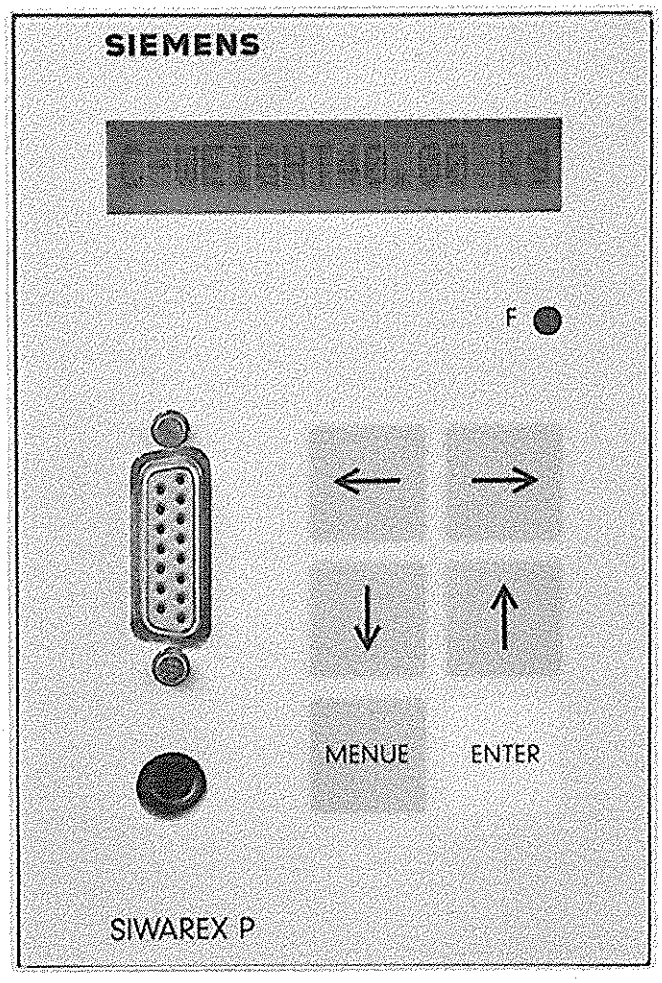
SIEMENS

SIWAREX P
7MH4205-... Load and Force Measuring System

Operating Instructions 03/97 B



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Operating Instructions

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1 Short Description

1.1 General

The SIWAREX P is a measurement system designed for industrial applications. It can be used for many tasks in the area of weight and force measurement.

Several possible applications:

- Capacity measurement of storage containers such as silos and bins
- Measurement of load on cranes (overload protection)
- Measurement of belt tension for conveyor belts
- Load measurement systems for railroads

The SIWAREX P can be used as a stand–alone system or as a subsystem integrated into decentrally structured automation concepts (via TTY or SIMATIC S5–100U bus interface). Using the SIMATIC S5–100U bus, the SIWAREX P can be combined with a SIMATIC S5–90U/95U/100U and additional submodules such as analog and digital modules. For example, a bus link to the SINEC L1 (slave) can be implemented with SIMATIC 115U systems when CPUs 102 and 103 are used. Integrated wire break monitoring immediately indicates an interruption of the feed and/or measuring line of the load cells.

⚠ 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.

(4) J31069–D0607–U001–A2–7618

1.2 Mechanical Setup

SIWAREX P

The measuring system is contained in a double–width housing of the SIMATIC S5–100U series.

After the bus submodule is snapped on to 35–mm standard rail, the measuring system can be hung in the top of the bus submodule and inserted.

If load cells are to be connected in an explosive area, an intermediate box which acts as an interface outside of the explosive area can be used to connect the measuring system.

The ribbon cable of the bus submodule provides the connection with the SIMATIC S5–90U/95U/100U (only for models with bus interface).

Several modules can be installed horizontally next to each other. When an AC 115 V or 230 V power supply is used, an additional module (i.e., PS 931) must be installed on the standard rail in addition to the measuring system.

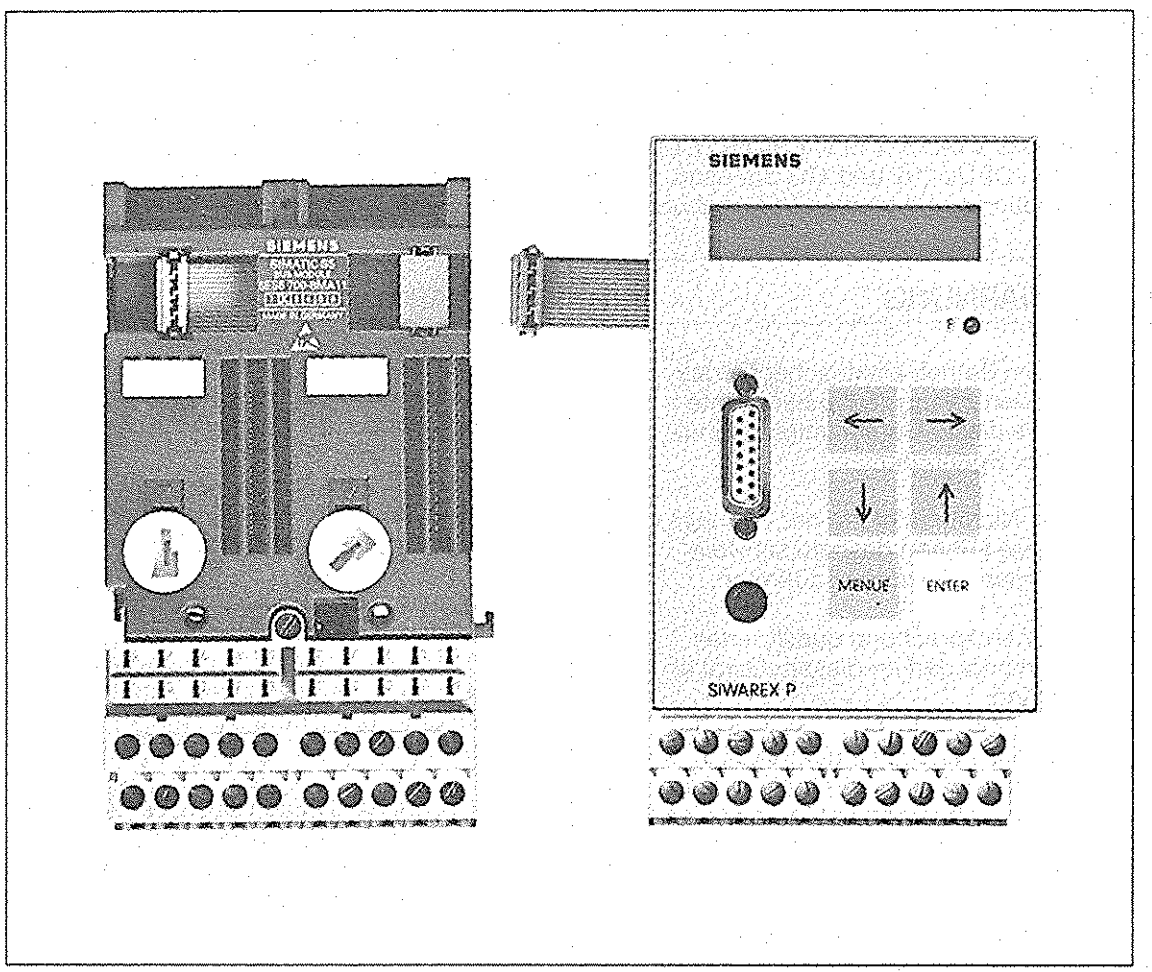


Figure 1.1 SIWAREX P with bus submodule

Indicator/operating elements and interfaces on the front panel

- LC display (1 line/16 characters)
  Depending on the operating mode, menu functions, parameterization data, measuring data or error messages are indicated on the display.
- Key field (6 keys for the selection of menus and parameterization)
- Error LED (red), lights up for various error messages
- The TTY interface (X1) for data communication with an external computer is located next to the key field on the front panel (15–way, sub D plug connector).
- Power is supplied via the righthand terminal block of the bus submodule (terminals 8, 9, 10).
- The relay inputs/outputs (monitoring of limit values and functions) are also located on the righthand terminal block of the bus submodule.
- The analog output of the module and the connections of the load cells are applied on the left-hand terminal block of the bus submodule.
- The ribbon cable of the bus submodule is used to connect the SIMATIC S5–100U bus with the CPU of the SIMATIC S5–90U/95U/100U.

Terminal Box

A set of instructions (C71000–T5964–C19) is included when the SIWAREX terminal box is ordered.

Intermediate Box

A set of instructions (C71000–T5974–C29) is included when the intermediate box (Ex–I–Interface) is ordered.

1.3 Electrical/Electronic Setup

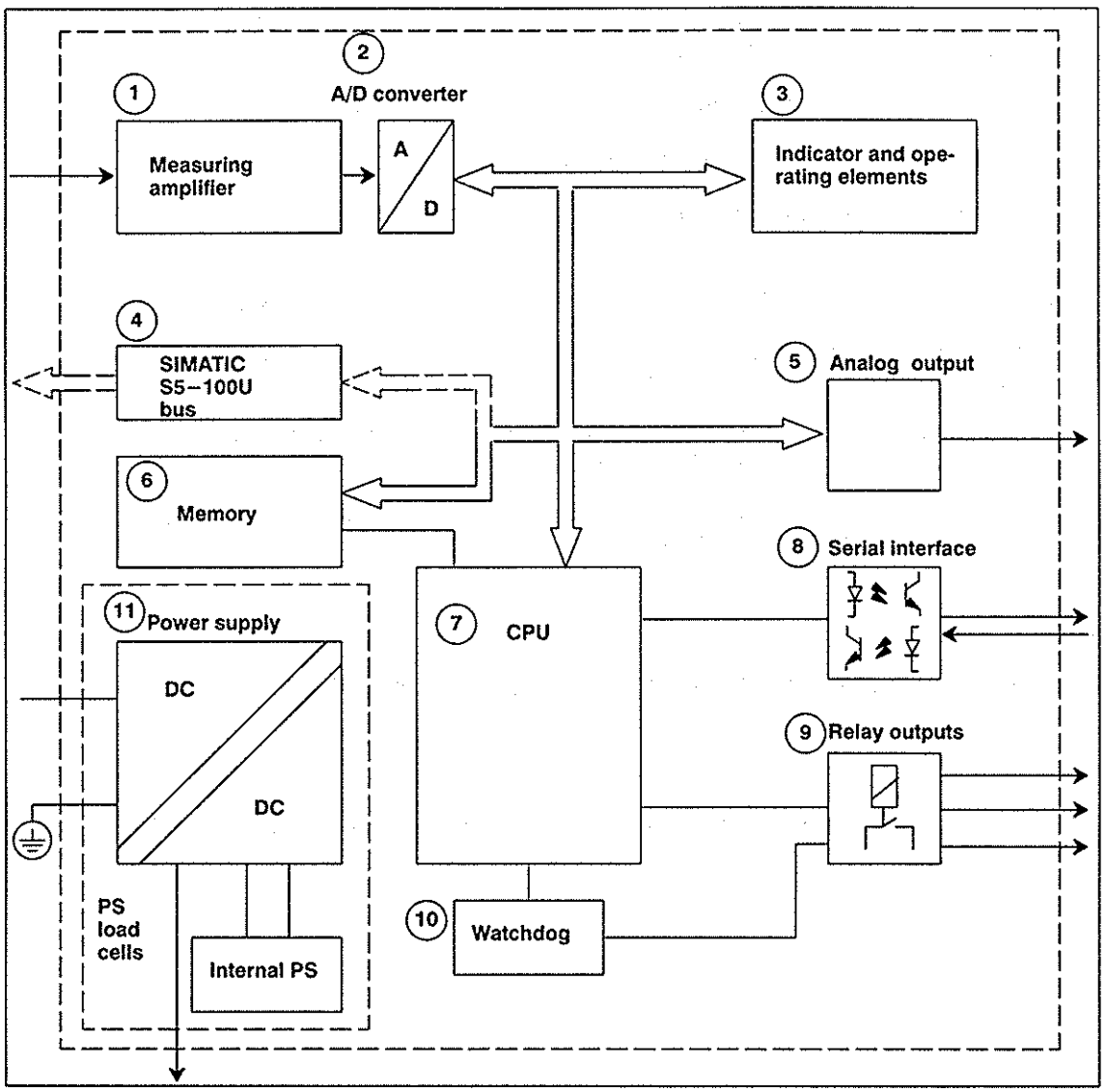


Figure 1.2 Block circuit diagram of the SIWAREX P

(1) The measuring value amplifier picks up the high–ohm measuring signal on the LC. An integrated low pass filter filters out high–frequency interference on the measuring lines.

(2) The measured value is converted to a digital value with an analog digital converter. The resolution of the ADC is 20,000 stages plus sign.
The feed voltage of the load cell is used as the reference voltage for the ADC.

(3) 16–position LC display and 6 keys

(4) SIMATIC S5–100U interface (only for model 7MH4205–1AC01)

(5) Analog output with 10–bit DAC (0–20/4–20) mA

(6) Memory: EEPROM – Memory for parameterization data
EPROM – Program memory

(7) The CPU 80C31 coordinates the following:
- Measured value processing
- Measured value output
- Measured value transfer
- Parameter input/storage
- Interface handling (TTY/SIMATIC S5–100U / limit value outputs)

(8) TTY interface with electrical isolation (opto–electronic)

(9) 2 Relay outputs for min/max values and function monitoring

- The relay outputs (break) are closed during normal operation.
- The applicable relay outputs are open when the min/max values are exceeded or passed below.
- Both relay outputs are opened when function errors occur.

(10) Watchdog and voltage monitoring
The red error LED goes on if errors occur during the program or if the supply voltage is incorrect.

(11) The power supply is electrically isolated.
Input: +24 V DC Output: +10 V DC
± 5 V DC
±15 V DC

1.4 System Setup

A single load cell can be directly connected to the SIWAREX P.

Caution

Connect only load cells with characteristic values from 1.0 to 3.0 mV/V.

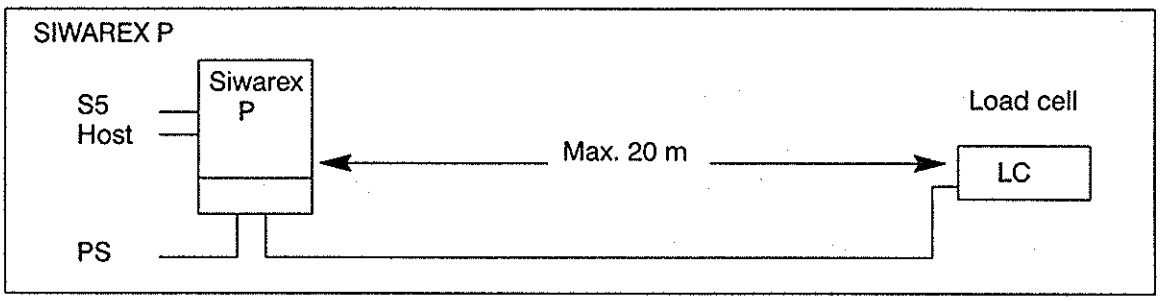


Figure 1.3 Connection of a load cell

Terminal box 7MH4710–1AA must always be used if more than one load cell is connected.

Caution

When several load cells are connected in parallel, only those with the same nominal load values and the same internal resistance values can be used.

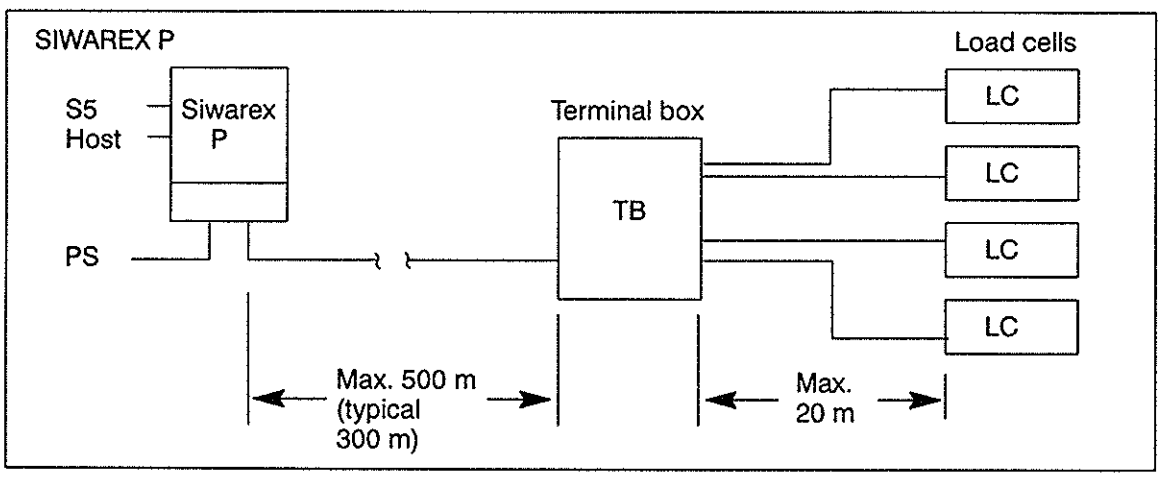


Figure 1.4 Connection of several load cells

When load cells are used in areas in which there is a danger of explosion, an intermediate box is required which is the interface between the SIWAREX P measuring system and the load cells or the terminal box.

> **Caution**
>
> Saftey in potentially explosive areas is not guaranteed unless the setup guidelines included with the IB are adhered to.

The intermediate box (7MH4710–5AA) is equipped with 6 safety barriers.

The combination of SIWAREX P and intermediate box is called SIWAREX Pi

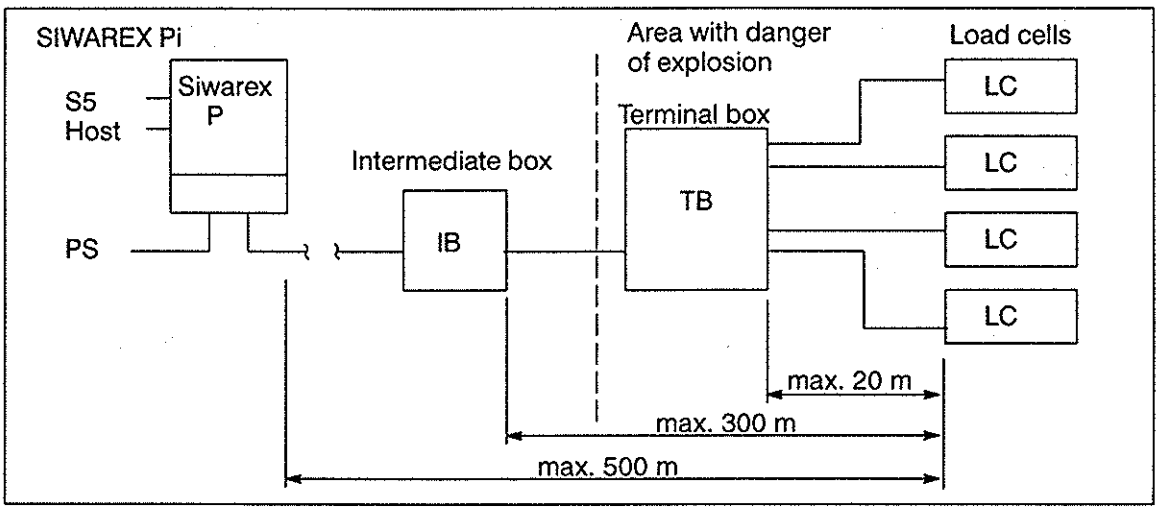


Figure 1.5 Connection of several load cells (intrinsically safe)

1.4.1 General Setup Guidelines

Remember the following points when setting up the SIWAREX P:

a) A main switch (see ① of figure 1.6) must be provided in accordance with VDE 0100 regulations for the load electronics (and, if present, for the programmable controller consisting of CPU and periphery).

b) If the stub lines are not longer than 3 m and grounded and short circuit proof, the power connection for the weighing electronics and/or the programmable controller does not require additional safety measures (see ② of figure 1.6).

c) For ungrounded operation (figure 1.9), the standard rail of the programmable controller must be capacitively connected with the protective conductor (i.e., diversion of high–frequency interference).

d) Connection of the load electronics to the central grounding point is always performed on terminal 4 (lefthand slot of the bus submodule) and terminal 8 (righthand slot of the bus submodule).

e) It is absolutely mandatory that the shield be applied to the central grounding rail in the switching cabinet.

Caution

The SIMATIC S5 setup guidelines must be adhered to unless other instructions are explicitly stated.

1.4.2 Setup as Stand–Alone Device

SIWAREX P System (Standard Model)

- Grounding
  The standard profile rail is connected to the ground conductor (PE) and acts as a central grounding point. The grounding terminals of the power supply and terminals 4 (bus submodule, left) and 8 (bus submodule, right) are connected to the rail.

- Shielding
  The shield of the analog output is connected to terminal 3 (bus submodule, left), and the shield of the measuring line to the load cell(s) is connected to terminal 4 (bus submodule, left).

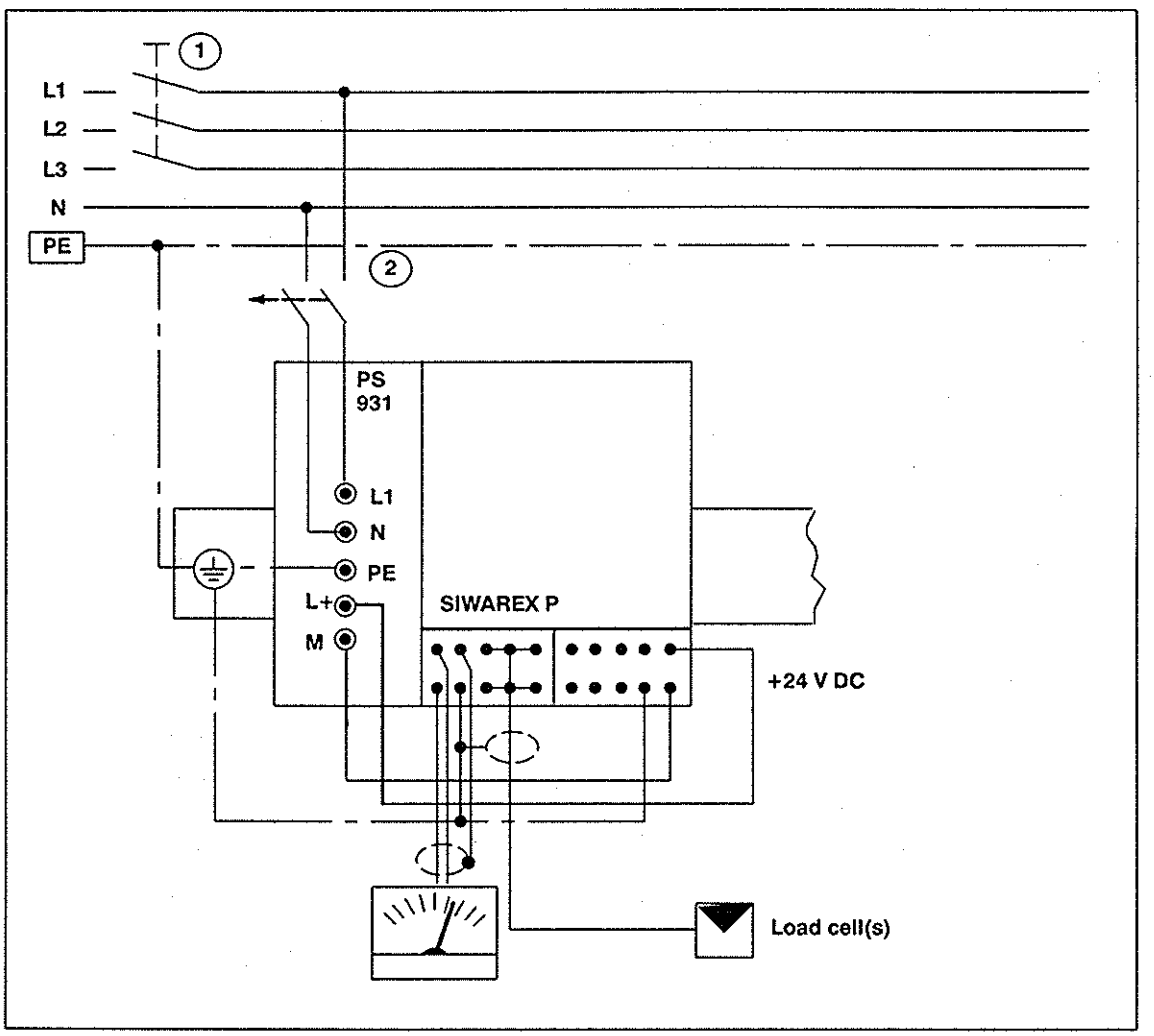


Figure 1.6 SIWAREX P as a stand–alone device (standard model)

SIWAREX Pi System (Model for Explosion Endangered Areas)

- Grounding
  The standard profile rail is connected to the protective conductor (PE). The grounding terminal of the power supply and terminal 4 (bus submodule, left) are connected to the standard profile rail. Terminal 8 (bus submodule, right) is also connected with the standard profile rail.

- Shielding
  The shield for the lines of the analog output are applied to terminal 3 (bus submodule, left).

  The shield for the signal lines between SIWAREX P and IB is applied to SIWAREX P terminal 4 (bus submodule, left).

Do not apply the shield to the intermediate box!

The shield for the signal lines from the IB to the load cells is applied to the IB. EBC (equipotential bonding) is used as the shield potential with wich the IB is connected (see description of the intermediate box for details on the EBC connection concept).

This shield is applied to the intermediate box!

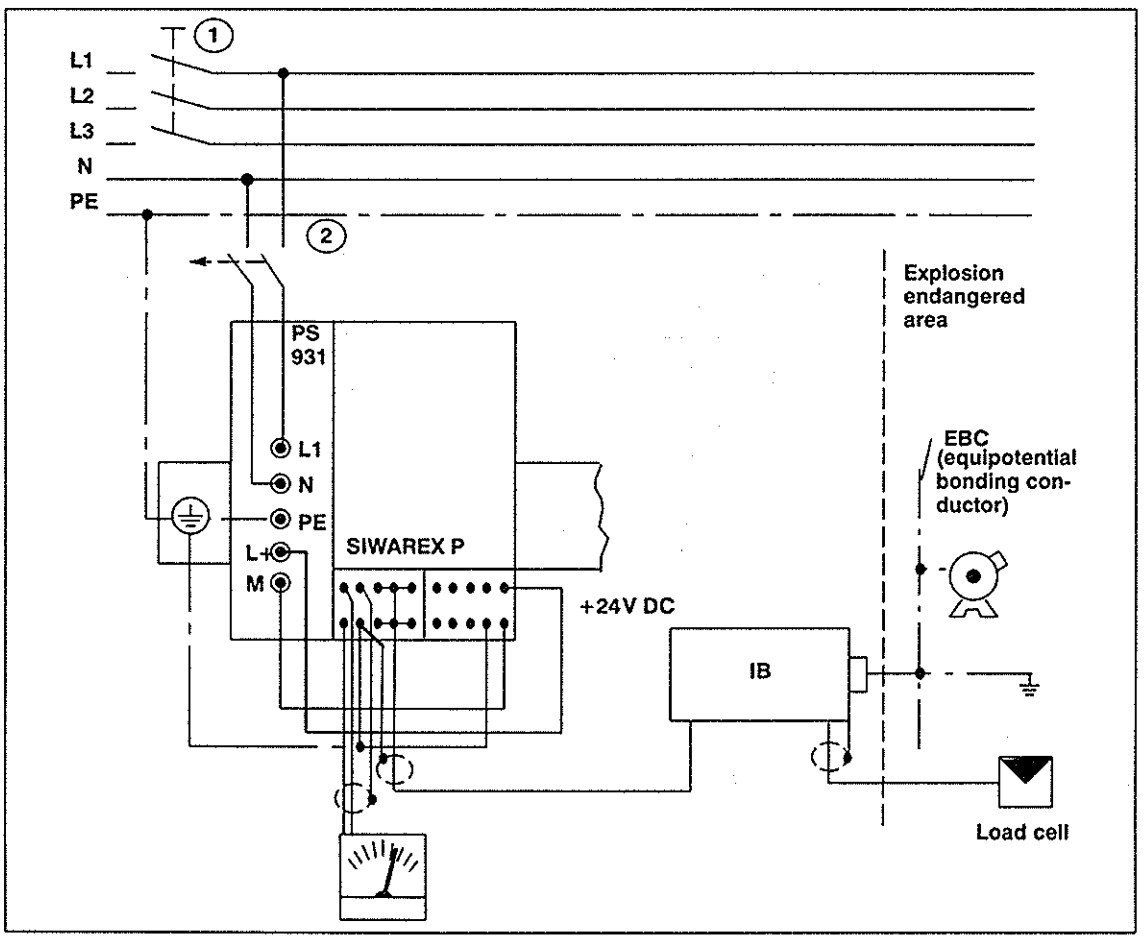


Figure 1.7 SIWAREX Pi as stand-alone device (model for explosion endandered areas)

1.4.3 Setup with Programmable Controller (SIMATIC S5–90U/95U/100U)

SIWAREX P System (Standard Model)

A) Grounded Operation

- Grounded
  The standard profile rail is connected to the grounding conductor PE and acts as the central grounding point. The grounding terminals of the power supply PE, the grounding terminals of the CPU and terminals 4 (left) and 8 (right) of the SIWAREX P measuring system are connected to the profile rail.

- Shielding
  The shield of the analog output is connected to terminal 3 (left) and the shield of the measuring line to the load cell(s) is connected to terminal 4 (left).

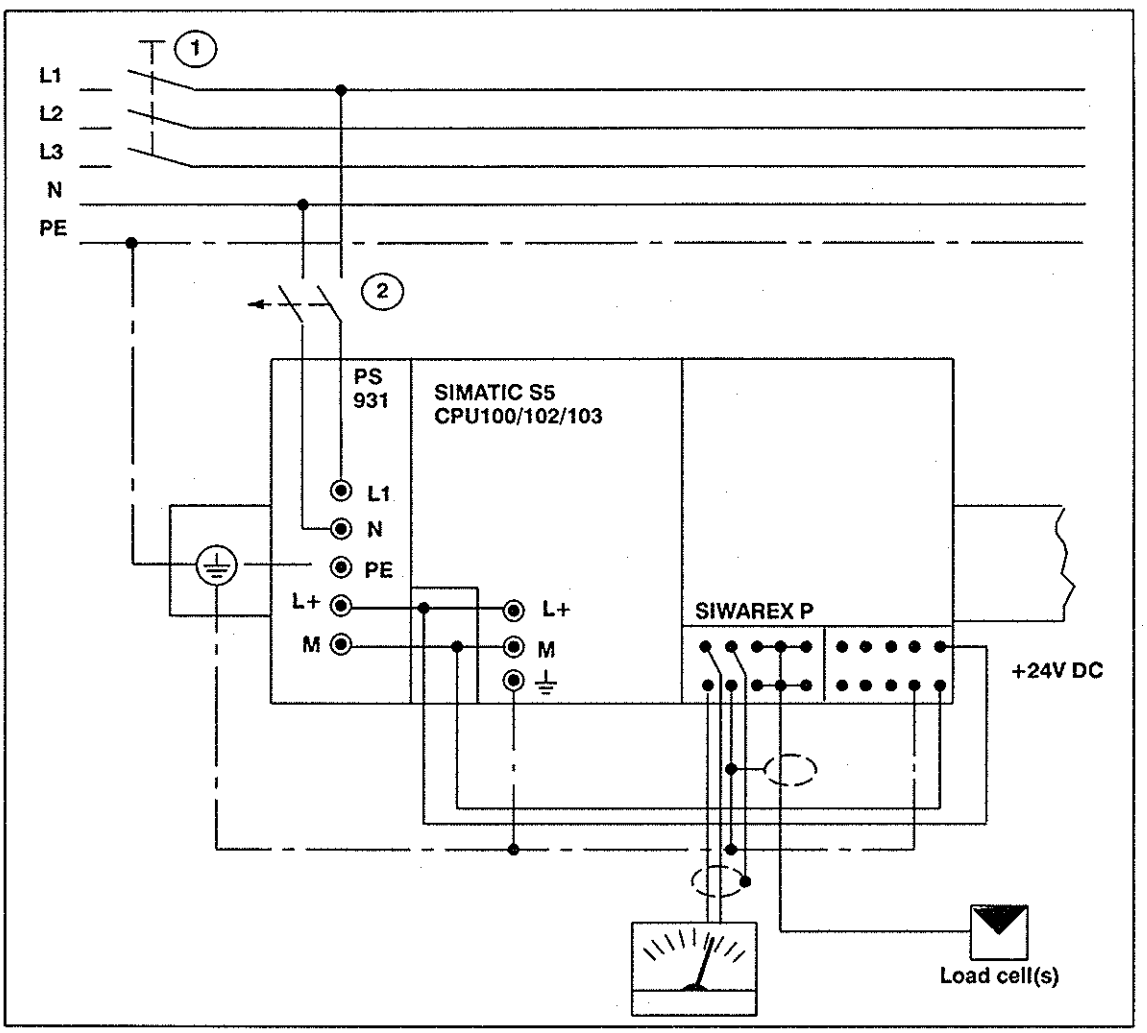


Figure 1.8 SIWAREX P with SIMATIC S5–100U (connected with ground)

B) Ungrounded Operation

- Grounding
  The protective conductor connection of the power supply and terminals 4 (left) and 8 (right) of the SIWAREX P measuring system are connected with PE. The standard profile rail is connected to PE with a high–ohm resistor (100 kΩ) to divert static charges. Interference voltages are diverted to the protective conductor (PE) with a capacitor (1 µF). The CPU is connected with the protective conductor connection of the standard profile rail.

- Shielding
  The shield of the analog output is connected to terminal 3 (left) and the shield of the measuring line to the load cell(s) is connected to terminal 4 (left).

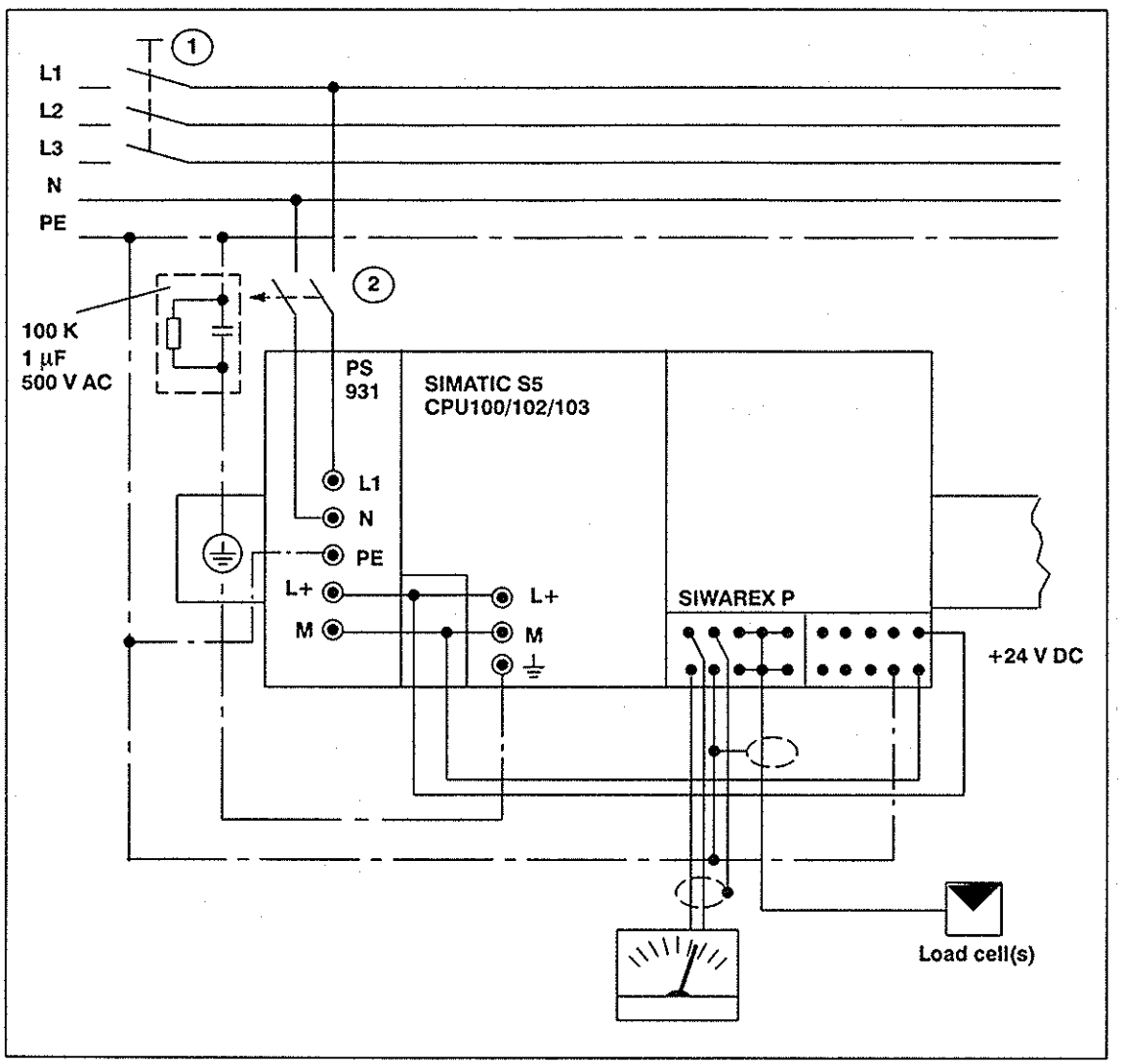


Figure 1.9 SIWAREX P with SIMATIC S5–100U (ungrounded)

SIWAREX Pi System (Model for Explosion Endangered Areas)

A) Grounded Operation

- Grounding
  The standard profile rail is connected to PE. The power supply is connected with the protective conductor via the PE terminal. The ground terminal of the CPU is connected with the EBC. Terminals 4 (left) and 8 (right) of the SIWAREX P measuring system are connected with the PE.

- Shielding
  The shield for the lines of the analog output are applied to terminal 3 (bus submodule, left).

  The shield for the signal lines between SIWAREX P and IB is applied to SIWAREX P terminal 4 (bus submodule, left).

Do not apply the shield to the intermediate box!

The shield for the signal lines from the IB to the load cells is applied to the IB. EBC (equipotential bonding) is used as the shield potential with wich the IB is connected (see description of the intermediate box for details on the EBC connection concept).

This shield is applied to the intermediate box!

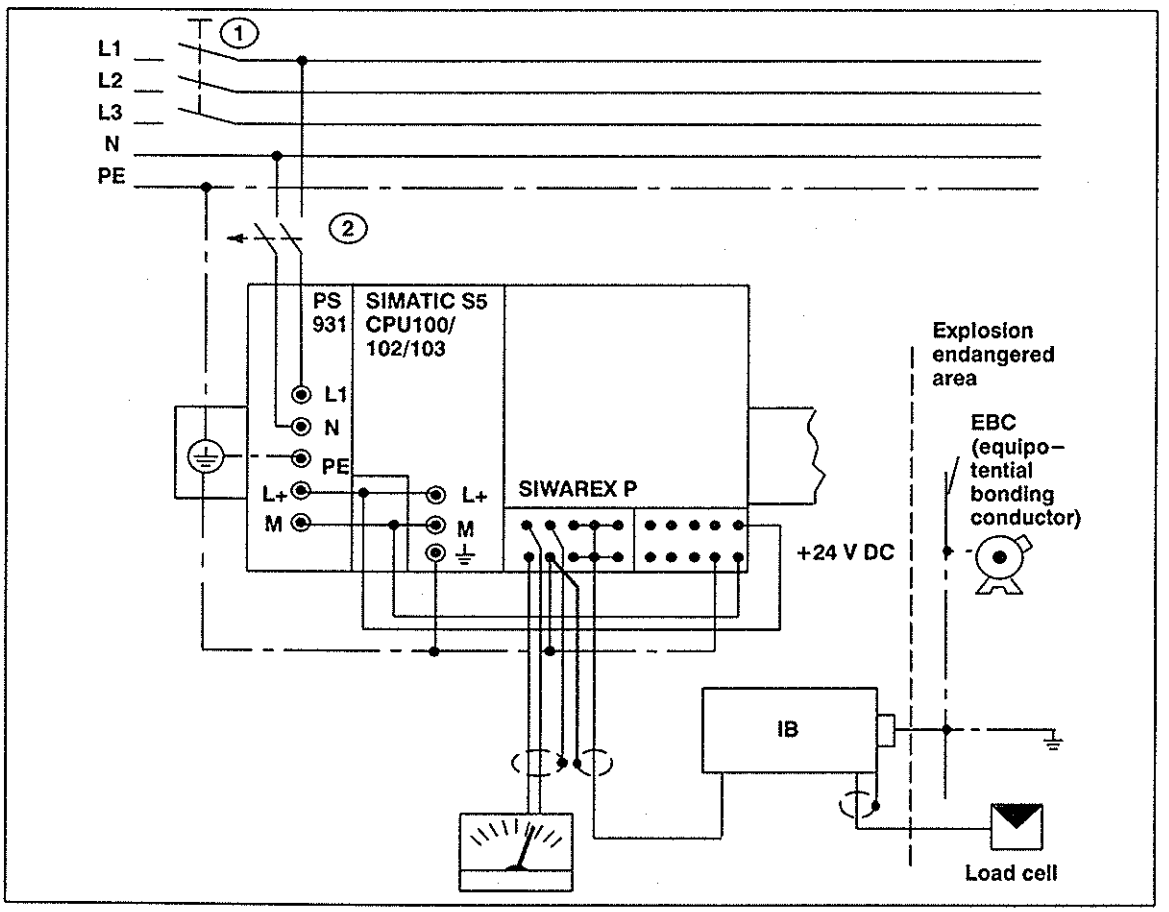


Figure 1.10 SIWAREX Pi with SIMATIC S5–100U (Grounded)

B) Grounding –Free Operation

- Grounding
  The protective conductor connection of the power supply and terminals 4 (left) and 8 (right) of the SIWAREX P measuring system are connected with PE (protective earth). The standard profile rail is connected via a high–impedance resistor (100 kΩ) to PE to lead off static charges. Interference voltages are led off to the protective conductor (PE) via a capacitor (1 µF). The CPU is connected to the protective conductor connection of the standard profile rail.

- Shielding
  The shield for the signal lines between SIWAREX P and IB is applied to SIWAREX P terminal 4 (bus submodule, left)

Do not apply the shield to the intermediate box!

The shield for the signal lines from the IB to the load cells is applied to the IB. EBC (equipotential bonding) is used as the shield potential with wich the IB is connected (see description of the intermediate box for details on the EBC connection concept).

This shield is applied to the intermediate box!

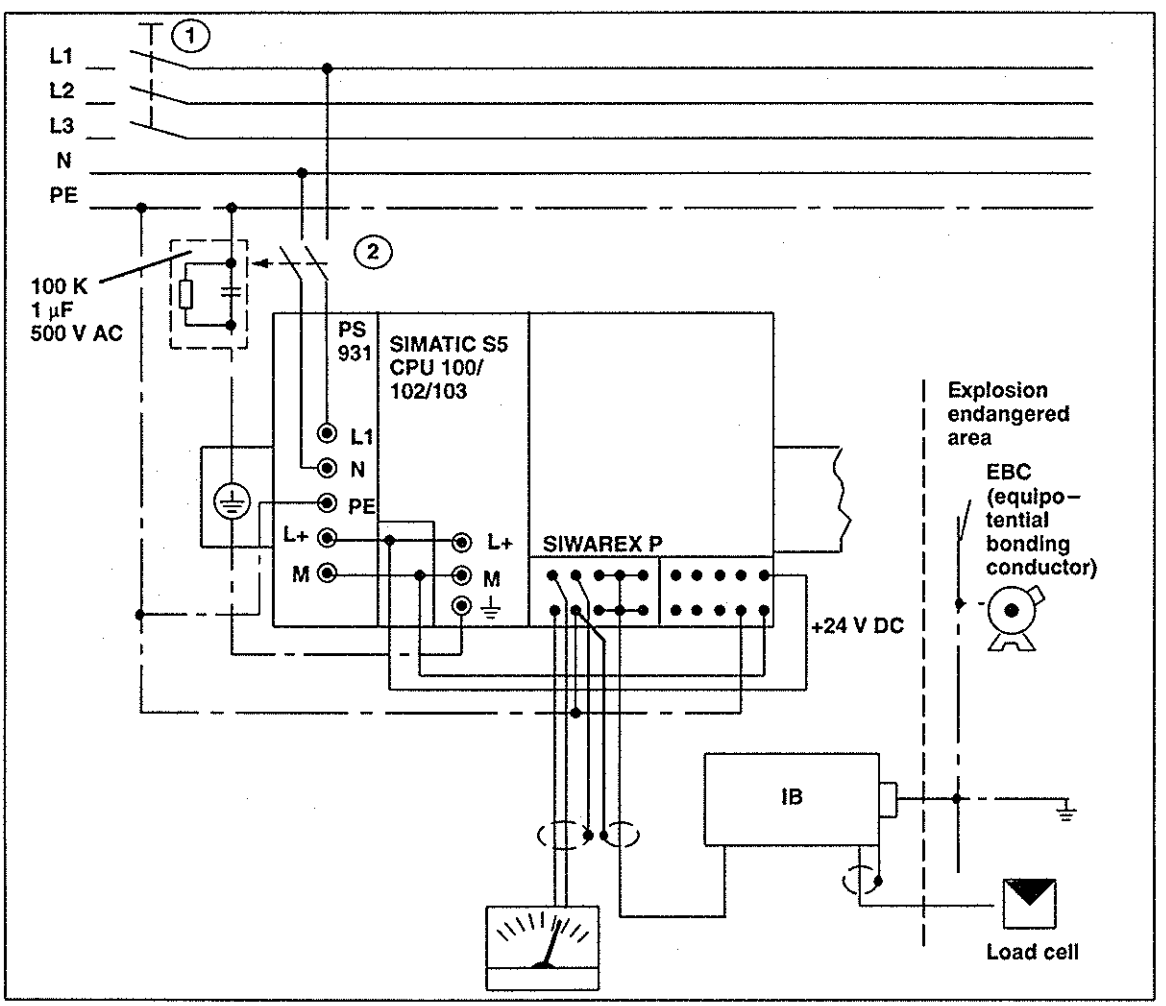


Figure 1.10a SIWAREX Pi with SIMATIC S5–100U (Grounding–Free)

1.5 Function Description

The SIWAREX P has three operating states.

- Startup mode
- Parameterization operating mode
- Measuring operating mode

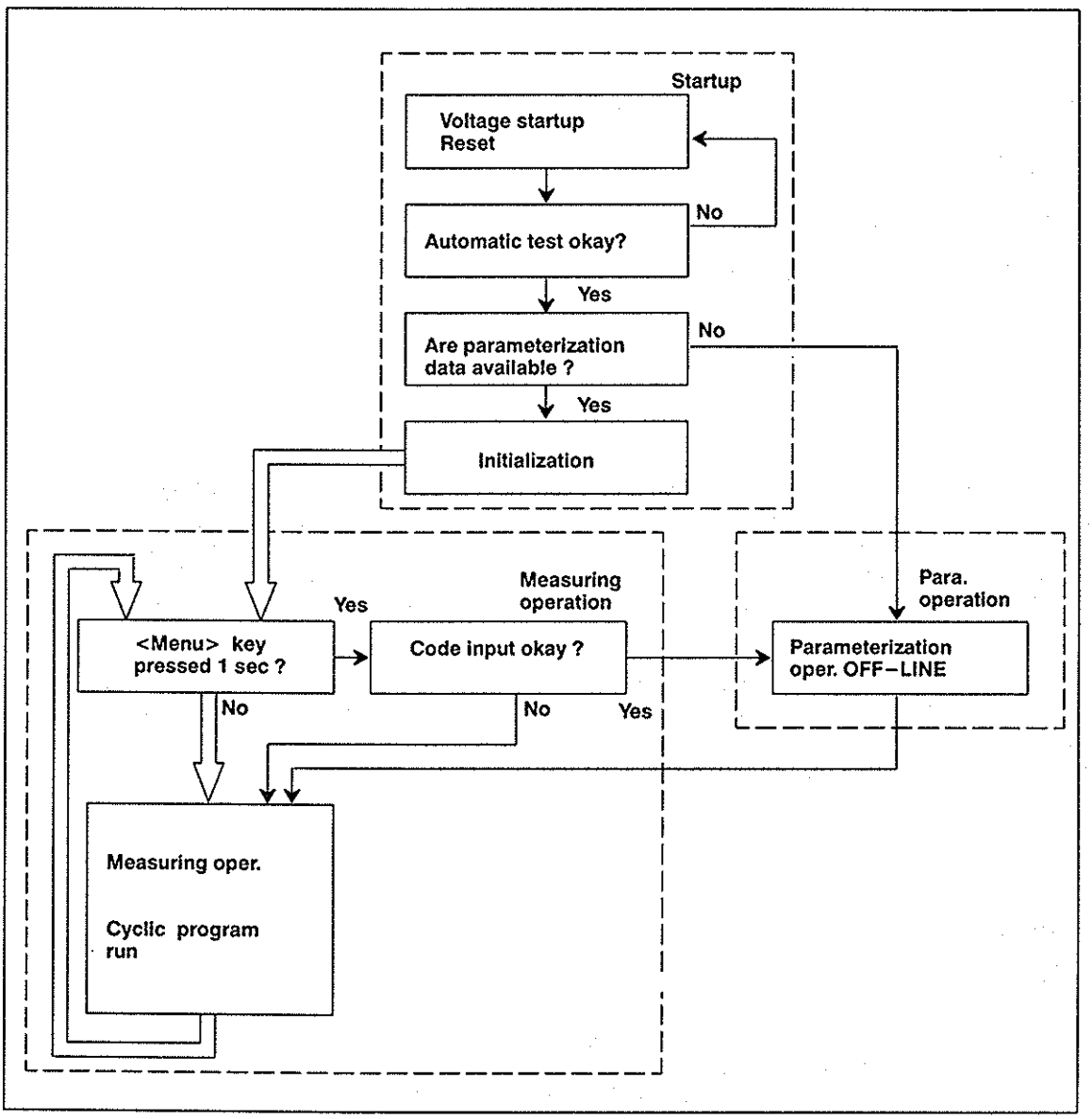


Figure 1.11 Overview of the operating states

1.5.1 Startup Operation

The module starts up after the load cells have been connected and the power supply turned on. During startup, the SIWAREX P measuring system performs automatic test routines which check the individual functions of the module. If an error occurs (see section 5), the test routine is continued until the error is corrected.

A check is then made to determine whether the module has already been parameterized. If this is the case, the module is initialized with the available parameters and starts measuring operation.

The startup time is 5 seconds

The following states apply during the startup:

- Inactive TTY interface
- Inactive SIMATIC S5–100U bus interface
- 0 mA or 4 mA on the analog output
- Relay contacts are open.

1.5.2 Parameterization Operation

No parameters are available after initial commissioning or after the module has been replaced. For this reason, the program branchs directly to the parameterization menu as soon as the automatic test routines are successfully completed without waiting for the code to be entered. The adaptation of the SIWAREX P measuring system to the load cell(s) (i.e., nominal load, characteristic value) and the parameterization of the entire system (i.e., dead load, filter, etc.) are performed here.

A branch is made to measuring operation when a restart is performed. The parameterization menu cannot be accessed from this operation mode unless a code is entered correctly.

The following states apply during parameterization operation:

- The entire measuring operation stops.
- Limit values are not monitored.
- The TTY interface is inactive.
  (i) TTY does not react to new requests.
  (ii) TTY cancels the reaction telegram.
- The SIMATIC S5–100U bus interface is inactive.
  (i) The "data invalid" bit is set in the status byte (see section 4.1 for more information on the status byte).
  (ii) SIMATIC S5–100U requests are not processed.
- 0 mA is on the analog output.

1.5.3 Measuring Operation

During measuring operation (i.e., weighing operation) the weight value and the unit of weight are indicated on the display. Error messages and cases in which the parameterized limit values are exceeded or passed below are also indicated.

1.6 Technical Specifications

Housing dimensions Including bus submodule	SIWAREX P	: 92 x 162 x 130 mm (W x H x D)
Weight with bus submodule	SIWAREX P	: 1.2 kg

Environmental Requirements

Environmental temperature	: 0° C to 55° C
Storage temperature	: –20° C to 70° C
Relative humidity	: ≤ 95%
Degree of protection	: IP 20

Power Supply, 24 V, floating	: 24 V DC SELV/PELV
Static limits	: Lower limit +20 V Upper limit +30 V
Dynamic limits including ripple	: Lower limit Value 14.25 V Duration 10 msec Recovery time 10 sec Upper limit Value +35 V Duration 500 msec Recovery time 50 sec
Ripple	: ≤ 3.6 V_{ss}
Current consumption	: Maximum of 300 mA[1)]
Overcurrent protection	: Fuse (self–restoring)

Load cell supply

Nominal value	: +10 V ± 0.5 V
Voltage monitoring	: U_{typ} = 8,5 V
Maximum current	: SIWAREX P = 160 mA SIWAREX Pi = 115 mA
Internal resistance (total) of the load cells	: SIWAREX P ≥ 60 Ω : SIWAREX Pi ≥ 87 Ω
Maximum resistance of the feed line	: ≤ 25 Ω (feeder and return circuit) This corresponds to a line cross–section of 0.75 mm^2 and a single line length of 500 m.

1) Depending on the total resistance of the connected load cells

Electro–Magnetic Compatibility

The following do not affect the SIWAREX P weighing and force measuring system.

Static discharge	: In accordance with EN 61000-4-2 Severity 4 (8 kV)
Electro–magnetic fields	: In accordance with EN 50140 Severity 3 Testing level 10 V/m Frequency range 80 MHz to 1000 MHz
Radio interference suppression	: In accordance with VDE 0871 Limit values of class A are not exceeded.

The EMC requirements in accordance with EN 50 081-2 and EN 50 082-2 are guaranteed.

Mechanical Stress

The SIWAREX P measuring system is not damaged mechanically or electrically by the following mechanical stress:

Vibration stress	: In accordance with DIN IEC 68–2–6
Drop and topple	: In accordance with DIN IEC 68–2–36

Measuring Range

Characteristic values of the LC	: 1 mV/V to 3 mV/V
Input signal	: ≤ 33 mV
Dead load	: Minimum dead load 2.5% of $N^{L1)}$ Maximum dead load 95% of NL[1)]
Standard weight	: >30% of NL [1)]

Principle of Measurement

Integrating A/D converter

Internal resolutions	: Maximum of 20,000 stages
Conversion time	: Approximately 40 msec
Scanning frequency of the measured value	: 10 Hz
Limit frequency of the parameterizable filter	: Adjustable: 2 Hz to 0.0625 Hz
Steepness of the filter	: 40 dB/decade

Compensation of the measured value by offset and reference measurements

Measuring Accuracy

The following values apply only to the indicator, TTY interface and SIMATIC S5 interface but not to the analog output:

Class of accuracy	: 0.1 of nominal load for nominal conditions 20°C ± 10°C; 24 V ± 2% Characteristic value 2 mV/V; No external field interferences
Linearity error	: ≤ 0.01% of NL 1)
Termperature influence	
Zero point	: ≤ 0.02%/10 K
Measured value	: ≤ 0.02%/10 K
Load cell supply	: Temperature–caused fluctations do not lead to additional errors for the load cell supply and use of the 6–conductor circuit.

1) of NL = of the parameterized nominal load

Wire Break Monitoring

Automatic monitoring of	: Feed line LC Measuring line LC Sensor line LC

Display (Integrated)

LC display	: 64 x 18 mm
Matrix	: 5 x 7 points
Number of positions	: 16 for parameterization 4½ for weight

Keyboard

Sealed keyboard for parameterization and adjustment	: 6 keys

Analog Output

Output current ranges (parameterizable)	: 0 to 20 mA 4 to 20 mA
Linearity error	: ≤ 0.4% (0 to 55° C)
Zero point error 0–20 mA, load = 500 Ω	: ≤ 0.2% } from analog end value
4–20 mA, load = 500 Ω	: ≤ 0.2% } (corresponding measuring range end value)
Update speed	: 10 Hz
Maximum permissible load resistance	: 500 Ω

Serial Interface

Type of interface	: TTY/current interface Passive/floating
Maximum cable lengths	
– For min. cable cross–section of 0.4 mm^2	: 1000 m
– For min. cable cross–section of 0.2 mm^2	: 500 m
Transmission speed (permanently set)	: 9600 baud
Plug type connection	: 15–way, sub D
Transmission protocol	: RK 512 (limited, sending on request only)
Transmission procedure	: 3964R

SIMATIC S5–100U BUS Interface

Only for model 7MH4205–1AC01/-3AC01

A maximum of 4 SIWAREX P measuring systems can be assigned to one SIMATIC S5 (S5–90U with IM90: only 3 SIWAREX Ps).

Address allocation	: 4–byte input area 4–byte output area
Addressing	: Same as two–channel analog module

Limit Value/Function Monitoring Outputs

Number of relay outputs (floating)	: 2
Contact position of both limit value relays in measuring operation	: Closed
Contact position of a limit value relay for parameterized maximum value monitoring and exceeding of the limit value	: Opened
Contact position of a limit value relay for parameterized minimum value monitoring and drops below the limit value	: Opened
Contact position of both limit value relays for module errors	: Opened
Contact position of function monitoring output for module malfunction	: Opened
Hysteresis of the limit value relay	: 2% of NL[1)]
Maximum time delay when limit value is exceeded (without filter)	: 300 msec
Maximum time delay for module malfunction	: 100 msec
Maximum switching voltage	: 120 V DC 50 V AC
Maximum switching current	: 2 A
Maximum continuous current	: 1 A

Bus Submodule	**6ES5700–8MA11**
Type of connection	: SIGUT connection technology
Number of SIWAREX P measuring systems which can be installed in one bus submodul	: 1
Maximum number of bus submodules with SIWAREX P measuring system per	
S5–90U + IM90	: 3
S5–95U/100U	: 4
ET 200	: 8
Connection between two bus submodules	: Integrated plug connector
Number of connections	: 2 x 10 per bus submodule
Connection cross–section Flexible	: 2 x 0.5 to 1.5 mm^2
Solid	: 2 x 0.5 to 2.5 mm^2

1) of NL = of the parameterized nominal load

2 Installation and Interface Description

2.1 Installation of the Module

The bus submodule is snapped onto the standard profile bus bar (EN 50022–35x15).

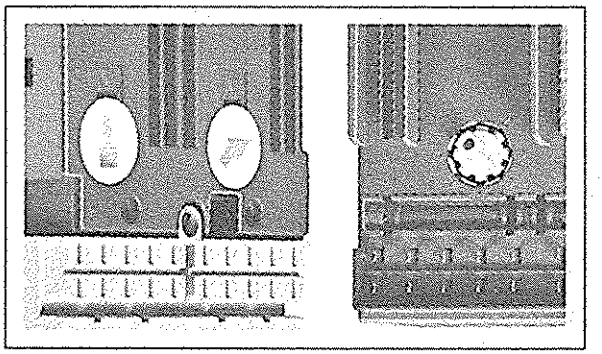
> **Caution**
>
> If the SIWAREX P measuring system is installed with the SIMATIC S5–100U bus, select the slot prescribed by SIMATIC S5 installation regulations. The fixed address allocation allows a maximum of 4 SIWAREX P measuring systems to be used with one SIMATIC S5–95U/100U (S5–90U, 3 SIWAREX Ps).

The SIMATIC S5–100U bus must be connected before the SIWAREX P measuring system is installed.

This is done by connecting the bus submodule with the bus submodule located to the left, or with the CPU of the SIMATIC S5–90U/95U/100U.

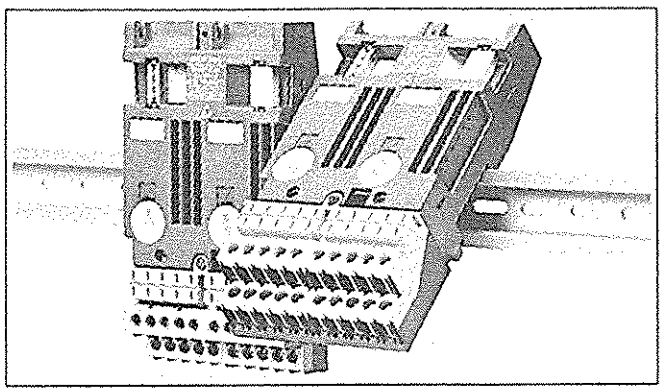
- Pull the plug connector of the ribbon cable on the bus submodule (upper left) from the holder.
- Plug the plug connector into the socket on the righthand side of the CPU or into the socket of the adjacent lefthand submodule.

> **Caution**
>
> Installation without SIMATIC S5–100U bus coupling:
> When one or more SIWAREX P measuring systems are used as stand–alone systems, the slot must always be to the right of the last SIMATIC S5–100U bus module. Any slot can be selected in this area.



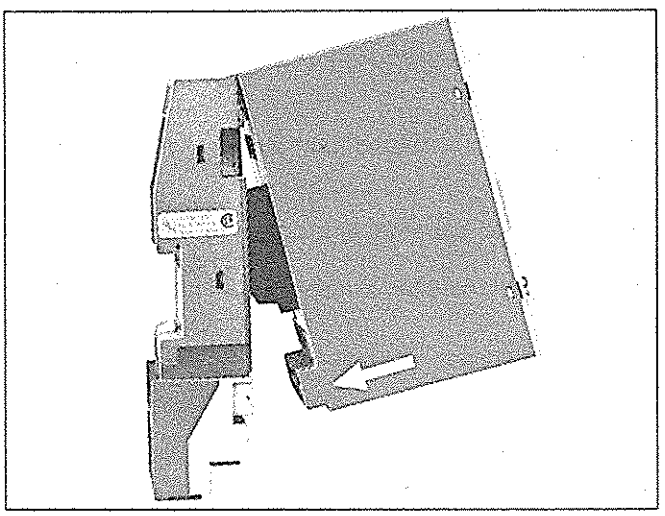
Use a screwdriver to adjust the lock of the submodule to number 6 before installing the module on the bus submodule (figure 2.1). A fixed coding pin is located on the back of the SIWAREX P to prevent incorrect replacement of the module.

Figure 2.1 Setting of the coding pin



With the upper edge of the cutout (back) at a slant, hang the bus submodule on the standard bus bar, press down and snap in.

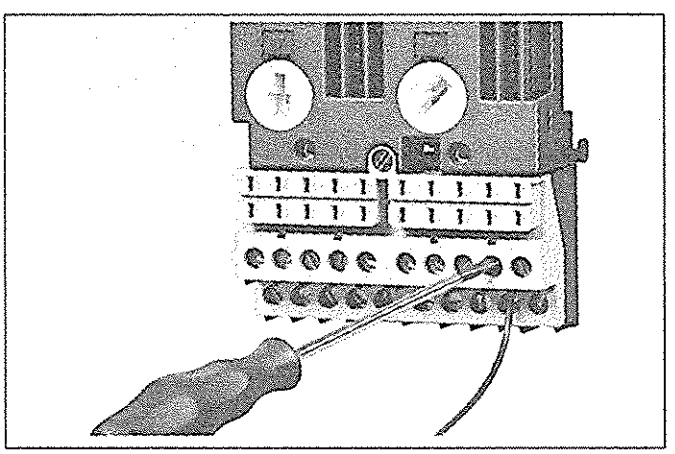
Figure 2.2 Snapping on the bus submodule



Hang upper edge of the SIWAREX P measuring system on the upper edge of the bus submodule. Swing in in the direction of the arrow (figure 2.3) and press in. Screw (medium tight) to the bus submodule with the mounting screw accessible from the front.

Figure 2.3 Snapping on the SIWAREX P measuring system

The signal lines are led to a terminal block which is screwed to the bottom of each bus submodule, and not directly to an I/O module. This makes it possible to insert and remove the I/O modules on the bus submodule without having to detach the wiring (i.e., fixed wiring). The terminal blocks are available in two models.



Model with screw connection (SIGUT technique). The signal lines are led in from below and screwed down from the front.

Figure 2.4 Screw connection

2.2 Location of the Interfaces

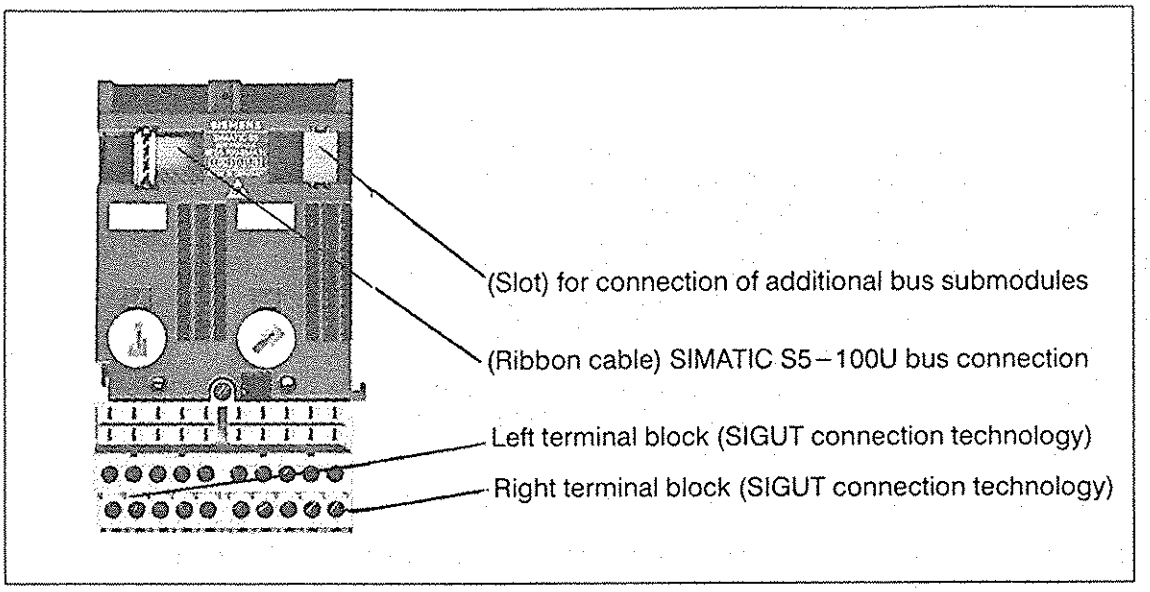


Figure 2.5 Bus submodule

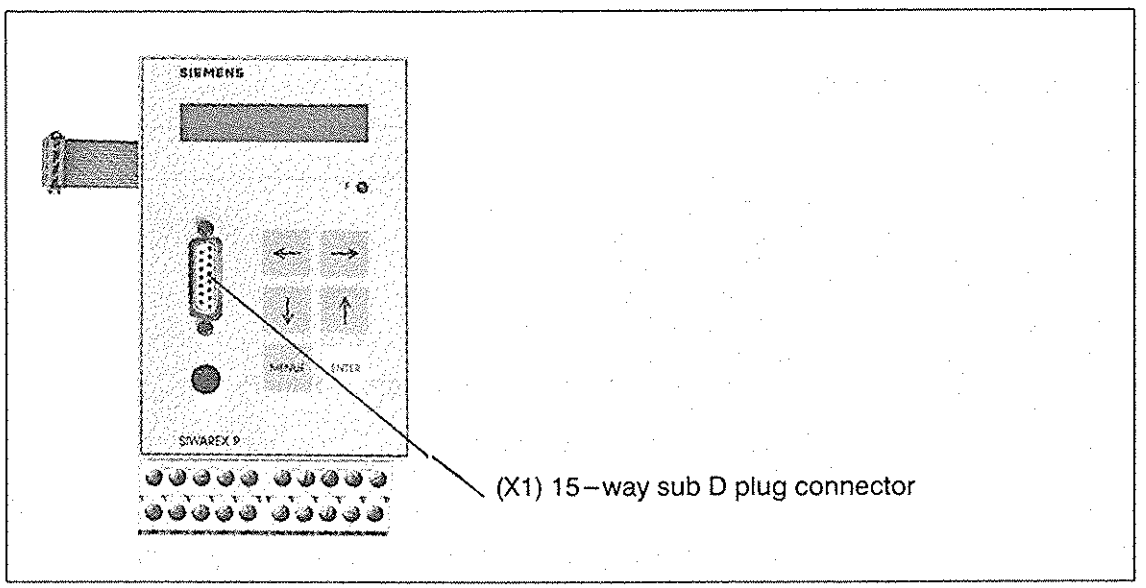


Figure 2.6 SIWAREX P measuring system

2.3 Allocation of the Terminal Blocks

Lefthand Terminal Block

Pin	I/O	Signal	Meaning
1	O	U_{20} mA +	Analog output 0 to 20 mA/4 to 20 mA (positive)
2	O	U_{20} mA –	Analog output 0 to 20 mA/4 to 20 mA (negative)
3	O	Shield 1)	Analog output 1)
4	O	Shield 1)	Load cell connection 1)
5	O	U_{S+}	Supply voltage of load cells (positive)
6	O	U_{S-}	Supply voltage of load cells (negative)
7	I	U_{S+} 3)	Sensor line, LC (positive) 3)
8	I	U_{S-} 3)	Sensor line, LC (negative) 3)
9	I	U_{M+}	Measuring voltage, LC (positive)
10	I	U_{M-}	Measuring voltage, LC (negative)

1) Connect connection terminal to pin 8, righthand terminal block (ground).

3) When a 4–conductor circuit is used to connect the load cell, connect pin 5 to pin 7, and pin 6 to pin 8, left.

Righthand Terminal Block

Pin	I/O	Signal	Meaning
1	O	REL 1 O	Function monitoring, output
2	I	REL 1 I	Function monitoring, input
3	O	REL 2 O	Limit value relay 1, output
4	I	REL 2 I	Limit value relay 1, input
5	O	REL 3 O	Limit value relay 2, output
6	I	REL 3 I	Limit value relay 2, input
7	O	EBC 4)	Equipotential bonding conductor (ground) for Pi
8	I	⏚ 2)	ground 2)
9	I	U_{24} V_{ex}	Supply voltage, 24 V, external
10	I	U_{24} V_{ex} G	Reference potential , 24 V, external/ground

2) Connect the connection terminal with pins 3 and 4, lefthand terminal block (shield).

4) This terminal (pin 7) is not connected unless the intermediate box is used.

2.4 Connection of the Supply Voltage

The SIWAREX P measuring system consists of an internal power supply (DC/DC converter, input 24 V DC) and the weighing electronics.

The external supply voltage of 24 V DC is connected to the righthand terminal block (do not forget polarity).

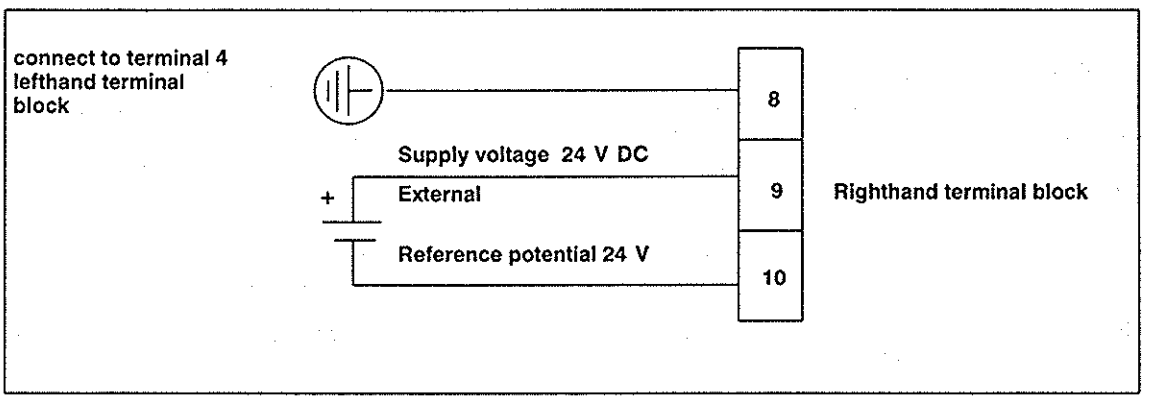
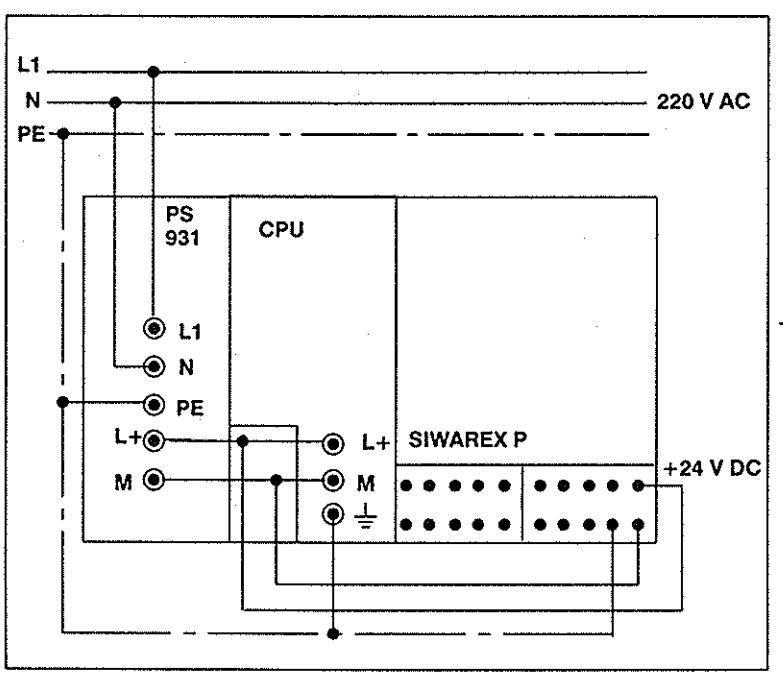


Figure 2.7 Voltage supply

If the polarity is transposed by mistake (terminals 9, 10) during connection, a self–restoring fuse activates and isolates the module from the supply.

Now connect supply voltage correctly. After approximately 1 minute, the module is again ready for operation.

The following power supply modules are recommended for generation of the 24 V DC voltage supply:



– PS 931 (6ES5 931–8MD11) for setup with programmable controller SIMATIC S5–100U or supply of several SIWAREX P measuring systems. If the SIWAREX P weighing electronics are integrated in the S5–100U programmable controller, supply from the control current circuit can be used.

Figure 2.8 Connection to 220 V with PS 931 (standard model, grounded operation)

2.5 Interfacing of Load Cells

2.5.1 Notes on Causes of Interference

Although measuring systems are not very sensitive to electrical interferences, certain installation regulations must be adhered to. The most important installation regulations are listed below. See the VDI/VDE 3551 installation guidelines for complete information.

Only measuring cables from Siemens should be used as sensor and extension cables. Do not install measuring cables parallel to power current lines or control lines (e.g., in cable ducts). If this cannot be avoided, a distance of at least 50 cm must be maintained between the lines, and the measuring cable installed in steel armored conduits. Power current and control lines must be twisted separately (i.e., power current lines twisted together alone and control lines twisted together alone) (15 twists per m).

In cases in which the cables are longer or a high degree of accuracy is required, use the six–conductor circuit which offsets resistance interferences of the cable caused by temperature.

Use shielded cable for all lines which lead in or out of the system (also output and control lines). See tables (page 2–4) for connections of the shielding.

If at all possible, the measuring system should not be installed in the same control cabinet with devices which generate strong interferences (e.g., thyristor controls, contactors) or create a great amount of heat. If this cannot be avoided, sheet metal isolators or fans must be in–stalled.

Never connect the measuring system to an "unsteady" power supply to which contactor controls are connected at the same time. If at all possible, use a separate transformer to supply the measuring system.

Circuit contactors must be interference–suppressed, particularly if they are connected to the same phase as the measuring electronics. Ready–to–use interference suppression sets (resis-tance–capacitor combination) can be obtained from contactor manufacturers.

In networks with a high degree of impulse interference, do not lead 220–V control lines for the measuring system in the direct vicinity of the electronics. We recommend prior conversion to interference–free, low voltage with isolating relays which are not in the same area as the mea-suring electronics. If cabinets are used, the isolating relays must be installed outisde the cabi-net.

It is absolutely mandatory that the shield be applied to the central grounding rail in the switching cabinet.

The shield should also be connected to the load cell if high fluctuations in measured values oc-cur. This does not apply to applications in potentially explosive areas, however.

The shield can be capacitively connected if high equalizing currents are to be expected over the shield.

The SIMATIC S5 Setup guidelines must be adhered to unless other instructions are explicitly stated.

2.5.2 Different Methods of Connection

The load cells are connected to the bus submodule, lefthand terminal block. Load cells with a characteristic value of 1.0 to 3 mV/V can be connected.

The nominal value of the feed voltage for the load cells is 10 V. It is potential–free against the 24–V supply voltage.

The maximum supply current for the load cells is 160 mA. The load cells can be connected in 4–conductor or 6–conductor technology.

4–Conductor Connection Technology

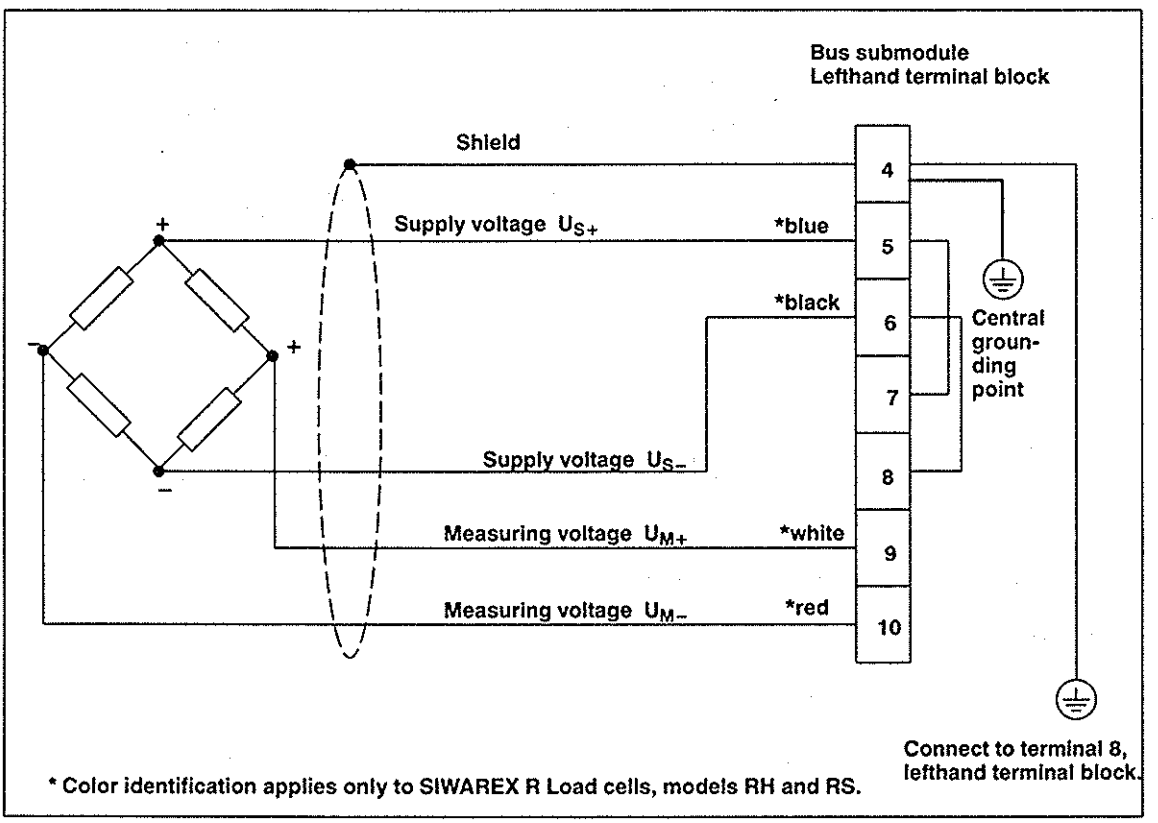


Figure 2.9 Load cell connection (4–conductor)

Terminals 5–7 and 6–8 must be jumpered for 6–conductor connection. Drops in voltage on the lines to the load cell(s) cannot be detected. This causes additional measuring errors.

When the intermediate box (Ex-i interface) is used, the 6-conductor technique is always used for the connection to the SIWAREX P. The jumpers between power line (+) and sensor line (+) or power line (-) and sensor line (-) must be installed directly on the Ex-i interface. See description of the Ex-i interface on page 11.

6–Conductor Connection Technology

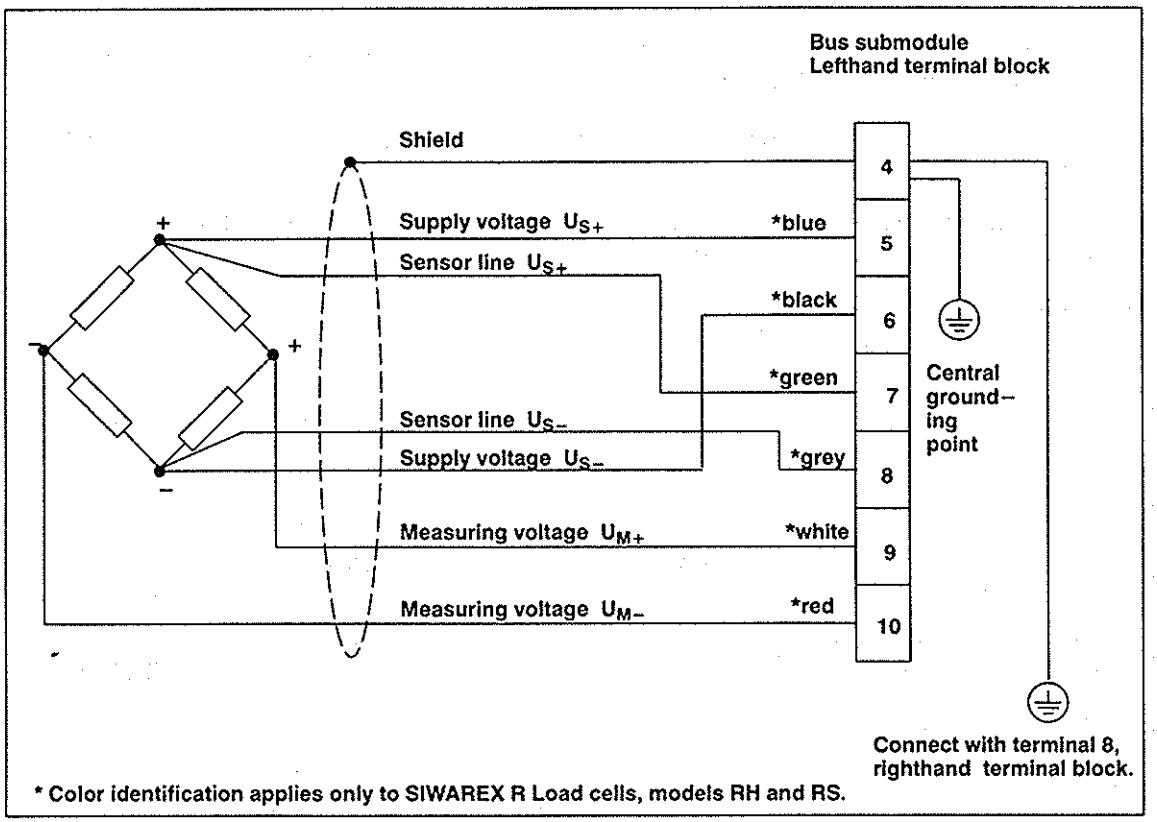


Figure 2.10 Load cell connection (6–conductor)

6–conductor technology must be used under the following circumstances:

– Lines longer than 20 m

– Use of the intermediate box

– Use of the terminal box (between terminal box and SIWAREX P measuring system)

Parallel Switching of Several Load Cells

The terminal box (7MH4710–1AA) must be used if several load cells are connected in parallel to the SIWAREX P measuring system.

Load cells may not be switched in parallel unless they have the same characteristic value, the same nominal load and the same internal resistance. The total resistance for parallel switching must not be less than 60 ohm.

If the intermediate box is used, the total resistance must not be less than 87 ohm.

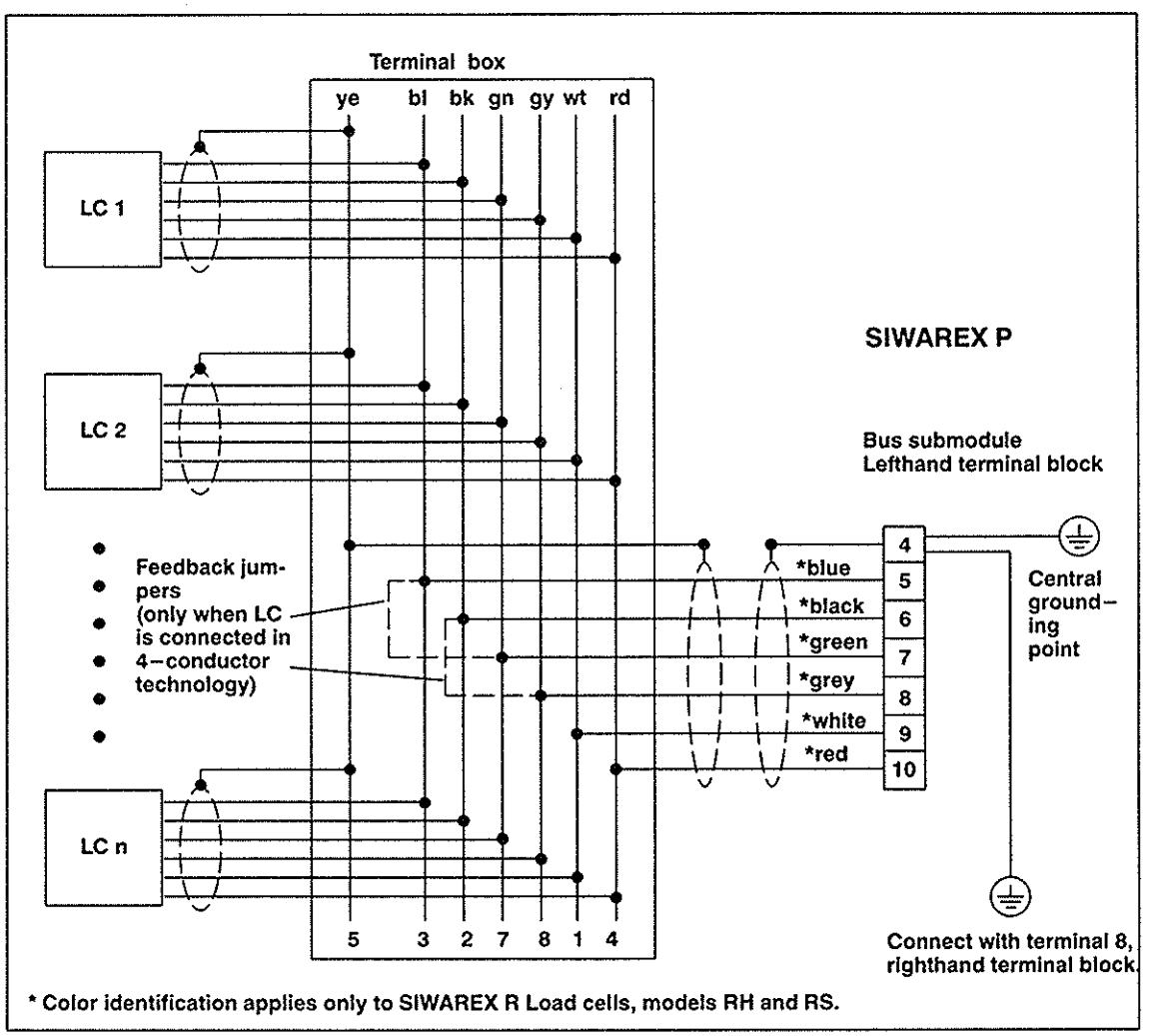


Figure 2.11 Parallel switching of several load cells with terminal box in 4 or 6–conductor technology

2.5.3 Wire Break Monitoring

When a load cell is connected, all lines between the SIWAREX P measuring system and the load cell are monitored for wire breaks. The error LED indicates an interruption has occured on a line. At the same time, the two limit value contacts and the function monitoring contact are opened.

If several load cells are switched parallel in one terminal box, only the lines between the terminal box and the SIWAREX P measuring system are monitored for wire breaks. An interruption of a line between terminal box and load cell cannot be detected when parallel switching is used.

2.6 Circuiting of the Relay Outputs

The relay outputs are led to the righthand terminal block. They are used for the limit value monitoring and the function monitoring.

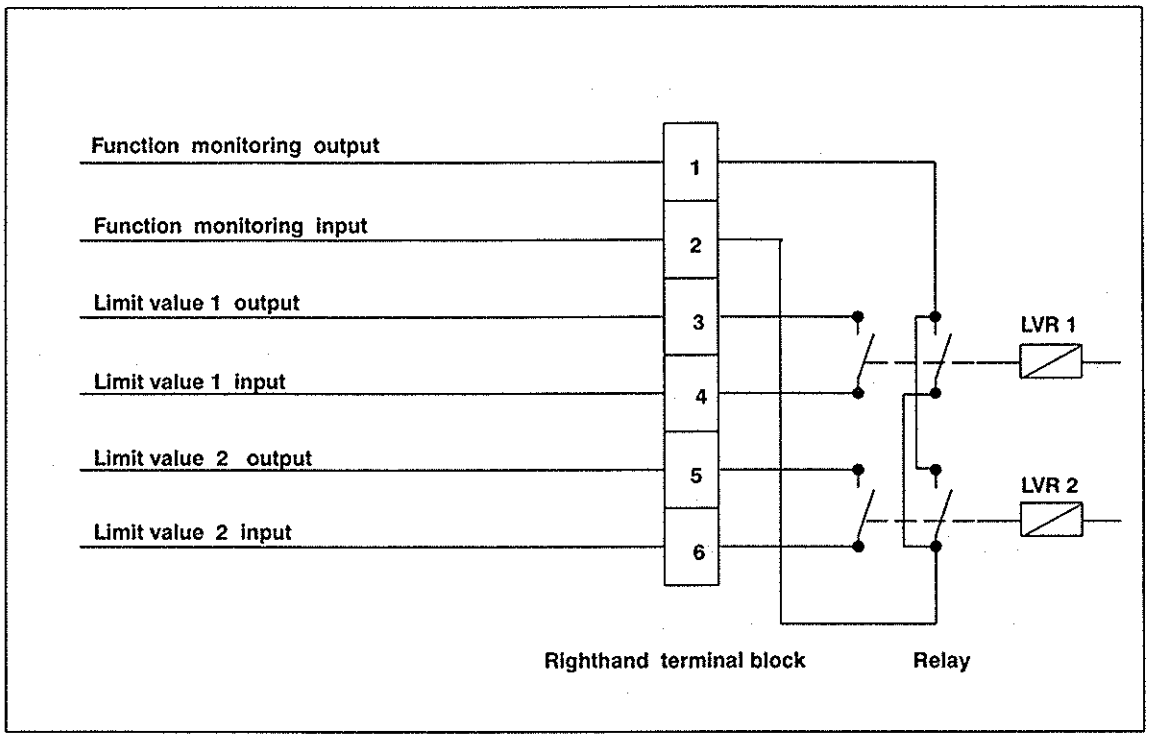


Figure 2.12 Relay inputs/outputs

Limit Value Monitoring

The SIWAREX P is equipped with two relay outputs (REL1, REL2) for the monitoring of limit values.

The limit value relays allow monitoring of maximum and/or minimum weight values.

The two relays can be parameterized for the monitoring of minimum or maximum values. Parameterization is described in section 3.3.8.

Function Monitoring

Both relays are equipped with 2 working contacts each. For operation monitoring, 2 contacts (one from each relay) are switched in parallel.

Module Errors (See Also Section 5 on Error Messages)

Both relay contacts are opened as soon as an error occurs on the module. The error LED goes on to indicate that an error occurred.

If both relay contacts are opened for a module error, the connection between the two terminals of the function monitoring relay is opened.

This is also the case when both limit value relays are opened because both limit values have been exceeded (e.g., both maximum values are exceeded for 2 parameterized maximum values).

2.7 Analog Output

The analog output is conducted to the lefthand terminal block.

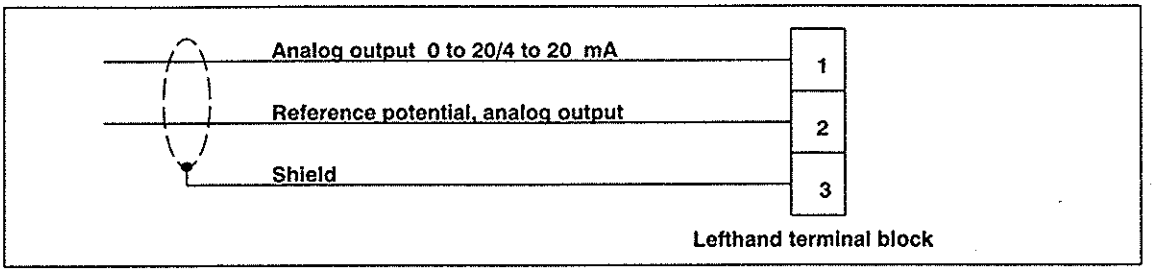


Figure 2.13 Analog output

1 Do not connect the analog output with ground. A short–circuit of the analog output against ground (internal mass) triggers a self–restoring fuse (1–minute regeneration time).

2 The reference potential of the analog output does not correspond to the internal mass. Do not connect the line with ground.

3 Use potential to ground as shielding.

The measured value is output as constant current on the analog output.

There are 2 ranges for the constant current output:

- 0 to 20 mA
- 4 to 20 mA

The constant current range can be selected with the keyboard. The lower value of the respective output range corresponds to the weight value (zero point set of the measuring system) specified by the dead load. The upper value corresponds to the end value of the measuring range. This is parameterized by the user.
The resolution of the output current is 1000 stages (0 to 20 mA)

Update Rate

The analog output is updated every 100 msec.

Parameterization Menu

After branching to the parameterization menu (entry of correct code), the analog output is set to 0 mA.

Load Impedance

The maximum permissible load resistance is 500 Ω.

Module Errors

The last value on the analog output is retained until the next update after the error was corrected.

Startup Behavior

After the measuring electronics are turned on (return of voltage), the value 0 mA or 4 mA (depending on the parameterization) is output on the analog output. The weight value is output after the completion of the 1st measuring cycle.

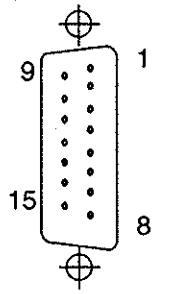
2.8 Serial Interfaces

Interface X1

The TTY interface is used to handle the data transfer. This is a serial current interface. Data transmission is performed potential–free.

The power supply for the TTY interface is integrated. Wire jumpers in the interface plug connector are used to specify the TTY interface as active or passive.

Pin	I/O	Signal	Meaning
4	O	VE+	20 mA output for receiver
5	O	VS+	20 mA output for sender
7	I	+RxD	Receiving data +
8	O	+TxD	Sending data +
11	O	TTY GND	Reference potentail for VE+ (mass)
12	O	TTY GND	Reference potential for VS+ (mass)
14	I	–RxD	Receiving data –
15	O	–TxD	Sending data –



15–way sub D socket on the front of the module

SIMATIC S5–100U Coupling

The coupling of the bus is performed during the installation of the bus submodule (see section 2.1).

Communication with the SIMATIC S5–90U/95U/100U programmable controller is performed with the serial SIMATIC S5–100U bus.

An IM90 interface (6ES5 090–8ME11) is required for communication with the SIMATIC S5–90U.

The interface is not active except in ON–LINE operation (normal operation).

TTY Interface Coupling

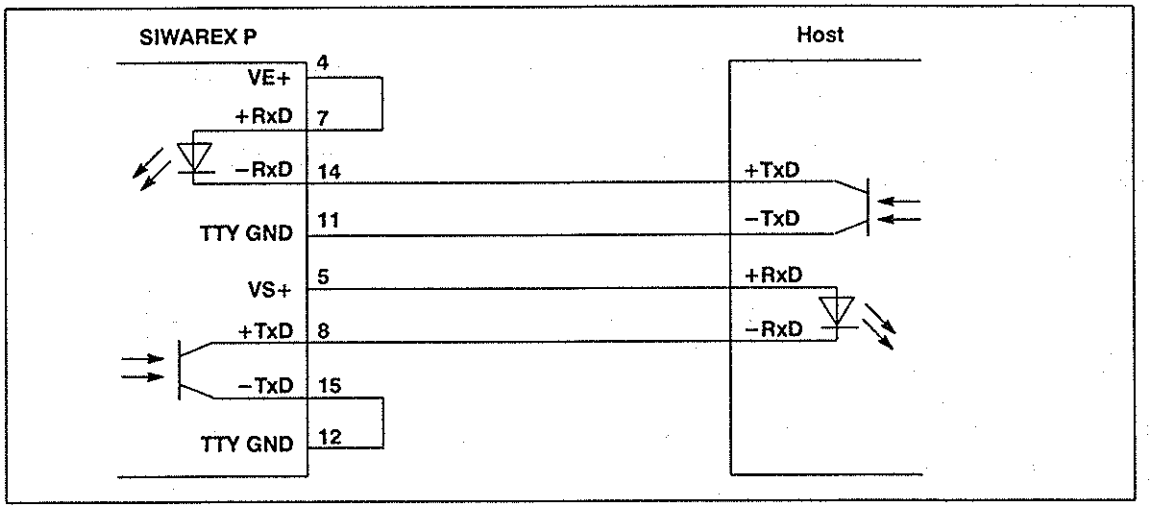


Figure 2.14 Active interface coupling

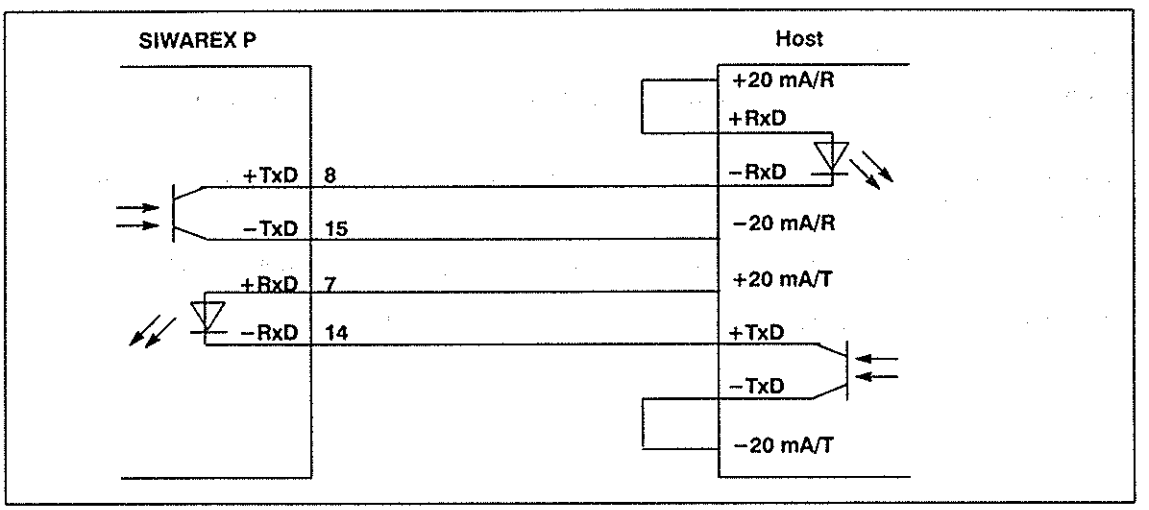


Figure 2.15 Passive interface coupling

The line for the serial interface may not exceed 1000 m.

A transmission speed of 9600 baud is permanently set.

Data transmission is performed by logical protocol RK 512 (computer–computer link), but with certain restrictions since sending is only performed on request with transmission procedure 3964 R.

The interface is not active except in ON−LINE operation (normal operation).

3 Commissioning

3.1 Overview

After the module is installed, the load cells connected and all connections established, the supply voltage is turned on. The SIWAREX P measuring system starts up. Various automatic test routines are performed.

The following states apply during startup:

- TTY interface inactive
- SIMATIC S5–100U bus interface inactive
- 0 mA on the analog output
- Relay contacts opened

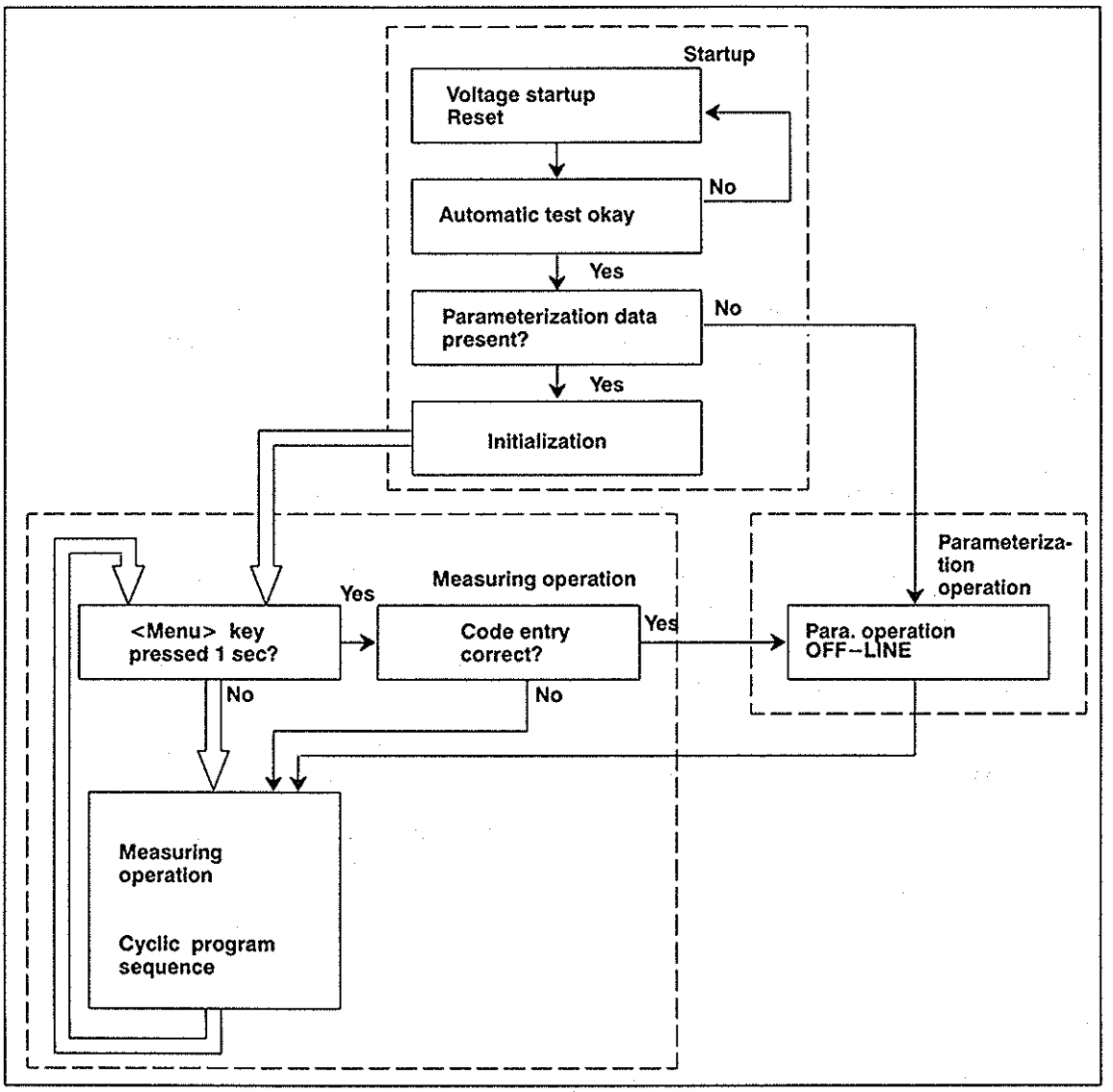


Figure 3.1 Overview of the operational states

The "parameterization data present?" inquiry appears automatically. A branch is made to the parameterization menu without entering a code, since no data has been parameterized when the initial startup occurs.

3.2 Adjustment of LCD Brightness

Before parameterization, check to determine whether the LCD can be easily read. Adjust if necessary.

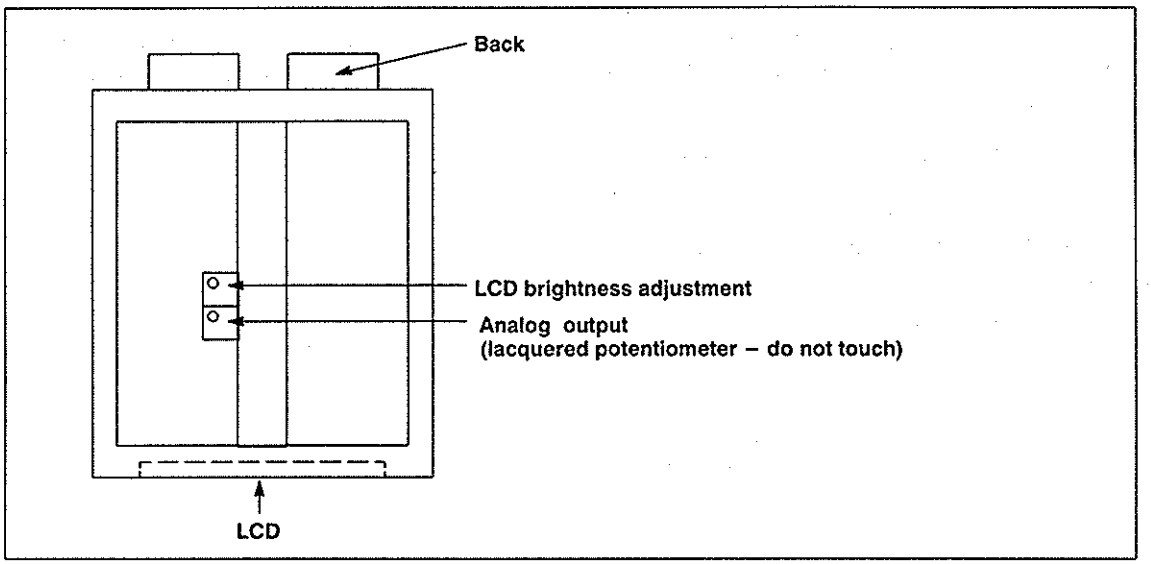


Figure 3.2 SIWAREX P (top view)

When delivered, the display is set to the preferred "6 o'clock" setting. This gives optimal LCD brightness when the operator's line of vision is directed upwards from below the display. If the line of vision is different because of the mounting height, adjust the brightness by turning the potentiometer.

VORSICHT !

- Einstellung darf nur mit einem vollisolierten Schraubendreher vorgenommen werden.
- Es darf dabei kein anderes Bauteil berührt werden.
- Die EGB–Vorschriften sind unbedingt einzuhalten

Bei Nichtbeachten besteht die Gefahr der Zerstörung der Baugruppe.

CAREFUL !

- Use only a fully insulated screwdriver to perform the setting.
- Do not touch any other components while making the setting.
- Observance of ESD regulations is absolutely mandatory.

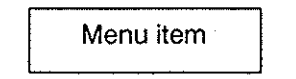
Danger of destruction of the module if above is not complied with.

Caution

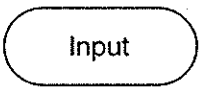
Never change the lacquered potentiometer since the analog output is adjusted in the testing lab.

3.3 Parameterization

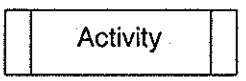
3.3.1 Parameterization Menu "Legend"



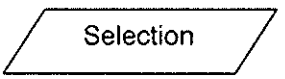
= Menu item or indication on the display



= Entry of values with the arrow keys



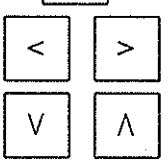
= Request of activities
(key pressing, placing weights on the scales, etc.)



= Choice of preset values
(Y/N or min/max)

= Activation of the "menu" key

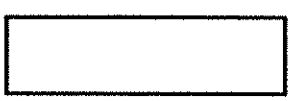
= Activation of the "enter" key



= Selection and input keys
(If the menu items are directly above/below each other, you can use [V] or [Λ] to switch between these menus.

< 1 sec >

= Key must be pressed for at least 1 second;
otherwise no function.



= Functions are available from release status C05

☞ All indicated texts appear in English. The table below provides additional explanatory information when necessary.

Text	Explanation		Text	Explanation
Status	Status menu		f_g Limit frequency	Self–explanatory
Display of Parameters	Self–explanatory		Limits	Limit value
N–Values	Characteristic values		Analog end value	Self–explanatory
Nominal Load	Self–explanatory		TTY Interface SS	Self–explanatory
Resolution norm./high	Resolution normal/high		Step	Digit step
D–Load	Dead load		Change Code	Self–explanatory
Zero Adj.. Inp.	Zero adjustment/ input		Save	Self–explanatory
Calibration	Self–explanatory			
C–Weight	Standard weight too small			

3.3.2 Menu Prompting

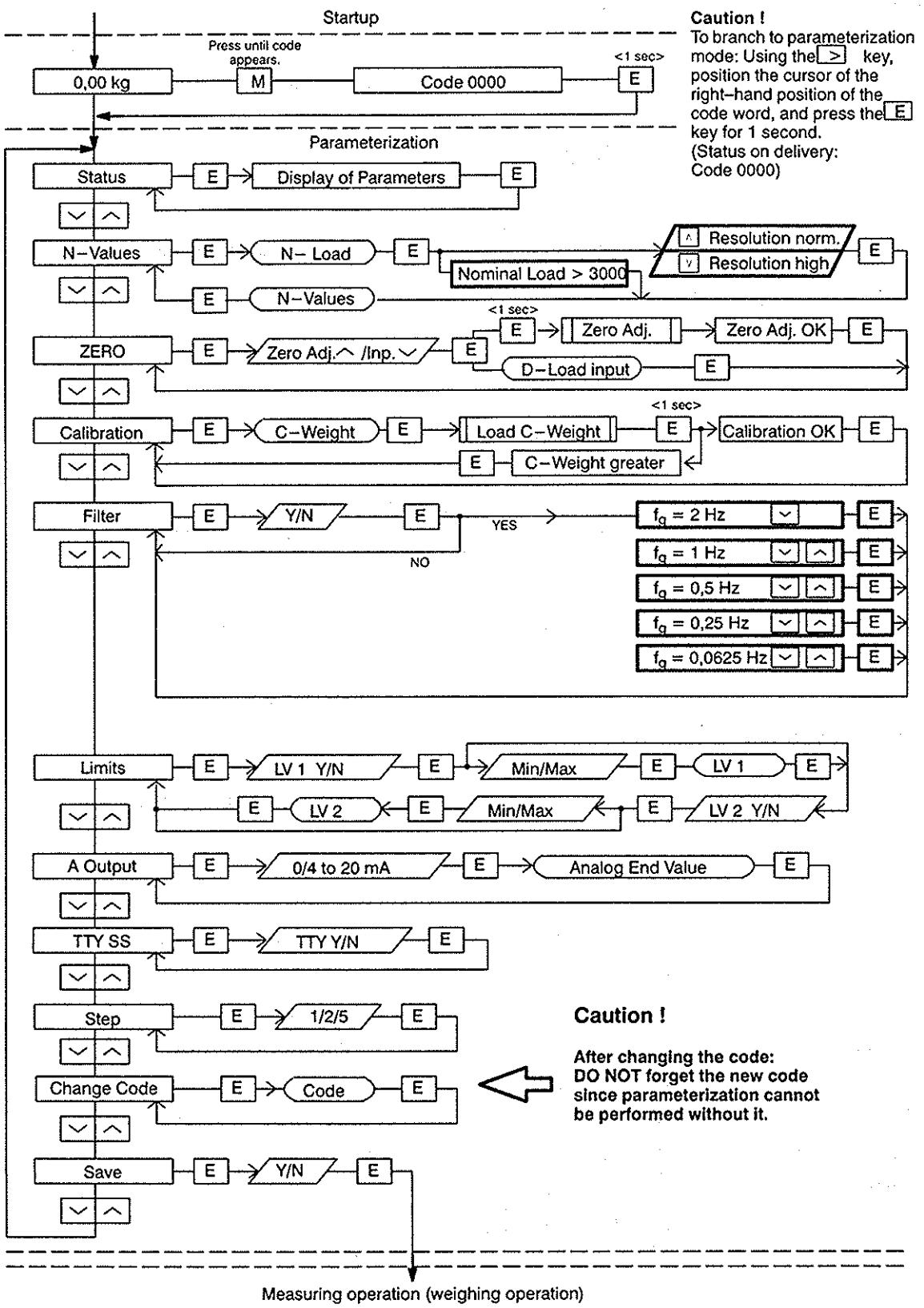
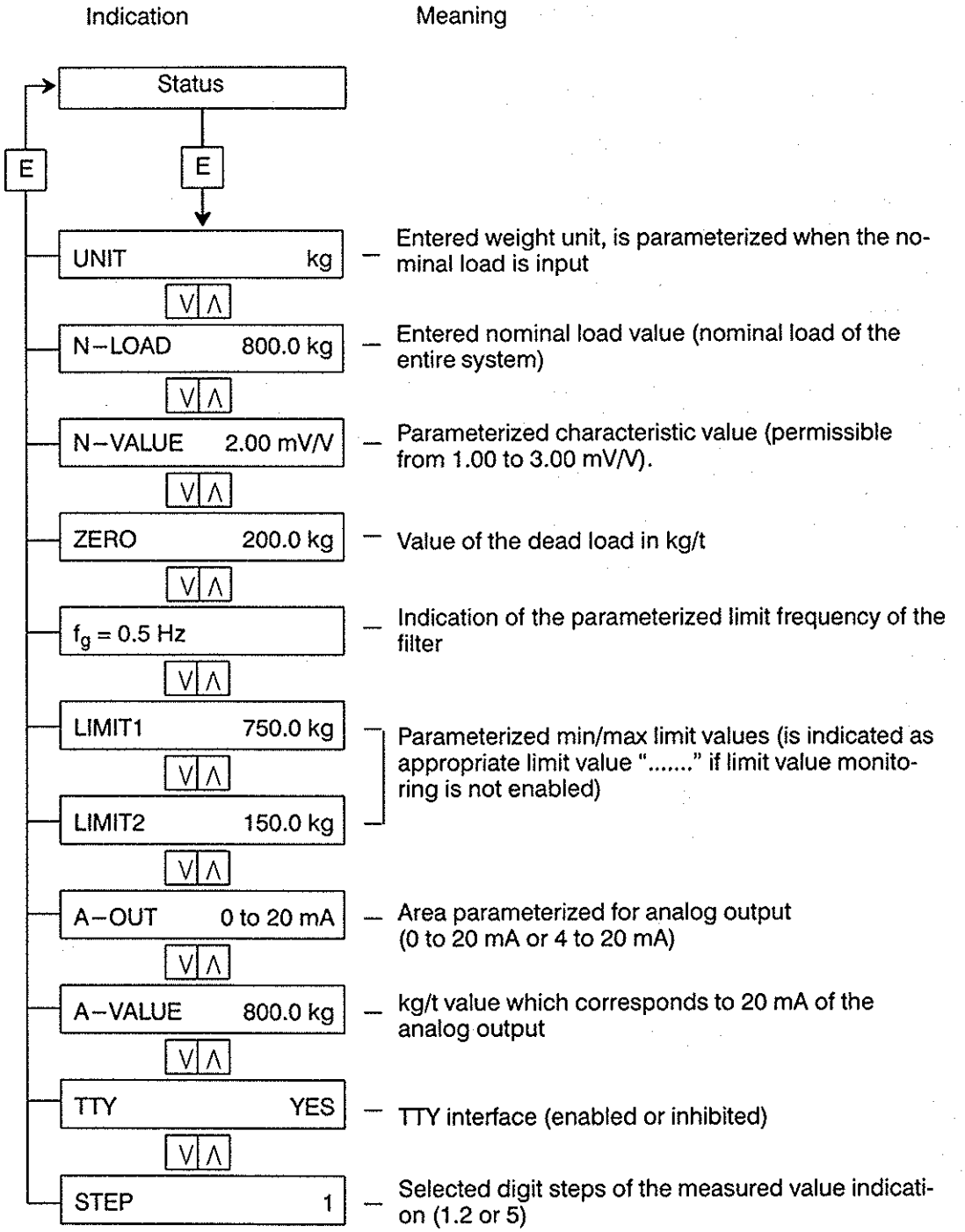


Figure 3.3 Menu logic

3.3.3 Status Menu

The status menu only indicates the parameterized data. Modifications or entries cannot be made in this menu.



E can be used to jump back to the main menu at all times.

3.3.4 Entry of the Characteristic Values

Caution

When parameterizing for the first time, it is absolutely essential that the nominal load (N–LOAD) be entered as the first value, followed by the characteristic value (N–VALUE) as the second value.

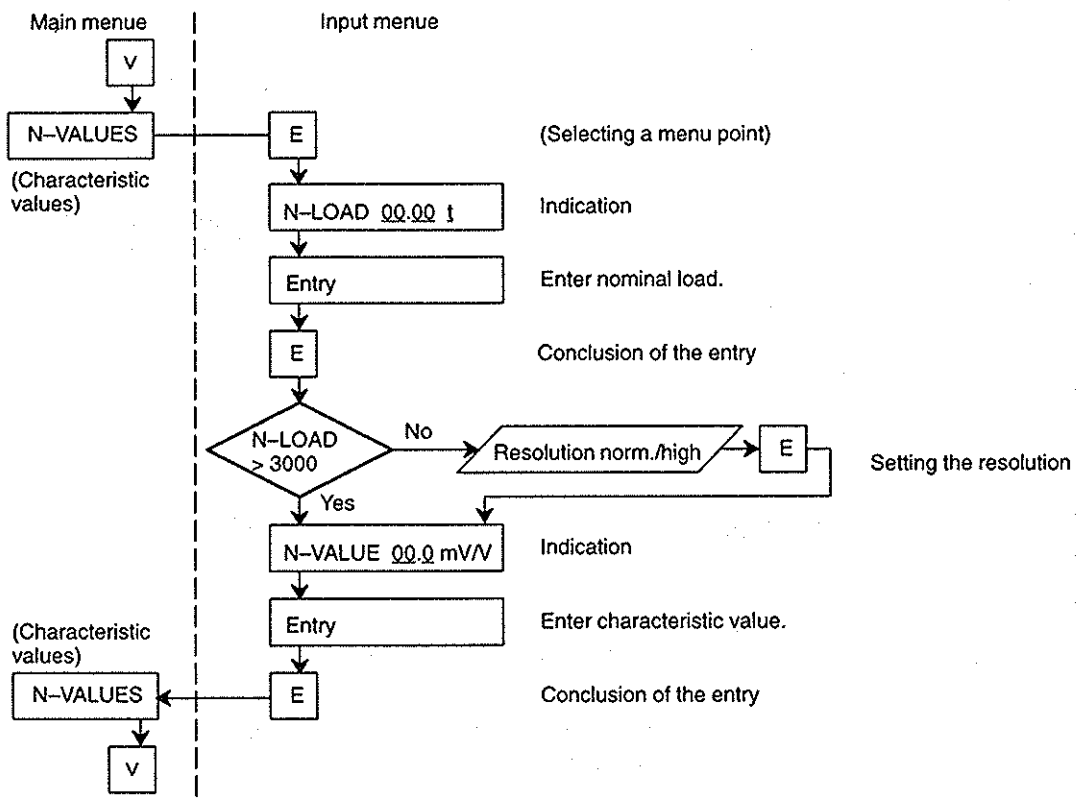
- During the entry of the nominal load, the decimal point and the unit of weight are specified.
- During the entry of the characteristic value, the measuring range is specified.

These specifications also apply to the other menu items and cannot be changed again during later parameterization procedures.

The following input description applies to all menu items in which values can be entered.

When several load cells are switched in parallel, the SUM of all single loads is to be input as the nominal load while the characteristic value is the value of only one load cell. Only identical load cells with the same nominal load, the same characteristic value and the same internal resistance value can be switched in parallel.

– Input of the Nominal Load and the Characteristic Value



a) Nominal Load

1) Determination of the Nominal Load

If several load cells with the same data (nominal load, characteristic value, internal resistance) are connected in parallel to the SIWAREX P, the nominal load of the entire system must be determined by multiplying the number of load cells by the nominal load of one cell.

N–LOAD = A • (nom. load of one load cell)

A = Number of load cells

2) Input of the Nominal Load

The display [N–LOAD 00.00 t] has 5 positions for value input (including the decimal point and 1 position for the input of the weight unit. The current position flashes beginning with the 1st position.

The keys [<] [>] are used to select the positions.
The keys [V] [Λ] are used to decrease or increase the digits by 1.

- The digit sequence is 0 to 9.
- The decimal point is between 9 and 0.
- The unit of weight position offers selection of (t) or (kg) with [V] [Λ].

The decimal point must always be set. Because of this, several input methods are provided. To increase the resolution, the decimal point must be positioned so that the best possible resolution of the nominal load values is achieved for the respective application.

The unit of weight must be entered again each time a change occurs.

3) Setting the Resolution (Starting with release status C05)

After confirmation, the entered nominal load value automatically goes through a prompting routine. The next menu item (characteristic value input) appears if the nominal load value is greater than 3000. If the nominal load value is less than 3000, a branch is made to the submenu (setting the resolution). This menu item can be used to increase the resolution of the indication on the S5 bus and the TTY interface by the factor 10 (→ section 4.1.8/4.1.9).

Ex:

Nominal Load	Input	Resolution Norm.	Resolution High
2800 kg	2800. kg 2.800 t	1 kg 1 kg	0.1 kg 0.1 kg
280 kg	280.0 kg	0.1 kg	0.01 kg
390 kg	390.0 kg	0.1 kg	—

b) Characteristic Value

1) Determination of the characteristic value

The characteristic value corresponds to the characteristic value of one load cell. Only load cells with the same characteristic value can be used.

2) Input of the characteristic value

The display N–VALUE 0.00 mV/V has 3 positions for inputting values. The decimal point and the unit are fixed. The value is input in the same way as the nominal load value.

Inputs in the range from 1.00 mV/V to 3.00 mV/V are permissible as characteristic values.

During modifications in the "nominal load" or "characteristic value" menu points, it is absolutely essential to also pass through menu points "limit values" and "analog output" since the processor has to calculate new hysteresis values for the limit values. For the analog output, a new scaling to the characteristic values is performed. A new dead load offset should also be performed.

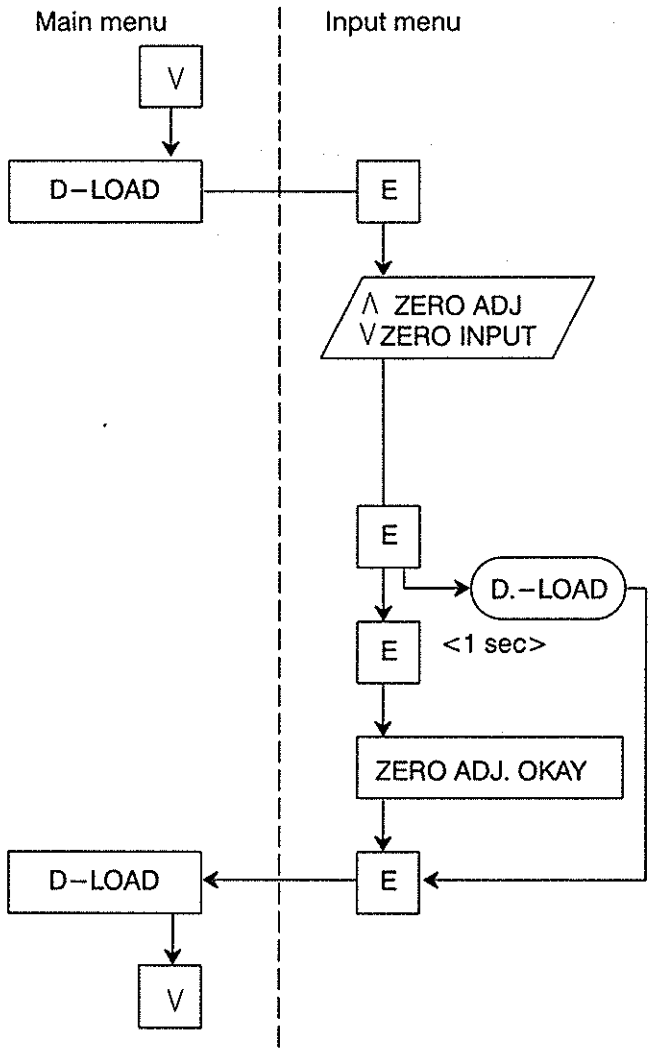
3.3.5 Dead Load (Offset or Input)

The selection of this menu function allows a choice between dead load offset and input of a dead load value.

A dead load value must be input when the SIWAREX P measuring system has to be replaced while the scales are loaded.

☞ The correct replacement of the SIWAREX P measuring system while the scales are loaded requires that the determined, entered dead load value of the system be known. For this reason, the parameterized values for nominal load, characteristic value and dead load must be filed in an appropriate location and updated when modifications are made. (Fill out label in the short description and stick on the measuring system in a suitable location.)

– Performance of the Offset/Input



Selection of the menu item

Choice between ZERO ADJ or ZERO INPUT. Selection is performed with the [V] [Λ] keys. The "A" in ADJ or the "I" in INPUT flashes until the selection is confirmed.

Confirmation of the selection.

Press Enter key for 1 second.

Offset is performed.

Indication

Conclusion of the offset or confirmation of the entered value

3.3.6 Calibration with Standard Weight

Calibration with standard weight is not mandatory. The decision as to whether calibration is necessary or not is based on the degree of accuracy required and the type of measuring.

- **Decision Aids**

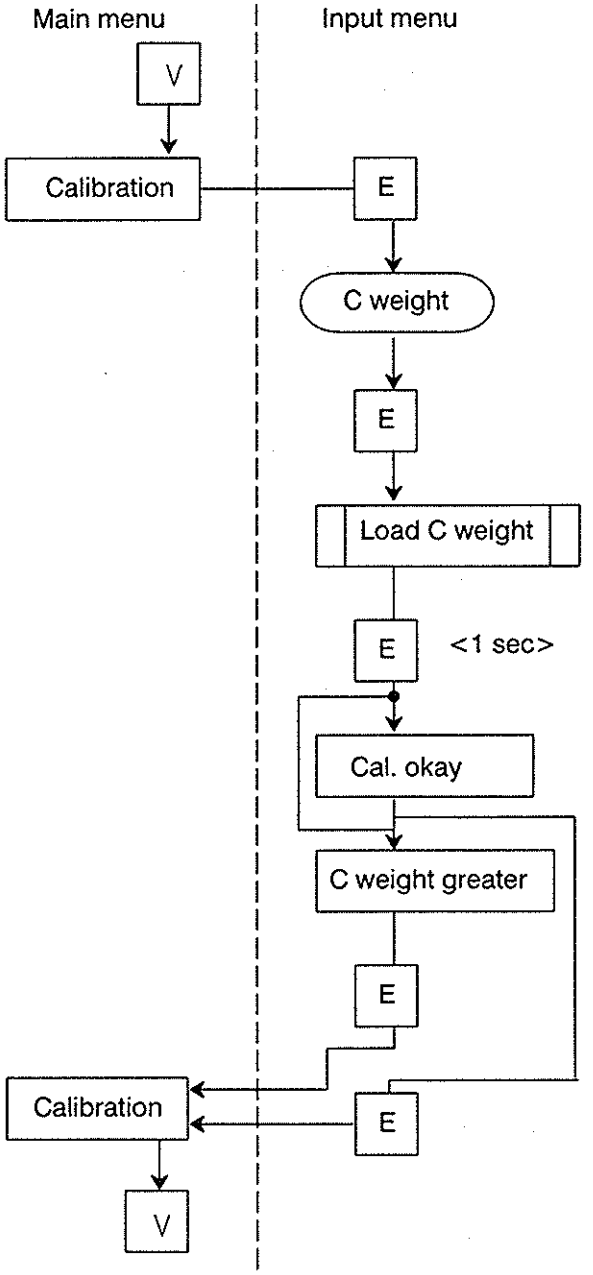
No calibration:	– Standard weight is omitted.
	– Less work during parameterization
	– Measurements are not as precise.
Calibration:	– Precise measurement (Leverages and deviations of the actual characteristic value from the specified characteristic value are offset.)
	– Standard weight > 30% of the load cell nominal load necessary
	– More work during parameterization

After this menu function is selected, the system is calibrated with a standard weight.

To increase measuring accuracy, the calibration should be performed with as large a standard weight as possible.

In all cases, the standard weight must be larger than 1000 d (internal system value). If not, the message "C weight greater" appears during calibration.

– Performance of the Offset



Selection of the menu point

Enter numerical value of the standard weight, same as 3.3.4a.

Confirmation of the entry

Place standard weight on scales (load cell).

Press <enter> key for 1 second.

Calibration being performed

Indication:
Calibration performed and okay

Indication:
Standard weight too small

Jump back for the placing of a larger standard weight

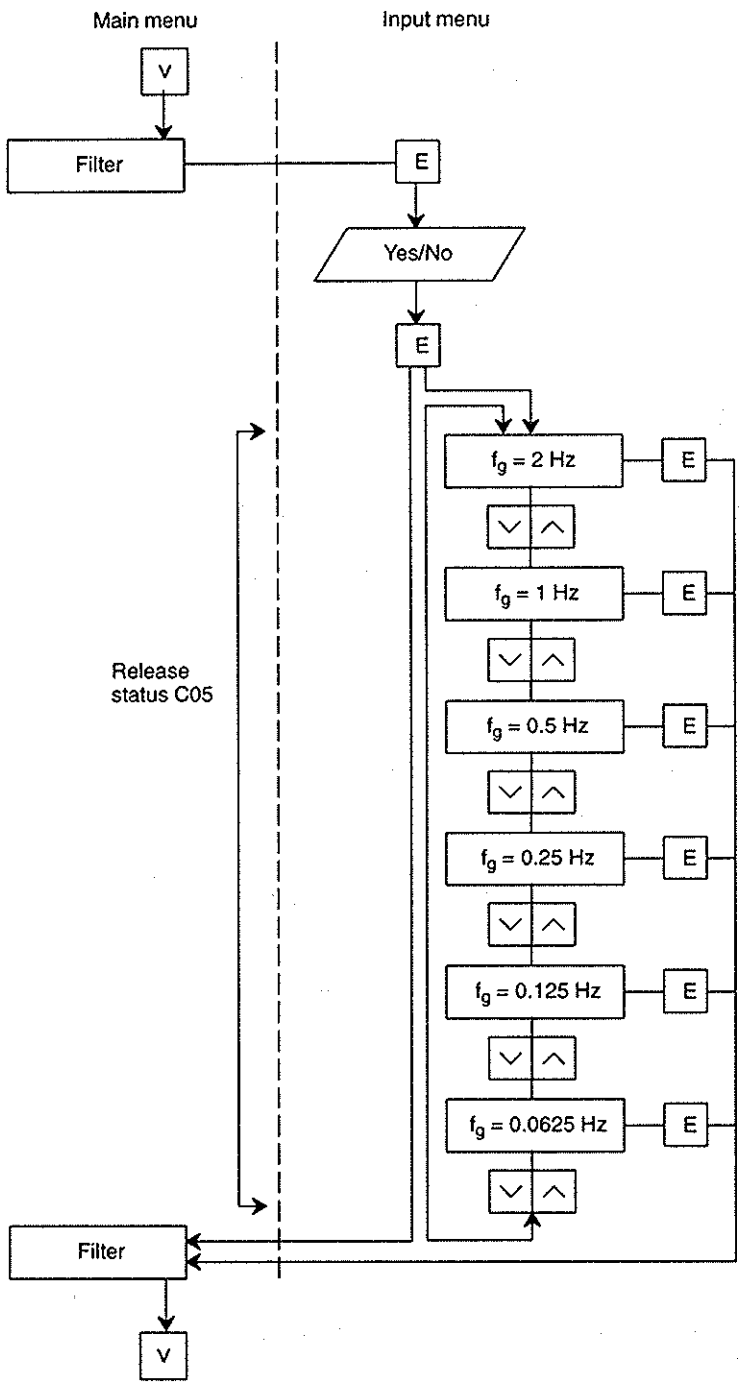
Concluding the calibration

It is absolutely necessary to run through the "limit values" and "analog output" menu points after each calibration.

The hysteresis values are recalculated for the limit values; the calibrated values are rescaled for the analog output.

3.3.7 Switching the Filter On/Off

This menu function can be used to switch the low pass filter for the measuring signal of the load cell on and off. The limit frequency of the filter can be set starting with release status C05.



Selection of the menu point

Use the V ∧ keys to select yes or no.

Confim the selection

Selection of the desired limit frequency (f_g) with the V ∧ keys.

Confirm selected f_g with E

3.3.8 Setting the Limit Values

Two limit values (LIMIT1 and LIMIT2) can be parameterized. Every limit value can be monitored as a minimum value or a maximum value. The type of monitoring (i.e., maximum or minimum) desired must be explicitly specified during the parameterization of the limit values.
The following monitoring capabilities are available:

LIMIT1	LIMIT2
Max	Min
Min	Max
Min	Min
Max	Max

In addition, monitoring of the limit values can be switched on and off individually.

It is absolutely essential to remember the following while entering limit values.

- The maximum value must be at least 5% of the measuring range.
- The minimum value must not be more than 95% of the measuring range.

If these rules are not observed, the hysteresis value of the limit value relay will be passed below (see figure 3.4).

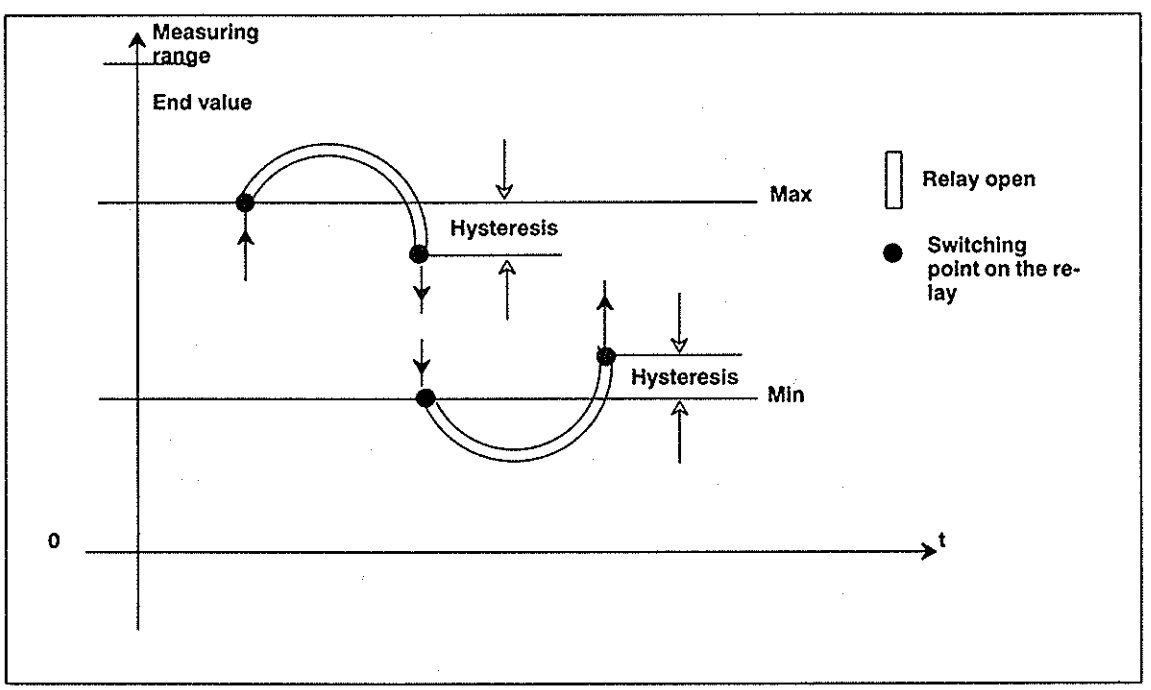
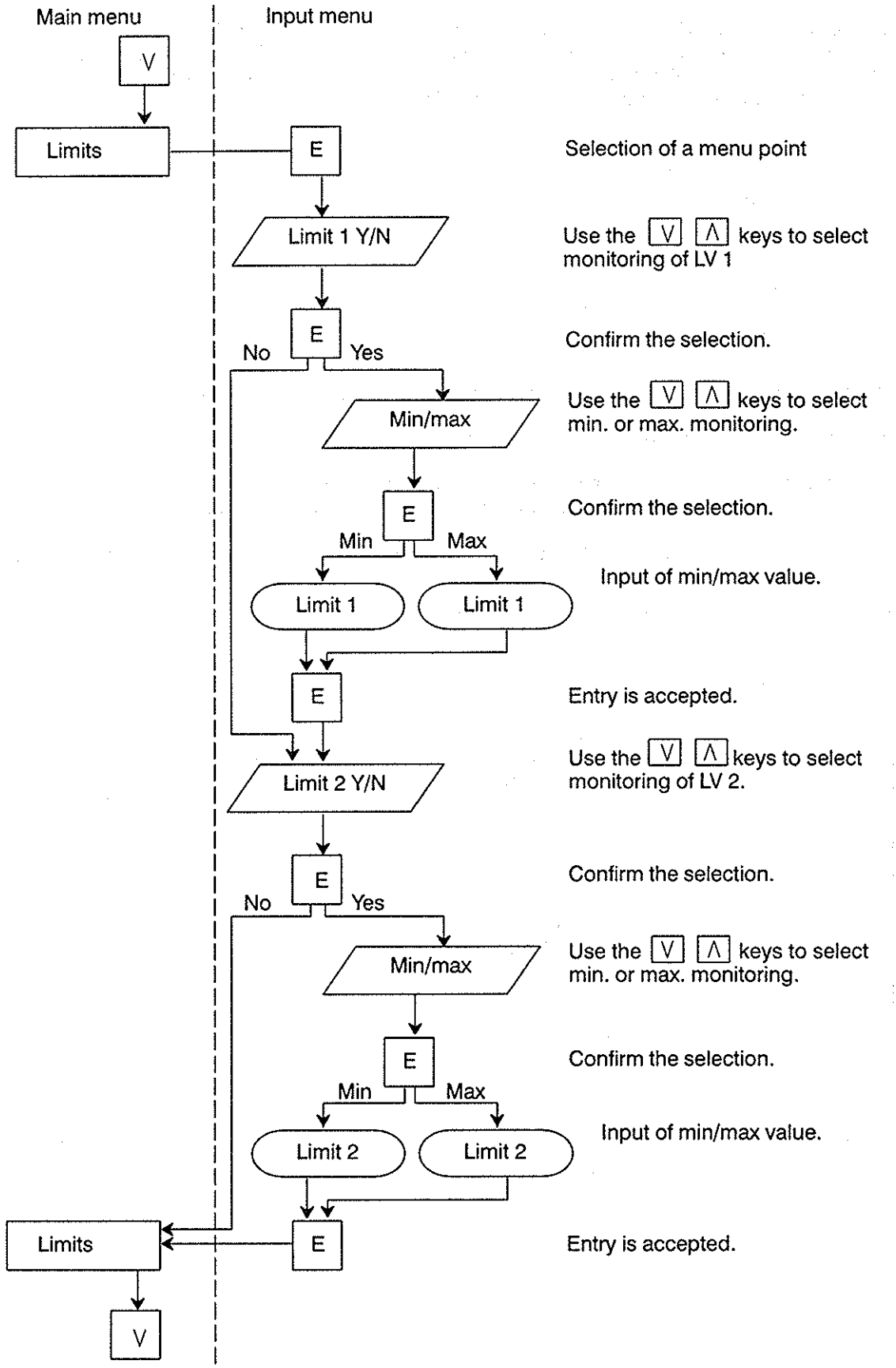


Figure 3.4 Switching behavior of the relay

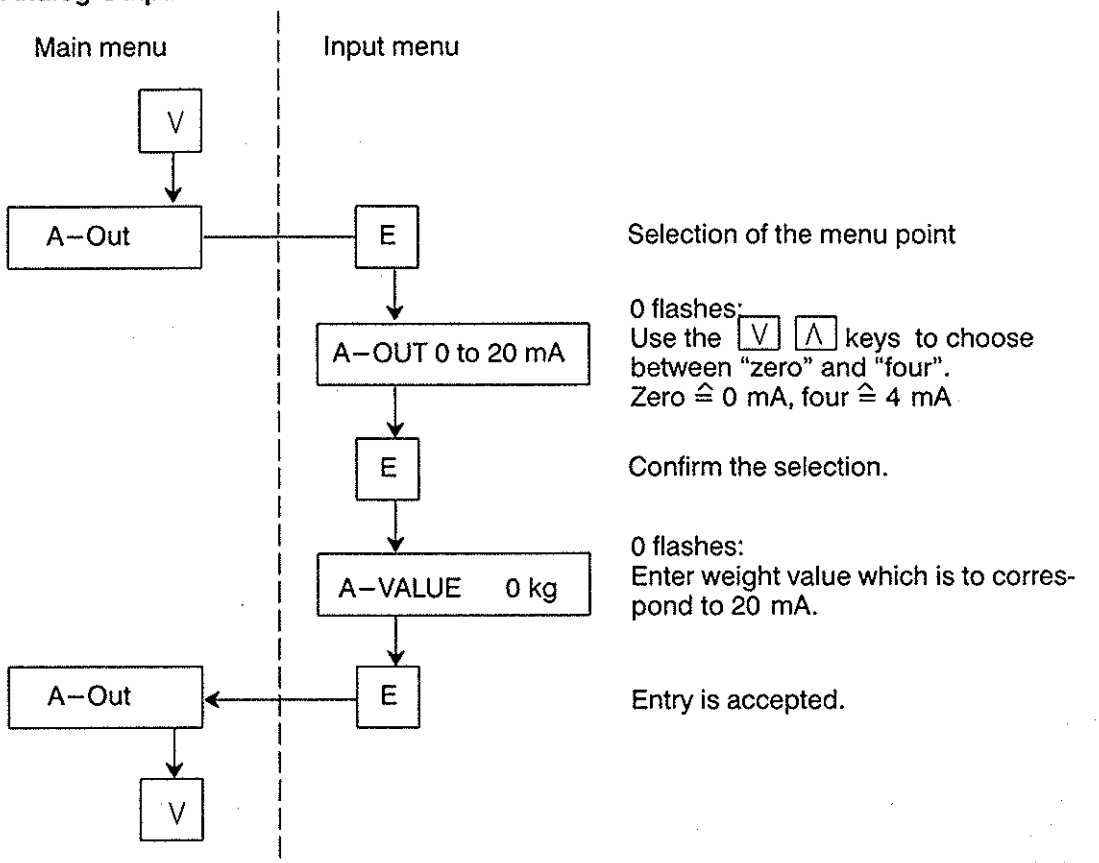
– Setting of Limit Values



3.3.9 Parameterization of the Analog Output

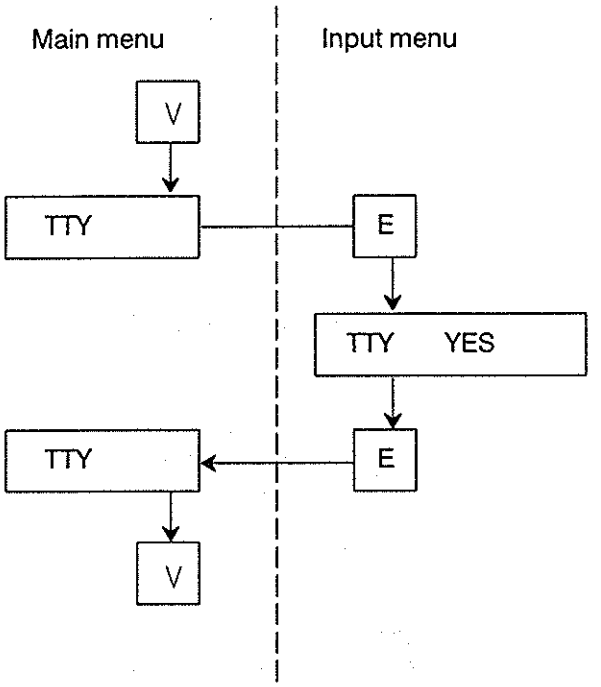
The output current range (0 to 20 mA or 4 to 20 mA) and the appropriate end weight value for 20 mA must be specified for the analog output.

– Analog Output



3.3.10 Enabling/Disabling the TTY Interface

The TTY interface can be disabled or enabled as required.



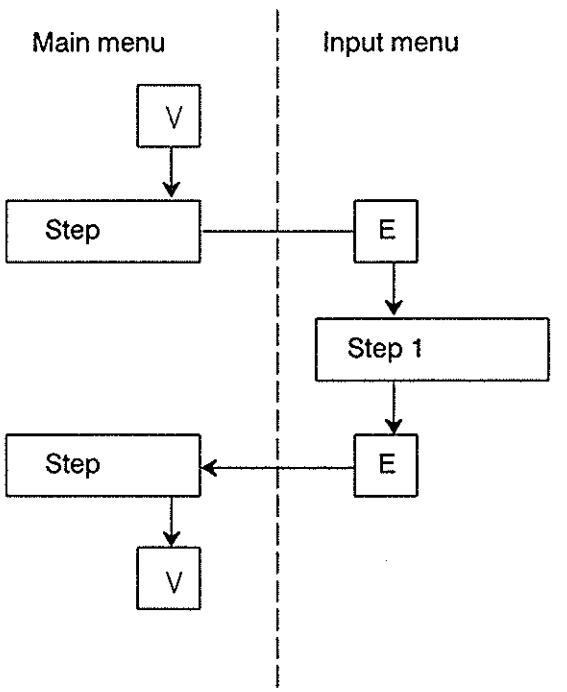
Selection of the menu point

YES flashes:
Use the [V] [Λ] keys to choose between
YES – enable TTY interface
NO – disable TTY interface

Confirm the selection.

3.3.11 Input of a Digit Step

Various digit steps can be selected for the measured value indication during weighing operation. Limit value monitoring and the measured values transmitted on the interfaces are not affected by this setting.



Selection of the menu point

1 flashes:
Use the [V] [Λ] keys to choose between 1, 2, 5 digit steps.

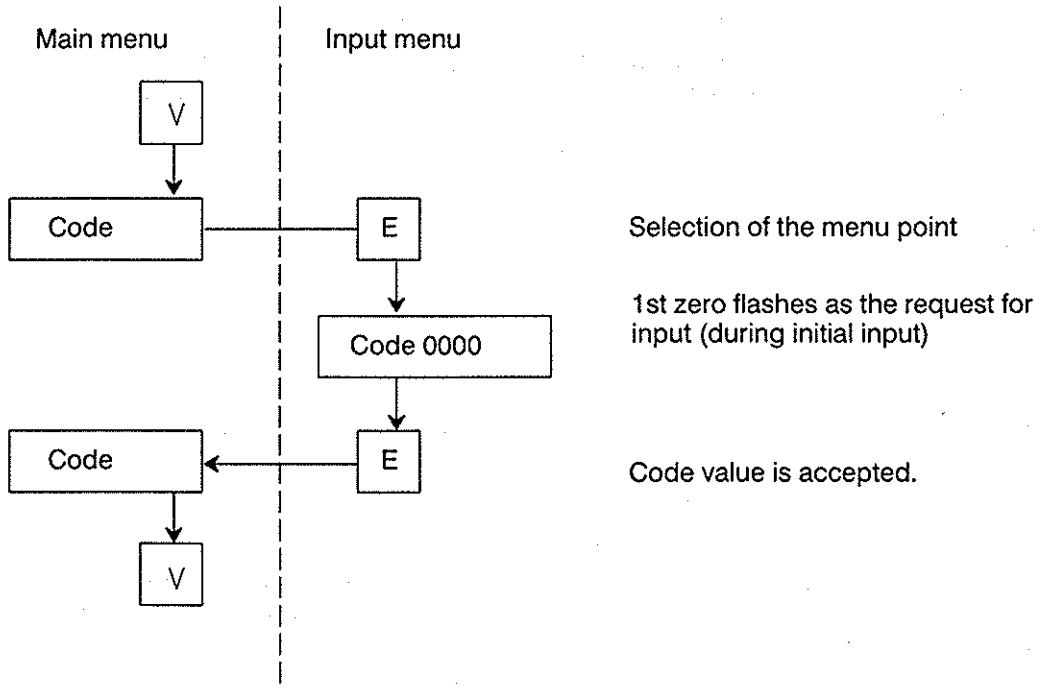
Confirm the selection.

3.3.12 Input/Modification of the Code

– Modification of the Code

The code has been set to 0000 at the factory.

The four–digit code which was last set is indicated and can be modified.



– Input of the Code

During ON–LINE operation, the code is entered as described in point 3.3.2. Remeber, however, that a key must be pressed for a minimum of 1 second at least every 10 seconds. If not, the code entry is cancelled and a jump back to the measured value indication occurs.

When an error (e.g., wire break) occurs while entering the code, the text "CODE" is overwritten with the appropriate error message. The only indication to the user that he/she is presently located in the code input is that the kg and/or t indication is missing.

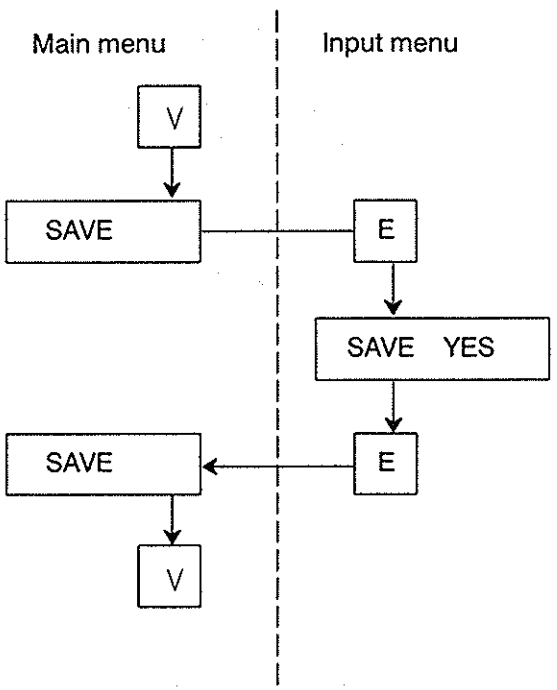
Caution

When changing the code, do NOT forget the new code since you will not be able to parameterize again without the code.

3.3.13 Storing the Parameterized Data

The parameterized data can be stored in either the non–buffered RAM or the buffered EEPROM.

> **Caution**
>
> All data stored in the RAM are lost if a voltage loss occurs or the measuring system is switched off. This data must then be parameterized again when a warm restart is performed.



Selection of the menu point

Y flashes:
Use the [V] [Λ] keys to choose between
YES (store in buffered EEPROM)
NO (store in non–buffered RAM)

Confirm the selection.

The code value is always stored in the EEPROM regardless of whether the parameterization menu was exited with SAVE YES or SAVE NO.

3.3.14 Starting the Measuring Operation (Measuring Cycles)

As soon as the parameterized data is stored, a jump to the measuring cycle is automatically made.

Only the current measured value is indicated.

Indication: | 123.4 kg |

If the measured value passes below a parameterized minimum value, this is indicated on the display as follows:

Indication: | MIN2 100.0 kg |

or | MIN1 100.0 kg |

If the measured value exceeds a parameterized maximum value, this is indicated on the display as follows:

Indication: | MAX1 900.0 kg |

or | MAX2 900.0 kg |

These indications are overwritten by error messages.

Indication: | Error1 900.0 kg |

3.4 Replacement of the System While Scales Are Loaded

The SIWAREX P measuring system can also be replaced when the scales are loaded (e.g., for service or repairs) and no readjustment (calibration) is required.

3.4.1 Replacement of the SIWAREX P Measuring System When Scales Are Not Calibrated

a) Turn off the power supply.

b) If present, disconnect plug connector X1 (TTY interface).

c) Dismount defective SIWAREX P (reverse of description in section 2.1).

d) Determine parameterization data of the defective SIWAREX P (nominal load, characteristic value, dead load) (See section 3.3.5.)

e) Mount new SIWAREX P (see section 2.1).

f) If present, connect host computer to X1.

g) Turn on the power supply.

h) Readjust LCD brightness if necessary (see section 3.2).

i) Parameterize the new SIWAREX P with the parameters of the defective SIWAREX P.

- Nominal load (section 3.3.4a)
- characteristic value (section 3.3.4b)
- Dead load input (section 3.3.5)
- Other parameters

k) Start measuring operation.

l) Measuring inaccuracies can occur since the actual new dead load value can deviate from the previous dead load value; this makes it necessary to perform a dead load offset (section 3.3.5) as soon as the presently running measuring procedure is concluded and the scales are no longer loaded.

Caution

A dead offset cannot be performed while the scales are loaded.

m) Enter changes in parameterization on the sticker.

3.5 Replacement of the SIWAREX P Measuring System With Calibrated Scales

a)
•
•
m) } These points are identical to those in section 3.4.1.

Calibration compensates for load cell errors, transition resistances, measuring errors caused by leverages, and differences between the nominal and the actual characteristic value. These factors can lead to measuring inaccuracies when the measuring system is not calibrated.

Caution

Calibration cannot be performed while the scales are loaded.

n) Calibration must be performed with standard weight (section 3.3.6) as soon as the presently running measuring procedure is concluded, the scales unloaded and a dead load offset performed.

4 Communication

Communication with the SIMATIC S5–90U/95U/100U or a host computer is controlled by a microprocessor. The 80C31 processor handles the following functions during a measuring cycle:

- Acquisition and processing of measured values
- Offset of the measuring amplifier
- Comparison of measured values with limit values and control of limit value relay
- Operating the indicators and keyboard
- Operating the analog output
- Communication with a host computer via the serial interface
- Communication with programmable controller SIMATIC S5–90U/95U/100U via the SIMATIC S5–100U bus

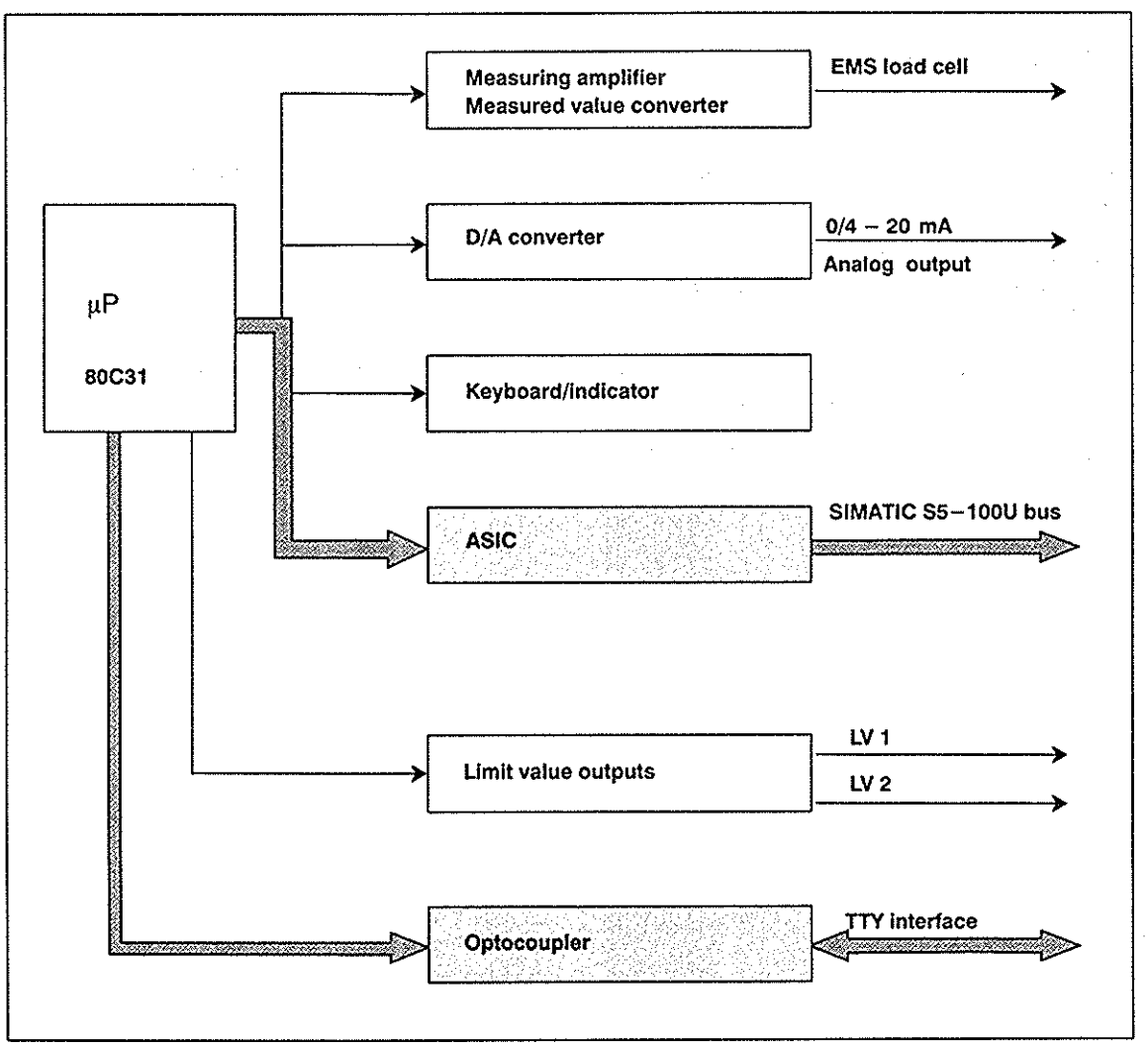


Figure 4.1 Functions of the microprocessor of the SIWAREX P

4.1 Host Computer – SIWAREX P Communication

Communication with the host computer is handled by the serial interface.

At the request of a host, the SIWAREX P sends a measured value and the current parameterization data. The following data are transmitted:

- Error status
- Parameterization status
- Exponent of the values
- Measured value
- Limit value 1
- Limit value 2
- Dead load
- Analog end value
- Nominal load
- characteristic value
- Limit frequency

The request is sent as a so–called FETCH telegram. The SIWAREX P responds with a response telegram containing information listed above.

The SIWAREX P(i) does not react to FETCH telegrams except when in measuring operation (weighing operation). The TTY interface is inactive during startup and/or while in the parameterization menu.

The transmission of a response telegram is aborted by the call of the parameterization menu. The host computer recognizes this as an error based on the 3964R transmission procedure.

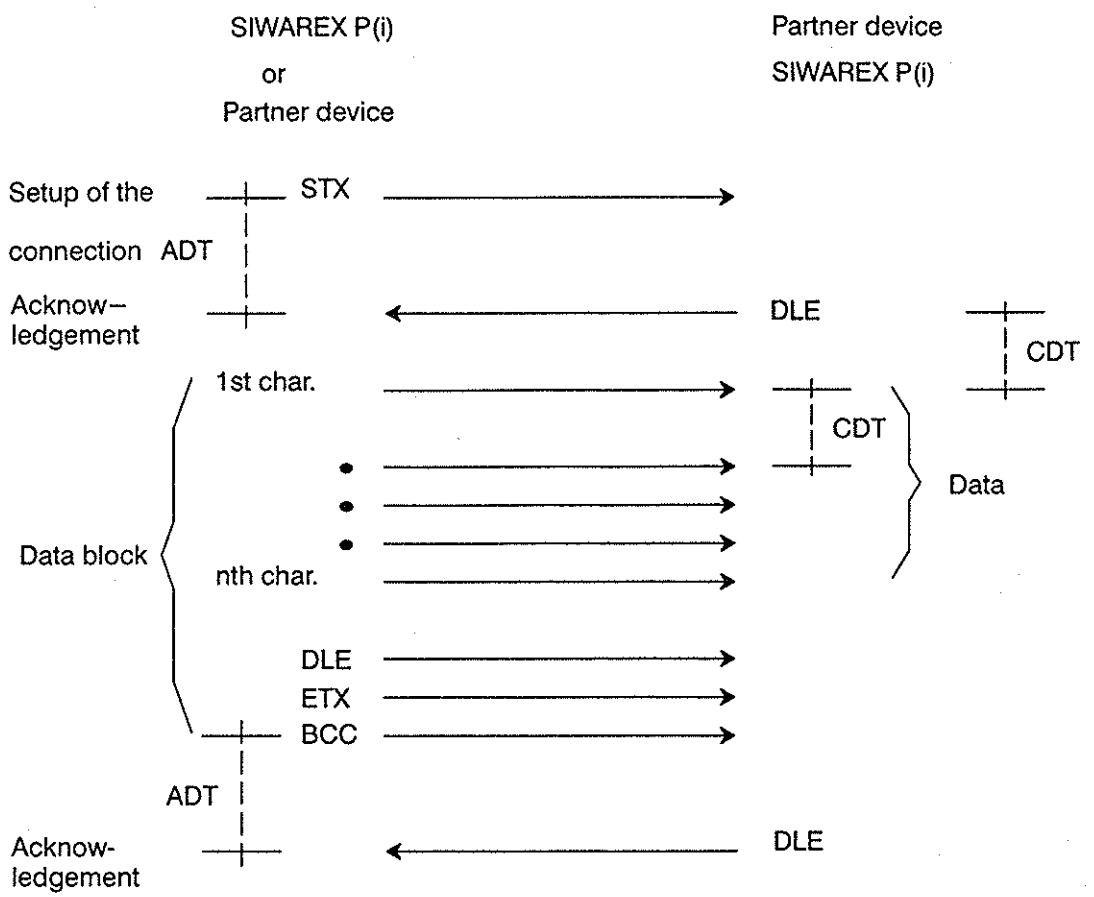
Procedure 3964R is used as the transmission procedure.

4.1.1 3964R Transmission Procedure

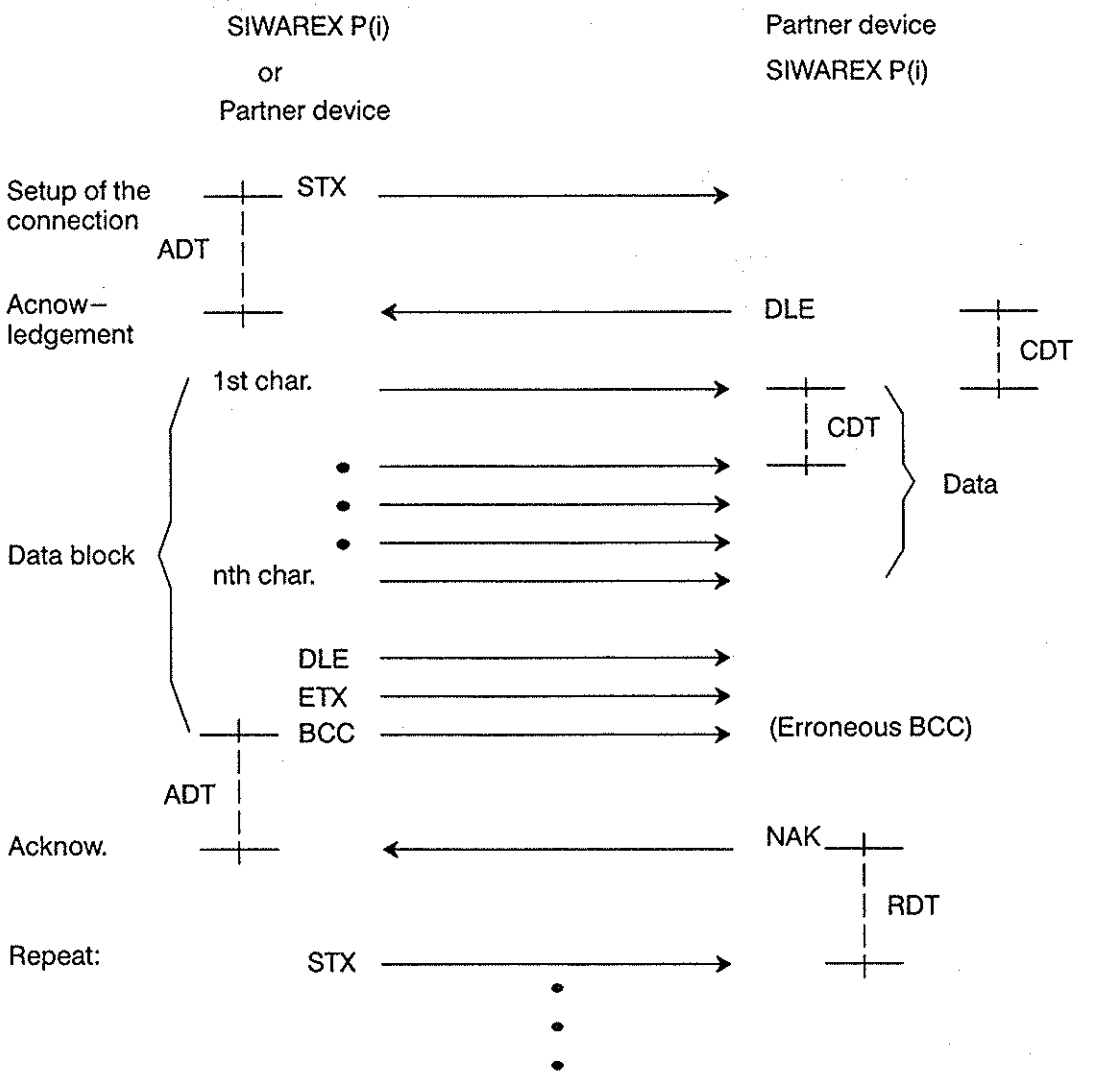
The data are transferred in asynchronous semi–duplex operation as hexadecimal characters with even parity. The transmission rate is 9600 bits/sec.

Character framework:
- 1 start bit
- 8 data bits
- 1 parity bit with check for even parity
- 1 stop bit

Example of correct data communication with 3964R:



Example of incorrect data communication with 3964R:



Monitoring Times:

Acknow. delay time	ADT =2000 msec	(Sending partner)
Char. delay time	CDT = 220 msec	(Receiving partner)
Repetition delay time	RDT = 4000 msec	(Receiving partner)

Acknowledgements:

Positive acknow.	DLE	(Correct BCC)
Negative acknow.	NAK	(Erroneous BBC, CDT up, transmission error)
	STX	Initialization conflict

Repetitions:

Number of sending attempts: 6

When a block in received incorrectly, the receiving partner responds with NAK and monitors the repetition with the RDT.

Abortion of the Procedure:

The procedure is aborted when the maximum number of sending attempts is exceeded or after the repetition delay time expires.

DLE Duplication:

In the user data area, the DLE character (10H) is sent as two DLE characters.

Initialization Conflict:

An initialization conflict has occurred when the partner device responds with STX within the ADT during establishment of the connection. The device with the lower priority delays its sending requirement and acknowledges with DLE on STX.

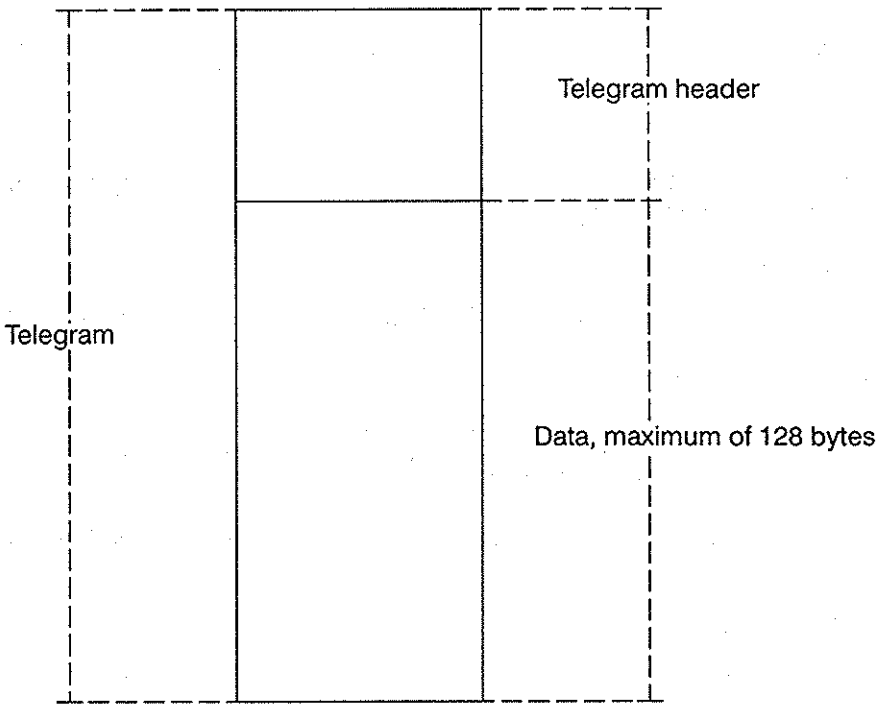
An initialization conflict cannot occur since the SIWAREX P does not send response telegrams unless requested.

BCC (Block Check):

The BCC is generated with the 1st character up to and including ETX (OR–linkage).

DLEs which are sent twice will be included in the calculation of BCC.

4.1.2 General RK512 Telegram Setup



In the telegram level, data communication is performed via command and response telegrams.

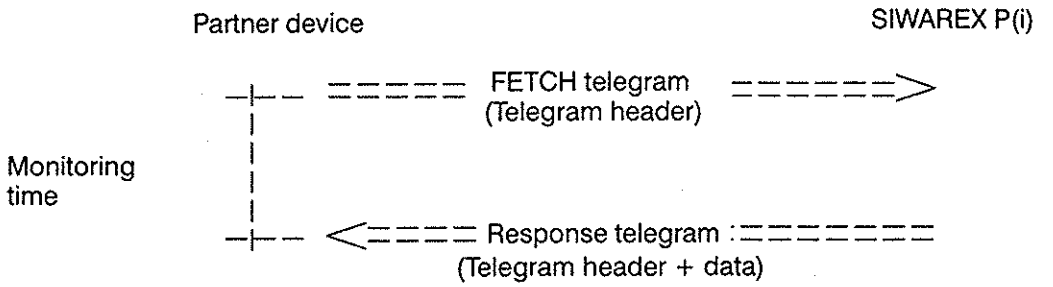
The telegram header of a command telegram consists of 10 bytes; the telegram header of a response telegram has 4 bytes.

4.1.3 Types of Telegrams

For the SIWAREX P(i), FETCH telegrams (telegram header only) are transferred from the host to the SIWAREX P and/or response telegrams with a maximum of 128 bytes are transferred from the SIWAREX P to the host.

4.1.4 Telegram Communication

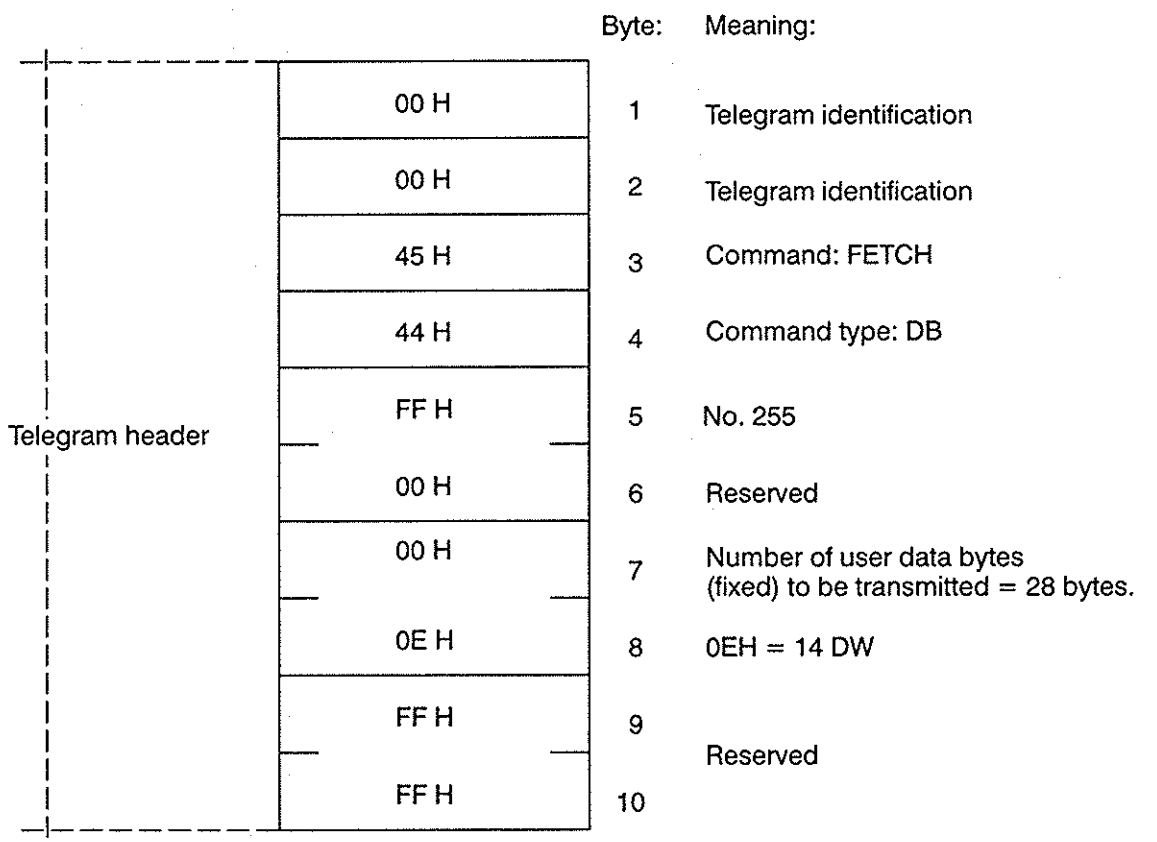
Example of "fetching data", not more than 128 bytes of user data



Monitoring Time:

The monitoring time must be parameterized in the partner device. The SIWAREX P(i) must reply to the FETCH telegram within the monitoring time.

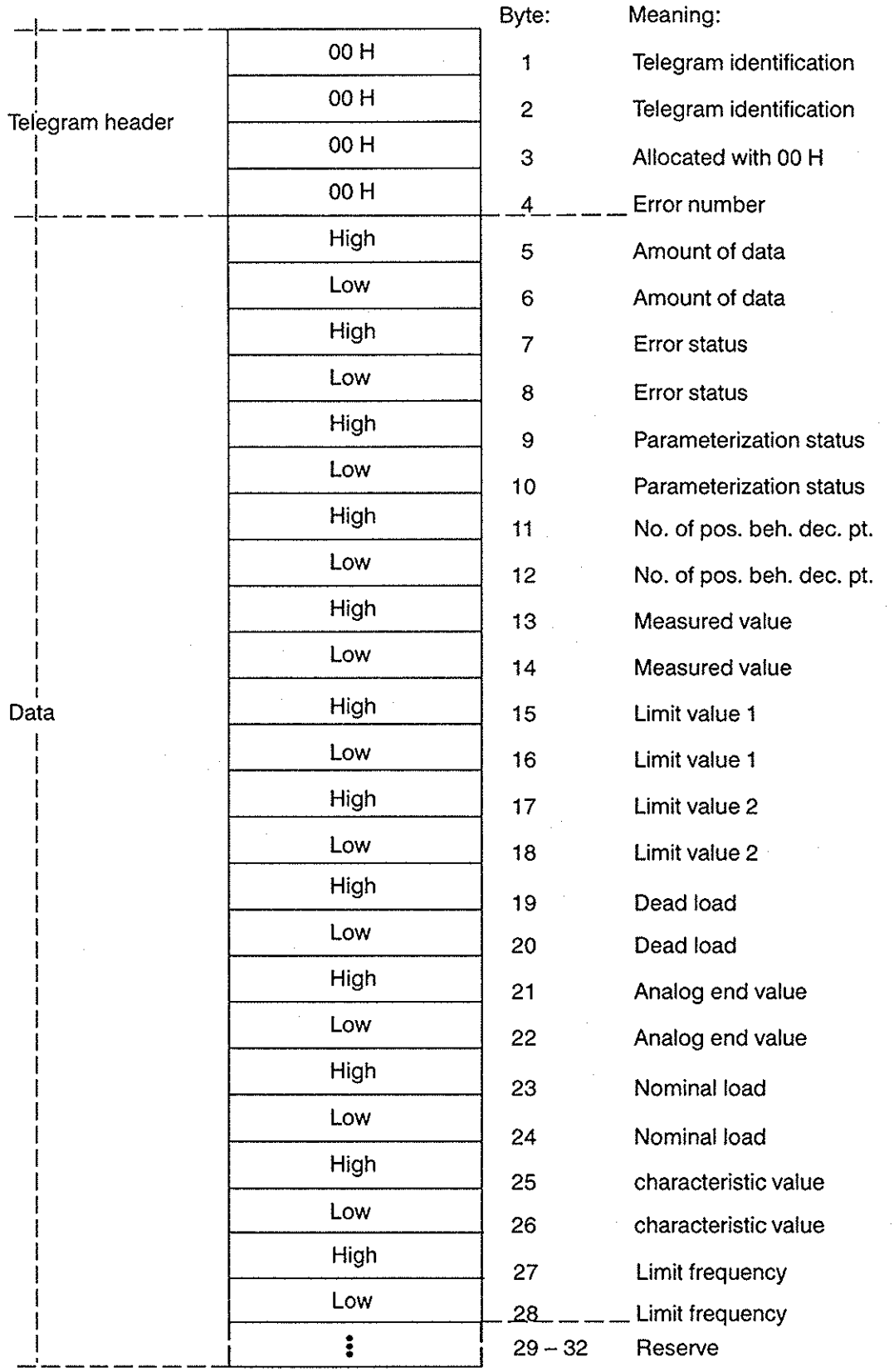
4.1.5 Setup of the FETCH Telegram



The FETCH telegram does not have a data area.

4.1.6 Setup of the Response Telegram

32 bytes are always transmitted.



		Byte:	Meaning:
Telegram header	00 H	1	Telegram identification
	00 H	2	Telegram identification
	00 H	3	Allocated with 00 H
	00 H	4	Error number
Data	High	5	Amount of data
	Low	6	Amount of data
	High	7	Error status
	Low	8	Error status
	High	9	Parameterization status
	Low	10	Parameterization status
	High	11	No. of pos. beh. dec. pt.
	Low	12	No. of pos. beh. dec. pt.
	High	13	Measured value
	Low	14	Measured value
	High	15	Limit value 1
	Low	16	Limit value 1
	High	17	Limit value 2
	Low	18	Limit value 2
	High	19	Dead load
	Low	20	Dead load
	High	21	Analog end value
	Low	22	Analog end value
	High	23	Nominal load
	Low	24	Nominal load
	High	25	characteristic value
	Low	26	characteristic value
	High	27	Limit frequency
	Low	28	Limit frequency
	⋮	29 – 32	Reserve

4.1.7 Error Status (Bytes 7 and 8)

High byte	E15	E14	E13	E12	E11	E10	E9	E8
Low byte	E7	E6	E5	E4	E3	E2	E1	E0

A set 1 indicates errors.

Meaning of the Bits:

E0 : Wire break

E1 : Analog voltage error (internally generated ±15V)

E2 : Load cell voltage error

E3 : Measuring range exceeded by ADC

E4 : Reference value outside tolerance

E5 : Watchdog error

E6 : TTY interface (connection to coupling partner interrupted)

E7 : Not assigned

E8 : Not assigned

E9 : Not assigned

E10 : Not assigned

E11 : EPROM error

E12 : Internal measured value overflow

E13 : 8155 RAM error

E14 : EEPROM error

E15 : ADC error

4.1.8 Parameterization Status (Bytes 9 and 10) (starting with release status C05)

High byte	S15	S14	S13	S12	S11	S10	S9	S8
	Not assigned = 00 H							
Low byte	S7	S6	S5	S4	S3	S2	S1	S0

Meaning of the Bits:

	Bit = 1	Bit = 0
S0 :	Filter on	Filter off
S1 :	4 to 20 mA	0 to 20 mA
S2 :	LV1 monitoring	LV1 no monitoring
S3 :	LV1 min. monitoring	LV1 max. monitoring
S4 :	LV2 monitoring	LV2 no monitoring
S5 :	LV2 min. monitoring	LV2 max. monitoring
S6 :	Higher resolution on S5 bus and TTY interface	Standard resolution
S7 :	Unit of measure = kg	Unit of measure = t

4.1.9 Limit Frequency (Bytes 27 and 28) (starting with release status C05)

KF=0 : Filter off

KF=1 : f_G = 2 HZ

KF=2 : f_G = 1 HZ

KF=3 : f_G = 0.5 HZ

KF=4 : f_G = 0.25 HZ

KF=5 : f_G = 0.125 HZ

KF=6 : f_G = 0.0625 HZ

KF≥7 : Not assigned

4.1.10 Data Format

– Number of Positions Behind the Decimal Point

The exponent (base 10) for measured values, limit values, dead load, analog end values and nominal load is interpreted as the number of positions behind the decimal point. The format is an 8–bit fixed point number (positive).

Ex:

Standard Resolution		Higher Resolution (Starting with Release Status C05)	
Decimal Position 8–Bit Fixed Point	Example	Decimal Position 8–Bit Fixed Point	Example
00	1000	01	1000.0
01	100.0	02	100.00
02	10.00	03	10.000
03	1.000	04	1.0000

– Data Format of the Values

Measured values, limit value 1, limit value 2, dead load, analog end value and nominal load are represented as follows:

16–bit, bipolar, fixed point number(–32768 to +32767)

Example:

7FFFH	=>	+ 32767D
0001H	=>	+ 1D
0000H	=>	0D
FFFFH	=>	– 1D
FFFEH	=>	– 2D
8000H	=>	– 32768D

See also sections 6.5 and 10.5 of the SIMATIC S5–100U equipment manual.

– Characteristic Value

The characteristic value of the load cell is also represented as a 16–bit fixed point number. The number of positions behind the decimal point is fixed and is always 2 (characteristic value = 1.00 to 3.00 mV).

4.2 SIMATIC S5–100U – SIWAREX P Bus Communication

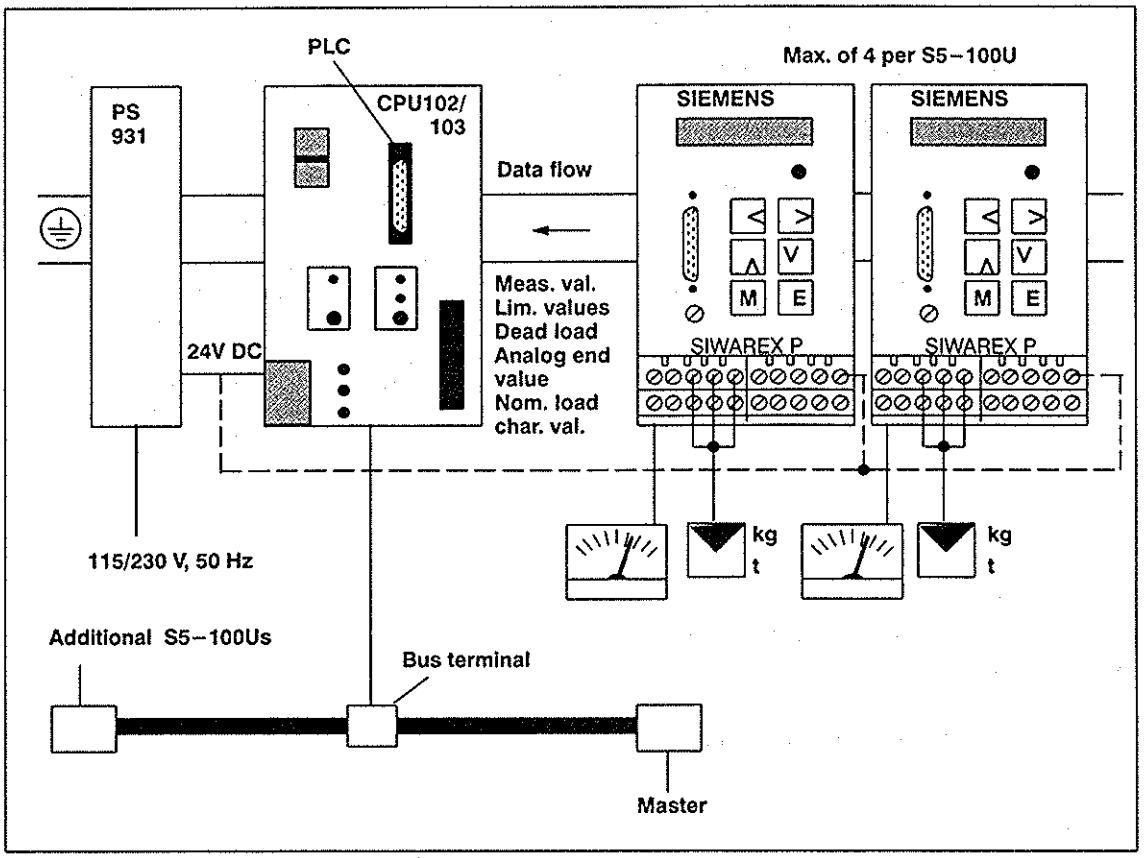


Figure 4.2 SIMATIC S5–100U – SIWAREX P bus communication

Up to four SIWAREX P can be connected to one CPU 100–103 via the SIMATIC S5–100U bus.

A function block (order no. 7MH4811–5AP02) is available for communication with the SIMATIC S5–90U/95U and S5–100U. This function block handles the cyclic reading in of all values provided by the SIWAREX P weighing system.

A link from SIWAREX P to SIMATIC S5–115U to S5–155U can be implemented via the decentral I/O system ET 200 (interfaces IM 318–B and IM 308–B) whereby up to eight SIWAREX Ps can be addressed by one IM 318–B.

Communication with the SIMATIC S5–90U requires an IM90 interface (6ES5 090–8ME11) whereby up to three SIWAREX Ps can be addressed by the IM90.

4.2.1 Allocation of the Address Areas

The address allocation of the SIWAREX P corresponds to a two–channel analog module. This means that a SIWAREX P occupies 4 bytes in both the input and output areas.

When addressing remember that the SIWAREX P requires two slots,

1st	SIWAREX P	→	Address 64
2nd	SIWAREX P	→	Address 80

The fixed address assignment in the system restricts the number of SIWAREX Ps to a maximum of 4 per SIMATIC S5–95U/100U system (S5–90U with IM90 only 3 SIWAREX Ps).

Data cannot be sent from the SIMATIC S5–100U to the SIWAREX P.

In the ET200 System:

When using the link via ET200, remember that the CPU–related read and write access behavior must be considered during I/O access in address area P (from 128) and Q (from 0) if you are using CPU 944. For reliable data transfer (read/write 4 bytes), configure identifier 221 or 2AX (DP standard) via COM–ET 200 for the SIWAREX P. The righthand slot must be configured as a free slot with identifier 000.

Input Area of SIWAREX P (= Output Area of SIMATIC S5)

Byte	Meaning
00	Reserve
01	Reserve
02	Reserve
03	Identification – PLC–CPU request

Output Area of SIWAREX P (= Input Area of SIMATIC S5)

Byte	Meaning
00	Status byte
01	Value output window (H)
02	Value output window (L)
03	Identification SIWAREX P response

Meaning of the Bits in the Status Byte:

Bit	Meaning (Bit = 0)	Meaning (Bit = 1)
00	Invalid data	Valid data
01	Wrong request no.	Right request no.
02	LV1 not addressed	LV1 addressed
03	LV2 not addressed	LV2 addressed
04	Malfunction	No malfunction
05	Reserve at present, preset to 0	
06	Reserve at present, preset to 0	
07	Reserve at present, preset to 0	

4.2.2 Principle of SIMATIC S5–90U/95U/100U CPU <–> SIWAREX P(i) Communication

In principle, communication between the SIWAREX P and the SIMATIC S5–90U/95U/100U CPU is possible in both directions.

The CPU of the SIMATIC S5–90U/95U/100U is the master and requests data from the SIWAREX P.

The SIMATIC S5 CPU writes a request identification in byte 3 of the input area of the SIWAREX P.

The request identification is a positive fixed point number which corresponds to the number (high byte) of the desired data word from the FETCH–response telegram (see section 4.1.6).

The measured value for request number "0" is output similarly to request number "13".

The use of invalid numbers (≥ 33) causes the status messages "invalid data" and "wrong request identification".

As soon as the new request identification is read out, the information output to date is no longer updated (except for the status bits), the "valid data" bit is reset, the requested data word is made available in the value output window, the response identification = request identification is written in the output byte, and the "valid data" status information is then set.

The information in the output area is updated continuously until a new request identification arrives.

The described procedure allows the SIMATIC S5 to make read accesses to all data which is sent via the serial interface.

If the SIWAREX P is not yet ready (startup) to transmit requested data to the SIMATIC S5 CPU, the "invalid data" identification is output.

As soon as the SIWAREX P branchs to the parameterization menu, the SIMATIC S5 interface becomes inactive (i.e., no new S5 requests are processed by the SIWAREX P. In addition, the "invalid data" identification is set in the status byte. The other status bits retain their last information.

4.2.3 Data Format (See Section 4.1.10)

4.2.4 Example

→ SIWAREX P in 2nd slot
–> SIWAREX P occupies the addresses 80 to 83 in the input/output area of the SIMATIC.

→ The measured value is to be read.
–> Specify identifier 13. See section 4.1.6.

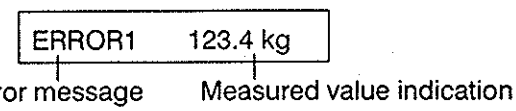
STEP5 code

```
      L   KF   13      ; Transfer identifier 13 for measured value on SIWAREX P
      T   QB   83      ; so that SIWAREX P outputs the measured value
      L   KF   13      ; Check whether SIWAREX P
      L   IB   83      ; outputs the measured value
      ><F              ; If = 13, then SIWAREX P outputs measured value
      JC=END;          Jump if measured value not output
      L   IW   81      ;  Read measured value and
      T   FW   100     ; store in flag word 100
      L   IB   80      ; Read status and
      T   FB   102     ; store in flag byte 102
END:  L   IW   ...     ;SIWAREX P hasn't output measured value yet
        •
        •
        •
```

5 Error Messages

5.1 Indication of the Error Messages

Indication = Example



Meaning of the Error Messages (See Section 5.2.2)

ERROR 1	:	Wire break monitoring of load cell lines
ERROR 2	:	Analog voltage error (internally applied ± 15 V)
ERROR 3	:	Load cell voltage error
ERROR 4	:	Measuring range exceeded by ADC
ERROR 5	:	Reference value outside tolerance
ERROR 6	:	Watchdog error
ERROR 7	:	TTY interface (connection to coupled partner interrupted)
ERROR 12	:	EPROM error
ERROR 13	:	Internal measured value overflow
ERROR 14	:	8155 RAM error
ERROR 15	:	EEPROM error
ERROR 16	:	ADC error

⚠ WARNUNG

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

Unsachgemäßer Umgang mit diesen Geräten kann deshalb zu Tod oder schweren Körperverletzungen sowie erheblichen Sachschäden führen.

Beachten Sie daher bei Instandhaltungsmaßnahmen an diesem Gerät alle in diesem Kapitel und auf dem Produkt selbst aufgeführten Hinweise.

- Die Instandhaltung des Gerätes darf nur durch entsprechend qualifiziertes Personal erfolgen.
- Vor Beginn jeglicher Arbeiten ist das Gerät vom Netz zu trennen und zu erden.
- Es dürfen nur vom Hersteller zugelassene Ersatzteile verwendet werden.

⚠ WARNING

Hazardous voltages are present in this electrical equipment during operation.

Failure to properly maintain the equipment can result in death, severe personal injury or substantial property damage.

The instructions contained in this section and on product labels must be followed.

- Maintenance shall be performed only by qualified personnel.
- Always de–energize and ground the equipment before maintenance.
- Use only authorized spare parts in the repair of the equipment.

5.2 Behavior During Malfunctions

5.2.1 Startup

During startup, the SIWAREX P automatically goes through routines which check the individual function portions of the module. The following tests are performed:

a. LCD connected? — If error: Red LED on, Send module for repairs.

b. EPROM test (error 12)

c. RAM test of the 8155 (error 14)

d. EPROM test (error 15)

e. ADC test (error 16)

— If error: Red LED on, Error message on the LCD, Send module in for repairs.

f. Error in analog voltage (error 2)

g. Error in load cell voltage (error 3)

h. Wire break (error 1)

When an error occurs, the CPU of the SIWAREX P remains in the test routine until the cause of the error is corrected. Measured values cannot be acquired.

i. Watchdog error (error 6)

When the watchdog causes a startup to be performed, the red LED goes on and the error message appears on the LCD. The acquisition of measured values starts again. Since these error messages can be overwritten by min/max messages during the measuring cycle, the red LED remains on to indicate that an error has occurred. It is deleted by turning off the device or by calling the parameterization menu.

k. TTY interface has no connection to the coupling partner (error 7).

If the TTY interface is enabled but the connection to a host is not established, the red LED goes on briefly and a message (error 7) appears on the display. The error message can be deleted while measured values are being acquired, or overwritten.
The TTY interface is also checked when a return is made from the parameterization menu to the measuring cycle, if enabled. If there is no connection to a host, the red LED goes on briefly, but no error message is displayed.

5.2.2 Measuring Cycle

When an error occurs, the corresponding bit is always set in the error status register (interfaces).

The following cases of errors are checked during the acquisition of measured values.

(Error 2) – Analog voltage ..... Highest indicator priority
If error occurs: Send module for repairs.

(Error 3) – Load cell voltage
If error occurs: Send module for repairs.

(Error 1) – Wire break
If error occurs: Check all lines from the SIWAREX P(i) measuring sytem to the load cell(s).

(Error 4) – Meas. range exceeded by the ADC ..... Lowest indicator priority
If error occurs: Send module for repairs. (If the measuring range is exceeded only briefly, the red LED goes out again and the error indication can be deleted by calling the parameterization menu.)

In addition, the following applies to error messages (i.e., errors 1 to 4):

If error occurs:
- Red LED goes on.
- Relays are opened.
- Processing of measured values is interrupted until the error is corrected.
- Monitoring continues.

After error is corrected:
- Red LED goes off.
- Relays close depending on the limit value status.
- Error message remains until:
  - Overwritten by the next error message
  - Overwritten by limit value message

(Error 5) – Reference value outside tolerance

If error occurs: SIWAREX P(i) remains in measuring operation. No effect on relay contacts Red LED off

(Error 13) – Internal measured value overflow

If error occurs: Processor goes into an endless loop. Watchdog is no longer triggered. Watchdog error (error 6) is indicated. Error 13 is overwritten by error 6. Red LED goes on. (See also section 5. 2.1.i.)

APPENDIX

A1 Abbreviations

ADC	Analog digital converter
ADT	Acknowledgement delay time
CDT	Character delay time
CPU	Central processing unit
DAC	Digital analog converter
EBC	Equipotential bonding conductor
EMS	Expansion measuring strips
IB	Intermediate box
LC	Load cell
LCD	Liquid crystal display
LED	Light emitting diode
LV	Limit value
LVR	Limit value relay
PLC	Programmable controller
PS	Power supply
RDT	Repetition delay time
REL	Relay output
TB	Terminal box

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