin supports of the junction box.)
3. Twisted core pairs should be used for the lines specified below.
   - (+) and (-) sensor line
   - (+) and (-) measuring voltage line
   - (+) and (-) supply voltage line
4. The shield on the SIWAREX M must be applied to the shield holder element.

Load cell connection for potentially explosive areas

The “SIWAREX IS” Ex-i interface (see section 9.4) is required when load cells are to be operated in potentially explosive areas.

Load cell connection, 6-wire technique with junction box

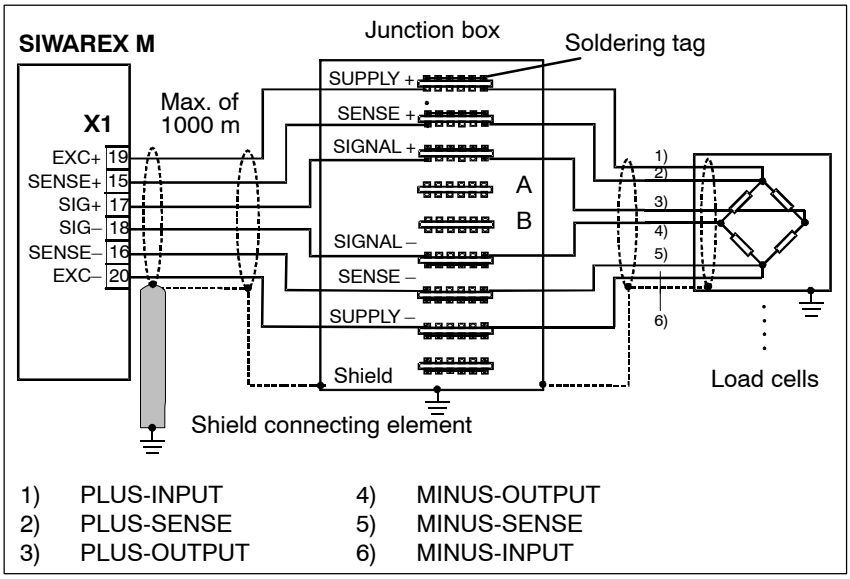


Figure 2-5 Connection of load cells using the 6-wire technique

Load cell connection, 4-wire technique with junction box

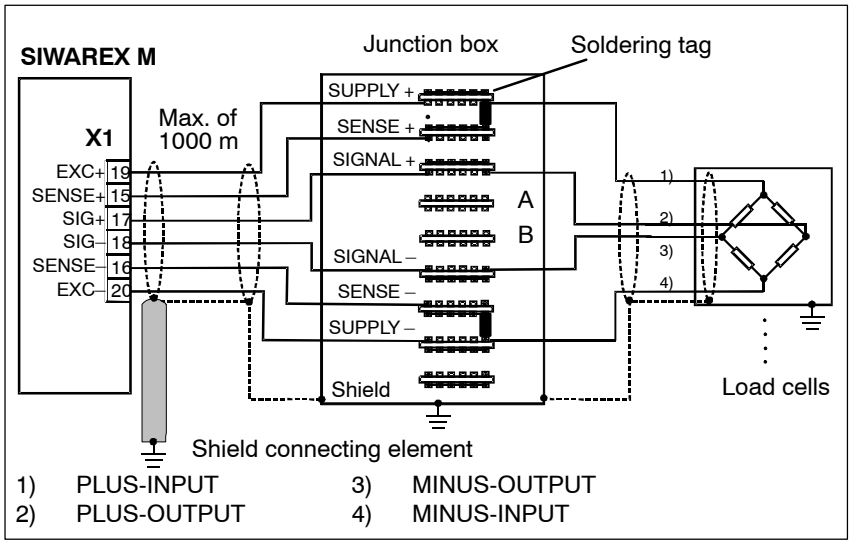


Figure 2-6 Connection of load cells using the 4-wire technique

When the 4-wire technique is used to connect the load cells, the signals (SUPPLY+) and (SENSE+), as well as (SUPPLY-) and (SENSE-) must be jumpered in the junction box.

The 6-wire technique must always be used for the connection of the junction box to the SIWAREX M to compensate for temperature and line influences.

Load cell connection, 4-wire technique without junction box

When the 4-wire technique is used to connect the load cells directly to the SIWAREX M, screw contact X1.15 must be jumpered with X1.19 in front plug connector X1, and X1.16 with X1.20.

Parallel circuiting of load cells in the junction box

The cable of each load cell is led through the cable leadin supports (PG screw-type connection). The cable shield must be applied to the PG screw-type connection.

The individual cores of the load cell cable are circuited in parallel to the respective soldering tags (i.e., SUPPLY, SENSE and SIGNAL).

- Solder all feeder voltage lines (+) of the load cells and the weighing electronics to soldering tag ”SUPPLY +”.
- Solder all feeder voltage lines (-) of the load cells and the weighing electronics to soldering tag ”SUPPLY -”.
- Use the same procedure on the remaining lines.

Soldering tags A and B are reserve connection elements (e.g., for installation of precision resistors for the cut-off load calibration). A cut-off load calibration is usually only performed for scales on which cut-off loads occur (e.g., vehicle scales).

2.2.3 Digital Outputs (X1)

Description

The SIWAREX M is equipped with four, floating digital outputs (DO) with a nominal voltage of +24 V and an output current of up to 0.5 A per output.

The four digital outputs are potentially bound with each other. They have a common ground and a 24 V voltage supply with fuse. The digital outputs are short circuit-proof and overload-proof.

The status of the digital outputs is indicated via LEDs on the front of the SIWAREX M.

When inductive consumers are connected, the digital output used must be equipped with a freewheeling diode.

The digital outputs can be assigned as desired to the 30 weighing functions available.

Warning

The 24 V power supply (terminal X1.3) may not be turned on until the assignment of the DO is known and the current signal status will not be a hazard to the system.

Connection

The four digital outputs are located on screw contacts 5 to 8 in front plug connector X1.

Screw contacts 3 and 4 provide the 24 V power supply (L+/M) for all four digital outputs.

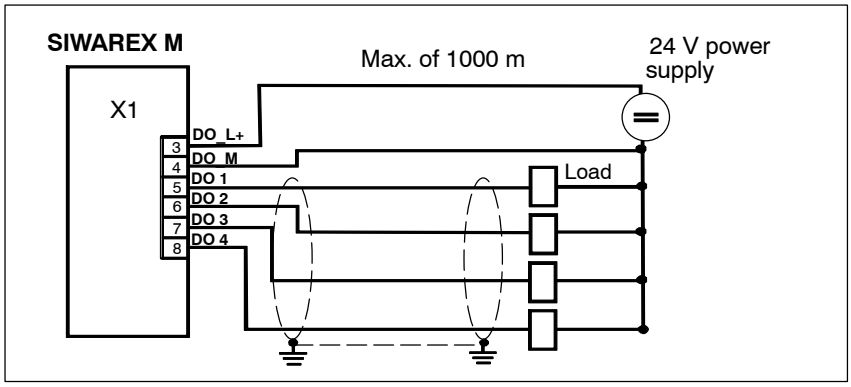


Figure 2-7 Digital outputs

Assignment

Table 2-5 Assignment of the digital outputs (X1)

Screw Terminal	Signal
X1.3	DO_L+
X1.4	DO_M
X1.5	DO1
X1.6	DO2
X1.7	DO3
X1.8	DO4

2.2.4 Digital Inputs (X1)

Description

The SIWAREX M is equipped with three, floating digital 24 V inputs (DI).

The three digital inputs are potentially bound with each other. They have a common reference point (M).

The digital inputs can be assigned as desired to the 20 weighing commands available.

The status of the digital inputs is indicated via LEDs on the front of the SIWAREX M.

Warning

The inputs may not be activated until the assignment of the DI is known and activation will not be a hazard to the system.

Connection

The three digital inputs are located on screw contacts 9 to 11 in front plug connector X1.

The common reference point (M) of all three digital inputs is screw contact 12.

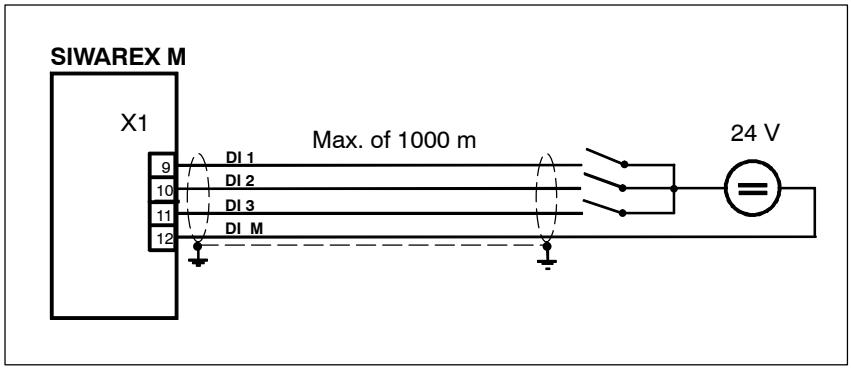


Figure 2-8 Digital inputs

Assignment

Table 2-6 Assignment of the digital inputs

Screw Terminal	Signal
X1.9	DI1
X1.10	DI2
X1.11	DI3
X1.12	DI_M

2.2.5 Analog Output (X1)

Description

The SIWAREX M is equipped with an analog output for outputting an analog value (e.g., for an analog display, a process recorder or a controller). The analog output is designed as a 0/4 to 20 mA current output. The analog output can be used to output the gross or net weight, or an externally prespecified value from the SIMATIC or from a host.

The output analog value can be supplied to measured value displays which are not under obligation of verification, process recorders or controllers, for example.

Warning

Before a new SIWAREX M is used, the parameter assignment of the analog output must be checked!

Connection

The analog output is located on screw contacts 13 and 14 in front plug connector X1. The output can be operated with either 0 to 20 mA or with 4 to 20 mA.

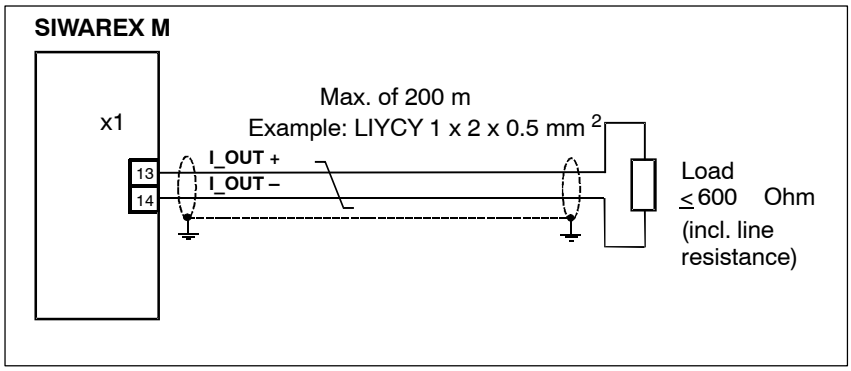


Figure 2-9 Example of the connection of the analog output

Assignment

Table 2-7 Assignment of the analog output

Screw Contact	Signal
X1.13	Current output + (I_OUT+)
X1.14	Current output - (I_OUT-)

2.2.6 RS 232C Interface (X2)

Description

The RS 232 interface uses the RxD and TxD signals.

The interface is non-floating.

Connection X2 on the front of the SIWAREX M is a 9-way, sub D, plug connection (socket).

Components which can be connected

Table 2-8 Components which can be connected to the RS 232C interface

Device	Protocol	For details, see
Printer	(XON/XOFF protocol)	Section 9.3
PC, host computer	SIWAREX driver	Section 7.1.1
PC, host computer	3964R	Section 7.1.2
Verifiable memory	B protocol	Section 9.2

Connection

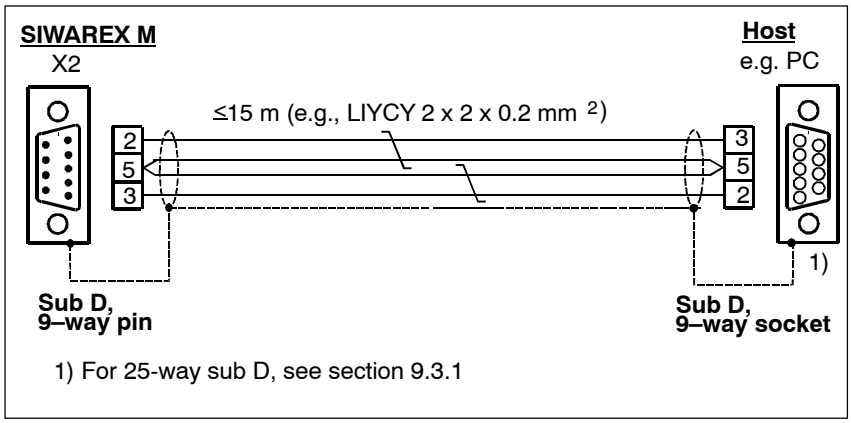


Figure 2-10 Connection cable for X2

Assignment

Table 2-9 Cable assignment for 9-way and 25-way PC connector

Pin Assignment			Signal Name	Explanation
9-Way PC Interface	25-Way PC Interface	SIWAREX M (X2)		
2	3	3	TxD	Sending data
3	2	2	RxD	Receiving data
5	7	5	GND	Operating ground

2.2.7 TTY Interface (X3)

Description

The TTY interface uses the RxD and TxD signals, and can be operated in either passive (floating) or active (non-floating) mode.

Jumpers in the plug connector of the connection cable are used to switch between passive and active modes.

Type of connection element

The connection element is a 15-way, sub D, plug connector (socket) with a screw lock.

Components which can be connected

Table 2-10 Components which can be connected to the TTY interface

Device	Protocol	For details, see
Remote digital display	4-digit display 5-digit display 6-digit display	Section 9.1
PC, host computer	SIWAREX driver	Section 7.1.1
PC, host computer	3964R	Section 7.1.2

Connection

For detailed information on the connection of the remote displays, see chapters 9.1 and 9.2.

Assignment

Table 2-11 Assignment of X3 (TTY interface of the SIWAREX M)

Connection X3		Meaning
Pin	Signal	
2	RxD -	Receiving data -
6	TxD +	Sending data +
7	TxD -	Sending data -
9	RxD +	Receiving data +
11	20 mA/R	Receiver power supply +
12	GND	Ground
13	20 mA/T	Sender power supply +
15	GND	Ground

2.3 Preparing the SIWAREX M for Operation

Introduction

After the module has been mounted and all connections have been set up, a partial function test of the SIWAREX M and all connected components must be performed at this stage of the commissioning procedure.

Perform the individual steps of the partial test in the order specified below.

Visual inspection

Check to determine whether you have performed all steps up to now correctly.

- Is the exterior of the module undamaged ?
- Is the module installed in the correct slot ?
- Have all mounting screws been tightened correctly ?
- Have all connection cables been connected correctly and secured ?
- Has the front plug connector been plugged in correctly ?
- Have all shields been applied to the shield holder element ?
- Have you removed all tools, materials and parts not belonging to the S7 or the SIWAREX M from the mounting rail and the modules ?

Caution

The 24 V power supply for the SIMATIC S7–CPU or ET 200M and the SIWAREX M must be turned on and off at the same time.

LED test on the SIWAREX M

After the power is turned on, the SIWAREX M switches to operation mode. If operating correctly, the LEDs below will indicate the following states.

LED (24 V) → ON status

LED (SF) → OFF status

LED (OF) → OFF status

If the LEDs do not indicate the correct states, proceed as described in section 11.

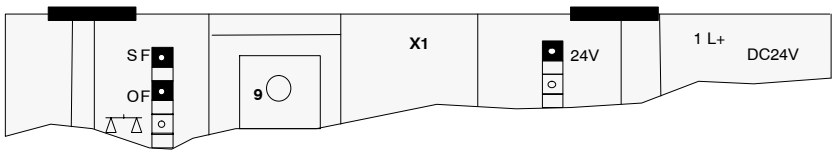


Figure 2-11 Location of the LEDs to be checked

2.4 Assigning Parameters

Introduction

Depending on your system configuration, there are various ways to assign parameters and commission the SIWAREX M.

Use the overview below to select the best method of parameter assignment and commissioning for your special system configuration.

Overview of possible parameter assignments and commissioning

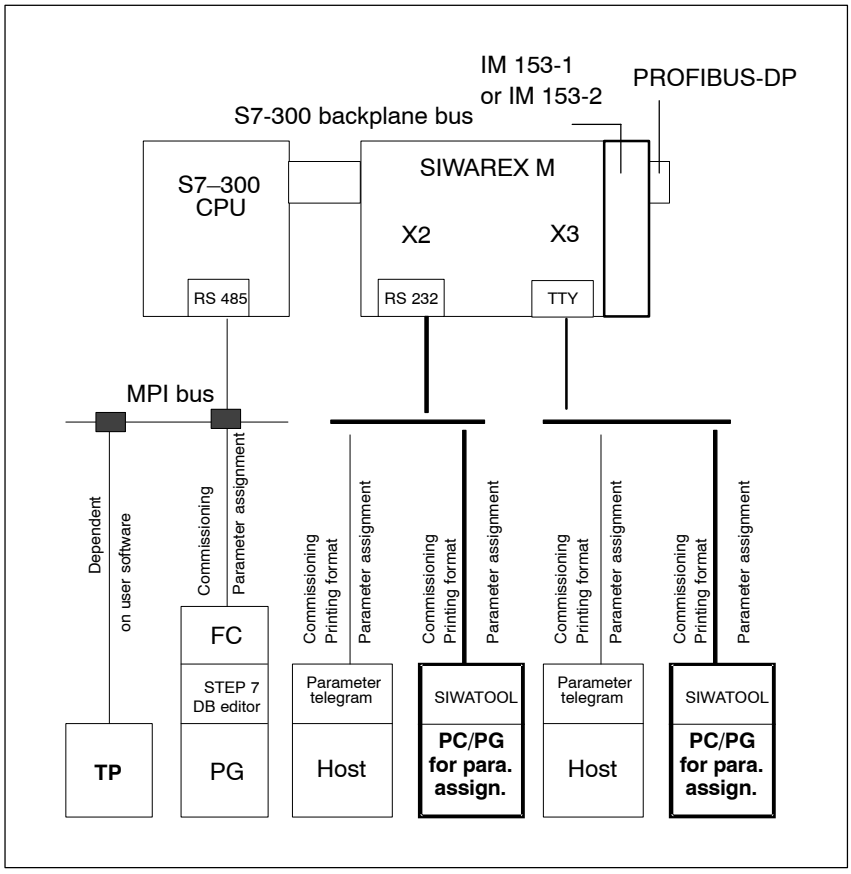


Figure 2-12 Methods of parameter assignment for various system configurations

Link to the SIMATIC S7

Via PG with DB editor

Edit data block with the editor in the SIMATIC S7, and transfer with the FC SIWA-M function to the SIWAREX M.

(Parameter assignment and commissioning are possible.)

Link to the SIMATIC PCS 7

Edit the I/O bar of the SIWAREX block in the CFC chart, and then transfer the modified data to the SIWAREX M.
(Commissioning with SIWATOOL)

Link to a PC with SIWATOOL

Via PC/PG with SIWATOOL

Install SIWATOOL on the PC/PG.

SIWATOOL uses pull-down menus and runs under WINDOWS.

(Parameter assignment, commissioning and printing formatting are possible.)

Link to the host

Via host with data telegram

Data telegrams are used to perform parameter assignment, commissioning and printing formatting.

2.5 Preparation and Certification of Scales Subject to Verification

Notice

Adhere to the latest qualification approval of SIWAREX.

Preparation

Preparations prior to actual certification by the office of weights and measures must be performed by the operator in accordance with following instructions.

- Commission the SIWAREX M.
- Adjust the scales as described in the manual.
- Check all relevant points for compliance with (1) and (2) or (3) below.

(1) = ER (90/384/EC) European guidelines on non-automatic scales

(2) = EN 45 501 European standards for non-automatic scales

(3) = National guidelines for automatic scales

Verification label

Fill in the appropriate data on the verification label for the remote display.

- Max. = maximum load; example: max. = 3 t or 3,000 kg
- Min. = 20 e (in accordance with EN 45 501, class III commercial scales)
  A maximum resolution of 6,000 e (digit intervals) is possible for operation with verification capability.
  Example: 20 e = 3,000 kg/6,000 x 20 = 10 kg
- e = verification value (in accordance with EN 45 501)
  Example: 3,000 kg/6,000 = 0.5 kg
- s = serial number of the name plate of the SIWAREX M

Affixing the verification label depends on the remote display being used.

For additional information, see the documentation of your remote display.

Certification of the SIWAREX M

- Certification of the verified scales is performed by an official of the weights and measures office.
- After certification, turn off the SIWAREX M.
- Remove the SIWAREX M from the rail so that the DIP switch on the back of the SIWAREX M can be accessed.

Write protection

Activate write protection via the DIP switch. (See section 2.1.1.)

DIP switch 4 to position “ON”

Inspection seal on the SIWAREX M

After activation of write protection, the official of the weights and measures office will affix the inspection seal and verification stamp.

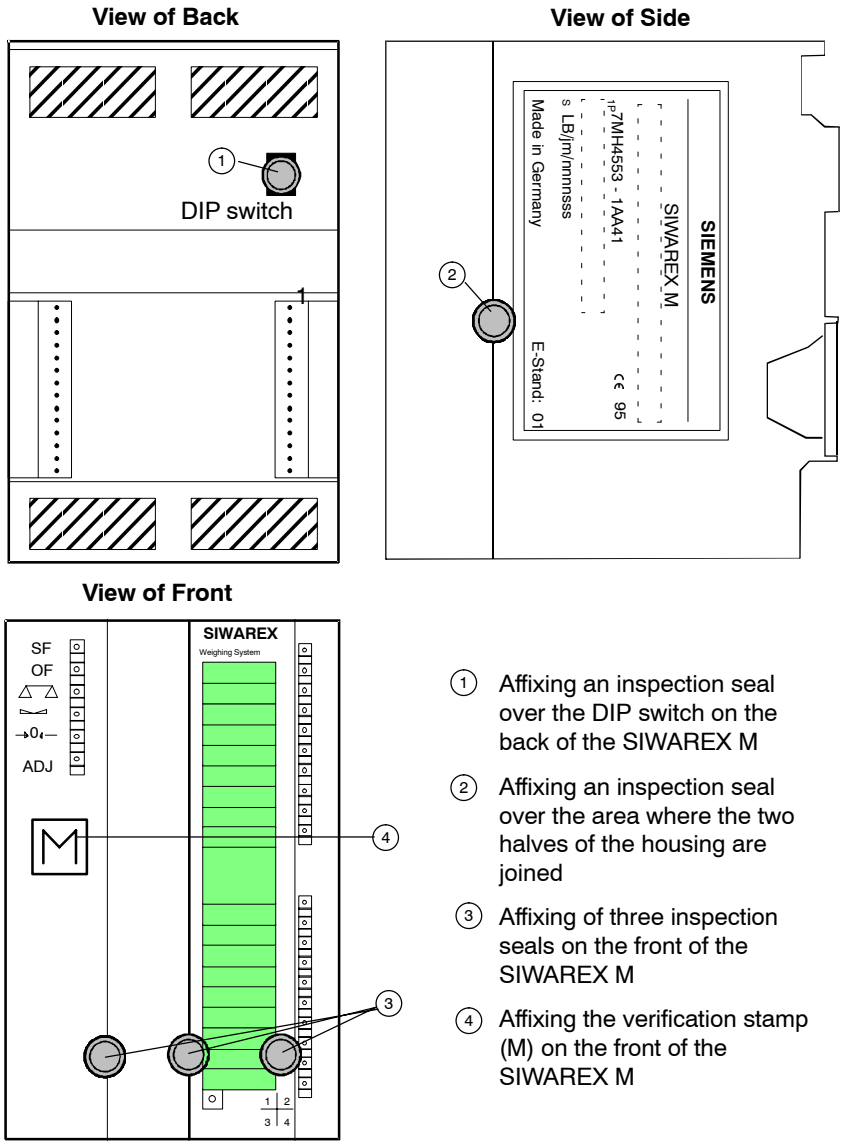


Figure 2-13 Placement of the inspection seal and verification stamp

Final check

A successful final check concludes certification of the SIWAREX M.

- Turn on the SIWAREX M.
- The ⏢ LED (scales verified) on the front of the SIWAREX M must light up.
- The verified scales are now certified and ready for operation.

Function Description

3

Introduction

The SIWAREX M can be integrated in SIMATIC S7-300 programmable controllers and can also be used as distributed periphery in the ET 200M. The SIWAREX M can also communicate with other host systems via the serial interfaces.

Independent of the cycle time of the host system, the SIWAREX M handles execution of the basic weighing functions and the time-critical control of proportioning elements for proportioning scales within a complete weighing system.

The SIWAREX M can be used in applications requiring verification certification and also in potentially explosive areas.

Overview

SIWAREX M offers the following functions.

- Zero setting and taring the scales
- Automatic zero point offset
- Scales standstill message
- Limit value generation (minimum/maximum/empty/overfilled)
- Proportioning valve control (coarse/fine)
- Tolerance monitoring of the proportioning process
- Automatic reproportioning
- Automatic proportioning optimization
- Inching mode
- Proportioning monitoring (material flow and time monitoring)

3.1 A/D Conversion (Measured Value Acquisition)

Description

The analog/digital converter of the SIWAREX M converts the analog measuring signal of the load cells into a digital signal.

Every 20 msec a measured value is determined with a ±524,000-part resolution.

Calibration

Since the SIWAREX M has been pre-calibrated at the factory, the module can be exchanged without having to adjust the scales again. A test weight can be used to adjust the SIWAREX M, or a theoretical adjustment can be performed using the characteristic value and nominal load of the load cell.

Notice

Theoretical adjustment cannot be used for applications requiring certification.

Table 3-1 Data word for A/D conversion

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Unfiltered raw value	*DIGITS* / UNFILTERED	346	33	0	-	8	DINT	Unit = digit

3.2 Digital Filtering

Description

An adjustable digital filter compensates for interference caused by vibration and load fluctuations, for example. This filter is particularly recommended if you are using worm drives, vibrating troughs and mixers.

The digital filter has the following features.

- Critical damped filter to the 4th power
- Settable filter frequencies: 0.05 to 5 Hz (default = 2 Hz)
- A floating mean value filter (MVF) can be switched in front of the digital filter.

Illegal filter settings are rejected, and the old value is retained. The filtered, raw, measured value can be viewed in the service data area.

Filtering principle

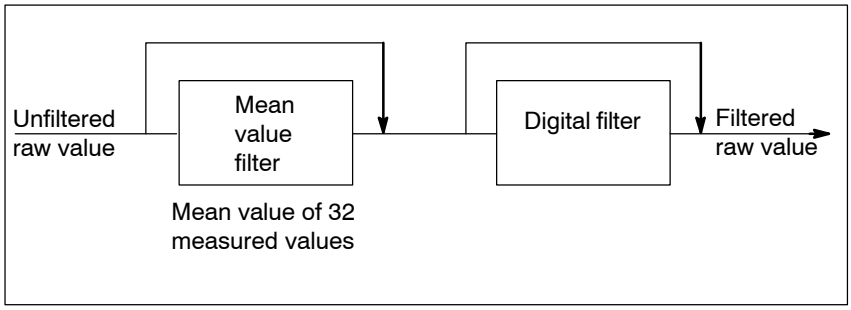


Figure 3-1 Filtering principle

Table 3-2 Data word for digital filtering

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Filter setting	*ADJ_DATA* / LIMIT_FREQ	111	3	21	-	42	BYTE	Sel. code + 100 = MVF active* 0 (100) = No limit value 1 (101) = 5 Hz 2* (102) = 2 Hz 3 (103) = 1 Hz 4 (104) = 0.5 Hz 5 (105) = 0.2 Hz 6 (106) = 0.1 Hz 7 (107) = 0.05 Hz
Filtered raw value	*DIGITS* / FILTERED	350	33	4	-	8	DINT	Unit = digit
Illegal limit frequency digital filter	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 01

* Factory setting of SIWAREX M

3.3 Weight Calculation and Adjustment

Weight calculation

Weight calculation is used to convert raw measured values into standardized, gross weight values. The calculation is performed every 20 msec. In addition, measured values with a higher resolution (by a factor of 10) are available to the user for service purposes. This is very helpful for scales requiring verification since the resolution of their indicated values is limited. The required standardization or adjustment factor is determined during adjustment.

Characteristic value

The characteristic value entry specifies the measuring range set for the A/D converter. Possible entries are 1, 2 and 4 mV/V (i.e., three measuring ranges).

The next greater characteristic value must be specified for the values which are between 1, 2 or 4. In individual cases, it is also possible to specify a smaller characteristic value when the load cell(s) is (are) not utilized up to their nominal load.

Decimal place

All input and output values related to weight refer to the same decimal place. This makes the internal calculations independent of the decimal place. The decimal place can be specified from 0 to 5. The decimal place is only relevant for the display or printer. Remember that a total of 6 digit positions is available.

Adjustment

Adjustment is performed in 2 steps.

During the first step, the filtered raw value is stored (via “zero point valid” adjustment command) for the scales zero point in adjustment digit 0.

During the second step, the filtered raw value is stored (via “adjustment weight valid” command) for the adjustment weight in adjustment digit 1.

Adjustment digits 0 and 1 are not indicated until adjustment has been completed.

Note

When certain commands (i.e., “zero point valid”, “adjustment valid” or “load factory setting”) are called directly after each other, a waiting period of 5 seconds must be maintained between calls. Otherwise the commands will be rejected by the SIWAREX M.

A timeout prevents the maximum permissible number of write cycles for an EEPROM from being exceeded by an accidental cyclic call of these commands (see section 3.17).

When an attempt is made to call one of these three commands again within these 5 seconds, the command is rejected and the 5-second waiting period is retriggered again.

The minimum adjustment weight must be at least 5% of the measuring range set. This is checked by the SIWAREX M during the adjustment procedure (≙ 25000 digits). The maximum permissible indication increments (“d”) for verified operation is not checked (maximum load, digit increment).

The scales are adjusted by transferring plausible adjustment digit 1 (adjustment digit 1 greater than adjustment digit 0).

The unit of weight can be specified as any 2 ASCII characters. This unit of weight is only used for the display and printer. The unit of weight is not used for internal calculations.

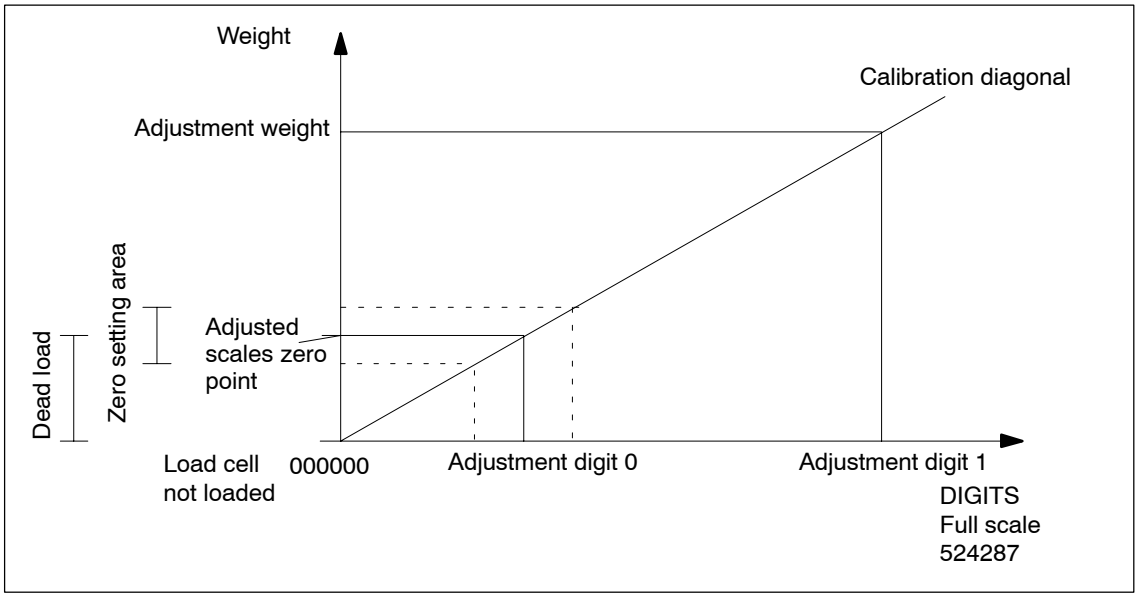


Figure 3-2 Adjustment procedure

Adjustment for verification capability

During adjustment (step 2) in operation requiring verification, the minimum increment voltage of 0.5 µV/e is monitored for a scale interval. The operating mode can be set to “verification required” or “verification not required”.

Readjustment

When the scales have already been adjusted, readjustment can be performed with the “zero point valid” and/or “adjustment weight valid” command.

Note

When adjustment digits 0 and 1 contain the value 0, this indicates that the SIWAREX M has not been adjusted.

Theoretical adjustment

In special situations (e.g., no verification weights are available, etc.), a theoretical adjustment can be performed although this reduces accuracy depending on the characteristic value tolerances of the load cells. (Do not use the theoretical adjustment for scales requiring verification.) The theoretical adjustment is possible because the modules have already been pre-calibrated at the factory. Use of the theoretical adjustment requires that the physical setup of the scales be correct (e.g., free of force bypasses, cut-off loads, etc.).

There are 2 ways to perform theoretical adjustment.

1. Calculation of the adjustment digits based on the nominal data of the load cells
2. Calculation of the adjustment digits based on the measuring logs of the load cells

Transmission of the JD0 adjustment digits for the zero point of the scales and the JD1 adjustment digits for the nominal load of the load cells on the SIWAREX M then replaces adjustment with adjustment weights.
You can calculate the adjustment digits yourself. Or you can enter the load cell parameters in SIWATOOL and have the calculation done by the program.

Calculation of the adjustment digits also calculates the characteristic curve of the scales. To conclude theoretical adjustment, the empty scales must be set to zero. This determines the dead weight and deducts it from the present weight value.

Calculation of the adjustment digits based on the nominal data of the load cells

1. Set characteristic value range of the SIWAREX M (i.e., 1, 2 or 4 mV/V).
2. Specify the sum of the load cell nominal loads as the adjustment weight.
3. Enter the value 0 digits in “JD0 adjustment digits ”.
4. Calculate JD1:

$$JD1 = \frac{\text{Char. val\_LC} * 504123 \text{ digits}}{\text{Char. val. range of SIWAREX M}}$$ Enter and send

5. Unload the scales, and activate the “set to zero” command.
   Remember to use the “set to zero” command and not the “zero point valid” adjustment command.

An even more precise theoretical adjustment can be achieved if the exact data (offset and characteristic value) of the load cells used is known (see measuring log of the load cells).

Calculation of the adjustment digits based on the measuring logs of the load cells

1. Since the load cells have a nominal characteristic value of 2 mV/V, the characteristic value range 0 to 2 mV/V must be set for the SIWAREX M.
2. Specify and send the sum of the nominal load cell loads as the adjustment weight.
3. Calculate JD0: $JD0 = \frac{\text{Offset\_LC} * 504123 \text{ digits}}{\text{Char. val. range of SIWAREX M}}$
4. Calculate JD1:
   $JD1 = \frac{\text{Char. val.\_LC} * 504123 \text{ digits}}{\text{Char. val. range of SIWAREX M}} + JD0$; Enter and send
5. Unload the scales and activate the “set to zero” command.
   Remember to use the “set to zero” command and not the “zero point valid” adjustment command.

Example

Since there are no verification weights for 20-ton, pig iron scales, a theoretical adjustment is to be performed. The following technical information can be taken from the measuring logs for the 3 load cells used.

	Characteristic Value	Offset
Load cell 1	2.0511 mV/V	+17.23 µV/V
Load cell 2	1.9998 mV/V	-12.47 µV/V
Load cell 3	2.0245 mV/V	-9.01 µV/V
Calculated mean values	2.0251 mV/V	-1.42 µV/V

Calculation of the adjustment digits:

$$\text{Adj. digit } 0 = \frac{-1.42\ \mu V/V \times 504123 \text{ digits}}{2\ mV/V} = -358 \text{ digits}$$

$$\text{Adj. digit } 1 = \frac{2.0251\ mV/V \times 504123 \text{ digits}}{2\ mV/V} + (-358 \text{ digits}) = 510091 \text{ digits}$$

Data Words, Commands and Messages

Table 3-3 Data words, commands and messages for adjustment

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Decimal point	*ADJ_DATA* / DEC_POINT	102	3	12	-	42	WORD	Selection code (dec.) 0= xxxxxx * 1= xxxxx.x 2= xxxx.xx 3= xxx.xxx 4= xx.xxxx 5= x.xxxxx
Characteristic value range, SIWAREX M	*ADJ_DATA* / CHAR_VAL	104	3	14	-	42	DINT	Selection code (dec.) 1= 0 to 1 mV/V 2= 0 to 2 mV/V * 4= 0 to 4 mV/V
Operating mode	*ADJ_DATA* / OPER_MODE	90	3	0	-	42	WORD	Selection code (dec.) 0= Not subject to verification* 2= Subject to verification
Adjustment digit 0	*ADJ_DATA* / ADJ_DIGITS_0	122	3	32	-	42	DINT	0*
Adjustment digit 1	*ADJ_DATA* / ADJ_DIGITS_1	126	3	36	-	42	DINT	0*
Adjustment weight	*ADJ_DATA* / ADJ_WEIGHT	112	3	22	-	42	DINT	10000*
Unit of weight	*ADJ_DATA* / WEIGHT_UNIT	108	3	18	-	42	ARRAY	kg*
Zero point valid	CMD	88	2	0	-	2	WORD	Selection code (dec.) = 1
Adjustment weight valid	CMD	88	2	0	-	2	WORD	Selection code (dec.) = 2
Gross weight	*WEIGHTS* / GROSS	320	30	0	-	12	DINT	
Gross weight indicated more precisely	*WEIGHTS_H* / GROSS	338	32	0	-	8	DINT	
Scales adjusted	*STATUS* / SCALE_ADJ	333	31	1	0	6	BOOL	Status information
Adjustment weight too small	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 02
Min. increment voltage too small	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 03
Distance between adjustment points too small	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 11
Specified weight greater than permissible number range	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 13
Illegal decimal point	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 14
Illegal characteristic value	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 15
Illegal digit increment	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 16
Adjustment data not permitted since proportioning procedure is running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 01
Adjustment command cannot be executed since proportioning procedure is running.	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 02

Table 3-3 Data words, commands and messages for adjustment

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Function not executed since scales are verified	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 07
Wait time of 5 seconds not adhered to	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 10
Distance between adjustment points too small	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 22

* Factory setting of SIWAREX M

3.4 Digit Increment

Description

The digit increment determines the increment width of the indication values gross, net and tare. Possible increments are 1, 2, 5, 10, 20 and 50. These values can be indicated with increased resolution (factor 10).

A resolution of up to 6000 e (e = verification value, digit increment) is possible for operation subject to verification.

Table 3-4 Parameters and data for digit increment

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Digit increment	*ADJ_DATA* / INCREMENT	110	3	20	-	42	BYTE	Selection code 1*,2,5,10,20,50 Code (dec.)corresponds to the digit increment.

* Factory setting of SIWAREX M

Example

The example below shows a digit increment with a scale interval of 5.

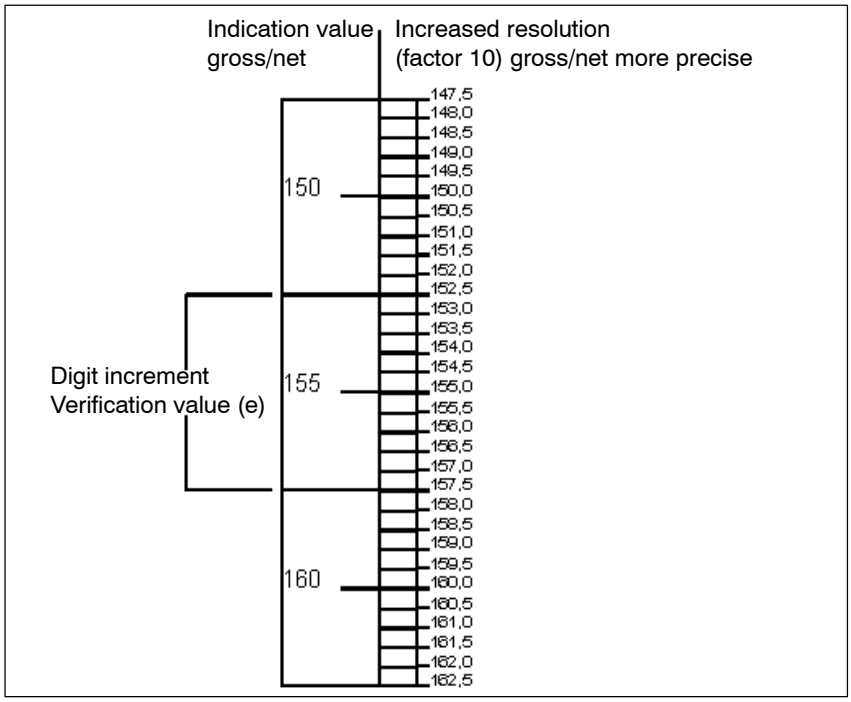


Figure 3-3 Digit increment indication

Verification value When scales are verified, the verification value “e” corresponds to the digit increment.

3.5 Setting to Zero/Automatic Zero Offset

Description of setting to zero

Soiled scales can cause a shift in the zero point of the scales. Setting to zero resets the gross weight to zero. This zero point is then used for all subsequent weighing procedures until setting to zero is triggered again or the zero point is shifted by the automatic zero point offset.

During operation with verification capability, the current gross value is monitored to determine whether it is within the permissible zero setting range of 2% of the maximum load. During operation without verification capability, there are no limits. After zero setting, the status display is set to 1/4d-zero and remains in this state until this condition is no longer fulfilled.

Execution of this function requires that the scales be at a standstill.

When setting to zero is performed, any taring is also cancelled (i.e., the tare memory is cleared).

Description of automatic zero offset

The automatic zero point offset can be activated to suppress slight drifts caused by temperature, creeping, etc. when the scales are not loaded.

The gross weight is automatically set to zero when the measured value remains within the offset area around the zero point for a certain amount of time.

The zero point offset operates with a maximum of 0.2 d/400 msec.

During operation with verification capability, the current gross value is monitored to determine whether it is within the permissible zero setting range of 2% of the maximum load. If the zero setting range is exceeded, the zero point is no longer updated automatically.

Caution

With very slow proportioning, it must be ensured that the weight value increases by more than 0.2 d/400 msec during the proportioning procedure or the SIWAREX M will automatically offset the zero point and the setpoint will never be reached.
If the weight increase during the proportioning procedure is less than 0.2 d/400 msec, the automatic zero offset function must be turned off.

Messages, Set to Zero/Automatic Zero Offset

Table 3-5 Parameters and data for digital increment

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Maximum load	*ADJ_DATA* / MAX_LOAD	116	3	26	-	42	DINT	Weight 10 000*
Automatic zero point offset ON/OFF	*SCALES_PARA* / AUTO_ZERO	133	4	1	0	34	BOOL	1=ON*, 0=OFF
Set to zero	CMD	88	2	0	-	2	WORD	Selection code 5
Zero value more precise	*EXTRA_INFO* / ZERO_VAL_H	430	43	4	-	10	DINT	0*
¼ d zero	*STATUS* / ZERO	333	31	1	2	6	BOOL	Status information
Gross weight outside the zero range	*STATUS* / ZERO_R_EX-CEEDED	332	31	0	5	6	BOOL	Status information
Set to zero/taring range exceeded (verified operation)	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 08
Set to zero not executed since scales not at a standstill	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 09
Set to zero not executed since scales not adjusted	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 11
Set to zero not executed since proportioning procedure running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 16

* Factory setting of SIWAREX M

3.6 Taring

Description

Taring sets the net weight to zero after the scales have been loaded with a weight. During taring, the tare weight is loaded with the current gross weight. After taring, only the additional weights on the scales are indicated in the net weight.

In contrast to setting to zero, taring only applies to the current weight procedure.

When weighing a container whose own weight is known, the weight of the contents of the container (i.e., net weight) can be indicated via **external tare specification**.

When external tare specification (manual, preset tare) is used, this value is rounded to the set digit increment and loaded in the tare memory with the "external tare specification valid" command.

The tare weight can be influenced in 3 different ways.

1. Via command: tare or delete tare memory. (Scales must be at a standstill.)
2. Automatically at the start of proportioning (i.e., start proportioning with automatic taring)
3. Via "external tare specification valid" (manual, preset tare)

Scales tared status

The SIWAREX M repors the status "tared" when the tare value is note equal to 0.

Calculation

The following formula is used to calculate the net weight for fill weighing.

Net* = Gross - Tare

If the scales have been parameterized for deduction weighing, the net value is calculated as follows.

Net* = Tare - Gross

* Since the net weight is calculated internally with values of a higher resolution, the calculation of normal weight values using the above formula can result in rounding discrepancies.

Operation which is subject to verification

During operation subject to verification, the current gross value is monitored to determine whether it is below -2% of the maximum scales load. Since taring is not permitted with the negative gross weight, setting to zero is performed instead. If the gross value is less than –2% of the scales' maximum load, setting to zero is not performed.

Messages and Commands

Table 3-6 Messages and commands for the tare function

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Tare specified externally	SPEC_TARE	256	28	0	-	4	DINT	0*
Tare	CMD	88	2	0	-	2	WORD	Selection code (dec.) 3
Externally specified tare is valid.	CMD	88	2	0	-	2	WORD	Selection code (dec.) 4
Delete tare	CMD	88	2	0	-	2	WORD	Selection code (dec.) 15
Net weight	*WEIGHTS* / NET	324	30	4	-	12	DINT	
Net more precise	*WEIGHTS_H* / NET	342	32	4	-	8	DINT	0*
Tare weight	*WEIGHTS* / TARE	328	30	8	-	12	DINT	0*
Tare more precise	*EXTRA_INFO* / TARE_H	426	43	0	-	10	DINT	0*
Tare information	*EXTRA_INFO* / TARE_INFO	434	43	9	0	10	WORD	Selection code: 0 = No manual (preset) tare value set * 1 = Manual (preset) tare value set
Scales tared	*STATUS* / SCALE_TARED	333	31	1	1	6	BOOL	Status information
Tare memory loaded with manual (preset) tare value	*STATUS* / MANUAL_TARE	332	31	0	3	6	BOOL	Status information
Tare specified externally > maximum load or < 0	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 04
Tare command not executed since scales not at a standstill	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 04
"Externally specified tare valid" command not permitted since proportioning procedure running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 05
Tare command not executed since maximum load exceeded	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 06
Set to zero/taring range exceeded (operation requiring verification)	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 08

* Factory setting of SIWAREX M

3.7 Limit Values/Empty Message

Description of limit values

The SIWAREX M has three parameterizable limit values two of which can be parameterized as minimum or maximum limit value. **Limit value 3 is always treated as the maximum limit value regardless of parameterization.** Limit value 3 is used as the overfill limit value for proportioning functions.

The minimum or maximum function and the hysteresis can be parameterized by specifying the switchon and cutoff points separately. For example, a hysteresis prevents the limit value output from constantly switching on and off when the weight value is hovering around the parameterized weight value. Specification of switchon value > cutoff value triggers the maximum function, and specification of cutoff value > switchon value triggers the minimum function.

The limit values refer to both fill weighing and deduction weighing for the gross weight. The state of the limit values is available as status information.

Example

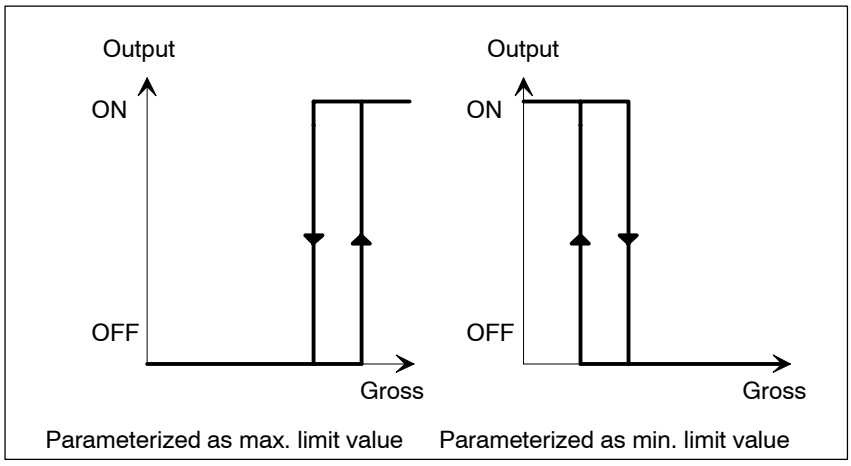


Figure 3-4 Example of assigning parameters to limit values 1 to 3

Overfill limit value

Like the other limit values, the overfill limit value (i.e., maximum limit value 3) can be parameterized with a hysteresis function. When the overfill limit value is triggered, a proportioning procedure in progress at the time is aborted in proportioning weighing mode.

Maximum load

The maximum load of the scales can be parameterized. When the maximum load of the scales is exceeded by more than 9 digit increments, an appropriate status message is output. In addition, the weight value is identified in indications as invalid and the weight value is not printed out. Exceeding the maximum load of the scales does not affect an active proportioning procedure.

Warning

The limit values may not be used for functions involving safety/security.

Special case

Specification of switchon value = cutoff value represents a special case.

The table below provides information on this special case.

Table 3-7 Limit values - special cases

Limit value 1 operates as max. function without hysteresis.	
Active if gross	> Switchon/cutoff point 1
Inactive if gross	≤ Switchon/cutoff point 1
Limit value 2 operates as min. function without hysteresis.	
Active if gross	< Switchon/cutoff point 2
Inactive if gross	≥ Switchon/cutoff point 2
Limit value 3 operates as max. function without hysteresis.	
Active if gross	> Switchon/cutoff point 3
Inactive if gross	≤ Switchon/cutoff point 3

Empty message

After the scales are emptied, the weight value may not return to zero because residual material is still left in the container. The empty message can be activated to determine whether the scales have been emptied even though the weight value is not zero.

The empty message is output when a specified weight value (i.e., empty message value) is passed below for a certain amount of time (i.e., empty message delay time).

The empty message is withdrawn as soon as the gross weight value exceeds the empty message value.

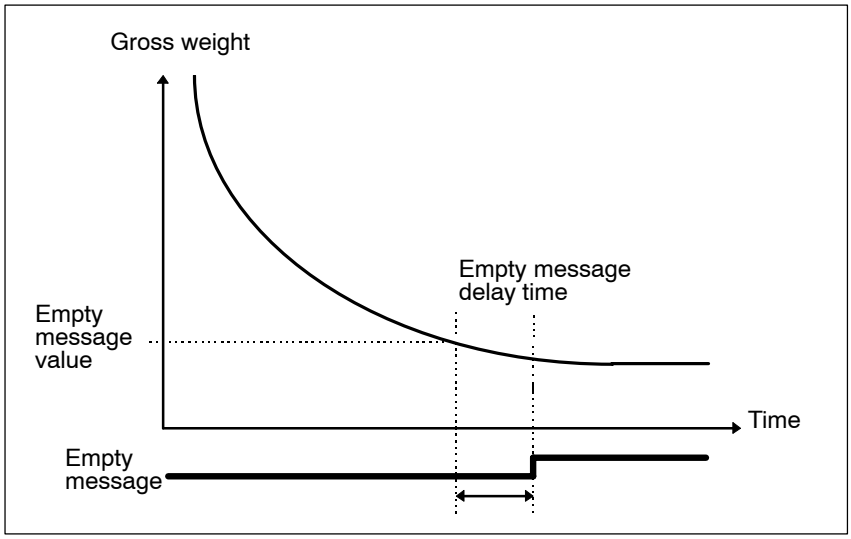


Figure 3-5 The empty message

Messages and Data

Table 3-8 Assigned messages and data for limit value and empty message

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Switch-on point for limit value 1	*SCALES_PARA* / ON_LIMIT_1	142	4	10	-	34	DINT	10000*
Switch-off point for limit value 1	*SCALES_PARA* / OFF_LIMIT_1	146	4	14	-	34	DINT	9990*
Switch-on point for limit value 2	*SCALES_PARA* / ON_LIMIT_2	150	4	18	-	34	DINT	1000*
Switch-off point for limit value 2	*SCALES_PARA* / OFF_LIMIT_2	154	4	22	-	34	DINT	1010*
Switch-on point for limit value 3	*SCALES_PARA* / ON_LIMIT 3	158	4	26	-	34	DINT	9000*
Switch-off point for limit value 3	*SCALES_PARA* / OFF_LIMIT 3	162	4	30	-	34	DINT	8990*
Empty message value	*SCALES_PARA* / EMPTY_VAL	134	4	2	-	34	DINT	50*
Empty message delay time	*SCALES_PARA* / EMPTY_D_TIME	138	4	6	-	34	TIME	5 sec.*
Limit value 1 active/inactive	*STATUS* / LIMIT_VAL_1	333	31	1	5	6	BOOL	Status information
Limit value 2 active/inactive	*STATUS* / LIMIT_VAL_2	333	31	1	6	6	BOOL	Status information
Limit value 3 active/inactive	*STATUS* / LIMIT_VAL_3	333	31	1	7	6	BOOL	Status information
Maximum load + 9 e exceeded	*STATUS* / MAX_LOAD	332	31	0	2	6	BOOL	Status information
Empty message active/inactive	*STATUS* / EMPTY	332	31	0	0	6	BOOL	Status information
Parameterization not executed since proportioning procedure is running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 12

* Factory setting of SIWAREX M

3.8 Standstill Monitoring

Description

Standstill monitoring is used to determine that the scales are in a state of stable equilibrium. Scales standstill is reported when the change in gross weight is less than a specified area of fluctuation (i.e., standstill value) within a specified period of time (i.e., standstill time). See figure 3-6.

Standstill time and standstill value can be parameterized as desired.

Standstill monitoring can be used to shorten a proportioning procedure. If the standstill message occurs before the end of the settling time, a tolerance check is immediately performed for the proportioning procedure. Premature conclusion of the proportioning procedure via the standstill message increases the productive time of the system. Shortening of the proportioning time with the standstill message can also be deactivated (see proportioning functions).

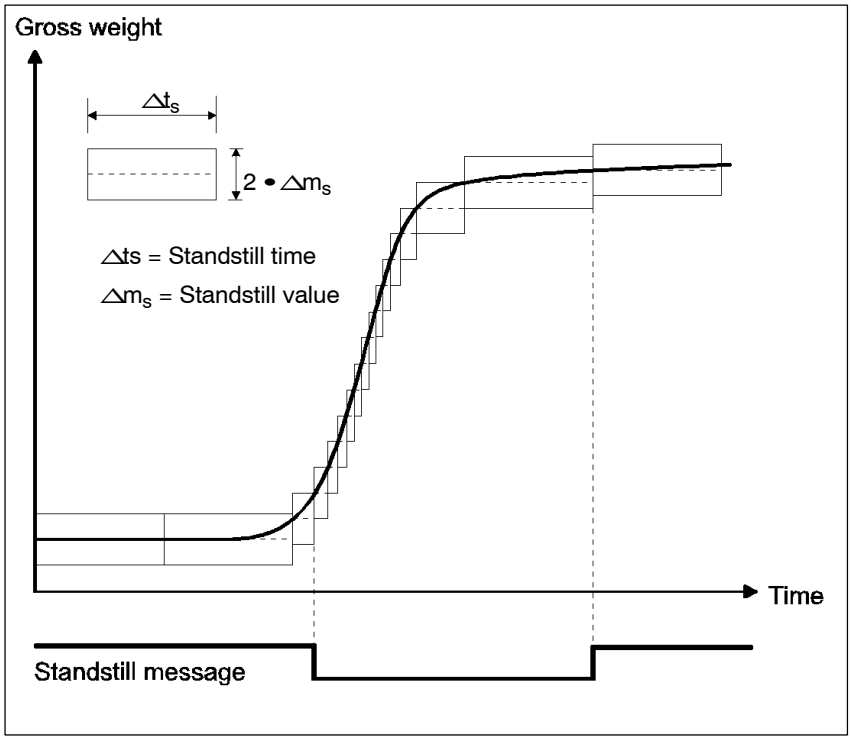


Figure 3-6 Standstill monitoring

Table 3-9 Assigned messages and data

Function	SIMATIC S7/C7 *Structure Name* Variable Name	Addr.	Data Record No.	Byte	Bit	Length (Byte)	Format	Comments
Standstill value	*ADJ_DATA* STANDSTILL_VAL	98	3	8	-	42	DINT	1*
Standstill time	*ADJ_DATA* STANDSTILL_TIME	94	3	4	-	42	TIME	2.5 sec.*
Standstill	*STATUS* STANDSTILL	332	31	1	1	6	BOOL	Status information

* Factory setting of SIWAREX M

3.9 Fill Weighing/Deduction Weighing (Proportioning Functions)

Proportioning can be performed in both fill weighing mode (i.e., proportioning upwards) and deduction weighing mode (proportioning downwards).

Start

Each time a “Start a proportioning procedure with automatic taring” is performed, the net weight indicated at this time is set to zero. The signals for coarse and fine flow are switched on.

Start with automatic taring

When the scales are not at a standstill, coarse and fine flow are not switched on until the SIWAREX M reports a scales standstill. When this happens, the SIWAREX M reports the status indicating that proportioning has started and standstill is being waited for.

Procedure

When the coarse flow switchoff point is reached, the coarse flow signal is switched off. When the fine flow switchoff point is reached, the fine flow signal is also switched off.

The settling time is then started when fine flow is shut off. When the standstill message (if parameterized) arrives or at least after the settling time has expired, a tolerance check is performed. With proportioning requiring verification (i.e., ”operation requiring verification” mode), the tolerance check is never performed until the standstill message arrives.

The finished message is output when no automatic reproportioning is to be performed for a tolerance minus. The tolerance limits (positive and negative tolerance specification value) can be specified separately.

If automatic log printout has been activated, the current weighing data at the time of the finished message are printed out. These weighing data are stored until the next proportioning procedure so that they can be called up via the host system.

Interruption of proportioning

A running proportioning procedure can be interrupted (i.e., aborted) by the following occurrences.

- A stop command
- A malfunction (operating mode: fault)
- The overfill limit value is exceeded.
- Transmission of proportioning parameters, proportioning data, adjustment data or scales parameters
- Transmission of data which are not plausible
- BASP/OD

An interruption is indicated by the status “Proportioning aborted”.

Continuation of proportioning

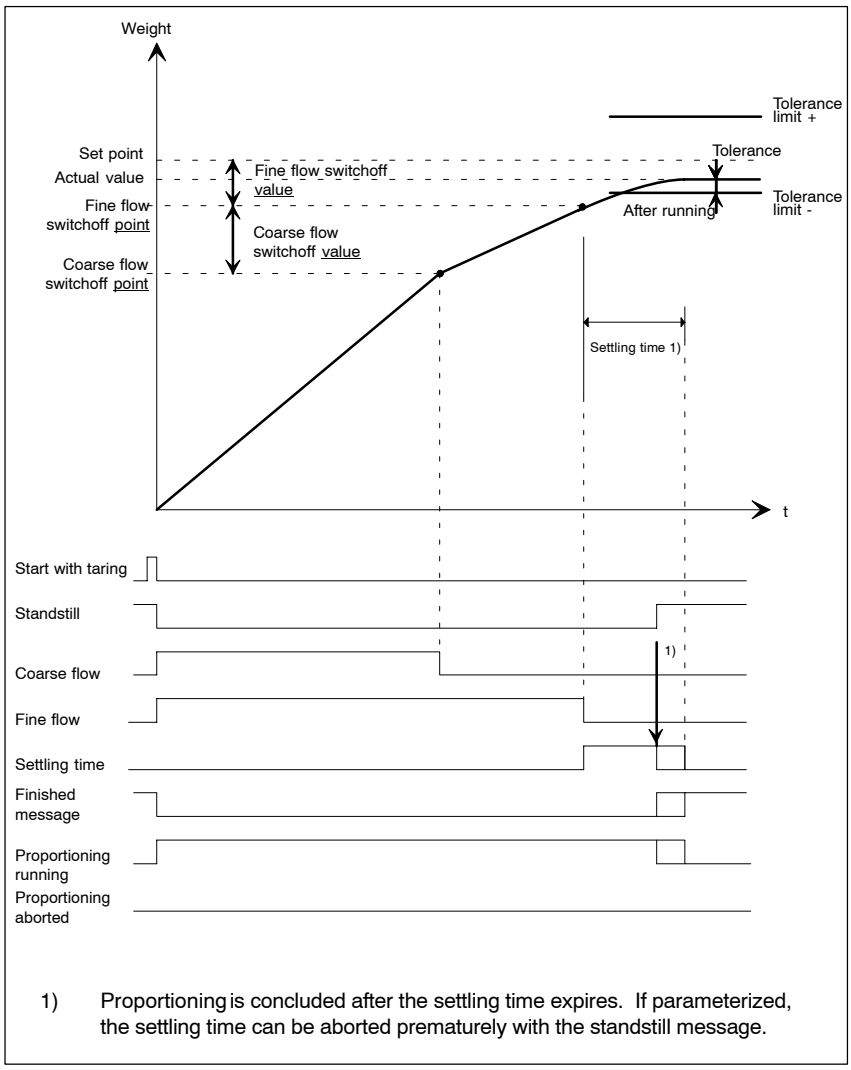
An interrupted proportioning procedure can be continued with the “Start without automatic taring” command. An interrupted proportioning procedure can be continued with the ”start without automatic taring” command.
If the current net value is above the fine–flow switchoff point when proportioning is interrupted, proportioning usually cannot be continued. The user can parameterize the ”proportioning above fine–flow switchoff point possible” parameters so that continuation of proportioning is permitted. In such cases, the fine flow is no longer activated, the tolerance is checked, and the finished message is output. The fine–flow switchoff value is not optimized. This is no longer possible after expiration of the internal SIWAREX M data backup time (process data backup).

Setpoint modification

The setpoint can always be modified during a proportioning procedure as long as the settling time is still inactive and the new setpoint is plausible.

If not plausible, the new setpoint is rejected with an error message and proportioning is aborted.

Diagram



1) Proportioning is concluded after the settling time expires. If parameterized, the settling time can be aborted prematurely with the standstill message.

Figure 3-7 Diagram of fill weighing

Switch-off points

Note

Remember that there is a difference between switchoff points and switchoff values.

Fine flow switchoff point = setpoint - fine flow switchoff value
Coarse flow switchoff point = setpoint - fine flow switchoff value
- coarse flow switchoff value

The switchoff values are always specified for SIWAREX M not the switchoff points.

The fine flow and coarse flow values are also called afterrunning and preliminary running.

The finished message is output when no automatic reproportioning is to be performed for a tolerance minus. The tolerance limits (positive and negative tolerance specification value) can be specified separately.

Value specifiacations

Coarse flow switchoff value
The coarse flow switchoff value is always a positive value.

Fine flow switchoff value
In exceptional cases, the fine flow switchoff value can also be a negative value. With negative values, the fine flow switchoff point exceeds the setpoint.

It may be necessary to switch off fine flow when the setpoint is exceeded (e.g., when the effect of compressed air creates an additive weight value when a pneumatic conveyor with compressed air is used).

Example:

Setpoint	= 100 kg
Fine flow switchoff point	= 101 kg (corresponds to fine flow switch–off value = -1 kg)

Due to material after running, an actual weight of 101.5 kg is achieved (0.5 kg after running). If the conveyor's compressed air is turned off now, the weight value sinks back to 100 kg due to the effect of the compressed air.

Tolerance specification
Tolerance specifications are always positive values and are always specified relative to the setpoint.

Example:

Setpoint	= 100 kg
Tol +	= 2 kg
Tol -	= 1 kg

A tolerance range of 99 kg to 102 kg is defined by the specifications.

3.10 Inching Mode

Inching mode is an alternate form of proportioning control. It is either used to control complete proportioning procedures or to provide reproportioning when initial proportioning was not sufficient (i.e., tolerance minus). See also section 3.11.

The inching process

The fine flow signal is switched on for a certain parameterizable inching time. After this time expires, the fine flow signal is switched off and the settling time is started. After the settling time expires, a check is made to determine whether the tolerance minus value has been exceeded (i.e., tolerance check). If yes, the proportioning procedure is concluded. If not, the fine flow signal is switched on again. This process is repeated until the tolerance minus limit has been exceeded after expiration of the settling time.

The coarse flow signal is not used for this type of operation. Only the '*fine flow*' signal is used for proportioning.

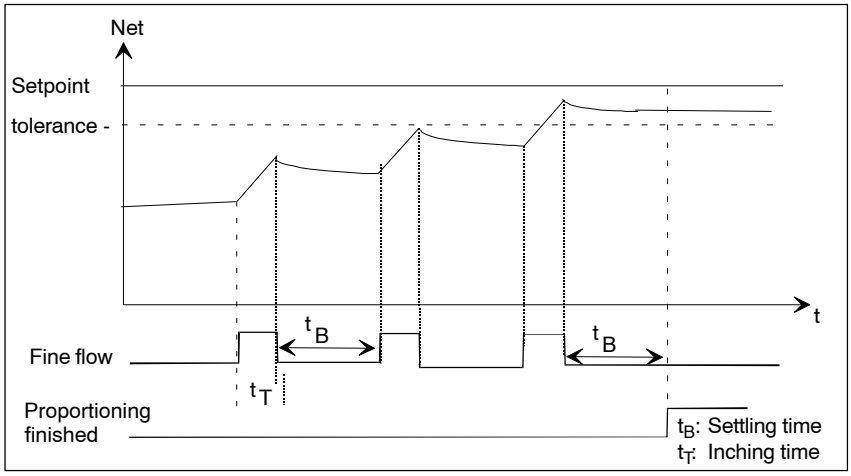


Figure 3-8 Inching mode

Inching mode can be activated by the following commands.

- Start inching mode without taring
- Start inching mode with taring
- Start proportioning without taring with reproportioning as inching mode
- Start proportioning with taring with reproportioning as inching mode

When the last two commands are used, proportioning is first started in standard proportioning mode (i.e., coarse/fine flow), and inching mode is only started when reproportioning is necessary.

When start *with taring* is used, a waiting period follows until the scales come to a standstill. Taring is then performed, and proportioning in the mode selected is started.

Data record 4 (i.e., scales setting) specifies whether filling or deduction weighing is to be used.

3.11 Automatic Reproportioning

Automatic reproportioning is used for retroactive correction of an insufficient proportioning procedure (i.e., underproportioning). During the first tolerance check, a check is made to determine whether proportioning has at least been performed up to the tolerance minus limit. If too little material has been proportioned, proportioning is continued automatically.

There are two types of automatic reproportioning.

1. Reproportioning during inching mode
2. Continuous reproportioning

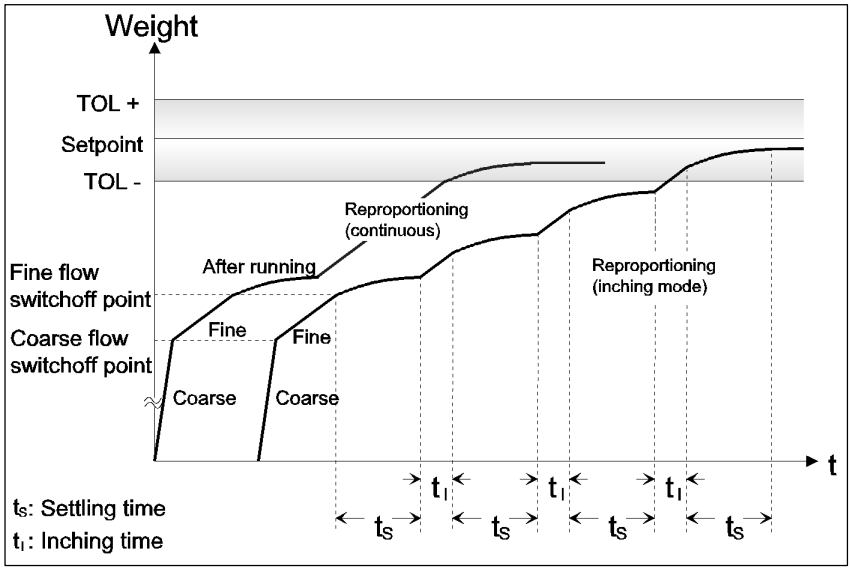


Figure 3-9 Automatic reproportioning when the tolerance minus limit is underranged

Continuous reproportioning

With continuous reproportioning, the fine flow signal remains on until the tolerance minus limit has been exceeded. The reproportioning procedure may be performed several times (e.g., due to a pneumatic conveyor, the actual value sinks back to below the tolerance minus limit after the compressed air is switched off). The effect of compressed air creates an additive weight value.

Reproportioning in inching mode

Reproportioning in inching mode is similar to proportioning in inching mode. See proportioning in inching mode in section 3.10.

Reproportioning message bit

Regardless of the type of reproportioning, a status bit indicates whether a reproportioning procedure is currently in progress or whether the last proportioning procedure involved an automatic reproportioning procedure. The status bit is cleared when a new proportioning procedure is started. The bit is also cleared when a new start is performed for the SIWAREX M. (e.g., power OFF/ON).

Start commands

The start command determines the type of reproportioning.

Proportioning can be started with the following commands. For command codes, see description of data record 2.

1. Start proportioning with taring (without reproportioning)
2. Start proportioning without taring (without reproportioning)
3. Start inching mode with taring
4. Start inching mode without taring
5. Start proportioning with taring with continuous reproportioning up to tolerance minus
6. Start proportioning without taring with continuous reproportioning up to tolerance minus
7. Start proportioning with taring with reproportioning as inching mode
8. Start proportioning without taring with reproportioning as inching mode

3.12 Time Monitoring

Time monitoring (inching mode/reproportioning)

Inching mode or automatic reproportioning is time-monitored. When a proportioning procedure has not been concluded or has not been terminated after expiration of the monitoring time t_M *(monitoring time reproportioning/inching mode)*, the *"time monitoring triggered for inching mode or reproportioning"* status is set. The status bit is not cleared until a new proportioning procedure is started. A running proportioning procedure is not terminated by time monitoring. *Monitoring time reproportioning/inching mode* is started under the following conditions.

- When a start of inching mode occurs
- When a reproportioning procedure begins regardless of the type of reproportioning

For additional information, see also figure in chapter 3.14 (Monitoring the Proportioning).

3.13 Material Flow Monitoring

The material flow monitoring functions permit system malfunctions (e.g., material feeder is clogged) to be detected. Monitoring has no effect on running proportioning procedures (i.e., proportioning is not interrupted when monitoring is triggered).

Material flow monitoring

The parameterizable material flow monitoring functions are used for monitoring filling and emptying procedures. Material flow monitoring is always active regardless of the proportioning procedures. The user must decide whether and, if so, when the queued material flow errors will be evaluated by logically linking appropriate status bits in the automation system. This provides a simple method of monitoring refilling and emptying procedures even when these are not controlled by the SIWAREX M.

A material flow error is reported when the change in gross weight is less than a specified fluctuation range (i.e., the material flow monitoring value) within a specified period of time (i.e., the material flow monitoring time). This monitoring function permits two different fluctuation ranges to be specified and two different messages (i.e., status bits) to be generated.

The material flow monitoring procedures are similar to standstill monitoring. See section 3.8.

The following parameters can be specified.

- Material flow monitoring value 1 (coarse)
- Material flow monitoring time 1 (coarse)
- Material flow monitoring value 2 (fine)
- Material flow monitoring time 2 (fine)

A material flow error is reported in DR31 (i.e., status information) with the *'material flow error 1'* and *'material flow error 2'* bits.

For additional information, see also figure in chapter 3.14 (Monitoring the Proportioning).

3.14 Monitoring the Proportioning: Coarse and Fine Flow Phase

In addition to material flow monitoring which is not dependent on a proportioning procedure (see section 3.13), two extra status bits are provided which only report a material flow error while a coarse-fine flow proportioning procedure is running and the coarse or fine flow signal is activated. These two proportioning phases (i.e., coarse/fine flow or only fine flow) are monitored separately as shown below.

Basis for monitoring the coarse flow phase:

- Material flow monitoring value coarse (Δm_C)
- Material flow monitoring time coarse (Δt_C)

Basis for monitoring the fine flow phase:

- Material flow monitoring value fine (Δm_F)
- Material flow monitoring time fine (Δt_F)

A delay time for flow monitoring is necessary if there are reaction times related to mechanical processes (e.g., switching on the coarse or fine flow).

- The *delay time for coarse flow monitoring* (t_{DC}) is started while the coarse flow is being switched on. The *material flow error - coarse flow* message is not activated until this time expires.
- The *delay time for fine flow monitoring* (t_{DF})is started or retriggered when the fine flow is being switched on and when the coarse flow is being switched off (i.e., transition from coarse/fine flow to 'only fine flow'). The *material flow error - fine flow* message is not activated until this time expires.

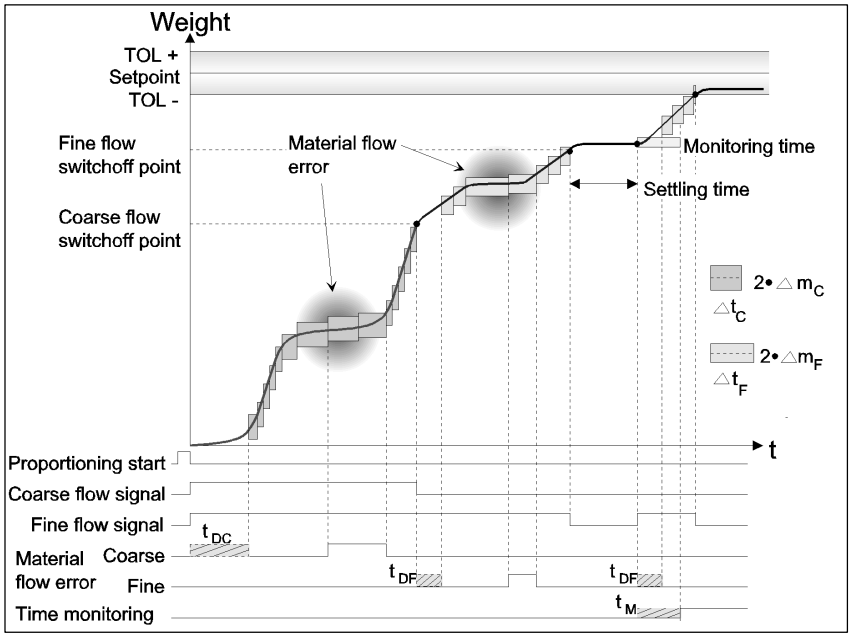


Figure 3-10 Monitoring proportioning (with reproportioning)

3.15 Optimization of the Fine Flow Switchoff Value

Optimization of the fine flow switchoff value is used to determine the optimum fine flow switchoff value. This optimizes subsequent proportioning procedures (i.e., short and precise proportioning times without reproportioning).

Function

At the end of a proportioning procedure, a new fine flow switchoff value (see DR35) is calculated when the settling time expires. If the settling time is terminated by a scales standstill (see proportioning parameters), the new value is calculated when the settling time is terminated.

The user can select whether this new switchoff value is to be used automatically during the next proportioning procedure or whether the old fine flow switchoff value will continue to be used. The optimized value is always calculated and offered as a suggestion anyway.

The new switchoff value is calculated with the formula shown below.

$FFSV_{New}$ = $FFSV_{Old}$ - (Setpoint - current net weight) x 0.5

whereby:

$FFSV_{New}$ = Newly calculated fine flow switchoff value

$FFSV_{Old}$ = Previous fine flow switchoff value

A negative fine flow switchoff value is permitted. It means that the fine flow switchoff point is above the setpoint.

The updated $FFSV_{New}$ is available with the finished message.

During an automatic reproportioning procedure, the calculation is only performed during the first tolerance check.

The calculation is omitted during proportioning in inching mode or when proportioning is terminated. The calculated switchoff value is not changed.

If parameterized, automatic acceptance of the new switchoff value in the proportioning data record (i.e., DR23) occurs together with the finished message. If new proportioning data are sent to the SIWAREX M before the next proportioning procedure is started, these data are accepted and the current fine flow switchoff value is overwritten.

The user is responsible for updating the user data outside the SIWAREX M (e.g., scales data block, etc.). If necessary, the user must read out the proportioning data after the FFSVs have been automatically accepted and, in particular when multi-component controllers are being used for different materials, store them separately.

Table 3-10 Assigned messages, data and commands

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Tolerance value +	*PROP_DAT* TOL_PLUS_VAL	198	23	0	-	20	DINT	0*
Tolerance value -	*PROP_DAT* TOL_MINUS_VAL	202	23	4	-	20	DINT	0*
Setpoint	SETPOINT	194	22	0	-	20	DINT	0*
Coarse flow switchoff value	*PROP_DAT* COARSE_VAL	206	23	8	-	20	DINT	0*
Fine flow switchoff value	*PROP_DAT* FINE_VAL	210	23	12	-	20	DINT	0*
Optimized fine flow switchoff value	*ADD_MEAS_VAL* OPTI_FINE_VAL	358	35	0	-	24	DINT	0*
Settling time	*PROP_DAT* SETTLING_TIME	214	23	16	-	20	TIME	2000 msec*
Inching time	*ADD_PROP_PARA* INCHING_TIME	260	29	0	-	48	TIME	1 sec*
Monitoring time Inching mode/reproportioning	*ADD_PROP_PARA* MON_TIME_INCH_ REPROP	264	29	4	-	48	TIME	10 sec*
Material flow monitoring time 1 (coarse)	*ADD_PROP_PARA* MAT_FL_MON_T1	268	29	8	-	48	TIME	3 sec*
Material flow monitoring value 1 (coarse)	*ADD_PROP_PARA* MAT_FL_MON_V1	272	29	12	-	48	DINT	2*
Material flow monitoring time 2 (fine)	*ADD_PROP_PARA* MAT_FL_MON_T2	276	29	16	-	48	TIME	3 sec*
Material flow monitoring value 2 (fine)	*ADD_PROP_PARA* MAT_FL_MON_V2	280	29	20	-	48	DINT	1*
Delay time for coarse flow monitoring	*ADD_PROP_PARA* DEL_TIME_MON_C	284	29	24	-	48	TIME	2 sec*
Delay time for fine flow monitoring	*ADD_PROP_PARA* DEL_TIME_MON_F	288	29	28	-	48	TIME	2 sec*
Settling time aborted by standstill	*PROP_PARA* SETTLING_ABORT	167	5	1	1	4	BOOL	Selection code 0= Off 1= On*
Automatic acceptance of the optimized fine flow switchoff value	*PROP_PARA* AUTO_FINE_VAL	167	5	1	2	4	BOOL	Selection code 0= Off 1= On*
Proportioning start above fine–flow switchoff point possible	*DOSI_PARA* DOSI_M	166	5	0	6	4	BOOL	0= Yes 1= No
Scales setting: fill/deduction weighing	*SCALES_PARA* FILL_DEDUCTION	133	4	1	1	34	BOOL	Selection code 0= Deduction weighing 1= Fill weighing.*
Start proportioning with taring without reproportioning	CMD	88	2	0	-	2	WORD	Selection code (dec.) 10
Start proportioning without taring without reproportioning	CMD	88	2	0	-	2	WORD	Selection code (dec.) 12
Start inching mode with taring	CMD	88	2	0	-	2	WORD	Selection code (dec.) 20
Start inching mode without taring	CMD	88	2	0	-	2	WORD	Selection code (dec.) 22
Start proportioning with taring with reproportioning	CMD	88	2	0	-	2	WORD	Selection code (dec.) 30

* Factory setting of SIWAREX M

Table 3-10 Assigned messages, data and commands

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Start proportioning without taring with reproportioning	CMD	88	2	0	-	2	WORD	Selection code (dec.) 32
Start proportioning with taring with reproportioning as inching mode	CMD	88	2	0	-	2	WORD	Selection code (dec.) 40
Start proportioning without taring with reproportioning as inching mode	CMD	88	2	0	-	2	WORD	Selection code (dec.) 42
Stop proportioning	CMD	88	2	0	-	2	WORD	Selection code (dec.) 11
Coarse flow on	*STATUS* / COARSE	335	31	3	0	6	BOOL	Status information
Fine flow on	*STATUS* / FINE	335	31	3	1	6	BOOL	Status information
Tolerance deviation +	*STATUS* / TOL_PLUS	335	31	3	2	6	BOOL	Status information
Tolerance deviation -	*STATUS* / TOL_MINUS	335	31	3	3	6	BOOL	Status information
Proportioning running	*STATUS* / PROP_RUN	335	31	3	4	6	BOOL	Status information
Proportioning started, wait for standstill	*STATUS* / PROP_START	335	31	3	5	6	BOOL	Status information
Proportioning aborted	*STATUS* / PROP_ABORT	335	31	3	6	6	BOOL	Status information
Proportioning concluded (finished message)	*STATUS* / PROP_END	335	31	3	7	6	BOOL	Status information
Reproportioning was activated	*STATUS* / REPROP_ACTIVE	334	31	2	0	6	BOOL	Status information
Material flow error 1	*STATUS* / MAT_FL_ERR_1	334	31	2	1	6	BOOL	Status information
Material flow error 2	*STATUS* / MAT_FL_ERR_2	334	31	2	2	6	BOOL	Status information
Material flow error - coarse flow	*STATUS* / MAT_FL_ERR_C	334	31	2	3	6	BOOL	Status information
Material flow error - fine flow	*STATUS* / MAT_FL_ERR_F	334	31	2	4	6	BOOL	Status information
Time monitoring for inching mode/reproportioning expired	*STATUS* / MON_INCH_REPROP	334	31	2	5	6	BOOL	Status information
Start command not permitted since proportioning procedure running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 23
Proportioning data not permitted since proportioning procedure running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 24
Proportioning parameter not permitted since proportioning procedure running	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 25

* Factory setting of SIWAREX M

Messages, Fill Weighing and Deduction Weighing

Table 3-11 Messages for fill weighing

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Start command was not executed since setpoint ≤ switchoff value for fine flow	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 05
Start command was not executed since setpoint > overfill value-gross weight (during start with automatic taring)	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 06
Start command was not executed since setpoint > overfill-tare weight (during start without automatic taring)	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 07
Proportioning was aborted since limit value 3 (overfill limit value) exceeded or zero setting or taring range exceeded	OPER_ERR**	9	-	1	-	1	BYTE	Operating error 03
		-	51	4	2	6	BOOL	
Start command was not executed since net > (setpoint-fine flow switchoff value) or net ≥ tolerance minus limit	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 26

** Message bit via indication word of FC SIWA-M

Table 3-12 Messages which differ for deduction weighing

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Start command was not executed since setpoint > gross weight (during start with automatic taring)	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 09
Start command was not executed since setpoint > tare weight (during start without automatic taring)	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 10

Table 3-13 Additional handling and data errors for setpoint change during running proportioning procedure

Function	SIMATIC S7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Setpoint was not accepted since setpoint-net weight < fine switchoff value	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 08
Setpoint was not accepted since **setpoint > overfill value-tare weight** (during fill weighing) Or setpoint > tare weight (deduction weighing)	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 12
Setpoint was not accepted since fine flow already switched off (after running)	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 15

"Start without taring" is used in the following situations.

- To continue proportioning after a proportioning procedure has been aborted
- When a container whose remaining contents are unknown is to be weighed and the tare value is specified "by hand"

3.16 Operational Reliability

Booting

To increase operational reliability, the following test procedures are automatically performed during each boot procedure of the SIWAREX M.

- Initialization of the micro-controller (e.g., wait states, CS logic, interrupt priorities, watchdog, timers, etc.)
- Initialization of the I/O blocks (e.g., UART, A/D converter, etc.)
- Initialization of the RAM (e.g., pointers, etc.)
- EPROM test
- RAM test
- Check for data loss on the buffered RAM
- EEPROM test
- Load parameterization and adjustment data from EEPROM
- Check load cell input for wire break

Table 3-14 Messages for the test routines

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
RAM error, read-write test	Message via diagnostic alarm		51	2	0	6	BOOL	Internal error 01
RAM error, checksum test (buffer malfunction)	Message via diagnostic alarm		51	2	1	6	BOOL	Internal error 02
EEPROM error, checksum test	Message via diagnostic alarm		51	2	2	6	BOOL	Internal error 03
A/D converter error during read-in	Message via diagnostic alarm		51	2	3	6	BOOL	Internal error 04
Watchdog error	Message via diagnostic alarm		51	2	4	6	BOOL	Internal error 05
Minimum voltages for sense line passed below	Message via diagnostic alarm		51	0	0	6	BOOL	Internal error 01
Control limits exceeded/passed below	Message via diagnostic alarm		51	0	1	6	BOOL	Internal error 02

3.17 Storing the Parameter Data

Data backup during power failure

The parameters are stored on an EEPROM, safe from loss due to a power failure.

Caution

Since the permissible number of write cycles on the EEPROM is 100,000 cycles, a write-access is only performed when the data to be written differs from the data already stored on the EEPROM. The parameter data (i.e., setting data and print formats) are stored on the EEPROM.

Since the number of write cycles on an EEPROM is limited, cyclic write-accesses to the EEPROM by the user program should be avoided.

Process data (i.e., data which change cyclically) are also protected from loss due to a power failure. They are buffered in the RAM. Buffering time is up to 72 hours but at least 6 hours.

Storing DR4 and DR5

When data records DR4/DR5 (i.e., scales and proportioning parameters) are being changed continuously, these records should only be stored in the RAM and not in the EEPROM. RAM/EEPROM storage can be selected in DR4/DR5.

Table 3-15 Messages for storage of DR4/DR5

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Storage of DR4 (scales parameters)	*SCALES_PARA* / RAM_EEPROM	132	4	0	7	34	BOOL	Storage in: 0 = EEPROM* 1 = RAM
Storage of DR5 (proportioning parameters)	*PROP_PARA* / RAM_EEPROM	166	5	0	7	4	BOOL	Storage in: 0 = EEPROM* 1 = RAM

* Factory setting of SIWAREX M

Write protection for adjustment data

Write protection of the adjustment data is set by a DIP switch. This DIP switch can be secured with a verification seal to prevent the adjustment data of verified scales from being changed.

The following data records are write-protected and cannot be overwritten.

- DR3
- DR80
- DR81

Table 3-16 Messages for operation with verification capability

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Write-access protection active	*STATUS* / WRITE_PROT	333	31	1	3	6	BOOL	Status information
Adjustment data were not changed since operation with verification capability	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 07

3.18 Special Functions

Load factory setting

The original state of the SIWAREX M on delivery can always be restored with the “Load factory setting” command after a data loss has occurred or parameterization errors have been made.

Note

When certain commands (i.e., “zero point valid”, “adjustment valid” or “load factory setting”) are called directly after each other, a waiting period of 5 seconds must be maintained between calls. Otherwise the commands will be rejected by the SIWAREX M.

A timeout prevents the maximum permissible number of write cycles for an EEPROM from being exceeded by an accidental cyclic call of these commands (see section 3.17).

When an attempt is made to call one of these three commands again within these 5 seconds, the command is rejected and the 5-second waiting period retriggered again.

Perform reset

After being turned on (i.e., power off/on), the SIWAREX M performs a reset.

Caution

The reset can also be triggered with a digital input. It is used exclusively for internal plant testing. A SIMATIC S5 or S7 CPU must be in STOP status.

Date and time

Date and time can be used for the print logs. The SIWAREX M can automatically read in date and time both via a connected TD20 remote display and an S7 CPU. To ensure synchronization when several scales are connected to one CPU, priority is placed on fetching date and time from the S7 CPU.

The update rate is a maximum of 10 seconds. If neither system supplies date and time, date and time are set to zero.

The source for date and time can be read from the data block.

When SIMATIC S7 applications are involved, SIWAREX M automatically gets the current date and time from the data block. It is up to the user to provide the current date and time (e.g., by reading the real time clock of the SIMATIC CPU).

Table 3-17 Data and messages for special functions

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Date (month, day, year) Time (hours, minutes)	DATE_TIME	410	41	-	-	8	DT	1990-01-01* 00:00:00
Source of date/time	*STATUS* / SOURCE_CLK	333	31	1	4	6	BOOL	Selection code 0=S5/S7 or none 1=TD20
Load factory setting	CMD	88	2	0	-	2	WORD	Selection code (dec.) 13

* Factory setting of SIWAREX M

The following applies if date/time are not available on any system.
- Status information 1, bit 4 = 0
- Date and time set to 0

3.18.1 Parameterization Function for Digital Inputs/Outputs

Digital inputs

The SIWAREX M is equipped with three, floating, digital inputs with a nominal voltage of 24 V.

These 3 digital inputs can be parameterized as desired. The internal command signals (e.g., set to zero, print, start proportioning, etc.) can be allocated to any input by assigning the number of the command to the desired input.

The status of each digital input is indicated on its own LED on the front of the SIWAREX M.

An attempt to enter an illegal (i.e., non-existent) allocation number will be rejected with an error message.

The digital inputs are read by the SIWAREX M every 20 msec.

For applications requiring a response message to non-executable commands on the digital outputs (e.g., no scales standstill for print or taring command), the “Command could not be executed via external contact” message can be assigned to a digital output. This message is automatically reset after 2 seconds.

Notice

No priorities or modification rights have been assigned to the individual interfaces. All commands assigned to the interfaces can always be issued without restrictions to all interfaces at all times. The user is responsible for realistic utilization.

Data and Messages - Digital Inputs

Table 3-18 Data and messages

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Command input 1	*DO_DI* / ASSIGN_DI_1	174	6	4	-	8	BYTE	Selection code (dec.) = 11
Command input 2	*DO_DI* / ASSIGN_DI_2	175	6	5	-	8	BYTE	Selection code (dec.) = 11
Command input 3	*DO_DI* / ASSIGN_DI_3	176	6	6	-	8	BYTE	Selection code (dec.) = 11
Command cannot be executed via external contact	*STATUS* / EXT_CMD_NEG	332	31	0	4	6	BOOL	Status information (is automatically reset after 2 seconds)
Illegal command code	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 18
Command assignment for input not permitted	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 18

Assignment for DI

Table 3-19 Selection codes for the digital inputs

Meaning	Selection Code (dec.)
Zero point valid (adjustment command)	01
Adjustment weight valid (adjustment command)	02
Taring	03
Externally specified tare valid	04
Set to zero	05
Reset (for plant testing purposes only)	06
Print text 1	07
Print text 2	08
Repeat last printout	09
Start proportioning with taring	10
Stop proportioning	11
Start proportioning without taring	12
Load factory setting	13
Delete tare	15
Start inching mode with taring	20
Start inching mode without taring	22
Start proportioning with taring and with reproportioning	30
Start proportioning without taring with reproportioning	32
Start proportioning with taring and with reproportioning as inching mode	40
Start proportioning without taring with reproportioning as inching mode	42

Digital outputs

The SIWAREX M has 4 floating, digital outputs (DO).

The digital outputs can be assigned as desired with weighing functions (internal status signals). Some examples are listed below.

- Limit value 1 triggered
- Proportioning running
- Coarse flow signal
- Group fault

The status of each digital output is indicated via an LED on the SIWAREX M.

An inverted output (active low) is also possible for some safety-related status signals.

An attempt to enter an illegal (i.e., non-existing) assignment number will be rejected with an error message.

The digital outputs are updated by the SIWAREX M every 20 msec.

Note

The digital outputs are switched off for the BASP signal of the S7 CPU if the BASP function was deactivated.

Table 3-20 Data and messages

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Signal output 1	*DO_DI* / ASSIGN_DO_1	170	6	0	-	8	BYTE	Selection code (dec.) = 23
Signal output 2	*DO_DI* / ASSIGN_DO_2	171	6	1	-	8	BYTE	Selection code (dec.) = 23
Signal output 3	*DO_DI* / ASSIGN_DO_3	172	6	2	-	8	BYTE	Selection code (dec.) = 23
Signal output 4	*DO_DI* / ASSIGN_DO_4	173	6	3	-	8	BYTE	Selection code (dec.) = 23
Signal assignment for output not permitted	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 17

Table 3-21 Selection codes for the digital outputs

Meaning	**Selection Code (High Active)**	**Selection Code Inverted (Low Active)**
Scales adjusted	0	-
Scales tared	1	-
1/4d-zero	2	-
Write-access protection active	3	-
Source of date/time (0 = S7 or none; 1 = TD20)	4	-
Limit value 1 active/inactive	5	105
Limit value 2 active/inactive	6	106
Limit value 3 active/inactive	7	107
Empty message active/inactive	8	108
Standstill	9	-
Max. load + 9 e exceeded	10	110
Load tare memory with manual (preset) tare value (pT)	11	-
Command could not be executed via external contact	12	-
Gross weight outside zero setting range	13	-
Group fault (hardware error)	15	115
Coarse flow on	16	-
Fine flow on	17	-
Tolerance deviation +	18	-
Tolerance deviation -	19	-
Proportioning running	20	-
Proportioning started, wait for standstill	21	-
Proportioning aborted	22	-
Proportioning concluded (finished message)	23	-
Material flow error 1	24	124
Material flow error 2	25	125
Material flow error, coarse flow	26	126
Material flow error, fine flow	27	127
Time monitoring in inching mode or reproportioning has expired	28	-
Printing not possible	29	-
Reproportioning was activated	30	-

3.18.2 Analog Output

Description

The analog output is used to output an analog value (e.g., for a measured value indication, a process recorder or a controller). This output is designed as a 0/4 to 20 mA current output. The gross or net weight, or an externally specified value from the SIMATIC or the host can be output on the analog output.

The following output values are available on the analog output.

- Gross weight
- Net weight
- Externally specified value

The analog output can be parameterized to either 0 to 20 mA, or 4 to 20 mA. Using the 4 to 20 mA setting reduces the maximum effective resolution by 20%. The output is updated approximately every 350 msec. A scaling procedure is performed when a maximum value is specified. The maximum resolution is 16 bits (65.535 parts).

When negative values are specified or when 0 is specified for the maximum value, 0 or 4 mA is always output.

The output values are calculated as follows.

I_{OUT} (0 to 20 mA) = Output Value / Max. Value * 20 mA

I_{OUT} (4 to 20 mA) = 4 mA + (Output Value / Max. Value * 16 mA)

Note

When SIWAREX M starts up, the analog output is set to the initial value of the output current range of the DA converter (i.e., 0 mA).

Note

When the BASP signal of the S7 CPU is active, 0 mA is output on the analog ouput if the BASP function was not deactivated.

Table 3-22 Data and messages

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (Byte)		
Setup of the analog output	*AO_PARA* / AO_SETUP	182	9	0	-	10	WORD	Selection code (dec.) 0= Output externally specified value 0 to 20 mA* 1= Output gross 0 to 20 mA 2= Output net **0 to 20 mA** 10= Output externally specified value 4 to 20 mA 11= Output gross 4 to 20 mA 12= Output net 4 to 20 mA
Output maximum value on analog output	*AO_PARA* / AO_MAX_VAL	188	9	6	-	10	DINT	10000*

* Factory setting of SIWAREX M

Example

Setup: Output gross 0 to 20 mA
Maximum output value: 10 000

If the gross weight value is 5000, 10 mA are output on the analog output.

Remember that weight values are represented on the interfaces (e.g., SIMATIC S7) in fixed point format without unit of weight and decimal point. Example: a gross weight value of 5000 can mean 50.00 kg or 500.0 t and so on.

In our example, the extra information on the converter value of the DA converter for the analog output includes approximately 32000 digits. This information is only required for service purposes.

Overview of System Integration

4

This section describes the available links to various host systems.

4.1 System Integration

Description

There are several ways to link the SIWAREX M with a higher order host system.

The P bus interface (i.e., the internal I/O bus of the SIMATIC S7) on the back of the SIWAREX M housing can be used to integrate the SIWAREX M as a function module directly in the SIMATIC S7-300. The SIWAREX M can also be decentrally connected to the SIMATIC S7/C7/PCS 7 with the IM 153-1 or IM 153-2 interface module.

The serial interfaces RS 232 and TTY permit connection to other host systems (e.g., a host computer).

Notice

No priorities or modification rights are assigned to the individual interfaces with respect to the use of various interfaces. This means that all commands assigned to the interfaces can be issued without restriction to all interfaces at all times. It is up to the user to ensure realistic utilization.

Configurator

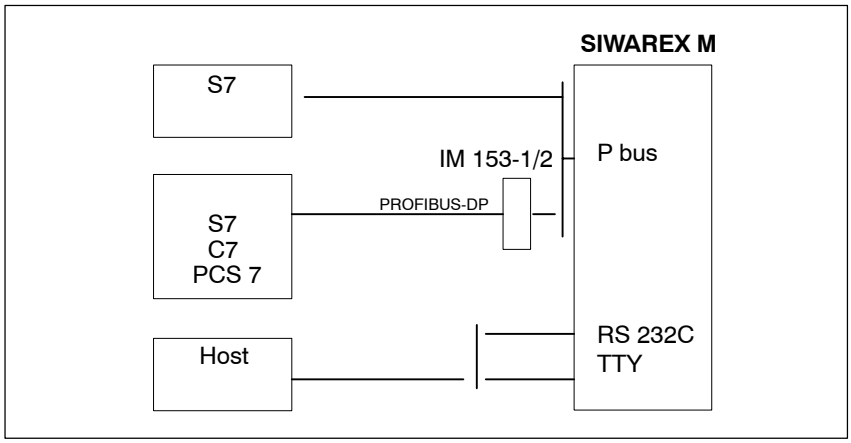


Figure 4-1 Possible links to a host system

Caution

Since only 100,000 write cycles are guaranteed for the EEPROM, write-accesses are only performed when the data to be written differ from the data already stored on the EEPROM. Parameter data (i.e., settings and print layouts) are stored on the EEPROM.

Since the number of write cycles is limited with an EEPROM, cyclic write-accesses to the EEPROM by the user program should be avoided.

Overview of data records

The following table gives you an overview of data records which are provided by the SIWAREX M and are required for communication with a host system.

Table 4-1 Data records provided by the SIWAREX M

DR No.	Function	Direction[1]	Length (Bytes)	Interfaces		Store in	
				S7	X1, X2 Serial	EEPROM	RAM (Buffered)
Diagnostic Data							
DR0	S7 diagnostic data record	r	4	Yes	No	No	No
DR1	S7 diagnostic data record	r	16	Yes	No	No	No
DR0	S7 parameter data record (not used)	w	4	No	No	No	No
DR1	S7 parameter data record (not used)	w	16	No	No	No	No
Setting Data: Adjustment and Setting Values							
DR2	Commands	w	2	Yes	Yes	No	No
DR3 *	Adjustment data	r/w	42	Yes	Yes	Yes	No
DR4	Scales parameter	r/w	34	Yes	Yes	Yes/no[2]	No/yes[2]
DR5	Proportioning parameter	r/w	4	Yes	Yes	Yes/no[2]	No/yes[2]
DR6	Parameter for digital inputs and outputs	r/w	8	Yes	Yes	Yes	No
DR7	Parameter for RS 232	r/w	2	Yes	Yes	Yes	No
DR8	Parameter for TTY	r/w	2	Yes	Yes	Yes	No
DR9	Parameter for analog output	r/w	10	Yes	Yes	Yes	No
Process Data: Weighing and Proportioning Data, Commands							
DR22	Setpoint	r/w	4	Yes	Yes	No	Yes
DR23	Proportioning data	r/w	20	Yes	Yes	No	Yes
DR24	Specified value f. analog output	r/w	4	Yes	Yes	No	Yes
DR26	String field 1	r/w	16	Yes	Yes	No	Yes
DR27	String field 2	r/w	16	Yes	Yes	No	Yes
DR28	External tare specification	r/w	4	Yes	Yes	No	Yes
DR29	Additional proportioning parameters	r/w	48	Yes	Yes	No	Yes

1 r: READ-access only; w: WRITE-access only; r/w: READ and WRITE-access
2 Depends on the parameter bit in data record DR4 or DR5
* After verification acceptance, can only be read–accessed

Table 4-1 Data records provided by the SIWAREX M

DR No.	Function	Direc-tion[1]	Length (Bytes)	Interfaces		Store in	
				S7	X1, X2 Serial	EEPROM	RAM (Buffered)
Measuring values							
DR30	Weight values	r	12	Yes	Yes	No	No
DR31	Status information (bit-coded)	r	6	Yes	Yes	No	No
DR32	Meas. values more precise	r	8	Yes	Yes	No	No
DR33	Raw digit values	r	8	Yes	Yes	No	No
DR34	Analog output value	r	4	Yes	Yes	No	No
DR35	Additional measured values	r	24	Yes	Yes	No	No
Other							
DR40	Print data of last printout	r	28	Yes	Yes	No	No
DR41	Date and time	w	8	Yes	Yes	No	No
DR42	Type identifier/program version/switches	r	8	Yes	Yes	No	No
DR43	Tare and set to zero value more precise	r/w	10	Yes	Yes	No	Yes
Diagnostic Information							
DR51	Error information	r	6	Yes	Yes	No	No
Print Layouts							
DR80	Text 1	r/w	80	No	Yes	Yes	No
DR81	Text 2	r/w	80	No	Yes	Yes	No
Communication							
DR100	Fetch telegram	w	1	No	Yes	No	No
DR101	Acknowledgment telegram	r	3	No	Yes	No	No

1 r: READ-access only; w: WRITE-access only; r/w: READ and WRITE-access
2 Depends on the parameter bit in data record DR4 or DR5
* After verification acceptance, can only be read–accessed

Centrally in SIMATIC S7-300

5

5.1 Introduction

Note

The information contained in this documentation requires a knowledge of handling the SIMATIC S7.

The FC SIWA-M function is required for communication of the SIWAREX M and the SIMATIC S7 CPU.

Tasks of FC SIWA-M (FC41)

- Performance of startup synchronization
- Transferring the weighing commands (e.g., taring, setting to zero and so on)
- Reading data from the SIWAREX M (e.g., reading measured values)
- Writing data to the SIWAREX M (e.g., limit values, adjustment data and so on)

5.1.1 Hardware Prerequisites

SIWAREX M

The SIWAREX M requires firmware status 0117 or higher.

SIMATIC S7

The standard blocks can be executed with both the S7-300/400 and the C7 CPUs.

5.1.2 Scope of Delivery

The SIMATIC S7 configuration package is supplied on CD-ROM. The CD-ROM contains a STEP 7 project with the standard blocks and a sample program. The sample program contains all data and code blocks required for operation of the
SIWAREX M module.

In addition to the DB-SIWAREX, the project contains a data type declaration (UDT).

SETUP

The S7 SETUP program must be executed so that STEP 7 will list the SIWAREX M in the catalog of modules.
The standard blocks and an example for the SIMATIC S7 are included on the CD as an archived project. The user can move the blocks to his/her project container.

5.2 Parameterizing the SIWAREX M Module

There are two ways to parameterize the SIWAREX M.

- Via the PC parameterization software SIWATOOL
- Via the SIMATIC S7 (entry of the scales parameters in the DB-SIWAREX)

5.3 Communication Principle

This section describes communication between the SIWAREX M and the SIMATIC S7 CPU.

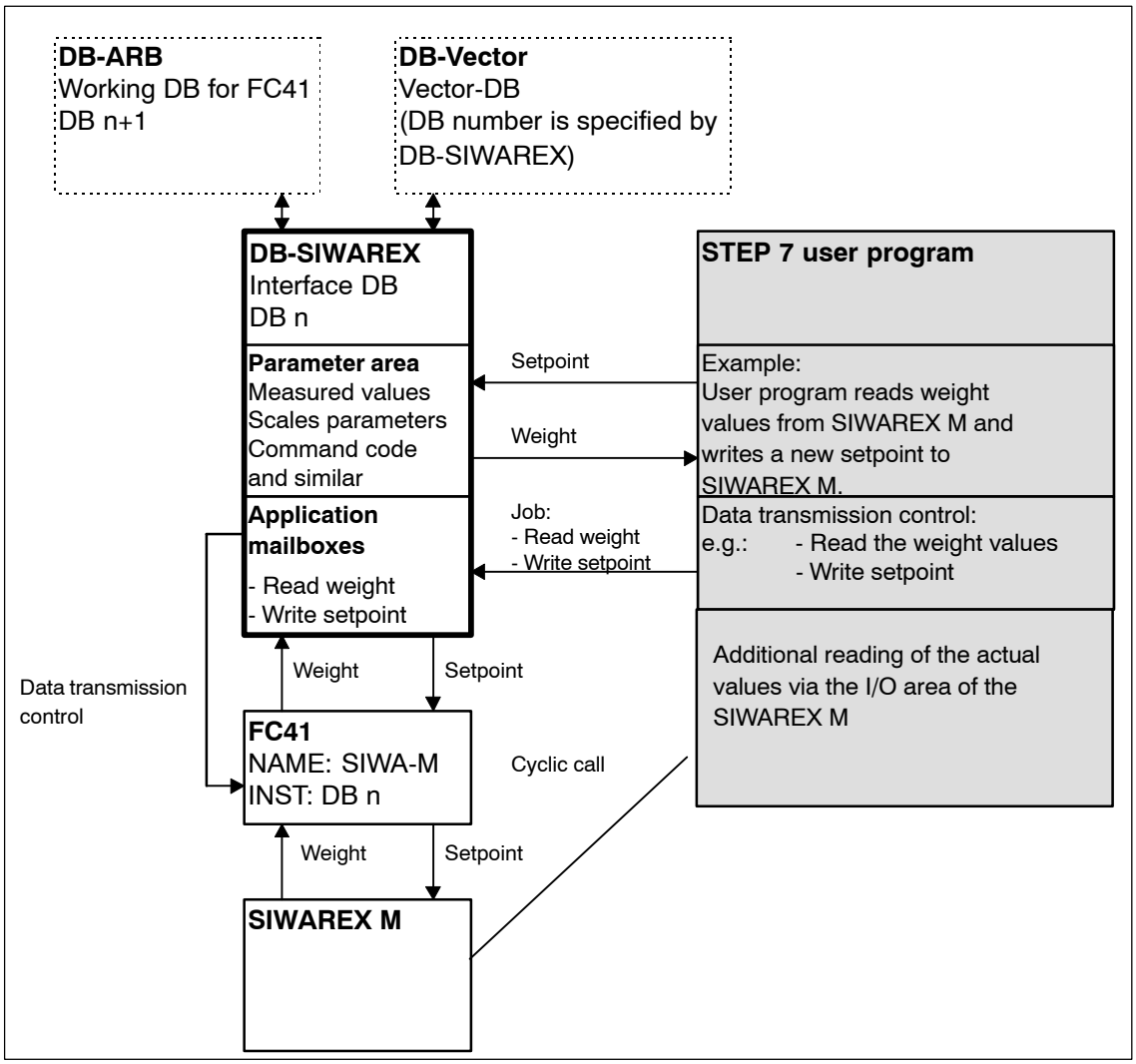


Figure 5-1 Transmission of weight values and the setpoint

Description

The DB-SIWAREX interface data block is the interface to the STEP 7 user program. One DB-SIWAREX is required for each SIWAREX M module. Using the parameter area of DB-SIWAREX, the STEP 7 user program can access weight values, status messages and scales parameters. In addition, weighing commands (e.g., start proportioning) can be triggered by making appropriate entries in the parameter area of the DB-SIWAREX.

Using a second area of the DB-SIWAREX (i.e., the application mailboxes), the STEP 7 user program can control data transmission between the S7 and the SIWAREX M. Appropriate entries in the application mailboxes specify which data are to be transferred to the SIWAREX M or which data are to be read by it. The FC SIWA-M standard function handles data transmission as specified by the information in the application mailboxes.

The FC SIWA-M function must be called once per SIMATIC CPU cycle for each SIWAREX M module with specification of the applicable DB number of the related DB-SIWAREX.

The DB-ARB and DB-VECTOR data blocks are used for internal purposes. Since they are of no interest to the user, they will not be described here.

Regardless of whether the FC SIWA–M function is called, the current actual values and the status values can be read directly from the I/O area of the SIWAREX M (see 5.13).

5.4 DB-SIWAREX, DB-ARB and DB-VECTOR

The DB-SIWAREX and DB-ARB data blocks are required once per SIWAREX M module. The DB-VECTOR data block is only required once per SIMATIC CPU.

DB-SIWAREX (interface DB)

DB-SIWAREX contains the data of the SIWAREX M module (i.e., parameter area) and specifications for controlling data communication (i.e., application mailboxes). Since DB-SIWAREX provides the user with the interface between the SIWAREX M and the SIMATIC S7, this DB will subsequently be called the interface DB. The DB number of DB-SIWAREX is parameterized with the INST parameter of FC SIWA-M. DB-SIWAREX must be present once per SIWAREX M in the memory of the SIMATIC CPU. The DB number of DB-SIWAREX can be assigned as desired (e.g., DB10).

Example: DB10 for DB-SIWAREX

DB-ARB

The second data block serves as the working data block for the FC SIWA-M standard function. The data in DB-ARB may not be changed by the user since this information is used for internal purposes. The DB-ARB must be present once per SIWAREX M in the memory of the SIMATIC CPU. The next higher DB number (as related to the DB-SIWAREX) must be assigned to the DB-ARB.

Example: DB10 was assigned to DB-SIWAREX.

→ DB11 is then automatically assigned to DB-ARB.

DB-VECTOR

A third data block, DB-VECTOR, is also required. The contents of DB-VECTOR are always included with the delivery and may not be changed by the user. DB-VECTOR must only be loaded once per CPU in the RAM of the SIMATIC CPU. It can be used by any number of SIWAREX M modules.

The DB number of DB-VECTOR can be assigned by the user as desired. The DB number of DB-VECTOR and the start address must be entered in data words DBW2 and DBW4 of the interface block (i.e., DB-SIWAREX).

Setting up the data blocks

One DB-SIWAREX and one DB-ARB must be set up for each SIWAREX M module.

Only one DB-VECTOR is required per SIMATIC CPU.

The DB-SIWAREX, DB-ARB and DB-VECTOR data blocks are set up by copying them from the included sample project to your own project or by generating them again using the data structure definition (UDT) included. The blocks can be renamed. Data blocks for additional scales cannot be set up as online copies within the CPU.

DB-VECTOR can also be easily appended to an existing data block by linking the included UDT for DB-VECTOR in the desired data block. Remember that the DB number and the start of the data area in DB-SIWAREX (DBW2 and DBW4) must be adapted.

Basic parameterization of the DB-SIWAREX

A separate DB-SIWAREX must be set up for each SIWAREX M module. The following information must be entered in the interface data block (i.e., DB-SIWAREX).

– The start address (i.e., interface address) of the SIWAREX M module. (Address must be divisible by 16.)

  And

– The pointer to DB-VECTOR

Copying the data block from the online project

Data blocks DB-SIWAREX and DB-ARB store the current processing status of FC SIWA-M.

Keep the following points in mind if data blocks are to be transferred from the CPU to the programmer and reloaded to the CPU at a later date.

Before performing a new start, the following measures must be performed.

1. Delete all jobs from the application mailboxes of DB-SIWAREX.
2. Delete the error words of the individual application mailboxes.
3. Delete all data bytes in DB-ARB.
4. Remember that the stored (i.e., old) status is indicated for the actual values (i.e., measured value, status and so on) until FC SIWA-M has updated them with an appropriate job.

The data areas are deleted by writing the value KH=00 in the corresponding data byte.

There are two ways to perform the measures described in points 1 to 3.

– Delete the data bytes with a routine in the startup OB.

– Delete the data words manually on the programmer (on the data medium).

5.5 Function Description of FC SIWA-M

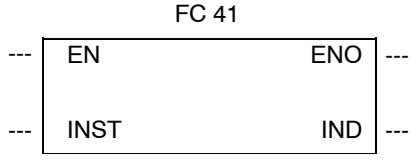
The FC SIWA-M standard function handles startup synchronization with the SIWAREX M. FC SIWA-M can be used to parameterize, control and monitor the module. The data required for the function are stored in the interface data block (i.e., DB-SIWAREX). The FC SIWA-M transfers data from the interface data block to the SIWAREX M module and vice versa.

5.5.1 Calling the Function Block

STL representation

```
CALL FC41: (
 INST  :=     ,
 IND   :=     );
```

LAD representation



5.5.2 Parameters of the Function Block

Table 5-1 Explanation of the parameters

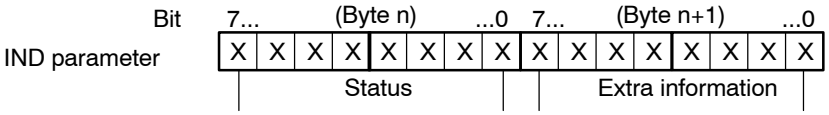
Name	Class	Data Type	Meaning	Is ... by the User	Is ... by the Block
INST	I	INT	Number of the DB-SIWAREX	Specified during the call	Scanned
IND	O	WORD	Job status, extra information	Scanned	Entered

The FC SIWA-M function must be called with an appropriate INST parameter once per CPU cycle and SIWAREX M.

It may only be called unconditionally in **one** processing level (i.e., either in the cycle or in a time-controlled program level). The number of function block may be changed (e.g., FC50).

5.5.3 Indication Word

The FC SIWA-M function contains an indication word (i.e., IND parameter) as output parameter. The indication word is used to provide the user with a return message on the current job status of the function.



X = Set by FC SIWA-M

Assignment of the extra information

When a job is concluded with errors (see bits of the indication word), the extra information contains an error number indicating the exact cause of the error.

Table 5-2 Causes of errors

Error No. (Decimal)	Error No. (Hexadecimal)	Cause of the Error
110	6E	Module address not divisible by 16
112	70	Synchronization not possible
115	73	Timeout life bit monitoring triggered
117	75	An operational error has occurred. Error evaluation via DB-SIWAREX (DBB 9)
223	DF	An error occurred in an application. Error evaluation via indication words of the application mailboxes

Definition of terms: Synchronous and asynchronous errors

Asynchronous error messages are errors which are not the direct result of a weighing command or a data transmission.

Example:

Asynchronous errors:	Internal errors, external errors and operational errors (e.g., RAM errors and wire breaks on load cells)
Synchronous errors:	Handling and data errors (e.g., illegal weighing command)

Definition of terms: Data records

A data record defines an area in DB-SIWAREX. For example, when data record DR23 (i.e., proportioning data) is transferred, address area 198 to 217 of DB-SIWAREX is transferred. See section 5.7 for the assignment of data record number ↔ address area.

The data records themselves are described in detail in chapter 8.3.

5.5.4 Description of the Bits of the Indication Word (IND)

Table 5-3 Description of the bits of the indication word

Bit in Indication Word	Explanation	Action by User	Action by Block
Byte n, bit 7: Startup finished with errors	= 1 Startup concluded with errors = 0 Startup (still not) concluded	**Scan only**	**Set** when startup was concluded with errors **Reset** when startup was concluded without errors
Byte n, bit 6: Startup running	= 1 Startup running = 0 Startup concluded	**Scan only**	**Set** when function detects a module startup **Reset** when startup synchronization with module has been concluded
Byte n, bit 5: Interface busy with another function	= 1 Interface is busy = 0 Interface is free	**Scan only**	**Set** when interface is busy with another job **Reset** as soon as own job is being processed
Byte n, bit 4: Finished with errors	= 1 Job concluded with errors = 0 Job (still) not concluded	**Scan** If 1, then extra information must be evaluated by the user. Can be **reset** by the user after error evaluation. (Recommended!)	**Set** when job was concluded with errors **Reset** automatically when job is triggered again
Byte n, bit 3: Data loss	Data loss message from SIWAREX M = 1 Data loss (buffer malfunction) = 0 SIWAREX M configured	**Scan** If 1, then user must write DR43 to SIWAREX M.	**Set** or **reset**. Set when SIWAREX M reports data loss **Reset** automatically when error acknowledged via: - Transfer of DR43 - TD20 - SIWATOOL
Byte n, bit 2: Group error	Group error bit of the block (indication of an operational error and timeout error for life bit) = 1 Changes occurred. = 0 No changes occurred.	**Scan**	**Set** when an operational error is reported (arriving or departing) **Reset** when no change (arriving/departing) in operational error (BF bit) and no timeout life bit were detected

Table 5-3 Description of the bits of the indication word

Bit in Indication Word	Explanation	Action by User	Action by Block
Byte n, bit 1: Finished without errors	= 1 Job concluded without errors = 0 Job (still) not concluded	**Scan** If 1, then job executed successfully Can be **reset** by user. Recommended !	**Set** when job was concluded without errors **Reset** automatically when job is triggered again
Byte n, bit 0: Job running	= 1 Job running = 0 Job not running	**Scan**	**Set** as soon as job is triggered **Reset** when job has been concluded
Byte n+1, bits 0 to 7: Extra information	<> 0 Job was concluded with errors = 0 Job was concluded without errors	**Scan** Extra information is valid if bit 4 of the low byte n (finished with errors) = 1.	**Write** when job has been concluded (depending on error status with 0 or a value not equal to 0) **Delete** automatically when job is triggered again

5.5.5 EN/ENO Mechanism

Parameters EN and ENO only pertain to the graphic representations (i.e., LAD and FBD). When ENO is involved, the binary result (i.e., BIE) is set to zero before the block is exited when processing was concluded with errors.

The binary result is set to one when processing was concluded without errors. Errors have occurred if bit 4 of the low byte n (i.e., finished with errors) is set in the indication word (i.e., the IND parameter).

An operational error message does not affect the binary result. Operational errors are indicated via the indication word (bit 2 of the low byte n) of the FC SIWA-M standard function.

5.5.6 How the FC SIWA-M Functions

Application mailboxes

The user uses the application mailboxes to specify which data are to be read from the SIWAREX M module and which data are to be written to the SIWAREX M module. The entry can be made either with the S7 Editor or from the user program. In addition, valid scales parameters must have already been entered in DB-SIWAREX.

There are 3 application mailboxes for writing data records.

1. WRITE_DATA_1
2. WRITE_DATA_2
3. WRITE_COMMAND

There are 2 application mailboxes for reading data records.

1. READ_DATA_1
2. READ_DATA_2

Calling the FC SIWA-M

When the function reports with the indication word that no job is running, new jobs can be specified with the application mailboxes. If the function is now called, the application mailboxes set up a copy which FC SIWA-M can access during continued processing. This copy contains the entire job to be processed. Several cycles may be required to process the job. The function reports with the “job running” indication word while the job is being processed.

Setup of the WRITE_DATA and READ_DATA applications

Bit	7...							...0	Bit	7...							...0	Meaning
DBB n	0								**DBB n+1**	X								Pointer to DR number (dec.)
DBB n+2	X	X	X	X	X	X	X	X	**DBB n+3**	X	X	X	X	X	X	X	X	Transmission control bit field
DBB n+4				X			X	X	**DBB n+5**	X	X	X	X	X	X	X	X	Indication word 1 (DBW n+4)
DBB n+6	X	X	X	X	X	X	X	X	**DBB n+7**	X	X	X	X	X	X	X	X	Indication word 2 (DBW n+6)

The user specifies which data records are to be read or written by specifying a pointer to a data record number and a transmission control bit field.

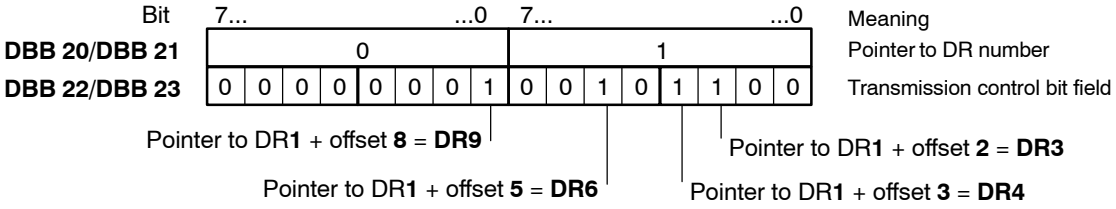
The pointer specifies the data record number at which the data transmission is to start. The bit position of the transmission control bit field specifies which of the 15 subsequent data records are to be transferred.

Error evaluation can be performed via the indication words.

The transmission control bit field is not reset until all related data records of the particular application have been read or written.

Example

Use of the WRITE_DATA_1 application
Data records DR3, 4, 6 and 9 are to be written.



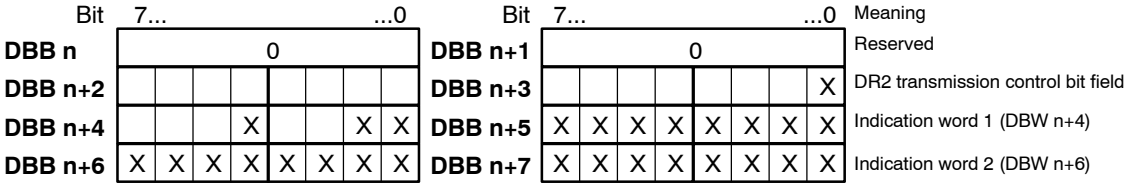
Setup of the WRITE_COMMAND application

The WRITE_COMMAND application is set up similar to the WRITE_DATA and READ_DATA applications.

To trigger a weighing command, the appropriate command code (e.g., command code 3 for taring) must be entered in data record DR2 of the DB-SIWAREX (DB_SIWAREX.CMD) and bit 0 in DBB 47 must be set to 1 in the bit field for DR2 transmission.

Note

Command data record DR2 must be transferred with the WRITE_COMMAND application. It cannot be transferred with the WRITE_DATA applications.



X = Set or read by the user

Assignment of the application mail-boxes

DBB n: *Always 0*

DBB n+1: *For WRITE_DATA and READ_DATA applications:*
Pointer to DR number: 0 to 51

For WRITE_COMMAND application:
Not used

DBB n+2: *For WRITE_DATA and READ_DATA applications:*

Bit field for transmission control:

Bit 0:	Offset 8 to “pointer to DR number”
:	:
Bit 6:	Offset 14 to “pointer to DR number”
Bit 7:	Offset 15 to “pointer to DR number”

For the WRITE_COMMAND application:

Bits 0 to 7: Not used

DBB n+3: *For WRITE_DATA and READ_DATA applications:*

Bit field for transmission control:

Bit 0:	Offset 0 to “pointer to DR number”
Bit 1:	Offset 1 to “pointer to DR number”
:	:
Bit 5:	Offset 5 to “pointer to DR number”
Bit 6:	Offset 6 to “pointer to DR number”
Bit 7:	Offset 7 to “pointer to DR number”

For the WRITE_COMMAND application:

Bit 0: Write command data record (DR2)

DBB n+4: *Assignment of indication word 1:*

Bit 7:	Not used
Bit 6:	Not used
Bit 5:	Not used
Bit 4:	Job finished with errors
Bit 3:	Not used
Bit 2:	Not used
Bit 1:	Job finished without errors
Bit 0:	Job running

DBB n+5: Bit 7 to 0: Extra information

Assignment of the extra information (indication word 1)

When a job is concluded with errors, extra information contains an error number specifying the exact cause of the error.

Table 5-4 Causes of errors (extra information)

Error No. (Decimal)	Error No. (Hexadecimal)	Cause of Error
14	0E	Error during internal call of SFC RD_REC
15	0F	Error during internal call of SFC WR_REC
17	11	Timeout for job interface
217	D9	Data record number does not exist
218	DA	Data record number not permitted
219	DB	WRITE_COMMAND was not transferred. – Is only reported via the WRITE_COMMAND application – Additional information: See “Errors While processing an Application.”
220	DC	Running job aborted by synchronization (e.g., for restart)
221	DD	SIWAREX M reports finished with handling error. (See section 11.3.)
222	DE	SIWAREX M reports finished with data error. (See section 11.1.)

DBW n+6: *Assignment of indication word 2:*

Indication word 2 contains extra information concerning an error reported by indication word 1. If the job is processed correctly, indication word 2 contains the value W#16#0000.

Table 5-5 Indication word

If indication word 1 (byte n+5) reports			Then indication word 2 contains
Error No. (Decimal)	Error No. (Hexadecimal)	Cause of Error	
14	0E	Error during internal call of SFC RD_REC (SIMATIC S7 system function)	RET_VAL of SFC RD_REC For error code, see manuals of SIMATIC S7.
15	0F	Error during internal call of SFC WR_REC (SIMATIC S7 system function)	RET_VAL of SFC WR_REC For error code, see manuals of SIMATIC S7.
221	DD	Finished with handling errors	Error code (handling errors) (See section 11.3.)
222	DE	Finished with data errors	Error code (data errors) (See section 11.1.)

Processing applications

After all jobs have been processed, a check is made at each call to determine whether the trigger parameters (transmission control bit field) is unequal to W#16#0000. If one or more jobs are found, the parameterization is checked and a copy is made for processing. This copy contains the entire job.

The IND indication word always refers to the entire job. The status message "job running" (bit 0 of low byte n = 1 in IND parameter of FC SIWA-M) is reported during the entire time of the execution of the entire job. "Job finished without errors" (bit 1 of low byte n = 1 in IND indication word) is not reported until all triggered jobs have been executed.

The trigger bits of the application (transmission control bit field) are not reset until all related data records of the particular application have been read or written.

When an application has been concluded with errors, "job finished with errors" (bit 4 of low byte n = 1 in IND indication word) is output with extra information (errors occurred during an application) after the entire job has been executed.

Errors during the processing of an application (synchronous errors)

When an error (synchronous error message) occurs during an application, processing of this application is aborted and the next application is called.

When a write function is concluded with errors, the application is aborted with the status "end with errors" and an appropriate error message. The WRITE_COMMAND application is no longer executed. The status "end with errors" and the error message "WRITE_COMMAND not transferred" are entered in the indication word 1.

Example:

Using the WRITE_DATA_1 application, a new (but incorrect because negative) setpoint is written to the SIWAREX M. At the same time, proportioning is started with command code 10 (start proportioning with automatic taring) using the WRITE_COMMAND application.

The SIWAREX M rejects the incorrect setpoint.

(Message via indication words of the WRITE_DATA_1 application)

- Indication word 1: DBB 24, bit 4 = 1: Job finished with error
- Indication word 1: DBB 25 (extra information)
  Code = DE (hex) → Finished with error since data error occurred
- Indication word 2: DBW 26
  Code = 13 (dec.) → Permissible number range exceeded. See section 11.1.

Starting proportioning can no longer be executed.
(Message via indication words of the WRITE_COMMAND application)

- Indication word 1: DBB 48, bit 4 = 1: Job finished with error
- Indication word 1: DBB 49 (extra information)
  Code = DB (hex) → WRITE_COMMAND was not transferred.
- Indication word 2: Irrelevant

Warning

When errors occur, take suitable measures to evaluate them.

When a job has been concluded with a data error or a handling error, the error code (see section 11) is copied to indication word 2 of the application. DB-SIWAREX always contains the latest data error or handling error.

Even when an error occurred during a write function, the parameterized read functions are always executed.

Special features of the WRITE_COMMAND application mailbox

The FC SIWA-M checks to determine whether the trigger bit (DBX47.0: transmission control command, bit 0) has been set in the WRITE_COMMAND application mailbox. If the trigger bit is set, data record DR2 (DB_SIWAREX.CMD) is then checked to determine whether the command code = 11 (STOP command) has been entered. If yes, this is transferred to the module first and then the write and read jobs are executed in sequence.

Processing sequence with STOP command:

1. **WRITE_COMMAND**
2. WRITE_DATA_1
3. WRITE_DATA_2
4. READ_DATA_1
5. READ_DATA_2

Processing sequence with unequal to STOP command:

1. WRITE_DATA_1
2. WRITE_DATA_2
3. **WRITE_COMMAND**
4. READ_DATA_1
5. READ_DATA_2

5.6 Reporting of Asynchronous Errors

Asynchronous error messages (i.e., life bit errors, operational errors, internal errors and external errors) can occur at any time.

Life bit monitoring

The FC SIWA-M monitors a life bit to determine whether the SIWAREX M is still “alive.” Monitoring is always active even when no jobs are running.

Output of the error message is derived from the number of FC calls. The number of FC calls that can occur before an error message (i.e., timeout) is issued is prespecified in DB-SIWAREX (DB_SIWAREX.MAX_CALLS).

The value can be changed if necessary by the user.

The permissible value range is between +20 and +32767. If the user enters an invalid value, the FC SIWA-M automatically overwrites this value with the maximum value (i.e., +32767). If the timeout is triggered, bit 2 of the low byte n (group error) of the indication word of FC SIWA-M is set and the error number 73 hex is entered in the extra infomation.

The timeout is self-acknowledging.

Operational errors

When the SIWAREX M reports an operational error, group error bit 2 of the low byte n in the indication word of FC SIWA-M is set and error number 75 hex is entered in the extra information. The “OPER_ERR” variables in SIWAREX-DB contain precise information on the operational error. For a detailed description of the error, see section 11.2 of this manual.

In addition, an entry is made in the diagnostic buffer of the CPU for operational errors. The following identifiers are entered in the diagnostic buffer.

Table 5-6 Entry in the diagnostic buffer of the CPU when operational error arrives

Operational Errors	Entry
Event-ID	W#16#A301
Extra information 1	Error code for operational errors
Extra information 2	Module address

The OPER_ERR data area of SIWAREX-DB is cleared during startup.

Warning

When errors occur, take suitable measures to evaluate them.

Internal errors and external errors

Internal and external errors are reported to the CPU with a diagnostic alarm. This causes an entry to be made in the diagnostic buffer and the diagnostic alarm OB (i.e., OB82) to be called. The user can then use the start information in the diagnostic alarm OB to determine the location and cause of the error and provide an appropriate reaction.

If the diagnostic alarm OB does not exist (i.e., CPU 312 IFM) or is not programmed, the CPU branches to STOP status when an alarm occurs.

How to proceed

1. When a diagnostic alarm is triggered, the diagnostic alarm OB (i.e., OB82) is called. If the S7 CPU does not have this OB, the CPU assumes the STOP state.
2. If the diagnostic alarm is to be evaluated, a program for evaluating the local data of OB82 or diagnostic data record DR0 must be provided in OB82. See section 8.3 for the layout of data record DR0.

For additional information on evaluating DR0, see the reference manual of the SIMATIC S7-300/400.

Table 5-7 Local data of OB82

Type of Error	Cause	Affected Local Data Bits	Measure
Int. error 01	RAM error (read-write check)	OB82_INT_FAULT OB82_RAM_FAULT	See section 11.4.
Int. error 02	RAM error (checksum test) - buffer malfunction	OB82_INT_FAULT OB82_BCKUP_FAULT OB82_RAM_FAULT	See section 11.4.
Int. error 03	EEPROM error (checksum test)	OB82_INT_FAULT OB82_EPROM_FAULT	See section 11.4.
Int. error 04	A/D conversion error during read-access	OB82_INT_FAULT OB82_ADU_FAULT	See section 11.4.
Int. error 05	Watchdog has triggered	OB82_INT_FAULT OB82_WTCH_DOG_FLT	If the error occurs again, call the hotline. The module may have to be sent in for repairs. See section 11.4.
Ext. error 01	Minimum voltage on sense lines underranged	OB82_EXT_FAULT OB82_ADU_FAULT	See section 11.5.
Ext. error 02	Control limit exceeded or underranged	OB82_EXT_FAULT OB82_ADU_FAULT	See section 11.5.
Ext. error 05	Remote display interface malfunction (time monitoring)	OB82_EXT_FAULT OB82_COMM_FAULT	See section 11.5.
	External 24 V is missing.	OB82_EXT_FAULT OB82_EXT_VOLTAGE	

Data loss message from the SIWAREX M module (buffer malfunction)

When the FC SIWA-M detects a data loss on the SIWAREX M module, this is reported to the user via the IND indication word
(bit 3 of the low byte n = 1). The error is acknowledged by transferring data record DR43 (tare and zero setting value more precise) to the SIWAREX M. Transmission of DR43 must be triggered by the user.

The error can also be acknowledged via SIWATOOL or a TD20 (if connected).

5.7 Assignment of SIWAREX-DB Data Block

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
0	MOD_ADDR_IN	INT	+256	Input/output address of the module (as specified in HW Config) Input and output addresses must be the same!
2	DB_VECTOR_NO	INT	+12	DB no. of DB-VECTOR
4	DB_VECTOR_BEGIN	INT	+0	Beginning of DB-VECTOR (1st byte)
6	MAX_CALLS	INT	1000	Maximum number of block calls (timeout monitoring for startup synchronization, life bit and job processing) Can be set from 10 to 32767
8	BGRD_OFF	BOOL	FALSE	Background processing off
9	OPER_ERR	BYTE	B#16#00	Error code for operational errors
10	RES_10	ARRAY [1..5] of WORD	5(W#16#0000)	In reserve
	APPL_WR_DT1	STRUCT		WRITE_DATA_1 application
20	RES_0	BYTE	B#16#00	In reserve
21	DRNO	BYTE	B#16#00	Data record number (DR3-DR81)
22	BITFIELD	WORD	W#16#0000	Bit field
24	INDW1	WORD	W#16#0000	Indication word 1
26	INDW2	WORD	W#16#0000	Indication word 2
		END_STRUCT		
	APPL_WR_DT2	STRUCT		WRITE_DATA_2 application
28	RES_0	BYTE	B#16#00	In reserve
29	DRNO	BYTE	B#16#00	Data record number (DR3-DR81)
30	BITFIELD	WORD	W#16#0000	Bit field
32	INDW1	WORD	W#16#0000	Indication word 1
34	INDW2	WORD	W#16#0000	Indication word 2
		END_STRUCT		
36	RES_36	ARRAY [1 to 4] of WORD	4(W#16#0000)	In reserve
	APPL_WR_CMD	STRUCT		WRITE_COMMAND application
44	RES_0	WORD	W#16#0000	In reserve
46	BITFIELD	WORD	W#16#0000	Bit field (bit 0 $\triangleq$ DR2)
48	INDW1	WORD	W#16#0000	Indication word 1
50	INDW2	WORD	W#16#0000	Indication word 2
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
	APPL_RD_DT1	STRUCT		READ_DATA_1 application
52	RES_0	BYTE	B#16#00	In reserve
53	DRNO	BYTE	B#16#00	Data record number (DR3-DR81)
54	BITFIELD	WORD	W#16#0000	Bit field
56	INDW1	WORD	W#16#0000	Indication word 1
58	INDW2	WORD	W#16#0000	Indication word 2
		END_STRUCT		
	APPL_RD_DT2	STRUCT		READ_DATA_2 application
60	RES_0	BYTE	B#16#00	In reserve
61	DRNO	BYTE	B#16#00	Data record number (DR3-DR81)
62	BITFIELD	WORD	W#16#0000	Bit field
64	INDW1	WORD	W#16#0000	Indication word 1
66	INDW2	WORD	W#16#0000	Indication word 2
		END_STRUCT		
68	RES_68	ARRAY [1 to 4] of WORD	4# (W#16#0000)	In reserve
76	RES_76	STRUCT		In reserve
		END_STRUCT		
	CMD	WORD	W#16#0000	DR2: Commands
	ADJ_DATA	STRUCT		DR3: Adjustment data
90	OPER_MODE	WORD	W#16#0000	Operating mode
92	SCALES_TYPE	WORD	W#16#0000	Type of scales
94	STANDSTILL_TIME	TIME	T#2s_500ms	Standstill time
98	STANDSTILL_VAL	DINT	L#1	Standstill value
102	DEC_POINT	WORD	W#16#0000	Decimal point
104	CHAR_VAL	DINT	L#2	Characteristic value area SIWAREX M
108	WEIGHT_UNIT	ARRAY [1, 2] of CHAR	:=1 ('k'), 1 ('g')	Unit of weight
110	INCREMENT	BYTE	B#16#01	Increment
111	LIMIT_FREQ	BYTE	B#16#02	Digital filter, limit frequency
112	ADJ_WEIGHT	DINT	L#10000	Adjustment weight
116	MAX_LOAD	DINT	L#10000	Maximum load
120	LANGUAGE	WORD	W#16#0000	Language
122	ADJ_DIGITS_0	DINT	L#0	Adjustment digits 0
126	ADJ_DIGITS_1	DINT	L#500000	Adjustment digits 1
130	SCALE_NO	BYTE	B#16#00	Scales number
131	BYTE41	BYTE	B#16#00	In reserve
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
	SCALES_PARA	STRUCT		DR4: Scales parameters
132.0	BIT8	BOOL	FALSE	In reserve
132.1	BIT9	BOOL	FALSE	In reserve
132.2	BIT10	BOOL	FALSE	In reserve
132.3	BIT11	BOOL	FALSE	In reserve
132.4	BIT12	BOOL	FALSE	In reserve
132.5	BIT13	BOOL	FALSE	In reserve
132.6	BIT14	BOOL	FALSE	In reserve
132.7	RAM_EEPROM	BOOL	FALSE	DR4 storage (1 = RAM, 0 = EEPROM)
133.0	AUTO_ZERO	BOOL	TRUE	Scales setting: Auto. zero offset
133.1	FILL_DEDUCTION	BOOL	TRUE	Scales setting: Fill/deduction weighing
133.2	BIT2	BOOL	FALSE	In reserve
133.3	BIT3	BOOL	FALSE	In reserve
133.4	BIT4	BOOL	FALSE	In reserve
133.5	BIT5	BOOL	FALSE	In reserve
133.6	BIT6	BOOL	FALSE	In reserve
133.7	BIT7	BOOL	FALSE	In reserve
134	EMPTY_VAL	DINT	L#50	Empty message value
138	EMPTY_D_TIME	TIME	T#5s_0ms	Empty message delay time
142	ON_LIMIT_1	DINT	L#10000	Switch-on point for limit value 1
146	OFF_LIMIT_1	DINT	L#9990	Switch-off point for limit value 1
150	ON_LIMIT_2	DINT	L#1000	Switch-on point for limit value 2
154	OFF_LIMIT_2	DINT	L#1010	Switch-off point for limit value 2
158	ON_LIMIT_3	DINT	L#9000	Switch-on point for limit value 3
162	OFF_LIMIT_3	DINT	L#8990	Switch-off point for limit value 3
		END_STRUCT		
	PROP_PARA	STRUCT		DR5: Proportioning parameters
166.0	BIT8	BOOL	FALSE	In reserve
166.1	BIT9	BOOL	FALSE	In reserve
166.2	BIT10	BOOL	FALSE	In reserve
166.3	BIT11	BOOL	FALSE	In reserve
166.4	BIT12	BOOL	FALSE	In reserve
166.5	BIT13	BOOL	FALSE	In reserve
166.6	DOSI_M	BOOL	FALSE	Proportioning above the fine–flow switchoff point possible
166.7	RAM_EEPROM	BOOL	FALSE	DR5 storage (1 = RAM, 0 = EEPROM)
167.0	AUTO_PRINT	BOOL	FALSE	Automatic printout for finished message
167.1	SETTLING_ABORT	BOOL	TRUE	Settling time aborted by standstill

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
167.2	AUTO_FINE_VALUE	BOOL	FALSE	Automatic acceptance of optim. fine flow switchoff value
167.3	BIT3	BOOL	FALSE	In reserve
167.4	BIT4	BOOL	FALSE	In reserve
167.5	BIT5	BOOL	FALSE	In reserve
167.6	BIT6	BOOL	FALSE	In reserve
167.7	BIT7	BOOL	FALSE	In reserve
168	WORD1	WORD	W#16#0000	In reserve
		END_STRUCT		
	DO_DI	STRUCT		DR6: Parameter for digital inputs and outputs
170	ASSIGN_DO_1	BYTE	B#16#05	Assignment signal output 1
171	ASSIGN_DO_2	BYTE	B#16#06	Assignment signal output 2
172	ASSIGN_DO_3	BYTE	B#16#07	Assignment signal output 3
173	ASSIGN_DO_4	BYTE	B#16#0F	Assignment signal output 4
174	ASSIGN_DI_1	BYTE	B#16#07	Assignment command input 1
175	ASSIGN_DI_2	BYTE	B#16#03	Assignment command input 2
176	ASSIGN_DI_3	BYTE	B#16#0F	Assignment command input 3
177	BYTE7	BYTE	B#16#00	In reserve
		END_STRUCT		
178	RS232_PARA	WORD	W#16#0003	DR7: Parameter for RS 232 interface
180	TTY_PARA	WORD	W#16#0000	DR8: Parameter for TTY interface
	AO_PARA	STRUCT		DR9: Parameter for analog output
182	AO_SETUP	WORD	W#16#0001	Basic setting for analog output
184	AO_RES	DINT	L#0	In reserve
188	AO_MAX_VAL	DINT	L#10000	Maximum output value for analog output (end value)
		END_STRUCT		
192	RESERVED_1	WORD	W#16#0000	DR20: In reserve
194	SETPOINT	DINT	L#0	DR22: Setpoint
	PROP_DATA	STRUCT		DR23: Proportioning data
198	TOL_PLUS_VAL	DINT	L#0	Tolerance plus value
202	TOL_MINUS_VAL	DINT	L#0	Tolerance minus value
206	COARSE_VAL	DINT	L#0	Coarse flow switchoff value
210	FINE_VAL	DINT	L#0	Fine flow switchoff value
214	SETTLING_TIME	TIME	T#2s_0ms	Settling time
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
218	SPEC_VAL_AO	DINT	L#0	DR24: Externally specified value for analog output
222	RESERVED_2	WORD	W#16#0000	DR25: In reserve
224	STRING_FIELD_1	ARRAY[1..16] OF CHAR	16 (' ')	DR26: String field 1
240	STRING_FIELD_2	ARRAY[1..16] OF CHAR	16 (' ')	DR27: String field 2
256	SPEC_TARE	DINT	L#0	DR28: Externally specified tare
	ADD_PROP_PARA	STRUCT		DR29: Additional proportioning parameters
260	INCHING_TIME	TIME	T#1s_0ms	Inching time
264	MON_TIME_INCH_ REPROP	TIME	T#10s_0ms	Monitoring time: Inching mode/ reproportioning
268	MAT_FL_MON_T1	TIME	T#3s_0ms	Material flow monitoring time 1 (coarse)
272	MAT_FL_MON_V1	DINT	L#2	Material flow monitoring value 1 (coarse)
276	MAT_FL_MON_T2	TIME	T#3s_0ms	Material flow monitoring time 2 (fine)
280	MAT_FL_MON_V2	DINT	L#1	Material flow monitoring value 2 (fine)
284	DEL_TIME_MON_C	TIME	T#2s_0ms	Delay time for coarse flow monitoring
288	DEL_TIME_MON_F	TIME	T#2s_0ms	Delay time for fine flow monitoring
292	RESERVE29_DINT1	DINT	L#0	In reserve
296	RESERVE29_DINT2	DINT	L#0	In reserve
300	RESERVE29_DINT3	DINT	L#0	In reserve
304	RESERVE29_DINT4	DINT	L#0	In reserve
308	RESERVE29_DINT5	DINT	L#0	In reserve
312	RESERVE29_DINT6	DINT	L#0	In reserve
316	RESERVE29_WORD1	WORD	W#16#0000	In reserve
318	RESERVE29_WORD2	WORD	W#16#0000	In reserve
		END_STRUCT		
	WEIGHTS	STRUCT		DR30: Weight values
320	GROSS	DINT	L#0	Gross weight
324	NET	DINT	L#0	Net weight
328	TARE	DINT	L#0	Tare weight
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
	STATUS	STRUCT		DR31: Status information
332.0	EMPTY	BOOL	FALSE	Empty message active/inactive
332.1	STANDSTILL	BOOL	FALSE	Standstill
332.2	MAX_LOAD	BOOL	FALSE	Maximum load + 9 e exceeded
332.3	MANUAL_TARE	BOOL	FALSE	Load tare memory with manual (preset) tare (pT)
332.4	EXT_CMD_NEG	BOOL	FALSE	Command cannot be executed via ext. contact.
332.5	ZERO_R_EXCEEDED	BOOL	FALSE	Gross weight not within zero setting range
332.6	PRINT_NOT_POSS	BOOL	FALSE	Printing not possible
332.7	SYS_ERR	BOOL	FALSE	System malfunction (hardware fault)
333.0	SCALE_ADJ	BOOL	FALSE	Scales adjusted
333.1	SCALE_TARED	BOOL	FALSE	Scales tared
333.2	ZERO	BOOL	FALSE	¼ d zero
333.3	WRITE_PROT	BOOL	FALSE	Write protection active
333.4	SOURCE_CLK	BOOL	FALSE	Source time/date (S7/TD20)
333.5	LIMIT_VAL_1	BOOL	FALSE	Limit value 1 active/inactive
333.6	LIMIT_VAL_2	BOOL	FALSE	Limit value 2 active/inactive
333.7	LIMIT_VAL_3	BOOL	FALSE	Limit value 3 active/inactive
334.0	REPROP_ACTIVE	BOOL	FALSE	Reproportioning was activated
334.1	MAT_FL_ERR_1	BOOL	FALSE	Material flow error 1
334.2	MAT_FL_ERR_2	BOOL	FALSE	Material flow error 2
334.3	MAT_FL_ERR_C	BOOL	FALSE	Material flow error, coarse
334.4	MAT_FL_ERR_F	BOOL	FALSE	Material flow error, fine
334.5	MON_INCH_REPROP	BOOL	FALSE	Time monitoring for inching mode/reproportioning has been triggered.
334.6	OP_ERR	BOOL	FALSE	Operational error
334.7	BIT_2_15	BOOL	FALSE	In reserve
335.0	COARSE	BOOL	FALSE	Coarse flow on
335.1	FINE	BOOL	FALSE	Fine flow on
335.2	TOL_PLUS	BOOL	FALSE	Tolerance deviation +
335.3	TOL_MINUS	BOOL	FALSE	Tolerance deviation -
335.4	PROP_RUN	BOOL	FALSE	Proportioning running
335.5	PROP_START	BOOL	FALSE	Proportioning started. Wait for standstill.
335.6	PROP_ABORT	BOOL	FALSE	Proportioning aborted
335.7	PROP_END	BOOL	FALSE	Proportioning finished
336	WORD2	WORD	W#16#0000	In reserve
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
	WEIGHTS_H	STRUCT		DR32: Measured values more precise
338	GROSS	DINT	L#0	Gross more precise
342	NET	DINT	L#0	Net more precise
		END_STRUCT		
	DIGITS	STRUCT		DR33: Raw digit values
346	UNFILTERED	DINT	L#0	Unfiltered raw value
350	FILTERED	DINT	L#0	Filtered raw value
		END_STRUCT		
	AO_VAL	DINT	L#0	DR34: Analog output value
	ADD_MEAS_VAL	STRUCT		DR35: Additional measured values
358	OPTI_FINE_VAL	DINT	L#0	Optimized fine flow switchoff value
362	RESERVE35_DINT1	DINT	L#0	In reserve
366	RESERVE35_DINT2	DINT	L#0	In reserve
370	RESERVE35_DINT3	DINT	L#0	In reserve
374	RESERVE35_DINT4	DINT	L#0	In reserve
378	RESERVE35_WORD1	WORD	W#16#0000	In reserve
380	RESERVE35_WORD2	WORD	W#16#0000	In reserve
		END_STRUCT		
	PRINT_DAT	STRUCT		DR40: Print data of last printout
382	GROSS	DINT	L#0	Gross weight of last printout
386	NET	DINT	L#0	Net weight of last printout
390	TARE	DINT	L#0	Tare weight of last printout
394	WEIGHING_NO	DINT	L#0	Consecutive weighing number
398	DATE_TIME	DT	DT#1990-01-01-00:00:00	Date and time of last printout
406	SETPOINT	DINT	L#0	Setpoint of last printout
		END_STRUCT		
	DATE_TIME	DT	DT#1990-01-01-00:00:00	DR41: Date and time
	VERS	STRUCT		DR42: Type ID/program version/ switches
418	TYPE_ID	WORD	W#16#0000	Type identifier
420	PROG_VERSION	WORD	W#16#0000	Program version
422	SWITCHES	WORD	W#16#0000	Switch settings (DIP switches)
424	CHANNEL_TYPE	BYTE	B#16#00	Channel type
425	BYTE9	BYTE	B#16#00	In reserve
		END_STRUCT		

Table 5-8 Layout of DB-SIWAREX

Addr.	Variable Name	Type	Initial Value	Comments
	EXTRA_INFO	STRUCT		DR43 Tare and zero setting value more precise
426	TARE_H	DINT	L#0	Tare more precise
430	ZERO_VAL_H	DINT	L#0	Zero setting value more precise
434	TARE_INFO	WORD	W#16#0000	Tare information
		END_STRUCT		
	USER_INFO	STRUCT		DR50 In reserve
436	BYTE0	BYTE	B#16#00	In reserve
437	BYTE 1	BYTE	B#16#00	In reserve
438	BYTE 2	BYTE	B#16#00	In reserve
439	BYTE 3	BYTE	B#16#00	In reserve
440	BYTE 4	BYTE	B#16#00	In reserve
441	BYTE 5	BYTE	B#16#00	In reserve
442	WORD4	WORD	W#16#0000	In reserve
		END_STRUCT		
	ERR_CODE	STRUCT		DR51: Asynchronous error messages for internal service purposes only
444	EXT_ERR	WORD	W#16#0000	Error information on external errors, bit-coded
446	INT_ERR	WORD	W#16#0000	Error information on internal errors, bit-coded
448	OPER_ERR	WORD	W#16#0000	Error information on operational errors, bit-coded
		END_STRUCT		

DB-ARB

Working data block DB-ARB is present once per SIWAREX M module. It is used by the FC SIWA-M function for internal data storage. It may not be overwritten by the user. DB-ARB must be set up with a minimum length of 80 bytes.

DB-VECTOR

DB-VECTOR is present once per CPU. The contents of DB-VECTOR are included and may not be changed by the user.

Use of a separate data block for DB-VECTOR is not mandatory. If necessary, the data area can also be located in another data block. This only requires that the included UDT be linked to the desired data block. The DB number and the start of DB-VECTOR must also be entered in DB-SIWAREX.

5.8 Background Processing

On request of the module, the standard function FC SIWA-M can nest in a background job. Background jobs can be switched off by the user via the BGRD_OFF in DB-SIWAREX. A running background job is indicated with bit 5 of low byte n = “1” in the IND word (i.e., interface currently busy with another function).

The background jobs are listed below.

Table 5-9 Background jobs

Data Record		Meaning	Triggered By
Write	**Read**		
DR41		Write date and time	Request of the SIWAREX M module
	DR43	Read process data (tare and zero setting value more precise)	
	DR42	Read type identifier and program version	Startup synchronization (DR42 is always read after startup synchronization and cannot be disabled.)

When the date and time are requested by the SIWAREX M module, FC SIWA-M transfers data record DR41 to the module. The user must ensure that the contents (i.e., date and time) in DB-SIWAREX are current at this point in time.

The SIWAREX M module informs FC SIWA-M that data record DR43 (i.e., tare and zero setting value more precise) is to be read by the module. This job is enabled as soon as the interface is free (i.e., background processing).

5.9 Startup Behavior

The interface is synchronized during the initial accesses to the module after CPU startup. The “startup running” status message (bit 6 of low byte n) is output in the IND indication word of the FC SIWA-M function as long as the startup routines are being executed. After startup synchronization is completed, the status bit is reset and the block is in standby status (i.e., “job running” status bit = “0”). The type identifier and the firmware version number (i.e., data record DR42) are then read once and entered in DB-SIWAREX. The applications can now be processed.

If synchronization cannot be performed within a certain period of time, the “startup finished with errors” status message (i.e., bit 7 of low byte n = “1”) is output together with appropriate extra information in the IND indication word. The monitoring time is specified with the MAX_CALLS variable in DB-SIWAREX.

CPU new start

During a CPU new start, the new start OB (i.e., OB100) is executed first followed by cyclic program processing which starts at the beginning of OB1.

FC SIWA-M cannot be called in the new start OB (i.e., OB100).

If a running job is interrupted by a new start, indication word 1 reports “job aborted due to synchronization” to the application. Block parameter IND does not indicate an error message. After conclusion of startup synchronization, FC SIWA-M places a new copy of the application in the working DB and starts processing the job again from the beginning.

5.10 Alarm Processing

Basic parameters DR0 and DR1

The basic parameters (DR0) can be modified in HW-CONFIG (STEP 7). During configuration of the rack, the parameterization window for the basic parameters (DR0) can be accessed by a double click after the SIWAREX M modules have been entered. Any modified data are stored in an SDB and then transferred from the CPU to the module each time a startup occurs.

The diagnostic alarms of the SIWAREX M can be enabled or disabled in the parameterization window for the basic parameters.

Process alarms

SIWAREX M does not use process alarms.

Diagnostic alarms (asynchronous errors)

If enabled in HW-CONFIG, internal and external asynchronous errors are reported by **diagnostic alarms**.

Caution

The 24 V must be turned on and off at the same time as the 24 V for the SIMATIC CPU or the ET 200. Otherwise there may be problems with alarm generation.

Evaluation of alarms

Evaluation of the diagnostic alarms is described under “Internal and external errors” in section 5.6 (“Reporting of Asynchronous Errors”).

5.11 Technical Data

Table 5-10 Technical data

	FC SIWA-M	DB SIWAREX	DB ARB	DB VECTOR
Name	SIWA_M	DB_SIWA	DB_ARB	DB_VECTO
Family	SIWAREX M	SIWAREX M	SIWAREX M	SIWAREX M
Block number[1)]	FC41	DB10	DB11	DB12
Version	V1.1	V1.2	V1.1	V1.1
Loading memory requirements	3600 bytes	1240 bytes	178 bytes	718 bytes
MC7 code length	3130 bytes	450 bytes	80 bytes	208 bytes
Working storage requirements	3166 bytes	486 bytes	116 bytes	244 bytes
Allocation in local data area	50 bytes	-	-	-
Allocation in marker area	0 bytes	-	-	-
Nesting depth	1[2)]	0	0	0

1) Can be changed by the user
2) System functions of the operating system (SFCs) are called.

Block processing times

The processing times of the FC SIWA-M standard function are listed in the tables below. Depending on the hardware configuration (i.e., central or distributed configuration of the SIWAREX M module) and cycle time of the CPU, varying numbers of FC calls are required for processing a single read or write job. While a read job can be executed with one block call under optimal conditions, a write job always requires at least 3 block calls.

Table 5-11 Processing times in msec with the S7-300

	CPU 313/CPU 314	CPU 315/CPU 315-2DP
Standby	0.8 to 1.2	0.6 to 1.0
Read data record	3.5 to 4.1	0.8 to 2.2
Write data record	0.7 to 3.3	0.4 to 0.6

Table 5-12 Processing times in msec with the S7-400

	CPU 413-2DP
Standby	0.2 to 0.3
Read data record	1.4 to 2.3
Write data record	0.4 to 1.9

5.12 Sample Application

5.12.1 Description

Function scope

The included example shows the application of the FC SIWA-M standard function. It contains all required coding and data blocks and provides a quick introduction to the use of the SIWAREX M. The sample application can be executed on both the S7-300 and S7-400. It demonstrates how the SIWAREX M can be controlled and monitored with the FC SIWA-M standard function.

It is easy to modify or expand the sample program, if necessary, to suit your own requirements.

The program is organized in two phases.

- During the first phase, the weight values are read cyclically for faster and simpler hardware testing.
- During the second phase of the sample program (i.e., expanded sample application), all functions of the SIWAREX M can be run through.

Hardware prerequisites

The sample program requires the following hardware.

- S7-300 programmable controller (mounting rail, power supply and CPU)
  Or

  S7-400 programmable controller (module rack, power supply and CPU with DP connection) with distributed I/O (mounting rail, power supply, IM 153-1 and PROFIBUS-DP connection cable)
  Or

  S7-300 programmable controller (mounting rail, power supply and CPU with DP connection) with distributed I/O (mounting rail, power supply, IM 153-1 and PROFIBUS-DP connection cable)
- SIWAREX M with connected load cell
- Programmer with STEP 7 (e.g., PG 740)
- If the expanded sample program is being used, digital input modules (4 bytes) and digital output modules (4 bytes) or simulator modules are also required.

  The digital inputs and digital outputs are not required when all functions are performed with the “monitor and force variable” PG function. If you use this method, copying in OB1 of the inputs to the markers and markers to outputs must be deleted.

The sample program is designed for the following I/O addresses.

Table 5-13 I/O addresses for the sample program

Module	I/O Addresses
Digital inputs	IB0, IB1, IB4, IB5
Digital outputs	QB8, QB9, QB12, QB13
SIWAREX M	PIB320 to PIB335 and PQB320 to PQB335

When other addresses are used, the symbol table must be modified (for digital inputs and digital outputs), or the new module address must be entered in DB-SIWAREX and the sample program compiled again.

Installation

The following procedure is recommended.

- Set up an S7 project, and generate your hardware configuration.
- Transfer the symbol table from the included SIWAREX project to the new project.
- Transfer all blocks from the included SIWAREX project to the new project.
- If necessary, adjust the module addresses in the sample program to the existing hardware configuration.
- Transfer all blocks to the CPU.
- Execute a CPU new start.

Inputs and outputs used (only for expanded sample application)

The sample program is designed for easy adjustment to various input and output addresses. The inputs and outputs are imaged on markers in OB1, network 2, and the sample program works only with these marker bits.

Table 5-14 Inputs and outputs used

I0.0	M4.0	Enter job in WRITE_DATA_1 application
I0.1	M4.1	Enter job in WRITE_DATA_2 application
I0.2	M4.2	Enter job in WRITE_COMMAND application
I0.3	M4.3	Enter job in READ_DATA_1 application
I0.4	M4.4	Enter job in READ_DATA_2 application
I0.5	M4.5	Clear error indications
I0.6	M4.6	Call FC41 cyclically
I0.7	M4.7	Edge-triggered call of FC41

Table 5-14 Inputs and outputs used

I1.0	M5.0	Significance 1:	Select DR no. (binary) for WRITE_DATA_1, WRITE_DATA_2, READ_DATA_1 and READ_DATA_2 (Permitted: DR3 to DR51 except DR20 and DR25)
I1.1	M5.1	Significance 2:	
I1.2	M5.2	Significance 4:	
I1.3	M5.3	Significance 8:	
I1.4	M5.4	Significance 16:	
I1.5	M5.5	Significance 32:	
I1.6	M5.6	Significance 64:	
I1.7	M5.7	Significance 128:	
I4.0	M6.0	Bit 0:	Select for bit pattern in application mailbox (bits 0 to 7 of low byte) for WRITE_DATA_1, WRITE_DATA_2, READ_DATA_1 and READ_DATA_2
I4.1	M6.1	Bit 1:	
I4.2	M6.2	Bit 2:	
I4.3	M6.3	Bit 3:	
I4.4	M6.4	Bit 4:	
I4.5	M6.5	Bit 5:	
I4.6	M6.6	Bit 6:	
I4.7	M6.7	Bit 7:	
I5.0	M7.0	Bit 0:	Select for bit pattern in application mailbox (bits 0 to 7 of high byte) for WRITE_DATA_1, WRITE_DATA_2, READ_DATA_1 and READ_DATA_2
I5.1	M7.1	Bit 1:	
I5.2	M7.2	Bit 2:	
I5.3	M7.3	Bit 3:	
I5.4	M7.4	Bit 4:	
I5.5	M7.5	Bit 5:	
I5.6	M7.6	Bit 6:	
I5.7	M7.7	Bit 7:	
Q8.0	M8.0	Job running	
Q8.1	M8.1	Job finished without errors	
Q8.2	M8.2	System error	
Q8.3	M8.3	Data loss	
Q8.4	M8.4	Job finished with errors	
Q8.5	M8.5	Interface currently busy with a background function	
Q8.6	M8.6	Startup running	
Q8.7	M8.7	Startup finished with errors	
Q9.0	M9.0	Extra information (error number), binary from IND block parameter of FC SIWA-M	
Q9.1	M9.1		
Q9.2	M9.2		
Q9.3	M9.3		
Q9.4	M9.4		
Q9.5	M9.5		
Q9.6	M9.6		
Q9.7	M9.7		

Table 5-14 Inputs and outputs used

Q12.0	M10.0	An error has occurred.
Q12.1	M10.1	-
Q12.2	M10.2	-
Q12.3	M10.3	-
Q12.4	M10.4	-
Q12.5	M10.5	-
Q12.6	M10.6	-
Q12.7	M10.7	-
Q13.0	M11.0	-
Q13.1	M11.1	-
Q13.2	M11.2	-
Q13.3	M11.3	-
Q13.4	M11.4	-
Q13.5	M11.5	-
Q13.6	M11.6	-
Q13.7	M11.7	-

Markers used

Table 5-15 Markers used (continued)

Symbol Name	Operand	Data Type	Meaning
ENTER_WR_DT1	M 4.0	BOOL	Enter job in APPL_WR_DT1
ENTER_WR_DT2	M 4.1	BOOL	Enter job in APPL_WR_DT2
ENTER_WR_CMD	M 4.2	BOOL	Enter job in APPL_WR_CMD
ENTER_RD_DT1	M 4.3	BOOL	Enter job in APPL_RD_DT1
ENTER_RD_DT2	M 4.4	BOOL	Enter job in APPL_RD_DT2
CLEAR_ERR_IND	M 4.5	BOOL	Clear error indications
FC_SIWA_M_CYCLE	M 4.6	BOOL	Call FC SIWA-M cyclically
SINGLE_CALL_FC_SIWA_M	M 4.7	BOOL	Edge-triggered call of FC SIWA-M standard function

Table 5-15 Markers used (continued)

Symbol Name	Operand	Data Type	Meaning
ERROR_IND	M 10.0	BOOL	Error indication
EM_WR_DT1	M 12.0	BOOL	Edge marker for WRITE_DATA_1 job
EM_WR_DT2	M 12.1	BOOL	Edge marker for WRITE_DATA_2 job
EM_WR_CMD	M 12.2	BOOL	Edge marker for WRITE_COMMAND job
EM_RD_DT1	M 12.3	BOOL	Edge marker for READ_DATA_1 job
EM_RD_DT2	M 12.4	BOOL	Edge marker for READ_DATA_2 job
EM_CALL_FC_SIWA_M	M 12.7	BOOL	Edge marker for call of FC SIWA-M
IND_FINISHED_ WITHOUT_ERR	M 14.1	BOOL	Job finished without errors
IND_GROUP_ERR	M 14.2	BOOL	System error
IND_DATA_LOSS	M 14.3	BOOL	SIWAREX M reports data loss
IND_FINISHED_WITH_ERR	M 14.4	BOOL	Job finished with errors
IND_STARTUP_WITH_ERR	M 14.7	BOOL	Startup concluded with errors
M_DR_NO	MB 5	BYTE	Set data record number
IMAGE_IN_1	MW 4	WORD	Image of the inputs
IMAGE_IN_2	MW 6	WORD	Image of the inputs
IMAGE_OUT_1	MW 8	WORD	Image of the outputs
IMAGE_OUT_2	MW 10	WORD	Image of the outputs
INDW_FC_SIWA_M	MW 14	WORD	Indication word of the FC SIWA-M standard function
LAST_ERROR	MW 16	WORD	Intermediate storage of the error that occurred last
DIAGNOSTIC_ALARM_ SIW_M	MD 80	DWORD	Message of diagnostic alarms

Blocks used

Table 5-16 Blocks used

Symbol Name	Block Number	Meaning
DB_SIWAREX	DB 10	Interface data block for SIWAREX M
DB_ARB	DB 11	Working data block for SIWAREX M
DB_VEKTOR	DB 12	Vector data block for SIWAREX M
FC_EXT_SAMPLE	FC 10	Expanded sample program for SIWAREX M
FC_SIWA_M	FC 41	Standard function for SIWAREX M
CYCLE	OB 1	Cyclic program processing
DIAG	OB 82	Evaluation of diagnostic alarms

Caution

Remember the following when using the CPU 312 IFM.

- The CPU 312 IFM does not have OB82.
- The block numbers for FCs on the CPU 312 IFM are limited to FC0 to FC31.

  ⇒ FC41 must be renamed (e.g., FC10)

Data type declarations (UDT) used

Since each data block used in the sample program is based on a UDT, it is easy to generate an additional data block of the same type.

Table 5-17 Blocks used

Symbol Name	Block Number	Meaning
UDT_SIWAREX	UDT 10	Data type declaration for DB-SIWAREX
UDT_ARB	UDT 11	Data type declaration for DB-ARB
UDT_VEKTOR	UDT 12	Data type declaration for DB-VECTOR

Variable tables used

Table 5-18 VAT10: Parameters and weight values from DB-SIWAREX

Operand	Symbol	Status Format	Status Value	Control Value
DB10.DBW 0	“DB_SIWAREX”.MOD_ADDR_IN	DEC	320	
DB10.DBW 2	“DB_SIWAREX”.DB_VECTOR_NO	DEC	12	
DB10.DBW 4	“DB_SIWAREX”.DB_VECTOR_BEGIN	DEC	0	
DB10.DBW 6	“DB_SIWAREX”.MAX_CALLS	DEC	1000	
DB10.DBX 8.0	“DB_SIWAREX”.BGRD_OFF	BIN	0	2#1
DB10.DBB 9	“DB_SIWAREX”.OPER_ERR	DEC	0	
DB10.DBD 320	“DB_SIWAREX”.WEIGHTS.GROSS	DEC	L#10	
DB10.DBD 324	“DB_SIWAREX”.WEIGHTS.NET	DEC	L#10	
DB10.DBD 328	“DB_SIWAREX”.WEIGHTS.TARE	DEC	L#0	
MW 14	“INDW_FC_SIWA_M”	HEX	W#16#0000	
DB10.DB	“DB_SIWAREX”	DEC		
MD	“DIAGNOSTIC_ALARM_SIW_M”	CHARACTER	Yes	

Table 5-19 VAT11: Application mailboxes in DB-SIWAREX

Operand	Symbol	Status Value	Control Value
// APPL_WR_DT1			
DB10.DBB 21	“DB_SIWAREX”.APPL_WR_DT1.DRNO	0	
DB10.DBW 22	“DB_SIWAREX”.APPL_WR_DT1.BITFIELD	2#0000_0000_0000_0000	
DB10.DBW 24	“DB_SIWAREX”.APPL_WR_DT1.INDW1	W#16#0000	W#16#1111
DB10.DBW 26	“DB_SIWAREX”.APPL_WR_DT1.INDW2	W#16#0000	W#16#1111
// APPL_WR_DT2			
DB10.DBB 29	“DB_SIWAREX”.APPL_WR_DT2.DRNO	0	
DB10.DBW 30	“DB_SIWAREX”.APPL_WR_DT2.BITFIELD	2#0000_0000_0000_0000	
DB10.DBW 32	“DB_SIWAREX”.APPL_WR_DT2.IND1	W#16#0000	W#16#1111
DB10.DBW 34	“DB_SIWAREX”.APPL_WR_DT2.INDW2	W#16#0000	W#16#1111
// APPL_WR_CMD			
DB10.DBW 46	“DB_SIWAREX”.APPL_WR_CMD.BITFIELD	2#0000_0000_0000_0000	
DB10.DBW 48	“DB_SIWAREX”.APPL_WR_CMD.INDW1	W#16#0000	W#16#1111
DB10.DBW 50	“DB_SIWAREX”.APPL_WR_CMD.INDW2	W#16#0000	W#16#1111
// APPL_RD_DT1			
DB10.DBB 53	“DB_SIWAREX”.APPL_RD_DT1.DRNO	0	
DB10.DBW 54	“DB_SIWAREX”.APPL_RD_DT1.BITFIELD	2#0000_0000_0000_0000	
DB10.DBW 56	“DB_SIWAREX”.APPL_RD_DT1.INDW1	W#16#0000	W#16#1111
DB10.DBW 58	“DB_SIWAREX”.APPL_RD_DT1.INDW2	W#16#0000	W#16#1111
// APPL_RD_DT2			
DB10.DBB 61	“DB_SIWAREX”.APPL_RD_DT2.DRNO	0	
DB10.DBW 62	“DB_SIWAREX”.APPL_RD_DT2.BITFIELD	2#0000_0000_0000_0000	
DB10.DBW 64	“DB_SIWAREX”.APPL_RD_DT2.INDW1	W#16#0000	W#16#1111
DB10.DBW 66	“DB_SIWAREX”.APPL_RD_DT2.AINDW2	W#16#0000	W#16#1111

5.12.2 Using the Sample Program

After a total reset of the CPU, the hardware configuration and the sample program can be transferred to the CPU. All inputs should have “zero” signal status.

When a new start of the CPU is then performed, no errors may be reported by the LEDs of either the CPU or the SIWAREX M module. If an error LED does light up, this indicates a hardware error or an faulty hardware configuration.

Using the “force and monitor variable” STEP 7 function, the weight values and the indication word of FC SIWA-M in variable table VAT 10 can be monitored.

Synchronization with the SIWAREX M module is performed during the initial cycles of the CPU. If FC SIWA-M reports “startup finished with errors” in the indication word, communication with the module cannot take place.

The first stage of the example is then executed (i.e., the weight values (data record DR30) are read cyclically).

A change in load on the load cell causes a change in the weight values. The indication word alternates between “job running” and “job finished without errors.”

This part of the program is located in network 1 of OB1. The digital inputs are not required for the first stage.

The second stage of the sample application uses the inputs and outputs specified. This part of the program is not executed until OB1 is modified so that network 1 can no longer be processed (i.e., either deleted or a jump to another sector is programmed).

FC SIWA-M cannot been called yet. To call the block cyclically, input I0.6 must be set to one.

Jobs can now be entered in the application mailboxes via the digital inputs. To do this, a data record number and the desired bits in the bit pattern must be selected first. The job is entered in the application mailbox when a rising edge occurs on one of the input bits I0.0 to I0.4.

All permitted data records can be written to or read from the module via the application mailboxes listed below.

- APPL_WR_DT1
- APPL_WR_DT2
- APPL_WR_CMD
- APPL_RD_DT1
- APPL_RD_DT2

The individual application mailboxes can be monitored with variable table VAT 11.

To be able to follow the execution of job processing step by step, the cyclic call can also be switched off (i.e., I0.6 = 0) and input I0.7 can be used to call (edge-triggered) FC SIWA-M. Using this method, the IND indication word of FC SIWA-M can be monitored on the output word.

Behavior when errors occur

As soon as FC SIWA-M reports an error, Q12.0 is set and the indication word (i.e., parameter IND of FC SIWA-M) is saved in marker word LAST_ERROR (i.e., MW 16).

This marker word can then be used for further error evaluation. See also the indication word of FC SIWA-M and STEP 7 code of the sample program.

Input I0.5 can be used to clear the error output again.

5.13 Communication via the I/O Interface

The I/O interface of the SIWAREX M can be used for fast reading of measured values and status information (starting with firmware version 0122). This method can be used regardless of whether the FC SIWA_M function is used. If the information read in from the I/O interface is sufficient for a certain application, the FC SIWA_M function does not need to be called at all.
Transmission takes place via the I/O area. Parameters or commands cannot be transferred to the SIWAREX M with this interface.
The measuring results can be provided very quickly to the SIMATIC CPU. The measuring cycle counter makes it possible to implement flow measurement with STEP 7 resources for loss in weight or proportioning conveyor–belt scales, for instance.

The status information and the measured values are made available in the input area of the S7. Since not many transfer bytes are available, only one measured value can be read in addition to the status information. The user can use the ”measured value selection” byte in the output area to determine which measured value will be provided by the SIWAREX M.
The SIWAREX M has a counter in the input area so that the time at which the measured values and status values are updated can be recognized by the S7 program. The counter is incremented for each new measured value (0 to 127). When a new measured value becomes available, these data are provided along with the measured value in the input area together with the current status information and an ID.

The data are made available immediately after the values are calculated (approx. every 20 msec) without a request by the user program from the SIMATIC CPU. Before the values are provided, a check is made to determine which measured value was requested by the user.

To maintain error–free communication, the user program must monitor that the data are read and the measured value is updated by the module not simultaneously.

Safety routine:
While the measured values are being made available by the SIWAREX M, the most significant bit of the measured value counter is set.

Procedure while measured values are being provided by the SIWAREX M

	Counter state
• Set most significant bit in the counter	0xxxxxx → 1xxxxxx
• Provide desired measured value and status	1xxxxxx
• Clear most significant bit in the counter and increment the counter	1xxxxxx → **0**xxxxx**y**

Principal routine for evaluation in the user program

- Read counter and check whether > 127. If yes, repeat (or exit read routine). If no, store counter state
- Read measured value and, if necessary, status info
- Read counter again and check whether > 127. If yes, repeat everything. If no, compare with stored counter state. If counter states equal, read access was successful. If not, entire read access must be repeated.

With fast CPU cycles (<< 20 msec), a read access may be terminated immediately after the counter state is evaluated when it is detected that the measured value has already been read.

When the request for the measured value is changed, a check must still be made to determine whether the desired measured value was supplied (" measured value information) or whether a just changed request was issued too late.

Table 5-20 Allocation of the I/O input byte

Byte No.	Meaning		Remarks
0	– Already assigned for FB communication –		
1	– Already assigned for FB communication –		
2	– Already assigned for FB communication –		
3	– Already assigned for FB communication –		
4	– Already assigned for FB communication –		
5	–		
6	**Measured value information**		Codes: See *measured value selection*.
7	**Bit 2^7**	**Bits 2^6 to 2^0: Counter**	Counter is continuously incremented (0 to 127) Bit 27: For access signaling
8	**Measured value**		For possible values, see below
9			
10			
11			
12	**Status information 1**		(See DS31)
13			
14	**Status information 2**		(See DS31)
15			

Table 5-21 Allocation of the I/O output byte

Byte No.	Meaning	Remarks
0	– Already assigned for FB communication –	
1	– Already assigned for FB communication –	
2	– Already assigned for FB communication –	
3	– Already assigned for FB communication –	
4	– Already assigned for FB communication –	
5		
6		
7		
8	**Measured value selction**	see below
9		
10		
. . .		
15		

Measured value selection

The user program can specify in the ”measured value selection” byte which measured value is to transferred to the I/O area. The identifier for the value currently entered by SIWAREX M is returned in the ”measured value information” byte.

Table 5-22 Reading the measured values

Code	Weight valvue	from DR no.	Remarls
00	Digit,, unfiltered	DR33	Default setting
01	Digit, filtered	DR33	
02	Gross	DR30	
03	Net	DR30	
04	Tare	DR30	
05	Gross more precise	DR32	
06	Net more precise	DR32	

Important

The SIMATIC S7 program may only access the I/O area with word or double-word accesses. Otherwise error-free communication cannot be guaranteed

Sample program

```
FUNCTION_BLOCK FB 43
TITLE =
//This block is used to read measured values and status via
//I/O of the SIWAREX M.
//
//Parameter:
//
//ADR:   The base address of the SIWAREX M to be read is specified here as
//       entered in HW–Config. DBW0 of the
//       SIWAREX–DB can also be parameterized here
//
//Selection:   The measured value to be read is selected here.
//             !!!See parameter ”Act_Selection”!!!
//             Valid values:
//                                  0 for unfiltered digits
//                                  1 for filtered digits
//                                  2 for gross value
//                                  3 for net value
//                                  4 for tare value
//                                  5 for more precise gross value
//                                  6 for more precise net value
//             For all other selection values, ”unfiltered digits” are output.
//
//
//ERR:   This output becomes ”1” when three read attempts in
//       succession produce an invalid measured value.
//
//Meas. v.:    Measured value which was read from the SIWAREX M. The
//             ”Act_Selection” parameter shows which measured
//             value was read.
//
//Counter:     Each time the SIWAREX M supplies a !new! measured value,
//       this counter is incremented by one (every 20 msec). When
//       the counter reaches 127, it jumps with the next measured value
//       back to 0. This FB terminates processing when the same value
//       was read during the previous call.
//
//Act_Selection : Indicates which measured value was !really! read.
//                The ”selection” and ”Act_Selection” parameter may
//                differ directly after a switchover of ”selection” if
//                no new measured value was read or if the
//                ”selection” parameter is an invalid value.
//
//
//Status1:        The 1st word of the status data record (DR31) is output
//                here.
//
//Status2:        The 2nd word of the status data record (DR31) is output
//                here.
//
//
```

```
AUTHOR : Siwarex
FAMILY : Siwarex
NAME : HW_READ
VERSION : 1.2


VAR_INPUT
   ADR: INT ;       //Base address SIWAREX M
   Selection: INT ;      //Measured value selection
END_VAR
VAR_OUTPUT
   ERR : BOOL ;       //Error while reading measured value
   Measu_V : DINT ;       //Measured value of SIWAREX M module
   Counter_M : INT ;       //Measured value counter
   Act_Selection : INT ;   //Measured value selection of the output value
   Status1 : WORD ;       //Status word 1 (DR31)
   Status2 : WORD ;       //Status word 2 (DR31)
END_VAR
VAR
   Counter_old : INT ; //Measured value counter of previous cycle
END_VAR
VAR_TEMP
   TempW : WORD ;
   Counter_t : INT ;
   ReadC : INT ;    //Read counter
   Measu_V_t : DINT ;//Temp measured value
   Status_t : DWORD ;//Temp status
END_VAR
BEGIN
NETWORK
TITLE =Init
//Init
      L     #ADR; //Base address SIWAREX M
      SLD   3;
      LAR1 ;

      CLR   ;
      =     #ERR; //Clear error

      L     0;
      T     #ReadC; //Initialize read counter
NETWORK
TITLE = Measured value selection
//Set measured value selection to desired value
      L     #Selection;
      L     B#16#FF;
      UW    ;
      SLW   8;
      T     PAW [AR1,P#8.0];


NETWORK
TITLE = Read measured value
//Read ,measured value, counter and status
```

```
loop:  L     PIW [AR1,P#6.0]; // SIWAREX M Counter/selection
       T     #TempW;
       L     B#16#FF;
       AW    ; // Mask out measured value counter
       T     #Counter_t; // Counter state
       L     127;
       >I    ; // Measured value invalid?
       JC    neul; // Read again?
//
       TAK   ;
       L     #Counter_old;
       ==I   ; // No new value?
       JC    ende;
//
       L     PID [AR1,P#8.0]; // SIWAREX M measured value
       T     #Measu_V_t;
       L     PID [AR1,P#12.0]; // Status info
       T     #Status_t;
       L     PIW [AR1,P#6.0]; // SIWAREX M counter/selection
       L     #TempW; // still valid?
       <>I   ; // No–>neul(Read new)
       JC    neul;

       L     #Counter_t;
       T     #Counter_old; // Save new counter value as old
       T     #Counter_M; // and output

       L     #Measu_V_t; // SIWAREX M measured value
       T     #Measu_V;

       L     #Status_t; // Status info
       T     #Status2; // Status 2
       SRD   16;
       T     #Status1; // Status 1
       L     #TempW;
       SRW   8;
       T     #Act_Selection; // Indicated value
       BEU   ; // End
//
neul:  L     #ReadC;
       INC   1;
       T     #ReadC;
       L     3;
       <=I   ; // Max. no. of read reaches? No–>read again
       JC    loop;
       SET   ;
       =     #ERR; // Error
ende:  BE    ; // End of block

END_FUNCTION_BLOCK
```

Distributed Link to SIMATIC S7/C7/PCS 7 6

6.1 Distributed Link to SIMATIC S7/C7

The only difference between the distributed link to the SIMATIC S7-300, S7-400 and C7 and the central integration of the SIWAREX M into the SIMATIC S7-300 is the parameterization under HW-CONFIG.

Prerequisites

Interface IM 153-1 or IM 153-2
The IM 153-2 is only required when needed by other modules (e.g., FM 353).

SIWAREX M configuration package in SIMATIC S7

Master in the SIMATIC S7:
An S7 CPU with integrated PROFIBUS-DP interface or a CP 443-5 (starting with release status 2) or an IM 467 is required for the distributed connection of the SIWAREX M to the SIMATIC S7.

The current version of the CP 342-5 (status 4/99) cannot be used for the bus connection.

Connection to the SIMATIC C7:
A SIMATIC C7 with integrated PROFIBUS-DP interface is required for distributed connection of SIWAREX M to the SIMATIC C7.

CPU restart (for S7-400 only)

During a CPU restart, the restart OB (i.e., OB101) is executed followed by cyclic program processing at the point at which the interruption occurred.

FC SIWA-M cannot be called in the restart OB.

If a running job is interrupted by a restart, indication word 1 reports “job aborted due to synchronization” to the application. After conclusion of startup synchronization, FC SIWA-M places a new copy of the application in the working DB and starts processing the job again from the beginning.

Multi-processor operation (for S7-400 only)

In multi-processor operation, each SIWAREX M module is assigned to a certain CPU. One module cannot be accessed by several CPUs.

Active backplane bus (for S7-400 only)

Connecting and disconnecting the SIWAREX M under power can only be performed in connection with an active backplane bus of the S7-300.

The active backplane bus is based on a special model of the ET 200M modular I/O device which is connected via PROFIBUS-DP to a SIMATIC S7-400.

6.2 Distributed Link to SIMATIC PCS 7

Configuration package for SIMATIC PCS 7

Linking the SIWAREX M to the SIMATIC PCS 7 process control system requires the optional configuration package with the order no. 7MH4 583-*EA6*.

While the SIWAREX M is usually integrated in SIMATIC S5/S7 programmable controllers with the typical PLC programming languages STL (statement list), LAD (ladder diagram) or FBD (function block diagram, integration in the SIMATIC PCS 7 process control system is performed via graphic configuration in the CFC diagram (continuous function chart). In other words, integration is structured instead of programmed.

Integration in the engineering system (ES)

The SIWAREX M is integrated in the SIMATIC PCS 7 process control system via graphic configuration in the CFC diagram (CFC = Continuous Function Chart).

CFC is a technology-oriented, graphics configuration tool with which technology blocks (e.g., controller blocks, logical links, scales blocks, and so on) are taken from libraries and placed in CFC diagrams.

Each SIWAREX M module is represented by a block. The inputs and outputs of this block can be circuited with each other or with other blocks.

The SIWAREX M block has integrated message and maintenance functions.

The SIWAREX M supports removing and installing the module during running operation in connection with ”active bus modules.”

After a defective module has been replaced, the scales parameters can be sent to the new module either manually by pressing a button on the OS (i.e., Operator Station) or automatically (if configured in the CFC diagram), and the new weighing module becomes available for use immediately.

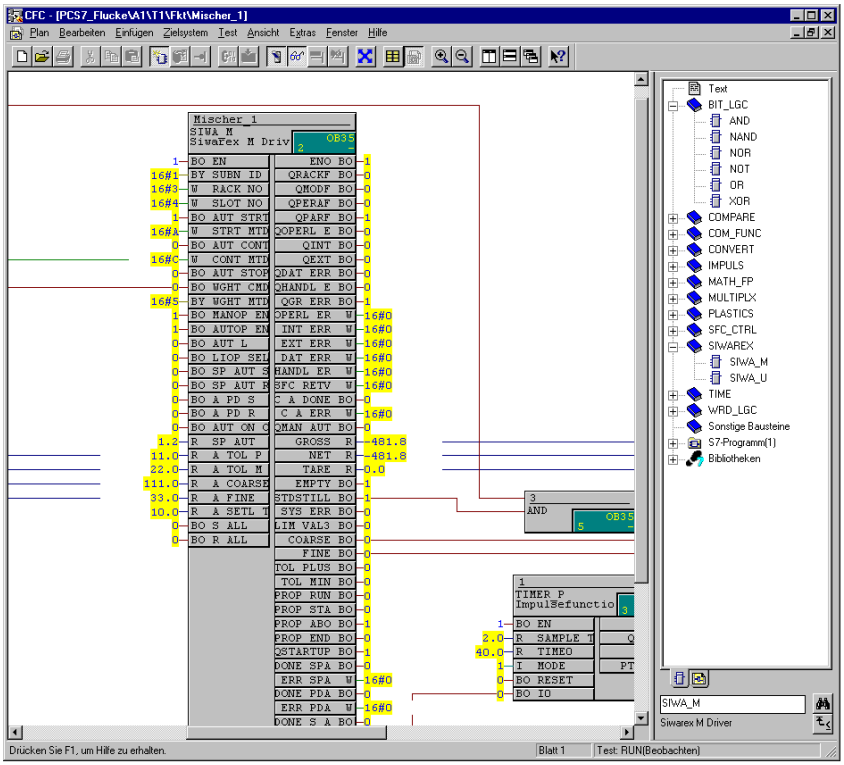


Figure 6-1 Graphic circuiting of the SIWAREX M via the CFC diagram

Integration in the operator station (OS)

A faceplate for visualization and use of the scales via the OS (WinCC) is available within the SIMATIC PCS 7 process control system to represent the SIWAREX M.

The faceplate can be used to handle the scales (e.g., set to zero, tare, start proportioning, and so on) and monitor the weighing values.

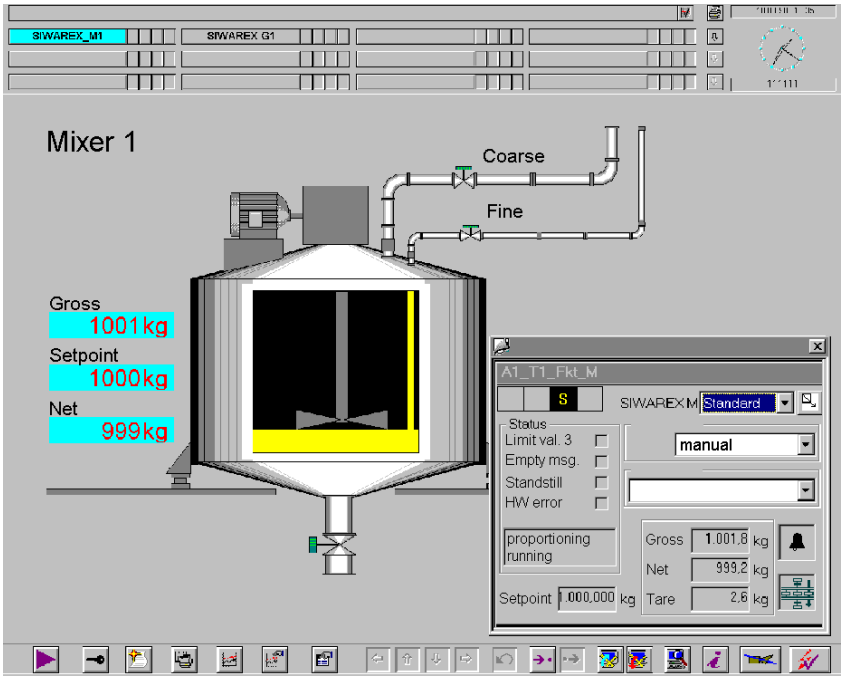


Figure 6-2 Faceplate for visualization of the SIWAREX M

The faceplate can be shown in various views (e.g., standard, maintenance, parameter, batch, and so on) depending on the particular requirements.

Serial Link 7

Introduction

One of the two serial interfaces (X2/X3) can be used for the link to other host systems (e.g., SIMATIC S5-95U or host PC). Two drivers (SIWAREX driver and 3964 R) are provided for this purpose.
The SIWAREX M can be adjusted, parameterized and controlled by sending (sending telegrams) or fetching (fetch telegrams) data records.

Restrictions

When the RS 232 interface (X2) is used for the link to a host system, a printer cannot be connected.

When the TTY interface (X3) is used for the link to a host system, a remote display cannot be connected.

7.1 Data Communication with the SIWAREX M

Method of function

If a host system link is implemented via the serial link, the SIWAREX M is always the slave, and the host system is always the master.

When the partner (master) wants to read a data record from the SIWAREX M, this record must first be requested with a fetch telegram (DR100). Using a response telegram, the requested data record (DRxx) is sent back from the SIWAREX M. When the master transfers a data telegram, the SIWAREX M then sends back an acknowledgment telegram (DR101). This acknowledgment telegram may contain positive and negative response messages.

The maximum length of user data is currently limited to 80 bytes (DR80 and 81). The data records which are available are listed in section 8.

In data record 51, two bytes each are reserved for the error types external errors, internal errors and operational errors. The error numbers are set up as bit structures and not as codes. Since each error code has an appropriate bit number allocated to it, errors of the same type which are waiting at the same time can be reported simultaneously.

The SIWAREX M extends error messages via DR51 to at least 3 seconds so that even briefly queued asynchronous errors (i.e., internal, external and operational errors) can be detected. This means that data record DR51 should be read at shorter intervals so that all errors can be acquired by the user.

7.1.1 SIWAREX Driver

How the driver functions

The **SIWAREX driver** operates in the lowest level with a simple telegram layout with 2 end characters. The telegrams also contain characters (BCC and length byte) used to improve transmission reliability and identification. These characters should be evaluated by partner stations.

In the data to be transferred, each telegram header contains a scales number for identification. Scales numbers from 1 to 16 are permitted. If the scales number does not match the entry in DR3, the telegram received is rejected in the SIWAREX M. If the scales number matches the entry in DR3, the address of the sender of the request telegram is entered as the receiver address in the response telegram. Each set of scales can be addressed with either its individual scales number or the address 0. The host has a default sender address of 255.

Table 7-1 Telegram layout

1st byte	Receiver address
2nd byte	Sender address
3rd byte	Data record number
4th byte	Length in n bytes (user data length + 7)
5th byte	User data DRx, first byte
. (n-3)th byte	. User data DRx, last byte
(n-2)th byte	BCC
(n-1)th byte	End ID 1 (DLE) 0x10
nth byte	End ID 2 (ETX) 0x3

When a byte with the code DLE (0x10) occurs within bytes 1 to (n-2) byte, this byte is doubled by the sender (to avoid a chance end ID within the user data) without including it in the calculation of the length.

The receiver must “undouble” the byte again.

The block check character (BCC) is generated with bytes 1 up to and including byte (n-3).

Example:
Link 1st byte with 2nd byte via EXOR
Link result with 3rd byte via EXOR
...
Link result with $(n-3)^{th}$ byte via EXOR
The end result is the BCC block check character.

When the character delay time is exceeded on the SIWAREX M, the interface is reset to its basic state. An error message is not generated. In addition, the block check characters and the length data are verified on the SIWAREX M. Errors are reported in the acknowledgment telegram with the identifier 60hex. If the length and the BCC byte in the telegram are zero, no check is performed.

When the SIWAREX driver is used with the RS 232 interface, a timeout monitoring function (no fetch telegram for 30 sec) causes an automatic switch from the SIWAREX driver to the printer protocol when no fetch telegram has occurred within 30 seconds.

Parameters of the SIWAREX driver

Table 7-2 Interface data

Baud rate	TTY interface: RS 232 interface:	9600 bit/sec 2400 or 9600 bit/sec
Parity bit	TTY interface: RS 232 interface:	Even Even or odd
Number of data bits	8	
Number of stop bits	1	
Character frame	11 bits	
Character delay time	220 msec	
Signals	TxD, RxD	

7.1.2 3964R Driver

How the driver functions

A link in accordance with the 3964R protocol can be made on the TTY and RS 232 interface of the SIWAREX M.

The 3964R protocol specifies the mechanisms required for reliable and secure transmission (e.g., checksums, control characters and so on).

In the data to be transferred, each telegram header contains a scales number. Scales numbers from 1 to 16 are permitted. If the scales number does not match the entry in DR3, the telegram received is rejected in the SIWAREX M. If the scales number matches the entry in DR3, the address of the sender of the request telegram is entered in the response telegram as the receiver address. Each set of scales can be addressed with either its individual scales number or the address 0. The host has a default sender address of 100.

Table 7-3 Layout of the sending telegram

Byte	Meaning	Example
1st byte	Receiver address (scales number)	0
2nd byte	Sender address (always 100 here for 3964R partner)	100
3rd byte	Data record number	100 (fetch telegram)
4th byte	Length in n bytes (user data + 7)	8 (1 byte user data + 7)
5th byte	User data DRx, first byte	30 (data record DR30, weight values)
...	...	-- (Not used for DR100)
nth byte	User data DRx, last byte	-- (Not used for DR100)

Table 7-4 Layout of the receiving telegram

Byte	Meaning	Example
1st byte	Receiver address (identifier 3964R)	100
2nd byte	Sender address (scales number)	0
3rd byte	Data record number	101 (acknowledgment telegram)
4th byte	Length in n bytes (user data + 7)	10 (3 bytes user data + 7)
5th byte	User data DRx, first byte	20 No. for acknowledged data record
6th byte	User data DRx, second byte	40 Type of error
7th byte	User data DRx, third byte	04 Error number
...		-- (Not used for DR101)
(nth-1). byte	...	-- (Not used for DR101)
nth byte	User data DRx, last byte	-- (Not used for DR101)

Table 7-5 Parameters ot the 3964R protocol

Baud rate	TTY interface: 9600 bit/sec RS 232 interface: 2400 or 9600 bit/sec
Parity bit	TTY interface: Even RS 232 interface: Even or odd*
Number of data bits	8
Number of stop bits	1
Character frame	11 bit
Acknowledgment delay time	2 sec
Character delay time	220 msec
Signals	TxD, RxD

* *Even parity* must be set for the 3964R protocol.

7.2 Selecting the Driver on the TTY Interface

Setting the TTY interface can be accomplished by sending DR8 via the SIMATIC interface or by using SIWATOOL.

Table 7-6 Selection codes for the TTY interface

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (in bytes)		
Parameters for TTY interface	TTY_PARA	180	8	0	-	2	WORD	Selection code 0 = No indication* 1 = TD20 2 = Indication 1 3 = Indication 2 4 = SIWAREX driver 5 = 4-position indication 6 = 5-position indication 7 = 6-position indication 8 = 3964R protocol

* Factory setting of SIWAREX M

7.3 Selecting the Driver on the RS 232 Interface

Setting the RS 232 interface can be accomplished by sending DR7 via the SIMATIC interface or by using SIWATOOL.

Table 7-7 Data and messages

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length (in bytes)		
Transmission rate of the RS 232 interface	RS232_PARA	178	7	1	0	2	WORD	0 = 2400 bit/sec 1 = 9600 bit/sec*
Parity of the RS 232 interface	RS232_PARA	178	7	1	1	2	WORD	0 = Odd 1 = Even*
Protocol of the RS232 interface	RS232_PARA	178	7	1	3	2	WORD	0 = Printer/SIWAREX protocol * 1 = 3964R protocol
Protocol of the RS232 interface	RS232_PARA	178	7	1	4	2	WORD	0 = No B protocol * 1 = B protocol
Scales number	*ADJ_DATA* / SCALES_NO	130	3	40	-	42	BYTE	Scales number 0*
Fetch telegram	-	-	100	0	-	1	BYTE	Number of the request data record
Acknowledgment telegram	-	-	101	0	-	3	BYTE	Acknowledgment telegram
Data transmission error on the TTY interface	OPER_ERR**	9	-	1	-	1	BYTE	Operational error 06
		-	51	4	5	6	BOOL	Operational error 06
Data transmission error on the RS 232 interface	OPER_ERR**	9	-	1	-	1	BYTE	Operational error 07
			51	4	5	6	BOOL	Operational error 06

* Factory setting of SIWAREX M
** Message bit via indication word of FC SIWA-M

When using the 3964R protocol, adhere to following points.

Always set *even parity* for the 3964R protocol.

If parameterization was performed with SIWATOOL, the 3964R protocol does not become active until a telegram has not been received from SIWATOOL for over 5 seconds.

Communication with SIWATOOL can be resumed on the RS 232 interface regardless of whether the 3964R or printer/SIWAREX protocol was selected.

Description of the Data Records

8

8.1 Overview Data Records

Table 8-1 Data records provided by the SIWAREX M

DR No.	Function	Direc-tion[1]	Length (Bytes)	Interfaces		Store in	
				S7	X1, X2 Serial	EEPROM	RAM (Buffered)
Diagnostic Data							
DR0	S7 diagnostic data record	r	4	Yes	No	No	No
DR1	S7 diagnostic data record	r	16	Yes	No	No	No
DR0	S7 parameter data record (not used)	w	4	No	No	No	No
DR1	S7 parameter data record (not used)	w	16	No	No	No	No
Setting Data: Adjustment and Setting Values							
DR2	Commands	w	2	Yes	Yes	No	No
DR3*	Adjustment data	r/w	42	Yes	Yes	Yes	No
DR4	Scales parameter	r/w	34	Yes	Yes	Yes/no[2]	No/yes[2]
DR5	Proportioning parameter	r/w	4	Yes	Yes	Yes/no[2]	No/yes[2]
DR6	Parameter for digital inputs and outputs	r/w	8	Yes	Yes	Yes	No
DR7	Parameter for RS 232	r/w	2	Yes	Yes	Yes	No
DR8	Parameter for TTY	r/w	2	Yes	Yes	Yes	No
DR9	Parameter for analog output	r/w	10	Yes	Yes	Yes	No
Process Data: Weighing and Proportioning Data, Commands							
DR22	Setpoint	r/w	4	Yes	Yes	No	Yes
DR23	Proportioning data	r/w	20	Yes	Yes	No	Yes
DR24	Specified value f. analog output	r/w	4	Yes	Yes	No	Yes
DR26	String field 1	r/w	16	Yes	Yes	No	Yes
DR27	String field 2	r/w	16	Yes	Yes	No	Yes
DR28	External tare specification	r/w	4	Yes	Yes	No	Yes
DR29	Additional proportioning parameters	r/w	48	Yes	Yes	No	Yes

1 r: READ-access only; w: WRITE-access only; r/w: READ and WRITE-access
2 Depends on the parameter bit in data record DR4 or DR5
* After verification acceptance, can only be read–accessed

Table 8-1 Data records provided by the SIWAREX M

DR No.	Function	Direc-tion[1]	Length (Bytes)	Interfaces		Store in	
				S7	X1, X2 Serial	EEPROM	RAM (Buffered)
Measuring values							
DR30	Weight values	r	12	Yes	Yes	No	No
DR31	Status information (bit-coded)	r	6	Yes	Yes	No	No
DR32	Meas. values more precise	r	8	Yes	Yes	No	No
DR33	Raw digit values	r	8	Yes	Yes	No	No
DR34	Analog output value	r	4	Yes	Yes	No	No
DR35	Additional measured values	r	24	Yes	Yes	No	No
Other							
DR40	Print data of last printout	r	28	Yes	Yes	No	No
DR41	Date and time	w	8	Yes	Yes	No	No
DR42	Type identifier/program version/switches	r	8	Yes	Yes	No	No
DR43	Tare and set to zero value more precise	r/w	10	Yes	Yes	No	Yes
Diagnostic Information							
DR51	Error information	r	6	Yes	Yes	No	No
Print Layouts							
DR80	Text 1	r/w	80	No	Yes	Yes	No
DR81	Text 2	r/w	80	No	Yes	Yes	No
Communication							
DR100	Fetch telegram	w	1	No	Yes	No	No
DR101	Acknowledgment telegram	r	3	No	Yes	No	No

1 r: READ-access only; w: WRITE-access only; r/w: READ and WRITE-access
2 Depends on the parameter bit in data record DR4 or DR5
* After verification acceptance, can only be read–accessed

8.2 Data Formats for S5/S7

Data formats in S7

Table 8-2 Data record formats

DS byte n+3	DS byte n+2	DS byte n+1	DS byte n+0
Byte, char			
2^7 2^0			
Word			
High byte	Low byte		
2^{15}	2^7 2^0		
	dint	, time (msec)	
High word		Low word	
High byte	Low byte	High byte	Low byte
2^{31}	2^{23}	2^{15}	2^7 2^0

Table 8-3 Format for data and time in the SIMATIC S7

Date and Time DT (BCD-Coded)							
Byte n+7	Byte n+6	Byte n+5	Byte n+4	Byte n+3	Byte n+2	Byte n+1	Byte n
Day of the week[1]	Millisec.[1]	Seconds	Minutes	Hours	Day	Month	Year

1 Not used

8.3 Detailed Description of Data Records

8.3.1 Diagnostic Data

Note

The data of DR0 are also available in the local data of OB82.

DR0
Diagnosis, part 1

Table 8-4 Diagnostic data

Byte	Bit	Meaning	Remarks
0	0	Module error	
	1	Internal error	
	2	External error	
	3		Not used, always 0
	4	External auxiliary voltage missing	
	5		Not used, always 0
	6	Parameterization missing	
	7		Not used, always 0
1	0 to 3	Module class	0101 = Analog module 0000 = CPU 1000 = Function module = SIWAREX M 1100 = CP 1111 = Digital module
	4	Channel information exists	
	5	User information exists	
	6		Not used, always 0
	7		Not used, always 0
2	0		Not used, always 0
	1	Communication error	
	2		Not used, always 0
	3	Watchdog-error	
	4		Not used, always 0
	5		Not used, always 0
	6	Buffer error	
	7		Not used, always 0

Table 8-4 Diagnostic data

Byte	Bit	Meaning	Remarks
3	0		Not used, always 0
	1		Not used, always 0
	2	EPROM error	
	3	RAM error	
	4	ADC error	(ADC error during read-access)
	5		Not used, always 0
	6		Not used, always 0
	7		Not used, always 0

DR1
Diagnosis, part 2

Data record DR1 is not used by the SIWAREX M for diagnostic purposes.

8.3.2 Setting Data (Adjustment and Setting Values)

DR2 Commands

Table 8-5 Description of DR2

Meaning	Format
Commands	WORD

Table 8-6 Commands

Selection Code (Decimal)	Meaning
0	No command execution
1	Zero point valid (adjustment command)
2	Adjustment weight valid (adjustment command)
3	Taring
4	Externally spec. tare valid
5	Set to zero
6	Reserved
7	Print text 1
8	Print text 2
9	Repeat last printout
10	Start proportioning with automatic taring
11	Stop proportioning
12	Start proportioning without automatic taring or continue proportioning
13	Load factory setting
15	Delete tare
20	Start inching mode with taring
22	Start inching mode without taring or continue proportioning
30	Start proportioning with taring with reproportioning
32	Start proportioning without taring with reproportioning or continue proportioning
40	Start proportioning with taring with reproportioning as inching mode
42	Start proportioning without taring with reproportioning as inching mode or continue proportioning

DR3 Adjustment data

Table 8-7 Description of DR3

Meaning	Unit	Format	Factory Setting SIWAREX M
Operating mode		WORD	0
Type of scales		WORD	0
Standstill time	msec	TIME	2500
Standstill value	Weight	DINT	1
Decimal point		WORD	0
Char. value area of SIWAREX M	mV/V	DINT	2
Unit of weight		CHAR	'kg'
Digit increment		BYTE	1
Limit frequency of digital filter		BYTE	2
Adjustment weight	Weight	DINT	10000
Maximum load	Weight	DINT	10000
Language		WORD	0
Adjustment digits 0		DINT	0
Adjustment digits 1		DINT	0
Scales number		BYTE	0
In reserve		BYTE	0

Table 8-8 Selection code of the adjustment data (decimal specification)

Selection Code	Meaning
Operating mode	
0	Operation without verification obligation
2	Operation with verification obligation as non-automatic scales
Type of scales	
	Not used at this time
Characteristic value range, SIWAREX M	
1	Char. value range 0 to 1 mV/V
2	Char. value range 0 to 2 mV/V
4	Char. value range 0 to 4 mV/V
Digit increment parameterization byte	
1	Digit increment: 1
2	Digit increment: 2
5	Digit increment: 5
10	Digit increment: 10
20	Digit increment: 20
50	Digit increment: 50

Table 8-8 Selection code of the adjustment data (decimal specification)

Selection Code	**Meaning**
Decimal point parameterization byte	
0	xxxxx (no decimal point)
1	xxxx.x
2	xxx.xx
3	xx.xxx
4	x.xxxx
5	.xxxxx
Digital filter/average value filter	
0/(100)	No filtering/mean value filter active
1/(101)	Limit frequency: 5 Hz/mean value filter active
2/(102)	Limit frequency: 2 Hz/mean value filter active
3/(103)	Limit frequency: 1 Hz/mean value filter active
4/(104)	Limit frequency: 0.5 Hz/mean value filter active
5/(105)	Limit frequency: 0.2 Hz/mean value filter active
6/(106)	Limit frequency: 0.1 Hz/mean value filter active
7/(107)	Limit frequency: 0.05 Hz/mean value filter active
Language	
0	German
1	English

DR4 Scales parameters

Table 8-9 Description of DR4

Meaning	Unit	Format	Factory Setting SIWAREX M
Scales settings (bit-coded)		WORD	0003
Empty message value	Weight	DINT	50
Empty message delay time	msec	TIME	5000
Switch-on point for limit value 1	Weight	DINT	10000
Switch-off point for limit value 1	Weight	DINT	9990
Switch-on point for limit value 2	Weight	DINT	1000
Switch-off point for limit value 2	Weight	DINT	1010
Switch-on point for limit value 3	Weight	DINT	9000
Switch-off point for limit value 3	Weight	DINT	8990

Table 8-10 Scales settings

Bit No. 15	Bit No. 1	Bit No. 0	Meaning	Factory Setting SIWAREX M
		0/1	Automatic zero point offset 1: On 0: Off	1
	0/1		1: Fill weighing 0: Deduction weighing	1
0/1			1: Store in RAM 0: Store in EEPROM	0

DR5 Proportioning parameters

Table 8-11 Description of DR5

Meaning	Unit	Format	Factory Setting SIWAREX M
Proportioning parameter word 1 (bit-coded)		WORD	2
Reserve2		WORD	0

Table 8-12 Proportioning parameter value

Bit No. 15	Bit No. 14	Bit No. 1	Bit No. 0	Meaning	Factory Setting SIWAREX M
			0 = Off 1 = On	Automatic printout for finished message	0
		0 = Off 1 = On		Settling time is terminated by standstill.	1
0/1				1: Store in RAM 0: Store in EEPROM	0
	0 = Yes 1 = No			Proportioning above fine–flow switchoff point possible	0

DR6 Parameters for digital inputs and outputs

Table 8-13 Description of DR6

Meaning	Possible Entry	Format	Factory Setting SIWAREX M (Decimal)
Allocation signal output 1	Number	BYTE	23
Allocation signal output 2	Number	BYTE	23
Allocation signal output 3	Number	BYTE	23
Allocation signal output 4	Number	BYTE	23
Allocation command input 1	Number	BYTE	11
Allocation command input 2	Number	BYTE	11
Allocation command input 3	Number	BYTE	11

Allocation for DI

Table 8-14 Selection codes for DI

Meaning	Selection Code (Decimal)
Zero point valid (adjustment command)	1
Adjustment weight valid (adjustment command)	2
Taring	3
Externally specified tare valid	4
Set to zero	5
Reset SIWAREX *	6
Print text 1	7
Print text 2	8
Repeat last printout	9
Start proportioning with automatic taring	10
Stop proportioning	11
Start proportioning without automatic taring or continue proportioning	12
Load factory setting	13
Delete tare	15
Start inching mode with taring	20
Start inching mode with taring or continue proportioning	22
Start proportioning with taring with reproportioning	30
Start proportioning without taring with reproportioning or continue proportioning	32
Start proportioning with taring with reproportioning as inching mode	40
Start proportioning without taring with reproportioning as inching mode or continue proportioning	42

* For service purposes only

Allocation for DO

Table 8-15 Selection codes for DO (decimal specification)

Meaning	Selection Code (High Active)	Inverted Selection Code (Low Active)
Scales adjusted	0	-
Scales tared	1	-
1/4d-zero	2	-
Write protection active	3	-
Source of date/time (0 = S7 or none; 1 = TD20)	4	-
Limit value 1 active/inactive	5	105
Limit value 2 active/inactive	6	106
Limit value 3 active/inactive	7	107
Empty message active/inactive	8	108
Standstill	9	-
Maximum load + 9 e exceeded	10	110
Tare memory loaded with manual tare value (preset)	11	-
Command via external contact could not be executed.	12	-
Gross weight outside zero setting range	13	-
Group error (hardware error)	15	115
Coarse flow on	16	-
Fine flow on	17	-
Tolerance deviation +	18	-
Tolerance deviation -	19	-
Proportioning running	20	-
Proportioning started. Wait for standstill.	21	-
Proportioning aborted	22	-
Proportioning finished (finished message)	23	-
Material flow error 1	24	124
Material flow error 2	25	125
Material flow error, coarse flow	26	126
Material flow error, fine flow	27	127
Time monitoring for inching mode or reproportioning has expired	28	-
Printing not possible	29	-
Reproportioning was activated	30	-

DR7 RS 232C interface parameters

Table 8-16 Description of DR7

Meaning	Unit	Format	Factory Setting SIWAREX M
RS 232 settings (bit-coded)		WORD	3

Table 8-17 Transmission values

Bit No.	Meaning			Factory Setting SIWAREX M
0	Transmission rate: 0 = 2400 bit/sec; 1 = 9600 bit/sec			1
1	Parity: 1 = even; 0 = odd			1
3	**Protocol:**	**Bit 3:**	**Bit 4::**	0
	XON/XOFF:	0	0 (printer)	0
	Proz. 3964R:	1	0	
	B protocol:	0	1	

DR8 TTY interface parameters

Table 8-18 Description of DR8

Meaning	Unit	Format	Factory Setting SIWAREX M
TTY setting		WORD	0

Table 8-19 Type of remote display/driver

Selection Code	Meaning
0	No display (factory setting)
1	TD20
2	Reserved for display 1
3	Reserved for display 2
4	Serial SIWAREX protocol
5	4-digit display
6	5-digit display
7	6-digit display
8	3964R procedure

DR9 Parameters for analog output

Table 8-20 Description of DR9

Meaning	Unit	Format	Factory Setting SIWAREX M
Basic settings of the analog output		WORD	0
In reserve		DINT	0
Maximum output value for analog output	Weight	DINT	10000

Table 8-21 Basic settings of the analog output

Selection Code (Decimal)	Meaning
0	External output (specified value), 0 to 20 mA
1	Gross output, 0 to 20 mA
2	Net output, 0 to 20 mA
10	External output (specified value), 4 to 20 mA
11	Gross output, 4 to 20 mA
12	Net output, 4 to 20 mA

8.3.3 Process Data: Weighing and Proportioning Data and Commands

DR22 Setpoint

Table 8-22 Description of DR22

Meaning	Unit	Format	Factory Setting SIWAREX M
Setpoint		DINT	0

DR23 Proportioning data

Table 8-23 Description of DR23

Meaning	Unit	Format	Factory Setting SIWAREX M
Tolerance plus value	WEIGHT	DINT	0
Tolerance minus value	WEIGHT	DINT	0
Coarse flow switchoff value	WEIGHT	DINT	0
Fine flow switchoff value	WEIGHT	DINT	0
Settling time	msec	TIME	2000

DR24 Specified value, analog output

Table 8-24 Description of DR24

Meaning	Unit	Format	Factory Setting SIWAREX M
Externally specified value for analog output		DINT	0

DR26 String field 1

Table 8-25 Description of DR26

Meaning	Unit	Format	Factory Setting SIWAREX M
String field 1 (16 characters, value 00 to FF hex)		Char	16 times ‘ ‘

DR27 String field 2

Table 8-26 Description of DR27

Meaning	Unit	Format	Factory Setting SIWAREX M
String field 2 (16 characters, value 00 to FF hex)		Char	16 times ‘ ‘

DR28 Externally specified tare

Table 8-27 Description of DR28

Meaning	Unit	Format	Factory Setting SIWAREX M
Externally specified tare	Weight	DINT	0

DR29 Expanded proportioning parameters

Table 8-28 Description of DR29

Meaning	Unit	Format	Factory setting, SIWAREX M
Inching time	msec	TIME	1000
Monitoring time (inching mode/reproportioning)	msec	TIME	10000
Material flow monitoring time 1 (coarse)	msec	TIME	3000
Material flow monitoring value 1 (coarse)	Weight	DINT	2
Material flow monitoring time 2 (fine)	msec	TIME	3000
Material flow monitoring value 2 (fine)	Weight	DINT	1
Delay time for monitoring coarse flow	msec	TIME	2000
Delay time for monitoring fine flow	msec	TIME	2000
In reserve		6xDINT 2xWORD	0

8.3.4 Measured Values

DR30 Weight values

Table 8-29 Description of DR30

Meaning	Unit	Format
Gross weight	Weight	DINT
Net weight	Weight	DINT
Tare weight	Weight	DINT

DR31 Status information

Table 8-30 Description of DR31

Meaning	Format
Status information 1 (bit-coded)	WORD
Status information 2 (bit-coded)	WORD
In reserve	WORD

Table 8-31 Status information

Status 1 (General status information)

Bit No.	Meaning
0	Scales adjusted
1	Scales tared
2	1/4d-zero
3	Write protection active
4	Source of data/time (0 = S7 or none; 1 = TD20)
5	Limit value 1 active/inactive
6	Limit value 2 active/inactive
7	Limit value 3 active/inactive
8	Empty message active/inactive
9	Standstill
10	Maximum load + 9 e exceeded
11	Tare memory loaded with manual tare value (preset)
12	Command could not be executed via external contact.
13	Gross weight outside zero setting range
14	Printing not possible
15	Group error (hardware error)

Status 2 (for proportioning scales)

0	Coarse flow on
1	Fine flow on
2	Tolerance deviation +
3	Tolerance deviation -
4	Proportioning running
5	Proportioning started. Wait for standstill.
6	Proportioning aborted
7	Proportioning finished (finished message)
8	Reproportioning was activated.
9	Material flow error 1
10	Material flow error 2
11	Material flow error, coarse
12	Material flow error, fine
13	Time monitoring for inching operation/reproportioning has been triggered.
14	Operational error
15	In reserve

DR32 Measured values more precise

Table 8-32 Description of DR32

Meaning	Unit	Format
Gross more precise	Weight	DINT
Net more precise	Weight	DINT

DR33
Raw digit values

Table 8-33 Description of DR33

Meaning	Unit	Format
Unfiltered raw value	Digit	DINT
Filtered raw value	Digit	DINT

DR34
Analog output value (for service purpuses only)

Table 8-34 Description of DR34

Meaning	Unit	Format
D/A converter value	Digit	DINT

DR35
Additional measured values

Table 8-35 Description of DR35

Meaning	Unit	Format
Optimized fine flow switchoff value	Weight	DINT
In reserve		4xDINT
In reserve		2xWORD

8.3.5 Other Functions

DR40
Print data of last printout

Table 8-36 Description of DR40

Meaning	Unit	Format	Factory Setting SIWAREX M
Gross weight of the last printout	Weight	DINT	0
Net weight of the last printout	Weight	DINT	0
Tare weight of the last printout	Weight	DINT	0
Consecutive weighing number	Weight	DINT	0
Date and time of the last printout	Date and time	DT	0
Setpoint of the last printout	Weight	DINT	0

DR41
Date and time

Table 8-37 Description of DR41

Meaning	Unit	Format	Factory Setting SIWAREX M
Date	Date	DT	1990-01-01-00
Time	Time	DT	00:00

DR42 Type identifier/ program version/ switches

Table 8-38 Description of DR42

Meaning	Unit	Format	Factory Setting SIWAREX M
Type identifier		WORD	2243
Program version		WORD	Cur. version
Switch positions (DIP switches)		WORD	Cur. settings*
IN RESERVE 3		WORD	0

* Binary representation

DR43 Tare and set to zero more precise

Table 8-39 Description of DR43

Meaning	Unit	Format	Factory Setting SIWAREX M
Tare more precise	Weight	DINT	0
Set to zero value more precise	Weight	DINT	0
Tare information (bit-coded)	See below.	WORD	0

Table 8-40 Tare information

Bit 0	Meaning
0	No manual tare (preset) value set (no external tare specification)
1	Manual tare (preset) value set (external tare specification)

8.3.6 Diagnostic Information

DR51 Error information

Table 8-41 Description of DR51

Meaning	Unit	Format	Factory Setting SIWAREX M
Error information on external errors, bit-coded *		WORD	0
Error information on internal errors, bit-coded *		WORD	0
Error information on operational errors, bit-coded *		WORD	0

* Bit number = Error number minus “1” in accordance with sections 11.2, 11.4 and 11.5

8.3.7 Print Layouts

DR80
Print layout 1

Table 8-42 Description of DR80

Meaning	Unit	Format	Factory Setting SIWAREX M
Text 1 (80 characters, value 00 to FFhex)		Char	See below.

Factory setting, text 1:

LF,D,a,t,u,m,TAB,TAB,U,h,r,TAB,TAB,M,a,t,e,r,i,a,l,TAB,TAB,V,e,r,w,.,SP,N,r,.,TAB,N,e,t,t,o,g,e,w ,.,TAB,SP,SP,B,r,u,t,t,o,g,e,w,.,LF,LF,F3,TAB,F4,TAB,TAB,F6,TAB,TAB,F5,TAB,F1,TAB,F0,CR,EOT;

DR81
Print layout 2

Table 8-43 Description of DR81

Meaning	Unit	Format	Factory Setting SIWAREX M
Text 2 (80 characters, value 00 to FFhex)		Char	See below.

Factory setting, text 2:

F3,TAB,F4,TAB,TAB,F6,TAB,TAB,F5,TAB,F1,TAB,F0,LF,EOT;

8.3.8 Communication

DR100 Fetch telegram

Table 8-44 Description of DR100

Meaning	Unit	Format
Number of data record request		BYTE

DR101 Acknowledgment telegram

Table 8-45 Description of DR101

Meaning	Unit	Format
No. for acknowledged data record (0 for error type 60 hex)		BYTE
Type of error		BYTE
Error number		BYTE

Table 8-46 Types of errors in acknowledgment telegrams

Selection Code	Meaning
00hex	No error
40hex	Handling error
50hex	Data error
60hex	Transmission error

Optional Components

9

Overview

Optional components are external devices such as remote displays, printers, and so on.

The figure below shows how external devices can be connected.

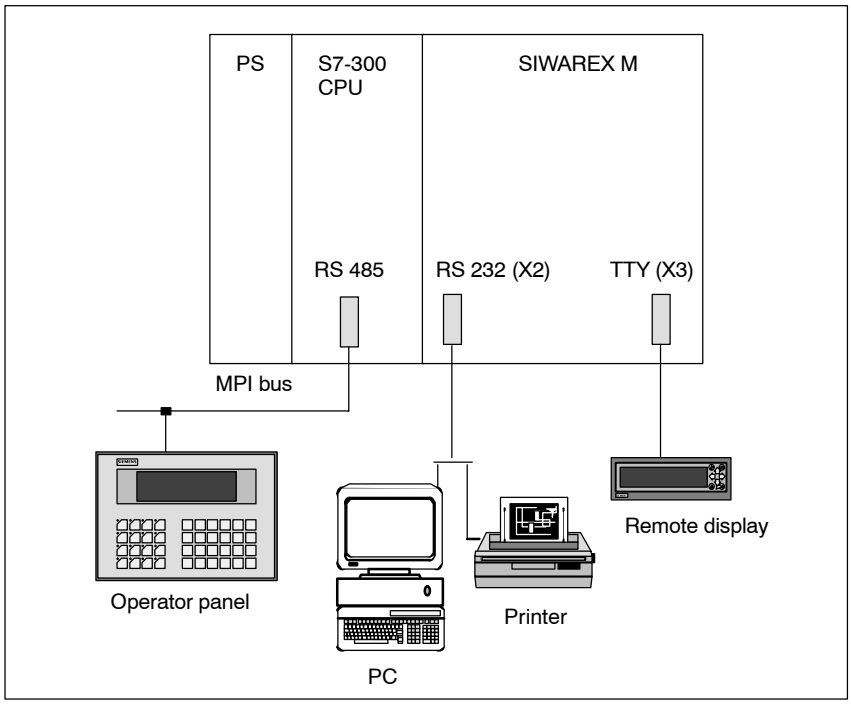


Figure 9-1 Connection of optional components

A remote display appropriate for verification can be connected to the TTY interface (X3).

The RS 232 interface (X2) can be used to connect either a printer for logging requiring verification capability, or a PC for commissioning purposes.

The telegram communication enables the SIWAREX M to recognize when a PC is connected. During this phase, triggered print jobs are rejected with an error message.

9.1 Connection of Digital Remote Displays

Introduction

Digital remote displays can be connected to the TTY interface of the SIWAREX M. The SIWAREX M contains an appropriate protocol for connection of digital remote displays. All digital remote displays which support this protocol and are equipped with a TTY interface can be connected to the SIWAREX M. 4-digit, 5-digit and 6-digit remote displays are supported.

Note

The SIWAREX M contains a protocol for addressing digital remote displays. It is the user's responsibility to determine whether the digital remote display chosen actually supports this protocol. Siemens AG accepts no liability for damage caused by connection of remote displays.

The documentation of the remote display manufacturer must be adhered to.

Description

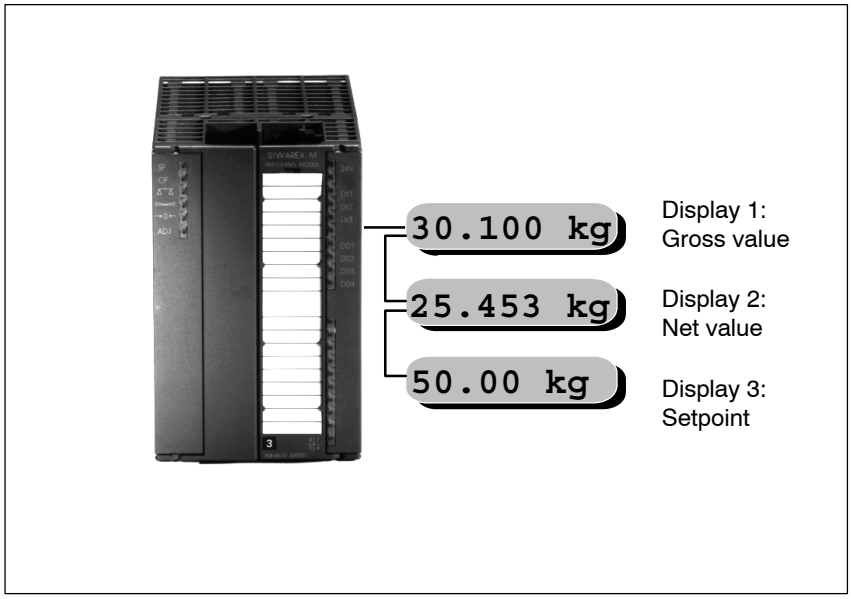


Figure 9-2 Example: Connection of 3 digital remote displays to SIWAREX M

Weight representation

The following weight values can be represented on a digital remote display.

- Gross weight value
- Net weight value
- Setpoint

A setting on the remote display determines which of the weight values is represented.

Unit of weight and status symbols

If supported by the remote displays, the following information can also be indicated.

- Unit of weight (g, kg or t)
- Status symbol for the 1/4d-zero (-0-)
- NET symbol (for tared scales)
- Scales standstill

Special operating states

When special operating states occur (e.g., the indication range of the remote display is exceeded), the SIWAREX M sends appropriate ASCII characters via the protocol. If the remote display can indicate these ASCII characters, the special operating state is indicated on the remote display. See also character set used for display data, table 9-8.

Table 9-1 Special states

Indication	Description
"_ _ _ _ _"	The indication range of the remote display has been exceeded (e.g., 345.546 kg cannot be shown on a 4-digit display).
"_ _ _ _ _"	The maximum load of the scales was exceeded by more than 9 e (1 e = 1 digit increment). The maximum load of the scales is parameterized on the SIWAREX M.
"E r r o r"	The SIWAREX M reports a system error (e.g., EEPROM error).
"_ _ _ _ _" or "≡ ≡ ≡ ≡ ≡"	Timeout function for monitoring the serial connection for wire break. This function must be included in the remote display. The function is indicated differently depending on the type of display.

Connection of the remote displays

The connection to the remote display is made with the free-floating TTY interface of the SIWAREX M (15-way, sub D socket). The interface is unidirectional (i.e., the weight values are transferred cyclically to the remote display(s).

Depending on the type of indication, several digital remote displays can also be connected to the SIWAREX M.

Either the SIWAREX M or a remote display must be operated actively.

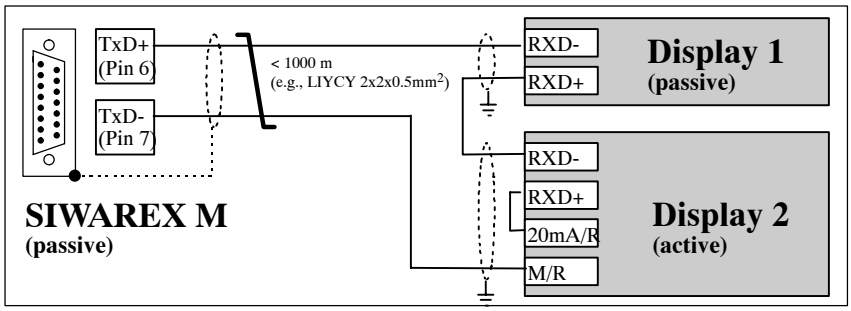


Figure 9-3 Connection of several remote displays

Assignment of the TTY interface for the SIWAREX M

Table 9-2 Pin assignment of the TTY interface on the SIWAREX M

Pin	Signal Name	Explanation
2	RxD-	Receiver data -
6	TxD+	Sender data +
7	TxD-	Sender data -
9	RxD+	Receiver data +
11	20 mA/R	Receiver power +
12	GND	Ground
13	20 mA/T	Sender power +
15	GND	Ground

For pin assignment of the remote display, see the documentation of your remote display.

Note

Pin assignment of the remote displays may differ depending on the manufacturer. For example, S+/S- is used for sender power, and TX+/TX-/RX+/RX- is used for sender or receiver lines. Some remote displays use the 24 V connection instead of 20 mA/R and GND instead of M/R since these types of remote displays are equipped with constant current control which limits the current on the TTY interface. For details, see the documentation of your remote display.
When several remote displays are to be connected to the TTY interface of the SIWAREX M, we recommend asking the manufacturer of the remote displays whether this is possible.

Settings on the SIWAREX M

4-digit, 5-digit and 6-digit displays can be connected to the SIWAREX M. Selection of the display to be connected is made in DR8 via SIMATIC S7 or via SIWATOOL.

The number of positions set applies to all remote displays connected to the TTY interface.

Table 9-3 Selection codes for the TTY interface

Funktion	SIMATIC S7		Data Record				Format	Comments
	Stuktur name / Variable name	Addr.	No.	Byte	Bit	Length in bytes		
Parameter for TTY interface	TTY_PARA	180	8	0	-	2	WORD	Selection code 0 = No display* 1 = TD20 2 = Reserved 1 3 = Reserved 2 4 = SIWAREX driver 5 = 4-digit display 6 = 5-digit display 7 = 6-digit display 8 = Procedure 3964R

* Factory setting of SIWAREX M

Settings on the remote display

When a digital remote display is connected to the SIWAREX M, settings must be made on the remote display. The number of settings depends on the remote display used.
For detailed information on the parameterization of remote displays, see the documentation of the manufacturer of your remote display.

Table 9-4 Settings on digital remote displays

Meaning	Setting
Interface	TTY
Data format	8-bit
Parity	Even
Baud rate	9600 Baud
Protocol	STX/ETX
Protocol response	None
Ignore characters (See protocol layout in table 9-7)	Ignore no characters for remote displays with status indication. Ignore one character for remote displays without status indication.
Address length	2 positions
Address	Gross value = 01 Net value = 02 Setpoint = 04
Timeout	Example: timeout after 2 sec
Decimal point	No decimal point is specified via remote display.
Leading zeros	Leading zeros are indicated.
Dimension (only applicable to remote displays with weight symbol)	No indication
Segment test	If present on the remote display, segment test should be enabled.

Number range which can be represented

Depending on the remote display selected, the weight value can be indicated with 4, 5 or 6 digits. When negative values are involved, the minus sign takes up one of the positions.

Example of a 6-digit display with 3 positions after the decimal point: Display range -99.999 to 999.999.

When the number range which can be represented is exceeded, this is shown by ”- - - -”.

The following configurations should be avoided when representing gross or net weight values since negative values cannot be represented.

Table 9-5 Representation of the decimal point positions

Remote Display Type	Number of Positions Configured after the Decimal Point	Example
4-digit remote display	3 positions after the decimal point	0.123 -0.123 cannot be represented since 5 positions required.
5-digit remote display	4 positions after the decimal point	0.1234 -0.1234 cannot be represented since 6 positions required.
6-digit remote display	5 positions after the decimal point	0.12345 -0.12345 cannot be represented since 7 positions required.

Position of the decimal point

Only one decimal point position can be specified for all weight values. The decimal point position can be specified via SIWATOOL or via the SIMATIC (DR3, adjustment data).

The decimal point position is kept static. After a decimal point position has been parameterized, it is transferred with the protocol. When several remote displays are used, the decimal point position can be set individually on each remote display by not specifying a decimal point position for the SIWAREX M. The desired decimal point position must then be set directly on the remote display.

Addressing

An address must be set on each display (e.g., by using the appropriate parameterization menu of the display). The address determines the value to be indicated.

Table 9-6 Possible settings

Address ASCII coded [1]	Remote Display Data
01	Gross value
02	Net value
03	Reserved
04	Setpoint

[1] Since the address is represented as ASCII characters in the remote display protocol, address “02” corresponds to the ASCII characters 30h and 32h.

Remote displays with status indication

When remote displays which can evaluate the scales status with byte 4 of the remote display protocol (cf. table 9-7) and indicate status messages (e.g., NET), address 02 (i.e., net weight) must be set. If the scales are not tared, the gross weight value is indicated. If the scales are tared, the net weight value is indicated and the NET symbol lights up. 1/4d-zero is indicated as status symbol **-0-**. When the maximum load is exceeded by 9 e, the weight values are no longer indicated. If the scales are not at a standstill, this is indicated by the ⏥ symbol.

Displays with weight symbol

When the SIWAREX M is parameterized for the unit of weight (g, kg or t), remote displays which can indicate the weight symbol display the unit of weight.

Protocol layout

The layout of the protocol will now be described. All digital remote displays which can be connected electrically to the SIWAREX M and which can be operated with the described protocol can be used with the SIWAREX M.

Description of the protocol

Data format:	8 bits, even parity, 1 stop bit
Baud rate:	9600 Baud
Protocol:	STX/ETX without protocol response
Addressing:	2 bytes for addressing the displays
Status:	Displays which cannot indicate NET status and 1/4d-zero must ignore byte 4.
Unit of weight:	Displays which cannot indicate a unit of weight must ignore the related control codes.

Table 9-7 Description of the string layout

Byte No.			Contents		Commentary/Example
4-digit Display	**5-digit Display**	**6-digit Display**		**HEX (Ex.)**	
1	1	1	STX	02	02h
2	2	2	Address	30	2 digits, ASCII-coded
3	3	3	Address	31	(can be parameterized on display)
4	4	4	Status, NET ¼d-zero	4D	
5	5	5	1st digit	35	Gross, net or setpoint
6	6	6	2nd digit	34	
7	7	7	Decimal point	2C	*1)
8	8	8	3rd digit	33	
9	9	9	4th digit	32	
Blank	10	10	5th digit	31	
Blank	Blank	11	6th digit	30	
12	12	12	ESC	1B	Selection of unit of weight
13	13	13	D	44	Selection of unit of weight
14	14	14	2	32	1=“***g***”, 2=“***kg***”, 3= “***t***” *0 = No scales standstill*
15	15	15	ETX	03	

*1) Position depends on the decimal point position parameterized for SIWAREX M.
If no decimal point is parameterized, the data string has one byte less.
If English is set as the language (DR3), the ASCII character is output for the decimal point (2Eh). Only applicable to remote displays which differentiate between a comma and a point.

Table 9-8 Character set used for display data

Character	Hexadecimal Code	Commentary
Digits 0 to 9	30 to 39	Representation of the digits
Minus sign ”-”	2D	Sign for negative values or Maximum load of scales exceeded
Underline ”_”	5F	For ”range exceeded” - indicated in all character positions
Decimal point	2C/2E	For German: 2C For English: 2E
Blank	20	For blanking out characters
Letter E Letter r Letter o	45 72 6F	For error display: “Error”
STX	02	Protocol control character for start of data string
ETX	03	Protocol control character for end of data string
ESC	1B	Introduction of a control character
Status: NET Status: NET and -0- Status: -0- No status	4E 4D 4F 20	Indication of the scales status

Siebert remote displays

Digital remote displays from the company Siebert Industrieelektronik GmbH can be directly connected to the SIWAREX M via the TTY interface.

Remote displays S11 and S310 can be used as remote displays appropriate for verification. In addition to the weight value, both remote displays show status 1/4e, NET and scales standstill on the display.

Remote displays which can be used:
-S10/SX10
-S11 (appropriate for verification)
-S30
-S70 (with option 97/16)
-S300
-S310 (appropriate for verification)

Siebert Industrieelektronik GmbH
Postfach 1180
D-66565 Eppelborn
Tel: +49 6806/980-150
Fax: +49 6806/980-111
Internet: http://www.siebert.de

Contact the manufacturer for detailed information.

9.2 External verifiable memory

Starting with firmware release 0122, an external verifiable memory can be connected to the RS 232 interface. Connection of the verifiable memory is designed especially for the ”Omniscale” unit from CSM GmbH.
The B protocol is used for communication with the verifiable memory.

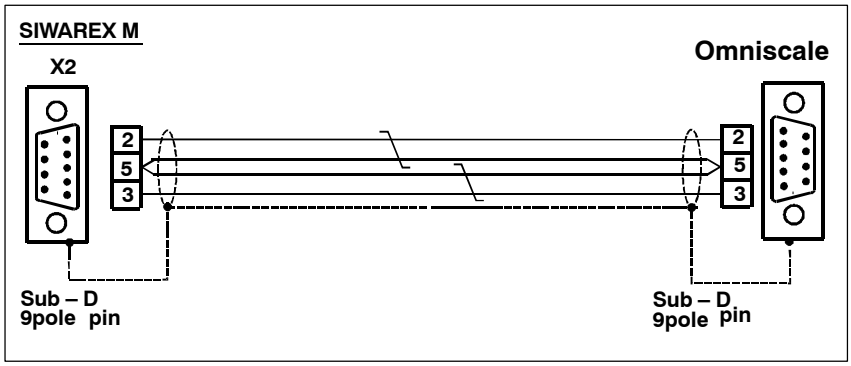


Figure 9-4 Connection cable X2-Omniscale

A 9–pin, sub D, plug connector (pins on both sides) is used for the connection to the SIWAREX M.

The interface uses the signals RxD and TxD. No other signals are required. The interface is galvanically isolated (not floating) and thus nonreactive.

The protocol can be activated for the SIWAREX M with an entry in DR7. The definition of the RS 232 setting in DR7 is shown in table 10.9.

Table 9-9 Parameterization of the RS 232 interface

Bit-Nr.	Meaning				Default setting
0	Transmission rate: 0 = 2400 bit/sec; 1 = 9600 bit/sec				1
1	Parity: 1 = even; 0 = odd				1
3	**Protocol:**	**Bit 3:**	**Bit 4:**		0
4	XON/XOFF:	0	0	(Printer)	0
	Proc. 3964R:	1	0		
	B protocol:	0	1		

Using SIWATOOL, the selection is made in menu item “Schnittstellen > RS232”.

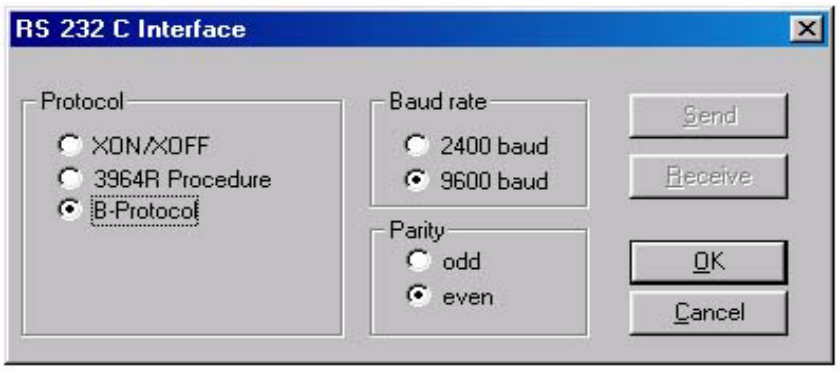


Figure 9-5 Selection of the B protocol

Data selection for storage in Omniscale

As with the printer protocols, the data to be saved are specified with SIWATOOL in menu item ”Parameter” > ”Druckertexte”.

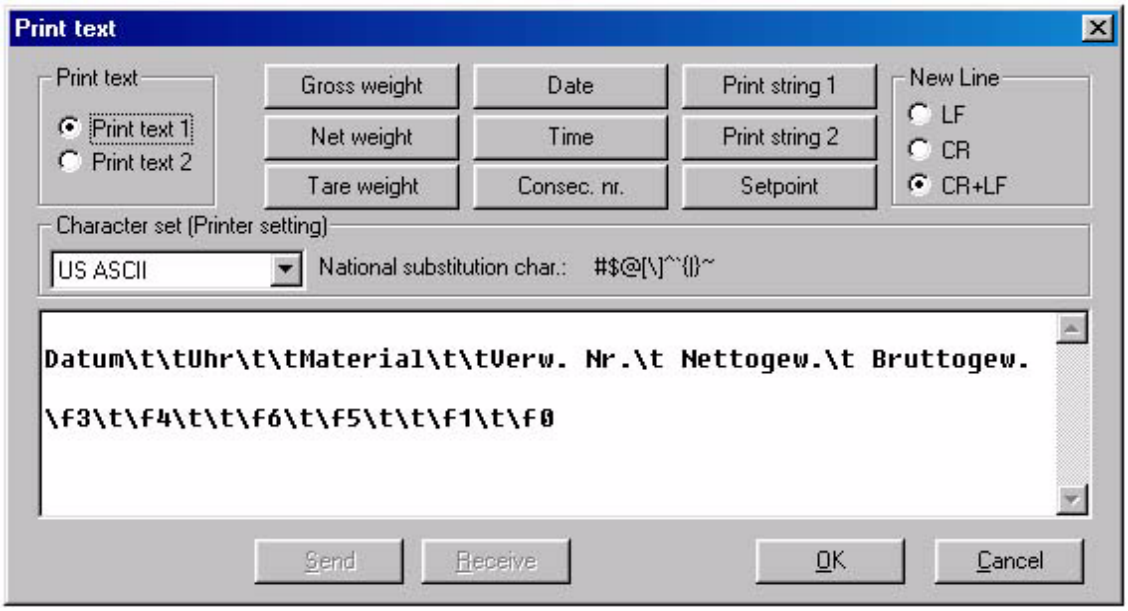


Figure 9-6 Selection of the data to be saved

OmniscaleManager substitutes 6 spaces for the tab characters.

After the B protocol has been selected, all printouts are sent to the Omni-Scale device with the B protocol (or to the Alibi printer with the B protocol). When problems occur during transmission (e.g., repeated protocol errors/timeouts/SIWATOOL ...), external error 6 ”communication to RS 232 interface faulty (arriving)” is output after the finished message of the proportioning procedure when automatic printout is parameterized, for example. No further proportioning procedures can be performed in this state.
In this error state, print commands are immediately rejected (e.g., printing not possible since printer not ready).
When an error occurs, SIWAREX M cyclically checks to determine whether the Omniscale device is ready for operation. As soon as the device is ready for operation again, the error is reported as ”departing” and the scales are ready for proportioning again. A print job which was triggered before can then be executed with the ”REPEAT PRINTOUT” command.

Readiness check

In standby (i.e., nothing to be saved), the Omniscale device is cyclically checked for readiness to receive. If not ready to receive, the ”printing not possible” status bit in DR31 is set and arriving print jobs are rejected.

Device-specific information

For a description of the device and other information, contact the manufacturer below.

CSM Computer-Systeme-Meßtechnik GmbH
Raiffeisenstraße 34
D-70794 Filderstadt-Bonlanden
Tel.: +49 (0)711 77964 0
Fax: +49 (0)711 77964 40
Internet: www.csm.de

9.3 Printer

Introduction

The following functions are available to the user when a printer is connected.

- Logging (appropriate for verification) of the weight values with date/time and consecutive number
- Flexible configuration of 2 print texts via parameterizable ASCII strings, fields and string fields

The RS 232 interface (X2) is available for connection of a printer.

Note

The printers can be used as printers with verification capability in accordance with enclosure 1 of SIWAREX M qualification approval (certificate no. D95-09-042). In addition, all printers with a CE seal can be connected.

If the application does not require verification capability, any EPSON-compatible printer with an RS 232 interface can be connected.

Printer protocol

The XON/XOFF protocol is used as the printer protocol. The baud rate and parity can be parameterized. The number of data bits is permanently set to 8. The number of stop bits is permanently set to 1. The interface parameters of the printer and the SIWAREX M must be identical.

Table 9-10 Interface parameters

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure name / Variable name	Addr.	No.	Byte	Bit	Length in bytes		
Transmission speed of the RS 232 interface	RS232_PARA	178	7	1	0	2	WORD	0 = 2400 bit/sec 1 = 9600 bit/sec*
Parity of the RS 232 interface	RS232_PARA	178	7	1	1	2	WORD	0 = Odd 1 = Even*

* Factory setting of the SIWAREX M

9.3.1 Connecting the Printer

The printer is connected to the SIWAREX M with a 9-way, sub D, plug-in connector.

The interface uses the signals RxD and TxD. Other signals are not required. The interface is galvanically isolated (i.e., not non-floating) and therefore nonreactive.

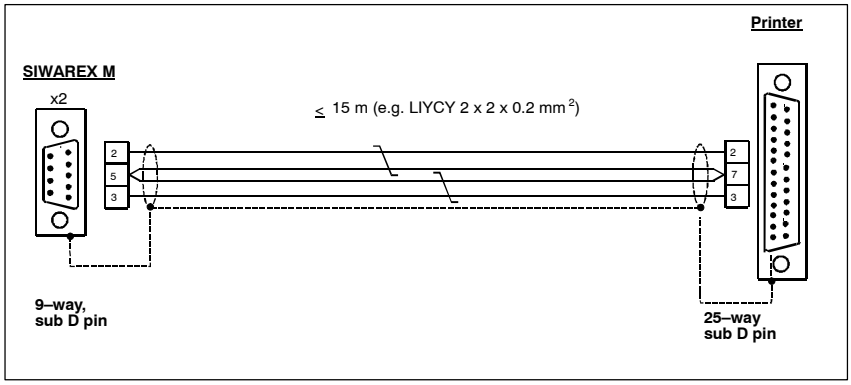


Figure 9-7 Printer cable

Table 9-11 Pin assignment on the printer side

Pin	Signal name	Explanation
3	RxD	Sending data
2	TxD	Receiving data
7	GND	Ground

9.3.2 Printer Functions

Commands

Three commands are available for triggering print functions. These commands are “Print text 1”, “Print text 2”, and “Repeat print”. When the “repeat print” command is used, the last triggered print text with the latest weighing data from the buffered RAM is repeated. When the print function is triggered from the remote display, text 2 is always printed.

Consecutive weighing number

With the exception of “repeat print”, the 6-position, consecutive weighing number is incremented (0 to 999,999) each time a printout is triggered. In addition, the weighing data (i.e., gross weight, net weight, tare, setpoint, date and time) are stored separately in the buffered RAM for the print repetition function. After a buffer interruption (e.g., power failure lasting more than 72 hours), the data are set to zero.

Automatic printout

When the SIWAREX M is used as proportioning scales, text 2 is automatically printed (if parameterized) with the finished message.

Printing not possible

If a print command cannot be executed, this is reported as a handling or operational error.

The “printing not possible” status bit in DR31 can be evaluated so that a printer fault can be determined during automatic printing after the finished message of a proportioning procedure.

This bit is set by SIWAREX M when it is determined that printing is currently not possible. The bit is set even when a print job has not been issued.

Some possible causes are listed below.

- The printer has sent XOFF (e.g., no more paper).
- SIWATOOL is connected to the RS 232 interface.
- The RS 232 interface is parameterized for the 3964R procedure.
- Implausible characters are being received by the RS 232 interface.

If the printer is selected for the RS 232 interface, it is assumed after startup or receipt of the parameterization that a functional printer in XON status is actually connected. Once the XOFF control character is received, the “*printing not possible*” bit is not cleared until an XON control character is received again.

If another character (e.g., from SIWATOOL) is received while in XON status, the “*printing not possible*” bit is set and not cleared again until at least 5 seconds have passed since a character was received on the RS 232 interface.

Table 9-12 Data for print function

Function	SIMATIC S7/C7		Data Record				Format	Comments
	Structure Name / Variable Name	Addr.	No.	Byte	Bit	Length in bytes		
Print command	CMD	88	2	0	-	2	WORD	Selection code (decimal) 7 = Print text 1 8 = Print text 2 9 = Repeat print
Gross weight of last printout	*PRINT_DATA* / GROSS	382	40	0	-	28	DINT	0*
Net weight of last printout	*PRINT_DATA* / NET	386	40	4	-	28	DINT	0*
Tare weight of last printout	*PRINT_DATA* / TARE	390	40	8	-	28	DINT	0*
Weighing number of last printout	*PRINT_DATA* / WEIGHING_NO	394	40	12	-	28	DINT	0*
Date/time of last printout	*PRINT_DATA* / DATE_TIME	398	40	16	-	28	DT	1990-01-01-00 00:00*
Setpoint of last printout	*PRINT_DATA* / SETPOINT	406	40	24	-	28	DINT	0*
Internal print buffer overflow	OPER_ERR**	9	-	1	-	1	BYTE	Operational error 04
		-	51	4	3	6	BOOL	
Internal print buffer overflow (task communication)	OPER_ERR**	9	-	1	-	1	BYTE	Operational error 05
		-	51	4	4	6	BOOL	
Print not executed since maximum load exceeded	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 03
Print not executed since printer not ready (XOFF)	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 13
Print not possible since printer not connected	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 19
Print not executed since no standstill	Message via indication words of the applications		101	0-2	-	3	BYTE	Handling error 20
Printing not possible	*STATUS* / PRINT_NOT_POSS	332	31	0	6	6	BOOL	Status information
Automatic printout after proportioning finished message	*PROP_PARA* / AUTO_PRINT	167	5	1	0	4	BOOL	0*

* Factory setting of SIWAREX M
** Message bit via indication word of FC SIWA M.

9.3.3 Print Layout

Two texts (80 characters each) which can be printed are stored in the EEPROM of the SIWAREX M. This EEPROM is protected against data loss caused by a power failure. The texts can only be configured via the WINDOWS parameterization software package SIWATOOL or via a serial interface to a host.

The print texts can contain printable ASCII characters (examples: a b c 1 2 3 ( )....

and control characters; examples: HT (horizontal tabulator), LF (line feed), CR (carriage return) ....

in the range from 0x00 and 0x7F. See the manual of your printer to determine which control characters your printer can handle.

The characters \1b start an ESC sequence and the character \ a control code.

Example for DR 215 printer:
\1b!1: Bold on
\1b!0: Bold off
\1b3 : Italics on
\1b4 : Italics off
\0C : Form feed (FF)

In addition, placeholders (1 character) can be included in the print layout (e.g., \fl for net weight) for various fields (e.g., weight values, date/time, etc.).

The control character EOT (i.e., end of text) defines the end of the printed text. This character is not sent to the printer.

Fields

Table 9-13 Possible fields

Field Type	**Placeholder**	**Field Length**	**Field layout_ (Example)**
Gross weight	F0 hex	15	_<634.50kg>_G__
Net weight	F1 hex	15	__<234.5_t>_Net
Tare weight	F2 hex	15	____<100_g>_PT_
Date	F3 hex	8	05.27.94
Time	F4 hex	5	13:05
Weighing no.	F5 hex	6	123456
String field 1	F6 hex	16	xxxxxxxxxxxxxxx
String field 2	F7 hex	16	yyyyyyyyyyyyyyy
Setpoint	F8 hex	9	__9.999kg

Blanks are identified with "_".

The decimal points of the weighing values are indicated as parameterized in the SIWAREX M. If decimal point is parameterized as 0, no decimal point is indicated. The type of weight is identified with an abbreviation: **G** for gross, **Net** for net, **T** for tare, and **PT** for preset tare (manual tare).

Language

When German is parameterized as the language, the gross weight identifier B is printed. The date format changes from “month.day.year” to “day.month.year”. The 24-hour time format is retained. The decimal point is shown as a comma.

String fields

Two string fields with 16 characters each can be included in the print texts. The contents of these two fields can be specified via the S7 interface or via one of the serial interfaces. After a print job is triggered, these data are also stored separately in case they are needed for a print repetition function. These separately stored string fields cannot be read back.

Table 9-14 String fields

Meaning	Format	Default
String field 1 (16 characters, values 00 to FF hex)	char	16 times ‘ ‘
String field 2 (16 characters, values 00 to FF hex)	char	16 times ‘ ‘

Factory setting

The standard setting of these two texts is shown below. The contents of the fields are only examples. The factory setting is German texts.

Layout of text 1:

Datum	Uhr	Material	Verw. Nr.	Nettogew.	Bruttogew.
27.05.94	13:05	Kakaop. 01	000123	<234,5kg> Net	<634,5kg> B

Layout of text 2:

27.05.94	13:45	Kakaop. 01	000124	<300,0kg> Net	<934,5kg> B

Format of the standard texts

Format of text 1:

LF,D,a,t,u,m,TAB,TAB,U,h,r,TAB,TAB,M,a,t,e,r,i,a,l,TAB,TAB,V,e,r,w,.,SP, N,r,.,TAB,N,e,t,t,o,g,e,w ,.,TAB,SP,SP,B,r,u,t,t,o,g,e,w,.,LF,LF,F3,TAB,F4,TA B,TAB,F6, TAB,TAB,F5,TAB,F1,TAB,F0,CR,EOT;

(Sum = 72 characters; TAB = 6 columns)

Format of text 2:

F3,TAB,F4,TAB,TAB,F6,TAB,TAB,F5,TAB,F1,TAB,F0,LF,EOT;

(Sum = 15 characters; TAB = 6 columns)

Table 9-15 Labelling

Function	SIMATIC S7		Data Record				Format	Comments
	Structure name / Variable name	Addr.	No.	Byte	Bit	Length in bytes		
Language	*ADJ_DATA* / LANGUAGE	120	3	30	-	42	WORD	Selection code (dec.) 0 = German* 1 = English
Printing format 1	-	-	80	0	-	80	ARRAY	See description.
Printing format 2	-	-	81	0	-	80	ARRAY	See description.
String field 1	STRING_FIELD	224	26	0	-	16	ARRAY	16 (' ')*
String field 2	STRING_FIELD	243	27	0	-	16	ARRAY	16 (' ')*
Illegal language	Message via indication words of the applications		101	0-2	-	3	BYTE	Data error 17

* Factory setting of SIWAREX M

9.4 Ex-i Interface SIWAREX IS

Description

An Ex-i interface must be switched between the SIWAREX M and the force and pressure sensors when these sensors are located in potentially explosive areas. The Ex-i interface SIWAREX IS is used for this purpose. This interface can be used for both SIWAREX P, SIWAREX U and SIWAREX M.

Danger

The safety of the potentially explosive area is dependent on this device. Only qualified personnel may perform the required connection and installation work.

When the mounting and setup regulations for potential explosive areas are not adhered to

D A N G E R O F E X P L O S I O N !

For details on the Ex–i interface, see the manual and the Ex certification.

SIWATOOL - Description and Use

10

Purpose

SIWATOOL is used to administer, generate and change configuration and process data for the SIWAREX M. It is also used for adjustment and for triggering weighing commands.

This program permits several scales to be processed at the same time.

However, only **one** set of scales can be parameterized online at the same time.

When several scales are parameterized, the individual parameterization windows of several offline scales and one online set of scales can be indicated simultaneously on the monitor screen.

This makes it easy to adjust parameters of different scales to each other, or compare them.

Use

SIWATOOL runs under WINDOWS. It uses the typical WINDOWS environment and structure.

WINDOWS users will have no trouble using SIWATOOL. Its well-organized pull-down menus make it almost self-explanatory.

The status of the scales (or one set of scales) can be used as a diagnostic tool or for error diagnostics.

10.1 Installing SIWATOOL on PC/PG

Prerequisites

The following prerequisites are required for the installation and use of SIWATOOL.

- WINDOWS: 95/98, WINDOWS NT, WINDOWS 200ß and WINDOWS ME

Installation

Proceed as follows to install SIWATOOL.

1. Insert the installation floppy disk or installation CD ("SIWAREX M configuration package") in the drive.
2. Call the installation program.

   Call SETUP.EXE.
   SETUP.EXE is included in the SIWATOOL directory on the installation CD.

10.2 Commissioning SIWAREX M with SIWATOOL

If your SIWAREX M is to be commissioned online, the SIWAREX M must be connected to the PC or PG (i.e., programmer) with a suitable, serial interface cable.

Start SIWATOOL

Call SIWATOOL:

- Double click the program symbol in the WINDOWS program manager.
- Or double click SIWATOOL.EXE in the file manager.

Select interface

After SIWATOOL has been started, the serial interface used on the PC/PG (e.g., COM1) must be set via the menu command “Setup > Choose interface”.

Language

The SIWATOOL language can be set under menu item ”Einstellungen > Sprache.” The setting takes effect the next time the program starts up.

Set up new scales

After the interface has been selected, a new set of scales can be set up via the menu command “File > New”. The scales name and unit of weight must be set. The numbers 0 to 16 may be used as scales numbers.

Notice

Every SIWAREX M can be addressed with scales number “0” regardless of which scales number is assigned to it.

If, for example, the scales number “4” was assigned to a SIWAREX M, this SIWAREX M can be addressed under scales number “0” and “4”.

On delivery, the scales number for SIWAREX M has been set to “0” at the factory. This means that the scales number must always be specified as “0” during initial commissioning. The scales number can then be changed later.

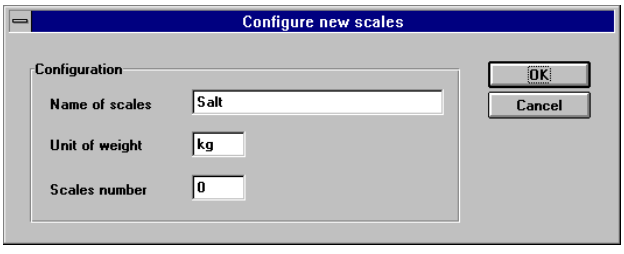


Figure 10-1 Dialog for setting up a new set of scales

Activate communication

The PC establishes communication to the SIWAREX M with the menu command ”Kommunikation > Kommunikation aktivieren.” The message ”no communication” disappears, and a measured value is indicated.

If the SIWAREX M has not been adjusted yet (i.e., Adj. LED = off), the measured value is still “frozen” (i.e., it does not change when the scales are loaded).

Note

Even if the parity or baud rate of the RS 232 interface has been set incorrectly, SIWATOOL determines the correct interface setting automatically. If communication cannot be established after 8 attempts, check the following.

- The wiring
- The COM setting (COM1, COM2 ...)
- Is the interface used by a STEP 5 or STEP 7 package?

Zero value and tare

The ”set to zero” and ”taring” scales commands affect the contents of data record DR43 (i.e., tare value and zero setting value more precise). To ensure that the current data record DR43 (i.e., tare value and zero setting value more precise) is always stored when the scales parameters are saved to floppy disk, SIWATOOL reads data record DR43 (i.e., tare value and zero setting value more precise) cyclically in online mode from the SIWAREX M.
When communication is then established later with the SIWAREX M, it can be specified (see figure) whether the “tare value and the zero setting value more precise” value stored in SIWATOOL are to be transferred to the SIWAREX M, or whether SIWATOOL is to use the “tare value and the zero setting value more precise” value from the SIWAREX M.

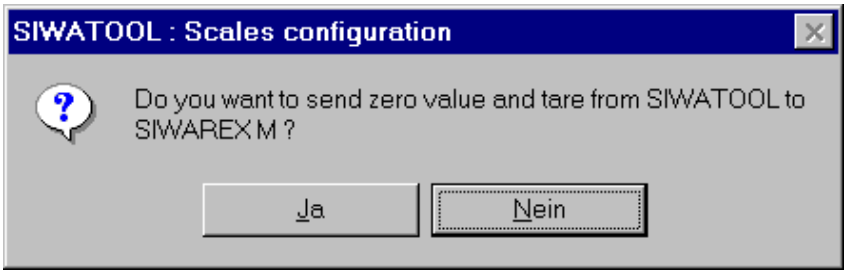
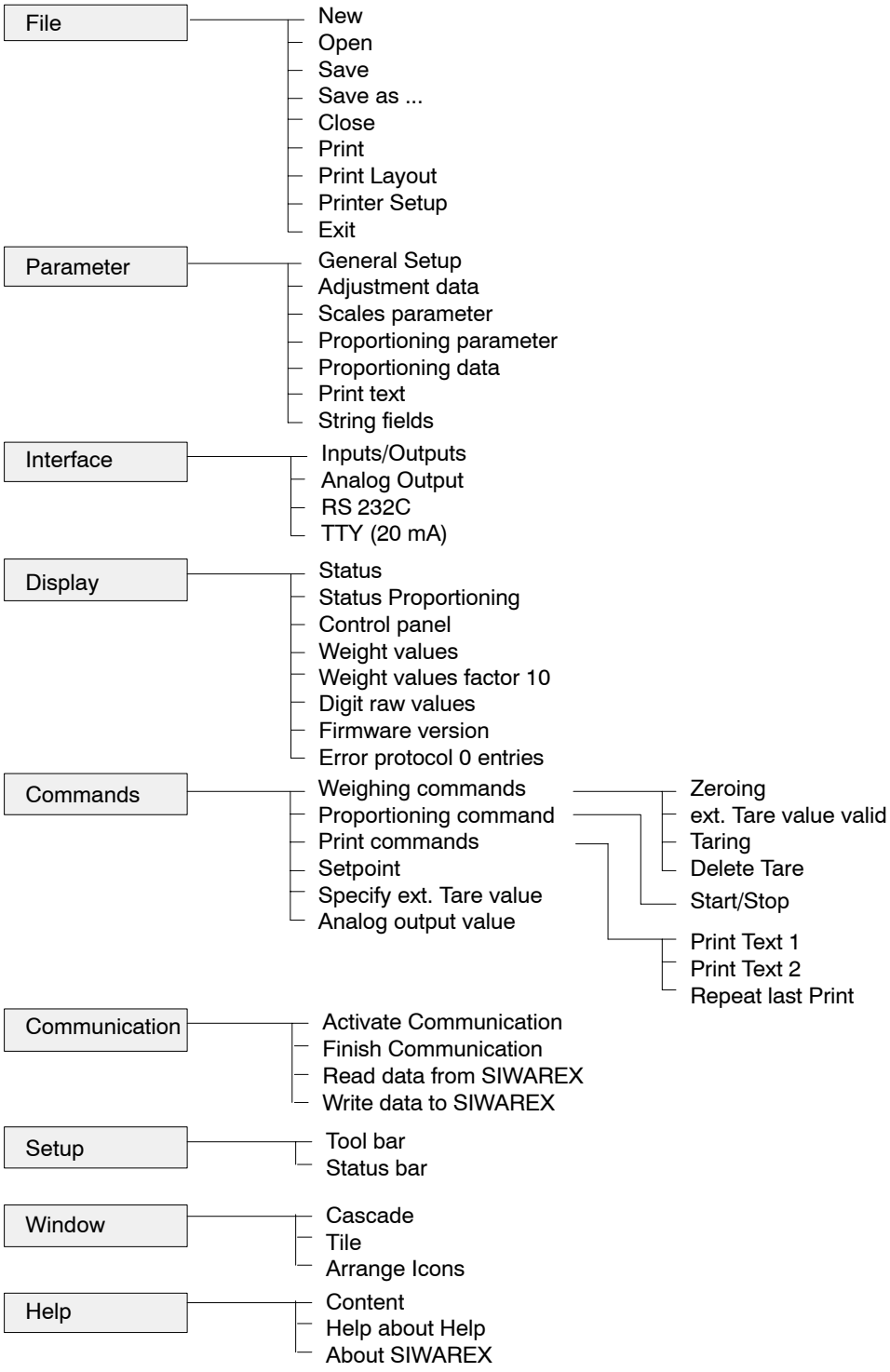


Figure 10-2 Zero value and tare

10.2.1 SIWATOOL Menu Tree

After a new set of scales has been set up, the main menu bar is displayed. The main menu bar contains the following submenus.



10.3 Adjustment of the Scales

Before adjusting the scales, you should always know the number of positions after the decimal point and the indication increment since both of these factors determine the available resolution (see also section 10.4).

Use the menu command “Parameter > Adjustment data” to access the ”Adjustment data” dialog.

If the parameterization of SIWAREX M differs from the SIWATOOL data, you will be asked whether SIWATOOL is to accept the adjustment data of the SIWAREX M.

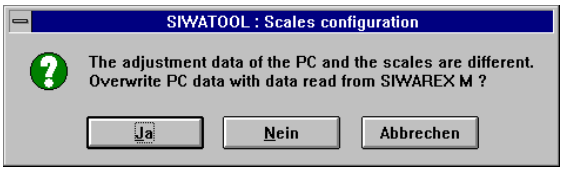


Figure 10-3 Message when adjustment data differ

After “Ja” (Yes) or “Nein” (No) is activated, the “Adjustment data” dialog appears. “Ja” and “Nein” appear if you are using the German version of Windows.

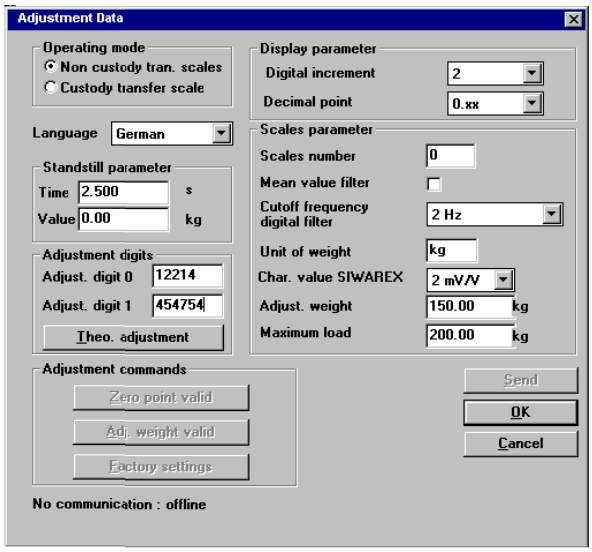


Figure 10-4 Dialog on scales adjustment

New adjustment

When a new adjustment is to be performed, the default settings should always be loaded first (i.e., “Factory settings”).

The number of positions after the decimal point and the unit of weight should then be specified since the format of all other entries is based on these two factors.

As the next step, enter the adjustment weight and the maximum load. These values are transferred to the SIWAREX by activating “Send”.

Note

Decimal points must be entered as “.” in SIWATOOL.

Adjust with test weight

Adjustment with a test weight is described in detail in section 3.3.

Proceed as follows with SIWATOOL.

- Empty the scales, and activate “Zero point valid”.
- Load the scales with the test weight, and activate “Adj. weight valid”.

The adjustment digits “0” and “1” are not indicated by SIWATOOL until the scales are in adjusted status (i.e., both the zero point and the adjustment weight have been declared valid).

Theoretical adjustment

Theoretical adjustment is also described in section 3.3.

Other settings

After the scales have been adjusted, you can then enter the remaining settings such as filter, digit increment, and so on.

SEND

Clicking the “Send” button sends the settings entered with SIWATOOL to the SIWAREX M.

RECEIVE

In reverse, the parameters set in SIWAREX M can be sent to SIWATOOL by clicking the “Receive” button.

10.4 Important Notes on Settings in SIWATOOL

Language, decimal point and unit of weight only apply when a remote display and/or printer are connected.

Unit of weight

The unit of weight consists of any two ASCII characters. Changing the unit of weight does not change the measured value itself.

Language

The language set for the adjustment data of SIWATOOL refers to the representation of weighing values on the TD20 remote display and the printer.

Table 10-1 Representation of the weighing values based on language

Language	TD20	Printer
German	23,34kg (comma)	23,34kg (comma) B for Brutto (gross) Date: DD.MM.YY
English	23.34kg (point)	23.34kg (point) G for gross Date: MM.DD.YY

Decimal point

The weighing values are represented as fixed point numbers without decimal point on the S7 bus and the serial interfaces.

Example:

If the decimal point 0.XXX is set via SIWATOOL, a weighing value is indicated by SIWATOOL as 45.123kg for example, and as the fixed point number 45123 by the SIMATIC.

On the printer and remote displays, the weighing values are indicated the same as by SIWATOOL.

Resolution

The setting of the number of positions after the decimal point and the indication increments determine the resolution which will be available.

Table 10-2 Example

Adjustment Weight	Measuring Range	Digit Increment	Resolution in g	Resolution of Measuring Range
100 kg	0 to 200 kg	1	1000 g	200 parts
100.00 kg	0 to 200.000 kg	1	1 g	200,000 parts
100.00 kg	0 to 200.000 kg	50	50 g	4,000 parts

Changing the decimal point later may mean that you will also have to make changes on the SIMATIC side.

10.5 Weighing Status and Weighing Commands

The status window can be used to view the weighing status of the SIWAREX M and to trigger weighing commands.

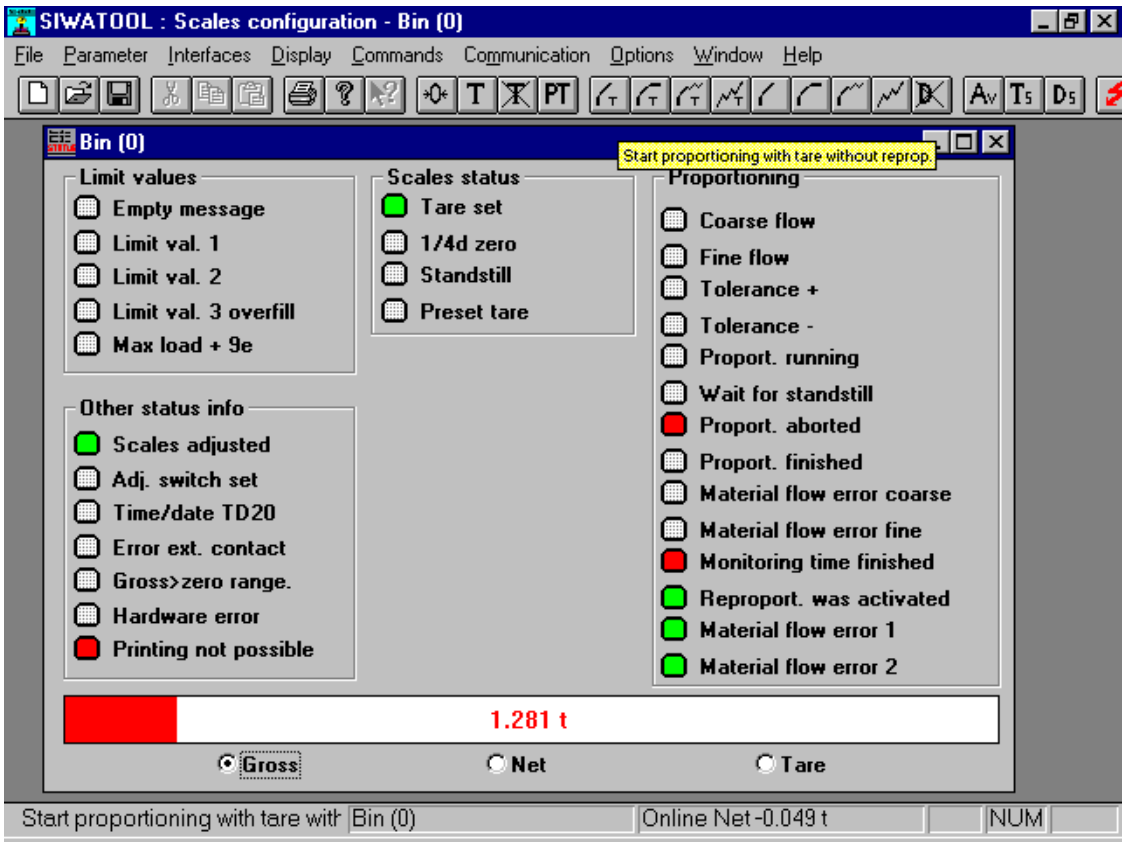


Figure 10-5 Status window of the set scales

Functions of the function keys (from left to right)

1st function key:	Set new weighing parameters
2nd function key:	Load weighing parameters
3rd function key:	Store weighing parameters
4th function key:	Cut
5th function key:	Copy to intermediate storage location
6th function key:	No function
7th function key:	No function
8th function key:	Indicate program information
9th function key:	No function
10th function key:	Set to zero
11th function key:	Tare

12th function key:	Delete tare memory
13th function key:	External tare specification (manual tare = preset)
14th function key:	Start proportioning with taring without reproportioning
15th function key:	Start proportioning with taring with reproportioning
16th function key:	Start proportioning with taring with reproportioning in inching mode
17th function key:	Start inching mode with taring
18th function key:	Start proportioning without taring without reproportioning (also continue a terminated proportioning procedure)
19th function key:	Start proportioning without taring with reproportioning (also continue a terminated proportioning procedure)
20th function key:	Start proportioning without taring with reproportioning in inching mode (also continue an aborted proportioning procedure)
21st function key:	Start inching mode without taring (also continue an aborted proportioning procedure)
22nd function key:	Terminate proportioning
23rd function key:	Set analog output value
24th function key:	Set external tare specification value (manual tare = preset)
25th function key:	Set proportioning setpoint
26th function key:	Error report

The weighing status and the weighing value are displayed on the monitor screen. You can switch between gross, net and tare weight.

10.6 Proportioning Window

Test proportioning can be triggered in the proportioning window.

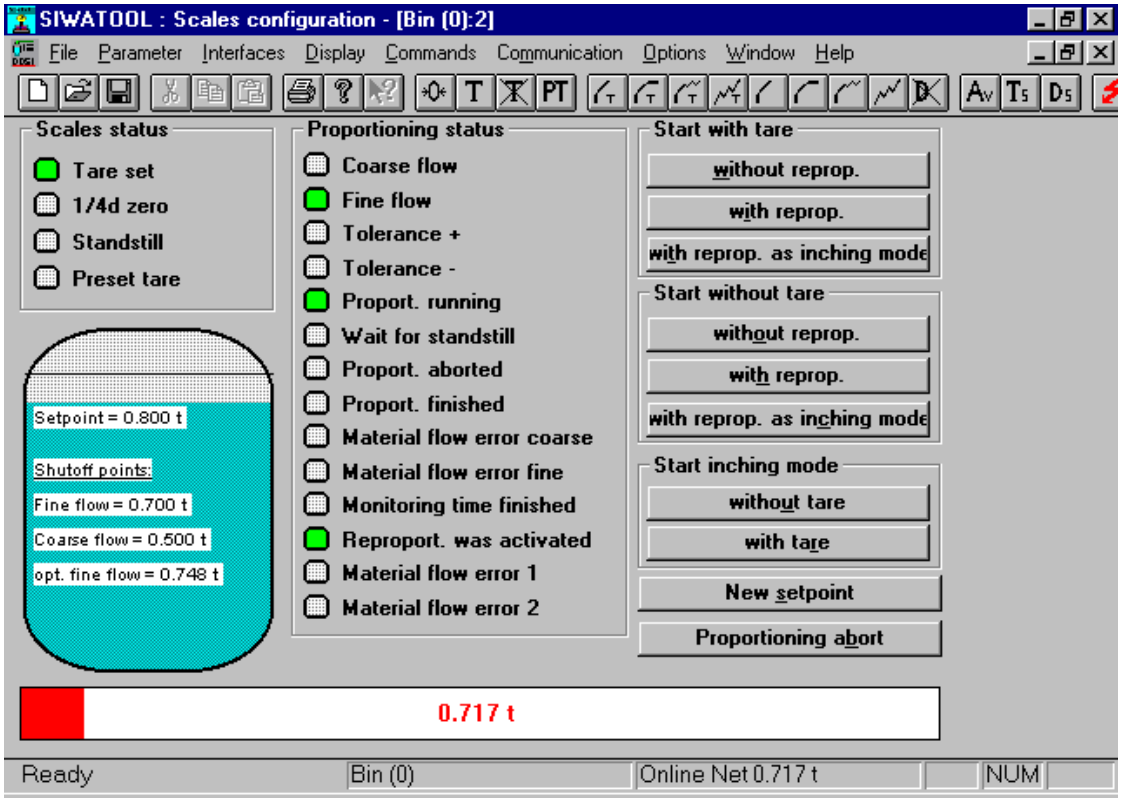


Figure 10-6 Proportioning window of the set scales

Switch off point

In contrast to the “Parameter/Proportioning data” window, the “Proportioning status” window shows the switch off points “Fine flow” and “Coarse flow”.

Cutoff values

The “Parameter/Proportioning data” window shows the cutoff values of “Coarse flow” and “Fine flow”.

Since the switch off points always take the set setpoint into consideration, they deviate from the cutoff values.

10.7 Scales Parameters

The “Parameter” menu is used to specify the scales parameters. The windows and dialogs shown below are self-explanatory. The scales parameters are described in detail in section 3.

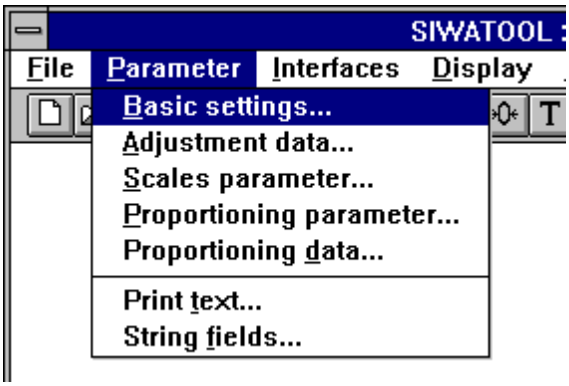


Figure 10-7 The “Parameter” menu

We will now describe a few specific features of SIWATOOL.

Operator’s console

The display of the operator’s console can be switched on and off with the menu command “Display > Control panel”.

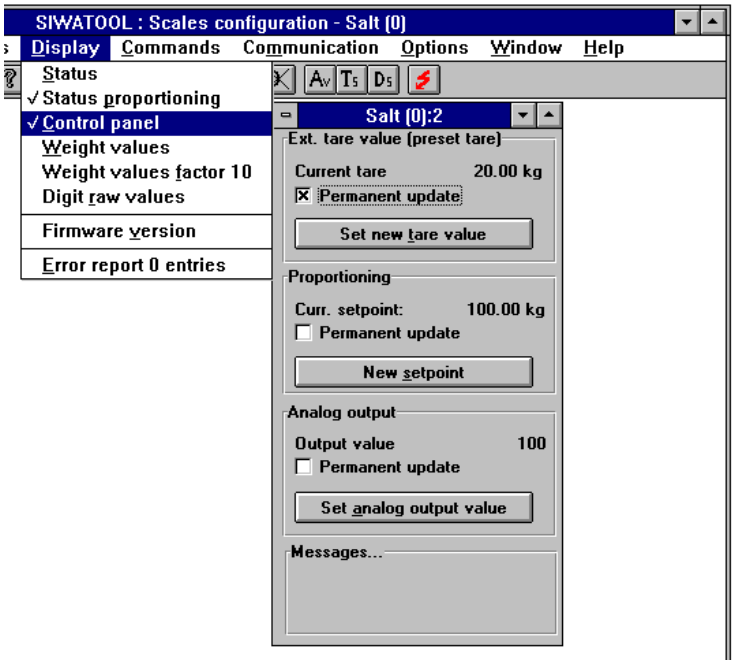


Figure 10-8 The control panel

The control panel is used to specify the prespecified values of tare, setpoint or analog output.

When a connected SIMATIC can change the specification values, the “Permanent update” option should be switched on. This gives you the capability of registering changes to the specifications via the SIMATIC, for example. When a SIMATIC is not connected, the “Permanent update” option should not be used so that the measured values can be indicated at a high update rate.

Online error log

In online operation, SIWATOOL acquires and logs errors occurring on the scales.

When error messages are waiting, the error report symbol appears in the main window of SIWATOOL.

The online error report is displayed when this symbol is double clicked.

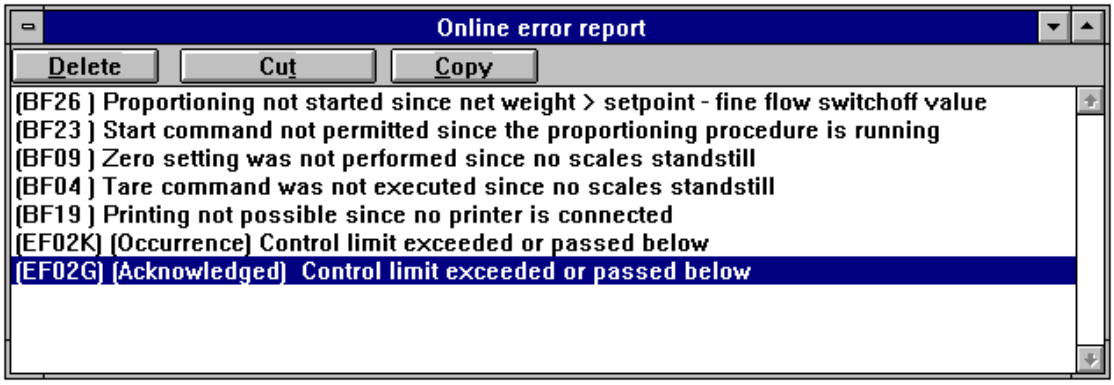


Figure 10-9 Online error report

Version information

The menu command “Help > About SIWAREX” can be used to read access the firmware version of the SIWAREX M. The same applies to the software version of SIWATOOL. Please read out the following information before calling the hotline with technical problems.

1. The firmware version of the SIWAREX M
2. The software version of SIWATOOL

Compatibility

Starting with version V4.1, SIWATOOL can also be used to configure SIWAREX M modules with firmware status older than 0117.

The following information applies.

- When an older SIWATOOL file (i.e., SKF file) is read, this file is converted to a new format when stored. A file in this new format can no longer be read by older versions of SIWATOOL (i.e., < V4.1).

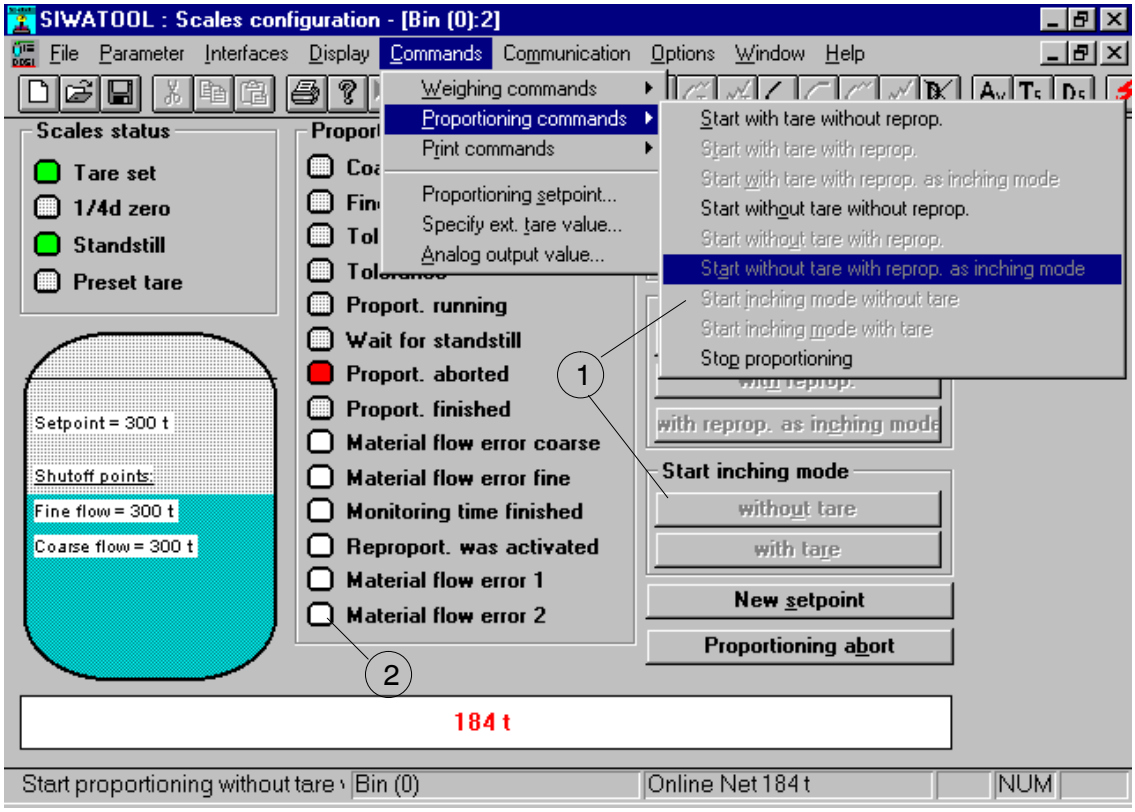
When the "Module → Connect" menu item is used to activate communication with the SIWAREX M, SIWATOOL reads the firmware status of SIWAREX M once. If some of the functions indicated by SIWATOOL are not available on the SIWAREX M, this is indicated as shown below.

① Buttons and menus are indicated in gray and cannot be selected.

② Non-existing status messages are indicated in white.

③ The firmware version is indicated starting at which the function is available.

The functionality of the SIWAREX M with firmware release starting at 0122 is not completely supported until version 5.5 of SIWATOOL.



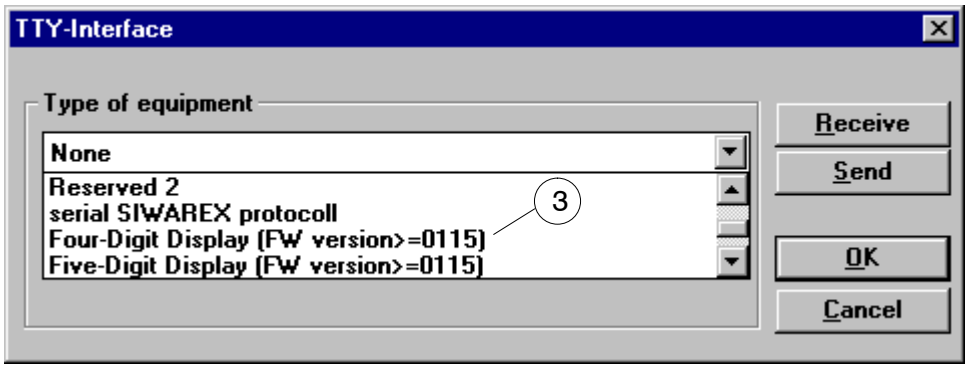


Figure 10-10 SIWATOOL (version V4.1) in online operation with SIWAREX M (version < 0117).

Error Diagnostics and Treatment 11

General faults

The SIWAREX M supports the user during commissioning and trouble-shooting with a structured diagnostic concept. The malfunction and error messages are divided into various classes of errors.

When an error causes the SIWAREX M to switch to FAULT operating mode, no weighing, proportioning or print commands are possible. This operating mode is retained until the fault has been corrected. An error acknowledgment is not required.

In this state, a command is rejected with an error message. Reading and writing of data records is still possible if the type of error permits.

Internal errors and **external errors** cause the system error status. The module switches to FAULT operating mode.

Any proportioning procedures are cancelled. FAULT operating mode is exited automatically after the fault has been corrected (e.g., A/D converter, control level limit exceeded). An interrupted proportioning procedure is not continued again automatically.

Warning

When errors and interference occur, suitable measures must be used to put the system into a defined state.

Error classification

The following table provides an overview of the various types of fault and error messages and their differences.

Table 11-1 Types of errors

	Type of Error	Description	Abbreviation in the Error Protocol of SIWATOOL
Synchronuous errors	Data errors * (section 11.1)	Plausibility errors which occur when parameters and prespecified values are transferred	DF
	Handling errors * (section 11.3)	Errors which occur while a command is being executed	BF
Asynchronuous errors	Operational errors (section 11.2)	Errors which occur while a function is being executed during operation	BSF
	Internal errors (section 11.4)	Hardware errors which are detected by the module and which can be reported	IF
	External errors (section 11.5)	Errors of the connected periphery (hardware errors)	EF
	Other errors (section 11.6)	Errors which do not fit into one of the above mentioned classes	-

* These errors are only reported back to the interface which caused the error.

Synchronous and asynchronous errors

Asynchronous error messages are errors which are not directly related to a weighing command or a data transmission.

Example:

Asynchronous errors	Internal errors, external errors and operational errors (e.g., RAM error and load cell wire break)
Synchronous errors	Handling errors and data errors (e.g., illegal weighing commands)

11.1 Data Errors

Description

Data errors are plausibility errors which occur during the transmission of parameters and prespecified values.

These error messages are output in DB-SIWAREX on the S5/S7 interface after the FB/FC has been called.

These error messages are reported in the acknowledgment telegram on the two serial interfaces (i.e., X2 and X3).

When a data error occurs, none of the data of this data record are accepted and processing continues with the old data. A proportioning procedure which is currently running is aborted.

Data errors are only reported back on the interface which caused the particular error.

List of data errors

Table 11-2 Data errors

Error No. (Dec.) for S5/S7/ X2/X3	Cause	Corrective Measures
01	Illegal limit frequency, digital filter	See section 3.2 for correct specification.
02	Adjustment weight too small	Use a larger adjustment weight (min. of 5% FS). See section 3 for minimum adjustment weights.
03	Minimum step increment too small	Only for scales subject to verification. Select larger digit increment or smaller adjustment weight.
04	External tare specification > maximum load or < 0	Enter permissible tare specification.
05	Start command was not executed since setpoint ≤ switchoff value for fine flow.	Enter permissible setpoint or fine flow value.
06	Start command was not executed since setpoint > overfill limit value - gross weight.	Empty scales or specify smaller setpoint.
07	Start command was not executed since setpoint > overfill limit value - tare weight.	Specify smaller setpoint, or empty scales and tare again.
08	Setpoint was not accepted since setpoint - net weight < cut-off value for fine flow.	Setpoint modification during running proportioning too small. Specify larger setpoint.
09	Start command was not executed since setpoint > gross weight.	Select smaller setpoint. Container contents insufficient for deduction weighing
10	Start command was not executed since setpoint > tare weight.	Select smaller setpoint. Container contents insufficient for deduction weighing
11	Distance adjustment points too small	Use greater adjustment weight (min. 5% FS*).

* FS = Full scale measuring range

Table 11-2 Data errors

Error No. (Dec.) for S5/S7/ X2/X3	Cause	Corrective Measures
12	Setpoint was not accepted since setpoint > overfill limit value - tare weight (for fill weighing) or setpoint > tare weight (deduction weighing)	Setpoint modification during running proportioning too large Specify smaller setpoint.
13	Specification > permissible number range	Permissible number range exceeded Example: – Settling time ≤ 0 specified – Negative setpoint specified
14	Illegal decimal point	Specify correct decimal point.
15	Illegal identifier value	Specify correct identifier value.
16	Illegal digit increment	Specify correct digit increment.
17	Illegal language	Specify correct language code.
18	Illegal command code	Specify correct command code

* FS = Full scale measuring range

11.2 Operational Errors

Description

Operational errors are errors which occur while a function is being executed during operation.

These errors are output in DB-SIWAREX on the S7 interface after the FC has been called.

The current error states can be fetched with a fetch telegram for DR 51 on the two serial interfaces (i.e., X2 and X3). The error numbers are indicated as bit structures on the serial interfaces and not as codes. A bit number is assigned to each error code so that errors of the same type which are queued at the same time can be reported simultaneously.

Operational errors are reported on all interfaces.

List of operational errors

Table 11-3 Operational errors

Error No. (Dec.) for S7	Error No. for X2,X3, S5	Cause	Corrective Measures
01	0	Division by zero	Temporary error. If necessary, start SIWAREX again (i.e., software reset). If error occurs again, call hotline.
02	1	Internal counting overflow	Temporary error. If necessary, start SIWAREX again (i.e., software reset). If error occurs again, call hotline.
03	2	Proportioning was terminated because limit value 3 (overfilling limit value) was exceeded or the zero setting or taring range was exceeded.	Empty scales and repeat proportioning if necessary.
04	3	Internal printer buffer overflow	Temporary error (e.g., when a blank printer text is sent). If necessary, start SIWAREX again (i.e., software reset). If error occurs again, call hotline.
05	4	Internal buffer overflow (task communication)	Temporary error. If necessary, start SIWAREX again (i.e., software reset). If error occurs again, call hotline.
06	5	Erroneous data transmission on interface X3 (TTY)	- Check connection and wiring. - Check shield connection. - Remove external source of interference.
07	6	Erroneous data transmission on interface X2 (RS 232C)	- Check connection and wiring. - Check shield connection. - Remove external source of interference.

11.3 Handling Errors

Description

Handling errors are errors which usually occur while a command is being executed. When a handling error occurs, the desired command is not executed. In addition, handling errors are reported when proportioning or adjustment data are transferred while a proportioning procedure is running. In this case, all data of this data record are rejected and a proportioning procedure which is running is aborted.

These error messages are output in DB-SIWAREX on the S7 interface after the FC has been called.

These error messages are reported in the acknowledgment telegram on the two serial interfaces (i.e., X2 and X3).

Handling errors are only reported back on the interface which caused the particular error.

List of handling errors

Table 11-4 Handling errors

Err. No. (Dec.) for S5/S7/ X2/X3	Cause	Corrective Measures
01	Adjustment data not permitted since proportioning procedure is running	Send adjustment data to SIWAREX M after running proportioning procedure has been concluded.
02	Adjustment command cannot be executed since proportioning procedure is running.	Repeat adjustment command after proportioning procedure has been concluded.
03	Printing was not performed since maximum load was exceeded.	Reduce load on scales until below maximum load, and repeat the print command.
04	Tare command was not executed since no scales standstill.	Wait until the scales come to a standstill.
05	“External tare specification valid” command not permitted since proportioning procedure is running	Repeat command after proportioning command has been concluded.
06	Tare command was not executed since maximum load was exceeded.	Reduce load on scales until below maximum load, and repeat command.
07	Data which are subject to verification were not changed.	Write protection is activated. If you really want to change data subject to verification, deactivate the calibration switch (write protection). The scales must be recertified by official authorities after data subject to verification have been changed.
08	Zero setting/taring range exceeded (operation subject to verification)	Zero setting: Check object to be weighed for soil, and clean if necessary so that the permissible zero setting range of 2% (as related to the adjusted scales zero point) is achieved again. Taring: Increase gross weight
09	Zero setting was not performed since no scales standstill	Wait for the scales to come to a standstill, and repeat zero setting.
10	Waiting time of 5 seconds not adhered to	Allow waiting time of 5 seconds between the command “zero point valid”, “adjustment weight valid”, and “load factory setting”.

Table 11-4 Handling errors

Err. No. (Dec.) for S5/S7/ X2/X3	Cause	Corrective Measures
11	Zero setting was not executed since scales were not adjusted.	Adjust scales.
12	Parameter assignment was not executed since proportioning procedure was running.	Wait for running proportioning procedure to finish, and repeat parameter assignment.
13	Printing was not performed since printer was not ready (XOFF).	- Printer not connected - Printer offline - No paper in the printer - PC or host connected to interface X2
14	Tare command was not executed since proportioning procedure was running.	Wait for proportioning procedure to finish.
15	Setpoint was not accepted since fine flow had already shut off (after-running).	Change of setpoint performed too late
16	Zero setting was not executed since the proportioning procedure was running.	Wait for proportioning procedure to finish.
17	Signal allocation for output not permissible	Use permissible signal allocation.
18	Command allocation for input not permissible	Use permissible command allocation
19	Printing not possible since no printer is connected	PC or host is connected to interface X2.
20	Printing was not executed since no standstill.	Wait for scales standstill, and repeat print command.
21	Command cannot be executed in this operating mode.	Error message has been output (e.g., operational error/internal error/external error) or an attempt was made to start a proportioning procedure while the BASP/OD signal was queued (function activated via DIP switch). Correct error, and repeat command.
22	Distance of adjustment points too small	Repeat adjustment with larger adjustment weight.
23	Start command not permitted since the proportioning procedure is running	Wait for proportioning procedure to finish.
24	Proportioning data not permitted since proportioning procedure is running	Wait for proportioning procedure to finish.
25	Proportioning parameter not permitted since proportioning procedure is running	Wait for proportioning procedure to finish.
26	Start command was not executed since net weight > setpoint - fine flow switchoff value or net weight $\geq$ tolerance-minus limit	Correct setpoint.

11.4 Internal Errors

Description

Internal errors are hardware errors which have been detected by the module and which can be reported.

These errors are reported on the S7 interface with a diagnosis alarm.

The current error states can be fetched with a fetch telegram for DR51 on the two serial interfaces (i.e., X2 and X3). The error numbers are indicated as bit structures on the serial interfaces and not as codes. A bit number is assigned to each error code so that errors of the same type which are queued at the same time can be reported simultaneously.

Internal errors are reported on all interfaces.

List of internal errors

Table 11-5 Internal errors

Error No. (Dec.) for S7	Error Bit No. for X2,X3, S5	Cause	Corrective Measures
01	0	RAM error, read-write test	Start SIWAREX M again (i.e., software reset). If the error occurs again, contact hotline. If necessary, the SIWAREX M may have to be sent in for repairs.
02	1	RAM error, checksum test (buffer malfunction)	The maximum buffer time has been exceeded. The RAM error is acknowledged by transfer of DR43, and the fault state is exited.
03	2	EEPROM error, checksum test	Start SIWAREX M again. If the error occurs again, transfer the adjustment and parameter data again. If the error still occurs, contact hotline. If necessary, the SIWAREX M may have to be sent in for repairs.
04	3	A/D converter error during read-access	Start SIWAREX M again. The problem may also be caused by EMC problems. It is imperative to adhere to the notes in sections 2.1 and 2.2. (If the error occurs again, contact hotline. If necessary, the SIWAREX M may have to be sent in for repairs.
05	4	Watch dog error	Start SIWAREX M again. If the error occurs again, contact hotline. If necessary, the SIWAREX M may have to be sent in for repairs.

11.5 External Errors

Description

External errors are hardware errors of the connected periphery.

These errors are reported on the S7 interface with a diagnosis alarm.

The current error states can be fetched with a fetch telegram for DR 51 on the two serial interfaces X2 and X3. The error numbers are indicated on the serial interfaces as bit structures and not codes. A bit number is assigned to each error code so that errors of the same type which are queued at the same time can be reported simultaneously.

External errors are reported on all interfaces

List of external errors

Table 11-6 External errors

Error No. (Dec.) for S7	Error Bit No. for X2,X3, S5	Cause	Corrective Measures
01	0	Minimum voltage has been passed below on the sense lines.	The signal levels on the load cell input are in nonpermissible range. - Check connection and wiring of the load cells (e.g., wire break). Voltage drop on the load cell lines too great - Line cross sections are insufficient, or lines are too long.
02	1	Control limit exceeded or passed below	Measuring signal too great in relation to the measuring range - Poles have been reversed in the load cell connection. - Measuring range is too small. - Wire break (see external error 01) The problem may also be caused by EMC problems. It is imperative to adhere to the notes in sections 2.1 and 2.2.
05	4	Interface remote display malfunctioning (time monitoring)	Check connections and SIWAREX M - TD20 link. Check program module of the TD20 (e.g., correct position and right module). Reset TD20, or reset SIWAREX M (with software reset).
06	5	Communication to RS 232 interface faulty	B protocol is selected, but the connection is faulty.

11.6 Other Errors

Description

Other errors are errors which do not fit the error classes previously mentioned. Examples include errors which can be deduced from the front LEDs or errors which cause unusual behavior.

LED-related errors

Various status and error message lamps are located on the left side of the housing (see view of the front). These LEDs indicate various operating states.

Eight additional status lamps are located on the right side of the housing. They indicate the status of the DI/DOs and the 24 V supply. The LEDs are permanently allocated to the respective input/output.

Table 11-7 LED allocation

Position	Color	Labelling	Cause/Status
LED 1	Red	SF	System fault (internal or external error has occurred)
LED 2	Red	OF	Operation fault
LED 3	Green		Scales verified
LED 4	Green		Standstill
LED 5	Green		1/4d zero
LED 6	Green	ADJ	Scales adjusted

Table 11-8 Description of the LED states

LEDs						Cause/Status	Corrective Measures
1	2	3	4	5	6		
+	-	-	-	-	-	System error	See sections 11.4 / 11.5.
-	+	-	-	-	-	Operational error	See section 11.2.
+ + + +	+ + + +	- + + +	- - + +	- - - +	- - - -	Program error	Boot SIWAREX M again (software reset). Contact service if error occurs again.
+	+	+	+	+	+	DIL switch 3 = ON	Set switch to OFF. (ON is only for service and maintenance purposes.)
x	x	x	x	x	x	DIL switch 4 = ON	Set switch to OFF. (ON is only for service and maintenance purposes.)

- LED off, + LED on, x LED flashing

List of diverse errors

Table 11-9 Diverse errors

Behavior	Possible Cause	Corrective Measures
Digital outputs do not switch through.	• The soldered in overload fuse for the digital outputs on the SIWAREX M is defective. • Short circuit on the output	Send in module for repairs. Correct short circuit.
24 V is present on X1 (24 V LED on), but no other function	• Soldered in fuse on the power supply PCB is defective, or other hardware defect.	Send in module for repairs.

12 Technical Specifications

12.1 Interfaces

Voltage supply, 24 V DC (X1)

A function low voltage with intrinsically safe isolation (in accordance with EN 60204-1, section 6.4, PELV) must be provided by the sys. voltage supply.

Nominal Voltage	24 V DC
Lower/upper limits, static	20.4 V/30.2 V DC (in acc. with DIN 19240)
Lower/upper limits, dynamic	18.5 V/30.2 V DC (in acc. with DIN 19240)
Noncyclic overvoltages	35 V DC for 500 msec at a recovery time of 50 sec
Maximum current consumption	300 mA
Power loss of the module (typical)	6 W
Switchon current surge at 25° C	Max. of 4.5 A

Voltage supply from the SIMATIC S7-300

Current consumption from S7-300 backplane bus	50 mA (typical)

Load cell interface

Weighing accuracy in acc. with EN 45501 (n_{IND}) Certification as non-automatic scales, commercial class III	6000 d
Weighing accuracy with Ex-i interface SIWAREX Pi in acc. with EN45501 (n_{IND})	6000 d
Class accuracy at 20° C $\pm$ 10 K	0.01%
Update rate:	20 msec
Resolution:	$\pm$ 19 bits ($\pm$ 524,000 parts)
3 measuring ranges:	0 to 1 mV/V 0 to 2 mV/V 0 to 4 mV/V
Permissible range of the measuring signals (largest characteristic value set)	-41.5 to 41.5 mV
Max. distance of the load cell (verification capability)	1000 m (500 m)
Max. distance of the load cell to the Ex-i interface in Ex area – for gas group IIC – for gas group IIB	 300 m 1000 m
Minimum measuring signal Δu_{Min} per d	0.5 µV
Load cell supply Voltage: Current:	10.2 V DC, typical* $\leq$ 180 mA
Permissible load cell resistance without Ex-i interface:	> 60 Ω < 4010 Ω
Permissible load cell resistance with Ex-i interface:	> 87 Ω < 4010 Ω

Monitoring of the sense inputs:	2.5 V Hysteresis, 300 mV
Triggering time of the sense line monitor	≤ 1 sec
Noise (band width of 10 Hz)	150 nV, typical
Common mode suppression, CMRR @ 50 Hz	200 dB, typical
Measured value filter - (Digital filter, 4th order, critical attenuation) - Switchable, average value filter	0.05 to 5 Hz

* Values apply to the output of the module

Step response

Step Response	Response Time with Filters Disabled
From 10% to 90%	60 msec (3 measuring cycles)
From 0% to 100%	100 msec (5 measuring cycles)

Analog output (X1)

0 mA is always output when the BASP signal (S7 CPU) is active. The BASP function must have been activated for the SIWAREX M.

Output current range 1:	0 to 20 mA
Output current range 2: (20% reduced resolution)	4 to 20 mA
Typ. total error at 25° C:	0.15%
Typ. temperature drift	20 ppm/° C
Update rate:	Approx. 350 msec
Load (incl. line resistance):	≤ 600 Ω
Total temperature coefficient:	± 75 ppm/K
Resolution	16 bits (65, 536 parts)*

* Resolution reduced by 20% for operating mode 4 to 20 mA

Digital inputs (DI) Digital outputs (DO)

The signal status is low when DIs are not circuited. A low signal level is always output on the DO when the BASP signal (S7 CPU) is active.

A free wheeling diode must be provided on the consumer when inductive loads are present on the DO.

	DI	DO
Number	3	4
Nominal voltage	24 V DC	
Potential isolation: In acc. with IEC 1131, UL 508, CSA C22.0 no. 142	500 V	
Voltage range, H signal:	15 V to 30 V DC	
Voltage range, L signal:	-3 V to 5 V DC	

	DI	DO
Input current (15 to 30 V):	4 to 13 mA	
Switching frequency:	Max. of 10 Hz	
Nominal current:		0.5 A
Max. output current:		0.6 A
Max. cum. current		1 A
Potential isolation:		500 V
Voltage drop on the module		3 V
Switching delay:		$\leq$ 22 msec
Short-circuit proof:		Yes

RS 232 interface

Baud rate:	2400 or 9600 baud
Max. distance:	15 m
Signal level:	In acc. with EIA-RS232C

TTY interface

Max. loop current for external supply (Must be provided by the user)	25 mA
Typ. loop current:	20 mA
Potential isolation (for external supply):	500 V
Baud rate:	9600 baud
Max. distance: Caution: No potential isolation for own supply	1000 m
Own voltage:	5 V, $\pm$ 5%
Max. external voltage, sender:	Max. of 28.8 V
Voltage drop, receiver (typ.):	1.1 V
Voltage drop, sender (typ.):	0.5 V

Data buffering

Basic data (i.e., parameterization data and adjustment data) are backed up on EEPROM memory safe from loss due to a power failure. Gold capacitors are used to buffer the dynamic process data.

Since it is not equipped with a battery, the module is completely maintenance free.

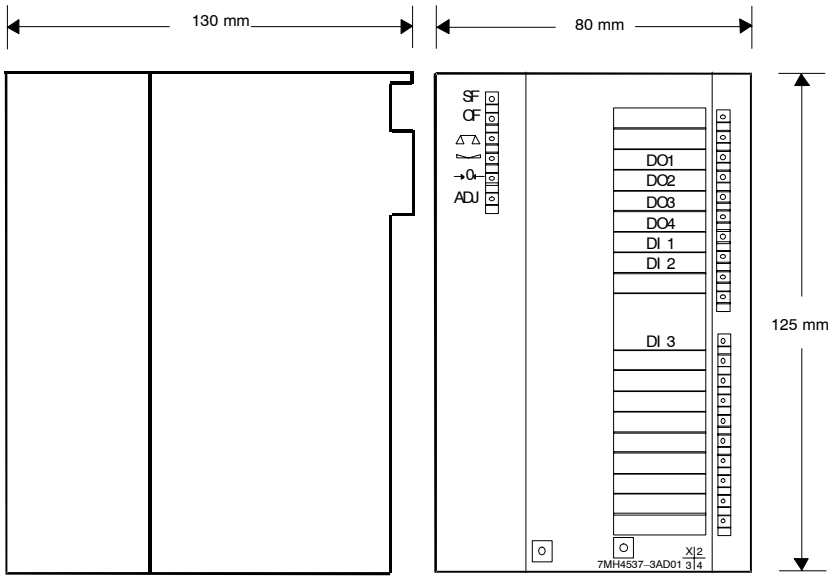
Buffering time of the data in the EEPROM	100 years
Permissible number of write accesses for EEPROM	100,000
Typ. backup time of the process data at 25° C	72 hours
Min. backup time of the process data at 25° C	6 hours

Reliability

MTBF	SN 29500	> 20 years at +40° C

12.2 Physical Requirements and Data

Dimensions



Weight: Approx. 600 g

Figure 12-1 Dimensions

Tests

Test	Standards	Test Values
Vibration stress during operation	DIN IEC 68-2-6 DIN IEC 721, part 3-3 IEC 1131-2	Class 3M3 Test Fc 10 to 58 Hz: 0.075 mm displacement 58 to 150 Hz: 9.8 m/sec^2 10 cycles per axis 1 octave/min.
Shock stress during operation	DIN IEC 68-2-27 DIN IEC 721, part 3-3 IEC 1131-2	Class 3M3 Test Ea 150 m/sec^2, semi-sinus Duration: 11 msec Number: 3 per axis In neg. and pos. direction

12.3 Electrical, EMC and Climatic Requirements

Electrical Protection and Safety Requirements		
Requirement Met	**Standards**	**Remarks**
Safety regulations	EN 60204, DIN VDE 0113 IEC 1131, UL 508 CSA C22.2, no. 142 FM class I, div. 2 UL/CSA	The electrical protection and safety requirements stated in UL, CSA and FM are met. UL, CSA, and FM certification has been granted.
Protection class	VDE 0106, part 1 IEC 536	Protection class I, with protective conductor
IP protection class	DIN 60529 (x.xx) IEC 529	In S7 rack: IP20 SIWAREX M alone: IP10
Air and creep paths	IEC 1131 UL 508 CSA C22.2, no. 142	Overvoltage category II Degree of soiling: 2 PCB material IIIa Printed circuit interval: 0.5 mm
Isolation test	IEC 1131-2: 1992 CSA C22.2, no. 142	Nominal voltage: 24 V Test voltage: 500 V DC
Fire resistance	For open type controller: IEC 1131-2: 1992, UL 508	
Manufacturing materials	SN 36350 (3.93)	

Electromagnetic Compatibility		
Remarks	**Standards**	**Remarks**
Burst pulses on current supply lines:	DIN EN 61000 4 4 (DIN VDE 0843, part 4)	2 kV (in acc. w. 90/384/EWG 1 kV)
Burst pulses on data and signal lines:	DIN EN 61000 4 4 (DIN VDE 0843, part 4)	2 kV (in acc. w. 90/384/EWG 0.5 kV)
Electrostatic contact discharge (ESD)	DIN EN 61000 4 4 (DIN VDE 0843, part 2)	6 kV
Surge voltage on power supply lines	DIN EN 61000 4 5 (DIN VDE 0847 T 4-5)	± 2 kV unsym.* ± 1 kV sym.
Surge voltage on data and signal lines	DIN EN 61000-4-5 (DIN VDE 0847 T 4-5)	± 1 kV unsym.*
Single, high energy pulse (surge) Non-symmetric	DIN EN 61000 4 5 (DIN VDE 0839, part 10)	2 kV*
RF emission (electromagnetic fields), 10 kHz to 80 MHz	DIN EN 61000 4 3 (DIN VDE 0843, part 3)	Up to 3 V/m
RF emission (electromagnetic fields), 80 MHz to 1000 MHz	DIN EN 61000 4 3 (DIN VDE 0843, part 3)	Up to 10 V/m (in acc. w. 90/384/EWG 3 V/m)

Remarks	Standards	Accuracy
RF electrification 10 kHz to 80 MHz	IEC 801-6	10 V (mod: 80% AM with 1 kHz)
Interference suppression**	EN 55011, VDE 0875, part 11	Class A

* Must be ensured via external protective components
** Additional measures are required (e.g., installation in 8MC cabinets) when used in residential areas.

EMC

The guidelines contained in part 1 of NAMUR NE21, and European guidelines 90/384/EWG covering non-automatic scales, and 89/336/EWG covering emission and resistance to electromagnetic interferences have been complied with for electromagnetic compatibility (i.e., EMC).

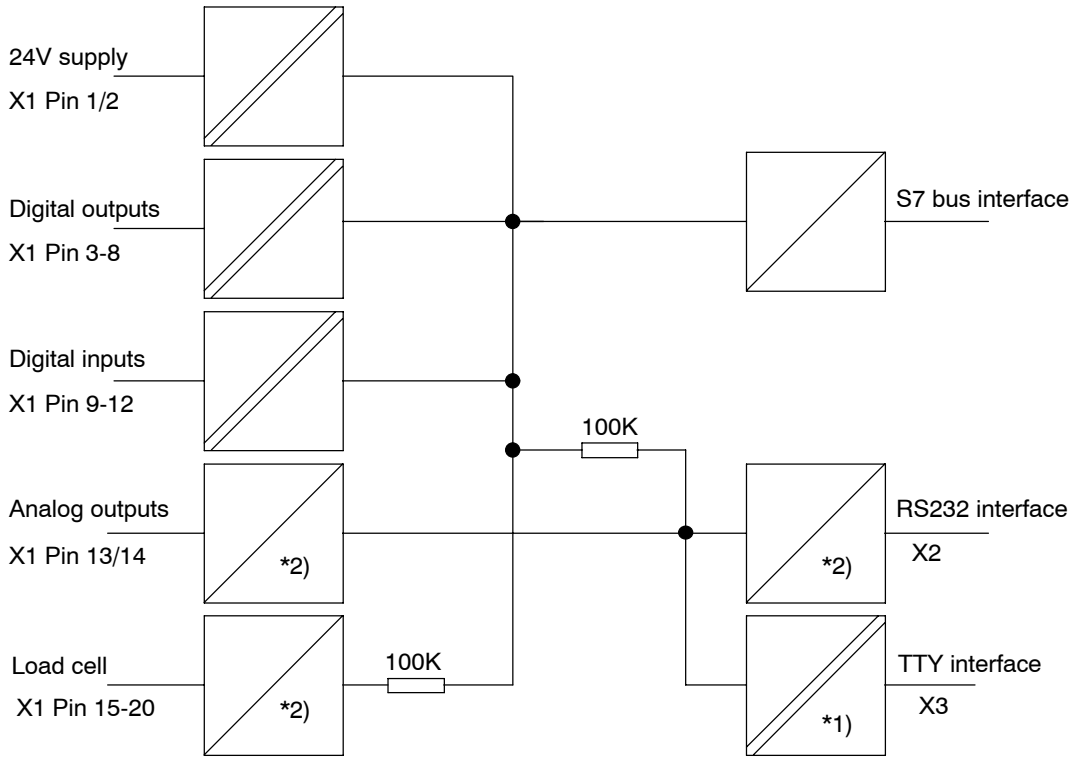
Environmental requirements

The SIWAREX M is designed for permanent use in SIMATIC S7-300 systems, protected from the weather. IEC 1131-2 describes the conditions of use.

When used under particularly rugged conditions (e.g., high degree of dust, presence of caustic fumes or gases, etc.), additional protection must be provided (e.g., encapsulation).

Climatic Requirements		
Remarks	**Environmental Requirements**	**Application Areas**
Operating temperature: Vertical installation in S7-300 Horizontal installation in S7-300 Operation requiring verification capability	 -10° to +60° C -10° to +40° C -10° to +40° C	The standard S7-300 modules may not be operated at temperatures of under 0° C.
Storage and transportation temperature	-40° to +70° C	
Relative humidity	5 to 95%	Without condensation. Corresponds to relative humidity degree 2 in acc. with DIN IEC 1131-2.
Air pressure during operation	795 to 1080 hPa	Corresponds to a height of (-1000 to 1500 m above sea level)
Air pressure during storage	660 to 1080 hPa	Corresponds to a height of (-1000 to 3500 m above sea level)
Pollution concentration	SO_2: < 0.5 ppm H_2S: < 0.1 ppm	Rel. hum. < 60%, no condensation

12.4 Potential Isolation



*1) Galvanic isolation (potential isolation) only for external power supply

*2) No galvanic isolation (potential non-isolation via 100 kOhm resistor)

Sales/Hotline/Repairs/Replacement Parts/ Training/Internet 13

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