

# SIEMENS

## SIWAREX<sup>®</sup> MS

Device Manual

Status 08/2011



## Warning and Safety Terms

This manual contains notices that are for your personal safety and to prevent damage to devices or surroundings. These notices are indicated by a warning triangle and are presented as follows depending on the degree of danger:



### Danger

means, that death, severe injury or considerable material damage may **result**, if the respective safety measures are not taken.



### Warning

Means that death, severe injury or serious material damage **can** result if the corresponding safety precautions are not followed carefully.



### Caution

Means that material damage or minor injuries can result if the corresponding safety precautions are not followed carefully.

### Caution

Means that material damage can result if the corresponding safety precautions are not followed carefully.

### Attention

Refers to important information on the product, handling of a product or a corresponding segment of the documentation to which special attention should be given.

## Qualified Personnel

Commissioning and operation of a device may only be performed by **qualified personnel**. Qualified personnel as indicated in the safety information in this manual are people that have the authorization to install, ground and label devices, systems and power circuits.

## Intended Utilization



### Warning

The device may only be utilized for the applications described in the catalog and the technical description and only in conjunction with external devices and components that are approved or recommended by Siemens. Fault-free and safe operation of the product depend on proper transport, proper storage, assembly, installation, operation and maintenance.

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## Disclaimer

We have tested the contents of this document for compatibility with the hardware and software described. This does not exclude the possibility of discrepancies, in which case we do not guarantee the complete compatibility of this document. The information in this document is assessed regularly and any necessary corrections are included in the next revision.

We are grateful for any suggestions for improvement.

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<u>Safety Instructions</u>	
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# 1 Preface

## 1.1 Purpose of Manual

This manual contains all the information required to set up and operate the SIWAREX MS.

## 1.2 Basic Knowledge Required

To understand this manual, a general knowledge of SIMATIC S7-200 automation technology is required. Weighing technology is also beneficial.

## 1.3 Scope of Manual

This manual applies to the SIWAREX MS - Expansion module:

Type	Name	Order number	From product revision (Version)	
<b>SIWAREX MS</b>	SIWAREX Micro Scale	7MH4930-0AA01	<b>HW 1</b>	<b>FW V. 1.3</b>

Table 1-1 Scope of this manual

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### Note

This manual describes the SIWAREX MS weighing electronics as part of the SIMATIC S7-200 system and should be used as a supplement to the manual for the S7-200.

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### Note

This manual contains a description of the module that is valid at the time of publication.

We reserve the right to supply new modules or newer versions of modules with product information containing current information about the module.

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

<b>Chapter</b>	<b>Description of Content</b>
<i>1 Preface</i>	Notes on using this manual
<i>2 Scope of Delivery</i>	Description of the SIWAREX MS delivery contents.
<i>3 Product Overview</i>	Overview of <ul style="list-style-type: none"> <li>- Structure</li> <li>- Functionality</li> <li>- System integration of SIWAREX MS.</li> </ul>
<i>4 Hardware Configuration and Assembly</i>	Description <ul style="list-style-type: none"> <li>- of individual hardware components</li> <li>- of structure and installation</li> <li>- of connections</li> <li>- of preparations for operation.</li> </ul>
<i>5 Weighing Functions</i>	Description of all weighing parameters and corresponding functions.
<i>6 Commands</i>	Description of commands that can be executed by SIWAREX MS.
<i>7 Messages and Diagnosis</i>	Description of messages with notes on problem resolution.
<i>8 Programming in STEP 7</i>	Description of data exchange with the SIMATIC CPU. This chapter is meant for you if you write application software.
<i>9 Setting the Scale – SIWATOOL MS</i>	Description of software functions
<i>10 Accessories</i>	Ordering information for optional components such as: <ul style="list-style-type: none"> <li>- Remote digital displays</li> <li>- Ex-Interface</li> <li>- Connection cables</li> </ul>
<i>11 Technical Data</i>	Technical Data
<i>12 Index</i>	Index
<i>13 Abbreviations</i>	List of Abbreviations

Table 1-2 Overview of the chapter

## 1.4 Further Support

Do you still have questions concerning the use of the SIWAREX MS? Then please contact your Siemens representative in the office or business location that is responsible for your area or technical support for SIWAREX  
Tel.: +49 (0)721 595 2811.

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

<http://www.siemens.com/weighing-technology>

## 2 Scope of Delivery

### 2.1 Scope of Delivery

The declaration of conformity from the manufacturer and an additional sheet containing up-to-date product information are included in the scope of delivery of the SIWAREX MS.

To configure the SIWAREX MS, you will require the SIWAREX MS configuration package, which must be ordered separately.

The configuration package consists of the following components:

- The SIWATOOL MS Windows program for setting up the scale during commissioning
- Standard software for operating the SIWAREX MS in SIMATIC S7-200
- Device manuals in several languages

The “Getting Started” software is extremely useful during the first steps of programming. It is located on the supplied CD along with the configuration package or it can be obtained free of charge on the Internet (<http://www.siemens.com/weighing-technology>).

Any necessary or optional accessories are detailed in chapter *10 Accessories*.

### 2.2 Released SIMATIC S7-200 CPUs

SIWAREX MS can be operated with the following S7-200 CPUs:

6ES7212-1AB23-0XB0, 6ES7212-1BB23-0XB0, 6ES7214-1AD23-0XB0,  
6ES7214-1BD23-0XB0, 6ES7214-2AD23-0XB0, 6ES7214-2BD23-0XB0,  
6ES7216-2AD23-0XB0, 6ES7216-2BD23-0XB0.

SIWAREX MS can also be used with the S7-200 SIPLUS CPUs but SIWAREX MS itself is not designed for expanded environmental conditions:

6AG1212-1AB23-2XB0, 6AG1212-1BB23-2XB0, 6AG1214-1AD23-2XB0,  
6AG1214-1BD23-2XB0, 6AG1214-2AD23-2XB0, 6AG1214-2BD23-2XB0,  
6AG1216-2AD23-2XB0, 6AG1216-2BD23-2XB0.

## 3 Product Overview

### 3.1 General

SIWAREX MS (Micro Scale) is a versatile and flexible weighing module, which can be used wherever scales are to be used in the SIMATIC S7-200 automation system or a force measurement is necessary.

The SIWAREX MS module advantageously utilizes all features of the modern automation system, such as integrated communication, the diagnostics system and the available configuration tools.

Customer benefits:

SIWAREX MS is characterized by a few clear advantages:

- Standardized connection technology and integrated communication due to use in SIMATIC S7-200
- Standardized configuration with STEP 7 Micro/Win Version 4.0 SP2 and higher
- Weight or force measurement to a high resolution of 16 Bit
- Height accuracy 0.05 %
- Fast measuring times can be chosen between 20 ms or 33 ms
- Monitoring of limit values
- Flexible adaptation to different requirements with SIMATIC control
- Easy adjustment of scales using the SIWATOOL MS program via the RS 232 interface
- Theoretical adjustment without adjustment weights
- Exchange of module, possibly without readjusting scales
- Intrinsically safe load cell power for use in zone 1 areas with risk of explosion (Option SIWAREX IS)
- Diagnostics functions

### 3.2 Area of Application

SIWAREX MS is the optimum solution wherever signals from STRAIN GAUGE sensors or load cells are to be recorded. SIWAREX MS provides high accuracy as weighing electronics. With measuring times of 20 ms (or 33 ms), the module can also be used for electronic evaluation for force measurement.

SIWAREX MS is optimally equipped for the following applications:

- Non-Automatic Weighing Instrument
- Discontinuous and continuous weighing processes
- Filling level monitoring for Silos and Bunkers

- Measurement of Crane and Cable loads
- Load measurement with industrial lifts or rolling mills
- Scales in explosion hazard areas (Zone 2 or Zone 1 with Ex-Interface SIWAREX IS or Pi)
- Monitoring belt tension
- Force measurement, container scales, platform scales and crane scales

### 3.3 Structure

SIWAREX MS is an expansion module for the SIMATIC S7-200 and operates together with other expansion modules of the system. The installation and cabling for the 71,2 mm wide module is minimal. Load cell, power supply and TTY interface connections are made with screw terminals and the RS232 serial interface with a 9-pin D-sub connector. Weighing electronics can be completely integrated into the automation system with SIWAREX MS operation in SIMATIC.

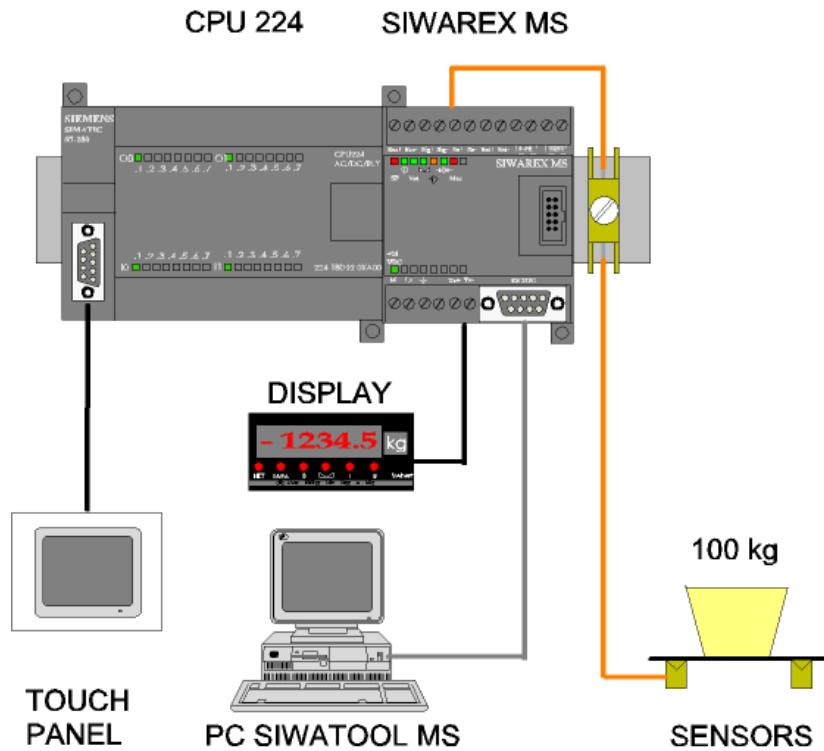


Figure 3-1 SIWAREX MS - System overview

### **3.4 Function**

The primary task of the SIWAREX MS consists of measuring the actual weight value. Integration into SIMATIC enables the processing of weight values directly in the PLC.

SIWAREX MS is already being adjusted in house. This means that the scale can be adjusted to theoretical settings without using any adjustment weights and modules can be exchanged without readjusting the scale.

The SIWAREX MS has two serial interfaces. A TTY interface is used for connecting remote digital displays. A PC can be connected to the RS 232 interface to set up the scale using the SIWATOOL MS.

The SIWAREX MS weighing module can be used in zone 2 explosion hazard areas. An optional Ex interface on SIWAREX IS or SIWAREX Pi gives load cells an intrinsically safe power supply for applications in zone 1.

### **3.5 System Integration in SIMATIC S7-200**

SIWAREX MS is a component of SIMATIC S7-200. This gives you complete freedom for configuration of the automation solution - including the weighing application. The optimum solution can be created for small, medium and large systems by selectively combining the SIMATIC components. Customer specific or branch specific solutions can be developed quickly and easily using the configuration package and the "ready to use" application "Getting started".

### **3.6 Scale Adjustment with SIWATOOL MS**

For adjustment of the scale, there is a special program - SIWATOOL MS for Windows operating systems (Windows XP and higher).

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

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

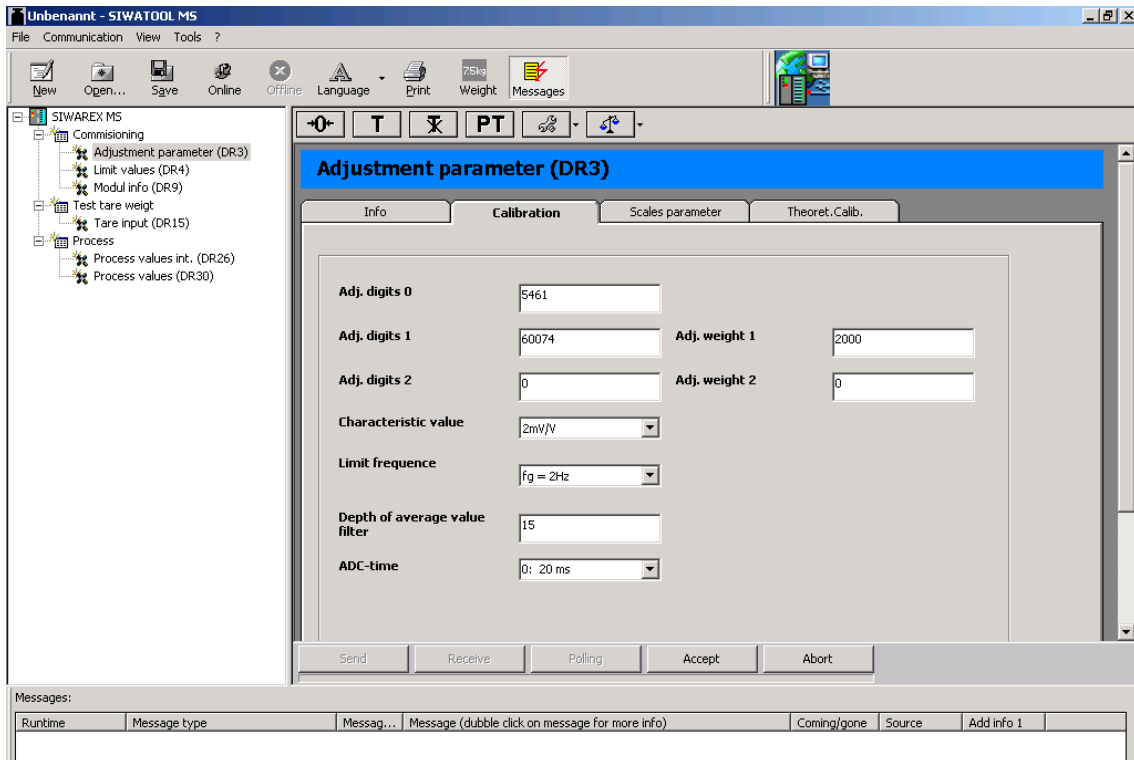


Figure 3-2 SIWATool MS Overview

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

You can switch between languages German, English, French, Italian and Spanish in the program.

## 4 Hardware Configuration and Assembly



### Warning Notes

For configuration, assembly and commissioning, the definitions from the manual for the SIMATIC S7-200 are applicable. This chapter provides you with additional information for hardware configuration and assembly, and for preparing the SIWAREX MS for operation.

The technical safety information is to be strictly adhered to.



### Warning

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



### Warning

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



### Danger

Commissioning is not permitted until it is guaranteed that the machine in which these components are to be integrated conforms with the guidelines in 89/392/EWG (within the European Union).



## 4.1 Configuring the Hardware

SIWAREX MS is an analog expansion module running in the SIMATIC S7-200 automation system.

The maximum possible number of SIWAREX MS expansion modules per rack corresponds with the maximum number of expansion modules of the respective CPU type according to the S7-200 system manual. If the S7-200 system manual allows more than 4 expansion modules for the CPU type, the number of SIWAREX MS modules is limited to 4.

CPU type	Max number of SIWAREX MS
CPU 222	2
CPU 224	4
CPU 226	4

Table 4-1 Expansion module in the S7-200 system

All SIWAREX MS modules have to be placed directly behind the CPU. All other modules have to be added behind the SIWAREX MS modules.

The utilization of other expansion modules can reduce the permitted number of SIWAREX MS. Check the current requirements on the expansion bus according to the S7-200 system manual.

Selecting the suitable SIMATIC CPU, the SIMATIC HMI (Human Machine Interface) does not only depend on weighing technology requirements but also on the overall job that the automation system has to perform.

## 4.2 Structure to EMC Guidelines

SIWAREX MS is a highly precise measuring device, which must measure low signal levels (approx. 1.5  $\mu\text{V}$ ) reliably. Because of this, proper assembly and wiring are absolutely essential for fault-free operation.

### 4.2.1 Definition: EMC

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

### 4.2.2 Introduction

Although SIWAREX MS was developed for use in industrial environments and meets high EMC specifications, you should carry out EMC planning before installing your controller to determine and take into account any possible interference sources.

#### 4.2.3 Possible Effects of Interference

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

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

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

#### 4.2.4 Coupling Mechanisms

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

Galvanic coupling

Capacitive coupling

Inductive coupling

Radiation coupling

#### 4.2.5 Five Basic Rules for Guaranteeing EMC

If you follow these five basic rules, EMC can be guaranteed in most cases!

##### **Rule 1: Large surface area grounding connection**

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

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

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

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

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

### **Rule 2: Proper wiring**

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

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

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

### **Rule 3: Fixed cable shielding**

Ensure that the cable shielding is connected properly.

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

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

The shielding should continue right up to the connection area. Unshielded cable ends should be kept as short as possible. Connect the cable shielding directly next to the SIMATIC on the shielding connection clamp. The connection between the shielding rail and the cabinet/housing must be low impedance.

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

### **Rule 4: Special EMC measures**

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

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

### **Rule 5: Uniform reference potential**

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

Run sufficiently dimensioned potential equalizing cabling if potential differences exist or are to be expected in the system. The respective potential compensation is mandatory for Ex applications.

## **4.3 Assembly**

When assembling the SIMATIC components and the SIWAREX MS, the installation, assembly and wiring guidelines for the SIMATIC S7-200 must be followed (see S7-200 manual).

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

## 4.4 Connection and Wiring

### 4.4.1 Connection Areas for SIWAREX MS

All connections can be made from the front.

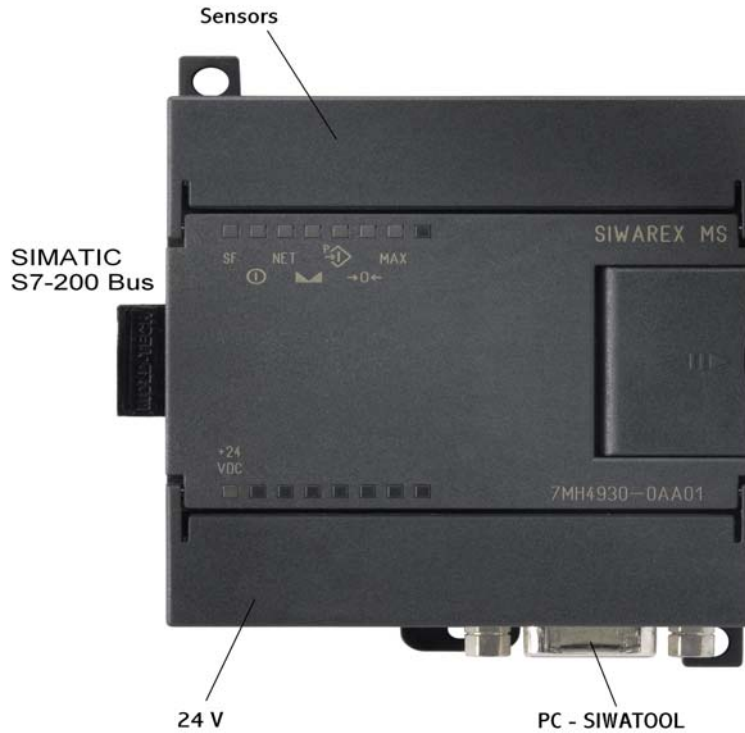


Figure 4-1 SIWAREX MS connection areas

### 4.4.2 Shielding Connection

Special attention must be given to the shield strip for the shielded lines. Only correct installation guarantees that the system will be immune to interference. A cable is shielded to decrease the affects of magnetic, electrical and electromagnetic interference on this line. Interference on cable shielding is routed to ground through the shielding connection clamp. To ensure that this interference does not become a source of interference, a low impedance connection to ground is especially important.

Only use wires with braided shielding (see recommended cable types in chapter 10 *Accessories*). Shielding should provide at least 80% coverage.

The shielding clamps must be ordered separately. The following image shows the shield clamp assembly.

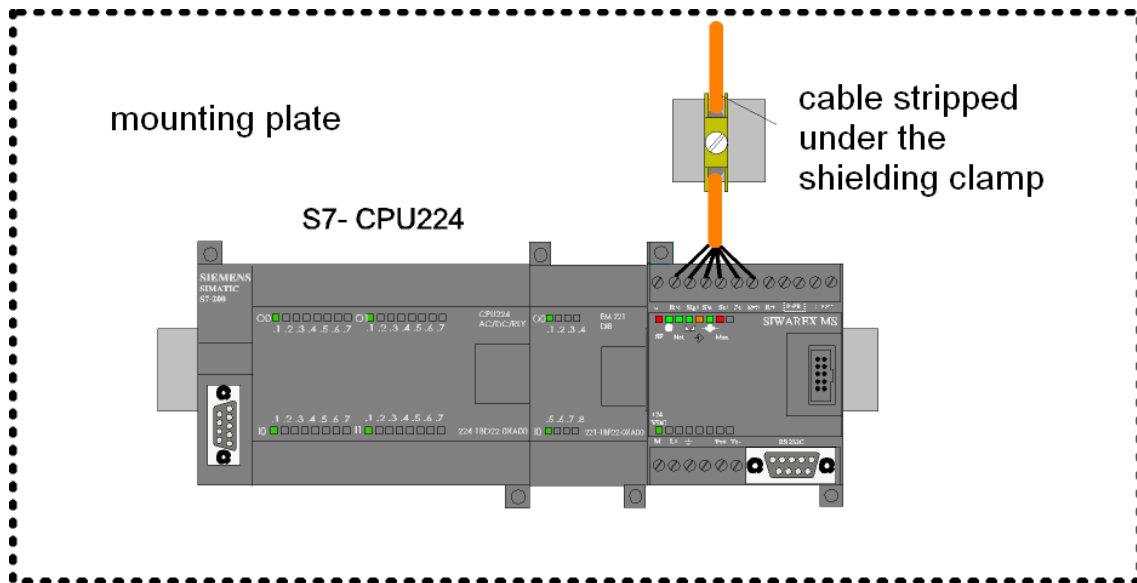


Figure 4-2 Shielding connection for load cell cable

#### 4.4.3 Connection of 24 V Power Supply

The power supply 24 V is connected directly to the terminals M and L+ on the SIWAREX MS expansion module.

#### 4.4.4 Ground Connection to the Interference Dissipation

The ground wire is connected to a suitable point for dissipating interference.

#### 4.4.5 Load Cell Connection

Measuring sensors can be connected to the SIWAREX MS if they are fitted with strain gauges (full bridge) and meet the following conditions (see the technical data as well – Chapter 11.4):

- Characteristic value 1.... 4 mV/V
- Supply voltage of 6 V is permissible

The following rules are to be followed when connecting load cells (WZ).

1. Use of a junction box (SIWAREX JB) is necessary if more than one load cell is connected (the load cells must be connected in parallel). If the distance from a load cell to SIWAREX MS or to the junction box is greater than the available length of the load cell connecting cable, the SIWAREX EB extension box should be used.
2. The cable shielding is always run to the cable gland on the junction box (SIWAREX JB) or the extension box.

If there is a danger of potential equalization currents on the cable shielding, a potential equalization conductor should be run in parallel to the load cell cable.

3. Twisted pair cables should be used for the specified lines and should also be shielded:

- Sensor line SEN+ and SEN-
- Measuring voltage lines SIG+ and SIG-
- Supply voltage lines EXT+ and EXT-

We recommend using the cable indicated in chapter *10 Accessories*.

4. The shielding must be connected to the shielding connection clamp.

The maximum distance between the SIWAREX MS and the load cell is applicable when using the recommended cables.

The power supply (6V) for the load cells comes from the SIWAREX MS. (terminal EXC+ and EXC-).

The connection should be made using the cable indicated in chapter *10 Accessories*.

Connection and signal designations	Comment
SEN+	Sensor line +
SEN-	Sensor line -
SIG+	Measurement line +
SIG-	Measurement line -
EXC+	Load cell supply output +
EXC-	Load cell supply output -

Table 4-2 Load cell connections

The two figures below show the load cell connection using 4-wire and 6-wire systems.

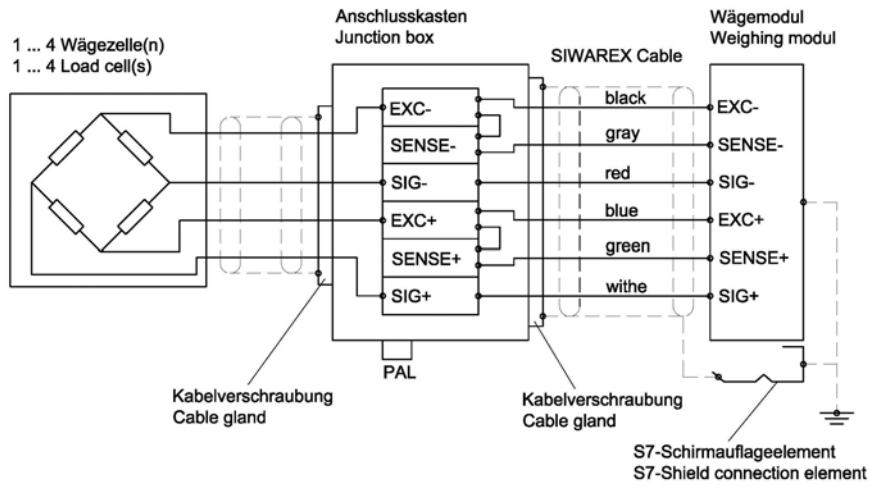


Figure 4-3 Load cell connection with a 4-wire system

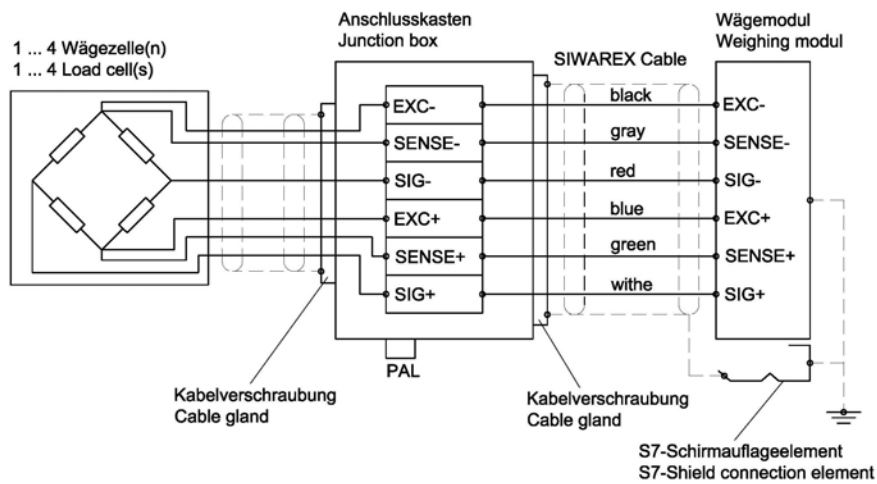


Figure 4-4 Load cell connection with a 6-wire system

The maximum distance of 500 m applies to using cables as specified in chapter 10 *Accessories*.

#### 4.4.6 Connecting the Remote Display from Siebert

The type S102 display made by Siebert can be connected to the TTY interface.

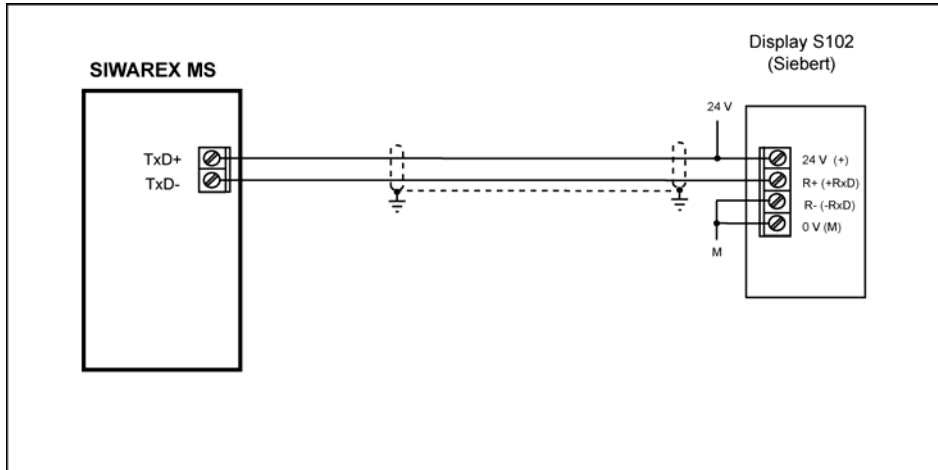


Figure 4-5 Connecting the S102 display

#### 4.4.7 Connecting the PC for SIWATOOL MS

Ready-made cables are available for connecting to the PC (see *Accessories*)

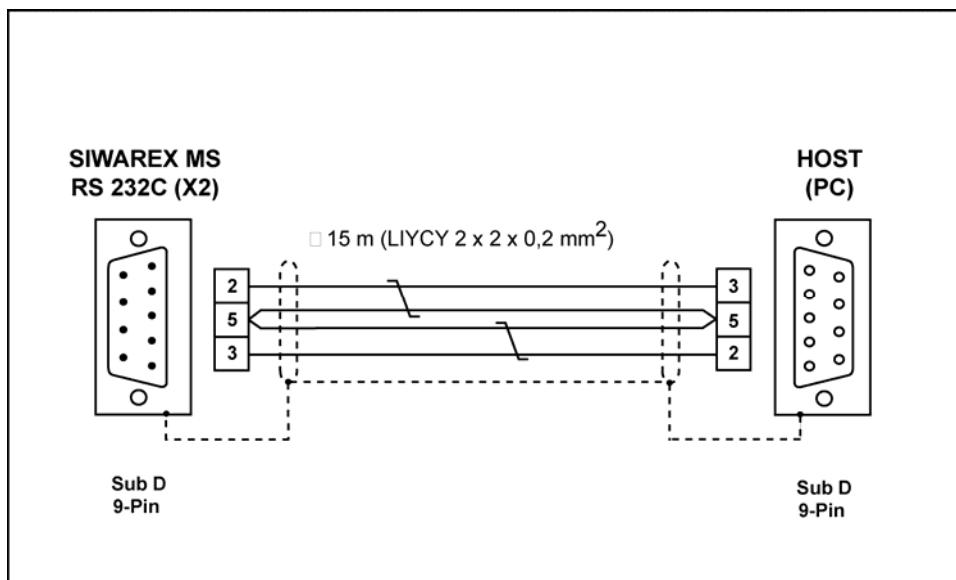


Figure 4-6 Connecting the PC



## 4.4.8 LED Display Elements




Label	LED color	LED	Description
SF	Red	LED 1	System Fault Hardware fault
	Green	LED 2	RUN
NET	Green	LED 3	Net
	Green	LED 4	Standstill
	Orange	LED 5	Write protection activated
→ 0 ←	Green	LED 6	¼ d zero
MAX	Red	LED 7	Max. exceeded
+ 24 VDC	Green	LED 8	24 V connected

Table 4-3 Display elements (LED)

For more information on LEDs, see chapter 7.7.

## 4.5 Preparing for Operation

**Introduction** At this point in the commissioning procedure, after assembling the module group and making all connections, you should perform a partial functionality test for the SIWAREX MS and all connected components.  
The individual steps for partial testing are to be performed in the following sequence:

**Visual check** Check all previously performed steps for proper execution:

- Does the SIWAREX MS have any external damage?
- Is the SIWAREX MS in the correct installation position?
- Are all connecting cables properly connected and fastened tightly?
- Is all shielding in place?
- Is the U mounting channel connected to the ground bus?
- Have all tools, materials or components that do not belong to the S7-200 or SIWAREX MS components removed from the modules?

**Turn on 24 V** Turn on power supply on.

**LED check on SIWAREX MS** After applying the 24V supply voltage and a short initialization phase (internal tests, are indicated by LED running sequence), the SIWAREX MS goes into operating status. The following LEDs must have the status that is indicated below if the unit is running correctly:

LED (System Fault) --> OFF status  
LED (RUN) --> ON status

For more information on LEDs, see chapter 7.7.

## 4.6 Use for potentially explosive area



### **Danger**

Failure to observe the setup instructions can result in  
**DANGER OF EXPLOSION!**



For using the SIWAREX MS in areas with a risk of explosion, the important information in the “SIMATIC Automation Systems - Basics of Explosion protection (Doc.No. A5E00206200)” must be observed!

Below you will find important information on the installation of the SIWAREX MS in a hazardous area.

SIWAREX MS may only be used under the conditions, which are specified in the appropriate certificates.

The SIWAREX MS can be used in Ex zone 2 (acc. to IEC/CENELEC, directive 94/9/EG).

In the following you find some details about the certificates ATEX (Europe) and UL (USA, Canada).

### **Certificate: ATEX:**

Type Examination Certificate Number: ATEX Nr. KEMA 08ATEX0002 X



Please always observe the relevant safety instructions.  
These can be accessed on the Internet at  
<http://support.automation.siemens.com/WW/view/en/29443327>

### **Certificate: c-UL-us haz. loc.**

UL file number. USA: NRAG.E239877

UL file number Canada: NRAG7.E239877

Note to c-UL-us haz.loc:

Warning – Explosion Hazard – Do not disconnect while circuit is live unless area is known to be non-hazardous.

Warning – Explosion Hazard – Substitution of components may impair suitability for Class I, Division 2.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

**Connection from load cells to SIWAREX MS:**

The SIWAREX CS can be connected with load cells in zone 1 or zone 2.

For a connection of load cells in zone 2 it is sufficient, that the load cells also have an approval for zone 2 and all associated directives as well as the installation instructions are respected.

For a connection of load cells in zone 1 load cells with the adequate approvals are needed and appropriate provisions according to the guidelines must ensure explosion protected operation. For example SIWAREX R load cells can be connected intrinsically safe via the Ex-Interface SIWAREX IS. The instructions for the Ex-Interface, the load cells and the ATEX as well as the c-UL-CSA directives have to be respected.

**Installation and Maintenance:**

Required connection and installation work must be performed by qualified personnel.

Repairs can only be carried out at the production location.

## 5 Weighing Functions

### 5.1 General

The SIWAREX MS can be used as a weighing instrument or as measuring electronics for force measurement. SIWAREX MS has no legal certification for calibration however.

All parameters are set with default values from the manufacturer. Using the "Load factory settings" command, the parameter definitions are loaded as they were defined at the factory.

The default parameters are set so that the scale is immediately ready for operation. It is not necessary to re-enter all parameters. The advantage of this solution is that you can define how many of the default values should be retained and how much the behavior of the scale has to be adapted for the application.

All parameters are split into data records (DS). The parameters are adjusted using the SIWATOOL MS program or via SIWATIC PLC during commissioning. The actual weight value and the status information is output at the SIMATIC CPU based on the parameters that have been defined.

In the following parameter description, you will find a description of the weighing functions that are influenced by that parameter. The parameters of a data record are shown in a table to start with. This is then followed by the exact parameter description for the parameters of that data record.

After receiving a new parameter, SIWAREX MS runs a plausibility check. If a parameter definition error exists, the data record is not accepted by the SIWAREX MS (not saved) and a message concerning the error is output (see chapter 7 *Messages and Diagnosis*).

### 5.2 DS3 Adjustment Parameter

The adjustment parameter must be tested for every scale and changed if necessary.

The scale is basically defined using the adjustment parameter and by performing the adjustment. The adjustment data of the DS3 can be protected against rewriting/changing after commissioning with a wire bridge on terminal P-PR (parameter-protection).

## Procedures:

- Check all parameters and change if necessary.
- Send the DS3 to the scale (*Not possible with the wire bridge on terminal P-PR, the data is not accepted*)
- Perform the scale adjustment
- Receive DS3 from the scale

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning
Adjustment digits for zero point	WORD (0-1)	2	5461	Scale zero point (JD0) [ 0 to: 2 <sup>16</sup> ] Other definitions not permitted. For description see chapter 5.2.1
Adjustment digits for Adjustment weight 1	WORD (2-3)	2	60074	Adjustment digits for adjustment weight 1 (JD1) [ 0 to: 2 <sup>16</sup> ] Other definitions not permitted. For description see chapter 5.2.1
Adjustment digits for adjustment weight 2	WORD (4-5)	2	0	Adjustment digits for adjustment weight 2 (JD2) [ 0 to: 2 <sup>16</sup> ] Other definitions not permitted. For description see chapter 5.2.1
Adjustment weight 1	INT (6-7)	2	2000	Adjustment weight 1 (JG1) For description see chapter 5.2.1
Adjustment weight 2	INT (8-9)	2	0	Adjustment weight 2 (JG2) For description see chapter 5.2.1
Characteristic value range	BYTE (10)	1	2	1: Characteristic value range 1mV/V 2: Characteristic value range 2mV/V 3: Characteristic value range 3mV/V 4: Characteristic value range 4mV/V Other definitions not permitted. For description see chapter 5.2.2
Measurement time	BYTE (11)	1	0	<i>Bit 0 Measurement time</i> 0 = the measurement time is 20 ms (Sample rate 50 Hz) 1 = the measurement time is 33 1/3 ms (Sample rate 30 Hz) For description see chapter 5.2.3  <i>Bit 2 to 7 not used</i>
Limit frequency for low pass filter fg	BYTE (12)	1	4	3: fg = 5Hz 4: fg = 2Hz 5: fg = 1Hz 6: fg = 0.5Hz 7: fg = 0.2Hz 8: fg = 0.1Hz 9: fg = 0.05Hz Other definitions not permitted. For description see chapter 5.2.4
Filter depth - Average value filter	BYTE (13)	1	15	Filter depth of average value filter [ 0 .. 255] 0 and 1: Average value filter deactivated >1: Filter depth For description see chapter 5.2.6
Scale Name	STRING[10] (14-25)	12	“SIWARE X MS”	Customer specific scale designation For description see chapter 5.2.7
Min. weighing range	INT (26-27)	2	20	Minimum Weight for Weighing Range For description see chapter 5.2.8
Weighing range	INT (28-29)	2	2000	Maximum Weight for Weighing Range For description see chapter 5.2.9
Numeral step	INT (30-31)	2	1	Numeral step (1, 2, 5, 10, 20) For description see chapter 5.2.10
Standstill Range	INT (32-33)	2	10	Standstill range in weight unit For description see chapter 5.2.12
Standstill Time	TIME (34-37)	4	1000	Standstill time in ms For description see chapter 5.2.11

Decimal place for remote display and ASCII weight output	BYTE (38)	1	2	0...5 For description see chapter 5.2.13
Maximum negative weight for zero setting	BYTE (39)	1	1	Negative range of zero setting device [in % of WBB <sub>B</sub> ] For description see chapter 5.2.14
Maximum positive weight for zero setting	BYTE (40)	1	3	Positive range of zero setting device [in % of WBB <sub>B</sub> ] For description see chapter 5.2.15
Tare max. weight T-	BYTE (41)	1	100	Subtractive tare device range in % of weighing range For description see chapter 5.2.16
TTY protocol selection	WORD (42)	1	0	0: Protocol for S102 by Siebert 1: ASCII Protocol Other definitions not permitted. For description see chapter 5.2.17
Reserve1	BYTE (43)	1	0	Reserve1
Reserve2	STRING[4] (44-49)	6	“----”	“----”; For description see chapter 5.2.18
Unit	STRING[4] (50-55)	6	“kg”	Weight unit for weight display For description see chapter 5.2.19
		56		

Table 5-1 Allocation of DS3

### 5.2.1 DS3 – Adjustment Digits 0, 1, 2, for Zero Point and Adjustment Weights 1, 2

The analogue measurement value coming from the load cells is converted into a digital value with an analog-digital converter. A weight value is then calculated from this digital value. All functions of the SIWAREX MS then use this weight value to determine the status and for messages.

To calculate the weight value from the digital value, the characteristic curve of the measurement system must be determined. In the simplest case, the characteristic curve is defined by points 0 and 1. The first operating point (point 0) is always determined by the empty scale alone with its own construction weight. The weight of the scale's own construction causes the load cell to supply a measurement voltage to SIWAREX MS. After analog-digital conversion of the measurement voltage, the digital value (adjustment digits for zero point) is assigned the zero point (Weight = 0).

If the scale is loaded with a known adjustment weight (e.g. 100 % of the measurement range), then the second operating point can be determined. The new digital value from the analog-digital converter is now assigned the adjustment weight.

In addition, the characteristic curve can be linearized using a further point lying above point 1.

Ensure that the difference between two adjustment weights is at least 5 % of the total nominal load of all load cells. This will ensure that the adjustment points are not too close together.

The adjustment consists of the following steps:

Define adjustment weights and other parameters of the DS 3 data record.

Send DS 3 to the scale

With an empty scale, give the command “Valid adjustment weight = 0”

Load the scale with the defined adjustment weight  
Give the command "Valid adjustment weight = 1"  
Receive DS 3 from the scale  
Save the data to a data carrier

The adjustment sequence for the increasing adjustment weights must be retained.

Example:

Zero point = 0.0 kg (always)	gives 7800 digits
Adjustment weight 1 = 100 kg	gives 60074 digits

This defines the characteristic curve (0 is entered as the weight value for further adjustment weights) and the scale can now perform the calculations for the weight values over the entire measurement range.

**Note:**

Since the theoretical maximum value for adjustment digits is 60074 and the value for completely empty load cells (without the weight of the construction itself) is 5461, the plausibility of the characteristic curve can be roughly estimated, to determine load deviations for example.

The illustration shows the relationship between the adjustment digits and the adjustment weight.



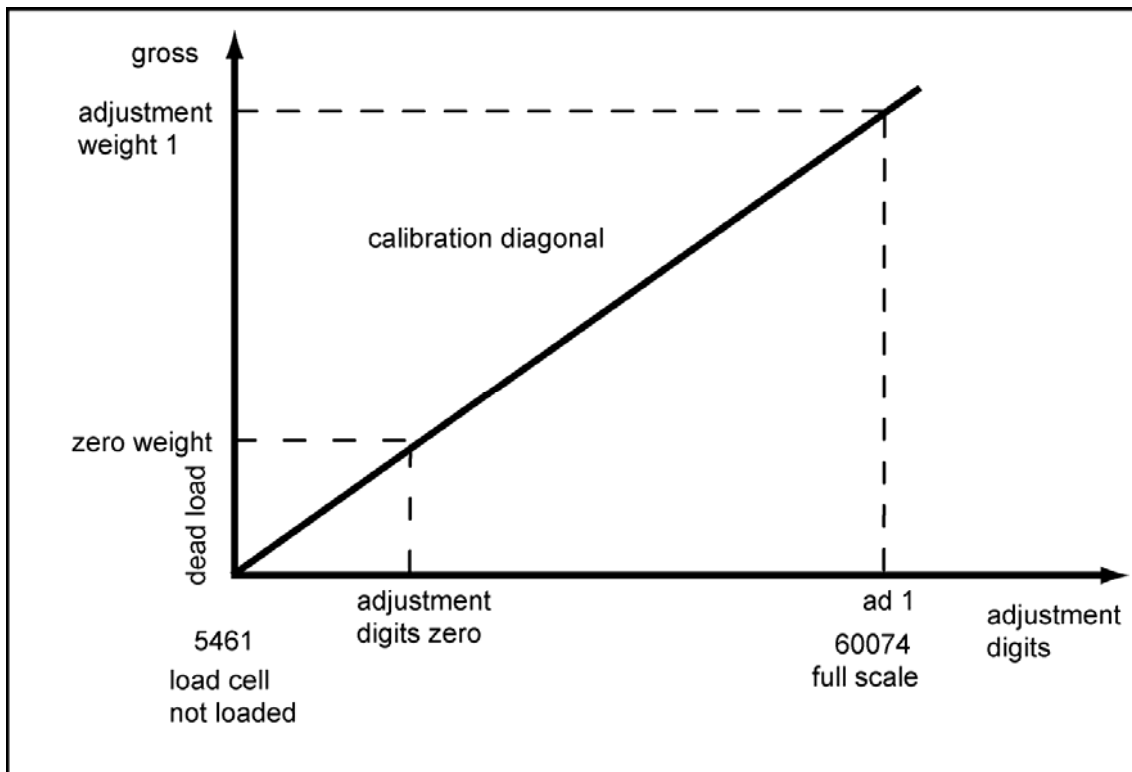


Figure 5-1 Adjustment digits and weight value

If the adjustment weights and adjustment digits of a SIWAREX MS are known then the adjustment procedure does not need to be performed. These are simply sent with the data record DS3 to the SIWAREX MS and the scale is immediately ready for operation.

The SIWATOOL MS program supports you in quickly performing an adjustment.

Option 1:

After commissioning and after adjustment, all data records for the scale are read from SIWAREX MS and are stored as a scale file ScaleX.MS.

Identical scales can now be put into operation immediately. Connect the PC to the new scale and activate the "Send all data records" function. This also transfers the adjustment weights and the adjustment digits - the characteristic curve is defined immediately. Of course, the same applies for exchanging a SIWAREX MS.

Option 2:

Use the SIWATOOL MS "Theoretical adjustment" function and determine the characteristic curve of the scale from the technical data of the load cells alone. This case assumes proper construction of the scale.

**Note:**

Normally, defining two operating points is sufficient to determine the characteristic curve for the scale. A further operating point only has to be defined for non-linear systems - an additional adjustment weight (e.g. 80% of the measuring range) is assigned a new digital value (adjustment digits 2).

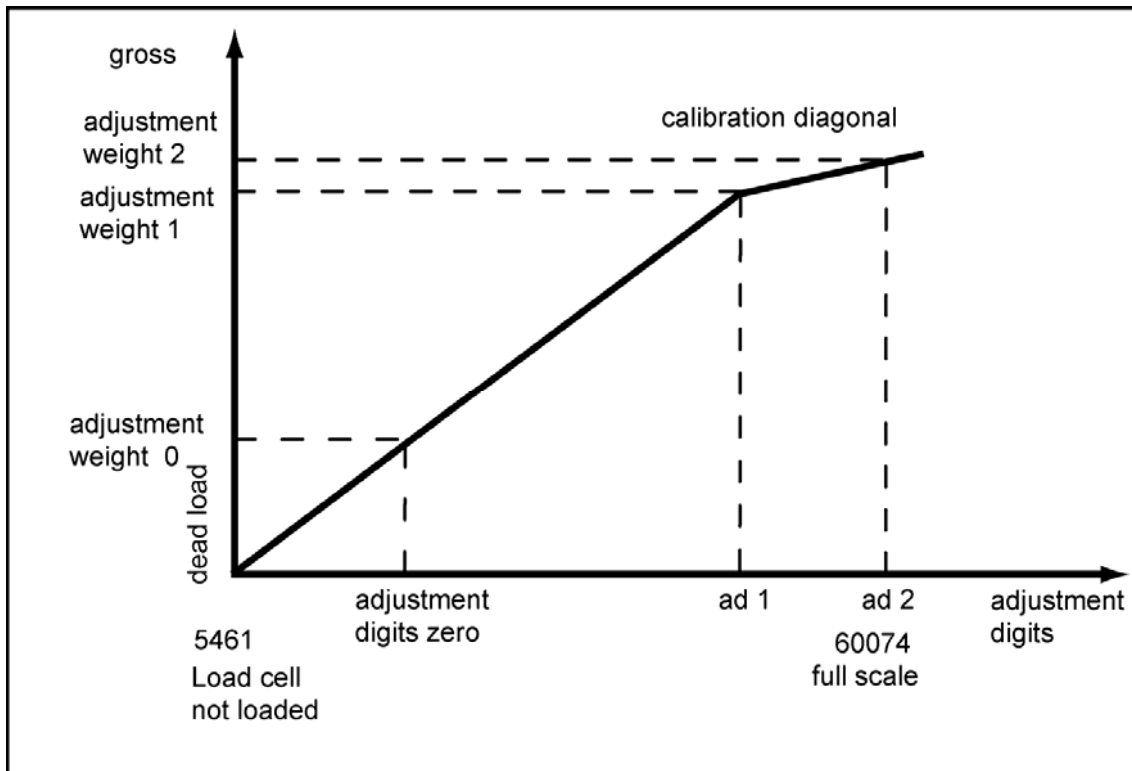


Figure 5-2 Linearization of the scale characteristic curve

### 5.2.2 DS3 – Characteristic Value Range

Depending on the characteristic value of the connected load cells, the value 1 mV/V, 2 mV/V, 3 mV/V or 4 mV/V must be selected. Since the SIWAREX MS supplies the load cells with approximately 6 V, the measuring input is redefined according to the expected measurement voltage (max. 6 mV, max. 12 mV, max. 18 mV or max. 24 mV).

For example, if the characteristic value of the connected load cells is 3.85 mV/V then the next higher characteristic value must normally be set, i.e. 4 mV/V.

### 5.2.3 DS3 – Measurement Time

The measurement time can be selected depending on the region of application (50 Hz or 60 Hz mains power frequency). This selection achieves optimal interference suppression from the power supply. Setting:

- 20 ms for 50 Hz mains supply
- 33 1/3 ms for 60 Hz mains supply

### 5.2.4 DS3 – Low Pass Filter

A critically energized low pass filter is provided for suppression of interference. The figure below shows the step response of the filter ( $f_g = 2$  Hz).

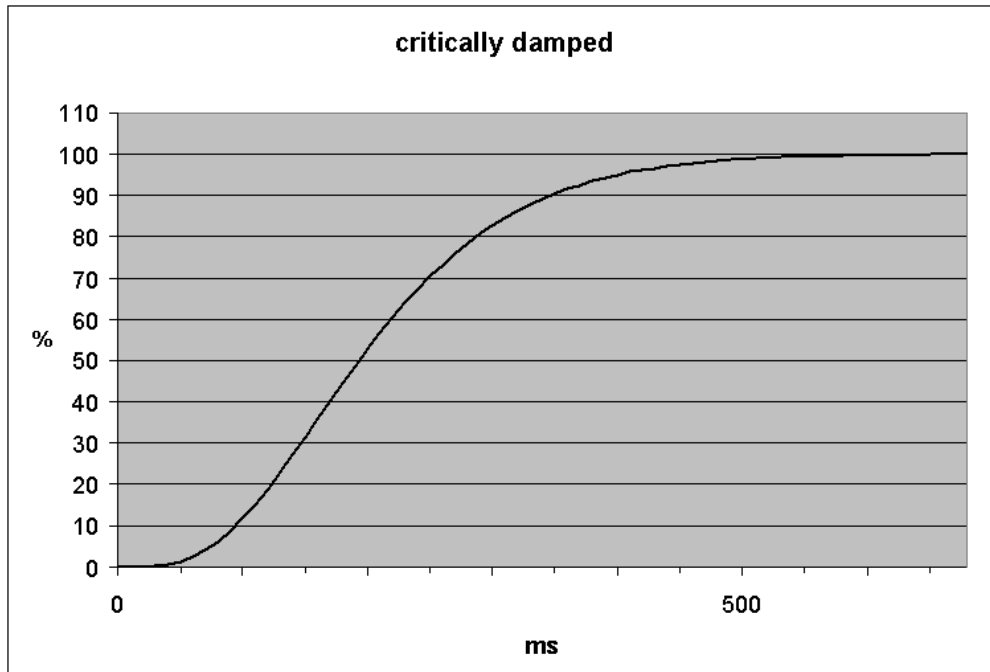


Figure 5-3 Step response of digital low pass filter at  $f_g = 2$  Hz

### 5.2.5 DS3 – Limit Frequency

Defining the limit frequency is critically important for suppressing interference. The “speed” of the scale’s reaction to the change in the measured value is determined by specifying the limit frequency.

For example, a value of 5 Hz results in a relatively fast scale reaction to a weight change, while a value of 0.5 Hz makes the scale “sluggish”.

### 5.2.6 DS3 – Depth of Average Value Filter

The average value filter is used to settle the weight value against interference. The weight value is based on the average of the  $n$  weight values that the SIWAREX MS calculates every 20 ms or  $33 \frac{1}{3}$  ms, e.g. if  $n=10$ , 10 measurement values are used to calculate the average value. Every 20 ms or  $33 \frac{1}{3}$  ms, the oldest value is dropped and the newest is included in the calculation.

The average value filter also achieves very good attenuation of periodic interference, if the interference frequency corresponds to an integral multiple of the relationship.

$1/(\text{Filter depth} * \text{measurement time})$ .

### 5.2.7 DS3 – Scale Name

The name consists of a maximum of 10 characters and can be freely selected.

**5.2.8 DS3 – Minimum Weight for the Weighing Range**

The minimum weight is defined during adjustment. If the current weight is less than the minimum weight, a status bit is output.

**5.2.9 DS3 – Weighing Range**

The maximum weight is defined during adjustment. The “integer” number format limits the entry to a maximum of 32767.

The maximum weight depends on the number and type of load cells used.

**5.2.10 DS3 – Numeral Step**

The numeral step can be defined accordingly as 1, 2, 5, 10 or 20.

**5.2.11 DS3 – Standstill Time**

Standstill monitoring is used to identify when the scale is at a stable equilibrium. Scale standstill is determined if the weight value changes by less than a defined deviation range (standstill value) within a defined time (standstill time). Standstill monitoring is used in static operation of the scale (for the commands: Zero, Tare).

**5.2.12 DS3 – Standstill Range**

Standstill monitoring is used to identify when the scale is at a stable equilibrium. Scale standstill is determined if the weight value changes by less than a defined deviation range (standstill value) within a defined time (standstill time). Standstill monitoring is used in static operation of the scale (commands: Zero, Tare). The figure below illustrates the functioning of the standstill monitoring feature.

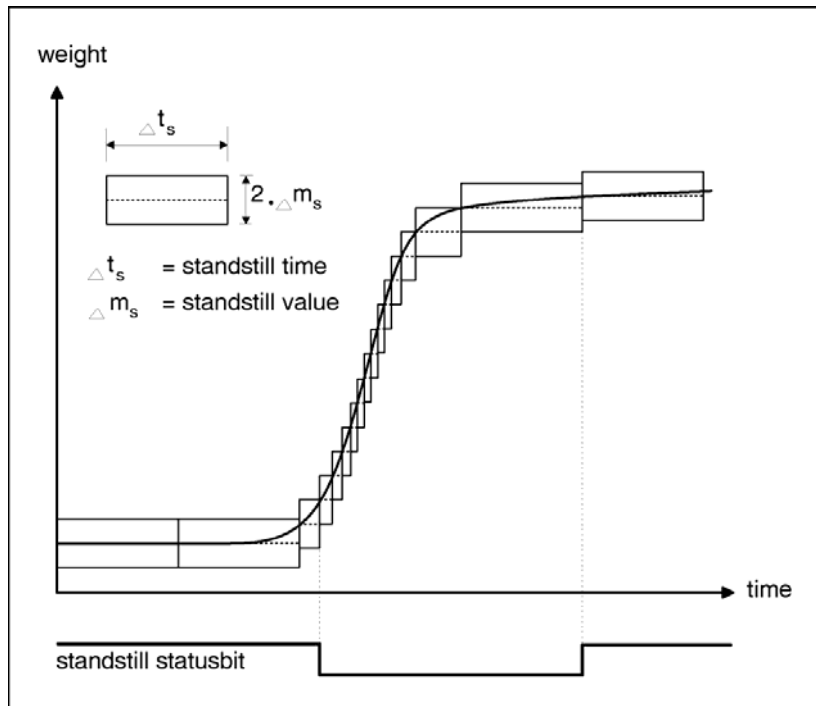


Figure 5-4 Standstill monitoring

### 5.2.13 DS3 – Decimal Place for Remote Display and ASCII Weight Output

A decimal place can be specified for the Siebert remote display connected and for ASCII weight output in DS30. As the decimal place cannot be shown in the 16 bit numerical representation, all weight entries are assumed to have this decimal place.

For example, if the decimal place is set to 2, the measuring range of 20 kg should be specified as 2000. In ASCII weight output in DS30, at nominal load the value of 20.00 kg is output. At the same time, the weight value of 2000 is output to the SIMATIC CPU as the process value.

### 5.2.14 DS3 – Maximum Negative Weight for Zero Setting

For zero setting, the current weight from the scale is defined as the zero weight.

For zero setting, this specification can be used to limit the effect of the function. The reference point for the effect of the limitation is not the current gross weight but the weight that the scale would display without the preceding zero settings (from time of scale adjustment).

### 5.2.15 DS3 – Maximum Positive Weight for Zero Setting

For zero setting, the specification can be used to limit the effect of the function.

The reference point for the effect of the limitation is not the current weight but the weight that the scale would display without the preceding zero settings (from time of scale adjustment).

### 5.2.16 DS3 – Tare Max. Weight T

The SIWAREX MS will accept any external tare specification, which is smaller than the max. tare weight (percentage of weighing range). The tare commands are also accepted as long as the current gross weight is still below the tare max. weight that can be parameterized.

The value is limited to 100% of the maximum weighing range.

### 5.2.17 DS3 – TTY Protocol Selection

Various remote displays can be connected to the TTY interface. There are two protocols available:

0 – Protocol for the display S102 by Siebert

1 – ASCII Protocol with the content STX - Weight value - ETX

### 5.2.18 DS3 – Reserve

The field is currently occupied with the fixed value “----”. Other definitions are not permitted.

### 5.2.19 DS3 – Unit of Measurement

Up to a 4 character string can be used as the unit of measurement e.g.: t, kg, lbs

The defined unit of measurement applies for all weight definitions. When the unit of measurement is changed, no conversion is performed.

### 5.3 DS 4 Limit Value Parameters

In DS4, the switch on and switch off values for the limit values are parameterized.

Procedures:

- Check all parameters and change if necessary.
- Send DS 4 to the scale

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning
Switch on value Limit value 1	SHORT (0-1)	2	400	Switch on point, limit value 1
Switch off value Limit value 1	SHORT (2-3)	2	220	Switch off point, limit value 1
Switch on value Limit value 2	SHORT (4-5)	2	1000	Switch on point, limit value 2
Switch off value Limit value 2	SHORT (6-7)	2	980	Switch off point, limit value 2
Limit value parameter flag	UBYTE (8)	1	0	<i>Bit 0 GW1 gross/net reference for GW1</i> 0 = limit value 1 works on gross weight 1 = limit value 1 works on net weight  <i>Bit 1 GW2 gross/net reference for GW2:</i> 0 = limit value 2 works on gross weight 1 = limit value 2 works on net weight  <i>Bit 2 to 7 not used</i>
Reserve 1	UBYTE (9)	1	0	Reserve 1

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Table 5-2 Allocation of DS 4

#### 5.3.1 DS 4 – Switch On Weight, Limit Value 1

Switch on and switch off weights can be defined separately for each limit value. In this way, a minimum value monitor and a maximum value monitor can be realized by hysteresis.

A maximum value monitor is realized with the following specification:

Switch on value > Switch off value

A minimum value monitor is realized with the following specification:

Switch on value < Switch off value

The figure below illustrates the function of limit values 1 and 2.

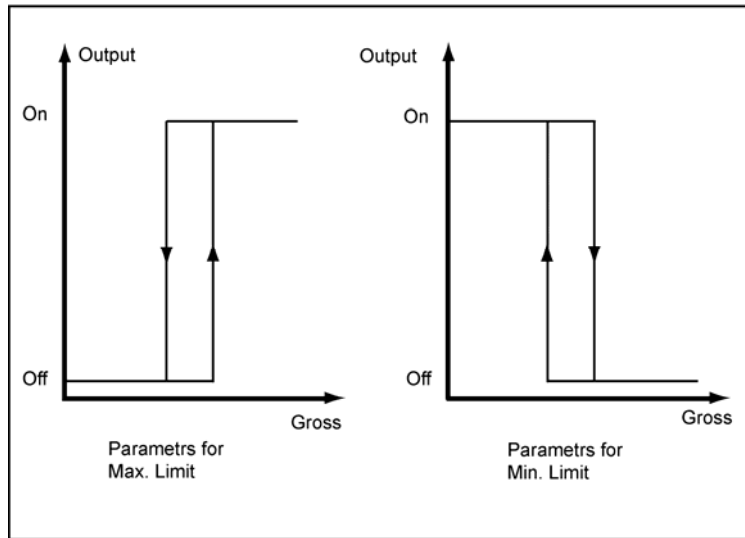


Figure 5-5 Parameter definition of limit values

**5.3.2 DS 2 – Switch-off weight, Limit value 1**

See: Switch On Weight, Limit Value 1

**5.3.3 DS 4 – Switch-on weight, Limit value 2**

See: Switch On Weight, Limit Value 1

**5.3.4 DS 4 – Switch-off weight, Limit value 2**

See: Switch On Weight, Limit Value 1

**5.3.5 DS 4 – Basis Weight for Limit Values**

The limit values can be defined in relation to the gross weight or the net weight of the scale.

## 5.4 DS 9 Info on Module

No entries can be made in DS9. The data record is used for information about the module's firmware version.

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning / Display
Module name	STRING[10] (0-11)	12	SIWAREX MS	Name of weighing module
MLFB (20 characters)	STRING[20] (12-33)	22	7MH4930- 0AA01	MLFB order number
Edition 1 HW	WORD (34-35)	2	1	HW version
Firmware version	STRING[4] (36-41)	6	V1.0	FW version
CRC checksum of package	WORD (42-43)	2	----	Depending on code
		44		

Table 5-3 Allocation of DS 9

The purpose of the information in data record 9 is to identify the module, the hardware and the firmware.

## 5.5 DS 15 Tare Entry

DS 15 is used for external specification of the tare weight.

Procedures:

- Enter tare weight
- Send DS 15 to the scale
- Activate the command "Accept tare entry (24)"

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning
Tare input value	INT (0-1)	2	0	Tare input value (preset Tare pT)
		2		

Table 5-4 Allocation of DS 15

### 5.5.1 DS 15 – Tare Entry

DS 15 is used for external specification of the tare weight. Once specified with DS 15, the tare value is not yet activated. The transfer to SIWAREX MS tare memory is then done using command "Accept tare entry" (see command code 24). The specified tare value is rounded to the numeral step set in the parameters. The rounded tare value is output in DS 30.

If the tare weight is defined through the controller then the transfer is not done through data record DS15, it is done through the variable range. See chapter 8.



## 5.6 DS 26 Internal Process Values

DS 26 is used to store the current internal process values. These values can be read, saved and written back to the SIWAREX MS. However, you may not change the values. Procedures:

- Read the values.
- Send the values to SIWAREX MS as required (after replacing modules)  
(*Not possible if the wire bridge is on terminal P-PR*).

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning
Checksum	WORD (0-1)	2	0	Checksum
	BYTE (2)	1	0	Reserved
Preset tare	BYTE (3)	1	0	1 = Tare memory contains ext. default value
Tare process value *100	DINT (4-7)	4	0	Tare weight * 100
Zero set value *100	DINT (8-11)	4	0	Zero set value * 100 (set during zero setting)
		12		

Table 5-5 Allocation of DS 26

## 5.7 DS 30 Process Values

The current states and data in the scale can be monitored using process values.

Name	Type (Byte assignment for S7-200)	Length	Default	Range of Values / Meaning
Checksum	WORD (0-1)	2	---	Checksum CRC16
Scale status	WORD (2-3)	2	---	Scale status For description see chapter 5.7.1
Operating error bits	BYTE (4)	1	---	Operating error bits For description see chapter 5.7.2
Reserved	BYTE (5)	1	0	Reserve 1
Gross process value	INT (6-7)	2	---	Gross weight For description see chapter 5.7.3
Net process value	INT (8-9)	2	---	Net weight For description see chapter 5.7.4
Tare process value	INT (10-11)	2	---	Tare weight For description see chapter 5.7.5
G/N weight	INT (12-13)	2	---	B/N weight value to display For description see chapter 5.7.6
G/N weight *10	DINT (14-17)	4	---	B/N weight value with 10x resolution (basis for ASCII weight value) For description see chapter 5.7.7
Tare weight	INT (18-19)	2	---	Tare weight value For description see chapter 5.7.8
Unfiltered raw value	WORD (20-21)	2	---	Unfiltered digital value from ADU For description see chapter 5.7.9

Filtered raw value	WORD (22-23)	2	---	Filtered digital value For description see chapter 5.7.10
Weight value ASCII	STRING[14] (24-39)	16	---	ASCII weight value (at an increased resolution for a short time after the command) For description see chapter 5.7.11
Millisecond	INT (40-41)	2	0	Runtime – Milliseconds (0...999) For description see chapter 5.7.12
Second	BYTE (42)	1	0	Runtime – Seconds (0...59)
Minute	BYTE (43)	1	0	Runtime – Minutes (0...59)
Hour	INT (44-45)	2	0	Runtime – Hours (0...32000)

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Table 5-6 Allocation of DS 30

**5.7.1 DS 30 – Scale Status**

The status information provides details of the current state of the scale.

Bit No.	Name	Range of Values / Meaning
0	Limit value 1	1 = Limit value 1 has responded
1	Limit value 2	1 = Limit value 2 has responded
2	Scale tared	1 = Tare memory occupied (≠ 0)
3	Preset tare	1 = Tare memory contains ext. default value
4	Max+9e	1 = Gross weighing range exceeded or undershot by more than 9 display steps
5	¼d zero	1 = Gross less than ± 0.25d (d corresponds to set numeral step)
6	Standstill	1 = Standstill exists
7	Module adjusted	1 = Module adjusted
8	Parameter definition blocked	1 = Write protect switch active; (No adjustment parameter DS3 or adjustment commands can be sent)
9	Min. weighing range undershot	1 = Min. weighing range undershot
10	--	--
11	--	--
12	--	--
13	--	--
14	Booting	The SIWAREX module is starting up
15	Module group fault	1 = Global module fault / operating error (SF)

Table 5-7 Status information

**5.7.2 DS 30 – Operating Errors**

The byte displays the current operating errors.

Bit No.	Name	Comment
0	1= Reboot due to RAM error	See message list Chapter 7.6
1	1= Restart because of a watchdog error or program fault	See message list Chapter 7.6
2	1= No 24 V module voltage (can only be read in SIMATIC-CPU, not with SIWATOOL MS)	See message list Chapter 7.6
3	1= Number overflow in weight calculation	See message list Chapter 7.6
4	1= Parameter error	See message list Chapter 7.6
5	1= AD converter at limit of measuring range	See message list Chapter 7.6
6	1= Minimum voltage undershot on sensor line	See message list Chapter 7.6
7	1= AD converter fault	See message list Chapter 7.6

Table 5-8 Operating error (Bit information)

**5.7.3 DS 30 – Gross Process Value**

The current gross weight value.

**5.7.4 DS 30 – Net Process Value**

The current net weight value.

**5.7.5 DS 30 – Tare Process Value**

The current tare weight value.

**5.7.6 DS 30 – G/N Weight**

The current weight value, which is shown in the scale's main display (external remote display, type Siebert S102 or ASCII).

**5.7.7 DS 30 – G/N Weight\_x10**

The current weight value with a higher resolution, which can be displayed temporarily in the main display (external remote display type Siebert S102 or ASCII) for a duration of 5 seconds.

**5.7.8 DS 30 – Tare**

The current tare weight, in the resolution specified in the numeral step (DS3).

**5.7.9 DS 30 – Unfiltered Raw Digit Value from AD Converter**

The current digit value from the AD converter without digital signal filtering.

**5.7.10 DS 30 – Filtered Digital Value from the AD Converter**

The current digit value from the AD converter after digital signal filtering (Low pass filter and average value filter).

The filter parameters are specified in DS3.

**5.7.11 DS 30 – ASCII Weight Value**

The current weight value with decimal point, as it is sent to the main scale display (external remote display type Siebert S102 or ASCII).

**5.7.12 DS 30 – Runtime Duration**

When the SIWAREX MS module is switched on, a timer is started to ensure correct assignment of the messages in the message buffer. When the messages are entered in the message buffer, they are given the current time value from this timer.

## 6 Commands

### 6.1 Command Groups

The SIWAREX commands are divided into groups. The combining of the commands into a group is done according to their functionalities.

Every command has a unique number. A command can be sent via various interfaces (SIMATIC-CPU, SIWATOOL MS).

Each time a command is sent to SIWAREX MS, a check must be made to determine whether the command has been executed properly or not. The data and operating errors (synchronous errors, see chapter 7.5) generated provide information on why the command could not be executed.

The **service and adjustment commands** group is used during scale commissioning. The **scale commands group** contains all commands relating to the handling of a static scale (e.g. zero setting, tare).

After receiving a command, SIWAREX MS checks whether the command can be executed. If the results of the check are negative, the user is informed of the cause with a “synchronous” message (see chapter 7.5).

### 6.2 Command List

Code	Command explanation	Comment
	<b>Service and adjustment commands</b>	
1	<b>Back up DS4 in Flash</b> Back up limit value parameters in Flash (DS4)	
2	<b>Back up DS26 in Flash</b> Back up tare and zero setting value in Flash (DS26)	
3	<b>Adjustment command zero point valid</b> Command zero point valid	Executable if no write protection (jumper P-PR)
4	<b>Adjustment command Adjustment weight 1 valid</b> The first adjustment point is determined by the adjustment weight.	Executable if no write protection (jumper P-PR)
5	<b>Adjustment command Adjustment weight 2 valid</b> The second adjustment point is determined by the second adjustment weight.	Executable if no write protection (jumper P-PR)
8	<b>Predefine all data records with default values</b> All parameters are set to the status that was assigned originally by the manufacturer.	Executable if no write protection (jumper P-PR)

<b>Code</b>	<b>Command explanation</b>	<b>Comment</b>
15	<p><b>Characteristic curve shift</b></p> <p>The characteristic curve of the scale, determined by the scale adjustment, is shifted temporarily so that the current scale load corresponds with the zero point (zero weight).</p>	Executable if no write protection (jumper P-PR)
	<b>Scale commands</b>	
21	<p><b>Scale zero setting</b></p> <p>The current weight is set to zero. The tare weight is deleted at the same time.</p>	
22	<p><b>Tare</b></p> <p>The current weight is set to zero and the weight display is simultaneously designated as “Net”.</p>	
23	<p><b>Delete tare</b></p> <p>The tare weight is deleted. The current weight is displayed and the designation is changed from “Net” to “Gross”, the “Net” designation and, if necessary, the “Preset tare” status are reset.</p>	
24	<p><b>Accept tare entry from DS 15</b></p> <p>The defined tare weight is accepted as tare and the weight display is simultaneously designated as “Net” and the “Preset tare pT” status is set.</p>	
25	<p><b>Switch on increased resolution</b></p> <p>Activate output / display of weight value with increased resolution for 5 seconds.</p>	
26	<p><b>Transfer tare weight from S7 control range</b></p> <p>Tare specification from S7 control range valid. The weight display is simultaneously designated as “Net” and the status “Preset tare pT” is set.</p>	
	<b>Read/write data records</b>	
254	<p><b>Read data record</b></p> <p>This command allows you to read a data record in part or in full. The command code can only be set via the “MicroScale_additional” library.</p>	
255	<p><b>Write data record</b></p> <p>This command allows you to write a data record in part or in full. The command code can only be set via the “MicroScale_additional” library.</p>	

Table 6-1 SIWAREX MS command list

More information on command transfers from the control program via the SIMATIC interface can be found in chapter 8 *Programming in STEP 7*.

## 7 Messages and Diagnosis

### 7.1 Message Types

The SIWAREX MS messages are divided into several types.

The **asynchronous** messages (see chapter 7.6) can be generated spontaneously at any time due to an unexpected event. These include internal and external hardware faults (operating messages) that can occur spontaneously during a weighing procedure.

The **synchronous** messages (see chapter 7.5) always originate as a response to a command.

There are data errors if a plausibility error is determined in a data package that has been sent to the module and the module rejects that data package. These are operating errors if the module group in the current operating status cannot execute the given command.

**The status bit** (see chapter 5.7.1) are not messages however. The status displays describe the status of the scale in normal operation and can be monitored or evaluated at any time.

### 7.2 Message Paths

The SIWAREX MS messages are passed on to the operator by various paths. During configuration, it is important to choose the right path for routing and processing the messages.

Essentially, the messages are processed for two purposes:

- For display on an operating panel
- For connection to control software to control certain reactions in a process.

The following message paths are possible:

- Output message buffer to the SIWATOOL MS program
- Output to the SIMATIC CPU with the help of the MicroScale library

### **7.3 Detection of Messages Using SIWATOOL MS**

A message buffer is integrated into the module and can hold up to 99 entries. If the number of messages in the message buffer reaches 99 then a new message will immediately delete the oldest message. The message buffer can be read using SIWATOOL MS (menu option "Read all data records") and can be saved along with the scale parameters. This assists in detecting, analyzing and resolving problems in the system. After switching the power supply for the SIMATIC CPU off, the contents of the message buffer are lost.

### **7.4 Detection of Messages Using the MicroScale Library**

All of the messages of the SIWAREX expansion module can be detected and processed in the controller with the MicroScale library.

Errors can be detected in library work with an output variable Lib\_error\_bits.

The operating errors and operation and data errors are indicated in the parameter defined variable memory (see chapter 8 *Programming in STEP 7*.)



## 7.5 Message List Data and Operating Errors (Synchronous Messages)

<b>Error No.</b>	<b>Data and operating errors - Meaning</b>	<b>Description</b>
1	Unknown command code	The SIWAREX does not recognize the command code or the data record or is unable to process the command or data record in the current operating status.
2	Unknown data record	The specified data record does not exist.
4	Reserved	
5	Parameter transfer, transfer of int. process values and adjustment commands not permitted with active write protection	The adjustment parameters (DS3), the int. process values (DS26) and the adjustment commands may only be transferred if write protection is inactive (jumper inserted between connecting terminals 1-5). First deactivate the write protection.
7	Command can only be executed at standstill	The command can only be executed when the scale is at a standstill. Wait until it is at a standstill or change the standstill parameters in DS3.
8	Minimum time span between two commands not observed	There must be a waiting time of at least 5 seconds between two successive commands. This applies to the command codes 1, 2, 3, 4, 5, 8.
20	Command only permissible with adjusted scale	Scale commands can only be executed if the module has been calibrated. First calibrate the module.
21	Module failure	Command is not permissible due to a module failure.
77	Reserve in DS3 – Content not permitted.	Enter “----”.
78	Reserved	Reserved
80	Incorrect standstill range	The specified standstill range is not plausible.
81	Incorrect decimal place	The defined decimal point is not plausible for the remote display. 0.....5 is permitted.
82	Numeral step not plausible	Numeral step is incorrect in DS 3. The following values are possible as the numeral step: 20, 10, 5, 2, 1.
83	Filter parameter implausible	The filter parameter definition is not plausible in DS 3. Check the limit frequency (selection 0...9).
84	Characteristic value not plausible	The characteristic value in DS3 is incorrect. Set the parameter to a valid value (1, 2 or 4).
85	Adjustment weight implausible	At least one weight setting for scale adjustment is not plausible.
86	Adjustment weight error	The defined adjustment weights are incorrect. The weight values must be in ascending order or 0 if not used.
87	Defined percentage incorrect	A percentage definition is incorrect. A definition exceeding 100% is not permitted for defining the zero set value or the maximum tare value.
88	Negative value not permitted	A parameter contains a negative value that is not permitted.
89	Selection code not permitted for the TTY interface	The selection code for the TTY interface is not permitted. Set a valid value (0 or 1).

<b>Error No.</b>	<b>Data and operating errors - Meaning</b>	<b>Description</b>
94	Adjustment weight too low	The adjustment weight is too low in DS 3. Increase the adjustment weight interval. The measured values between successive adjustment weights must have an interval of at least 5% of the measuring range.
96	Tare T- invalid	The subtractive tare weight has been exceeded. This error is generated in the following cases: <ul style="list-style-type: none"> <li>▪ The gross value lies above the defined permitted tare range for the taring command.</li> <li>▪ An externally specified tare value is negative.</li> </ul>
100	Weight outside zero definition range	Zero definition cannot be executed since the current zero point lies outside the zero definition range defined in DS 3 or the current gross value lies above the highest defined weighing range value.
171	Checksum error	Checksum error in data record 26. The data was falsified or the DS versions do not match.
172	Error saving data record	An error occurred while saving the data record to the Flash memory.
173	Data record transfer error	An error occurred while transferring the data record. The data record was not transferred.
200	Read command error	Read command was executed during inactive read mode (i.e. VB n+10 ≠ 7).
201	Write command error	The “Transfer data” command was not preceded by a “Write data” command.
202	Read/write command error	Incorrect byte, offset or DS No. specification
203	Write command error	Data record number was changed between two write operations (first data record described not yet saved).
220	Error in calibration function	Error occurred in calibration function.

Table 7-1 List of data and operating errors

## 7.6 Message List of Operating Messages (Asynchronous Errors)

If an error generates an operating message, the red SF LED on the front of the module is illuminated. The incoming and outgoing operating messages are signaled in the diagnostic buffer.

Error No.	Operating messages - Meaning	Description
1	Reboot due to error in RAM read-write testing	The error can mean that the module is defective.
2	Reboot due to watchdog error	The module had to be reset because of a critical error.
3	Reboot due to program error	The error can mean that the module is defective. Contact the SIWAREX Hotline.
4	Reserved	Reserved
5	Parameter error	The parameters are not consistent (the checksum is incorrect). Re-transfer all data records.
7	Number overflow	A number overflow occurred in the weight calculation.
17	Limit for load cell signal exceeded or undershot	The measurement is too high. Measure the measurement voltage with a multimeter and check the load cells. Check the set characteristic value in DS3.
18	Wire break	The connection to the load cells has been broken. Check the load cell connection.
19	ADC error	The AD converter had to be restarted due to a fault.
20	Reboot after voltage recovery	Information about completed reboot only.
21	Reboot after firmware error	Information about completed reboot only.
22	No 24 V power supply	There is no 24 V supply voltage to the module.

Table 7-2 List of operating messages

The operating messages are output to the SIMATIC interface as a byte. The meaning of individual bits is summarized in the table below.

Bit	Range of Values / Meaning
0	1= Reboot due to RAM error
1	1= Restart because of a watchdog error or program fault
2	1= No 24 V power supply
3	1= Number overflow in weight calculation
4	1= Parameter error
5	1= AD converter at limit of measuring range
6	1= Minimum voltage undershot on sensor line
7	1= AD converter fault

Table 7-3 Message byte for operating messages

## 7.7 Messages via LEDs

The LEDs on the front of the SIWAREX MS are used to signal the following status and error messages.




Label	LED color	LED	Description	State display during operation
SF	Red	LED 1	System Fault Hardware fault	OFF: No operating error ON: Operating error
	Green	LED 2	RUN	OFF: Fatal error / defect ON: Module flashes in cycle: S7-CPU is stopped or the SBR SiwaMS subroutine is not called cyclically
NET	Green	LED 3	Net	OFF: Scale not tared (gross weight is output) ON: Scaled tared (net weight is output)
	Green	LED 4	Standstill	OFF: No standstill ON: Standstill
	Orange	LED 5	Parameter protection activated	OFF: Parameter protection not activated ON: Parameter protection activated
→ 0 ←	Green	LED 6	¼ d zero	OFF: Weight is outside of ¼ d zero range ON: Weight is within ¼ d zero range
MAX	Red	LED 7	Max. exceeded	OFF: G/N weight within the permitted weighing range ON: Weighing range exceeded by more than 9 numeral steps
+ 24 VDC	Green	LED 8	24 V connected	OFF: No 24 V supply ON: 24 V supply OK

Table 7-4 List of LED messages

## 8 Programming in STEP 7-Micro/Win

### 8.1 General

At least STEP 7 Micro/Win Version 4.0 SP6 is required for programming. SIWAREX MS was developed specifically for operation with the SIMATIC S7-200. The hardware setup is described in chapter 4 Hardware configuration. SIWAREX MS is used similar to an analog expansion module. A MicroScale library is delivered with the configuration package, which is required for operating the SIWAREX MS. A complete project – “Getting Started” is also available. Creating application software is described in the “Getting Started”, which is also used in Micro Set 6. We recommend using the program and expanding it for different applications.

### 8.2 Presetting the System Data Module

The system data module must be adapted during the configuration of the expansion module SIWAREX MS. The intended analog input range (AEW) is not to be filtered for the SIWAREX MS!

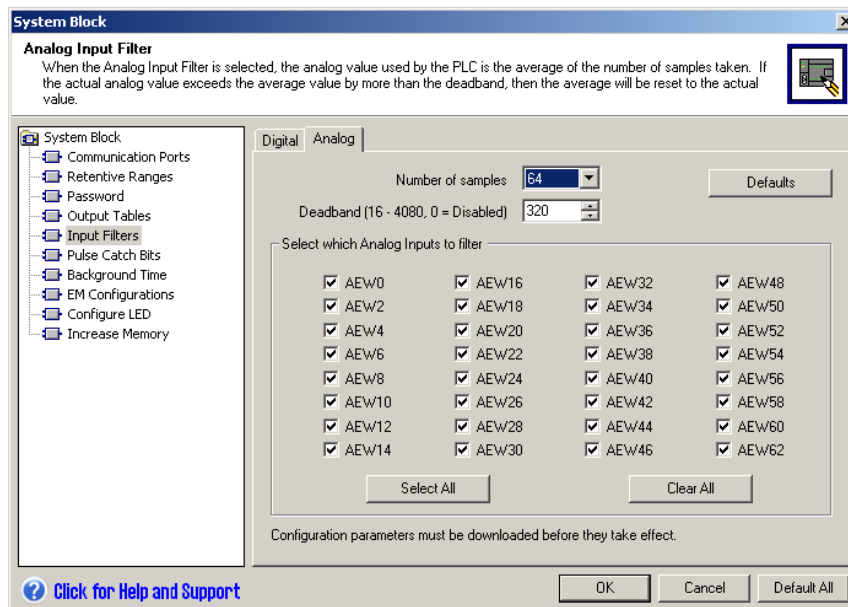


Figure 8-1 System data module before the adjustment

The filter is deactivated after the adjustment.

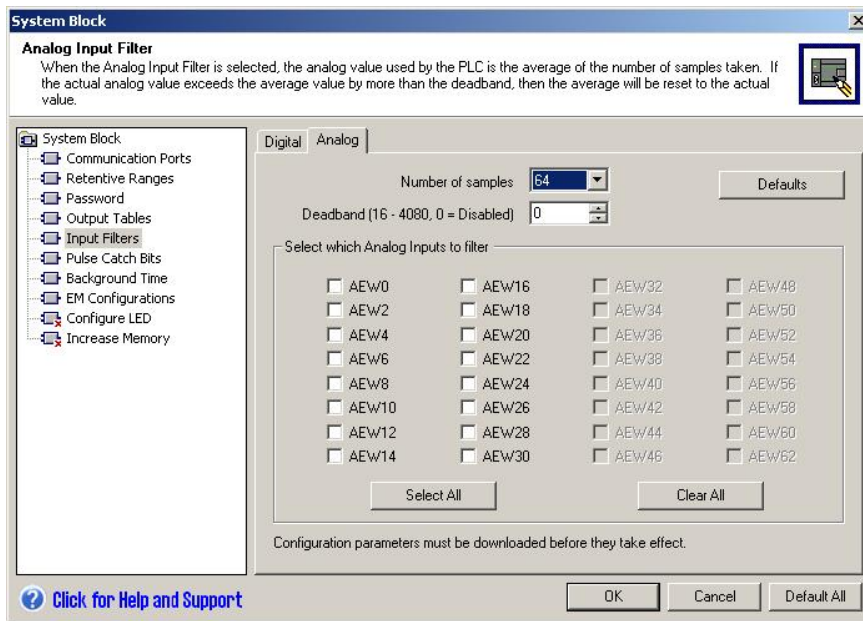


Figure 8-2 System data module after the adjustment (for 4 SIWAREX MS module)

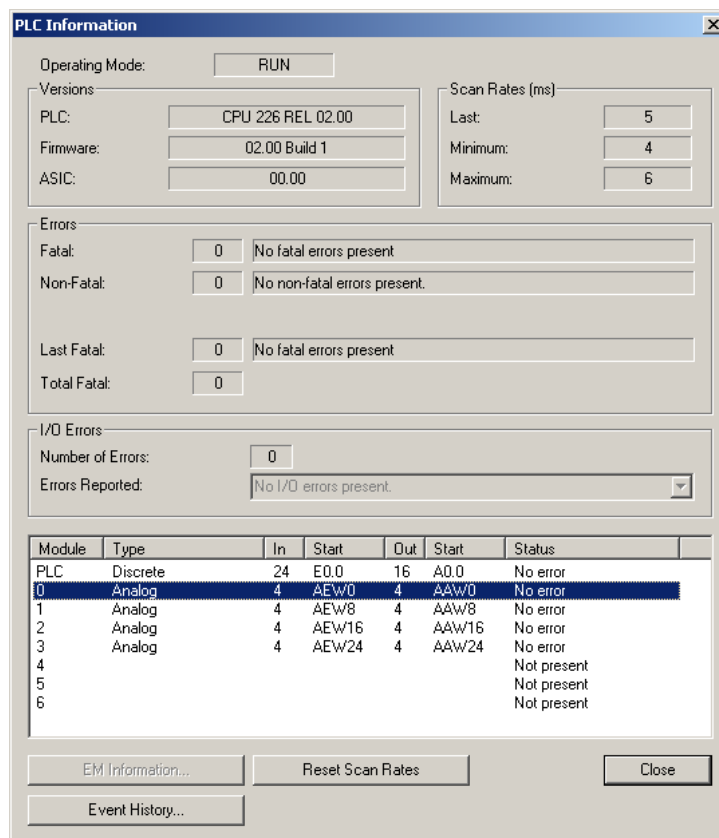


Figure 8-3 Module addresses

### 8.3 Using the “MicroScale” and “MicroScale\_additional” Libraries in Micro/Win

The two libraries “MicroScale” and “MicroScale\_additional” are included in Micro/Win as described below.

First, the two libraries must be copied from the configuration CD (Folder: “SIWAREX\_MS\_Library”) to the local hard disk, e.g. to “C:\Program Files\Siemens\STEP 7-MicroWIN V4.0\Lib”.

Both libraries can then be included in Micro/WIN.

The menu option in Micro/WIN: “File / Add/Remove Libraries...” activates the “Add” button, and allows you to select one of the libraries:

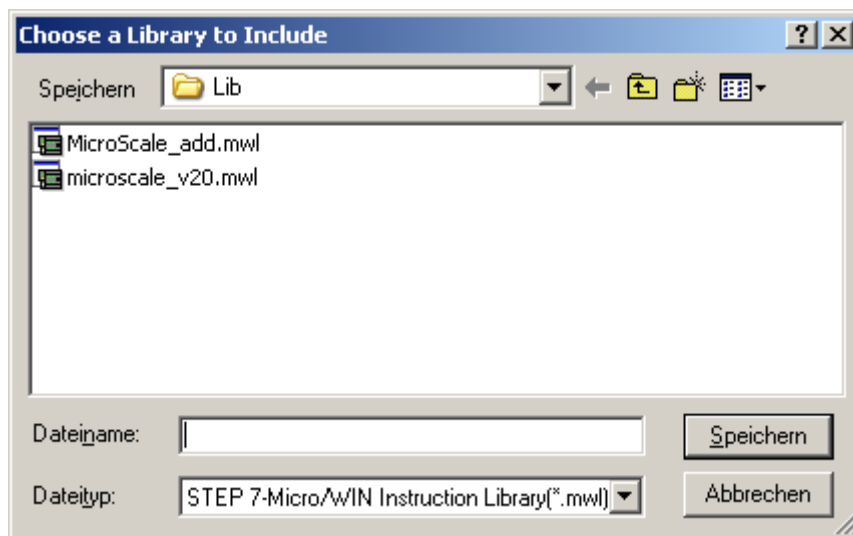


Figure 8-4 Linking the libraries into Micro/Win

After saving, the library appears in the operation tree.

The other library is then included in Micro/WIN in the same way as the first library.

If both libraries were successfully included in Micro/WIN, the libraries appear in the operation tree:

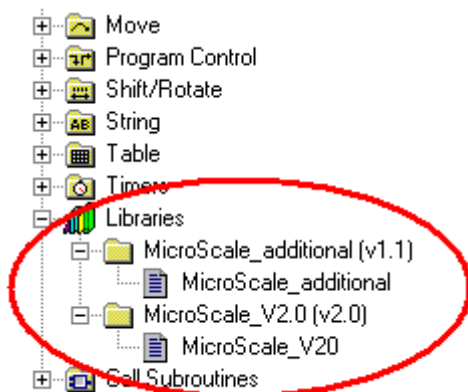


Figure 8-5 Libraries bound into Micro/Win

### 8.4 SIWAREX MS in Cyclic Program

The SIWAREX MS module communicates with the SIMATIC CPU using the “MicroScale” library.

The “MicroScale\_additional” library is used to execute commands such as tare or read/write data records.

Both libraries are found on the CD of the configuration package SIWAREX MS for SIMATIC S7-200 in the “SIWAREX\_MS\_Library” directory.

In the user program, the libraries “MicroScale” and “MicroScale\_additional” are called once for each scale cyclically in a program level (e.g. in OB1) and assigned call parameters.

Calling the libraries “MicroScale” and “MicroScale\_additional” for a scale in the program:

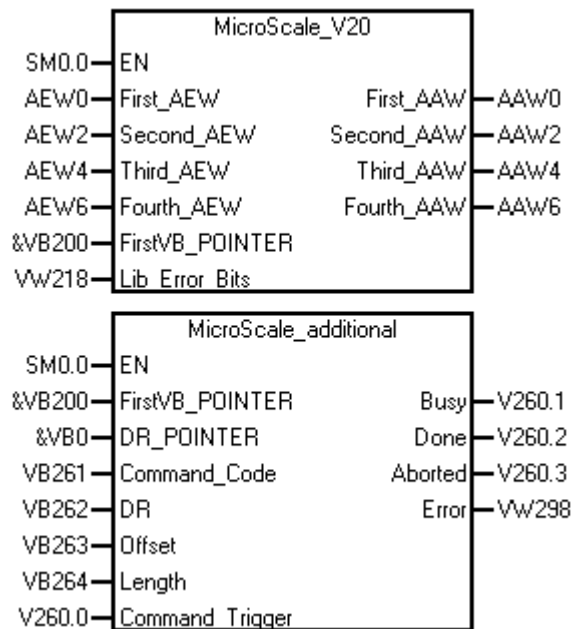


Figure 8-6 Call parameters of the libraries MicroScale and MicroScale\_additional for one scale



Calling the MicroScale and Microscale\_additional libraries for two scales in the program:

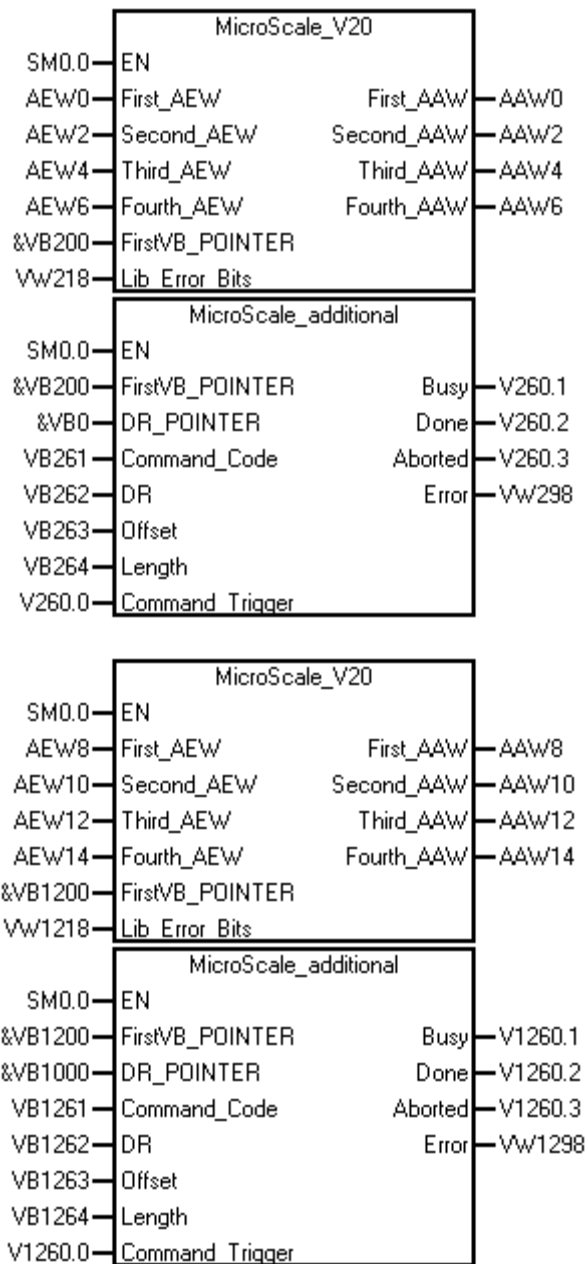


Figure 8-7 Call parameter of the libraries MicroScale and Microscale\_additional for two scales

## 8.5 Call Parameter of the MicroScale Library

The call parameters for the MicroScale library are described in the following section. The variable memory is used for communication with the SIWAREX module (e.g. Data storage, commands, etc.).

### 8.5.1 First\_AEW, Second\_AEW, Third\_AEW, Fourth\_AEW: IN, WORD

SIWAREX MS requires 4 words in the input area of the SIMATIC CPU for operation. The parameters First\_AEW, Second\_AEW, Third\_AEW and Fourth\_AEW must match with the actual module addresses.

### 8.5.2 FirstVB\_POINTER: IN, DWORD

A range in the variable memory having a length of 26 bytes is used for communication with the SIWAREX Module for every scale. The start byte of this range is transferred with the parameter "FirstVB\_POINTER" of the library in Pointer-Format, e.g. for variable byte VB200: "&VB200".

The structure of the variable memory is explained in the following chapter "Variable memory allocation".

### 8.5.3 Lib\_Error\_Bits: IN\_OUT, WORD

If an error occurs while processing in the library, it is indicated by this word.



Warning

If a processing error occurs for the MicroScale library, it must be assumed that the variables that have been output do not correspond with the actual status in the module.

Bit0...7:	Reserved
Bit8:	Error in Parameter "FirstVB_POINTER"
Bit9:	Lifebit-Error Siwarex MS
Bit10:	Error in Parameter "Select_Process_Value" (value: 0...6)
Bit11:	Command aborted because of reboot
Bit12...15:	Reserved

### 8.5.4 First\_AAW, Second\_AAW, Third\_AAW, Fourth\_AAW: OUT, WORD

SIWAREX MS requires 4 words in the output area of the SIMATIC CPU for operation. The parameters First\_AAW, Second\_AAW, Third\_AAW and Fourth\_AAW must match with the actual module addresses.

## 8.6 Variable Memory Allocation of the Microscale library

The following describes the variable memory allocation for the library MicroScale.

Variable memory-Byte	Name	Type	Default	Comment
VB n	Actual_Process_Value	BYTE	B#16#0	Display, which process value is currently output to position VW n+2. 0: Gross/Net weight 1: Tare weight 2: Gross process value 3: Net process value 4: Tare process value 5: Filtered raw value 6: Unfiltered raw value 7: Read mode <b>ATTENTION:</b> IF YOU SELECT READ MODE, THE DISPLAYED PROCESS VALUE IS INVALID!!! To use the process value, the number must correspond with the definition in position VB n+10. The value that is output to position VW n+2 only corresponds with the desired selection in position VB n+10 if the number matches.
VB n+1	Reserved	INT	0	Reserved
VW n+2	Process_Value	WORD	W#16#0	Current process value
VB n+4	Bit_Messages	BYTE	B#16#0	Information on command processing: Bit0: Command is processed Bit1: Command processed with no error (TRUE for 1 cycle) Bit2: During command processing, an error has occurred (=synchronous error) (TRUE for 1 cycle) Bit3: Read/write mode supported by Siwax MS firmware Bit4: The displayed process value is invalid! This is because read mode was selected. Bit5...7: Reserve
VB n+5	Synchronous_Error_Code	BYTE	B#16#0	Synchronous error messages Number of the message if bit 2 was set in variable VB n+4 for one cycle. Allocation see chapter 7.5
VB n+6	Asynchronous_Error_Bits	BYTE	B#16#0	Asynchronous error messages Operating error bits. Allocation see chapter 7.6
VB n+7	Refresh_Counter	BYTE	B#16#0	Refresh counter Number of the measurement cycle in the SIWAREX module, which originates from the current process value.
VW n+8	Scale_Status_Bits	WORD	0	Scale status Status bits see chapter 5.7.1
VB n+10	Select_Process_Value	BYTE	B#16#0	Current process value selection for the display in position VW n+2: (see also VB n: "Actual Process Value")
VB n+11	Command_Code	BYTE	B#16#0	Command code Number of the command that is to be triggered next. Always enter the number of the command first and then trigger the command (VB n+12, Bit 0).
VB n+12	Bit_Commands	BYTE	B#16#0	Bit commands: Bit 0: Command trigger: Bit is set by the edge, the library sets the bit back again automatically. Bit 1...7: Reserved
	Reserved	INT	0	Reserved
VW n+14	Preset_Tare_Value	INT	0	Preset tare weight This variable is used for defining a "preset" tare weight.
VW n+16	Lifebit_Counter	WORD	W#16#0	Internal counter to lifebit check (Only to be used for library MicroScale)

VW n+18	Lib_Error_Bits	WORD	W#16#0	Error during library processing (=Library parameter "SBR_Error_Bits") Bit0...7: Reserve Bit8: Error in parameter "FirstVB_POINTER". Too much memory space was transferred for the CPU type. Bit9: Lifebit error Siwarex Bit10: Error in parameter "select processvalue" (permitted values: 0...7) VB n+10 Bit11: Command could not be processed because the SIWAREX MS was restarted Bit12...15: Reserve
VB n+20	RW_Mode_DR_No	BYTE	B#16#0	Data record number for read/write mode
VB n+21	RW_Mode_Byteoffset	BYTE	B#16#0	Byte offset for read/write mode
VW n+22	RW_Mode_Write_Data	WORD	W#16#0	Parameter value for write mode
VW n+24	RW_Mode_Read_Data	WORD	W#16#0	Parameter value for read mode

n = Start byte in variable memory of MicroScale Library, see library parameter "FirstVB\_POINTER"

Table 8-1 Variable memory allocation of Library Microscale

## 8.7 Call Parameter of the MicroScale\_additional Library

The call parameters of the MicroScale\_additional library are described in the following section. The variable memory is used when communicating with the SIWAREX module (e.g. data storage, commands etc.).

### 8.7.1 FirstVB\_POINTER: IN, DWORD

This parameter must be configured with the same pointer address as for the "MicroScale" library. For example, if the pointer address is "&VB0" in the "MicroScale" library for the parameter "FirstVB\_POINTER", the pointer address for the parameter "FirstVB\_POINTER" in the "MicroScale\_additional" library must also be "&VB0".

It is only possible for both libraries to communicate with each other if the two pointer addresses are the same.

### 8.7.2 DR\_POINTER: IN, DWORD

The "MicroScale\_additional" library uses a range with a length of 186 bytes for each scale in the variable memory. The initial byte of this range is transferred to the library with the parameter "DR\_POINTER" in the pointer format, for example, for the variable byte VB0: "&VB0".

The structure of the variable memory is explained in the "Variable Memory Allocation" chapter that follows.

### 8.7.3 Command\_Code: IN, BYTE

The user controls all commands via this input variable, for example to transfer a data record or execute a weighing task (e.g. tare). The commands are explained in chapter 6.2 "Command List". The user prepares the command number using this variable and triggers the command using the "Command\_Trigger" variable. The library does not delete the command number, but resets the trigger variable "Command\_Trigger" after execution of the command.

**8.7.4 DR: IN, BYTE**

This variable determines which data record should be read or written.  
Possible data record numbers are: 3, 4, 9, 15, 26 and 30.

**8.7.5 Offset: IN, BYTE**

This variable specifies the offset for the first parameter of the data record (call parameter "DR") and the parameter (record) that is supposed to be written or read.

In combination with the DR26 for the call parameter "DR", this call parameter "Offset" has no function. The complete DR26 is always read (CRC Check).

**8.7.6 Length: IN, BYTE**

This variable specifies the byte length to be read or written after the "Offset" call parameter. If the value is "0", the complete data record is read or written after the offset.

In combination with the DR26 for the call parameter "DR", this call parameter "Length" has no function. The complete DR26 is always read (CRC Check).

**8.7.7 Command\_Trigger: INOUT, BOOL**

After the entry of the command number in the variable "Command\_Code", the execution of the command is triggered with this bit. To prevent the command from being triggered more than once, the bit must be created once as an edge. After execution of the command, the library resets the trigger variable "Command\_Trigger".

**8.7.8 Busy: OUT, BOOL**

This bit is set immediately after the "Command\_Trigger" bit is set. This is reset as soon as the command has been processed.

**8.7.9 Done: OUT, BOOL**

If the last triggered command was processed without errors, the "Done" bit is set.

**8.7.10 Aborted: OUT, BOOL**

If the last triggered command terminated with an error, the "Aborted" bit is set. The cause of the error can be analyzed using the call parameter "Error".

### 8.7.11 Error: OUT, WORD

If the last triggered command terminated with an error, the cause of the error can be analyzed using the call parameter "Error". The following error messages may occur:

- 0 = Error analysis via "Synchronous\_Error\_Code" of the "MicroScale" library (=VB n+5). See also chapter 7.5 "Message List Data and Operating Errors (Synchronous Messages)"
- 1 = Read/write commands are not supported by Siwarex MS Firmware.
- 2 = Unknown data record number was specified (only 3, 4, 9, 15, 26 and 30 are permitted)
- 3 = Error in parameter information for "Offset" or "Length".
- 4 = An attempt was made to write data record 9, 26 or 30

## 8.8 Variable Memory Allocation of the MicroScale\_additional Library

The following section explains the variable memory allocation of the "MicroScale\_additional" library.

Variable memory, bytes	Name	Length in bytes	Comment
VB m	DR03	56	Data record 3 has a length of 56 bytes
VB m+56	DR04	10	Data record 4 has a length of 10 bytes
VB m+66	DR09	44	Data record 9 has a length of 44 bytes
VB m+110	DR15	2	Data record 15 has a length of 2 bytes
VB m+112	DR26	12	Data record 26 has a length of 12 bytes
VB m+124	DR30	46	Data record 30 has a length of 46 bytes
VB m+170	MS_add	16	Only for internal use for MicroScale_additional library

m = Initial byte in the variable memory of the "MicroScale\_additional" library; see the library parameter "DR\_POINTER"

Tabelle 8-2 Variable Memory Allocation of "MicroScale\_additional" Library

### 8.9 S7-200 Program Examples

The following section explains how to carry out the command “tare” and read/write the adjustment weight from/to the Siwarex MS module.

Note that during configuration, the parameter “FirstVB\_POINTER” for the two libraries must be the same:

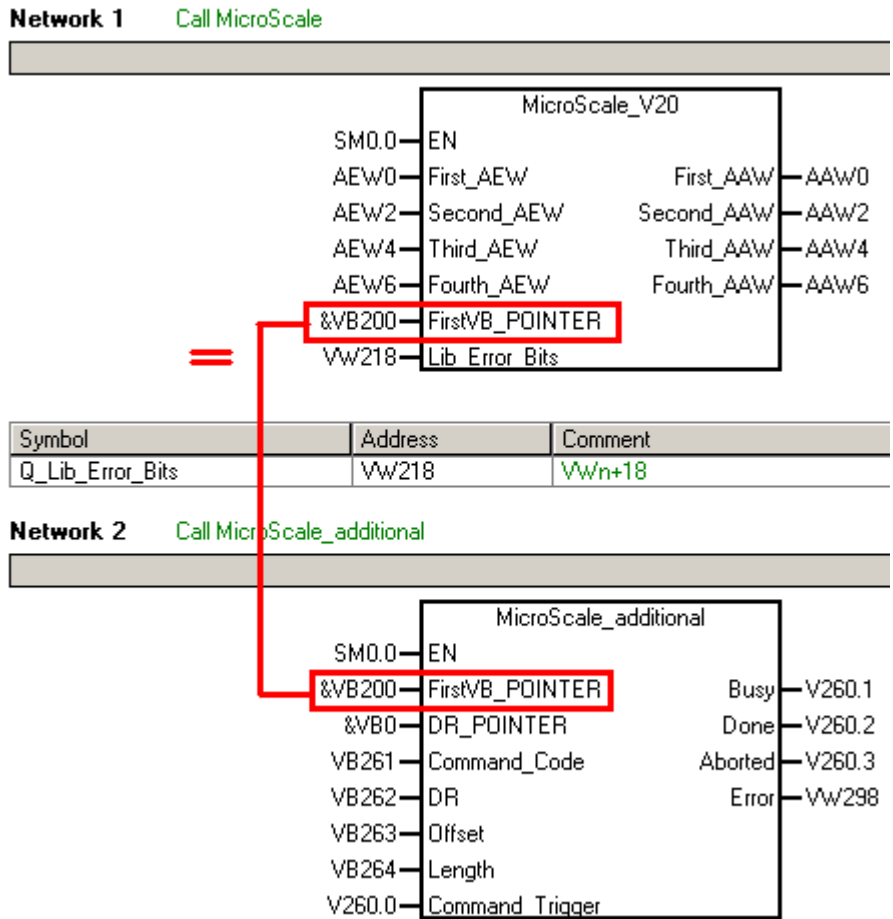


Figure 8-8    Parameter “FirstVB\_POINTER”

### 8.9.1 Process for Executing the Command “Tare” using the S7-200 Program

The command “Tare” corresponds to the command code “22” (see also chapter 6.2 “Command List”). This command code must be entered for the parameter “Command\_Code”, and executed with a one-time positive edge for the parameter “Command\_Trigger”:

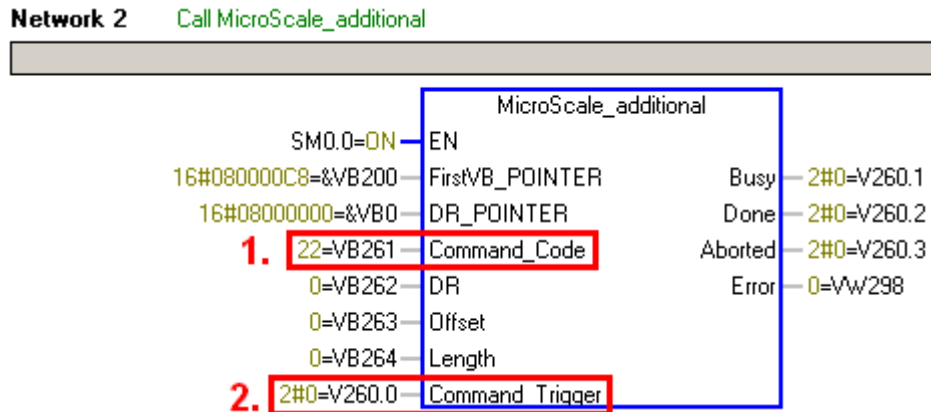


Figure 8-9 Command execution

After the command has been successfully processed, the “Done” bit is set to TRUE:

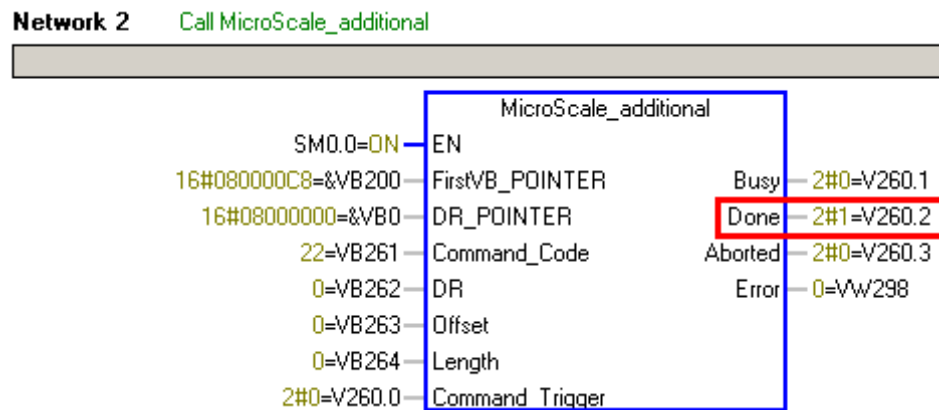


Figure 8-10 Command execution without errors



If an error occurred when the command was being processed, the bit “Aborted” is set to TRUE:

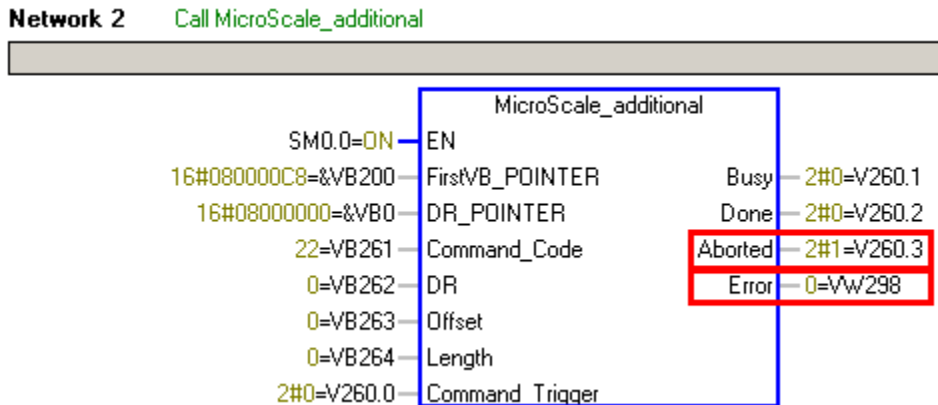


Figure 8-11 Command execution with error

The parameter “Error” is analyzed first to determine the cause of the error. If the status of this parameter is 0 (see Figure above), the “Synchronous\_Error\_Code” of the “MicroScale” library (=VB n+5) must be analyzed:

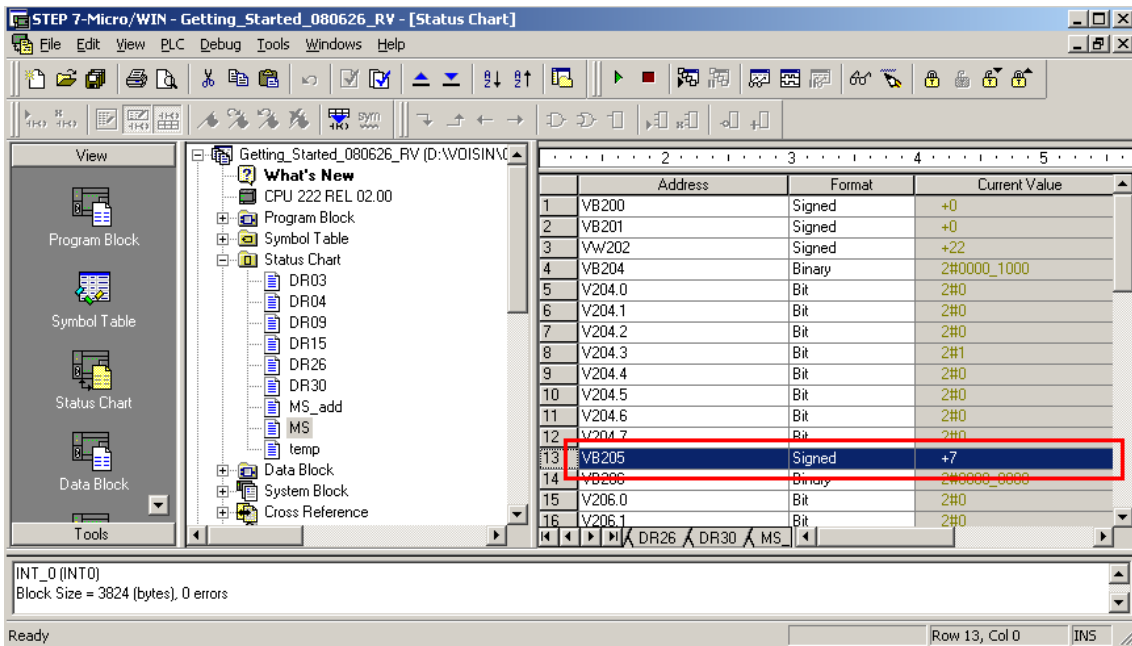


Figure 8-12 Message of the synchronous error

The example shows “Synchronous\_Error\_Code” number 7. This means that there was no scales-standstill during the tare process. This list of synchronous errors is explained in the chapter 7.5 “Message List Data and Operating Errors (Synchronous Messages)”.

**A new command may only be triggered once the “Done” or “Aborted” bit has been displayed after a command has been processed.**

### 8.9.2 Process for Reading and Writing the Adjustment Weight from/to the Siwax MS Module via the S7-200 Program

The adjustment weight is found in data record 3, has a byte offset of 6 bytes, and a length of 2 bytes 2 (=Format INTEGER). This information can be found in the table in chapter 5.2 “Adjustment Parameter”.

Command code “254” is used to read data from a data record (in part or in full) — see the table in chapter 6.2 “Command List”.

This returns the following parameter definitions for the “MicroScale\_additional” library:

- Command\_Code = 254
- DR = 3
- Offset = 6
- Length = 2

After defining the parameters, the read command for the “Command\_Trigger” parameter can be executed with a one-off positive edge.

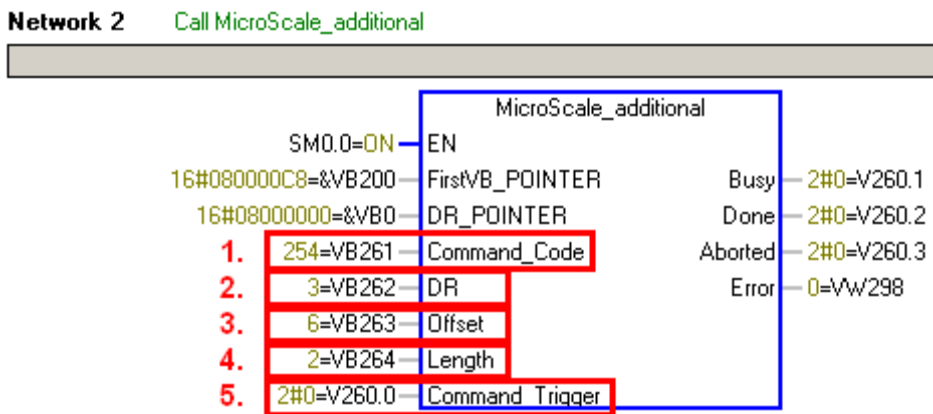


Figure 8-13 Reading the adjustment weight from the DS3

#### **ATTENTION:**

**If read command is executed, only one frozen process value VW(n+2) is displayed during this period! The bit V(n+4).4 is also set as a reference. See chapter 8.6 “Variable Memory Allocation of the MicroScale Library”**

After the read command has been executed, the parameters “Done” and “Aborted” must be monitored to see if the command is executed correctly:

If the “Done” parameter has the status TRUE, the adjustment weight was read correctly.

If the “Aborted” parameter has the status TRUE, the adjustment weight was not read correctly, and the “Error” parameter must be used for error analysis. The “Error” parameter is explained in chapter 8.7.11.

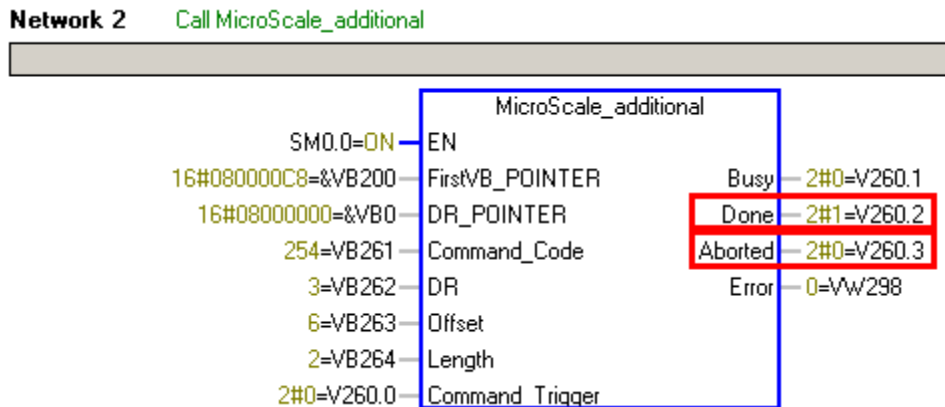


Figure 8-14 Checking the command processing

**A new command may only be triggered once the “Done” or “Aborted” bit has been displayed after the command has been processed.**

The library occupies a total of 186 bytes in the variable memory. The initial byte is visible in the “DR\_POINTER” parameter — in this example “&VB0”, i.e. VB0. Data record 3 in this range occupies the first 56 bytes (see also chapter 8.8 “Variable Memory Allocation of the MicroScale\_additional Library”). Since the adjustment weight has a byte offset of 6 bytes, the read adjustment weight is stored at the address VW6.

This adjustment weight can now be changed at the address VW6.

The changed adjustment weight is then sent to the Siwarex MS module.

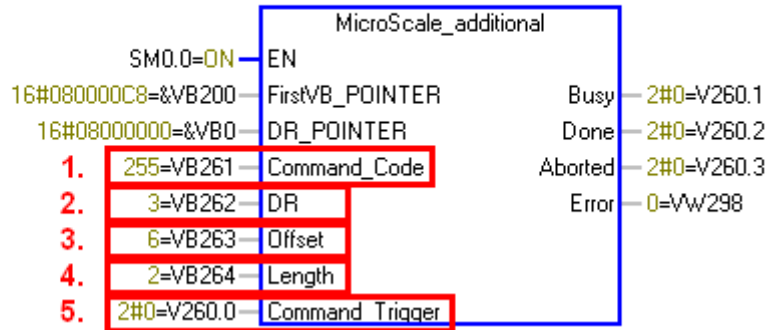
The command code “255” (write data record (in part or in full)) is used; see the table in chapter 6.2 “Command List”.

This returns the following parameter definitions for the “MicroScale\_additional” library:

- Command\_Code = 255
- DR = 3
- Offset = 6
- Length = 2

After defining the parameters, the write command for the “Command\_Trigger” parameter can be executed with a one-off positive edge.

**Network 2** Call MicroScale\_additional



After the write command has been executed, the parameters “Done” and “Aborted” must be monitored again to see if the command is executed correctly:

If the “Done” parameter has the status TRUE, the adjustment weight was written correctly.

If the “Aborted” parameter has the status TRUE, the adjustment weight was not written correctly, and the “Error” parameter must be used for error analysis. The “Error” parameter is explained in chapter 8.7.11.

**A new command may only be triggered once the “Done” or “Aborted” bit has been displayed after a command has been processed.**

### 8.10 SIWAREX MS Getting started

SIWAREX MS Getting started is “ready to use” application software for a scale. It consists of a project with the following programs:

#### 8.10.1 STEP 7-Micro/Win Programm

The libraries “MicroScale\_V20” and “MicroScale\_additional” are called in the program.

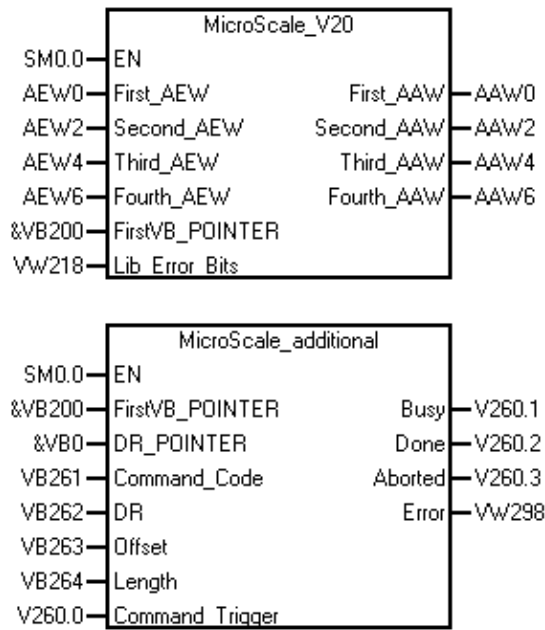


Figure 8-15 Program call-ups in the SIWAREX MS Getting started project

### 8.10.2 Operating and Monitoring for TP 177Micro Based on WinCC Flexible

WinCC flexible of at least edition 2007 is required for the programming.

In the image for the scale display, the weight value, the status information and the messages are displayed. To load the image into the operating unit, you must have the WinCC flexible software.

In addition to the image for displaying the current weight value, other system images can be created depending on the application.

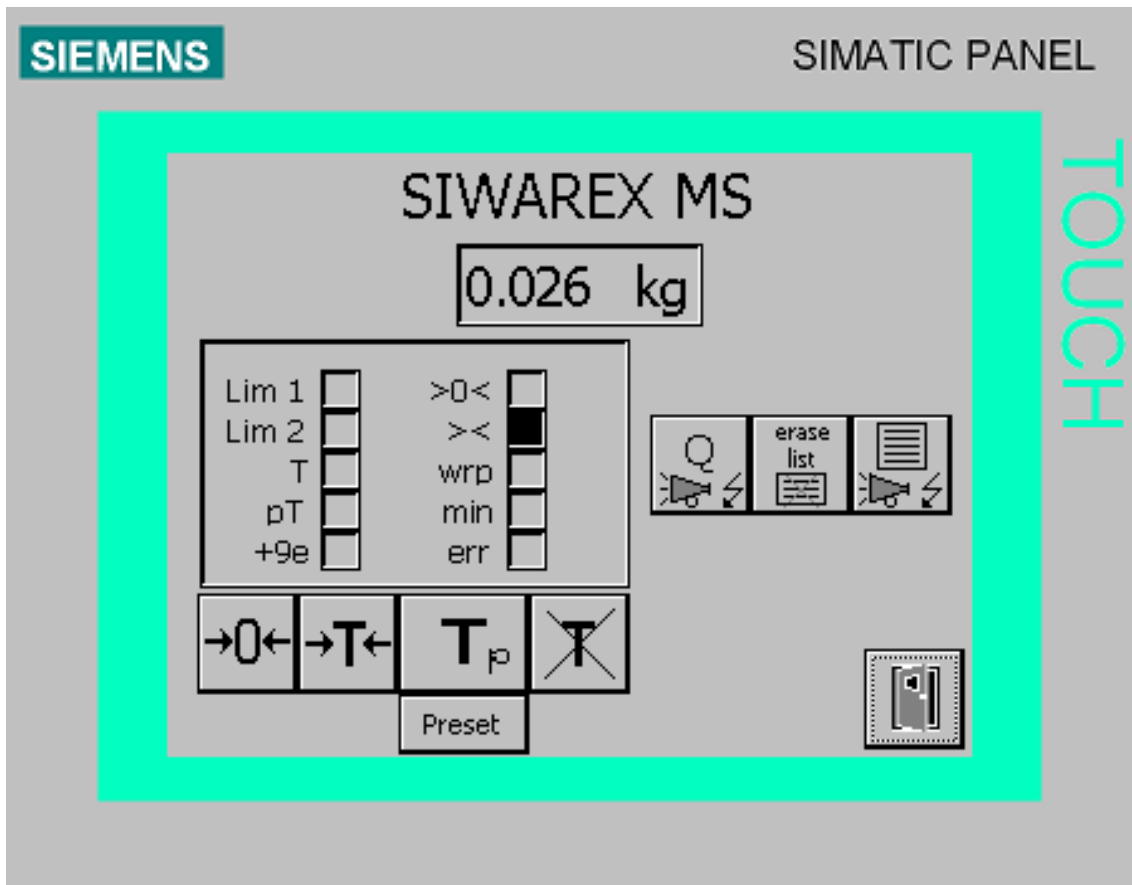


Figure 8-16 Overview screen for SIWAREX MS in TP177micro

To adjust TP 177micro, the adjustment screen is called first. The adjustment is carried out in this screen as follows:

1. Enter the new adjustment weight.
2. Send the changed adjustment weight to the Siwarex MS module.
3. If the scales are empty, the button "Zero valid" is activated. The scales value now indicates 0 kg.
4. The adjustment weight is placed on the scales.
5. The button "Weight 1 valid" is confirmed. The scales value now indicates the adjustment weight.

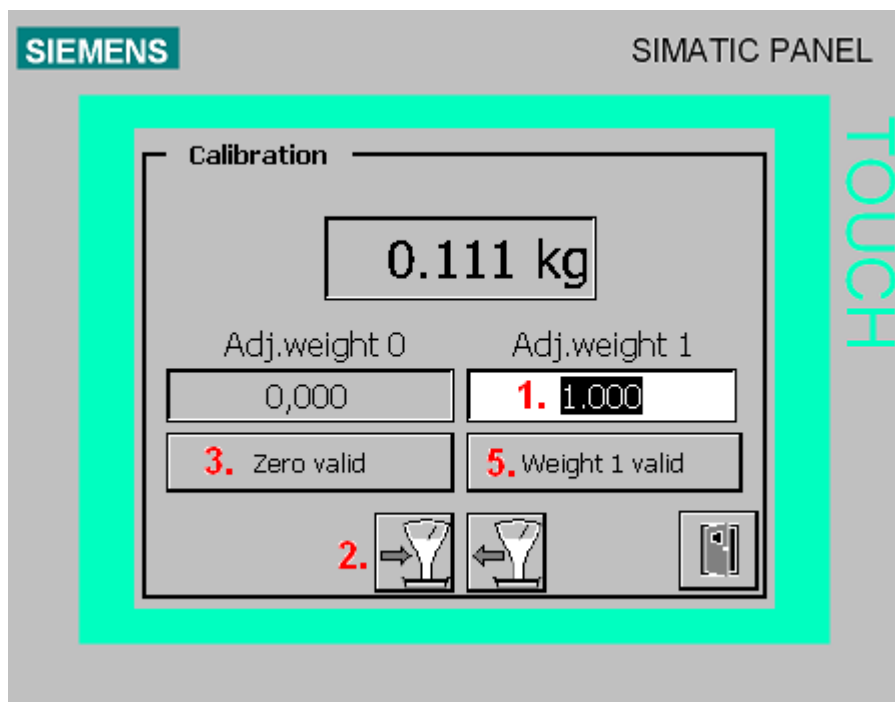


Figure 8-17 Calibration screen for SIWAREX MS in TP177micro

## 9 Setting the Scale – SIWATOOL MS

### 9.1 General

You can use the SIWATOOL MS program to set the scale independent of commissioning the SIMATIC S7-200 automation system. This program is included in the configuration package supplied. The first step is to install the program (directory SIWATOOL\_MS). It requires less than 10 MB on the hard disk.

### 9.2 Windows and Functions of SIWATOOL MS

The program window is constructed so that navigating through the parameter definition areas of the SIWAREX MS is made easier. In the left-hand portion, the overview of the parameters is shown as a tree-structure. The parameter grouping corresponds with the various activities which can happen during the project planning, commissioning, tests and for service cases. Each branch of the tree structure corresponds to a data record in SIWAREX MS. A data record summarizes several parameters. In the right-hand window, the parameters in a data record can be edited in index card format. The first card in a box is set up as an information sheet. This info sheet describes which tasks can be processed using the parameters from the selected data record. For sending, receiving and transferring, the entire data record is always handled and not just one single index card.

### 9.3 Setting the Parameter Offline

All scale parameters can be processed and stored without the SIWAREX MS. This reduces the commissioning time. The parameters for more than one scale can be prepared in the office and only have to be transferred to the SIWAREX MS during commissioning. Data from one scale that is currently in operation can be read and used in the commissioning of another scale.

### 9.4 Setting the Parameter Online

To switch to online operation, the PC must be connected to SIWAREX MS using the SIWATOOL cable (see *Accessories*). The PC's COM interface can be set up in the communication menu. All parameters can be changed in online operation. A message window shows the current content of the message buffer on the SIWAREX MS. The current process values can be viewed in various windows. For testing purposes, all commands can be sent to the SIWAREX MS. All data can be read out and stored as a file or printed for archiving purposes.



All data can be edited in the module in online operation.

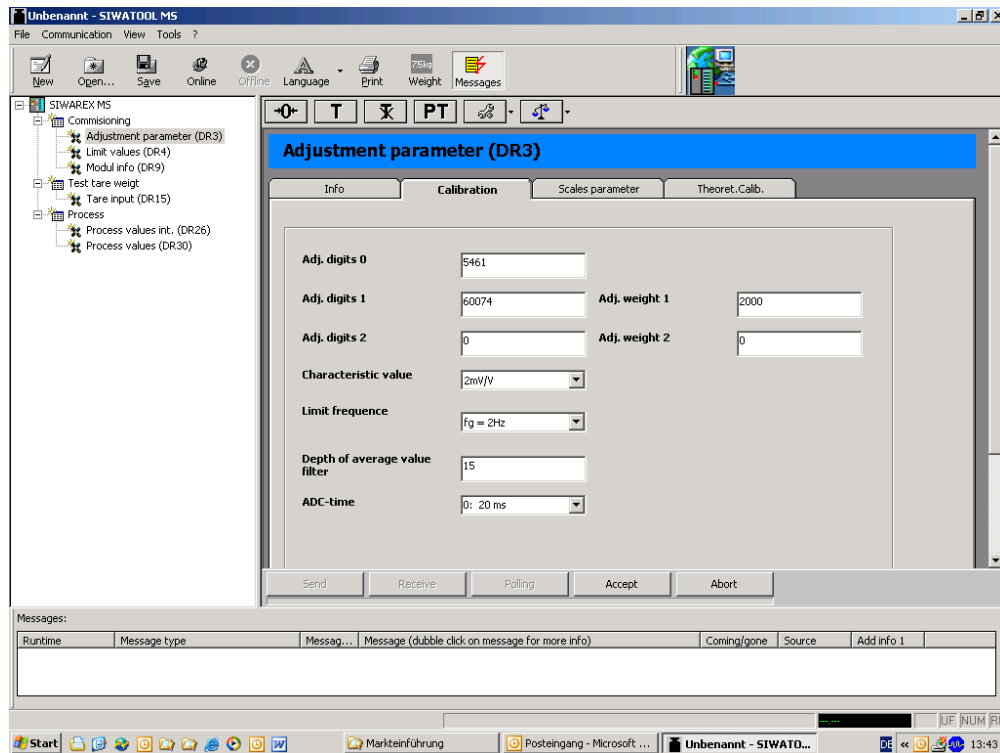


Figure 9-1 SIWATOOL MS Windows

## 9.5 Help

After clicking on a data record in the left-hand program window, the “Info” card can be selected in the right-hand program window, which explains the effect of the data record on the conduct of the scale.

After selecting a card, a segment of the corresponding data record is shown in the form of input and output fields. In addition to the parameter designation, the Tool Tips can also be helpful in remembering the meanings of certain parameters (text is displayed if the mouse pointer is positioned over a field).

Clicking on the menu option “Help”, calls up the “SIWAREX MS” manual. Installation of Acrobat Reader is necessary to read the manual.

## 10 Accessories

There are necessary and optional accessories for the SIWAREX MS.

<p><b>SIWAREX MS</b></p> <p>Scale electronics for scales in SIMATIC S7-200 for non-calibratable applications, Weight 0.2 kg</p> <p>for connection of a scale</p> <p>SIWAREX MS Device Manual German, English, Italian, Spanish, French</p> <p><b>Configuration package</b> SIWAREX MS for SIMATIC Micro/Win Version 4.0 SP2 and higher</p> <p>CD-ROM, consisting of:</p> <ul style="list-style-type: none"> <li>• PC parameter definition software SIWATOOL (German, English, Italian, Spanish, French)</li> <li>• SIWAREX MS device manuals on CD (German, English, Italian, Spanish, French)</li> <li>• Micro/Win library for communication between SIWAREX MS and SIMATIC S7-200 CPU</li> </ul> <p>SIWAREX MS Getting Started “ready to use” application software for easy start-up in programming the scale</p> <p><b>SIWATOOL connection cable</b> from SIWAREX MS with serial PC interface</p> <ul style="list-style-type: none"> <li>• Length 2 m</li> <li>• Length 5 m</li> </ul> <p>Shielding connection clamp Content: 10 units</p> <p><u>Note:</u> One shielding connection clamp is required for each of the following:</p> <ul style="list-style-type: none"> <li>• Load cell connection cable and</li> <li>• TTY interface connection</li> </ul>	<p><b>7MH4 930-0AA01</b></p> <p>Cost-free download from the Internet <a href="http://www.siemens.de/waergetechnik">www.siemens.de/waergetechnik</a></p> <p><b>7MH4 930-0AK01</b></p> <p>Free download from Internet <a href="http://www.siemens.de/waergetechnik">www.siemens.de/waergetechnik</a></p> <p><b>7MH4 702-8CA</b></p> <p><b>7MH4 702-8CB</b></p> <p><b>6ES5 728-8MA11</b></p>
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<p>Optional accessories</p> <p>The remote digital displays can be connected directly to the SIWAREX MS via a TTY interface. Usable remote displays: S102</p> <p>Siebert Industrieelektronik GmbH Postfach 1180 D-66565 Eppelborn Tel.: 06806/980-0 Fax: 06806/980-999 Internet: <a href="http://www.siebert.de">http://www.siebert.de</a></p> <p>For detailed information, please contact the manufacturer.</p> <p><b>SIWAREX JB connection and distribution box</b></p> <p>for parallel load cell switching</p> <p><b>SIWAREX EB expansion box</b></p> <p>to extend load cell cable</p> <p><b>Ex interface, Type SIWAREX Pi</b> <b>without ATEX certification</b></p> <p>for intrinsically safe connection of load cells, suitable for SIWAREX MS, U, M, FTA, FTC and P weighing modules. With UL and FM certification</p> <p>SIWAREX Pi Ex interface device manual</p> <p><b>Ex interface, Type SIWAREX IS</b></p> <p>with ATEX certification</p> <p>for intrinsically safe connection of load cells, including device manual, suitable for weighing modules SIWAREX MS, U, M, FTA, FTC and P. Without UL and FM certification</p> <p><b>with short-circuit current &lt; DC 199 mA</b></p> <p><b>with short-circuit current &lt; DC 137 mA</b></p> <p>Cables (optional)</p> <p><b>Cable Li2Y 1 x 2 x 0.75 ST + 2 x (2 x 0.34 ST) - CY</b></p> <p>for connection of SIWAREX MS, U, M, FTA, FTC, P with connection and junction box (JB), expansion box (EB) or Ex interface (Ex-I) and between two JBs, for stationary installation, occasional bending is possible 10.8 mm outer diameter for ambient temperature -20 to +70°C</p>	<p><b>7MH4 710-1BA</b></p> <p><b>7MH4 710-2AA</b></p> <p><b>7MH4 710-5AA</b></p> <p><b>C71000-T5974-C29</b></p> <p><b>7MH4 710-5BA</b></p> <p><b>7MH4 710-5CA</b></p> <p><b>7MH4 702-8AG</b></p>
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## 11 Technical Data

### 11.1 Integration in the Automation Systems

Operation is possible with the following S7-200 CPUs

6ES7212-1AB23-0XB0, 6ES7212-1BB23-0XB0, 6ES7214-1AD23-0XB0, 6ES7214-1BD23-0XB0, 6ES7214-2AD23-0XB0, 6ES7214-2BD23-0XB0, 6ES7216-2AD23-0XB0, 6ES7216-2BD23-0XB0.

SIWAREX MS can also be used with the S7-200 SIPLUS CPUs but the SIWAREX MS expansion module itself is not designed for expanded environmental conditions:

6AG1212-1AB23-2XB0, 6AG1212-1BB23-2XB0, 6AG1214-1AD23-2XB0, 6AG1214-1BD23-2XB0, 6AG1214-2AD23-2XB0, 6AG1214-2BD23-2XB0, 6AG1216-2AD23-2XB0, 6AG1216-2BD23-2XB0.

Table 11-1 SIMATIC CPU

### 11.2 24 V Power Supply

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

Rated voltage	DC 24 V
Static upper / lower limits	DC 20.4 V/28.8V
Dynamic upper / lower limits	DC 18.5 V/30.2 V
Non-periodic over-voltages	DC 35 V for 500 msec with a recovery time of 50 sec.
Max. current consumption	130 mA
Typical module power loss	5 W

Table 11-2 Data: 24 V power supply

### 11.3 Power Supply from S7-200 Busline

Current consumption 5 V from the SIMATIC Bus	Typical < 140 mA
----------------------------------------------	------------------

Table 11-3 Data: Power supply from the SIMATIC Bus

## 11.4 Load Cell Connection

Connection	STRAIN GAUGE full bridge in 4-wire or 6-wire technology
Error limit conforming to DIN1319-1 from measurement range end value at 20 °C + 10 K	≤ 0.05 %
Temperature coefficient span	≤ ± 20 ppm/K v. E
Temperature coefficient zero point	≤ ± 0.1 μV/K
Linearity error	≤ 0,015%
Refresh rate can be switched	50 Hz or 30 Hz
Internal resolution	65,535 parts
4 measuring ranges	0 to 1 mV/V 0 to 2 mV/V 0 to 3 mV/V 0 to 4 mV/V
Max. distance to load cell	500 m
Max. distance between load cell and Ex-I interface in Ex area	150/500 m for gas group IIC 500 m for gas group IIB (see SIWAREX IS device manual)
Load cell power Voltage Maximum current	Typical DC 6 V * 150 mA
Permitted load cell resistance without Ex-I interface with feed from SIWAREX MS	> 40 Ω < 4010 Ω
Permitted load cell resistance with Ex-i-Interface	> 87 Ω < 4010 Ω
Monitor for sensor inputs	typically ≥ 5.3 V ± 2% Hysteresis 0.1 V
Response time for sensor line monitor	≤ 1 s
Common mode rejection CMRR @50/60 Hz	Typical 80 dB
Low pass filter limit frequency	0.05...5 Hz
Measured value filtering for average value filter	2...255 values
Isolation	500 V (DC)

\* Values apply at output of the module

\*\*When using recommended cables (accessories)

Table 11-4 Data: Load cell connection

## 11.5 RS 232C Interface

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

Table 11-5 Data: RS 232C interface

## 11.6 TTY Interface

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

Table 11-6 Data: TTY interface

## 11.7 Dimensions and Weight

Dimensions W x H x D	71,2 x 80 x 62 mm
Weight	165 g

Table 11-7 Data: Dimensions and weight

## 11.8 Environmental Conditions

The SIWAREX MS is designed for use in SIMATIC S7 200 systems under the following conditions.

Conditions of use in accordance with IEC 60721:

**Operation:** IEC60721-3-3  
Stationary application, weatherproof  
Class 3M3, 3K3

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

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

Table 11-8 Data: Environmental conditions

## 11.9 Mechanical Requirements and Data

Testing	Standards	Test values
Vibration in operation	IEC 60068-2-6	<u>Test Fc</u> <u>Switching cabinet installation:</u> 0.30 mm from 10 to 57 Hz; 2 G from 57 to 150 Hz <u>Top-hat rail mount:</u> 15 mm from 10 to 57 Hz; 1 G from 57 to 150 Hz 10 deflections per axis, 1 Octave/Minute
Shock in operation	IEC 60068-2-27	<u>Test Ea</u> 150 m/s; Half sinus Duration: 11 ms Number: 3 per axis each in neg. and pos. direction
Free fall	IEC 68000-2-32	<u>Test Ed</u> Fall height 1m, 5 times in shipping packaging
Tipping over	IEC 68000-2-32	<u>100 mm, four times without packaging</u>


Table 11-9 Data: Mechanical requirements

## 11.10 Electrical-, EMC- and Climatic Requirements




### 11.10.1 Electrical Protection and Safety Requirements

**Note:**

The licenses that are currently valid for SIWAREX MS are indicated on the SIWAREX MS rating plate.

	Directives: 2004/108/EC “Electromagnetic Compatibility”
-------------------------------------------------------------------------------------	------------------------------------------------------------



	94/9/EC “Explosion protection” <b>Note:</b> Further information on EC directives can be found in the product documentation accompanying every SIWAREX MS.
 HAZ. LOC.	Underwriters Laboratories Inc. to UL 508 (Industrial Control Equipment) MSA C22.2 No. 142 (Process Control Equipment) UL 1604 (Hazardous Location) MSA-213 (Hazardous Location) APPROVED for use in Class I, Division 2, Group A, B, C, D Tx; Class I, Zone 2, Group IIC Tx
	Factory Mutual Research (FM) to Approval Standard Class Number 3611, 3600, 3810 APPROVED for use in Class I, Division 2, Group A, B, C, D T4; Class I, Zone 2, Group IIC T4
	Explosion protection to EN 60079-15: 2005 (Electrical apparatus for potentially explosive atmospheres; Type of protection “n”) Class II 3 G EEx nA II T4 <b>Note:</b> The specifications in the “S7-200 system manual” and the regulations for setting up and operating devices in Ex areas are mandatory for use in Ex areas!

The SIWARERX MS meets the following requirements:

Requirement met	Standards	Comments
Safety regulations	EN60204; DIN VDE 0113; IEC 1131; UL 508; CSA C22.2 No.142; FM class I, Div.2; UL/CSA	UL-/MSA-/FM Zone 2 certification upon request
Protection class	Class I to IEC 60536	
IP protection	IP 20 to IEC 60529	<ul style="list-style-type: none"> <li>• Protection against contact with standard probes</li> <li>• Protection against foreign bodies with diameters above 12.5 mm</li> <li>• No special protection against water</li> </ul>
Air and creepage distances	IEC 61131	Surge category II Pollution degree 2 Circuit board material IIIa Circuit track spacing 0.5 mm

Requirement met	Standards	Comments
Insulation resistance	IEC 61131-2:	The insulation resistance was demonstrated with a test voltage of 500V in the type test.
Material	SN 36350 (3.93)	

Table 11-10 Data: Electr. protection and safety requirements

### 11.10.2 Electromagnetic compatibility

Spurious emission ( <b>residential and industrial areas</b> ):		
Comments	Standard	Limit values
Emission radiated Industrial area <sup>1</sup>	EN 61000-6-4	EN 55011 Class A, Group 1  30 – 230 MHz: < 40dB(μV/m) Q 230-1000MHz: < 47dB(μV/m) Q
Emission routed Industrial area <sup>1</sup>	EN 61000-6-4	EN 55011 Class A, Group 1  <u>0.15 - 0.5 MHz,</u> < 79 dBμV Quasi-tip < 66 dBμV Average value  <u>0.5 - 5 MHz,</u> < 73 dBμV Quasi-tip < 60 dBμV Average value  <u>5 - 30 MHz</u> < 73 dBμV Quasi-tip < 60 dBμV Average value
Emission radiated <sup>2</sup> residential	EN 61000-6-3	EN 55011 Class B, Group 1  30 – 230 MHz: < 30dB(μV/m) Q 230-1000MHz: < 37dB(μV/m) Q
Emission routed <sup>2</sup> residential	EN 61000-6-3	EN 55011 Class B, Group 1  <u>0.15 - 0.5 MHz,</u> < 66 - 56 dBμV Quasi-tip < 56 - 46 dBμV average value  <u>0.5 - 5 MHz,</u> < 56 dBVμ Quasi-tip < 46 dBVμ Average value  <u>5 - 30 MHz</u> < 60 dBVμ Quasi-tip < 50 dBVμ Average value
Interference immunity ( <b>Industrial use</b> ):		
Comments	Standard	Degree of severity
Burst pulses on power supply lines:	IEC 61000-4-4	2 kV

Spurious emission ( <b>residential and industrial areas</b> ):		
Comments	Standard	Limit values
Burst pulses on data and signal lines:	IEC 61000-4-4	1 kV ( <i>RS232 interface</i> ) 2 kV (remaining data and signal lines)
Electrostatic discharge (ESD)	IEC 61000-4-2	6 kV
Electrostatic air discharge (ESD)	IEC 61000-4-2	8 kV
Surge voltage / Surge on power supply lines <sup>3</sup>	IEC 61000-4-5	± 2 kV asymmetrical ± 1 kV symmetrical
Surge on data and signal lines:	IEC 61000-4-5	± 1 kV asym. (to cable shielding)
HF irradiation (electromagnetic fields)	IEC 61000-4-3	26 MHz to 1000 MHz and 1.4 to 2.0 GHz 10 V/m (80% AM with 1 kHz) 900 MHz and 1.89 GHz Up to 10 V/m (50% PM) 2.0 GHz – 2,7 GHz: 1V/m
Cable fed interferences Data, signal and power supply lines	IEC 61000-4-6	10 kHz – 80 MHz 10 V <sub>eff</sub> (80% AM 1 kHz)
Damped vibration on power supply line	EN 61000-4-12	1 MHz  1.0 kV symmetrical 1.0 kV asymmetric Refresh rate: 1 sec. Duration 10 min.
Voltage interruptions the power supply	EN 61000-4-29	Interruption time: 0...20 ms Refresh rate: 1 s  (Load cell impedance ≥ 85 Ohm)

Table 11-11 Data: Electromagnetic Compatibility

<sup>1</sup> The module must be mounted on a grounded metal frame. The S7-200 must be grounded directly over the metal frame. With the exception of the 24 V power supply line, shielded cable must be used for all lines. The cable shielding must be grounded on both ends at low resistance.

<sup>2</sup> The S7-200 must be installed in a closed metal housing. For all cables, shielded cable must be used. The cable shielding must be grounded on both ends at low resistance.

<sup>3</sup> To meet requirements, an external protection element should be used (e.g.: Blitzductor VT AD24V, by Dehn&Söhne)

### 11.10.3 Climatic Requirements

Climatic requirements		
Comments	Standard	Application range
Operating temperature:	-	Horizontal installation 0 to +55°C  Other installation locations 0 to +45°C  95% Atmospheric humidity. No condensation
Storage and transport temperature	IEC 60068-2-1 IEC 60068-2-2 IEC 60068-2-28	-40 to +70°C
Relative humidity	IEC 60068-2-30	25°C to 55°C, 95 %
Air pressure	-	from 1080 to 795 hPa corresponds to an altitude of -1000 to 2000 m above sea level
Pollutant concentration	-	SO <sub>2</sub> : < 0.5 ppm; Rel. humidity < 60 %,  H <sub>2</sub> S: < 0.1 ppm; rel. humidity < 60 % non-condensing

Table 11-12      Data: Climatic requirements

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## 13 Abbreviations

ADC	Analog-Digital Converter
ASCII	American Standard Code for Information Interchange
B	Gross weight
BG	Module
O&O	Operating and Observing
CPU	Central processing unit
DB	Data block
HMI	Human machine interface (SIMATIC Operator Panel)
HW	Hardware
PPI	Point-Point-Interface
NAWI	Non-automatic weighing instrument
NSW	Non-automatic weighing instrument
OIML	Organisation Internationale de Metrologie Legale
OP	Operator Panel (SIMATIC)
P-RP	Parameter Protection
PC	Personal Computer
pT	Preset tare (predefined tare weight with manual taring)
RAM	Random Access Memory
STEP 7	Programming device software for SIMATIC S7
SBR	Subroutine
T	Tare weight
TP	Touch Panel (SIMATIC)
VB	Variable range
LC	Load cell(s)