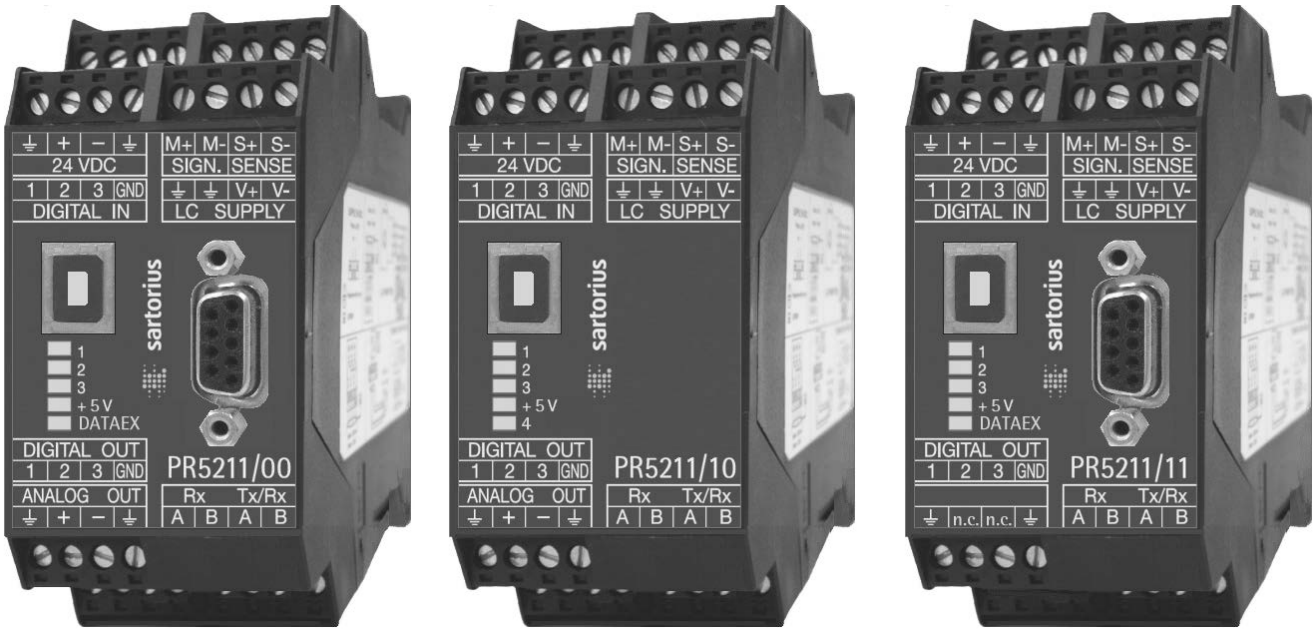
Instrument Manual

PR 5211 Transmitter Series
PR 5211/00 ProfiBus Transmitter
PR 5211/10 Digital Process Transmitter
PR 5211/11 ProfiBus Transmitter (without Analog Output)



Instrument Manual for PR 5211	9499 050 52100 Release 6.00	Edition 1	20.01.2014

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Table of Contents

1 Safety Hints 5
1.1 Electrical Protection Class 5
1.2 Intended Use 5
1.3 Initial Inspection 5
1.4 Before Commissioning 5
1.4.1 Installation 6
1.4.2 Electrostatically Sensitive Components 6
1.4.3 Protective Earth 6
1.4.4 Supply Voltage Connection 6
1.4.5 Failure and Excessive Stress 7
1.4.6 Fuse 7
1.4.7 EMC-Compliant Installation 7

2 PR 5211 Transmitter Series 8
2.1 The Transmitter Versions 8
2.1.1 PR 5211/00 Version 8
2.1.2 PR 5211/10 Version (without ProfiBus) 8
2.1.3 PR 5211/11 Version (without Analog Output) 8
2.2 Transmitter Survey 9
2.3 Label on the Housing 10
2.4 Housing Dimensions 10
2.5 Open Housing 10
2.6 Display 11
2.6.1 Status LEDs 11
2.7 Overview of Connections 12

3 Installing the Instrument 13
3.1 General 13
3.2 Connections 13
3.2.1 USB Interface 13
3.2.2 RS-485 Interface 14
3.2.3 Analog Output 16
3.2.4 3 Opto Inputs 17
3.2.5 3 Opto Outputs 18
3.2.6 Load Cell Connection 19
3.2.7 ProfiBus Interface (for PR 5211/00 and PR 5211/11 only) 23

4 Commissioning ... 24
4.1 Data Backup/Power Failure ... 24
4.1.1 CAL Switch ... 24
4.1.2 Factory Settings ... 25
4.1.3 Power Failure ... 25
4.2 Switching on the Instrument ... 26
4.3 Installation of USB Chip Drivers ... 26
4.4 Installation of ConfigureIt! ... 27
4.5 Load and Store Setup and Configuration ... 28
4.5.1 Data in the PR 5211 ... 28
4.5.2 Archive Data in the PC ... 28
4.6 Print Data Set ... 28
4.7 Select Language ... 29
4.8 Status Line ... 30
4.9 ADU ... 31
4.9.1 Calibration ... 31
4.9.2 Configuration ... 33
4.10 Parameter ... 35
4.10.1 Analog Output ... 35
4.10.2 ProfiBus Address ... 36
4.10.3 Bus Size ... 36
4.10.4 Communication ... 37
4.10.5 Baudrate ... 37
4.10.6 Access Code ... 37
4.10.7 Outputs ... 37
4.10.8 Inputs ... 37
4.10.9 Limits ... 38
4.11 Calibration ... 39
4.11.1 Smart Calibration ... 42
4.12 Analog Output Adaption ... 44
4.13 Status ... 45
4.13.1 Analog Part/Weight Status ... 46

5 SMA Protocol ... 46
5.1 General ... 46
5.2 Key to Symbols Used ... 47
5.3 Scale Command Set ... 48
5.3.1 Request Displayed Weight ... 48
5.3.2 Request High-Resolution Weight ... 48
5.3.3 Request Displayed Weight after Stability ... 48
5.3.4 Request Scale to Zero ... 48
5.3.5 Request Scale to Tare ... 49
5.3.6 Set Scale Tare Weight ... 49
5.3.7 Return Tare Weight ... 49
5.3.8 Clear Scale Tare Weight ... 49
5.3.9 Invoke Scale Diagnostics ... 49
5.3.10 About Scale First Line ... 49
5.3.11 About Scale Scroll ... 50
5.3.12 Scale Information ... 50
5.3.13 Scale Information Scroll ... 50
5.3.14 Abort Command ... 50
5.3.15 Repeat Displayed Weight Continuously ... 50

5.4 Scale Response Messages 51
5.4.1 Standard Scale Response Message 51
5.4.2 Unrecognized Command Response 52
5.4.3 Communication Error Response 52
5.4.4 Diagnostics Command Response 52
5.4.5 About 'A' and 'B' Command Response 53
5.4.6 Scale Information 'I' and 'N' Command Response 54
5.5 Communication Error Handling 54

6 ProfiBus Interface 55
6.1 ProfiBus Interface Protocol 55
6.1.1 Write Window (Input Area) 56
6.1.2 Read Window (Output Area) 56
6.1.3 Data Reading and Writing 56
6.1.4 Description of I/O Area (Read/Write Window) 57
6.1.5 Register Read and Write via ProfiBus 59
6.1.6 Parameter Read and Write via ProfiBus 61
6.2 ProfiBus Register 63
6.2.1 Register 0: IO-Status Bits for Reading 63
6.2.2 Register 1: Scale Status 63
6.2.3 Register 2: Status of State Controlled Action Bits 64
6.2.4 Register 3: Status of Transition Controlled Action Bits 64
6.2.5 Register 4: Calibration Information, Error Byte 64
6.2.6 Register 5: Transmitter Type and Version 66
6.2.7 Register 6: Board Number 66
6.2.8 Register 7: (Reserved) 66
6.2.9 Register 8 ...14: Weight data 66
6.2.10 Register 20 and 21: Parameter channel (read/write) 67
6.2.11 Register 22...27: Limit values (read/write) 67
6.2.12 Register 30: Analog output (read/write) 67
6.2.13 Register 31: Fixtare (read/write) 67
6.2.14 Register 80...93: Action bits state controlled (write) 68
6.2.15 Register 112...125: Action bits transition controlled (write) 69
6.3 ProfiBus Parameter Numbers 70
6.3.1 Configuration parameter 70
6.3.2 Calibration 73
6.3.3 ADU parameter 75
6.3.4 Parameter P99: Access Code 80

7 Repair and Maintenance ... 81
7.1 Soldering Work ... 81
7.2 Cleaning ... 81

8 Disposal ... 82

9 Error Messages ... 83
9.1 Weight Error Status ... 83

10 Technical Data ... 84
10.1 Weighing Electronics ... 84
10.1.1 Accuracy and Stability ... 84
10.1.2 Sensitivity ... 84
10.1.3 Load Cells ... 84
10.2 ProfiBus DP ... 85
10.3 Power Supply ... 85
10.4 Environmental Effects ... 85
10.4.1 Environmental Conditions ... 85
10.4.2 Electromagnetic Compatibility (EMC) ... 86
10.4.3 RF interference suppression ... 86
10.5 Mechanical Data ... 87
10.5.1 Construction Type ... 87
10.5.2 Dimensions ... 87
10.5.3 Connections ... 87
10.5.4 Weight ... 87
10.6 Equipment Supplied ... 87
10.7 Options ... 87

11 Index ... 89

12 Appendix ... 91
12.1 Pin Assignment for Interface RS-485 ... 91
12.2 EC Declaration of Conformity ... 91
12.3 GSD File for ProfiBus DP ... 91
12.4 Spare Parts ... 91
12.5 Example Print Out ... 92

1 Safety Hints

1.1 Electrical Protection Class

This instrument was built and tested in accordance with the safety regulations for measuring and control instrumentation. The instrument was delivered in safe condition. To maintain this condition and to ensure safe operation, the operator must follow the hints and warnings given in this documentation.

1.2 Intended Use

The instrument is intended for weighing installations and is particularly suitable for tank and hopper weighing and as a weight transmitter in intelligent control systems. Product operation, commissioning and maintenance must be done by well trained and qualified persons who know of the risks and avoid them, or take measures to protect themselves.

The instrument is latest state of the art. No warranty is taken that the product is free of errors, especially with reference to the software and hardware required for operation and supplied by third parties. The manufacturer does not take any liability for damage caused by incorrect use of this product. Using this product implies recognition of the above-mentioned regulations.

1.3 Initial Inspection

Check the contents of the consignment for completeness and note whether any damage has occurred during transport. If the content is incomplete or damaged, a claim must be filed with the carrier immediately and the Sartorius sales or service organization must be informed to permit repair or replacement of the unit.

1.4 Before Commissioning

Visual inspection!

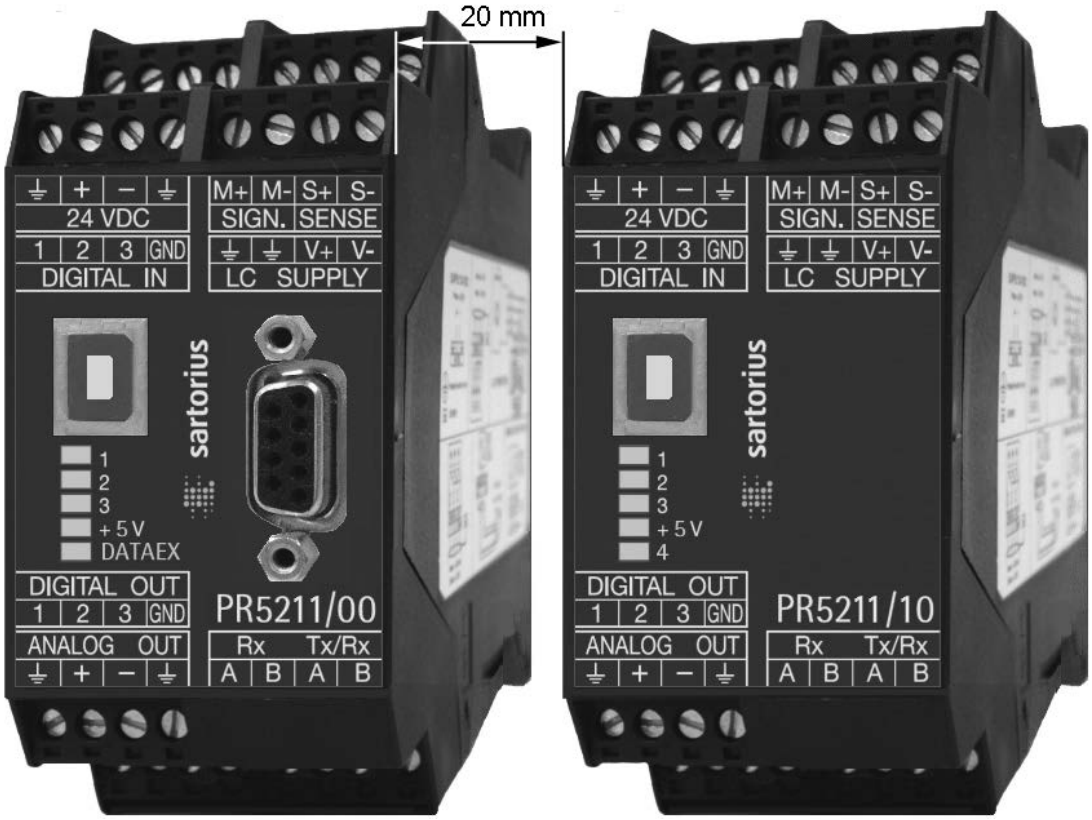
Before commissioning and after storage or transport, inspect the instruments visually for signs of mechanical damage.

1.4.1 Installation

The instrument is designed for mounting on standard rails (35 mm, acc. to DIN 46277).

Caution!
Excessive heat may reduce the instrument lifetime!

When mounting on the rail, make sure that the distance from other instruments left and right of the module is at least 20 mm.



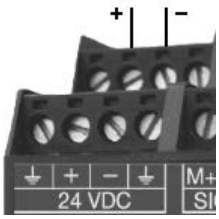
1.4.2 Electrostatically Sensitive Components

This instrument contains electrostatically sensitive components. Therefore, potential equalization must be provided when working at the instrument (antistatic protection).

1.4.3 Protective Earth

The connection to protective earth is done via the mounting rail.

1.4.4 Supply Voltage Connection



The supply voltage is 24 V DC +10 %/-15 %.

The power consumption is 8.2 W maximum.

For connection to 230/115 V AC an external power supply (e.g. Sartorius PR 1624/00 or Phoenix Mini Power) is required.

1.4.5 Failure and Excessive Stress

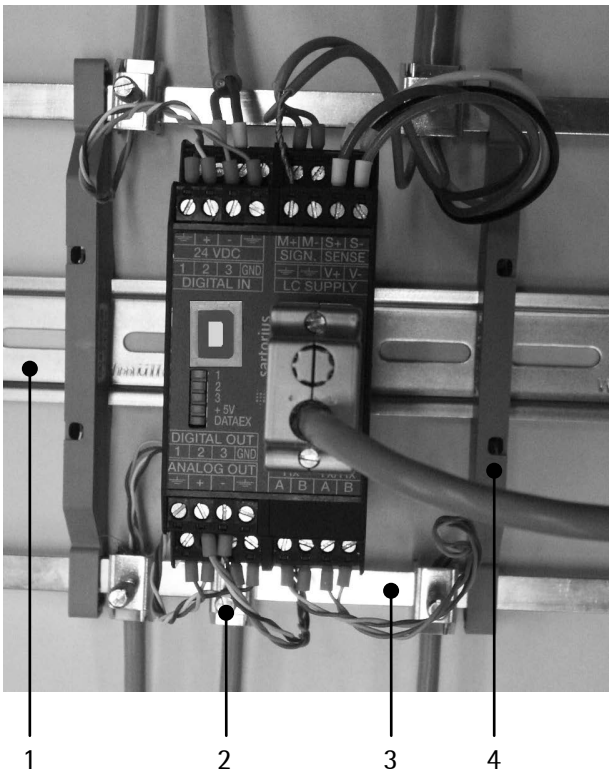
If the instrument is suspected of being unsafe, shut it down and protect it against accidental operation. This is the case when the unit:

- is physically damaged,
- does not function any more,
- is stressed beyond the tolerable limits (e.g. during storage, transport).

1.4.6 Fuse

The instrument has got no fuse to be exchanged. The load cell supply is protected against short circuit by multifuse elements. If the load cell supply switches off, disconnect the device from power. Search for the reason and eliminate it. After a cooling down period of about 3 minutes the power can be switched on again.

1.4.7 EMC-Compliant Installation



- Use only screened data cables.
- Connect screens on both ends with ground.
- Keep unscreened cable ends short.
- Connect screen rail to cabinet / housing with low impedance.
- Use metal or metallized connector housings.
- Establish equipotential bonding between instruments/system modules (Mandatory for Ex-applications).
- Use standard reference potential.
- Connect mounting rail to protective earth.
- Install measure and data cables separately from power cables.

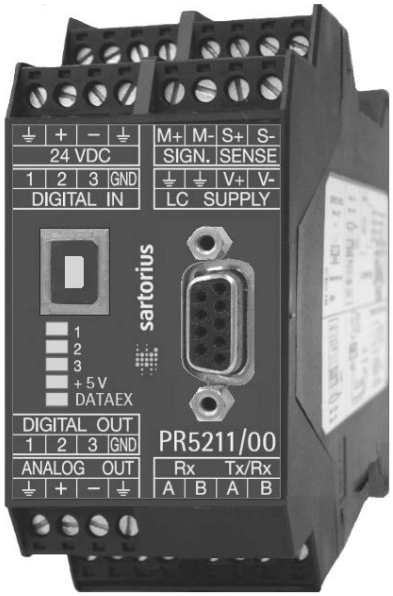
Pos.	Designation
1	Mounting rail (35 mm)
2	Screen clamp (e.g. Phoenix SK8-D)
3	Screen rail (e.g. Phoenix NLS-CU 3/10)
4	Rail connection (e.g. Phoenix AB-SK 65D)

2 PR 5211 Transmitter Series

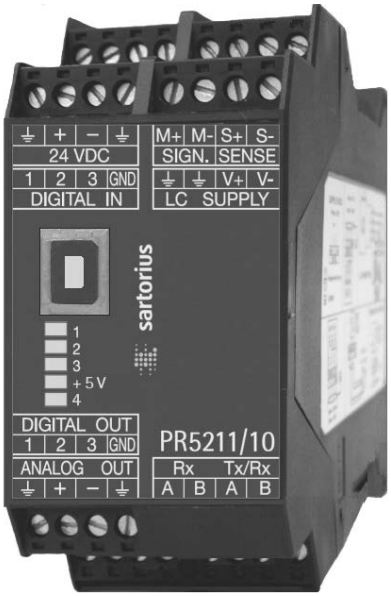
2.1 The Transmitter Versions

The transmitters of series 5211 are available in 3 models, a later extension to a different model is not possible. The respective version is clearly defined by the type number. The front foils are adapted to the version.

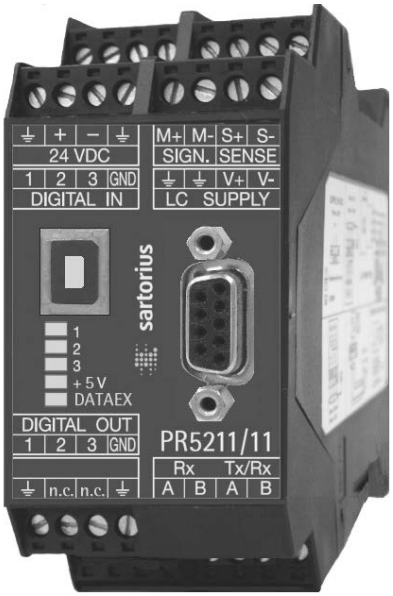
PR 5211/00



PR 5211/10



PR 5211/11



2.1.1 PR 5211/00 Version

This is the fully equipped version. It has digital in and outputs as well as an analog output and USB-B connection for the configuration of the device. Via serial output an e.g. remote display can be connected. This version is additionally equipped with a ProfiBus connection.

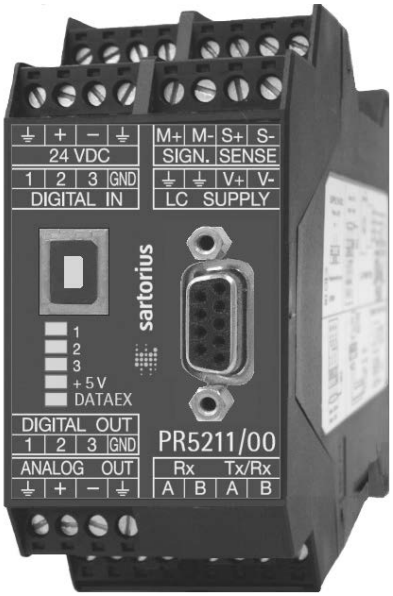
2.1.2 PR 5211/10 Version (without ProfiBus)

This is the fully equipped version. It has digital in and outputs as well as an analog output and USB-B connection for the configuration of the device. Via serial output an e.g. remote display can be connected. This version is not equipped with a ProfiBus connection. The respective menus in the operating tools are adapted to it.

2.1.3 PR 5211/11 Version (without Analog Output)

This version has digital in and outputs and USB-B connection for the configuration of the device. Via serial output an e.g. remote display can be connected. This version is equipped with a ProfiBus connection, but not with an analog output. The respective menus in the operating tools are adapted to it.

2.2 Transmitter Survey



- Accuracy 6000 d @ 6 samples/sec
- Internal resolution 4.8 Mio counts
- Linearity <0.002% (typ.)
- Sample rate selectable: 6 ... 100/sec
- Digital filter with selectable characteristic
- Interfaces are galvanically isolated
- 3 pairs of programmable limits
- 24 V DC Supply voltage
- Connection using 7 plug-in terminal blocks
- Connector (female) for ProfiBus
- Connector USB-B for PC
- Connection cable (1.8 m) for PC (USB 2.0; A>B)
- The unit is suitable for snap-in mounting (rail).
- 5 status LEDs for power, communication, error detection
- Calibration and configuration of the instrument are menu-guided via PC or via ProfiBus commands.
- Calibration by means of weights or by entry of the mV/V values without additional calculations
- Analog Output 0/4...20 mA, configurable for gross/net (PR 5211/00 and PR 5211/10 only)
- Analog Output value defined by ProfiBus (PR 5211/00 only)
- Digital Input 3 channels, galvanically isolated
- Digital Output 3 channels, galvanically isolated

Communication protocols

For the internal RS-485:

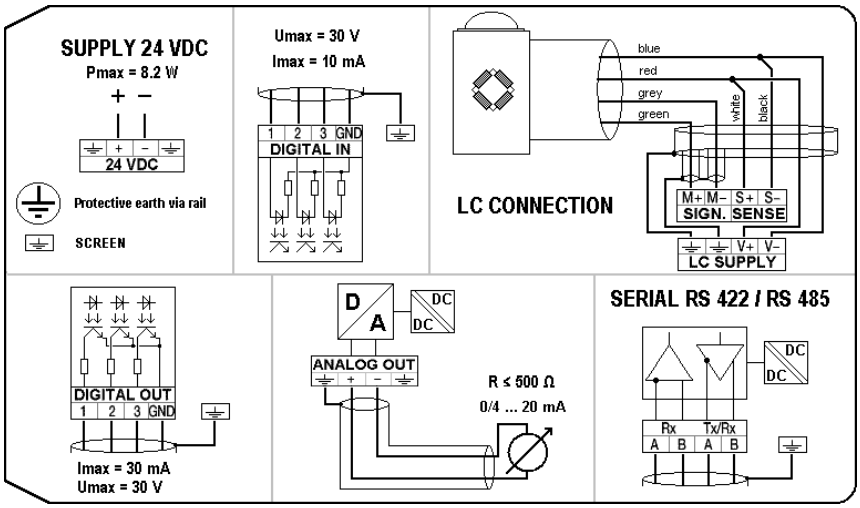
- Remote display protocol
- SMA protocol

Slave:

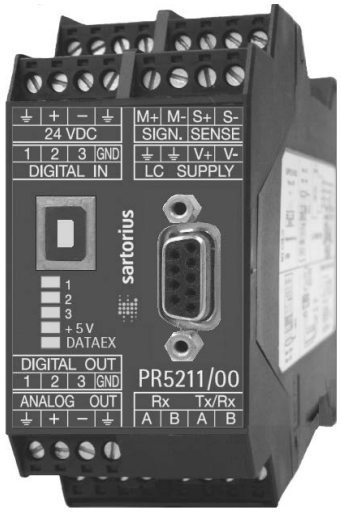
- PR 5211/00 ProfiBus-DP
- PR 5211/11 ProfiBus-DP

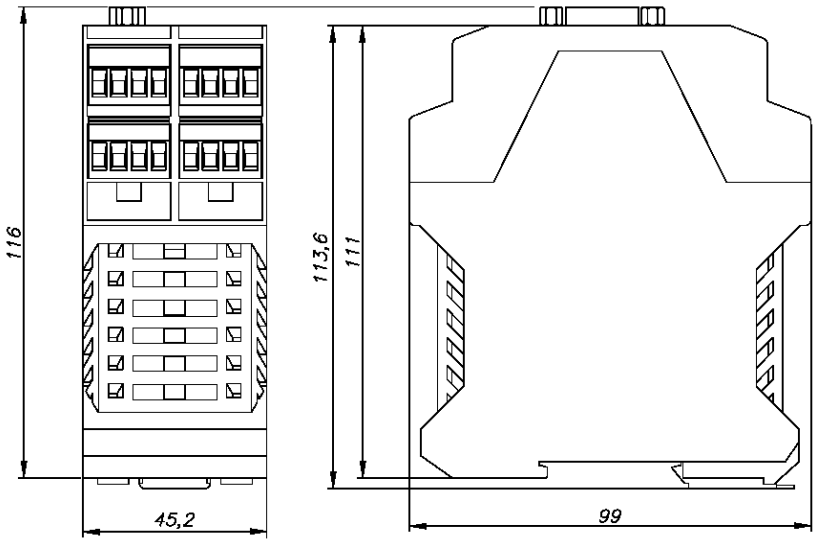
2.3 Label on the Housing

The wiring principle is located at the side of the housing:

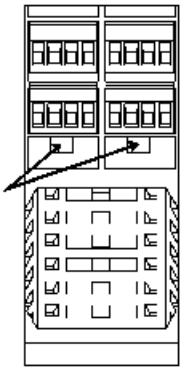


2.4 Housing Dimensions





2.5 Open Housing



To open the housing, press the four closings (two on each side).

During assembly, take care of the earth connection in the bottom of the housing.

2.6 Display

2.6.1 Status LEDs

The instrument has got 5 green LEDs to display the operating or error status.

2.6.1.1 Power, ProfiBus

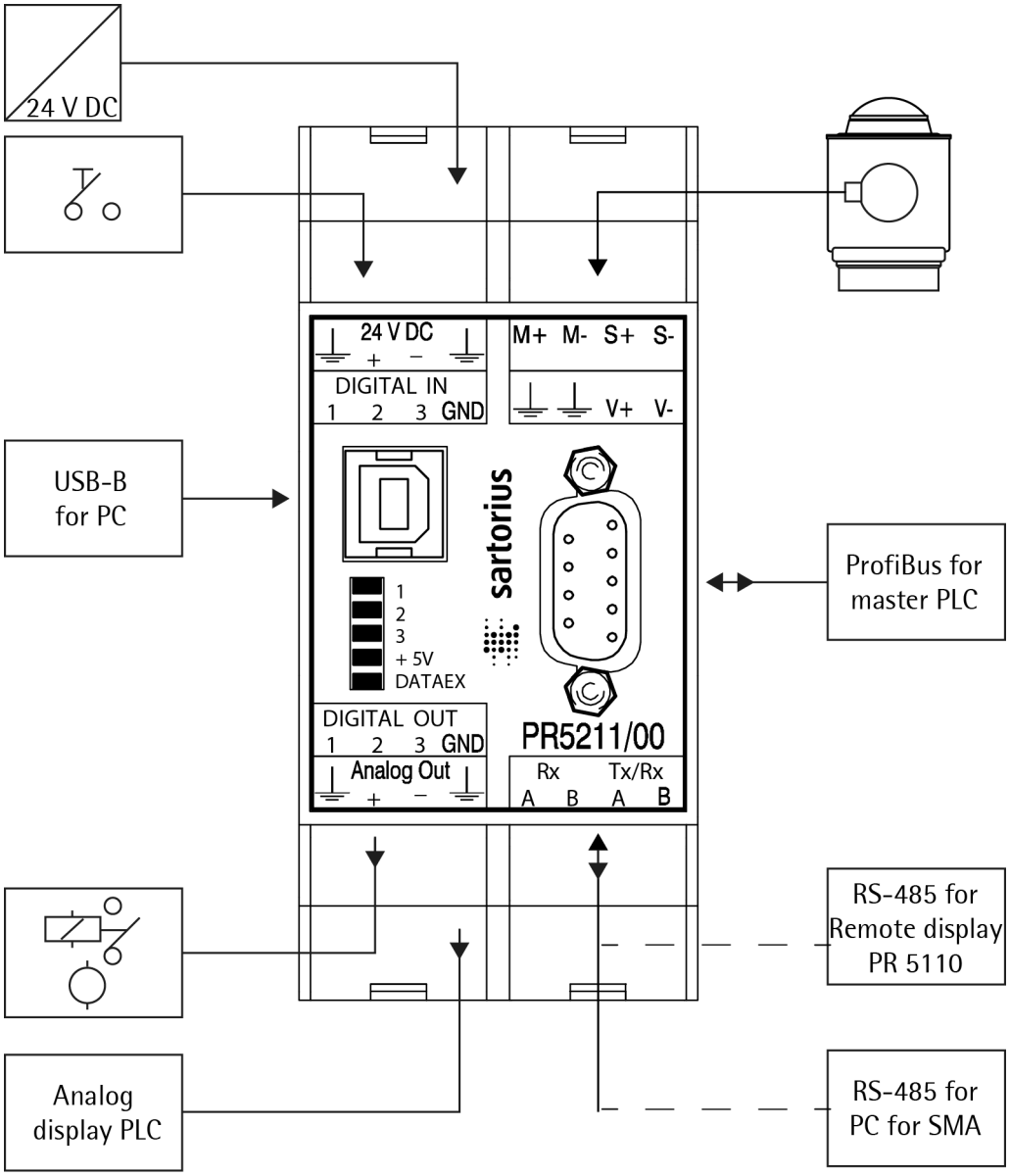
	Power on	ProfiBus activity*	ProfiBus conn. not established
1			
2			
3			
+ 5V	on		
DATAEX		on	Flash. 1 Hz

* The LED for ProfiBus activity (PR 5211/00 and PR 5211/11 only) is activated if a connection has been established. It remains on, even if the communication is not running or the physical connection is interrupted!

2.6.1.2 Weight status indication

	Standstill	Center zero	Below zero or above FSD
1	on		
2		on	
3			on
+ 5V			
DATAEX			

2.7 Overview of Connections



3 Installing the Instrument

3.1 General

Before starting work, please read Chapter 1 and follow all instructions.

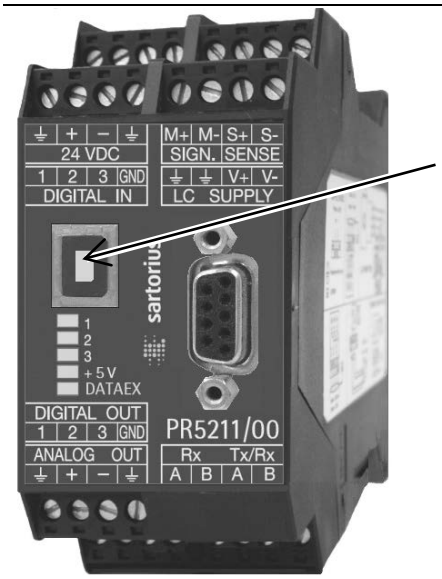
Further procedures:

- Check the consignment: unpack the components specific to the application.
- Safety check: inspect all components for damage.
- Make sure the on-site installation is correct and complete including cables, e.g. power cable fuse protection, load cells, cable junction box, data cable, console/cabinet, etc.
- Follow the instructions for installation of the unit relating to application, safety, ventilation, sealing and environmental influences.
- Connect the cable from cable junction box or platform/load cell.
- If applicable: connect other data cables, network cables, etc.
- Connect the instrument to the supply voltage.
- Check the installation.

3.2 Connections

3.2.1 USB Interface

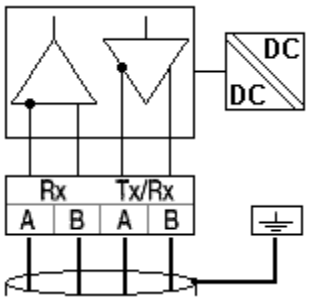
The configuration and calibration can be carried out from the PC program ConfigureIt! Via (release 6.00 or higher) the USB interface, see Chapter 4.4 and 4.5.



Connection	USB-B connector
Connection cable	USB 2.0 A>B
Cable length	Max. 5 m

3.2.2 RS-485 Interface

The interface is intended for connecting a remote display and a PC for data transmission using the SMA protocol.



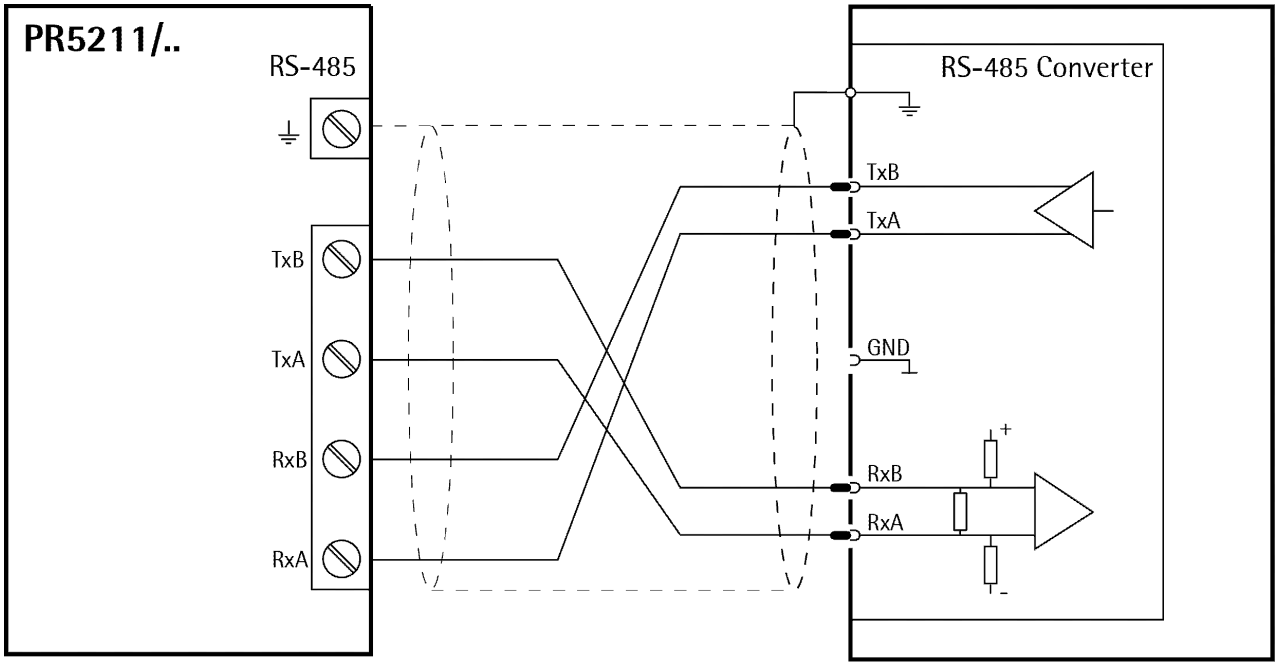
Connection method	4-pin plug-in terminal block
Number of channels/type	1 RS-485, full duplex
Transfer rate (Bits/s)	300, 600, 1200, 2400, 4800, <9600>, 19200
Bits/stop bits:	
Remote display	<7/1>
SMA protocol	<8/1>
Parity:	
Remote display	<even>
SMA protocol	<none>
Signals RS-485	RxA (R-), RxB (R+), TxA, TxB
Electrical isolation	yes
Cable length	max. 1000 m
Cable type	Shielded twisted pair (e.g. LifYCY 2x2x0.20)

<...> = default settings (factory settings)

The RS-485-receiver (Rx) has an internal terminal resistance of 120 Ω and 1.6 kΩ to the internal bus supply voltage (- at RxA + at RxB).

3.2.2.1 Connecting to PC or to RS-485 Converter

Point-to-point connection for the SMA protocol.



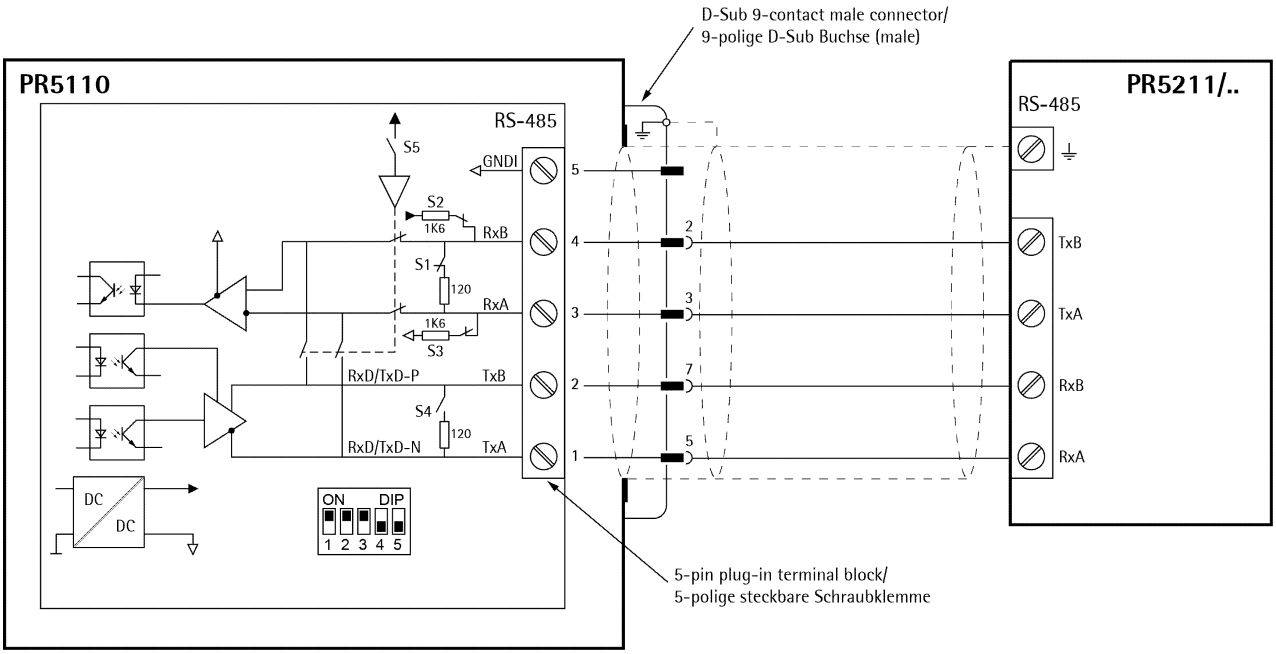
Configuration PR 5211/..

[Parameter]-[Communication]: 'SMA protocol'

3.2.2.2 Connecting a PR 5110 Remote Display

Four-wire transmission, point to point, full duplex (simultaneous sending and receiving possible) with PR 5110 remote display.

Note: When replacing PR 1627/PR 1628 with PR 5110, note the pin assignment in Chapter 12.1! Description see instrument manual PR 5110.



Switch settings

ON: S1, S2, S3

OFF: S4, S5

Configuration PR 5110

Setup - oP 10 - LI nE - rS485

Setup - oP 12 - toKEn - oFF

Setup - oP 13 - SEndModE - SEnd

Setup - oP 14 - WEI GHt - FoLLoW

Setup - oP 15 - WPKEY - SELECt

Configuration PR 5211/..

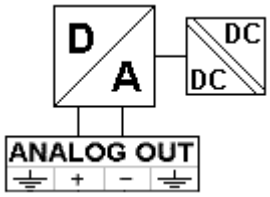
[Parameter]-[Communication]: 'Remote display'

The following operations are possible from the connected remote display:

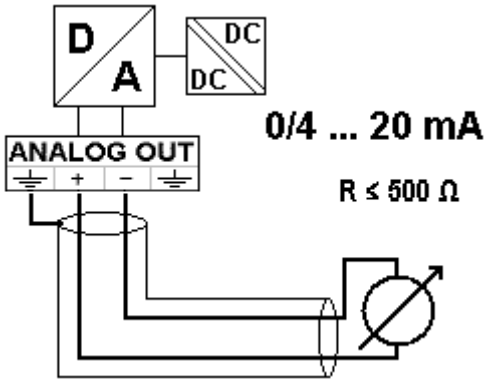
- Indicate current value type
- Set tare
- Reset tare
- Set zero

3.2.3 Analog Output

For PR 5211/00 and PR 5211/10 only.



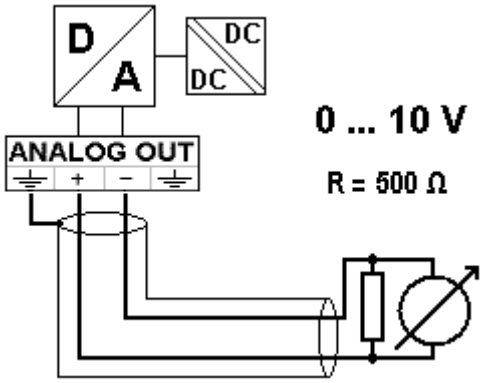
Connecting method	4-pin plug-in terminal block
Number of outputs	1 current output, output voltage by use of external resistor
Output	Gross, net weight
Range	0/4...20mA, configurable via setup
Resolution	e.g. 0 - 20 mA in max. 40.000 parts
Linearity error	@ 0 - 20mA: <0.05 % @ 4 - 20 mA: 0.025 %
Temperature error	<100 ppm/K
Load	0...500 Ω max.
Protected against short circ.	yes
Potential isolation	yes
Cable length (screened)	150 m (current output)



0/4...20mA

analog signal, current output

The current is supplied directly from the terminals.



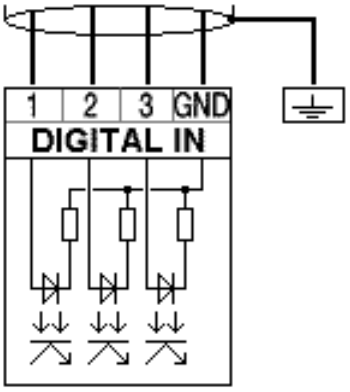
0...10V

analog signal, voltage output

The voltage level corresponds to the voltage drop at the 500 Ohm (10 ppm/K) resistor.

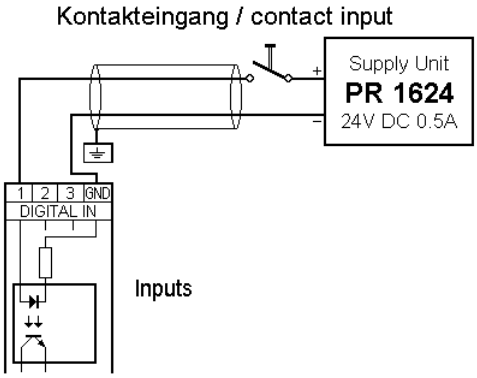
3.2.4 3 Opto Inputs

The optocoupler inputs have one common potential (GND), separated from the common potential of the output group.



Connecting method	4-pin plug-in terminal block
Cable	Shielded, max. 50 m
Number of inputs	3
Input signal	External supply required 10 ... 30 VDC for 'high' 0 ... 5 VDC for 'low'
Input voltage	Max. 30 VDC
Input current	< 11 mA @ 24 VDC < 5 mA @ 12 VDC
Potential isolation	Yes, 3 inputs have got 1 common minus potential

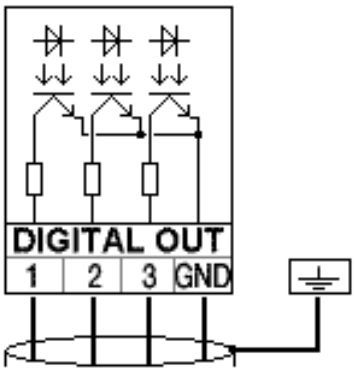
Example: contact input connection



When a voltage ≥10 V DC is applied to the terminals (in the example: 1-GND), input 1 is active (true).

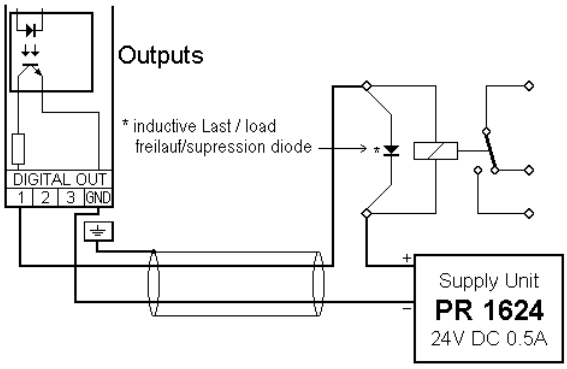
3.2.5 3 Opto Outputs

The optocoupler outputs have one common potential (GND), separated from the common potential of the input group.



Connecting method	4-pin plug-in terminal block
Cable	Shielded, max. 50 m
Number of outputs	3
Output signal	External supply required
Output current	Max. 30 mA
Output voltage	Max. switching voltage: 30 V
Potential isolation	Yes, 3 outputs have got 1 common minus potential

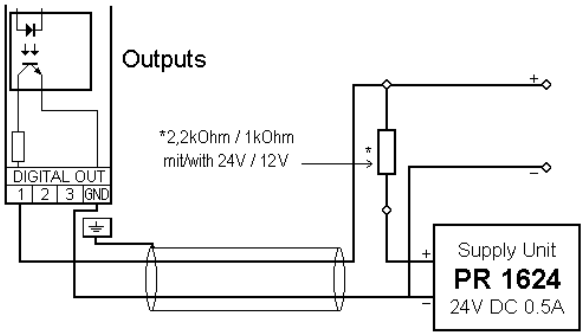
Example: relay control connection



Stromausgang / Current output

When output 1 is active (true), the relay switches. For protection of the output circuit, relays with free-wheel diode must be provided.

Example: voltage output connection



Spannungsausgang / Voltage output

When output 1 is active (true), the output voltage changes from 24/12 V DC into <3 V DC.
A load resistance of 2.2/1 kΩ must be provided.

3.2.6 Load Cell Connection

The cable colours shown in this chapter are of Sartorius load cells series PR 62XX.
Before connection of other types, strictly necessary read the instructions concerning cable colours of the load cell/platform.

- The distance between the measuring cables and the power cables should be at least 1 m.
- The measuring cables should be laid in separate cable conduits or steel pipes connected to earth potential.
- Power cables should be crossed at right angles.

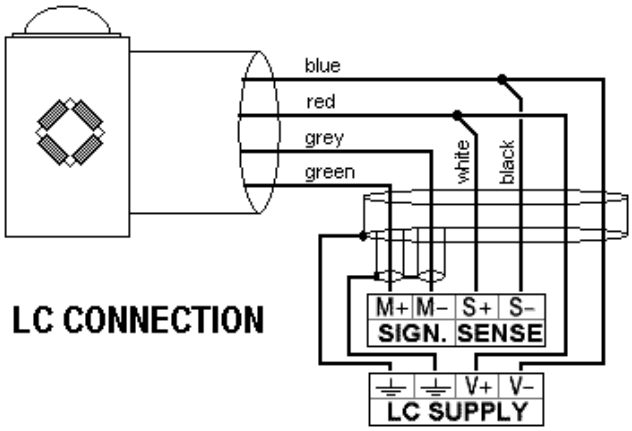
Load cell supply circuit

The voltage for load cell supply is firmly adjusted to 12 V DC and protected by multifuse elements (see chapter 1.4.6).

Load resistance of load cells ≥75 Ω, e.g. 8 load cells of 650 Ω each.

3.2.6.1 Connection of one Load Cell in 6-Wire Technique

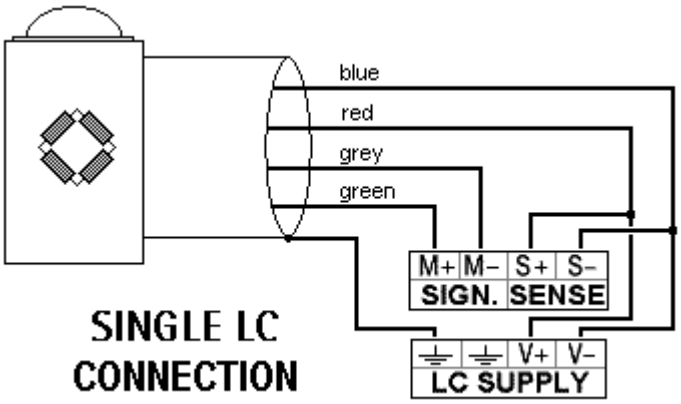
See label on the housing (see chapter 2.3) and documentation for the junction box.



Terminal	Description
SIGN. M+	+ signal / + LC output
SIGN. M-	- signal / - LC output
SENSE S+	+ sense
SENSE S-	- sense
LC SUPPLY V+	+ supply / + excitation
LC SUPPLY V-	- supply / - excitation

3.2.6.2 Connection of one Load Cell in 4-Wire Technique

Pay attention, that SENSE S+ has to be connected to LC SUPPLY V+ and SENSE S- has to be connected to LC SUPPLY V- directly at the transmitter.



Terminal	Description
SIGN. M+	+ signal / + LC output
SIGN. M-	- signal / - LC output
SENSE S+	+ sense
SENSE S-	- sense
LC SUPPLY V+	+ supply / + excitation
LC SUPPLY V-	- supply / - excitation

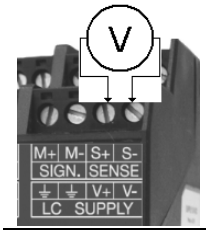
3.2.6.3 Connection of PR 6221 Load Cells

Please refer to the installation manual PR 6021/08...68.

3.2.6.4 Testing the Measuring Circuit

A simple test with the load cells connected can be carried out with a multimeter (not with external supply or intrinsically safe load cell interface):

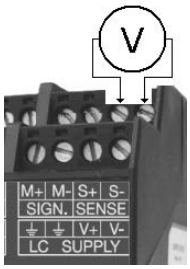
Supply voltage



V+ to **V-** :

V ±0,8 V
(symmetrical to housing GND)

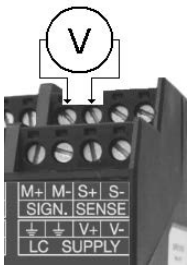
Sense voltage



S+ to **S-** :

12 V ±0,8 V
(symmetrical to housing GND)

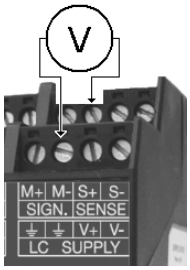
Measuring voltage



M+ to **M-** :

0 - 12 mV @ WZ mit 1,0 mV/V
0 - 24 mV @ WZ mit 2,0 mV/V

Measuring voltage

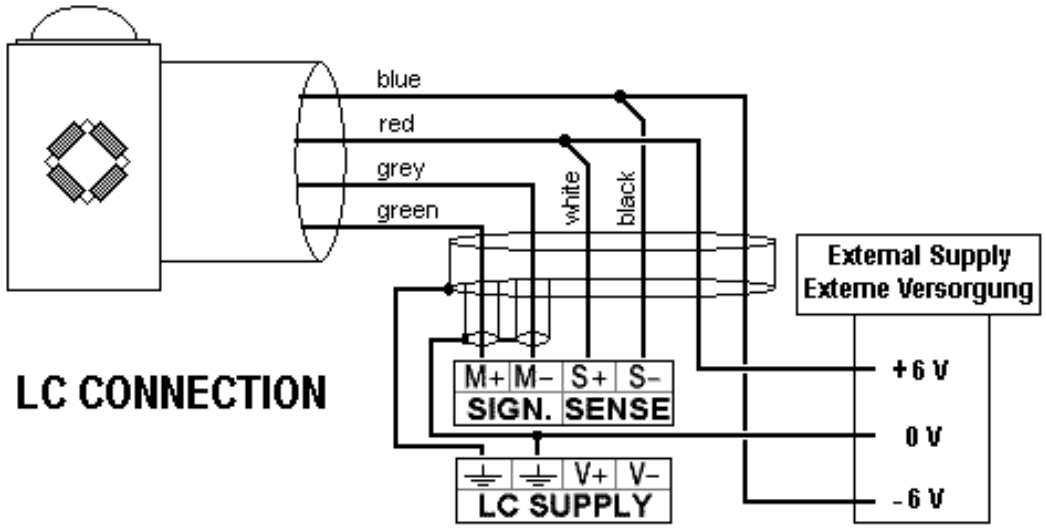


Ground (earth) to **M-** :

0 V ±0,5 V

3.2.6.5 External Load Cell Supply

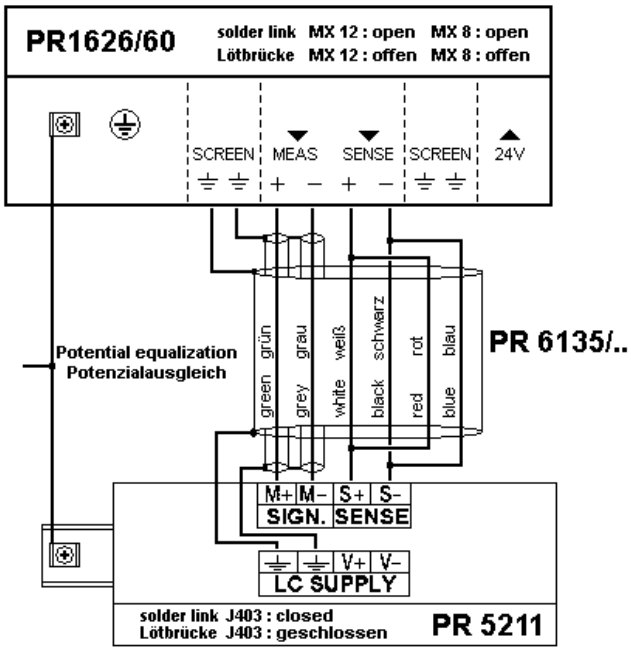
The common line of the symmetrical external supply has to be connected to the same terminal at PR 5211 as the screen of the load cell cable/connecting cable.



Specification external supply:
6 V DC +5 %, -30 %; ripple max. 50 mVpp; asymmetry max. ±3 %.

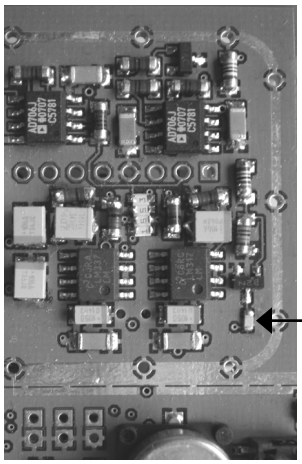
3.2.6.6 Connection via PR 1626/60

The connection to the PR 1626/60 has to be done as follows, for general connections please refer to the PR 1626/60 manual.



For 7.5 V DC load cell supply, the following settings are required:

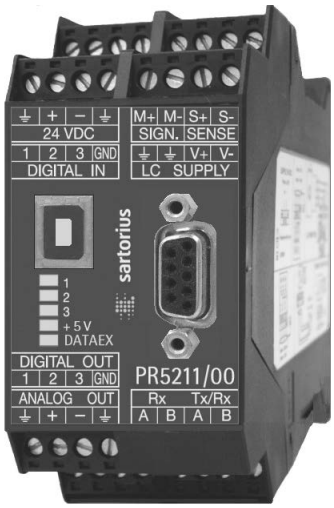
Device	Component	Action
PR 1626/60:	Solder link MX 8	must be fitted on the interface p.c.b., see instrument manual.
PR 5211/xx:	Solder link J300	must be opened on the A/D converter print (0 Ω resistance removed).



Note: Delivery condition: Solder link is closed with 0 Ω resistance.
When J300 is open; Sense voltage monitoring is switched off!

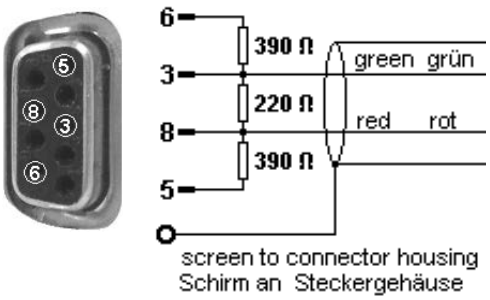
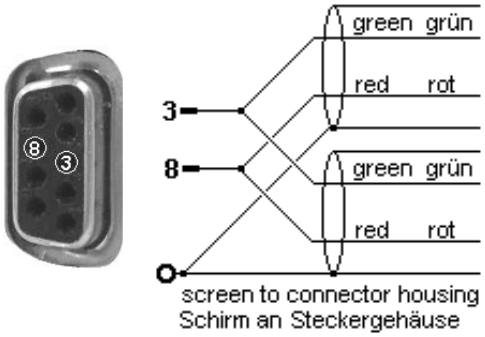
3.2.7 ProfiBus Interface (for PR 5211/00 and PR 5211/11 only)

Communication protocols and syntax comply with the ProfiBus-DP standard to IEC 61158 with transfer rates up to 12 Mbit/s.



Transfer rate	9.6 kbit/s to 12 Mbit/s, baud rate auto-detection
Protocol	PROFIBUS-DP-V0 slave to EN 50 170 (DIN 19245) Max. 126 nodes possible. Watchdog timer
Configuration	GSD file (‚gwt_5211.gsd' stored on the CD in directory 'Fieldbus')
Cable	Special ProfiBus color: violet shielded twisted pair cable
Cable impedance	150 Ω
Electrical isolation	Optocoupler
Cable length	Max. distances 200 m @ 1.5 Mbit/s

The ProfiBus connection is done via the 9-pin D-Sub connector (female) on the front.

Transmitter is the only or the last slave on the bus	Transmitter is not the only/ not the last slave on the bus	PIN	Signal
		3 4 5 6 8	RxD/TxD-P CNTR-P DGND VP RxD/TxD-N

4 Commissioning

The meaning of indicator LEDs is described in Chapter 2.6.

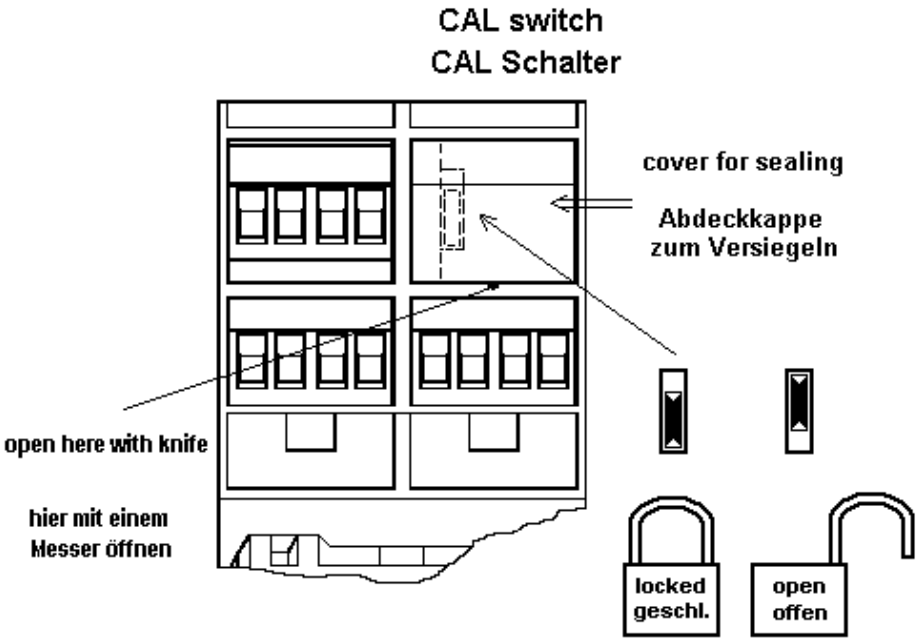
4.1 Data Backup/Power Failure

4.1.1 CAL Switch

The CAL switch is used to protect the calibration data/parameters from unauthorized access.

If the CAL switch is in the position 'open', the calibration data and parameters can be altered via the PC program or via the ProfiBus connection.

If the CAL switch is in the position 'locked', the calibration data (e.g. deadload, SPAN) and the calibration parameters (e.g. measure time, zerotracking etc.) cannot be altered.



4.1.2 Factory Settings

Calibration data <default>	**Calibration parameters <default>**
Full scale (FSD) <3000> <Kg>	Measuring time (M) <320>ms
Step width <1>	Measuring rate <160>ms
Deadload <0.000000>mV/V	Standstill time <1>M
Span <1.000000>mV/V	Standstill range <1.00>d Standstill timeout <8>M

Calibration parameters <default>	Test mode <absolute>
Overload (range above FSD) <9>d	Zeroset range <50.00>d
* W&M mode <off>	Zerotrack range <0.25>d
Filter <off>	Zerotrack step <0.25>d
Frequency <1.56 Hz>	Zerotrack repeat <0>M

* Default: 'off'

At delivery the calibration data and parameters are set to default (factory settings).

If a new calibration is started, the calibration data are set to default (The parameters remain unchanged).

4.1.3 Power Failure

Calibration data and parameters are stored in EAROM and kept in case of power failure or if the instrument is disconnected from power supply.

4.2 Switching on the Instrument

All setup and configuration will be done with the program 'ConfigureIt! 6.00 (or higher) Setup.exe'.
Via the ProfiBus interface an additional access to each parameter is possible.

4.3 Installation of USB Chip Drivers

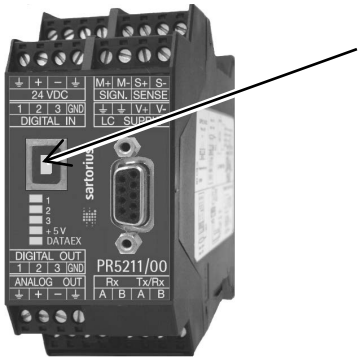
- If necessary download the USB chip driver from the internet.
- Open the internet browser.

Note: The internet address may have changed (In this case contact Sartorius.).

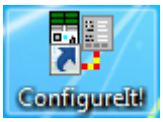
- Enter ‚www.ftdichip.com/Drivers/VCP.htm' and confirm.
  The web page is displayed.
- Select and click the link of the appropriate operating system in the table (e.g. ‚2.08.28').
  A ZIP folder is downloaded.
- In the menu of the opened ZIP folder select: [Order]-[Unpack in selected file...], then choose target file and click OK.
- Click the link ‚Installation Guides' to open the installation instructions.
- Install the driver as described in the installation instructions.

4.4 Installation of ConfigureIt!

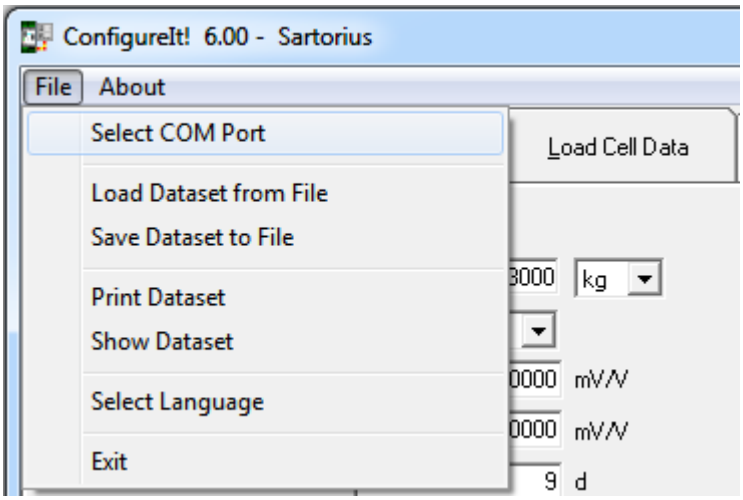
The Windows tool for the configuration/calibration of the transmitter is contained on the CD-ROM.
It can be run under Windows XP or Windows 7.



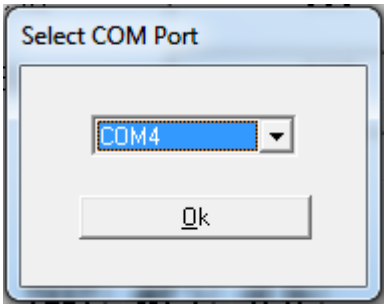
- Connect notebook/PC and PR 5211 with the PC connecting cable USB A/B and switch on.
- If the required driver is not found, download from the internet as described in Chapter 4.3.
- Ensure that the necessary administrator rights are given to install executable programs.
- Start the program 'ConfigureIt! 6.00 Setup.exe'.
- Follow the instructions given.
- Select the destination directory (e.g. C:\Programs\Sartorius\PR 5211).
- After successful installation the message: Installation finished will appear.
- Start the program in the previously defined directory: ConfigureIt!.exe.



- Start the program on the desktop of the notebook/PC. The connection to the program ‚ConfigureIt!' is installed as a symbol on the desktop.



- At [File] the menu [Select COM Port] has to be chosen.

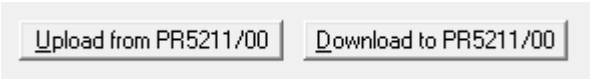


- The program will automatically look for the free COM ports. Select the COM port where the PR 5211 is connected to.
- After [Ok] the connection to the instrument will be established

4.5 Load and Store Setup and Configuration

4.5.1 Data in the PR 5211

The current data can be loaded from the PR 5211 to the ConfigureIt!, edited and save back to the PR 5211.



In the menu 'ADU' and 'Parameter' the data sets can be loaded and stored.

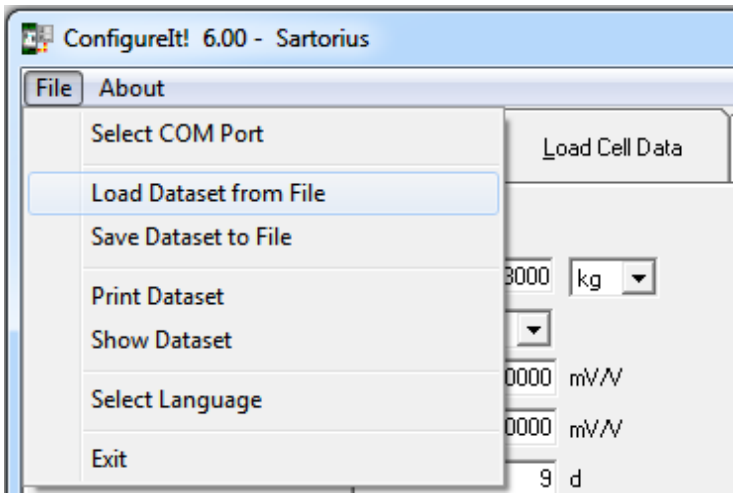
Each time all data are loaded or stored.

If the data are changed, the program asks when a page is changed or the program will be quit, if the changes should be stored or not.

If an access code is set, it will be asked now.

4.5.2 Archive Data in the PC

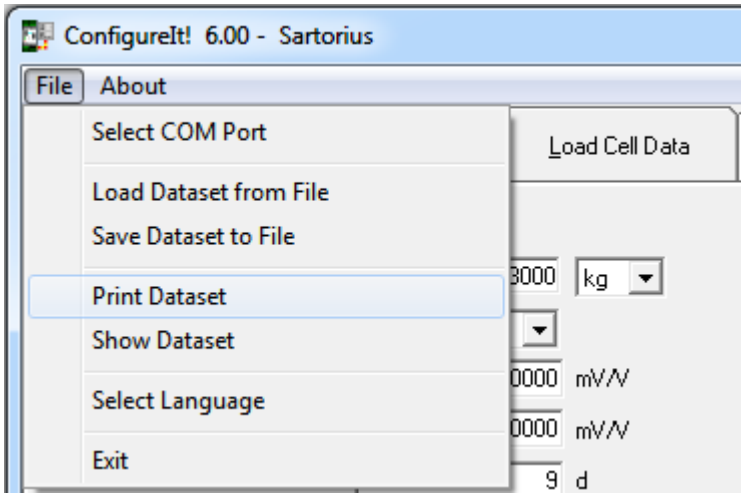
The actual data set in the ConfigureIt! can be stored as a file on the PC and reloaded again. So, all configuration data can be archived on the PC.



Load from File
Load the default values (factory delivery) contained in the file DEFAULT.DAT for ConfigureIt!. The default dataset cannot be overwritten. If a new configuration has to be stored, change the name.

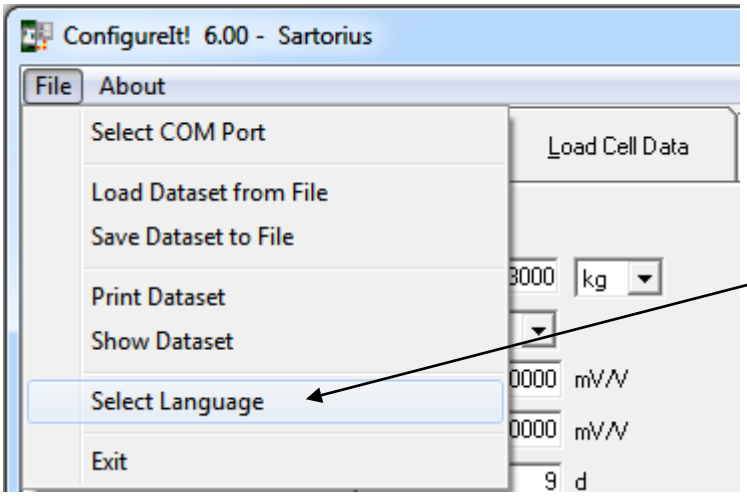
Save to File
Store the modified data under a name different to DEFAULT.DAT

4.6 Print Data Set

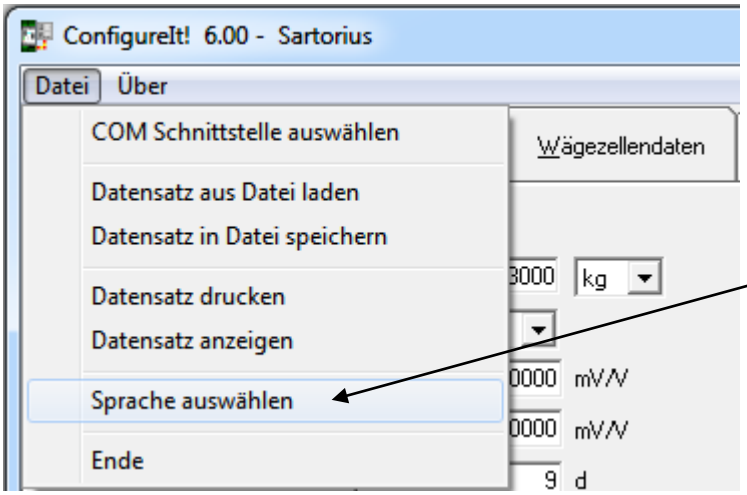


Print Dataset
The current calibration data and all parameters are printed on the printer assigned as standard printer, see example in chapter 12.5.

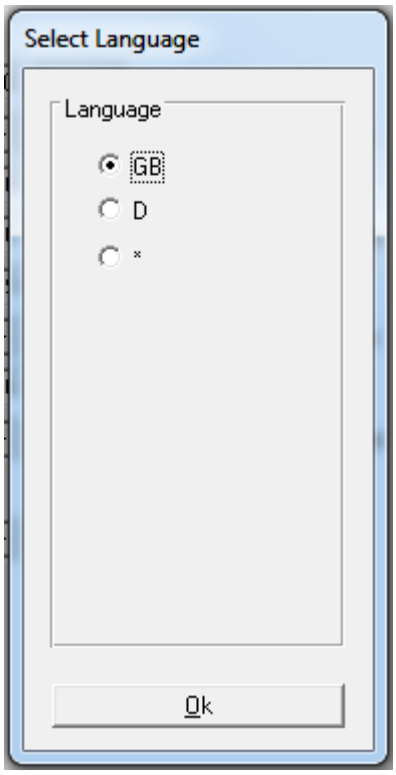
4.7 Select Language



If the program was set to English [GB]



If the program was set to German [D]



Select Language (Sprache auswählen)

At the first start of the program it will wake up with [GB] as default and will show the language selection mask.

The language can be selected between D, GB and *. The * is used for user defined (translated) definitions. It means, that items can appear as user defined text.

4.8 Status Line

The bottom line of ConfigureIt is the status line.

COM4: PR5211/00 Rel. 06.00	Dataset for device type: PR5211/00 - Rel. 06.00	Board no.: 4294967295	Weight: + 2426 kg

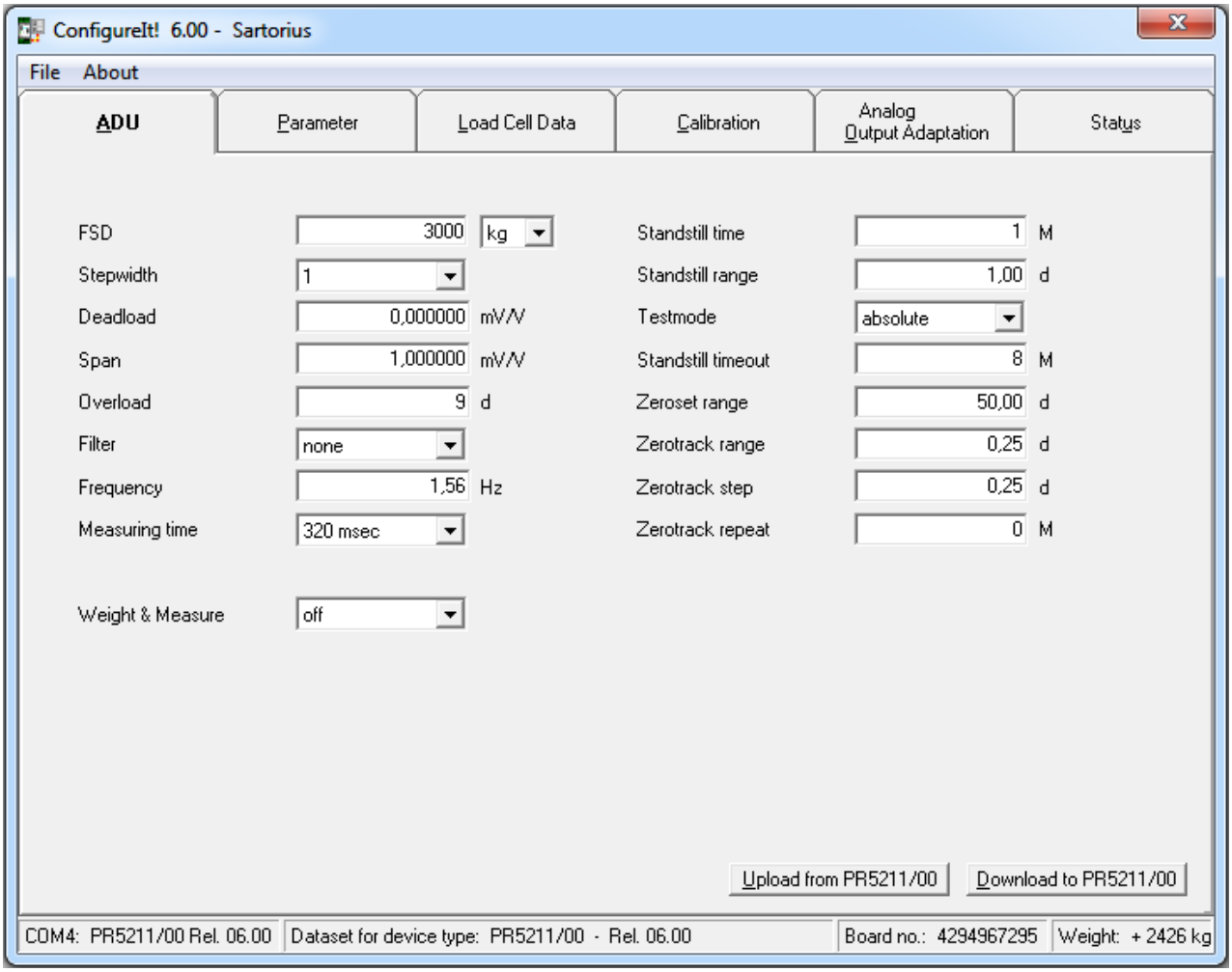
The program has established a communication connection using COM4 with a PR 5211 of release 06.00.

A data set for the device type PR 5211/00 is loaded.

The instrument has got the board number 4294967295.

The actual weight is +2426 kg.

4.9 ADU



4.9.1 Calibration

With this menu calibration data can be read and written. The calibration of the scale is done with the menu 'Calibrate'!

See chapter 4.11.

4.9.1.1 FSD (Full Scale Deflection, Max)

The full scale deflection (FSD) determines the maximum weight which can be measured.

overall weight range
within 0.100 and 9999900
in mg, g, kg, t or lb.

The value must be divisible by the step width and can have max. 5 digits behind the decimal point/comma.

The default value is 3000 kg.

4.9.1.2 Scale interval (stepwidth)

The scale interval which is valid for the total scale range has to be selected: 1, 2, 5, 10, 20, 50, default: 1.

4.9.1.3 Resolution magnifier: x10

During calibration the display resolution (scale interval) can be increased by factor 10.

4.9.1.4 Deadload

The value of the unloaded scale/empty hopper is the deadload. The input voltage equivalent to this weight value is displayed/ stored in mV/V. For calculating the voltage for deadload the same formula is applied as for SPAN (Full scale has to be replaced by dead load), see chapter 4.9.1.5.

Default: 0.000000 mV/V

During calibration it has to be decided:

- To use the empty scale as deadload (normal case)
- To enter the deadload in mV/V (if the scale cannot be unloaded,
- or the value is known from previous calibration)

If the deadload has to be changed later (due to weight decrease or increase of the empty scale), it can be done without influence on the other data like SPAN.

4.9.1.5 SPAN

The SPAN indicates the equivalent input voltage in mV/V related between deadload and the scale FSD (full scale, maximum capacity Max).

$$SPAN\ [mV/V] = \frac{full\ scale\ *\ load\ cell\ sensitivity\ C_n\ [mV/V]}{load\ cell\ capacity\ (\max.\ capacity\ E_{max} * number\ of\ all\ load\ cells)}$$

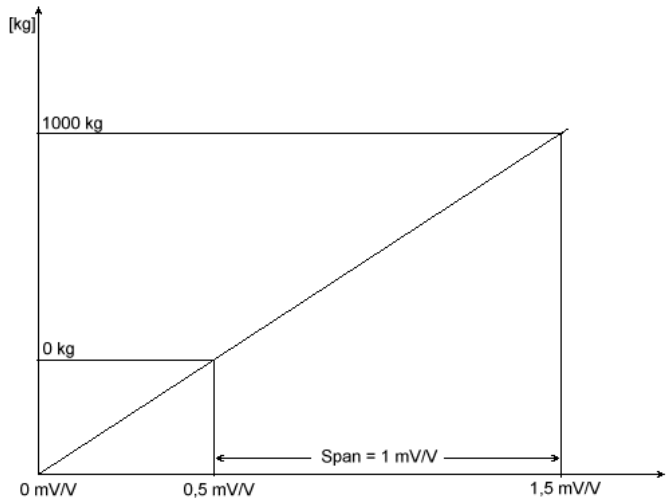
Span in [mV/V]; Full scale (Max) as a weight value;
Load cell sensitivity C_n [mV/V] = rated output (see technical data of the load cell);
Load cell capacity (= sum of all load cells) as a weight value

Default: 1.000000 mV/V

During calibration it has to be decided:

- Set SPAN by weight (load the scale with the calibration weight and enter the value of the calibration weight)
- Enter the SPAN in mV/V (from calculation of above formula or if the value is known from previous calibration)

Example of a scale with a load cell capacity of 2 t, 2 mV/V load cell sensibility and a full scale deflection of 1000 kg:



After the calibration a value of 0.5 mV/V had been generated for the deadload.

The SPAN value is determined to 1 mV/V.

With 12 Volt supply a measuring signal of 6 mV could be calculated for deadload.

This measuring signal could be measured directly with a voltage meter at the measuring inputs (M+, M-).

For the SPAN a measuring signal of 12 mV could be calculated. At full scale deflection the measuring signal is deadload value + SPAN = 18 mV (M+, M-).

4.9.2 Configuration

4.9.2.1 Overload

Entry is in d, maximum permissible range 0d to 9999999d, default = 9d

Weight values above FSD + overload are generating an error message. The overload range prevents the scale from going into error condition in case that the weight is only some digits above the FSD range.

4.9.2.2 Filter

Select between none or Bessel, Aperiodic, Butterworth. The digital filter (low-pass, 4-th order) is located behind the ADC, in intervals of the measuring rate a new value is calculated.

With digital filter activated, the cutoff frequency (see chapter 4.9.2.3) has to be defined. Weight values to be displayed are generated behind the digital filter.

- After changing the filter parameters, the maximum accuracy should be reestablished by re-calibration.

4.9.2.3 Frequency

The range of the filter cutoff frequency is depending on the measuring rate (see table), it is only used if the filter is not set to none!

Measuring rate	Min. frequency	Max. frequency
10 ms	0.25 Hz	1.84 Hz
20 ms	0.12 Hz	1.98 Hz
40 ms	0.06 Hz	1.83 Hz
80 ms	0.03 Hz	1.97 Hz
160 ms	0.02 Hz	1.56 Hz
>160 ms	0.02 Hz	1.56 Hz

4.9.2.4 Measuring Time

The measuring time is the time at which a weight value is measured.

Enter 10...1920 ms, default: 320 ms.

Up to 160 ms the measuring time equates the conversion time for the internal ADC.

Over 160 ms the conversion time for the internal ADC remains on 160 ms, but the average weight is presented in the given time.

4.9.2.5 Standstill Time

The standstill detection requires two parameters to determine the mechanical standstill of the scale. During a defined period of time (Standstill time expressed in multiples of measuring time = Standstill time), the weight value of the scale must be within defined limits (Standstill range). In this case, the scale is in standstill condition.

Entry 'Number of measuring times', permissible range: 1...9, default: 1.

4.9.2.6 Standstill Range

Permissible range: 0.00...50.00 d, default: 1.00 d

4.9.2.7 Test Mode

Determination, whether the test measurement displays FullScale (absolute) or the deviation related to FullScale (relative) is made. Example: FSD = 3000, result: Should be 3000 for absolute, should be 0 for relative.

Calibration (with/ without weights) is completed with a test measurement and the result is scaled so that FullScale is displayed.

Default: 'absolute'

4.9.2.8 Standstill Time-out

Unless a tare- or Zero-set-command can be executed within time n (n = multiples of measuring times), e.g. because the scale does not fulfill the standstill condition, the transmitter generates a message (e.g. no standstill) and the command is aborted.

Enter the time in multiples of measuring time, 1...100, default: 8.

4.9.2.9 Zero Set Range

Definition of a +/- range around the calibration zero, within which

- the displayed gross weight can be set to zero (by a corresponding external command), or
- automatic zero tracking is active, see chapter 4.9.2.12.

Permissible range: 0.00...500.00 d, default: 50.00 d

4.9.2.10 Zero Track Range

This function is only valid, if Zerotrack repeat is not set to 0 (see chapter 4.9.2.12)!

The zero tracking does only work as long as the weight signal is still in the zero set range.

Permissible range: 0.00...500.00 d, default: 0.25 d

4.9.2.11 Zero Track Step

The automatic zero tracking stepwidth must be smaller than the standstill range.

This function is only valid, if Zerotrack repeat is not set to 0 (see chapter 4.9.2.12)!

Permissible range 0.00...10.00d, default: 0.25 d

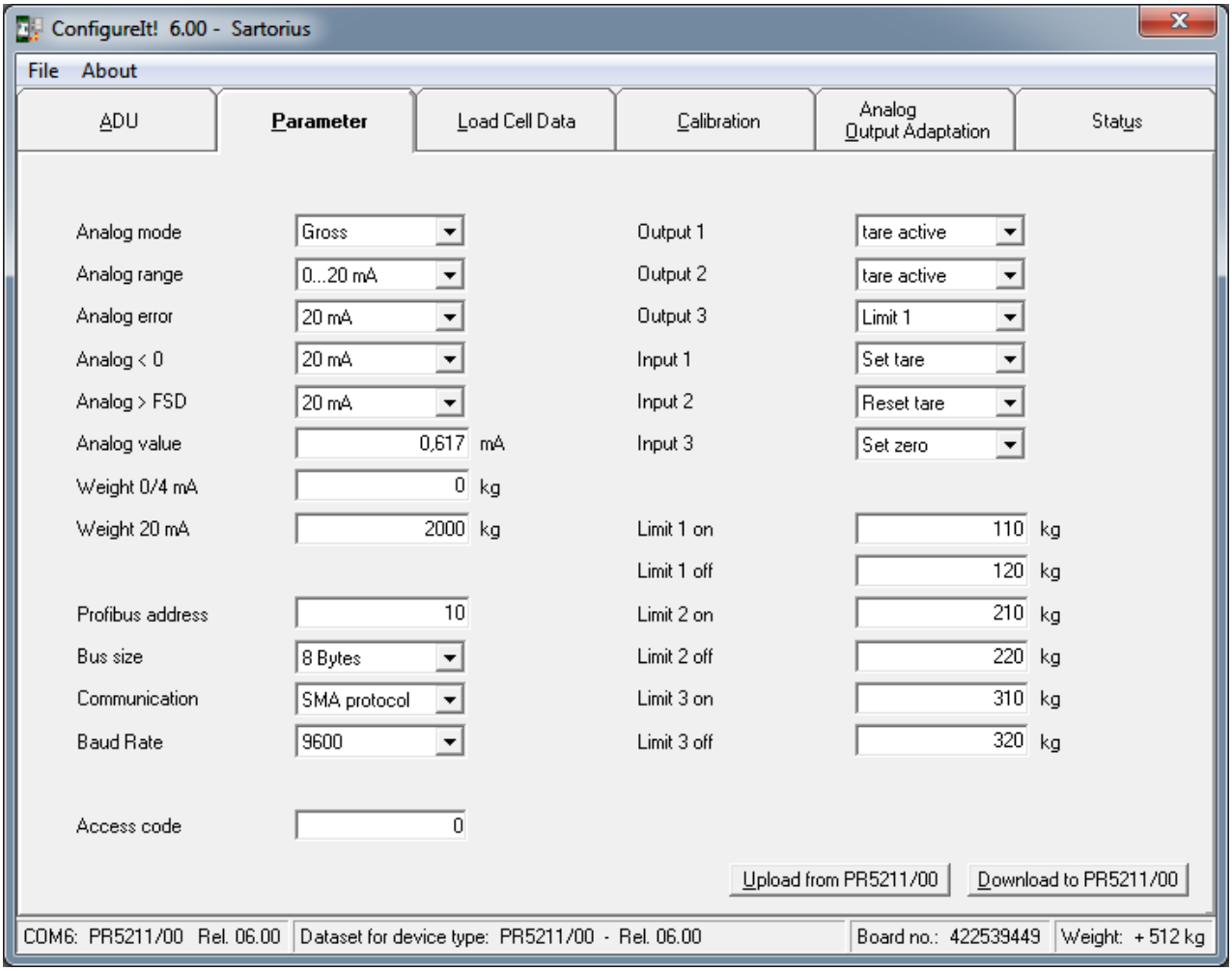
4.9.2.12 Zero Track Repeat

With the scale in standstill condition and the gross weight within the zero set range (Zeroset range), automatic zero tracking is stepwisely done (Zerotrack step) at defined intervals (Zerotrack repeat).

Entry is in multiples of measuring time, permissible range 0 to 100, default = 0
(Automatic zero tracking = off)

- Switching off the automatic zero tracking is by setting Zerotrack repeat to = 0.

4.10 Parameter



4.10.1 Analog Output

For PR 5211/00 and PR 5211/10 only.

4.10.1.1 Analog Mode

The following selections are possible:

off	Analog output is not used
transparent	Analog output is controlled via PLC (e.g. to set the mixer speed)
gross	Gross weight value is linked to the analog output
net	Net weight value is linked to the analog output (if not tared : gross)

4.10.1.2 Analog Range

The following selections are possible:

0-20 mA	Analog output range
4-20 mA	Analog output range

4.10.1.3 Analog Error

The following selections are possible:

hold	In case of error the analog output keeps the last value
0 mA	In case of error the analog output goes to 0 mA
4 mA	In case of error the analog output goes to 4 mA
20 mA	In case of error the analog output goes to 20 mA

4.10.1.4 Analog < 0

Behaviour when the weight value is blow zero. The following selections are possible:

linear	In case of negative weight the analog output continues (only possible if the output value for zero weight is larger than 0 mA)
0 mA	In case of negative weight the analog output goes to 0 mA
4 mA	In case of negative weight the analog output goes to 4 mA
20 mA	In case of negative weight the analog output goes to 20 mA

4.10.1.5 Analog > FSD

Behaviour when the weight value is above FSD. The following selections are possible:

linear	In case of weight above end of the scale the analog output continues (only possible if the output value for FSD is smaller than 20 mA)
0 mA	In case of weight above end of the scale the analog output goes to 0 mA
4 mA	In case of weight above end of the scale the analog output goes to 4 mA
20 mA	In case of weight above end of the scale the analog output goes to 20 mA

4.10.1.6 Analog Value

A fixed analog value can be entered to set the analog output. The analog mode has to be set to: [transparent]. If the PLC has written the analog value it is displayed in the mask [parameter].

4.10.1.7 Weight for 0/4 mA

Enter the weight value at which the analog output shall show 0 mA (or 4 mA, if analog range is set to 4...20 mA)

4.10.1.8 Weight for 20 mA

Enter the weight value at which the analog output shall show 20 mA.

4.10.2 ProfiBus Address

The address on the ProfiBus has to be defined here, valid addresses are in the range 1, 2 ... 126.

Default: 10

4.10.3 Bus Size

The normal bus size is 8.

10 byte bus size is used for a coded data transfer.

Default: 8

4.10.4 Communication

The serial line could be used for data communication with a remote display (e.g. PR 5110, PR 1627 or PR 1628) or a SMA data protocol.

Default: 'off', see chapter 3.2.2.

4.10.5 Baudrate

The baudrate can be selected between 300, 600 ... and 19.200, care has to be taken that the same transfer speed is set at the remote display/terminal. Default: 9600, see Chapter 3.2.2.

4.10.6 Access Code

The access code can consist of 9 decimal digits at maximum. If the access code is set to 0, no check on the code is done. If an access code has been set (has to be entered twice for security reason), data and parameters cannot be altered, without entering the code. As long as the user has got access, he is allowed to change the access code.

Default: 0

4.10.7 Outputs

The following selections are possible per each of the 3 digital outputs:

transparent	The PLC is controlling the output
ADU error	Output is set if ADU is in error state
Limit1	Result of comparison of limit 1 values with actual weight (see chapter 4.10.9)
Limit2	Result of comparison of limit 2 values with actual weight (see chapter 4.10.9)
Limit3	Result of comparison of limit 3 values with actual weight (see chapter 4.10.9)
Tare active	Output is set, if transmitter is in net mode

4.10.8 Inputs

The following selections are possible per each of the 3 digital inputs:

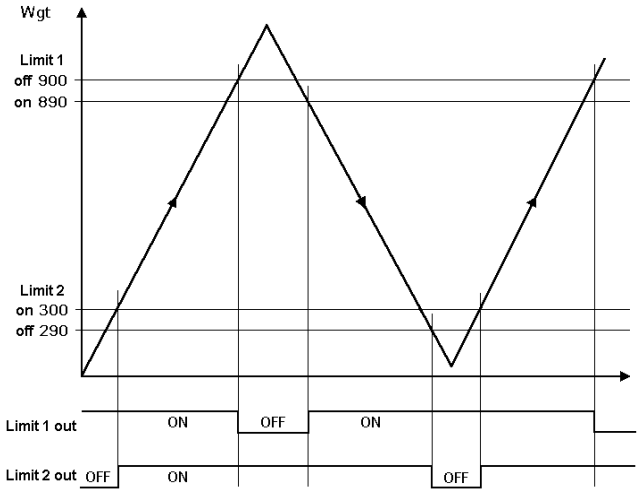
none	Input is not used for transmitter control
set zero	The transmitter will be set to zero (see chapter 4.9.2.9). (standstill has to be fulfilled, else standstill timeout will be given, see chapter 4.9.2.6 and 4.9.2.8)
set tare	The transmitter will be switched to net mode. (standstill has to be fulfilled, else standstill timeout will be given, see chapter, 4.9.2.6 and 4.9.2.8)
reset tare	The transmitter will be switched to gross mode

4.10.9 Limits

3 pairs of limits can be set to get e.g. information on the filling status of a hopper and to generate a signal.

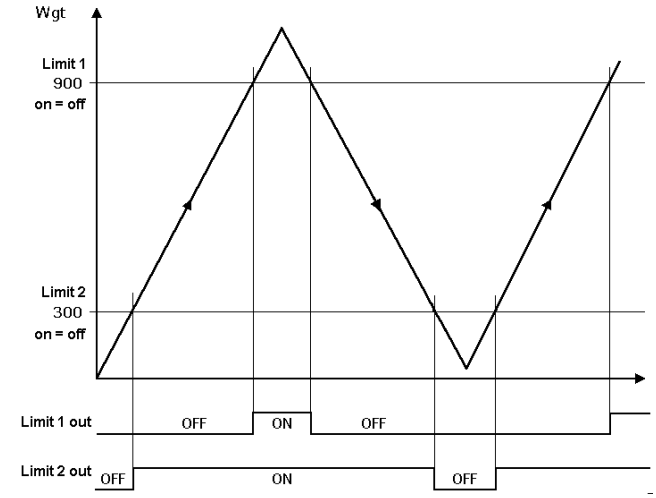
Each limit has got two weight data: The limit on and the limit off value. These two values are compared with the actual weight and in case of coincidence an output signal is generated which can be linked to one of the 3 outputs.

Example (detection of filling status, low and high limit):



The output signal (Limit 1 out) of limit 1 switches OFF above a weight of 900 kg. The output signal (Limit 2 out) of limit 2 switches OFF below a weight of 290 kg. Both limit values have a hysteresis of 10 kg.

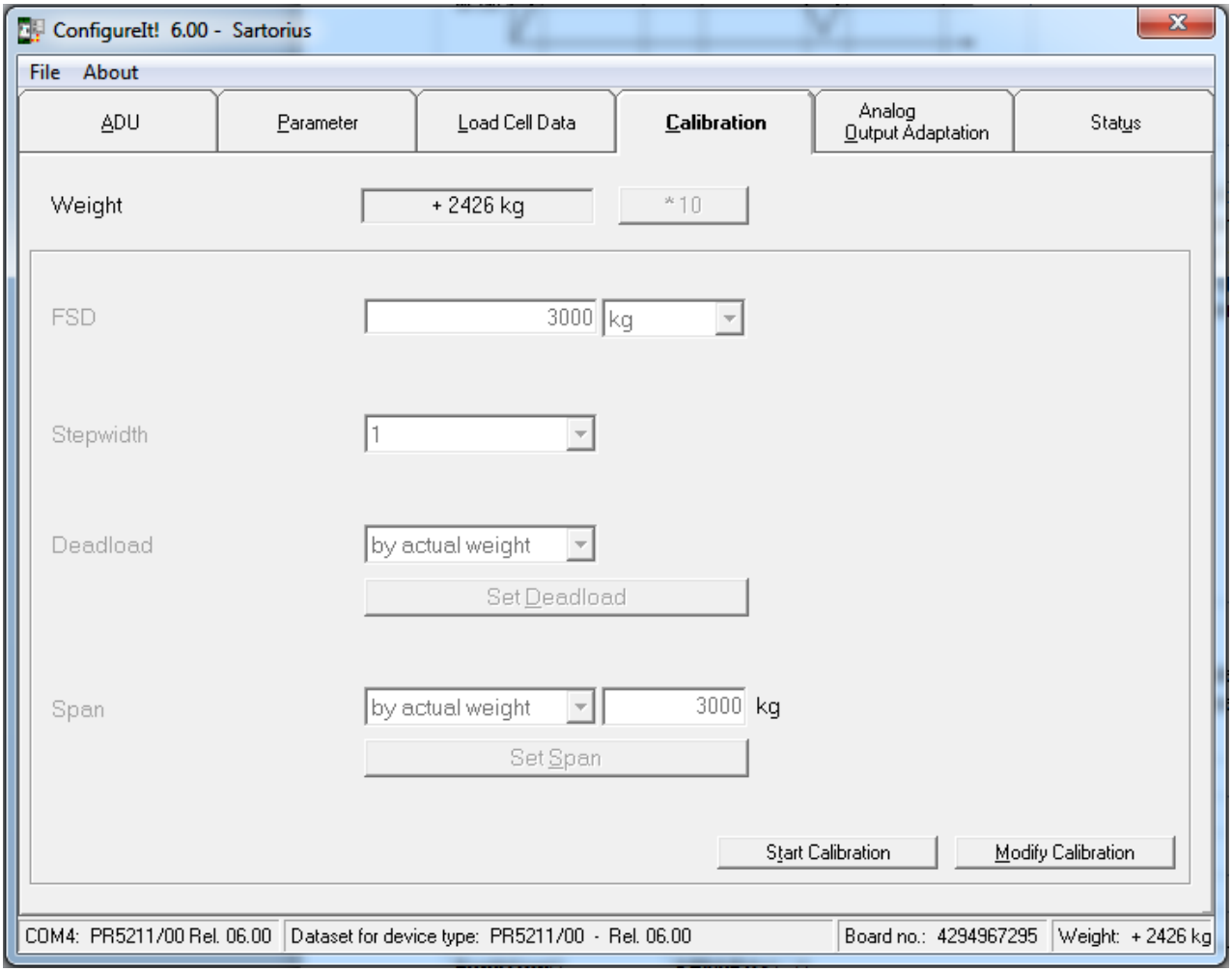
In the event of a power failure, the two outputs go to OFF, thus indicating underfill and overfill at the same time.



If the limits (Limit 1 and Limit 2) for 'On' and 'Off' are equal (on = off), output 1 (Limit 1 out) switches ON, when the weight (Wgt) exceeds the value and output 2 (Limit 2 out) switches OFF, when the weight drops below the value.

Default values for Limit1 – Limit 3 are 0 kg.

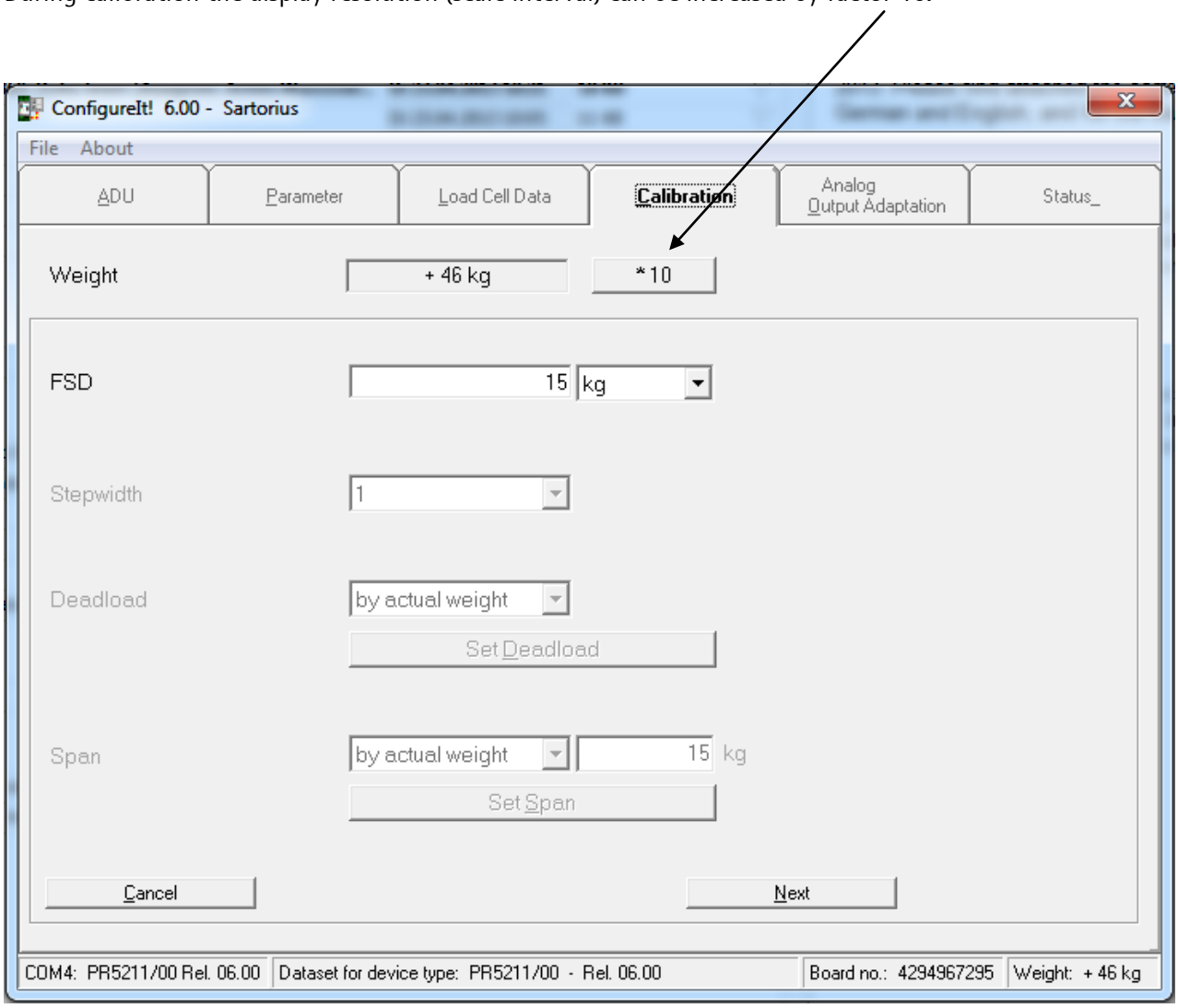
4.11 Calibration

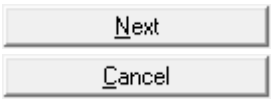


The Calibration of the instrument is done via this mask.

Start Calibration	A new calibration will be done.
Modify Calibration	An existing calibration should be changed, e.g. only the dead load should be recalibrated.

During calibration the display resolution (scale interval) can be increased by factor 10.





The calibration is done in several steps. Press this button after each entry.

Cancel the calibration, if necessary.

1. step: Enter the full scale deflection value (FSD). Maximum weight (maximum capacity) on the scale.

2. step: Enter the stepwidth.

3. step: Enter the deadload. The deadload is the weight of the empty scale.

By entering by weight the scale must be completely emptied. Press [Set deadload].

By entering by mV/V, enter the mV/V value which corresponds to the weight of the empty scale.

4. step: Enter a calibration weight or the SPAN in mV/V or by load cell data (SMART CALIBRATION).

By entering by weight the scale is loaded with a known calibration weight. This weight could be smaller as the full scale deflection value (FSD) and will be entered. Press [Set Span].

By entering by mV/V, enter the mV/V value for the full SPAN (zero to full scale deflection value (FSD)).

By selecting With load cell data the load cell data are used for calibration (see chapter 4.11.1).

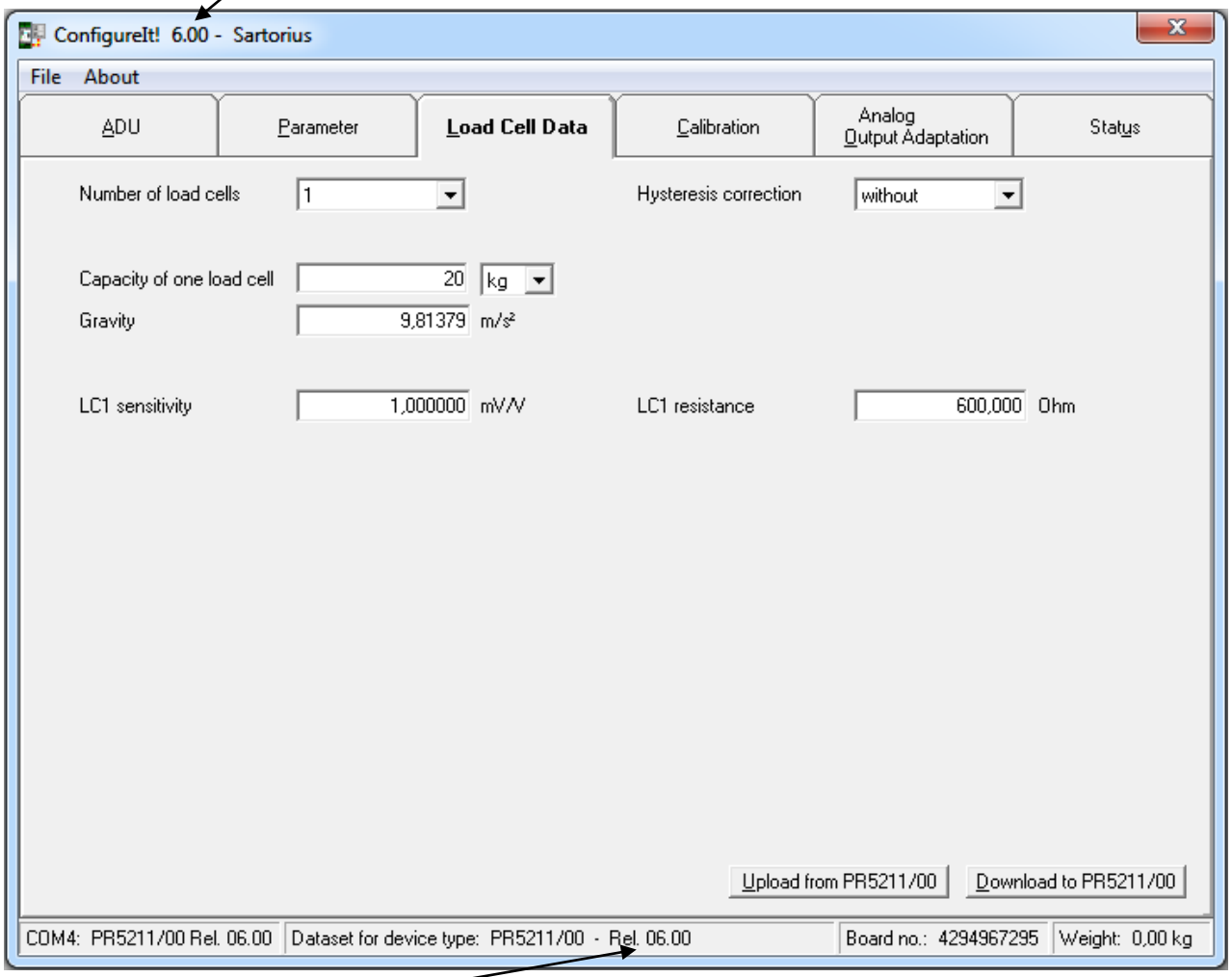
5. step: Save calibration.

Previous	If necessary return to previous step of calibration.
Save Calibration	Save the calibration.

4.11.1 Smart Calibration

If the scale to be calibrated is not in 'legal for trade' application, the calibration can be performed by using the load cell data. Before start of the calibration the load cell data have to be entered and downloaded to PR 5211.

Software ConfigureIt! 6.00 is required.

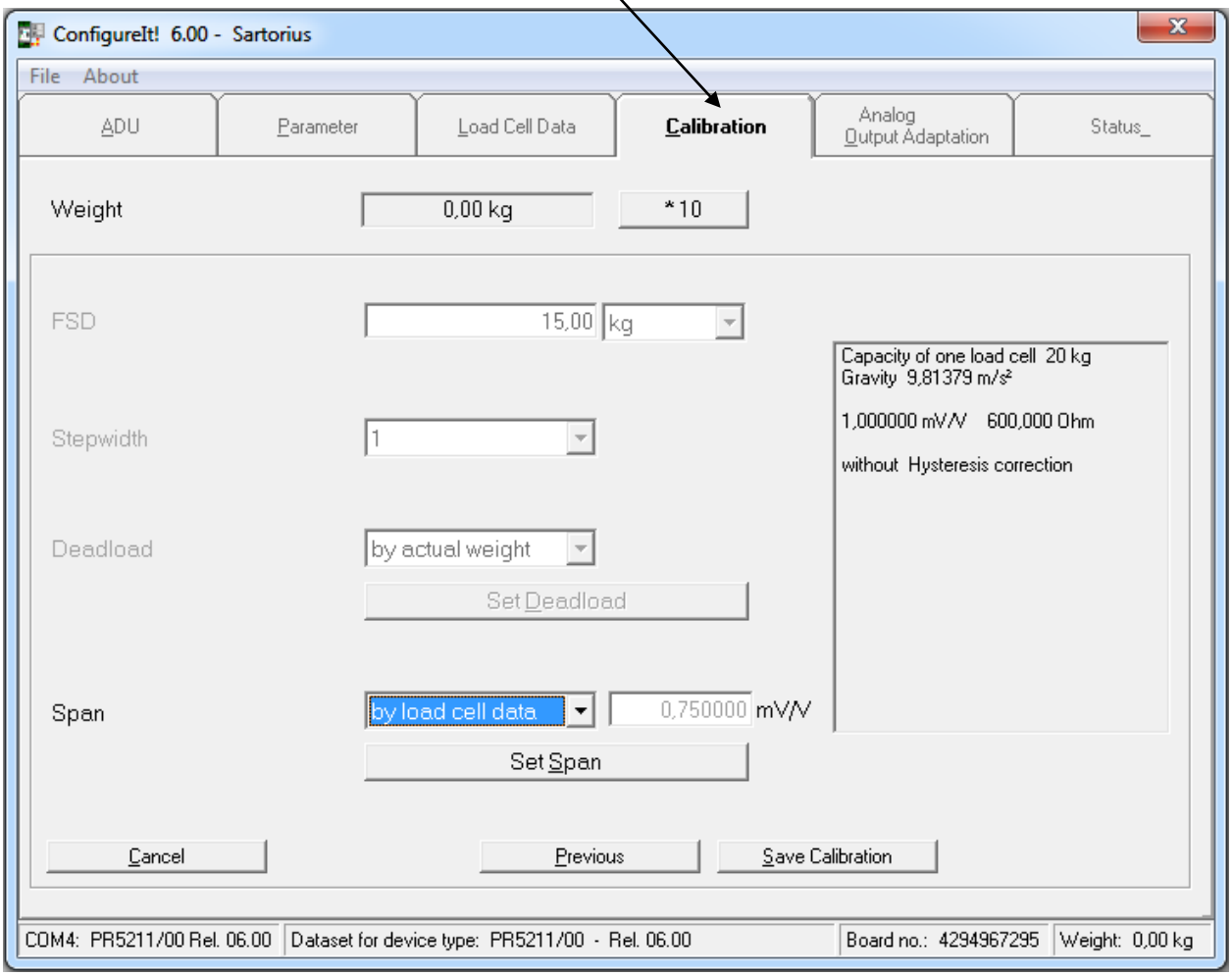


Instrument software 6.00 is required.

Number of load cells	Number of load cells connected in parallel (1, 2 .... 10)
Capacity of one load cell	Maximum capacity (E_{MAX}) of one load cell (not the total load, not the weighing range)
[Gravity]	Gravity at place of installation, as default value 9.81379 m/s², the value for Hamburg/Germany has been taken.
Sensitivity, Resistance	Data can be taken from the 'Calibration certificate' for the specific load cell(s). For [Sensitivity] the Rated output and for [Resistance] the output impedance has to be taken.
Hysteresis correction	Only if [with] has been selected, the data for [Correction A/B] have to be entered. The data can be obtained from the load cell certificate.

Download to PR5211/00

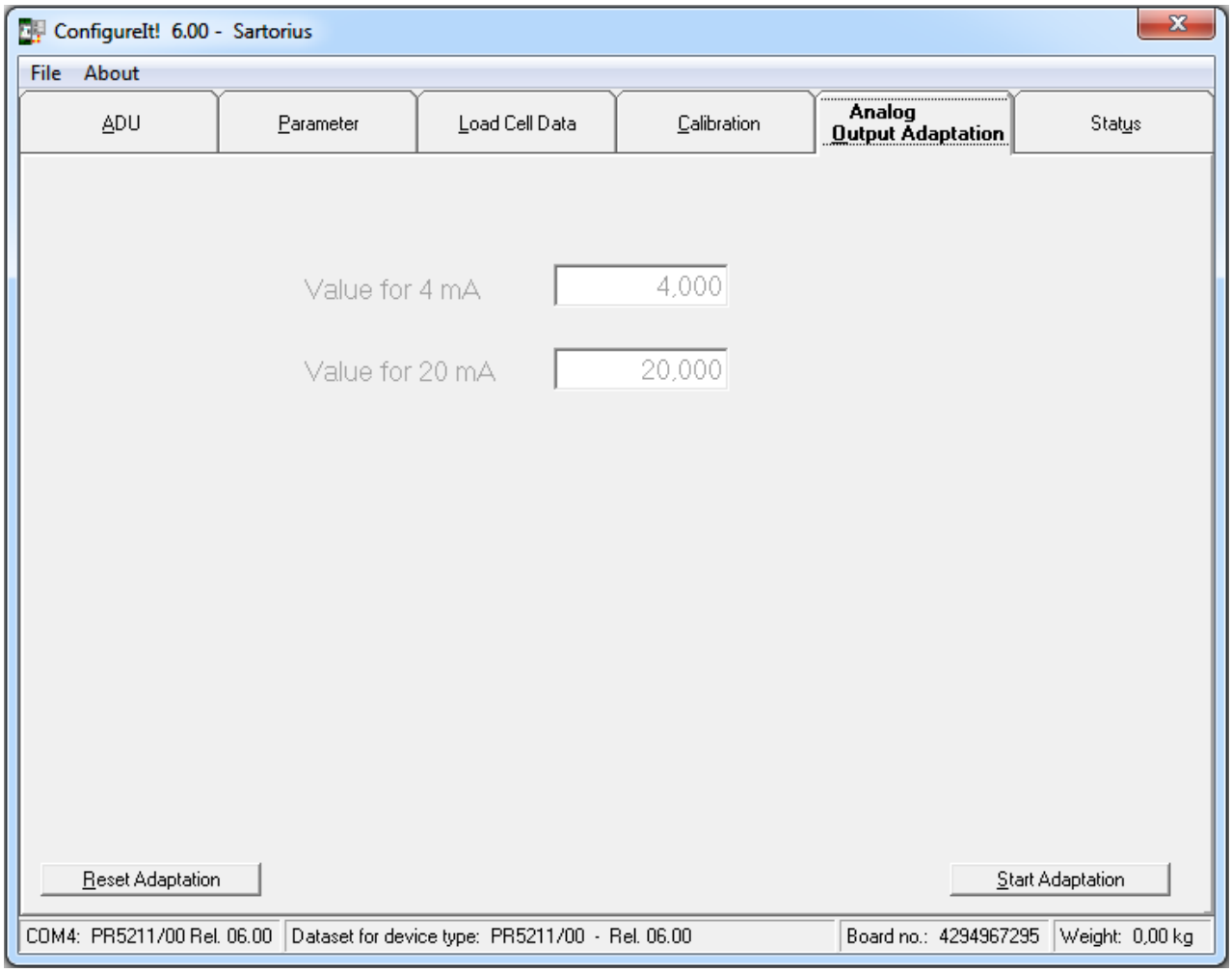
Press the button after entering the data to load the load cell data into the device.
Select [Calibration].



The sequence has to be performed as described in chapter 4.11, only in step 4 [by load cell data] has to be chosen.

4.12 Analog Output Adaption

For PR 5211/00 and PR 5211/10 only.



The analog output current is at the receiver side usually routed over a resistor, measured as voltage and then digitized. The errors of this transfer chain can be compensated in the instrument.

With this menu the points for 4 and 20 mA can be individually adapted, so that they are precise again at the receiver side.

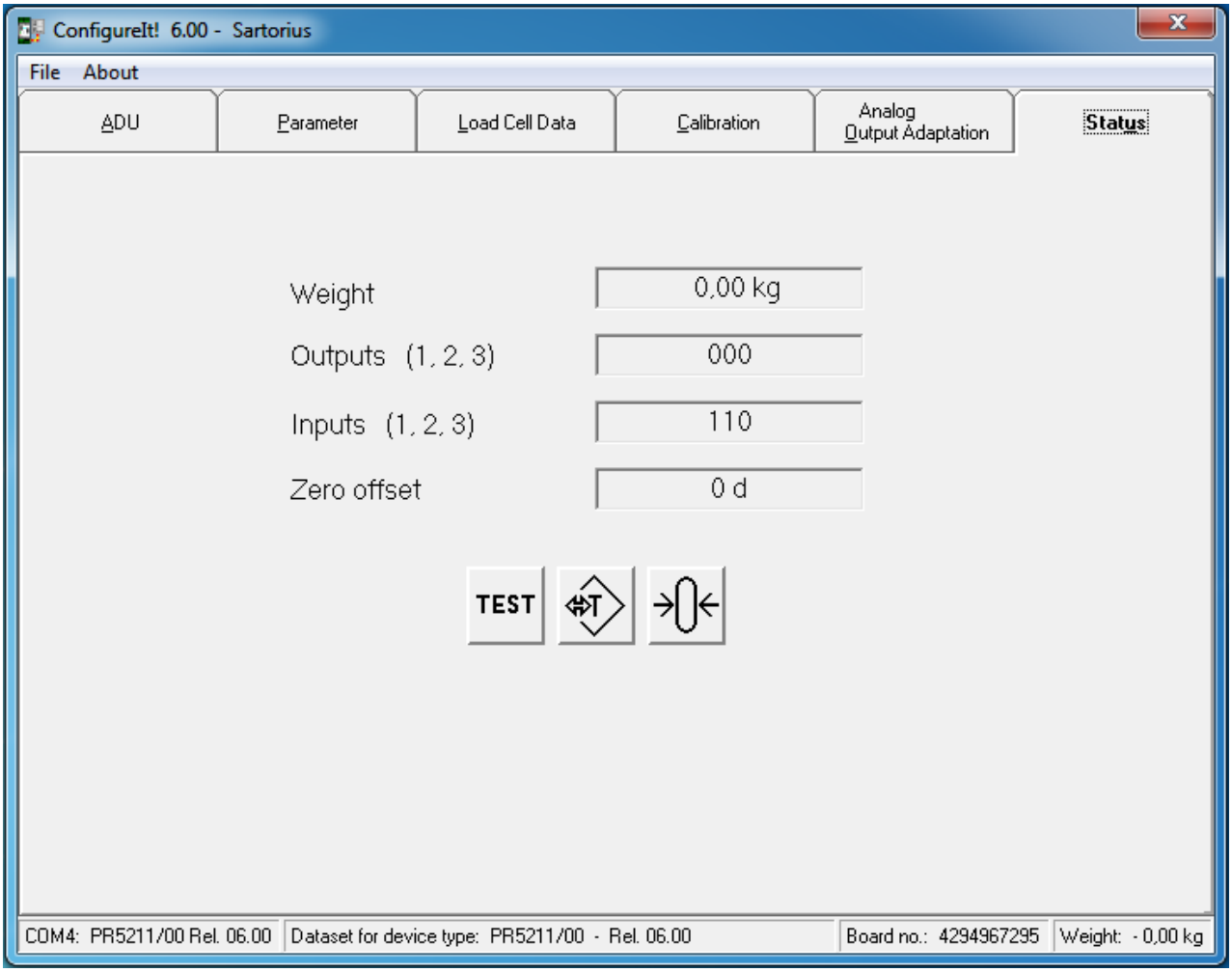
The adaptation is done in several steps:

1. step: Press [Start Adaption].
2. step: The analog output is set to 4 mA. Measure the current at the receiver side and enter the value of the measured current, e.g. 4.002 mA.
3. step Press [next].
4. step: The analog output is set to 20mA. Measure the current at the receiver side and enter the value of the measured current, e.g. 20.003 mA.
5. step Press [next].

The current on the receiver side is now corrected to 4.000 mA and 20.000 mA.

With [Reset Adaption] the values are reset to [4,000] and [20,000].

4.13 Status



In this menu the actual status of the weight and the digital inputs and outputs is displayed. The scale can be tared, set to zero and switched to the test mode.

Weight	actual weight
Outputs	Status of the digital outputs 1-3
Inputs	Status of the digital inputs 1-3
Zero Offset	Zero offset from calibrated zero point. By using the set zero function the new zero point differs from the calibrated zero point.
TEST	Switch test mode on- and off.
	Tare and reset tare
	Set zero

4.13.1 Analog Part/Weight Status

Display	Error 3	Error 7	negative	0 ↓	positive	FSD (SKE) ↓		Error 2	Error 3
				←±0,25d→			←overload→		
Bit	E3	E7	Below0	CZERO			aboveFSD	E2	E3
InZSR				←DeadLd±InsideZSR→					
ADUERR	ADUERR								ADUERR
W&M off	-		-	-			DIMM		

5 SMA Protocol

5.1 General

The Scale Manufacturers Association (SMA) protocol provides a simple access to the scale. Data could be read and functions could be executed.

The RS-485 interface is used. The setting of the interface is fixed to 8 bit, no parity and 1 stop bit.

The scale commands are printable ASCII characters and start with a <LF> (0A hex) and end with a <CR> (0D hex).

On each received command the transmitter sends after about 100ms an answer.

5.2 Key to Symbols Used

All characters used in this standard are printable ASCII except <CR> <LF> <SPACE> and <ESC>.

< >	The symbols < and > are used to bracket communication fields and identify non-printable ASCII characters. They are never a part of any actual communication message.
<LF>	Line Feed character used for start of data frame (0A hex).
<CR>	Carriage Return character used for end of data frame (0D hex).
'_' <space>	The underscore or <space> are used to denote an ASCII space character (20 Hex).
<ESC>	Escape character used as an abort command (1B hex).
'!'	ASCII exclamation mark character is used for a data communication error. (21 hex).
':'	ASCII colon used as a field delimiter (3A hex)
'-'	ASCII center dash character (2D hex)
'?'	ASCII question mark character is used for unrecognized or unsupported commands (3F hex).
'c'	Command characters all printable ASCII characters.
<s><r><n>	Scale status indicators; ASCII letter characters or space
<m><f>	See chapter 5.4.1 for exact status details.
<r><e>	Scale diagnostic indicators; ASCII uppercase characters or space
<c><m>	See chapter 5.4.4 for exact status details
<xxxxxx.xxx>	Weight data including minus sign (right justified when needed) and decimal point (if needed). Leading spaces are used with a leading zero to the left of the decimal point if needed. This field is always fixed at 10 characters in length. During some error condition this field is filled with '-' dashes. Examples: <_ _ _ _ _0.000>; <_ _ _ _11.120>; <_ _ _ _ -1.000>; <- - - - - - - - - - ->
<yyyyyy>	Text field of printable ASCII characters used to convey scale information. This field will not exceed a maximum of 25 characters.
<uuu>	Unit-of-Measure abbreviation. This field is always 3 characters long with a trailing space(s) when appropriate.

5.3 Scale Command Set

The following section defines the host commands that are used to command the scale to either send information or perform operations as directed.

All scale commands start with a <LF> and end with a <CR> to ensure proper handling by the scale.

Format: <LF>c<CR>

5.3.1 Request Displayed Weight

Command:	<LF>W<CR>
Response:	Scale returns Weight and status information immediately: gross weight if not tared, net weight if tared. <LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.2 Request High-Resolution Weight

Command:	<LF>H<CR>
Response:	Scale returns High-resolution (10x) weight and status information immediately: gross weight if not tared, net weight if tared. Note: the gross/net status indicator <n> will be in lower case during highresolution weight transmission. <LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.3 Request Displayed Weight after Stability

Command:	<LF>P<CR>
Response:	Scale returns displayed weight and status information only after scale has achieved a stable weight: gross weight if not tared, net weight if tared. For this function the standstill condition of the scale must be fullfilled. The maximum wait time for standstill could set with the 'Standstill time-out', see chapter 4.9.2.8. <LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR> After the standstill wait time without reaching a standsill, the following respond is send: <LF><_><1><n><_><f><----------><___><CR> For detail see chapter 5.4.1. See chapter 4.9.2.8.

5.3.4 Request Scale to Zero

Command:	<LF>Z<CR>
Response:	Scale attempts to zero itself and reports zero status in the <s> status indicator. For this function the standstill condition of the scale must be fullfilled. The maximum wait time for standstill could set with the 'Standstill time-out', see chapter 4.9.2.8. <LF><Z><r><n><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1. If the scale is not inside the zero set range, an error message is generated.

5.3.5 Request Scale to Tare

Command:	<LF>T<CR>
Response:	Scale attempts to tare itself using the weight on the scale display and reports the tare status in the <s> and <n> status indicators. For this function the standstill condition of the scale must be fullfilled. The maximum wait time for standstill could set with the 'Standstill time-out', see chapter 4.9.2.8. <LF><s><r><N><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.6 Set Scale Tare Weight

Command:	<LF>T<xxxxxx.xxx><CR>
Response:	Scale attempts to take the <xxxxxx.xxx> data as the tare weight and reports the tare status in the <s> and <n> status indicators. <LF><s><r><N><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.7 Return Tare Weight

Command:	<LF>M<CR>
Response:	Scale returns tare weight stored in scale Memory and identifies the weight as tare in the <n> status indicator. <LF><s><r><T><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.8 Clear Scale Tare Weight

Command:	<LF>C<CR>
Response:	Scale Clears tare weight and reports the tare status in the <n> status indicator. The tare of scale is reset. <LF><s><r><G><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

5.3.9 Invoke Scale Diagnostics

Command:	<LF>D<CR>
Response:	The scale runs scale diagnostics and sends a diagnostic response message with the results of the tests. <LF><r><e><c><m><CR> For detail see chapter 5.4.4.

5.3.10 About Scale First Line

Command:	<LF>A<CR>
Response:	The scale will send the first line of the About scale data. <LF><SMA>:<yyyyyy><CR> For detail see chapter 5.4.5.

5.3.11 About Scale Scroll

Command:	<LF>B<CR>
Response:	The scale will send the rest of the ABout the scale data. <LF><MFG>:<yyyyyy><CR> For detail see chapter 5.4.5.

5.3.12 Scale Information

Command:	<LF>I<CR>
Response:	The scale will send the first line of the scale Information data. <LF><SMA>:<yyyyyy><CR> For detail see chapter 5.4.6.

5.3.13 Scale Information Scroll

Command:	<LF>N<CR>
Response:	The scale will send the rest of the scale INformation data. <LF><TYP>:<yyyyyy><CR> For detail see chapter 5.4.6.

5.3.14 Abort Command

Command:	<ESC>
Response:	This is the only command that the scale receives which does not follow the <LF>c<CR> protocol and does not have a response. The <ESC> character can be detected at any time and any command is aborted.

5.3.15 Repeat Displayed Weight Continuously

This is a command with Unsolicited Response. It defines a host command that is not considered strictly command/ response. This is because the scale will respond continuously as commanded to do so by the host.

Command:	<LF>R<CR>
Response:	Scale Repeats weight and status information continuously until another command is received. <LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR> For detail see chapter 5.4.1.

Depending on the used baud rate, the following approximately repetition times of response messages are possible:

19200	Bd	⇨	100 ms
9600	Bd	⇨	110 ms
4800	Bd	⇨	170 ms

5.4 Scale Response Messages

This section details each scale response to host-scale commands. Each response has a "fixed field" data format. Every response is deterministic with only a scale communication error being the exception. The host can parse the scale response message with explicit rules because each field of each response message is in a fixed position format.

5.4.1 Standard Scale Response Message

Most of the host commands are responded to in the following message format.

The only host commands that do not are the: Diagnostic, ABout and INformation commands

<LF> <s> <r> <n> <m> <f> <xxxxxx.xxx> <uuu> <CR>

where:

<LF>	Start of response message	
<s>	scale status	definition/example
	'Z'	Center of Zero <xxxxxx.xxx>= 0.000
	'O'	Over Capacity <xxxxxx.xxx>= +weight
	'U'	Under Capacity <xxxxxx.xxx>= -weight
	'E'	Zero Error (clears when condition clears)
	'T'	Tare Error (clears after being read)
	<space>	None of the above conditions
		Note: For 'E', 'I', 'T' error conditions <xxxxxx.xxx>= ––––– (center dashes) and 'Z', 'O', 'U' are overridden.
<r>	range	('1', '2', '3', etc.) always '1' for single range
<n>	gross/net	Status
	'G'	Gross normal weight
	'T'	Tare weight (in response to 'M' command)
	'N'	Net normal weight
	'g'	gross weight in high-resolution
	'n'	net weight in high-resolution
<m>	motion status	
	'M'	scale in Motion
	<space>	scale not in Motion
<f>		future reserved for future or custom use
<xxxxxx.xxx>	weight data	this field is fixed at 10 characters
<uuu>		Unit of Measure
<CR>		End of response message

Examples:

Command	Response
<LF>W<CR>	<LF> <_> <1> <G> <_> <_> <_ _ _ _ 5.025> <lb_> <CR>
<LF>W<CR>	<LF> <_> <1> <N> <_> <_> <_ _ _ _ 100000> <lb_> <CR>
<LF>H<CR>	<LF> <_> <1> <g> <_> <_> <_ _ _ _5.0025> <lb_> <CR>
<LF>Z<CR>	<LF> <Z> <1> <G> <_> <_> <_ _ _ _ _0.000> <lb_> <CR>
<LF>R<CR>	<LF> <_> <1> <G> <_> <_> <_ _ _ _ 7.025> <kg_> <CR>
	<LF> <_> <1> <G> <M> <_> <_ _ _ _ 7.650> <kg_> <CR>
	...repeat...
	<LF> <_> <1> <G> <_> <_> <_ _ _ _ 7.650> <kg_> <CR>
	The scale will repeat weight until next command is received.

5.4.2 Unrecognized Command Response

Any host command that the scale does not recognize either because it is not supported by the implemented SMA level or because it is simply not a recognized command will be responded to by the scale with an ASCII '?' question mark.

<LF> ? <CR>

5.4.3 Communication Error Response

Any host command that the scale does not recognize due to a communication error will be responded to by the scale with an ASCII '!' exclamation mark. This would include a parity error (if used) or data framing error.

<LF> ! <CR>

5.4.4 Diagnostics Command Response

When the scale is commanded to perform internal diagnostics, a the test is performed and the following response is returned with the appropriate error indicators set or cleared.

<LF> <r> <e> <c> <m> <CR>

where:

<LF>	Start of diagnostic response
<r>	'R' = RAM or ROM error, '_' = OK,
<e>	'E' = EEPR OM error, '_' = OK
<c>	'C' = Calibration error, '_' = OK
<m>	Always: '_' = OK
<CR>	End of diagnostic message

Example:

With no errors!

Command	Response
<LF>D<CR>	<LF> <_> <_> <_> <_> <CR>

5.4.5 About 'A' and 'B' Command Response

Response Format for 'About' commands A, B (variable length):

<LF><xxx>:<yyyyyy><CR>

where:

<LF>	Start of About response
<xxx>	About field descriptor is fixed at 3 characters, is left justified, filled with blanks on the right side.
	Following fields are send:
	"SMA" compliance level/revision
	(response of 'A' command)
	"MFG" manufacturer
	(response of 1st 'B' command)
	"MOD" product model identification
	(response of 2nd 'B' command)
	"REV" software revision
	(response of 3rd 'B' command)
	"SN_" serial number
	(response of 4th 'B' command)
	"END" this is always the last About field
	(response of the last 'B' command)
':'	Separator between field name and field contents.
<yyyyyy>	Data field contain 25 characters maximum.
	SMA field contents <level/revision>
	where: level= (1, 2, etc.); revision= (1.0, 1.1, etc.)
<CR>	End of About response

Examples:

Command	Response
<LF> A <CR>	<LF>SMA:1/1.0 <CR>
<LF> B <CR>	<LF>MFG:Sartorius <CR>
<LF> B <CR>	<LF>MOD:PR 5211 <CR>
<LF> B <CR>	<LF>REV:02.09.9 <CR>
<LF> B <CR>	<LF>SN_:148388723 <CR>
<LF> B <CR>	<LF>END: <CR>
Note: if the host should ask for additional 'B' status then.	
<LF> B <CR>	<LF> ? <CR>

5.4.6 Scale Information 'I' and 'N' Command Response

Response Format for Information commands 'I', 'N' (variable length):

<LF><xxx>:<yyyyyy><CR>

where:

<LF>	Start of Information response		
<xxx>	About field descriptor is fixed at 3 characters, is left justified, filled with blanks on the right side.		
	Following fields are required:		
	"SMA"	compliance level/revision	
		(response of 'I' command)	
	"TYP"	Scale type: 'S'= Scale	
		(response 1st 'N" command)	
	"CAP"	capacity of range, unit-of-measure, count-by and decimal position, each delimited by ':'	
		where:	yyyyyy= uuu:c..c:n:d
			uuu= unit-of-measure
			c..c= full scale capacity of this range (may include decimal point)
			n= least significant count-by digit (e.g. 1, 2, 5,10,20...) no decimal point
			d= decimal point position
			'0'= none
			'1'= xxxx.x
			'2'= xxx.xx
			'3'= xx.xxx . . etc. (response of 2nd 'N' command)
	"CMD"	supported SMA commands	
		(response of 3nd 'N' command)	
	"END"	this is the last INformation field	
		(response of the last 'N' command)	
':'	Separator between field name and field contents.		
<yyyyyy>	About fields contain 25 characters maximum.		
	SMA field contents <level/revision>		
	where: level= (1, 2, etc.); revision= (1.0, 1.1, etc.)		
<CR>	End of Information response		

Example:

6000 kg × 1 kg platform scale

Command	Response
<LF> I <CR>	<LF>SMA:2/1.0 <CR>
<LF>N<CR>	<LF>TYP:S <CR>
<LF>N<CR>	<LF>CAP:kg_:6000:1:0 <CR>
<LF>N<CR>	<LF>CMD:HPTMCR <CR>
<LF>N<CR>	<LF>END: <CR>

5.5 Communication Error Handling

If a communication error is detected by the scale either through parity bit (optional) or a data framing error the scale will respond with an ASCII '!'. The only other error mechanism that has been incorporated into the scale is the unrecognized or unsupported command response message, in this case the scale responds with an ASCII '?'. Upon error discovery the host can then decide which course of action to take to re-affirm or re-establish proper communications with the scale.

6 ProfiBus Interface

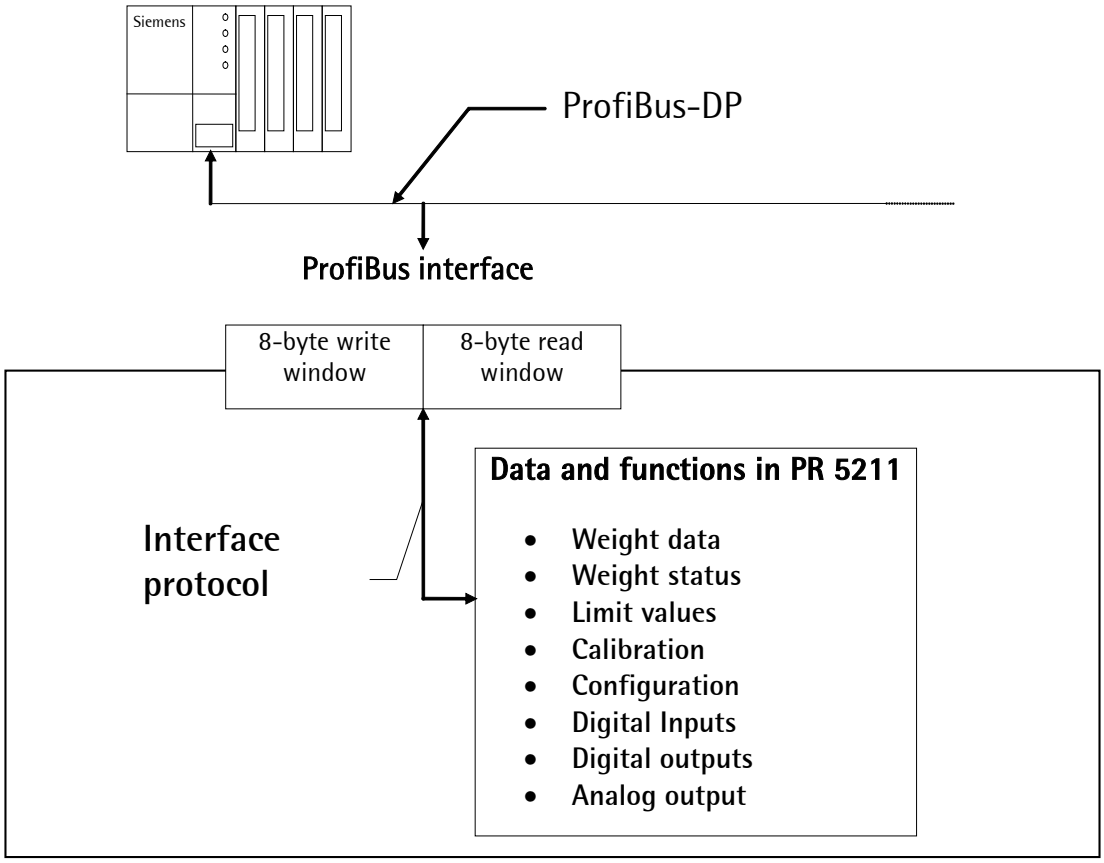
For PR 5211/00 and PR 5211/11 only.

6.1 ProfiBus Interface Protocol

The interface works with an 8-byte write window and an 8-byte read window. The ProfiBus exchanges its data cyclically from each slave. This means: in each cycle, 8 bytes are written and 8 bytes are read also if the data contents are unchanged.

The ProfiBus protocol ensures the data transport between ProfiBus master and the 2*8-byte data windows.

The interface protocol is below the ProfiBus level and manages the access to a large variety of data via the 8-byte wide read and write windows.



6.1.1 Write Window (Input Area)

In this window, data are transmitted from master to slave (PR 5211). The first four bytes are used only for writing a data value. The register number is written in byte 5. Bytes 6 and 7 contain bits in direct access independent of the write data. After a 0-1 transition of the relevant bit, the command is executed.	Byte 0	Write data: MSB
	Byte 1	"
	Byte 2	"
	Byte 3	Write data: LSB
	Byte 4	Read_Value _Select
	Byte 5	**Write_Value** _Select
	Byte 6	Direct control bits
	Byte 7	Direct control bits

6.1.2 Read Window (Output Area)

In this window, data are transmitted from slave (PR 5211) to master. The first four bytes are used for reading a data value. The register number is mirrored by the write window in byte 4, when the data are available. Bytes 5, 6 and 7 contain status bits independent of the read data.	Byte 0	Read data: MSB
	Byte 1	"
	Byte 2	"
	Byte 3	Read data: LSB
	Byte 4	Read_Value _Selected
	Byte 5	General system bits: - **Write_Active** - **Power_fail** - **ADU_Error** ...
	Byte 6	Status bits
	Byte 7	Status bits

6.1.3 Data Reading and Writing

The number of data exceeds the size of the write/read windows by far. Therefore, the datas are addressed with **Write_Value_Select** and **Read_Value_Select**. For this purpose, the first six bytes of the write window and the first five bytes of the read window are required. Thus the master can describe data in PR 5211: e.g. a limit value shall be set to 100 kg. Weight values or other data can also be read out of the PR 5211 by the master. For this, the write and the read window are always required. Thereby, safe data exchange is ensured by a write and a read procedure.

For reading status bits and writing direct control bits, however, no procedure is required. The general system bits and the status bits are always present and need not be requested. The direct control bits are also continuously available.

Procedure for Data Reading:

1. Write the register number into byte 4 of the **write window** (e.g. net weight) as a Read_Value_Select.
2. Wait, until in the byte 4 of the **read window**, the Read_Value _Selected is equal to the Read_Value_Select in the byte 4 of the **write window.**
3. Now, the value is available in byte 0 to 3.

Procedure for Writing Data:

1. Wait, until **Write_Active** = 0 in the **read window** (ready to receive new data).
2. Write value in byte 0 to 3.
3. Write register number in byte 5 (**Write_Value_Select**)
4. Wait, until **Write_Active** = 1 (acknowledges data reception)
5. Write 0 into byte 5 (**Write_Value_Select**) -> **Write_Active** will go to 0.

6.1.4 Description of I/O Area (Read/Write Window)

6.1.4.1 Output Area

Data are transferred from PR 5211 to the master via the output area. The PR 5211 has writing access, the master has reading access.

Byte	Name								Description
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	`Read_Value` (MSB)								e.g. gross value
1	:::								"
2	:::								"
3	`Read_Value` (LSB)								"
4	`Read_Value _Selected`								e.g. gross
5	Write Active	Power Fail	Out 3	Out 2	Out 1	Limit 3	Limit 2	Limit 1	Status
6	Cmd Busy	Cmd Error	Inp.3	Inp.2	Inp.1	Tare Active	Cal Changed	Test Active	Command status
7	Dimmed	Stand-Still	Inside ZSR	Center Zero	Below Zero	Over-load	Above FSD	Adu Error	Transmitter status

Variable	Function
`Read_Value`	The weight value is transferred as 32bit binary number with sign. Datatype: DINT
`Read_Value_Selected`	Acknowledgement of transferred value.
`Write_Active`	The function selected with Write_Value_Select is executed once. This bit is erased if Write_Value_Select is set to 0.
`Power_Fail`	Will be set at power on of the transmitter. Will be reset at 0→1 transition of ResPower.
`Cmd_Busy`	The transmitter is busy with executing a command. (e.g. the transmitter got a taring command and is waiting for StandStill)
`Cmd_Error`	The transmitter has interrupted the execution of a command (e.g. within the defined StandstillTimeout duration StandStill could not be reached) The error number can be read at Lasterror. It is only set if an action is executed!
`Tare_Active`	The transmitter has been tared.
`Cal_Changed`	The transmitter is/has been configurated. If this bit is 1, the scale parameters (Expo/Unit/Step) have to be read again. Will be set after Power on and reset after reading of FSD .
`Test_Active`	The transmitter is executing the ADU-Test. The weight value read is not the gross value but the testvalue.
`Dimmed`	Above-FSD or Below-Zero
`StandStill`	The transmitter is in stand still
`InsideZSR`	The weight value is within zero set range
`CenterZero`	The weight value is within center zero (ABS(Gross)<=0,25d)
`BelowZero`	The weight value is negative (Gross< -0,25d)
`Overload`	The weight value has exceeded the measuring range, no valid weight data are given (Gross>FSD+Overload)
`AboveFSD`	The weight value has exceeded FSD, but is still within FSD+Overload. (Gross <= FSD+Overload)
`AduError`	Error in AD conversion.(Details are available at register 1, Read_Value_Select = 1)

6.1.4.2 Input Area

Data are transferred via the input area from the master to the PR 5211 (slave).
The master has got writing access, the slave has got reading access.

Byte	Name								Description
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	`Write_Value` (MSB)								e.g. limit value
1	:::								"
2	:::								"
3	`Write_Value` (LSB)								"
4	`Read_Value_Select`								e.g. Gross
5	`Write_Value_Select`								write: Limit 1 On
6	free	free	free	free	free	outp. 3	outp. 2	outp. 1	digital outputs
7	Get FixTare	Set FixTare	Res Power	Res Test	Set Test	Res Tare	Set Tare	Set Zero	**Transm. Control Byte**, reaction on 0->1 transition

The Transmitter control byte is triggering with a set bit the related action in the transmitter.
After execution of the action the bit should be reset.

Variable	Function
`Write_Value`	The weight value is transferred as 32bit binary number with sign. Datatype: DINT
`Read_Value_Select`	To select the value, which has to be sent from the transmitter.
`Write_Value_Select`	To select the function to be carried out by the transmitter.
`GetFixTare`	Gross will be copied to the fixtare memory
`SetFixTare`	Taring is done with the value stored in the fixtare memory
`ResPower`	The bit Power_Fail in the output area will be erased
`ResTest`	The Test mode will be finished
`SetTest`	The Test mode will be started. Now the test number is shown, by reading the gross weight.
`ResTare`	Tare will be reset
`SetTare`	The transmitter will be tared
`SetZero`	The transmitter will be set to zero

6.1.5 Register Read and Write via ProfiBus

6.1.5.1 Data Read: Read_Value, Read_Value_Select, Read_Value_Selected

If the master shall read from the transmitter, then the register number is transferred in **Read_Value_Select** in the input area. The result will be indicated in the output area with **Read_Value_Selected** .

Master	Transmitter
Write registerno. to Read_Value_Select	
	Write selected register in Read_Value
	Copy Read_Value_Select to Read_Value_Selected
Wait until Read_Value_Selected = Read_Value_Select	
Read Read_Value	

6.1.5.2 Write Data: Write_Value, Write_Value_Select, Write_Active

If the master shall write to the transmitter, then the required action will be transferred with **Write_Value_Select** together with the data in the input area. The execution will be indicated with the bit **Write_Active** in the output area.

Master action	Transmitter action
Write value in Write_Value	
Register number in Write_Value_Select	
	Write Write_Value to selected register
	Set bit Write_Active
Wait until Write_Active is set	
Write 0 in Write_Value_Select	
	Reset bit Write_Active

6.1.5.3 Set/Reset Bit: Write_Value_Select, Write_Active

Single bits can be set or reset directly with **Write_Value_Select**.

To set, the bit number (80.. 127) is written to **Write_Value_Select**.

To reset, the bit number + 128 (208...255) is written to **Write_Value_Select**.

The Write_Value itself is not relevant.

Master	Transmitter
Register number in Write_Value_Select	
	Write Write_Value to selected register
	Set bit Write_Active
Wait until Write_Active is set	
Write 0 in Write_Value_Select	
	Reset bit Write_Active

6.1.5.4 Read Bit

Reading of single bits is only possible by reading a register. The sequence is the same as in chapter 6.1.5.1.

6.1.5.5 Transmitter Control Byte

Some transmitter functions can be executed by directly setting bits in the input area.

Master	Transmitter
Set bits in TransmitterControl Byte	
	Action is executed
Reset bits in TransmitterControl Byte	

6.1.5.6 Waiting for Result of Action

If an action which takes longer time has been triggered, the end of execution can be waited for **after** the triggering (see chapter 6.1.5.3 and chapter 6.1.5.5).

Master	Transmitter
Set bit as in chapter 6.1.5.3 or 6.1.5.5	Acknowledges set-bit as in chapter 6.1.5.3
	Set bit CmdBusy
	Action is executed
	IF error occurs: Set bit CmdError and byte LastError
	Reset bit CmdBusy
Wait until CmdBusy is reset	
Test bit CmdError: If set, read LastError (see chapter 6.1.5.1)	

This is valid for taring, standstill, zero setting, calibrating, reading and writing of parameters via ProfiBus.

6.1.5.7 Example: Read out of Gross Value

The Master writes a 8 to the 'Read_Value_Select' (Byte 4) of the input area.

Input area

Byte	Value								Description
0									
1									
2									
3									
4	**8**								gross
5									
6									
7									

The Master waits until an 8 in **Read_Value_Selected** (Byte 4) is reflected of the output area.

Output area

Byte	Value								Description
0	**00**								gross value
1	**00**								"
2	**4**								"
3	**D2**								"
4	**8**								gross request detected
5									Status
6								**Test Active**	Command status
7		Stand-Still	Inside ZSR	Center Zero	Below Zero	**Over-load**	Above FSD	**Adu Error**	Transmitter-Status

The gross value (hex:000004D2 <=> 1234) could be read out from Bytes 0...3. If the status-Bits **Overload**, **Test Active** or **Adu Error** is set, the read out value is not valid.

Negative values are given in two's complement.

6.1.6 Parameter Read and Write via ProfiBus

6.1.6.1 Parameter Writing

The following is done subsequently:

Master	Transmitter
Write parameter value in register 20 (method see chapter 6.1.5.2)	The value is stored intermediately
Write parameter index in register 21 (method see chapter 6.1.5.2)	The value is stored intermediately.
Set bit 123, set parameter (method see chapter 6.1.5.3)	The parameter is taken over. The bit is reset immediately

6.1.6.2 Parameter Reading

The following is done subsequently:

Master	Transmitter
Write parameter index in register 21 (method see chapter 6.1.5.2)	The value is stored intermediately
Set Bit 124, get parameter (method see chapter 6.1.5.3)	The parameter is copied to register 20. The bit is reset immediately
Read parameter value in register 20 (method see chapter 6.1.5.1)	

6.1.6.3 Calibration Procedure

The calibration is controlled by writing parameters subsequently:

Master	Transmitter
Set parameter P20 to 1 (start Cal) (method see chapter 6.1.6.1)	The CAL switch is tested, the calibration procedure is started. If the CAL switch is 'locked', an error code is stored in LastError, see chapter 6.2.5.
Proceed with calibration (parameter see chapter 6.3.2) (method see chapter 6.1.6.1)	CmdBusy and CmdError as in chapter 6.1.5.6 If a parameter is not within the valid value range, an error code is stored in LastError. The cause can be detedted by reading register 4, byte 3.
Set parameter P20 to 3 (SaveAndExit) (method see chapter 6.1.6.1)	Data are stored in the non-volatile EAROM
Set parameter P20 to 4 (UndoAndQuitCal) (method see chapter 6.1.6.1)	All modified data are erased, continue with the previously stored data.

6.1.6.4 Reset transmitter to default (factory data)

Master	Transmitter
Set parameter P20 to 1 (Start Cal) (method see chapter 6.1.6.1)	The CAL switch is tested, if the switch is not in the 'locked' position, the procedure is started.
Set parameter P20 to 2 (default = factory data) (method see chapter 6.1.6.1)	Default data are taken as calibration data. All ADU data will be reset, see chapter 4.9.
Set parameter P20 to 3 (SaveAndExit) (method see chapter 6.1.6.1)	Data are stored in the non-volatile EAROM.

6.2 ProfiBus Register

6.2.1 Register 0: IO-Status Bits for Reading

Dynamic status, only reading is allowed.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
byte 0						Input 3	Input 2	Input 1
byte 1						Output 3	Output 2	Output 1
byte 2						Limit 3	Limit 2	Limit 1
byte 3								

6.2.2 Register 1: Scale Status

Dynamic status, only reading is allowed.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
byte 0	DIM	STND	INZSR	CZERO	BELOW0	OVL	>FSD	ADUERR
byte 1						E1	E3	E7
byte 2						PowerFail	ActionActiv	CmdError
byte 3						TareActiv	CalChanged	TestActiv

Byte 0 corresponds to byte 7 in the output area, for weight errors see table in chapter 0.

ADUERR	Errror in analog conversion/ load cell circuitry (OR-function of bits E1,E3,E7)
>FSD	gross value larger FSD (german SKE), scale range exceeded
OVL	scale overloaded, gross > FSD + Overload, `Error 2`
BELOW0	Gross weight negative (< 0-1/4 d)
CZERO	Center of zero, weight within 1/4d range
INZSR	Gross weight is within zeroset range
STND	Scale is in stand still
DIM	Gross weight has exceeded the scale range (0-1/4d > weight > FSD+overload), (OR-funktion of bits BELOW0, OVL).
E7	Measuring signal is negative (inverse conversion), Error 7
E6	Sense voltage missing/too low, Error 6
E3	Measuring signal is > 36mV (no end of conversion), Error 3
E1	Arithmetic error (overflow), Error 1

CmdError	Error during execution (cmdError), e.g. action 'taring' is not executed as there is no standstill. In LastError (register 4) the error is specified. With ResetError register 89/89+128 or register 121 the bit is reset again.
ActionActiv	Action will be executed, is still processed
PowerFail	Power failure, will be set at each power-on. With bit ResetPWF register 85/85+128 or register 117) 'Power failure reset' the bit PowerFail is reset.
TestActiv	Analog test is aktive
CalChanged	Calibration mode is active or calibration data have been changed. FSD has to be read again to reset this bit.
TareActiv	Transmitter has beeen tared

6.2.3 Register 2: Status of State Controlled Action Bits

Only reading is allowed, the status of signals is shown.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	87: GetFixTare	86: SetFixTare	85: ResetPWF	84: ResetTest	83: SetTest	82: ResetTare	81: SetTare	80: SetZero
Byte 3			93: SaveConfig	92: GetParam	91: SetParam	90: SaveProcess	89: ResetError	

6.2.4 Register 3: Status of Transition Controlled Action Bits

Only reading is allowed, it is always 0.

6.2.5 Register 4: Calibration Information, Error Byte

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	EXPO							
Byte 1	UNIT							
Byte 2	STEP							
Byte 3	LASTERROR							

EXPO	One byte for position of decimal comma/point (Exponent), content in decimal representation 0 ... 255.			
	0 = 0000			
	1 = 000.0			
	2 = 00.00			
	3 = 0.000			
UNIT	One byte for the weight unit, content in decimal representation: 0 ...255			
	1 = mg	milligram	2 = g	gram
	3 = kg	kilogram	4 = t	ton
	5 = lb	pound	6 = l	liter
STEP	One byte for the stepwidth, content in decimal representation: 0...255			
	1 = stepwidth '1'		2 = stepwidth '2'	5 = stepwidth '5'
	10 = stepwidth '10'		20 = stepwidth '20'	50 = stepwidth '50'
LASTERROR	Last Error Byte, see also bit CmdError ,number of 'last error':			
	31 =	stand still not reached (e.g. at taring, calibrating)		
	33 =	negative weight at taring		
	35 =	weight exceeds allowed range		
	40 =	CAL switch 'locked'		
	41 =	transmitter not in calibration mode		
	42 =	calibration active, transmitter is in calibration mode		
	46 =	tare active (can occur at start calibration)		
	47 =	zero set not executed, weight is not within zero set range		
	50 =	invalid step width		
	51 =	not enough counts/d		
	53 =	FSD < calibration weight		
	55 =	arithmetic overflow		
	57 =	entered unit does not comply with FSD weight unit		
	58 =	SPAN above maximum		
	59 =	fullscale cannot be divided by stepwidth		
	30 =	weight smaller than deadload		
	102, 103 =	EAROM error (command SaveProcess, register 2)		
	104 =	wrong access code		
	106 =	baudrate of remote display cannot be altered		
	107 =	no standstill at Getfixtare		
	108 =	parameter not valid (at entering via PLC)		

6.2.6 Register 5: Transmitter Type and Version

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	TYPE MSB							
Byte 1	TYPE LSB							
Byte 2	MAINVERSION							
Byte 3	SUBVERSION							

e.g. 5210 rel. 1.23 = 52100123_{hex}

6.2.7 Register 6: Board Number

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Board number MSB							
Byte 1	""							
Byte 2	""							
Byte 3	Board number LSB							

e.g. 148388723 = $08D83B73_{hex}$

6.2.8 Register 7: (Reserved)

6.2.9 Register 8 ...14: Weight data

Only reading is allowed.

Gross, net, tare

Are stored as DINT-fixed point. The real data value is derived from DINT and EXPO as follows:

$$Value_{Real}=Readout_{DINT}*10^{(-EXPO}$$

Register 8	Actual gross value
Register 9	Actual net value, if tared, else gross
Register10	Actual tare value, if tared, else 0
Register11	Reserved
Register12	Reserved
Register13	Reserved
Register14	Full scale deflection FSD
Register15	Reserved (free)

6.2.10 Register 20 and 21: Parameter channel (read/write)

Register 20	Parameter value
Register 21	Parameter index

6.2.11 Register 22...27: Limit values (read/write)

Register 22	`limit 1` on
Register 23	`limit 1` off
Register 24	`limit 2` on
Register 25	`limit 2` off
Register 26	`limit 3` on
Register 27	`limit 3` off

6.2.12 Register 30: Analog output (read/write)

Register 30	Fixed value for analog output. Value(num) 0... 40000 Correspond to 20mA

6.2.13 Register 31: Fixtare (read/write)

Register 31	Fixed value for fixtare, see also SetFixTare, GetFixTare (see chapter 6.2.3)

6.2.14 Register 80...93: Action bits state controlled (write)

Set bits, see chapter 6.1.5.3

Only setting and resetting of single bits are possible.

If a bit is changed from 0 to 1, the corresponding action is started. After execution of the command the bit has to be reset. Application: Master is writing cyclically.

The bit is set with the shown number as Write_Value_Select (see chapter 6.1.5.3), with the shown number+128 the bit is reset.

Register 80	SetZero	Set gross to zero
Register 81	SetTare	Execute taring
Register 82	ResetTare	Reset tare
Register 83	SetTest	Start ADU test
Register 84	ResetTest	Terminate ADU test
Register 85	ResetPwf	Reset bit PowerFail (register 1, bit has been set after power-on)
Register 86	SetFixTare	Taring with weight in numerical address D 31 'Fixtare'
Register 87	GetFixTare	The actual gross weight is copied to the numerical address D31
Register 89	ResetError	The error bit CmdError will be reset
Register 90	SaveProcess	The process data will be stored to EAROM limit values (register 22...27) fixed analog output value (register 30) fixtare (register 31)
Register 91	SetParam	Write parameter (value R20 to parameter R21)
Register 92	GetParam	Read parameter (parameter R21 to R20)
Register 93	SaveConfig	The configuration parameter will be stored to EAROM analog output (parameter 1...3) I/O parameter (parameter 4, 6) input/output configuration (parameter 5, 7) access control parameter (parameter 99)

6.2.15 Register 112...125: Action bits transition controlled (write)

Set bits, see chapter 6.1.5.3

As soon as the bit is set, it is reset internally and the action is executed, it is transition triggered (for writing once).

The bit is set with the shown number as **Write_Value_Select** (see chapter 6.1.5.3).

Register 112	SetZero
Register 113	SetTare
Register 114	ResetTare
Register 115	SetTest
Register 116	ResetTest
Register 117	ResetPwf
Register 118	SetFixTare
Register 119	GetFixTare
Register 121	ResetError
Register 122	SaveProcess
Register 123	SetParam
Register 124	GetParam
Register 125	SaveConfig

To prevent the EAROM from being written too often, the writing rate for taring and zero setting should not be shorter than 15 seconds, for configuration data not shorter than 5 minutes.

6.3 ProfiBus Parameter Numbers

With the following parameters all configuration and calibration data can be written to or read from the transmitter.

All other parameters belong to the class extended configuration, which can be found on separate pages.

Values which are marked with **(factory setting)** represent the factory delivery data.

A parameter uses always 4 bytes (format DINT).

6.3.1 Configuration parameter

6.3.1.1 Parameter 1: Analog output

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	Range				Output mode			
Byte 3			ADU in error state		ADU below zero		ADU above FSD	

Analog output			
Description	**Range / signal**		**Factory setting**
Output mode	off,	0,	0
	(reg. 30)*,	1,	
	gross,	8,	
	net	9	
Analog range	0...20 mA	0	1
	4...20 mA	1	
ADU in error state**	hold	0	1
	0 mA	1	
	4 mA	2	
	20 mA	3	
ADU below zero	Linear ***	0	0
	0 mA	1	
	4 mA	2	
	20 mA	3	
ADU above FSD	Linear***	0	3
	0 mA	1	
	4 mA	2	
	20 mA	3	

* Output value 1 means that the value contained in register 30 is written to the analog output.

** The ADU error state is only valid if output value is set to gross (8) or net (9).

*** The linear selection can be used to get a proportional output signal outside the range 0 to FSD.

6.3.1.2 Parameter 2: Scaling Weight Value for 0/4 mA Output

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	WEIGHT MSB							
Byte 1	""							
Byte 2	""							
Byte 3	WEIGHT LSB							

The weight value is stored at which the analog output is giving 0 or 4 mA.
Default = 0

6.3.1.3 Parameter 3: Scaling Weight Value for 20 mA Output

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	WEIGHT MSB							
Byte 1	""							
Byte 2	""							
Byte 3	WEIGHT LSB							

The weight value is stored at which the analog output is giving 20 mA.
Default = 3000

6.3.1.4 Parameter 4: Communication

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3							COM 2^1	COM 2^0

The transmission to a remote terminal (e.g. PR 1628) or the SMA protocol can be switched on or off.
COM = 0: switched off,
COM = 1: a remote terminal (e.g. PR 5110) switched on,
COM = 2: SMA protocol switched on,
Default = 1.

6.3.1.5 Parameter 5: Digital Outputs

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1						Output 1 , default = 0		
Byte 2						Output 2 , default = 0		
Byte 3						Output 3 , default = 0		

Description	Value
transparent*	0
aduerr	1
Limit1**	2
Limit2**	3
Limit3**	4
Tare active	5

* Transparent mode means, that the PLC is writing to the outputs directly.

** Limit(x) means, that the transmitter is writing the limit result to the outputs directly.

6.3.1.6 Parameter 6: RS-485 Interface

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2					Baudrate			
Byte 3					Parity		Stopbits	Bits

Baudrate	0=300, 600, 1200, 2400, 4800, 9600, 6=19200	Default = 9600
Bits	0 = 7 bit, 1 = 8 bit	Default = 0
Stop bits	0 = 1 stop bit 1 = 2 stopbits	Default = 0
Parity	0 = no, 1 = odd, 2 = even	Default = 2

Unvalid parameters are not taken. E.G. the SMA protocol has always 8 bit and no parity.

6.3.1.7 Parameter 7: Digital Inputs

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1							Input 1 default 0	
Byte 2							Input 2 default 0	
Byte 3							Input 3 default 0	

Description	Value
none	0
set Zero	1
set Tare	2
reset Tare	3

The PLC can read the status of the inputs at any time.

6.3.2 Calibration

6.3.2.1 Procedure

To change the calibration-data and calibration-parameters (parameters 21...53), P20 has to be set to Start previously, afterwards the P20 has to be set to Save (to store) or Undo (to indicate that the changes are not valid).

The access to parameter 21...53 will deliver an error message, if **CalActiv** is not set.

P21 - P24 and P27 can only written. Reading will result in an error code108.

The calibration data (parameters 21...27) must be written in a specific sequence.

The calibration parameter (parameters 40...53) can be written in any sequence.

1. Example for a new calibration with mV/V:

- Parameter 20 = 1
- All parameter writing (P40 .. P53)
- Parameter 20 = 5 ⇨ set SPAN = 1.000000 mV/V, deadload = 0.000000 mV/V, FSD=3000kg, step = 1
- Parameter 21 = 0x000FA013 ⇔ 400.0 kg
- Parameter 22 = 2 ⇔ 2 stepwidth
- Parameter 25 = 5670 ⇔ 0.00567 mV/V
- Parameter 26 = 1234500 ⇔ 1.23450 mV/V
- Parameter 20 = 3 save and exit calibration

After each step, the error has to be tested under each circumstances.

2. Example for a new Calibration with Weights:

- Parameter 20 = 1
- All parameter writing (P40 .. P53)
- Parameter 20 = 5 ⇨ set SPAN = 1.000000 mV/V, deadload = 0.000000 mV/V, FSD=3000kg, step = 1
- Parameter 21 = 0x000FA013 ⇔ 400.0 kg
- Parameter 22 = 2 ⇔ 2 stepwidth

unload the scale

- Parameter 23 = 1 ⇔ the actual weight is taken for the deadload

load the scale with a known calibration weight (e.g. 250.0 kg)

- Parameter 24 = 2500 ⇔ 250.0 kg
- Parameter 20 = 3 save and exit calibration

After each step, the error has to be tested under each circumstances.

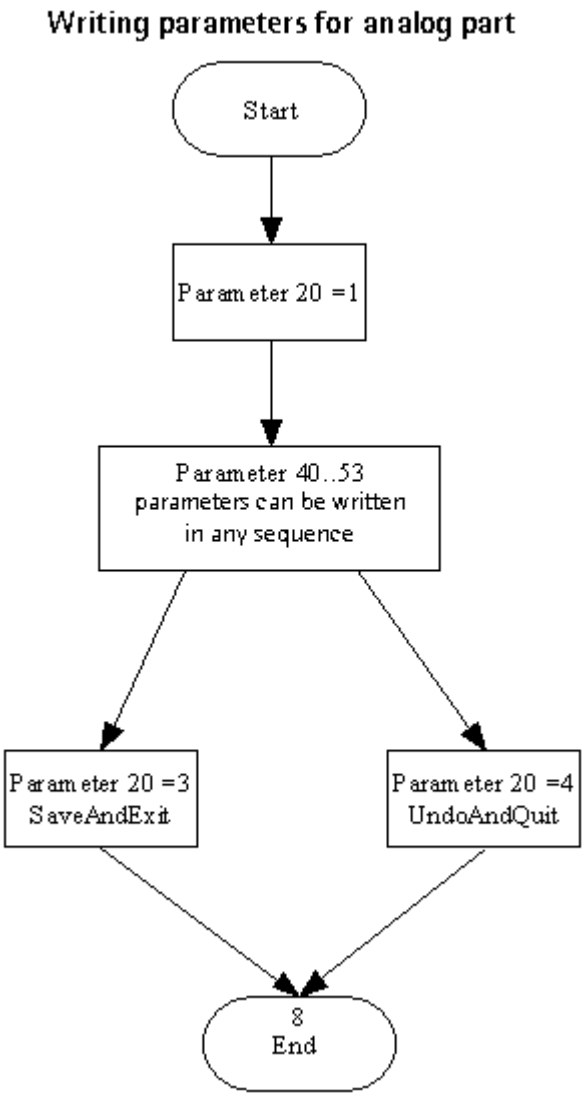
6.3.2.2 Parameter 20: Calibration Start/Stop

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3						Function		

Function

1	StartCal Test the CAL switch, set CalActiv
2	Factory standard Calibration data and paramters are reset to factory delivery status (see chapter 4.1.2)
3	SaveAndExit The calibration data and parameters 21...53 are stored in EAROM. CalActiv is reset.
4	UndoAndQuitCal All changes since start calibration are not valid. CalActiv is reset.
5	SetDefaultSpan To be used to start a calibration: All calibration data are reset, scale in status not calibrated FSD = 3000 kg, stepwidth = 1, SPAN = 1.000000 mV/V, deadload = 0.000000 mV/V.



6.3.3 ADU parameter

6.3.3.1 Parameter P21: SetFullScale

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	FSD MSB							
Byte 1	""							
Byte 2	FSD LSB							
Byte 3	EXPONENT				UNIT			

FSD	3 bytes for the full scale deflection
EXPONENT	(4 bit) Number of digits behind the decimal comma/point
UNIT	(4 bit) weight unit (as in register 4)

6.3.3.2 Parameter P22: Stepwidth

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3	Stepwidth							

Step width: 1, 2, 5, 10, 20, 50

6.3.3.3 Parameter P23: SetDeadload with Weight

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3								1

At writing to this parameter, the actual weight will be stored as deadload.

6.3.3.4 Parameter P24: SetSpan

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Weight MSB							
Byte 1	""							
Byte 2	Weight LSB							
Byte 3	Exponent				Unit			

Calibrating with Weights

Weight	3 Bytes for the weight value
Exponent	Number of digits behind the decimal comma/point
Unit	Weight unit (as in register 4)

6.3.3.5 Parameter P25: Set/GetDeadloadMvpv

Write and read

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DEADLOAD MSB							
Byte 1	""							
Byte 2	""							
Byte 3	DEADLOAD LSB							

DEADLOAD in mV/V (value in mV/V)*10^6

6.3.3.6 Parameter P26: Set/GetSpanMvpv

Write and read

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	SPAN MSB							
Byte 1	""							
Byte 2	""							
Byte 3	SPAN LSB							

SPAN in mV/V (value in mV/V)*10^6

6.3.3.7 Parameter P27: CalcTest

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3								1

Calculate testvalue

6.3.3.8 Parameter P40: Digital Filter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3						Filter		

Filter 0 = off, 1 = Bessel, 2 = aperiodic, 3 = Butterworth, default = off

6.3.3.9 Parameter P41: Filter Frequency

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3	FREQ							

FREQ Value has to be entered in frequency*100. Example: for 1.56 Hz enter 156.
Frequency range depends on the measuring time, see table in chapter 4.9.2.3
Only valid if the digital filter is not set to 'off'.
If the digital filter is set, the maximum measuring time is 160 ms.

6.3.3.10 Parameter P42: Measuring Time

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	TIME MSB							
Byte 3	TIME LSB							

TIME measuring time in ms 10...1920, default = 320 ms
Only valid if the digital filter is set to 'off'.

Parameter P53 will be set accordingly.

10...160 ms -> P53: 4...0

320...1920 ms -> P53: 0

6.3.3.11 Parameter P43: Test Mode

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3								MODE

MODE 0 = absolute, 1 = relative, default = 0

6.3.3.12 Parameter P44: Standstill Time

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3					STIME			

Time expressed in multiples of measuring time at which a standstill is detected.

STIME 1...9 times measuring time, default = 1

6.3.3.13 Parameter P45: Standstill Range

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	SRANGE MSB							
Byte 3	SRANGE LSB							

Limit to define the weight to be in standstill.

SRANGE 0...10.00d default = 1d

Value = d*100

6.3.3.14 Parameter P46: Standstill Timeout

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3	TIME							

Number of measuring times during the standstill condition should be reached.

TIME 0...100 M (measuring times), default = 8

If the standstill timeout is exceeded by a function, which needed the standstill condition, the function is aborted (Taring, set zero, calibrate, 'P'-command of the SMA-protocol). Additional the error code 31 and the 'CmdError' bit are set.

6.3.3.15 Parameter P47: Zeroset Range

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	RANGE MSB							
Byte 3	RANGE LSB							

RANGE 0...500.00 d default = 50 d

Value = d*100

6.3.3.16 Parameter P48: Zerotrack Range

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	RANGE MSB							
Byte 3	RANGE LSB							

RANGE 0 ... 500.00 d default = 0.25 d
Value = d*100

6.3.3.17 Parameter P49: Zerotrack Step

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2	STEP MSB							
Byte 3	STEP LSB							

STEP 0 ... 10.00 d default = 0.25 d
Value = d*100

6.3.3.18 Parameter P50: Zerotrack Repeat

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3	REPEAT							

REPEAT 0 ... 100 measuring times default = 0 (Zero tracking is off)

6.3.3.19 Parameter P51: Overload

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	OVL MSB							
Byte 1	""							
Byte 2	""							
Byte 3	OVL LSB							

OVL Overload in d 0...9999999 default = 9 d

6.3.3.20 Parameter P53: A/D Converter Sample Time (Measuring Rate)

Read only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0								
Byte 1								
Byte 2								
Byte 3						SAMPLETIME		

SAMPLETIME	0:	6.25 Hz == 160 ms = default
	1:	12.5 Hz == 80 ms
	2:	25 Hz == 40 ms
	3:	50 Hz == 20 ms
	4:	100 Hz == 10 ms

6.3.4 Parameter P99: Access Code

Write only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	CODE MSB							
Byte 1	""							
Byte 2	""							
Byte 3	CODE LSB							

CODE If an access code was entered in the configuration tool, parameters and the registers for limits can only be written if the access code is contained in register P99. Parameter P99 can always be written. To activate the protection P99 has to be set to –1 again. If CODE is set to 0, no access check is done.

7 Repair and Maintenance

Repairs are subject to checking and can be carried out only at Sartorius. In case of defect or functional trouble, please, contact your local Sartorius organization for repair. When returning the instrument for repair, an exact and complete fault description must be supplied. Maintenance work may be carried out only by a trained technician aware of the involved hazards, whereby the relevant precautions must be taken.

7.1 Soldering Work

Carrying out any soldering work on the unit is not allowed, excepting the solder link (see chapter 3.2.6.5 and 3.2.6.6).

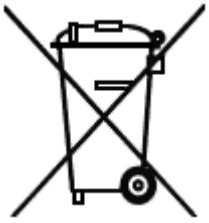
7.2 Cleaning

If necessary, the front panel can be cleaned using a damp, soft cloth. Use only little water or isopropyl alcohol for moisturizing.

8 Disposal

The packaging is made from environmentally friendly materials, which are suitable for recycling.
For more information, please see the T&Cs.

If the packaging is no longer needed, it can be disposed of by local waste disposal authorities.



Contact your local authorities regarding the disposal of the devices.

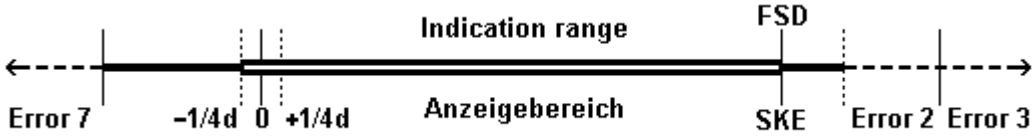
In Germany, Sartorius also offers a return service and legally compliant recycling of its equipment.

In other countries, please consult with the local authorities.

9 Error Messages

9.1 Weight Error Status

	Error 1 Arithmetic	Error 7 (negative)	Error 2 Overload	Error 3 (>36 mV)	Error 6 Sense control
1	Flash. 1Hz	Flash. 1Hz			Altern. flash 1 Hz
2	Flash. 1Hz			Flash. 1Hz	Altern. flash 1 Hz
3	Flash. 1Hz	Flash. 1Hz	Flash. 1Hz	Flash. 1Hz	Altern. flash 1 Hz
+ 5V					
DATAEX					



10 Technical Data

The characteristic data are valid after a min. warm-up time of 30 minutes (reference temperature 23° C). Values specified without tolerances are average values and are only used for information.

10.1 Weighing Electronics

Principle	DC voltage, Delta-Sigma conversion, ratiometric to the load cell supply voltage
Measuring time	Min. 10 ms to max 1920 ms)
Analog filter	1st order low-pass filter, cut-off frequency 70Hz
Digital filter	Active 4th order (low-pass) Bessel, Aperiodic or Butterworth filter, cut-off frequency adjustable (max. 0.25/measuring rate or approx.1.56 Hz)

10.1.1 Accuracy and Stability

Accuracy class	≤ 6000 d
Min. meas. signal	≥ 0.25 mV/V or ≥ 3 mV for 6000 e ≥ 0.125 mV/V or ≥ 1.5 mV for 3000 e
Linearity error	< 0.002 %
Zero stability error	TK_0 < 0.02 µV/K RTI
SPAN stability error	TK_{Spn} < +/- 2 ppm/K

10.1.2 Sensitivity

Sensitivity	0.5 µV/d @ 6000d 0.5 µV/d @ 3000d 0.2 µV/d
Resolution internal	Approx 4.8 Mio steps for 36 mV
Min. meas. Signal	>0.05 mV/V for 3000 d
Input voltage (meas.-signal + deadload)	0 ... max. 36 mV
Deadload range	36 mV - (max. meas. signal); entry/ calibration via software

10.1.3 Load Cells

Load cell connection	all strain gauge cells, 6 or 4-wire connection possible.	
Load cell supply	U= ± 6 VDC for I_{max}= 160 mA, protected by multifuses	
Load cell supply circuit	12 V DC	for max. 8 load cells each with 650 Ω for max. 4 load cells each with 350 Ω
Max. load	≥75 Ω	

10.2 ProfiBus DP

Standard	EN 50 179 volume 2, PROFIBUS DIN 19245: PROFIBUS, Process Field Bus (part 1 and 3)
Baudrates	9.6, 19.2, 93.75, 187.5, 500 [kBps], 1.5, 3.0, 6.0, 12.0 [MBps], automatic detection
Buffer size	8 bytes
I/O data	8 bytes
UserPrm	No
Sync	YES
Freeze	YES
Clear	YES
Set-Slave-Add	No

10.3 Power Supply

Power voltage	24 VDC	+10% / -15%
Power consumption	8.2 W	

10.4 Environmental Effects

10.4.1 Environmental Conditions

Temperature range	
Reference temperature	23 °C
Ambient temperature operation	-10... +55 °C
Switch-on temperature	0... +55 °C
Storage/ transport	-40... +70 °C
Humidity	<95 %, without condensation, (acc. to IEC 68-2)
Protection type	IP 20
Vibration	to IEC 68-2-6, test Fc

10.4.2 Electromagnetic Compatibility (EMC)

All data comply to NAMUR NE 21 and EN 61326

Housing	Radio frequency electromagnetic field (80 – 3000 MHz)	EN 61000-4-3	10 V/m
	Electrostatic discharge (ESD)	EN 61000-4-2	6 kV/8 kV
Signal and control lines	Electrical fast transients (Burst)	EN 61000-4-4	2 kV
	Peak voltage (surge) 1.2/50 µs	EN 61000-4-5	2 kV
	Conducted disturbances by radio-frequency (0.15 – 80 MHz)	EN 61000-4-6	10 V
DC input power port	Electrical fast transients (Burst)	EN 61000-4-4	2 kV
	Peak voltage (surge) 1.2/50 µs	EN 61000-4-5	1 kV/2 kV
	Conducted disturbances by radio-frequency (0.15 – 80 MHz)	EN 61000-4-6	10 V
	Voltage variations	NAMUR NE21	100%-0%-100%, 2 s-1 s-2 s 100%-40%-100%, 2 s-1 s-2 s
	Voltage interrupts	NAMUR NE21	0%, 20 ms

10.4.3 RF interference suppression

Electromagnetic emission acc. To EN 55011 group 1, limit value class A

10.5 Mechanical Data

10.5.1 Construction Type

Polyamide housing, black, flammability class V0 (UL 94).
Protection class according to DIN 40050: IP 20.

10.5.2 Dimensions

Housing	Dimensions
Width	45 mm
Height	99 mm
Depth	116 mm

10.5.3 Connections

- Via plug-in screw terminals, cross-section max. 2.5 mm^2
- 9-pin D-Sub connector (female) for ProfiBus
- USB-B for PC

10.5.4 Weight

Net weight	0.3 kg
Shipping weight	0.45 kg

10.6 Equipment Supplied

- Operation manual in English and German on CD-ROM
- ConfigureIt! to configure/calibrate the transmitter via PC on CD-ROM
- Connection cable for PC; length 1.8 m

10.7 Options

- Operation manual on paper (English), order no. 9499 050 52100
- Operation manual on paper (German), order no. 9499 050 52108

11 Index

A

A/D conversion 84
Accuracy and Stability 84
Analog Part 46

C

CAL Switch 24
Calibration 31, 33, 73
Calibration data 31
Calibration parameters 33
Commissioning 24
Connections 12
Converter 14

D

Deadload 32
Digital Inputs 17, 18
Disposal 82

E

EMC 7
Environmental Effects 85
Error 1 2 3 6 7 83
Error 1 3 6 7 63
Error status 11
External Load Cell Supply 21

F

Factory settings 25

G

GSD file for ProfiBus DP 91

I

Input Area 58
Interface RS-485
  Pin assignment 91
Intrinsically Safe Interface 22
IO-Status bits for reading 63

L

LEDs 11
Link Sense Voltage 22
Load Cell with 4-Wire Cable 19
Load Cell with 6-Wire Cable 19
Load Cells 84

M

Measuring circuit
  testing 20
Mechanical Data 87

O

Optocoupler Inputs 17
Optocoupler Outputs 18
Output Area 57

P

Pin assignment
  Interface RS-485 91
Power on 11
Power Supply 85
PR 1626/60 22
PR 5110 .... 14, 15
PR 5211/00 23
PR 5211/11 23
Print out 92
ProfiBus activity 11
ProfiBus connection 11
ProfiBus connector 23
ProfiBus DP 85
ProfiBus Interface 23
ProfiBus Parameter Numbers 70

R

Read window 56
Register read and write via ProfiBus 59
Relay Control Connection 18
Remote display PR 5110 15
Reset transmitter to default 62
RS-485 Converter 14
RS-485 Interface 14

S

Safety Hints 5
Scale interval 31
Scale status 63
Select language 29
Sensitivity 84
SMA 46
SMA Protocol 46
Smart Calibration 42
SPAN 32
Spare parts 91
Sprache auswählen 29
Stepwidth 31
Supply Voltage Connection 6

U

USB Interface 13

V

Voltage Output Connection 18

W

Weight error 83
Weight Status 46
Weight status indication 11
Write window 56

12 Appendix

12.1 Pin Assignment for Interface RS-485

PR 5110: Pin assignment female		PR 1627/PR 1628 with interface card PR 1604: Pin assignment male	
GND	= 8	GND	= 3
RxB	= 2	RxB	= 8
RxA	= 3	RxA	= 9
TxB	= 7	TxB	= 4
TxA	= 5	TxA	= 5

12.2 EC Declaration of Conformity

The certificate can be found in the directory Certificates on the CD-ROM delivered with the instrument.

12.3 GSD File for ProfiBus DP

The GSD file can be found in the directory ProfiBus-Files on the CD-ROM delivered with the instrument.

12.4 Spare Parts

Order number	Description	Beschreibung
5312 264 48012	Connector 4-pin	Stecker 4-polig
5312 321 28052	PC connecting cable USB-A/B 1.8 m	PC-Anschlusskabel USB-A/B 1,8 m
5312 447 98005	Blind cap	Blindkappe

12.5 Example Print Out

Configuration / Calibration Data

Dataset for device type: PR5211/00 - Rel. 06.00 **20.01.2014 08:45:37**
Board no.: 422539449

Parameter	Value
Number of load cells	1
Capacity of one load cell	20 kg
Gravity	9,81379 m/s²
LC1 sensitivity	1,000000 mV/V
Hysteresis correction	without
LC1 resistance	600,000 Ohm
FSD	2500 kg
Stepwidth	1
Deadload	0,000000 mV/V
Span	1,000000 mV/V
Overload	9 d
Filter	none
Frequency	1,56 Hz
Measuring time	160 msec
Weight & Measure	off
Standstill time	1 M
Standstill range	1,00 d
Testmode	absolute
Standstill timeout	8 M
Zeroset range	50,00 d
Zerotrack range	0,25 d
Zerotrack step	0,25 d
Zerotrack repeat	0 M
Analog mode	Gross
Analog range	0...20 mA
Analog error	20 mA
Analog < 0	20 mA
Analog > FSD	20 mA
Analog value	0,617 mA
Weight 0/4 mA	0 kg
Weight 20 mA	2000 kg
Profibus address	10
Bus size	8 Bytes
Communication	SMA protocol
Baud Rate	9600
Access code	0
Output 1	tare active
Output 2	tare active
Output 3	Limit 1
Input 1	Set tare
Input 2	Reset tare
Input 3	Set zero
Limit 1 on	110 kg
Limit 1 off	120 kg
Limit 2 on	210 kg
Limit 2 off	220 kg
Limit 3 on	310 kg
Limit 3 off	320 kg
Value for 4 mA	4,000
Value for 20 mA	20,000

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