SIEMENS

SIWAREX S
WPS (i) Weighing Processor

Operating Instructions

01950.05

Release 03/94

Order no.: C71000–B5976–C51–1

Contents

Editor: AUT7, B1 T1
Publisher: AUT V731

ENVIRONMENTAL
PROTECTION
IN ACTION

Information Concerning
Packaging Material/Notes on Disposal

Dear Customer !

Our high–quality products cannot reach you safely without effective protective packaging. The size of the packaging is kept to an absolute minimum.

All our packaging materials are harmless to the environment and can be disposed over without danger.

Wood is not chemically treated.

Cardboard is made primarily of waste paper which can then be torn up and given to a waste paper collection.

Sheeting is made of polyethylene (PE), tapes of polypropylene (PP) and CFC–free padding of foamed polystyrene (PS).

These materials are pure hydrocarbons and can be recycled. Please dispose of these valuable secondary raw materials at a recycling center.

Recycling saves raw materials and cuts down on the amount of refuse.

Ask your city administration for the address of the recycling center nearest you to dispose of packing materials and discarded devices.

Thank you for your help !

Guidelines for Handling Electrostatic Sensitive Devices (ESD)

1 What Does ESD Mean?

Almost all SIMATIC–TELEPERM modules contain many integrated blocks or elements which use MOS technology. The technology used makes these electronic components very sensitive to overvoltages and thus to electrostatic discharge.

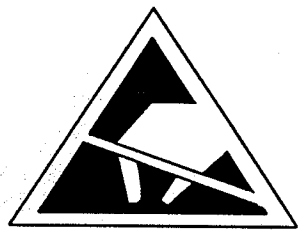
The German abbreviation for such modules is

"EGB": Elektrostatisch Gefährdeten Bauelemente Baugruppen

Next to this abbreviation you will often find the common international abbreviation

"ESD": Electrostatic Sensitive Device

When found on cabinets, module subracks or packaging, the symbol shown below indicates that electrostatic sensitive components have been used in this device and the module is thus sensitive to touch.



ESDs can be destroyed by voltages and energies far below those perceived by humans. Such voltages can even occur when a component or a module is touched by a person who is not statically discharged. Components which have been subjected to such overvoltages can usually not be immediately identified as defective since a malfunction may not occur until the module has been in operation for a longer period of time.

To be perceived by humans, the following minimum voltages are required:

- To be felt – 3500 volts
- To be heard – 4500 volts
- To be seen – 5000 volts

But a fraction of this voltage can already damage or destroy electronic components.

Components which have been damaged, overloaded or weakened by static discharge can malfunction temporarily when average technical specifications are deviated from. A few examples are listed below.

- Temperature changes
- Impact
- Jarring
- Changes in stress

Only through rigorous use of protective measures and careful adherence to the handling guidelines can malfunctions and downtime of ESD modules be effectively prevented.

2 When Does a Static Charge Occur?

You can never be absolutely certain that you yourself or the materials and tools you are using are not electrostatically charged.

Small charges of up to 100 V are common but these can increase to 35,000 V in a very short time!

Examples:			
	– Walking on carpeting	Up to	35 000 V
	– Walking on plastic flooring	Up to	12 000 V
	– Sitting on upholstered chair	Up to	18 000 V
	– Unsoldering device made of plastic	Up to	8 000 V
	– Plastic coffee cups	Up to	5 000 V
	– Plastic covers	Up to	5 000 V
	– Books and pads with synthetic binding	Up to	8 000 V

3 Important Protective Measures Against Static Charging

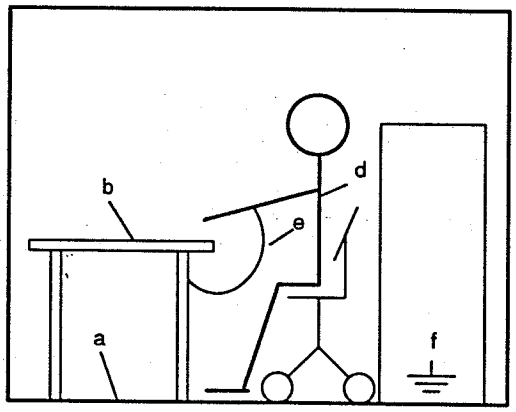
- Since most plastics have a strong tendency to charge, it is imperative that they be kept away from sensitive components.
- Be sure to provide good grounding of people, your workplace and the packaging when working with electrostatic sensitive components.

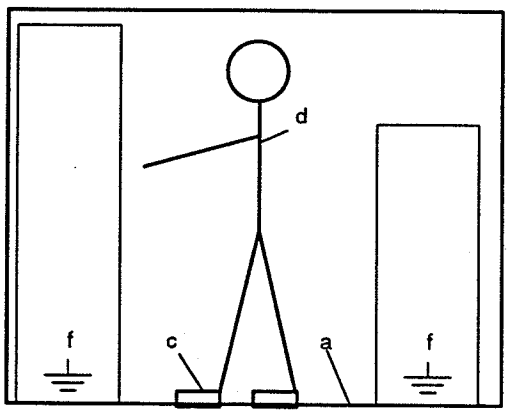
4 Handling ESD Modules

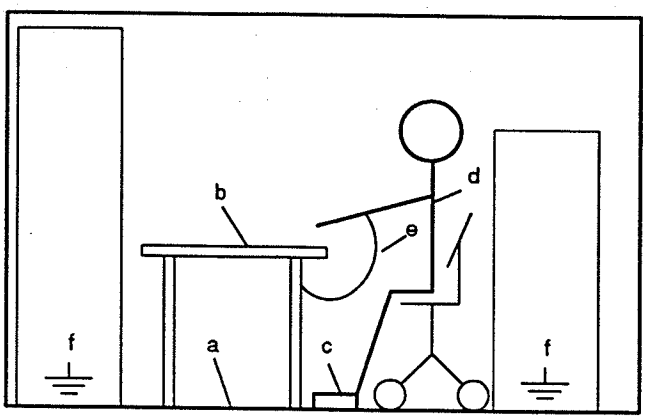
- As a matter of principle, electronic modules should not be touched unless the work to be performed on them makes this absolutely necessary.
- Components should not be touched unless
  - you are continuously grounded with an ESD bracelet

  or
  - you are wearing ESD shoes or ESD shoe protective grounding strips on an ESD floor.
- Before touching an electronic module, your own body must be discharged. The easiest way to do this is to touch a conductive, grounded object (e.g., blank metal parts of switching cabinets, water pipes, etc.) immediately prior to touching the component.
- Modules should not come in contact with chargeable and highly insulating materials (e.g., plastic foil, insulating tabletops, synthetic fiber clothing).
- Modules should only be placed on conductive surfaces (e.g., table with ESD covering, conductive ESD foam, ESD packaging bag, ESD shipping container).
- Do not allow modules in the vicinity of CRTs, monitors or television sets (minimum distance to the screen > 10 cm).

Required ESD protective measures are shown in the figure below.







a Conductive floor
b ESD table
c ESD shoes
d ESD shop coat
e ESD bracelet
f Grounding connection of the cabinets

5 Measuring and Modifying ESD Modules

- Measurements may not be performed on the modules unless
  - the measuring device is grounded (e.g., with protective conductor) or
  - the measuring head is briefly discharged (e.g., touching blank metal part of the controller housing) prior to measuring when using a floating measuring device.
- For soldering use only a grounded soldering device.

6 Shipping ESD Modules

As a matter of principle, modules and components must always be stored or shipped in conductive packaging (e.g., metallized plastic boxes, metal cans).

When packaging is not conductive, the modules must be wrapped in conductive material prior to packaging. For example, conductive foam rubber, ESD bags, household aluminum foil or paper can be used (never use plastic bags or foil).

Be sure that the conductive packaging of modules with built–in batteries does not touch or short circuit the battery connections (if necessary, cover the connections with insulating tape or material beforehand).

Important information on the Operating Instructions

This document does not contain all details of types of the product for reasons of clarity and cannot take account of every possible eventuality in setting up, operation or service.

If you should require further information, or if problems should occur that are not dealt with in these Operating Instructions in detail, you can request the required information from your local Siemens office.

We should also like to point out that the contents of these Operating Instructions are not part of an earlier or existing agreement, or legal contract and do not modify any existing agreement or legal contract. All obligations that Siemens has result from the purchase contract that contains the complete and exclusively valid guarantee conditions. The guarantee conditions stipulated in the contract are neither extended nor restricted by anything contained in the Operating Instructions.

Introduction

What you should know !

The Operating Instructions were developed for various target groups and are for use as a working aid.

The modular structure of the Operating Instructions permits efficient work. **ONLY** read what you really need to read.

The following target group specification tells you **WHAT** you need to read.

Target group / activity	Section required	Section recommended
Fitter Mounting, installation and connection of the WPS(i) weighing processor	2, 3 and 4	1
System programmer Developer of the user program	2, 7	1, 3 and 4
Service Commissioning, troubleshooting	all sections	

If the sections referred to contain references to other sections or parts of other sections, these are also required reading.

(4) J31037–D5603–U1–A0–7619

Agreements

Safety – and warnings

In these Operating Instructions, notes and warnings, the non–observance of which can endanger or harm people or machines, are marked as follows:

Danger

Danger

means that death, serious injury or considerable material damage **will** occur if the precautionary measures in question are not taken or observed.

Warning

Warning

means that serious injury or considerable material damage **can** occur if the precautionary measures in question are not taken or observed.

Caution

Caution

means that slight injury or material damage **can** occur if the measures in question are not taken or observed.

Note

Important information on the product or Operating Instructions which is especially emphasized.

Abbreviations

If an abbreviation is not used in general language, its full meaning is given the first time it is used. The appendix also has a summary of the abbreviations used.

Cross–references

A cross–reference to parts of other chapters is only made if repetition of the information would be too long and the description at the other location is sufficient. Cross–references to parts of other sections are given with the number of the section and subsections, e.g. (→ Section 3.2) or (see Section 3.2).

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Structure of the Operating Instructions

This document describes several physically separated modules and devices. These are dealt with together in separate sections. The devices together form the SIWAREX S controller. The Operating Instructions therefore also contain sections about the whole system. The sections are structured so as to avoid reference to later sections and cross–references. Especially long or complex sections are introduced by a section overview.

Structure of the Operating Instructions

Introduction
- What you should know
- Agreements, *Safety – and warnings*
- Structure of the Operating Instructions

Section1
System overview
- Features, *Brief description and application of the entire system*
- Structure of the system, *Function of the system, configurations*

Section 2
Measured value processing
- Description, *Tasks, structure and technical data*
- Installation *Mechanical structure, mounting in the S5, connecting, coding switch*
- Interfaces, *Measured value acquisition, pulse input, analog input/output, remote display*
- User access and communication, *Tasks, function principle, call, interface description, command processing, command list, data word list.*
- Function description, *Basic settings, adjusting, weighing, system monitoring, special functions*
- User program, *Startup program, cyclic program, supplied example program*

Section 3
Measured value acquisition
- Description, *Structure and function, monitoring, technical data*
- Installation, *Mounting, connecting, settings*
- Interfaces, *Serial interfaces and load cell connection*
- Service, *MA error word, operation display LED, replacing the board*

Section 4
Measured value acquisition (intrinsically safe)
- Description, *Structure and function, monitoring, technical data*
- Installation, *Mounting, connecting, settings*
- Interfaces, *Serial interfaces and load cell connection*
- Service, *MA error word, operation display LED, replacing the board*

Section 5 Remote display (Option)	– See operating instructions for the remote display for setup, operation, etc.
Section 6 Ordering data Accessories	– Junction box – Cables
Section 7 Error diagnostics	– During adjustment – During weighing operation – Faults in the plant – Faults in the WPS(i) – Failures that cannot be signalled
Appendix	– Abbreviations – Indexes of figures and tables – Drilling jig MA – Drilling jig MAi
Index	– Index – Answer form

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Warnung

Beim Betrieb elektrischer Geräte stehen zwangsläufig bestimmte Teile dieser Geräte unter gefährlicher Spannung.

Bei Nichtbeachtung der Warnhinweise können deshalb schwere Körperverletzungen auftreten.

Nur entsprechend qualifiziertes Personal darf an diesem Gerät arbeiten.

Dieses Personal muß gründlich mit allen Warnungen und Instandhaltungsmaßnahmen gemäß dieser Betriebsanleitung vertraut sein.

Der einwandfreie und sichere Betrieb dieses Gerätes setzt sachgemäßen Transport, fachgerechte Lagerung und Montage sowie sorgfältige Bedienung und Instandhaltung voraus.

Warning

Hazardous voltages are present in this electrical equipment during operation.

Non–observance of the safety instructions can result in severe personal injury or property damage.

Only qualified personnel should work on this equipment after becoming thoroughly familiar with all warnings, safety notices and maintenance procedures contained herein.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

Contents

 (4) J31037–D5603–U1–A0–7619

 (4) J31037–D5603–U1–A0–7619

1 System Overview

(4) J31037–D5603–U1–A0–7619

1 System Overview

1.1 Features

The WPS(i) weighing processor is conceived for industrial use. It can be used for various tasks in the area of weight measurement. The WPS(i) weighing processor is used in conjunction with a SIMATIC S5 programmable controller (PLC). Together with the PLC, the WPS(i) weighing processor provides a weighing and proportioning system. The complete system is called the SIWAREX S.

1.1.1 Brief description

The WPS(i) weighing processor system is a single–component weighing machine that is controlled via a programmable controller.

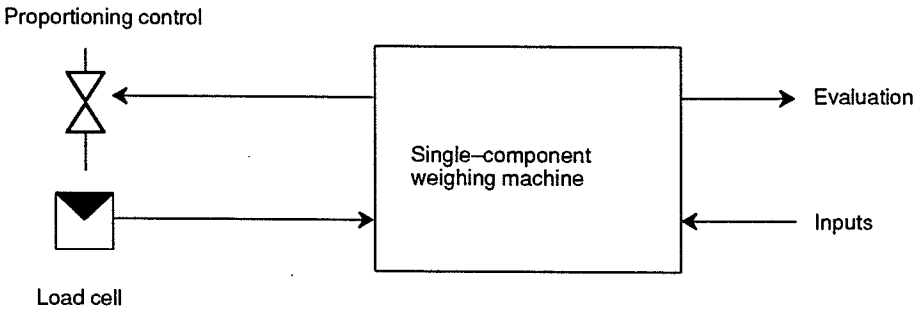


Fig. 1.1 Principle of a single–component load and proportioning control

Basic functions of a single–component weighing machine:

- Acquiring the weight value
- Accepting setpoint entry
- Output of a signal for material feed to the weigh–bin (coarse and fine proportioning)
- Output of the measured values.

The WPS(i) weighing processor has the following features in addition to the basic functions:

- Extensive system and threshold value monitoring
- Powerful measured value processing (digital filtering)
- Reliable measured value transmission over long distances
- Calculation and monitoring volume values
- High proportioning accuracy with various functions for handling dribble errors in the flow of materials.

The WPS(i) weighing processor consists of 2 modules.

- Measured value processing (MP)
- Measured value acquisition (MA)

Measured value processing

Tasks
- Accepting measuring data
- Evaluation of data because of set parameters
- Control of a proportioning device
- Communication with the programmable controller

Measured value acquisition

Tasks
- Junction box and measuring amplifier for weight sensors (load cells)
- Digital transfer of measuring data

1.1.2 Use of the WPS(i) weighing processor

With the help of the programmable controller the WPS(i) weighing processor can perform various tasks.

1.1.2.1 Single–component weighing machine upwards

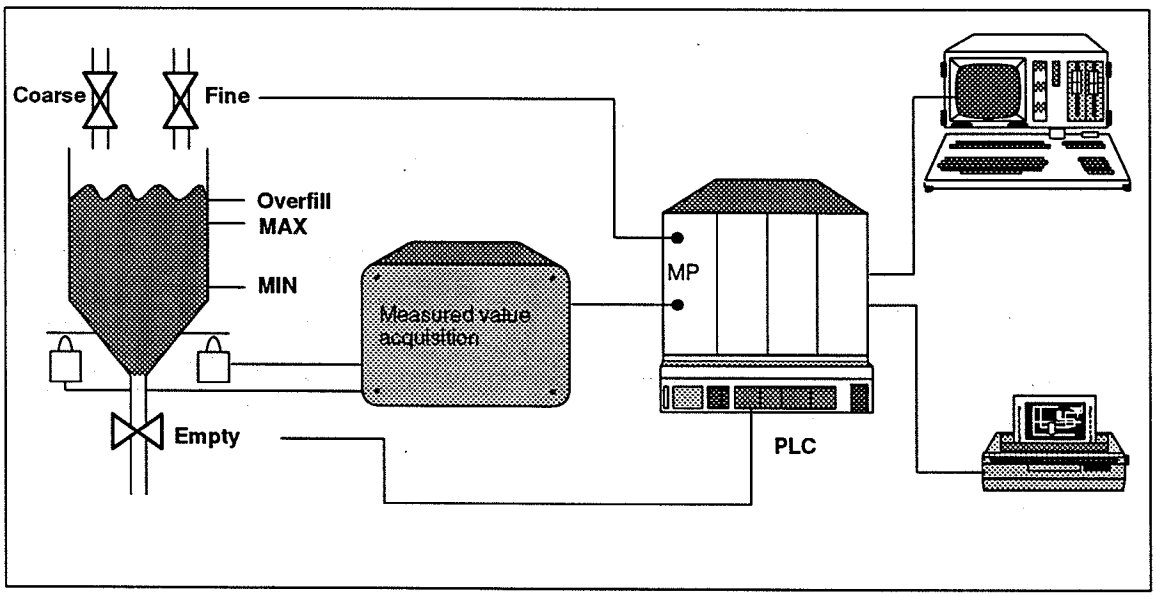


Fig. 1.2 Proportioning upwards

The measured value processing module (MP) is located in the programmable controller (PLC) and performs the control of the proportioning equipment. The signal to empty the weigh–bin is provided via an output module of the PLC.
With the appropriate PLC accessories visualization or operator control of the process is also possible.

1.1.2.2 Single–component weighing machine downwards

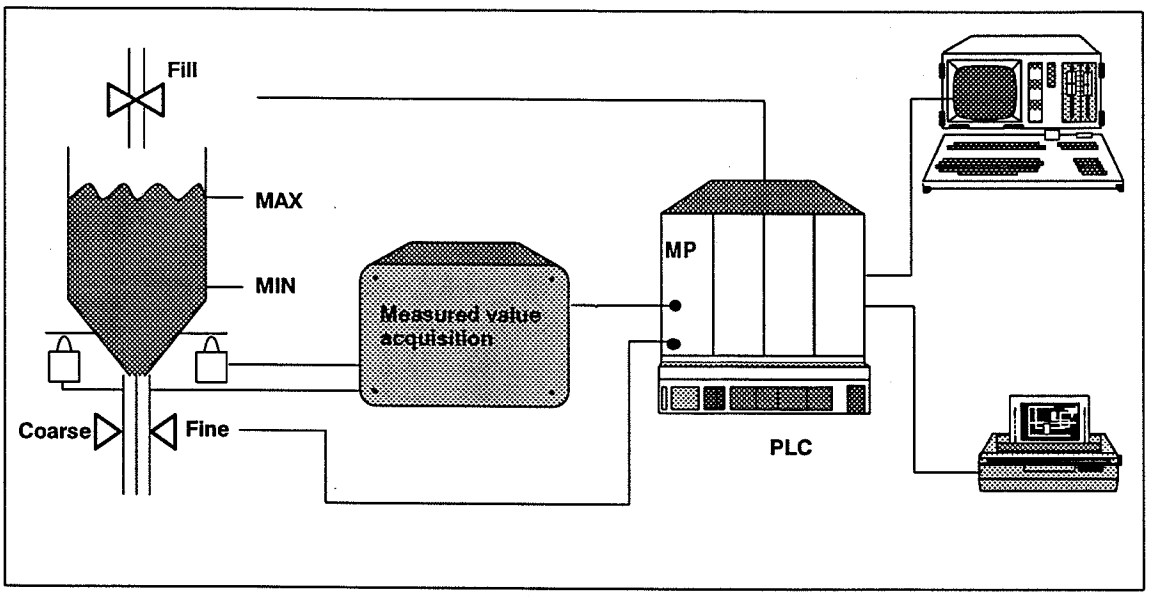


Fig. 1.3 Proportioning downwards

The coarse and fine proportioning devices are not arranged as filling devices as in the single–component weighing machine upwards, but as emptying devices. The command for filling comes from the PLC.

(4) J31037–D5603–U1–A0–7619

1.1.2.3 Multi–component weighing machines

Although the WPS(i) weighing processor is represented as a single–component weighing machine it can be implemented as a multi–component weighing machine using the PLC.

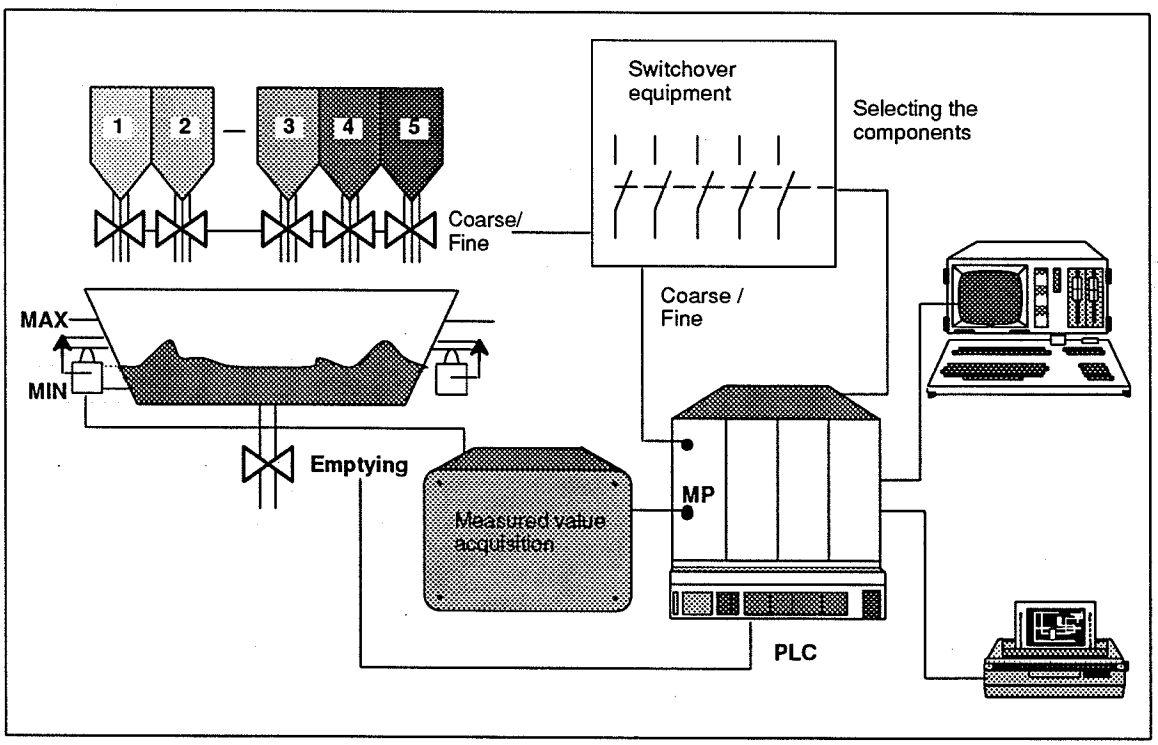


Fig. 1.4 Proportioning using several components

Because the MP only provides the control lines for one proportioning device, these lines are switched through to the proportioning device of each component (material silo) through a switching device. This switching device consists of switches that are actuated by the PLC in order to select a component.

The rest of the configuration is the same as for the single–component weighing machine upwards.

1.2 Structure of the system

1.2.1 Function

1.2.1.1 Mechanical structure and components of a weighing machine

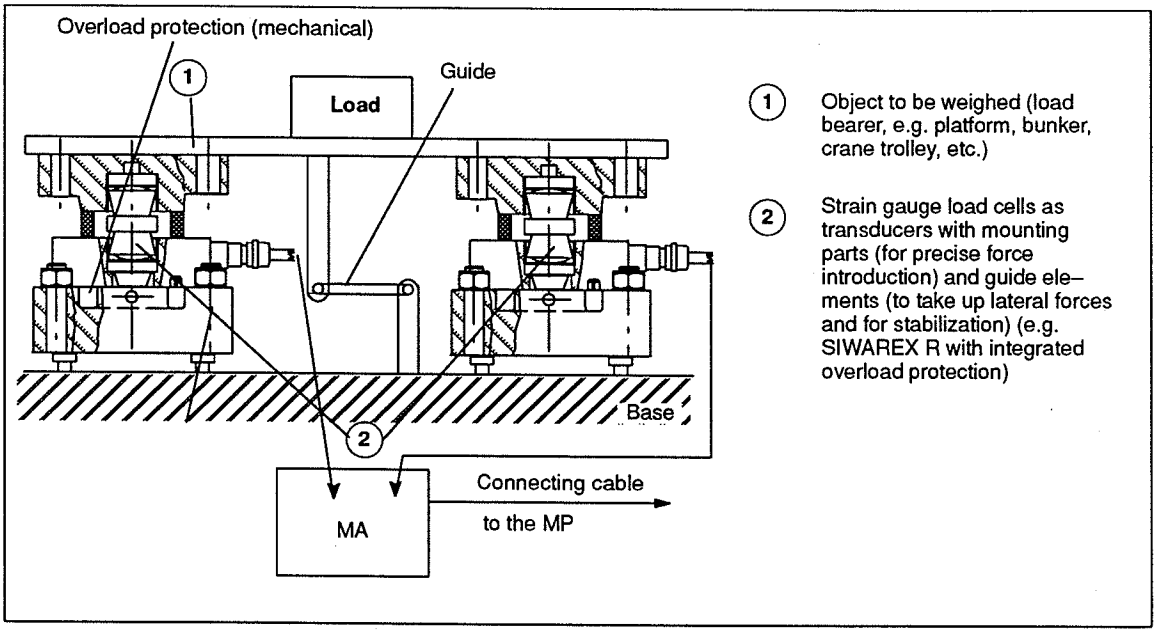


Fig. 1.5 Mechanical structure of a weighing machine

The overload protection prevents the load cells from being destroyed. The load is placed on fixed stops if overloaded. The guide elements are used to take up lateral forces.

Many weighing machines work with several load cells. Up to 6 load cells in the MA value acquisition are connected in parallel and a mean value is formed from the single values (parallel switching of more than 6 load cells requires an additional junction box).

1.2.1.2 Weighing and proportioning system with the WPS(i) weighing processor

Local measured value acquisition and digital transfer of the data prevents measuring errors that arise when long cables are used. The data are then processed further at a central point in the programmable controller. The PLC does not have to be located in the weighing equipment. The measured value processing module is mounted in the PLC as a plug–in module.

 (4) J31037–D5603–U1–A0–7619

The following diagram shows the distribution of tasks and the interrelation between them:

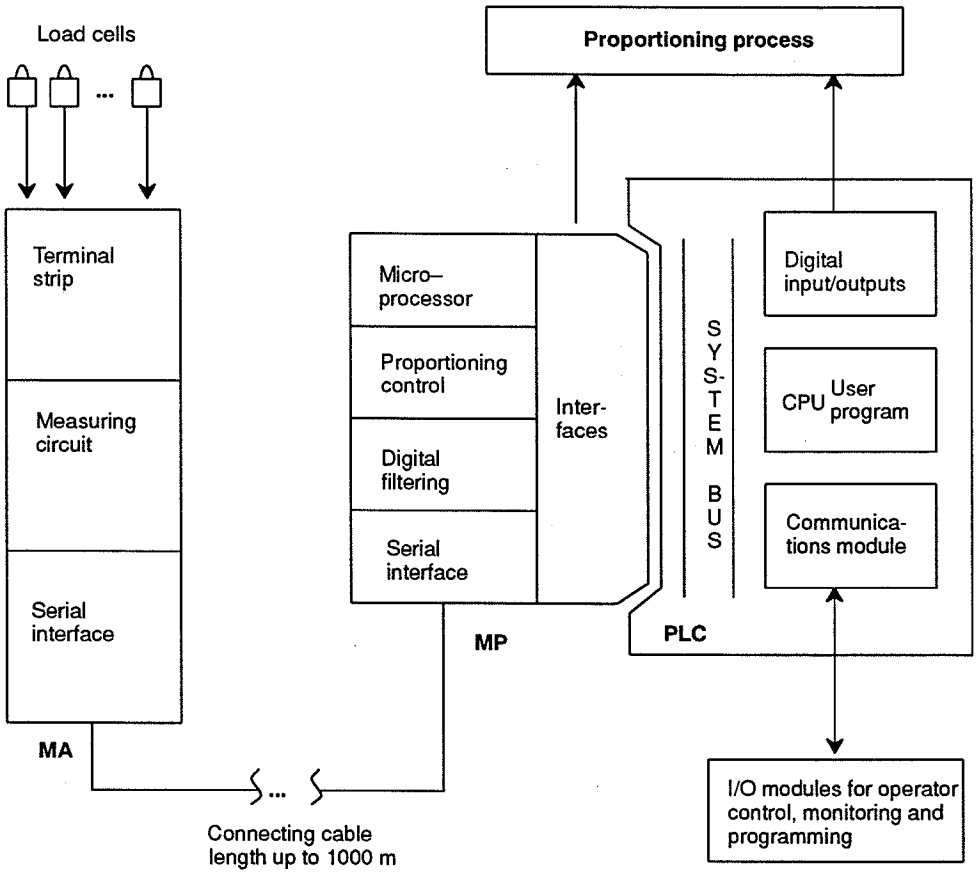


Fig. 1.6 Weighing and proportioning system

The tasks of the single components are grouped into modules.

Measured value acquisition:

Terminal strip Connection of the measured voltages from the individual load cells.

Measuring circuit Amplification and analog/digital conversion of the measured voltage based on a time–keeping compensation mechanism.

Serial interface Data transfer to measured value processing.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Measured value processing

Serial interface	Accepting data from the transmission line
Digital filtering	Measured values can be treated using various filter functions (Exponent, Bessel, Butterworth).
Proportioning control	The timing of coarse and fine proportioning is determined from the measured values and the setpoints and parameter values.
Interfaces	Establish the connection to the progammable controller. Actuate the proportioning devices.

Programmable controller

System bus	Connects all modules of the PLC to the CPU. The MP is linked via the system bus.
CPU	Coordinates the modules and executes user program.
User program	Adaptation of the system to the process in hand. (Multi–component weighing, subtask in complex plants).
Digital input/output	Digital interface to the automation process (can also be used for the proportioning process).
Communications module	Interface from the PLC to the I/O modules.

Further components of the weighing and proportioning system

Proportioning process	Material flow control (coarse/fine proportioning), emptying bins, switching to various material silos, emergency OFF, etc.
I/O devices	Developing and adapting the user programs, monitoring the process, reading the measured values, statistical evaluation, logging, starting and controlling the process, manual mode.

1.2.2 Configuration

The measured value processing module of the WPS(i) weighing processor is designed as an I/O module for use in SIMATIC S5 programmable controllers. The following programmable controllers can be used:

SIMATIC S5 – 115 U
SIMATIC S5 – 135 U
SIMATIC S5 – 155 U

Whatever the configuration of the loading and proportioning system, the user can use all additional and expansion devices that are suitable for the chosen PLC. Precise information on this is given in the manual for the PLC. The PLC is not described in detail in the following configuration diagrams.

1.2.2.1 Basic system

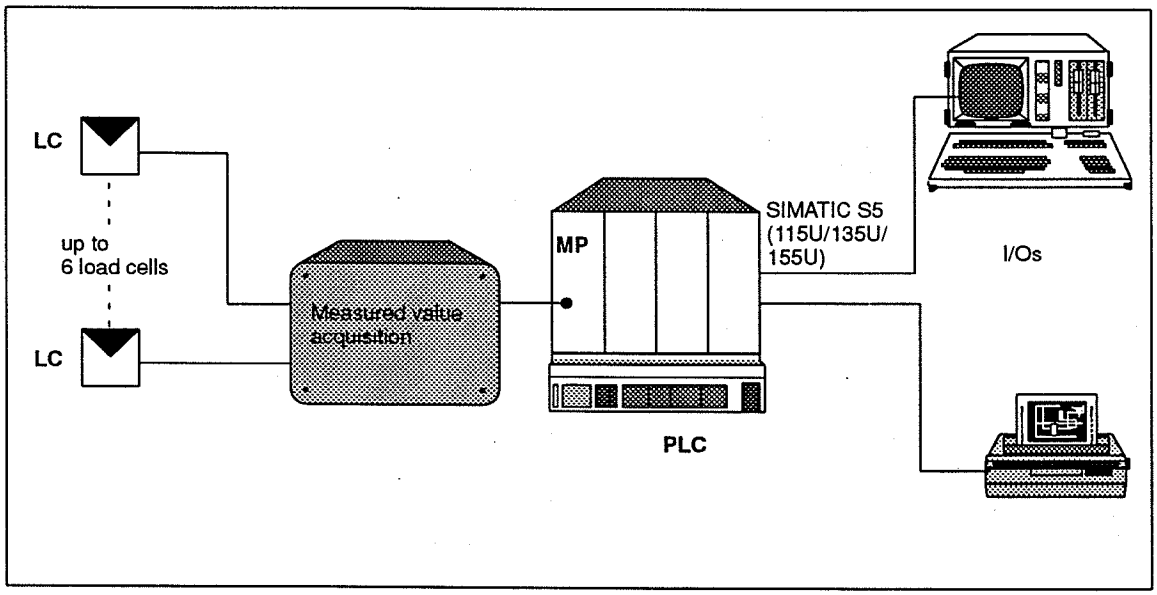


Fig. 1.7 Simple configuration with a WPS(i) weighing processor

1.2.2.2 Connecting a remote display (optional)

The MP is equipped with an interface for a remote display which can be used to display measured values.

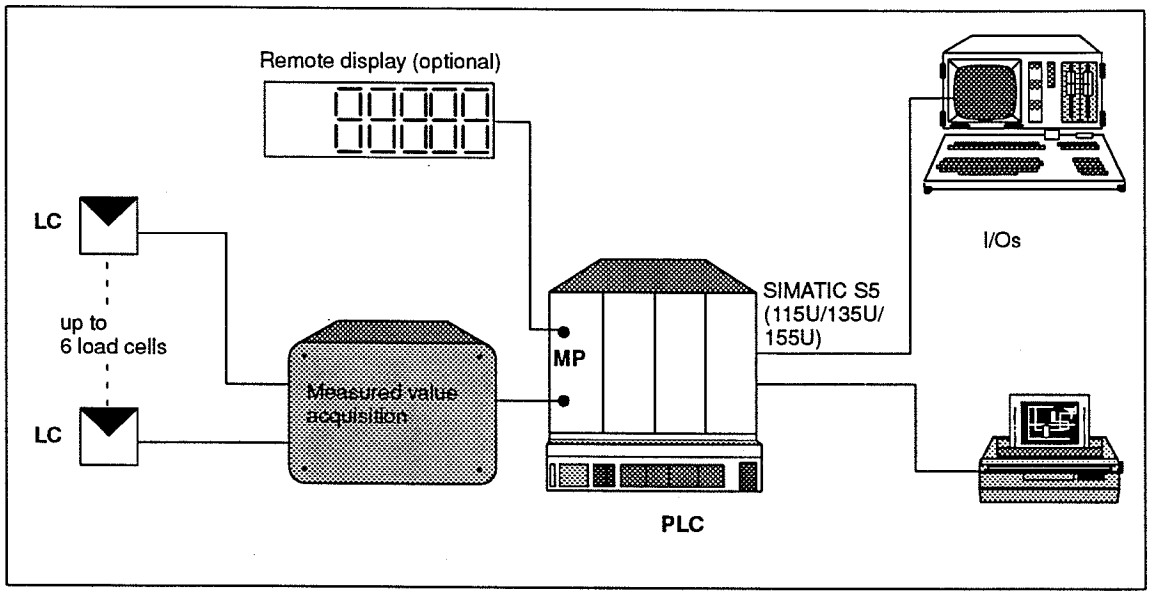


Fig. 1.8 WPS(i) weighing processor with remote display

1.2.2.3 Use of several WPS(i) weighing processors

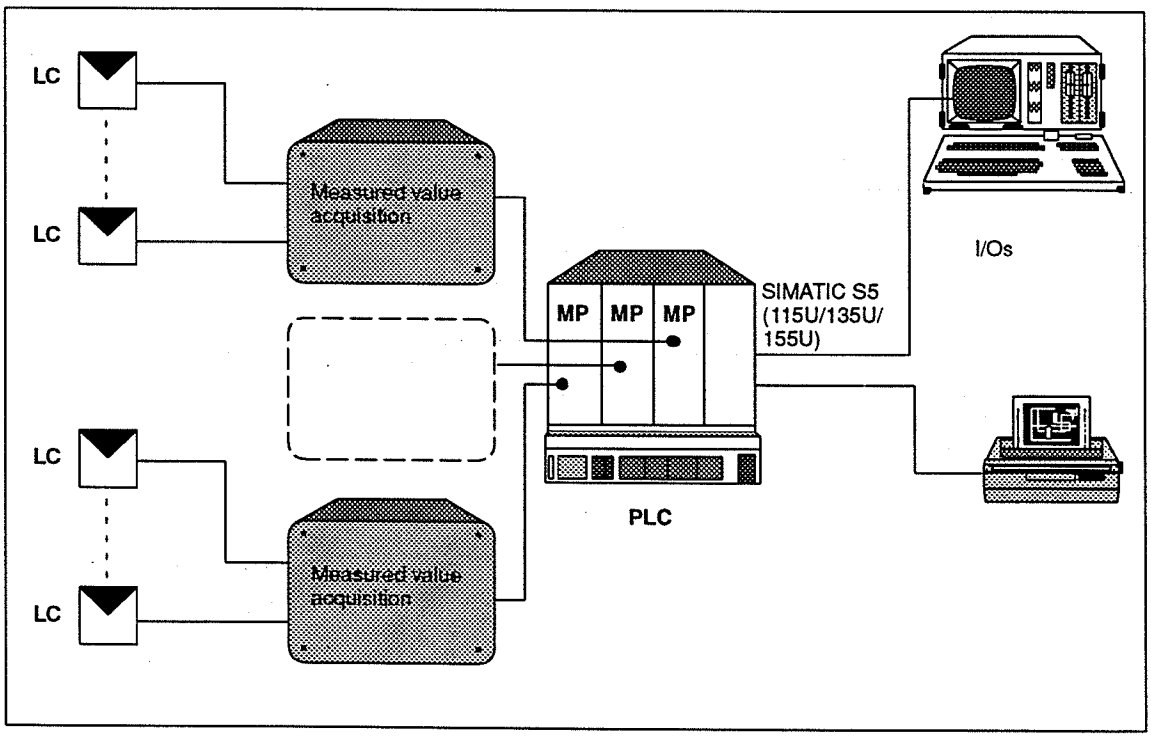


Fig. 1.9 Example with several WPS(i) weighing processors

The possible number of weighing processor systems is limited by the addressing capacity and the number of free slots in the PLC.

Addressing 256 different MPs (256 page addresses)

Slots Depending on PLC (possibly with use of expansion units to S5)

1.2.2.4 Use of the intrinsically safe version of the MA: MAi

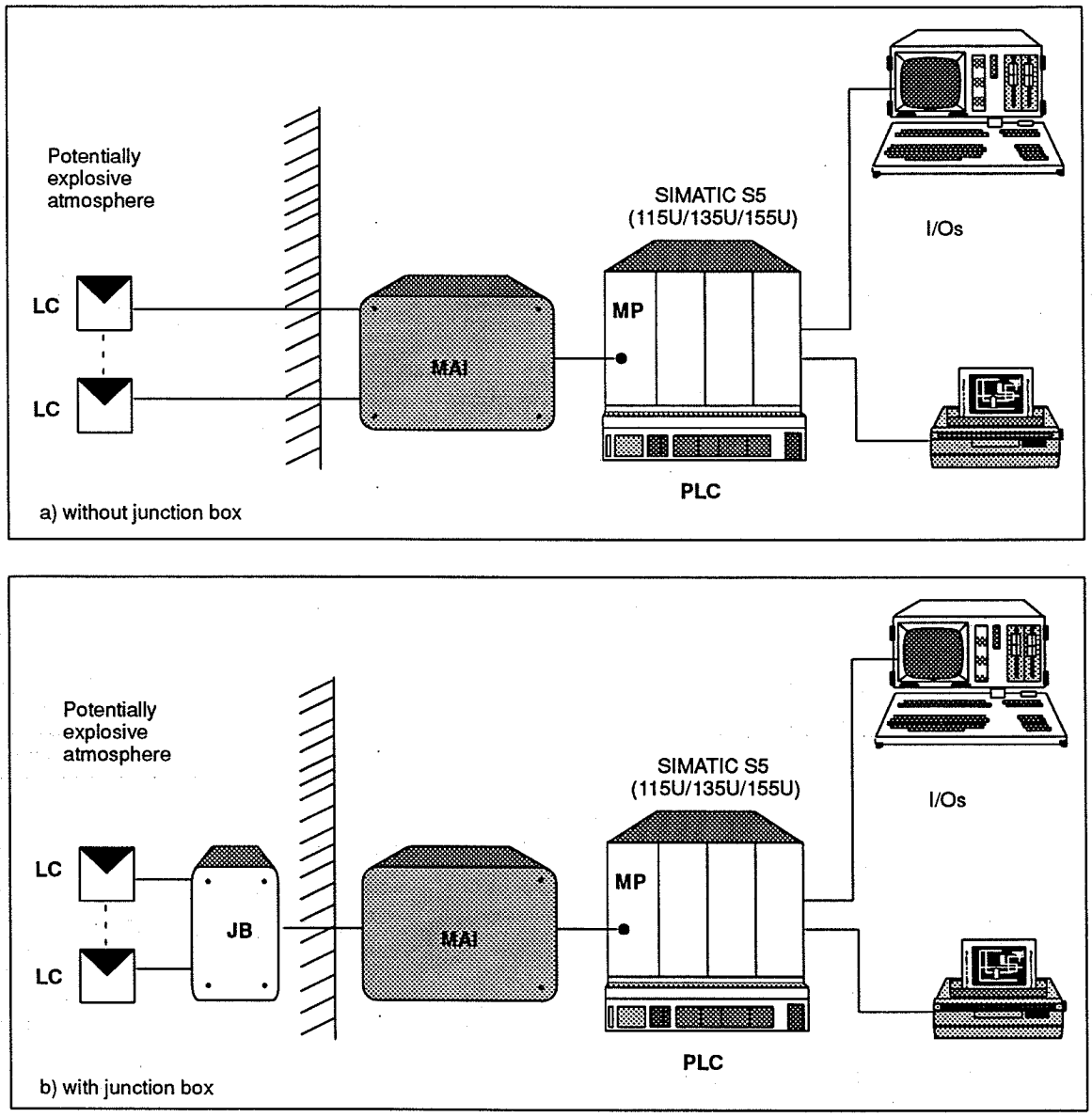


Fig. 1.10 Use of the WPS(i) weighing processor in potentially explosive atmospheres

The MAi is a variant of the measured value acquisition module that was developed especially for use in potentially explosive atmospheres. It is important that only the load cells be located in the potentially explosive atmosphere, not the MAi itself.

The intrinsically safe variant of the measured value acquisition module (MAi) is functionally identical to the standard MA. The differences are in the technical design:

- Voltage and current limits on all measuring and power supply lines.
- Different design of housing and terminals.

MAi measured value acquisition is described in section 4.

(4) J31037–D5603–U1–A0–7619

2 Measured Value Processing MP

2 Measured Value Processing MP

2.1 Description

The measured value processing module is an I/O module for an S5 programmable controller.

2.1.1 Tasks of the MP

MP measured value processing is the main module of the WPS(i) weighing processor, Digital signals are primarily processed.

Passing on measured values	The MP receives measured values from the measured value acquisition module already in digital form, The weight value from a weighing device is processed, The measured value is passed on to the programmable controller.
Proportioning control	Acting on the setpoint and the measured value, the MA automatically controls the proportioning operation, The material supply in the weigh–bins is supported by a few special functions to reach the setpoint as precisely as possible.
Proportioning monitoring	Proper functioning of the proportioning operation and of the proportioning devices is constantly monitored in the MP.
System monitoring	The MP firmware contains monitoring routines that check the hard–ware for proper functioning, Any faults detected are passed on to the programmable controller. Proper functioning of the firmware is monitored using a watchdog circuit.
Communication with the MA	Signals from the MA are passed on to the programmable controller and plant–specific parameters are transferred to the MA.
Communication with the S5	Passive provision and acceptance of data at the request of the programmable controller.
Special connections	Processing of pulses and analog signals.

 (4) J31037–D5603–U1–A0–7619

2.1.2 Structure and function of the MP

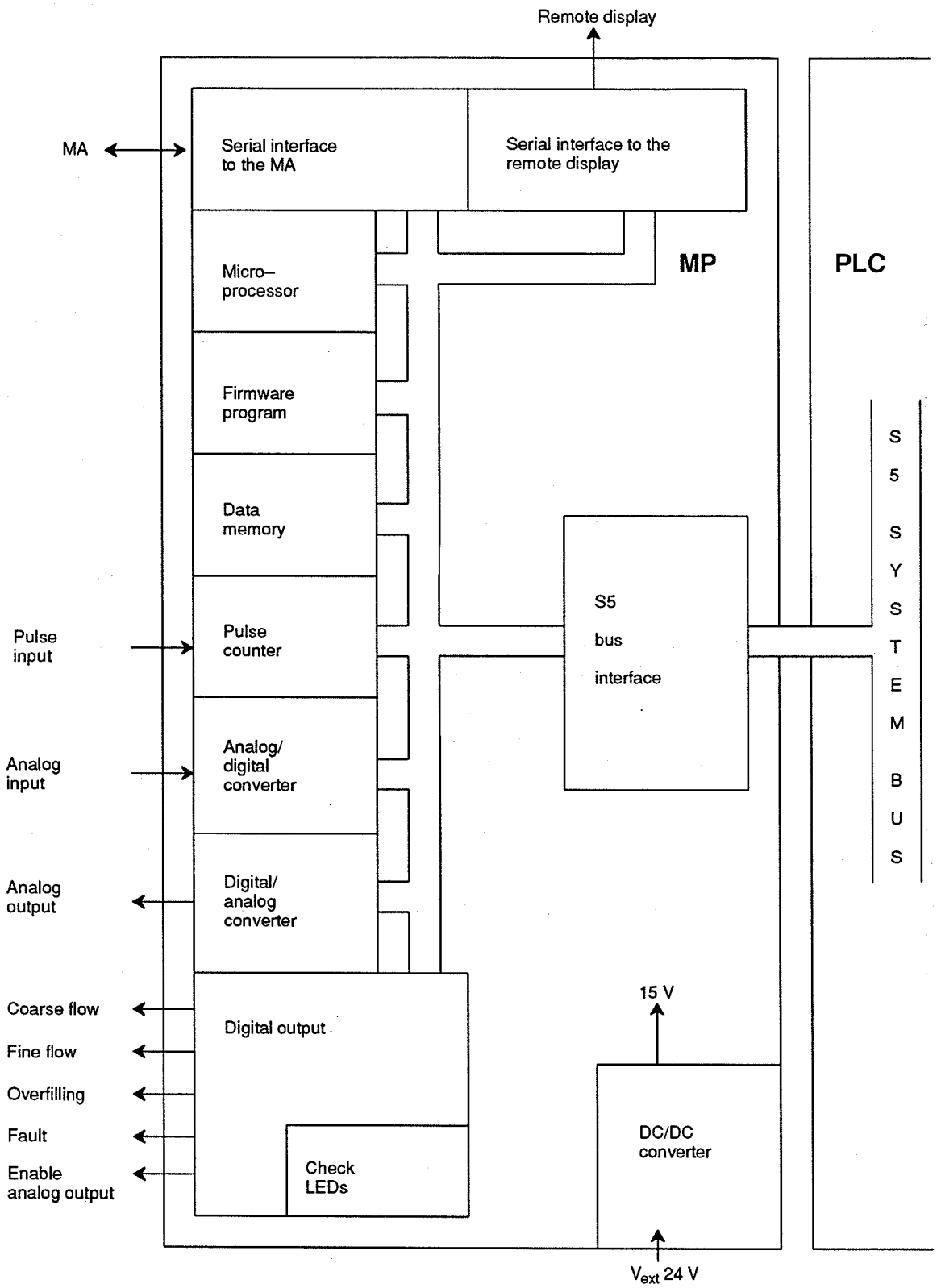


Fig. 2.1 *Diagram of the structure of the MP*

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Explanation of each component

Serial interface to the MA	Communication with the MA
Serial interface to the remote display	Supplies the remote display (option) with actual values.
Microprocessor	Control of all activities and functions within the module.
Data memory	Storage of current parameters, This memory is battery–backed.
Pulse counter	Recording the pulses of the freely usable pulse input.
Analog/digital converter	Acquisition of an analog value for free use (e.g. additional temperature or humidity measuring for compensation purposes).The input of the analog/digital converter can be parameterized as either voltage or current input.
Digital/analog converter	Analog value output, e.g. for analog measured value display. The output of the digital/analog converter can be parameterized as either voltage or current output.
Digital output	Output of proportioning control signals and the signals for overfilling/fault.
Check LEDs	Displays the operating state of the WPS(i) weighing processor on the front panel of the MP.
S5 bus interface	Communication system for data exchange with the S5 programmable controller.
DC/DC converter	Power supply to the serial interfaces, the analog part and the digital outputs of the MP, e.g. from the 24 V cable of the programmable controller.

(4) J31037–D5603–U1–A0–7619

2.1.3 Technical data

The same requirements apply to the MP as to SIMATIC I/O modules.

2.1.3.1 Power supply

External supply voltage V_{ext}	Rating	24 V DC
	Lower limit	20 V
	Upper limit	30 V
Current consumption	Of connected outputs	200 mA
Internal supply voltage V_{int} (via backplane connector X1)	Rating	+ 5 V
	Lower limit	+ 4.75 V
	Upper limit	+ 5.25 V
Current consumption	norm.	500 mA
	max.	700 mA

☞ For battery see Section 2.2.2.2.

2.1.3.2 Analog input

	For maximum permissible potential difference to internal 5 V voltage	500 V
	Resolution	12 bits
	Minimum precision	± 1%
	Scan rate	100 ms
Voltage input	Input voltage range	0 ... 10 V
	Input resistance	10 kΩ
Current input	Input current range	0 ... 20 mA
	Input resistance	approx. 50 Ω

2.1.3.3 Analog output

	Maximum permissible potential difference to internal 5 V voltage	500 V
	Resolution	12 bits
	Minimum precision	± 1%
	Updating cycle	100 ms
Voltage output	Voltage range	0 ... 10 V
	Minimum load resistance	2 kΩ
Current output	Current range	0 ... 20 mA
	Maximum load resistance	500 Ω

2.1.3.4 Pulse input

Maximum permissible potential difference to the internal 5 V voltage ..... 500 V
Maximum input frequency ..... 5 kHz
Maximum input current ..... < 1 mA

Input voltage

Total permissible range ..... –3 V ... + 33 V
Range for 0 level ..... U < 8 V
Range for 1 level ..... U > 13 V

2.1.3.5 24 V digital outputs

Maximum permissible potential difference to the internal 5 V voltage ..... 500 V

Output voltage

Active state: at least module power supply – 2 V
Inactive state: maximum + 3 V

Output current

The digital outputs "coarse flow". "fine flow" can be loaded with 300 mA each. The digital outputs "fault", "overfilling" and "enable evaluation of analog outputs" can be loaded with 200 mA each.

Caution

When connecting inductive loads, it is necessary to use the appropriate free–wheeling diodes.

MTBF

To SN 29500 ..... > 75.000 hours.
(reference temperature 40° C. without battery)

(4) J31037–D5603–U1–A0–7619

2.2 Installation

The following steps are required to install the module:

- Setting the jumpers and coding switches (→ Section 2.2.4)
- Inserting the module in the PLC
- Inserting the connectors

All steps involve work on the module or in the PLC.

Warnung

Sicherer Betrieb des Wägesystems SIWAREX setzt voraus, daß es von qualifiziertem Personal sachgemäß unter Beachtung der Warnhinweise dieser Betriebsanleitung montiert und in Betrieb gesetzt wird.

Insbesondere sind sowohl die allgemeinen Montage– und Sicherheitsvorschriften zu Arbeiten an stromführenden Anlagen (z.B. DIN VDE) als auch die den fachgerechten Einsatz von Werkzeugen und Hilfsmitteln und die Benutzung persönlicher Schutzausstattungen betreffenden Vorschriften zu beachten.

Bei Nichtbeachtung können Tod. schwere Körperverletzung oder erhebliche Sachschäden die Folge sein.

Warning

Safe operation of SIWAREX is dependent upon proper handling and installation by qualified personnel under observance of all warnings contained in these Operating Instructions.

In particular the general installation and safety regulations (e.g. DIN VDE, IEC) and regulations regarding the correct use of hoisting gear and tools and of personal protective gear (safety goggles and the like) must be observed.

Non–observance can result in death, severe personal injury or substantial property damage.

Observe ESD protective measures !

Almost all SIMATIC S5 and SIWAREX modules contain highly integrated components in MOS technology. These electronic components are necessarily very sensitive to overvoltages and therefore also to electrostatic discharge.

The ESD symbol on labels, modules, racks and packaging indicates that electrostatically sensitive devices have been used and that the modules are therefore sensitive to touch.

Only by consistent use of protective equipment and responsible observance of handling rules can functional faults and failures of ESD modules be avoided.

2.2.1 Mechanical format of the module

The module is of double–height Eurocard format. The front panel contains SUB–D connectors for the inputs and outputs of the MP. It also contains 7 LEDs for displaying the current operating state and a 24 V female connector.

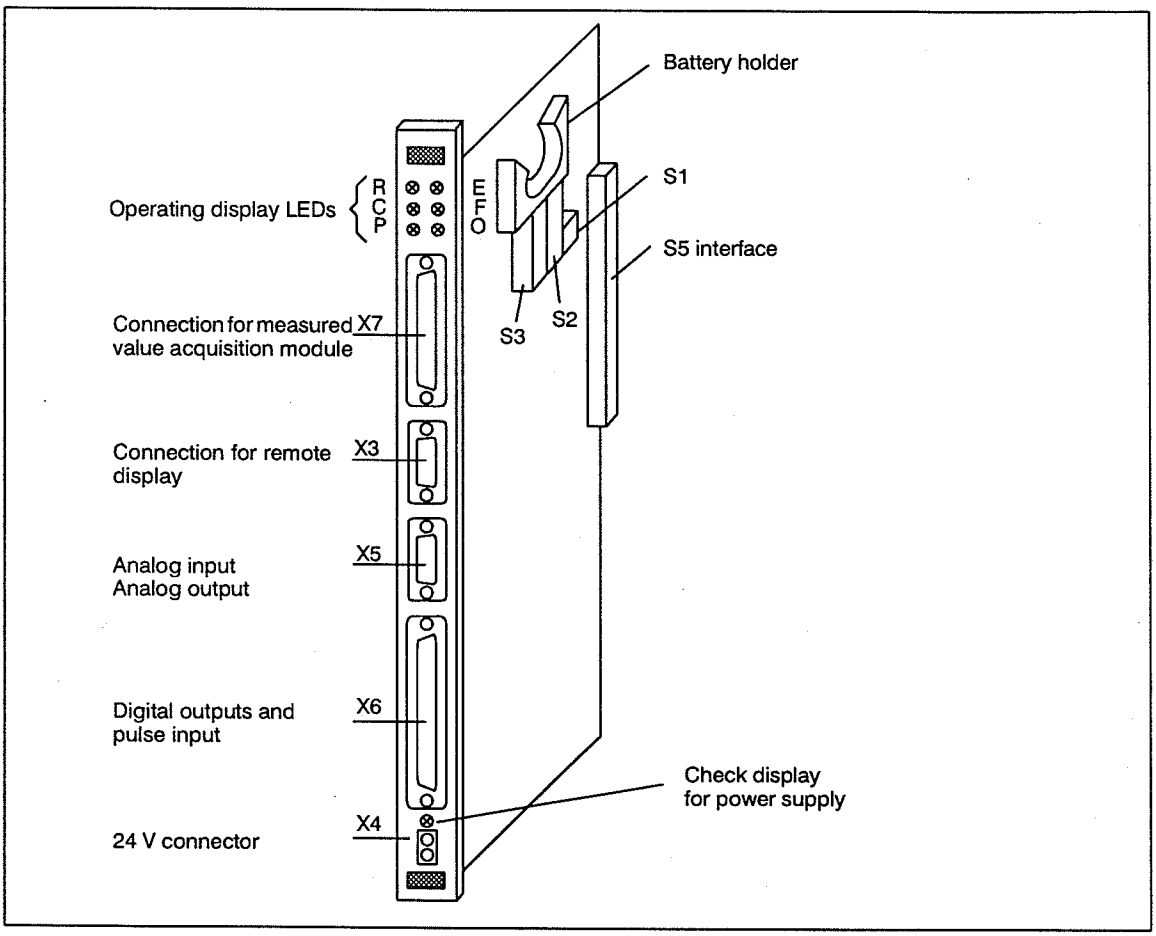


Fig. 2.2 Layout of the MP module

(4) J31037–D5603–U1–A0–7619

Designation	Color	Meaning
RUN (R)	green	Operation (blinks until adjustment completed)
ERROR (E)	red	Fault
COARSE (C)	green	Coarse flow
FINE (F)	green	Fine flow
PULSE (P)	green	Pulse / standstill
OVERLOAD (O)	red	Overfilling / overload

Table 2.1 Meaning of the operating display

Explanations of the operating display

RUN This LED flashes until a valid adjustment has been performed. After adjustment has been completed the LED lights up permanently. The LED goes out if an error has occurred and the error LED is lit.

ERROR This LED lights up if an error has been detected (see error words DW 72 ff), The LED goes out if the error has been remedied and an error acknowledgement has been sent to the MP.

COARSE This LED lights up if the coarse flow output is active.

FINE This LED lights up if the fine flow output is active.

PULSE (Standstill display) This LED lights up permanently if the stop condition has been fulfilled. If this condition has not been met, the LED flashes (see Section 2.5.3.13).

OVERLOAD (Overfilling) This LED lights up if the weighing machine has been overfilled. This can be caused if either the weight or volume limit has been exceeded.

☞ On power–up and after a RESET command has been performed, all operating state LEDs remain lit for several seconds during start–up (LAMP TEST function).

All LEDs off Fault in the supply voltage of the PLC or function fault of the MP.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.2.2 Installation in the SIMATIC S5

2.2.2.1 Selecting the slot

The interface to the S5 bus is a 48–way backplane connector. The width of the module is $1^1/_3$ SPS (Standard Plug–in Station). This is the same as a SIMATIC slot.

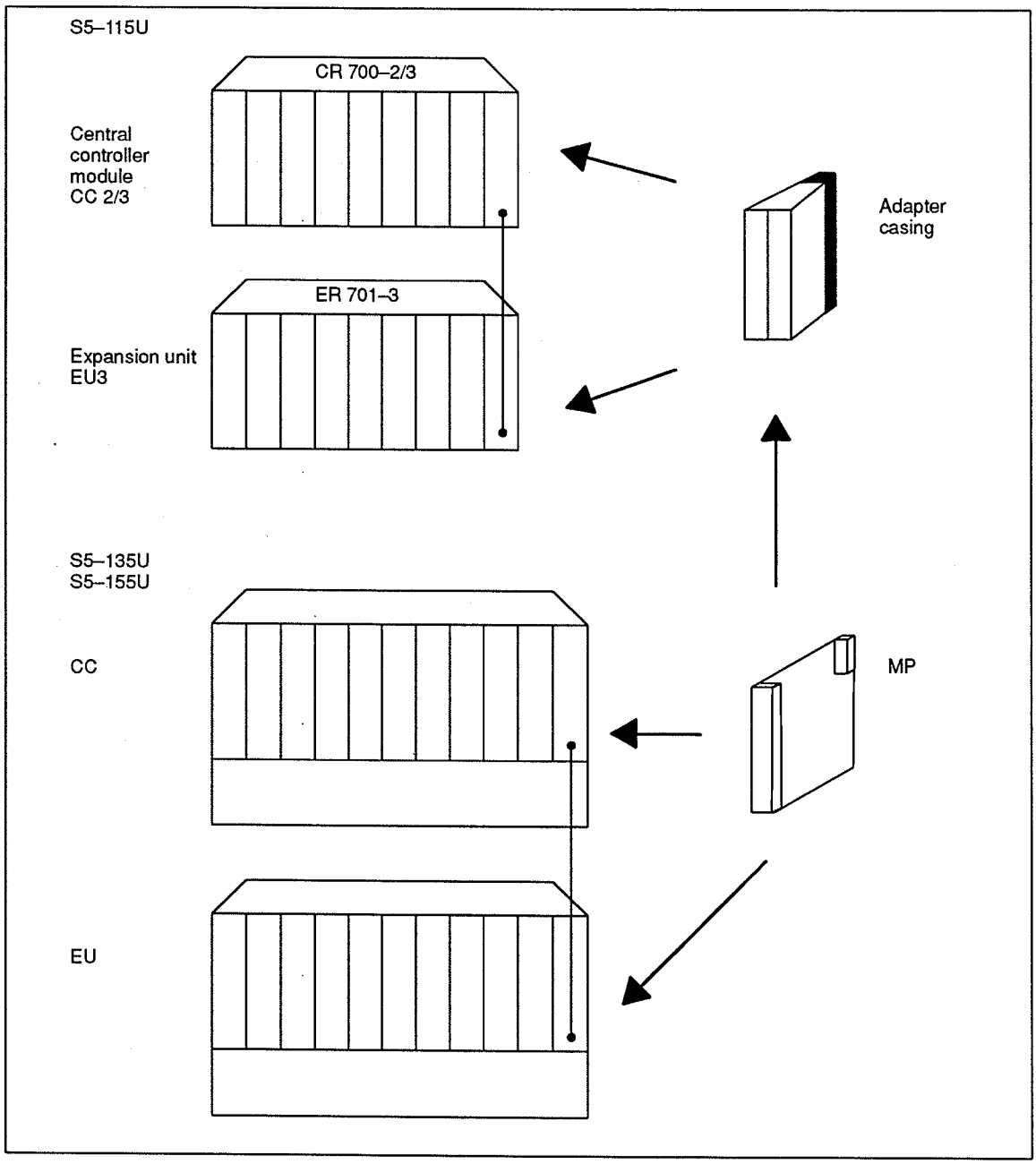


Fig. 2.3 How to slot the module into various S5 programmable controllers.

(4) J31037–D5603–U1–A0–7619

Overview of slots for MP

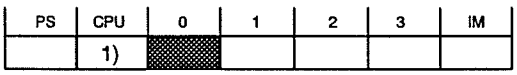
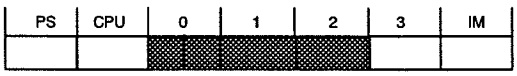
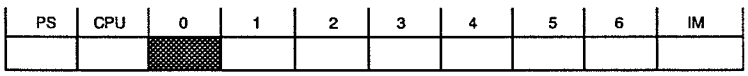
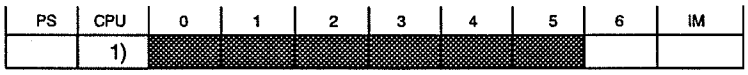
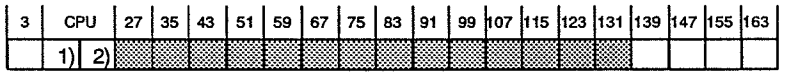
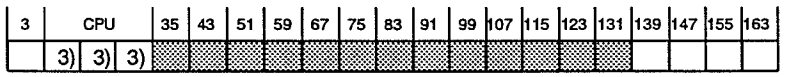
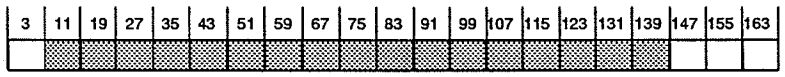
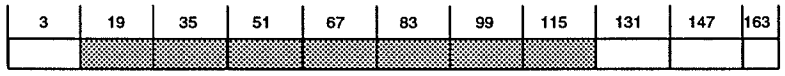
Programmable controller	Rack	Slot designation = possible = only possible with adapter casing [4]
CC 115U	CR 700–0LA	
	CR 700–0LB	
	CR 700–1	
	CR 700–2/3	
EU 115U	ER 701–3	
CC 135U		
CC 155U		
EU 185U		
EU 186U		

Table 2.2 Slots that can be used

Possible CPUs:

CC.115U	CPU 941 to CPU 945[1)] CPU 941B to CPU 944B[1)]	
CC.135U	CPU 922 (A9)[1)] CPU 928[2)], CPU 928B[2)]	} can also be used in the CC 155U
CC.155U	CPU 946/947[3)] CPU 948[2)]	

1) The CPU requires one slot.

2) The CPU requires two slots.

3) The CPU requires three slots.

4) Adapter casing 6ES5 491–OLB11

2.2.2.2 How to insert and replace the battery

Insertion

The MP module is equipped with a battery. This is used to back up the data memory if the 5 V power supply of the module is switched off.

The battery is included in the packaging of the module and must be inserted before mounting the battery holder. The battery holder is on the component side right next to switches S2 and S3.

> **Caution**
>
> It is important to pay attention to the remaining life of the battery otherwise the data stored in the MP could be lost.

The life of the battery depends on the operating time of the module in the PLC and on ambient conditions. When the module is not under power the battery has a life of 35.000 hours at 20° C and approx. 15.000 hours at 40°C. For this reason it is important to remove the battery when the module is stored. Due to the temperature–dependent self–discharge of the battery, the battery should be replaced at least every 6 years (at 20° C) or every 4 years (at 40° C).

Replacement

To replace the battery of the MP proceed as follows:

- Observe the ESD guidelines (see introduction)
- Back up important data e.g. adjustment data on an appropriate medium (PLC, programmer, diskette, ...).
- Switch off the PLC
- Remove the MP
- Remove the battery
- Insert the new battery (Be sure polarity is correct as shown in figure 2.9).
- Slot in the module (MP)
- Transfer the data back to the MP module

> **Caution**
>
> Never remove or slot in the module while the PLC is under power!

2.2.3 Connecting the interfaces

The S5 interface is an X1 backplane connector on the rear of the MP.

The front panel contains the interface connectors of the MP module. All of them are miniature SUB–D female or male connectors.

2.2.3.1 S5 interface

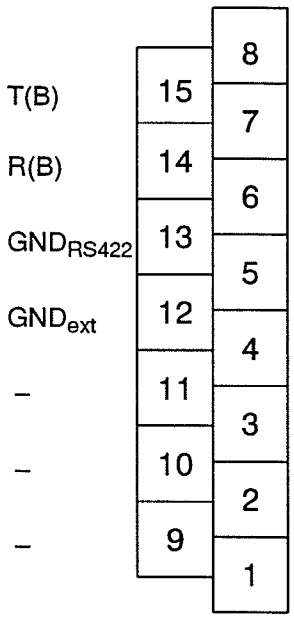
Assignment of the X1 backplane connector

	d	b	z
2	NC	M	5V
4	NC	NC	NC
6	ADB12	ADB0	/CPKL
8	ADB13	ADB1	/MEMR
10	ADB14	ADB2	/MEMW
12	ADB15	ADB3	/RDY
14	/IRA *)	ADB4	DB0
16	/IRB *)	ADB5	DB1
18	/IRC *)	ADB6	DB2
20	/IRD *)	ADB7	DB3
22	NC	ADB8	DB4
24	/NAU **)	ADB9	DB5
26	NC	ADB10	DB6
28	/DSI	ADB11	DB7
30	NC	BASP	NC
32	NC	M	NC

*) Is not used
**) Used with S5–115 only (→ Section 2.2.4.3 [X31])
NC Not assigned

2.2.3.2 Connecting the measured value acquisition (X7)

Design: 15–way SUB–D female connector



T(A):	Transmit (inverting)
R(A):	Receive (inverting)
T(B):	Tansmit (non–inverting)
R(B):	Receive (non–inverting)
GND$_{RS422}$:	Ground of serial transmission
V$_{ext}$:	Voltage supply for MA
GND$_{ext}$:	Ground of the voltage supply

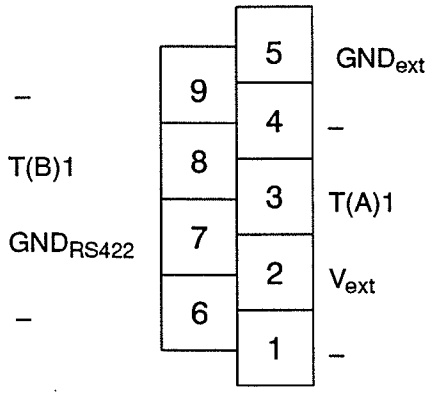
Terminals 1, 2, 5, 8, 9, 10, 11 must not be connected !

Fig. 2.4 Pin assignments for measured value acquisition

(4) J31037–D5603–U1–A0–7619

2.2.3.3 Connection of the remote display (X3)

Design: 9–way SUB–D female connector



T(A)1: Send (inverting)

T(B)1: Send (non–inverting)

GND$_{RS422}$: Ground for serial transmission

V$_{ext}$: External voltage supply

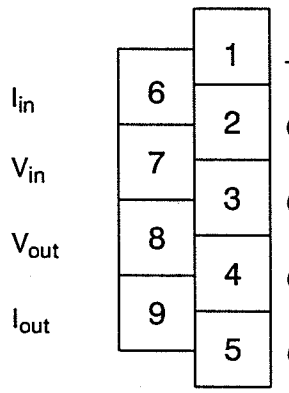
GND$_{ext}$: Ground for external voltage supply

Terminals 1, 4, 6 and 9 must not be connected!

Fig. 2.5 Pin assignments for remote display

2.2.3.4 Analog input and analog output (X5)

Design: 9–way SUB–D male connector



V$_{out}$: Analog output (voltage)

I$_{out}$: Analog output (current)

V$_{in}$: Analog input (voltage)

I$_{in}$: Analog input (current)

GND$_{out}$: Ground for analog output

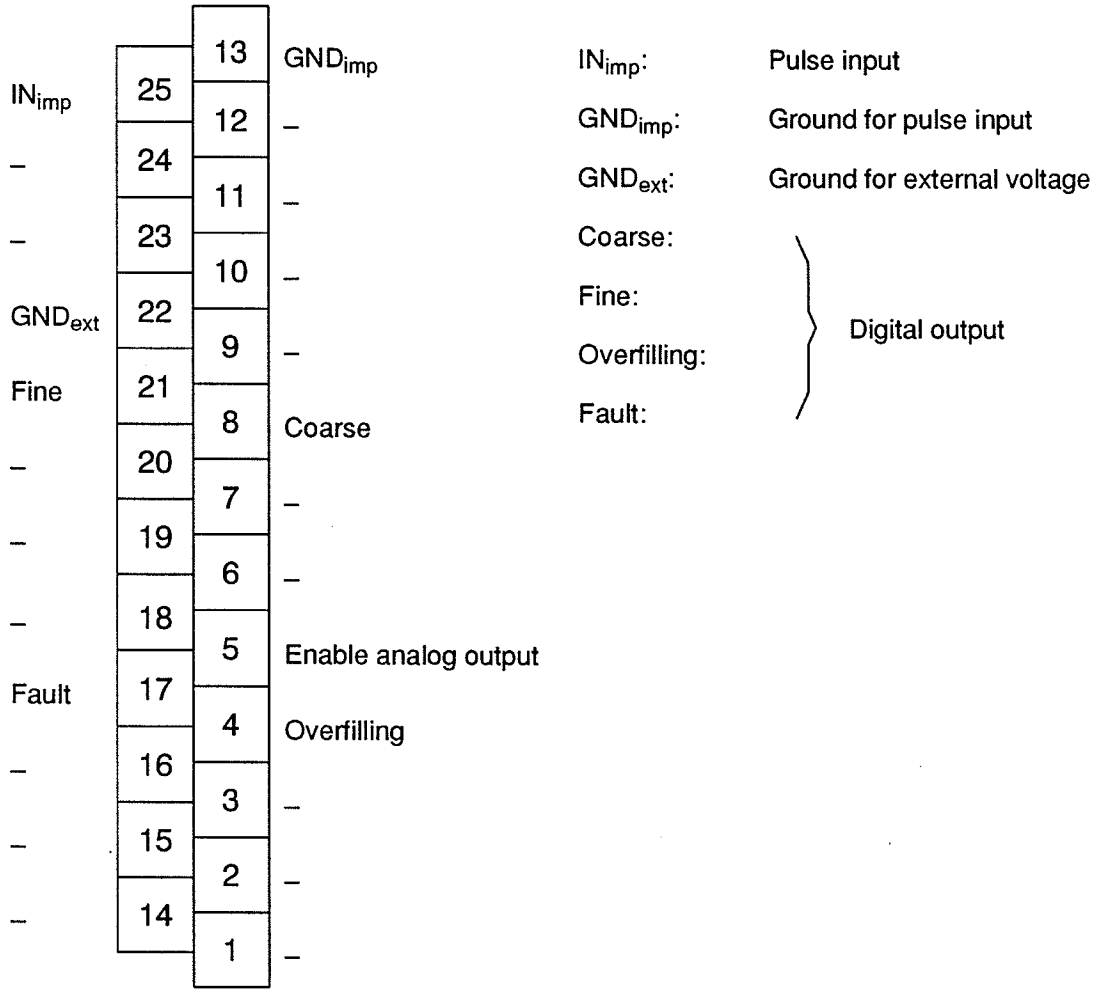
GND$_{in}$: Ground for analog input

Fig. 2.6 Pin assignments for analog input / analog output

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.2.3.5 Digital outputs and pulse input (X6)

Design: 25–way SUB–D female connector



Terminals 1–3, 6, 7, 9–12, 14–16, 18–20, 23 and 24 must not be connected.

Fig. 2.7 Pin assignments for digital outputs and pulse input

2.2.3.6 Connection of the external supply voltage (X4)

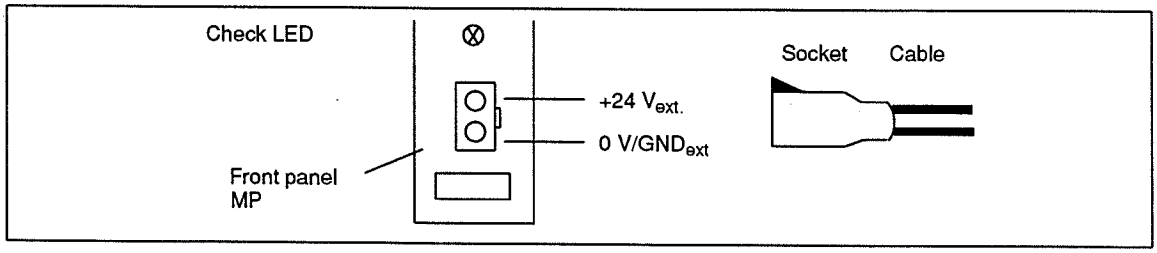


Fig. 2.8 Supply voltage connection

When connecting the cable to the connector the plus and 0–potentials must not be connected the wrong way round.

2.2.4 Settings

Before commissioning, a few settings are required to adapt to the automation system on the measured value processing module.

2.2.4.1 Position of the setting elements

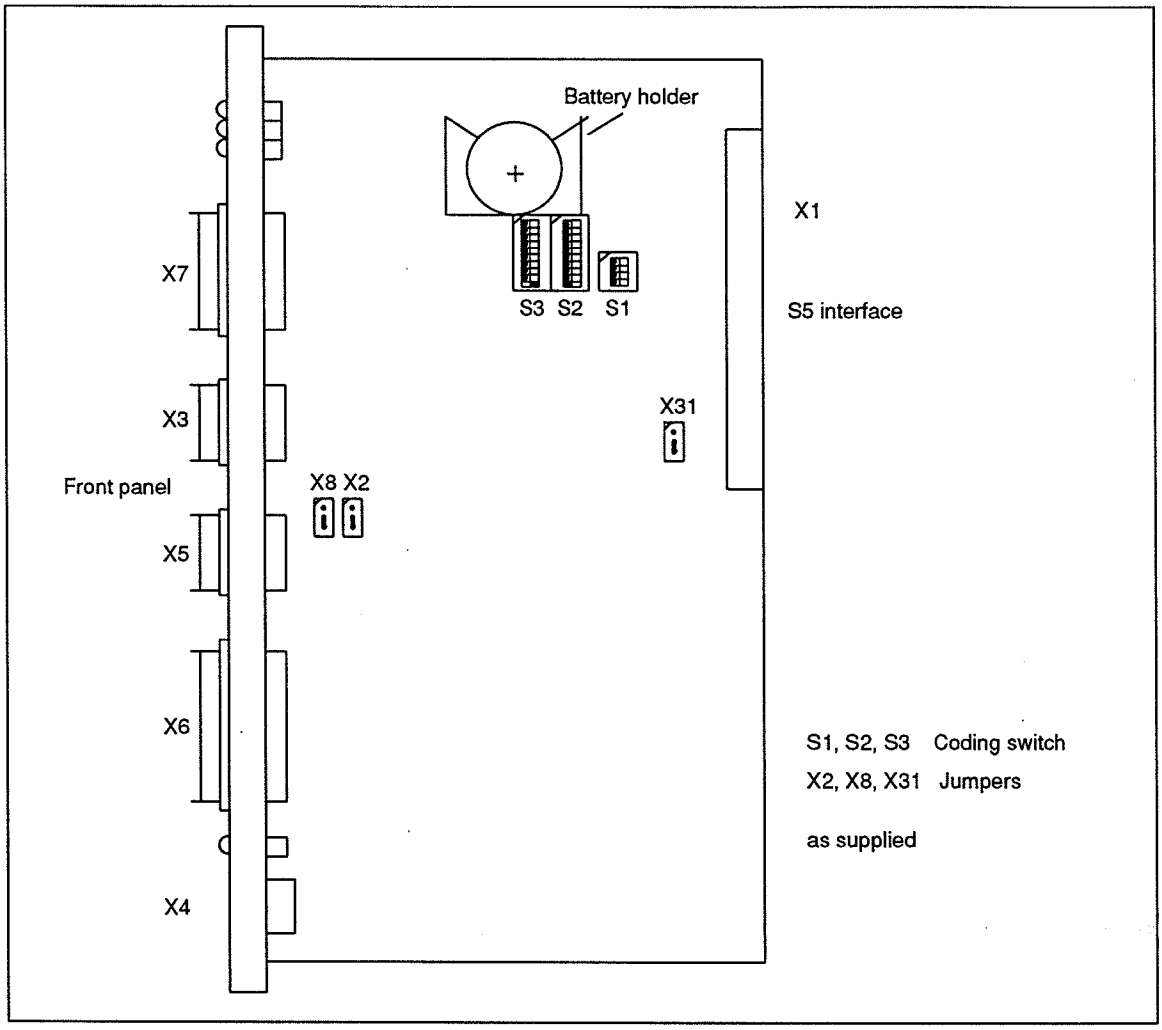


Fig. 2.9 Positions of the jumpers, coding switches and the battery holder

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.2.4.2 Coding switches

Caution

Switches S1.1 to S1.4 and S2.1 to S2.10 must always be in "OFF" position !

Addressing: (S3)

Use switch S3 to set the number of the interface via which the module is to be addressed by the PLC.

Switch S3 still contains the disable–enable (BASP) for the binary outputs of the module.

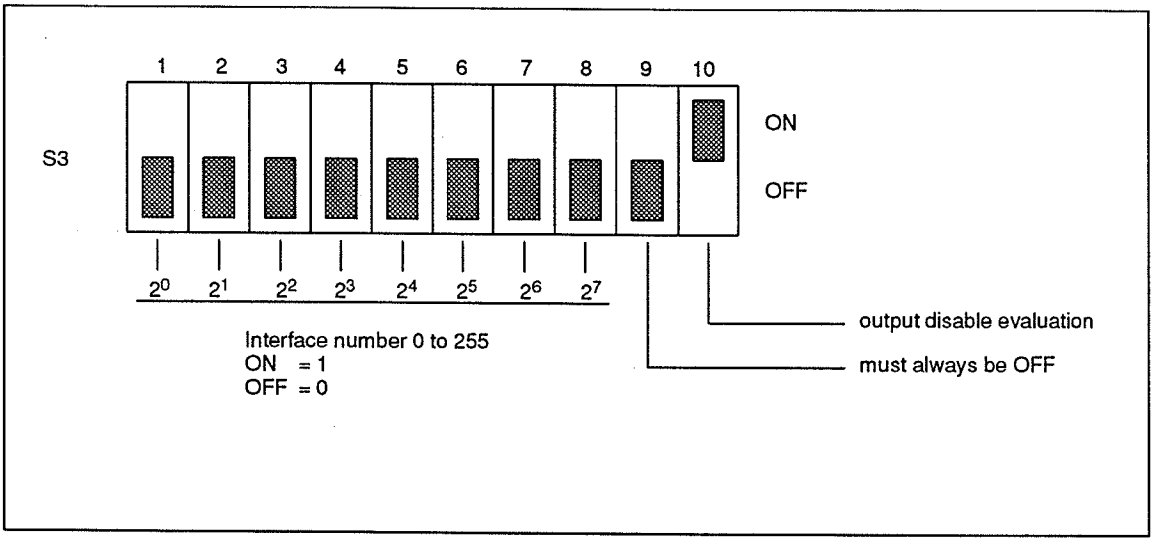


Fig. 2.10 Assignments of switch 3

BASP (output disable)

- ON : Disable the digital outputs by the BASP signal from PLC is possible.
- OFF: BASP has no effect on the digital outputs.

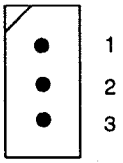
Factory setting of switch S3:

- Interface no. 0 set
- BASP = ON

(4) J31037–D5603–U1–A0–7619

2.2.4.3 Jumpers

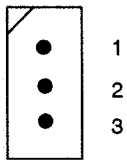
X2 Setting of the analog output



Position 1–2:	current output	0(4)	– 20 mA
Position 2–3:	voltage output	0	– 10 V
Factory setting:	voltage output	0	– 10 V

The setting of 0 – 20 mA or 4 – 20 mA is made by parameters (→ Section 2)

X8 Setting the analog input

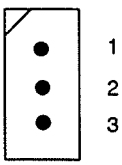


Position 1–2:	current input	0(4)	– 20 mA
Position 2–3:	voltage input	0	– 10 V
Factory setting:	voltage input	0	– 10 V

The setting of 0 – 20 mA or 4 mA is made by parameters (→ Section 2.5.5.1).

X31 Adapting the data backup to the programmable controller used.

So that the data battery backed on the module are not destroyed on switching off or power failure, it is necessary to make the adaptations to the PLC used.



Position 1–2:	PLC S5–115U (NAU signal)
Position 2–3:	PLC S5–135U/S5–155U (DSI signal)
Factory setting:	PLC S5–135U/S5–155U

Caution

Jumper X31 must be in the correct position otherwise correct functioning of the module cannot be guaranteed.

2.3 Interfaces

2.3.1 Interface to the programmable controller PLC

The WPS(i) weighing processor system becomes accessible to the user through the interface to the PLC. The PLC contains the user program. This interface is described in a separate section (section 2.4) since the entire control of the WPS(i) weighing processor is handled by this interface.

2.3.2 Interface to the measured value acquisition

This interface is used exclusively for connecting the measured value acquisition. Precise know–ledge of the transmission protocol is therefore not required.

Adjustment data are sent to the MA when the system begins operation. Measured values, status and error messages are received by the MA.

Transmission is secured by several methods simultaneously. After several failed attempts at receiving a message the fault is signalled to the PLC.

Data of the interface:	– Transmission rate	19200 bit/s
	– Frame sequence	10 ms

The non–stabilized plant supply voltage (24 V) is applied to the interface or fed in locally at the MA. Stabilizing is performed in the MA.

Over longer distances (depending on the cable and the number and type of load cells), an external voltage supply is required locally for the MA (→ Section 3.2.2.3).

 (4) J31037–D5603–U1–A0–7619

2.3.3 Digital outputs

The MP module has 5 digital outputs for switching processes. The outputs have preset functions. They are used to actuate a material proportioning device for the weigh–bin.

Coarse valve	Switching the coarse material flow to approach the setpoint rapidly.
Fine valve	Switching the fine material flow to reach the setpoint precisely.
Overfilling	Output for switching off proportioning if the weigh–bin becomes too full.
Fault	The output is set if there is a fault in the weighing system. It can be used, for example, to switch off this plant.
Enable evaluation of analog output	Evaluation of the analog output is only permitted if this output is active.

If an output is active, the appropriate LED lights up on the front panel of the MP.

The outputs can be switched off using a signal (BASP) from the PLC (→ Section 2.2.4.2).

2.3.4 Pulse input

External pulses can be counted with this input. These pulses can, for example, be generated by a pulse encoding volume measuring device. The incoming pulses are fed to a counter.

The functions of the counter can be controlled by the appropriate commands via the PLC.

Possible commands for the counter:

Start	After this command the counter begins to record the incoming pulses.
Stop	All further incoming pulses are ignored.
Reset	Resetting the counter state.

The current counter state is read via the interface to the S5 and is evaluated by the user program in the PLC.

2.3.5 Analog input

The signal at the analog input is converted to a digital value. It is required every 100 ms. The value is transferred to the programmable controller for further use.

The analog input can be used as either a voltage or current input.

Voltage range 0 – 10 V

Current ranges 0 – 20 mA or 4 – 20 mA

Wire break monitoring is possible if you select the current range 4 – 20 mA. The fault signal is set when the current drops to below 2 mA.

2.3.6 Analog output

The analog output can be used for the following tasks:

- Output of one of the values preset by the S5 control.
- Throughput (weight per time unit) during proportioning.
- Actual value of the weighing machine (gross)
- Actual value of the weighing machine (net)

The output value is updated approx. every 100 ms.
The analog output can be used as either a voltage or current output.

Voltage range 0 – 10 V

Current ranges 0 – 20 mA
4 – 20 mA

2.3.7 Interface for the remote display

A remote display can be connected directly to the MP. The protocol of the serial interface is adapted to the remote display. Precise knowledge of the transmission protocol is therefore not required. The transmission rate is 1200 or 2400 baud.

See operating instructions for the remote display for additional information.

 (4) J31037–D5603–U1–A0–7619

2.4 User access and communication

This section explains how the WPS(i) weighing processor can be controlled by the user program in the programmable controller.

A detailed description of the commands and their effect is to be found in Section 2.5, function description.

The structure of the user program is described in Section 2.6.

2.4.1 Communication tasks

The user program performs the following tasks via the communications interface

- Adjustment of the MP
- Setting of setpoints
- Passing on commands
- Processing of signals

Adjustment

When the plant is started up the MP is supplied with adjustment data. The adjustment data are calculated by adjustment commands on commissioning.

The basic settings stored adapt the MP to the existing plant.

Setpoints

Before starting proportioning and weighing, the commands, setpoints, parameters and threshold values are transferred.

Commands

The actions of the MP are triggered by commands from the user program via the communications interface.

Message handling

During execution of the weighing and proportioning functions, states occur that are transferred to the user program as status messages.

In addition to the status messages there are fault messages that are generated by the monitoring functions of the module.
Error messages are acknowledged via the communications interface.

2.4.2 Working principle

Communication with the WPS(i) weighing processor is simplified for the user by a function block. The function block (FB 40) must be ordered separately.

The physical interface to the WPS(i) weighing processor is a dual port RAM (DPR). The DPR is a memory on the MP that is written and read both by the PLC and the measured value processing module. The DPR is hidden from the user's view and is only addressed via the FB 40.

For communication, a data block is used in addition to the function block.

☞ Explanations of the data block and communication interface use data block DB 221 as an example.

Commands are set, data exchanged and feedback from the MP sent via the data block (DB 221).

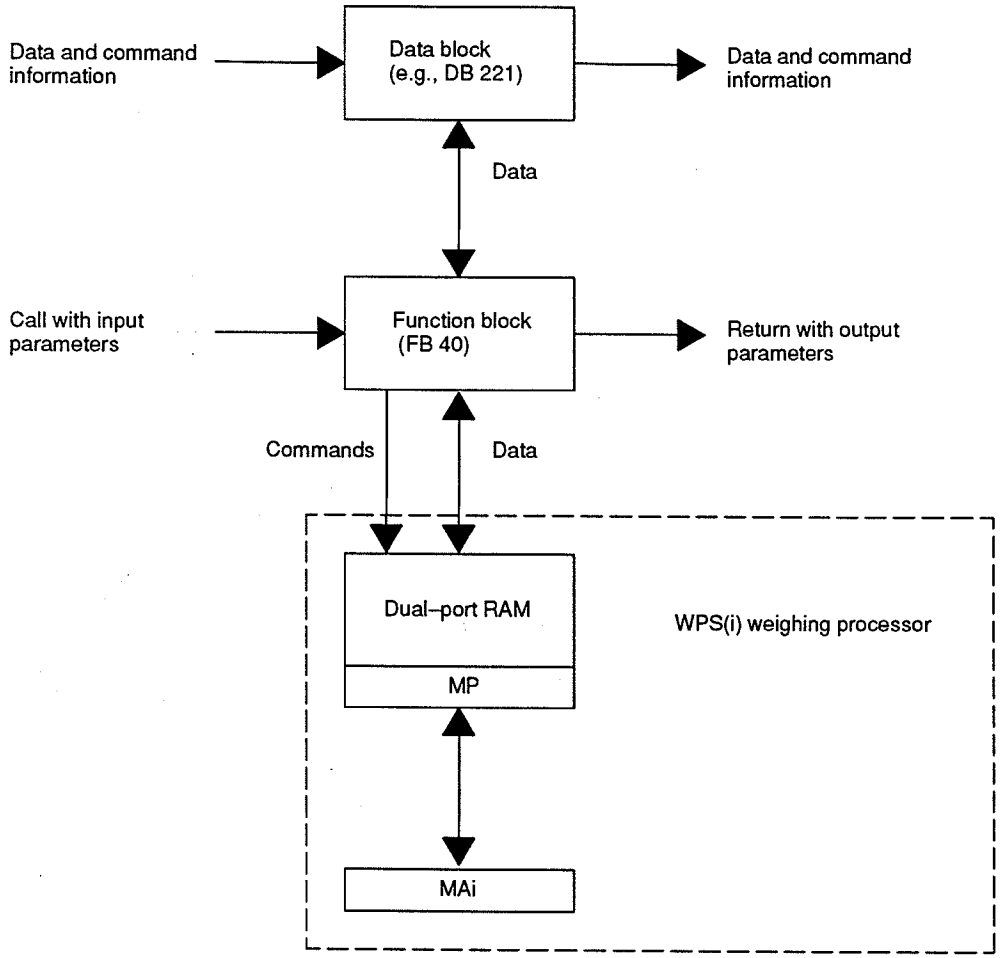


Fig. 2.11 User interface with FB 40

The user program enters the command to be executed in data block (DB 221) with its associated data and calls function block FB 40.

The function block transfers the commands and, if necessary, the associated data to the MP and enables command processing. After command processing, the MP outputs an acknowledgement and the function block can transfer the result data to the data block (DB 221).

Execution of FB 40 is terminated and the result data in the data block (DB 221) can be evaluated by the user program.

FB 40 is called with parameters that give the function block information about the data block (DB 221). The return parameters of the function block contain error messages and acknowledgements.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.4.3 Function block (FB 40)

Each of the progammable controllers S5–115U, S5–135U and S5–155U has its own function block FB 40 in the following files:

S5–115U (CPU 941 to CPU 944, CPU 941B to CPU 944B):	S5CV50ST.S5D
(CPU 945):	S5CV55ST.S5D
S5–135U (CPU 922 release 9, CPU 928–3UA12, CPU 928–3UB11):	S5CV20ST.S5D
S5–155U (CPU 946/947/948):	S5CV60ST.S5D

Preset weighing machine block files are also available:

Number format	
16–bit fixed point	DBKF@@ST.S5D
BCD	DBBCD@ST.S5D
Floating point	DBKF@@ST.S5D

If you are using S5–135U CPUs in an S5–155U, you must use the function block for S5–135U.

Caution

If the wrong function block is used, proper functioning of the FBs or the module cannot be guaranteed.

2.4.3.1 Actions of the FB 40

Calling function block FB 40 causes execution of the commands in the data block (DB 221). The function block transfers adjustment commands, proportioning commands and data from the data block to the MP and transfers data blocks from the WPS(i) weighing processor to the data block (DB 221) on request after command execution.

Every time FB 40 is called it enters a complete message in the data block (DB 221). A message consists of data that characterize the current state of the MP.

Calling FB 40 updates the following data:

- Job status (execution status of the commands)
- Error words
- Status words
- Actual values

} not automatically, on request

If FB 40 is not called, the MP changes neither the data nor the job status in the data block.

2.4.3.2 Calling the function block (FB 40)

Function block FB 40 is called with STEP 5 instructions in the user program. It has no formal operands. The parameters are transferred to ACCUM 1 before the function block is called (data block type and number of the data block).

In addition to the command information and data in the data block (DB 221), the function block deals with the input and output parameters that are transferred together when the function block is called.

The parameters concern the way FB 40 runs.

Input parameters

When FB 40 is called, the type and number of the data block (e.g. DB 221) are specified as input parameters.

The input parameters are transferred to ACCUM 1. ACCUM 1 is loaded with the appropriate values before FB 40 is called.

ACCUM 1:

Bit no.:

31 24	23 16	15 8	7 0
not assigned		type	number

Type

Data block – type

0: DB
1: DX

Number

Data block – number. This can be any number between 10 and 255. (These operating instructions use the number 221 as an example).

The unassigned bits of ACCUM 1 do not exist on the SIMATIC S5 – 115U.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Output parameters

The output parameters of FB 40 contain feedbacks on the way the commands were executed. The output parameters are transferred to ACCUM 1, ACCUM 2 and the result of logic operation RLO

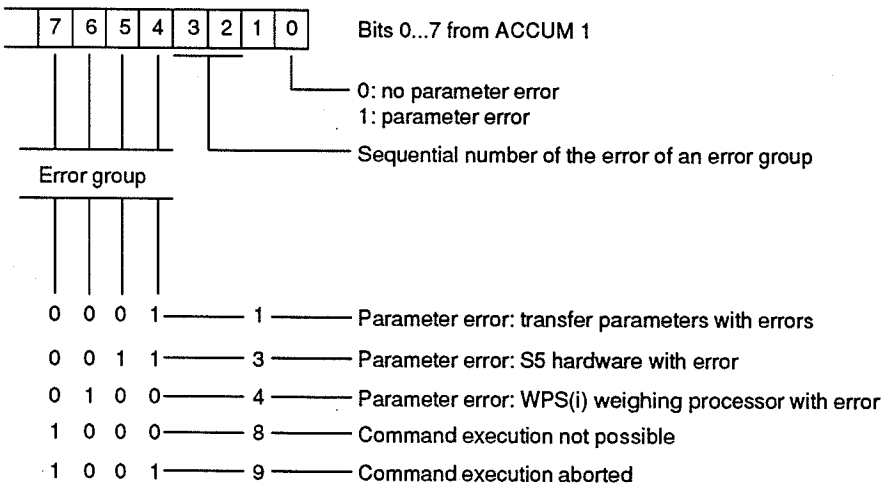
ACCUM 1:

Bit no.:

31 24	23 16	15 8	7 0
		Acknowledgements from MP	Error messages from FB 40

List of error messages from FB 40	
Bits 0...7 in ACCUM 1	Meaning
13H	An impermissible data block number was given as the input parameter.
17H	The data block with the specified number does not exist or is too short.
31H	FB 40 is not appropriate for the CPU of the PLC.
43H	The data block (DB 221) does not contain an interface number for the MP module
45H	No MP is addressed by the interface number in the data block (DB 221).
82H	The WPS(i) weighing processor is not ready or the MP is assigned to another CPU.
84H	The WPS(i) weighing processor is not functioning. No response was received to the command within time out.
86H	Identification for start–up of the module missing from the data block (DB 221). The WPS(i) weighing processor must be restarted (software reset).
90H	Starting up the WPS(i) weighing processor interrupted command execution. The data received might have errors.

The error messages from FB 40 can be structured in the following pattern so that program branches can be made dependent on particular errors:



List of acknowledgements from the WPS(i) weighing processor	
Bits 8...15 in ACCUM 1	Meaning
80H	All commands and data were accepted and transferred.
83H	Commands were not executed because start–up was initiated.

ACCUM 2:

Bit no.:

31 24	23 16	15 8	7 0
		Type	Number

ACCUM 2 has the contents of ACCUM 1 after FB 40 (state before FB 40 was called).

Result of logic operation RLO:

The result of logic operation indicates a group error message from the function blocks (FB 40).

1: Group error (bits 0...7) of ACCUM 1 not equal to 0

0: No error

If RLO signals a group error the user program must take appropriate measures.

The result of logic operation RLO can be used for conditional instructions (conditional jump).

Call instruction The STEP 5 instructions for calling function block FB 40 are explained by the example below

: L KY 0.221	Load ACCUM 1 with constant 221 0: data block – TYPE is DB 221:DB 221 is the DB SIWAREX here.
: JU FB 40	unconditional jump to FB 40.
Name: SIWAREX	Name of the function block
: T FW 104	Transfer ACCUM 1 to flag word 104 (for further evaluation of the feedback signals).
: T AK	Swap contents of ACCUM 1 and ACCUM 2
: T FW 106	Transfer ACCUM 1 (state before FB 40 was called) to flag word 106 (for further evaluation).
: JC = FEHL	Jump to group error

Call conditions A cyclic call of FB 40 ensures communication between the MP and the automation program. The FB can be called several times per cycle.

Function block FB 40 can only be called in a program execution level.

2.4.3.3 Multi–processor operation

Processing of several MPs by one CPU

Several MP modules can be plugged into one PLC. FB 40 permits the processing of several MPs.

A data block (DB) is created for every MP. Each DB contains all data for its associated MP.

The interface number of the associated MP module is contained in the DB. Selecting a DB when FB 40 is called selects the appropriate MP (→ Fig. 2.12).

Execution of measured value processing by several CPUs
(only possible in S5–135U and S5–155U)

FB 40 is designed for so–called "multi–processor operation", i.e. several CPUs can communicate with one MP. It is up to the user to provide a sensible division of tasks between the CPUs.

The MP can communicate with only one CPU at a time. If several CPUs attempt to access the MP at the same time, the MP only processes that CPU which has access authorization. Simultaneous access by several CPUs is rejected with an error message.

Error message: in ACCUM 1. bits 0 to 7

Error code: 82 Hex (→ Section 2.4.3.2)

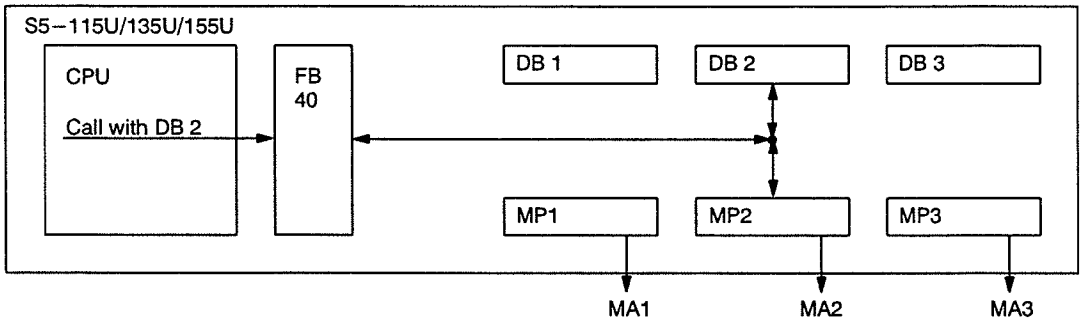
Meaning: MP not ready or assigned to another CPU

The command "RS", reset of the S5 interface, is an exception.

If the command "RS" is sent to the MP by one CPU (even without access rights), it always performs a cold restart.

 (4) J31037–D5603–U1–A0–7619

Operation with several MPs



Operation with several CPUs

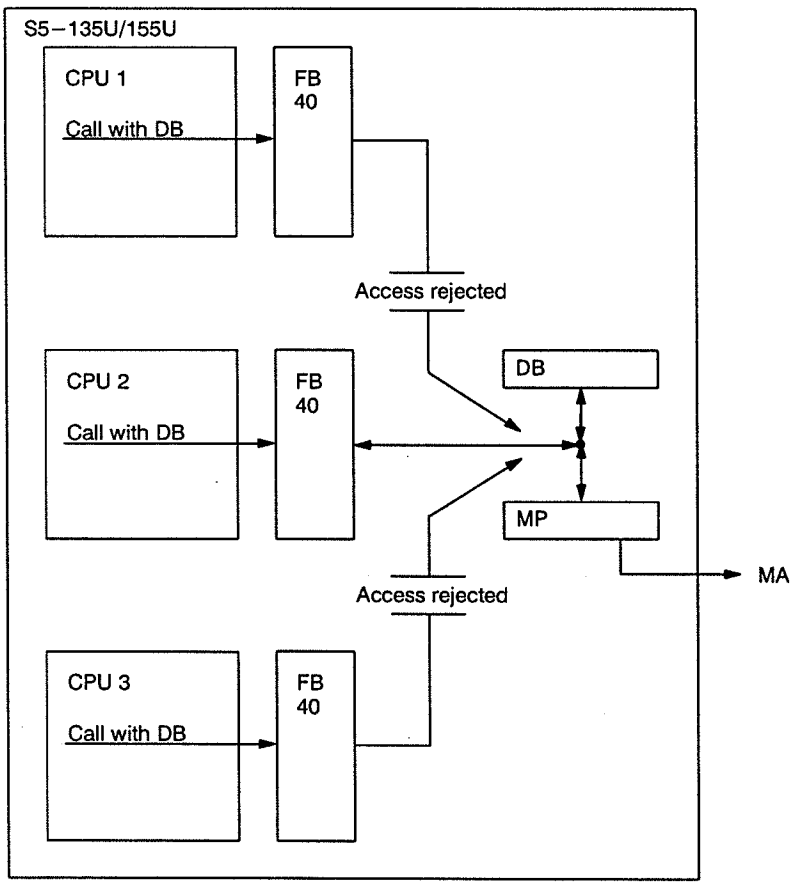


Fig. 2.12 Examples of multi–processor operation

2.4.3.4 Technical specifications of FB 40

	PLCs			
	S5–115U CPU 941–944 CPU 941B–944B	S5–115U CPU 945	S5–135U CPU 922 CPU 928–3UA12 CPU 928–3UB11	S5–155U CPU 946/947/948
Block number	FB 40			
Block name	SIWAREX			
Library number (P71200–S...)	5040–A–1	3040–A–1	9040–A–1	6040–A–3
Call length (words)	2			
Block length (words)	549	481	574	549
Nesting depth	0			
Assignment in the data area	DB SIWAREX DW 0 – DW 271			
Assignment in the flag area	from FY 210 to FY 255			
Assignment in the system data area	–		BS 60	–
Processing times	Table 2.4		2.5	

Table 2.3 FB 40 for S5–115/135/155U

(Runtime in ms)	CPU types							
Commands	941	942	943	944	941B and 942B	943B	944B	945
Reset command "RS"	13.42	5.15	3.03	1.54	2.63	2.51	0.94	
Adjustment and proportioning commands	34.8	15.6	9.9	3.4	8.7	8.5	2.9	
Read frame 0	43.0	16.9	11.2	3.8	9.7	9.5	3.1	1.7
Read frame 1	39.2	16.8	11.0	3.6	9.6	9.3	3.1	1.7
Read frame 2	50.1	20.7	13.4	3.9	11.6	11.4	3.1	1.9
Read frame 3, 10	48.7	19.5	12.1	3.7	10.4	10.2	3.1	1.8
Read frame 4	61.0	20.0	16.5	4.3	14.3	14.0	3.5	2.1
Read frame 8	45.5	20.2	11.9	3.7	10.3	10.0	3.1	1.8
Read frame 9, 13	51.3	22.3	13.8	3.9	12.0	11.7	3.3	2.2
Read frame 11	62.7	23.8	15.2	4.2	13.1	12.7	3.4	2.0
Read frame 12	54.9	22.4	13.4	4.0	11.6	11.3	3.3	1.9
Write frame 0	45.8	16.9	10.9	3.6	9.6	9.3	3.1	1.7
Write frame 1	44.3	16.7	10.7	3.6	9.4	9.0	3.1	1.7
Write frame 2	50.3	20.5	12.9	3.9	11.4	11.0	3.1	1.7
Write frame 3, 10	48.0	19.4	11.7	3.7	10.2	10.0	3.1	1.7
Write frame 8	50.9	20.2	11.6	3.8	10.2	9.7	3.1	1.7
Write frame 9, 13	55.0	22.1	13.3	3.9	11.7	11.4	3.6	2.0
Write frame 11	60.5	23.6	14.4	4.1	12.6	12.2	3.3	1.9
Write frame 12	56.6	22.3	12.8	4.0	11.4	10.9	3.2	1.8
Time extension while reading directory (after reset)	8.4	4.1	2.5	0.14	2.0	2.0	0.3	–

Table 2.4 Processing times of the S5–115U

(Runtime in ms)	S5–135U CPU types			S5–155U CPU types	
Commands	922	928	928B	946/947	948
Reset command "RS"	2.6	1.2	0.6	0.6	0.08
Adjustment and proportioning commands	13.3	7.6	5.5	2.7	1.91
Read frame 0	14.6	8.5	5.7	2.9	1.99
Read frame 1	14.2	8.5	5.9	2.9	1.97
Read frame 2	17.7	10.3	7.4	3.2	2.20
Read frame 3, 10	16.4	9.6	6.6	3.0	2.04
Read frame 4	21.6	12.4	9.1	3.7	2.43
Read frame 8	17.1	10.0	6.6	3.1	2.09
Read frame 9, 13	19.6	11.5	7.6	3.4	2.57
Read frame 11	21.2	12.3	8.2	3.6	2.33
Read frame 12	19.5	11.4	7.3	3.4	2.22
Write frame 0	14.6	8.4	6.0	2.9	1.95
Write frame 1	14.4	8.3	5.7	2.9	1.94
Write frame 2	17.9	10.5	7.3	3.1	2.20
Write frame 3, 10	16.5	9.6	6.6	3.0	2.03
Write frame 8	17.2	10.0	6.5	3.1	2.03
Write frame 9, 13	19.8	11.6	7.6	3.3	2.35
Write frame 11	21.5	12.6	8.1	3.4	2.20
Write frame 12	19.7	11.5	7.2	3.3	2.12
Time extension while reading directory (after reset)	4.3	2.5	1.7	0.3	–

Table 2.5 Processing times of the S5–135U. S5–155U

2.4.4 The SIWAREX data block

The SIWAREX data block (DB 221 is used here as an example) contains all data for a WPS(i) weighing processor

- Module address (interface number) of the associated MP
- Command bits of the commands to be executed
- Job status (status of execution of the activated commands).
- Frames

Position and contents of the frames in the data block (DB 221) are equivalent to the assignment in the dual port RAM (interface of MP).

The data block (DB 221) can be accessed by the user at any time.

The data are not logically checked by the FB 40.

Input values are entered by the user program in the data block (DB 221).

Output fields are read by the user program. FB 40 enters the values in the output fields.

Structure of data block SIWAREX (DB 221)

Overview

Data word area	Meaning	
DW 0...DW 7	Global area	I/O
DW 8...DW 13	Command bits	Input
DW 14...DW 37	Job status	Output
DW 38...DW 255	Frames	I/O
DW 256...DW 271	Directory	Output

Summary of the areas

Global area

DW	Meaning	Format
0	Start–up ID (KH = 11)	KH
1	Interface number of MP module x: is ignored by function block FB 40 y: interface number 0 to 255	KY x, y
2	KS = "RS": software reset	KS
3	Write mode to the WPS(i) weighing processor (KS = "JU" or "DO")	KS
4	Read mode from the WPS(i) weighing processor (KS = "JU" or "DO")	KS
5	Input parameter ACCUM 1	KY
6	Output parameter ACCUM 1	KH
7	Version number of the WPS(i) weighing processor firmware	KH

Command bits

DW	Meaning	Format
8	Proportioning commands	KM
9	Spare	KM
10	Adjustment commands	KM
11	Spare	KM
12	Read block Bit numbers 0 to 15 correspond to frames 0 to 15	KM
13	Write block Bit numbers 0 to 15 correspond to frames 0 to 15	KM

Job status

DW	Meaning	Format
14 to 20	Job status I	KM
20 to 25	Job status II	KM
26 to 31	Job status III	KM
32 to 37	Job status IV	KM

(4) J31037–D5603–U1–A0–7619

Frames proportioning data

DW	Frame no.	Designation	Frame length (bytes)
38 to 41	0	Setpoint	8
42 to 43	1	Analog output	4
44 to 61	2	Proportioning data 1	36
62 to 71	3	Proportioning data 2	20
72 to 107	4	Error and status words and actual values	72
108 to 113	5	Spare	12
114 to 123	6	Spare	20
124 to 133	7	Spare	20

Frames adjustment data

DW	Frame no.	Designation	Frame length (bytes)
134 to 141	8	Service (assigned internally)	16
142 to 161	9	Threshold values	40
162 to 171	10	Plant parameters	20
172 to 197	11	Basic parameters	52
198 to 213	12	Adjustment weights	32
214 to 233	13	Adjustment digits	40
234 to 245	14	Spare	24
246 to 255	15	Spare	20

Directory

The directory is assigned to data words DW 256 to DW 271. Only service personnel may access the directory.

2.4.4.1 Overview of data formats

KM	Bit pattern (16 places)
KY	Two absolute numbers in two bytes in the range of: x = 0 to 255 y = 0 to 255
KH	Hexadecimal pattern up to 4 places
KS	Two alphanumerical characters
KT	Time value (BCD–coded) Time base = 0 to 3 Time value = 0 to 999
KF	Fixed–point number (–32768 to +32767)
KG	Floating–point number

The data words marked * without an assigned format can be either 32–bit floating point (KG), 32–bit BCD or 16–bit fixed point (KF) numbers (→ Section 2.6.1.3).

The format is selected in DW 172 and applies to all data words marked *.

(4) J31037–D5603–U1–A0–7619

> **Caution**
>
> Before writing the frames for the first time check whether the data format has been set properly in DW 172.

After checking the format, frame 11 must be transferred first. The following definitions apply.

Fixed point word

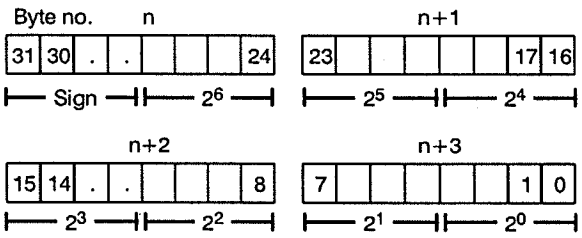
Bit 15: Sign bit: 0: positive
1: negative

Bit 14...0: 2^{14} ... 2^{0}

Number range min: –32768 = 8000H
max: +32768 = 7FFFH

If the format "fixed point word" is used, bits 16 ... 31 must be assigned the value 0 !

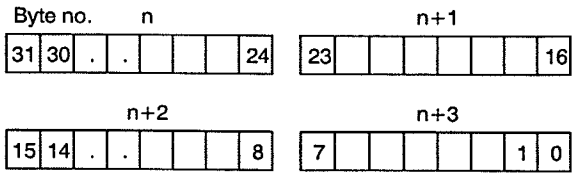
BCD



Bit 31–28: Sign (0 = positive)

Maximum number range: –9 999 999 to +9 999 999

Floating point word



Bits 31–28: Exponent with bit 31 = sign (0 = positive)
Bits 23– 0: Mantissa with bit 23 = sign (0 = positive)

Number = (mantissa) * 2 (exponent)

The floating point numbers are converted to fixed point numbers for internal computing operations.

When floating point numbers are used, it is important to make sure that the decimal point is at the right position in data word 189. The numbers are converted by the following method.

Write: transfer direction S5 to MP
Internal fixed point value = floating point value S5 * 10 decimal place

Read: transfer direction: from MP to S5
Floating point value = internal fixed point value S5 / 10 decimal place

Example: decimal place 2 (DW 189: DR = 02)
150.0 is equivalent in floating point format KG: +150 000+3
This results in the internal MP value: 150 * 10^2 = 15 000

Reconversion: internal value 15 000:
value read by S5 KG 15 000 / 10^2 = 150.0 corresponds to KG: 150 000+3

Caution

The MP–internal number range only covers the range -2^{31} to $+2^{31}$ (KG: +/– 2147483+10). This must be taken into account when selecting the decimal place. On an internal number overflow, bit 8 is set in error word 1 (internal error word–error MP).

2.4.4.2 Global area

DW 0 Unassigned

DW 1 Interface number of the MP (input value)

Format: KY x,y

- x: Interface number 0...255
- y: is not used

DW 2 Software reset (input value)

Format: KS "RS"

- "RS": The letters "RS" are entered to execute the reset.

DW 3 Write mode to the MP (input value)

Format: KS

DO: Proportioning
JU: Adjusting

To prevent accidental triggering of adjustment functions, processing of the adjustment commands can be "switched off". Setting the disabling information (mode write: "DO") causes execution of the adjustment commands and the transfer request for adjustment data to be acknowledged with an error (command status information). During adjustment, proportioning commands and the transfer of proportioning data are rejected in the same way.

DW 4 Read mode from the MP (output field)

Format: KS

DO: Proportioning
JU: Adjusting

DW 5 Type and number of DB 221 (output field)

Format: KY x, y

- x: Type of the DB
  0: DB
  1: DX
- y: Number of the DB

DW 6 Message word contents of ACCUM1 after execution of FB 40 (output field)

Format: KM

DW 7 Version number of the MP firmware (output field)

Format: KH

2.4.4.3 Command bits

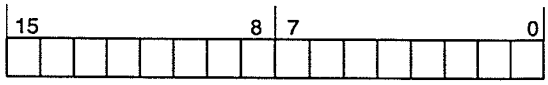
All data words of the command bits are input values and are written by the user program.

Commands are activated when the corresponding bits are set to 1.

Edge evaluation: 0 → 1 edge for proportioning, adjusting and data writing commands

DW 8

Format: KM



Proportioning commands are executed only in proportioning mode (DW 3 = DO). In "adjusting" mode, the proportioning commands are rejected with job status III.

Only one command is processed per FB 40 call. If several bits are set, the low priority bits are rejected with an error (job status III).

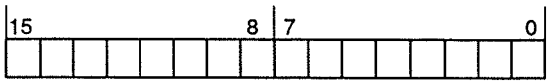
Bit no.	Command	Priority
0	Stop	high ↓
1	Tare	
2	Tare value valid	
3	Reset volume value	
4	–	
5	Start proportioning upwards (with automatic taring)	
6	Start proportioning downwards (with automatic taring)	
7	Start inching mode operation upwards	
8	Start inching mode operation downwards	
9	Start proportioning upwards (without automatic taring)	
10	Start proportioning downwards (without automatic taring)	
11	Stop pulse counter (pulse input)	
12	Delete pulse counter (pulse input)	
13	Start pulse counter (pulse input)	
14	Zero positions of the weighing machine	
15	Acknowledge all errors	low

DW 9 Not assigned

(4) J31037–D5603–U1–A0–7619

DW 10

Format: KM



Adjustment commands are only executed in adjustment mode (DW 3 = JU). In "proportioning" mode adjustment commands are rejected with job status III.

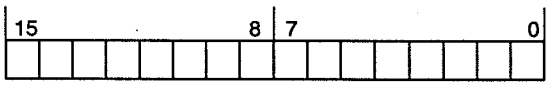
Only one command is executed per FB 40 call. If several bits are set. the lowest priority bits are rejected with an error (job status III).

Bit no.	Command	Priority
0	Adjustment weight 1 valid (Zero point)	high
1	Adjustment weight 2 valid	
2	Adjustment weight 3 valid	
3	Adjustment weight 4 valid	
4	Adjustment weight 5 valid	
5	Adjustment weight 6 valid	
6...12	Not assigned	
13	Delete all weighing machine parameters (adjustment and proportioning data)	
14	Zero positions of the weighing machine	
15	Acknowledge all errors	low

DW 11 Not assigned

DW 12 Data transfer commands (read frame).
no edge evaluation

Format: KM

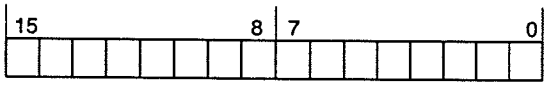


All bits are read during an FB 40 call in all modes.

Bit no.	Command
0	Read frame 0
1	Read frame 1
. . .	. . .
14	Read frame 14
15	Read frame 15

DW 13 Data transfer commands (write frames)

Format: KM



All bits are processed during an FB 40 call.

Bit no.	Command	
0	Write data block 0	
1	Write data block 1	
2	Write data block 2	
3	Write data block 3	only possible in proportioning mode
4	Write data block 4	
5	Write data block 5	
6	Write data block 6	
7	Write data block 7	
8	Write data block 8	
9	Write data block 9	
10	Write data block 10	
11	Write data block 11	only possible in adjustment mode
12	Write data block 12	
13	Write data block 13	
14	Write data block 14	
15	Write data block 15	

Caution

Adjustment frames are only checked for plausibility in adjustment mode (DW 3 = "JU"). Proportioning frames are only checked for plausibility in proportioning mode (DW 3 = "DO"), If the mode is incorrect, acknowledgement is negative, i.e. the appropriate job status bit III is set.

2.4.4.4 Job status register

All data words of the job status bits are output fields and are set by function block FB 40.

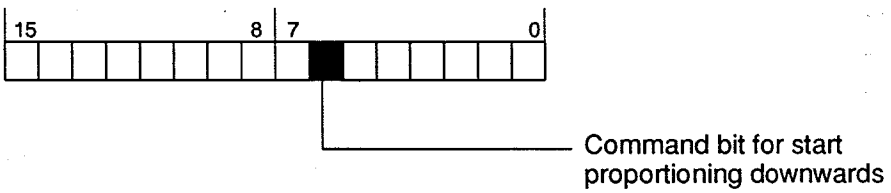
The job status (→ Section 2.4.5.1) specifies the execution status of the activated commands. It passes three assigned job status bits (job status I. job status II and job status III) to the MP for every command.

Example of arrangement of the job status bits:

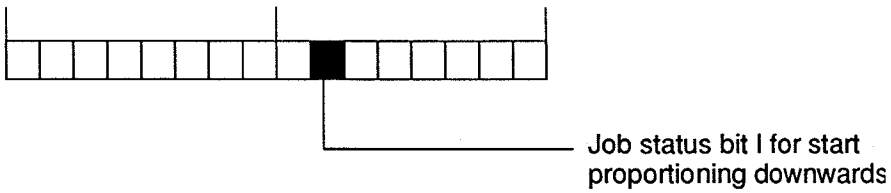
Command: Start proportioning downwards

DW 8	Data word for proportioning commands
DW 14	Data word job status I for proportioning commands
DW 20	Data word job status II for proportioning commands
DW 26	Data word job status III for proportioning commands

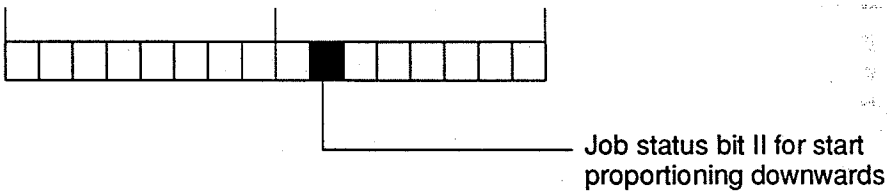
DW 8



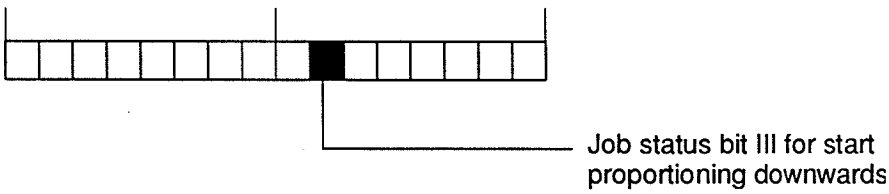
DW 14



DW 20



DW 26



WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

The data words listed below all have KM format

DW 14	Job status I for proportioning commands
DW 15	–
DW 16	Job status I for adjustment commands
DW 17	–
DW 18	Job status I for read frame
DW 19	Job status I for write frame
DW 20	Job status II for proportioning commands
DW 21	–
DW 22	Job status II for adjustment commands
DW 23	–
DW 24	Job status II for read frame
DW 25	Job status II for write frame
DW 26	Job status III for proportioning commands
DW 27	–
DW 28	Job status III for adjustment commands
DW 29	–
DW 30	Job status III for read frame
DW 31	Job status III for write frame

DW 32 to DW 37 are reserved.

 (4) J31037–D5603–U1–A0–7619

2.4.4.5 Frames

The SIWAREX data block (DB 221 is used as an example) contains 16 frames. The frames are divided among the main areas for proportioning data and adjustment data.

Overview of proportioning data:

Frame no.	Length	Contents
0	8 bytes	Setpoint
1	4 bytes	Analog output
2	36 bytes	Proportioning data 1 (frequent data exchange)
3	20 bytes	Proportioning data 2 (infrequent data exchange)
4	72 bytes	Error, status words and actual values
5...7	52 bytes	Spare

Overview of adjustment data:

Frame no.	Length	Contents	
8	16 bytes	Assigned internally	
9	40 bytes	Threshold values	Always write together !
10	20 bytes	Plant parameters	
11	52 bytes	Basic parameters	
12	32 bytes	Adjustment weights	
13	40 bytes	Adjustment digits	
14 and 15	44 bytes	Spare	

The data words in frame 4 (error/ status words and actual values) can only be read by the user program. All other data words can be both read and written by the user program.

If no data format is given in the following overview of data words, the data words can be 32–bit floating point, 32–bit BCD or 16–bit fixed point numbers (4 bytes or two data words).

The number format is selected in frame 11 (DW 172) and applies to all values marked with an *.

Important:
Every time the number format is changed **all** data marked with an * must be changed and transferred accordingly (written).
If the floating point number format is used, this must also be done if the decimal place (DW 189) is changed.

All data marked as “spare” or “assigned internally” must not be changed (service functions).

Setpoint (frame 0)

DW 38, DW 39 *	Setpoint
DW 40, DW 41	Not assigned

Analog output (frame 1)

DW 42	Analog output value (setpoint from S5. see also DW 172 and Section 2.5.5.2) Format KF (0...4095)
DW 43	Not assigned

Proportioning data 1 (frame 2)

DW 44, DW 45 *	Cut–off value COARSE The difference between this and the fine cut–off value is specified.
DW 46, DW 47 *	Cut–off value FINE The difference between this and the setpoint is specified.
DW 48, DW 49 *	Set tare weight (→ Section 2.5.3.4)
DW 50, DW 51 *	Tolerance plus value
DW 52, DW 53 *	Tolerance minus value
DW 54, DW 55 *	Minimal material flow value for proportioning FINE
DW 56, DW 57 *	Minimal material flow value for proportioning COARSE
DW 58	Closing delay for material flow monitoring. Format: KT
DW 59...DW 61	Spare

Proportioning data 2 (frame 3)

DW 62 Assigned internally (must always be 0)

DW 63 Specific weight unit: g/dm^3

Format KF

DW 64 Inching time

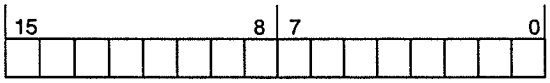
Format: KT

DW 65 Settling time

Format: KT

DW 66 Function selection

Format: KM



Bit no.	Meaning (set bit to 1)
0	Automatic reproportioning activated
1	Material flow monitoring switched on
2	Spare
3	Inching time is aborted on tolerance minus value violation
4...15	Spare

DW 67...DW 71 Spare

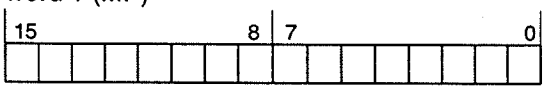
Error, staus words and actual values (frame 4)

All data in frame 4 can only be read, not written.

DW 72

Error word 1 (MP)

Format: KM



Bit no.	Meaning
0	Interface to measured value acquisition faulty 1)
1	Wire break analog input 2) (only with 4 ... 20 mA)
2	Error in the external voltage supply (24 V) 1)
3	Short circuit or overload in the digital output 1)
4	Module error (MP) 1)
5	Watchdog triggered (MP) 2)
6	EPROM error (MP) 2)
7	RAM error (MP) 2)
8	Internal FW error (MP)

1) Error must be remedied so that proportioning can be continued.

2) The MP continues once an acknowledgement has been received. The error is not signalled again until the supply voltage is switched on again or until the error occurs again.

All errors in this data word must be acknowledged (DW 8 or DW 10, bit 15). On acknowledgement all error words are deleted.

DW 72 bit 0

Interface to measured value acquisition faulty
This bit is set if an error occurs in communication between the MP and the MA. A fault in communication can be caused by a wire break in the cable connecting the MP to the MA or failure of the MA.

DW 72 bit 1

Wire break analog input
This error message is output if the analog input is run in 4 ... 20 mA mode and the measured value at the analog input sinks below 2 mA.

DW 72 bit 2

Error in external error supply
This bit is set if the external 24 V voltage supply on the MP (X4) fails or if it is incorrectly connected.

DW 72 bit 3

Short circuit or overload at the digital outputs
This bit is set if the digital outputs are overloaded or short-circuited.

DW 72 bit 4

Module error MP
This bit is set if errors occur whose cause cannot be clearly allocated.

DW 72 bit 5

Watchdog MP responded
If errors occur in the program run the watchdog can reset the hardware of the processor of the MP. The bit is set after the subsequent start–up.

DW 72 bit 6

EPROM error MP
The program code stored in the EPROMs is monitored using a check sum. After a reset of the MP module the current checksum is calculated and compared with the checksum stored on an EPROM. This bis is set if the checksums are not the same.

DW 72 bit 7

RAM error
The battery–backed data memory of the MP is complete when the module starts up. Each byte is checked for physical functioning during operation. This bit is set if errors are detected.

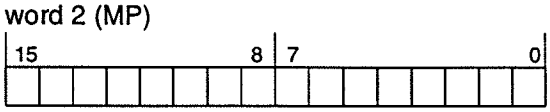
DW 72 bit 8

Internal FW error MP
This bit is set if an error in calculation occurs during the calculation of MP internal values (overflow, division by 0, ...).

DW 73

Error word 2 (MP)

Format: KM



Bit no.	Meaning
0	Setpoint cannot be accepted currently.
1	Setpoint not plausible
2	Zero point not plausible
3	Resetting range for zero point offset is exceeded.
4	Tare value not plausible
5	Material flow monitoring has responded.
6	Overflow in pulse counter
7...9	–
10	Adjustment error (weights)
11	Adjustment error (adjustment data)
12	Volume threshold value exceeded
13	Overflow value exceeded
14	Overfilling/overfill output active
15	Output fault active

DW 73 Bit 0

Setpoint is currently not accepted
This bit is set if the data block (setpoint) is transferred to the MP at the wrong moment (→ Section 2.5.3.5).

DW 73 bit 1

Setpoint not plausible
The setpoint is checked for plausibility after a start command (DW 8, bits 5...10):

- Setpoint must be greater than 0
- Proportioning with set setpoint must not cause overfilling of the weighing machine or of the container to be filled.
- Setpoint must be larger than the fine cut–off value (DW 46, 47)
- On overfilling: setpoint must be smaller than the gross weight.

This bit is set if one of the above conditions is fulfilled.

DW 73 bit 2

Zero point not plausible
This bit is set if the zero is no longer within the permitted limits (→ Section 2.5.2.3).

DW 73 bit 3

Resetting range zero point offset exceeded
This bit is set if the zero for automatic zero offset has left the set range (→ Section 2.5.2.4).

DW 73 bit 4

Tare value not plausible
This bit is set if the value specified in DW 48, 49 is not plausible (→ Section 2.5.3.4)

DW 73 bit 5

Material flow monitoring has responded.
This bit is set if the material flow monitoring has detected an interruption in the material flow (→ Section 2.5.3.12).

DW 73 bit 6

Overflow of pulse counter
This bit is set if the pulse counter has exceeded the count value 65535 (16–bit counter).

DW 73 bit 10

Adjustment error (weight)
This bit is set if processing of the adjustment weights has detected an error (→ Section 2.5.2).

DW 73 bit 11

Adjustment error (adjustment data)
This bit is set if an error in frame 13 has detected adjustment digits (e.g. spacing of adjustment digits < 1000d).

DW 73 bit 12

Volume threshold value exceeded
This bit is set if one of the set limits is exceeded (DW 150...153) by volume calculation (→ Section 2.5.3.11).

DW 73 bit 13

Overfilling exceeded
This bit is set if the gross weight exceeds the overfilling value set in DW 146/147 (→ Section 2.5.3.10).

 (4) J31037–D5603–U1–A0–7619

DW 73 bit 14

Overfill output active
This bit is set if overfilling occurs that was either caused by the weight or the volume. The overfill output (pin 4, X6) is set (→ Sections 2.5.3.10 and 2.5.3.11).

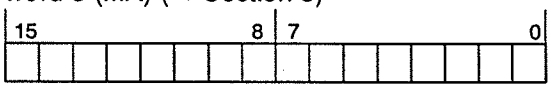
DW 73 bit 15

Fault
This bit is set if a fault occurs. The fault that has occurred can be identified from DW 72 or DW 74.

DW 74

Error word 3 (MA) (→ Section 3)

Format: KM



Bit No.	Meaning
0	EPROM error 2)
1	RAM error 2)
2	Overload (measuring range limit was exceeded) 1)
3	Lower measuring range limit was exceeded 1)
4	Reference voltage error (fault in the load cell power supply) 1)
5	Control loop fault 2)
6	Watchdog error (MA) 2)
7	Calibration running
8	Sensor adaptation not performed
9	Temperature range was exceeded 2)
10	Number range was exceeded 2)
11	Calibration line is outside tolerance 2)
12	–
13	General error MA1)
14	Assigned internally
15	Wire break (load cells) 1)

1) Error must be acknowledged and must be remedied so that proportioning can be continued.

2) Error must be acknowledged. Once an acknowledgement has been received, the MP continues. The error is only signalled again when the supply voltage is switched on again, or if the error occurs again.

Acknowledgement deletes all error words.

DW 74 bit 0

EPROM error
The program memory of the MA is monitored by a checksum. After resetting (start–up and cyclic operation) a checksum is calculated which is compared with the checksum stored in one of the program memories. This error bit is set if the two checksums are not the same.

DW 74 bit 1

RAM error
The internal RAM memory of the MA processor is cyclically checked for proper functioning. This error bit is set if a function fault is detected.

DW 74 bit 2

Overload
On an overload of load cells, the signal to be measured can become so large that the measuring range of the MA is exceeded. In this case this bit is set.

DW 74 bit 3

Lower measuring range limit is exceeded.
This bit is set if the lower measuring range limit of the MA is reached, e.g. by tensile load on the weighing machines.

DW 74 bit 4

Reference voltage error
"Reference voltage error" is set, if the MA has detected an error in the power supply of the load cell. Connection of the power supply and, if necessary, sensor lines must be checked.

DW 74 bit 5

Measuring loop fault
This bit is set if an error is detected in the measuring loop of the MA.

DW 74 bit 6

Watchdog error (MA)
This bit is set if the watchdog of the MA has responded. The cause might be, for example, a fault in the program of the MA.

DW 74 bit 7

Calibration running
In the MA measuring circuit the measuring circuit is "measured" at intervals of approximately two minutes, i.e. measurement factors are calculated that enable detection of changes in the measuring circuit (e.g. temperature drifts). During measurement of the compensation factors, the measured value (DW 88) is kept at the last value.
(→ Sections 2.5.4.1 and 3.1.2.8)

DW 74 bit 8

Sensor adaptation not performed
The MA is set to the appropriate load cell parameters by specifying the plant parameters (frame 10), i.e. the plant parameters are transferred from the MP to the MA. This bit is set if an error occurs in adaptation.
Remedy: check frame 10 and transfer rate again.

DW 74 bit 9

Temperature range was exceeded
There is a temperature sensor on the MA that measures the internal temperature. This bit is set if the permissible temperature range is exceeded.

DW 74 bit 10

Number range was exceeded
This bit is set if a number range overflow occurs during calculation of the digit actual value in the MA.

DW 74 bit 11

Calibration line outside tolerance
During calibration of the MA a check is made whether the correction factors calculated are within plausible limits. This bit is set if this is not the case (→ DW 74, bit 7).

 (4) J31037–D5603–U1–A0–7619

DW 74 bit 13

General error MA
This bit is set if the MA detects incorrect behavior on the part of the MA. e.g. a response to an instruction is not made within a certain time.

DW 74 bit 14

Assigned internally

DW 74 bit 15

Wire break load cells
This bit is set if a wire break is detected in the load cell connections.

This signal can occur if plant parameters DW 162 to 164 are changed, because these words are required for wire break monitoring.

If you have to change plant parameters DW 162 to 164, a complete adjustment of the module must also be performed; Command: "delete weighing machine parameters"!
This signal can be switched off (→ DW 172, bit 14).

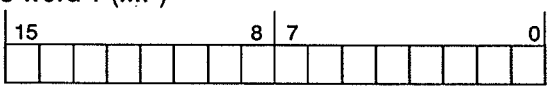
DW 75, DW 76

Spare

DW 77

Status word 1 (MP)

Format: KM



Bit No.	Meaning
0	Adjustment
1	Proportioning was terminated without error.
2	Proportioning was terminated with error.
3	Proportioning running
4	Tolerance plus value was violated.
5	Tolerance minus value was violated.
6	Maximum weight value was violated.
7	Minimum weight value was violated.
8	Empty signal value was violated.
9	–
10	–
11	Coarse is switched on.
12	Fine is switched on.
13	Standstill condition was fulfilled.
14	–
15	Proportioning direction: 0: Deduction weighing 1: Fill weighing

DW 77 bit 0

Adjusted

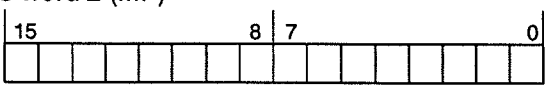
This bit is set if the adjustment data are complete (→ Section 2.5.2).

DW 77 bit 1	Proportioning was terminated without error This bit is set if a proportioning procedure is correct, i.e. completed within the permitted limits.
DW 77 bit 2	Proportioning was terminated with error This bit is set if a current proportioning procedure is aborted, i.e. not completed correctly.
DW 77 bit 3	Proportioning running This bit is set as long as proportioning has not been completed.
DW 77 bit 4	Tolerance plus value was violated (→ Section 2.5.3.6)
DW 77 bit 5	Tolerance minus value was violated (→ Section 2.5.3.6)
DW 77 bit 6	Maximum weight was violated This bit is set as long as the actual value gross is greater than the maximum value (DW 144/145).
DW 77 bit 7	Minimum weight was violated This bit is set as long as the actual value gross is smaller than the minimum value (DW 142/143).
DW 77 bit 8	Empty signal value was violated If the actual value gross (DW 80/81) goes below the empty signal value DW 148/149, this bit is set when the empty signal delay (DW 186) has elapsed.
DW 77 bit 11	Coarse is switched on This bit is set if the coarse valve is switched on during proportioning. It is reset again when the coarse valve is switched off.
DW 77 bit 12	Fine is switched on This bit is set as long as the fine valve is switched on during proportioning.
DW 77 bit 13	Standstill condition fulfilled This bit is set as long as the standstill condition is fulfilled (→ Section 2.5.3.13).
DW 77 bit 15	Proportioning direction This bit shows the current proportioning direction. 0 = Deduction weighing 1 = Fill weighing (→ Sections 2.5.3.1 and 2.5.3.2)

 (4) J31037–D5603–U1–A0–7619

DW 78 Status word 2 (MP)

Format: KM



Bit no.	Meaning
0	Pulse counter running
1	–
2	–
3	–
. . .	. . .
10	–
11	–
12	EXi interface connected
13	–
14	–
15	–

DW 78 bit 0 Pulse counter running
This bit is set if the pulse counter was started. This bit is reset when the pulse counter is stopped.

DW 78 bit 12 EXi interface connected
This bit is set if the MAi is used instead of the MA.

DW 79 Assigned internally

DW 80, DW 81 * Actual value gross

DW 82, DW 83 * Actual value net

DW 84, DW 85 * Actual value tare

DW 86, DW 87 * Optimized fine flow cut–off point (calculated) (→ Section 2.5.3.9)

DW 88 Actual value in digits (unfiltered)
DW 88 is not set to 0 by the command "delete weighing machine parameters" because the current value is displayed by the MA.

Format: KH

DW 89 Actual value in digits (filtered)

Format: KH

DW 90, DW 91 * Volume value

DW 92, DW 93 * Flow rate value

DW 94 Analog input value (analog input)

Format: KF (0...4095)

DW 95 Analog output value (analog output)

Format: KF (0...4095)

DW 96, DW 97 Counting value of the pulse input (16 bits)

Format: KH

DW 98, DW 99 Pulses per time unit (32 bits)

Format: KH

DW 100...DW 107 Spare

Spare (frames 5, 6, 7)

Service (frame 8)

DW 134...DW 141 All of frame 8 is assigned internally

The values are not set to zero by the "Delete weighing machine parameters". Writing this data is not allowed (service functions).

(4) J31037–D5603–U1–A0–7619

> **Caution**
>
> Frames 9...12 must always be written simultaneously (DW 13, bits 9...12 = 1).
> You are only allowed to write frames 9 to 12 individually for service purposes.

Limits (frame 9)

DW 142, DW 143 *	MIN value	(→ Section 2.5.3.10)
DW 144, DW 145 *	MAX value	
DW 146, DW 147 *	Overfill value	
DW 148, DW 149 *	Empty signal value	
DW 150, DW 151 *	Maximum volume for fill weighing (→ Section 2.5.3.11)	
DW 152, DW 153 *	Maximum volume for deduction weighing (is equivalent to the maximum volume of the container to be filled)	
DW 154, DW 155 *	Limit value for zero point offset (upper limit), must be smaller than JG2 (→ Section 2.5.2.3).	
DW 156, DW 157 *	Limit value for zero point offset (lower limit), input positive value	
DW 158...DW 161	Spare	

Plant parameters (frame 10)

DW 162 Internal resistance of a load cell [Ω]

Format: KF

DW 163 Characteristic value of the load cell

Format: KF
Unit: [0.1 mV/V] e.g.: characteristic value = 2 mV/V ≙ KF = +20

DW 164 Number of load cells

Format: KF

DW 165 Parameter setting of the digital filter (→ Section 2.5.1.2)

Format: KM
Settings:
- Filter type
- Limit frequency

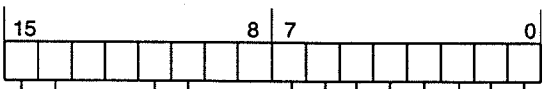
DW 166...DW 171 Spare

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Basic parameters (frame 11)

DW 172 Parameter word 1

Format: KM



Automatic zero offset
- Off: 0
- On: 1

Wire break monitoring Load cells:
- On: 0
- Off: 1

(→ Section 3.1.2.1)

Data format of the number values
- Fixed point word: 0 0
- Floating point: 1 0
- BCD: 1 1

Parameter setting of the interface for remote display
- no display 0 0
- 1200 bit/s 0 1
- 2400 bit/s 1 1

Analog input mode
- Voltage input 0...10 V: 0 0
- Current input 0...20 mA: 1 0
- Current input 4...20 mA: 1 1

Analog output mode
- Voltage output 0...10 V: 0 0
- Current output 0...20 mA: 1 0
- Current output 4...20 mA: 1 1

Source for the analog output
- Set value S5: 0 0
- Throughput: 0 1
- Actual value net weight: 1 0
- Actual value gross weight: 1 1

DW 173 Spare

DW 174 Weight unit
The weight unit is defined by two letters.

Format: KS

'GR':	Gram
'KG':	Kilogram
'TO':	Ton

DW 175 Volume unit
The volume unit is defined by two letters.

Format: KS

'MM':	mm^3
'CM':	cm^3
'DM':	dm^3
'ME':	m^3

(4) J31037–D5603–U1–A0–7619

DW 176, DW 177 * Minimum output value for analog output.
The value is specified at which 0 V, 0 mA or 4 mA is output
(→ Section 2.5.5.2).

DW 178, DW 179 * Maximum output value for analog output
The value is specified at which 10 V or 20 mA is output
(→ Section 2.5.5.2).

DW 180 Resetting value for automatic zero point offset.

Format: KF
Unit: digits

DW 181 Negative tolerance range for the external tare value.

Format: KF
Unit: value 1...100 % with reference to the external tare value.

DW 182, DW 183 * Standstill value

DW 184 Standstill time

Format: KT

DW 185 Resetting time for zero offset

Format: KT

DW 186 Empty signal delay time

Format: KT

DW 187 Throughput calculation time (monitoring time)
The length of the measuring period for calculating the flow of materials. The material flow value is used both for material flow monitoring and throughput output on the analog output.

Format: KT

DW 188 Time base for throughput output.
Time unit (reference value), to which the calculation of the throughput refers.

Format: KT

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

DW 189
Format KH

DL Increment for remote control
DR Decimal place for floating point format and remote control

DL: Input of the increment

DL = 0 1	≙	Increment = 1
0 2	≙	Increment = 2
0 5	≙	Increment = 5
1 0	≙	Increment = 10
2 0	≙	Increment = 20
5 0	≙	Increment = 50

DR:Decimal place for floating point format and remote display
The effect of the decimal place on floating point numbers is described under "Overview of Data Formats" (→ Section 2.4.4.1).

Important:
If the floating point format is used and the decimal place is changed, all frames with format dependent numbers must be transferred again!

The following applies to the remote display:

DR =	0 0	Decimal point on the right–hand side of the display
	0 1	Decimal point in front of the least significant position
	⋮	
DR =	0 5	Decimal point in front of the most significant position

☞ The decimal point is shifted to the right if the current display range is exceeded, If shifting to the right is not possible, a display overflow occurs and the decimal point moves from left to right on the display (→ operating instructions of the remote display).

DW 190

Measuring time for calculating the pulses per time unit

Format: KT

DW 191...DW 197

Spare

(4) J31037–D5603–U1–A0–7619

Adjustment weights (JG) (frame 12)

DW 198, DW 199 *	Adjustment weight 1 (weighing machine 0)
DW 200, DW 201 *	Adjustment weight 2 (must be not equal to 0)
DW 202, DW 203 *	Adjustment weight 3
DW 204, DW 205 *	Adjustment weight 4
DW 206, DW 207 *	Adjustment weight 5
DW 208, DW 209 *	Adjustment weight 6 – JG n must be smaller than JG n+1 – JGs not used must be assigned the value 0! – If one of the JGs 3 to 5 is assigned the value 0, all higher JGs that are not assigned the value 0 are ignored.
DW 210...DW 213	Spare

Adjustment digits (JD) (frame 13)

DW 214, DW 215	Adjustment digit 1 (weighing machine 0) Format: KH
DW 216, DW 217	Adjustment digit 2 Format: KH
DW 218, DW 219	Adjustment digit 3 Format: KH
DW 220, DW 221	Adjustment digit 4 Format: KH
DW 222, DW 223	Adjustment digit 5 Format: KH
DW 224, DW 225	Adjustment digit 6 Format: KH – The difference between 2 JDs must be at least 1000 digits. – Only those JDs are relevant for which a JG exists.
DW 226, DW 227	Assigned internally

DW 228, DW 229 Assigned internally

DW 230 Assigned internally

DW 231 Zero offset
Zero originally defined during adjustment in digits

Format: KH
Unit: Digits

DW 232, DW 233 Spare

(Frame 14/15)

DW 234...DW 255 Spare

2.4.4.6 Directory

The data area directory specifies the allocation of frames. The directory is automatically transferred once from the MP module to the data block when a startup is detected.

2.4.5 Command processing

Command processing with the WPS(i) weighing processor requires a cyclic call of FB 40.

Every time FB 40 is called, the job status of the activated commands must be evaluated, and, if necessary, error handling performed.

The following steps are involved in execution of a command in the WPS(i) weighing processor:

- All the parameters and setpoints required to execute the command are entered in the SIWAREX data block (DB 221) and the appropriate bits set in DW 13 (write data).
- The appropriate command bit in DW 8 (or DW 10, depending on the mode set in DW 3) is set.
- The next call of the FB activates these commands.
- Command completion is detected by evaluation of the job status. The result data in the DB is then evaluated by the user program.

 (4) J31037–D5603–U1–A0–7619

2.4.5.1 Job status

The job status indicates the version of the activated commands. There are three job status bits for every command to the MP module (job status I, job status II and job status III). The job status bits are set and reset by the MP and are read by the user program.

Job status I
Job running

A bit with value 1 means:
The command for this job status bit is processed.

A bit with value 0 means:
Processing of the command for this job status bit is completed or was not begun.

Job status II
Job complete without error

A bit with value 1 means:
Processing of the command for this job status bit was completed without error.

A bit is set for one cycle.

Job status III
Job complete with error

A bit with value 1 means:
The processing of the command was completed with an error.

A bit is set for one cycle.

Similarly the following applies:

DW 8	**Proportioning commands**
DW 14	Job status I for proportioning commands: command is still being processed
DW 20	Job status II for proportioning commands: command was executed without error
DW 26	Job status III for proportioning commands: command processed, error occurred

(Start commands: start could not be executed because of an error).

DW 10	**Adjustment commands**
DW 16	Job status I for adjustment commands: command still being executed
DW 22	Job status II for adjustment commands: command was executed without error
DW 28	Job status III for adjustment commands: command executed, error occurred.

DW 12	**Data transfer commands READ**
DW 18	Job status I for READ: data transmission running
DW 24	Job status II for READ: data transmission terminated without error
DW 30	Job status III for READ: error occurred on data transmission

DW 13	**Data transfer commands WRITE**
DW 19	Job status I for WRITE: data transmission running
DW 25	Job status II for WRITE: data transmission terminated without error
DW 31	Job status III for WRITE: data with error.

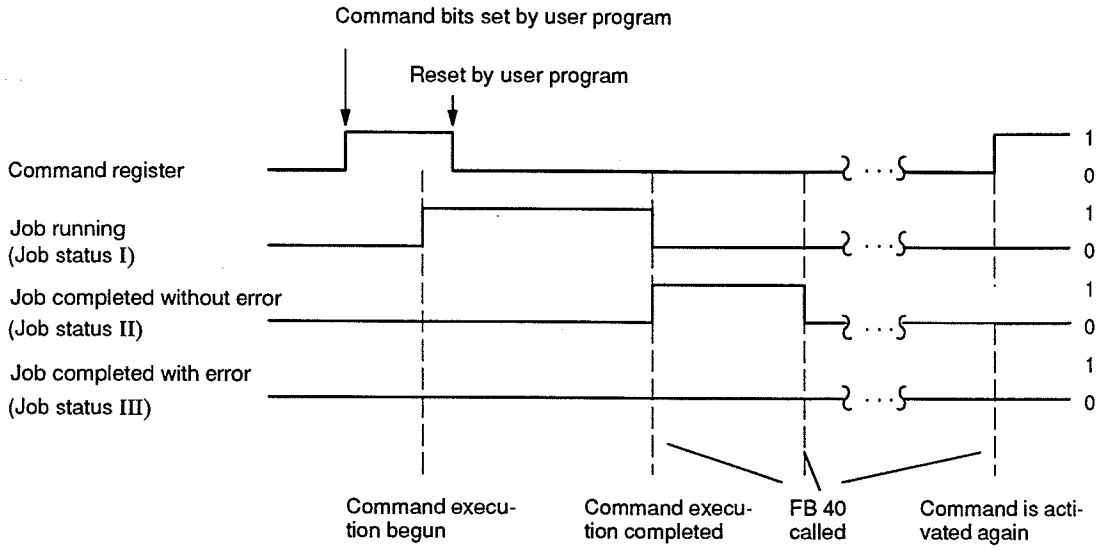


Fig. 2.13 Timing diagram for command execution without error

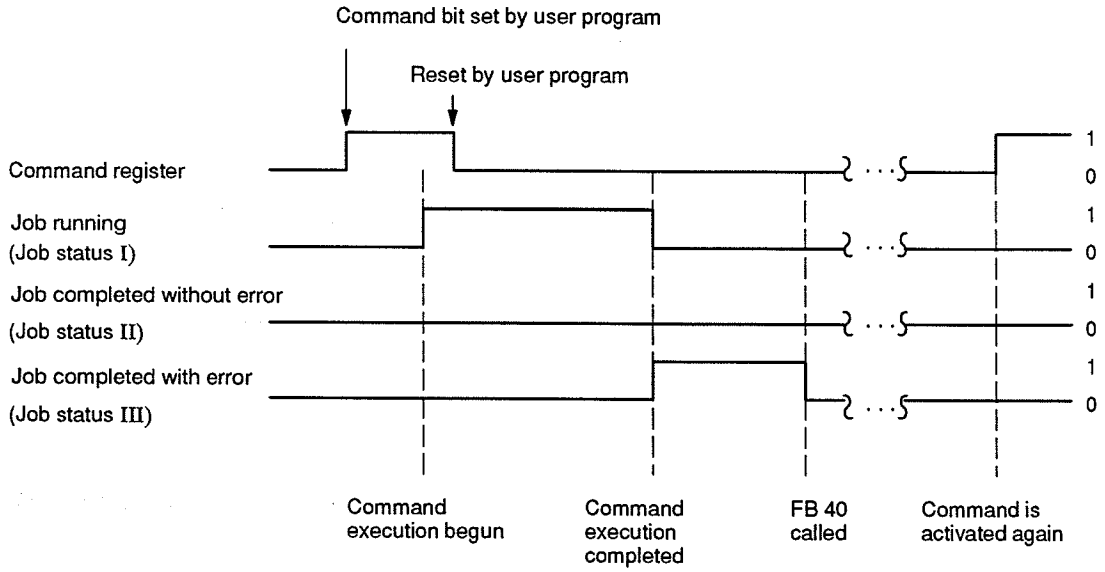


Fig. 2.14 Timing diagram for command execution with error

(4) J31037–D5603–U1–A0–7619

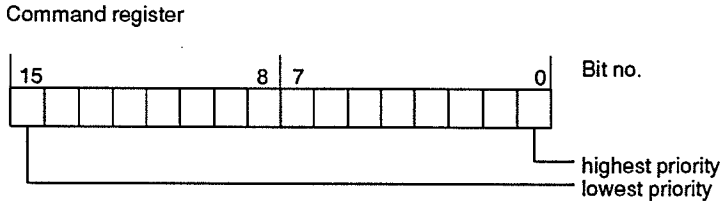
2.4.5.2 Modes of the measured value processing module

The MP can be switched between the proportioning and adjustment modes. In proportioning mode all adjustment commands (DW 10) and the writing of adjustment data (DB 8 ... 15) are rejected with an error (job status III). Similarly, in adjustment mode, all proportioning commands and writing of proportioning data (DB 0 ... 7) are rejected with an error (job status III).

The mode of the MP can be affected via DW 3, DW 4 is used for feedback of the mode.

2.4.5.3 Command priorities

The user can trigger several commands at the same time in different registers. The command priorities are defined by the bit number of the command bits.



If several command bits are set, the command with the lowest bit number is executed first.

With the command bits for

- Adjustment commands (DW 10)
- Proportioning commands (DW 8)

only one command is executed per register and cycle and that is the one with highest priority. The remaining set command bits are rejected with an error.

2.4.5.4 Cold restart (RESET) the WPS(i) weighing processor

If the MP module is to be restarted via the S5 program, this can be done using a soft restart. The command "RS" is written into the data word DW 2. The following program sequence can be used in a start–up OB:

```
      : C   DB   221          Open data block SIWAREX (DB 221 in
                              our example)
      : L   KY   0,128        DB type: DB, interface number: 128
      : T   DW   1
      : L   KS   RS           Enter reset command
      : T   DW   2
      : L   KS   DO           Select proportioning mode
      : T   DW   3
      :
      : L   KY 0,221          SIWAREX data block (DB 221)
      : JU  FB 40             Function block SIWAREX
NAME : SIWAREX
      :
      : T   FW   104          Status message
      : JC  FBxx              Error evaluation
```

Before function block FB 40 is called, the interface number must be stored in data word DW 1 of the SIWAREX DB. The code for proportioning mode "DO" in data word DW 3 makes the MP module inaccessible for adjustment commands.

If an error occurs that is caused by the parameter setting (e.g. DB 221 is not set up up to data word DW 271), the function block sets the result of logic operation RLO = "1". This can be used for a conditional call to a function block that evaluated the cause of error.

When the MP module has been successfully reset, function block FB 40 overwites the code "RS" in data word DW 2 with two blanks.

Any entry in data word DW 2 that is not equal to "RS" is ignored by function block FB 40 and not overwritten.

The effects of a RESET are described in Section 2.5.4.5 in more detail.

 (4) J31037–D5603–U1–A0–7619

2.4.5.5 Transfer adjustment commands

During transmission of adjustment commands to the MP module, the required command bits must be set in data word DW 10. The adjustment commands are then only processed by the MP if the MP module is in adjustment mode. Adjustment mode can be selected by storing the code "JU" in data word DW 3.

```
      :C    DB   221                 Open data block SIWAREX (DB 221 in our
                                     example)
      :L    KY   0,128               DB type: DB, interface number: 128
      :T    DW                       1
      :L    KS   JU                  Select adjustment mode
      :T    DW   3
      :L    KM   00100000 00000000   Adjustment command:
                                     delete weighing machine parameters
      :T    DW   10                  Adjustment command bits
      :
      :L    KY   0,221               SIWAREX data block (DB 221)
      :JU FB 40                      Function block FB 40
NAME :SIWAREX
      :
      :T    FW   104                 Status message
      :JU FBxx                       Error evaluation
      :
      :L    KB   0                   Reset adjustment commands
      :T    DW   10
```

2.4.5.6 Transfer proportioning commands

The handling of proportioning commands is for the most part the same as that of adjustment commands. The command bits must be stored in data word DW 8.

The proportioning mode can be selected by storing the code "DO" in data word DW 3. Adjustment commands are disabled as long as the module is in proportioning mode and they are rejected with an error (job status III).

```
      :A     DB   221                  Open data block SIWAREX (DB 221 in our
                                        example)
      :L     KY   0,128                DB type: DB, interface number: 128
      :T     DW   1
      :L     KS   DO                   Select proportioning mode
      :T     DW   3
      :L     KM   00000000 00000010    Proportioning command: tare
      :T     DW   8
      :
      :L     KY   0,221                SIWAREX data block (DB 221)
      :JU FB 40                        Function block SIWAREX
NAME :SIWAREX
      :
      :T     FW   104                  Status message
      :JC FBxx                         Error evaluation
      :
      :L     KB   0                    Reset adjustment commands
      :T     DW   8
```

The current mode (JU or DO) is stored in data word DW 4 and can be read out or displayed after FB 40 has functioned without an error.

(4) J31037–D5603–U1–A0–7619

2.4.5.7 Read frame

The following program sequence shows how a frame, for example frame 4, can be read:

```
      :C     DB   221                  Open data block SIWAREX (DB 221 in our
                                        example)
      :L     KY   0,128                DB type: DB, interface number: 128
      :T     DW   1
      :L     KM   00000000 00010000    Read frame 4
      :T     DW   12
      :
      :L     KY   0,221                SIWAREX data block (DB 221)
      :JU FB 40                        Function block FB 40
NAME :SIWAREX
      :
      :T     FW   104                  Status message
      :JC FBxx                         Error evaluation
      :
      :L     KB   0                    Reset frame read commands
      :T     DW 12
```

If FB 40 has been executed without an error, the required information for frame 4 can be taken from data words DW 72 to DW 107.

2.4.5.8 Write frame

The following program sequence shows how frame 2 is written to the MP module.

```
      :C     DB 221                    Open SIWAREX data block (DB 221 in our
                                       example)
      :
      :L     KH   xxxx                 * Supply frame 2 with data
      :T     DW   44                   *
      :      ...
      :L     KH   zzzz *
      :T     DW   46                   *
      :
      :L     KY   0,128                DB type: DB, interface number: 128
      :T     DW   1
      :L     KM   00000000 00000100    Write frame 2
      :T     DW   13
      :
      :L     KY   0,221                SIWAREX data block (DB 221)
      :JU FB 40                        Function block FB 40
NAME :SIWAREX
      :
      :T     FW   104                  Status message
      :JC         FBxx                 Error evaluation
      :
      :L     KB   0                    Reset frame write commands
      :T     DW   13
```


2.4.5.9 Behavior on time out

Only for S5–135U and S5–155U

If an interface number other than the one set on the MP is parameterized in function block FB 40, this causes error message 43 H in the message word.

Only for S5–115U

If an interface number other than the one set on the MP is parameterized, the PLC enters the stop state. The error number can be read out from flag byte FY 255.

The interface number parameterized can be read out from flag byte FY 254.

These values can be read out using the programmer functions "FORCE VAR" or "STATUS VAR".

(4) J31037–D5603–U1–A0–7619

2.5 Function description

2.5.1 Basic settings

Before the SIWAREX S controller can function, the electronic circuit must also be set by the user program. These basic settings largely replace the setting elements on the electronics board. Some parameters can be changed during operation.

With the command "Delete weighing machine parameters" (DW 10, Bit 13) the data stored in the MP is deleted, or assigned a default value.

The following data words are not deleted:	DW 88 DW 134 to 141 DW 162 to 164 DW 174, 175 DW 189

2.5.1.1 Adaptation of the load cell connections

The measuring circuit is adapted when the load cells are started up. It only makes sense to change these settings if the plant is reconfigured. The adaptation is made by entering plant parameters in frame 10. The following configurations are possible without changing the hardware:

– Number of load cells:	min 1 max 6
– Load cell characteristic value:	min 1 mV/V max 4 mV/V
– Internal resistance of the load cell(s)	min 40 Ω max 4010 Ω

Please note:
If several load cells are connected in parallel the total internal resistance must not drop below 40 Ω.

With a configuration that is not within the ranges stated above, adaptation can be performed with the use of special resistors on the adjustment module of the MA (→ Section 3.2.3.2 and Section 3.2.3.3).

Internal resistance of the load cell(s)	Frame 10:	Plant parameters
	Data word :	DW 162
	Format:	KF
	Unit:	Ω

If the special resistor wire break or the special resistor for amplification is used on the MA module (→ Page 3–23), the value 0 Ω must be entered here.

Load cell characteristic value	Frame 10: Data word: Format: Unit:	Plant parameters DW 163 KF 0.1 mV/V

☞ If the special resistor for amplification is used, enter characteristic value 1 mV/V, i.e. the figure 10.

Number of load cells	Frame 10: Data word: Format:	Plant parameters DW 164 KF

(4) J31037–D5603–U1–A0–7619

2.5.1.2 Setting the digital filter

The digital 16–bit measured values received from the MA can also be filtered by a digital measured value filter on the MP. The filtered measured value can be taken from DW 89. This value forms the basis for calculation of the weight values.

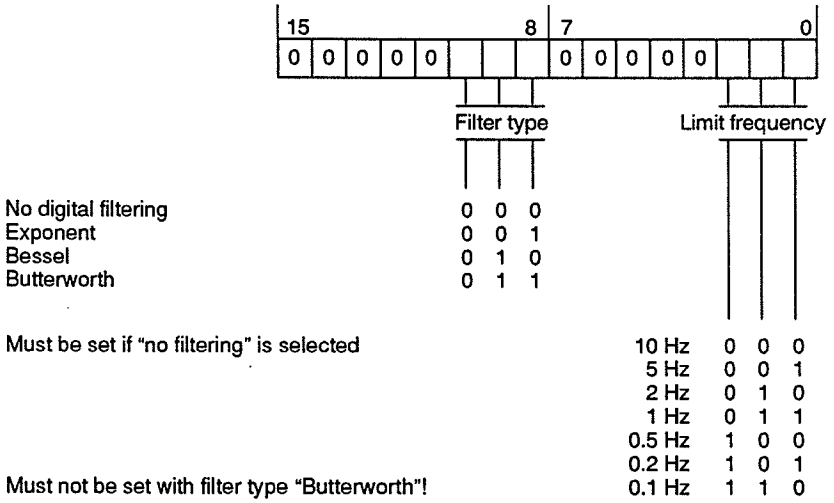
The unfiltered measured value from the MA can be taken from DW 88.

If no digital filtering is parameterized, the conditions of the MA (→ Section 3 "Filtering") apply. In this case the values in DW 88 and in DW 89 are identical.

You can select between several types of filters and limit frequencies.

Data word filter

Frame 10
Data word: DW 165
Format: KM



Step response of filter types that can be set

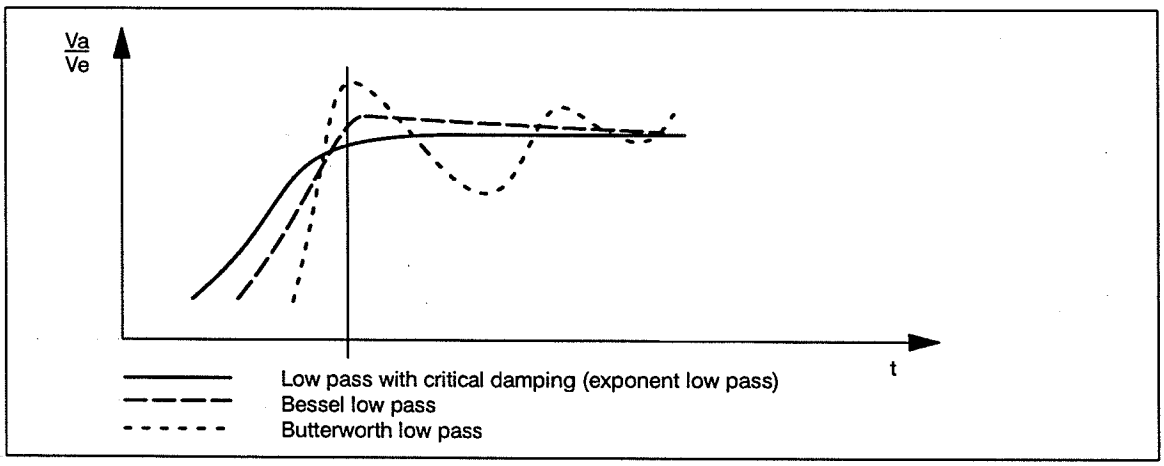


Fig. 2.15 Filter types

2.5.2 Adjustment

Adjustment is used to adapt the MP to the mechanics of the weighing equipment.

2.5.2.1 Adjustment

If the mechanics of the weighing equipment have a linear response, it is enough to specify an adjustment weight for adjustment (adjustment weight 1 (empty weighing machine with dead load) and adjustment weight 2 (1st adjustment weight).

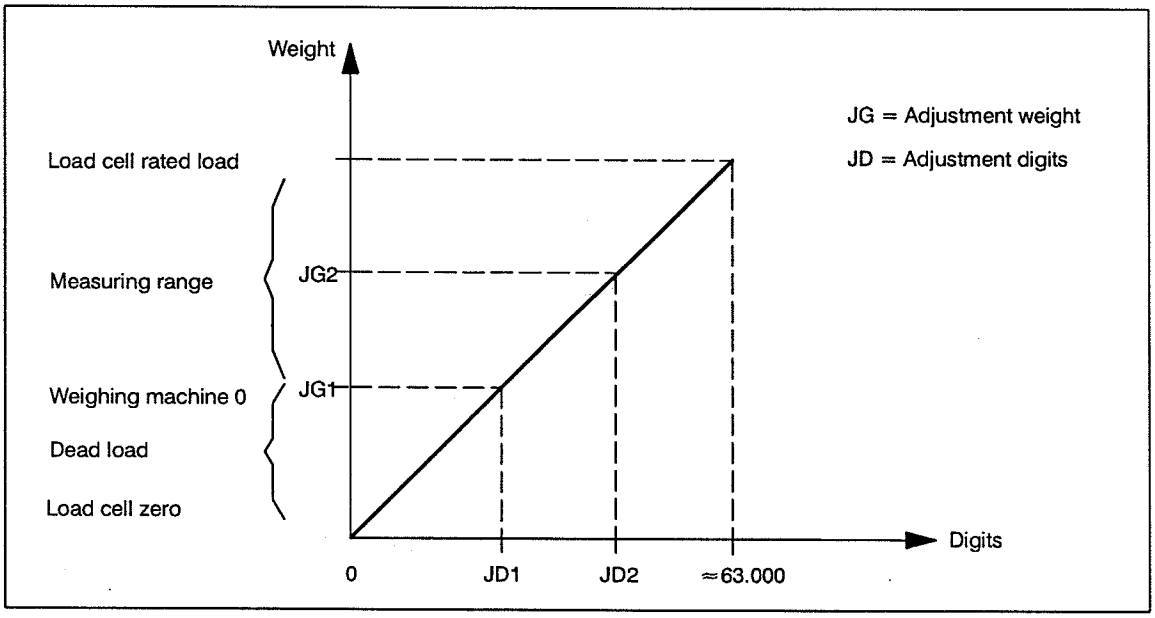


Fig. 2.16 Adjustment

The MA resolves the signal coming from the load cells into approx. 63,000 parts (digits) at rated load.

During adjustment the internal digits are assigned to the weight values. The weights are calculated according to the following formula:

$$\text{Weight per digit} \quad \frac{JG2 - JG1}{JD2 - JD1}$$

This ratio applies to the whole measuring range. Note that between JD1 and JD2 there must be a difference of at least 1,000 digits to provide sufficient accuracy.

The MP provides the option of observing the internal digits during adjustment.

Display of the measured values:

Gross weight	Frame 4:	Actual values
	Data words:	DW 80, DW 81
	Formats:	32–bit floating point, BCD or fixed point
Net weight	Frame 4:	Actual values
	Data words:	DW 82, DW 83
	Formats:	32–bit floating point, BCD or fixed point
Actual value in digits (unfiltered)	Frame 4:	Actual value
	Data word:	DW 88
	Format:	KH
Actual value in digits(filtered)	Frame 4:	Actual value
	Data word:	DW 89
	Format:	KH

☞ Dead load is the sum of all moving masses of the mechanical system of a weighing machine, i.e. the weight of the mechanical parts of a weighing machine.

Adjustment

- Select adjustment mode DW 3 "JU"
- Fill frames 9 to12 with data and transfer them together (bits for frames 9...12 in DW 13 = 1)
- Load the weighing machine with the dead load (empty weighing machine)
- Set command bits:
  Data word 10: Adjustment commands
  Bit no. 0: Adjustment weight 1 valid
- Perform command processing with FB 40
- Apply adjustment weight
  (The sequence JG 1 → JG 2 must be observed.)
- Set command bits:
  Data word10: Adjustment command
  Bit no. 1: Adjustment weight 2 valid
- Perform command execution with FB 40
- Read frames 9 ... 13 (backup)

After adjustment has been performed all adjustment data should be read and backed up (DB 9 to DB 13). In this way it is possible to adjust the weighing machine without applying the adjustment weight by applying the adjustment data.

Caution

Frames 9...12 must always be written simultaneously (DW 13,bits 9...12 = 1).
Writing frames 9 to 12 individually is only allowed for service purposes.

2.5.2.2 Linearization

The mechanical structure of a weighing machine can cause non–linearity over the entire measuring range.

The WPS(i) weighing processor provides a way of compensating for this behavior using up to 6 adjustment points (see Fig. 2.15). However, this can only be done if the measurement curve does not demonstrate any hysteresis.

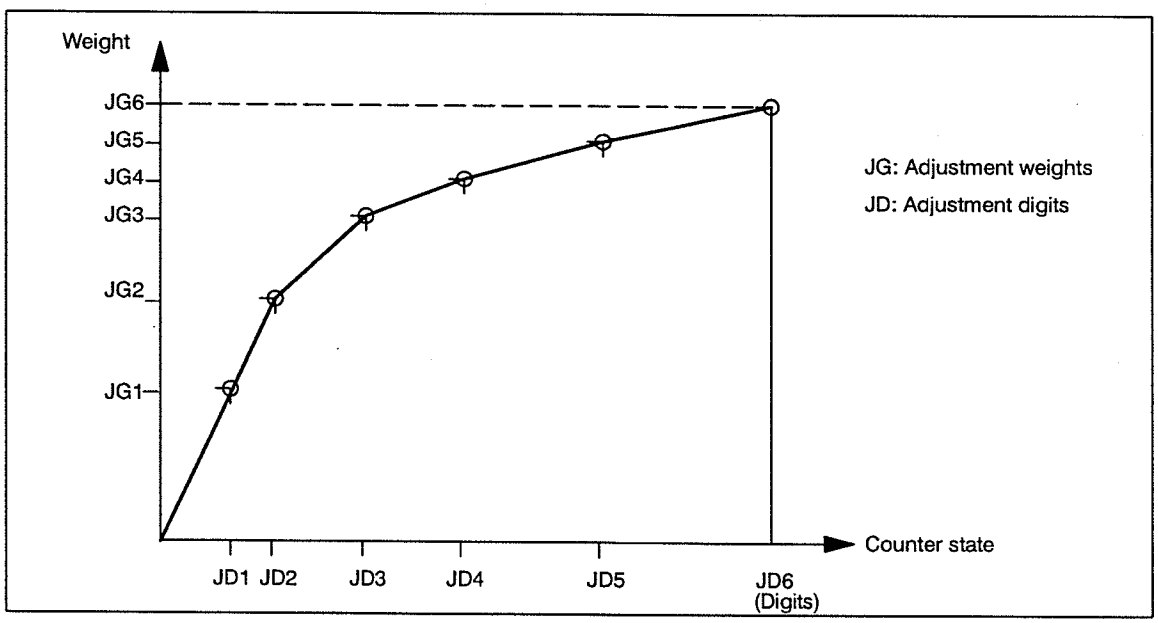


Fig. 2.17 Linearization of the characteristic curve

You can designate the short sections between the individual adjustment points as being relatively linear, even though the entire curve is non–linear. To perform linearization, up to 5 adjustment weights (adjustment weight 1 (empty weighing machine) to adjustment weight 6) must be weighed with appropriate spacing.

There must be a distance of at least 1,000 digits between the adjustment weights.

Adjustment point 1 (weighing machine empty; weighing machine 0) gives adjustment value 1 (JD1). Adjustment point 2 is calculated by loading the weighing machine with adjustment weight 2 (JG2). This results in adjustment weight 2 (JD2) etc.

An adjustment factor 1...5 is calculated between adjustment points and reflects the gradient of the curve. It is measured in the unit weight/digit. Beyond the adjustment points, the straight line between the two nearest adjustment points applies (linear extension).

Measured value processing adjustment factors are calculated in the weighing processor from the adjustment points:

$$LIFAK_n = \frac{JG_{(n+1)} - JG_{(n)}}{JD_{(n+1)} - JD_{(n)}}$$

LIFAK: Adjustment factor
JG: Adjustment weight
JD: Adjustment digit
n: Sequential index ($1 < n < 5$)

The current weight is calculated as follows:

$$Weight = JG_{(n)} + ((Actual\ value_d - JD_n) \cdot LIFAK_n))$$

$Actual\ value_d$: current actual value in digits

The weighing machine parameters and the weights calculated during linearization of the characteristic curve are stored in the battery–backed RAM.

Adjustment procedure – Enter adjustment weights in frame 12 and transfer to MP (write)

– Empty weighing machine

– Set command bits:
Data word 10: Adjustment commands
Bit no. 0: Adjustment weight 1 valid

– Perform command processing with FB 40

– Apply 1st adjustment weight

– Set command bits:
Data word 10: Adjustment commands
Bit no. 1: Adjustment weight 2 valid

– Perform command execution with FB 40

:

– Apply 5th adjustment weight

– Set command bits:
Data word 10: Adjustment commands
Bit no. 5: Adjustment weight 6 valid

– Perform command execution with FB 40

☞ Back up all adjustment data after successful adjustment !

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.5.2.3 Setting to zero

The weighing machine zero can shift because of dirt in the mechanics of the weighing machine. Setting to zero means setting the gross weight to zero. This zero applies to all weighing operations that follow until the weighing machine is set to zero again or the zero point is offset by an automatic zero offset (→ Section 2.5.2.4).

The range in which the zero can be offset is defined by the upper and lower limits. Positive values must be input as the limits.

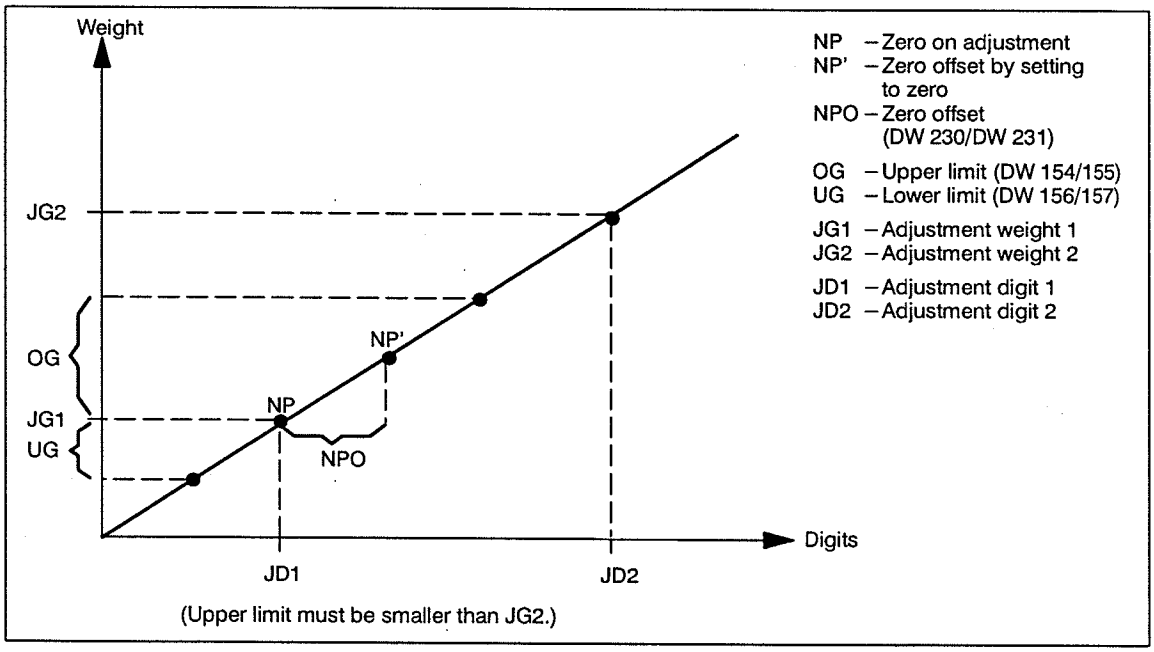


Fig. 2.18 Zeroing range

Range (Upper limit/OG)
Frame 9: Basic parameters
Data words: DW 154, DW 155
Formats: 32–bit floating point, BCD or fixed point

Weight value for upper limit must not be larger than JG2.

Range (Lower limit/UG)
Frame 9: Basic parameters
Data words: DW 156, DW 157
Formats: 32–bit floating point, BCD or fixed point

Weight value for lower limit must always be smaller than JG1.

 (4) J31037–D5603–U1–A0–7619

Error message on violation of the range limit for zero point offset:

Frame 4:	Error, status words and actual values
Data word 73:	Error word 2
Bit no. 2:	Zero is not plausible.
Bit no. 3:	Range for zero point offset violated

The function setting to zero can be performed both in adjustment mode and in proportioning mode.

Setting to zero

- Empty scale
- Set command bits:
  Data word 8: Proportioning command, or
  Data word 10: adjustment commands
  (DW 8 or DW 10 depends on the mode)
  Bit no. 14: Setting the weighing machine to zero
- Perform command execution with FB 40

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.5.2.4 Automatic zero point offset

To suppress small drifts (because of the effect of temperature etc.) on an unloaded weighing machine, there is an automatic zero point offset function.

The gross weight is automatically set to zero if the measured value retains a value within the resetting range around the previous zero for a certain time (resetting time).

An error message is output if the zero drifts out of a set range. Resetting time, resetting value and limit range can all be set (→ Section 2.5.2.3):

Resetting time	Frame 11:	Basic parameters
	Data word:	DW 185
	Format:	KT
Resetting value	Frame 11:	Basic parameters
	Data word:	DW 180
	Format:	KH
	Unit:	Digits

Selecting the resetting time and resetting value:

During extremely slow proportioning that can be started from the weighing machine zero (gross weight =0), a small increase in weight can be seen as a zero drift and no increase in weight is shown in the net weight (DW 82/DW 83).

If the zero point is offset, the distance from the originally defined zero point can be read from DW 231 in digits.

Format: KH

Switching on automatic zero point offset:

Frame 11:	Basic parameters
Data word 172:	Parameterizing word 1
Bit no. 15:	Zero offset on = 1

 (4) J31037–D5603–U1–A0–7619

2.5.3 Weighing

2.5.3.1 Fill weighing

In fill weighing the net weight increases from zero until no extra load is applied to the weighing machine.

The following applies: **Net weight = gross weight – tare weight**

Fill weighing mode is selected by command bits "Proportioning commands" (DW 8) and flagged in DW 77 (bit 15 = 1).

2.5.3.2 Deduction weighing

In deduction weighing the net weight starts at zero and continues to increase until no further load is taken from the weighing machine:

The following applies: **Net weight = tare weight – gross weight**

Deduction weighing mode is selected by command bits "Proportioning commands" (DW 8).

2.5.3.3 Taring

By taring, the net weight can be set to zero while the weighing machine is subjected to an unknown weight. Thereafter, the net weight only applies to any weights applied on top of that. The tare weight is loaded with the current gross weight in taring.

Taring only applies to the current weighing operation, unlike setting to zero.

Taring

- The weighing machine is loaded with an unknown weight that need not be weighed.
- Set command bits:
  Data word 8: Proportioning commands
  Bit no. 1: Taring
- Perform command execution with FB.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.5.3.4 Tare value

If the weight of a container to be weighed is known, this weight can be specified as a tare value.

The net weight is calculated as follows:

Net weight = gross weight – tare value

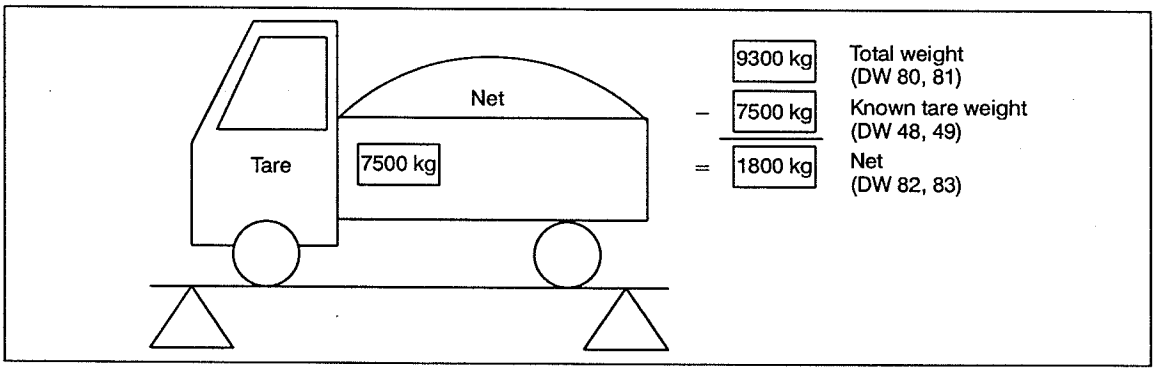


Fig. 2.19 Example of a tare value

Specifying a tare value (only for fill weighing)

– Enter the tare weight

Frame 2:	Proportioning data
Data words:	DW 48, DW 49
Formats:	32–bit floating point, BCD or fixed point

– Load weighing machine

– Set the command bits

Data word 8:	Proportioning commands
Bit no. 2:	Declare tare value to be valid

– Perform command execution with FB

– Read the weight value

Actual value gross

Frame 4:	Actual value
Data words:	DW 80, DW 81
Formats:	32–bit floating point, BCD or fixed point

Actual value net

Frame 3:	Actual value
Data words:	DW 82, DW 83
Formats:	32–bit floating point, BCD or fixed point

The gross weight must be zero before loading the weighing machine, otherwise an incorrect net weight is calculated (if necessary reset the gross weight to zero).

A plausibility check is made when weighing with a tare value. An error message is output if the gross weight is smaller than the tare value (tolerance value specified in DW 181).

Tare value is not plausible

Frame 4:	Error, status words and actual values
Data word:	DW 73
Bit no.:	4

2.5.3.5 Proportioning

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

Every time proportioning with automatic taring is started (DW 8, bits 5 and 6), taring is automatic. The net weight indicated at this time is set to zero. The outputs for coarse and fine flow are switched on (→ Section 2.2.3.5).

The net weight is not set to zero with the commands "Start without automatic taring, upwards/ downwards" (DW 8, bits 9 and 10).

Proportioning can only be started when the weighing machine is stopped (standstill signal). When the command to start proportioning is given, proportioning does not start until the standstill signal has been sent.

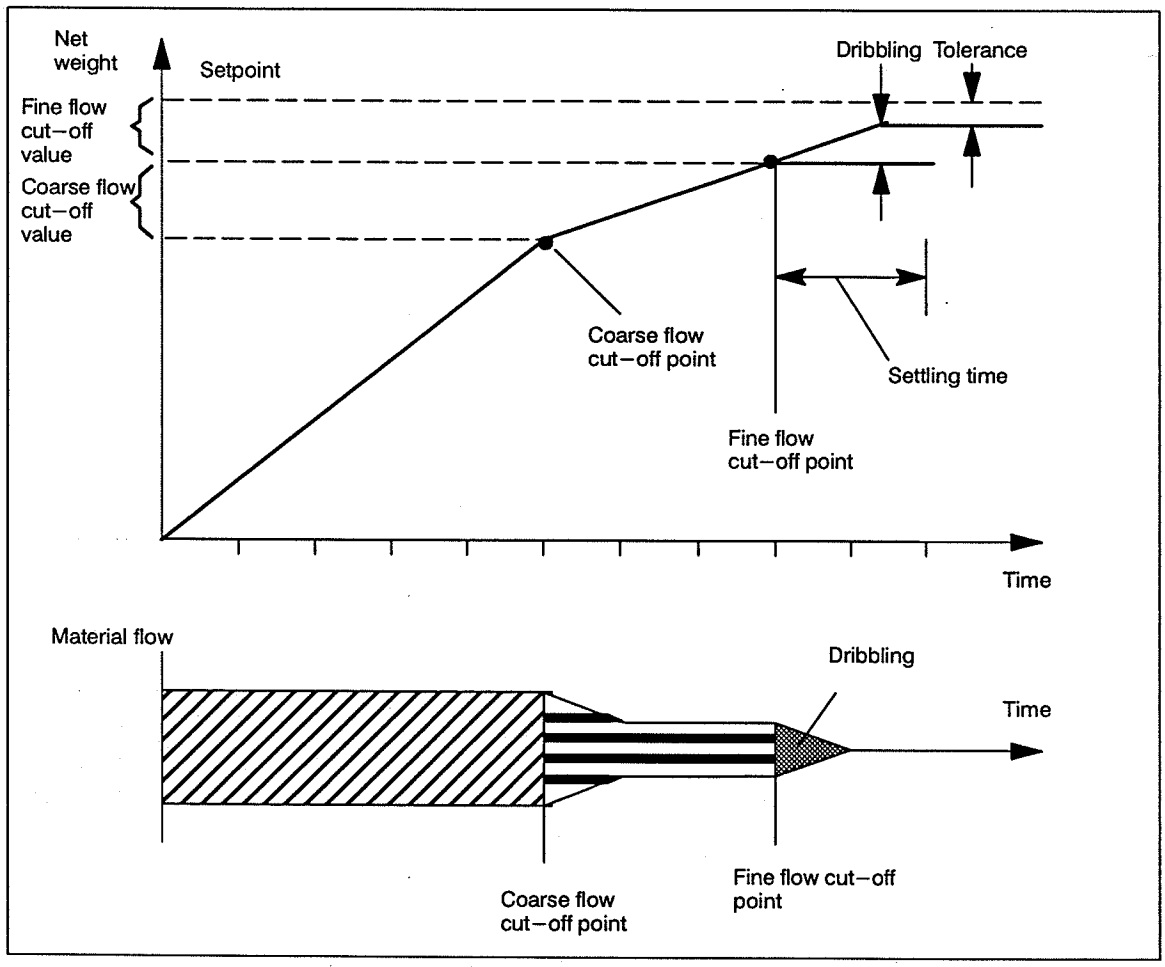


Fig. 2.20 Proportioning

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

When the coarse flow cut–off point is reached, the coarse flow output is switched off. If the fine flow cut–off point is reached, the fine flow output is also switched off. After this, the settling time begins.

As soon as the standstill signal has been received or after the end of the settling time at the latest, a tolerance check is performed and reproportioning carried out if necessary (DW 66, bit 0) (→ Section 2.5.3.7).

The end of proportioning is indicated by a signal.

The following applies: Coarse flow cut–off point = Setpoint – cut–off value COARSE – Cut–off value FINE

Fine flow cut–off point = Setpoint – cut–off value FINE

If the coarse flow is switched off during proportioning, the coarse flow is no longer switched off, even if the current goes below the coarse flow cut–off point.

Plausibility check of the setpoint

The setpoint is checked for plausibility before proportioning starts. A plausibility error is signalled in DW 73, bit 1 and arises under one of the following conditions:

- Setpoint > gross weight (for deduction weighing)
- Setpoint > overfill value – gross weight (for fill weighing)
- Setpoint ≤ 0
- Setpoint < cut–off value FINE
- The setpoint would cause violation of the volume limit value.

Setpoint change during proportioning:

During proportioning the following conditions apply if a new setpoint is to be accepted (frame 0, DW 38, DW 39):

- A new small setpoint is only accepted if the currrent net weight is not larger than the new coarse flow cut–off point.
- The already switched–off coarse flow valve is no longer switched on by an increased setpoint.
- If the fine flow is switched off, a new setpoint is no longer accepted.
- If the setpoint is not accepted, proportioning is stopped and the error message "Setpoint currently not accepted" (DW 73, bit 0) is output. The error information bit for "Write frame 0" (DW 13, bit 0) is set.

(4) J31037–D5603–U1–A0–7619

The proportioning procedure

– Setting proportioning data in frames 0, 2 and 3:
Setpoint, cut–off value COARSE, cut–off value FINE, tolerance plus value, tolerance minus value, settling time

– Setting the command bits:

Data word 8:	Proportioning commands
Bit no. 5:	Start proportioning upwards (with automatic taring) or
Bit no. 6:	Start proportioning downwards (with automatic taring)

– Perform command execution with FB 40

The end of proportioning can be detected by reading status word 1.

Proportioning terminated

Frame 4	Error, status words and actual values
Data word 77:	Status words 1
Bit no. 1:	Proportioning was ended without error
Bit no. 2:	Proportioning was ended with error

Interruption of proportioning

Proportioning can be interrupted with the command Stop.
Proportioning can be continued with the commands "Start without taring upwards /downwards". Taring is not performed.

– Setting command bits

Data word 8:	Proportioning commands
Bit no. 0:	Stop

– Perform command execution with FB 40

Continue proportioning

– Setting command bits:

Data word 8:	Proportioning commands
Bit no. 9:	Start proportioning upwards (without automatic taring)
or	
Bit no. 10:	Start proportioning downwards (with automatic taring)

2.5.3.6 Tolerance check

A tolerance check is performed after every proportioning procedure.

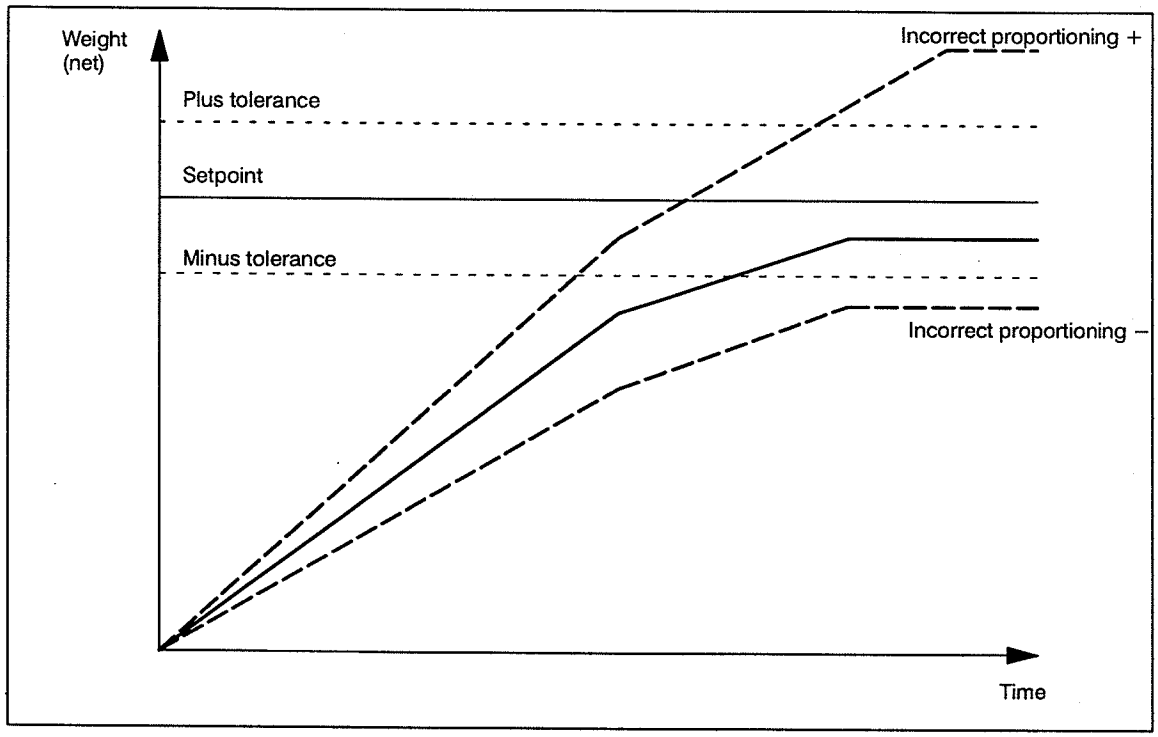


Fig. 2.21 Tolerance check

If the net weight is less than setpoint – tolerance minus value, the following message is output

"Tol minus violated"

If the net weight is greater than setpoint + tolerance plus value, the following message is output

"Tol plus violated"

Message to the S5

Frame 4:	Error, status values and actual values
Data word 77:	Status word 1
Bit no. 4:	Tolerance plus value was violated or
Bit no. 5:	Tolerance minus value was violated

If the WPS(i) weighing processor detects a tolerance violation, the response of the MP depends on how the parameters are set:

Frame 3:	Proportioning data 2
Data word 66:	Function selection
Bit no. 0:	Automatic reproportioning On/Off

When this bit is set, automatic reproportioning is performed. If this bit is not set, it is possible to perform reproportioning in inching operation (→ Section 2.5.3.8).

 (4) J31037–D5603–U1–A0–7619

2.5.3.7 Automatic reproportioning

When the settling time has elapsed, or if a standstill signal has been sent, a check is made whether the actual value is above the tolerance minus limit. If the value is below this limit, the fine flow remains switched on until the tolerance minus limit is exceeded again.

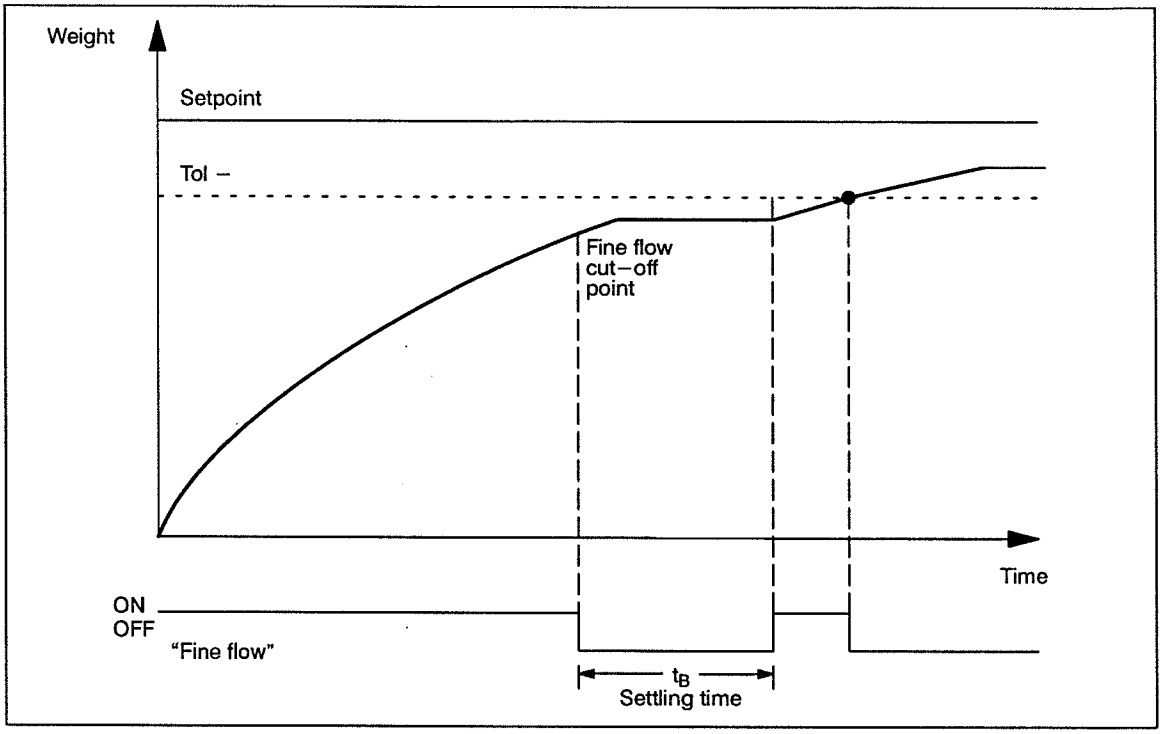


Fig. 2.22 Reproportioning

After the settling time has elapsed or after a stopped message has been sent, the end of proportioning is signalled to the S5.

The tolerance plus value can be exceeded with very high dribbling values. Work in inching operation if this happens. (–> Section 2.5.3.8)

Automatic reproportioning can be switched on or off as required:

Frame 3:	Proportioning data 2
Data word 66:	Function selection
Bit no. 0:	Automatic reproportioning ON/OFF (1 = ON)

2.5.3.8 Inching operation

In inching operation, the fine flow output is switched on for a set time. The set time is designated inching time. The settling time is started after every inching time.

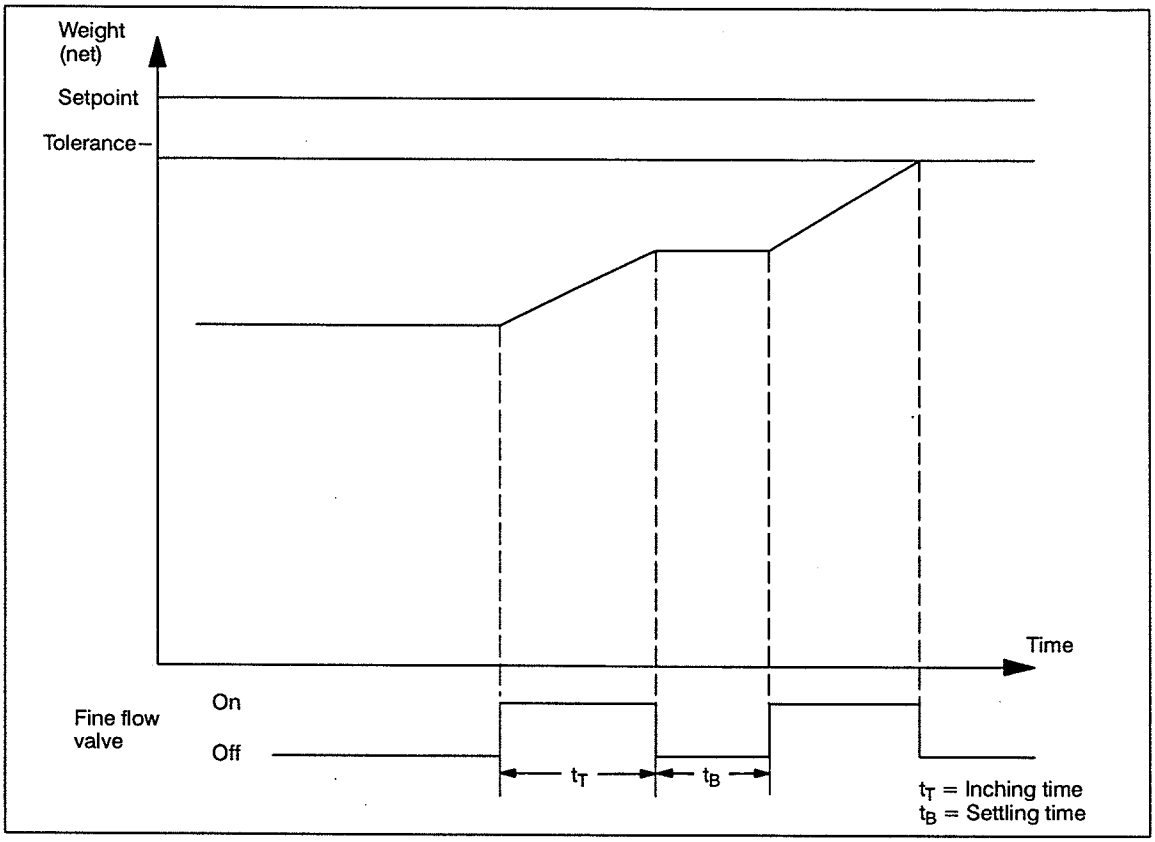


Fig. 2.23 Inching operation

In inching operation, the settling time is always allowed to elapse. It cannot be interrupted by a standstill signal.

Inching time

Frame 3:	Proportioning data 2
Data word:	DW 64
Format:	KT

The inching time can also be shorter if bit 3 is set in DW 66. Then the fine flow valve is switched off if the tolerance minus limit is exceeded.

Executing inching operation

– Specify inching time **(DW 64)**

– Set command bits:

Data word 8:	Proportioning commands
Bit no. 7:	Start inching operation upwards
or	
Bit no. 8:	Start inching operation downwards

– Perform command execution with FB 40
(When inching operation is started, no taring is performed, there is no delay until the weighing machine is in the standstill state.)

Inching operation can be aborted with the stop command (DW 8, bit 0).

(4) J31037–D5603–U1–A0–7619

2.5.3.9 Fine flow optimization

The WPS(i) weighing processor has a function for calculating the optimum fine flow so that the setpoint can be reached with greater accuracy over several consecutive proportioning operations with the same material. When a proportioning procedure is completed, the optimized fine flow cut–off value can be taken from DW 86, 87 as a new "cut–off value FINE" (DW 46/47). If the automatic reproportioning function is switched on, the fine flow optimization function is only performed when the first settling time has elapsed. The offset calculation does **not** offset the cut–off value of the fine flow.

Optimized fine flow cut–off value	Frame 4:	Error, status words and actual values
	Data words:	DW 86, DW 87
	Formats:	32–bit floating point, BCD or fixed point

The calculation is done according to the following formula:

$$ASW_{new} = ASW_{old} - (\text{setpoint} - \text{net weight}) \times FKF$$

with ASW_{new}: new calculated cut–off value FINE DW 86, 87

ASW_{old}: previous cut–off value FINE DW 46, 47

FKF: fine flow compensation factor

If the result of the calculation of the ASW_{new} is a negative value, the ASW_{new} is set to zero.

Deviation of the net weight from the setpoint	Fine flow compensation factor
> 0.5 % > 1 % > 4 %.	0.25 0.5 1

Table 2.6 Calculation of the fine flow compensation factor

The variable fine flow compensation factor is used in calculating the optimized fine flow cut–off value for the following reasons:

The actual dribbling depends on statistical fluctuations. Only those setpoint/actual value differences are to be compensated that do not result from statistical dribbling fluctuations. This gives rise to the following requirements:

- Large setpoint/actual value differences should be compensated as fast as possible.
- Small setpoint/actual value differences that could have arisen from dribbling fluctuations should be compensated over a longer period.

The adapted fine flow compensation factor fulfills these requirements.

The calculation of the compensation is performed when the settling time has elapsed or when the settling time has been aborted by a stop. The newly calculated cut–off value FINE is entered before the ready message (DW 77, Bit 1).

☞ The calculation is not performed if proportioning was performed only with fine flow (start above coarse flow cut–off point).

2.5.3.10 Fill level monitoring (weight)

The following data can be set for monitoring weight thresholds:

Frame 9:	Limit values
DW 142, DW 143:	MIN value
DW 144, DW 145:	MAX value
DW 146, DW 147:	Overfill value
DW 148, DW 149:	Empty signal value
Formats:	32–bit floating point, BCD or fixed point

Frame 11:	Basic parameters
Data word 186:	Empty signal delay
Format:	KT

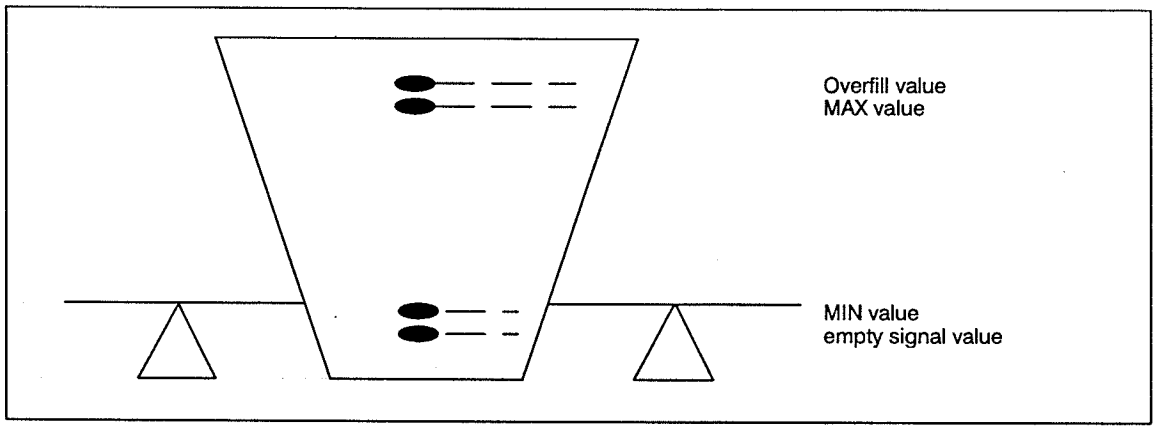


Fig. 2.24 Position of the thresholds

Violation of the MAX and MIN thresholds are entered in the status word.

Violation of the overfill value not only causes entry in error word 2 but also halts proportioning. The outputs COARSE and FINE are switched off. The output OVERFILLING is switched on.

Data word 73:	Error word 2
Bit no. 14:	Overfilling/overfill output active.

If the empty signal value is violated, the empty signal delay begins. If the empty signal value remains below the empty signal value entered until the end of the empty signal delay, the empty signal is entered in the status word 1. If the empty signal value is exceeded, the empty signal is reset again. If a proportioning operation is running, it is aborted.

Limit value violation

Frame 4:	Error, status words and actual values
Data word 77:	Status word 1
Bit no. 6:	Maximum limit value violated
Bit no. 7:	Minimum limit value violated
Bit no. 8:	Empty signal value violated.

2.5.3.11 Filling state monitoring (volume)

In addition to weight monitoring, the volume of material can be monitored for limit values. The volume monitoring is useful if different components with very different specific weights are proportioned. To do this the following information is required:

Specific weight	Frame 3: Data words: Format: Unit:	Proportioning data 2 DW 63 KF g/dm^3

or

Maximum volume (fill weighing)	Frame 3: Data words: Formats:	Limit values DW 150, DW 151 32–bit floating point, BCD or fixed point
Maximum volume (deduction weighing)	Frame 9: Data words: Formats:	Limit values DW 152, DW 153 32–bit floating point, BCD or fixed point

Depending on the mode of the weighing machine, only one maximum volume value (fill weighing or deduction weighing) must be set.

The maximum volume for deduction weighing corresponds to the volume of the container to be filled.

Volume monitoring is switched off if zero was entered as the specific weight.

The volume is calculated from the current weight and the specific weight of the material. The volume is monitored for the set limit value.

If the limit value is violated, the proportioning operation is aborted and overfilling signalled in error word 2 (DW 73, bit 14).

☞ Monitoring of the volume is only performed in accordance with the proportioning direction, i.e. with deduction weighing, only the volume of the container to be filled is monitored and not the container standing on the weighing machine.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Fill weighing with several material components:

The current volume is calculated as follows:

$$V_{new} = V_{old} + \frac{\text{Gross weight} - VTG}{SG}$$

with V_{new}: new current volume

V_{old}: previously stored volume of previous component

VTG: volume tare weight

SG: specific weight of the current components

When a new specific weight is transferred, V_{old} is loaded with the current volume and VTG with the gross weight.

The volume value is set to zero when the container is emptied as soon as the empty signal has been set. To ensure that the next weighing operation begins with a volume of zero, you must either wait for the empty signal or output the command "Reset volume value" (DW 8, bit 3).

With the command "Reset volume value", V_{old} is reset and VTG is loaded with the gross value.

In general the following applies: if a negative volume is calculated internally (e.g. net is less than zero), the volume value is reset to zero.

If the mode is switched from deduction weighing to fill weighing, the volume is calculated from the current gross value.

Every time proportioning of a further component is started, the total volume is formed from the material so far proportioned and the setpoint of a new component and this total volume is monitored for the volume limit. If a violation is detected, proportioning start is disabled and a message output:

Frame 4:	Error, status words and actual values
Data word 73:	Error word 2
Bit no. 1:	Setpoint is not plausible

Deduction weighing:

During deduction weighing, only the volume of the container to be filled and the setpoint are checked. The maximum volume of the container to be filled determines the limit.

The volume removed is calculated from the net weight and the specific weight.

If a new specific weight is entered during downwards mode, the volume value changes immediately if the net weight is not zero.

2.5.3.12 Material flow monitoring

It is possible to monitor the flow of materials during proportioning. A check is made to see whether a change in weight occurs over a certain period.

A minimum material flow rate is specified for the coarse flow valve and for the fine flow valve. The monitoring period is the same for both valves and can be set. If no change in weight that is greater than the minimum material flow rate has been detected when the monitoring period has elapsed and the coarse and fine flow valves were actuated, the message "Material flow interrupted" is output. The current proportioning operation is not interrupted.

Monitoring can be delayed for possible mechanical response times on switching on a coarse flow. This switch–on delay time for material flow monitoring can be set.

Material flow monitoring can be switched on and off by the S5 as required.

Switching on material flow monitoring:

	Frame 3:	Proportioning data 2
	Data word 66:	Function selection
	Bit no. 1:	Material flow monitoring on/off (1 = on)

Required data:

Minimum material flow FINE	Frame 2: Data words: Formats:	Proportioning data 1 DW 54, DW 55 32–bit floating point, BCD or fixed point
Minimum material flow COARSE	Frame 2: Data words: Formats:	Proportioning data 1 DW 56, DW 57 32–bit floating point, BCD or fixed point
Throughput calculation time (scanning time)	Frame 11: Data word: Format: The throughput calculation time ought to be greater than 100 ms.	Basic parameters DW 187 KT
Closing delay for monitoring	Frame 2: Data word: Format:	Proportioning data 1 DW 58 KT

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Message for faulty material flow:

Frame 4:	Error, status words and actual values
Data word 73:	Error word 2
Bit no. 5:	Material flow monitoring has responded.

The current throughput value can be taken from DW 92/93. Standardization is then performed here in the time specified in DW 188.

Time base for throughput output	Frame 11:	Basic parameters
	Data word:	DW 188
	Format:	KT
Throughput value	Frame 4:	Error and status words and actual values
	Data word:	DW 92, DW 93
	Formats:	32–bit floating point, BCD or fixed point

2.5.3.13 Standstill monitoring

The standstill monitoring function is constantly performed. If the standstill conditions are fulfilled, the standstill signal is set and the pulse LED on the front panel is lit continuously (→ Section 2.2.1). If the condition is no longer fulfilled, the signal is reset and the PULSE LED blinks.

The standstill condition is fulfilled if the gross weight is less than a set fluctuation range (standstill time, DW 184) within a specified time (stop value, DD 182). The standstill time is reset every time the standstill value is exceeded.

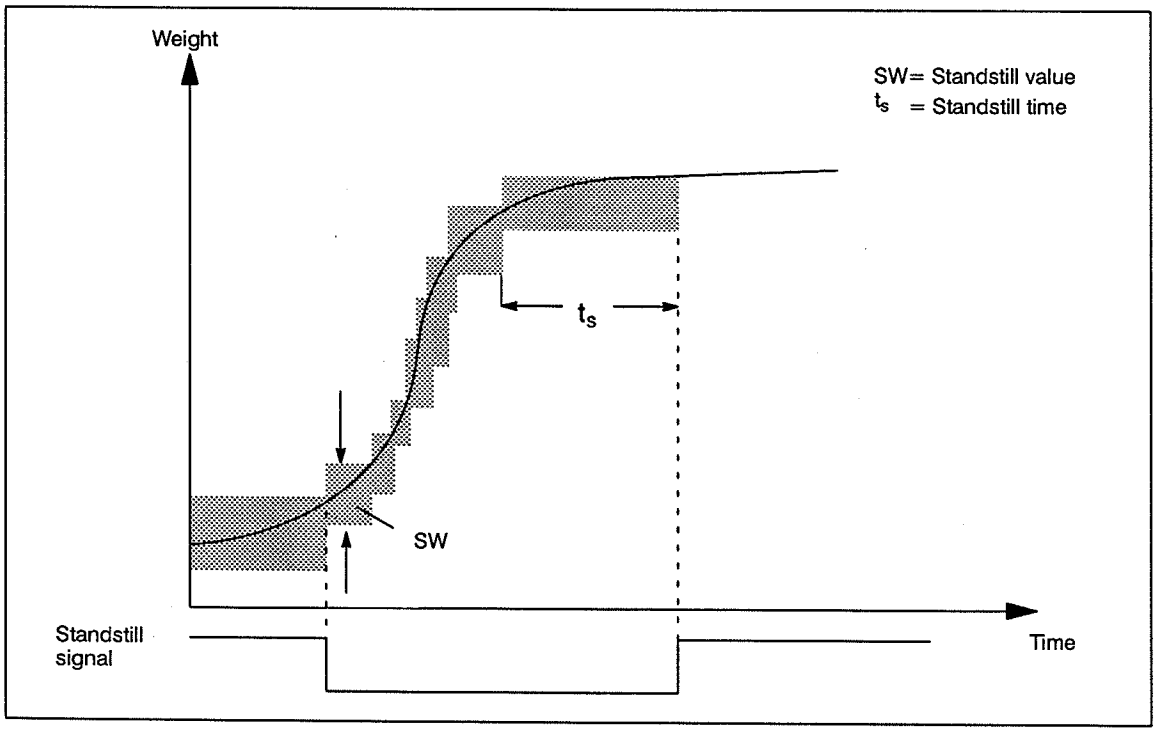


Fig. 2.25 Example of standstill monitoring

After the fine flow has been switched off during proportioning, the settling time is started and the standstill signal evaluated at the same time. The end of proportioning is signalled when either the standstill signal has been given or the settling time has elapsed.

If vibrations prevent the weighing machine from giving the standstill signal, the ready signal is given when the settling time has elapsed.

Parameters for standstill monitoring:

Standstill value	Frame 11:	Basic parameters
	Data words:	DW 182, DW 183
	Formats:	32–bit floating point, BCD or fixed point
Standstill time	Frame 11:	Basic parameters
	Data word:	DW 184,
	Format:	KT

Standstill signal via status word:

Frame 4:	Error, status words and actual values
Data word 77:	Status word 1
Bit no. 13:	Standstill condition is fulfilled

2.5.3.14 Multi–component weighing

Multi–component weighing can be implemented in the programmable controller with the aid of the user program.

The MP provides aids for multi–component weighing:

- Proportioning start with automatic taring
- Summation of volumes of various components for volume monitoring (fill weighing)

How multi–component weighing is done:

- Adjustment and parameter setting of the MP via a start–up program

For every material component:

- Specification of the setpoint and, if necessary, the specific gravity for the material to be dosed entered in the appropriate data words
- Switchover of outputs COARSE and FINE to proportioning devices of the material silos using the outputs of an S5 output module
- Proportioning start with automatic taring
- Wait for end of the proportioning operation

- Empty weigh–bin and wait for empty signal
- The weighing machine is ready for further weighing operations

In fill weighing mode with active volume monitoring, summation of the volumes of single components is automatic.

(4) J31037–D5603–U1–A0–7619

2.5.4 System monitoring

All errors in measured value acquisition and measured value processing that are detected by system monitoring (error words 1 and 3), must be acknowledged by the PLC. If a proportioning operation is running, it is aborted and can only be continued when the error has been acknowledged by a start command.

2.5.4.1 Measuring loop monitoring

Monitoring of the load cell measuring loop is performed by the measured value acquisition module. Measured value processing passes the error messages on to the PLC.

An exact explanation of the monitoring functions is to be found in Section 3.1.2 (Measured value acquisition).

Measuring loop error signal	Frame 4:	Error, status words and actual values
	Data word 74:	Error word 3
	Bit no. 0:	EPROM error
	Bit no. 1:	RAM error
	Bit no. 2:	Measuring range overload
	Bit no. 3:	Violation of measuring range lower limit
	Bit no. 4:	Fault in load cell power supply
	Bit no. 5:	Measuring loop fault
	Bit no. 8:	Sensor adaptation not performed
	Bit no. 9:	Temperature range was exceeded
	Bit no. 10:	Counting range was exceeded
	Bit no. 11:	Calibration straight line is outside tolerance
	Bit no. 13:	General error MA
	Bit no. 15:	Wire break (load cells)

The measuring circuit of the MA is calibrated at intervals of approximately 2 minutes (→ Section 3.1.2.8). The time is set by the MP. Calibration is not performed if coarse flow was switched off during proportioning and only fine flow is used.

The measured value processing module has a measuring loop itself with the analog input and pulse input. The analog input can be monitored for wire break in the mode "Current input 4–20 mA":

Frame 4:	Error, status words and actual values
Data word 72:	Error word 1
Bit no. 1:	Wire break at analog input

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.5.4.2 Interface monitoring

The interface to measured value acquisition is monitored by the transmission protocol. The protocol consists of the measured value and the check and status information. Additional data is contained in the protocol for synchronization and data protection purposes.

If an error is detected in a frame in measured value processing, it is rejected and transmission is repeated. After several frames with errors, a fault signal is given by the S5 interface.

Frame 4:	Error, status words and actual values
Data word 72:	Error word 1
Bit no. 0:	Interface to MA faulty

2.5.4.3 Monitoring the MP module

The hardware of the MP module is checked during the start–up phase and during cyclic operation.

RAM test

During start–up a read and write check is made of all memory cells.
In cyclic operation one memory cell is checked at a time.
Checksums are formed of certain data areas (e.g. adjustment data) and stored in the memory. Every time the memory content is changed, the checksum is regenerated. On a program start, the checksum is calculated and compared with the value stored.

EPROM test

When the EPROM is programmed, a checksum is stored in the memory. A checksum is formed for test purposes and compared with the stored value. If a deviation is detected, the test is repeated. An error signal is output if a deviation is detected again.

Signals on the S5 interface

Frame 4:	Error, status words and actual values
Data word 72:	Error word 1
Bit no. 6:	EPROM error
Bit no. 7:	RAM error

The other hardware components (microprocessor etc.) are checked indirectly by the firmware test.

2.5.4.4 Firmware monitoring

The run–time of the processes in the firmware main program are monitored for maximum time. The firmware program sends pulses at regular intervals to a watchdog circuit. If the signals are not received, the program is reset. At the same time an error signal is given:

Frame 4:	Error, status words and actual values
Data word 72:	Error word 1
Bit no. 5:	Watchdog has responded

The firmware program can only run properly if the module is in perfect condition. This test is therefore also a test of the hardware.

2.5.4.5 Reset

The entry "RS" in DW 2 (or switching on the MP) restarts the program:

The following applies:
- The EPROM test and the RAM test are performed (→ Section 2.5.4.3)
- A proportioning operation running before the reset is not automatically started. Coarse flow and fine flow are switched off.
- The pulse counter is stopped.
- The analog output is switched off.
- Any signals requiring acknowledgement before the reset remain and must still be acknowledged.
- The proportioning and adjustment data are retained.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.5.5 Special functions

In addition to the weighing and proportioning functions, the weighing processor can also process analog and pulse signals.

2.5.5.1 Analog input

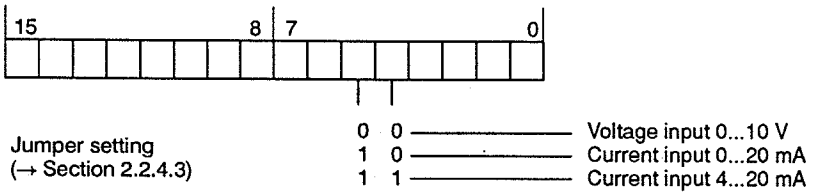
The analog input can be used for any purpose by the user program. It can be used to acquire an offset value.

Example: The humidity of the material to be dosed has an effect on the setpoint. A humidity sensor is connected to the analog input.

The analog signal is converted into a 12-bit digital signal in 100 ms cycles. The input value can be taken from data frame 4, DW 94 once the actual values have been read. Observe jumper setting (→ Section 2.2.4.3).

Parameterizing of the analog input:

Frame 11: Basic parameters
Data word 172: Parameter setting word 1
Format: KM



If 4 ... 20 mA is set, error bit 1 in error word 1 (DW 72) "Wire break analog input" is set if the input current drops below 2 mA.

Measured value of the analog input
Frame 3: Error, status words and actual values
Data word: DW 94
Format: KF (0...4095)

 (4) J31037-D5603-U1-A0-7619

2.5.5.2 Analog output

The analog output can output the following values:

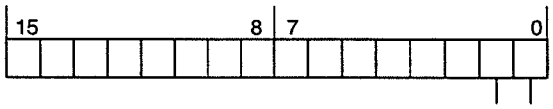
- Any value set by the user program in the PLC
- Material throughput (weight per time unit) (–> Section 2.5.3.12)
- Actual value net (DW 82/83)
- Actual value gross (DW 80/81)

The analog output can be parameterized to be either a voltage or current output with a resolution of 12 bits. Observe setting of the jumper (→ Section 2.2.4.3).

Parameter setting of the analog output

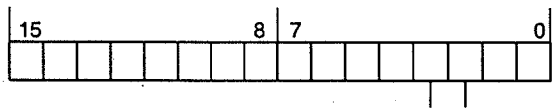
Frame 11: Basic parameters
Data word 172: Parameter setting word 1
Format: KM

Source for the analog output



0 0 — Set value from the user program (DW 42)
0 1 — Material throughput
1 0 — Actual value net weight
1 1 — Actual value gross weight

Mode of the analog output



0 0 ——— Voltage output 0...10 V
1 0 ——— Current output 0...20 mA
1 1 ——— Current output 4...20 mA

Jumper setting:
(→ Section 2.2.4.3)

The value range of the analog output can be adapted to requirements of the application by setting the parameters for source to internal values (material throughput, gross, net).

One numeric value is set for the lower limit and one for the upper limit of the analog output.

Example: The analog output is parameterized to be a 4...20 mA current output. The lower limit (4 mA) must be output if the numeric value to be output is 200. The upper limit (20 mA) must be 10,000:

Output minimum value = 200

Output maximum value = 10,000

The output currents between 4 mA and 20 mA are evenly distributed over the range 200...10,000 in the example.

Output minimum value	Frame 11:	Basic parameters
	Data words:	DW 176, DW 177
	Formats:	32–bit floating point, BCD or fixed point
Output maximum value	Frame 11:	Basic parameters
	Data words:	DW 178, DW 179
	Formats:	32–bit floating point, BCD or fixed point

Setting of the analog value from the user program: (DW 172, bit 0 and bit 1 = 0)

Analog output value	Frame 1:	Analog output
	Data word:	DW 42
	Format:	KF (0...4095)

The value set in DW 42 is output according to the mode of the analog output.

Example:

0 ≙ 0 mA
4095 ≙ 20 mA
} for setting current output 0 ... 20 mA

If 4...20 mA is set, the value set in DW 42 does not appear in DW 95 (analog output) because 4 mA are already output, if, for example, 0 is set in DW 42.

(4) J31037–D5603–U1–A0–7619

2.5.5.3 Pulse input

The WPS(i) weighing processor has one free pulse input. The pulse input is suitable for the connection of pulse encoding measuring instruments. The limit frequency is approximately 5 kHz. Incoming pulses are fed to a 16–bit counter. The maximum counter state is 65535. The counter is in the stop state after power–up or after a reset.

It is possible to calculate the pulses per time unit while the pulse counter is running. The measuring period can be set by the user. The value in DW 98/99 is updated when the measuring period has elapsed. If the counter is stopped, DW 98/99 are deleted.

Error signal	Frame 4:	Error, status words and actual values
	Data word 73:	Error word 2
	Bit no. 6:	Overflow of pulse counter
Status signal	Frame 4:	Error, status words and actual values
	Data word 78:	Status word 2
	Bit no. 0:	Pulse counter running
Measured value pulse counter	Frame 4:	Error, status words and actual values
	Data words:	DW 96, DW 97
Pulses per time unit	Frame 4:	Error, status words and actual values
	Data words:	DW 98, DW 99
Measuring period for pulses per time unit	Frame 11:	Basic parameters
	Data word:	DW 190

The functions of the counter can be controlled by commands via the PLC. A command is initiated by setting the command bits and then executing the command with FB 40.

Command bits	Data word 8:	Proportioning commands
	Bit no. 11:	Stop pulse counter
	Bit no. 12:	Delete pulse counter
	Bit no. 13:	Start pulse counter

Start The incoming pulses are recorded from this moment on.

Stop All further pulses are ignored.

Clear The counter state is reset.

2.6 Program diskette FB 40

The following modules are on the program diskette of the FB 40 function block:

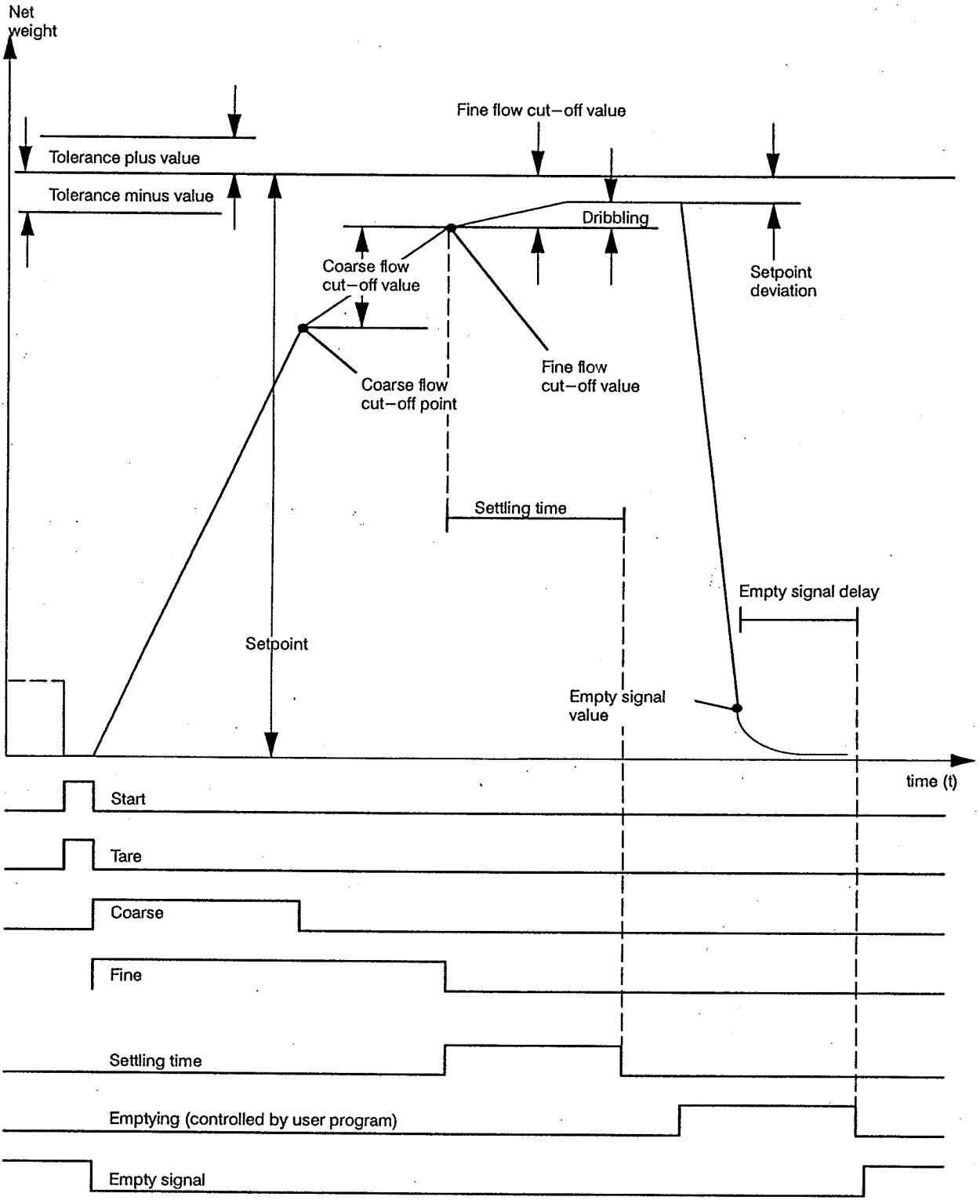
Designation	Meaning
OB 1	Cyclic program execution
OB 20	Cold restart of programmable controller (only for S5–135U/S5–155U)
OB 21	Manual warm restart (cold restart on S5–115U)
OB 22	Automatic warm restart (automatic cold restart on S5–115U)
FB 40	Handling block for the WPS(i) weighing processor

Example data block

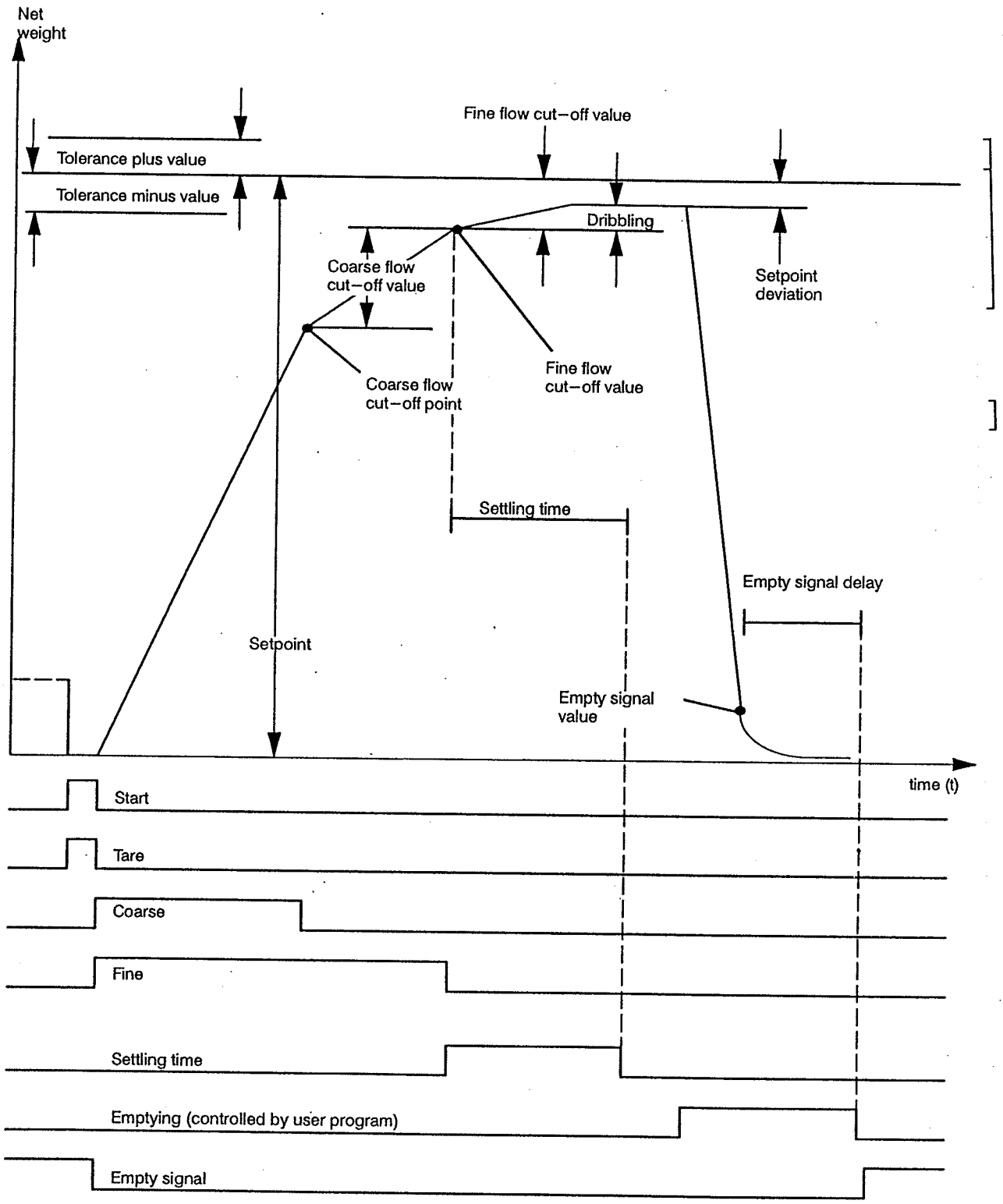
DB 221	Example of data block in formats KF, KG and BCD

The data block is assigned values for a weighing machine with one load cell (350 Ω, 2 mV/V) and can be transferred to the MP on initial installation.

 (4) J31037–D5603–U1–A0–7619



 (4) J31037–D5603–U1–A0–7619



WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.6.1 Aids of the most important data words

2.6.1.1 Procedure of the most important characteristic data of a proportioning (→ see foldout figure)

2.6.1.2 Overview of the most important data words

The bit assignment for those data words with a page reference is explained explicitly.

DW 8 Proportioning commands

Bit no.	Command	Priority
0	Stop	high
1	Taring	
2	Tare value valid	
3	Reset volume value	
5	Start proportioning upwards with automatic taring	
6	Start proportioning downwards with automatic taring	
7	Start inching operation upwards	
8	Start inching operation downwards	
9	Start proportioning upwards without automatic taring	
10	Start proportioning downwards without automatic taring	
11	Stop pulse counter	
12	Reset pulse counter	
13	Start pulse counter	
14	Set weighing machine to zero	
15	Acknowledge all errors	low

DW 10 Adjustment commands

Bit no.	Command	Priority
0 – 5	Adjustment weight 1 to 6 valid	high
13	Reset all weighing machine parameters	
14	Set weighing machine to zero	
15	Acknowledge all errors	low

DW 12 Read frames

Bit no.	Command
0 – 15	Read frames 0 to 15

DW 13 Write frames

Bit no.	Command
0 – 7	Write frames 0 – 7 (only possible in proportioning mode)
8 – 15	Write frames 8 – 15 (only possible in adjustment mode)

DW 72 Error word 1 (MP)

Bit no.	Meaning
0	Interface to measured value acquisition module faulty
1	Wire break analog input (only in 4–20 mA)
2	Fault in 24 V external voltage supply
3	Short circuit or overload at the digital outputs
4	Module error MP
5	Watchdog MP has responded
6	EPROM error MP
7	RAM error MP
8	Internal FW error MP

(4) J31037–D5603–U1–A0–7619

DW 73 Error word 2 (MP)

Bit no.	Meaning
0	Setpoint currently not accepted
1	Setpoint not plausible
2	Zero not plausible
3	Resetting range for zero offset exceeded
4	Tare value not plausible
5	Material flow monitoring has responded
6	Overflow of pulse counter
10	Adjustment error (adjustment weights)
11	Adjustment error (adjustment data)
12	Volume limit exceeded
13	Overfill value
14	Overfill value active
15	Output FAULT active

DW 74 Error word 3 (MA)

Bit no.	Meaning
0	EPROM error
1	RAM error
2	Overload (measuring range limit)
3	Underload (measuring range limit)
4	Reference voltage error (fault in load cell power supply)
5	Measuring loop fault
6	Watchdog error MA
7	Calibration running
8	Sensor adaptation not performed
9	Temperature range exceeded
10	Number range exceeded
11	Calibration line outside tolerance
13	General error MA
14	Assigned internally (error in check values)
15	Wire break (load cells)

DW 77 Status word 1 (MP)

Bit no.	Meaning
0	Adjusted
1	Proportioning operation terminated without error
2	Proportioning operation terminated with error
3	Proportioning operation running
4	Tolerance plus value was violated
5	Tolerance minus value was violated
6	Maximum weight value was violated
7	Minimum weight value was violated
8	Empty signal value violated
11	Coarse flow valve is switched on
12	Fine flow valve is switched on
13	Standstill condition is fulfilled
15	Proportioning direction (0 = deduction weighing, 1 = fill weighing)

DW 78 Status word 2 (MP)

Bit no.	Meaning
0	Pulse counter running
12	EXi interface connected

2.6.1.3 Example of assignment of the data block in 16–bit fixed point format

File: DBKF@@ST.S5D

Data word	Format	Example	Value	Designation
0	KH	1111	– – –	Start–up identification
1	KY	00,128		Interface number of the MP module
2	KS	' '		Software reset = RS
3	KS	'JU'		Write mode to MP ('JU' or 'DO')
4	KS	'JU'	– – –	Read mode from MP
5	KY	000,221		Input parameter ACCU 1 (number of the DB)
6	KH	0000	– – –	Output parameter ACCU 1
7	KH	0000		Firmware version MP
8	KM	00000000 00000000		Proportioning commands
9	KH	0000	– – –	– (spare)
10	KM	00000000 00000000		Adjustment commands
11	KH	0000	– – –	– (spare)
12	KM	00000000 00010000		Read frame 0 to 15
13	KM	00000000 00000000		Write frame 0 to 15
14	KM	00000000 00000000	– – –	Job status 1: Proportioning commands
15	KM	00000000 00000000	– – –	– (spare)
16	KM	00000000 00000000	– – –	Job status 1: Adjustment commands
17	KM	00000000 00000000	– – –	– (spare)
18	KM	00000000 00000000	– – –	Job status 1: Read frame
19	KM	00000000 00000000	– – –	Job status 1: Write frame
20	KM	00000000 00000000	– – –	Job status 2: Proportioning commands
21	KM	00000000 00000000	– – –	–
22	KM	00000000 00000000	– – –	Job status 2: Adjustment commands
23	KM	00000000 00000000	– – –	–
24	KM	00000000 00000000	– – –	Job status 2: Read frame
25	KM	00000000 00000000	– – –	Job status 2: Write frame
26	KM	00000000 00000000	– – –	Job status 3: Proportioning commands
27	KM	00000000 00000000	– – –	–
28	KM	00000000 00000000	– – –	Job status 3: Adjustment commands
29	KM	00000000 00000000	– – –	–
30	KM	00000000 00000000	– – –	Job status 3: Read frame
31	KM	00000000 00000000	– – –	Job status 3: Write frame
32...37	KH	00000000 00000000	– – –	–
				Frame 0: Setpoint
39	KF	+00240		Setpoint
				Frame 1: Analog output
42	KF	+00000		Analog output value 0...4095
				Frame 2
45	KF	+00040		Cut–off value COARSE
47	KF	+00010		Cut–off value FINE
49	KF	+00000		Tare weight
51	KF	+00002		Tolerance plus value

Data word	Format	Example	Value	Designation
53	KF	+00002		Tolerance minus value
55	KF	+00005		Min. flow rate with fine proportioning
57	KF	+00010		Min. flow rate with coarse proportioning
58	KT	100.1		Closing delay for material flow monitoring
				Frame 3, proportioning data 2
62	KH	0000	---	Assigned internally
63	KF	+00000		Specific weight
64	KT	050.1		Inching time
65	KT	200.1		Settling time
66	KM	00000000 00000001		Function selection
				Frame 4, error, status words, actual values
72	KM	00000000 00000000	---	Error word 1 (MP)
73	KM	00000000 00000000	---	Error word 2
74	KM	00000000 00000000	---	Error word 3 (MA)
75	KH	0000	---	–
76	KH	0000	---	–
77	KM	00000000 00000000	---	Status word 1
78	KM	00000000 00000000	---	Status word 2
79	KM	00000000 00000000	---	Assigned internally
81	KF	+00000	---	Actual value GROSS
83	KF	+00000	---	Actual value NET
85	KF	+00000	---	Actual value TARE
87	KF	+00000	---	New cut–off value FINE suggestion
88	KH	0000	---	Unfiltered digit actual value
89	KH	0000	---	Filtered digit actual value
91	KF	+00000	---	Volume value
93	KF	+00000	---	Flow rate value
94	KF	+00000	---	Analog input value (0...4095)
95	KF	+00000	---	Analog output value (0...4095)
96	KH	0000	---	
97	KH	0000	---	Count value pulse input
98	KH	0000	---	
99	KH	0000	---	Pulses/time unit
108...113			---	**Frame 5: spare**
114...123			---	**Frame 6: spare**
124...133			---	**Frame 7: spare**
				Frame 8: assigned internally (service data)
134...141	KH	---	---	
				Frame 9: Limit values
143	KF	+00010		Min. value
145	KF	+01000		Max. value
147	KF	+01200		Overfill value
149	KF	+00003		Empty signal value
151	KF	+01000		Max volume fill weighing
153	KF	+00800		Max volume deduction weighing
155	KF	+00050		Upper limit for zero point offset

Data word	Format	Example	Value	Designation
157	KF	+00020		Lower limit for zero point offset
				Frame 10: plant parameters
162	KF	+00350		Internal resistance of the load cell
163	KF	+00020		Characteristic value of load cell x 10
164	KF	+00001		Number of load cells
165	KM	00000000 00000000		Parameter setting of the digital filter
				Frame 11: basic parameters
172	KM	00000000 01000000		Parameter setting value 1
173	KH	0000	---	–
174	KS	'KG'		Weight unit
175	KS	'DM'		Volume unit
177	KF	+00000		Min. value analog output
179	KF	+01000		Max. value analog output
180	KF	+00004		Resetting value autom. zero point offset (digits)
181	KF	+00005		Tolerance tare value (1...100%)
183	KF	+00003		Standstill value
184	KT	050.1		Standstill time
185	KT	020.1		Resetting time for zero point offset
186	KT	050.1		Empty signal delay
187	KT	010.1		Throughput calculation time
188	KT	010.1		Time base for throughput output
189	KH	0100		Increment, decimal place for remote display / floating point format
190	KT	200.1		Measuring time for pulses/time units
				Frame 12: adjustment weights
199	KF	+00000		Adjustment weight 1 (zero)
201	KF	+01000		Adjustment weight 2
203	KF	+00000		Adjustment weight 3
205	KF	+00000		Adjustment weight 4
207	KF	+00000		Adjustment weight 5
209	KF	+00000		Adjustment weight 6
				Frame 13: adjustment digits
214	KH	0000	---	–
215	KH	065E		Adjustment digits 1 (zero)
216	KH	0000	---	–
217	KH	7F02		Adjustment digits 2
218	KH	0000	---	–
219	KH	0000		Adjustment digits 3
220	KH	0000	---	–
221	KH	0000		Adjustment digits 4
222	KH	0000	---	–
223	KH	0000		Adjustment digits 5
224	KH	0000	---	–
225	KH	0000		Adjustment digits 6
226	KH	0000	---	(assigned internally)
227	KH	0000	---	(–assigned internally–FLPW)
228	KH	0000	---	(assigned internally)

Data word	Format	Example	Value	Designation
229	KH	0000	– – –	(– assigned internally – MLPW)
231	KF	+00000		Zero point offset (digit value)
234...245			– – –	**Frame 14: spare**
246...255			– – –	**Frame 15: spare**

2.6.1.4 Example of assignment of the data block in floating point format

File: DBKG@@ST.S5D

Data word	Format	Example	Value	Designation
0	KH	1111	– – –	Start–up identification
1	KY	00,128		Interface number of the MP module
2	KS	' '		Software reset = "RS"
3	KS	'JU'		Write mode to MP ('JU' or 'DO')
4	KS	'JU'	– – –	Read mode from MP
5	KY	000,221		Input parameter ACCU 1 (number of the DB)
6	KH	0000	– – –	Output parameter ACCU 1
7	KH	0000	– – –	Firmware version MP
8	KM	00000000 00000000		Proportioning commands
9	KH	0000	– – –	– (spare)
10	KM	00000000 00000000		Adjustment commands
11	KH	0000	– – –	– (spare)
12	KM	00000000 00010000		Read frames 0 to 15
13	KM	00000000 00000000		Write frames 0 to 15
14	KM	00000000 00000000	– – –	Job status 1: Proportioning commands
15	KM	00000000 00000000	– – –	– (spare)
16	KM	00000000 00000000	– – –	Job status 1: Adjustment commands
17	KM	00000000 00000000	– – –	– (spare)
18	KM	00000000 00000000	– – –	Job status 1: Read frame
19	KM	00000000 00000000	– – –	Job status 1: Write frame
20	KM	00000000 00000000	– – –	Job status 2: Proportioning commands
21	KM	00000000 00000000	– – –	–
22	KM	00000000 00000000	– – –	Job status 2: Adjustment commands
23	KM	00000000 00000000	– – –	–
24	KM	00000000 00000000	– – –	Job status 2: Read frame
25	KM	00000000 00000000	– – –	Job status 2: Write frame
26	KM	00000000 00000000	– – –	Job status 3: Proportioning commands
27	KM	00000000 00000000	– – –	–
28	KM	00000000 00000000	– – –	Job status 3: Adjustment command
29	KM	00000000 00000000	– – –	–
30	KM	00000000 00000000	– – –	Job status 3: Read frame
31	KM	00000000 00000000	– – –	Job status 3: Write frame
32...37	KH	00000000 00000000	– – –	**Spare**
				Frame 0: Setpoint
38	KG	+2400000+03		Setpoint
				Frame 1: Analog output
42	KF	+00000		Analog output values 0...4095
				Frame 2
44	KG	+4000000+02		Cut–off value COARSE
46	KG	+1000000+02		Cut–off value FINE
48	KG	+0000000+00		Tare weight
50	KG	+2000000+01		Tolerance plus value

(4) J31037–D5603–U1–A0–7619

Data word	Format	Example	Value	Designation
52	KG	+2000000+01		Tolerance minus value
54	KG	+5000000+01		Min. flow rate with fine proportioning
56	KG	+1000000+02		Min. flow rate with fine proportioning
58	KT	100.1		Closing delay for material flow monitoring
				Frame 3, proportioning data 2
62	KH	0000	---	Assigned internally
63	KF	+00000		Specific weight
64	KT	050.1		Inching time
65	KT	200.1		Settling time
66	KM	00000000 00000001		Function selection
				Frame 4, error, status words, actual values
72	KM	00000000 00000000	---	Error word 1 (MP)
73	KM	00000000 00000000	---	Error word 2
74	KM	00000000 00000000	---	Error word 3 (MA)
75, 76	KH	0000	---	–
77	KM	00000000 00000000	---	Status word 1
78	KM	00000000 00000000	---	Status word 2
79	KM	00000000 00000000	---	Assigned internally
80	KG	+0000000+00	---	Actual value GROSS
82	KG	+0000000+00	---	Actual value NET
84	KG	+0000000+00	---	Actual value TARE
86	KG	+0000000+00	---	New cut–off value FINE
88	KH	0000	---	Unfiltered digit actual value
89	KH	0000	---	Filtered digit actual value
90	KG	+0000000+00	---	Volume value
92	KG	+0000000+00	---	Flow rate value
94	KF	00000	---	Analog input value (0...4095)
95	KF	00000	---	Analog output value (0...4095)
96	KH	0000	---	
97	KH	0000	---	Count value pulse input
98	KH	0000	---	
99	KH	0000	---	Pulses/time unit
108...113			---	**Frame 5: spare**
114...123			---	**Frame 6: spare**
124...133			---	**Frame 7: spare**
				Frame 8: assigned internally (service data)
134...141	KH	---	---	
				Frame 9: Limit values
142	KG	+1000000+02		Min. value
144	KG	+1000000+04		Max. value
146	KG	+1200000+04		Overfill value
148	KG	+3000000+01		Empty signal value
150	KG	+1000000+04		Max volume fill weighing
152	KG	+8000000+03		Max volume deduction weighing
154	KG	+5000000+02		Upper limit for zero point offset

Data word	Format	Example	Value	Designation
156	KG	+2000000+02		Lower limit for zero point offset
				Frame 10: Plant parameters
162	KF	+00350		Internal resistance of the load cell
163	KF	+00020		Characteristic value of the load cell x 10
164	KF	+00001		Number of load cells
165	KM	00000000 00000000		Parameter setting of the digital filter
				Frame 11: Basic parameters
172	KM	00001000 01000000		Parameter setting word 1
173	KH	0000	---	–
174	KS	'KG'		Weight unit
175	KS	'DM'		Volume unit
176	KG	+0000000+00		Min value analog output
178	KG	+1000000+04		Max value analog output
180	KF	+00004		Resetting value autom. zero point offset (digits)
181	KF	+00005		Tolerance tare value (1...100%)
182	KG	+3000000+01		Standstill value
184	KT	050.1		Standstill time
185	KT	020.1		Resetting time for zero point offset
186	KT	050.1		Empty signal delay
187	KT	010.1		Throughput calculation
188	KT	010.1		Time base for throughput output
189	KH	0100		Increment, decimal place for remote display / floating point format
190	KT	200.1		Measuring time for pulses/time unit
				Frame 12: Adjustment weights
198	KG	+0000000+00		Adjustment weight 1 (zero)
200	KG	+1000000+04		Adjustment weight 2
202	KG	+0000000+00		Adjustment weight 3
204	KG	+0000000+00		Adjustment weight 4
206	KG	+0000000+00		Adjustment weight 5
208	KG	+0000000+00		Adjustment weight 6
				Frame 13: Adjustment digits
214	KH	0000	---	–
215	KH	065E		Adjustment digits 1 (zero)
216	KH	0000	---	–
217	KH	720F		Adjustment digits 2
218	KH	0000	---	–
219	KH	0000		Adjustment digits 3
220	KH	0000	---	–
221	KH	0000		Adjustment digits 4
222	KH	0000	---	–
223	KH	0000		Adjustment digits 5
224	KH	0000	---	–
225	KH	0000		Adjustment digits 6
226	KH	0000	---	(assigned internally)
227	KH	0000	---	(–assigned internally–FLPW)
228	KH	0000	---	(assigned internally)

Data word	Format	Example	Value	Designation
229	KH	0000	– – –	(–assigned internally–MLDPW)
231	KF	+00000		Zero point offset (digit value)
234...245			– – –	**Frame 14: spare**
246...255			– – –	**Frame 15: spare**

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.6.1.5 Example of assignment of the data block in BCD format

File: DBBCD@ST.S5D

Data word	Format	Example	Value	Designation
0	KH	1111	---	Start-up identification
1	KY	00,128		Interface number of the MP module
2	KS	' '		Software reset = RS
3	KS	'JU'		Write mode to MP ('JU' or 'DO')
4	KS	'JU'	---	Read mode from MP
5	KY	000,221		Input parameter ACCU 1 (number of the DB)
6	KH	0000	---	Output parameter ACCU 1
7	KH	0000	---	Firmware version MP
8	KM	00000000 00000000		Proportioning commands
9	KH	0000	---	- (spare)
10	KM	00000000 00000000		Adjustment commands
11	KH	0000	---	- (spare)
12	KM	00000000 00010000		Read frame 0 to 15
13	KM	00000000 00000000		Write frame 0 to 15
14	KM	00000000 00000000	---	Job status 1: Proportioning commands
15	KM	00000000 00000000	---	- (spare)
16	KM	00000000 00000000	---	Job status 1: Adjustment commands
17	KM	00000000 00000000	---	- (spare)
18	KM	00000000 00000000	---	Job status 1: Read frame
19	KM	00000000 00000000	---	Job status 1: Write frame
20	KM	00000000 00000000	---	Job status 2: Proportioning commands
21	KM	00000000 00000000	---	-
22	KM	00000000 00000000	---	Job status 2: Adjustment commands
23	KM	00000000 00000000	---	-
24	KM	00000000 00000000	---	Job status 2: Read frame
25	KM	00000000 00000000	---	Job status 2: Write frame
26	KM	00000000 00000000	---	Job status 3: Proportioning commands
27	KM	00000000 00000000	---	-
28	KM	00000000 00000000	---	Job status 3: Adjustment commands
29	KM	00000000 00000000	---	-
30	KM	00000000 00000000	---	Job status 3: Read frame
31	KM	00000000 00000000	---	Job status 3: Write frame
32...37	KH	00000000 00000000	---	-
				Frame 0: Setpoint
38	KH	+0000		Setpoint (MSW)
39	KH	+0240		Setpoint (LSW)
				Frame 1: Analog output
42	KF	+00000		Analog output value 0...4095
				Frame 2
44	KH	0000		Cut-off value COARSE (MSW)
45	KH	0040		Cut-off value COARSE (LSW)
46	KH	0000		Cut-off value FINE (MSW)
47	KH	0010		Cut-off value FINE (LSW)

Data word	Format	Example	Value	Designation
48	KH	0000		Tare weight (MSW)
49	KH	0000		Tare weight (LSW)
50	KH	0000		Tolerance plus value
51	KH	0002		Tolerance plus value (LSW)
52	KH	0000		Tolerance minus value
53	KH	0002		Tolerance minus value (LSW)
54	KH	0000		Min. flow rate with fine proportioning
55	KH	0005		Min. flow rate with fine proportioning (LSW)
56	KH	0000		Min. flow rate with coarse proportioning
57	KH	0010		Min. flow rate with coarse proportioning (LSW)
58	KT	100.1		Closing delay for material flow monitoring
				Frame 3, proportioning data 2
62	KH	0000	---	Assigned internally
63	KF	+00000		Specific weight (g/dm^3)
64	KT	050.1		Inching time
65	KT	200.1		Settling time
66	KM	00000000 00000001		Function selection
				Frame 4, error, status words, actual values
72	KM	00000000 00000000	---	Error word 1 (MP)
73	KM	00000000 00000000	---	Error word 2
74	KM	00000000 00000000	---	Error word 3 (MA)
75	KH	0000	---	–
76	KH	0000	---	–
77	KM	00000000 00000000	---	Status word 1
78	KM	00000000 00000000	---	Status word 2
79	KM	00000000 00000000	---	Assigned internally
80	KH	0000	---	Actual value GROSS (MSW)
81	KH	0000	---	Actual value GROSS (LSW)
82	KH	0000	---	Actual value NET
83	KH	0000	---	Actual value NET (LSW)
84	KH	0000	---	Actual value TARE
85	KH	0000	---	Actual value TARE (LSW)
86	KH	0000	---	Suggestion for new cut–off value FINE (MSW)
87	KH	0000	---	Suggestion for new cut–off value FINE (LSW)
88	KH	0000	---	Unfiltered digit actual value
89	KH	0000	---	Filtered digit actual value
90	KH	0000	---	Volume value
91	KH	0000	---	Volume value (LSW)
92	KH	0000	---	Flow rate value
93	KH	0000	---	Flow rate value (LSW)
94	KF	+00000	---	Analog input value (0...4095)
95	KF	+00000	---	Analog output value (0...4095)
96	KH	0000	---	–
97	KH	0000	---	Count value pulse input
98	KH	0000	---	
99	KH	0000	---	Pulses/time unit

Data word	Format	Example	Value	Designation
108...113			---	**Frame 5: spare**
114...123			---	**Frame 6: spare**
124...133			---	**Frame 7: spare**
				Frame 8: assigned internally (service data)
134...141	KH	---	---	
				Frame 9: Limit value
142	KH	0000		Min. value (MSW)
143	KH	0010		Min. value (LSW)
144	KH	0000		Max. value (MSW)
145	KH	1000		Max. value (LSW)
146	KH	0000		Overfill value
147	KH	1200		Overfill value (LSW)
148	KH	0000		Empty signal value
149	KH	0003		Empty signal value (LSW)
150	KH	0000		Max volume fill weighing
151	KH	1000		Max volume fill weighing (LSW)
152	KH	0000		Max volume deduction weighing
153	KH	0800		Max volume deduction weighing (LSW)
154	KH	0000		Upper limit for zero point offset
155	KH	0050		Upper limit for zero point offset (LSW)
156	KH	0000		Lower limit for zero point offset
157	KH	0020		Lower limit for zero point offset (LSW)
				Frame 10: Plant parameters
162	KF	+00350		Internal resistance of load cell
163	KF	+00020		Characteristic value of load cell x 10
164	KF	+00001		Number of load cells
165	KM	00000000 00000000		Parameter setting of the digital filter
				Frame 11: Basic parameters
172	KM	00001100 01000000		Parameter setting word 1
173	KH	0000	---	–
174	KS	'KG'		Weight unit
175	KS	'DM'		Volume unit
176	KH	0000		Min value analog output
177	KH	0000		Min value analog output (LSW)
178	KH	0000		Max value analog output
179	KH	1000		Max value analog output (LSW)
180	KF	+00004		Resetting value autom. zero point offset
181	KF	+00005		Tolerance tare value (1...100%)
182	KH	0000		Standstill value
183	KH	0003		Standstill value (LSW)
184	KT	050.1		Standstill time
185	KT	020.1		Resetting time for zero point offset
186	KT	050.1		Empty signal delay
187	KT	010.1		Throughput calculation time
188	KT	010.1		Time base for throughput output
189	KH	0100		Increment, decimal place for remote display / floating point format

Data word	Format	Example	Value	Designation
190	KT	200.1		Measuring time for pulses/time
				Frame 12: Adjustment weights
198	KH	0000		Adjustment weight 1 (zero)
199	KH	0000		Adjustment weight 1 (zero)
200	KH	0000		Adjustment weight 2 (MSW)
201	KH	1000		Adjustment weight 2 (LSW)
202	KH	0000		Adjustment weight 3
203	KH	0000		Adjustment weight 3 (LSW)
204	KH	0000		Adjustment weight 4
205	KH	0000		Adjustment weight 4 (LSW)
206	KH	0000		Adjustment weight 5
207	KH	0000		Adjustment weight 5 (LSW)
208	KH	0000		Adjustment weight 6
209	KH	0000		Adjustment weight 6 (LSW)
				Frame 13: Adjustment digits
214	KH	0000	---	–
215	KH	065E		Adjustment digits 1 (zero)
216	KH	0000	---	–
217	KH	7F02		Adjustment digits 2
218	KH	0000	---	–
219	KH	0000		Adjustment digits 3
220	KH	0000	---	–
221	KH	0000		Adjustment digits 4
222	KH	0000	---	–
223	KH	0000		Adjustment digits 5
224	KH	0000	---	–
225	KH	0000		Adjustment digits 6
226	KH	0000	---	(assigned internally)
227	KH	0000	---	(–assigned internally–FLPW)
228	KH	0000	---	(assigned internally)
229	KH	0000	---	(–assigned internally–MLPW)
231	KF	+00000		Zero offset (digit value)
234...245			---	**Frame 14: spare**
246...255			---	**Frame 15: spare**

2.6.2 Settings

2.6.2.1 Address switch MP

MP: S3 (→ Section 2.2.4)

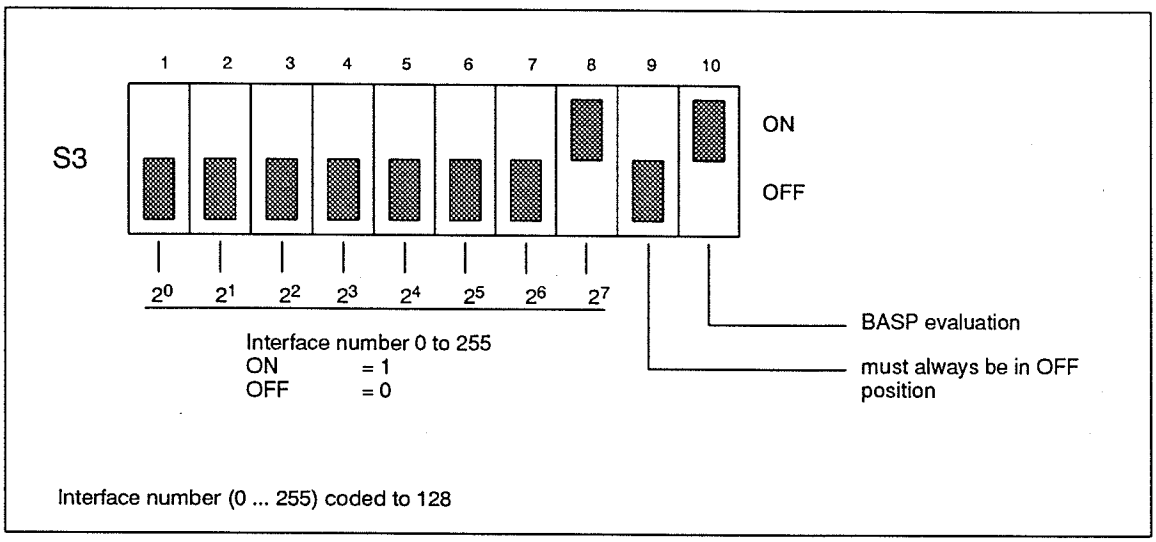


Fig. 2.26 Default setting of the address switch

Caution

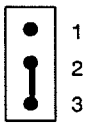
Switches S1.1 to S1.4 and S2.1 to S2.10 must always in the "OFF" position!

(4) J31037–D5603–U1–A0–7619

2.6.2.2 Jumper setting

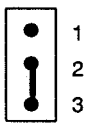
WPS(i) weighing processor –MP

X2 Analog output



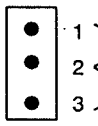
Setting: Voltage output 0 to 10 V

X8 Analog input



Setting: Voltage input 0 to 10 V

X31
Adaptation to the PLC



Setting: (NAU signal) for S5–115U
Setting: (DSI signal) for S5–135U/155U

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

2.6.3 Start–up behavior

Cold restart

On a cold restart, a "Software reset" is performed on the MP module. The software reset is triggered by entering the command "RS" in data word DW 2 (DB 221).

Warm restart (manual)

A manual warm restart must not be triggered on any account because the state of the MP between the switch–off time and the restart could change.

Warm restart (automatic)

An automatic warm restart must only be performed if the "cold restart" type of start–up was reassigned in data block DX 0.

(4) J31037–D5603–U1–A0–7619

3 Measured Value Acquisition MA

(4) J31037–D5603–U1–A0–7619

3 Measured Value Acquisition MA

Sections 3 and 4 are structured in exactly the same way. Text in *italics* means that if you are using intrinsically safe measured value acquisition it is essential to look up this point in Section 4 because there are differences in function, format or handling.

3.1 Description

Measured value acquisition (MA) can only be used in conjunction with measured value processing.

The MA is accommodated in a robust aluminium housing and also serves as a junction box for connecting up to 6 load cells.

The device is conceived as a quasi intelligent sensor for local installation. This practically precludes measuring errors and interference through long cables.

3.1.1 Structure and function of the MA

The flow of information between the MA and the MP goes in both directions via the serial interface:

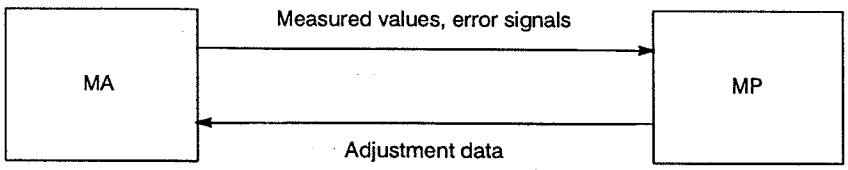


Fig. 3.1 Information flow

The MA is adjusted at the same time as the MP is parameterized by the programmable controller. Data for the MA are relayed by the MP. How to perform adjustment is described in Section 2.

(4) J31037–D5603–U1–A0–7619

Internal structure of the MA:

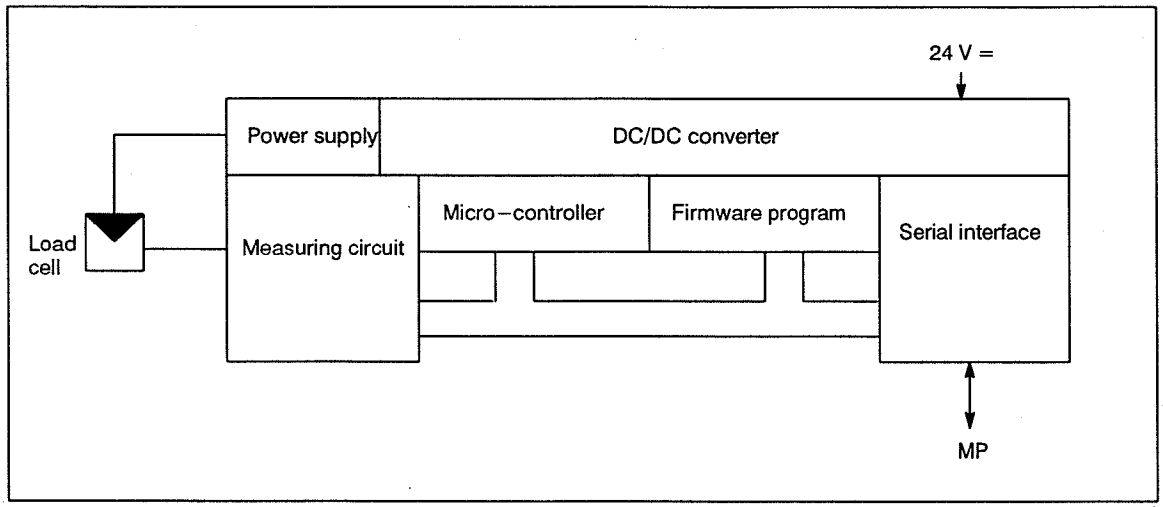


Fig. 3.2 Block diagram of the measured value acquisition module

The function of each component:

Load cell (LC) Strain gauge sensor in bridge circuit. The load cell requires a supply voltage in order to be able to obtain the weight–dependent measuring voltage from it.

Voltage supply The load cell is supplied with 10 Volt. The supply voltage is subject to a current limitation. A short circuit on the load cell cannot lead to destruction or overheating of the device.

Measuring circuit Amplification and digital conversion of the measuring signal. A low–pass filter is integrated in the measuring circuit.

Micro–controller

- Control of the measuring circuit
- Processing of the adjustment data
- System tests
- Generation of error signals

Firmware program: Instructions for the micro–controller

Serial interface Data link to the MP

DC/DC converter Power supply of the module. Galvanic isolation from the supply cable. Faults on the supply cable are not transferred to the measuring circuit.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.1.2 Monitoring functions

Numerous monitoring functions have been implemented in the MA. Error signals are relayed to the MP by these functions. The signals are transferred as an MA error word through the interface to the S5 programmable controller.

Error and status word	Frame 4:	Error, status words and actual values
	Data word 74:	Error word 3 (MA)
	Format:	KM

3.1.2.1 Wire break monitoring

All cables that lead from the 6 connectors (X1 to X6) to the load cells are monitored for wire break. Errors in power supply, measuring and sensor lines from the load cells can be detected.

Using a switch (S 4.7) you can select between two modes:

- Cyclic check
- Check only on start–up and sensor adaptation

A cyclic check is not to be recommended if the sensor signal is to be evaluated by another measuring instrument. During the test the sensor measuring bridge is unbalanced by a test resistance.

☞ If the load cells are not connected in parallel via the cable provided on the MA but via a junction box connected ahead of it, the sensor lines can only be checked for a wire break up to the junction box.

Error signal on the S5 interface:

Wire break load cell	Frame 4:	Error, status words and actual values
	Data word 74:	Error word 3 (MA)
	Format:	KM
	Bit no. 15:	Wire break load cell

Wire break monitoring can be switched off (→ Sections 3.2.3.2 and 2.4.4.5 under basic parameter DW 172).

3.1.2.2 Reference voltage monitoring

An error signal occurs if the supply voltage of the load cell (measured on the sensor line) drops below 9 V. Depending on the technique used to connect the load cell (→ Section 3.3.2), the voltage of the power supply circuit or the supply voltage fed back via the sensor lines is monitored at the load cell. Monitoring can be switched off.

Error signal on the S5 interface:

Reference voltage fault	Frame 4:	Error, status words and actual values
	Data word 74:	Error word 3 (MA)
	Format:	KM
	Bit no. 4:	Reference voltage fault

(4) J31037–D5603–U1–A0–7619

3.1.2.3 Temperature monitoring

The ambient temperature is monitored for limits.

Error message S5 interface:

Permissible temperature range exceeded	Data word 74: Bit no. 9	Error word 3

3.1.2.4 Measuring amplifier monitoring

The primary measuring branch of the measuring amplifier is monitored for synchronism with a secondary branch. If the deviation between the two reaches a set limit, an error signal is output.

Error signal on the S5 interface:

Measuring loop fault	Data word 74: Bit no. 5	Error word 3

3.1.2.5 Program run monitoring

A watchdog circuit receives pulses sent in cycles from the program as it runs. If any of these pulses is not received, the program is restarted and an error signal is output.

Error signal on the S5 interface:

Watchdog error MA	Data word 74: Bit no. 6	Error word 3

3.1.2.6 Memory monitoring

The memories are monitored both during the start–up phase of the weighing processor and during operation.

RAM test:	Write–read test
EPROM test:	Checking the checksum of the memory contents

Error signal on the S5 interface:

EPROM error MA	Data word 74: Bit no. 0	Error word 3
RAM error MA	Data word 74: Bit no. 1	Error word 3

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.1.2.7 Measuring range monitoring

The control range of the measuring and transformer circuit is monitored for an upper and a lower limit.

Error signal on the S5 interface:

Lower measuring range limit reached	Data word 74: Bit no. 3	Error word 3
Upper measuring range limit reached	Data word 74: Bit no. 2	Error word 3

The MA can be controlled by about 2% above or below its set measuring range. This control margin is required for tolerances of the components used and for characteristic value tolerances of the load cells. If these limits are violated the following error messages are output via the S5 interface:

"lower measuring range limit reached" ⇒ MA error word bit 3

"upper measuring range limit reached" ⇒ MA error word bit 2

If a measuring range violation occurs during operation while the sensor is loaded with the rated load (e.g. because of a greater characteristic value tolerance than 1 to 2 %), this can be remedied by setting a larger characteristic value in the S5 data block.

3.1.2.8 Calibration monitoring

Calibration eliminates most of the temperature–dependent measured value changes that are caused by the measuring electronics themselves.

The offset and the reference value are connected one after the other. A calibration straight line is calculated from these two measuring points. This line can only deviate by a certain tolerance from the stored standard line.

Calibration takes approximately 1 second and is performed every two minutes, as long as there is no connection to the MP. If there is a connection, the MP sets the time intervals (→ Section 2.5.4.1).

Error signal on the S5 interface:

Calibration line outside tolerance	Data word 74: Bit no. 11	Error word 3

3.1.2.9 Number range monitoring

An error signal is output if a number range overflow occurs during the actual value calculation.

Error signal on the S5 interface:

Permissible number range exceeded	Data word 74: Bit no. 10	Error word 3

3.1.3 Technical data

3.1.3.1 Power supply

Supply voltage

Static values	Rated value		24 V DC
	Lower limit		15 V DC
	Upper limit		30 V DC
Dynamic values	Lower limit	Value	10.5 V
		Duration	10 msec
		Recovery time	10 sec
	Upper limit	Value	35 V
		Duration	500 msec
		Recovery time	50 sec
	Ripple		≤ 3.6 V
Current consumption	Max. 24		350 mA
Overcurrent protection	Fuse self–restoring after short interruption of the 24 V supply.		

3.1.3.2 *Connection values for strain gauge load cells*

Feed voltage	Rated value	10 V DC
	Voltage monitoring	*≥ 9 V DC*
	Supply current	*≤ 250 mA*
Internal resistance of the load cell	Upper limit	4010 Ω
	Lower limit	40 Ω

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.1.3.3 Data of the measuring circuit

	Internal resolution ..... approx. 63,000 parts
	Sampling frequency of the measured values ..... 500 Hz
	Measuring range ..... 1 to 4 mV/V programmable
	Setting time ..... ≤ 500 msec to 0.003 %
	Input noise ..... ≤ 0.2 µ V pp
Filter	Limit frequency ..... 3.5 Hz
	Gradient (from 10 Hz) ..... > 50dB/decade

3.1.3.4 Measurement accuracy

All values refer to rated load and only apply under the following conditions:

- No thermal EMF
- No cable interference
- No external magnetic field interference
- Ambient temperature 0 to 55 °C
- 6–wire connection of the load cells

	Linearity error ..... ≤ 0.005 %
	Long term stability (25 °C) ..... ≤ 0.005 % / year
	Warm–up time ..... *≤ 5 min*
Total error under rated conditions and temp. 10...30 °C	for characteristic value 1 mV/V ..... 0.03 %
	for characteristic value 2 mV/V ..... 0.02 %
Temperature influence	*Zero (without dead load)* ..... *≤ 0.001 %/10 K*
	Measured value ..... ≤ 0.005 %/10 K
Quantization deviation	for characteristic value 1 mV/V ..... 0.014 %
	for characteristic value 2 mV/V ..... 0.007 %

3.1.3.5 Dimensions and weights

	Housing dimensions (WxLxH) ..... *160x260x90 mm*
	Weight ..... *approx. 2.6 kg*

(4) J31037–D5603–U1–A0–7619

3.1.3.6 Ambient conditions

Storage temperature ..... – 40...+ 85 °C
Humidity class (DIN 40040) ..... F
Degree of protection (DIN 40050) ..... *IP 65*

Ambient temperature

MA type A (→ Section 6.2.2) ..... *0...+ 55 °C*
MA type B ..... *– 20...+ 70 °C*

Electromagnetic compatibility

Static discharge (IEC 801–2)
• Intensity ..... 8 kV

Electromagnetic fields (IEC 801–3)
• Intensity 3
• Test field intensity ..... 3 V/m
• Frequency ..... 25...500 MHz

Immunity to pulses with large gradient (burst) (IEC 801–4)
• Intensity ..... 1 kV

Depending on the load cell used and the shielding concept, the measured value can be affected by interference. The maximum deviations of the measured value can exceed the specific total error of the module by a small amount.
A reduction of the interference can be achieved by
– Capacitive coupling of the cable shields
(load cell cable, connecting cable to the MP)
– Connect cable shields on both sides (observe equalizing currents !)

Radio interference suppression (VDE 0871) ..... limit class B

Mechanical strain

Vibration strain (DIN IEC 68–2–6) T1 ..... intensity 12
Transport strain (DIN IEC 68–2–6) T2 ..... intensity 22

MTBF acc. to SN 29500 ..... > 84,000 hrs.
(reference temperature 40 °C on PCB)

3.1.3.7 Serial interface to the MP

Type interface ..... EIA RS 422–A
Receiver sensitivity ..... ± 200 mV
Receiver input impedance ..... 120 Ω
Transmitter signal level ..... 5 V
Max. cable length with local 24 V supply ..... 1000 m
Transmission speed ..... 19200 bit/sec
Number of data bits 8
Number of stop bits 1
Parity ..... odd

3.2 Mounting

The following work must be done to mount the device:

- *Fixing the device where it is to be used*
- *Attaching the connections*
- *Making settings to adapt it to the existing plant.*

All these steps involve intervention in the device.

Warnung

Sicherer Betrieb des Wägesystems SIWAREX S setzt voraus, daß es von qualifiziertem Personal sachgemäß unter Beachtung der Warnhinweise dieser Betriebsanleitung montiert und in Betrieb gesetzt wird.

Insbesondere sind sowohl die allgemeinen Montage– und Sicherheitsvorschriften zu Arbeiten an stromführenden Anlagen (z. B DIN VDE) als auch die den fachgerechten Einsatz von Werkzeugen und Hilfsmitteln und die Benutzung persönlicher Schutzausstattungen betreffenden Vorschriften zu beachten.

Bei Nichtbeachtung können Tod, schwere Körperverletzung oder erhebliche Sachschaden die Folge sein.

Warning

Safe operation of the SIWAREX S weighing system is dependent upon proper handling and installation by qualified personnel under observance of all warnings contained in these Operating Instructions.

In particular the general installation and safety regulations (e. g. DIN VDE, IEC) and regulations regarding the correct use of hoisting gear and tools and of personal protective gear (safety goggles and the like) must be observed.

Non–observance can result in death, severe personal injury or substantial property damage.

Observe ESD protective measures !

(4) J31037–D5603–U1–A0–7619

3.2.1 Mounting the MA

The WPS(i) weighing processor is conceived for local use: the robust housing (degree of protection IP 65) is resistant even to tough ambient conditions. The metal casing guarantees optimum shielding against electromagnetic interference.

3.2.1.1 Mounting location

At the mounting location the ambient conditions must be those that are permitted according to the technical specifications (→ Section 3.1.3.6).

Suitable bases are stable fixed walls, supports or racks. The device must be protected from mechanical shocks.

Avoid constant subjection of the casing to liquids. The mounting position of the device can be chosen to meet the requirements.

Avoid direct sunlight.

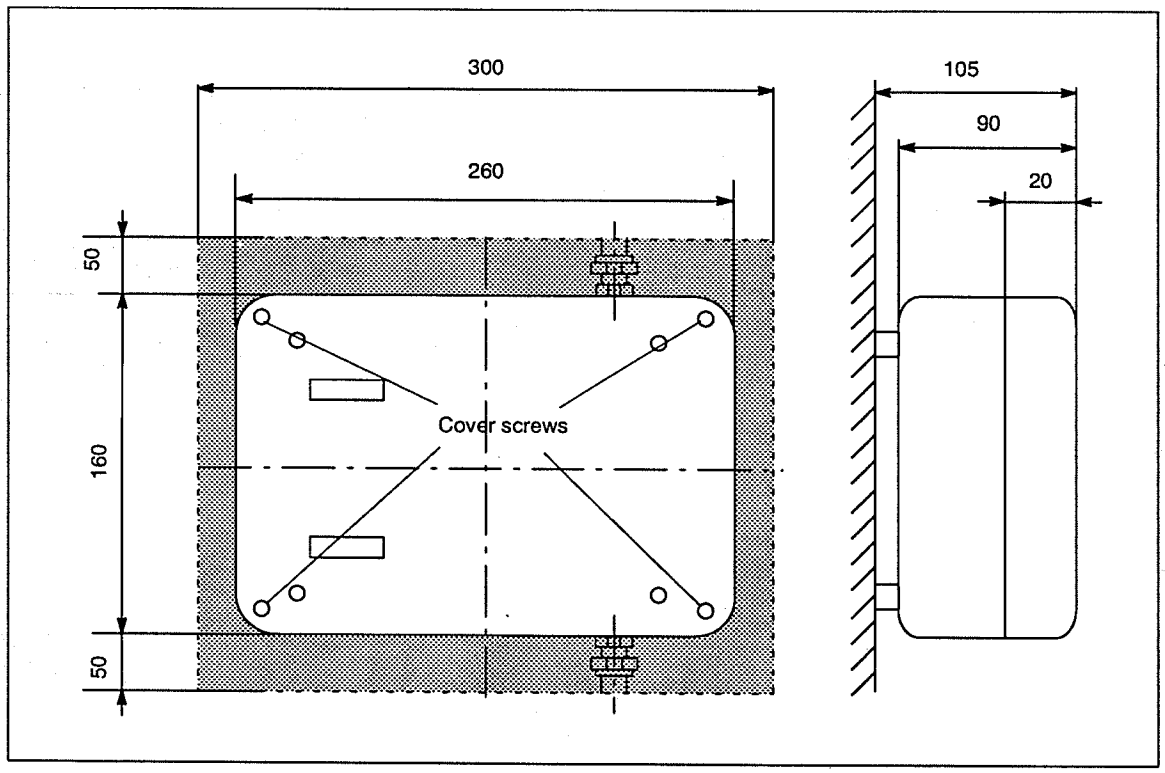


Fig. 3.3 Space requirements for mounting.

The space beneath the device is required for cable laying.

3.2.1.2 Mounting instructions

(1) Determine mounting location and mark out space requirements as shown in Fig. 3.3.

(2) Take the drilling template from the appendix and place it on the mounting locations.

(3) Mark and drill the 4 holes for the fixing screws
- 6.5 mm ∅ for through holes (for wall thicknesses ≤ 2 mm)
- 4.8 mm ∅ for M6 thread holes (for wall thicknesses > 2 mm)

(4) Remove the 4 cover fixing screws (Fig. 3.3) and remove cover.

(5) Determine required length of the 4 fixing screws. Slotted pan head screws M6xL
- for through holes: L = 30 mm + wall thickness
- for thread holes : L = 20 mm + thread depth

(6) Place the housing on the fixing screw holes and screw it on.

(7) Mount the cable bushings (→ Section 3.2.2.1)

(8) Make the cable connections (→ Section 3.2.2)

(9) Remove protective cardboard

(10) Make any necessary jumper and switch settings (only while the device is not under power).

(11) Position cover (making sure the seal fits) and screw tight.

(4) J31037–D5603–U1–A0–7619

3.2.2 *Mounting the connections*

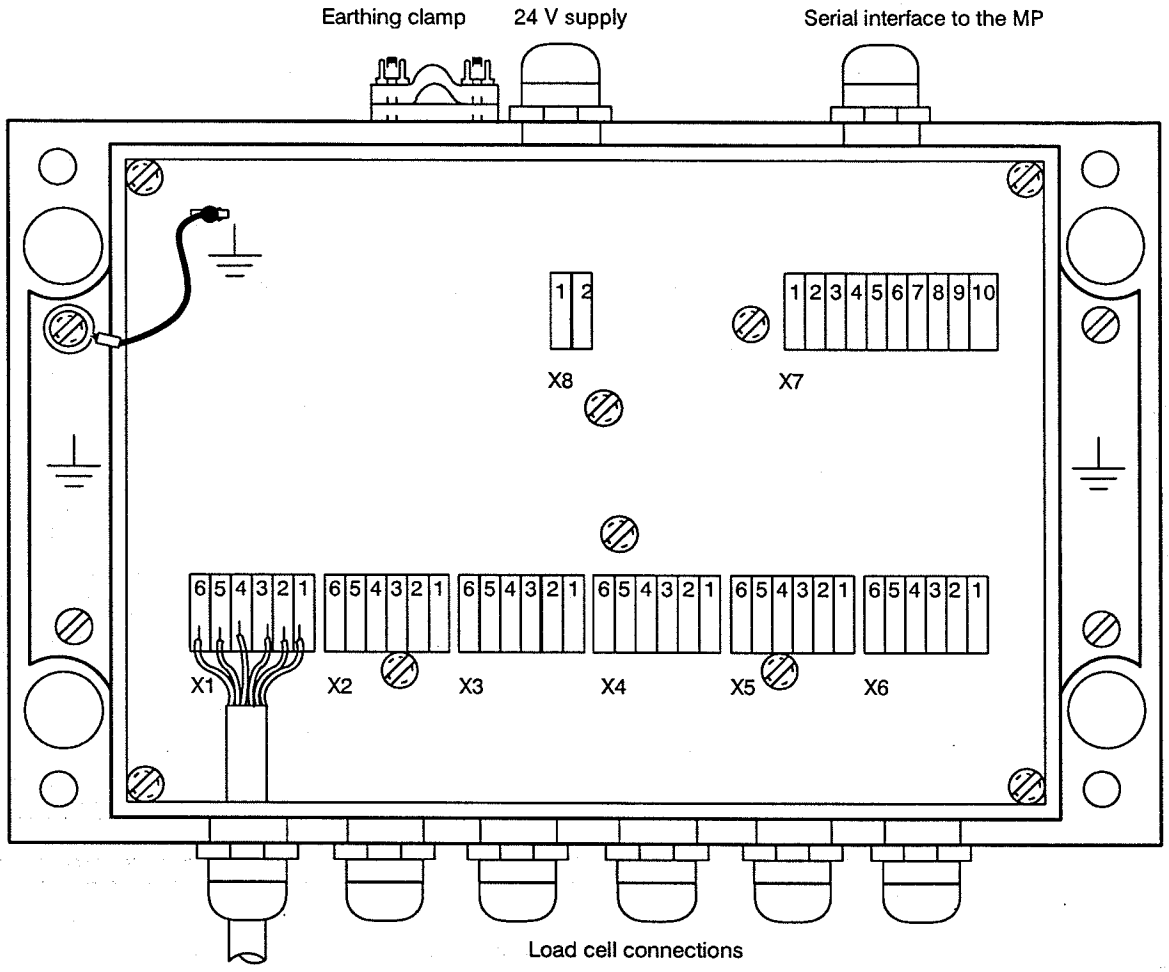


Fig. 3.4 Positions of the cable bushings and terminals

A conduit thread bushing is physically allocated to every terminal on the PCB.

The housing contains a labelled piece of protective cardboard that indicates the position and meaning of the terminals to facilitate mounting the cables. The cardboard must be removed once the cables have been led through and the conduit thread bushings screwed tight.

3.2.2.1 How to screw the cables in

To guarantee the degree of protection IP65 and to ensure that the housing is RF shielded, observe the instructions on how to screw in the cables exactly.

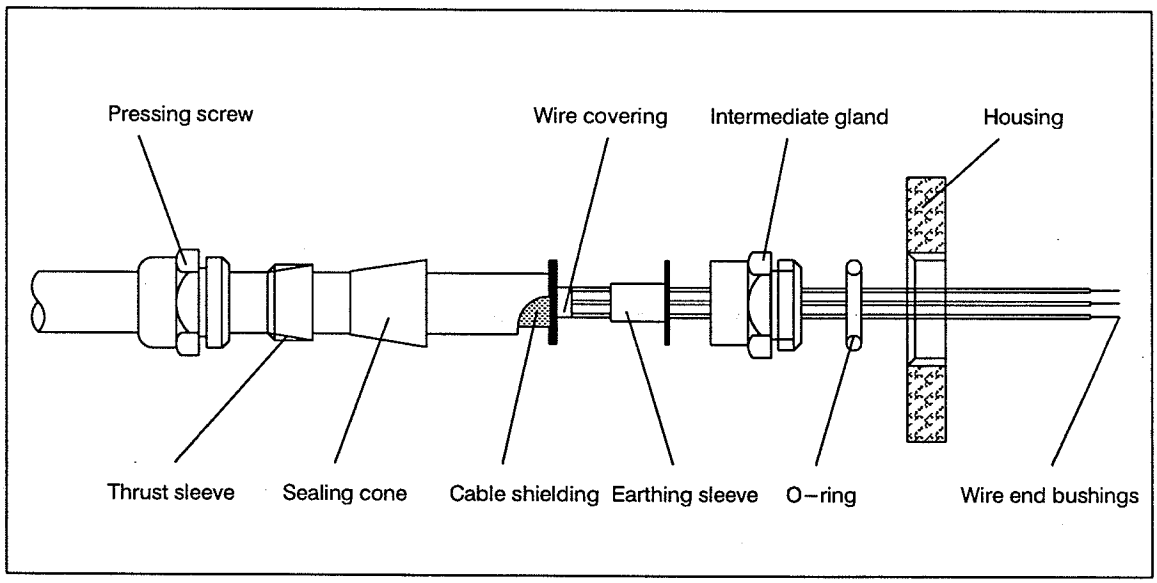


Fig. 3.5 Cable mounting

- Remove dummy plugs
- Strip the cables required for the chosen cable bushing and terminal assignment (100–200 mm)
- Fit the cores with wire end bushings
- Measure the external diameter of the cable (for sealing cone)
- Pull the pressing screw, thrust sleeve and sealing cone onto the cable
- Remove shielding up to the level of the earthing sleeve flange
- Push the earthing sleeve onto the cable under the shielding until the flange is against the cable sheath
- Press the O–ring into the slot of the intermediate gland
- Screw the intermediate gland into the selected cable bushing and tighten (A/F 22)
- Introduce the cable into the intermediate gland until the earthing sleeve is against it
- Now slide on the sealing cone and thrust sleeve
- Press on the pressing screw and tighten (A/F 22)
- The 13.5 conduit thread screws are supplied as a separate item. They can be used for cables with an external diameter of 7 to 11 mm.

Plug–in connectors are located on the board into which the ends of the wires are clamped. The plug–in connectors can be removed from the board so that the board can be replaced quickly and simply if necessary.

The terminals are wired as shown by the labelling on the protective cardboard. For explanations, see the following sections.

3.2.2.2 Voltage supply

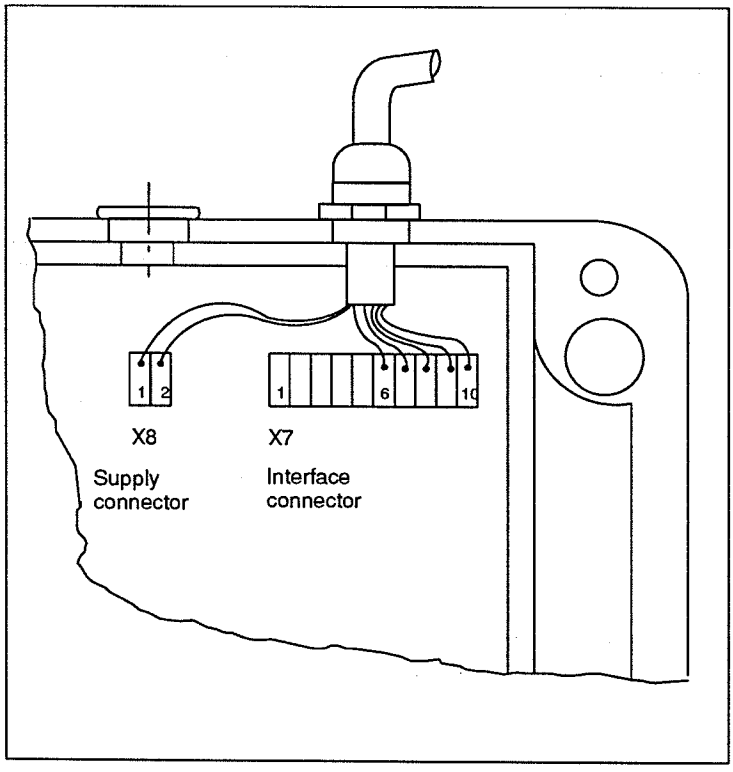
There are two ways of ensuring a voltage supply to the measured value acquisition module (24 V DC):

- via the interface cable of the measured value processing module
- via a local voltage connection

A local voltage connection is required in the following cases:

- The connecting cable between the measured value acquisition module and the measured value processing module is longer than 100 m (see also Section 3.2.2.3). The voltage drop is too great.
- The supply voltage is required for other loads such as motors and contactors. This would cause interference on the interface connection.

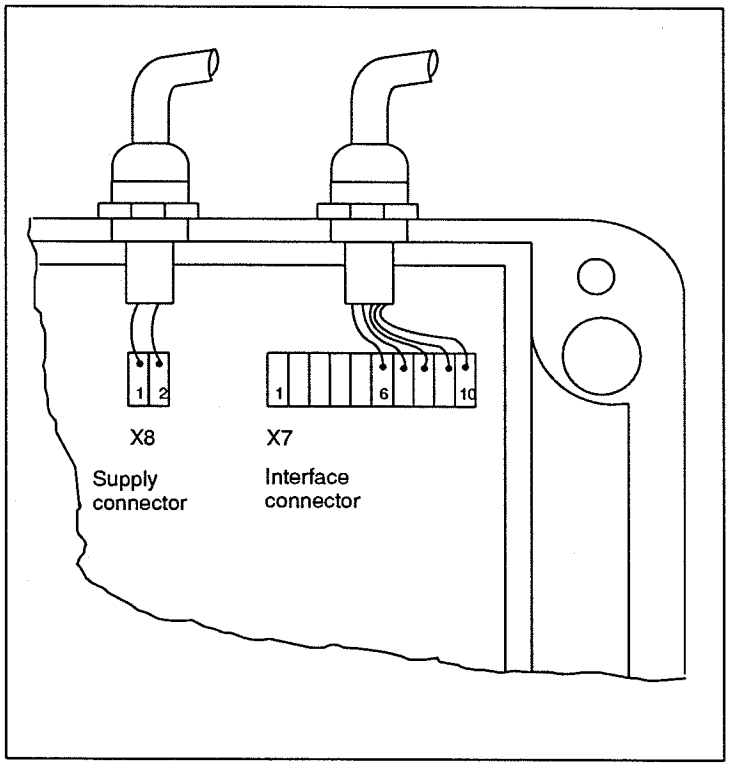
The following diagrams show how to connect the supply voltage for both options.



The supply lines of the interface cable are led to the supply connectors in the housing. The bushing for a separate supply remains plugged.

Fig. 3.6 Voltage supply via the interface cable

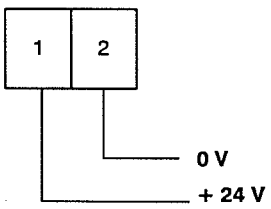
WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619



With a separate local voltage supply, the supply cable is led into the housing through the second cable bushing.

Fig. 3.7 Separate voltage supply

Assignments of the supply connector (X8)

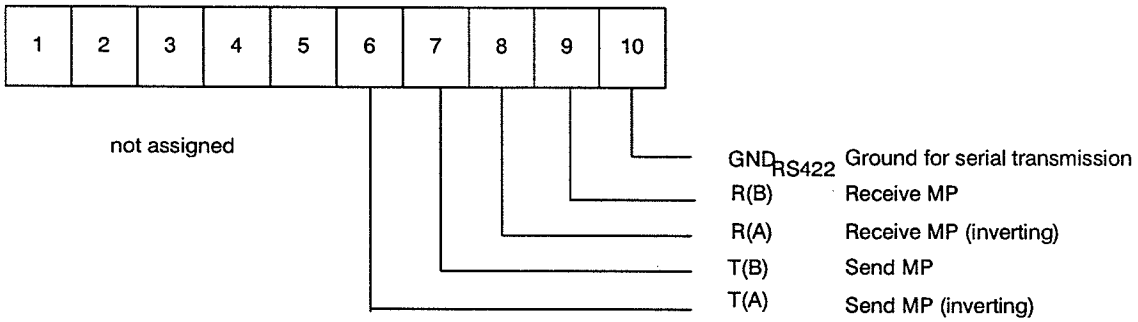


Recommended cable for separate supply (→ Section 6)

(4) J31037–D5603–U1–A0–7619

3.2.2.3 Connecting the serial interface to the MP

Assignments of interface connector (X7) on the MA



☞ Only shielded cables twisted in pairs must be used to connect the MP and the MA (see also Section 6.3.6.3).

Recommended cable types for the serial interface (→ Section 6)

Cable lengths:

≤ 1000 m (without 24 V supply)
≤ 100 m *1 (with 24 V supply)

*1 depending on the core cross–section, the size of the input voltage and the total resistance of the connected load cells.

The actual maximum permissible cable length for the 24 V carried in the connecting cable without interference depends on the following criteria and can be calculated precisely using the formula below.

- min. input voltage V_E on the MP for 24 V (minimum of 20 V)
- cable cross–section A [mm²] of the connecting cables
- min. input voltage on the MA (V_A = 15 V)
- power loss P_{total} of the MA (load dependent)

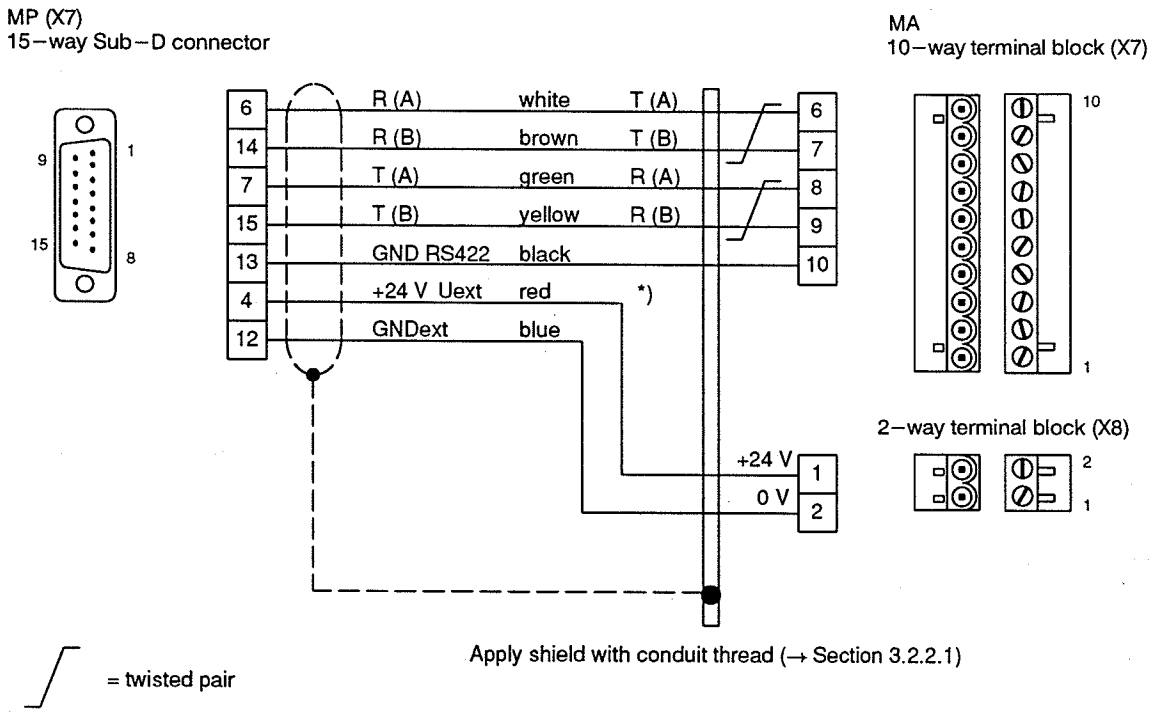
$$P_{total} = 3.0 + P_{Load\ cells} / 0{,}5 \quad [W]$$

$$P_{Load\ cells} = \frac{V_{LC}^2 * n}{R_b} \quad [W]$$

$$L_{max} = \frac{(V_E - V_A) * V_A * æ * A}{P_{total} * 2} \quad [m]$$

æ = Conductivity (of copper approx. 58)
R_b = Internal resistance of the load cells
n = Number of load cells in parallel
V_{LC} = Supply voltage 10 V

Connection from MP to MA with 24 V supply



*) By connecting the unassigned cores in parallel with the voltage supply lines (+24 V, 0 V) the permissible cable length between the MP and the MA can be increased.

Connect on both sides:
- red with grey and red–blue
- blue with grey–pink and pink

Number example of determining the line lengths:

Three load cells with an internal resistance of 350 Ω each are used. This results in the following values at a load cell feeder voltage of 10 V.

$P_{Load\ cells}$ = 0.86 Watt

P_{Total} = 4.72 Watt

A line length of 345 m can be used when the free lines in the cable are switched in parallel to MP/MA (A = 0.75 mm^2) and a V_E of least 20 V is present.

(4) J31037–D5603–U1–A0–7619

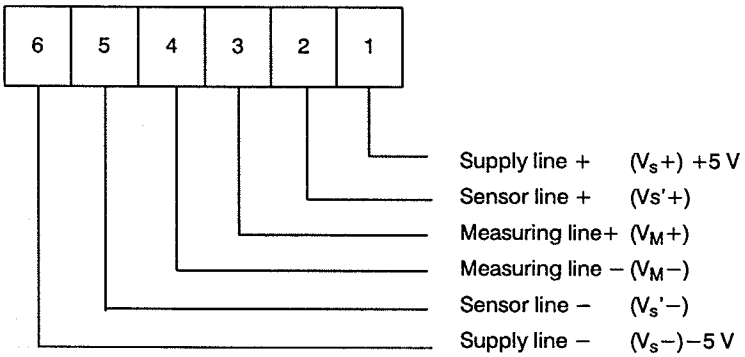
3.2.2.4 Connecting the load cells

Up to 6 load cells can be directly connected to the measured value acquisition module.

The load cells can be connected using a 4–line technique or 6–line technique. The 6–line technique should be preferably used for reasons of measuring accuracy. Both techniques are explained in Section 3.3.2.

☞ If you are connecting several load cells, all the load cells must be of the same type and connected by the same technique (parallel).

Assignments of the load cell connectors (X1 to X6)



Load cell connection cables:

The load cells are fitted with a cable with a permanent molded connector. The maximum length is 20 m.

If a cable length of 20 meters is not long enough an extension cable can be fitted via a junction box (see operating instructions for the junction box).

Only cables recommended by Siemens must be used as sensor and extension cables.

Recommended extension cable (→ Section 6)

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.2.2.5 *Earthing and equipotential bonding*

The housing must be earthed to the nearest earth potential PE with the lowest resistance via the external earthing clamp.

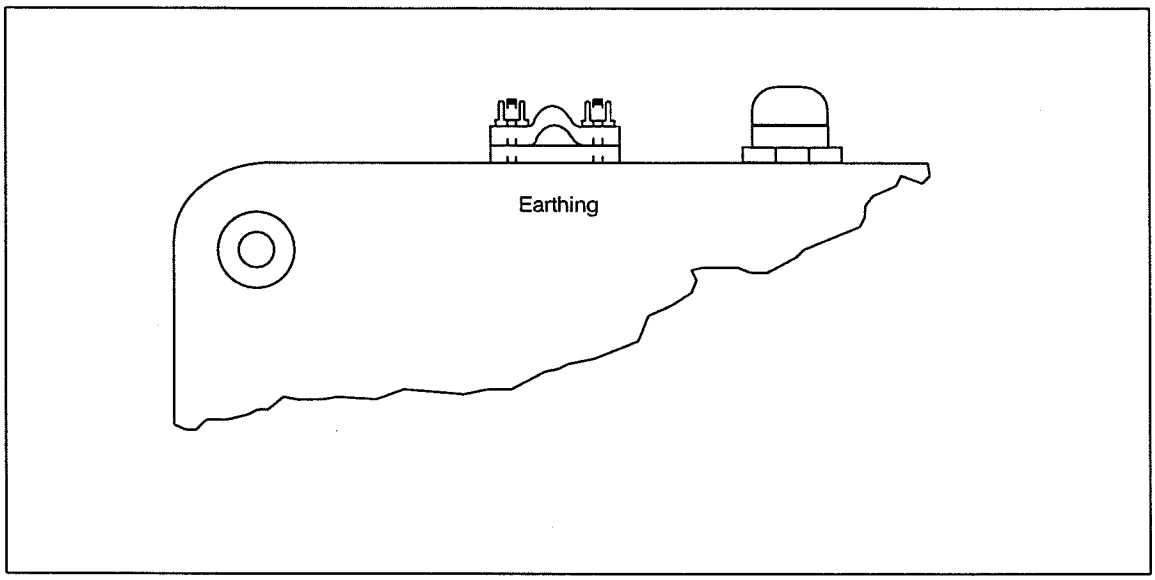


Fig. 3.8 Position of the earthing clamp

To keep interference away from the electronics, all cable connections must be shielded. The MA is equipped with special conduit threads that provide a perfect shielded connection. Interference is thus conducted directly from the conduit thread through the housing to earth. The shields of the connecting cable to the load cells must be connected to the MA. If you observe the cable mounting instructions (→ Section 3.2.2.1) exactly, connection between the cable shielding and the housing is ensured.

Earthing the load cells:

If the cable shielding is connected to the housing at the load cell itself, an equipotential bonding conductor might be required if the two earth potentials are different.

The equipotential bonding conductor should take account of local conditions. However, it must have a cross–section of at least 4 mm^2 and be laid immediately parallel to the load cell cable.

Earthing the interface cable:

With the conduit thread, the shield of the connecting cable to the measured value processing module is connected to the housing of the MA. The cable shielding is usually not connected to the measured value processing module.

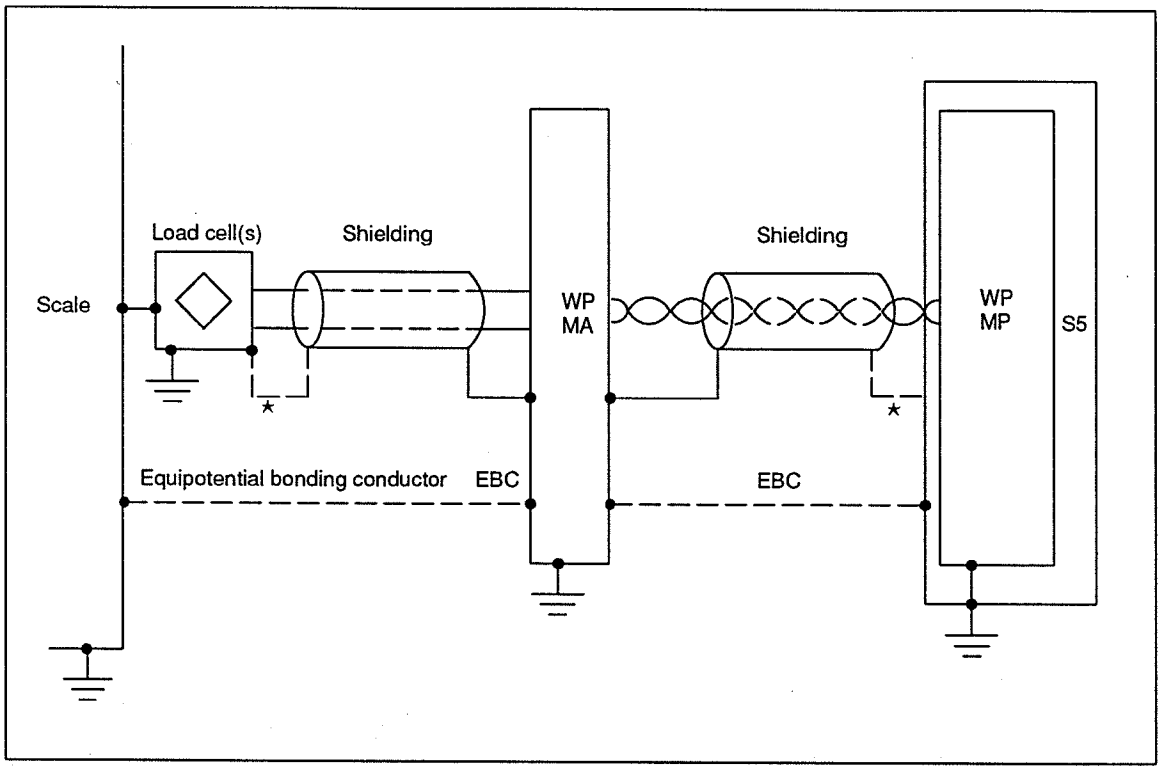


Fig. 3.9 Earthing and shielding concept

The equipotential bonding conductor is required if the connection ★ exists and circulating currents can be expected because of earth potential differences.

The equipotential bonding conductor must be laid immediately next to the measuring and interface cable (→ Section 3.2.2.5).

If the connections ★ exist suppression of external interference is improved considerably.

3.2.3 Settings

To keep settings to a minimum, the module has been set at the factory.

It will be necessary to make some settings for special applications using the coding switches and jumpers on the module.

3.2.3.1 *Positions of the switches and jumpers*

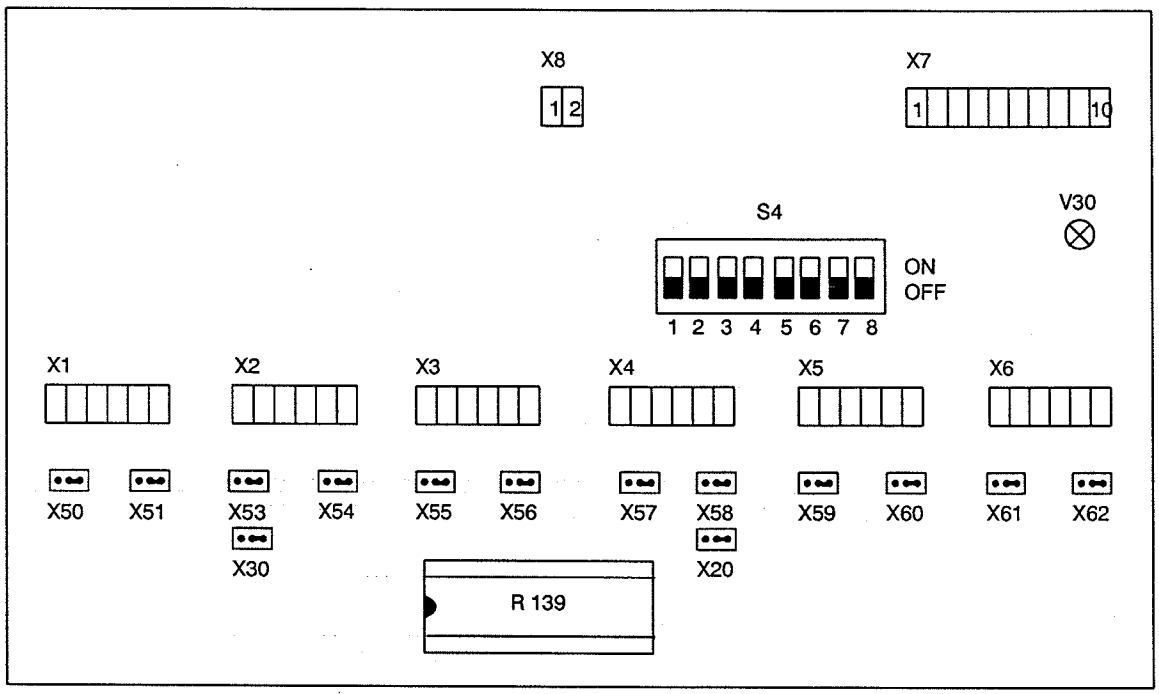


Fig. 3.10 Positions of the switches and jumpers on the board (presetting)

X1 to X6	Load cell connector
X7	Serial interface to the MP
X8	Voltage supply
X50 to X62	Jumpers for 4–wire/6–wire connection switchover
X20	Jumper for reference voltage switchover
X30	Jumpers for amplifier setting
S4	Mode switch
R 139	Calibration submodule
V30	Operating display (LED)

(4) J31037–D5603–U1–A0–7619

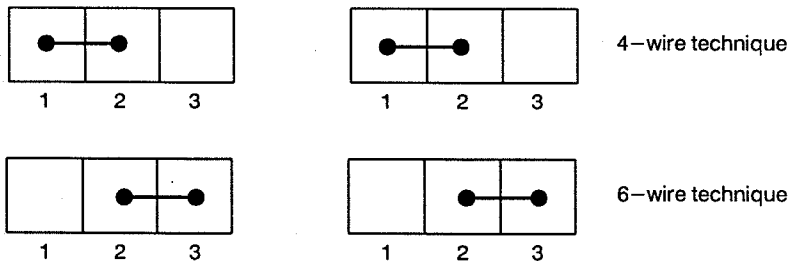
3.2.3.2 *Presettings and the meanings of the elements*

If the setting made at the factory meets all requirements there is no reason to make any change to any elements.

X50 and X51
X53 and X54
X55 and X56
X57 and X58
X59 and X60
X61 and X62

The jumpers are used to adapt the load cell connections (4 or 6–wire technique). A pair of jumpers is assigned to every load cell connector. Both jumpers must always be inserted.

Unused connectors must be set to the 6–wire techique.

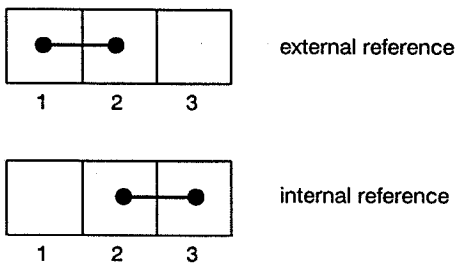


Presetting: 6–wire technique

X20 (MA)

In exceptional cases an internal reference voltage can be used instead of the external ratio reference (load cell supply voltage fed back via the sensor lines). In this way it is also possible to process input signals (minimum range 0 to 10 mV; maximum range with special setting on the calibration resistor submodule 0 to 1 V) that do not originate from the bridge circuit. The measuring accuracy, especially the temperature coefficient of the measured value is considerably reduced in this mode (→ Section 3.3.2.3).

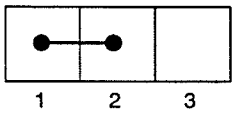
Note:
If an internal reference is used, the 4 wire technique must always be employed. The wire break monitoring must be switched off (DW 172, bit 14=1) (→ Section 2.4.4.5, Basic Parameters).



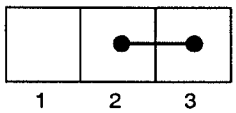
Presetting: external reference for strain gauge load cells

X30

Setting the amplifier. The standard setting permits an input sensitivity of 1 to 4 mV/V. In exceptional cases, another amplification can be selected. This is set by special resistor.



Standard setting



Special resistor for other amplification

Presetting: amplification standard setting

(4) J31037–D5603–U1–A0–7619

Mode switch S4:

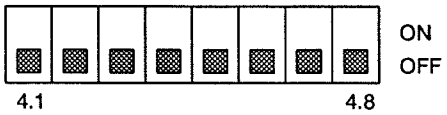


Fig. 3.11 Mode switch

S4.1 Always in OFF position (only for field test)

S4.2 Unassigned

S4.3 ON Temperature monitoring for limits – 25 °C and + 90 °C inside the housing. This switch setting must only be selected in the measured value acquisition module with the extended temperature range (type B and E).

OFF Temperature monitoring for the limits – 5 °C and + 75 °C inside the housing (normal temperature range, type A).

Presetting: device independent

S4.4 ON No monitoring of load cell supply voltage (measured on the sense lines)

OFF *Monitoring of the load cell supply voltage–lower limit 9 V.*

Presetting: monitoring

S4.5 ON Transmission rate of the serial interface = 9600 bit/s

OFF Transmission rate of the serial interface = 19200 bit/s

Presetting: 19200 bit/s

S4.6 Always in the OFF position (only used for field test)

S4.7 ON No wire break monitoring: the cyclic connection of the test resistor is switched off. Test only made on initial start–up and during load cell adaptation. In this case, bit no. 14 of DW 172 must be set to 1 (→ Section 2.4.4.5, Basic Parameters starting with firmware version 3.0 of the MA measured value processing).

OFF Wire break monitoring active.

Presetting: wire break monitoring active

S4.8 Not assigned.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Resistance calibration submodule R 139:

Six standard reference resistors for the measuring ranges 1 to 4 mV/V are soldered onto the plug–in resistor calibration submodule.

Special resistors (→ Section 3.2.3.3) can be soldered on for deviations from the measuring range (> 4 mV/V) or for special cases of wire break monitoring.

If the MA module is replaced (→ Section 3.4.3), the R139 submodule is removed and plugged onto the new MA module. This saves performing adjustment again.

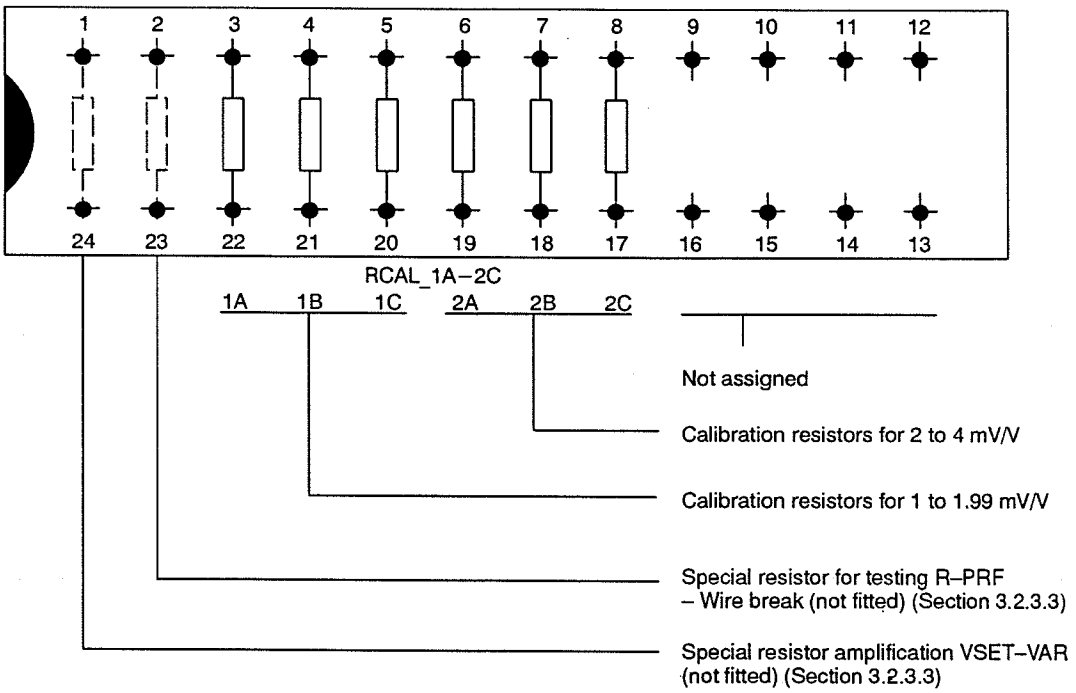


Fig. 3.12 Resistance calibration submodule

If the R139 resistor calibration submodule consists of a thick film hybrid, no special resistors (R–PRF/VSET–VAR) can be soldered on.

If necessary, a conventionally wired submodule can be used on request.

Operating LED display (→ Section 3.4.2)

3.2.3.3 Special resistors

Special resistors for wire break monitoring and amplification can be soldered into the resistor calibration submodule.

Special resistor "Wire break check"

A defined test resistance is required for wire break monitoring. The existing resistors cover the range $\leq$ 750 kΩ (with standard values for characteristic value, internal resistance, number of load cells). If a higher test resistance is required because these values have been changed, a special resistor must be soldered onto the R139 submudule (Pins 2, 23)

Calculation of the resistance:

$$RP = \frac{Rb \times 525}{K \times n}$$

RP = Test resistance (Ω)

Rb = Internal resistance of load cell (Ω)

K = Characteristic value of load cell (mV/V)

n = Number of load cells

Technical specifications of the resistor:

- Metal film resistor
- Tolerance $\leq$ 2%
- Temp. coefficient (TK) $\leq$ 50 ppm/K

Settings for selecting the special resistor:

DW 162 — In DW 162, the internal resistance of the load cell must be entered as 0. Format: KF (→ Section 2.4.4.5 under plant parameters)

Special resistor "amplification"

Using a programmable amplifier, all common load cells with a characteristic value between 1 and 4 mV/V can be connected without any problem. The amplification is programmed by entering values in the data words 162, 163 and 164 (→ Section 2.4.4.5 under plant parameters).

If you want to use load cells with a larger characteristic value (up to max. 100 mV/V), a special resistor must be soldered onto the R139 calibration submodule (pins 1, 24).

Calculation of the resistance:

$$VSET\_VAR = \frac{200{,}000}{\frac{1.15}{K \times 10} - 1}$$

VSET_VAR = amplifier resistance (Ω)

K = Characteristic value of the load cell (mV/V)

Technical specification of the resistance:

- Metal film resistor (series E24)
- Tolerance ≤ 0.1%
- Temp. coefficient (TK) ≤ 50 ppm/K

Settings for activation of the special resistor:

X30 — Move jumper from pins 1–2 to pin 2–3

DW 162 — Enter the internal resistance of the load cell in data word 162 as zero.

DW 163 — Enter the characteristic value 1 mV/V ≙ 10 in data word 163.

RCAL_1B — The calibration resistor RCAL_1B (Pin 4 – 21) must be adapted (calculate and solder).

$$RCAL\_1B = \frac{K \times 10{,}000}{10 - K}$$

Data: Metal film precision resistor (E96 series)
Tolerance ≤ 0.5%
Temperature coefficient ≤ 0 to 5 ppm/K

RP — Recalculate and replace test resistor (→ see special resistor wire break).

(4) J31037–D5603–U1–A0–7619

3.2.3.4 Filtering

The measuring principle of the MA is an integrating compensation method whose characteristics cause filtering of the input signals.

The settling times (step response) and the damping characteristic can be seen in the diagrams (→ Fig. 3.13/Fig. 3.14).

With unsettled measuring equipment, the additional parameterizable, digital filter on the MP must be switched on (→ Section 2.5.1.2).

If large interference quantities with frequencies above 100 Hz are expected, the monitoring function "Wire break monitoring measuring cells" can cause unsettled measured values. This function interrupts the measured values and intervals to connect the test resistance and thus interferes with the analog–to–digital conversion procedure used.

This interference can be removed by switching off the wire break monitoring function with mode switch S4 (→ Section 3.2.3.2).

S4.7 = ON → no wire break monitoring

Wire break monitoring is then severely restricted. Failure of one load cell within a parallel circuit of several cells can no longer be detected.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

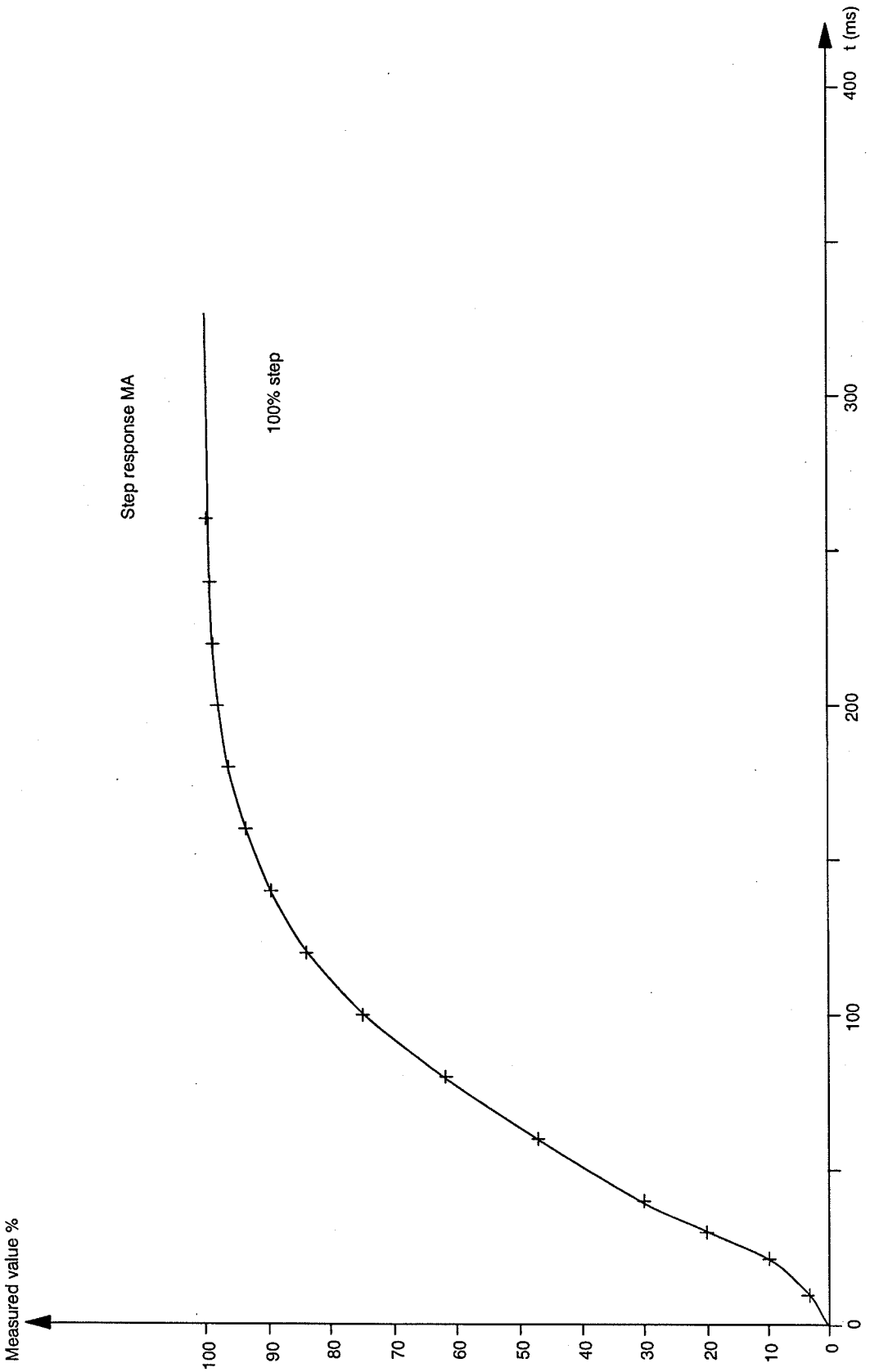


Fig. 3.13 Step response MA (without additional filtering in the MP)

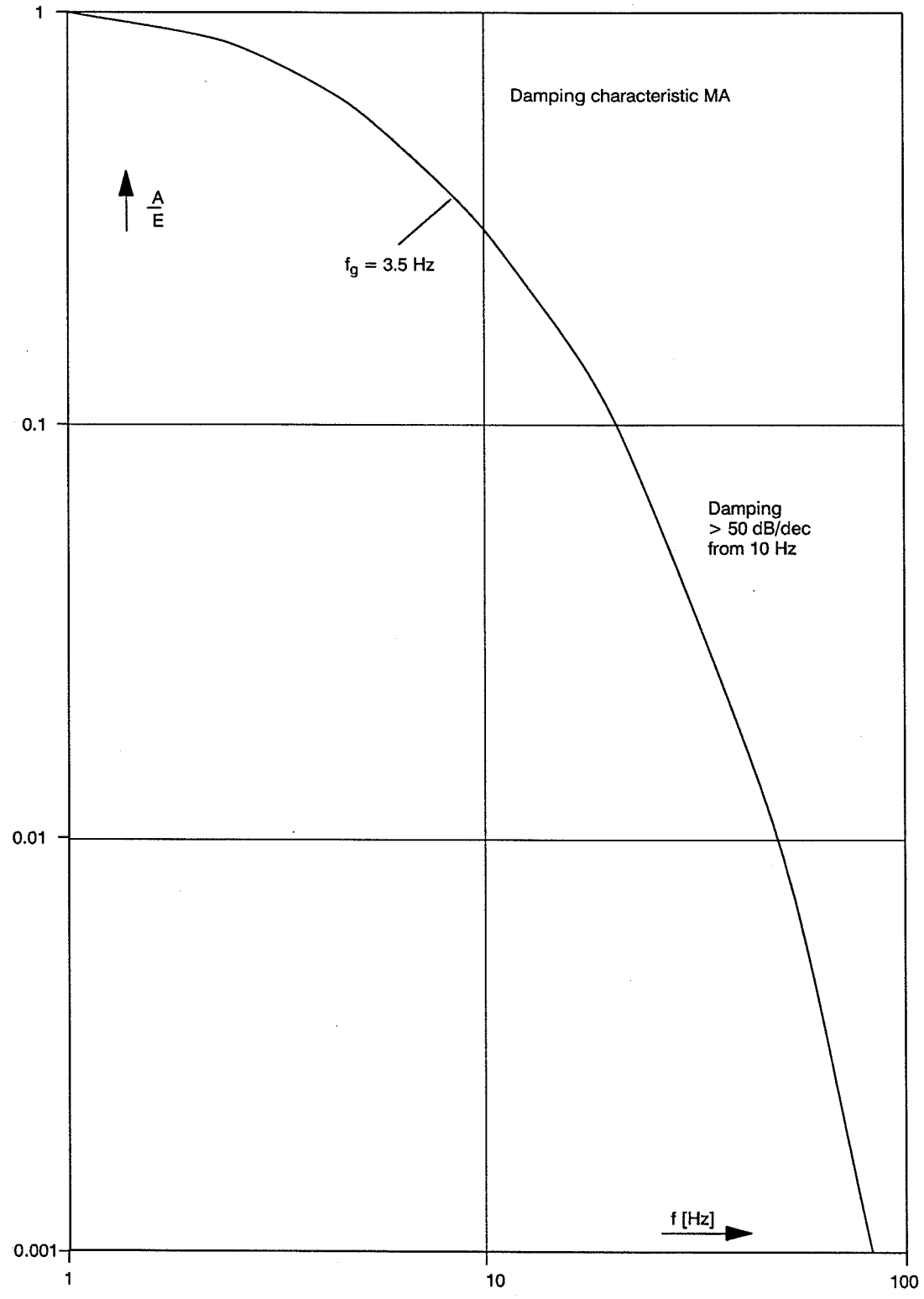


Fig. 3.14 *Damping characteristsic*

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.3 Interfaces

3.3.1 Serial interface

The serial interface is used for data transmission in both directions between the measured value acquisition module (MA) and the measured value processing module (MP).

Transmission from the MA to the MP:

- Measured values
- Status and error signals

Transmission from MP to MA:

- Parameter data

Transmission of measured values or frames is performed with a time base of 10 ms.

Error detection during data transmission is effected using one parity bit per character and one block checksum per frame.

If an error is detected in a frame, the frame is retransmitted. After several failed transmission attempts an error signal is output.

Data of the interface:

– Max. transmission rate	19200 bit/s
– Parity	odd
– Number of data bits	8
– Frame sequence	10 ms

Because the serial interface is used exclusively for connecting the measured value processing module, precise knowledge of the transmission protocol is not required.

(4) J31037–D5603–U1–A0–7619

3.3.2 Connecting load cells

Up to 6 load cells can be connected to the measured value acquisition module. You can select between two connection techniques (4 wire/6 wire). The connection technique is set using jumpers X50 to X62 (→ Section 3.2.3.1).

3.3.2.1 4–wire connection technique

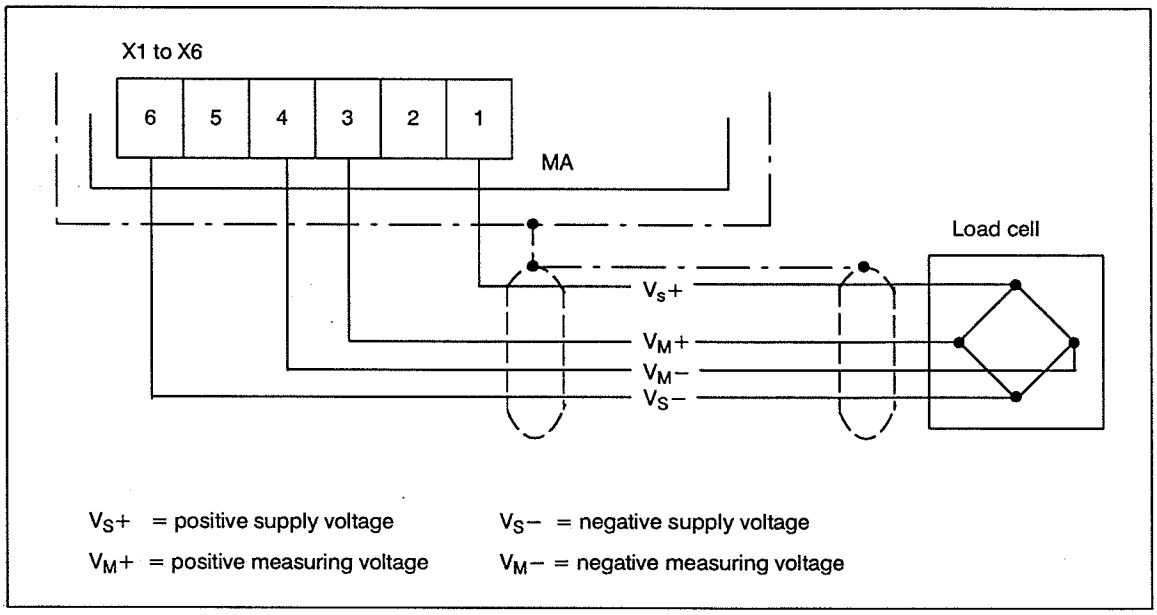


Fig. 3.15 4–wire connection of a load cell

The load cell measuring bridge is supplied with a reference voltage via V_S+ and V_S-. The measuring voltage is acquired via V_M+ and V_M-.

☞ Disadvantage:
The temperature dependent voltage drop on the supply lines influences the measuring result.

Existing load cells in plant may require this connection technique despite the above disadvantage.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.3.2.2 6–wire connection technique

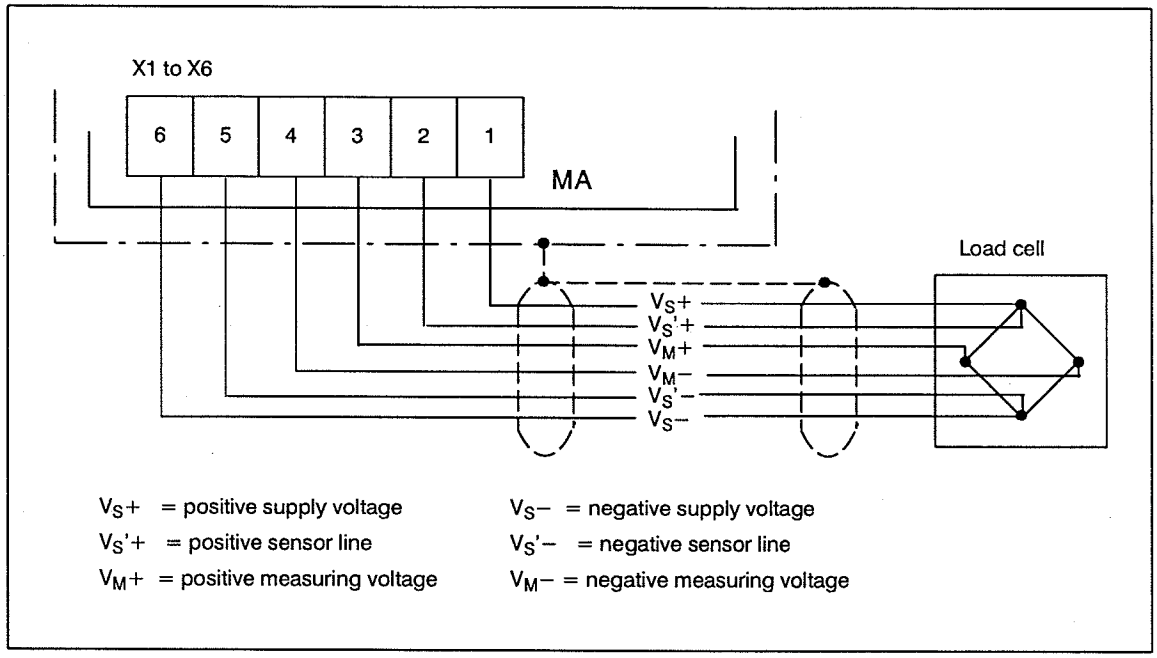


Fig. 3.16 6–wire connection of a load cell

The load cell is supplied with a reference voltage via V_S+ and V_M–. The reference voltage applied directly to the load cell is fed back via V_S'+ and V_S'– and used by the measured value acquisition module for evaluating the measured signal. The measured signal is acquired via V_M+ and V_M–.

☞ Advantage:
The temperature of the load cell connection line does **not** influence the result. If plants are to be replanned, this technique should be preferred.

3.3.2.3 Use of internal voltage reference

The use of an internal reference permits processing of measured signals that do not originate from the bridge circuit (strain gauge load cells).
Setting(→ Section 3.2.3.2)

Minimum measuring range:	0–10 mV
Maximum measuring range:	0–1 V (Special resistor on the resistor calibration submodule R 139 required)

The measuring accuracy, in particular the temperature coefficient of the measured value, is considerably reduced in this mode.

Maximum temperature coefficient: 0.22 %/10 °C of full–scale value

☞ If an internal reference is used always choose the 4–wire connection technique.

3.4 Service

3.4.1 Overview of the MA error signal word 3

If one of the monitoring functions in the measured value acquisition module responds, a signal is sent to the measured value processing module. In the MP an entry is made in an MA error word.

The MA error word 3 is contained in frame 4 of data block SIWAREX and can be read by the user program.

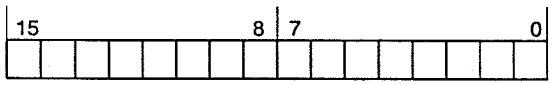


Fig. 3.17 MA error and status word 3 (DW 74)

Meaning of the bits

DW 74	Bit 0	EPROM error (MA)
	Bit 1	RAM error (MA)
	Bit 2	Upper measuring range limit reached
	Bit 3	Lower measuring range limit reached
	Bit 4	Fault in load cell power supply
	Bit 5	Measuring fault (measuring amplifier)
	Bit 6	Watchdog error MA (program run error)
	Bit 7	Calibration running
	Bit 8	Sensor adaptation not performed
	Bit 9	Permissible temperature range exceeded
	Bit 10	Permissible number range exceeded
	Bit 11	Calibration line outside tolerance
	Bit 13	General error MA
	Bit 15	Wire break load cells

See Section 3.1.2 for an exact description of the monitoring function.

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

3.4.2 Operating display (LED)

A small green LED (V30) is located on the module as an operating display. The LED can only be seen when the housing cover is open. The following displays are possible:

LED off	– Power supply missing
LED flashing	– The module is in cyclic measuring operation and signals an error
	– The module is not yet calibrated
LED off for a moment	– Calibration being performed
LED on	– Module is in cyclic measuring operation and is functioning without error

The following errors cause the LED to flash

- EPROM error
- RAM error
- upper measuring range limit reached
- lower measuring range limit reached
- Reference voltage error
- internal measuring loop fault
- Watchdog error
- Set temperature range exceeded
- Internal calculation error
- Calibration straight line outside tolerance
- Connection to MP interrupted (only on start–up)

Which of these errors has actually occurred in cyclic measuring operation can be seen by looking at the S5 interface (MA error signal word).

All error states are reset in the MA automatically if the corresponding error condition is no longer fulfilled. The display "Watchdog error" in the MA (flashing LED) can be reset by interrupting the power supply for a short time.

To continue operation, all error signals must be acknowledged by the programmable controller via the interface to the measured value processing module.

There are various reasons why the display might show error–free operation (LED on) although the module is not functioning (Example: EPROM or micro–processor not plugged in).

3.4.3 Replacing the module

Note on adjustment of a substitute measuring electronics module:

The measured value acquisition module is adjusted at the beginning of operation by a start–up program.

When the electronics board is replaced, these data do not need to be changed if the resistor calibration submodule R 139 of the old module is used on the new board.

How to replace the electronics board

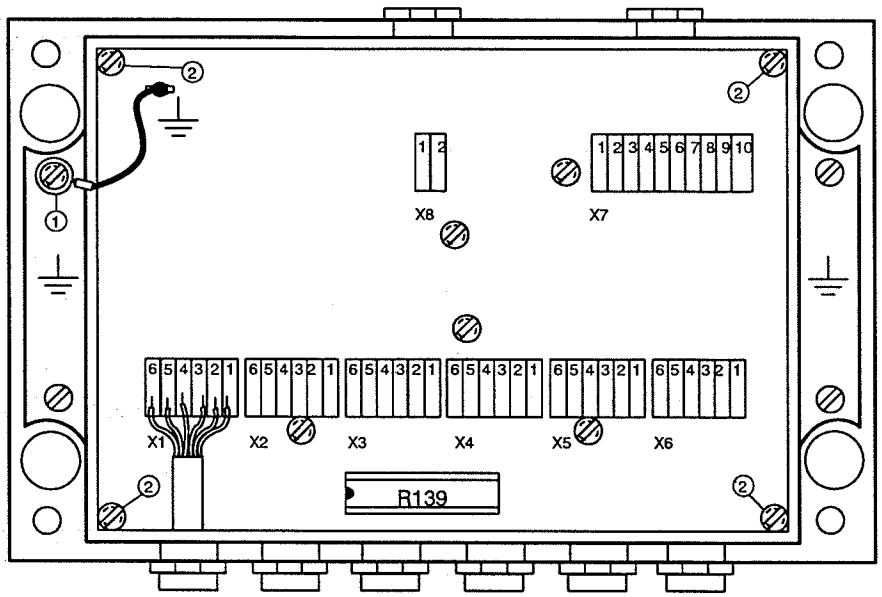


Fig. 3.18 Format of the board

Procedure

Observe ESD regulations, use a suitable tool, do not touch the pins with your fingers.

1) Switch off the voltage and secure it against being switched on again.
2) Remove the 4 cover fixing screws.
3) Remove cover.
4) Remove voltage supply (connector X8)
5) Undo earthing screw ①
6) Separate connection to the MP, pull out connector X7
7) Undo load cell connections, pull out connectors X1 to X6
8) Carefully remove the calibration submodule
9) Undo the fixing screws of the board ②
10) Carefully remove the board by connectors X7 and X1
11) Adapt positions of all setting elements on the new board to the settings on the old board.
12) Follow these instructions in reverse order to install the new board.

4 Measured Value Acquisition (Intrinsically Safe) MAi

4 Measured Value Acquisition (Intrinsically Safe) MAi

Section 4 supplements Section 3 when the intrinsically safe measured value acquisition module is used. It only deals with the differences between the MA and the MAi. Subheadings, figures and tables include references to Section 3, example "Fig. 4.1 (→ Fig. 3.2)".

4.1 Description

The MAi is used to safely isolate the intrinsically safe load cell circuit from the non–intrinsically safe circuits of the measured value acquisition module. The MAi possesses PTB approval as an intrinsically safe device PTB No. Ex–92.C.2009X (see end of section 4). Strain gauge sensors installed in zone 1 or 2 can be connected to the MAi.

4.1.1 Structure and function of the MAi

Internal structure of the MAi

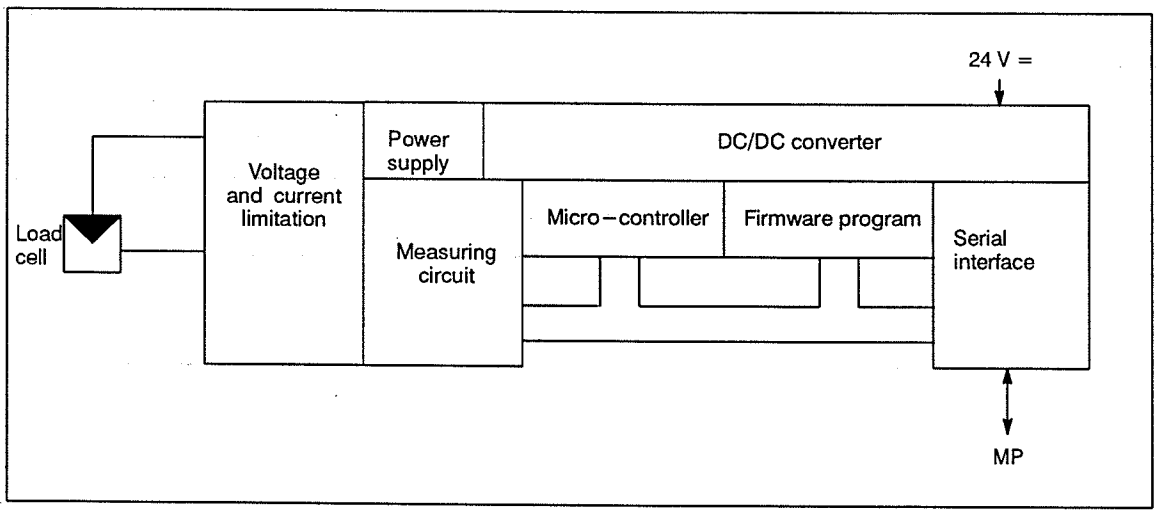


Fig. 4.1 (→ Fig. 3.2) Block diagram of the intrinsically safe measured value acquisition module

Function of each component (→ Section 3.1.1):

Power supply The load cells ($U_N \approx 10$ V) are supplied with power through a protective circuit, making it intrinsically safe and protecting it against the effects of external voltage. The protective circuit consists of active and passive components.

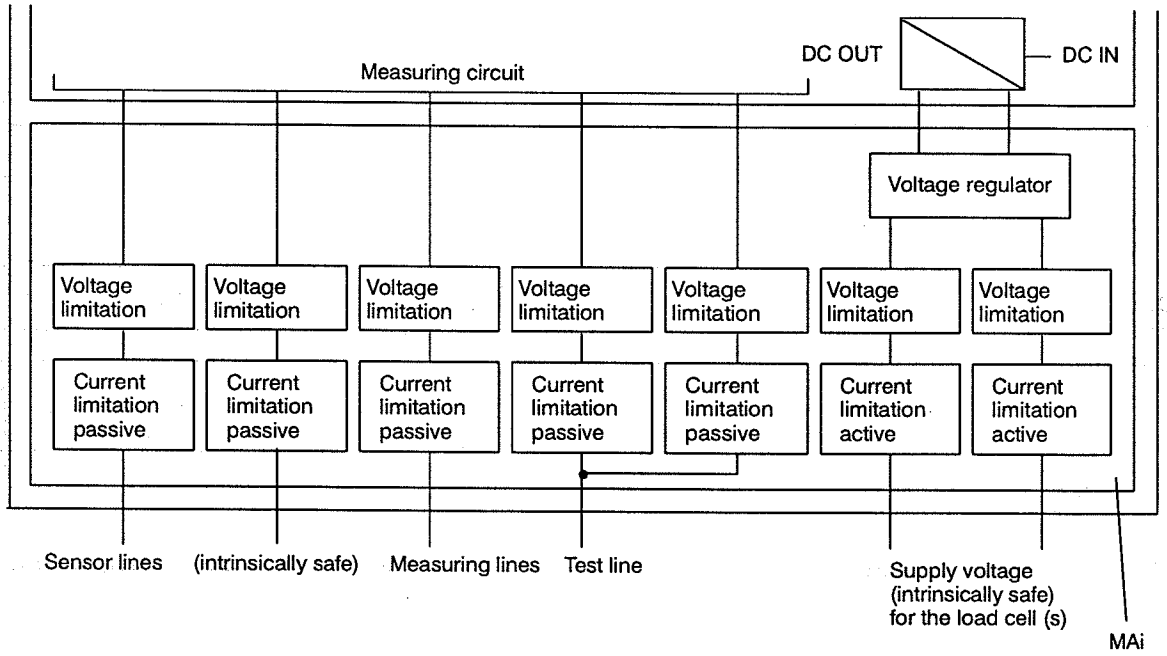


Fig. 4.2 Structure of the MAi

4.1.2 Monitoring functions (→ Section 3.1.2)

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

4.1.3 Technical data

4.1.3.1 Power supply (→ Section 3.1.3.1)

4.1.3.2 Connection values for strain gauge load cells (→ Section 3.1.3.2)

Connection in type of protection "intrinsically safe" (EEx ib)IIC

Supply lines	Rated value (switchable with X20/X21)	8 V DC/10 V DC
	Maximum value	$V_0 \leq 13.2$ V (≤ 6.6 V against earth) $I_k \leq 122$ mA
Voltage monitoring		≥ 7 V
Rated supply current (max)		115 mA
Measuring lines	Maximum value	$V_0 \leq 12.6$ V (≤ 6.3 V against earth) $I_k \leq 42$ mA
Sensor lines	Maximum value	$V_0 \leq 14.8$ V (≤ 7.4 V against earth) $I_k \leq 3.7$ mA
Test line	Maximum value	$V_0 \leq 6.3$ V (≤ 6.3 V against earth) $I_k \leq 3.15$ mA

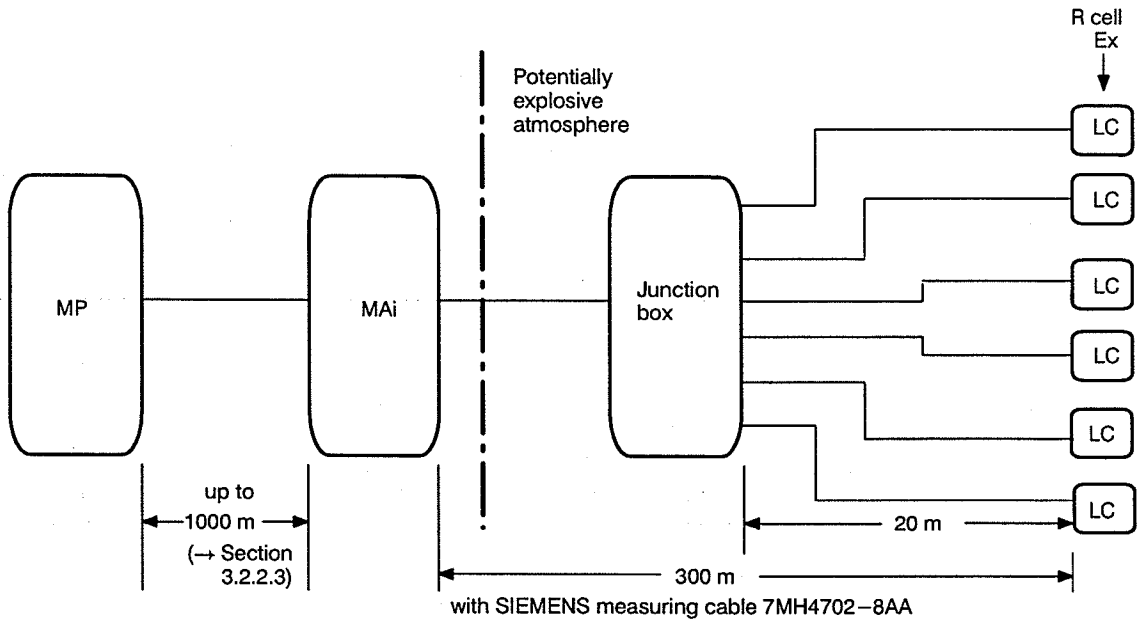
Electrical data of the intrinsically safe load cell connection

Maximum values	Voltage	$V_L = 14.8$ V
	Current	$I_K = 171$ mA
	Capacitance	$C_a = 210$ nF
	Inductance	$L_a = 0.3$ mH
Connection impedance (load cells)	at 10 V DC	$\geq 87\ \Omega$
	at 8 V DC	$\geq 70\ \Omega$

(4) J31037–D5603–U1–A0–7619

Cable length in the zone subject to explosion hazard

With SIEMENS measuring cable 7MH4702–8AA and max. 6 load cells of SIWAREX R, type RH:
L = 300m



4.1.3.3 Data of the measuring circuit (→ Section 3.1.3.3)

4.1.3.4 Measuring accuracy (→ Section 3.1.3.4)

Warm–up time ..... ≤ 30 min
Zero (without dead load) ..... 0.002 %/10 K

4.1.3.5 Dimensions and weights

Housing dimensions (W x L x H) ..... 232 x 332 x 110 mm
Weight ..... approx. 4.5 kg

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

4.1.3.6 Ambient conditions (→ Section 3.1.3.6)

Degree of protection (DIN 40050) ..... IP 65
Ambient temperature .....–10 ... +70° C

Immunity to pulses with large gradient (burst) DIN IEC 801–4 (1 kV)

Depending on the load cell used and the shielding concept, the measured value can be affected by interference. The maximum deviations of the measured value can be up to 1 % if a load cell with a resistance of 1000 Ω is used.

A reduction of the interference can be achieved by
- Capacitive coupling of the cable shields (load cell cable, connecting cable to the MP)
- Connect cable shields on both sides (observe equalizing currents and installation regulations in the potentially explosive atmosphere !)

4.1.3.7 Serial interface to the MP (→ Section 3.1.3.7)

 (4) J31037–D5603–U1–A0–7619

4.2 Mounting

The following work must be done to mount the device:

- *Fixing the device where it is to be used*
- *Attaching the connections*
- *Making settings to adapt it to the existing plant*

All these steps involve intervention in the device.

Warnung

Sicherer Betrieb des Wägesystems SIWAREX S mit MEi setzt voraus, daß es von qualifiziertem Personal sachgemäß unter Beachtung der Warnhinweise dieser Betriebsanleitung montiert und in Betrieb gesetzt wird.

Insbesondere sind sowohl die allgemeinen Montage– und Sicherheitsvorschriften zu Arbeiten an stromführenden Anlagen (z. B DIN VDE) als auch die den fachgerechten Einsatz von Werkzeugen und Hilfsmitteln und die Benutzung persönlicher Schutzausstattungen betreffenden Vorschriften zu beachten. Die besonderen Vorschriften bei der Errichtung von Anlagen im Ex–Bereich (z.B. DIN VDE 0165) sind zu beachten.

Bei Nichtbeachtung können Tod, schwere Körperverletzung oder erheblicher Sachschaden die Folge sein.

Warning

Safe operation of SIWAREX S weighing system with MAi is dependent upon proper handling and installation by qualified personnel under observance of all warnings contained in these Operating Instructions.

In particular the general installation and safety regulations (e. g. DIN VDE, IEC) and regulations regarding the correct use of hoisting gear and tools and of personal protective gear (safety goggles and the like) must be observed. The special regulations applicable to setting up systems in potentially explosive atmospheres (e.g., DIN VDE 0165) must be adhered to.

Non–observance can result in death, severe personal injury or substantial property damage.

Warnung

Die Sicherheit des Ex–Bereiches hängt von diesem Gerät ab!

Die notwendigen Anschluß und Montagearbeiten dürfen nur von qualifiziertem Personal durchgeführt werden.

Bei Nichtbeachtung der Montage– und Errichtungsvorschriften besteht

EXPLOSIONSGEFAHR

Warning

The safety of the potentially explosive atmosphere is dependent on this device.

Necessary connection and installation work may only be performed by qualified personnel.

Danger of explosion if the installation and setup regulations are not adhered to.

DANGER OF EXPLOSION

4.2.1 Mounting the MAi (→ Section 3.2.1)

4.2.1.1 Mounting location (→ Section 3.2.1.1)

> **Caution**
>
> The mounting location must always be outside the zone subject to potentially explosive atmosphere!

4.2.1.2 Mounting instructions (→ Section 3.2.1.2)

4.2.2 Attaching the connections

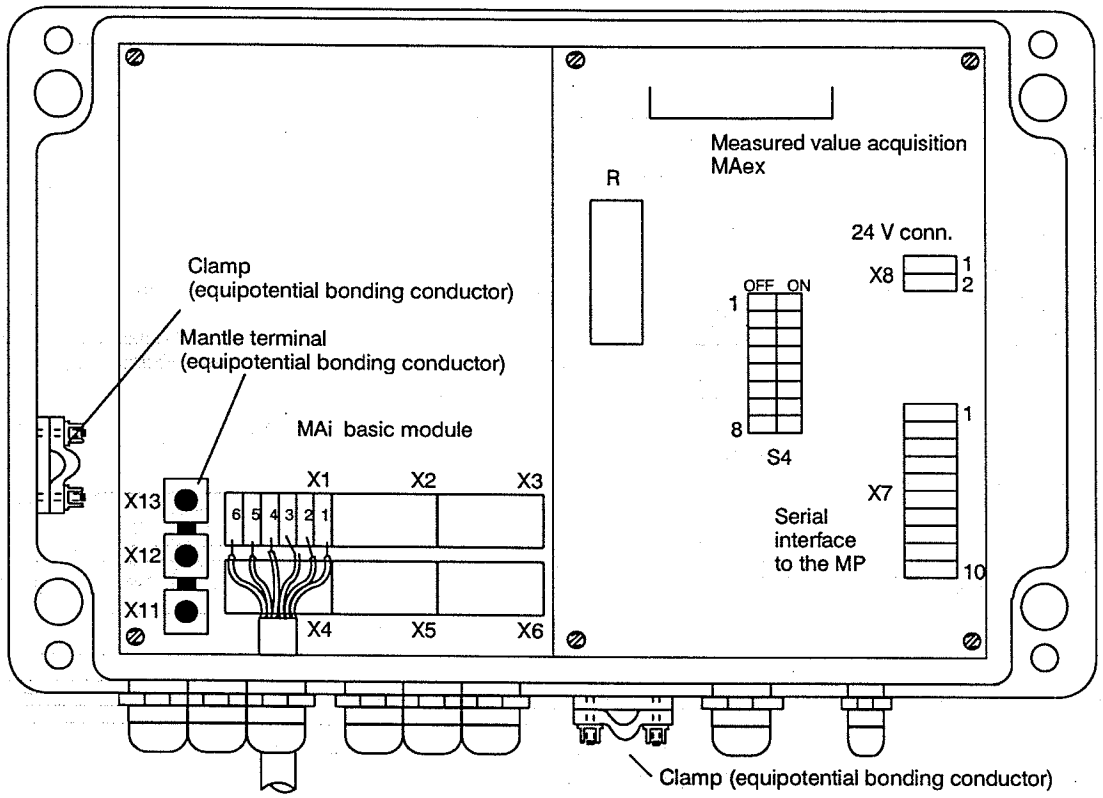


Fig. 4.3 Positions of the cable bushings and terminals

The housing contains a labelled piece of protective cardboard that indicates the position and meaning of the terminals to facilitate mounting the cables. The cardboard must be removed once the cables have been led through and the conduit thread bushings screwed tight.

4.2.2.1 How to screw on the cables (→ Section 3.2.2.1)

On the module there are connectors. The cable ends equipped with wire end bushings are screwed onto the cable connectors and additionally secured by cable binders.

The terminals for the intrinsically safe load cell circuits are physically isolated from those of the non–intrinsically safe circuits (→ Fig. 4.3).

The cable connectors for the intrinsically safe load cell circuits are labelled "intrinsically safe circuits".

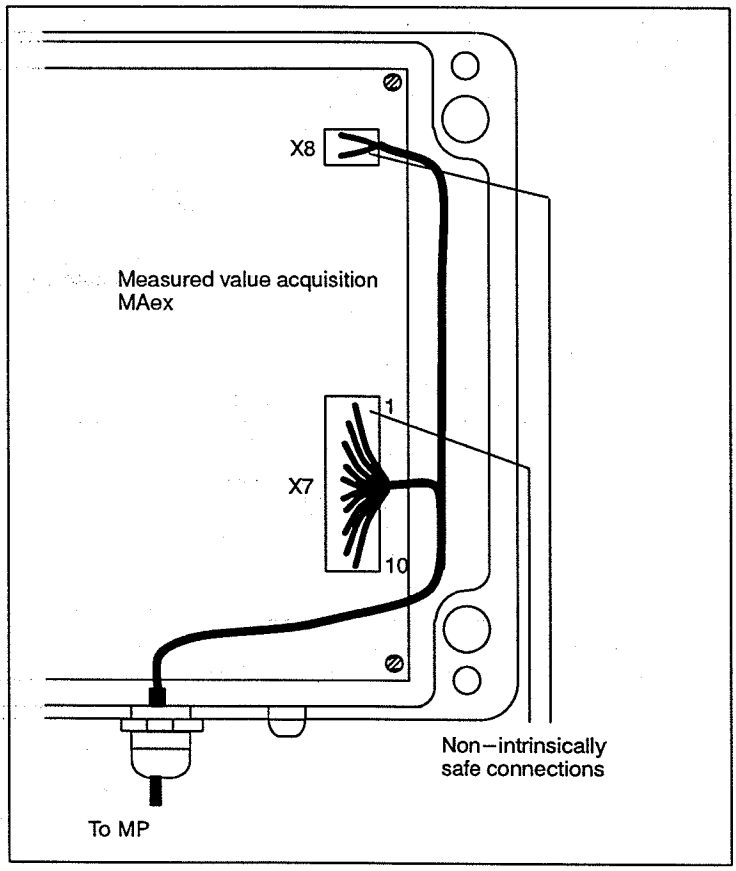
The conduit thread of the cables for the intrinsically safe circuits is blue.

The wiring is labelled on the protective cardboard (explained in the following subsections).

4.2.2.2 Voltage supply (→ Section 3.2.2.2)

The following diagrams explain the two ways of connecting the voltage supply.

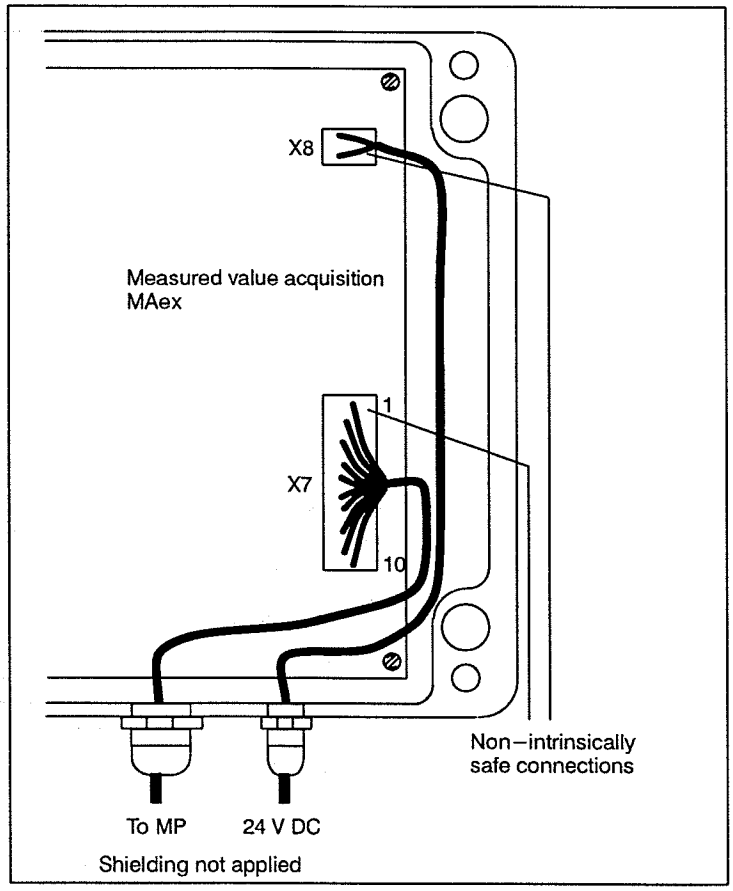
A. Supply via the interface cable



The voltage carrying cores of the interface cable are led in the housing to the supply connector X8. The cable bushing for a separate supply cable remains plugged. The shielding must not be applied to the conduit thread.

Fig. 4.4 Voltage supply via the interface cable

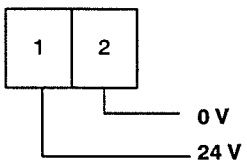
B. Supply via separate supply cable



If a separate local voltage supply is used, the supply cable is led into the housing via the second cable bushing.

Fig. 4.5 Separate voltage supply

Assignment of the supply connector (X8)



Recommended cables for separate supply (→ Section 6)

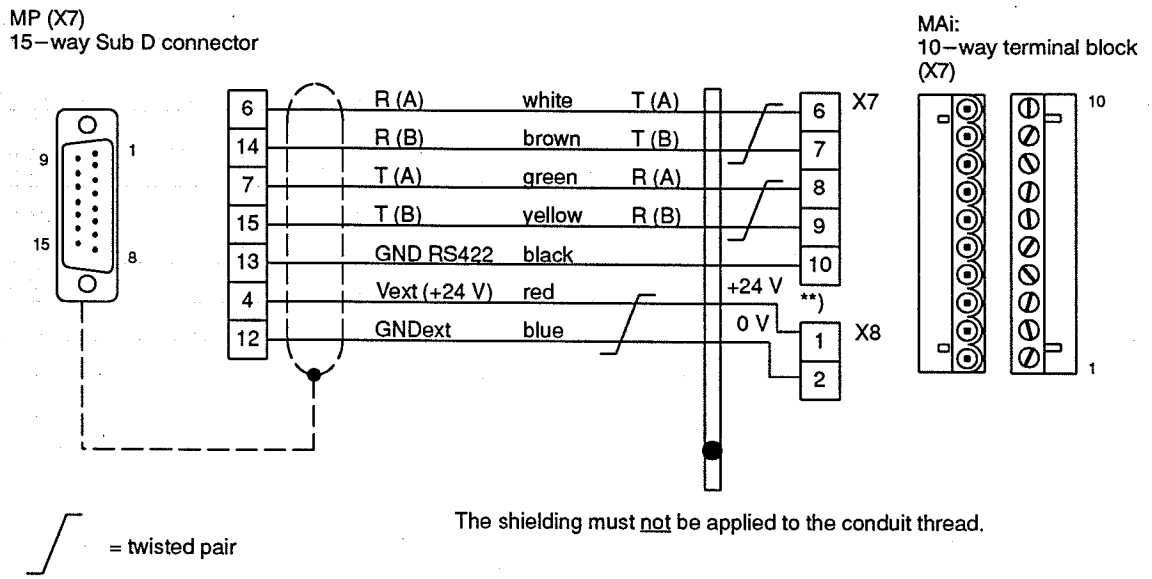
4.2.2.3 Connection of the serial interface to the MP (→ Section 3.2.2.3)

Connecting to the measured value processing (MP)

1) Connector assignments of X7

1	Unassigned
2	Unassigned
3	Unassigned
4	Unassigned
5	Unassigned
6	Send MP (inv.) T(A)
7	Send MP T(B)
8	Receive MP (inv.) R(A)
9	Receive MP R(B)
10	Ground MP (RS422)

Connection MP to MAi with 24 V supply



**) By connecting the unassigned cores in parallel with the voltage supply lines (+24 V, 0 V) the permissible cable length between the MP and the MAi can be increased (→ Section 3.2.2.3).

Connect on both sides:
- red with grey and red–blue
- blue with pink and grey–pink

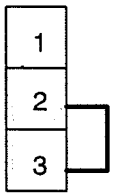
WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

4.2.2.4 Connecting the load cells (→ Section 3.2.2.4)

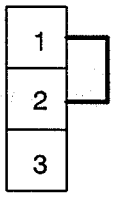
a) Assignment of the load cell connectors X1–X6

1	Load cell power supply positive V_s^+
2	Sense line positive V_{sense}^+
3	Measuring line positive V_m^+
4	Measuring line negative V_m^-
5	Sense line negative V_{sense}^-
6	Load cell supply positive V_s^-

b) Setting 4/ 6–wire technique with X30 to X41



6–wire technique:
Jumpers X30 to X41 strap pins 2–3

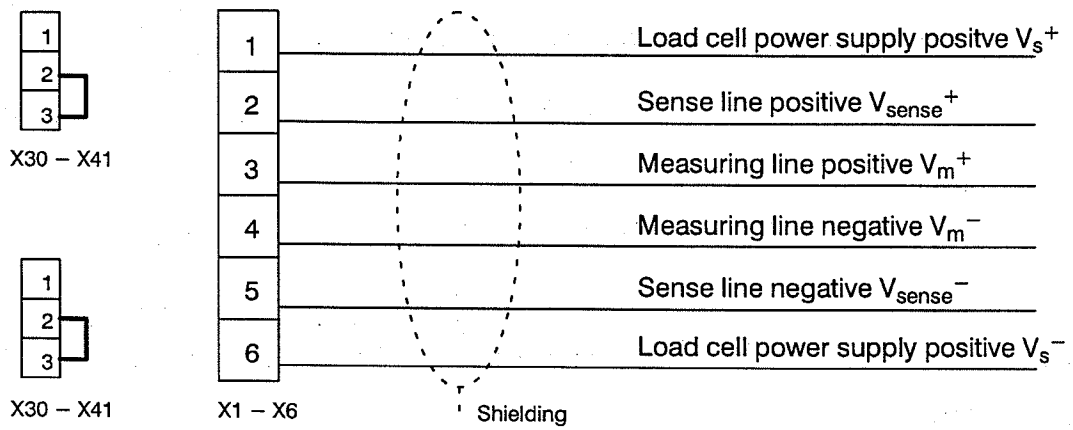


4–wire technique:
Jumpers X30 to X41 strap pins 1–2

Mixing the 4 and 6–wire connection techniques is not permitted!

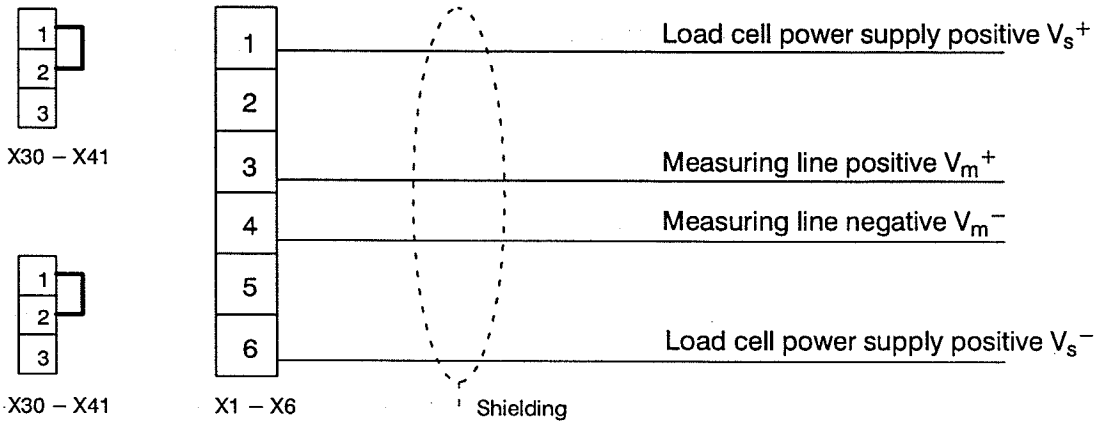
c) Connection of 1 to 6 load cells directly to the MAi

1) 6–wire technique



The shielding must be applied to the conduit threads.

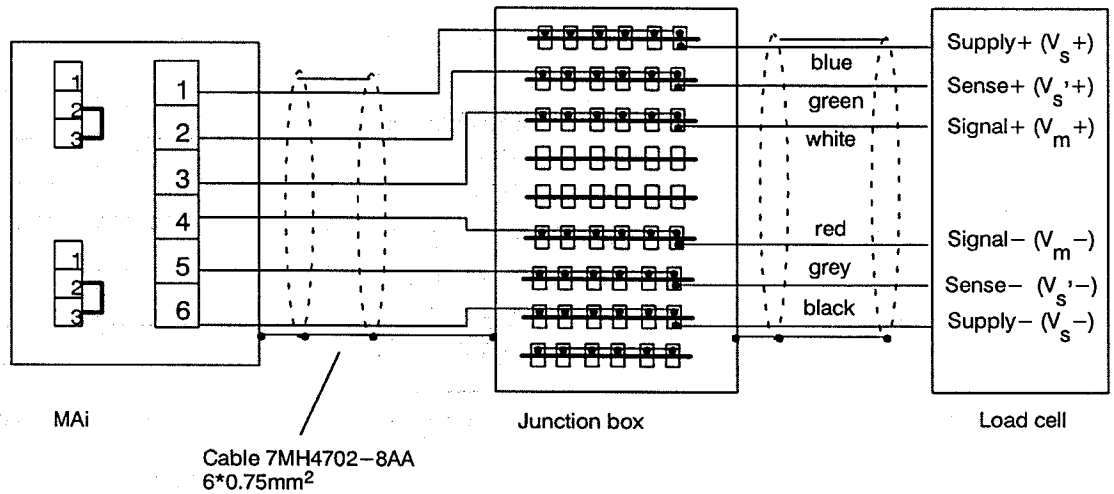
2) 4–wire technique



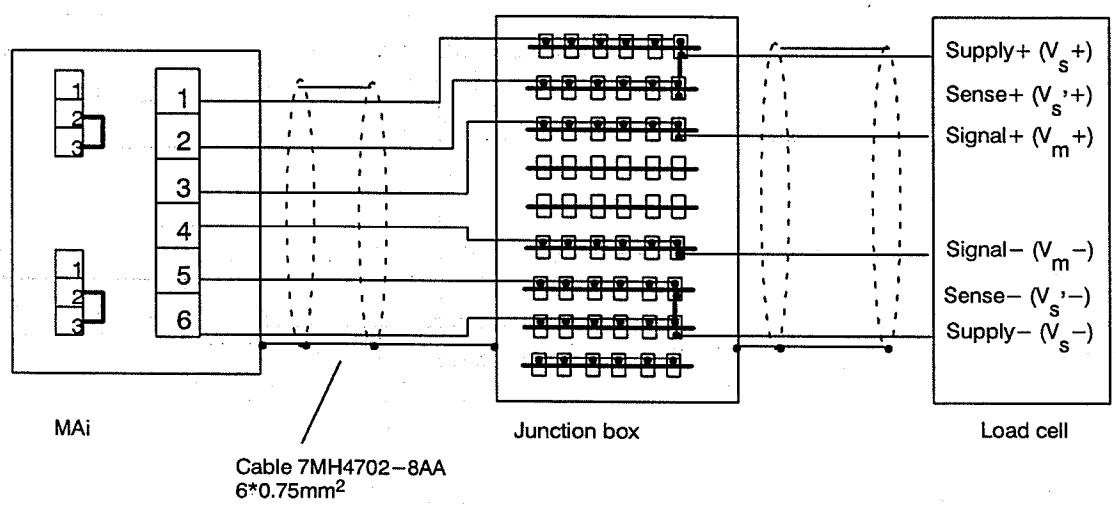
The shielding must be applied to the conduit threads (→ Section 3.2.2.1: Fig. 3.5).

d) Connecting load cells via a junction box.

1) 6–wire technique



2) 4–wire technique



WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

Mounting notes

MAi (X7/X8)

- Caution: The shielding must not be applied to the cable screw on connection.
- Screw cores into terminal block X7 and X8 according to the wiring plan.

Local 24 V power supply

- If a local (external) 24 V power supply is used, the 24 V supply cable is led through a separate conduit thread bushing and connected to terminal block X8. In this case, the supply lines in the cable to the MP are not used.

Caution

The shielding of the separate 24 V power supply must not be applied to the cable screw on connection.

4.2.2.5 Earthing and equipotential bonding (→ Section 3.2.2.5)

Caution

Equipotential bonding must always be connected.

The equipotential bonding conductor can be connected to the safety barriers in two ways (→ Fig. 4.6).

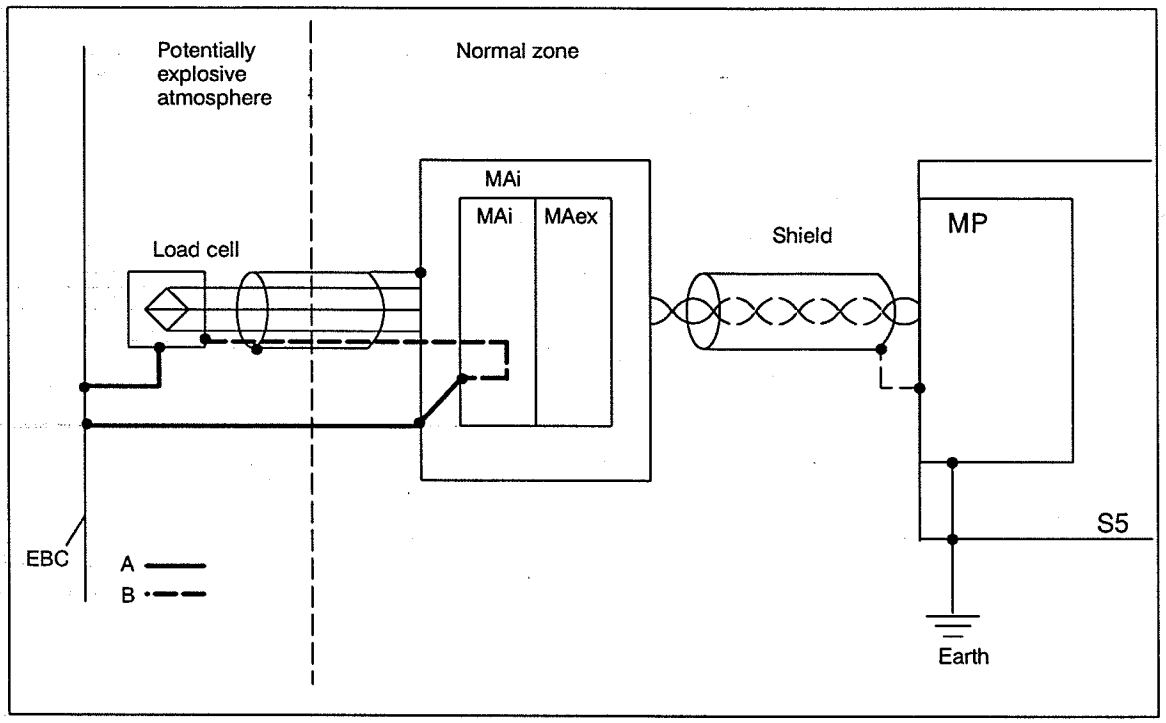


Fig. 4.6 Equipotential bonding conductor (EBC) concept

A) Standard connection
The equipotential bonding conductor is connected to the cable clamp on the outside of the MAi

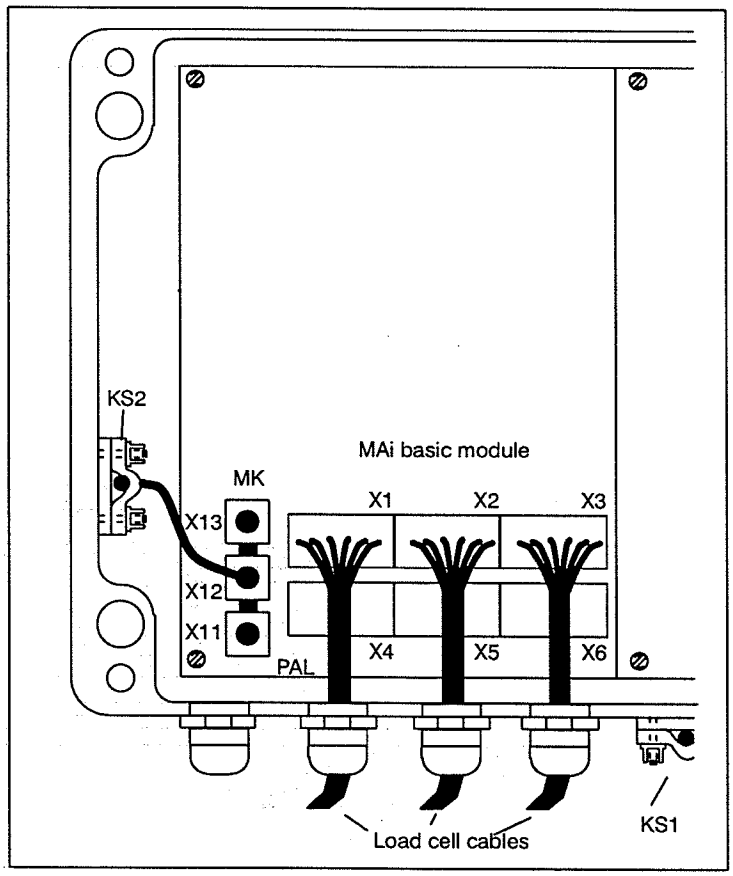
B) The equipotential bonding conductor (EBC) is in the cable to the load cell(s).

Only one method can be used: either A or B!

Caution

If it is not guaranteed that parts to which the housing is fixed do not carry exclusively equipotential bonding conductor potential, the MAi housing must be fixed so that it is isolated. The mounting must isolate a test voltage of up to 500 V (housing against earth).

A) Standard: Equipotential bonding conductor outside connection



The equipotential bonding conductor is connected to the outside of the housing of the MAi by clamp 1 (KS1). It is connected to the safety barriers by clamp 2 and the secured mantle clamp X12 (MK) (connection made at the factory).

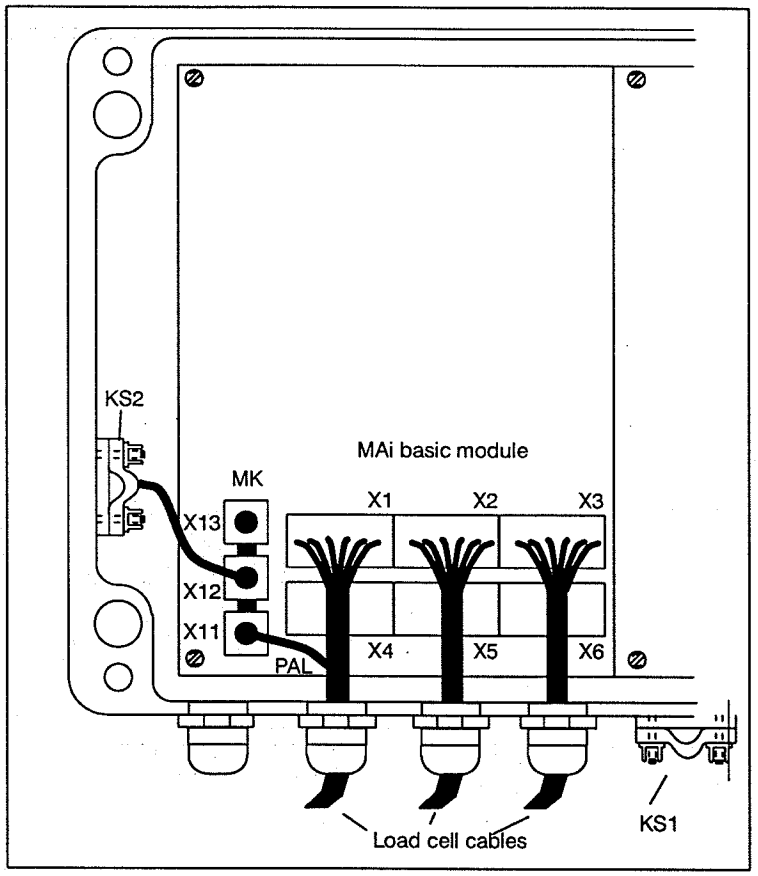
With cable lengths over 50 meters only use this method of connection !

Fig. 4.7 Standard equipotential bonding conductor connection

Caution

To prevent meshing of the equipotential bonding conductors and the protective conductors, neither the shielding of the cable leading to the MP nor any other part connected to the protective conductor must be connected to the MAi housing.

B) Equipotential bonding conductor connection via load cell cable



The cable of the MAi to the load cell(s) consists of 8 cores, each with a cross-section of 0.75 mm^2. Two of these cores are used as equipotential bonding conductors. **The maximum length of this cable is 50 m.**

The connection of the equipotential bonding conductor to the module is made using a secured mantle clamp (MK) X11.

The equipotential bonding conductor is marked yellow and green in the housing.

The housing of the MAi is connected to the equipotential bonding conductor via the mantle clamp X12 and clamp 2 (KS2) (connection made at the factory).

Fig. 4.8 Equipotential bonding conductor connection via load cell cables

Caution

To prevent meshing of the equipotential bonding conductors and the protective conductors, neither the shielding of the cable leading to the MP nor any other part connected to the protective conductor must be connected to the MAi housing.

Caution

The load cell cable must withstand a test voltage of at least 500 V (shielding to earth) inside the intrinsically safe zone.

(4) J31037–D5603–U1–A0–7619

4.2.3 Settings (→ also Section 3.2.3)

4.2.3.1 Positions of the switches and jumpers

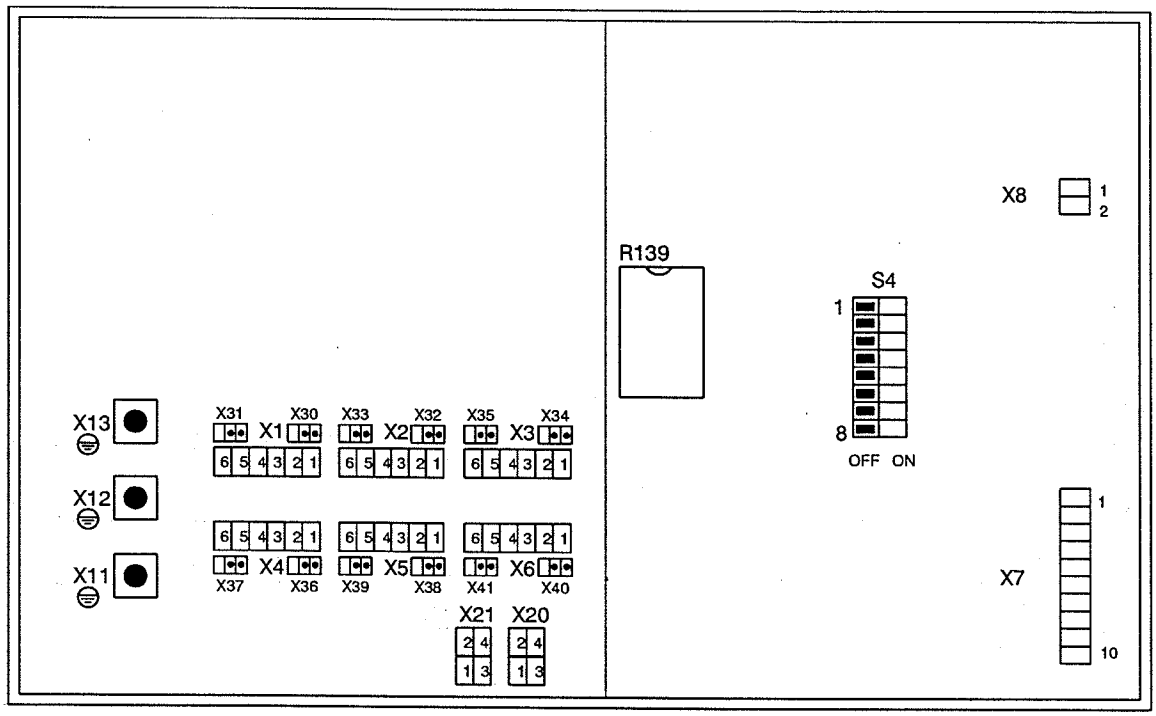


Fig. 4.9 Positions of the switches and jumpers on the board with standard settings

X1 to X6	Load cell connectors
X7	Serial interface to the MP
X8	Voltage supply
X11 to X13	Mantle clamps (secured) for connecting the equipotential bonding conductor
X20/X21	Setting of the load cell supply voltage
X30 to X41	4–wire / 6–wire connection switchover
R 139	Calibration submodule
S4	Mode switch

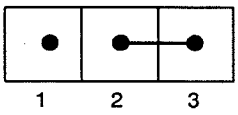
4.2.3.2 Settings and meanings of the elements (→ Section 3.2.3.2)

If the setting of an element made at the factory meets your requirements, do not change it.

X30 to X41

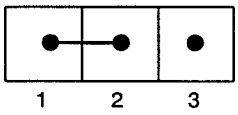
Standard setting for the load cell connection technique is the 6–wire connection.

Example X31



To set the 4–wire connection technique move the jumpers X30 to X41.

Example X31



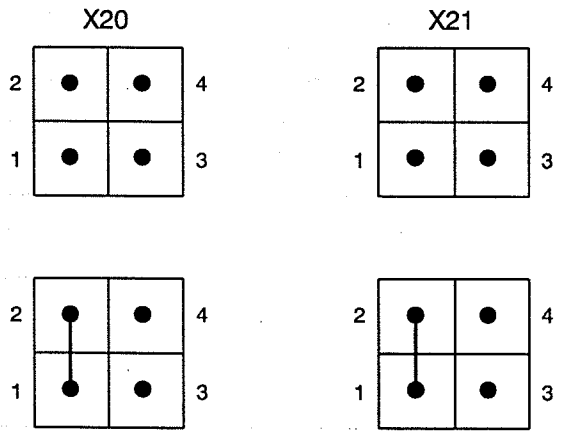
Caution

Jumpers X30 to X41 must always be set identically!

X20/X21 (MAi)

The standard setting for the load cell supply voltage is 10 V. In this way, the load cells can be run with an internal resistance $R_i \geq 87\ \Omega$. (If load cells are connected in parallel, the total resistance must be $\geq 87\ \Omega$.)

If smaller connection impedances are required, the load cell supply voltage can be reduced to 8 V with jumpers X20/X21. The load cells can then be connected with an internal resistance of $\geq 70\ \Omega$. (If load cells are connected in parallel, the total resistance must be $\geq 70\ \Omega$.)



With a reduced load cell supply voltage it is important to make sure that the permitted voltage range for the specified input voltage of the load connected is maintained (taking cable resistances into account). The accuracy of the weighing machines is reduced if the load cell supply voltage is reduced.

Mode switch S4	S4.4	ON	No monitoring of load cell supply voltage (measured on the sensor lines)
		OFF	Monitoring of the load cell supply voltage lower limit 7 V **Presetting: Monitoring**

4.2.3.3 Special resistors (→ Section 3.2.3.3)

4.2.3.4 Filtering (→ Section 3.2.3.4)

4.3 Interfaces (→ Section 3.3)

4.4 Service (→ Section 3.4)

4.4.1 Overview of the MAi error signal word 3 (→ Section 3.4.1)

4.4.2 Operating display (LED) (→ Section 3.4.2)

Physikalisch-Technische Bundesanstalt

Nur zur Information
Diese Unterlage wird
bei Änderungen nicht
ausgetauscht

(1) KONFORMITÄTSBESCHEINIGUNG

(2) PTB Nr. Ex-92.C.2009 X

(3) Diese Bescheinigung gilt für das elektrische Betriebsmittel:

Ex-i-Interface SIWAREX Si Typ WP-MEi

(4) der Firma Siemens AG
D-8510 Fürth

(5) Die Bauart dieses elektrischen Betriebsmittels sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Konformitätsbescheinigung festgelegt.

(6) Die Physikalisch-Technische Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 der Richtlinie des Rates der Europäischen Gemeinschaften vom 18. Dezember 1975 (76/117/EWG) die Übereinstimmung dieses elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

Elektrische Betriebsmittel für explosionsgefährdete Bereiche

EN 50 014:1977 + A1...A5 (VDE 0170/0171 Teil 1/1.87) Allgemeine Bestimmungen
EN 50 020:1977 + A1...A2 (VDE 0170/0171 Teil 7/1.87) Eigensicherheit "i"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen Prüfprotokoll festgelegt.

(7) Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen:

[EEx ib] IIC

(8) Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Bescheinigung aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich durchgeführt wurden.

(9) Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6. Februar 1979 (79/196/EWG) gekennzeichnet werden.

Im Auftrag

Braunschweig, 17.02.1992

Dr.-Ing. Schebstat
Regierungsdirektor

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT

Physikalisch-Technische Bundesanstalt

1. N A C H T R A G

zur Konformitätsbescheinigung PTB Nr. Ex-92.C.2009 X

der Firma Siemens AG
D-Fürth

Das Ex-i-Interface SIWAREX Si Typ WP-MEi darf künftig nach den unten aufgeführten Prüfungsunterlagen gefertigt und betrieben werden.

Die Änderungen betreffen die Lage des PAL-Anschlusses am Gehäuse, die Typenbezeichnung sowie ein neues 19"-Volleinschubgehäuse.

Die Bezeichnung lautet künftig:

Ex-i-Interface SIWAREX WPSi Typ MEi

Die "Elektrischen Daten" und die "Besonderen Bedingungen" gelten unverändert für diesen 1. Nachtrag.

Alle übrigen Daten bleiben unverändert.

Prüfungsunterlagen

1. Beschreibung (8 Blatt)
2. Zeichnung Nr. J31035-B0102-C001-A
   J31035-B0102-C002-A
   J31035-B0102-C004-A
   J31035-B0102-C005-A
   J31035-B0109-C001-A
   J31035-B0109-C002-A
   J31035-B0109-C003-A

unterschrieben am 07.04.1993

Im Auftrag

Braunschweig, 16.06.1993

Dr.-Ing. Schedat
Regierungsdirektor

[EEx ib] IIC

5 Remote Display (Option)

The remote display can be used to display measured values of the WPS(i) weighing processor.

The remote display comes with operating instructions. These operating instructions contain detailed information on the following subjects.

- Layout
- Functionality
- Technical specifications
- Installation
- Operation

Use these operating instructions to install and commission your remote display.

(4) J31037–D5603–U1–A0–7619

6 Ordering Data / Accessories

(4) J31037–D5603–U1–A0–7619

6 Ordering Data / Accessories

6.1 WPS(i) weighing processor

The WPS(i) weighing processor (packing unit) consists of:

- Measured value processing MP
- Measured value acquisition MA or measured value acquisition MAi (intrinsically safe)

Order number:

For operating temperature 0° to 55°C 7MH4 401–1AA00

For operating temperature –20° to 70°C 7MH4 401–1BA00

For operating temperature –10° to 70°C 7MH4 401–1EA00
(with intrinsically safe load cell supply)

6.2 Single components of the WPS(i) weighing processor

6.2.1 Measured value processing MP

Order number: 7MH4 405–1AA00

6.2.2 Measured value acquisition MA

Order number:

For operating temperature 0° to 55°C 7MH4 402–1AA00

For operating temperature –20° to 70°C 7MH4 402–1BA00

6.2.3 Measured value acquisition MAi (intrinsically safe)

Order number: For operating temperature –10° to 70°C 7MH4 402–1EA00

(4) J31037–D5603–U1–A0–7619

6.3 Accessories

6.3.1 Operating instructions for WPS(i) weighing processor

Order number:

In German C71000–B5900–C51

In English C71000–B5976–C51

6.3.2 SIWAREX (FB 40) function block (MS–DOS, 3.5")

Function block for data communication between the following:

Order number:

MP and PLC S5–115U 7MH4 811–1AS02
(CPU 941 to 945, CPU 941B to 945B)

MP and PLC S5–135U and MV and PLC S5–155U 7MH4 811–4AS02
(CPU 922, CPU 946/947/948)
CPU 928–3UA12,
CPU 928–3UB11)

6.3.3 Buffer battery for data memory (MP)

Type of battery: CR 2477, Lithium, 3 V

Order number: 7MH4 406–8AA

6.3.4 SIWAREX junction box

Order number: 7MH4 710–1AA

6.3.5 Remote display with RS 422 connection

Order number:

Front panel size 144 mm x 72 mm 7MH4 504–8BA
(Digit height 20 mm)

Front panel size 96 mm x 48 mm 7MH4 504–8BB
(Digit height 14 mm)

6.3.6 Interface cable prepared (including connector and wire end bushings)

Order number: Standard length 2.5 m for

MP (X7) for MA (X7) 7MH4 407–8CA0
MP (X7) for MAi (X7) 7MH4 407–8CB0
MP (X6) digital/pulse output 7MH4 407–8CC0
MP (X3) for remote display 7MH4 407–8CD0
MP (X5) analog input/output 7MH4 407–8CE0

Special lengths from 1 m to 999 m
(When ordering the additional specification of Z is for the cable length.)

MP (X7) for MA (X7) 7MH4 407–8DA0–Zxxx
MP (X7) for MAi (X7) 7MH4 407–8DB0–Zxxx
MP (X6) digital/pulse output 7MH4 407–8DC0–Zxxx
MP (X3) for remote display 7MH4 407–8DD0–Zxxx
MP (X5) analog input/output 7MH4 407–8DE0–Zxxx

6.3.7 Interface cable mounting kit

The mounting kit consists of the connector kit and an optional cable to be ordered.

☞ Notes on the MP to MA connection (Internal/external 24 V supply → section 3.2.2.3)
Notes on the MP to MAi connection (Internal/external 24 V supply → section 4.2.2.3)

6.3.7.1 Connector kit

Order number: 7MH4 407–8AA0

The connector kit contains the following:

- 15 way sub D (pin) for MP (X7) connection to MA(i)
- 25 way sub D (pin) for MP (X6) digital outputs, pulse counter
- 9 way sub D (pin) for MP (X3) connection to remote display
- 9 way sub D (socket) for MP (X5) analog input/output
- 2 way terminal block for MA(i) (X4) 24 V supply

 (4) J31037–D5603–U1–A0–7619

6.3.7.2 Cable types

Order number:

MP to MA(i) 7MH4 407–8BA0
Cable type LiYCY, 6 x 2 x 0.25 mm^2

Digital signals 7MH4 407–8BC0
Cable type LiYCY, 8 x 0.25 mm^2

MP to remote display 7MH4 407–8BD0
Cable type LiYCY, 4 x 2 x 0.25 mm^2

Analog signals 7MH4 407–8BD0
Cable type LiYCY, 4 x 2 x 0.25 mm^2

Connection of MAi to the junction box 7MH4 702–8AA
(→ Section 4.2.2.4)

Suggested cables for external, 24 V supply of the MP

LiYCY, 2 x 1.0 mm^2
or
LiYY, 2 x 1.0 mm^2
(2 x 0.5 mm^2 for short distances up to 4 m)

Suggested cables for external, 24 V supply of the MA/MAi

LiYCY, 2 x 1.0 mm^2
(2 x 0.5 mm^2 for short distances up to 4 m)

6.3.8 Software package for commissioning and servicing (MS–DOS, 3.5")

Order number:

for SIMATIC S5
for PLC S5–135U and for PLC S5–155U ... 7MH4 811–4ES02
(CPU 922, 928, 928B)
with CP 527

6.3.9 Mixing control (MS–DOS, 3.5")

Order number:

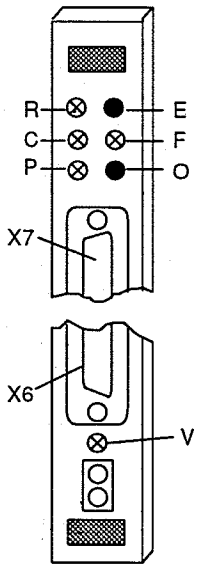
PLC S5–135U and PLC S5–155U 7MH4 811–4GS01
(CPU 928, 928B, 946/947, 948)
in connection with CP527/528 and CP524/525

7 Error Diagnostics

(4) J31037–D5603–U1–A0–7619

7 Error Diagnostics

On the front panel of the MP there are 7 LEDs used for monitoring and error diagnostics.



R = RUN (green)

C = COARSE (green)

P = PULSE/standstill display (green)

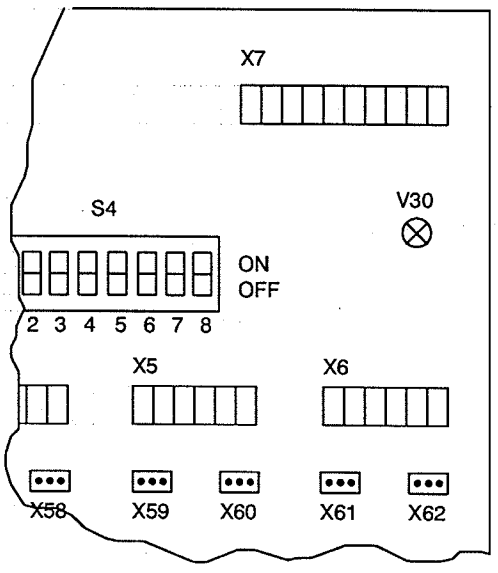
F = FINE (green)

E = ERROR (red)

O = OVERLOAD (red)

V = POWER (green)

On the board of the MA and the MA(i) there is a green LED (V30) beneath the X7 interface. This can display various states (off/flashing/momentarily off/on). The LED can only be seen when the housing cover of the MA or MA(i) is removed.



LED V30 states

–	OFF	Supply voltage missing
–	FLASHING	Module signals error or module not parameterized
–	OFF (brief)	Calibration running
–	ON	Operation without error

A rough diagnosis of errors can be made using these LEDs. A precise diagnosis can only be made using the user program and the programmable controller.

(4) J31037–D5603–U1–A0–7619

7.1 Error list LEDs

State	Possible cause	Remedy
All LEDs off	– No supply voltage	• Switch on supply voltage • Check and if necessary make connections
	– Function fault in the MP	• See user program
LED R flashing	– No valid adjustment performed	• Perform adjustment
LED E on LED R off	– Error detected and signalled	• See user program (error words)
LED O on	– Weighing machine overfilled (upper limit, weight or volume exceeded)	• Empty weighing machine • Change values • Delete volume
LED V off (MP)	– External 24 V supply voltage missing	• Check connections and switches
	– Supply voltage wrongly connected	• Connect correctly
LED V30 off (MA or MAi)	– Supply voltage missing	• Check or make internal supply connection to MP (LED V on MP must be on) • Check external supply, connection
LED V30 flashing	– EPROM error – RAM error – Upper measuring range limit violated – Lower measuring range limit reached – Reference voltage error – Internal control loop fault – Set temperature range exceeded – Internal calculation error – Calibration straight line outside tolerance – Interrupt connection to MP (only on start–up)	• Which of these errors has occurred during cyclic measuring operation can be seen from error word 3 via the S5 interface. • All error states, except for watchdog errors, are automatically reset by the MA itself when the error conditions are no longer fulfilled. • All error signals must be acknowledged by the PLC via the interface to the MP.
	– Plant parameters incompletely or incorrectly set.	• Change, complete parameter setting
	– Watchdog errors	• Inspect error word 3 • Can only be reset by briefly interrupting power supply
LED V30 on, (operation without error) but module is not functional	– EPROM not inserted	• Insert EPROM and start up system
	– Micro–processor not inserted	• Insert micro–processor and start up system

7.2 Error list data words

7.2.1 Job status III (errors)

DW	Description	Possible cause
26	– Job status III for proportioning commands ERROR	• Error (see error words) • Mode (DW 3) incorrect • Set values incorrect or incomplete
28	– Job status III for adjustment commands ERROR	• Error (see error words) • Mode (DW 3) incorrect • Set values incorrect or incomplete
31	– Job status III for write data ERROR	• Mode incorrectly selected (DW 3) • Data entered are incorrect or incomplete • Frames 9 ... 12 were not written together

7.2.2 Error words

DW	Bit	Description	Cause
Error word 1 DW 72 All error signals in this data word must be acknowledged On acknowledgement all error words are cleared	0	Interface to MA faulty [1]	• A fault in communication can be caused by a wire break in the connection cable in the MP and MA or by a failure in the MA itself
	1	Wire break analog input [2] (only for 4–20 mA)	• If the analog input is in 4 – 20 mA mode and the measured value at the analog input drops below 2 mA, this fault signal is output.
	2	Fault in external voltage supply [1]	• Error in external voltage supply This bit is set if the external 24 V voltage supply on the MP (X4) fails or is incorrectly connected.
	3	Short circuit / overload at the digital outputs [1]	• The digital outputs are overloaded or short–circuited.
	4	Module error [2]	• This bit is set if errors occur whose cause cannot be clearly identified (e.g. impermissible EMC interference that affect the error word briefly).
	5	Watchdog responded [2]	• If errors occur in the program execution, the watchdog can reset the processor of the MP.
	6	EPROM error MP [2]	• The program code stored in the EPROMS is monitored using a checksum. When the MP module has been reset, the current checksum is calculated and compared with a checksum stored on the EPROM. This bit is set if the checksums do not agree.
	7	RAM error MP [2]	• The backed up data memory of the MP is complete when the module is started up and each byte is checked for physical function during operation. This bit is set if errors are detected.
	8	Interner firmware error	• This bit is set if a calculation error occurs during calculation by the MP of internal values (count overflow, division by 0, ...).

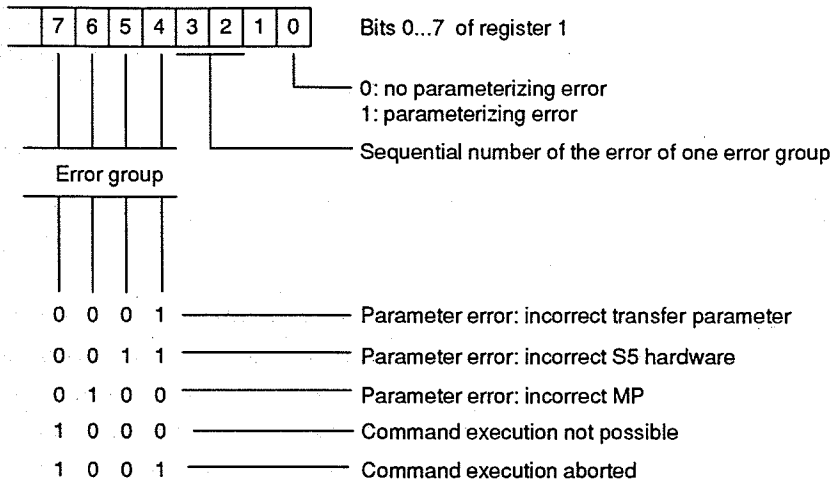
1) Error must be remedied so that proportioning can be continued.
2) On receiving an acknowledgement the weighing processor continues. The error is only signalled again when the module starts up again (reset).

DW	Bit	Description	Cause
Error word 2 DW 73 On acknowledgement all error words are cleared	0	Setpoint is currently not accepted	• This bit is set if frame 0 (setpoint) is transferred to the MP at the wrong moment (→ Section 2.5.3.5).
	1	Setpoint not plausible. The setpoint is checked for plausibility after a start command (DW 8, bits 5...10).	• Setpoint must be larger than 0. • Proportioning with setpoint must not cause overfilling of the weighing machine or of the container to be filled (deduction weighing). • Setpoint must be larger than the fine cut–off value (DW 46, 47). • In deduction weighing, setpoint must be smaller than the gross weight. This bit is set if one of the above conditions is not fulfilled.
	2	Zero not plausible	• This bit is set if the zero is no longer within the permitted limits (→ Section 2.5.2.3).
	3	Resetting area zero offset exceeded	• This bit is set if the zero has left the set range because of the automatic zero point offset (→ Section 2.5.2.4).
	4	Tare value not plausible	• This bit is set if the value set in DW 48, 49 is not plausible (→ Section 2.5.3.4).
	5	Material flow monitoring	• This bit is set if an interruption of the material flow is detected (→ Section 2.5.3.12).
	6	Overflow pulse counter	• This bit is set if the pulse counter has violated the count range 65535 (16 bit counter).
	10	Adjustment error (weight)	• This bit is set if an error is detected in processing the adjustment weights (→ Section 2.5.2).
	11	Adjustment error (data)	• This bit is set if an error is detected in frame 13 adjustment digits (e.g. spacing of the adjustment digits < 1000d).
	12	Volume limit exceeded	• This bit is set if one of the set limits (DW 150...153) is exceeded during volume calculation (→ Section 2.5.3.11).
	13	Overfill value exceeded	• This bit is set if the gross weight exceeds the overfill value set in DW 146/147 (→ Section 2.5.3.10).
	14	Overfill output active	• This bit is set if overfilling occurs that is caused either by the weight or by the volume. The overfill output (pins 4 and 6) is set (→ Sections 2.5.3.10 and 2.5.3.11).
	15	Fault	• This bit is always set if a fault occurs. The fault that has occurred can be seen in DW 72 or DW 74.
Error word 3 DW 74 All error signals in this frame must be acknowledged. On acknowledgement all error words are cleared.	0	EPROM error (MA)	• The program memory of the MA is monitored with a checksum. After resetting (start–up in cyclic operation) a checksum is calculated that is compared with the checksum stored in the program memory. This bit is set if the two checksums are not the same.
	1	RAM error (MA)	• The internal RAM memory of the MA processor is cyclically checked for correct functioning. This error bit is set if a function error is detected.
	2	Overload	• If the load cells are overloaded, the measuring signal can become so large that the measuring area of the MA is exceeded. In that case this bit is set.
	3	Lower measuring limit violated	• This bit is set if the lower measuring limit of the MA is reached, for example, by tensile load on the weighing machine.

DW	Bit	Description	Cause
	4	Reference voltage error	• "Reference voltage error" is set if the MA has detected a fault in the power supply of the load cells. Check the connection of the supply and sense lines.
	5	Measuring loop fault	• This bit is set if an error is detected in the MA.
	6	Watchdog error (MA)	• This bit is set if the watchdog of the MA has responded. The cause can be a fault in the program execution of the MA, for example.
	7	Calibration running	• The measuring circuit of the MA is "measured" at intervals of approximately 2 minutes, i.e. correction factors are calculated that enable detection of changes in the measuring circuit (e.g. temperature drifts). During measurement of the correction factors, the measured value (DW 80) is maintained at its last value
	8	Sensor adaptation not performed	• The MA is set to the appropriate weighing cell parameters by specifying the plant parameters (frame 12), i.e. the plant parameters are transferred from the MP to the MA. This bit is set if a fault occurs during adaptation. Remedy: Check frame 10 and transfer it again.
	9	Temperature range exceeded	• There is a temperature sensor on the MA that measures the internal temperature. This bit is set if the permissible temperature range is exceeded.
	10	Number range exceeded	• This bit is set if a number range overflow occurs during calculation of the digit actual value in the MA.
	11	Calibration straight line outside tolerance	• During calibration of the MA a check is made to see whether the calculated correction values are within plausible limit. If this is the case, this bit is set (→ DW 74, bit 7)
	13	General error MA	• This bit is set if the MP detects incorrect behavior on the part of the MA, e.g. the response to an instruction is not received within a certain time.
	15	Wire break load cells	• This bit is set if a wire break is detected in the load cell connections. • This signal can occur on changes in the plant parameter DW 162 to DW 164, because these words are required for wire break monitoring. Wire break monitoring can be switched off (DW 172, bit 14).
		Wire break signal cannot be acknowledged	• Values in frame 10 were changed. Check the data and transfer the weighing machine parameters again if necessary. • If a change is required in the plant parameters in frame 10 DW 162 to DW 164, complete adjustment of the module must be carried out; command: "clear weighing machine parameters"
Status word 1 DW 77	2	Proportioning operation was terminated with error	• This bit is set if a proportioning operation is aborted, i.e. not correctly terminated.

 (4) J31037–D5603–U1–A0–7619

7.3 Error list FB 40



List of the error signals from FB 40	
Bits 0...7 in ACCUM 1	Meaning
13H	An impermissible number of the SIWAREX data block was given as the input parameter
17H	The SIWAREX data block with the specified number is either too short or does not exist.
31H	The FB 40 does not match the CPU of the PLC.
43H	The SIWAREX DB does not contain an interface number for the MP.
45H	No MP is addressed by the interface number specified in the SIWAREX DB
82H	The WPS(I) weighing processor is not ready or the MP is assigned to another CPU.
84H	The WPS(I) weighing processor is not functioning. No response was received to a command within the time–out.
86H	Identification for startup of the module missing in SIWAREX DB. The SIWAREX S must be re-started (software reset)
90H	Startup of the WPS(i) weighing processor has interrupted command execution. The data received might be incorrect.

List of acknowledgements from the weighing processor	
Bits 8...15 in ACCUM 1	Meaning
80H	All commands and data were received or sent
83H	Commands were not executed because start–up was triggered.

FB 40 signals implausible error

Example: error code 17, although DB o.k.
Cause: selected FB 40 does not match CPU

Abbreviations

BASP	–	Output disable
CPU	–	Central processing unit
DB	–	Data block
DW	–	Data word
EBC	–	Equipotential bonding conductor
ESD	–	Electrostatically sensitive device
EU	–	Expansion unit
FB	–	Function block
FCF	–	Fine flow compensation factor
GND	–	Ground
JD	–	Adjustment digit
JG	–	Adjustment weight
KS	–	Clamp
LC	–	Load cell
MA	–	Measured value acquisition
MAi	–	Measured value acquisition (intrinsically safe)
MK	–	Mantle clamp
MP	–	Measured value processing
MTBF	–	Mean time between failures
NAU	–	Power failure
OG	–	Upper limit
PLC	–	Programmable logic controller
PS	–	Power supply
RLO	–	Result of logic operation
SPS	–	Standard plug–in station
SW	–	Software
UG	–	Lower limit
WPS	–	Weighing processor system
WPS(i)	–	Weighing processor system (intrinsically safe)

(4) J31037–D5603–U1–A0–7619

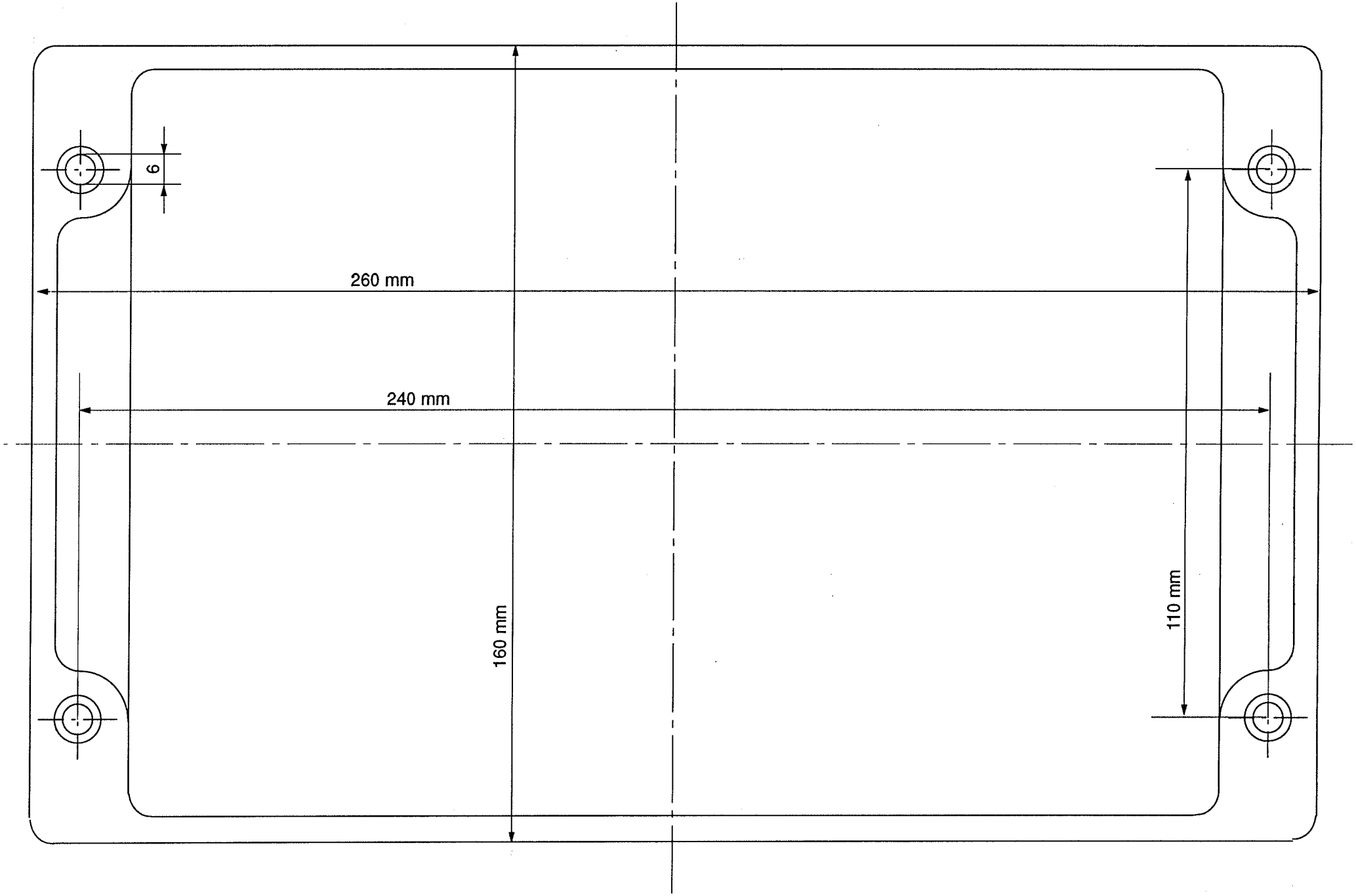
Index of Figures

Index of Tables

WPS(i) Oper. Instr.
(4) J31037–D5603–U1–A0–7619

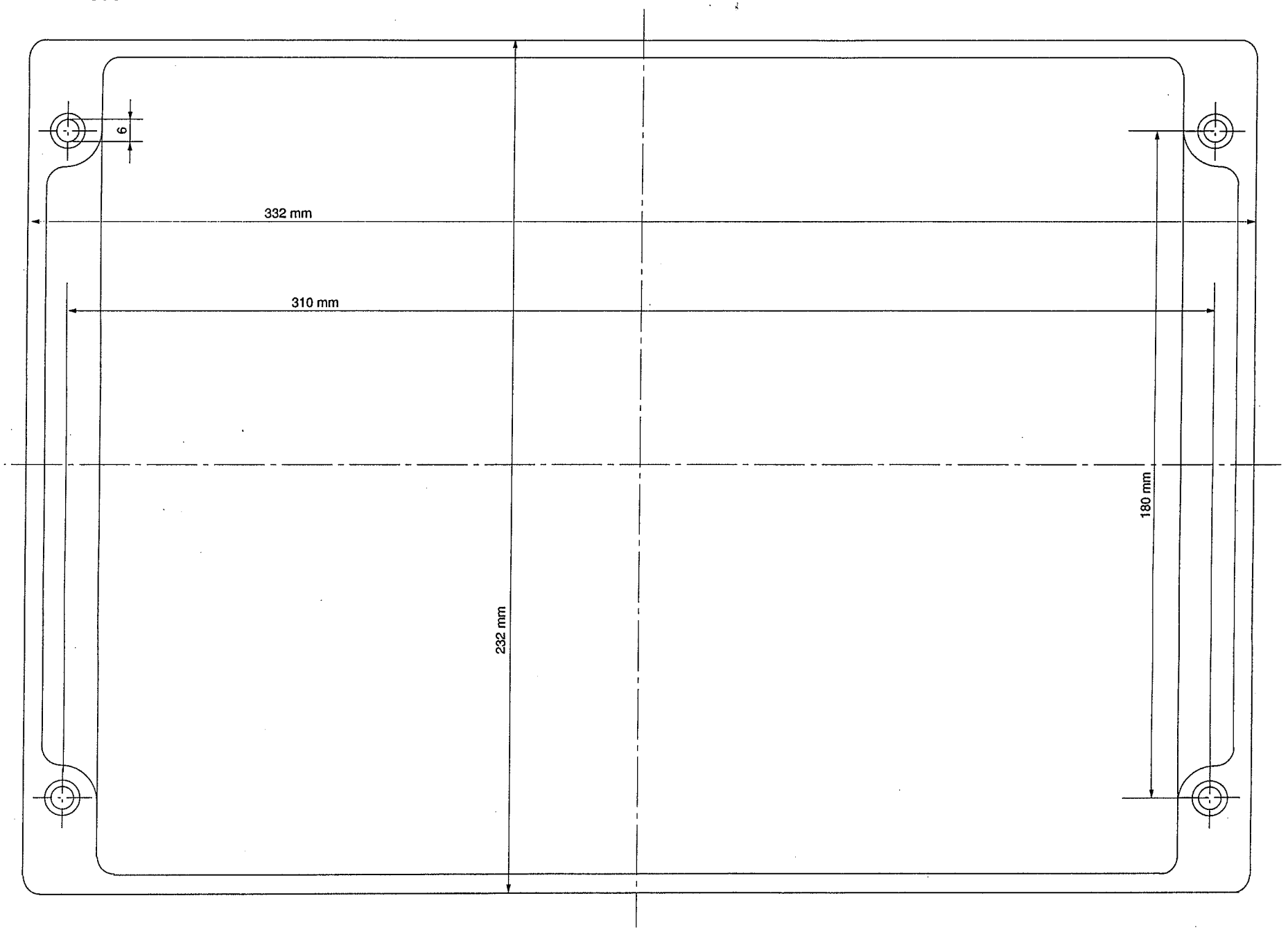
Drilling jig MA

(Scale



Drilling jig MAi

(Scale 1:1)



Index

(4) J31037–D5603–U1–A0–7619

D

E

F

G

I

J

L

M

N

O

P

R

S

T

V

W

Z

